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REPAIR MANUAL
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The following pages are the collation of the contents pages from each section and chapter of the T2410, T2420 Repair manual. Complete Repair part # 87725020.

The sections used through out all New Holland product Repair manuals may not be used for each product. Each Repair manual will be made up of one or several books. Each book will be labeled as to which sections are in the overall Repair manual and which sections are in each book.

The sections listed above are the sections utilized for the T2410, T2420 Tractors.

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87725022 9/07
Replaces 87693289

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SECTION 90 - PLATFORM

BOOK 5 - 87693288

Chapter 1 - Platform

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SECTION 90 - PLATFORM

BOOK 5A - 87725021

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SECTION 90 - PLATFORM

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Chapter 1 - General Information

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PRECAUTIONARY STATEMENTS

PERSONAL SAFETY

Throughout this manual and on machine decals, you will find precautionary statements ("**DANGER**", "**WARNING**", and "**CAUTION**") followed by specific instructions. These precautions are intended for the personal safety of you and those working with you. Please take the time to read them.

⚠ DANGER ⚠

This word "DANGER" indicates an immediate hazardous situation that, if not avoided, will result in death or serious injury. The color associated with Danger is RED.

⚠ WARNING ⚠

This word "WARNING" indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. The color associated with Warning is ORANGE.

⚠ CAUTION ⚠

This word "CAUTION" indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. The color associated with Caution is YELLOW.

FAILURE TO FOLLOW THE "DANGER", "WARNING", AND "CAUTION" INSTRUCTIONS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.

MACHINE SAFETY

The precautionary statement ("**IMPORTANT**") is followed by specific instructions. This statement is intended for machine safety.

IMPORTANT: *The word "IMPORTANT" is used to inform the reader of something he needs to know to prevent minor machine damage if a certain procedure is not followed.*

INFORMATION

NOTE: *Instructions used to identify and present supplementary information.*

SAFETY

PRECAUTIONARY STATEMENTS

A careful operator is the best operator. Most accidents can be avoided by observing certain precautions. To help prevent accidents, read the following precautions before operating this equipment. Equipment should be operated only by those who are responsible and instructed to do so.

Carefully review the procedures given in this manual with all operators. It is important that all operators be familiar with and follow safety precautions.

THE TRACTOR

1. Read the Operator's Manual carefully before using the tractor. Lack of operating knowledge can lead to accidents.
2. Use an approved roll bar and seat belt for safe operation. Overturning a tractor without a roll bar can result in death or injury. If your tractor is not equipped with a roll bar and seat belt, see your New Holland Dealer.
3. Always use the seat belt. The only instance when the seat belt should not be used is if the roll bar has been removed from the tractor or folding ROPS is in down position.
4. If a front end loader is to be installed, always use a FOPS (Falling Object Protective Structure) canopy to avoid injury from falling objects.
5. Use the handholds and step plates when getting on and off the tractor to prevent falls. Keep steps and platform cleared of mud and debris.
6. Do not permit anyone but the operator to ride on the tractor. There is no safe place for extra riders.
7. Keep all safety decals clean of dirt and grime, and replace all missing, illegible, or damaged safety decals. See the list of decals in the Decal section of this manual.

SERVICING THE TRACTOR

1. The cooling system operates under pressure which is controlled by the radiator cap. It is dangerous to remove the cap while the system is hot. Always turn the cap slowly to the first stop and allow pressure to escape before removing the cap entirely.
2. Keep any type of open flame away from the tractor and do not smoke while refueling. Wait for the engine to cool before refueling.
3. Keep the tractor and equipment, particularly brakes and steering, maintained in a reliable and satisfactory condition to ensure your safety and comply with legal requirements.
4. Keep open flame or cold weather starting aids away from the battery to prevent fires or explosions. Use jumper cables according to instructions to prevent sparks which could cause explosion. Do not use chemical starting aids on glow plug equipped tractors.
5. Stop the engine before performing any service on the tractor.
6. Escaping hydraulic/diesel fluid under pressure can penetrate the skin causing serious injury. If fluid is injected into the skin, obtain medical attention immediately or gangrene may result.
   - DO NOT use your hand to check for leaks. Use a piece of cardboard or paper to search for leaks.
   - Stop the engine and relieve pressure before connecting or disconnecting lines.
   - Tighten all connections before starting the engine or pressurizing lines.
7. Do not modify or permit anyone else to modify or alter this tractor or any of its components or functions without first consulting a New Holland Dealer.
8. The fuel oil in the injection system is under high pressure and can penetrate the skin. Unqualified persons should not remove or attempt to adjust a pump, injector, nozzle, or any other part of the fuel injection system. Failure to follow these instructions can result in serious injury.
9. Continuous long-term contact with used engine oil may cause skin cancer. Avoid prolonged contact with used engine oil. Wash skin promptly with soap and water.

10. Some components of your tractor, such as gaskets and friction surfaces (brake linings, clutch linings, etc.) may contain asbestos. Breathing asbestos dust is dangerous to your health. You are advised to have any maintenance or repair on such components carried out by an authorized New Holland Dealer. However, if service operations are to be undertaken on parts that contain asbestos, the essential precautions listed below must be observed:
    - Work out of doors or in a well ventilated area.
    - Dust found on the tractor or produced during work on the tractor should be removed by extraction, not by blowing.
    - Dust waste should be dampened, placed in a sealed container, and marked to ensure safe disposal.
    - If any cutting, drilling, etc. is attempted on materials containing asbestos, the item should be dampened and only hand tools or low speed power tools used.

OPERATING THE TRACTOR

1. Before starting the tractor, apply the parking brake, place the PTO lever in the “OFF” position, the lift control lever in the down position, the remote control valve levers in the neutral position, and the transmission in neutral.
2. Always sit in the tractor seat when starting the engine or operating controls. Do not start the engine or operate controls while standing beside the tractor.
3. Do not bypass the neutral start switches. Consult your New Holland Dealer if your neutral start controls malfunction. Use jumper cables only in the recommended manner. Improper use can result in tractor runaway.
4. Avoid accidental contact with the gear shift lever while the engine is running, as this can cause unexpected tractor movement.
5. Before getting off the tractor, disengage the PTO, turn the engine off, and apply the parking brake. Never get off the tractor while it is in motion.
6. Do not park the tractor on a steep incline.
7. Do not operate the tractor engine in an enclosed building without adequate ventilation. Exhaust fumes can cause death or illness.
8. If the power steering or engine ceases operating, stop the tractor immediately.
9. Pull only from the drawbar or the lower link drawbar in the down position. Use only a drawbar pin that locks in place. Pulling from the tractor rear axle or any point above the axle may cause the tractor to upset.
10. If the front end of the tractor tends to rise when heavy implements are attached to the three-point hitch, install front end weights. Do not operate the tractor with a light front end.
11. Always set the hydraulic selector lever in position control when attaching or transporting equipment. Ensure hydraulic couplers are properly mounted and will disconnect safely in case of accidental detachment of implement.
12. Do not leave equipment in the raised position.
13. Use the flasher/turn signal lights and SMV signs when traveling on public roads both day and night (unless prohibited by law).
14. When operating at night, adjust lights to prevent blinding oncoming drivers.

DRIVING THE TRACTOR

1. Watch where you are going, especially at row ends, on roads, around trees and low hanging obstacles.
2. To avoid upsets, drive the tractor with care and at a safe speed. Use extra caution when operating over rough ground, when crossing ditches or slopes, and when turning corners.
3. To provide two-wheel braking, lock tractor brake pedals together when transporting on roads.
4. Do not coast or free wheel down hills. Use the same gear when going downhill as is used when going uphill.
5. Any towed vehicle with a total weight exceeding that of the towing tractor should be equipped with brakes for safe operation.
6. If the tractor becomes stuck or the tires become frozen to the ground, back up the tractor to prevent upset.
7. Always check overhead clearance, especially when transporting the tractor.
8. When operating at night, adjust lights to prevent blinding oncoming drivers.

OPERATING THE PTO

1. When operating PTO driven equipment, shut off the engine and wait until the PTO stops before getting off the tractor and disconnecting the equipment.
2. Do not wear loose clothing when operating the power take-off or when near rotating equipment.
3. When operating stationary PTO driven equipment, always place range gear shift lever in neutral, apply the tractor parking brake, and block the rear wheels front and back.
4. To avoid injury, do not clean, adjust, unclog, or service PTO driven equipment when the tractor engine is running.
5. Ensure the PTO master shield is installed at all times. Always replace the PTO shield cap when the PTO is not in use.

DIESEL FUEL

1. UNDER NO CIRCUMSTANCES should gasoline, alcohol, or blended fuels be added to diesel fuel. These combinations can create an increased fire or explosive hazard. Such blends are more explosive than pure gasoline in a closed container such as a fuel tank. DO NOT USE THESE BLENDS.
2. Never remove the fuel cap or refuel with the engine running or hot.
3. Do not smoke while refueling or when standing near fuel.
4. Maintain control of the fuel filler pipe nozzle when filling the tank.
5. Do not fill the fuel tank to capacity. Allow room for expansion.
6. Wipe up spilled fuel immediately.
7. Always tighten the fuel tank cap securely.
8. If the original fuel tank cap is lost, replace it with a New Holland approved cap. A non-approved, proprietary cap may not be safe.
9. Keep equipment clean and properly maintained.
10. Do not drive equipment near open fires.
11. Never use fuel for cleaning purposes.
12. Arrange fuel purchases so that winter grade fuels are not held over and used in the spring.

SAFETY FRAME (ROPS)

Your New Holland tractor is equipped with a safety frame. It must be maintained in a serviceable condition. Be careful when driving through doorways or working in confined spaces with low headroom.

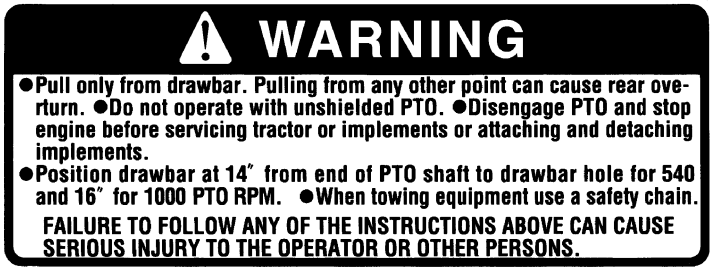
UNDER NO CIRCUMSTANCES should you:

- modify, drill, or alter the safety frame in any way. Doing so may render you liable to legal prosecution.
- attempt to straighten or weld any part of the main frame or retaining brackets which have suffered damage. Doing so may weaken the structure and endanger your safety.
- secure any parts on the main frame or attach your safety frame with anything other than the special high tensile bolts and nuts specified.
- attach chains or ropes to the main frame for pulling purposes.
- take unnecessary risks even though your safety frame affords you the maximum protection possible.

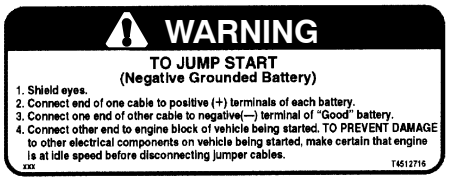
SAFETY DECALS

The following safety decals have been placed on your machine in the areas indicated. They are intended for your personal safety and for those working with you. Please take this manual and walk around your machine to note the content and location of these warning signs. Review these warning signs and the operating instructions detailed in this manual with your machine operators.

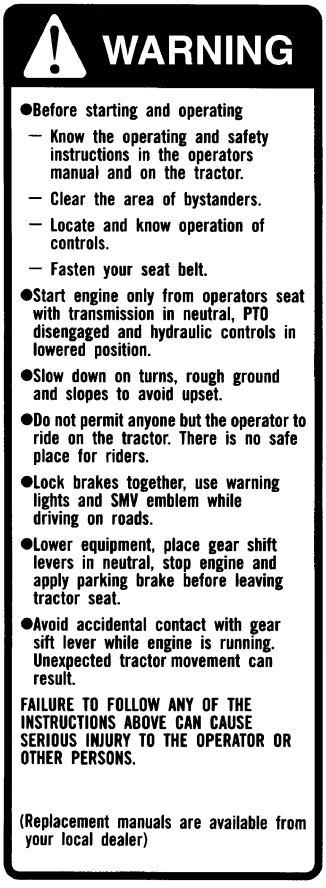
Keep the decals legible. If they are not, obtain replacements from your authorized dealer. The decal replacement part numbers are listed with each decal.



WARNING: Pull Only From Drawbar
PART NO: SBA390192293
LOCATION: Top of PTO Shield

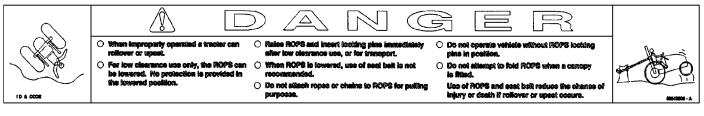


WARNING: To Jump Start
PART NO: SBA490990571
LOCATION: Right Side of Battery Box

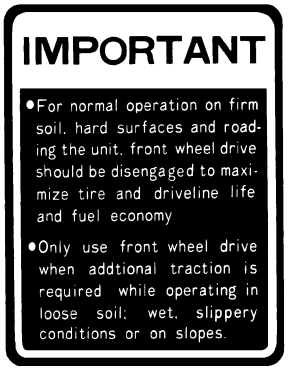


WARNING: Before Starting and Operating
PART NO: SBA390198380
LOCATION: Inside Left-Hand Fender

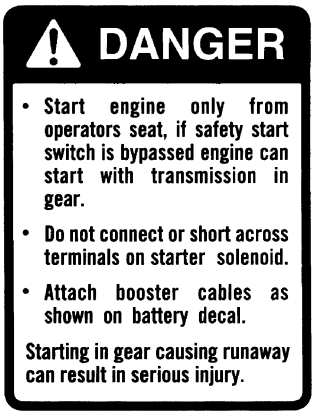
WARNING: Rotating Fan and Belts
PART NO: SBA390198470
LOCATION: Both Sides of Radiator Shroud



DANGER: ROPS
PART NO: SBA390197530
LOCATION: Top Under Side of ROPS



IMPORTANT: Front-Wheel Drive Usage
PART NO: SBA390198310
LOCATION: Lower Left Seat Platform



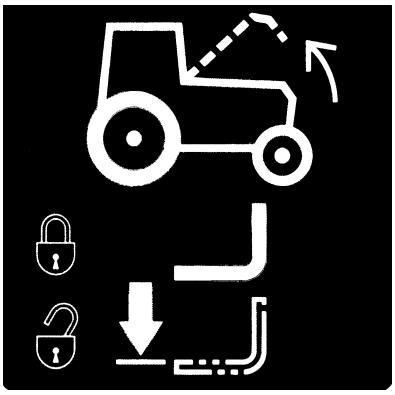
DANGER: Start Engine Only From Operator's Seat
PART NO: SBA390196683
LOCATION: On Firewall near the Starter Motor

WARNING: Lock Park Brake
PART NO: SBA390195301
LOCATION: Right Side of Steering Column Shroud

DANGER: Explosive/Acid - Poison
PART NO: SBA390197660
LOCATION: Left Side of Battery Box

WARNING: Do Not Operate with Shield Removed
PART NO: SBA390198480
LOCATION: Rear Corners of Battery Box and Engine Side shields

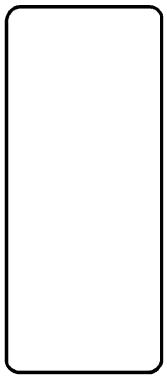
WARNING: Operate Controls only from Tractor seat
PART NO: 87300025
LOCATION: Rear of Right and Left Fenders



Hood Lock
PART NO: SBA390198960
LOCATION: Right side of front frame

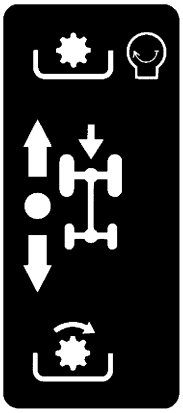
Red Reflective Tape
PART NO: 86400366
LOCATION: Rear of both fenders

Steering Wheel Tilt
PART NO: SBA390198970
LOCATION: Left side of steering column shroud

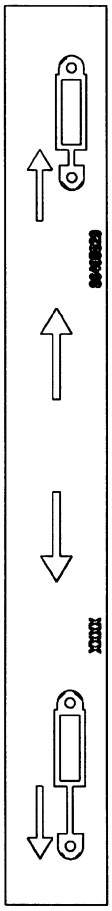


Red Reflective Tape
PART NO: SBA385150241
LOCATION: Both sides, Rear upright of ROPS

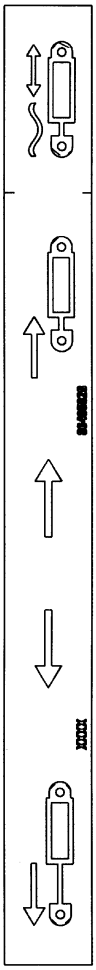
INSTRUCTION DECALS



PTO Engagement
PART NO:
SBA390174160
LOCATION:
Left Control Quadrant

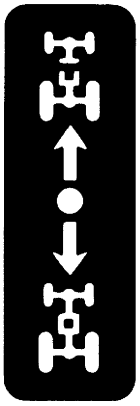


Operating Rear
Remote Control
Valve-Single Spool
PART NO:
86405829 - Brown #3 Valve
LOCATION:
Right Control Quadrant

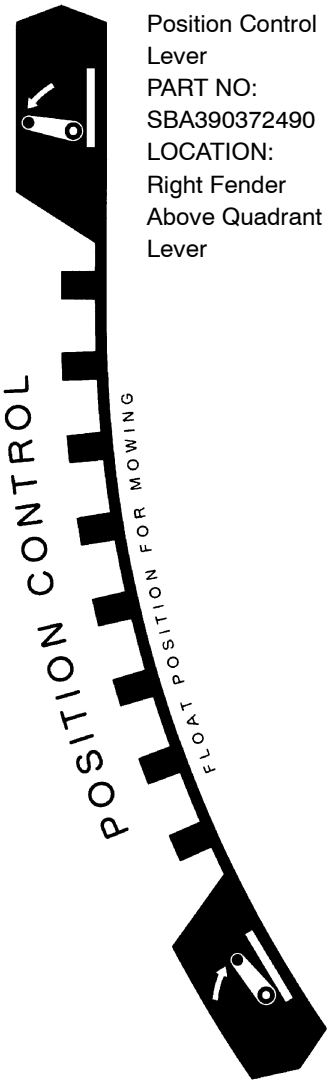


Operating Rear
Remote Control
Valve-Single Spool
PART NO:
86405828 - Green #1 Valve
PART NO:
86405827 - Blue #2 Valve
LOCATION:
Right Control Quadrant

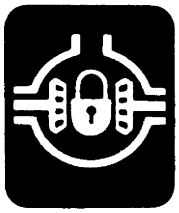
Range Selector
Lever
PART NO:
SBA390174120
LOCATION:
Left Control Quadrant



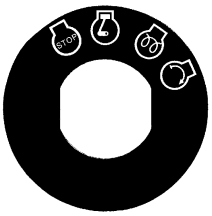
Front-Wheel
Drive Control
Lever
PART NO:
SBA390173870
LOCATION:
Lower Left Side of
Operator's Platform



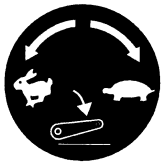
Position Control
Lever
PART NO:
SBA390372490
LOCATION:
Right Fender
Above Quadrant
Lever



Differential Lock
PART NO:
SBA390198300
LOCATION:Above Pedal Right Side of Operator's Platform

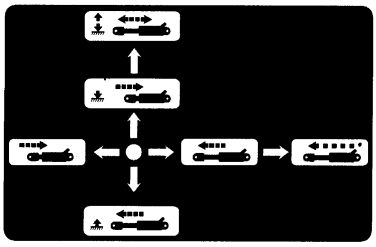


Starter Switch
PART NO:
SBA390197280
LOCATION:
Starter Switch, Right Side of Instrument Panel



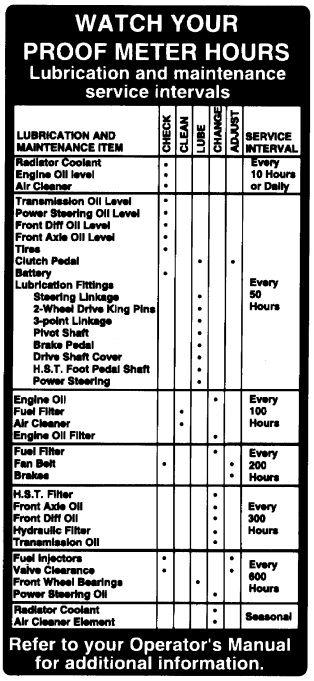
Flow Control Valve
PART NO:
SBA390372470
LOCATION:
Top of Flow Control Knob

Engine Oil
PART NO:
SBA390230220
LOCATION:
Engine Oil Filler Cap



Operating Remote Control Valve-Double Spool
PART NO:
86401095
LOCATION:
Cover of 2-Spool Remote Valve

Power Steering Fluid
PART NO:
SBA390230230
LOCATION:
Top of P.S. Reservoir



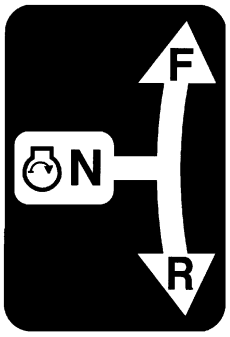
WATCH YOUR PROOF METER HOURS
Lubrication and maintenance service intervals

LUBRICATION AND MAINTENANCE ITEM	CHECK	CLEAN	LUBE	CHANGE	ADJUST	SERVICE INTERVAL
Radiator Coolant	•					Every 10 Hours or Daily
Engine Oil level	•					
Air Cleaner	•					
Transmission Oil Level	•					Every 50 Hours
Power Steering Oil Level	•					
Front Diff Oil Level	•					
Front Axle Oil Level	•					
Tires	•					
Clutch Pedal			•		•	
Battery	•					
Lubrication Fittings						
Steering Linkage			•			
2-Wheel Drive King Pins			•			
3-point Linkage			•			
Pivot Shaft			•			
Brake Pedal			•			
Drive Shaft Cover			•			
H.S.T. Foot Pedal Shaft			•			
Power Steering			•			
Engine Oil				•		Every 100 Hours
Fuel Filter		•				
Air Cleaner		•				
Engine Oil Filter				•		
Fuel Filter				•		Every 200 Hours
Fan Belt	•				•	
Brakes					•	
H.S.T. Filter				•		Every 300 Hours
Front Axle Oil				•		
Front Diff Oil				•		
Hydraulic Filter				•		
Transmission Oil				•		
Fuel Injectors	•				•	Every 600 Hours
Valve Clearance	•				•	
Front Wheel Bearings			•			
Power Steering Oil				•		
Radiator Coolant				•		Seasonal
Air Cleaner Element				•		

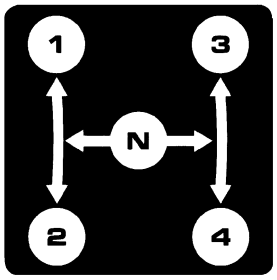
Refer to your Operator's Manual for additional information.

Lubrication and Maintenance Intervals
PART NO:
SBA390198350
LOCATION:
Air Filter Housing

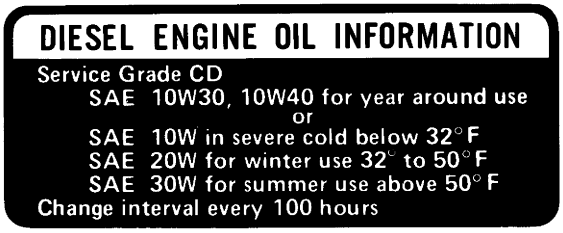
Auxiliary Power Socket
10 Amp Maximum Fuse
PART NO:
SBA390198780
LOCATION:
Right Control Quadrant



Forward/Reverse
Shuttle Lever
PART NO:
SBA390174131
LOCATION:Left
Side of Dash

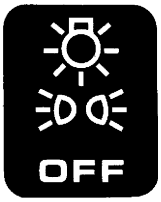


4-Speed Transmission
Lever
PART NO:
SBA390174140
LOCATION:
Right Side of Dash

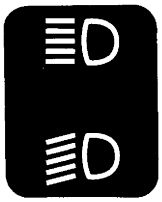


Diesel Engine Oil Information
PART NO: SBA190196490
LOCATION:
Fuel Tank Support Bracket Beside Oil Filler Neck

Parking Brake
PART NO: SBA390198360
LOCATION: Right Side
Steering Column Shroud



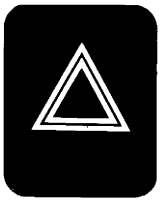
Road Light Switch
PART NO:
SBA390380790
LOCATION:
Left Side of Dash



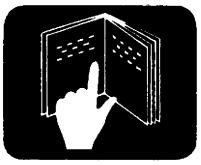
Road Light High
Beam Switch
PART NO:
SBA390230810
LOCATION:
Left Side of Dash

Field Lights Switch
PART NO:
SBA390380780
LOCATION:
Right Side of Dash

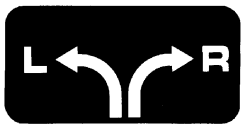
Throttle
PART NO: SBA390430290
LOCATION: Top Right Dash



Hazard Flasher Light
Switch
PART NO:
SBA390380770
LOCATION:
Right Side of Dash

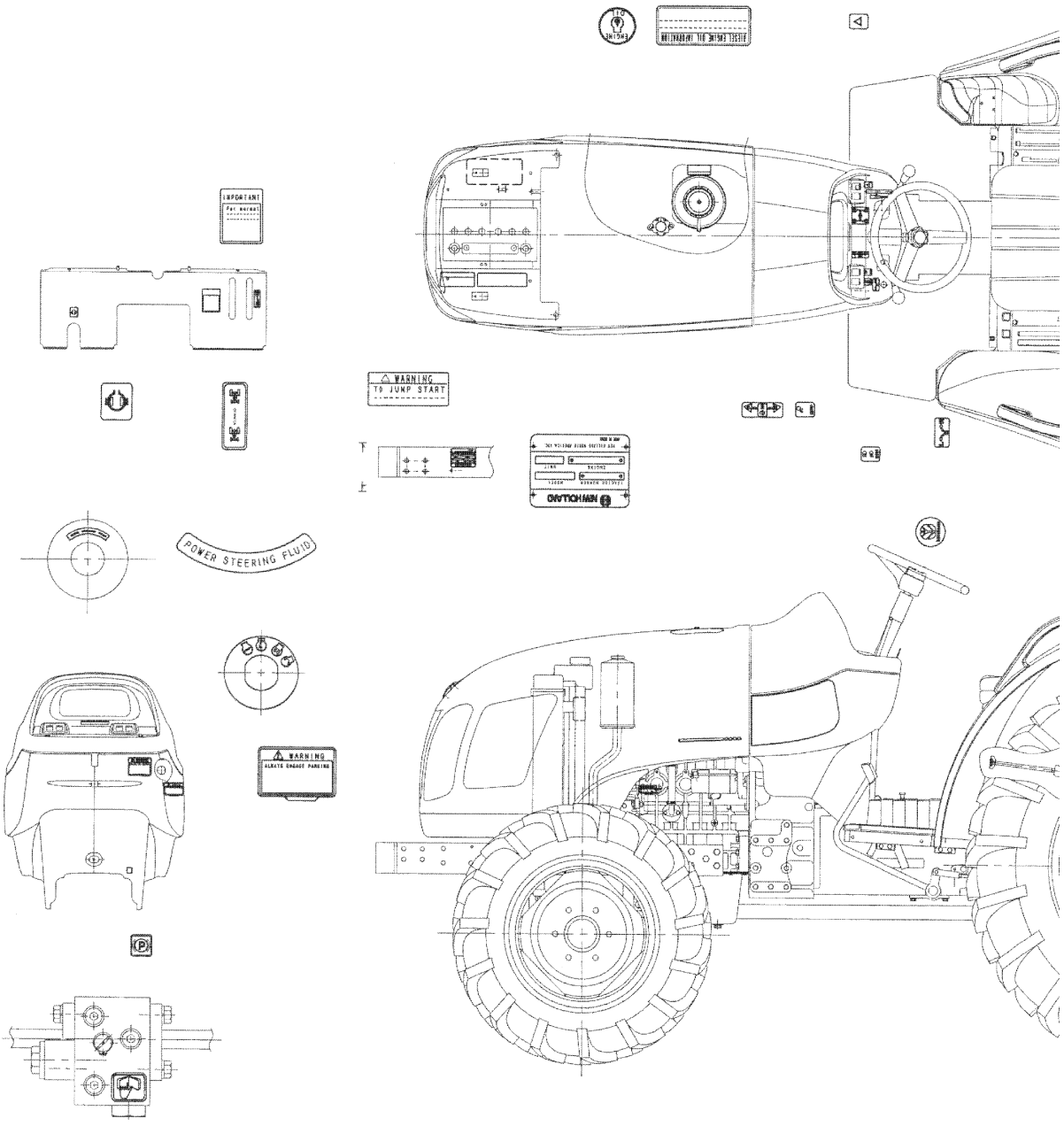


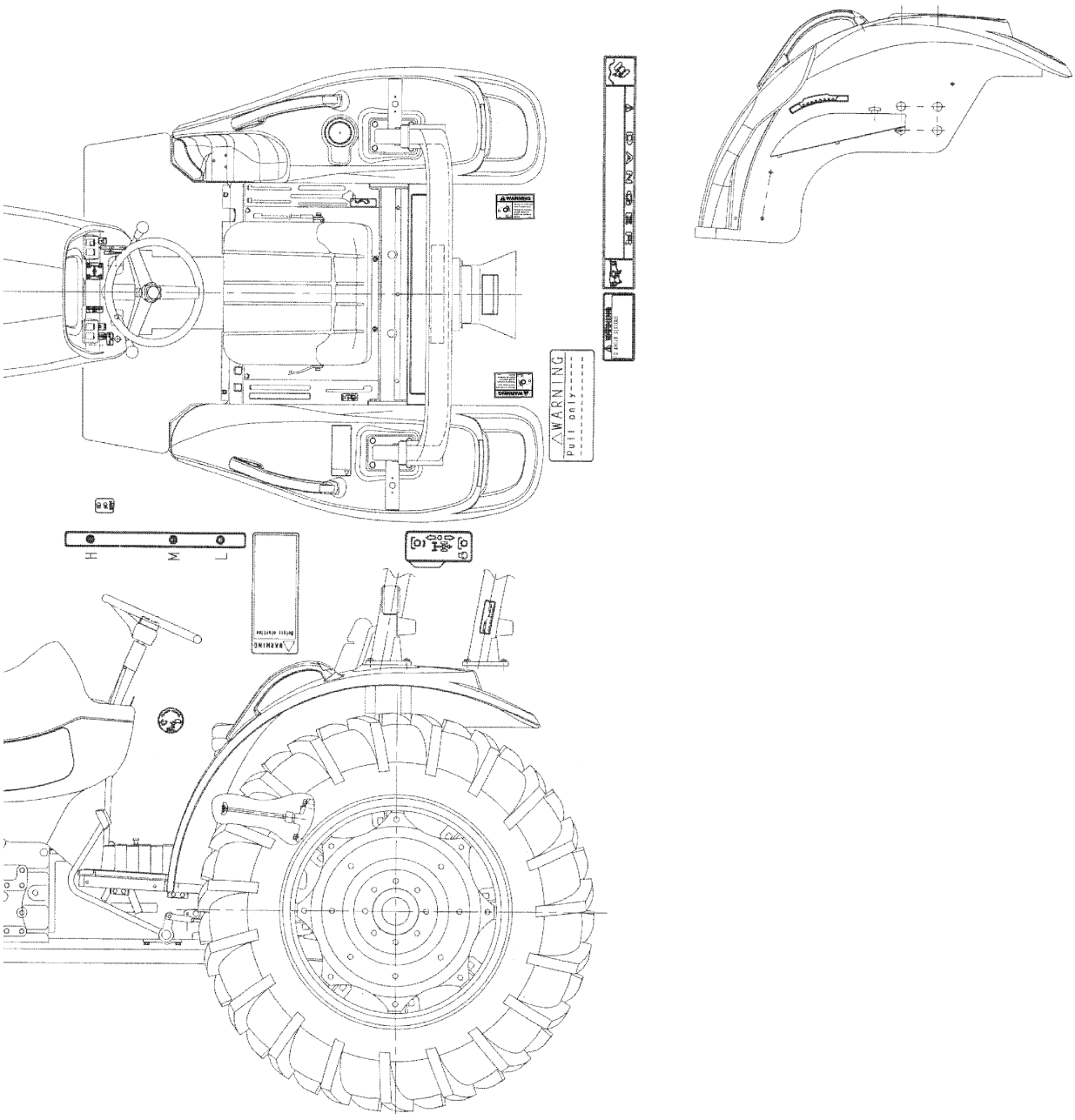
Hydraulic Manifold Operation
(see Operator's Manual)
PART NO: SBA390197660
LOCATION:
Top of Hydraulic Manifold Block



Turn Signal
PART NO: SBA390380800
LOCATION: Top Left Dash

DECAL PLACEMENT GUIDE




WARNING
Pull only

ECOLOGY AND THE ENVIRONMENT

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances which are required by advanced technology, common sense should govern the use and disposal of products of a chemical and petrochemical nature.

The following are recommendations which may be of assistance:

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use and dispose of these substances. Agricultural consultants will, in many cases, be able to help you as well.

HELPFUL HINTS

1. Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems which may cause considerable spillage.
2. In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances which may be harmful to your health.
3. Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
4. Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
5. Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil but should be collected and disposed of safely.
6. Do not open the air-conditioning system yourself. It contains gases which should not be released into the atmosphere. Your dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
7. Repair any leaks or defects in the engine cooling or hydraulic system immediately.
8. Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
9. Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

UNIVERSAL SYMBOLS

As a guide to the operation of your tractor, various universal symbols have been utilized on the instruments, controls, switches, and fuse box. The symbols are shown below with an indication of their meaning.

Thermostart starting aid

Alternator charge

Fuel level

Automatic Fuel shut-off

Engine speed (rev/min x 100)

Hours recorded

Engine oil pressure

Engine coolant temperature

Coolant level

Tractor lights

Headlamp main beam

Headlamp dipped beam

Work lamps

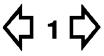
Stop lamps

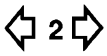
Horn

Radio

KAM Keep alive memory

Turn signals


Turn signals -one trailer


Turn signals -two trailers

Front wind-screen wash/wipe

Rear wind-screen wash/wipe

Heater temp-erature control

Heater fan

Air conditioner

Air filter blocked

Parking brake

Brake fluid level

Trailer brake

Roof beacon

Warning! Corrosive substance

P.T.O.

N Transmission in neutral

Creeper gears

Slow or low setting

Fast or high setting

Ground speed

Differential lock

Rear axle oil tem-perature

Transmission oil pressure

FWD engaged

FWD disengaged

Warning!

Hazard warning lights

Variable control

Pressurized! Open carefully

Position Control

Draft Control

Accessory socket

Implement socket

%age slip

Hitch raise (rear)

Hitch lower (rear)

Hitch height limit (rear)

Hitch height limit (front)

Hitch disabled

Hydraulic and transmission filters

Remote valve extend

Remote valve retract

Remote valve float

Malfunction! See Operator's Manual

Malfunction! (alternative symbol) See Operator's Manual

GENERAL INFORMATION

PLEASE READ CAREFULLY:

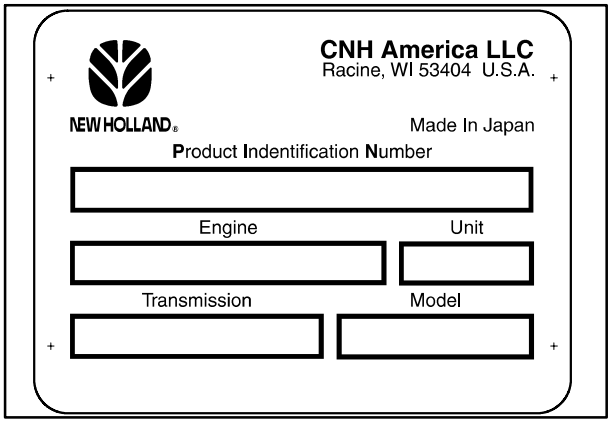
For a complete list of the pre-delivery service checks performed by your dealer, refer to the PRE-DELIVERY SERVICE checklist found at the back of this manual. Keep one copy as your record of the service performed. The other copy should be removed from the manual and kept by your dealer. MAKE SURE THAT BOTH COPIES ARE COMPLETED AND THAT YOU AND THE DEALER SIGN BOTH COPIES.

A PRODUCT IDENTIFICATION PLATE, 1, is located on the right-hand side of the tractor front end. The numbers on the plate are important in the event your tractor should require future service. For your convenience, have your dealer record these numbers in the appropriate spaces below.

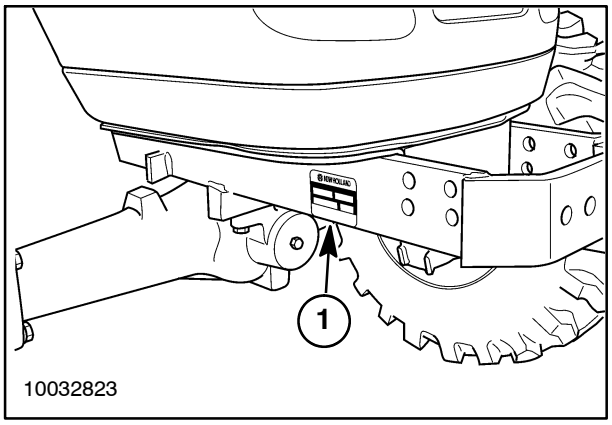
CNH America LLC is continually striving to improve its products. We reserve the right to change prices, specification, or equipment at any time without notice.

All data given in this book is subject to production variations. Dimensions and weights are approximate only, and the illustrations do not necessarily depict tractors in standard condition. For exact information about any particular tractor, please consult your New Holland dealer.

This tractor has been designed for doing light work, such as mowing, light tilling, blowing snow, and light loader work. Do not attempt to use implements that were not designed for this tractor, as they may cause damage to the tractor.



1



2

MINIMUM HARDWARE TIGHTENING TORQUES

IN NEWTON-METERS (FOOT POUNDS) FOR NORMAL ASSEMBLY APPLICATIONS

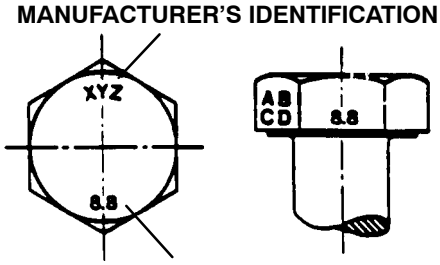
METRIC NON-FLANGED HARDWARE AND LOCKNUTS

NOMINAL SIZE	CLASS 5.8		CLASS 8.8		CLASS 10.9		LOCKNUT CL.8 W/CL8.8 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	
M4	1.7 (15)*	2.2 (19)*	2.6 (23)*	3.4 (30)*	3.7 (33)*	4.8 (42)*	2.3 (20)*
M6	5.8 (51)*	7.6 (67)*	8.9 (79)*	12 (102)*	13 (115)*	17 (150)*	7.8 (69)*
M8	14 (124)*	18 (159)*	22 (195)*	28 (248)*	31 (274)*	40 (354)*	19 (169)*
M10	28 (21)	36 (27)	43 (32)	56 (41)	61 (45)	79 (58)	38 (28)
M12	49 (36)	63 (46)	75 (55)	97 (72)	107 (79)	138 (102)	66 (49)
M16	121 (89)	158 (117)	186 (137)	240 (177)	266 (196)	344 (254)	164 (121)
M20	237 (175)	307 (226)	375 (277)	485 (358)	519 (383)	671 (495)	330 (243)
M24	411 (303)	531 (392)	648 (478)	839 (619)	897 (662)	1160 (855)	572 (422)

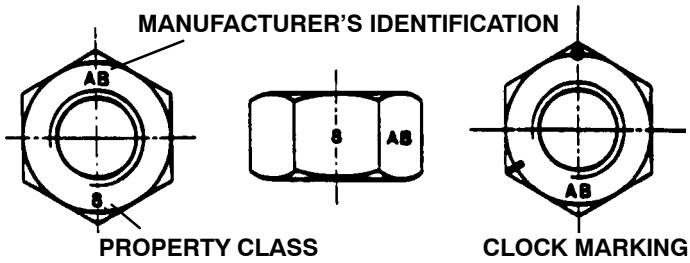
NOTE: Torque values shown with * are inch pounds.

IDENTIFICATION

HEX CAP SCREW AND CARRIAGE BOLTS CLASSES 5.6 AND UP



HEX NUTS AND LOCKNUTS CLASSES 05 AND UP



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MINIMUM HARDWARE TIGHTENING TORQUES

IN NEWTON-METERS (FOOT POUNDS) FOR NORMAL ASSEMBLY APPLICATIONS

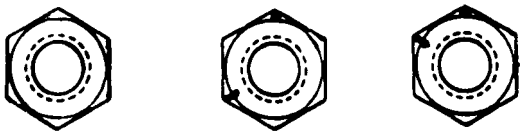
INCH NON-FLANGED HARDWARE AND LOCKNUTS

NOMINAL SIZE	SAE GRADE 2		SAE GRADE 5		SAE GRADE 8		LOCKNUTS		NOMINAL SIZE
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	GR.B w/GR5 BOLT	GR.C w/GR8 BOLT	
1/4	6.2 (55)*	8.1 (72)*	9.7 (86)*	13 (112)*	14 (121)*	18 (157)*	8.5 (75)*	12.2 (109)*	1/4
5/16	13 (115)*	17 (149)*	20 (178)*	26 (229)*	28 (250)*	37 (324)*	17.5 (155)*	25 (220)*	5/16
3/8	23 (17)	30 (22)	35 (26)	46 (34)	50 (37)	65 (48)	31 (23)	44 (33)	3/8
7/16	37 (27)	47 (35)	57 (42)	73 (54)	80 (59)	104 (77)	50 (37)	71 (53)	7/16
1/2	57 (42)	73 (54)	87 (64)	113 (83)	123 (91)	159 (117)	76 (56)	108 (80)	1/2
9/16	81 (60)	104 (77)	125 (92)	163 (120)	176 (130)	229 (169)	111 (82)	156 (115)	9/16
5/8	112 (83)	145 (107)	174 (128)	224 (165)	244 (180)	316 (233)	153 (113)	215 (159)	5/8
3/4	198 (146)	256 (189)	306 (226)	397 (293)	432 (319)	560 (413)	271 (200)	383 (282)	3/4
7/8	193 (142)	248 (183)	495 (365)	641 (473)	698 (515)	904 (667)	437 (323)	617 (455)	7/8
1	289 (213)	373 (275)	742 (547)	960 (708)	1048 (773)	1356 (1000)	654 (483)	924 (681)	1

NOTE: Torque values shown with * are inch pounds.

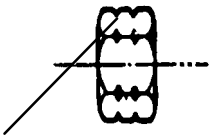
IDENTIFICATION
CAP SCREWS AND CARRIAGE BOLTS

SAE GRADE 2 SAE GRADE 5 SAE GRADE 8



REGULAR NUTS SAE GRADE 5 HEX NUTS SAE GRADE 8 HEX NUTS

LOCKNUTS



GRADE IDENTIFICATION
GRADE A NO NOTCHES
GRADE B ONE CIRCUMFERENTIAL NOTCH
GRADE C TWO CIRCUMFERENTIAL NOTCHES

GRADE IDENTIFICATION
GRADE A NO MARKS
GRADE B THREE MARKS
GRADE C SIX MARKS
MARKS NEED NOT BE LOCATED AT CORNERS

GRADE A NO MARK
GRADE B LETTER B
GRADE C LETTER C

GRADE IDENTIFICATION

86529681 REV F 5.2

LUBRICATION

Adequate lubrication and maintenance on a regular schedule is vital to maintaining your equipment. To ensure long service and efficient operation, follow the lubrication and maintenance schedules outlined in this manual. The use of proper fuels, oils, grease and filters, as well as keeping the systems clean, will also extend machine and component life.

IMPORTANT: *Always use genuine* ***New Holland*** *replacement parts, oils and filters to ensure proper operation, filtration of engine and hydraulic systems. See your* ***New Holland*** *dealer for additional oil quantities.*

GENERAL INFORMATION

Regular lubrication is the best insurance against delays and repairs. Proper lubrication will extend machine life. Refer to the following charts for lubricants and service intervals.

IMPORTANT: *Failure to complete the required maintenance at the recommended intervals can cause unnecessary downtime.*

The intervals listed in the Lubrication Chart are guidelines to be used when operating in normal conditions. Adjust the intervals for operating in adverse environmental and working conditions. The intervals should be shortened for sandy, dusty and extremely hot operating conditions.

⚠ CAUTION ⚠

Observe these safety precautions before performing lubrication and maintenance.

1. **Shut off engine.**
2. **Disengage all drives.**
3. **Lower all attachments to the ground or raise and engage all locks.**
4. **Close all shields opened and reinstall any shields removed for lubrication and maintenance proposes.**

⚠ CAUTION ⚠

Some illustrations in this manual show shields opened or removed to show areas being serviced. Replace all shields before operating this machine.

Always clean the area around dipsticks, fill caps, and check plugs when checking fluid levels. Failure to clean these areas may allow contamination to enter the system. Drain, flush and refill the system anytime you suspect it is contaminated.

Grease Fittings

Wipe dirt from fittings before greasing.

Pump fresh grease into fitting to adequately lubricate the component and force out any contamination from the grease passage.

Wipe off excess grease.

Use a grease gun containing clean high grade of multipurpose grease.

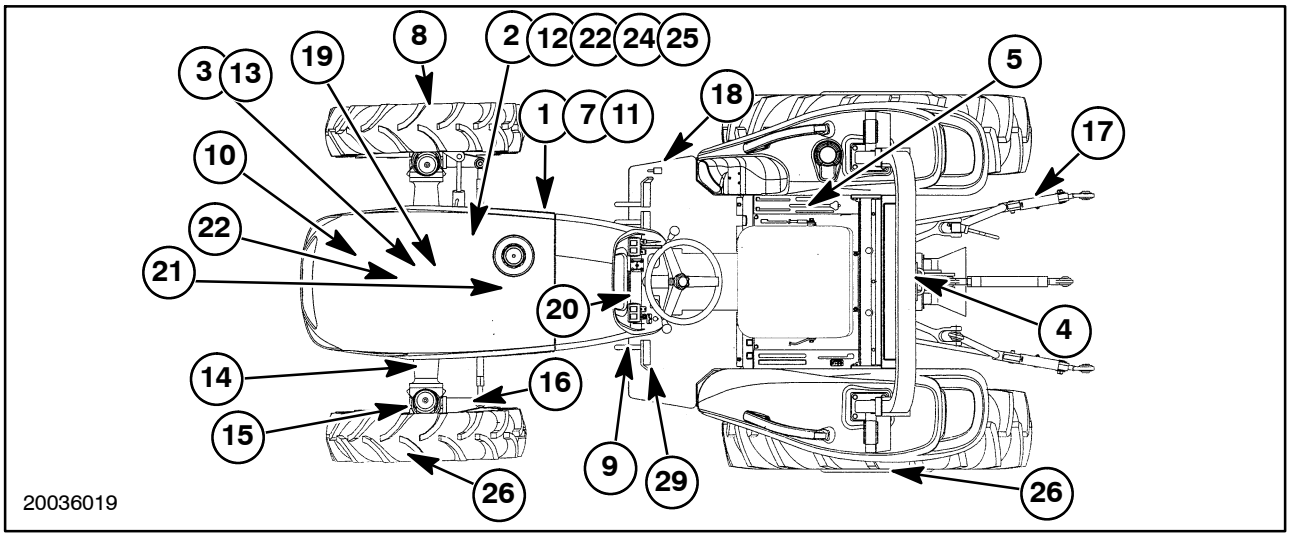
Chains

Stop all drives before lubricating chains.

Lubricant	Type and Description	Part Number	Container Size
Engine Oil	AMBRA SUPER GOLD SSL ENGINE OIL SAE 10W-40	86994335	2.5G / 9.46L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 10W	86641050	5G / 18.93L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 10W-30	9613313	1QT / .946L
		86641052	1G / 3.785L
		9613314	2.5G / 9.46L
		9673508DS	5G / 18.93L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 30	9613286	1QT / .946L
		86641043	1G / 3.785L
		9613289	2.5G / 9.46L
		86641044	5G / 18.93L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 40	9624812DS	55G / 208.2L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 15W-40	86641081	1QT / .946L
		86641082	1G / 3.785L
		86641084	2.5G / 9.46L
		86641083	5G / 18.93L
	AMBRA SUPER GOLD HSP ENGINE OIL SAE 20W-50	86994337	5G / 18.93L
	AMBRA AUTO SUPREME SAE 5W-30	9673589DS	1QT / .946L
	AMBRA AUTO SUPREME SAE 10W-30	86641101	1QT / .946L
Transmission Oil	AMBRA MULTI TRAN	86639558	1G / 3.785L
		86639559	2.5G / 9.46L
		86639560	5G / 18.93L
	AMBRA MULTI TRAN SSL	86994339	2.5G / 9.46L
	AMBRA MULTI BIO S	86994341	2.5G / 9.46L
Hydraulic Oil	AMBRA MULTI G 134	9624655DS	1QT / .946L
		9624656DS	1G / 3.785L
		9624450	2.5G / 9.46L
		9624451	5G / 18.93L
	AMBRA HYDROSYSTEM 46 HYD FLUID	86109085	5G / 18.93L
	AMBRA HYDROSYSTEM 68 HYD FLUID	86994331	5G / 18.93L
	AMBRA HYDROSYSTEM 100 HYD FLUID	86994343	5G / 18.93L
ATF Oil	AMBRA HYDRODEX 3 ATF	9613304	1QT / .946L
		9613312	2.5G / 9.46L
Gear Oil	AMBRA HYPOIDE 90 GEAR LUBE	9613295	1QT / .946L
		9613294	2.5G / 9.46L
		86994348	16G / 60.6L
	AMBRA HYPOIDE 140 GEAR LUBE	87027134*	1QT / .946L
		87027135	2.5G / 9.46L
		86994351	16G / 60.6L
	AMBRA TRANSAXLE FLUID	86994352	5G / 18.93L
	AMBRA HYPOIDE SSL GEAR LUBE	86994354	1QT / .946L
Grease	AMBRA GR-9 MULTI-PURPOSE GREASE	9613310	TUBE - 14 OZ.
	AMBRA HI-TEMP GREASE	9861804DS	TUBE - 14 OZ.
	AMBRA CORN HEAD GREASE	94107DS	TUBE - 14 OZ.
	AMBRA GR 75 MD GREASE	87400001	TUBE - 14 OZ.
	AMBRA GR 1000 SYNTHETIC GREASE	86994355	TUBE - 14 OZ.
	LIMITED SLIP ADDITIVE	B96606	
Brake Fluid	BRAKE LHM FLUID (Mineral Based Oil)	86541699DS	1QT / .946L
Coolant	ESE-M97B18-D, Ethylene Glycol Coolant Concentrate	FGCC2701DS	1G / 3.785L
	Propylene Glycol Concentrate	FGCC2711DS	1G / 3.785L

*See specifications pages for current fluids for your tractor.

LUBRICATION AND MAINTENANCE CHART
NEW HOLLAND T2410, T2420 — FRONT-WHEEL DRIVE



3

NO.	LUBRICATION & MAINTENANCE ITEMS	CHECK	CLEAN	LUBE	CHANGE	ADJUST	SERVICE INTER-VALS
1	Engine Oil Level	X					Every 10 Hours or Daily
2	Air Cleaner	X					
3	Radiator Coolant	X					
4	Transmission Oil Level	X					
5	Hydraulic Filter				X		First 50 Hours
1, 7	Engine Oil & Filter				X		
8	Tire Pressure	X					
11	Fuel Filter				X		
26	Wheel Bolt Torque	X					
—	All Fluid Levels	X					
8	Tires	X					Every 50 Hours
10	Battery	X					
12	Power Steering Oil Level	X					
13	Fan Belt	X					
14	Front Axle Oil Level	X					
15	Final Reduction Gear Cases Oil Level	X					
	Lubrication Fittings:						
16	Steering Linkage			X			
17	3-Point Linkage			X			
9	Brake Pedal			X			
19	Power Steering Cylinder			X			
20	Pedal Shaft			X			
21	Drive Cover Shaft			X			
22	Pivot Shaft			X			

NO.	LUBRICATION & MAINTENANCE ITEMS	CHECK	CLEAN	LUBE	CHANGE	ADJUST	SERVICE INTER-VALS
1, 7	Engine Oil & Filter				X		Every 100 Hours
2	Air Cleaner Element		X				
11	Fuel Filter		X				
29	Brake Pedal Free play					X	Every 200 Hours
11	Fuel Filter Element				X		
13	Fan Belt					X	
26	Wheel Bolt Torque	X					
4	Transmission Oil				X		Every 300 Hours
5	Hydraulic Filter				X		
14	Front Axle Oil				X		
15	Final Reduction Gear Cases Oil				X		
12	Power Steering Oil & Filter				X		Every 600 Hours *Refer to Repair Manual
24*	Fuel Injector	X				X	
25*	Valve Clearance	X				X	
2	Air Cleaner Element				X		Seasonal
3	Radiator Coolant				X		
2	Safety Air Filter Element				X		Every 3rd Primary Element Change or Every **1000** Hours, Whichever Comes First

LUBRICATION FITTINGS

NOTE: *After every 50 hours of normal operation, apply a good quality grease to the lubrication points listed below (refer to the Recommended Lubricants chart). When operating under extremely dirty conditions, lubricate more frequently than every 50 hours.*

- Steering Linkage
- Front Axle Pivot
- Power Steering Cylinder
- Pedal Shaft - Clutch & Brake Pedals
- 3-Point Linkage

To lubricate these points:

1. Wipe away all old grease and dirt from the lubrication fittings to prevent dirt or foreign material from entering as new grease is applied.
2. Use a high pressure grease gun to force in the new grease. Apply pressure until clean grease oozes from each lubrication point.
3. Wipe away any excess grease.

DIESEL FUEL

- Use clean, quality No. 1-D or No. 2-D fuel (ASTM D975).
- Use No. 1-D fuel if the ambient temperature is expected to be lower than 40°F (4°C) or if the tractor is to be used at an altitude exceeding 1524 m (5000 ft.).
- Use No. 2-D diesel fuel with a pour point of at least 10°F (-12°C) below the expected ambient temperature to prevent fuel flow problems in cold weather.
- Keep dirt from entering the fuel tank.
- Sulfur content of the fuel should be no more than 0.5%.
- Sediment and water content should not exceed 0.05%.
- Minimum cetane number is 40. Low temperature or high altitude operation may require use of fuel with a higher cetane number.
- Use properly mixed winter fuel when temperatures are extremely cold. In most areas, diesel fuel is properly blended for summer and winter grades as ambient temperatures change. In winter, use winter grade diesel fuel only. Otherwise, the fuel may cloud and block the fuel system.

Fuel Usage Safety

- UNDER NO CIRCUMSTANCES should gasoline, alcohol, or gasohol be added to diesel fuel. These combinations can create an increased fire or explosive hazard.
- Never remove the fuel cap or refuel the tractor while the engine is running or hot.
- Never smoke while refueling or anywhere near fuel.
- When filling the tank, maintain control of the nozzle.
- Do not fill the fuel tank to capacity. Allow room for expansion.
- Wipe up spills immediately.
- Always tighten the fuel cap securely.
- If the original fuel tank cap is lost, always replace it with a New Holland approved cap. A “will-fit” cap may not be safe.
- Keep equipment properly maintained.
- Do not drive equipment near open fires.
- Never use gasoline for cleaning parts.

SPECIFICATIONS

	Model T2410	Model T2420
ENGINE		
Type/Model	Diesel/844L	Diesel/N844L-T
Engine Gross Horsepower	41 kw (55)	44.8 kw (60)
Cylinders	4	4
Bore	84 mm (3.31″)	84 mm (3.31″)
Stroke	100 mm (3.94″)	100 mm (3.94″)
Displacement	2.2 L	2.2 L
	(135.2 cu-in)	(135.2 cu-in)
Compression Ratio	22.4:1	22.4:1
Firing Order	1-3-4-2	1-3-4-2
Low Idle Speed	1000 RPM (± 50)	1000 RPM (± 50)
Maximum Speed:		
High Idle	2900 RPM (± 50)	3000 RPM (± 50)
Rated	2700 RPM (± 50)	2800 RPM (± 50)
CAPACITIES		
Fuel Tank	51.0 liters/ 13.5 U.S. gals	51.0 liters/ 13.5 U.S. gals
Cooling System	5.5 liters/ 5.8 U.S. qts	5.5 liters/ 5.8 U.S. qts
Engine Crankcase:		
With Filter	7.0 liters/ 7.4 U.S. qts	7.0 liters/ 7.4 U.S. qts
Rear Axle & Transmission (EHSS & SSS) (Includes Hydraulics)	42.0 liters/ 11.1 U.S. gals	42.0 liters/ 11.1 U.S. gals
Power Steering	1.8 liters/ 1.9 U.S. qts	1.8 liters/ 1.9 U.S. qts
Front Axle Final Reduction /Differential Gear Case	5.8 liters/ 6.1 U.S. qts	5.8 liters/ 6.1 U.S. qts

	Model T2410/T2420
COOLING SYSTEM	
Type	Pressurized Liquid with Recirculating Bypass
Water Pump:	
Type	Centrifugal
Drive	V-Belt
Belt Deflection	5 mm-10 mm (0.2 - 0.4 in) when 5 kg (11 lbs) thumb pressure is applied midway between belt pulleys
Fan Diameter	410 mm (16.1″)
Number of Fan Blades	8
Thermostat:	
Start to Open	71°C (160°F)
Fully Open	82°C (180°F)
Radiator Cap	0.9 bar (13 psi)
ELECTRICAL SYSTEM	
Main System Protection	Fusible Link
Number Fuses for Circuit Protection	7
Alternator	12-volt, Heavy Duty, 55 amps
Battery Type	12-volt, w/ negative ground, 700 cca
Starter HP (KW) Rating	2.7 (2.0)
Starting Motor	Solenoid Pre-Engaged Reduction
FUEL SYSTEM	
Fuel Type	Diesel
Type of Fuel to Use if Above 40°F	No. 2-Diesel, Cetane Rating: Minimum 40
Type of Fuel to Use if Below 40°F	No. 1-Diesel, Cetane Rating: Minimum 40
Injection Pump:	
Type	In-Line
Timing	19° BTDC - T2420 19° BTDC - T2410

	Model T2410/T2420
BRAKES	
Type	Wet Disc
4 Disc Diameter (per axle)	175 mm x 143 mm (6.9″ x 5.6″)
STEERING	
Type	Power
Pump Flow @ Rated RPM	5.52 gpm (20.87 lpm)
Steering Relief Valve Setting	142 bar (2060 psi)
Turns Lock-to-Lock:	
FWD	4/3.2
Front Wheel Toe-In	0 mm-5 mm (0″-13/64″)
Turning Radius w/o Brakes:	
FWD	3150 mm (120.0″)
Max. Turn Angle: FWD	56°
Front to rear axle ratio	1.5968 to 1
POWER TAKE-OFF	
Type	Independent
Shaft:	
Rear PTO	35 mm (1-3/8″)
Mid PTO	N/A
Engine Speed for 540 RPM Rear PTO Operation	2475 RPM
Horsepower PTO Observed	34.3 kw (46 HP) - T2410 (EHSS) 35.0 kw (47 HP) - T2410 (SSS) 36.8 kw (49.4 HP) - T2420 (EHSS) 37.6 kw (50.5 HP) - T2420 (SSS)
HYDRAULIC LIFT SYSTEM	
Type	Open Center
Pump Type	Gear
Pump Capacity	43.9 lpm - T2410 (11.6 U.S. gpm) 45.5 lpm - T2420 (12.0 U.S. gpm)
System Relief Valve Setting	172 bar (2490 psi)
Number of Rear Remotes Available	3 (optional)
Number of Mid Remotes Available	2 (optional)

MODEL T2410—EHSS
TRANSMISSION SPEEDS: KPH (MPH)

Tire Size		R1 14.9 x 24	R1 14.9 x 28	R4 18.4 x 24	Turf 44 x 18-20.00
Range/Speed Lever Position **R = Range Lever S = Speed Lever**					
FORWARD	R=L, S=1	1.74 (1.08)	1.89 (1.17)	1.86 (1.16)	1.49 (0.93)
	R=L, S=2	2.35 (1.46)	2.56 (1.59)	2.51 (1.56)	2.02 (1.26)
	R=L, S=3	3.08 (1.91)	3.35 (2.08)	3.29 (2.04)	2.65 (1.64)
	R=L, S=4	3.96 (2.46)	4.30 (2.67)	4.22 (2.62)	3.40 (2.11)
	R=M, S=1	4.51 (2.80)	4.90 (3.04)	4.81 (2.98)	3.87 (2.40)
	R=M, S=2	6.10 (3.79)	6.63 (4.12)	6.51 (4.04)	5.24 (3.26)
	R=M, S=3	7.98 (4.96)	8.68 (5.39)	8.52 (5.29)	6.86 (4.26)
	R=M, S=4	10.24 (6.36)	11.14 (6.92)	10.94 (6.80)	8.81 (5.47)
	R=H, S=1	12.32 (7.65)	13.39 (8.32)	13.15 (8.17)	10.59 (6.58)
	R=H, S=2	16.69 (10.37)	18.14 (11.27)	17.81 (11.06)	14.34 (8.91)
	R=H, S=3	21.84 (13.57)	23.74 (14.75)	23.31 (14.48)	18.77 (11.66)
	R=H, S=4	28.03 (17.42)	30.47 (18.93)	29.92 (18.59)	24.09 (14.97)
REVERSE	R=L, S=1	1.77 (1.09)	1.92 (1.19)	1.88 (1.17)	1.51 (0.94)
	R=L, S=2	2.38 (1.48)	2.59 (1.61)	2.55 (1.58)	2.05 (1.27)
	R=L, S=3	3.13 (1.94)	3.40 (1.89)	3.33 (2.07)	2.69 (1.67)
	R=L, S=4	4.01 (2.49)	4.36 (2.71)	4.28 (2.66)	3.45 (2.14)
	R=M, S=1	4.56 (2.83)	4.96 (3.08)	4.87 (3.03)	3.92 (2.43)
	R=M, S=2	6.18 (3.84)	6.72 (4.17)	6.60 (4.10)	5.31 (3.30)
	R=M, S=3	8.10 (5.03)	8.80 (5.47)	8.64 (5.37)	6.95 (4.32)
	R=M, S=4	10.39 (6.46)	11.29 (7.02)	11.08 (6.88)	8.93 (5.55)
	R=H, S=1	12.48 (7.75)	13.57 (8.43)	13.33 (8.28)	10.73 (6.67)
	R=H, S=2	16.90 (10.50)	18.38 (11.42)	18.04 (11.20)	14.53 (9.03)
	R=H, S=3	22.13 (13.75)	24.06 (14.95)	23.62 (14.68)	19.02 (11.82)
	R=H, S=4	27.80 (17.27)	30.88 (19.19)	30.32 (18.84)	24.41 (15.17)

MODEL T2420—EHSS
TRANSMISSION SPEEDS: KPH (MPH)

Tire Size		R1 14.9 x 24	R1 14.9 x 28	R4 18.4 x 24	Turf 44 x 18-20.00
Range/Speed Lever Position **R = Range Lever S = Speed Lever**					
FORWARD	R=L, S=1	1.80 (1.11)	1.96 (1.22)	1.93 (1.20)	1.55 (0.96)
	R=L, S=2	2.45 (1.52)	2.66 (1.65)	2.61 (1.62)	2.10 (1.30)
	R=L, S=3	3.20 (1.98)	3.48 (2.16)	3.41 (2.12)	2.75 (1.70)
	R=L, S=4	4.10 (2.54)	4.46 (2.77)	4.38 (2.72)	3.53 (2.19)
	R=M, S=1	4.67 (2.90)	5.08 (3.16)	4.99 (3.10)	4.02 (2.50)
	R=M, S=2	6.33 (3.93)	6.88 (4.27)	6.75 (4.19)	5.44 (3.38)
	R=M, S=3	8.28 (5.14)	9.00 (5.59)	8.84 (5.49)	7.12 (4.42)
	R=M, S=4	10.62 (6.60)	11.55 (7.18)	11.34 (7.04)	9.13 (5.67)
	R=H, S=1	12.78 (7.94)	13.89 (8.63)	13.64 (8.47)	10.93 (6.79)
	R=H, S=2	17.30 (10.75)	18.81 (11.68)	18.47 (11.48)	14.87 (9.24)
	R=H, S=3	22.66 (14.08)	24.62 (15.30)	24.17 (15.01)	19.47 (12.09)
	R=H, S=4	29.07 (18.06)	31.60 (19.63)	31.02 (19.27)	24.98 (15.52)
REVERSE	R=L, S=1	1.83 (1.14)	1.99 (1.24)	1.95 (1.21)	1.57 (0.97)
	R=L, S=2	2.47 (1.53)	2.69 (1.67)	2.64 (1.64)	2.13 (1.32)
	R=L, S=3	3.24 (2.01)	3.52 (2.19)	3.46 (2.15)	2.78 (1.73)
	R=L, S=4	4.16 (2.58)	4.52 (2.80)	4.44 (2.76)	3.57 (2.21)
	R=M, S=1	4.74 (2.94)	5.15 (3.20)	5.05 (3.14)	4.07 (2.52)
	R=M, S=2	6.41 (3.98)	6.97 (4.33)	6.84 (4.25)	5.51 (3.42)
	R=M, S=3	8.39 (5.21)	9.12 (5.67)	8.96 (5.57)	7.21 (4.48)
	R=M, S=4	10.77 (6.69)	11.71 (7.28)	11.49 (7.14)	9.26 (5.76)
	R=H, S=1	12.95 (8.05)	14.08 (8.75)	13.82 (8.59)	11.13 (6.91)
	R=H, S=2	17.54 (10.90)	19.06 (11.84)	18.71 (12.25)	15.07 (9.36)
	R=H, S=3	22.95 (14.26)	24.95 (15.50)	24.50 (15.22)	19.73 (12.26)
	R=H, S=4	29.46 (18.30)	32.02 (19.90)	31.44 (19.53)	25.32 (15.73)

MODEL T2410—SSS (12 X 12)
TRANSMISSION SPEEDS: KPH (MPH)

Tire Size		R1 14.9 x 24	R1 14.9 x 28	R4 18.4 x 24	Turf 44 x 18-20.00
Range/Speed Lever Position **R = Range Lever S = Speed Lever**					
FORWARD	R=L, S=1	1.64 (1.02)	1.78 (1.10)	1.75 (1.08)	1.41 (0.88)
	R=L, S=2	2.22 (1.38)	2.41 (1.50)	2.37 (1.47)	1.91 (1.19)
	R=L, S=3	2.91 (1.80)	3.16 (1.96)	3.10 (1.93)	2.50 (1.55)
	R=L, S=4	3.73 (2.32)	4.05 (2.52)	3.98 (2.47)	3.20 (1.99)
	R=M, S=1	4.24 (2.63)	4.61 (2.86)	4.53 (2.81)	3.65 (2.27)
	R=M, S=2	5.75 (3.57)	6.25 (3.88)	6.13 (3.81)	4.94 (3.07)
	R=M, S=3	7.52 (4.67)	8.18 (5.08)	8.03 (4.99)	6.46 (4.01)
	R=M, S=4	9.65 (5.99)	10.49 (6.52)	10.30 (6.40)	8.30 (5.16)
	R=H, S=1	11.61 (7.21)	12.62 (7.84)	12.39 (7.70)	9.97 (6.19)
	R=H, S=2	15.71 (9.76)	17.08 (10.61)	16.77 (10.42)	13.51 (8.39)
	R=H, S=3	20.57 (12.78)	22.36 (13.89)	21.96 (13.64)	17.68 (10.98)
	R=H, S=4	26.40 (16.40)	28.70 (17.85)	28.18 (17.51)	22.69 (14.10)
REVERSE	R=L, S=1	1.77 (1.09)	1.92 (1.19)	1.88 (1.17)	1.51 (0.94)
	R=L, S=2	2.38 (1.48)	2.59 (1.61)	2.55 (1.58)	2.05 (1.27)
	R=L, S=3	3.13 (1.94)	3.40 (2.11)	3.33 (2.07)	2.69 (1.67)
	R=L, S=4	4.01 (2.94)	4.36 (2.71)	4.28 (2.66)	3.45 (2.14)
	R=M, S=1	4.56 (2.83)	4.96 (3.08)	4.87 (3.02)	3.92 (2.43)
	R=M, S=2	6.18 (3.84)	6.72 (4.17)	6.60 (4.10)	5.31 (3.30)
	R=M, S=3	8.09 (5.02)	8.80 (5.47)	8.64 (5.37)	6.95 (4.31)
	R=M, S=4	10.39 (6.45)	11.29 (7.01)	11.08 (6.88)	8.93 (5.55)
	R=H, S=1	12.48 (7.75)	13.57 (8.43)	13.33 (8.28)	10.73 (6.67)
	R=H, S=2	16.90 (10.50)	18.38 (11.42)	18.04 (11.21)	14.53 (9.02)
	R=H, S=3	22.13 (13.75)	24.06 (14.95)	23.62 (14.68)	19.02 (11.82)
	R=H, S=4	28.41 (17.65)	30.88 (19.18)	30.32 (18.84)	24.41 (15.17)

MODEL T2420—SSS (12 X 12)
TRANSMISSION SPEEDS: KPH (MPH)

Tire Size		R1 14.9 x 24	R1 14.9 x 28	R4 18.4 x 28	Turf 44 x 18-20.00
Range/Speed Lever Position **R = Range Lever S = Speed Lever**					
FORWARD	R=L, S=1	1.70 (1.05)	1.85 (1.15)	1.81 (1.24)	1.46 (0.91)
	R=L, S=2	2.30 (1.43)	2.50 (1.55)	2.46 (1.53)	1.98 (1.23)
	R=L, S=3	3.00 (1.86)	3.27 (2.03)	3.21 (1.99)	2.59 (1.61)
	R=L, S=4	3.86 (2.39)	4.20 (2.61)	4.13 (2.57)	3.32 (2.06)
	R=M, S=1	4.40 (2.73)	4.78 (2.97)	4.70 (2.92)	3.78 (2.35)
	R=M, S=2	5.96 (3.70)	6.48 (4.03)	6.36 (3.95)	5.12 (3.18)
	R=M, S=3	7.80 (4.85)	8.48 (5.27)	8.33 (5.18)	6.70 (4.16)
	R=M, S=4	10.00 (6.21)	10.88 (6.76)	10.68 (6.64)	8.60 (5.34)
	R=H, S=1	12.03 (7.47)	13.08 (8.13)	12.84 (7.98)	10.34 (6.42)
	R=H, S=2	16.30 (10.13)	17.72 (11.01)	17.39 (10.80)	14.01 (8.70)
	R=H, S=3	21.93 (13.62)	23.19 (14.41)	22.77 (14.15)	18.34 (11.40)
	R=H, S=4	27.37 (17.00)	29.76 (18.49)	29.22 (18.16)	23.53 (14.62)
REVERSE	R=L, S=1	1.83 (1.14)	1.99 (1.24)	1.95 (1.21)	1.57 (0.98)
	R=L, S=2	2.72 (1.69)	2.69 (1.67)	2.64 (1.64)	2.13 (1.32)
	R=L, S=3	3.23 (2.00)	3.52 (2.19)	3.46 (2.15)	2.78 (1.72)
	R=L, S=4	4.16 (2.58)	4.52 (2.80)	4.44 (2.76)	3.57 (2.22)
	R=M, S=1	4.73 (2.94)	5.15 (3.20)	5.05 (3.14)	4.07 (2.53)
	R=M, S=2	6.41 (3.98)	6.97 (4.33)	6.84 (4.25)	5.51 (3.42)
	R=M, S=3	8.40 (5.22)	9.12 (5.67)	8.96 (5.57)	7.21 (4.48)
	R=M, S=4	10.77 (6.69)	11.71 (7.27)	11.49 (7.14)	9.26 (5.75)
	R=H, S=1	12.95 (8.04)	14.08 (8.75)	13.82 (8.59)	11.13 (6.91)
	R=H, S=2	17.48 (10.86)	19.06 (11.84)	18.71 (11.63)	15.07 (9.36)
	R=H, S=3	22.95 (14.26)	24.95 (15.50)	24.50 (15.22)	19.73 (12.26)
	R=H, S=4	29.46 (18.30)	32.02 (19.90)	31.44 (19.54)	25.32 (15.73)

	Model T2410/T2420
CAST IRON WEIGHTS	
Front End:	
Ag, R-4 & Turf	
Tires with FWD	(2) weights @ 45 kg (100 lbs) each or (2) weights @ 26 kg (60 lbs) each
Rear Wheel:	
R-4 Tires	(4) weights (2) per wheel @ 34 kg (75 lbs) each
Turf Tires	---
Ag. Tires	(4) weights (2) per wheel @ 48 kg (105 lbs) each
DRAWBARS	
Swinging/	
Extendible	Standard
3 POINT HITCH	
Category Type	I/II
Position Control Type	Hydraulic
Drop Rate Control	Standard
Lift Capacity @ 24″ behind kg (lbs)	1571 (3465)

Model T2410/T2420

TIRES
FRONT:

Agricultural:

FWD	8 x 16, 6PR, R1 9.5 x 16, 6PR, R1

Turf:

FWD	27 x 10.5 x 15, 4PR, R3 27 x 12LL x 15, 6PR, R3

Industrial:

FWD	12 x 16.5, 8PR, R4

REAR:

Agricultural	14.9 x 24, 6PR, R1 14.9 x 28, 6PR, R1
Turf	44 x 18.00-20, 6PR, R3 22.5LL x 16.1, 6PR, R3
Industrial	18.4 x 24, 8PR, R4

WHEEL BOLT TORQUES
Front Wheel—

Disc-to-Hub:

FWD	169 N·m (125 ft-lbs)

Rear Wheel—

Rear Wheel & Disc-to Axle	169 N·m(125 ft-lbs)
Disc-to Rim	244 N·m (180 ft-lbs)

ROPS ATTACHING BOLT TORQUES

ROPS to Rear Axle	74 N·m (55 ft-lbs)
Seat Belt	47.4 N·m (35 ft-lbs)

GENERAL DIMENSIONS

	Model T2410/T2420
(1)—LENGTH Overall (Less 3 pt hitch and tires, to end of drawbar)	
FWD	3155 mm (124.2″)
(1)—LENGTH Overall (3 pt hitch horizontal position)	
FWD	
Sm AG Tires	3487 mm (137.3″)
Lg AG Tires	3487 mm (137.3″)
R4 Tires	3487 mm (137.3″)
TURF Tires	3487 mm (137.3″)

Model T2410/T2420

(2)—WHEEL BASE:

FWD . . . . . 1900 mm (74.8″)

HEIGHTS - in (mm):

(3)—Steering Wheel Height

Sm AG 4WD . . . . . Variable
Lg AG 4WD . . . . . Variable
R4 4WD . . . . . Variable
TURF 4WD . . . . . Variable

(4)—ROPS Height - FOLDING

Sm AG Tires - Up 2282 (89.8)
Sm AG Tires - Down* 2006 (80.0)
Lg AG Tires - Up 2310 (91.0)
Lg AG Tires - Down* 2034 (80.1)
R4 Tires - Up 2322 (91.4)
R4 Tires - Down* 2046 (80.6)
TURF Tires - Up 2196 (86.5)
TURF Tires - Down* 1920 (75.6)
TURF Tires - (Galaxy) - Up 2152 (84.7)
TURF Tires - (Galaxy) - Down* 1676 (66.0)
*Measured to top of ROPS upright

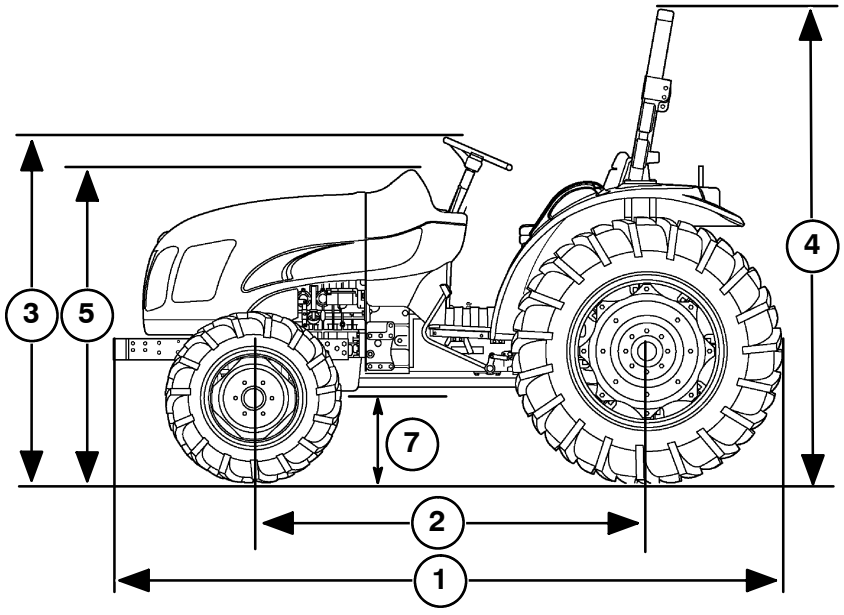
(5)—Hood Height (top inst. cluster)

Sm AG 4WD 1491 (58.7)
Lg AG 4WD 1545 (60.8)
R4 4WD 1531 (60.3)
TURF FWD 1407 (55.4)
TURF FWD (Galaxy) 1362 (53.6)

(6)—WIDTH: Rear Tires

TIRE TYPE	OUTSIDE to OUTSIDE
(AG) 14.9 x 24	1635 to 2338 mm (64.4 to 92.1″)
(AG) 14.9 x 28	1635 to 2338 mm (64.4 to 92.1″)
(TURF) 44 x 18 – 20	2300 mm (90.6″)
(TURF) 22.5 LL x 16.1	1709 mm (67.3″)
(INDUSTRIAL) 18.4 x 24	1819 to 2417 mm (71.6 to 95.2″)

	Model T2410/T2420
(7)—GROUND CLEARANCE (Under FWD Axle): sm AG TIRES	
D.) - Minimum Centerline Clearance	329 (13)
lg AG TIRES	
(D.) - Minimum Centerline Clearance	381 (15)
R4 TIRES	
(D.) - Minimum Centerline Clearance	369 (14.5)
TURF TIRES	
(D.) - Minimum Centerline Clearance	244 (9.6)
*Galaxy Turf Tire	*199 (7.83)



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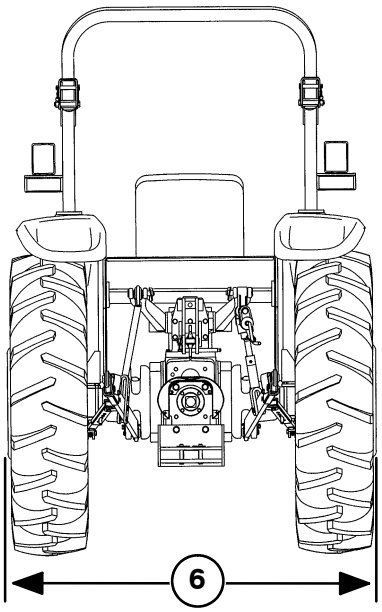

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WHEEL TREAD SETTINGS

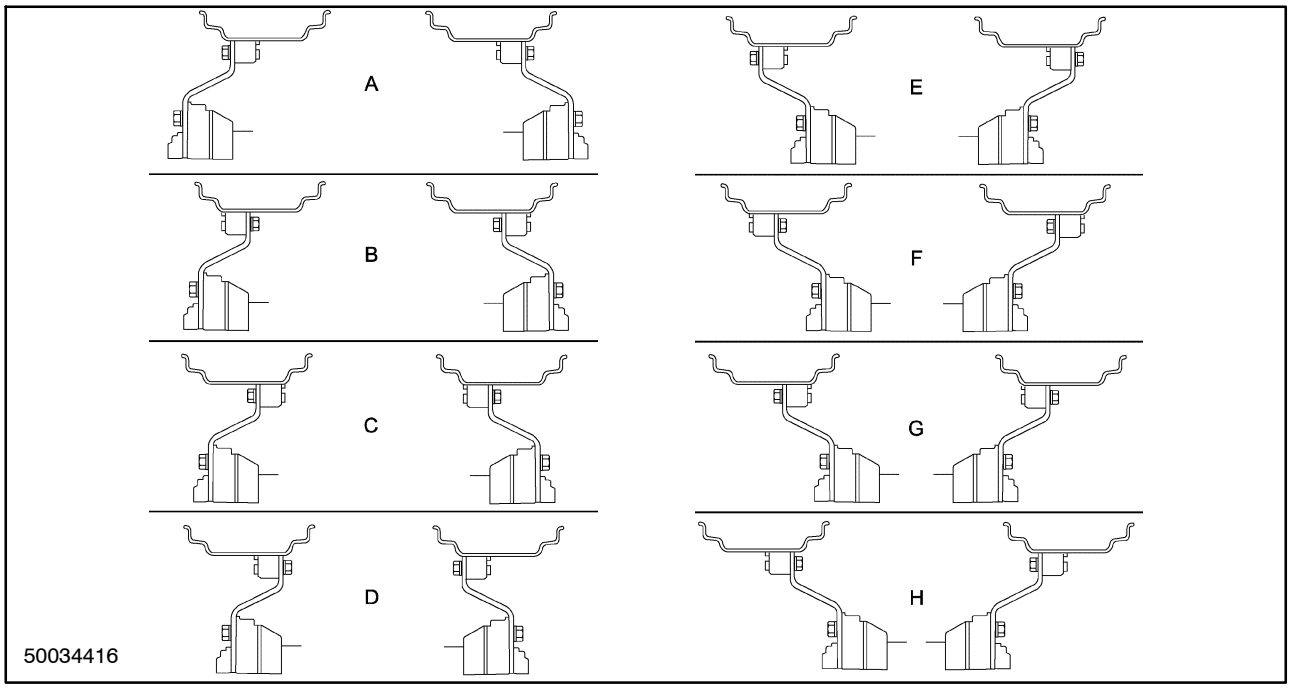
Front Axle (FWD) (Not Adjustable)

TIRE TYPE	SETTING
(AG) 8 x 16	1338 mm (52.6″)
(AG) 9.5 x 16	1419 mm (55.9″)
(TURF) 27 x 10.55 x 15	1444 mm (56.9″)
(TURF) 27 x 12LL x 15	1501 mm (59.1″)
(INDUSTRIAL) 12 x 16.5	1432 mm (56.4″)

Rear Axle (FWD)

TIRE TYPE	MIN (DISH IN)	MAX (DISH OUT)	NO. OF POSITIONS
(AG) 14.9 x 24	1236 mm (48.7″)	1939 mm (76.4″)	8
(AG) 14.9 x 28	1236 mm (48.7″)	1939 mm (76.4″)	8
(TURF) 44 x 18 –20	NA	1828 mm (72″)	1
(TURF) 22.5 LL x16.1	NA	1709 mm (67.3″)	1
(INDUSTRIAL) 18.4 x 24	1341 mm (52.8″)	1939 mm (76.4″)	7

Position	Rear 4WD Tire Dimensions, Inches (mm)			Tire Type
	Inside To Inside	Tread Setting	Outside To Outside	
A	33.26 (845)	48.66 (1236)	64.06 (1627)	AG-14.9 x 244PR R1
B	37.39 (950)	52.79 (1341)	68.19 (1732)	
C	41.26 (1048)	56.66 (1439)	72.06 (1830)	
D	45.39 (1153)	60.79 (1544)	76.19 (1935)	
E	48.82 (1240)	64.22 (1631)	79.62 (2022)	
F	52.95 (1345)	68.35 (1736)	83.75 (2127)	
G	56.82 (1443)	72.22 (1834)	87.62 (2225)	
H	60.95 (1548)	76.35 (1939)	91.75 (2330)	
A	32.96 (837)	48.66 (1236)	64.36 (1635)	AG-14.9 x 28 6PR R1
B	37.09 (942)	52.79 (1341)	68.49 (1740)	
C	40.96 (1040)	56.66 (1439)	72.36 (1838)	
D	45.09 (1145)	60.79 (1544)	76.49 (1943)	
E	48.52 (1232)	64.22 (1631)	79.92 (2030)	
F	52.65 (1337)	68.35 (1736)	84.05 (2135)	
G	56.52 (1435)	72.22 (1834)	87.92 (2233)	
H	60.65 (1540)	76.35 (1939)	92.05 (2338)	
B	33.99 (863)	52.79 (1341)	71.59 (1819)	18.4-24 8PR R4
C	37.86 (961)	56.66 (1439)	75.46 (1917)	
D	41.99 (1066)	60.79 (1544)	79.59 (2022)	
E	45.42 (1153)	64.22 (1631)	83.02 (2109)	
F	49.55 (1258)	68.35 (1736)	87.15 (2214)	
G	53.42 (1356)	72.22 (1834)	91.02 (2312)	
H	57.55 (1461)	76.35 (1939)	95.15 (2417)	
	36.00 (914)	54.6 (1387)	92.6 (2351)	Turf-44 x 18.00-20,6PR
	34.38 (873)	57.28 (1455)	80.18 (2037)	Galaxy-22.5LL x 16.1, 6PR



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WEIGHT (Bare Tractor):

With ROPS:

FWD	T2410/T2420 (EHSS)	1546 kg (3408 lbs)
	T2410/2420 (SSS) FWD	1524 kg (3360 lbs)

LIQUID BALLAST (OPTIONAL)

It is a common practice to add weight to the tractor by filling the rear tires with liquid. A calcium chloride ($CaCl_2$) and water solution is recommended due to its low freezing point and greater density (weight per gallon) than pure water.

Never exceed the total recommended weight for the tractor. Because special equipment is required to fill the tires, consult your New Holland Dealer.

Tires should never be filled beyond 75%. At 75% full, the liquid will come to the valve stem when the valve stem is at its highest point at the top of the wheel.

TIRE PRESSURE

Tire pressure must be considered when adding weights, implements, or attachments to the tractor or damage to the tractor may occur.

The chart below outlines tire inflation pressures.

FRONT TIRE INFLATION PRESSURES		
TIRE TYPE	**TIRE SIZE**	**INFLATION PRESSURE**
Agricultural FWD	 8.0 x 16 6PR, R1 9.5 x 16 6PR, R1	 1.4-2.0 bar (12-30 psi)
Turf FWD	 27 x 10.5-15 4PR R3 27 x 12LL x 15 6PR R3	 1.7-2.0 bar (25-30 psi) 0.8 bar (12 psi)
Industrial (R4) FWD	 12-16.5 8PR, R4	 1.1-3.5 bar (16-50 psi)
REAR TIRE INFLATION PRESSURES		
Agricultural FWD	 14.9 x 24 6PR, R1 14.9 x 28 6PR, R1	 0.8-1.4 bar (12-20 psi)
Turf FWD	 44 x 18.00-20 6PR, R3 22.5LL x 16.1 6PR, R3	 0.8-2.0 bar (12-30 psi) 0.45 bar (6 psi)
Industrial FWD	 18.4 x 24 8PR, R4	 0.8-1.7 bar (12-24 psi)

NOTE: *Do not underinflate or overinflate tires. Do not exceed maximum inflation pressure listed.*

REAR TIRE LIQUID

Ballast Weights (Per Tire)
5lbs/600g CaCL2/Gal Solution

Agricultural FWD	 14.9 x 24 6PR, R1 14.9 x 28 6PR, R1	 507 lbs (230 kg) 574 lbs (261 kg)
Turf FWD	 44 x 18.00-20 6PR, R3 22.5LL x 16.1 6PR, R3	 548 lbs (249 kg) Not Recommended
Industrial FWD	 18.4 x 24 8PR, R4	 800 lbs (363 kg)

SECTION 10 – ENGINE

Chapter 1 – Engine Components

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SPECIFICATIONS

GENERAL	2410	2420
Engine Model	N844L-T	N844L-T
Number of Cylinders	4	4
Bore x Stroke	84 x 100 mm. (3.31 x 3.94in)	84 x 100 mm. (3.31 x 3.94in)
Displacement	135.2 cu. In.(2216 cc)	135.2 cu. In.(2216 cc)
Compression Ratio	22.5:1	22.5:1
Rated Speed (rpm)	2700	2800
Firing Order	1-3-4-2	1-3-4-2
Low Idle Speed	1000	1000
Maximum No Load Speed	2900	3000
Cylinder Arrangement	In-line vertical	In-line vertical
Valve Arrangement	Overhead	Overhead
Compression Pressure At 200 rpm (cylinder speed)	29.4 ± 3.5 bar (427 ± 50 psi)	29.4 ± 3.5 bar (427 ± 50 psi)
Gross Engine Power	41.0 kw (55 hp)	44.7 kw (60 hp)
PTO Power @ Engine Rated rpm	34.3 kw (46 hp) EHSS @ 589 PTO rpm	37.3 kw (50 hp) EHSS @ 610 PTO rpm
	35.0 kw (47 hp) SSS @ 589 PTO rpm	38.0 kw (51 hp) SSS @ 610 PTO rpm
CYLINDER BLOCK	N844L-T	N844L-T
Bore		
Standard	84.0 mm (3.3071 in)	84.0 mm (3.3071 in)
Maximum	84.2 mm (3.315 in)	84.2 mm (3.315 in)
Head Surface Warp		
Standard	.05 mm (.002 in)	.05 mm (.002 in)
Maximum	.12 mm (.005 in)	.12 mm (.005 in)
CYLINDER HEAD	N844L-T	N844L-T
Head Warp		
Standard	.05 mm (.002 in)	.05 mm (.002 in)
Maximum	.12 mm (.005 in)	.12 mm (.005 in)
Valve seat width		
Standard	1.7-2.1 mm (0.067-0.082 in)	1.7-2.1 mm (0.067-0.082 in)
Maximum	1.8 mm (0.071 in)	1.8 mm (0.071 in)
Valve seat sink	N844L-T	N844L-T
Standard (recess)	0.85-1.15mm (0.0334-0.0453 in)	0.85-1.15mm (0.0334-0.0453 in)
Maximum	1.8 mm (0.071 in)	1.8 mm (0.071 in)
Valve Angle	45 degrees	45 degrees
PISTON	N844L-T	N844L-T
Diameter		
Standard	83.948-83.963 mm (3.30503-3.30562 in)	83.948-83.963 mm (3.30503-3.30562 in)
Minimum	83.7 mm (3.2953 in)	83.7 mm (3.2953 in)
BORE CLEARANCE	N844L-T	N844L-T
Standard	0.038-0.072 mm (0.0015-0.0028 in)	0.038-0.072 mm (0.0015-0.0028 in)
Maximum	0.25mm (0.010 in)	0.25mm (0.010 in)

PISTON PIN BORE	N844L-T	N844L-T
Standard	27.996-28.0mm (1.102-1.1023 in)	27.996-28.0mm (1.102-1.1023 in)
Maximum	27.98 mm (1.102 in)	27.98 mm (1.102 in)
PISTON PIN CLEARANCE	N844L-T	N844L-T
Standard	-0.001 +0.007mm (-0.00004 +0.0003)	-0.001 +0.007mm (-0.00004 +0.0003)
Maximum	0.02 mm (0.0008 in)	0.02 mm (0.0008 in)
PISTON PIN	N844L-T	N844L-T
Diameter		
Standard	27.996-28.0 mm (1.1022-1.10236 in)	27.996-28.0 mm (1.1022-1.10236 in)
minimum	27.98 mm (1.1016 in)	27.98 mm (1.1016 in)
PIN TO BUSHING CLEARANCE		
Standard	0.01-0.025 mm (0.00039-0.00098 in)	0.01-0.025 mm (0.00039-0.00098 in)
Maximum	0.08mm (0.0031 in)	0.08mm (0.0031 in)
PISTON RING	N844L-T	N844L-T
END GAP		
1st Ring	0.2-0.35 mm (0.008-0.0138 in)	0.2-0.35 mm (0.008-0.0138 in)
Maximum	1.0 mm (0.039 in)	1.0 mm (0.039 in)
2nd Ring	0.20-0.40 mm (0.008-0.016 in)	0.20-0.40 mm (0.008-0.016 in)
Maximum	1.0 mm (0.039 in)	1.0 mm (0.039 in)
Oil Ring	0.20-0.80 mm (0.008-0.0315 in)	0.20-0.80 mm (0.008-0.0315 in)
Maximum	1.2 mm (0.047 in)	1.2 mm (0.047 in)
COMPRESSION RING TO GROOVE CLEARANCE		
Standard (1st Ring)	0.7-0.11 mm (0.027-0.004 in)	0.7-0.11 mm (0.027-0.004 in)
2nd Ring	0.04-0.08 mm (0.0016-0.0031 in)	0.04-0.08 mm (0.0016-0.0031 in)
Maximum	0.25 mm (0.010 in)	0.25 mm (0.010 in)
OIL RING TO GROOVE CLEARANCE		
Standard	0.03-0.13 mm (0.001-0.00512 in)	0.03-0.13 mm (0.001-0.00512 in)
Maximum	0.25 mm (0.010 in)	0.25 mm (0.010 in)
RING WIDTH		
1st compression ring	2.0 mm (0.079 in)	2.0 mm (0.079 in)
2nd compression ring	1.5 mm (0.059 in)	1.5 mm (0.059 in)
Oil compression ring	4.0 mm (0.157 in)	4.0 mm (0.157 in)
CONNECTING ROD	N844L-T	N844L-T
ROD TWIST		
Standard	0.08 mm (0.003 in)	0.08 mm (0.003 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)
ROD BEND		
Standard	0.05 mm (0.002 in)	0.05 mm (0.002 in)
Maximum	0.15 mm (0.006 in)	0.15 mm (0.006 in)
ON CRANKSHAFT SIDE PLAY		
Standard	0.1-0.3 mm (0.004-0.012 in)	0.1-0.3 mm (0.004-0.012 in)
Maximum	0.7 mm (0.028 in)	0.7 mm (0.028 in)

CRANKSHAFT BEARING CLEARANCE		
Standard	0.035–0.083 mm (0.0014–0.0033 in)	0.035–0.083 mm (0.0014–0.0033 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)
CRANKSHAFT	N844L-T	N844L-T
JOURNAL DIAMETER		
Standard	67.957–67.97 mm. (2.675–2.676 in)	67.957–67.97 mm. (2.675–2.676 in)
Maximum	67.9 mm (2.673 in)	67.9 mm (2.673 in)
CRANKPIN DIAMETER	N844L-T	N844L-T
Standard	51.964–51.975 mm (2.0458–2.0462 in)	51.964–51.975 mm (2.0458–2.0462 in)
Maximum	51.9 mm (2.043 in)	51.9 mm (2.043 in)
RUNOUT		
Standard	0.03 mm (0.0012 in)	0.03 mm (0.0012 in)
Maximum	0.06 mm (0.0024 in)	0.06 mm (0.0024 in)
ENDPLAY		
Standard	0.1–0.4 mm (0.0039–0.0157 in)	0.1–0.4 mm (0.0039–0.0157 in)
Maximum	0.5 mm (0.0197 in)	0.5 mm (0.0197 in)
THRUST WASHER THICKNESS		
Standard	2.95–3.0 mm (0.116–0.118 in)	2.95–3.0 mm (0.116–0.118 in)
Minimum	2.8 mm (0.110 in)	2.8 mm (0.110 in)
CYLINDER BLOCK BEARING DIAMETER		
Standard	68x72 mm (2.677x2.835 in)	68x72 mm (2.677x2.835 in)
JOURNAL TO CYLINDER BLOCK BEARING CLEARANCE		
Standard	0.044–0.116 mm (0.0017–0.0046 in)	0.044–0.116 mm (0.0017–0.0046 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)
CENTER BEARING TO CRANKSHAFT CLEARANCE		
Standard	0.044–0.102 mm (0.0017–0.0040 in)	0.044–0.102 mm (0.0017–0.0040 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)
DYNAMIC BALANCER		
Counterweight gear backlash	0.2–0.4 mm (0.008–0.016 in)	0.2–0.4 mm (0.008–0.016 in)
Maximum	0.4 mm (0.016 in)	0.4 mm (0.016 in)
CAMSHAFT	N844L-T	N844L-T
CAM HEIGHT-VALVE		
Standard	34.433–34.508 mm (1.3556–1.3586 in)	34.433–34.508 mm (1.3556–1.3586 in)
Minimum	34.1 mm (1.3425 in)	34.1 mm (1.3425 in)
BEND		
Standard	0.03 mm (0.001 in)	0.03 mm (0.001 in)
Maximum	0.1 mm (0.004 in)	0.1 mm (0.004 in)
CAM HEIGHT FUEL		
Standard	42.94–43.06 mm (1.6905–1.6953 in)	42.94–43.06 mm (1.6905–1.6953 in)
Minimum	1.6850 in (42.8 mm)	1.6850 in (42.8 mm)

VALVES	N844L-T	N844L-T
STEM DIAMETER-INTAKE		
Standard	6.95–6.97 mm (0.2736–0.2744 in)	6.95–6.97 mm (0.2736–0.2744 in)
Minimum	6.89 mm (0.271 in)	6.89 mm (0.271 in)
STEM DIAMETER-EXHAUST		
Standard	6.94–6.95 mm (0.273–0.274 in)	6.94–6.95 mm (0.273–0.274 in)
Minimum	6.84 mm (0.269 in)	6.84 mm (0.269 in)
GUIDE CLEARANCE-INTAKE	N844L-T	N844L-T
Standard	0.03–0.06 mm (0.001–0.002 in)	0.03–0.06 mm (0.001–0.002 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)
GUIDE CLEARANCE-EXHAUST		
Standard	0.0451–0.075 mm (0.0018–0.0029 in)	0.0451–0.075 mm (0.0018–0.0029 in)
Maximum	0.25 mm (0.01 in)	0.25 mm (0.01 in)
VALVE MARGIN (THICKNESS)		
Standard	0.775–1.075 mm (0.0305–0.0423 in)	0.775–1.075 mm (0.0305–0.0423 in)
Minimum	0.5 mm (0.020 in)	0.5 mm (0.020 in)
VALVE LASH COLD CONDITION	0.2 mm (0.008 in)	0.2 mm (0.008 in)
VALVE SPRING FREE HEIGHT		
Standard	35 mm (1.378 in)	35 mm (1.378 in)
Minimum	33.5 mm (1.319 in)	33.5 mm (1.319 in)
VALVE SPRING SQUARENESS		
Standard	1.2 mm (0.0472 in)	1.2 mm (0.0472 in)
Maximum	2.0 mm (0.079 in)	2.0 mm (0.079 in)
VALVE TIMING-INTAKE		
Open before TDC	13°	13°
Close after BDC	43°	43°
VALVE TIMING-EXHAUST		
Open before TDC	43°	43°
Close after BDC	13°	13°
VALVE SPRING-COMPRESSED (load required to compress spring to 1.2 in (30.4 mm)		
Standard	8.1 kg (17.85-lbs)	8.1 kg (17.85-lbs)
Minimum	7 kg (15.43-lbs)	7 kg (15.43-lbs)
PUSH RODS	N844L-T	N844L-T
Length	226 mm (8.9 in)	226 mm (8.9 in)
Diameter	6.3 mm (0.248 in)	6.3 mm (0.248 in)
ROCKER ARM	N844L-T	N844L-T
SHAFT DIAMETER		
Standard	14.95–14.97 mm (0.5886–0.5894 in)	14.95–14.97 mm (0.5886–0.5894 in)
Minimum	14.87 mm (0.485 in)	14.87 mm (0.485 in)
SHAFT TO ROCKER CLEARANCE		
Standard	0.032–0.068 mm (0.00127–0.00268 in)	0.032–0.068 mm (0.00126–0.00268 in)
Maximum	0.2 mm (0.008 in)	0.2 mm (0.008 in)

LUBRICATION SYSTEM	N844L-T	N844L-T
PRESSURE RELIEF VALVE		
Opening pressure	2.9–3.4 bar (42.61–49.3–psi)	2.9–3.4 bar (42.61–49.3–psi)
Fully open at 3000 rpm	4.9 bar (71.1–psi)	4.9 bar (71.1–psi)
ROTOR TO VANE CLEARANCE		
Standard	0.1–0.15 mm (0.004–0.006 in)	0.1–0.15 mm (0.004–0.006 in)
Maximum	0.25 mm (0.010 in)	0.25 mm (0.010 in)
ROTOR TO COVER CLEARANCE		
Standard	0.1–0.15 mm (0.004–0.006 in)	0.1–0.15 mm (0.004–0.006 in)
Maximum	0.20 mm (0.008 in)	0.20 mm (0.008 in)
	N844L-T	N844L-T
OIL PUMP VOLUME	4.5 L (1.18–gal)	4.5 L (1.18–gal)
COOLING SYSTEM		
TYPE OF SYSTEM	Pressurized liquid w/ recirculating by pass	
WATER PUMP	Centrifugal	
Drive belt deflection (tension)	5–10 mm (0.2–0.4 in) when 5 kg (2.3–lbs) force is applied midway between pulleys	
THERMOSTAT		
Starts to open	156–163°F (69–73°C)	156–163°F (69–73°C)
Fully open	180°F (82°C)	180°F (82°C)
Radiator cap pressure rating	0.9 bar (13–psi)	0.9 bar (13–psi)
Coolant	Ethylene glycol and water in a 50/50 mixture	
Capacity 2410/2420	5.5 liters (5.8 U.S. quarts)	5.5 liters (5.8 U.S. quarts)

METRIC BOLT TORQUE SPECIFICATIONS

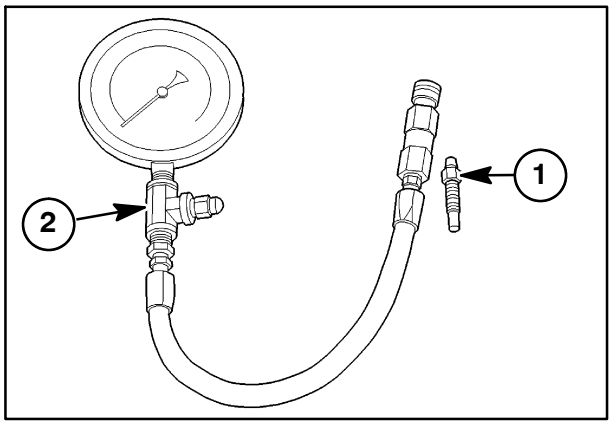
TORQUE SPECIFICATIONS	N844L-T
CONNECTING ROD CAP BOLTS	49–54 N·m (36–40 ft-lbs)
MAIN BEARING RETAINING BOLTS	49–54 N·m (36–40 ft-lbs)
RELIEF VALVE ASSEMBLY	59–69 N·m (43–51 ft-lbs)
CRANKSHAFT MAIN BEARING HOLDER BOLTS	49–54 N·m (36–40 ft-lbs)
REAR MAIN	25–29 N·m (18–22 ft-lbs)
CENTER MAINS	49–54 N·m (36–40 ft-lbs)
ENGINE REAR MOUNTING PLATE	13–17 N·m (9–13 ft-lbs)
FLYWHEEL RETAINING BOLTS	68–78 N·m (51–58 ft-lbs)
ENGINE FRONT PLATE	9–12 N·m (6–9 ft-lbs)
CRANKSHAFT PULLEY NUT	274–333 N·m (202–246 ft-lbs)
CYLINDER HEAD BOLTS	98–103 N·m (72–76 ft-lbs)
ROCKER ARM ASSEMBLY	27–39 N·m (20–29 ft-lbs)
ROCKER ARM LOCKNUT	12–17 N·m (9–12 ft-lbs)
OIL TUBE BANJO BOLT	9–12 N·m (6–9 ft-lbs)
OIL PRESSURE SWITCH	15–20 N·m (10–15 ft-lbs)
ROCKER COVER BOLTS	9–12 N·m (6–9 ft-lbs)
GLOW PLUGS	14–20 N·m (10–15 ft-lbs)
COOLING FAN BOLTS	9–12 N·m (6–9 ft-lbs)
BALANCER RETAINING BOLTS	49–54 N·m (36–40 ft-lbs)
OIL COOLER RETAINING BOLTS (FILTER JOINT)	55–65 N·m (40–48 ft-lbs)

SPECIAL TOOLS

Tool No.	Description
FNH00120	Adapter—Compression Tester
OEM1074	Compression Test Gauge Assembly
FNH00117	Port Block Installer
FNH11097	Port Block Remover
FNH00011	Oil Pressure Test Fitting
Micrometer, Outside	0 – 25 mm (0 – 1 inch)
Micrometer, Outside	25 – 51 mm (1 – 2 inch)
Micrometer, Outside	76 – 102 mm (3 – 4 inch)
Small Hole Gauge	19 – 25 mm (3/4 – 1 inch)
Cylinder Bore Gauge	76 – 102 mm (3 – 4 inch)
Cylinder Bore Gauge	25 – 51 mm (1 – 2 inch)

COMPRESSION TEST AND TOOLS

Compression test is performed through the glow plug ports. The test adapter tool, 1, is equipped with quick coupler ends for easy installation of the hose and gauge.



1

The procedures to perform a compression test are as follows:

1. Remove the wire lead from the fuel injection pump solenoid.
2. Remove the glow plug electrical wire and wire connector from top of the glow plugs.
3. Remove all of the glow plugs.

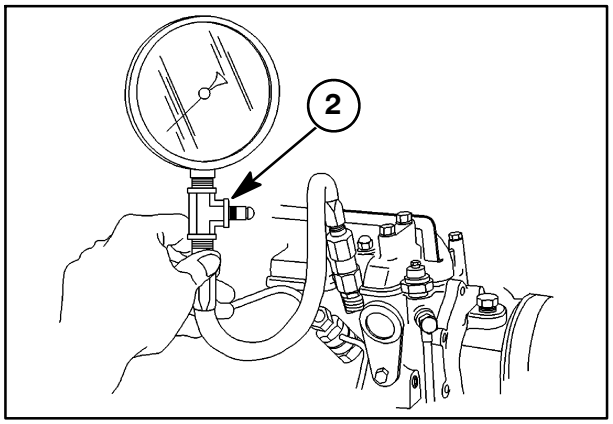
IMPORTANT: *Be sure all the glow plugs are removed before starting the compression tests.*

4. Install the adapter, 1, Tool No. FNH 00120, hose and gauge assembly OEM1074, 2, in each port and crank the engine until pressure stabilizes. The gauge should read 29.5 bar (427 psi) plus or minus 3.5 bar (50 psi).

NOTE: *It may be necessary to remove some injector fuel lines to install the adapter tool.*

NOTE: *There should not be more than 3.5 bar (50 psi) variation between the cylinders.*

5. When all cylinders have been tested, reinstall the glow plugs and electrical connections.



2

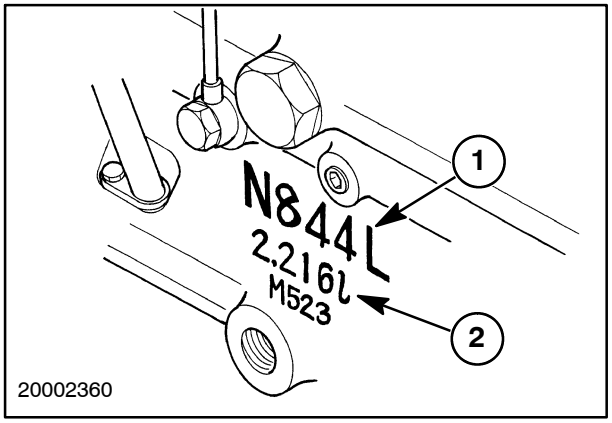
DESCRIPTION OF OPERATION - GENERAL INFORMATION

This chapter describes the engine overhaul and repair procedures of the Models 2410 and 2420 tractors. Repair procedures are essentially the same for all models except as noted in the repair procedures.

The 2410 and 2420 tractors are equipped with four-cylinder in-line engines. They are all four cycle, overhead valve, liquid cooled, diesel engines. The engines are identified by a code, 1, cast into the lower right side of the cylinder block. The 2420 engine are turbo charged.

NOTE: *Numeric value, 2, under the Engine Code indicates displacement of the engine in liters.*

Engine Identification	Tractor Model	Engine Power (Gross) Hp
N844L-T	2410	55
N844L-T	2420	60



3

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine does not develop full power	Clogged air cleaner	Inspect and replace air cleaner if necessary
	Fuel line obstructed	Check for crimped fuel line. Inspect fuel filter for cleanliness
	Improper injection timing	Repair/ replace components as required
	Improper nozzle injection pressure and angle	Check injection timing Inspect for proper injection pressure an angle
	Low cylinder compression	Check engine compression
	Insufficient fuel injection	Repair at authorized shop
	Improper valve lash adjustment	Adjust valves to correct tolerances
	Burned, worn or sticking valves	Inspect and replace as necessary
	Blown head gasket	Replace head gasket
	Worn or sticking piston rings	Overhaul as necessary
	Faulty engine stop solenoid	Replace stop solenoid
Low oil pressure	Engine oil level low	Fill to proper level
	Wrong grade of oil	Replace with correct grade oil
	Clogged oil pump filter	Change oil and filter
	Faulty oil pressure relief valve	Replace relief valve
	Worn oil pump drive shaft gears, or broken oil pipe	Inspect oil system and components. Replace defective components
	Excessive main or connecting rod bearing clearances	Replace bearings or shaft if necessary
	Oil pump axial clearance not properly set	Check pump clearance and shim as needed to proper tolerance
Engine will not stop	Faulty engine stop solenoid	Replace the stop solenoid
	Faulty starter switch	Replace starter switch
Low cylinder compression	Burned, worn or sticking valves	Replace valves
	Bent valve stem	Replace valves
	Broken or weak valve spring	Replace valve spring
	Blown cylinder head gasket	Replace head gasket
	Worn or sticking piston rings	Replace piston rings
	Scored piston	Replace piston
Poor engine idling	Improper injection timing	Correct the injection timing
	Air in injection pump	Purge air from the system
	Improper governor adjustment	Adjust the governor

PROBLEM	POSSIBLE CAUSE	CORRECTION
Oil pressure warning light fails to operate	Bulb burnt out	Replace the bulb
	Oil pressure sensor is faulty	Replace oil pressure sensor
	Warning light circuit faulty	Replace warning light circuit
Engine knocks	Diluted or thin oil	Change engine oil and filter
	Insufficient oil supply	Check engine oil level
	Low oil pressure	Inspect lube system for restrictions
	Worn crankshaft thrust bearing	Replace relief valve
	Excessive flywheel runout	Replace thrust bearing
	Excessive connecting rod or main bearing clearance	Replace flywheel Replace bearings
	Seized bearing	Replace bearing and affected component if necessary
	Clogged oil passage	Clean out oil passages
	Bent or twisted connecting rod	Replace connecting rod
	Crankshaft journals out of round	Rework or replace crankshaft
	Excessive piston to cylinder bore clearance	Replace piston with correct oversized piston
	Excessive piston ring side clearance	Replace piston rings
	Broken or damaged ring	Replace piston ring
	Excessive piston pin clearance	Replace piston pin or bushing
	Seized piston	Replace piston and, if necessary, engine block
	Piston pin retainer loose or missing	Replace retainer
	Improper valve lash adjustment	Adjust valve lash to specification
	Worn valve lifter	Replace valve lifter
	Excessive timing gear backlash	Replace all timing gears
Excessive oil consumption	Engine oil level too high	Remove excess oil
	Leakage in cylinder head gasket	Replace head gasket
	Oil loss past the pistons and rings	Replace piston rings
	Worn, broken, or sticking piston rings	Replace piston rings
	Clogged return hole of oil ring	Unclog return oil hole and replace rings
	Worn valves, guides, or seals	Replace valves, guides, or seals
	Leakage past oil seals and gaskets	Replace leaking seals and gaskets
	External oil leaks from engine	Locate leaks and repair

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine overheats	Insufficient amount of coolant in the radiator	Fill coolant to proper level
	Hose connection leaking or collapsed hose	Tighten hose connection or replace hose
	Radiator leakage	Locate leak and repair or replace radiator
	Loose, worn, or broken V-belt	Adjust V-belt tension or replace belt
	Radiator fins bent or clogged	Straighten out and clean fins
	Radiator cap not sealing	Replace radiator cap
	Thermostat operating improperly	Replace thermostat cap
	Insufficient amount of oil	Fill to proper level
	Water pump operating improperly	Replace water pump
	Improper valve clearance	Adjust valve clearance to specification
	Restriction in exhaust system	Remove restriction
	Improperly installed cylinder head gasket	Reinstall head gasket in proper position
	Rust and/or scale clogged water ports	Backflush cooling system
	Extended engine idling	Shutdown engine during extended idling periods
Temperature gauge fails to reach normal operating temperature	Faulty temperature sender	Replace temperature switch
	Faulty thermostat	Replace thermostat
	Faulty temperature gauge	Replace temperature gauge

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine does not start	Faulty starter switch	Replace switch
	Insufficient charging or complete discharge of battery	Check battery and charging system.
	Lack of fuel	Fill fuel tank
	Air mixed in fuel system	Inspect fuel system for tightness
	Clogged fuel filter	Replace fuel filter
	Irregular or faulty fuel supply	Replace fuel supply
	Glow plug not heating	Replace glow plug
	Improper lubricating oil viscosity	Replace lube oil
	Clogged air cleaner	Replace air cleaner
	Faulty engine stop solenoid	Replace solenoid
	Burned out fuse	Replace fuse
Excessive exhaust smoke	Air cleaner dirty or restricted	Replace air cleaner
	Excessive fuel delivery	Adjust fuel delivery
Engine stops while operating	Lack of fuel in fuel tank	Fill fuel tank
	Clogged fuel filter	Replace filter
	Air mixed in fuel system	Inspect for air leaks
	Faulty engine stop solenoid	Replace solenoid
	Burned out fuse	Replace fuse
Undesirable exhaust color (black or light grey)	Unsuitable fuel	Replace fuel
	Excess injection	Adjust injection
	Faulty engine component	Replace as required
	Over loading	Decrease load
	Clogged air filter	Replace filter
Undesirable exhaust smoke (white or pale)	Excess engine oil	Drain oil to proper oil level
	Improper lubricating oil viscosity	Replace oil with specified viscosity
	Faulty injection timing	Adjust injection timing

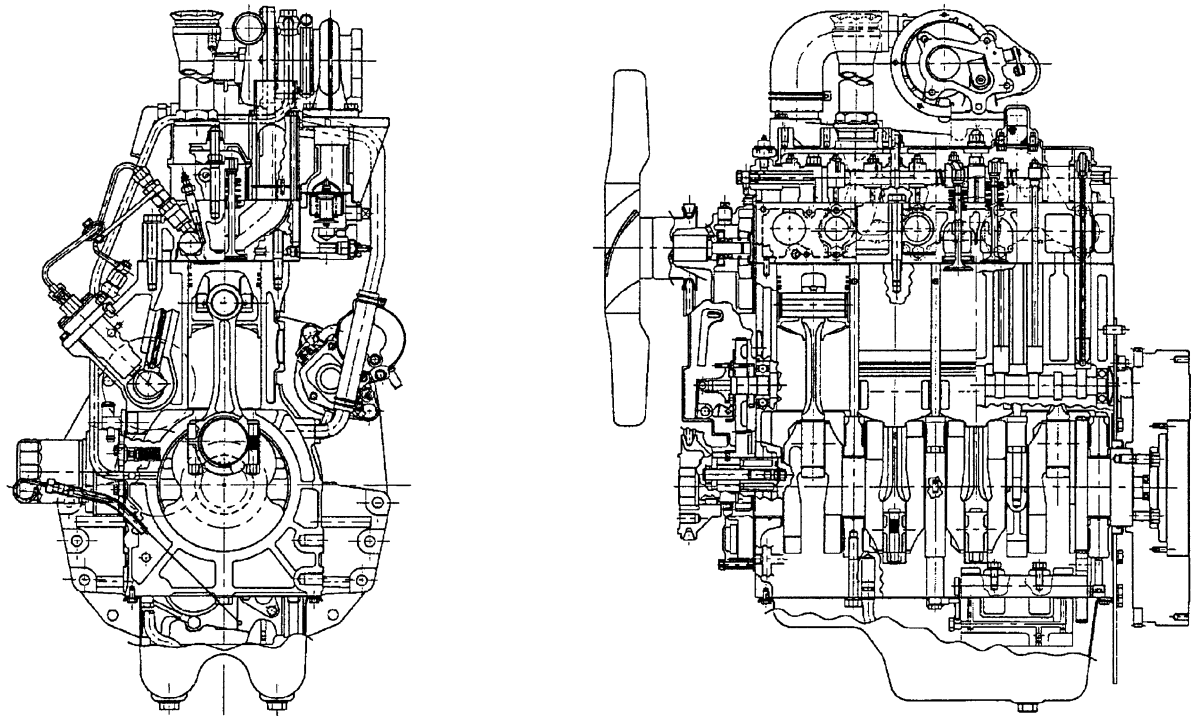
CYLINDER HEAD AND VALVE TRAIN COMPONENTS

The cylinder head incorporates the valve assemblies, rocker arms, rocker shaft, push rods, and lifters. A swirl chamber located between the injector assembly and the main combustion chamber of the cylinders provides improved starting and greater fuel efficiency. Initial combustion starts in the precombustion chamber and as the expansion occurs a strong swirl pattern is created in the main combustion chamber for more complete combustion of the air-fuel mixture. The air intake manifold is separate from the cast aluminum valve cover on all these engines. The exhaust manifold is bolted on the left-hand side of the cylinder head on each of the models. Cylinder heads have integral valve guides. Standard size valves only are used.

CYLINDER BLOCK ASSEMBLY

N844L-T

The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The crankshaft is supported on five main bearings. The front bearing is positioned in a bore in front of the block. The other bearings are split liners located in holders bolted to the block. The camshaft is supported on four ball bearings located in the block.



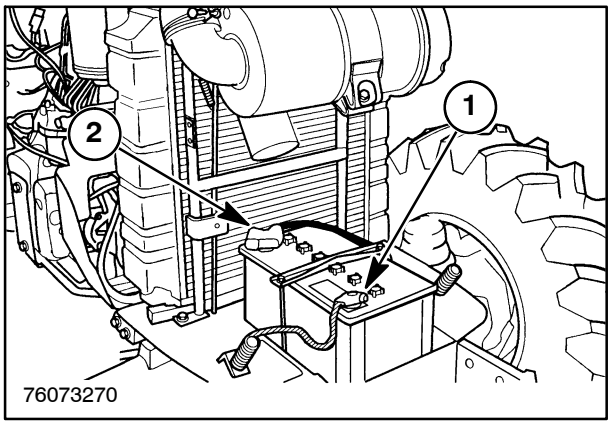
20035585 MODEL N844L-T (2410 and 2420)

4

ENGINE

Removal

1. Disconnect the negative (–) battery cable, 1, and positive (+) battery cable, 2, from the battery.



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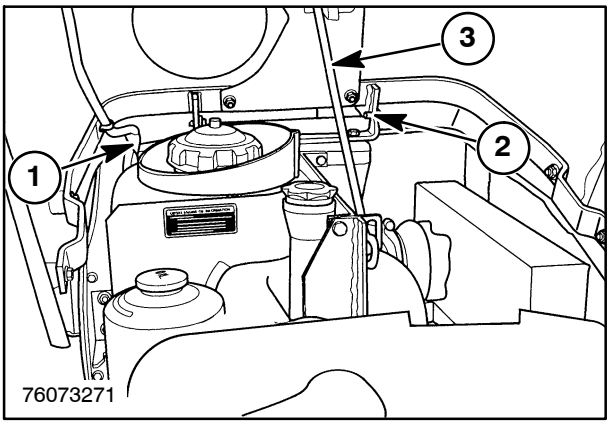
2. Disconnect the headlight wire harness plug, 1.
3. Remove the clips and pins, 2, from each side of the hood bracket.
4. Remove the support rod, 3, and remove the hood from the tractor.



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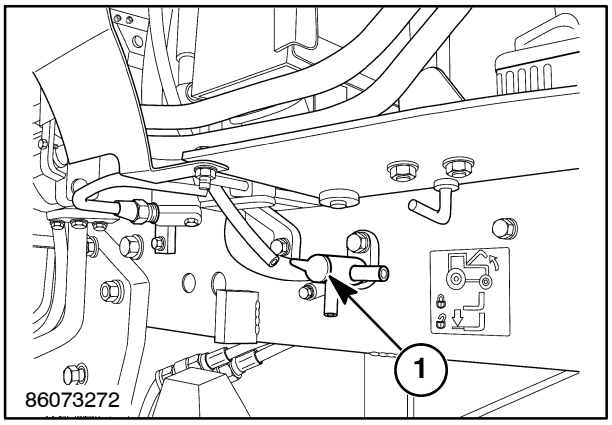
5. Drain the coolant from radiator, and engine using the petcock valve, 1. Remove radiator cap to assist draining.
6. Remove the radiator (see Radiator Removal in Section 10).



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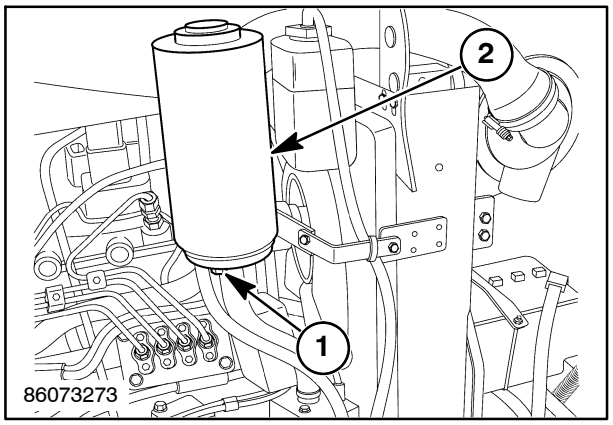
7. Loosen and remove the drain plug, 1, from the power steering reservoir, 2, and drain into a suitable container.

NOTE: *See "Separating the Tractor at the Transmission" in Section 21 to separate the tractor.*



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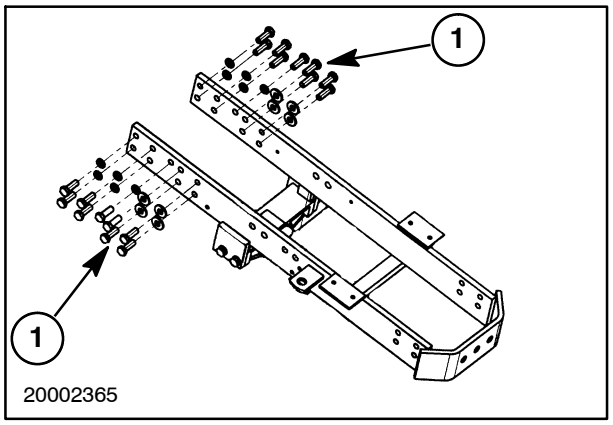
8. After the tractor has been successfully separated, support the front axle and the front support frame with jack stands.
9. Remove the firewall from the engine.
10. Remove the muffler and exhaust pipe from the tractor.
11. With the chain and hoist still attached to the engine, remove the mount bolts, 1, from each side of the frame rails.
12. Carefully remove the engine.



9

Installation

1. Attach a hoist to the engine, and position it onto the frame.
2. Install the engine mounting bolts on both sides of the frame. Apply Loctite® thread locker 242 to the thread of the bolts. TIghten bolts to the following torques:

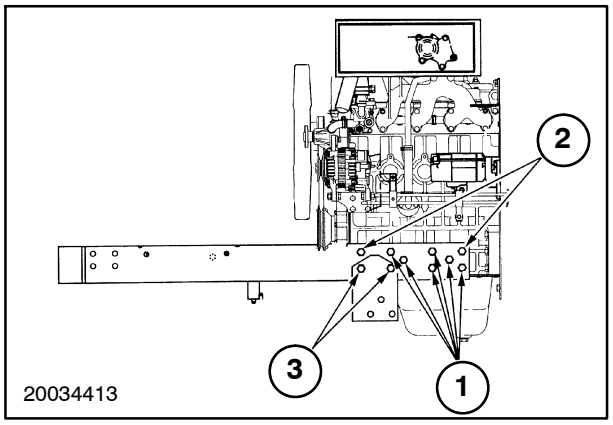
   torques #1 – 80 N·m (60 ft-lbs)

   torques #2 – 80 N·m (60 ft-lbs)

   torques #3 – 175 N·m (130 ft-lbs)

3. Install the muffler and exhaust pipe onto the tractor.
4. Install the firewall onto the engine.

NOTE: *See section 21 for attaching the engine to the transmission.*



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OVERHAUL

ENGINE

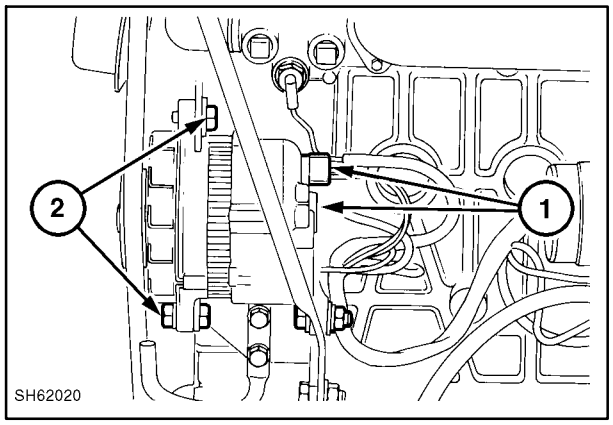
NOTE: *Some procedures discussed in this chapter are shown with the engine in the tractor. Many of the procedures can be done with the engine in or out of the tractor.*

ALTERNATOR

Removal

Disconnect the alternator wire harness and wires, 1.

Remove the alternator pivot and adjusting bracket, hardware, 2.

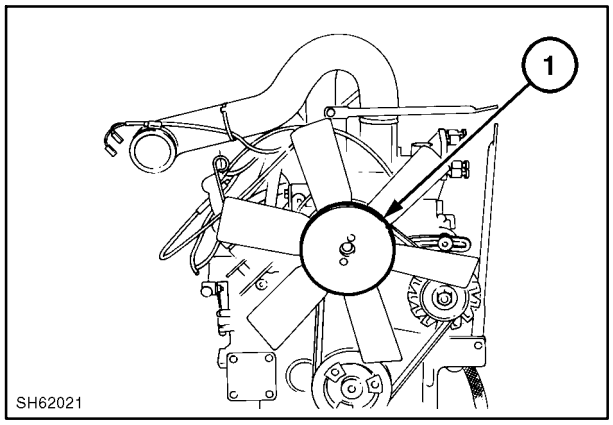


11

COOLING FAN AND PULLEY

Removal

Remove the fan, 1, retaining hardware and spacers.

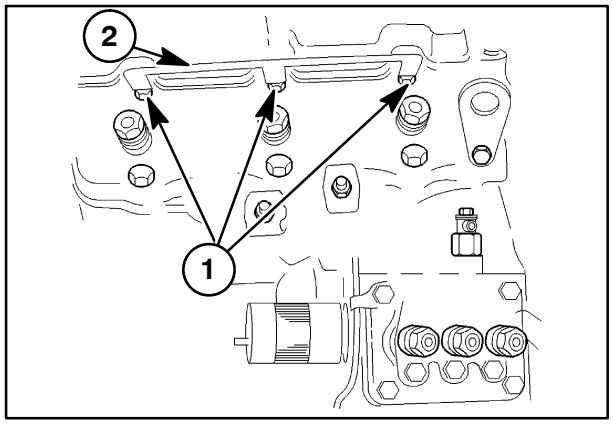


12

GLOW PLUG AND CONNECTOR

Removal

Remove the glow plugs, 1, and glow plug connectors, 2.

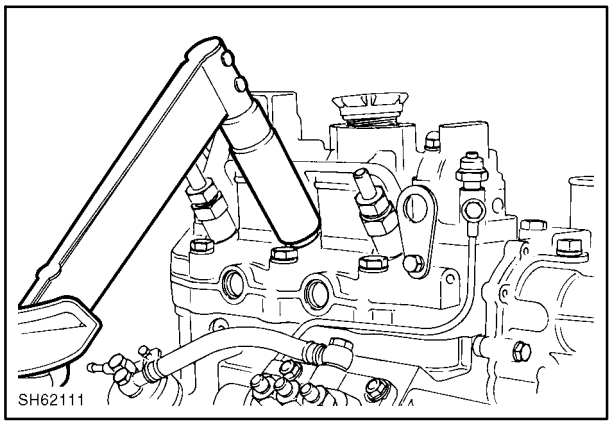


13

NOZZLE/HOLDER

Removal

Remove the nozzle and holder assembly with a socket for the nozzle holder.



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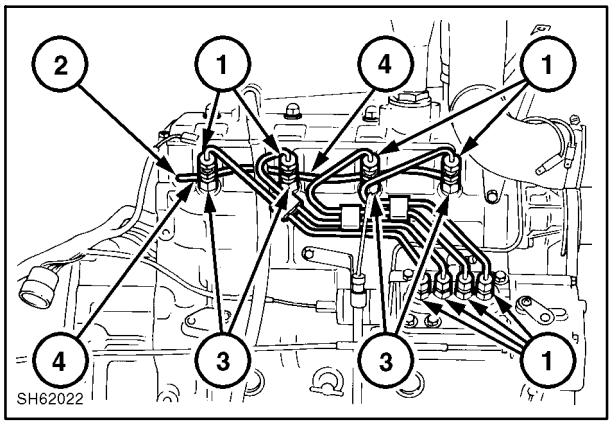
FUEL INJECTION PIPE

Removal

1. Loosen the fuel pipe nuts from the fuel injection pump and injectors, 1. Remove the pipes as an assembly.
2. Remove the spring clamp and fuel return hose, 2.



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INJECTOR

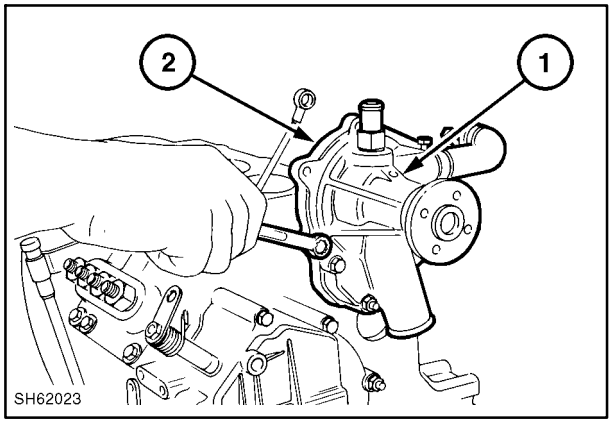
Removal

Loosen and remove the securing nuts, 3. Remove the leak-off rail, 4. Remove the aluminum washers and discard. Remove the injectors tagging or marking with the cylinder they were removed from.

WATER PUMP

Removal

Loosen the securing bolts and remove the water pump assembly, 1, and set plate, 2.



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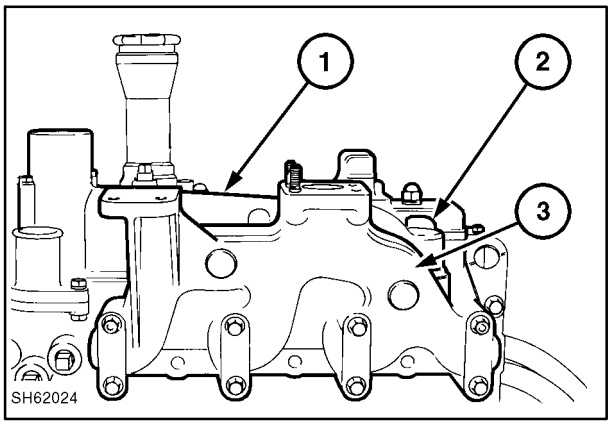
COVER/INTAKE MANIFOLD/EXHAUST MANIFOLD

Removal

Remove the intake manifold, 1, spacer, 2, and exhaust manifold, 3.

For the N844L-T turbocharged engine, refer to the turbocharger section of the manual for removal and replacement.



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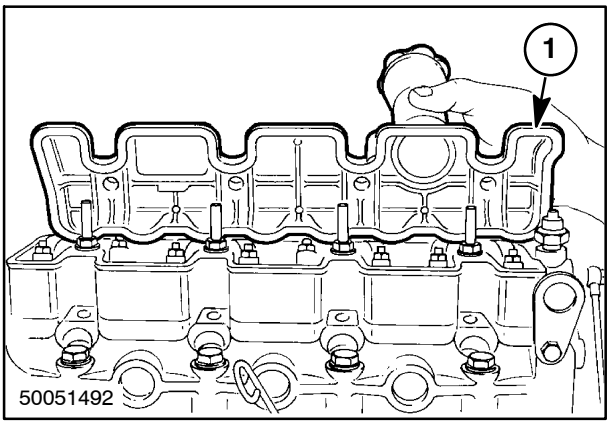
Loosen and remove four cap nuts with washers. Remove the head cover assembly, 1.



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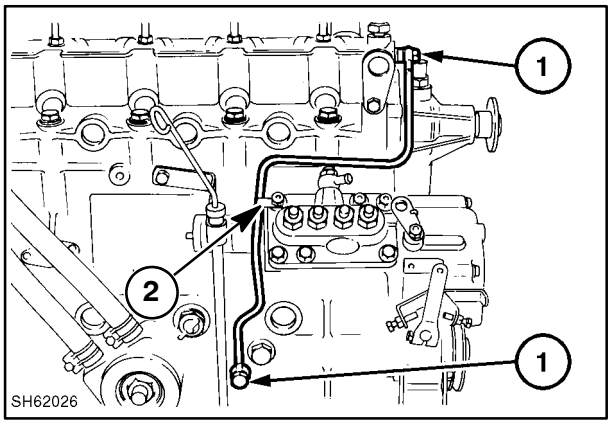
EXTERNAL OIL PIPE

Removal

1. Loosen and remove the two banjo bolts, 1, at the cylinder block main oil gallery and cylinder head assembly.
2. Remove the clamp, 2, from the fuel injection pump.



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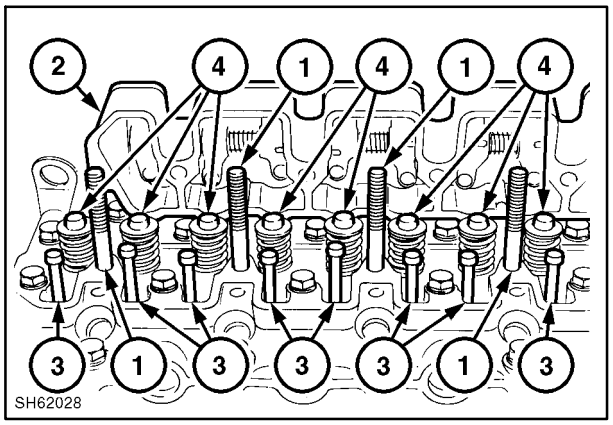
ROCKER ASSEMBLY

Removal

1. Loosen and remove nuts, lock washers, and flat washers from the rocker pillar stud, 1. Lift the rocker assembly, 2.
2. Remove the push rods, 3, and valve stem caps, 4.



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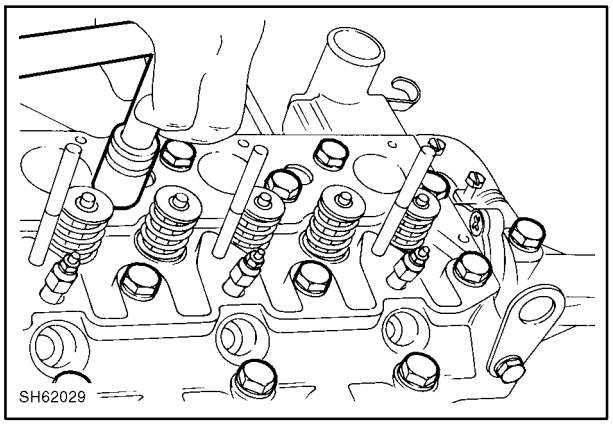
CYLINDER HEAD

Removal

Loosen the cylinder head bolts, starting from the center, in a circular pattern, using several steps of equal torque. Remove the head.



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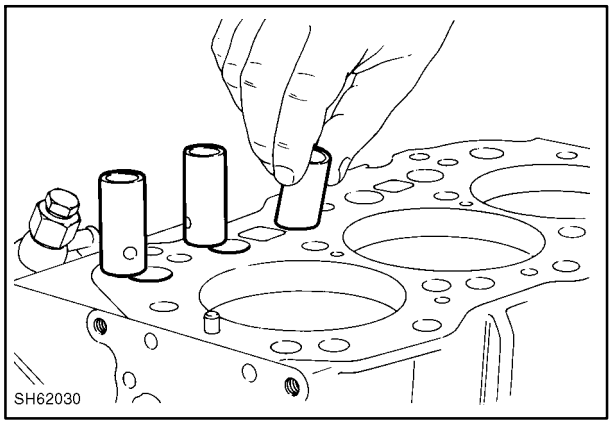
TAPPETS

Removal

Pull the tappets from the machined bore in the cylinder block.

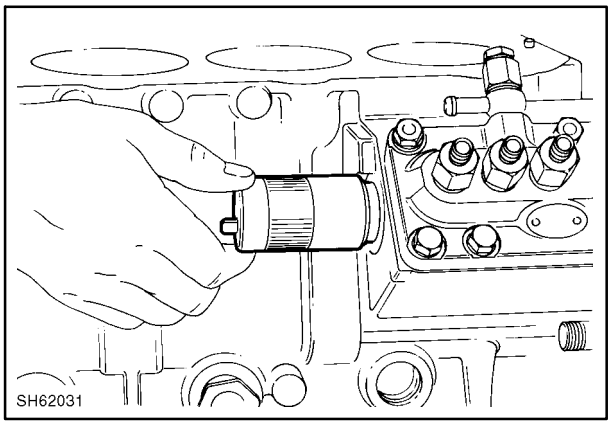


22

FUEL STOP SOLENOID

Removal

Unscrew the stop solenoid, and remove from the engine block.



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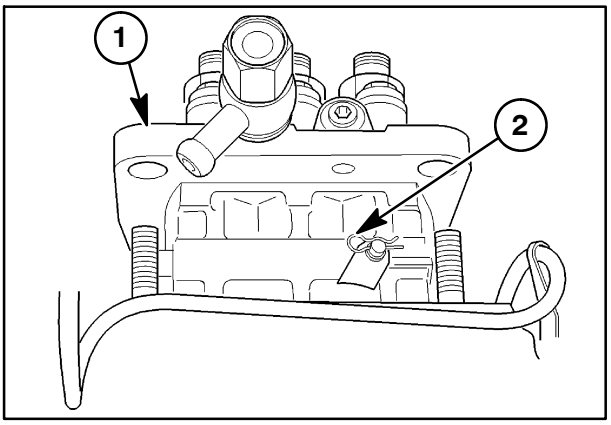
TIMING GEAR COVER

Removal

1. Drain the engine crankcase oil.
2. Remove the injection pump mounting nuts and raise the injection pump, 1, enough to remove the spring pin, 2, and separate the governor link from the control rack. Remove the injection pump.



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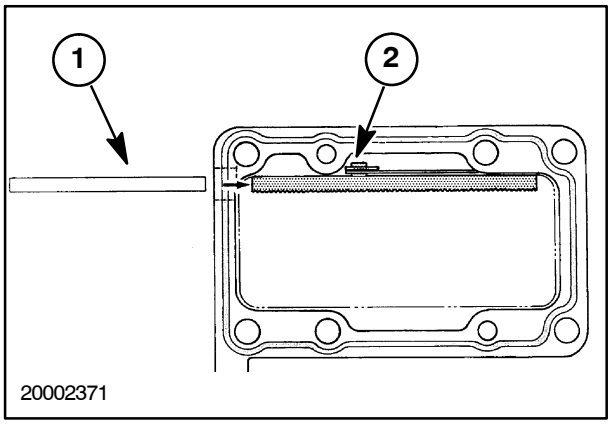
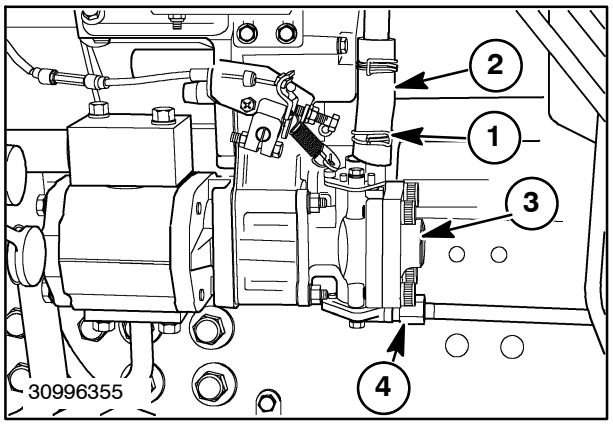
NOTE: *Insert a small dowel, 1, through the fuel shut-off solenoid hole and slide the control rack, 2, in to allow enough clearance to the cylinder block, for the pump to be removed.*



25

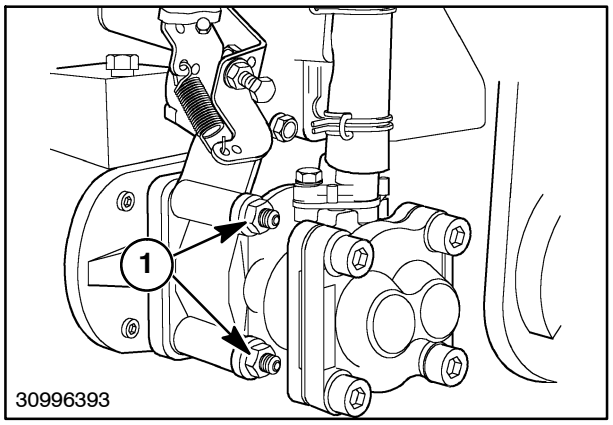
3. Loosen the hose clamp, 1, on the suction hose, 2, and remove the suction hose from the steering pump, 3.
4. Remove the pressure tube, 4, from the bottom of the steering pump.



26

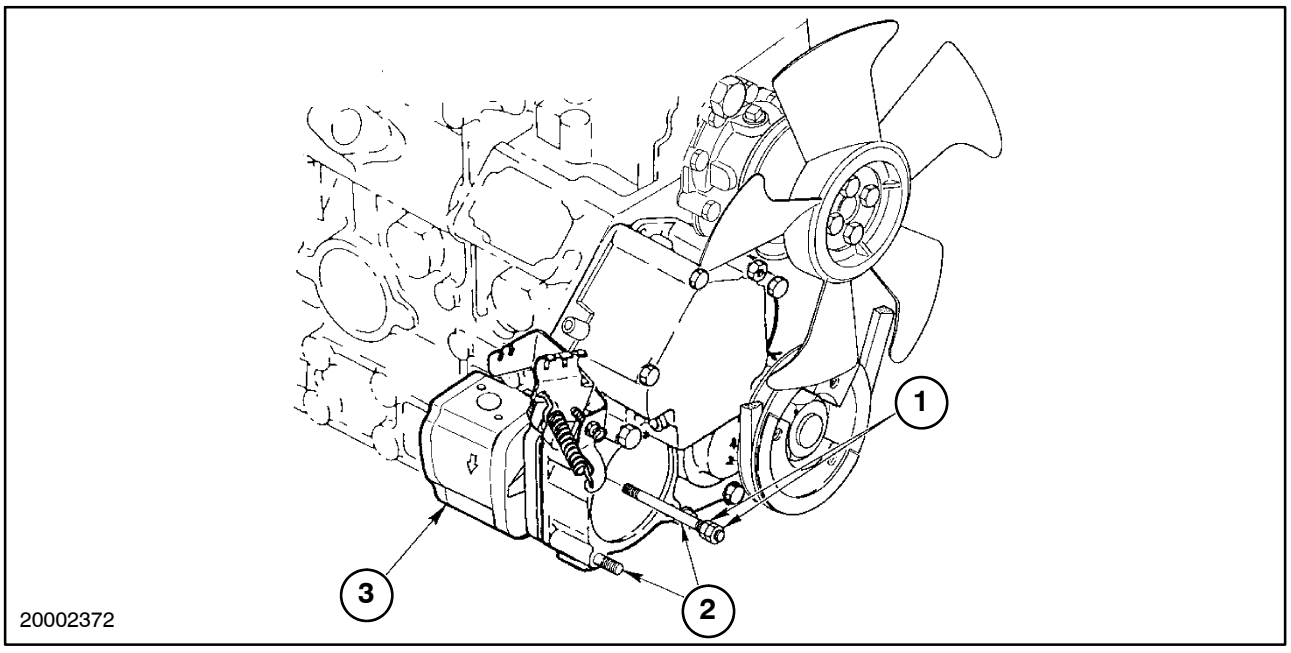
5. Remove the through bolts and nuts, 1, and remove the steering pump from the front cover. Cap the lines and pump openings.

NOTE: *Two of the power steering pump retaining bolts are not shown.*



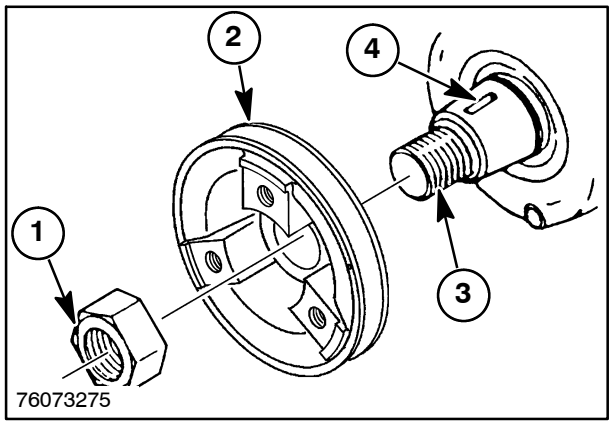
27

6. Install and tighten two nuts, 1, against each other, onto the retaining studs, 2. Remove the studs, 2, and the hydraulic pump, 3.



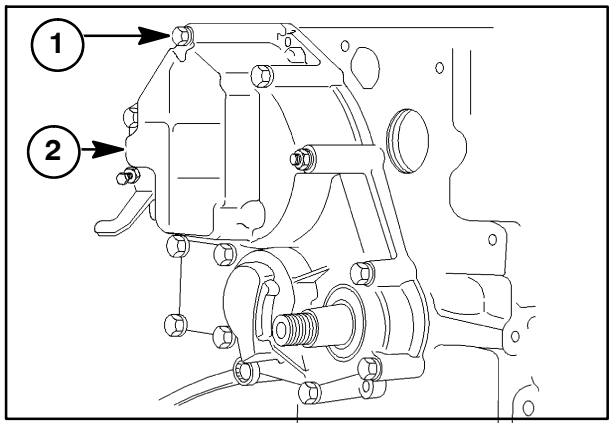
28

7. Remove the retaining nut, 1. Pull crankshaft pulley, 2, off of crankshaft, 3. Remove key, 4, from crankshaft.



29

8. Remove the retaining bolts, 1, and lift the cover, 2, off the locating dowels.

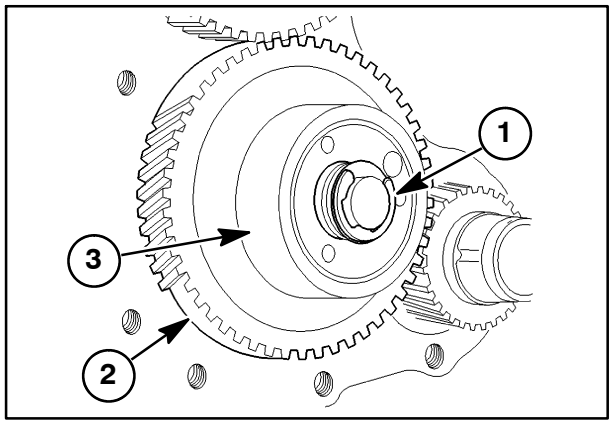


30

TIMING GEARS AND CAMSHAFT

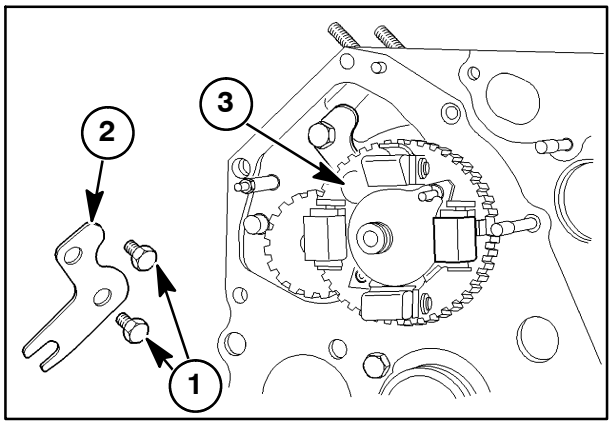
Removal

1. Remove retaining ring, 1, and remove the idler gear, 2, and oil pump assembly, 3.



31

2. Remove the two bolts, 1, securing the keeper plate, 2. One must be accessed using the access hole, 3, in the cam gear.
3. Slide the camshaft and gear out of the camshaft bore.

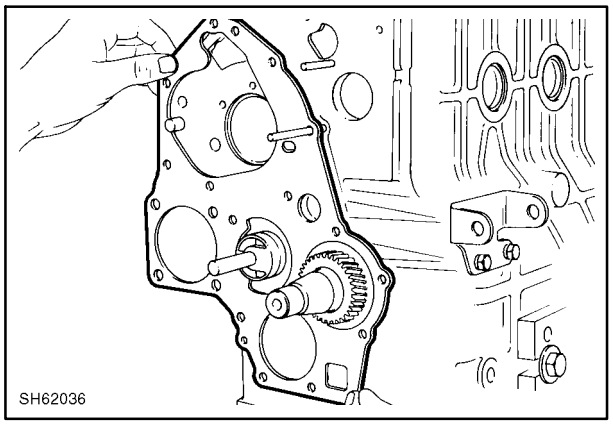


32

FRONT END PLATE

Removal

Remove the retaining bolts and lift the front plate off its locating dowels. Remove the gasket and discard.

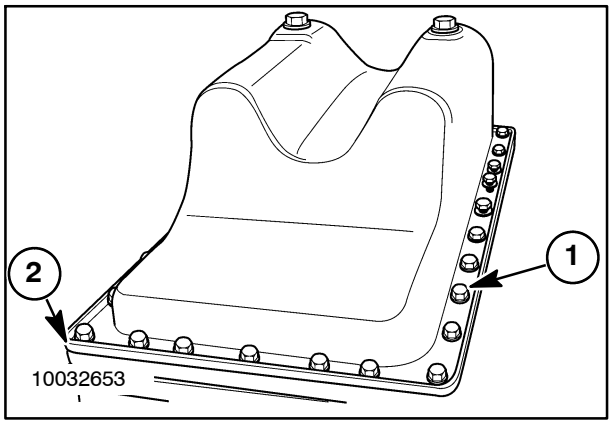


33

OIL SUMP

Removal

1. Remove the oil sump retainer bolts, 1.
2. Remove the oil sump and discard gasket.
3. Remove steel spacer, 2, from the block.



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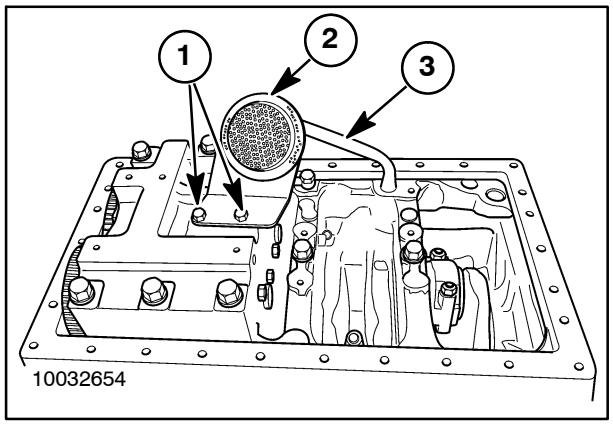
OIL SUCTION PIPE AND STRAINER

Removal

1. Remove the two retaining bolts, 1.
2. Remove the oil strainer, 2, and rotate the oil suction pipe, 3, out of its bore.



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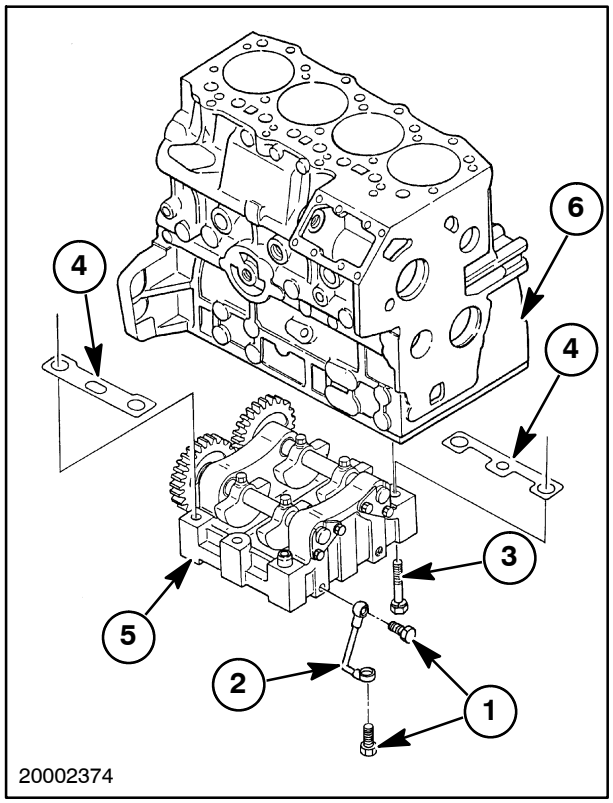
BALANCER ASSEMBLY

Removal

1. Remove the banjo bolts, 1, and the oil transfer pipe, 2.
2. Loosen and remove the balancer retaining bolts, 3.

NOTE: *Observe the quantity and thickness of the shims, 4, (if used) for re-installation upon assembly.*

3. Remove the balancer assembly, 5, from the engine block, 6.



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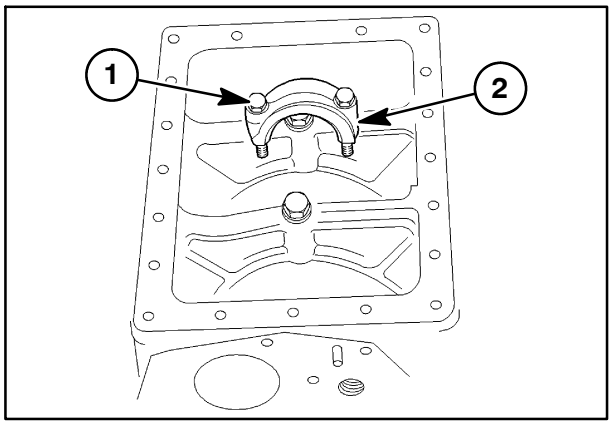
CONNECTING RODS, BEARINGS AND PISTONS, RINGS

Removal

1. Remove the two bolts, 1, retaining the connecting rod caps, 2.
2. Remove the connecting rod caps and lower half of connecting rod bearing.
3. If necessary, remove any ridge from the top of the cylinder bores using a suitable ridge reamer.



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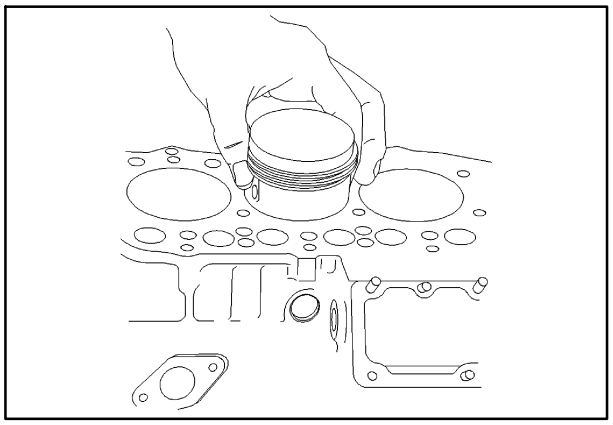
4. Push the piston and connecting rod out of the cylinder block.
5. Replace the connecting rod cap to the piston assembly it was removed from. Keep together in cylinder sequence.



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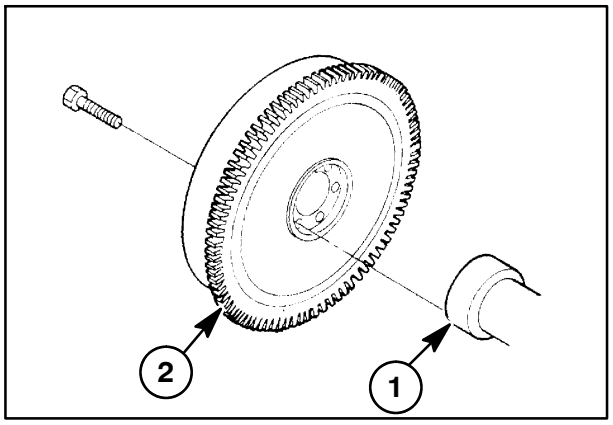
FLYWHEEL

Removal

1. Loosen the flywheel retaining bolts.
2. Using a brass drift and hammer, tap the end of the crankshaft, 1, to loosen the flywheel, 2, from the shaft.



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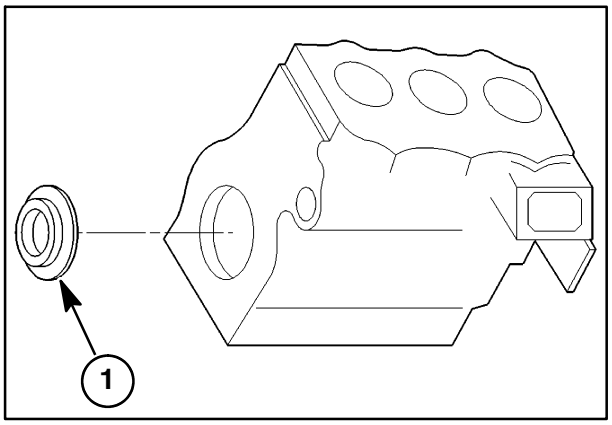
BACKPLATE AND OIL SEAL

Removal

1. Remove the backplate retaining bolts and remove the backplate.
2. Remove the rear oil seal, 1.



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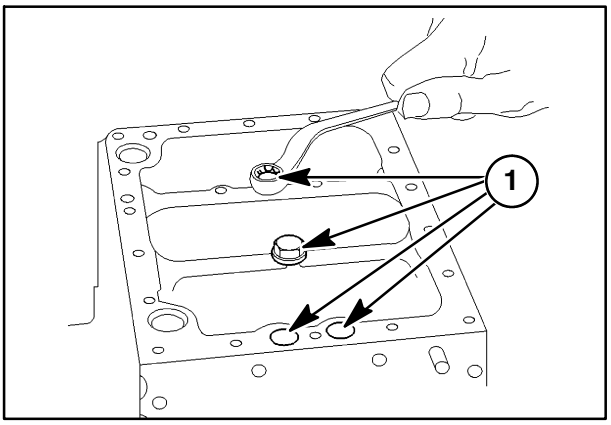
CRANKSHAFT AND MAIN BEARINGS

Removal

1. Remove the crankshaft bearing holder retaining bolts, 1.



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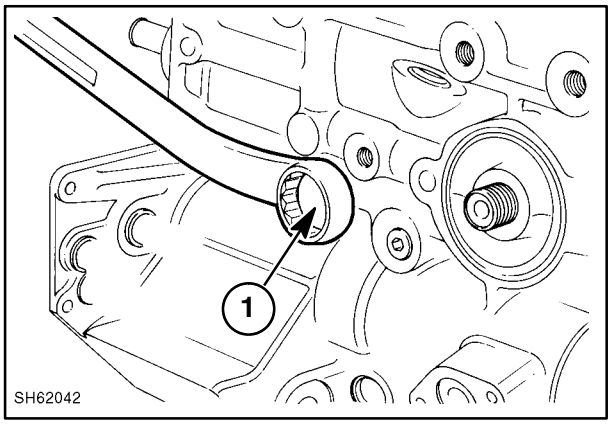
2. Remove the relief valve assembly, 1.
3. Slide the crankshaft and main bearing assembly through the rear of the engine.



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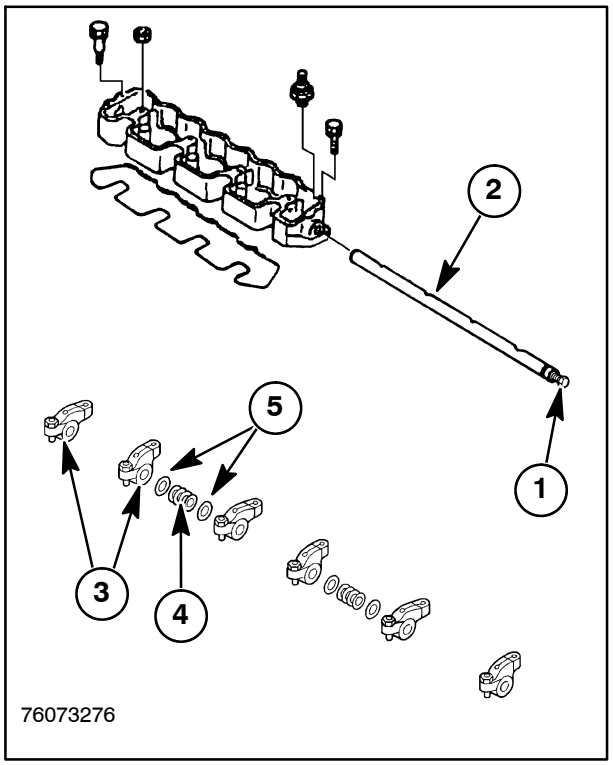
ROCKER ARM ASSEMBLY

Disassembly

1. Thread a 8 mm bolt, 1, into the rear end of the rocker shaft and slowly withdraw the rocker shaft, 2, while at the same time removing the rocker arms, 3, springs, 4, and shims, 5.

NOTE: *The rocker shaft housing must be removed from the cylinder head, before rocker shaft can be removed from housing. Housing mounting bolts retain rocker shaft.*



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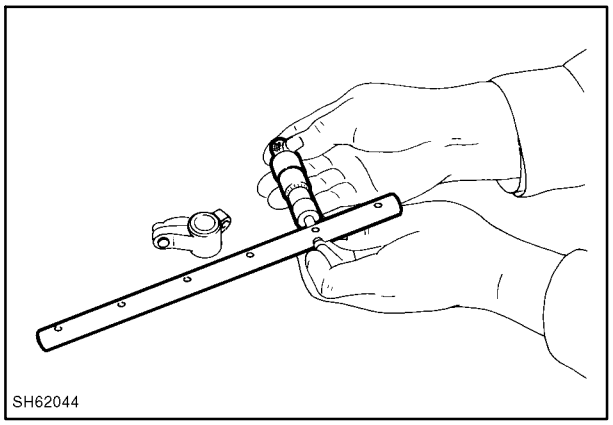
Inspection and Repair

1. Wear of Rocker Arm Shaft

   Using a micrometer, check the outside diameter of the rocker arm shaft. If the rocker arm shaft is worn beyond the allowable limit, replace.

Standard dimension	Allowable Limit
14.95 mm – 14.97 mm (0.588″ – 0.589″	14.87 mm (0.585″)



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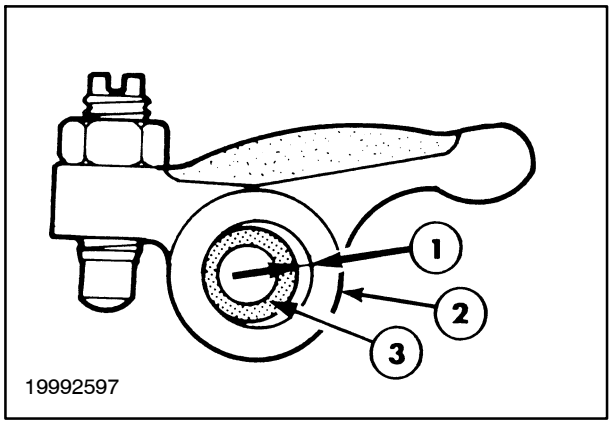
2. Rocker Arm-to-Shaft Clearance

   Measure the inside diameter of the rocker arm. Calculate the clearance at, 1, between the rocker arm, 2, and the rocker arm shaft, 3. If the clearance is excessive, replace.

Standard Clearance	Allowable Limit
0.030 mm – 0.093 mm (0.0012″ – .0037″)	0.2 mm (0.008″)

3. Wear on valve stem contacts face of the rocker arm.

   Check the face for step wear or score. Slight wear may be corrected using an oil stone.



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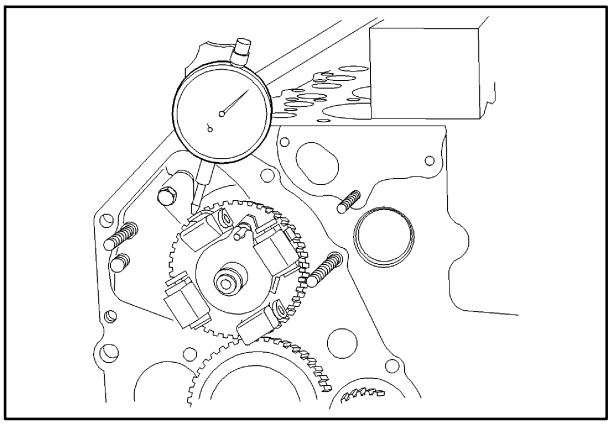
TIMING GEAR

Inspection

1. Check the timing gears for wear and damage on the contact area. Replace if any defect is found.
2. Measure the backlash of gears with a feeler gauge or dial indicator. If the allowable limit is exceeded, replace all timing gears.

Standard	Allowable Limit
0.08 mm (0.003″)	0.25 mm (0.010″)



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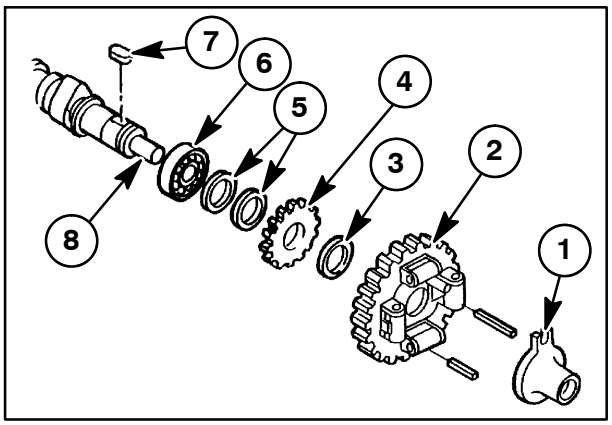
CAMSHAFT

Disassembly

1. Remove the slider, 1, from the camshaft gear.
2. Using a gear puller, remove the gear assembly, 2, spacer, 3, tachometer gear, 4, spacers, 5, bearing, 6, and key, 7, from the camshaft, 8.



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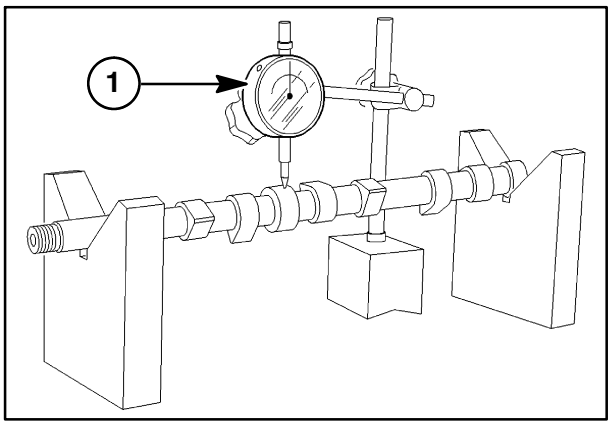
Inspection

1. Place the camshaft in a set of V-blocks and check the runout using a dial indicator, 1.
2. Replace or straighten the camshaft if the runout is greater than 0.1 mm (0.004″).
3. Using a micrometer, measure the height of the camshaft lobes.
4. Replace the camshaft if any of the cam lobes are worn to less than the following dimensions:

   Valve Lobe: 34.1 mm (1.3425″)

   Injection Pump Lobe: 42.8 mm (1.685″)



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OIL PUMP

Disassembly

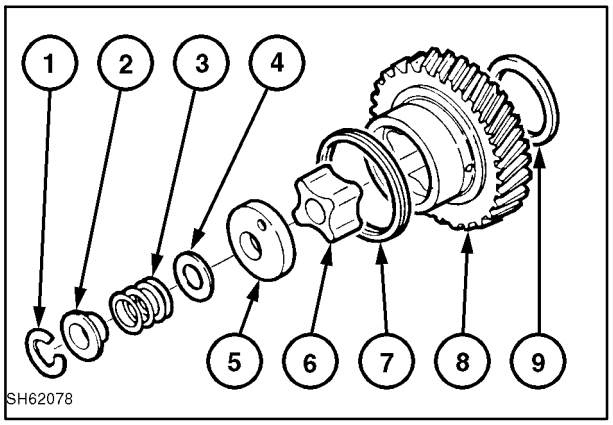
Remove the snap ring, 1.

Take out the collar, 2, spring, 3, and shim, 4.

Remove the oil pump cover, 5.

Remove the rotor, 6, and spring, 7, from idler gear, 8.

Remove the thrust washer, 9, from the idler gear.



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1. Snap ring
2. Collar
3. Spring
4. Shim
5. Oil pump cover
6. Rotor
7. Spring
8. Idler gear
9. Thrust washer

Inspection

Check the oil pump cover, rotor, and vane for wear. If excessively worn or damaged, replace.

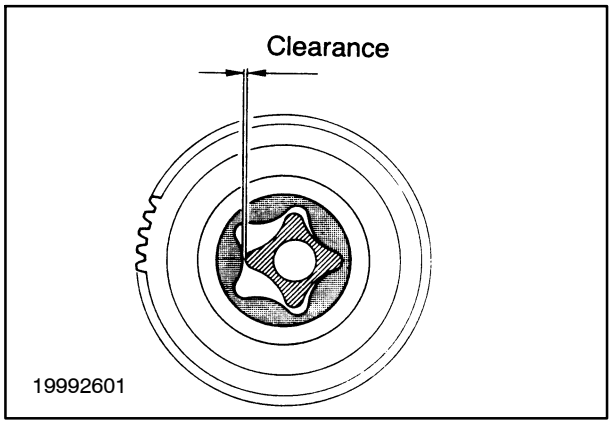
Check the clearance between the rotor and the vane.

Assembly (see Idler Gear)

Reassemble the oil pump in the reverse order of disassembly.

Align the set marks on the crankshaft gear and idler gear to reassemble.

Make sure the tip clearance between the rotor and the vane is 0.01 mm to 0.15 mm (0.0004″ to 0.006″). Allowable limit is 0.25 mm (0.010″) .



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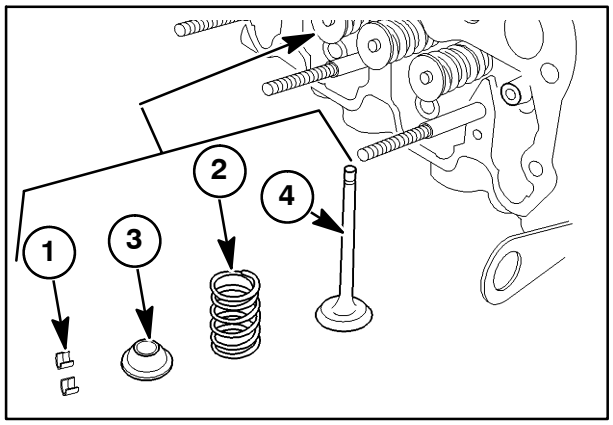
CYLINDER HEAD

Disassembly

1. Clean the cylinder head and remove any carbon deposits from around the valve heads.
2. Use a valve spring compressor and remove the valve spring retainer locks, 1, spring, 2, and spring retainer, 3, from each valve, 4.
3. Remove the valves and place the valve components together in separately marked containers for reassembly in their original position.



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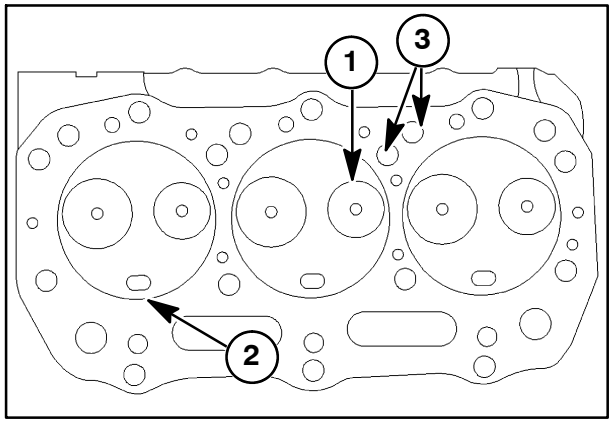
Inspection and Repair

1. Clean all carbon deposits from the combustion chamber and valve ports using a wire brush and scraper.
2. Clean all dirt and residue from the gasket surface using care not to scratch or nick the machined surface.
3. Clean the cylinder head in solvent and air dry.
4. Inspect the head for cracks or damage in the following areas:
   - Valve ports
   - Valve seats, 1
   - Prechamber, 2
   - External cracks in the water jackets, 3
5. Inspect the gasket surfaces for scratches or nicks, which could cause leakage.
6. Examine the core hole plugs for rust or signs of leakage. If a plug shows signs of damaging rust or leakage, replace all plugs in the head.
7. Inspect the prechamber for carbon deposits and looseness. Remove any carbon deposits found. If prechamber is found to be loose, cylinder head may be warped.
8. Check six positions (1 to 6 lines, as shown) for warping. If found to be warped excessively, correct with a surface grinder.

Standard Value	Allowable Limit
0.05 mm or less (0.002″)	0.12 mm 0.005″)



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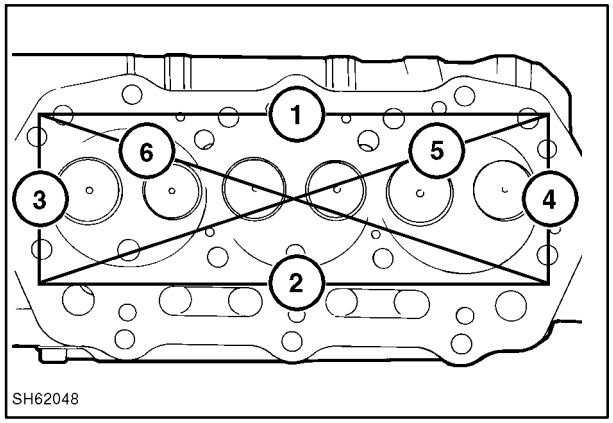

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VALVES

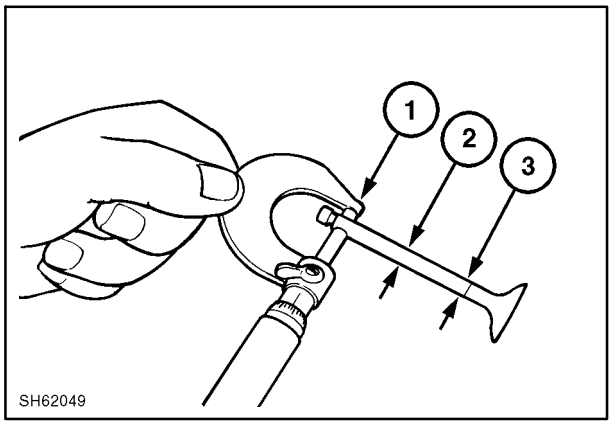
1. Check the valve stem for excessive wear or damage. If found to be excessively damaged, replace.
2. Check the valve stem diameters at positions 1, 2, and 3 with a micrometer. If the diameter is less than the allowable limit, replace.

Intake Valve

Standard Diameter	Allowable Limit
6.955 mm – 6.97 mm (0.2738″ – 0.2744″)	6.89 mm (0.271″)

Exhaust Valve

Standard Diameter	Allowable Limit
6.94 mm – 6.95 mm (0.2732″ – 0.2736″)	6.84 mm (0.269″)



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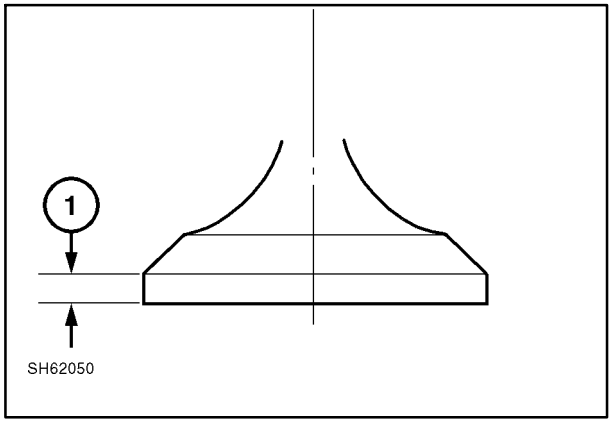
Thickness of Valve Head

If valve head thickness, 1, is less than the allowable limit, replace the valve.

All Engines

Standard Thickness	Allowable Limit
0.925 mm – 1.075 mm (0.036″ -0 .042″)	0.5 mm (0.020″)



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VALVE GUIDES

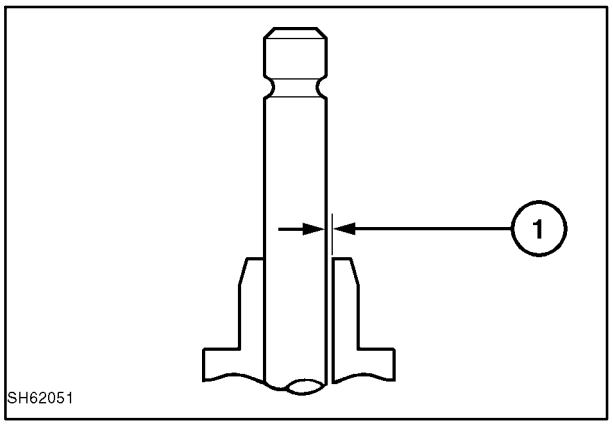
Check the clearance at, 1, between the valve and valve guide. If the clearance exceeds the allowable limit, replace.

Intake Valve – All Engines

Standard Clearance	Allowable Limit
0.03 mm – 0.06 mm (0.0012″ – 0.0024″)	0.2 mm (Max. 0.008″)

Exhaust Valve – All Engines

Standard Clearance	Allowable Limit
0.05 mm – 0.075 mm (0.002″ – 0.003″)	0.25 mm (Max. 0.010″)



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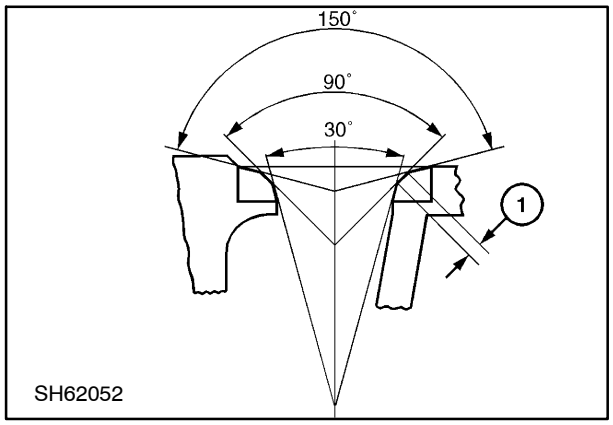
VALVE SEAT

Valve Seat Contact Width

If the contact width at 1 of the valve seat is more than the allowable width, check the wear condition of the valve guide first.

Using the seat cutters of 15°, 45°, and 75°, correct the seat.



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Intake

Standard Width	Allowable Limit
1.5 mm – 2.0 mm (0.06″ – 0.08″)	2.5 mm (0.098″ max.)

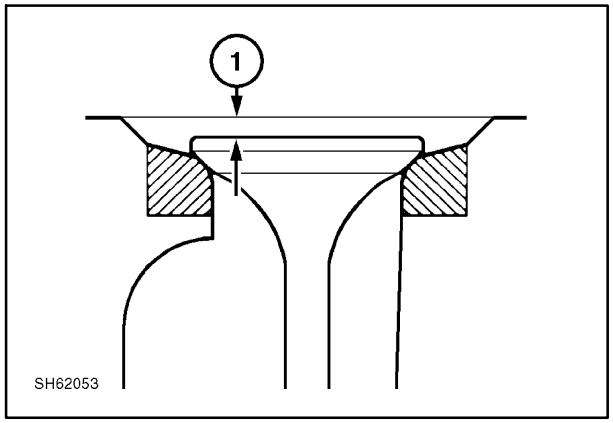
Exhaust

Standard Width	Allowable Limit
1.94 mm – 2.16 mm (0.076″ – 0.085″)	2.5 mm (0.098″ max.)

Recess of Valve Seat

If the recess depth, 1, is more than the allowable limit, replace the valve seat (if fitted).

Standard Recess	Allowable Limit
0.85 mm – 1.15 mm (0.033″ – 0.045″)	1.8 mm (0.071″ max.)



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Replacement of valve seat insert (where fitted:)

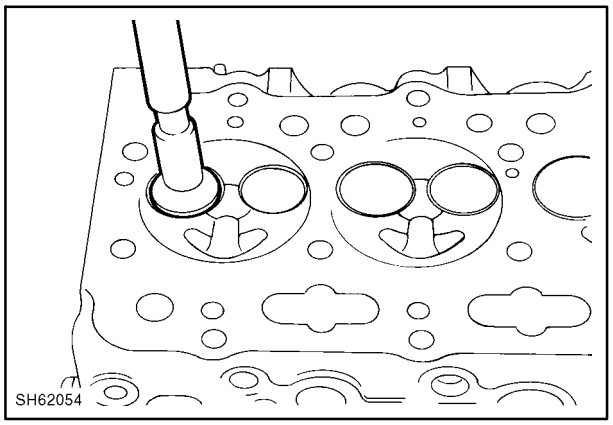
Method 1 – Using a gas burner, 700° C to 800° C (1300° F to 1475° F), heat diagonally across the valve seat insert. Leave in air for three to five minutes and remove the valve seat insert by light tapping (ensuring the head is not damaged).

Method 2 – Machine the insert out, taking care not to damage the head.

Clean up the insert bore and fit a new insert, using a press 1,000 kgf – 1,500 kgf (7,200 lbs – 10,850 lbs) and a suitable smooth surface tool. To assist the process, chill the valve seat insert with liquid nitrogen, etc., or heat the head to between 60°C and 100°C (140°F to 212°F).

Lapping of Contact Face of the Valve Seat
Correct valve seat contact using a valve lapper and lapping compound.

When using a new cylinder head, obtain correct seat contact width and seat recess using the seat cutter, and then carry out lapping.



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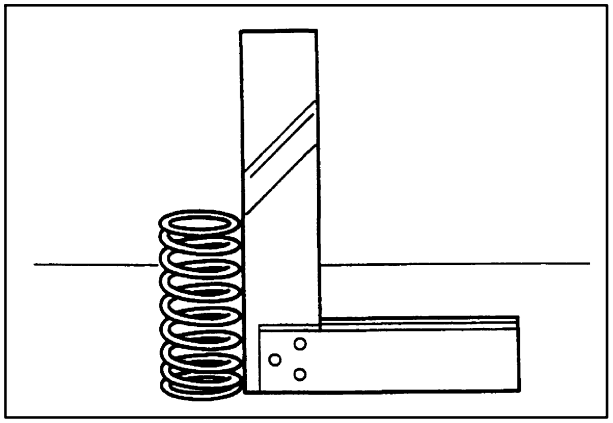
VALVE SPRINGS

1. Place the valve springs on a flat surface. Measure the free length of the spring and squareness. Replace springs that do not meet the following specifications (all models):

Max. Out of Square	Min. Free-Length
2.0 mm (0.079″)	33.5 mm (1.319″)

2. Place the springs in a suitable spring load tester and measure the spring load rating. Replace springs that do not meet the following specifications (all models):

Standard	Maximum
8.1 kg (17.86 lbs) at 30.4 mm (1.197″)	7 kg (15.43 lbs) at 30.4 mm (1.197″)



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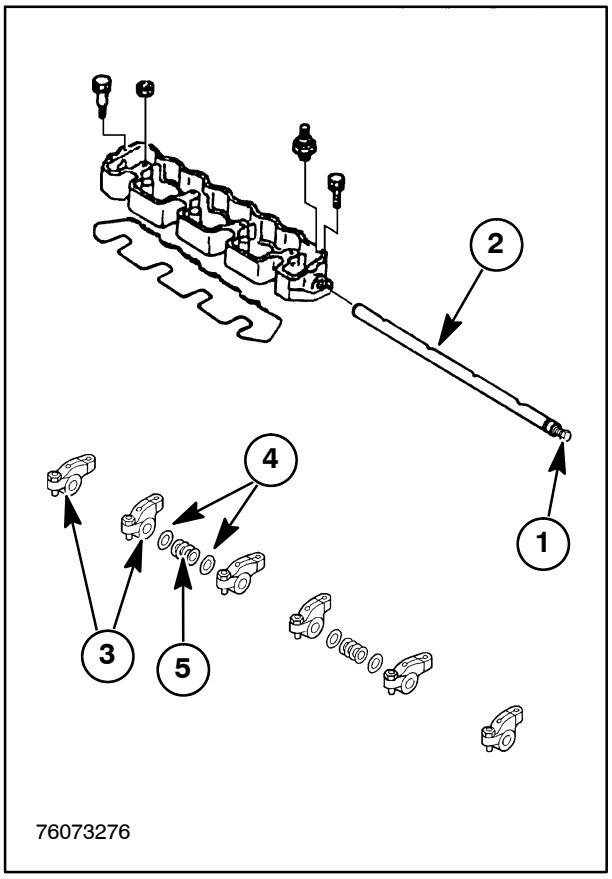
ROCKER ARMS

1. Thread an 8 mm bolt, 1, into the rear end of the rocker shaft, 2, and slowly withdraw the rocker shaft while at the same time removing the rocker arms and springs.
2. Inspect the rocker arms, 3, and shaft for wear or damage. Check the adjusting screws for damaged threads or excessive wear.
3. Check the valve stem contact area for pitting or excessive wear. Slight wear patterns may be removed using a fine grit oil stone.

NOTE: *The rocker shaft housing must be removed from the cylinder head, before rocker shaft can be removed from housing. Housing mounting bolts retain rocker shaft.*



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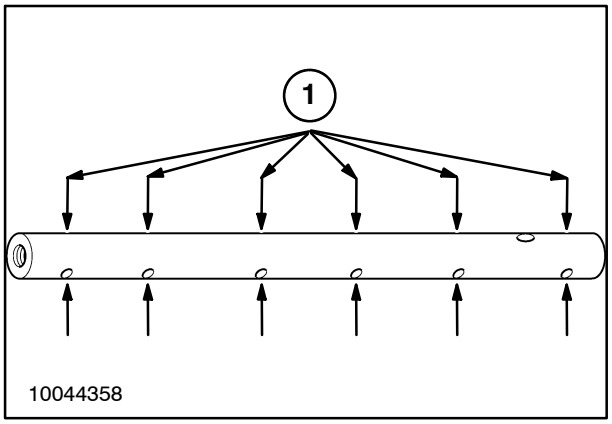
1. 8 mm Bolt
2. Rocker Arm Shaft
3. Rocker Arm
4. Shims
5. Spring

4. Using an outside micrometer, measure the wear points, 1, on the rocker shaft. Replace the rocker shaft if the wear at any point exceeds 0.2mm (0.008″).

NOTE: *Lube holes, one set on bottom of rocker shaft at 90° from the oil pressure check hole.*



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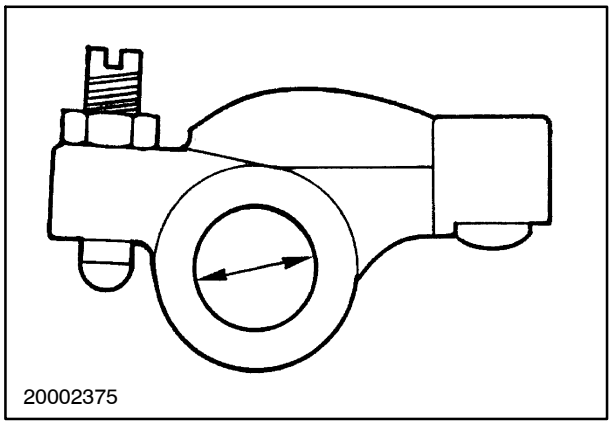
5. Using a telescoping gauge and micrometer, measure the inside of the rocker arm. Replace rocker arms having a bore diameter exceeding 14.87 mm (0.584″). Replace the rocker shaft and/or rocker arm if the rocker arm to shaft clearance exceeds 0.2 mm (0.008″).

NOTE: *Rocker arms have no bushings and only one lube hole.*



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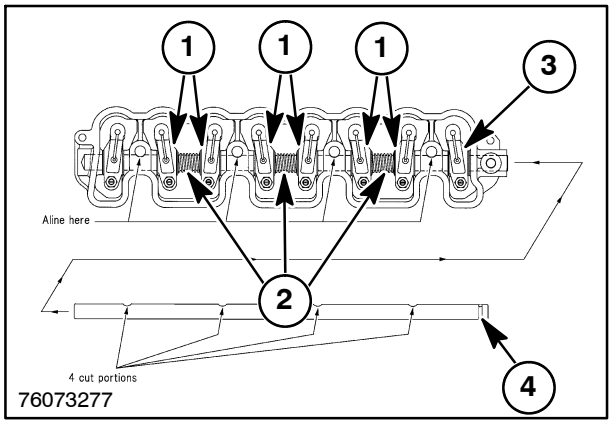
PUSH RODS

1. Check the push rods for straightness by rolling on a flat surface. Replace rods that are bent.
2. Inspect the ends of the push rods for excessive wear. If any push rod is worn, the corresponding lifter and rocker arm should also be inspected for excessive wear.

ROCKER ARM SHAFT

Installation

Position the shims, 1, springs, 2, and rockers arms, 3, in the rocker shaft housing. Insert the rocker shaft, 4, through the shims, springs, and rocker arms. Align the four cut portions of the rocker arm shaft to the hole of the rocker arm bracket. If not aligned, the rocker arm bracket cannot be installed on the cylinder head



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CYLINDER BLOCK

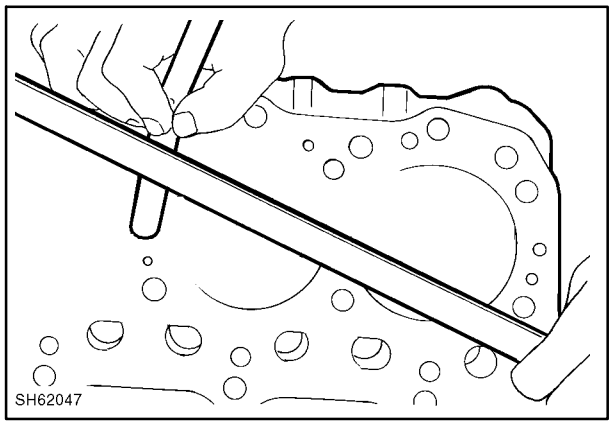
Inspection and Repair

Cylinder Block Top Face

Inspect the cylinder block top face for cracks, damage, and warping in the same way as for the cylinder head.

If outside the limit, replace the cylinder block.

Standard Value	Allowable Limit
Less than 0.05 mm (0.002″)	0.12 mm (0.005″)



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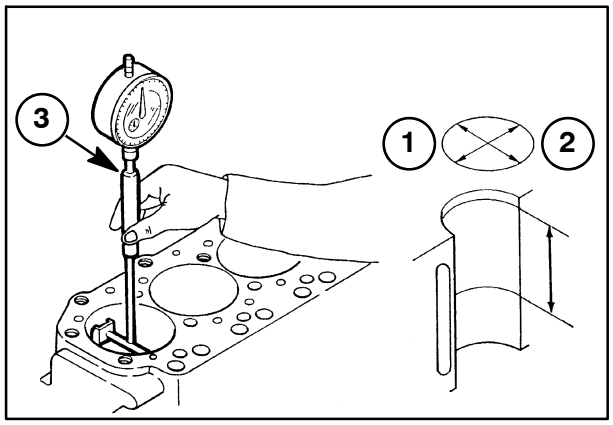
Cylinder Bore

1. Visually inspect the cylinder bore. There should be no scoring, rust, or corrosion.
2. Measure the cylinder bore at the upper, middle, and lower areas (piston ring contact area) in the direction of the crankshaft (1 direction) and at right angle to the crankshaft (2 direction).

   The upper area described above corresponds to the top ring when the piston is at the T.D.C. (about 0.40″ [10 mm] below the cylinder block top surface). The lower area corresponds to the piston oil ring when the piston is at the B.D.C. (about 3.94″ [100 mm] from top face).

   Check the bore using a cylinder gauge, 3.
3. If the bore is found to be outside the allowable limit, replace block.



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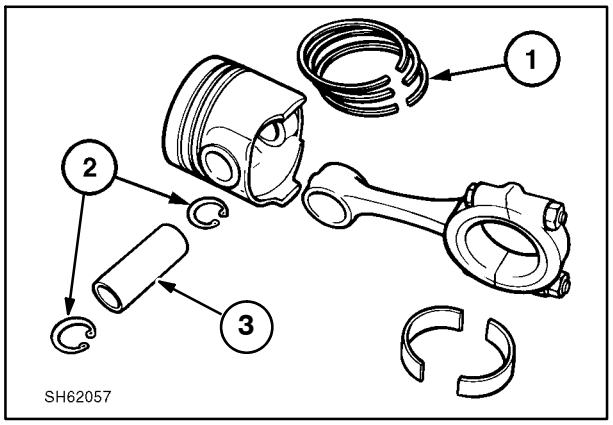
Bore Specifications:

Standard Bore	Allowable Limit
84 mm – 84.019 mm (3.307″ – 3.308″)	84.2 mm (3.315″)

PISTON AND PISTON RINGS

Disassembly

1. Remove piston rings, 1, using a piston ring tool.
2. Remove the retaining ring, 2, and remove the piston pin, 3.



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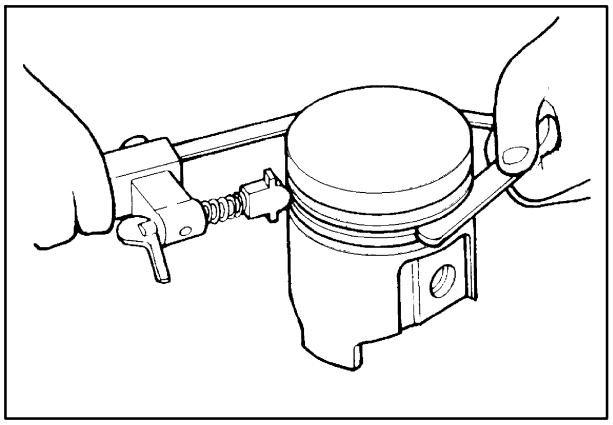
Inspection

1. If the outer surface of the piston is excessively damaged (cracked, scored, burning, etc.), replace.
2. Wash the pistons and connecting rods in a suitable solvent and air dry.
3. Using a groove cleaner, remove the carbon deposits from the ring grooves. Be careful to avoid cutting any metal from either side or the bottom of the grooves.



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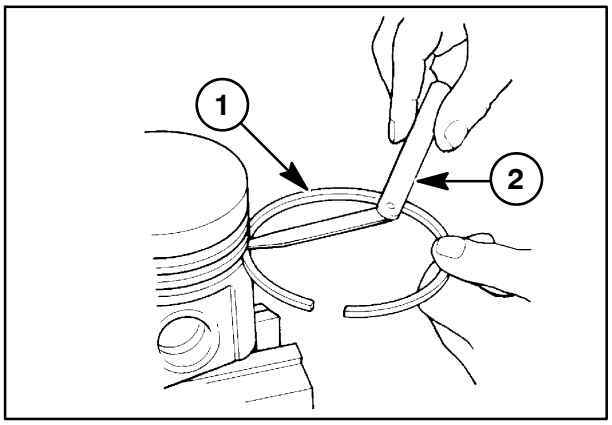
4. Inspect the piston ring lands for excessive wear. Use a new ring, 1, and feeler gauge, 2, to check the ring side clearance. Replace pistons having a ring side clearance exceeding the following dimensions:

Compression Ring	Oil Control Ring
0.25 mm (0.010″)	0.25 mm (0.010″)



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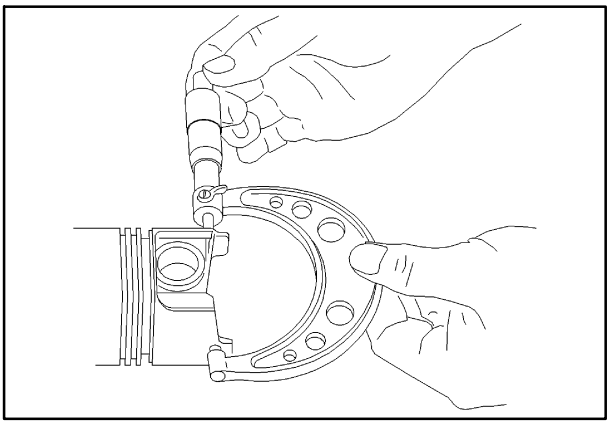
5. Using a micrometer, check the piston diameter at 90 degrees from the wrist pin bore. Replace pistons that are worn to less than the following dimensions:

Model	Wear Limit
All	83.9 mm (3.3″)



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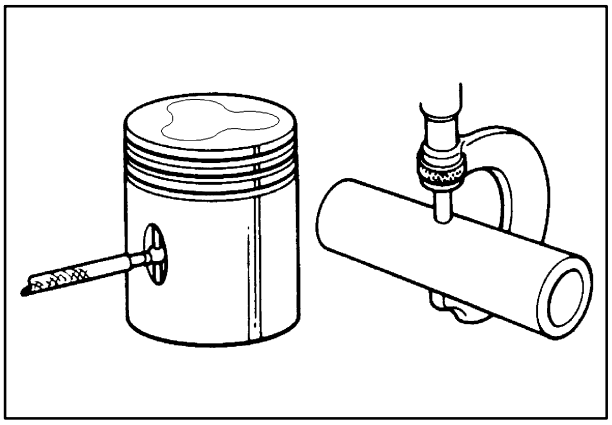
6. Using a telescoping gauge and a micrometer, measure the piston pin bore and the wrist pin diameter. Replace piston and/or wrist pins that exceed the following limits:

   Bore Diameter: 28.0 mm (1.102″)

   Pin Diameter: 27.98 mm (1.101″)

   Clearance: 0.02 mm (0.0008″)

NOTE: *In some instances the wrist pin diameter may be equal to or slightly larger than the wrist pin bore. This interference fit is normal.*



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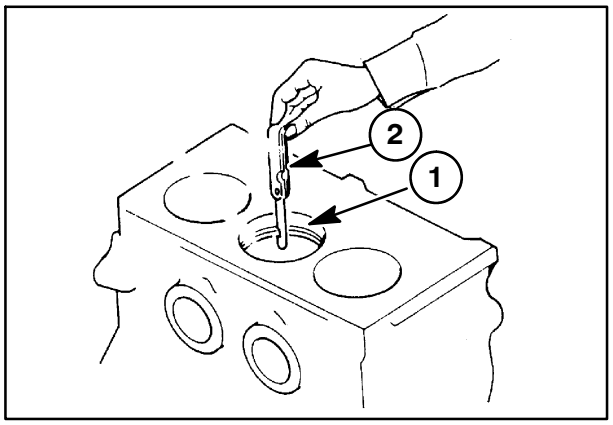
7. Position the piston rings, 1, one at a time, in the cylinder to the lowest point of travel. Use an inverted piston to square the ring in the bore.
8. With a feeler gauge, 2, measure the ring gap.

   The ring is shown at the top of its travel for clarity.
9. Replace worn rings with end gap clearance in excess of 1.0 mm (0.039″).



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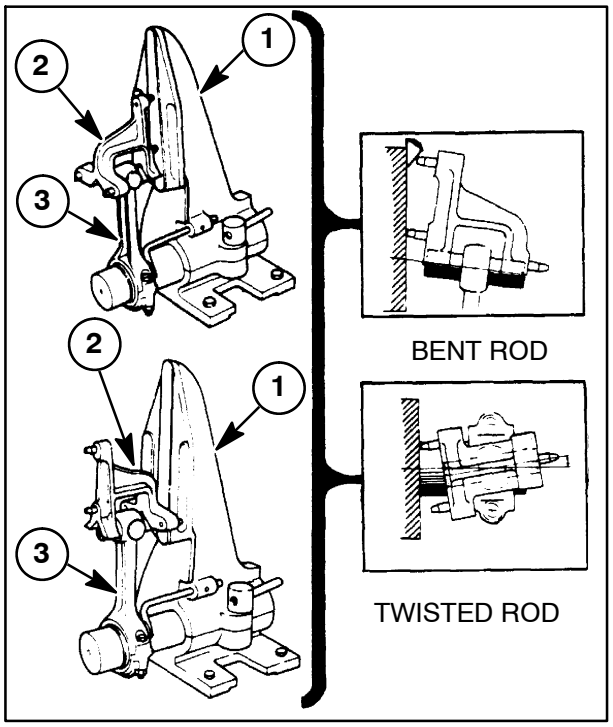
CONNECTING RODS

1. Check the connecting rods for damage and alignment. Place each rod in an alignment fixture to check for bent or twisted condition.
2. Straighten or replace rods that are bent or twisted more than the following dimensions:

   Max. Bend: 0.15 mm (0.006″) per 100 mm (3.94″)

   Twist: 0.2 mm (0.008″) per 100 mm (3.94″)



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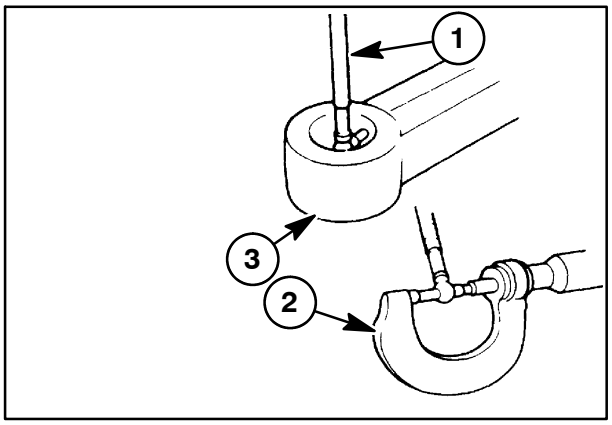
1. Alignment Fixture
2. Gauge
3. Connecting Rod

3. Using a telescoping gauge and a micrometer, measure the inside diameter of the connecting rod wrist pin bushing.
4. Replace bushings measuring more than the following:

Model	Max. Inside Diameter
All Models	28.021 mm (1.103″)



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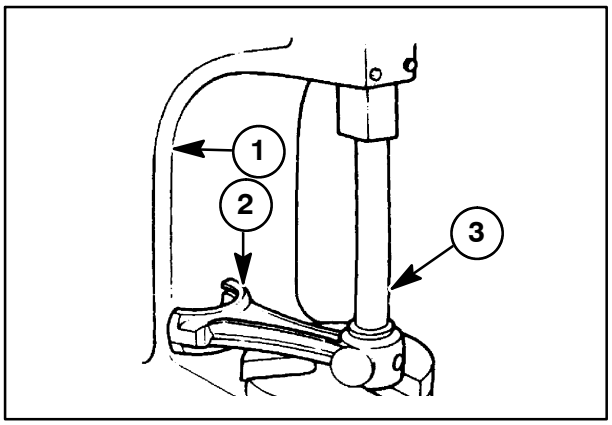
1. Hole Gauge
2. Micrometer
3. Connecting Rod

5. Remove and install the connecting rod wrist pin bushings using a suitable driver and press a new bushing into the rod bore.
6. Ream and hone the bushing to the following finish size.

Pin to Bushing Clearance

Std.	Max.
0.010 – 0.025 mm (0.00039″ – 0.00098″)	0.08 mm (0.0031″)



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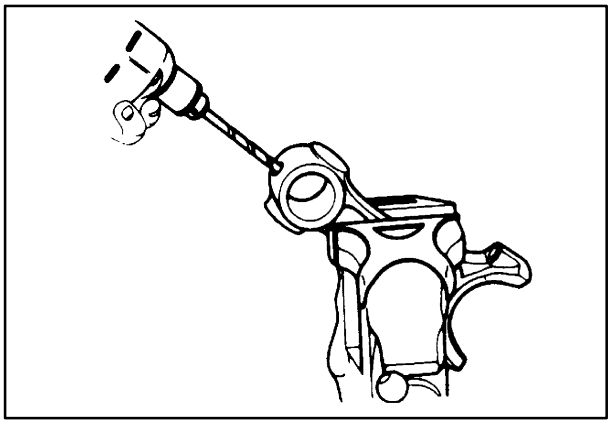
1. Press
2. Connecting Rod
3. Bushing Driver

7. When installing a new piston pin bushing, use the hole in the rod and drill a lube hole in the new bushing.



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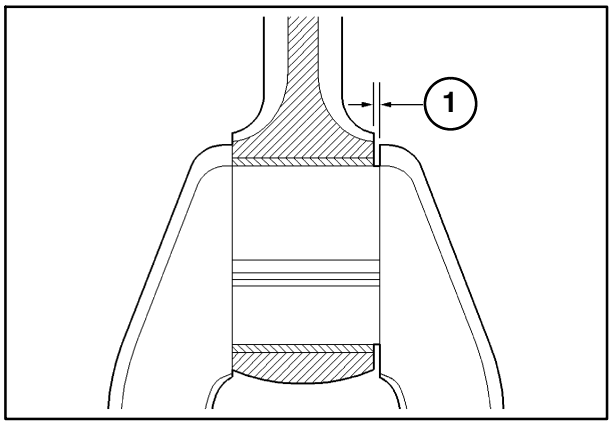
8. Install the connecting rod on the crankshaft and measure the play in shaft direction. If the play is more than 0.7 mm (0.028″) replace the connecting rod.



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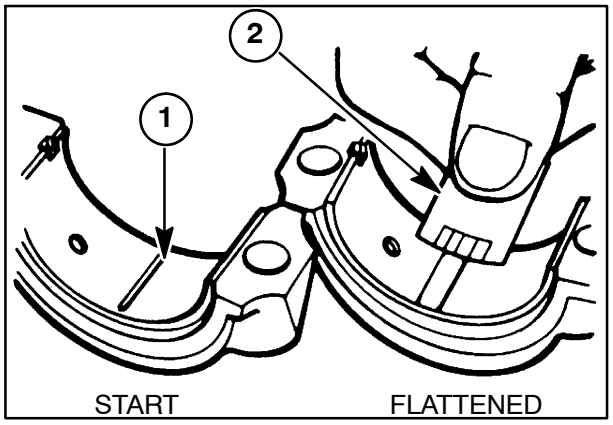
1. Side Clearance Check 0.7 mm (0.028″) Max.

Oil Clearance Check

1. Remove oil or foreign matter from the bearing and crankshaft.
2. Cut a piece of plastigauge, 1, to the same width as the bearing. Place it on the crankshaft. Avoid the oil hole.
3. Install the rod cap and torque to 49.0 – 53.9 N·m (36.2 – 39.8 ft-lbs).
4. Remove the rod cap and measure the width of the flattened plastigauge using the plastigauge scale.
5. The width of the widest flattened plastigauge is the minimum clearance and the width of the narrowest plastigauge is the greatest clearance. Select the proper size bearing liners to obtain the correct clearance. See “Specifications” later in this section.



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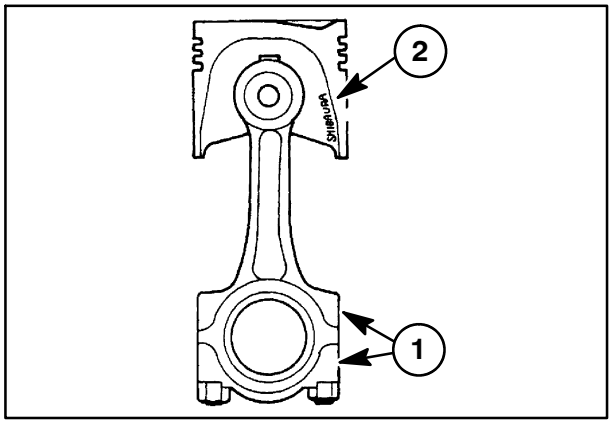
1. Plastigauge
2. Bearing Clearing Check

PISTONS, RINGS AND CONNECTING ROD

Assembly

1. Assemble the pistons and connecting rods with the matching marks, 1, on the rods on the same side as the trade name “SHIBAURA,” 2, embossed on the inside of the piston skirt. Install the piston pin, and retaining rings.



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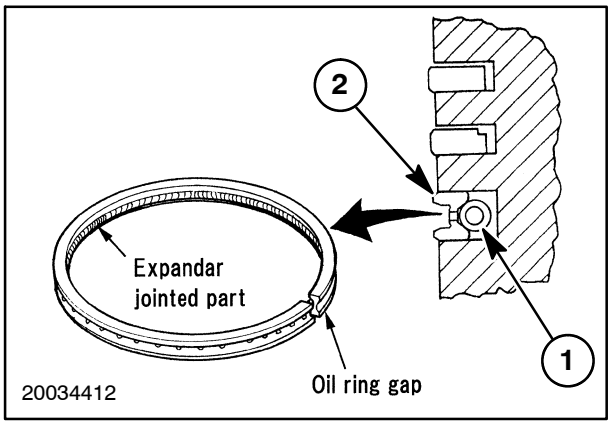
2. Using a suitable ring expander tool, install the piston rings positioning the ring gaps at approximately 120 degrees from each other. Install the third (oil ring) first as follows:

   Put the expander ring, 1, into position in its groove.

   Fit the outer oil ring, 2, on top of the expander.



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CRANKSHAFT MAIN BEARING AND THRUST WASHER

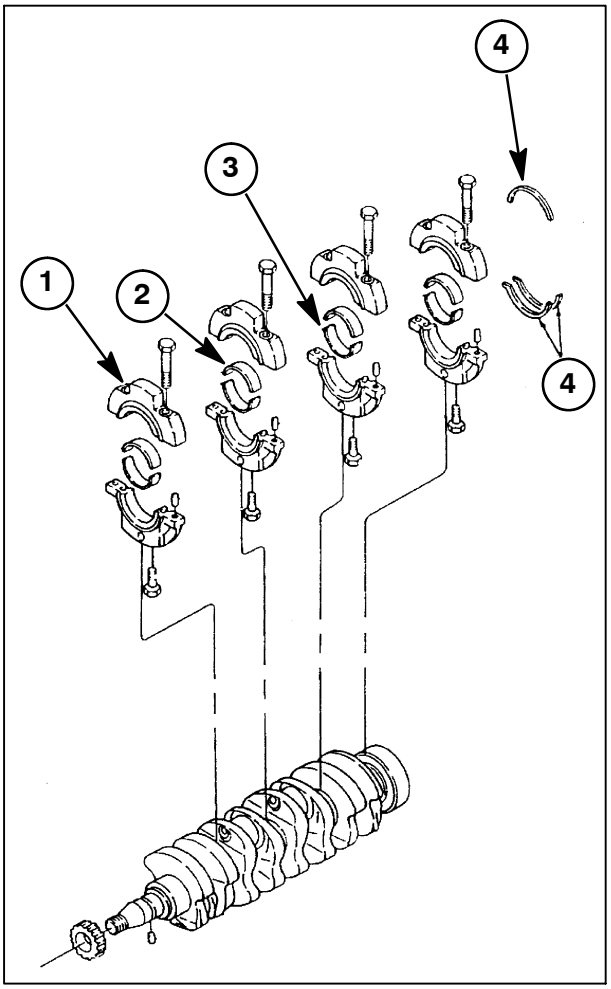
Removal and Inspection

1. Remove the two retaining bolts from the bearing holders, 1.
2. Remove the bearing holders and bearing liners, 2 and 3.
3. Position a piece of plastigauge across the full width of the bearing liners.
4. Install the bearing holder and tighten the bolts to 49.0 – 53.9 N·m (36.2 – 39.8 ft-lbs).

NOTE: *Do not permit the bearing holder to rotate, even the slightest amount.*

5. Remove the bearing holders and measure the width of the flattened plastigauge using the gauge printed on the plastigauge package.
6. Replace components or grind the crankshaft to the next undersize bearing as required to obtain the correct clearance. See “Specifications” later in this section.
7. Check the thrust bearings, 4, for wear, poor contact, burning, or other defects. Using a micrometer measure the washer thickness. If washer thickness is not within allowable limits or found to be defective, the washers must be replaced.

Standard Thickness:	2.95 mm-3.0 mm (0.116″-0.118″)
Allowable Limit:	2.8 mm (0.11″)



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1. Holder
2. Upper Main Liner (with oil groove)
3. Lower Main Liner (no oil groove)
4. Thrust Bearing

CRANKSHAFT BEARING (BUSHING)

Inspection

Check the bearing (bushing) for peeling, melting, seizure, or poor contact. If found to be defective, replace.

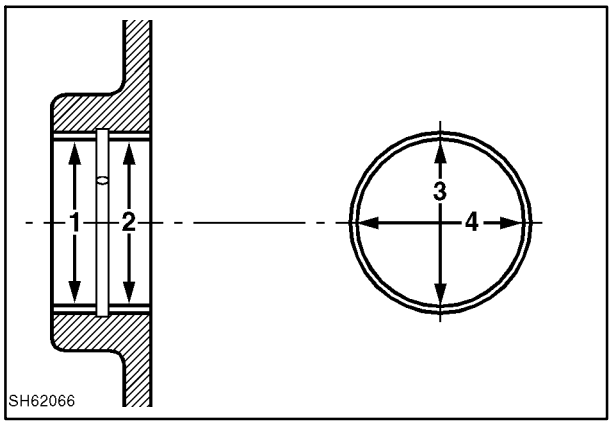
Using a cylinder gauge and micrometer, measure the oil clearance between the bearing (bushing) and the crankshaft journal.

Measure the inside diameters at positions 1 and 2. At each position, measure in both directions 3 and 4. The oil clearance can be obtained by subtracting this value from the maximum crankshaft journal diameter.

Standard Oil Clearance	Allowable Limit
0.044 mm – 0.116 mm (0.0017″ – 0.0046″)	0.2 mm (0.0078″)

If the oil clearance exceeds the allowable limit, replace the bearing (bushing) or grind the crankshaft journal. In this case, use an undersized bearing (bushing).

When replacing the crankshaft journal (bushing), use a press to install.



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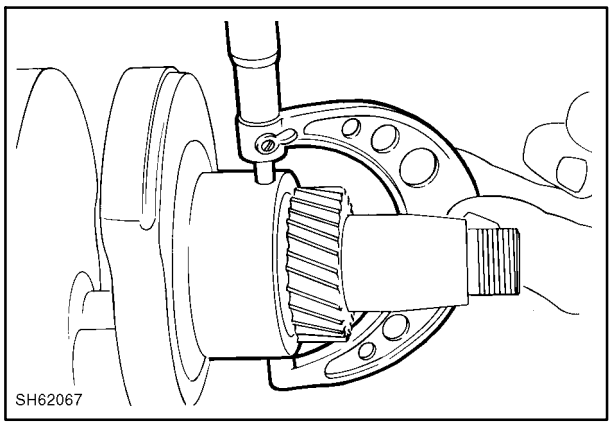

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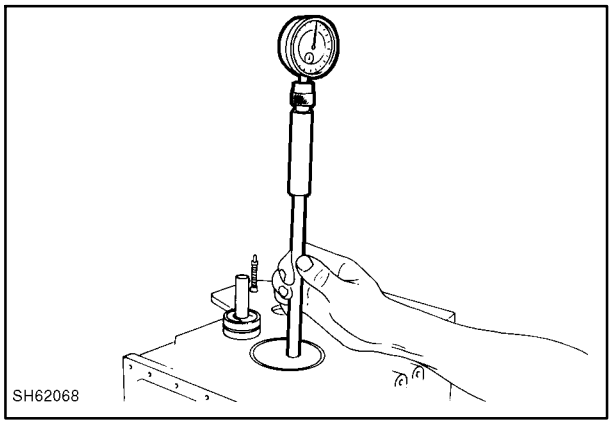
Crankshaft Journal (bushing)

Size	Outside Diameter
Standard	67.957 mm – 67.970 mm (2.6755″ – 2.6760″)
0.25 mm 0.010″	67.707 mm – 67.720 mm (2.6656″ – 2.6661″)
0.50 mm) 0.020″	67.457 mm – 67.470 mm (2.6558″ – 2.6563″)



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Removal

Remove the bushing from the housing (cylinder block) using a bushing driving tool to prevent damage.

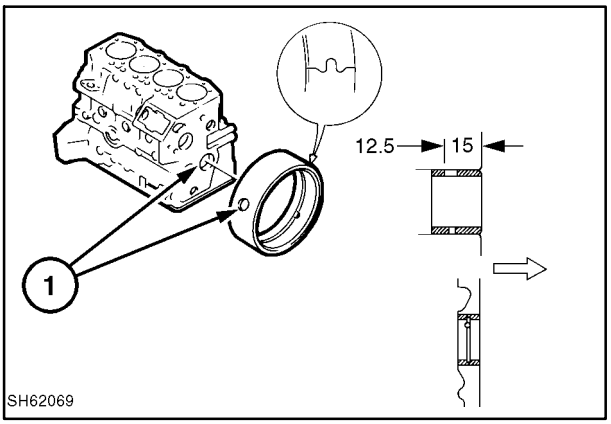
Replacement

1. Prior to installing the bushing, inspect the bushing housing for marks, scratches, etc.
2. The bushing should be smoothly pressed in to the correct depth by using a bushing driving tool, adjusting the oil hole and direction of bushing.
   - Press in the bushing to the cylinder block from the engine front side.

NOTE: *Do not press the bushing into the cylinder block from the opposite side.*

   The correct pressing side is chamfered, etc., to allow smooth operation.
   - Align the oil hole, 1, of the housing and bushing.
   - Install the bushing, confirming the mark and oil groove (hole).
   - Lubricate at the outer surface of the bushing.
   - Press in the bushing to the housing until correct depth, by using a bushing driving tool.
3. Confirm after installation.

   Confirm the alignment of the oil hole of the housing and the bushing. Also make sure the inner diameter is within tolerance.



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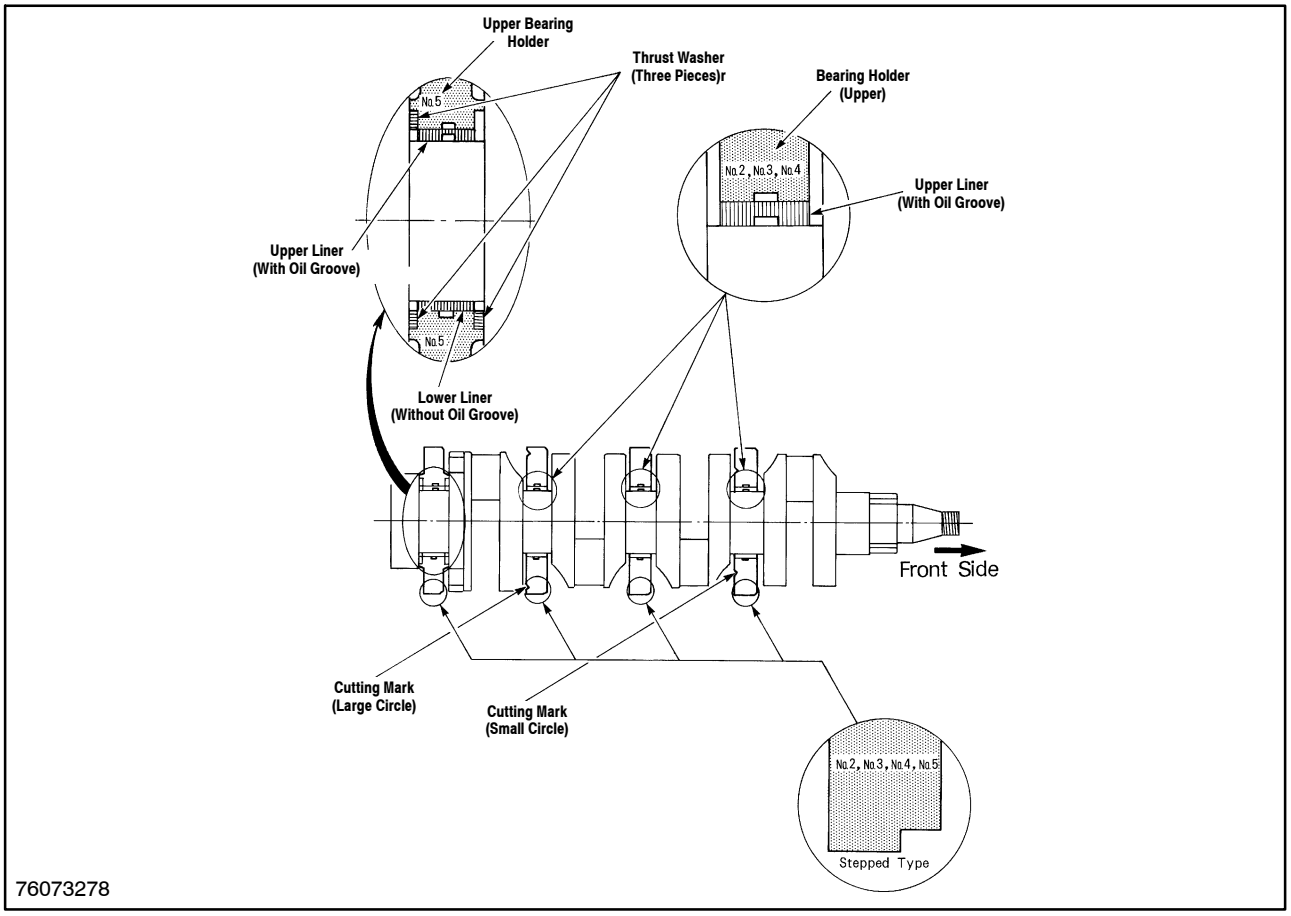
After grinding the crankshaft journal, check the oil clearance.

CRANKSHAFT MAIN BEARING

Installation

1. Install the bearing holders along with their liners. The rear bearing is also assembled along with the thrust bearing halves, one located on the upper rear and one on each side of lower portion of holder side of the bearing. Be sure the bearing holders are correctly positioned on the shaft with the chamfered edge facing forward.
2. Torque the bearing holder retaining bolts to 49.0 – 53.9 N·m (36.2 – 39.8 ft-lbs).



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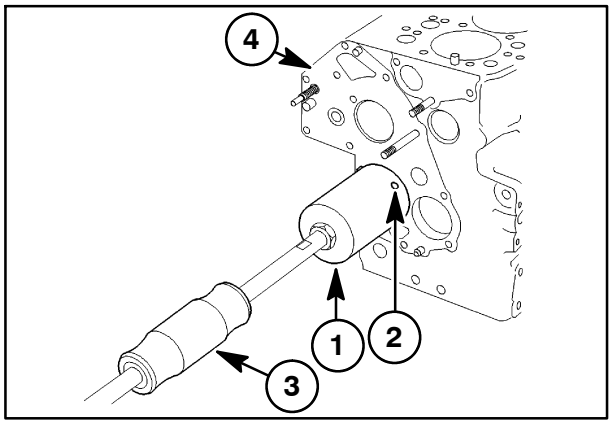
PORT BLOCK

Removal

NOTE: *The oil pump shaft and port block assembly is a press fit in the block.*

1. Using special Tool No. FNH11097, 1, place the collars in the grooves of the port block assembly.
2. Align the set screws, 2, of the puller, 1, with the counterbores in the collars and tighten.
3. Using a sliding hammer, 3, remove the port block.
4. Remove plate, 4, from the block.



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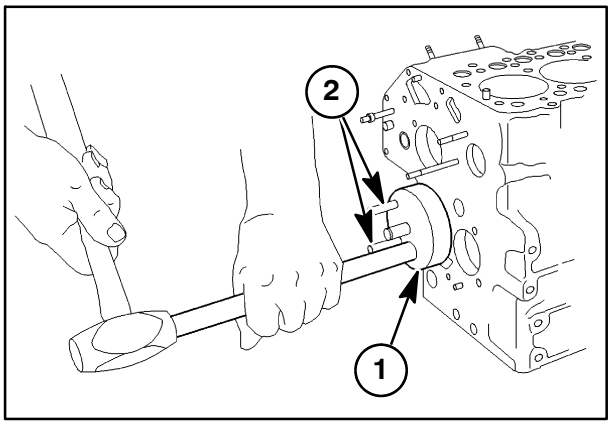
Installation

1. Using special Tool No. FNH00117, 1, insert the threaded guide pins, 2, into the cylinder block.
2. Assemble the oil pump shaft to the port block using nut and washer.
3. Insert the port block assembly into the installer and place on the guide pins.
4. Using a suitable driver, install the port block assembly. The installer must bottom against the engine block when fully positioned.

NOTE: *Plate, 4 (figure 87), must be removed from engine block for proper installation of the port block.*



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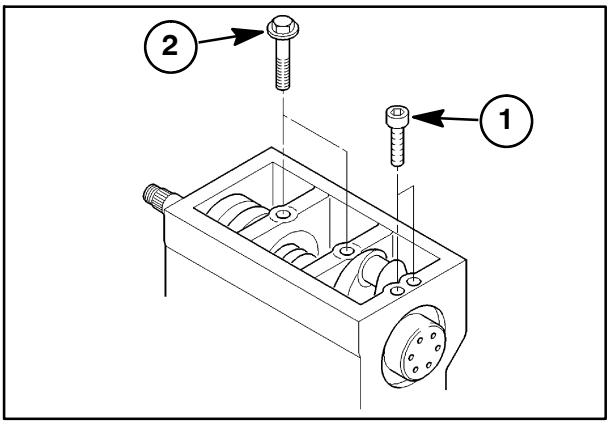
CRANKSHAFT AND BEARING HOLDER

Installation

1. Install the crankshaft with bearing holder through the rear of the cylinder block.
2. Align the threaded holes on the bearing holders with the bolt holes in the cylinder block.
3. At the flywheel end install the two socket head hex bolts, 1, at each center bearing install the hex head bolt, 2. Torque the socket head bolts to 24 – 31 N·m (18 – 22 ft-lbs). Torque the hex head bolts to 49 – 54 N·m (36 – 40 ft-lbs).



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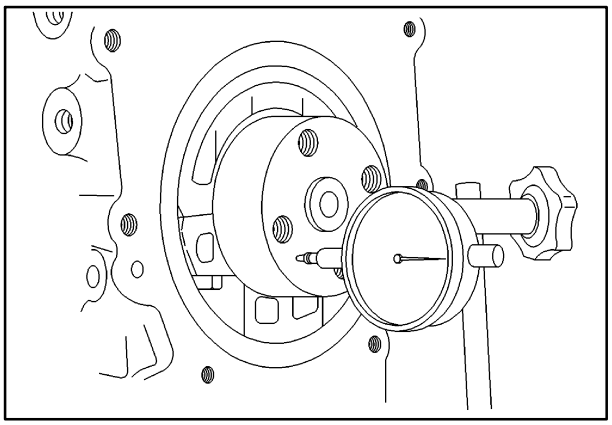
1. Bearing Holder Bolts

4. Using a dial indicator, measure the crankshaft end float (thrust).If the thrust is not within the allowable limit, remove the crankshaft and check the thrust washers.

Standard Thrust	Allowable Limit
0.1 – 0.4 mm (0.004 – 0.016″)	0.5 mm (0.020″)



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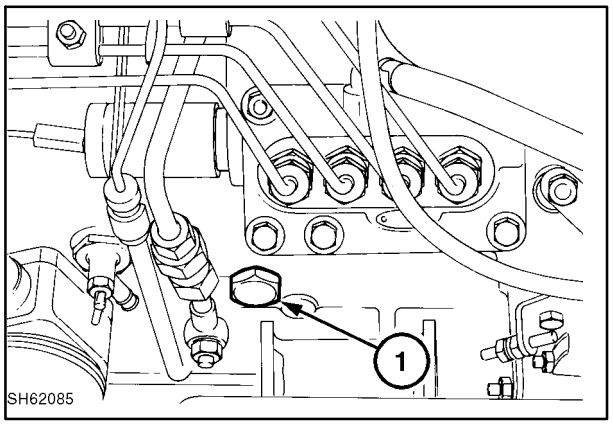
RELIEF VALVE

Installation

Install an O ring on the relief valve assembly, 1.

Relief valve tightening torque:
58 N·m – 68 N·m (43 ft-lbs to 50 ft-lbs)

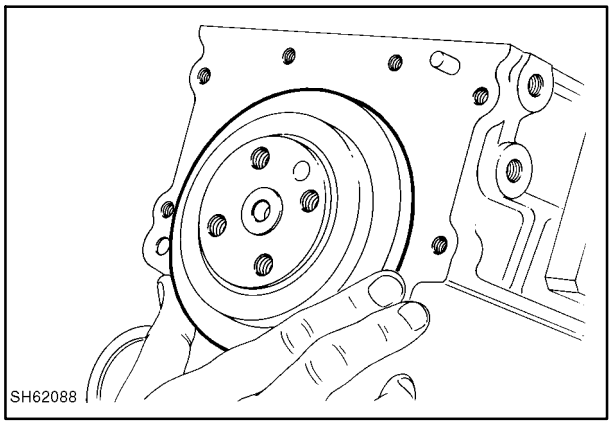


91

REAR OIL SEAL

Installation

This is a press-fit, retained by the backplate.



92

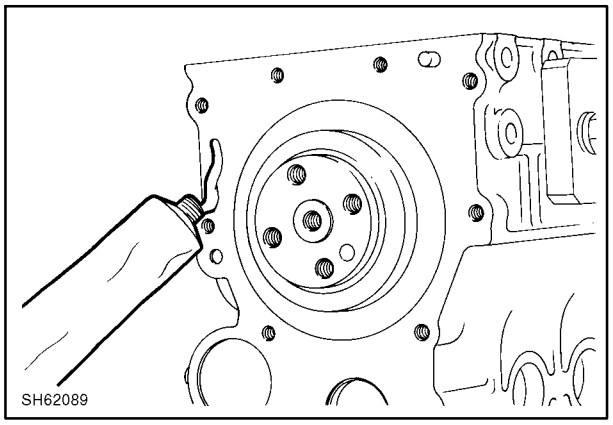
BACK PLATE/FLYWHEEL HOUSING

Installation

Coat the area around the M8 threaded holes with silicon sealant and install the backplate with bolts.

Backplate tightening torque:
13 – 17 N·m (9.6 – 12.5 ft-lbs)

Housing tightening torque:
24 – 28 N·m (18 – 21 ft-lbs)



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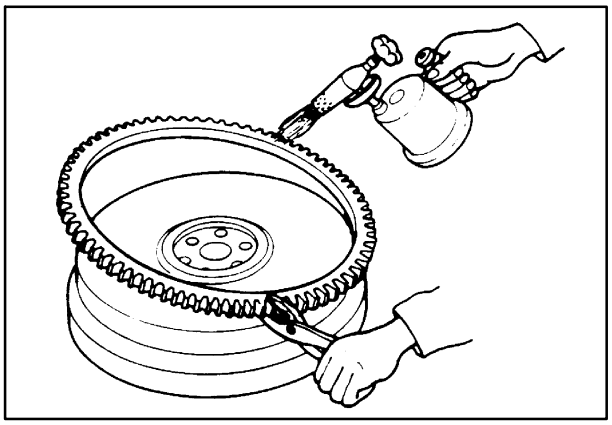
FLYWHEEL

Inspection and Repair

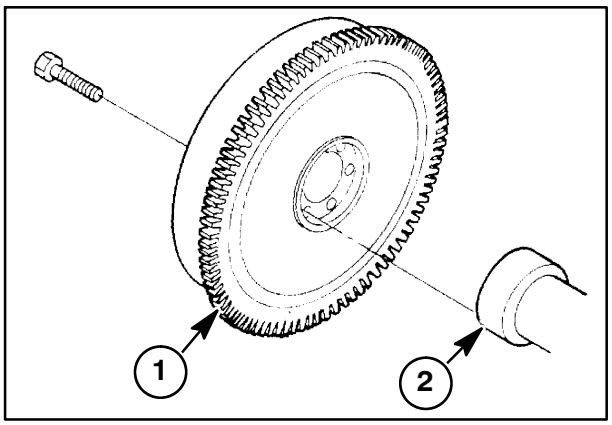
1. Inspect the ring gear for cracked, broken, chipped, or worn gear teeth. If found damaged, replace the ring gear.
2. If necessary, remove the starter ring gear using a hammer and chisel to crack the ring gear.
3. To reinstall a new ring gear, heat the new ring gear to 120 – 150°C (245 – 300°F) from the inside only. Be careful not to overheat the ring gear teeth. Use a temperature sensitive crayon to mark the inside of the ring gear. Quench the ring gear quickly to obtain a good shrink fit onto the flywheel.



94

Installation

1. Fit the flywheel, 1, to the crankshaft, 2, and align the bolt holes.
2. Install the flywheel retaining bolts and tighten to 69 – 78 N·m (51 – 57 ft-lbs).



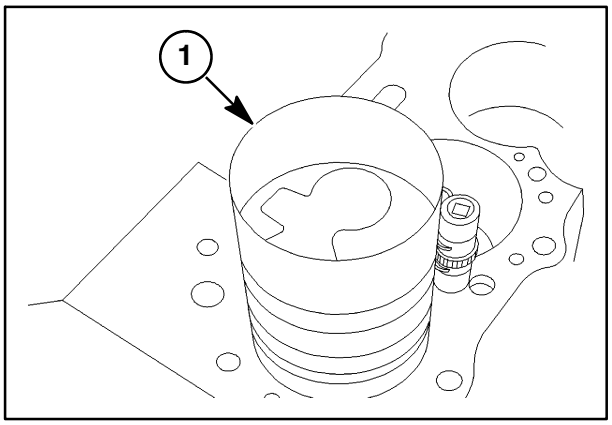
95

PISTONS AND CONNECTING RODS

Installation

1. Coat the bearing faces, pistons, and piston rings with clean engine oil. Slide the piston rings to permit a sufficient amount of oil to be applied in the grooves.
2. Set the piston ring gaps 90 degrees apart from each other. Do not position these gaps toward the piston pin or the right angle of the pin.
3. Using a piston ring compressor, 1, **insert the pistons in the cylinders with the prechamber side of the piston facing the injection pump side.** The connecting rod marks should also face the injection pump side.

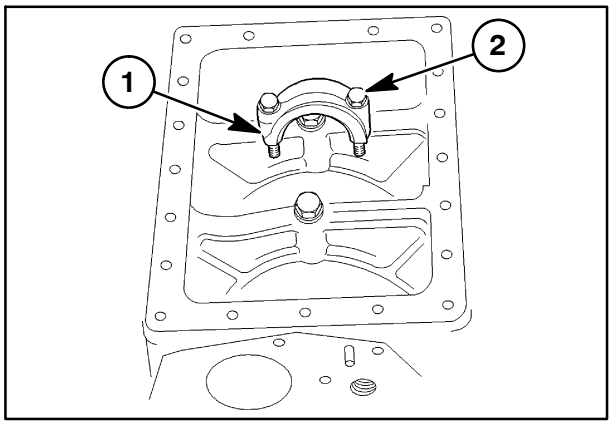
NOTE: *Install the pistons from the front to the rear in order.*



96

4. Install the connecting rod caps, 1, making sure the rod and cap matching marks align. Tighten the connecting rod cap screws, 2, to 49 – 54 N·m (36 – 40 ft. lbs).

NOTE: *After installation, ensure the crankshaft moves freely. Ensure the axial play of 0.1 – 0.3 mm (0.004 – 0.012 ″) is provided.*

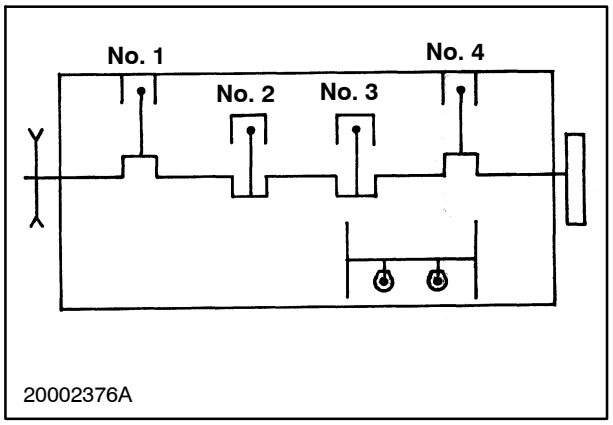


97

BALANCER ASSEMBLY

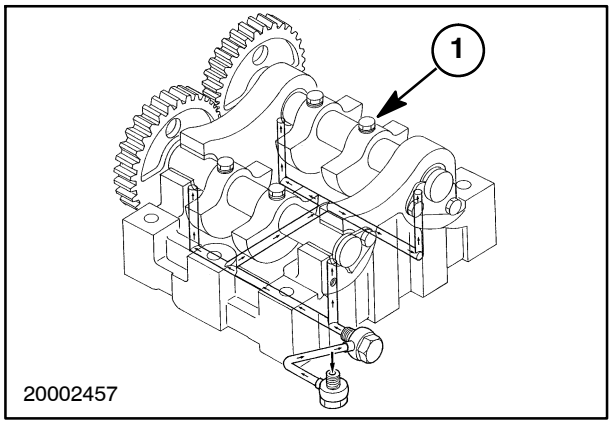
Installation

1. Position the cylinder block with the oil pan mounting surface facing down.
2. Position the No. 1, and the No. 4 pistons at top dead center.



98

3. If balancer weights were removed, torque bolts, 1, to 27 N·m (20 ft-lbs).



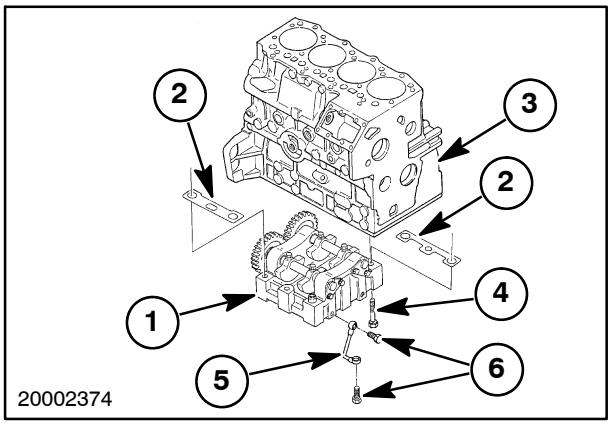
99

4. With the balancer weights centered straight down (weights facing away from engine block), position the balancer assembly, 1, and the original quantity of shims, 2 (if used) on the cylinder block, 3, using the dowel pins for alignment.
5. Install the retaining bolts, 4, and tighten to 52 N·m (38 ft-lbs).
6. Install the oil transfer pipe, 5, and secure with the banjo bolts, 6.

NOTE: *If required, inspect the backlash between the balancer gear and the drive gear. Adjust the backlash to 0.2 – 0.4 mm (0.008 – 0.016 in) using shims.*

Balancer Shims

Engine	Model	Shim Thickness
N844L-T	2410/2420	0.2 mm (.008 in)



100

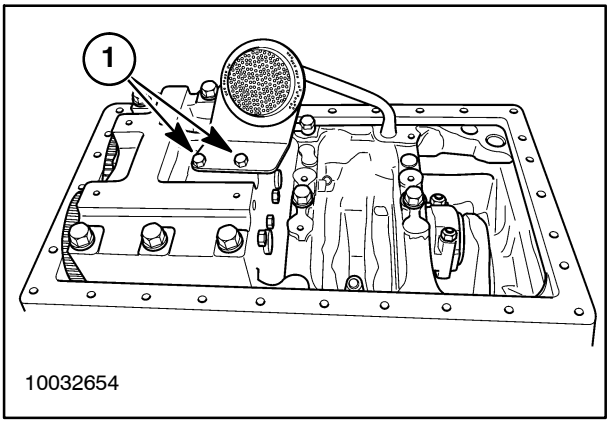
OIL SUCTION PIPE AND SUCTION STRAINER

Installation

1. Install a new O-ring on the suction pipe and rotate the suction pipe into its bore.
2. Install the suction strainer over the suction pipe and align the bolt holes.

NOTE: *If suction strainer bolt holes do not align, the suction pipe is either too far into its bore or not in far enough. Adjust as needed.*

3. Install the strainer retaining bolts, 1, and tighten to 8.8 – 12.9 N·m (6.5 – 9.5 ft-lbs).



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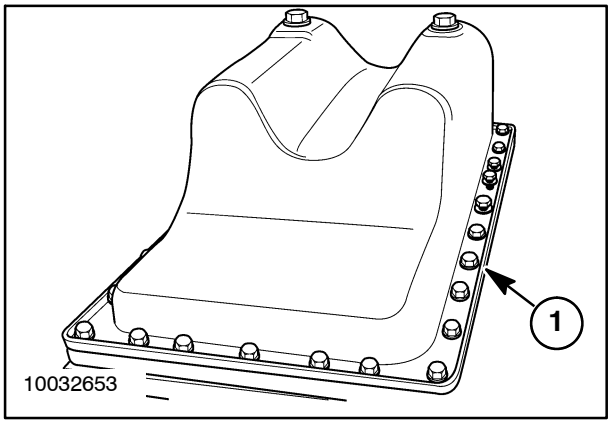
OIL SUMP

Installation

1. Apply a thin coat of gasket sealer to the oil sump sealing area.
2. Install a new gasket, the oil sump and the retaining bolts. Tighten the retaining bolts, 1, diagonally and evenly.



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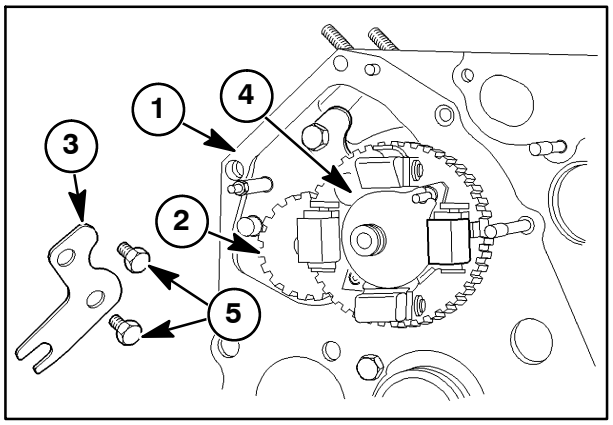
CAMSHAFT AND CAMSHAFT GEAR

Installation

1. Install the front plate, 1, and gasket on the mounting dowels and tighten the retaining bolts.
2. Install the tachometer drive, 2.
3. Carefully insert the camshaft with tachometer driveshaft into its bore so as not to damage the bearings or bearing surfaces.
4. Align the retaining plate, 3, to the block bolt holes, 4, and install the retaining bolts, 5. Tighten the bolts to 8.8 – 12.9 N·m (6.5 – 9.5 ft-lbs).



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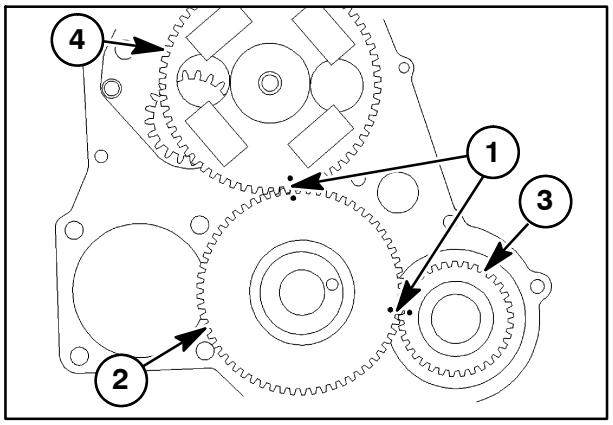
IDLER GEAR, OIL PUMP AND INJECTION TIMING

Installation

1. Install the thrust washer, on the idler gear shaft.
2. Align the timing marks, 1, on the idler gear, 2, crankshaft gear, 3, and the camshaft gear, 4.

NOTE: *Do not turn the crankshaft until the timing gear cover is installed.*



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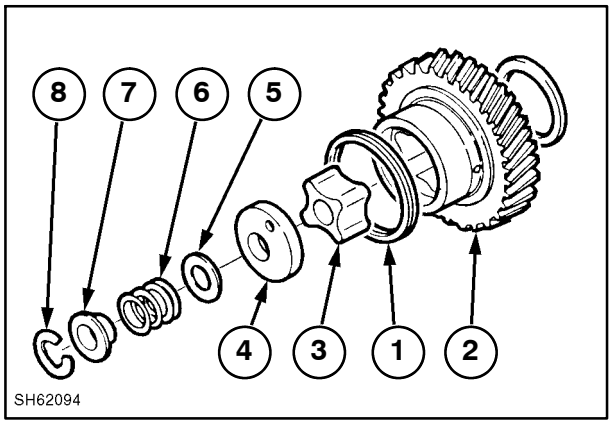
3. Assemble the spring, 1, on the idler gear, 2.
4. Install the rotor, 3.
5. Install the oil pump cover, 4, shim, 5, spring, 6 and collar, 7. Fix them with the retaining ring, 8.



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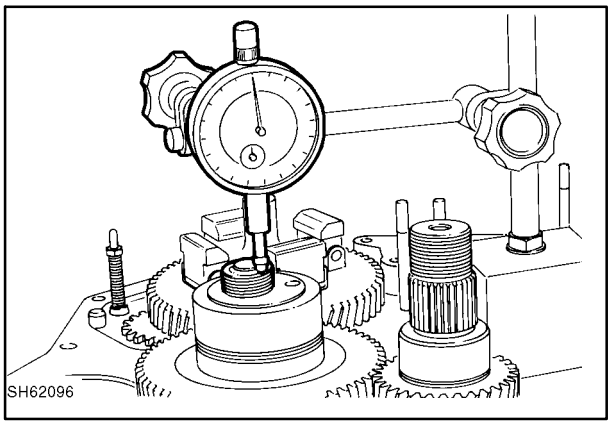
1. Spring
2. Idler gear
3. Rotor
4. Oil pump cover
5. Shim
6. Spring
7. Collar
8. Retaining Ring

6. Adjust with shim so the axial clearance of the oil pump, rotor, and vane is in the range of 0.1 mm to 0.15 mm (0.004″-0.006″). The allowable limit is 0.2 mm (0.008″) .

NOTE: *Coat both faces of the rotor and vane with petroleum jelly for assembly.*

	mm (in)
Oil Pump Shim Sizes	0.1 – 0.15 – 0.2 – 0.5 (0.0039 – 0.0059 – 0.0078 – 0.0196)



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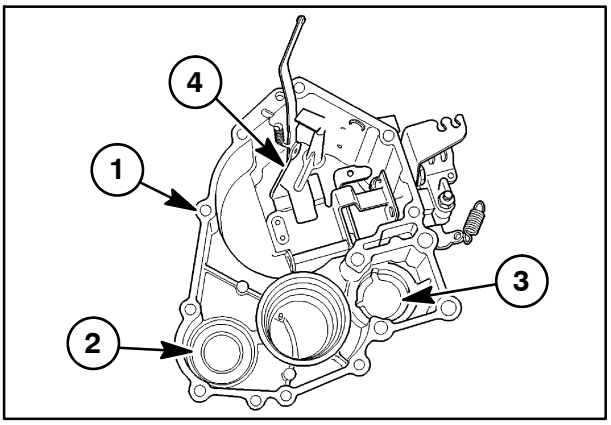
TIMING GEAR CASE

The timing gear housing, 1, contains the front oil seal, 2, power steering seal, 3, and the governor linkage assembly, 4. See “Governor Assembly”, for governor linkage repair and replacement procedures.



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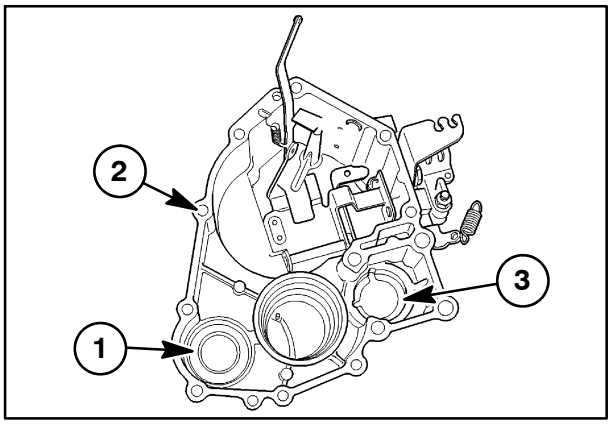
FRONT OIL SEAL AND STEERING PUMP SEAL

Replacement

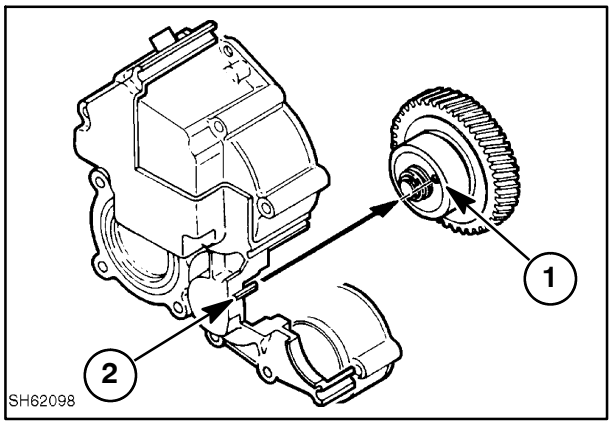
1. Remove the front oil seal, 1, from the timing gear cover, 2, and insert a new oil seal in its place.
2. Remove the steering pump O ring, 3, located on the front of the timing gear cover, and replace with a O ring.



108

NOTE: *DO NOT TURN the crankshaft until the timing gear case is fitted.*

Make sure oil pump cover spring pin hole, 1, aligns with spring pin, 2, in timing gear case.



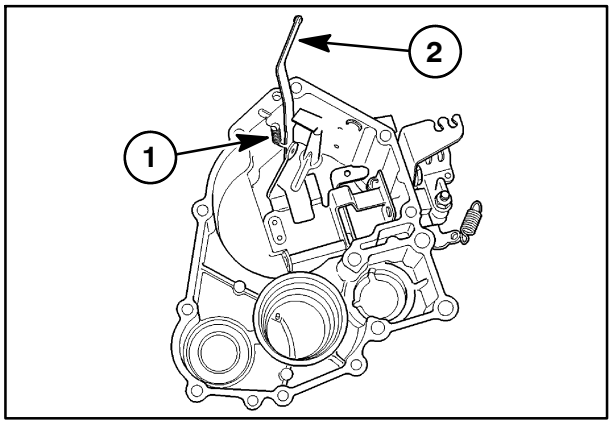
109

TIMING GEAR CASE

Installation

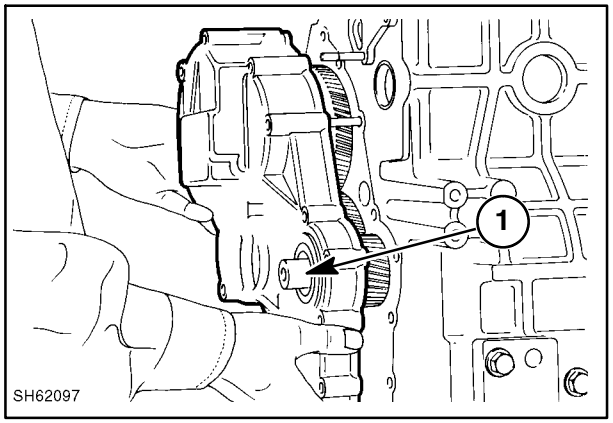
Install the governor dampener spring, 1.

Insert the injection pump link, 2, through the hole in the cylinder block. Install the cover locating pin in the oil pump cover plate.



110

NOTE: *Do not damage the oil seal, 1, when fitting.*



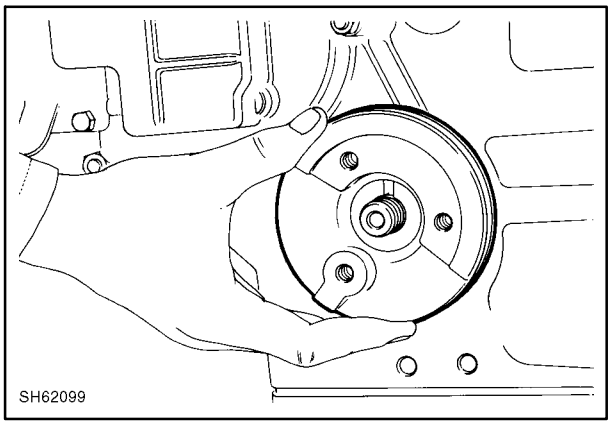
111

CRANKSHAFT PULLEY

Installation

Align the keyway and key on the crankshaft pulley and crankshaft and assemble them.

Crankshaft pulley tightening torque:
275 – 333 N·m (203 – 246 ft-lbs)



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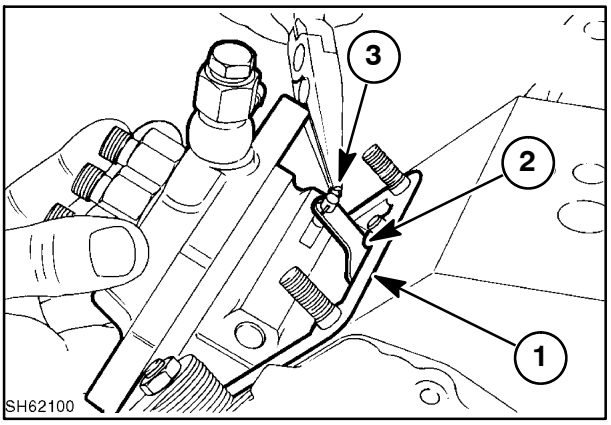
INJECTION PUMP

Installation

Reinstall the shim, 1. Connect the control rack of the injection pump with the link, 2, and fix with the hair pin, 3.

Tighten the injection pump bolts and nuts. For any adjustments see Chapter 2, Fuel Systems.



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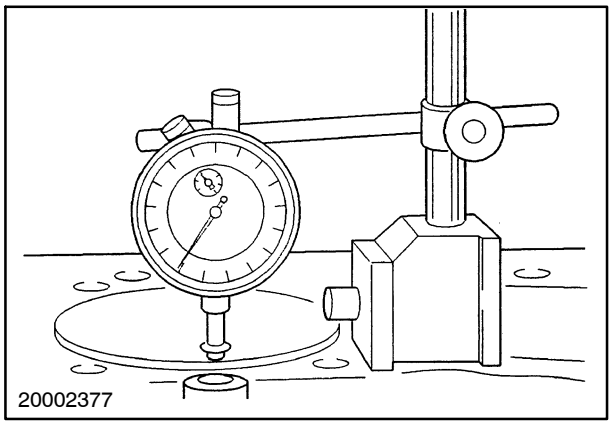
HEAD GASKET SELECTION

During assembly, the ultimate engine compression ratio is established by the thickness of the head gasket used. For service replacement, head gaskets of different thickness are available. The correct head gasket must be selected based upon the amount the piston protrudes above the face of the block when at top dead center. The correct head gasket usage is determined as follows:

1. Position each of the pistons at top dead center and, using a dial indicator, determine the distance each piston is recessed below the face of the block.

NOTE: *Measure each of the pistons while holding a slight down pressure on the piston. Use the dimension taken from the cylinder which has the greatest projection and select a head gasket as indicated in the following chart.*

NOTE: *The variation in the amount of recession among all pistons must be within 0.1 mm (0.004 in).*



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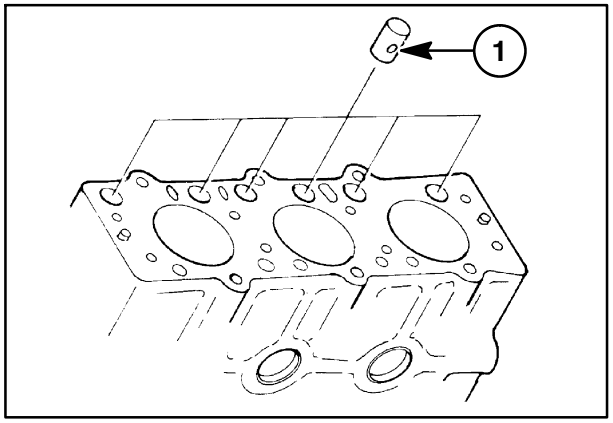
Head Gasket Selection Chart

Model	Measurement Value	Head Gasket Part No.	Installed Thickness
N844L-T 2410 2420	–0.3 – 0.45 mm (–0.0118 – 0.0177 in)	SBA111147711	0.4 mm (0.0157 in)
	–0.2 – 0.3 mm (–0.0079 – 0.0118 in)	SBA111147721	0.5 mm (0.0197 in)

CYLINDER HEAD

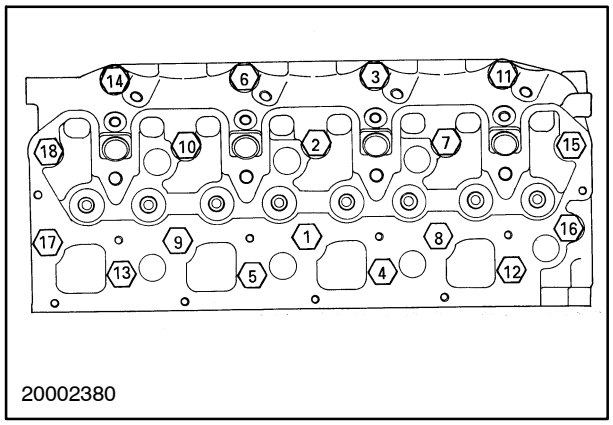
Assembly

1. Install the valve tappets, 1.



115

2. Select the proper head gasket and place it on the block with the side marked with the last four digits of the part code no. up.
3. Tighten the head bolts in the sequence as shown. Tighten first to half torque value, then to the final torque specification of 98 – 103 N·m (72.3 – 76 ft-lbs).



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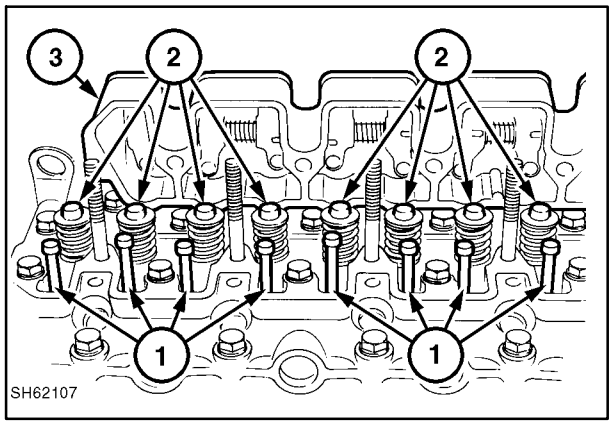
4. Replace the push rods, 1, and valve stem caps, 2, in their original location.
5. Install the rocker shaft support assembly, 3, onto the head and tighten the bolts to 27 – 39 N·m (20 – 29 ft-lbs).



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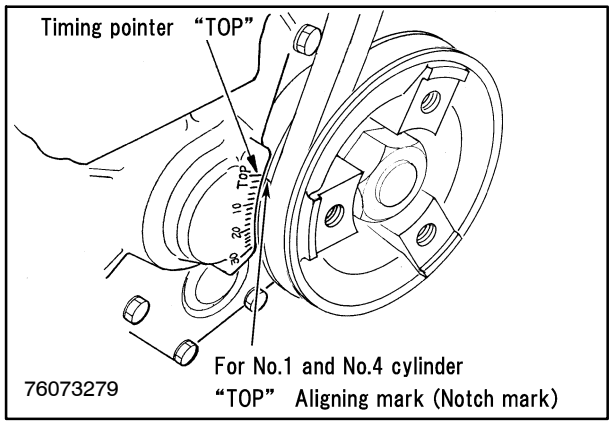
VALVE CLEARANCE ADJUSTMENT

IMPORTANT: *This N844L-T engine has a newly designed exhaust cam, due to reduced emissions by internal exhaust gas re-circulation (EGR) system. When adjusting the valve clearance pay attention to the following:*

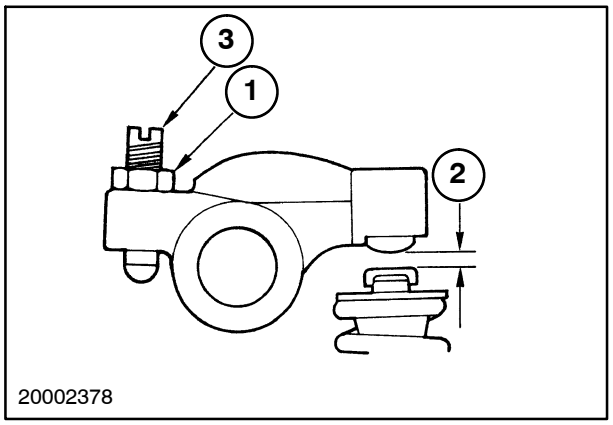
The valve clearance adjusting order of the cylinder is the same as the firing order 1-3-4-2.

1. **Number 1 Cylinder Valve Adjustment**
   - Align the top mark (notch) on the crankshaft pulley to the “TOP” mark on the timing gear case, on the compression stroke.



118

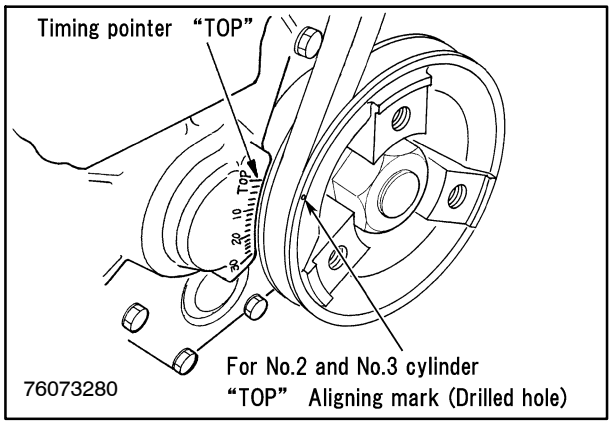
- Loosen the lock nut, 1, and adjust both the intake and exhaust valve clearances of the No. 1 cylinder to 0.2 mm (0.008″), 2, by turning the adjustment screw, 3.
- After adjustment has been set, tighten the locknut, 1.



119

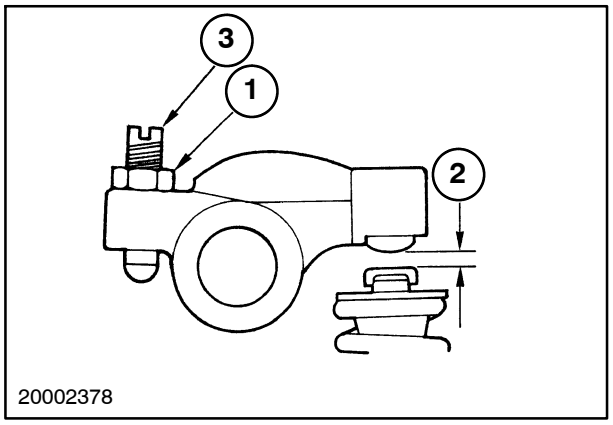
2. Number 3 Cylinder Valve Adjustment

- Turn the crankshaft pulley 180° clockwise, aligning the drilled hole in the crankshaft pulley to the “TOP” mark on the timing gear case, on the compression stroke.



120

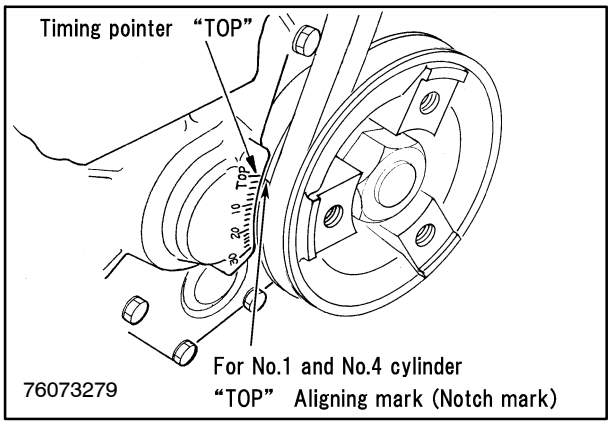
- Loosen the lock nut, 1, and adjust both the intake and exhaust valve clearances of the No. 3 cylinder to 0.2 mm (0.008″), 2, by turning the adjustment screw, 3.
- After adjustment has been set, tighten the locknut, 1.



121

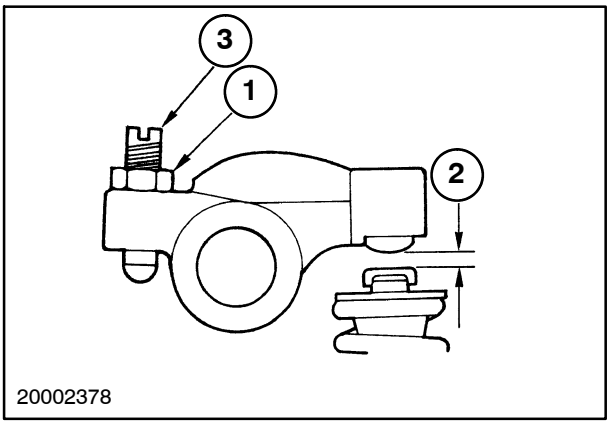
3. Number 4 Cylinder Valve Adjustment

- Turn the crankshaft pulley 180° clockwise, align the top mark (notch) on the crankshaft pulley to the “TOP” mark on the timing gear case, on the compression stroke.



122

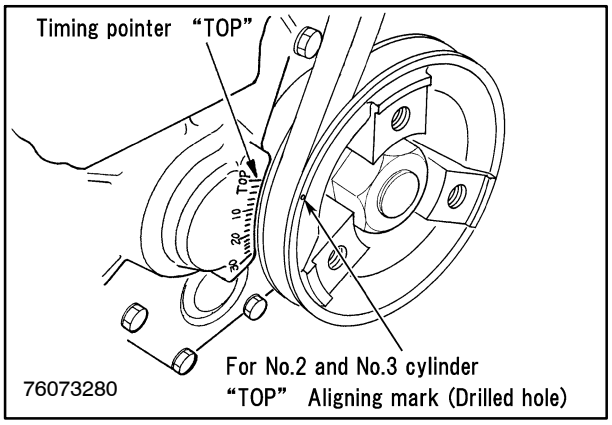
- Loosen the lock nut, 1, and adjust both the intake and exhaust valve clearances of the No. 4 cylinder to 0.2 mm (0.008″), 2, by turning the adjustment screw, 3.
- After adjustment has been set, tighten the locknut, 1.



123

4. Number 2 Cylinder Valve Adjustment

- Turn the crankshaft pulley 180° clockwise, aligning the drilled hole in the crankshaft pulley to the “TOP” mark on the timing gear case, on the compression stroke.



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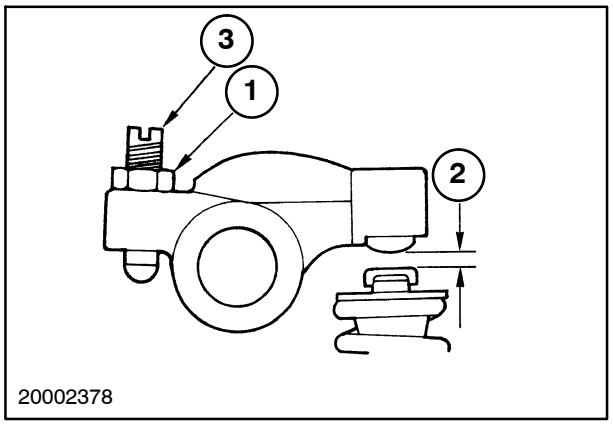
- Loosen the lock nut, 1, and adjust both the intake and exhaust valve clearances of the No. 2 cylinder to 0.2 mm (0.008″), 2, by turning the adjustment screw, 3.
- After adjustment has been set, tighten the locknut, 1.

IMPORTANT: *Reconfirm the valve clearances of each of the cylinders when corresponding marks are aligned with the "TOP" mark on the timing gear case, on the compression stroke.*



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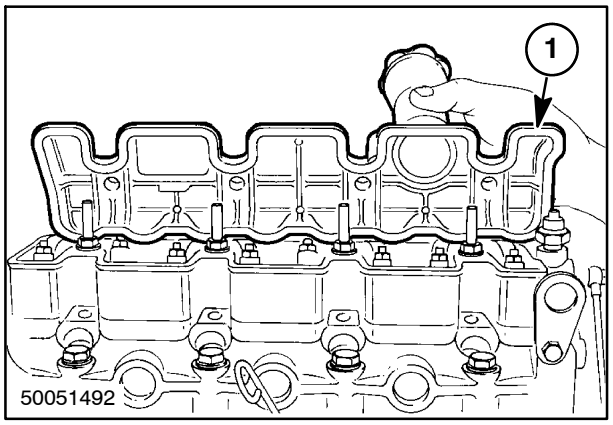
HEAD COVER

Installation

1. Install a new gasket and position the valve cover, 1, over the rocker arms.
2. Install the four valve cover retaining nuts and tighten to 12 – 16 N·m (9 – 12 ft-lbs).



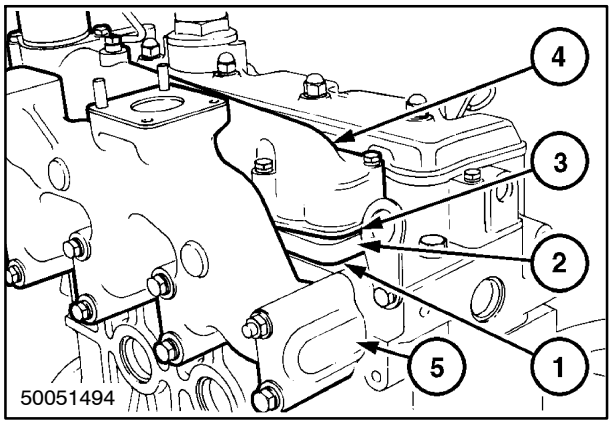
126

INTAKE/EXHAUST MANIFOLDS

Installation

Install in sequence of gasket, 1; spacer, 2; gasket, 3; and intake manifold, 4.

Install exhaust manifold, 5.



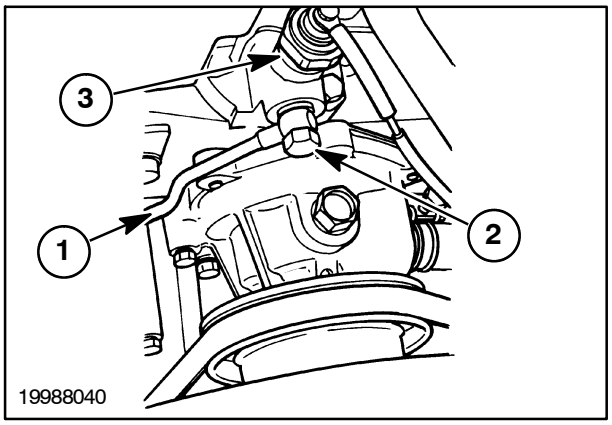
127

EXTERNAL OIL TUBE

Installation

Connect the external oil tube, 1, to the cylinder head and on side of engine block. Tighten the banjo bolt, 2, to 10 – 13 N·m (7 – 9 ft-lbs).

NOTE: *The banjo bolt has oil port holes drilled in it. Do not use a standard bolt in its place.*



128

OIL PRESSURE SWITCH

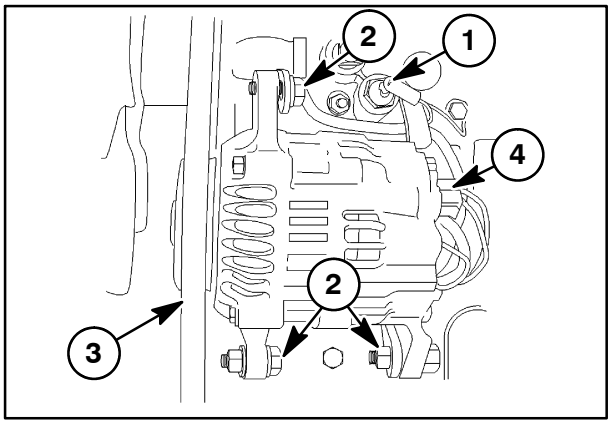
Installation

1. Install oil pressure switch, 3, and connect the wire. Tightening torque: 15 – 20 N·m (11 – 15 ft-lbs).

ALTERNATOR AND TEMPERATURE SENDER SWITCH

Installation

1. Install the temperature sending switch, 1, and torque to 25 – 29 N·m (18 – 21.7 ft-lbs).
2. Install the alternator with its mounting bolts, 2, snug.
3. Install the V-belt, 3, adjust to 10 – 15 mm (0.2 – 0.4″) deflection tension, and tighten the alternator bolts.
4. Connect the wiring to the back of the alternator at location 4.

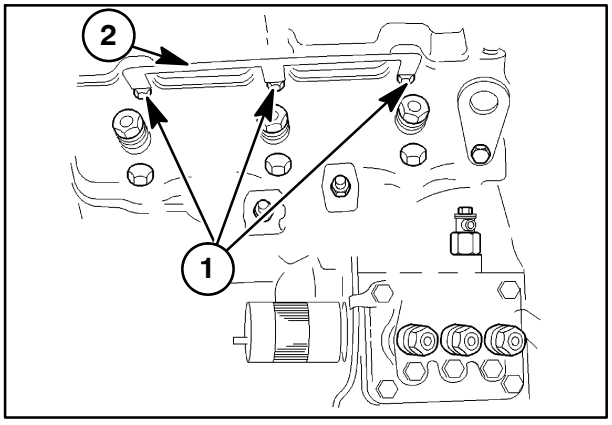


129

GLOW PLUG AND CONNECTOR

Installation

1. Install the glow plugs, 1, and torque to 15 – 20 N·m (11 – 15 ft-lbs).
2. Install the glow plug connector, 2.



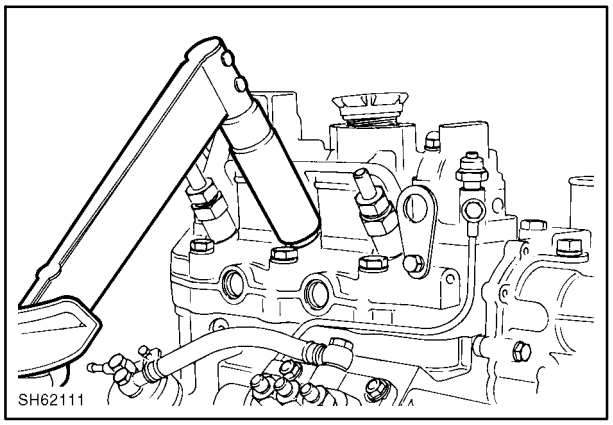
130

NOZZLE/HOLDER ASSEMBLY

Installation

Install the nozzle and holder assembly with a socket for the nozzle holder. Install the return pipe.

Nozzle/holder tightening torque:
60 – 69 N·m (44 – 51 ft-lbs)



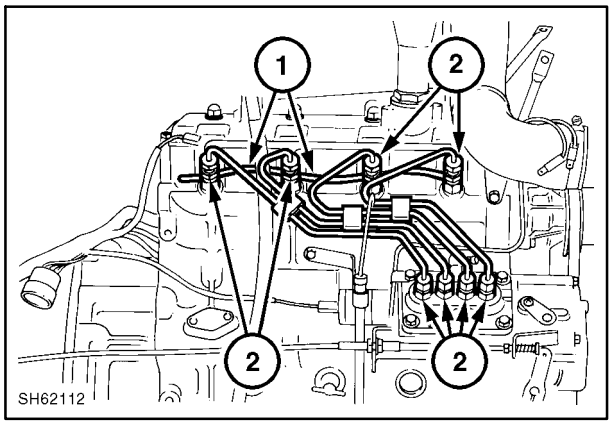
131

RETURN PIPE AND INJECTION PIPE

Installation

After installing the return pipe, 1, install injection pipes, 2.

Injection pipe tightening torque:
15 – 24 N·m (11 – 18 ft-lbs)

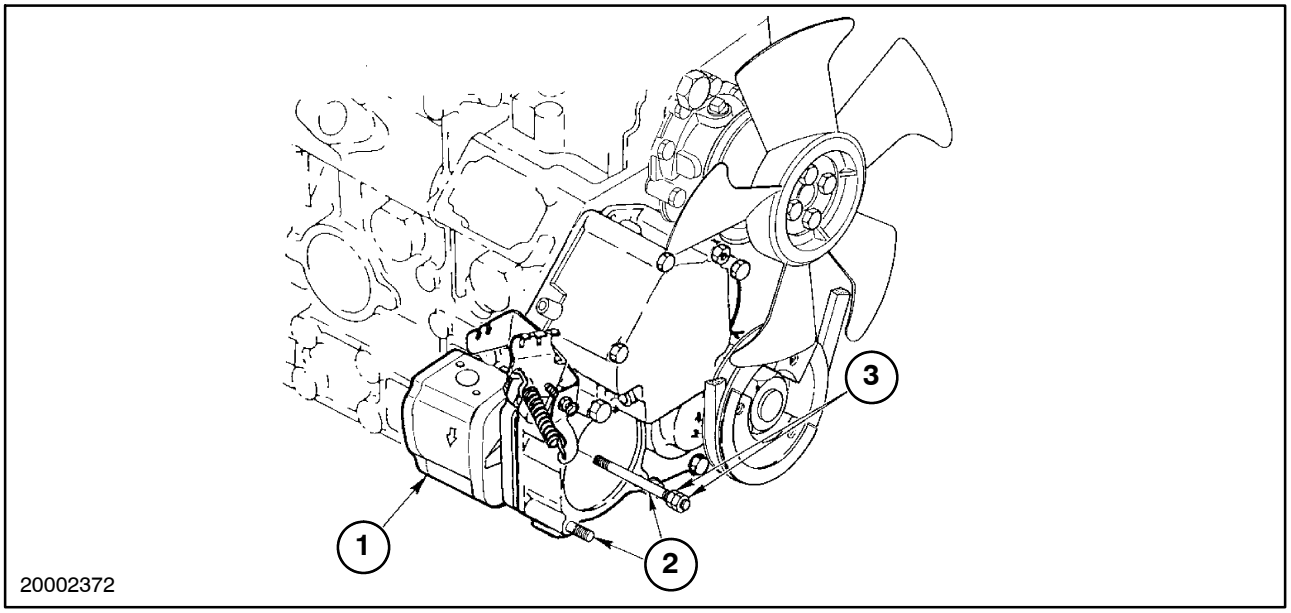


132

HYDRAULIC OIL PUMP

Installation

1. Mount the hydraulic oil pump, 1, on the timing case cover, and install the retaining studs, 2.
2. Remove the two nuts, 3, from the retaining studs, 2.

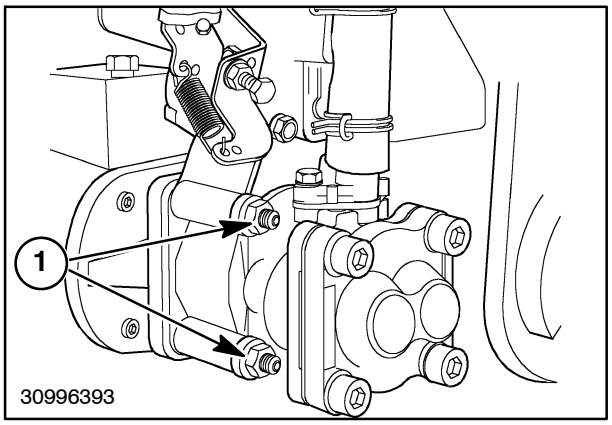


133

POWER STEERING PUMP

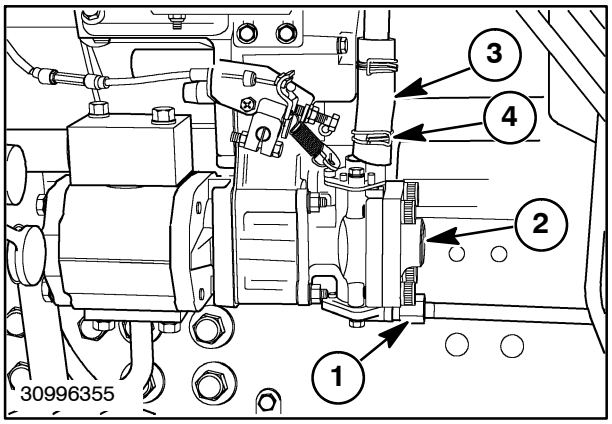
Installation

1. Mount the power steering pump in position on the timing gear cover with two retaining bolts (not shown), and two retaining nuts, 1.



134

2. Attach the pressure tube, 1, to the bottom of the steering pump, 2.
3. Install the suction line, 3, on the suction tube and install the hose clamp, 4.



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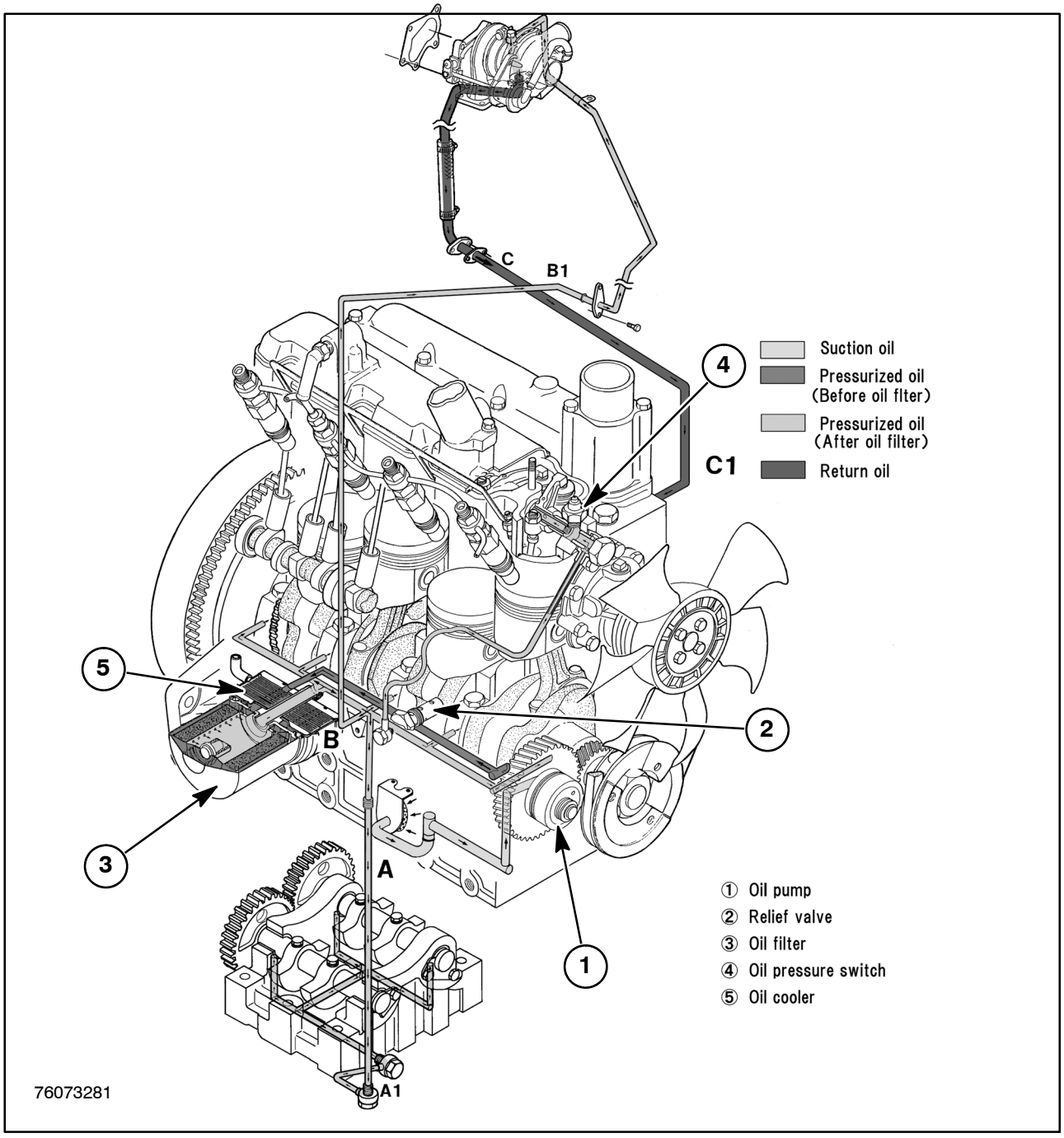
TURBO CHARGER

All tractor installed turbochargers – removal, inspection, and assembly of turbocharger are referred to in “Chapter 3 – Turbocharger” in this section.

DESCRIPTION OF OPERATION - ENGINE LUBRICATION SYSTEM

The oil pump assembly is located within the idler gear at the front of the block, below and to the left of the crankshaft as viewed from the front of the engine. The oil pump is driven by the crankshaft gear.

Oil is picked up from the sump through the suction strainer and intake tube and drawn into the lower side drilling in the block to the oil pump. Oil from the pump flows through passages in the block, past the relief valve, through the oil filter and returns to the main oil gallery in the area of the drilled bolt located on the side of the block. Oil flow in the main oil gallery extends to the four main bearings. Oil flow to the main bearings passes through drilled passages in the crankshaft to the three connecting rod bearings. The remaining portion of the oil flow is directed through the external tube to the rocker arm assembly. Oil flows from the external tube into a passage in the rocker arm bracket to the rocker arm shaft. Oil leakage from clearance between the rocker arms and the shaft overflows in the valve cover and lubricates the valve stems, push rods, and tappets. The relief valve is mounted on the side of the engine block and intersects the main oil passage. When the oil pressure exceeds the rated pressure, oil is bypassed through the relief valve directly to the sump. The cylinder walls, pistons, and piston pins are splash lubricated by the crankshaft.



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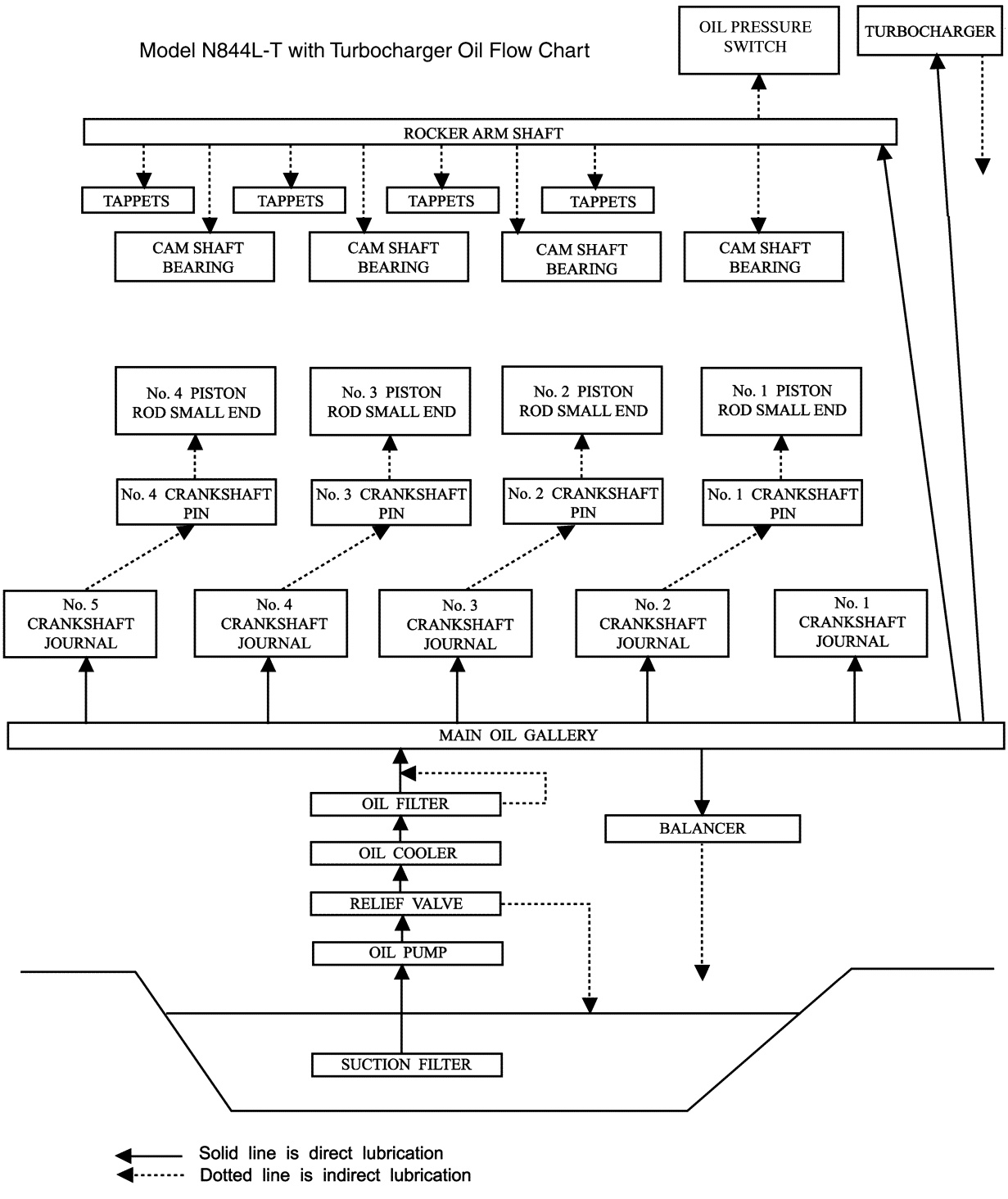
1. Oil Pump
2. Relief Valve
3. Oil Filter
4. Oil Pressure Switch
5. Oil Cooler

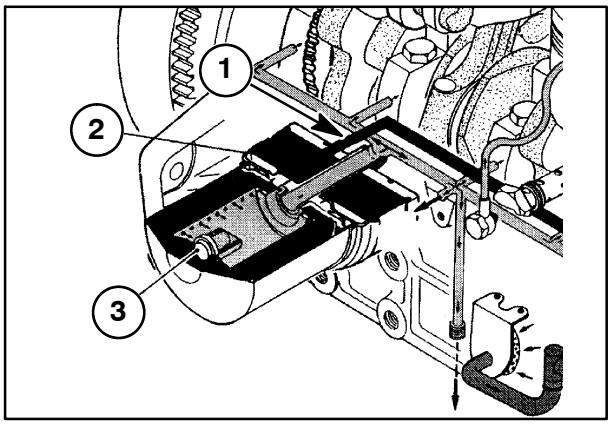
MODEL 844L-T


Model N844L-T with Turbocharger Oil Flow Chart
OIL PRESSURE SWITCH
TURBOCHARGER
ROCKER ARM SHAFT
TAPPETS
TAPPETS
TAPPETS
TAPPETS
CAM SHAFT BEARING
CAM SHAFT BEARING
CAM SHAFT BEARING
CAM SHAFT BEARING
No. 4 PISTON ROD SMALL END
No. 3 PISTON ROD SMALL END
No. 2 PISTON ROD SMALL END
No. 1 PISTON ROD SMALL END
No. 4 CRANKSHAFT PIN
No. 3 CRANKSHAFT PIN
No. 2 CRANKSHAFT PIN
No. 1 CRANKSHAFT PIN
No. 5 CRANKSHAFT JOURNAL
No. 4 CRANKSHAFT JOURNAL
No. 3 CRANKSHAFT JOURNAL
No. 2 CRANKSHAFT JOURNAL
No. 1 CRANKSHAFT JOURNAL
MAIN OIL GALLERY
OIL FILTER
BALANCER
OIL COOLER
RELIEF VALVE
OIL PUMP
SUCTION FILTER
Solid line is direct lubrication
Dotted line is indirect lubrication
76073282

OIL FILTER

Construction and Function

These engines utilize a spin-on type filter. Pressurized oil flow from the pump enters from 1, and is filtered by a full flow filter before discharge through 2. When the full flow filter is clogged, the safety valve, 3, opens to bypass the oil.



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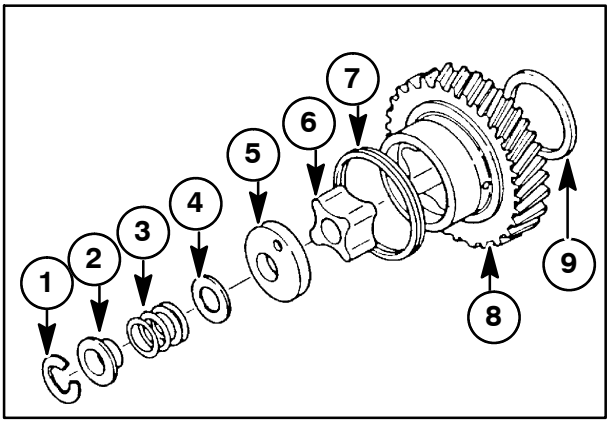
Maintenance

The oil filter must be replaced every 100 hours of operation. When installing a new filter, coat its face with clean oil. Hand tighten only.

OIL PUMP

Removal

1. Drain the engine oil and remove the spin-on type oil filter.
2. Drain the radiator and remove the cooling fan and water pump assemblies. See “Cooling Fan Removal” and “Water Pump Removal” discussed later in this section.
3. Remove the timing gear cover. See “Timing Gear Cover Removal” discussed earlier in this section.
4. Remove the retaining ring, 1. Remove the idler gear, 8, and oil pump assembly, 1 through 9.



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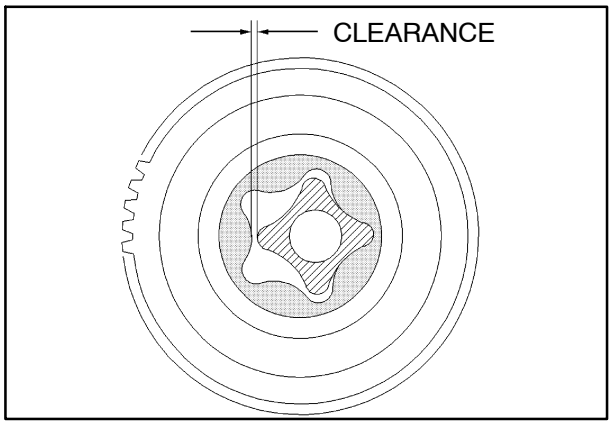
Inspection

1. Check for excessive wear on the pump cover, 5, and the port block. If port block requires replacement, see “Port Block Removal” discussed earlier in this section.
2. Inspect the pump shaft and rotor, 6, for excessive wear or scratches.

3. Measure the rotor to vane clearance. Replace the components as required, if clearance is not within specified tolerances.

Std.	Max.
0.01 – 0.15 mm (0.0004 – 0.006″)	0.25 mm (0.010″)



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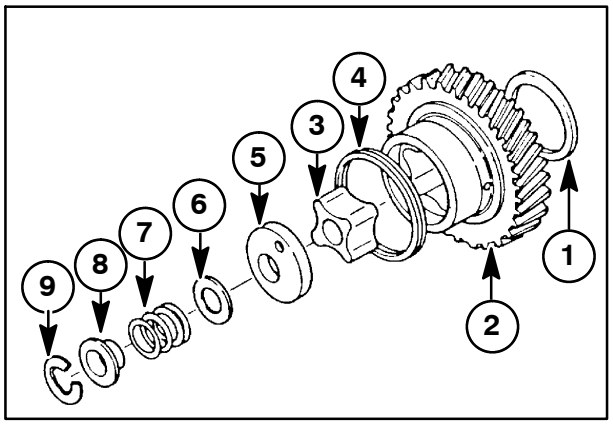
Installation and Adjustment

1. If the port block assembly was removed, install a new port block assembly. “See Port Block Assembly Installation” discussed earlier in this section.
2. Install the thrust washer, 1, and align the set marks on the idler gear, 2, crankshaft gear, and camshaft gear, and install the idler gear on the port shaft.
3. Install the rotor, 3, and spring, 4.
4. Install the oil pump cover, 5, shim, 6, spring, 7, and collar, 8. Secure the assembly to the shaft with the retaining ring, 9.
5. Using a dial indicator, 1, measure the axial movement of the collar, 2. The standard clearance is 0.01 – 0.15 mm (0.0004 – 0.006″) and the maximum allowable is 0.25 mm (0.010″). Install or remove shims, 3, as needed to obtain the standard clearance value.
6. Install the water pump and cooling fan assembly. See “Water Pump Installation” and “Cooling Fan Installation” discussed later in this section.
7. Install the timing gear cover. See “Timing Gear Cover Installation” discussed earlier in this section.
8. Refill the radiator to its proper coolant level.
9. Replace the engine oil filter and fill the sump with oil.



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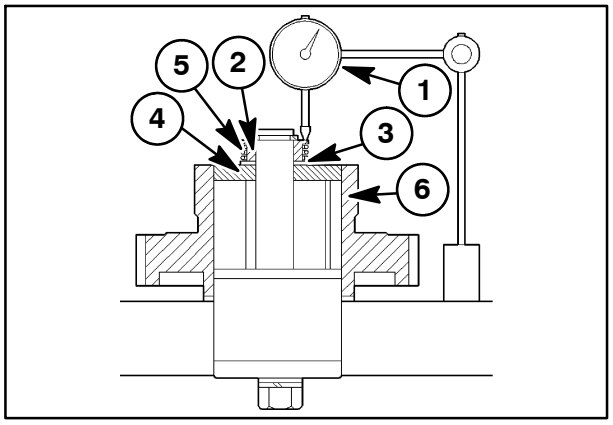

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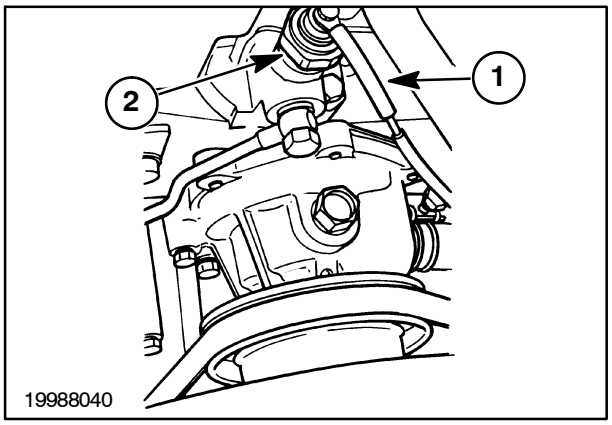
1. Dial Indicator
2. Collar
3. Shims
4. Oil Pump Cover
5. Spring
6. Idler Gear

ENGINE OIL PRESSURE CHECK

1. Disconnect the sending lead, 1, and remove the oil pressure sending unit, 2.



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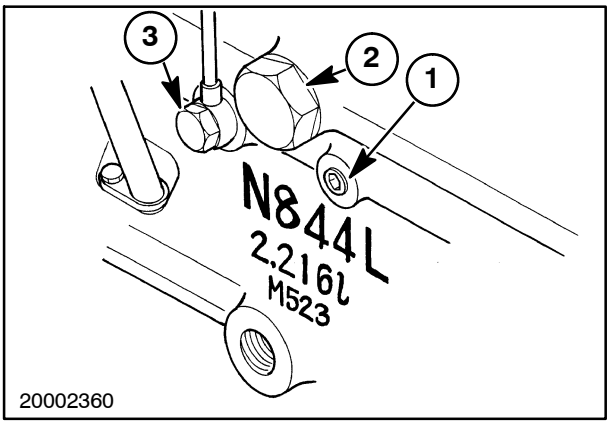
NOTE: *Main gallery access port, 1, located next to the relief valve, 2, and external oil tube, 3.*



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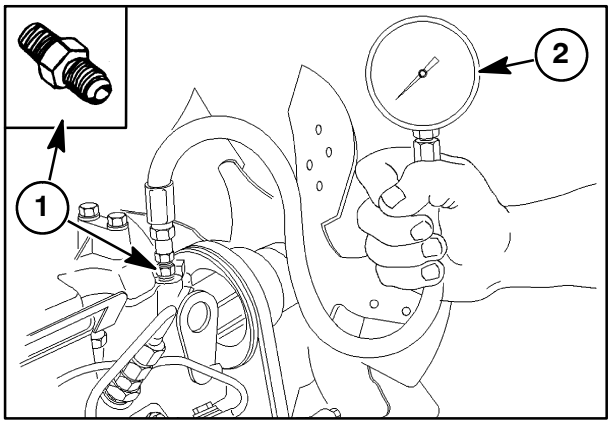
2. Install the oil pressure test fitting No. FNH00011, 1, and test gauge, 2. Start the engine and observe gauge indicator. Gauge should indicate between 0.98 – 1.47 bar (14.22 – 21.33 psi) at low idle and 2.45 – 3.43 bar (35.5 – 49.8 psi) at high idle.

NOTE: *Pressure test should be with engine at normal operating temperature.*

3. If the gauge did not indicate the oil pressure within specified tolerances at low and high idle, troubleshoot the lube oil system. See “Trouble-shooting” discussed later in this section.



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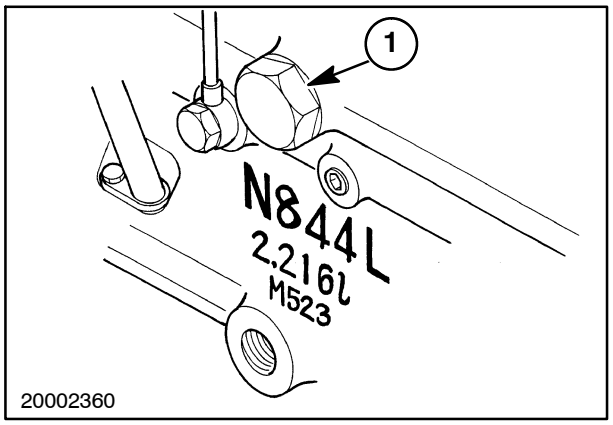
OIL PRESSURE RELIEF VALVE



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Removal

Unscrew the oil pressure relief valve, 1, and remove from the block.

NOTE: *Pressure test should be with engine at normal operating temperature.*

Installation

Install a new O-ring seal over the relief valve and screw the valve into the block. Tighten to 58.8 – 68.6 N·m (43.4 – 50.6 ft-lbs).

OIL CONSUMPTION

Log oil consumption as follows:

1. Change the engine oil and filter. Use the oil specified in the loader operator's manual.
2. Run the engine for 2 minutes.
3. Check the dipstick and add oil, if required, so the level is at the full mark.
4. Fill the fuel tank with fuel.
5. Record fuel consumption in liters (gallons), oil added in liters (gallons), and hour reading. Record fuel and oil use for 100 hours of operation, which is the recommended oil change interval. Check the dipstick before running the engine each day.

The maximum allowable oil consumption is 0.8%. The following table gives examples:

Fuel Consumption, Liters (Gallons)	Oil Consumption, Liters (Quarts)	Percentage
189.27 L (50 gal)	1.5 L (1.6 qts.)	0.79%
378.54 L (100 gal)	3.03 L (3.2 qts.)	0.80%
757.08 L (200 gal)	6.06 L (6.4 qts.)	0.80%

If the oil consumption is greater than 0.8% of the fuel consumption, oil usage is excessive. A sample calculation for oil consumption follows:

$$\% \text{ consumption} = \frac{\text{Quantity of Oil in Liters (gallons)}}{\text{Quantity of Fuel in Liters (gallons)}} \times 100$$

Assume 0.25 Liters (0.07 gallons) oil is added for 50 Liters (13.2 gallons) fuel.

$$\% \text{ consumption} = \frac{0.25 \text{ L}}{50 \text{ L}} \times 100 \quad \text{or} \quad \frac{0.07 \text{ gallons}}{13.2 \text{ gallons}} \times 100$$

$$\% \text{ consumption} = 0.5\%$$

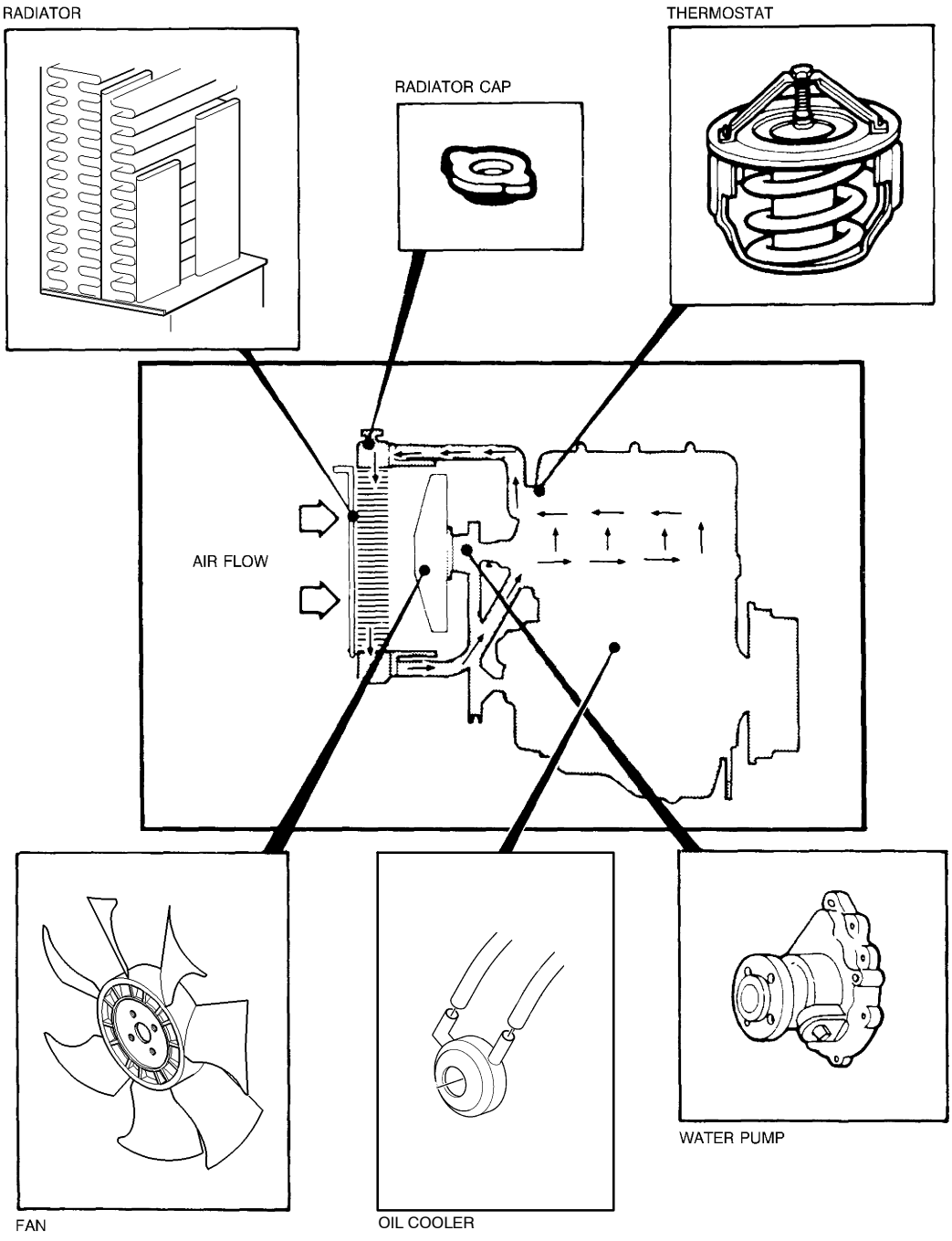
DESCRIPTION OF OPERATION – COOLING SYSTEM

The cooling system is the recirculating bypass type with a full length water jacket for each cylinder cast into the block. The coolant is drawn from the bottom of the radiator by the water pump and passes around the cylinders and into the cylinder head.

The thermostat is located in the front of the cylinder head and thermostatically controls the flow of coolant from the engine to the radiator. When the thermostat is closed only a small amount of coolant is permitted to flow through the thermostat bypass to the radiator to effect a faster warm-up. When the thermostat is open, the coolant flows from the water outlet connection to the top tank of the radiator for maximum cooling.

Cooling occurs as the coolant passes down through the radiator cores which are exposed to the air flow created by the fan as air is drawn through the radiator.

The engine cooler is installed between the cylinder block and oil filter. The cooler lowers the engine oil temperature. The cooling fluid flows from the cylinder head to the oil cooler then to the water pump.


RADIATOR
RADIATOR CAP
THERMOSTAT
AIR FLOW
FAN
OIL COOLER
WATER PUMP

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MAINTENANCE

⚠ WARNING ⚠

The cooling system operates under pressure which is controlled by the radiator cap. It is dangerous to remove the cap from a hot engine or while the engine is running. Always shut the engine off and allow it to cool before removing the radiator cap. When removing the cap, use a thick cloth to cover the cap and slowly turn the cap to the first stop to allow pressure to escape before removing the cap completely.

Clean the cooling system to remove rust, sludge, and other foreign material by using a coolant system cleaning solvent. In severe cases, pressure flushing may be required. A pulsating or reverse flow flushing will more effectively loosen and remove foreign material than a steady flushing in normal direction of coolant flow. If pressure flushing is to be used, always remove the thermostat and make sure the head bolts are tightened properly.

COOLANT

The coolant is a permanent type ethylene-glycol base antifreeze and should be used all year.

Drain and flush the cooling system every twelve months and replace the coolant with fresh antifreeze and pure water.

After the coolant has been drained from the radiator and block, flush the system by placing a water hose in the radiator filler neck. With the drain open and the system full of water, start the engine and run it until the water flowing from the drain is clear. Stop the engine and allow the system to drain, then replace the coolant with new 50/50 mixture antifreeze and pure water.

Cooling System Capacity

2410/2420	5.5 liters/5.8 qts

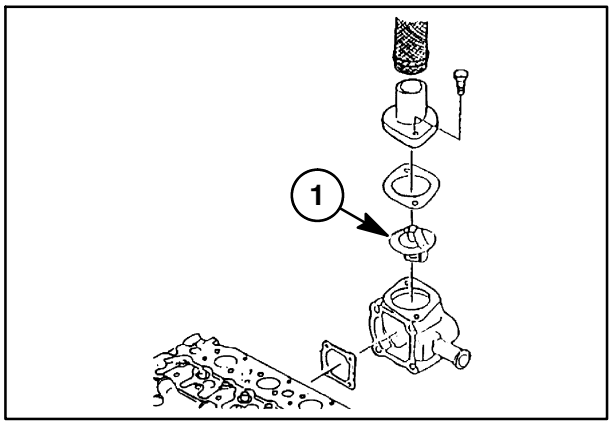
RADIATOR CAP

The radiator cap acts to pressurize the cooling system, as a pressure relief valve and also acts as a vent valve. The pressure valve permits a limited pressure buildup in the cooling system as the coolant heats up. This increased pressure increases the boiling point of the coolant. If excess pressure builds up in the system, the pressure relief valve will open until the pressure returns to the proper level, 0.9 bar (13 psi).

When the engine is shut off and the coolant cools, a vacuum condition is created in the system. A vent valve in the radiator cap opens to permit outside air pressure to enter the system when this condition exists.

THERMOSTAT

The thermostat, 1, is located between the coolant outlet on the engine and the radiator. In this position the thermostat is able to sense the coolant temperature in the engine and regulate the flow of coolant to the radiator. When the engine is cold, only a small amount of coolant flows to the radiator through the thermostat bypass. As the engine warms up, the thermostat opens to allow sufficient coolant flow to the radiator to maintain a constant engine temperature.



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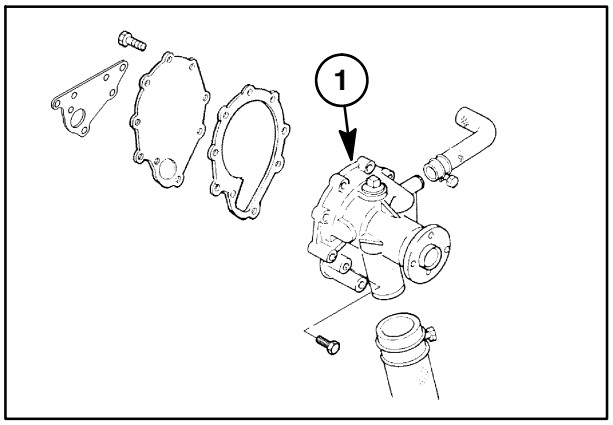
WATER PUMP

The water pump, 1, is an impeller attached to a shaft which is belt driven by the engine crankshaft. The impeller circulates water by centrifugal force. Coolant entering the pump housing from the radiator through the lower hose is thrown outward against the housing with sufficient force to cause a circulating action.



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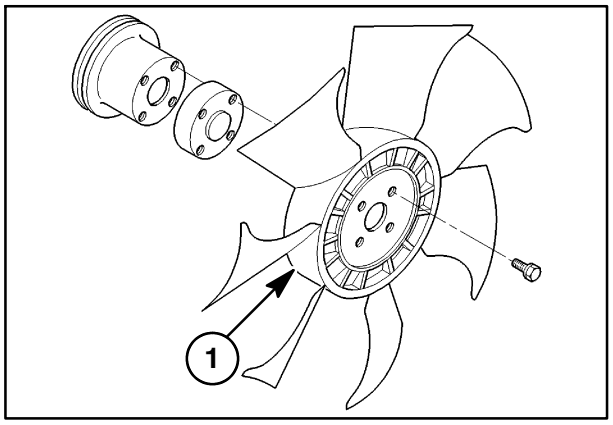
COOLING FAN

A eight-blade cooling fan, 1, is belt driven by the engine crankshaft and is mounted on the water pump shaft. The cooling fan is positioned behind the radiator to draw air over the radiator cooling fins. To increase and concentrate the volume of air flowing through the radiator, a shroud is positioned around the fan.



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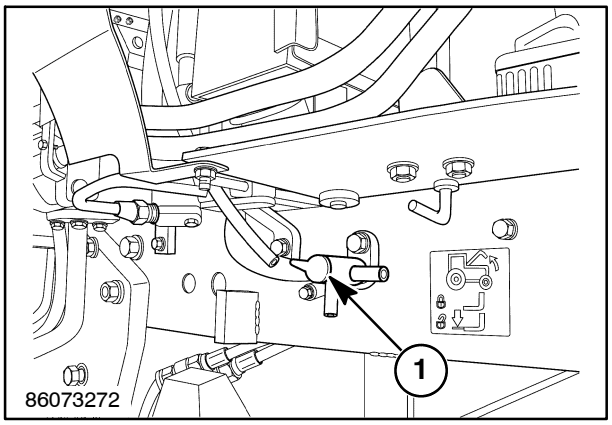
RADIATOR

Removal

NOTE: *With hood open, remove the tractor side guards.*

1. Drain the coolant from radiator, and engine using the petcock valve, 1. Remove radiator cap to assist draining.



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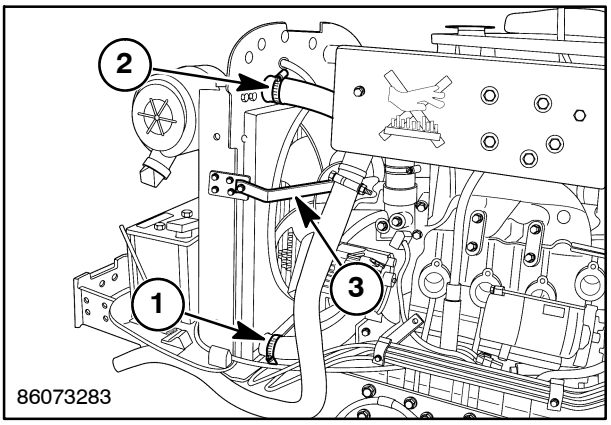
2. Loosen the lower radiator hose clamp, 1, and remove the hose from the radiator.
3. Loosen the upper radiator hose clamp, 2, and remove the hose.
4. Remove the radiator support brace, 3.



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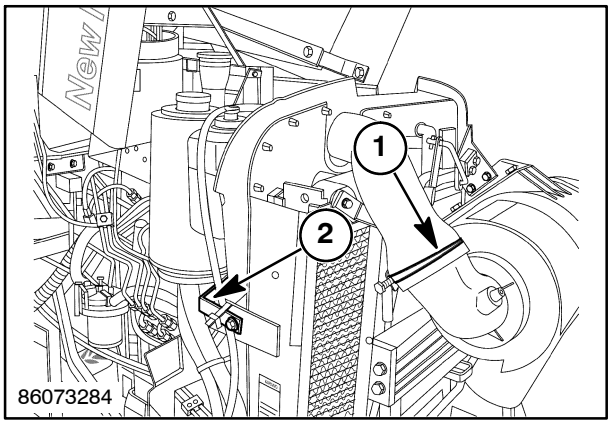
5. Remove the air cleaner intake tube, 1, by loosening the clamp.
6. Remove the radiator support brace, 2.



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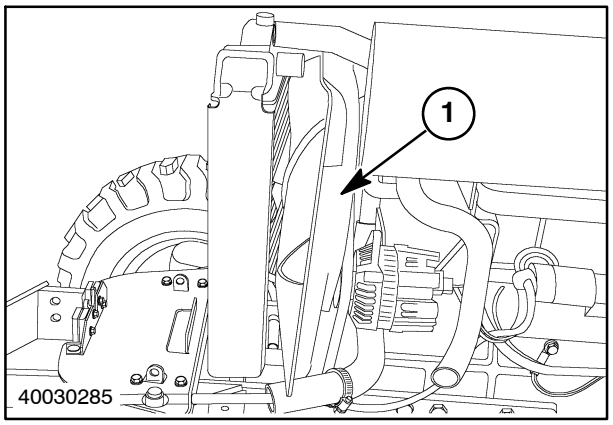
7. Remove the four bolts from the fan shroud, 1.
8. Position shroud over engine fan to allow clearance for radiator removal.



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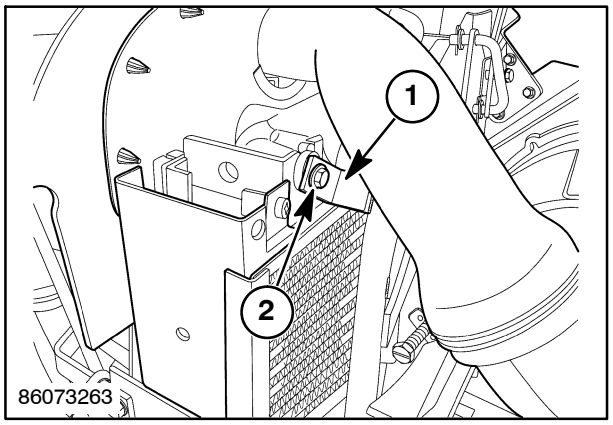
9. Remove the radiator support bolt, 1, with top radiator support bracket, 2.
10. Carefully remove radiator from tractor.
11. Remove radiator shroud from fan.



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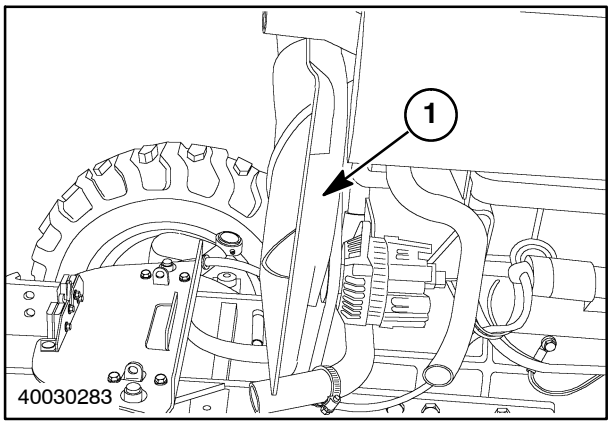
Inspection

Inspect radiator hoses for cracks, weak areas or other damage. Replace as necessary.

Installation

1. Position shroud, 1, over engine fan to allow for radiator installation.



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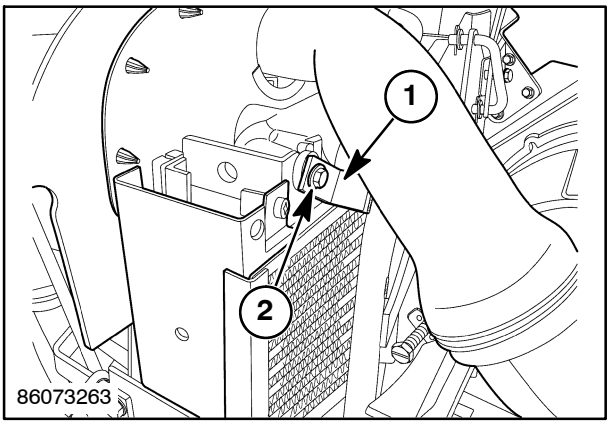
2. Install the radiator support bolt, 1, with top radiator support bracket, 2.
3. Install four fan shroud bolts securely.



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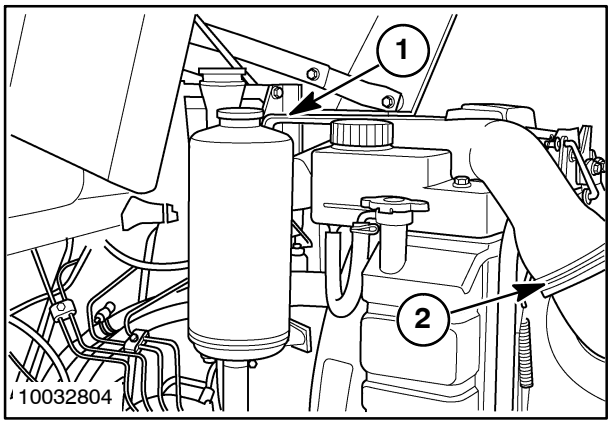
4. Install the radiator support brace, 1.
5. Install the air cleaner intake tube, 2, and tighten the clamp.



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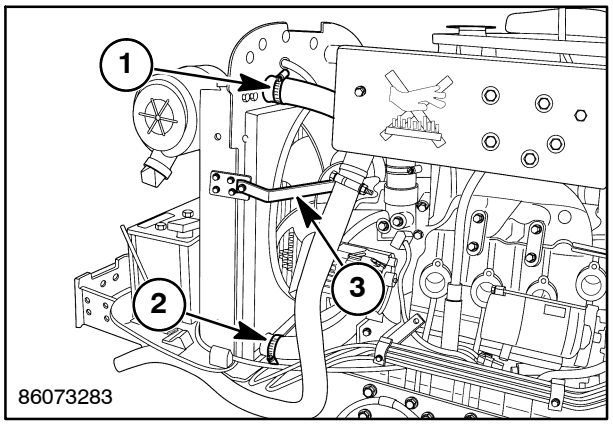
6. Install the upper radiator hose, 1, and tighten the clamp.
7. Install lower radiator hose, 2, and tighten the clamp.
8. Install the radiator support brace, 3.



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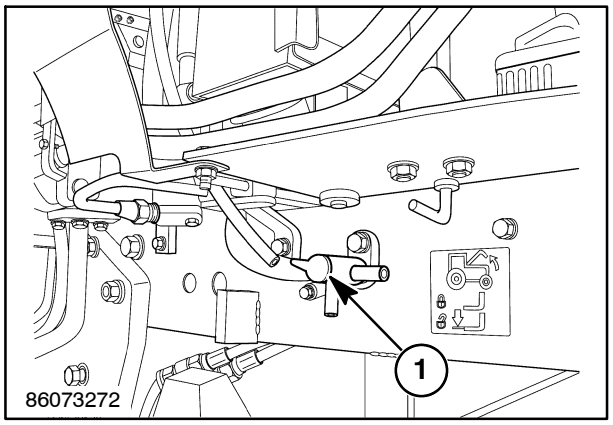
9. Tighten petcock valve, 1.
10. Replace coolant with 50/50 mixture antifreeze and pure water.
11. Connect the battery terminals.
12. Install the radiator cap. Start the engine and run for several minutes. Check hose connections for any leakage. Re-tighten clamps as necessary.
13. Install side guards, and close the hood.



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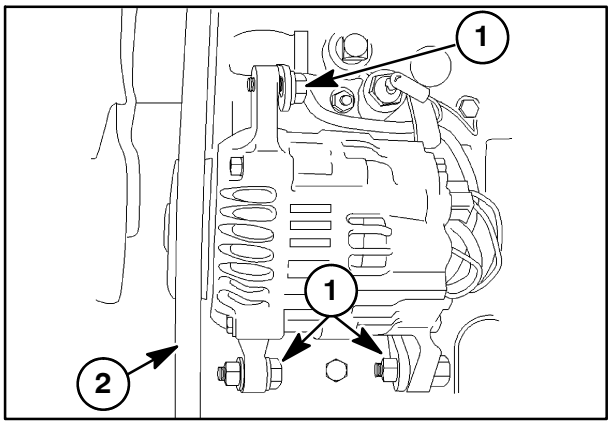
WATER PUMP

Removal

1. Remove the radiator assembly. See “Radiator Removal” discussed previously in this section.
2. Loosen the alternator mounting bolts, 1, and adjusting bracket and remove the drive belt, 2.



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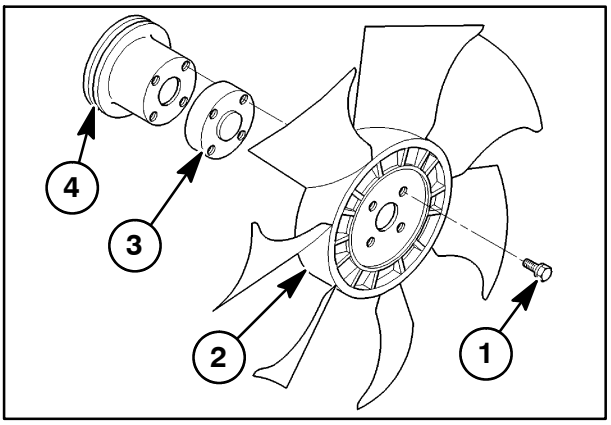
3. Remove the attaching bolts, 1, cooling fan, 2, fan holder, 3, and pulley, 4.



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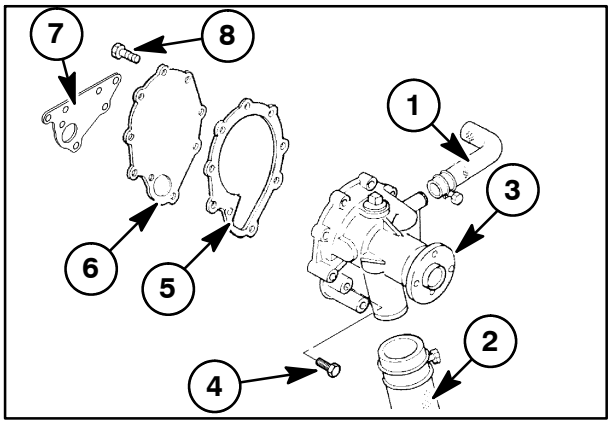
4. Remove the bypass hose, 1, and lower radiator hose, 2, from the water pump, 3.
5. Remove the water pump retaining bolts, 4, and remove the water pump, 3, and gasket, 5, from engine.
6. Remove the water pump mounting plate, 6, and gasket, 7.



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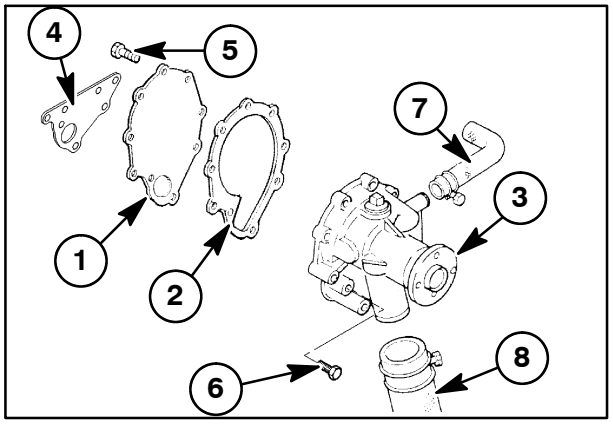
1. Bypass Hose
2. Lower Radiator Hose
3. Water Pump
4. Water Pump Retaining Bolt
5. Gasket
6. Mounting Plate
7. Gasket, Mounting Plate
8. Retaining Bolt, (Mounting Plate)

Inspection and Repair

Inspect the water pump for indications of coolant leakage from around the pump shaft. If coolant leakage is evident, or if the water pump is noisy when running, replace the water pump.

Installation

1. Install the water pump mounting plate, 1, and new gasket, 2.
2. Install the water pump, 3, and new gasket, 4, and tighten the retaining bolts, 5 and 6.
3. Install the bypass hose, 7, and lower radiator hose, 8, on the water pump and tighten the hose clamps.



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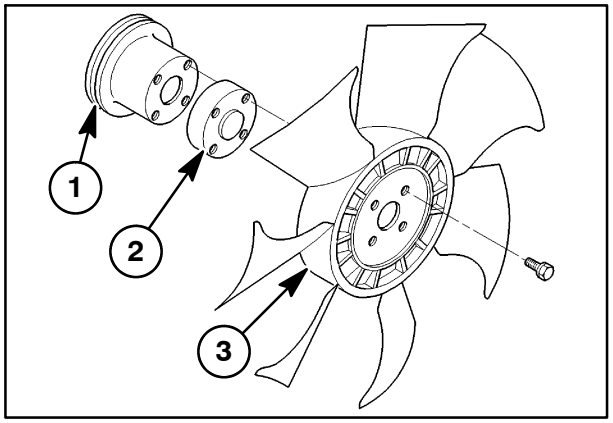
4. Install the pulley, 1, fan holder, 2, and cooling fan, 3, and tighten the attaching bolts.



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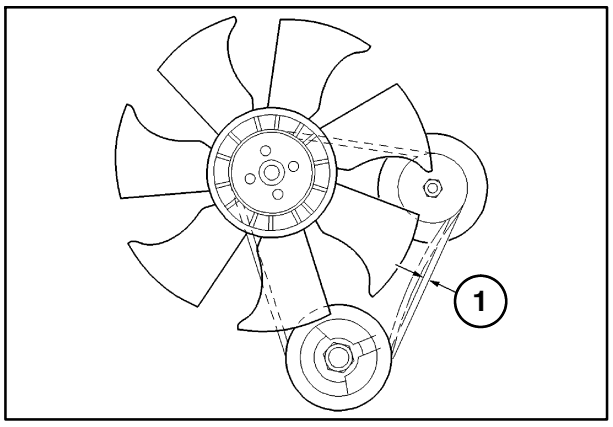
5. Install the drive pulley and adjust the alternator drive belt tension to obtain a deflection, 1, of 5 – 10 mm (0.2 – 0.4″) when 5 kg (11 lbs) is applied between the pulleys and tighten the alternator mounting bolts.
6. Install the radiator assembly. See “Radiator Installation” discussed earlier in this section.



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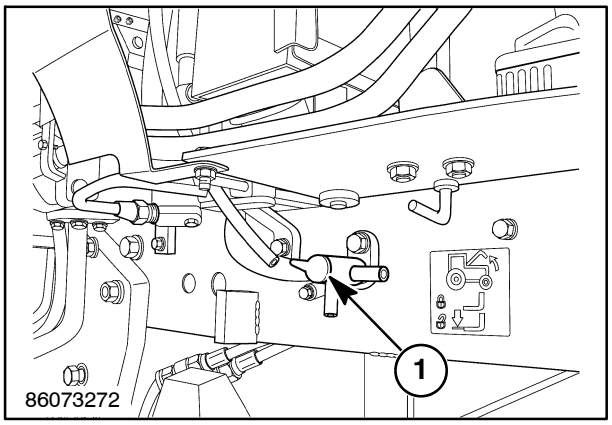
THERMOSTAT

Removal

1. Drain the coolant from radiator, and engine using the petcock valve, 1. Remove radiator cap to assist draining.



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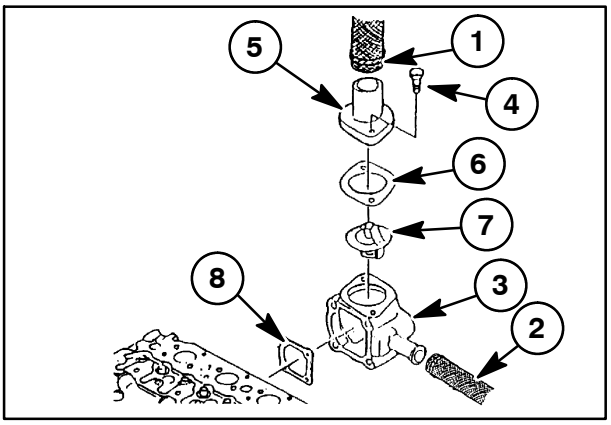
2. Remove the radiator hose, 1, and bypass hose, 2, from the thermostat housing, 3.
3. Remove the retaining bolts, 4, and remove the thermostat cover, 5, gasket, 6, thermostat, 7, and gasket, 8.



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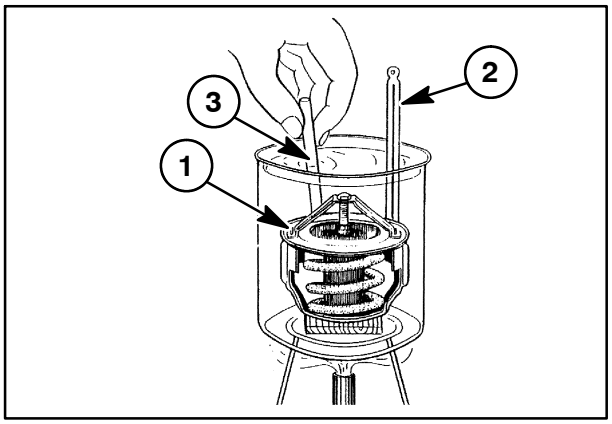
Inspection and Repair

1. Place the thermostat, 1, in a container filled with a 50/50 mixture of antifreeze and water. Insulate the thermostat from the bottom of the container.
2. Place a high temperature thermometer, 2, in the coolant mixture and heat the container.
3. Use a 0.08 mm (0.003″) feeler gauge, 3, to determine when the thermostat begins to open.

NOTE: *Three to five minutes will be required before the valve starts operating.*

	N844L-T
Type	Wax Pellet Type
Temperature when starting to open	69° – 73°C (156° – 163°F)
Temperature when fully open	82°C (180°F)
Valve lift fully open	8.0 mm (0.315″)



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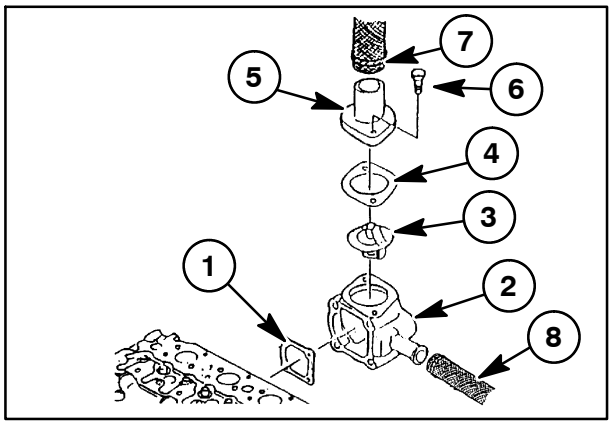
4. Replace the thermostat if it fails to open at the specified temperature.

   Thermostat opening temperature:
   Start to open: 71°C (160°F) – All models
   Fully open: 82°C (180°F)
5. Thoroughly clean the gasket mating surfaces before installing thermostat.

Installation

1. Attach gasket, 1, and thermostat housing, 2, to the engine block.
2. Place the thermostat, 3, in position in the thermostat housing, 2.
3. Install the gasket, 4, and thermostat cover, 5, and tighten the retaining bolts, 6.
4. Install the radiator hose, 7, and bypass hose, 8, on the thermostat housing, 2, and tighten the hose clamps.
5. Close the radiator drain and refill the radiator with 50/50 mixture of antifreeze and pure water.
6. Install the radiator cap and start the engine and run for a few minutes to check for any leakage.



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OIL COOLER

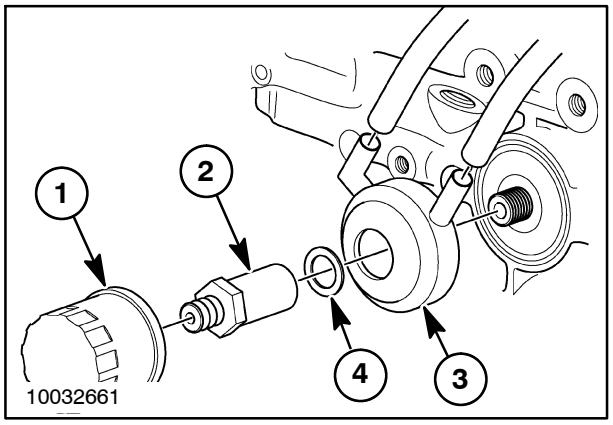
The turbo charged engine cools the engine lubricating oil by the means of a liquid oil cooler. The cooler is located between the engine oil filter and engine block.

Removal

1. Remove oil filter, 1.
2. Loosen clamps and remove hoses.
3. Remove joint nut, 2.
4. Remove cooler, 3.

Installation

1. Install and lube rubber O ring, 4, to the cooler, 3.
2. Install joint nut, 2, and torque to 16 – 20 N·m (12–15 ft-lbs).
3. Install hoses and tighten clamps.
4. Install oil filter, 1.



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SECTION 10 – ENGINE

Chapter 2 – Fuel Systems

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SPECIFICATIONS

Table 1

INJECTION PUMP	2410 (N844L-T)	2420 (N844L-T)
Pump Manufacturer Assembly Number	ZEXEL 104134- 4030	ZEXEL 104135- 4030
Type	In-Line	In-Line
Timing (Before TDC)	17 – 19°	18 – 20°
Timing (Piston Height at Injection: Start BTDC)	2.854 – 3.554 mm (0.1123″ – 0.1399″)	3.195 – 3.932 mm (0.1258″ – 0.1548″)
Injection Nozzle		
• Nozzle Type	Throttle	Throttle
• Needle Valve Diameter	0.4 mm (0.0157″)	0.4 mm (0.0157″)
• Pintle Diameter	1.0 mm (0.039″)	1.0 mm (0.039″)
Injection Pressure	146 bar (2117 psi)	146 bar (2117 psi)
Spray Angle	4°	4°
Service Adjustments		
• Idle Speed	1000 rpm	1000 rpm
• Max. No-Load Speed	2900 – 2950 rpm	3000 – 3050 rpm
TORQUE SPECIFICATIONS		
Delivery Valve Holder	39.2 – 44.1 N·m (28.9 – 32.5 ft-lbs)	39.2 – 44.1 N·m (28.9 – 32.5 ft-lbs)
Injector Assemble	59 – 69 N·m (43 – 51 ft-lbs)	59 – 69 N·m (43 – 51 ft-lbs)
Injection Pump Retaining Nuts and Bolts	4.5 – 6.8 N·m (3.3 – 5.0 ft-lbs)	4.5 – 6.8 N·m (3.3 – 5.0 ft-lbs)

STANDARDS FOR ADJUSTING THE INJECTION PUMP

Use the following standards when checking or adjusting the fuel injection pump, or after field rebuilding of the pump.

Rotation . . . . . Clockwise, viewed from driving side

Nozzle NP-DN4PDN117

Nozzle Holder 105148-1170

Nozzle Valve Opening Pressure . . . . . 146 bar (2117 psi)

Injection Pipe . . . . . 2 mm inside diameter x 6 mm outside diameter – 380 mm long

Oil Flowing Pressure . . . . . 0.2 bar (2.9 psi)

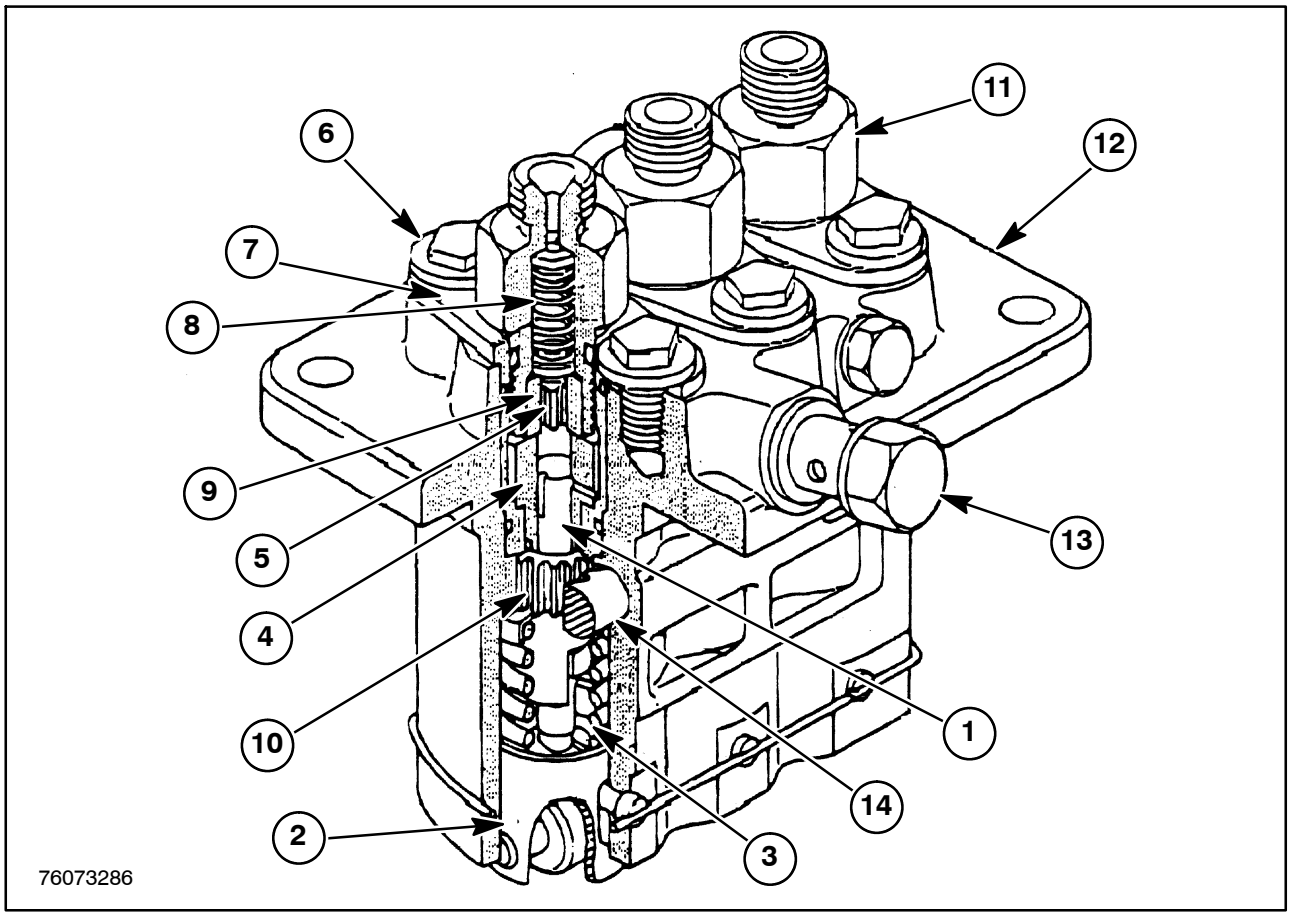
Test Oil . . . . . Light Oil

SPECIAL TOOLS

Injector Tester FNH01721

DESCRIPTION OF OPERATION

INJECTION PUMP



1

1. Plunger
2. Tappet
3. Plunger Spring
4. Plunger Barrel
5. Delivery Valve
6. Lock Bolt
7. Sleeve Flange
8. Delivery Valve Spring
9. Delivery Valve Seat
10. Control Sleeve
11. Delivery Valve Holder
12. Pump Housing
13. Bleed Screw
14. Control Rack

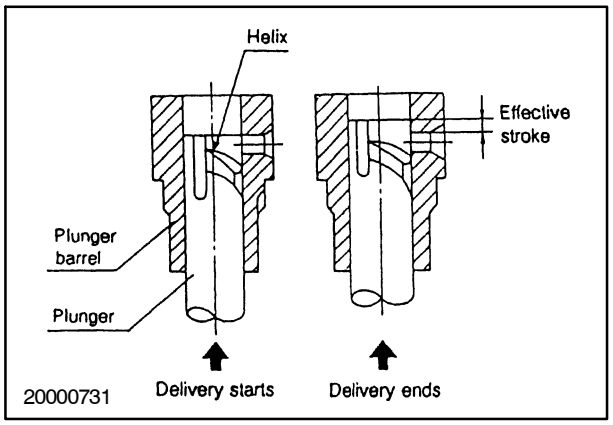
The injection pump is mounted in the engine's cylinder block. It does not have a camshaft, but is driven by the engine's camshaft. Plunger, 1, movement is constant, being raised by tappet, 2, and returned by the plunger spring, 3, as the engine rotates. The plunger barrel's, 4, suction and discharge port opens onto the pump housing's fuel oil chamber, which is always filled with fuel.

When the plunger descends, fuel oil is sucked into the plunger barrel, and when the plunger reaches it's lowest point, the suction of fuel oil stops.

The plunger then ascends, and when the plunger barrel's suction and discharge port is closed by the plunger, the fuel oil pressure increases. The fuel oil then raises the delivery valve, 5, and is delivered through the injection pipe to the nozzle holder. When the fuel oil pressure exceeds the force of the nozzle spring's set force, fuel is injected into the engine's combustion chamber in the form of a fine spray.

The plunger further ascends, and when the plunger helix meets the plunger barrel's suction and discharge port, fuel delivery ends (at the same time injection from the nozzle ends). The delivery valve is then closed by the set force of the delivery valve spring so that fuel oil is no longer delivered, even though the plunger continues to ascend.

The effective stroke is from the moment that the plunger barrel's suction and discharge port is closed by the end of the plunger (beginning-of-injection) until the suction and discharge port meets the plunger helix (end-of-injection). The effective stroke can be altered by rotating the plunger. Accordingly, the relationship between injection quantity and effective stroke is proportional.



2

TROUBLESHOOTING

GENERAL

CONDITION	CAUSE	REMEDY
Fuel not reaching injection point	Fuel shutoff valve closed	Open the fuel shutoff valve
	Restricted fuel filter	Check and flush the fuel filter clean
	Faulty fuel stop solenoid	Check fuel stop solenoid. See “Fuel Stop Solenoid”, Section 55
	Air in fuel system	Check for air leaks on the suction side of system. Bleed the fuel system
	Fuel leakage	Check the condition of the fuel lines and connections for tightness or possible damage
Fuel reaching nozzles but engine will not start	Low cranking speed	Check cranking
	Incorrect throttle adjustment	Check throttle control or travel
	Incorrect pump	Check pump timing
	Fuel Leakage	Check all fuel lines for leakage or possible damage
	Faulty injectors	See “Troubleshooting – Fuel Injectors” later in this section
	Low compression	Check for air leaks on the suction side of system. Bleed the fuel system
Engine hard to start	Low cranking speed	Check cranking
	Incorrect throttle adjustment	Check throttle control or travel
	Restricted fuel filter	Check and flush fuel filter clean
	Contaminated fuel	Check for water in fuel
	Low compression	Check engine compression. See “Engine Compression Test”, Section 10
	Air in fuel	Check for air leaks on the suction side of system. Bleed the fuel system

CONDITION	CAUSE	REMEDY
Engine starts and stops	Low cranking speed	Check cranking
	Contaminated fuel	Check for water in fuel
	Restricted air intake	Check for restrictions in the air intake
	Air in fuel system	Check for air leaks on the suction side of system. Bleed the fuel system
	Engine overheating	Check cooling system
Erratic engine operation (surge, misfiring, poor governor regulation)	Fuel leakage	Check all fuel lines for leakage or possible damage
	Fuel starvation	Check and flush clean restricted fuel lines
	Air in fuel system	Check for air leaks on the suction side of system. Bleed the fuel system
	Contaminated fuel	Check for water in fuel
	Faulty or sticking injector nozzles	See “Troubleshooting – Fuel Injectors” later in this section
	Incorrect engine timing	Check for improper valve adjustment or faulty valve
	Sticky nose cone	Check nose cone for proper operation. Lubricate or replace if nose cone is binding on end of camshaft
Engine does not develop full power or speed	Incorrect throttle adjustment	Check for insufficient throttle movement
	Incorrect Maximum no-load speed	Check maximum no-load speed adjustment
	Fuel starvation	Check and flush clean restricted fuel lines and filter
	Air in fuel system	Check for air leaks on the suction side of system. Bleed the fuel system
	Incorrect timing	Check pump timing
	Low compression	Check for air leaks on the suction side of system. Bleed the fuel system
	Incorrect engine timing	Check for improper valve adjustment or faulty valve

CONDITION	CAUSE	REMEDY
Engine emits black smoke	Restricted air intake	Check for restrictions in the air intake
	Engine overheating	Check cooling system
	Incorrect timing	Check pump timing
	Faulty injectors	See “Troubleshooting – Fuel Injectors” later in this section
	Low compression	Check for air leaks on the suction side of system. Bleed the fuel system
	Incorrect engine timing	Check for improper valve adjustment or faulty valve
Pump fails to deliver fuel to all injectors	Blocked fuel lines to pump	Remove fuel lines and flush or replace
	Air in system	Check for air leaks on the suction side of system. Bleed the fuel system
	Control rod seized in “OFF” position	Repair or replace control rod
Pump fails to deliver fuel to one injector	Air in fuel line to injector	Bleed fuel line
	Plunger spring broken	Replace spring
	Plunger seized	Repair or replace barrel and plunger assembly
	Delivery valve seized	Repair or replace delivery valve
	Badly scored plunger and barrel	Replace plunger and barrel assembly
Governor fails to maintain maximum or minimum no-load fuel delivery	Control spring broken	Replace control spring
	Governor weights seized	Repair or replace weight assembly and/or camshaft
	Governor weight carrier broken	Replace weight assembly
	Nose cone seized	Replace nose cone and/or camshaft
	Pump link spring broken	Replace spring

FUEL INJECTORS

CONDITION	CAUSE	REMEDY
Nozzle does not “buzz” while injecting	Needle valve stuck	Check needle valve for carbon build-up and binding
	Excessive fuel leakage	Check valve and valve seat for scores or other indications of leakage
	Nozzle damage	Inspect faces and tighten nozzle retaining nut
Nozzle leakage	Needle valve worn	Replace nozzle assembly
	Blocked nozzle assembly	Check for carbon or foreign matter on faces of nozzle and nozzle holder. Flush, clean, or replace
	Loose nozzle retaining nut	Inspect faces and tighten nozzle retaining nut
Nozzle opening pressure incorrect	Incorrectly adjusted nozzle retaining nut	Check retaining nut for looseness
	Damaged nozzle or seized needle valve	Replace nozzle assembly
	Blocked nozzle orifice	Check orifice for carbon or foreign matter. Flush clean or replace.
Nozzle seat leakage	Nozzle incorrectly seated	Check for carbon or foreign matter on faces of nozzle and nozzle holder. Flush, clean, or replace
	Sticking or binding needle valve	Repair or replace nozzle assembly

GOVERNOR

CONDITION	CAUSE	REMEDY
Sluggish governor response	Nose cone binding on camshaft	Replace or lubricate nose cone on end of camshaft
	Fuel rack binding in injection pump	Lubricate rack with penetrating oil or submerse rack mechanism in automatic transmission fluid. Repair or replace injection pump
	Governor weights binding on pivot pins	Repair governor assembly
	Linkage arm between governor linkage and injection pump rubbing on cylinder block	Straighten or replace linkage arm assembly
	Binding of throttle arm pivot shaft	Lubricate or replace throttle arm shaft
Engine runs away (excessive speed)	Nose cone stuck at “in” position	Replace nose cone or check camshaft for binding
	Linkage arm between governor linkage and injection pump stuck	Repair or replace linkage arm assembly
	Fuel rack stuck in full fuel position	Lubricate or repair injection pump
Engine will not develop rated speed	Fuel screw adjusted too far into engine block	Contact New Holland representative for adjustment
	Fuel rack stuck in low fuel position	Lubricate or repair injection pump.
Engine speed surging	Broken dampener spring on linkage arm	Replace dampener spring
	Damaged governor spring	Replace governor spring
	Worn linkage	Inspect and repair linkage as needed

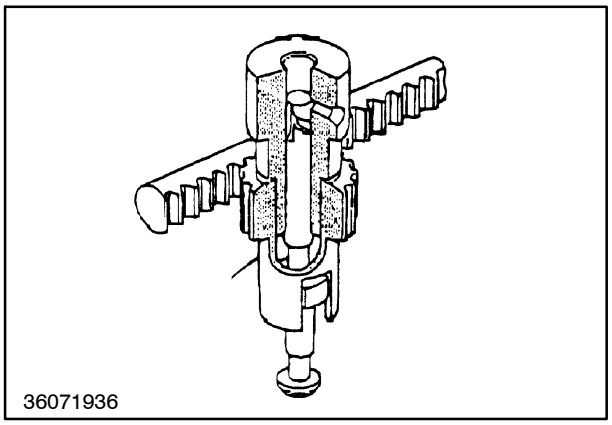
ENGINE BREATHER VALVE

CONDITION	CAUSE	REMEDY
Engine emitting a bluish smoke	Excessive blow by gases of engine. Possible worn piston rings or scored cylinder walls	Replace piston rings, hone cylinder walls to seat new rings
	Engine breather valve is stuck in "OPEN" position. Valve diaphragm is damaged allowing valve not to close	Replace engine breather valve diaphragm
	Oil mist separator mesh screens allowing oil to enter intake manifold damaged or missing separator mesh screens	Replace oil mist separator mesh screens
Engine seals leaking oil	Excessive crankcase pressure. High pressure caused by breather valve not opening	Inspect diaphragm for damage or contamination. Replace diaphragm if necessary
	Vent hole in valve body plugged	Remove valve body from engine and clean vent hole

FUEL VARIATION MECHANISM

As well as pressurizing the fuel oil, the injection pump also functions to vary the fuel injection quantity.

A control sleeve is installed around the plunger barrel, and a flange on the bottom of the plunger is inserted into a groove in the control sleeve. Teeth on the control sleeve are engaged with teeth on the control rack so that movement of the control rack results in rotation of the plunger and, consequently, variation of the fuel injection quantity.



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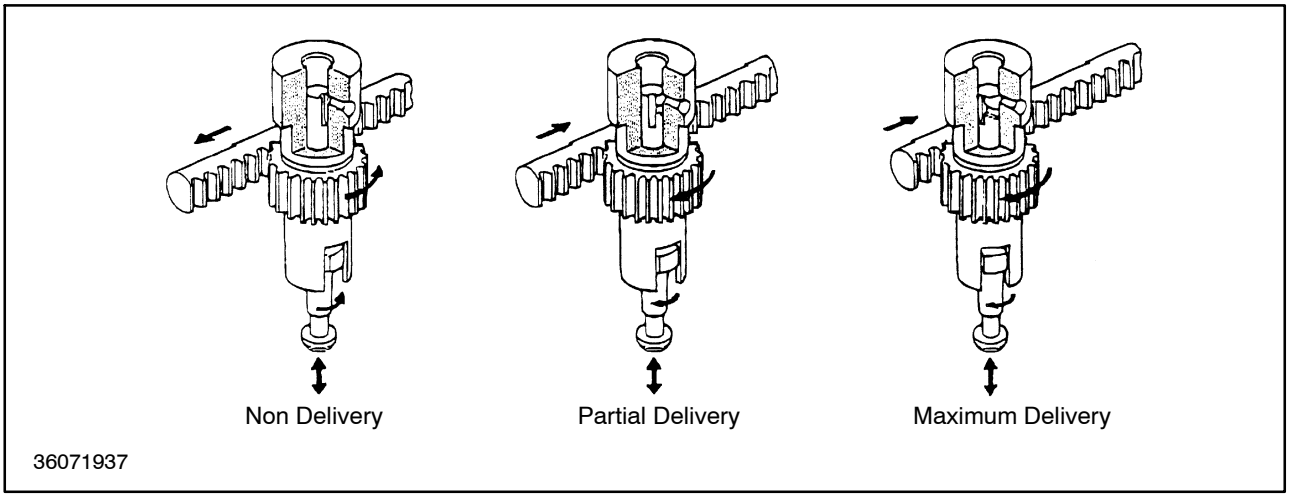

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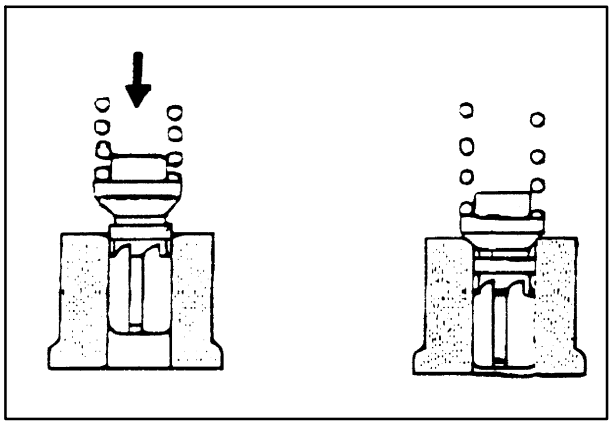
DELIVERY VALVE ASSEMBLY

The delivery valve assembly consists of the delivery valve and the valve seat.

When the force of the high-pressure fuel oil delivered by the plunger exceeds the force of the delivery valve spring, the delivery valve opens and fuel oil is delivered through the injection pipe to the nozzle holder.

After injection, the injection pipe retains a degree of residual pressure adequate for the subsequent injection. The delivery valve prevents the reverse flow of this fuel oil in the injection pipe to the plunger side. If the residual pressure is too high, then the flow of fuel oil will not be properly cut after injection.

By allowing the fuel oil in the injection pipe to retract an amount equal to the piston's retraction stroke, the delivery valve improves the ability of the nozzle to cut injection, as well as preventing dribbling.

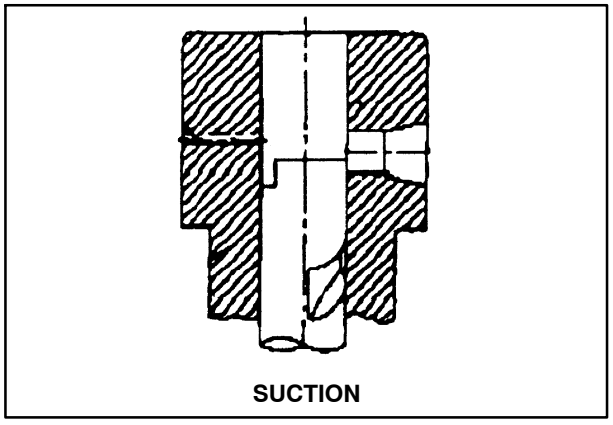


5

CTD (COMPACT TIMING DEVICE) MECHANISM

NOTE: *The CTD (Compact Timing Device) mechanism is installed on the tractors to reduce noise, smoke, and exhaust gas emission etc.*

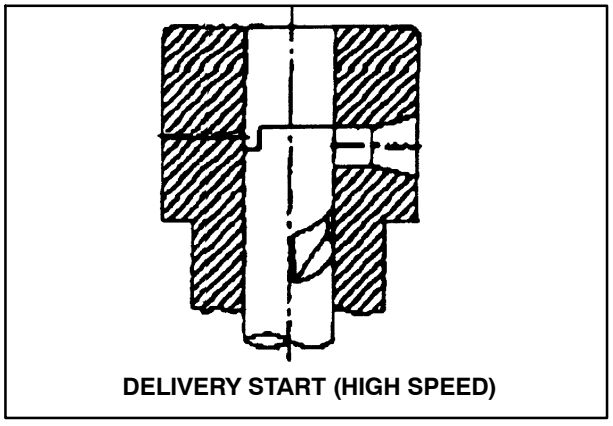
When the plunger descends, fuel oil is sucked into the barrel, and when the plunger reaches its lowest point, the suction is finished.



6

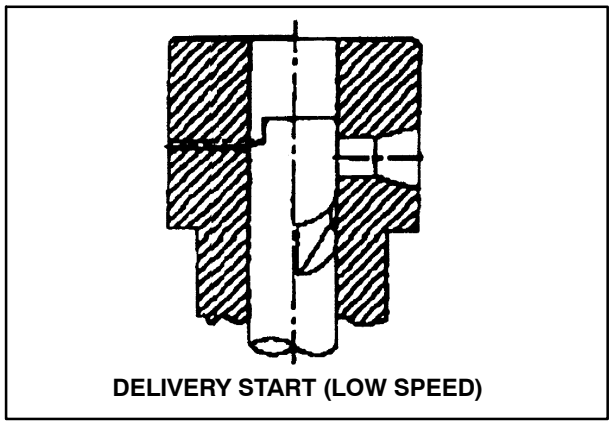
In case of the standard plunger, the plunger then ascends, and when the barrel's main port is closed by the plunger, the fuel oil pressure increases, and the fuel delivery starts.

CTD type plunger (the barrel has sub port), whether the fuel delivery starts or not is determined by the engine's rev speed. When the engine's rev speed is low, the delivery does not start, because the sub port is still opened, and fuel oil pressure does not increase. But, when the engine's rev speed is high, the sub port's diameter is so small that it can be considered as being closed. For this reason, fuel oil pressure increases and the delivery starts.



7

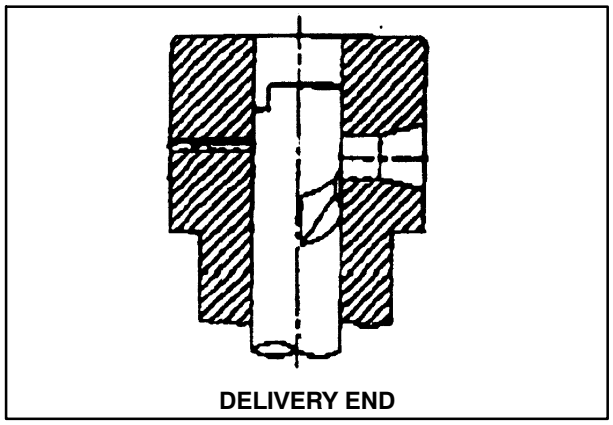
The plunger further ascends, and when the barrel's sub port is closed by the plunger, the fuel oil pressure increases and the delivery starts, regardless of the engine's rev speed.



DELIVERY START (LOW SPEED)

8

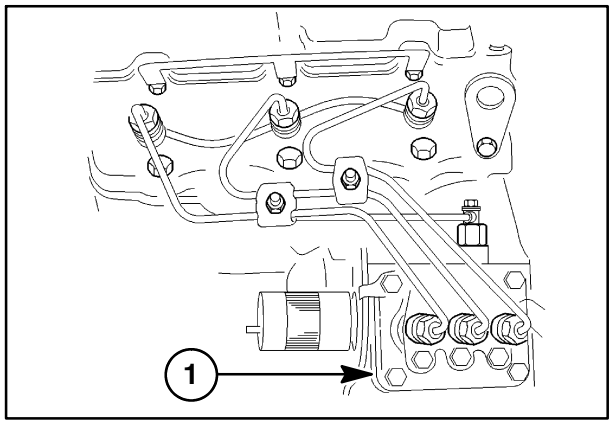
The plunger further more ascends, and when the plunger main lead meets the barrel's main port, the fuel oil pressure decreases, and the fuel delivery ends.



DELIVERY END

9

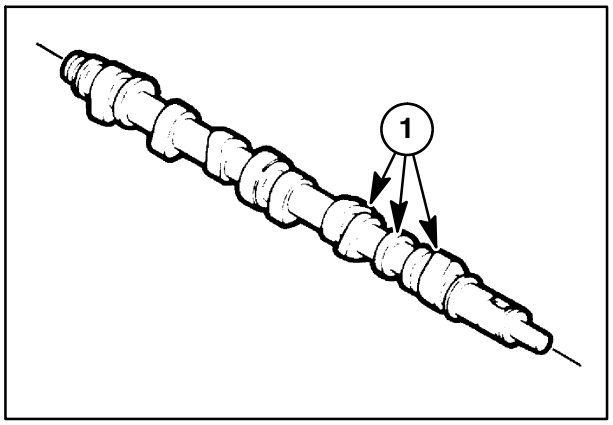
The fuel injection pump, 1, is a constant stroke type pump and has one pumping element for each cylinder. The injection pump operates at one-half engine speed.



10

PUMPING ELEMENTS

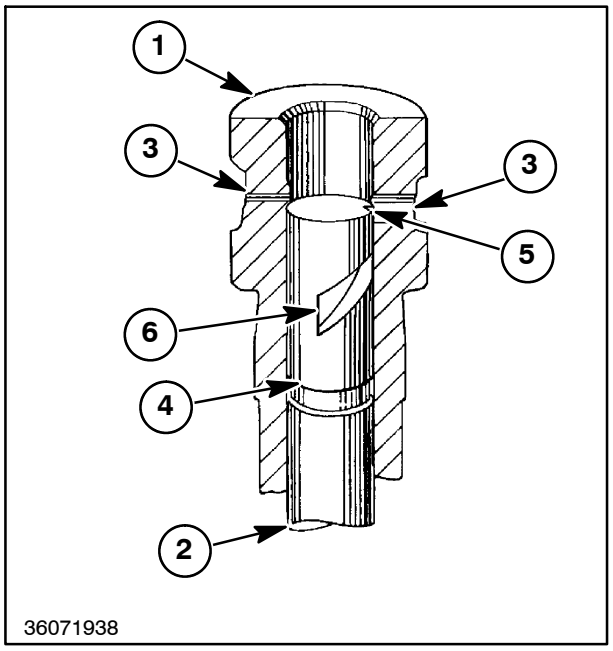
The pumping elements are operated by cam lobes, 1, that are incorporated on the engine valve train cam shaft, which is driven by the engine oil pump.



11

The pumping elements accurately meter and deliver the fuel to the injectors. Each of the pumping elements consists of a barrel, 1, and plunger, 2, lapped together to give an accurate fit. Two diametrical drillings in the barrel form fuel inlets, 3, and the barrel is splined, with a master spline, for correct location within the pump body.

An angular groove, 4, is machined around the plunger into which fuel leaking between the barrel and plunger may accumulate. This leakage provides lubrication of the barrel and plunger surfaces. The plunger has a fuel port, 5, which terminates in a helical groove, 6, machined in the periphery of the plunger. The purpose of the groove is to control the effective pumping stroke of the plunger.



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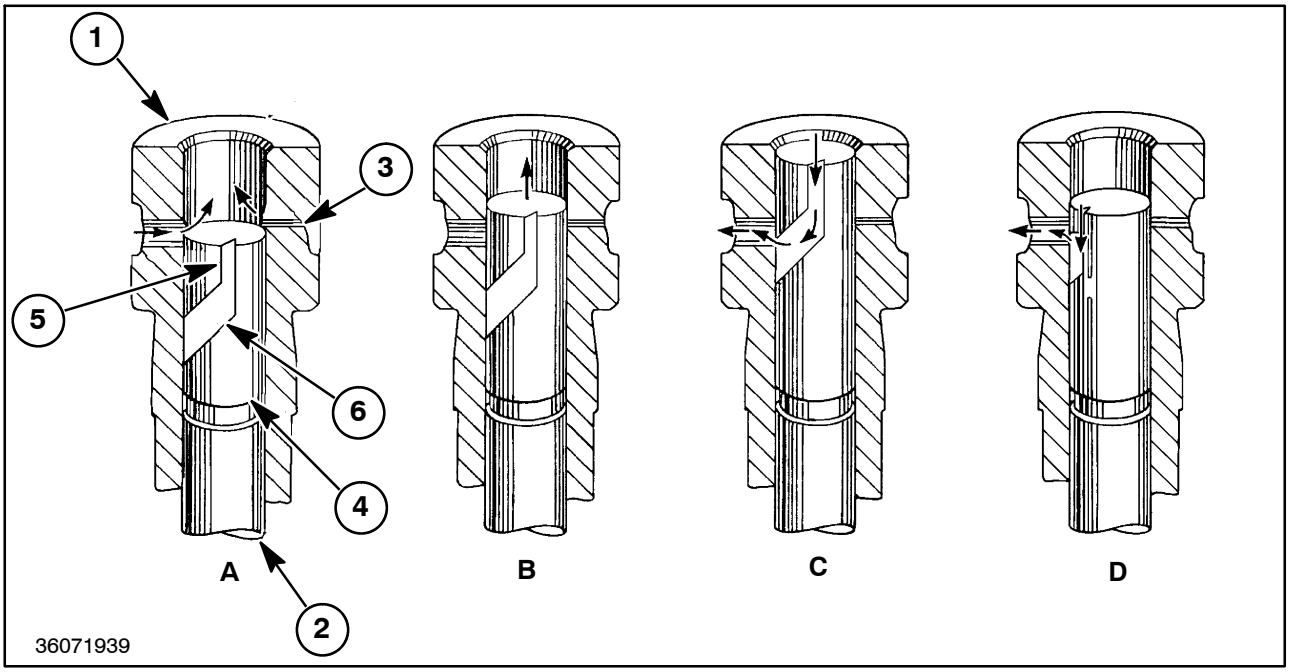


13

1. Barrel
2. Plunger
3. Fuel Inlet
4. Angular Groove
5. Fuel Port
6. Helical Groove

The element operates as follows:

Position A: With the plunger, 2, at the bottom of the stroke, fuel flows into the barrel, 1, through the two inlet ports, 3, to fill the space above the plunger, the vertical groove, 5, and the helical groove, 6.

Position B: As the plunger rises, the two inlet ports in the barrel are cut off by the plunger, and the fuel is trapped. This point is called “spill cut-off” or “point of injection”. Further upward movement of the plunger tends to compress the trapped fuel until the delivery valve, which acts as a non-return and unload valve, is lifted from the seat and allows the fuel to pass through the injector line to the injector. The pressure developed lifts the injector needle valve off the seat and injection takes place.

Position C: Injection ceases when the upper edge of the helical groove uncovers the lower edge of the inlet port. The pressurized fuel is allowed to escape back through the drilling to the low pressure area of the inlet port. This pressure drop causes the injector needle valve to close and injection to cease. The plunger continues to the top of the stroke and is returned by a spring for the next cycle.

The effective pumping stroke is the distance between the top of the plunger and the point on the helical groove, which uncovers the inlet port.

If the plunger is rotated clockwise so the helical groove uncovers the inlet port at a lower point on the plunger, the pumping stroke and the amount of fuel injected will be increased. Conversely, if the plunger is rotated counterclockwise, the effective pumping stroke and amount of fuel injected will be reduced. The rotation of the plunger is effected by an arm at the base of the plunger which engages with a fork on the control rod. Movement of the control rod towards the rear of the engine turns the plungers clockwise and increases the fuel flow.

Position D: At this stage, the plunger has rotated to a position where the helical groove has reached the bottom of the inlet port before the plunger has risen sufficiently to close both inlet ports.

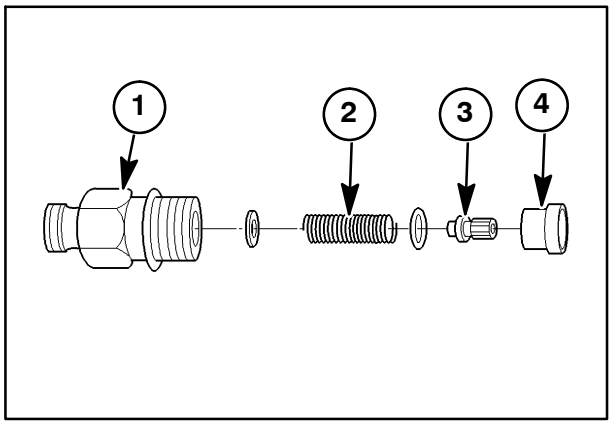
During the remainder of the stroke, the helical groove remains in contact with the inlet ports, so no pressure is produced, and no injection can take place. This is the “no delivery” or “stop” position, which occurs when the stop lever moves the control rod to the fully forward position.

NOTE: *The plungers have a slot machined across the crown. When the access fuel device is operated and the control rod is in the maximum fuel position, the slots align with the inlet ports of the barrel to retard inlet port closure and assist easy starting*

DELIVERY VALVES

Located above each pumping element is a delivery valve assembly. The delivery valve consists of a delivery valve holder, 1, spring, 2, piston and stem assembly, 3, operating within a cylindrical guide, 4, which terminates in a conical seat. The lower part of the stem has four vertical flutes which accurately locate within the guide while permitting fuel to pass. Above the flutes is a piston which is a lapped fit in the bore of the valve guide.

The delivery valve serves as a non-return valve and also as a means of rapidly reducing the fuel pressure in the injector line when injection ceases. Rapid pressure reduction is required to be sure injector needle valve "snaps" shut to prevent fuel "dribble", a condition which can cause carbon formation on the injector tip.



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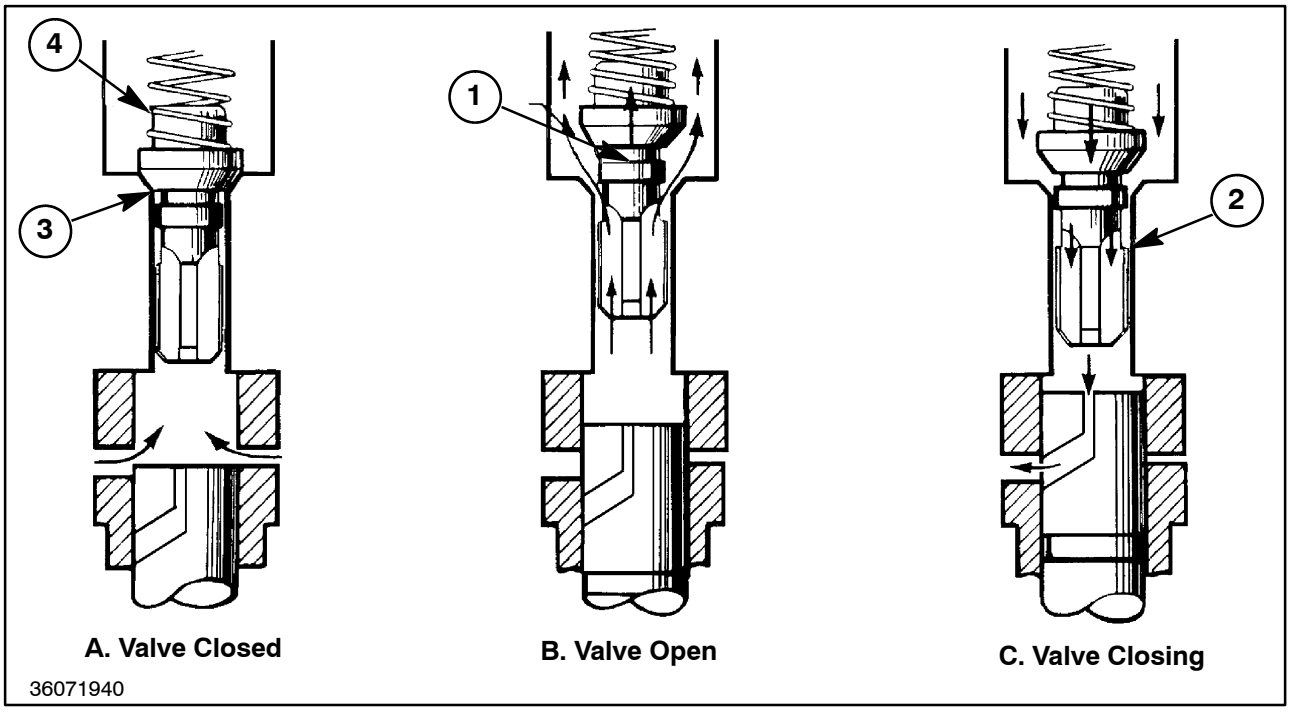


15

1. Piston
2. Valve Guide
3. Conical Seat
4. Spring

The delivery valve operates as follows:

Position A: The pump plunger is at the bottom of the stroke and the inlet ports are uncovered, so the barrel and delivery guides are filled with fuel. As the fuel is at low pressure, the delivery valve is retained on the seat by spring pressure.

Position B: The plunger has risen and closed both inlet ports, pressurized the fuel and the injection process begins. The pressurized fuel overcomes the spring tension, lifting the delivery valve off its seat until the piston is clear of the guide, permitting fuel to pass to the injector.

Position C: The helical groove has uncovered the inlet port and released the fuel pressure. The delivery valve spring, aided by the high pressure still existing in the pipeline, forces the delivery valve to close rapidly.

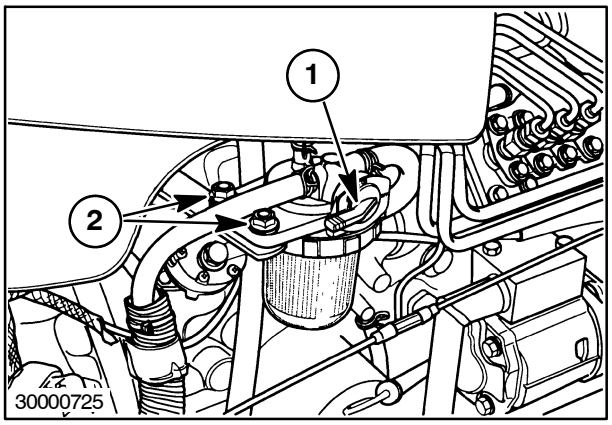
During closing, the piston portion of the valve returning into the guide increases the volume of the injector line by the volume of this part of the valve.

This sudden increase in the volume of the injector line causes a rapid collapse of pressure and allows the injector needle valve to "snap" shut.

INJECTION PUMP

Removal

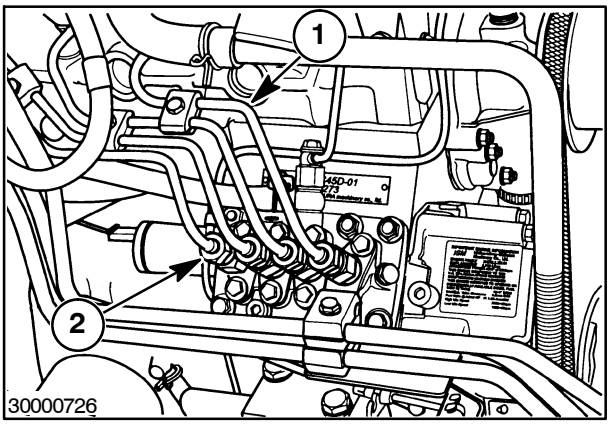
1. Turn the fuel shut-off valve, 1 to the “off” position.
2. For easier access to the injector line nuts, remove the filter from the bracket by removing the two nuts, 2.



16

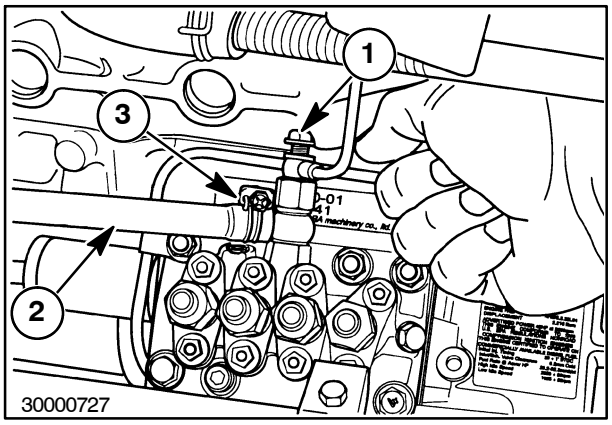
3. Remove the fuel injection lines, 1, by loosening nuts, 2, on the injection pump and the nuts on the injectors.

NOTE: *Cap and plug all openings to prevent contamination.*



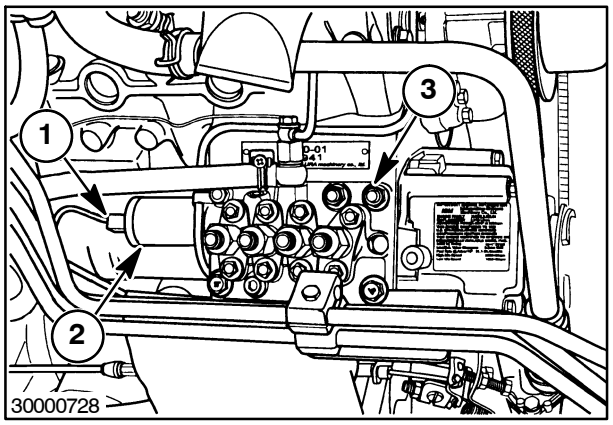
17

4. Disconnect the fuel tank return line by removing bolt, 1.
5. Disconnect fuel inlet line, 2, by loosening clamp screw, 3.



18

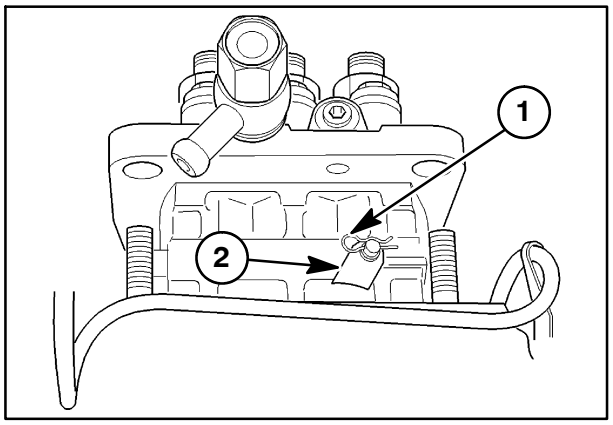
6. Disconnect the wire, 1, to the fuel shut-off solenoid, 2, and remove the fuel shut-off solenoid.
7. Remove the mounting nuts and bolts, 3, for the injection pump.



19

8. Raise the pump and remove the snap pin, 1, and separate the governor link, 2, from the pump control rack, 3 (fig. 21).
9. Remove the injection pump from the engine.

NOTE: *If there are shims between the pump mounting flange and the engine block, carefully remove the shims and retain for installation.*



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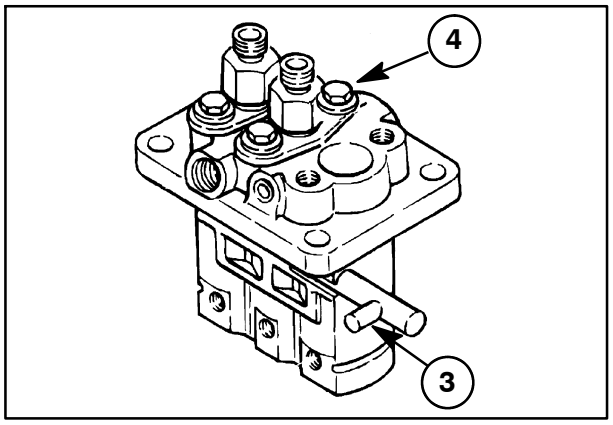
NOTE: *A special socket is needed to remove the lock bolts, 4. (Contact a Zexel supplier, Part Number 157914-3100).*



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Repair

If the injection pump is suspected of being faulty, it should be repaired by an authorized Diesel Service Station only.

NOTE: *If repair is within New Holland warranty period, replace injection pump with a new pump from the "New Holland Parts Department".*

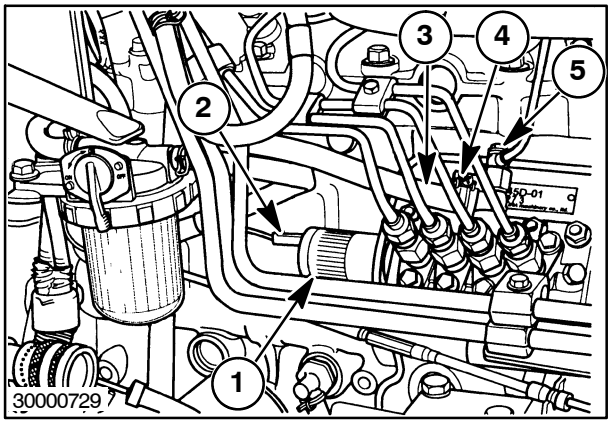
Installation

Installation generally follows removal procedures in reverse. If the pump is being replaced or if the timing is unknown, proceed to "Timing and Governor Adjustment", later in this section.

1. Attach the pump rack to the governor linkage.
2. Install injection pump assembly with shims into engine housing.
3. Install the pump mounting nuts and bolts and tighten to 13 – 17 N·m (9.6 – 12.5 ft-lbs).
4. Install fuel solenoid, 1, into rear of injector housing and connect the electrical lead, 2.
5. Connect the fuel inlet line, 3, by tightening clamp screw, 4.
6. Install the fuel return line by installing bolt, 5.
7. Install injector lines, 1, by tightening nuts, 2, at the pump and nuts at the injectors.
8. If removed, reinstall the fuel filter onto its bracket by tightening two nuts, 3.
9. Turn the fuel select, 4, to the on position.

After installation bleed air from the fuel system. See "Bleeding the Fuel System", later in this section.

NOTE: *It may be necessary to verify pump timing. Spill-time the pump as outlined in "Spill-Timing Procedure", discussed in this section.*



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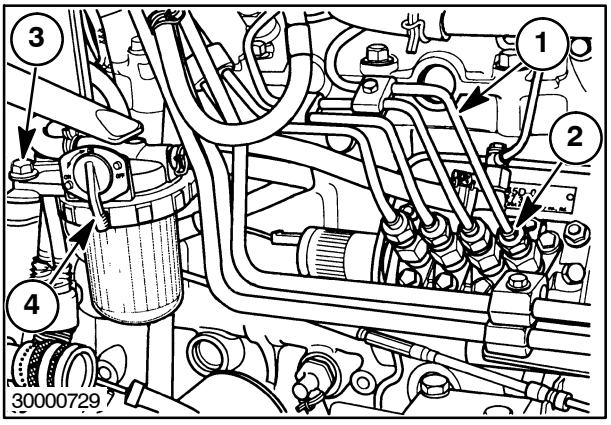

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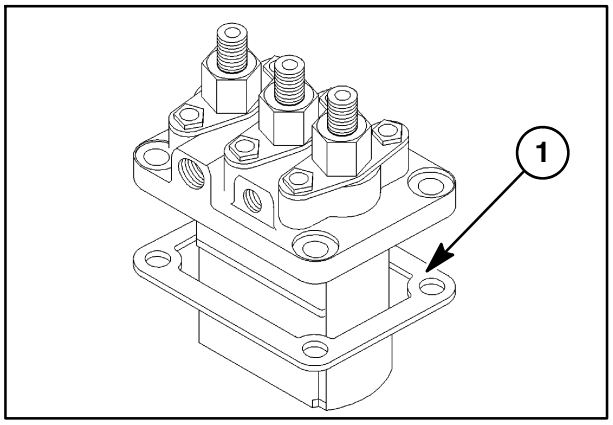
TIMING AND GOVERNOR ADJUSTMENTS

Installation (New Pump or Drive Component)

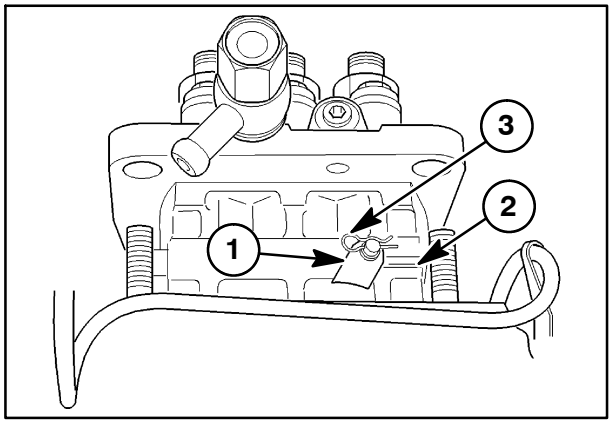
NOTE: *Installation of a new pump is the same as installation of an original pump. When installing a new pump, however, checking the timing is required.*

1. Position the pump in the block using a new shim gasket, 1, of 0.3 mm (0.012″) thickness, or original shim pack from removed pump.



24

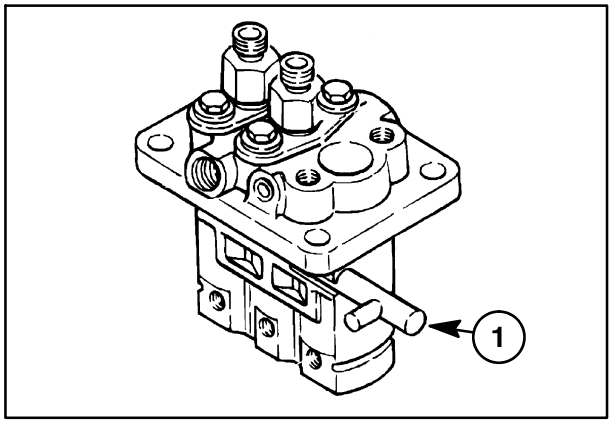
2. Connect the governor link, 1, to the pump control rack, 2, and secure with snap pin, 3.



25

NOTE: *Check the control rack, 1, for any binding conditions by moving the control lever back and forth. Lubricate control rack with clean engine oil before installation.*

3. Install the mounting bolts and tighten to 13 – 17 N·m (9.6 – 12.5 ft-lbs).
4. Connect the fuel inlet line.
5. Connect the fuel injection lines.
6. Connect the fuel return line to the number four injector.
7. Spill-time the pump.



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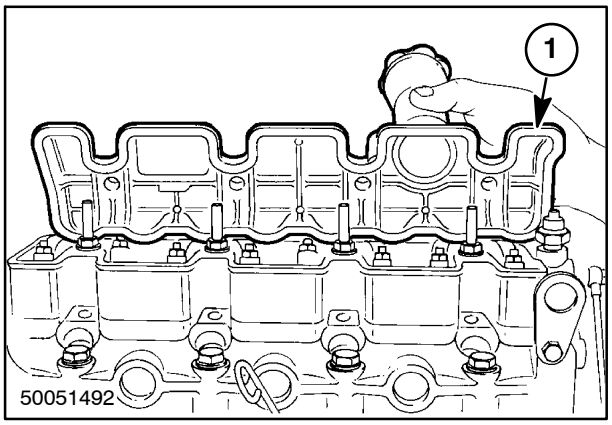
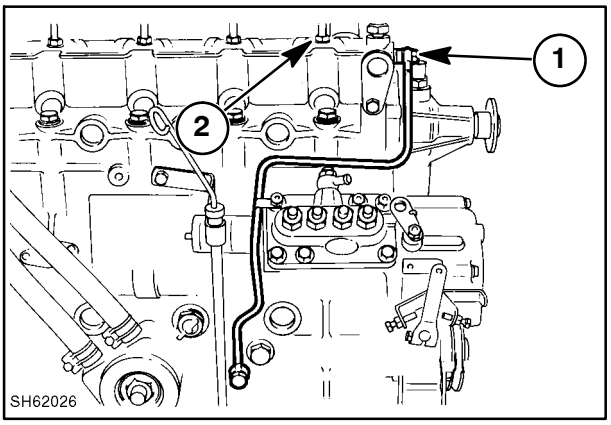
SPILL-TIMING PROCEDURE

1. Remove the valve cover, 1, from the top of the engine.
2. Find top dead center of the No. 1 cylinder (No. 1 cylinder is the closest to the engine fan). No. 1 cylinder must be on the compression stroke. (Intake and exhaust rocker arms will be loose.)



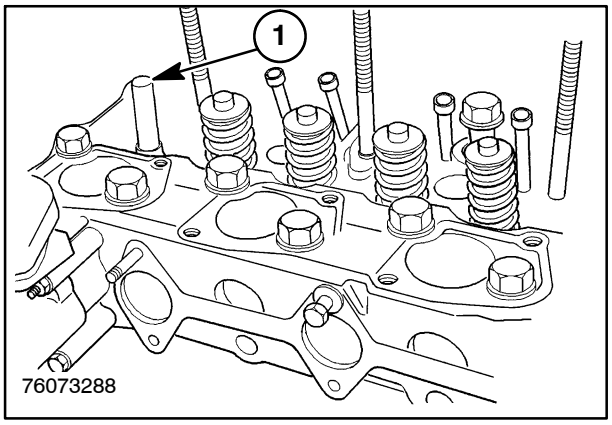
27

3. Loosen and remove banjo bolt, 1, at the cylinder head assembly.
4. Remove the rocker arm housing and rocker arm assembly, 2, from the engine.



28

5. Remove the keepers and spring from No. 1 cylinder intake valve, 1.



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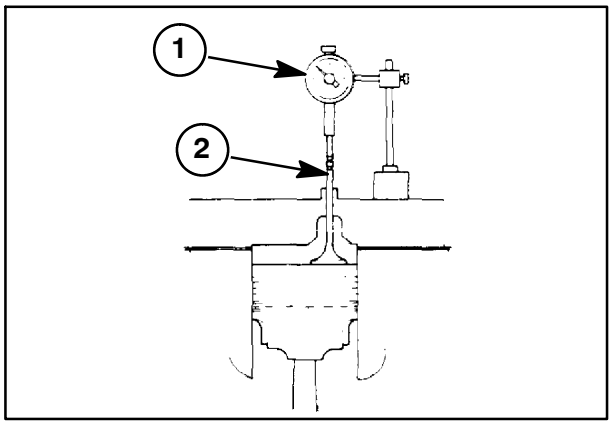
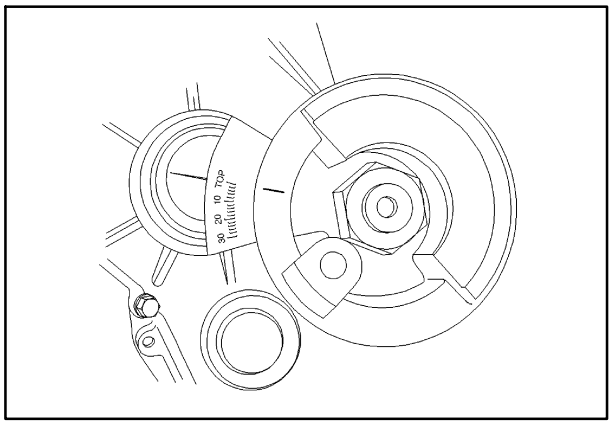
6. To verify true top dead center of piston travel, install a dial indicator, 1, on the valve stem (No. 1 cylinder), 2. Be sure the valve stem is sitting on top of the piston. Rotate the crankshaft until the indicator needle reverses direction. The point the needle reverses direction is true top dead center.



30

7. Verify that the timing mark on the crankshaft pulley is in line with the “TOP” mark on the timing scale. If the mark on the crankshaft pulley is not in line with the “TOP” mark, verify piston top dead center by repeating step 5. If the pulley mark is slightly off, remark the pulley and proceed.

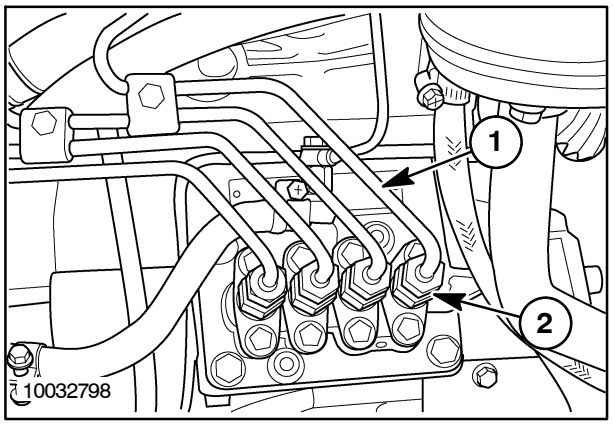
NOTE: *Color the timing mark on the crankshaft pulley and appropriate marks on the timing scale to increase visibility.*



31

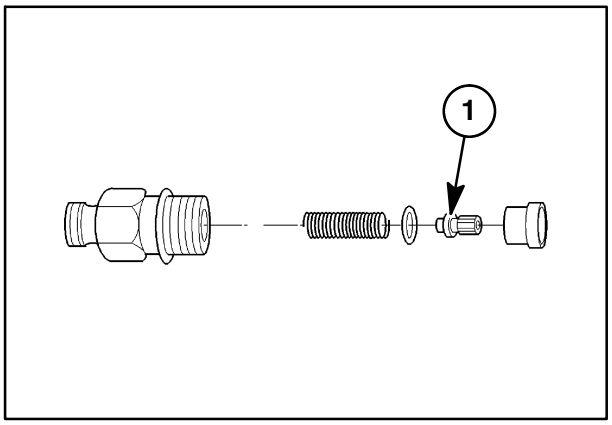
8. Reinstall the valve spring, keepers, rocker arm assembly, housing and valve cover.
9. Shut off the fuel supply to the injection pump at the fuel filter.

10. Remove the No. 1 injection line from the number 1 injector, 1.
11. Remove the holder, 2.



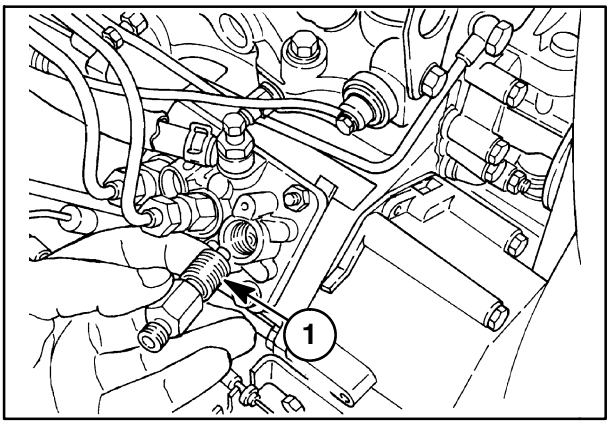
32

12. Remove **ONLY** the delivery valve piston, 1, from the No. 1 delivery valve.



33

13. Reinstall the holder, 1, with spring into the injection pump and tighten securely.



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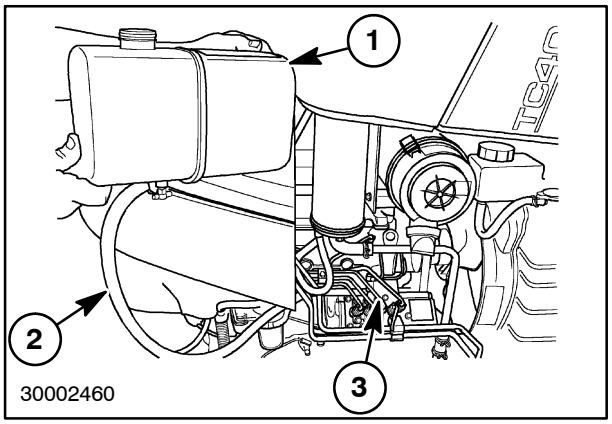
NOTE: *A remote fuel supply and fuel line must be used to check spill timing. The fuel tank on the tractor and the mechanical fuel pump will not allow free gravity flow of fuel to the injection pump. Fabricate fuel tank locally.*

14. Use a remote fuel tank, 1, and fuel line, 2, for the spill timing. Disconnect the fuel supply line at the injection pump, 3.
15. Connect the remote fuel line, 2, to the injection pump, 3. Put fuel in the remote tank, 1, and turn on the fuel shutoff on the remote tank.



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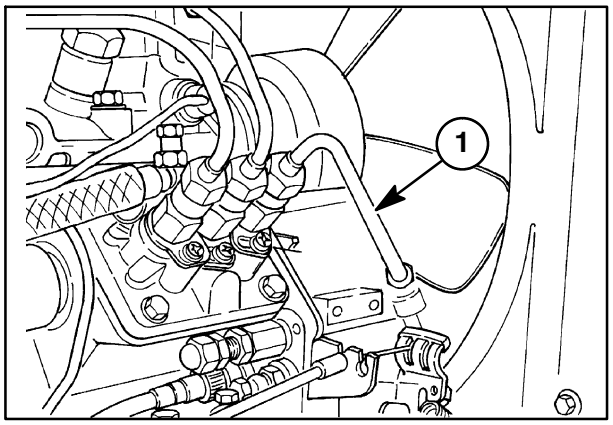
16. Fabricate a spill tube, 1, from a discarded injection line and install the tube on the No. 1 port on the injection pump.
17. The fuel shut-off solenoid has to be removed from the injection pump, if installed.



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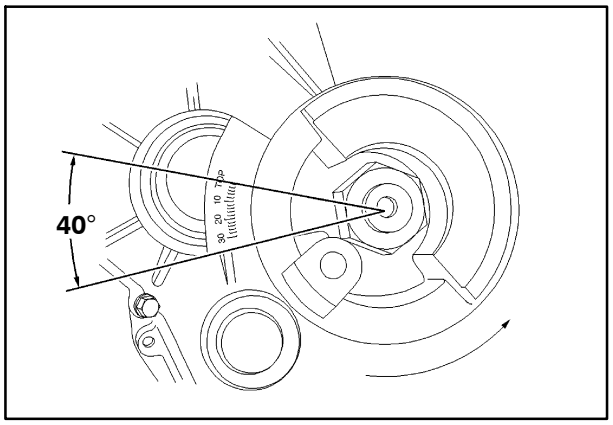
18. Rotate the crankshaft counterclockwise (viewed from the front of the engine) approximately 40°.
19. Turn on the fuel supply to the injection pump. Fuel should flow out of the spill tube on the No. 1 cylinder port.

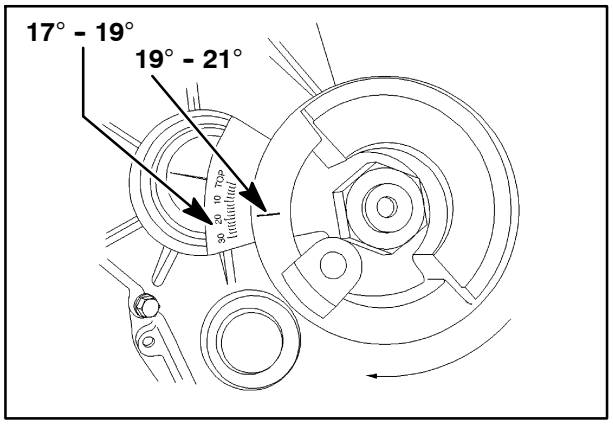


37

20. Rotate the crankshaft clockwise. When the timing mark on the crankshaft pulley is in line with the below degree marks on the scale, fuel should stop flowing from the spill tube.

Engine Model	Degree
N844L-T/2410	17 – 19° BTDC
N844L-T/2420	19 – 20° BTDC

***** BTDC – Before Top Dead Center



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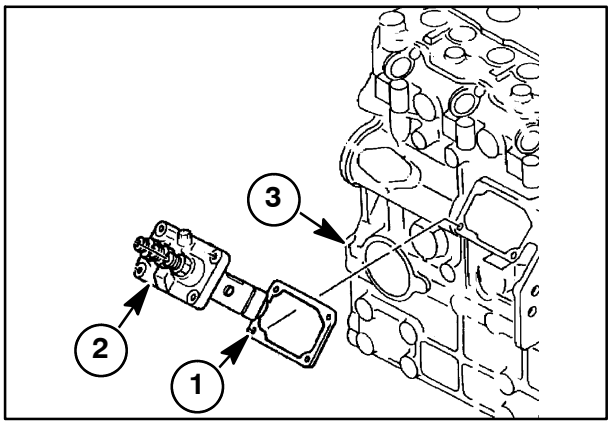
21. If fuel does not stop flowing at the appropriate timing mark, the injection pump timing must be adjusted by adding or removing shims, 1, located between the injection pump, 2, and the engine block, 3.
22. Adding shims will retard the pump timing and removing shims will advance the pump timing.

NOTE: *A shim thickness of 0.1 mm (0.004″) will change the pump timing by approximately 1°.*

23. Assemble all components that were removed from the engine and fuel system.

NOTE: *Apply a small amount of petroleum jelly to the delivery valve assembly to hold delivery valve inside holder during reassembly.*

24. Disconnect the remote fuel line and tank, and reconnect the fuel supply line to the injection pump.



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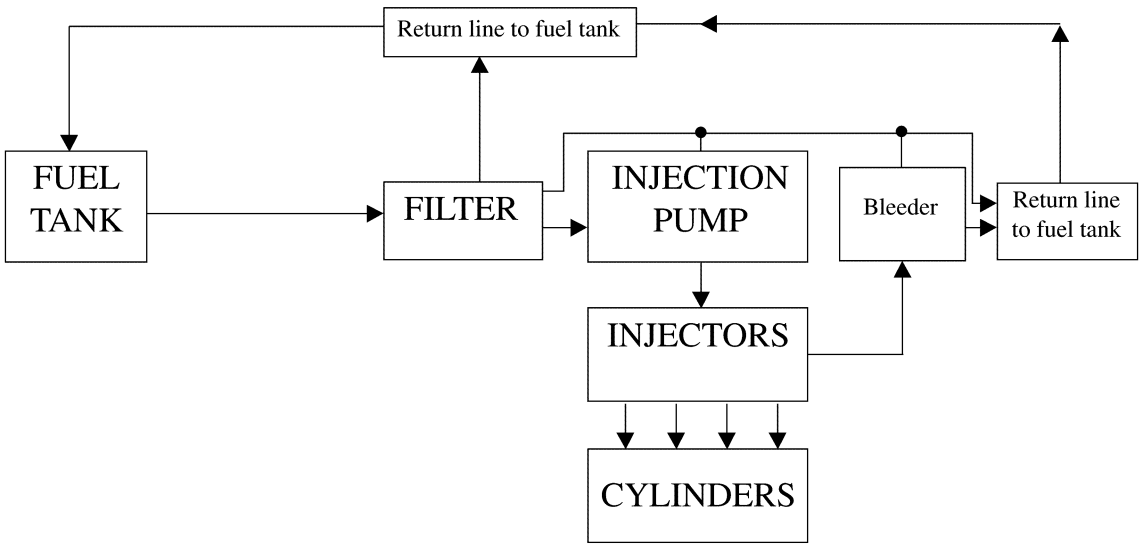
FUEL FLOW CHART



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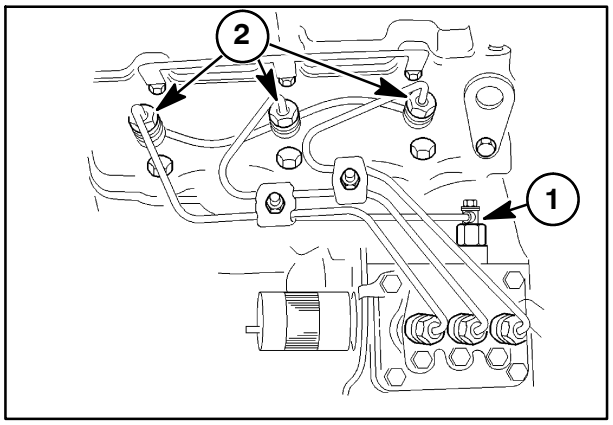
BLEEDING THE FUEL SYSTEM

Bleeding the fuel system is the process of removing unwanted air trapped within the system and must be removed as a step towards optimum performance. The fuel system should be bled after any of the following conditions.

- When a new filter is installed.
- After the tractor has run out of fuel.
- When any of the fuel lines have been disconnected.
- When the injection pump has been removed.

1. Make sure adequate fuel is in the fuel tank and the fuel shutoff valve is open.
2. Open the bleed screw, 1, on the injection pump.
3. Allow system to bleed air at fuel screw, 1, until clear fuel, without air bubbles is present. Tighten bleed screw.
4. If the engine does not start, loosen the injector lines at the injectors, 2, one at a time while cranking the engine. Leave injector line loose until clear fuel, without air bubbles, is discharged from injector line. Tighten injector nut and proceed to the next injector.
5. Be sure all lines are properly tightened when completed.



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FUEL SCREW/HIGH IDLE ADJUSTMENT

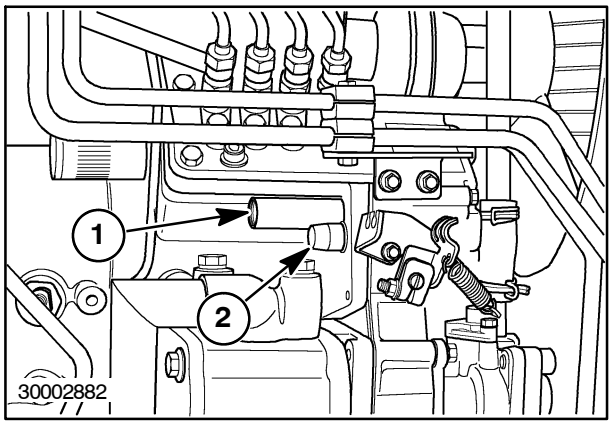
The correct adjustment is required to reset to the original production setting to ensure the engine will be within the certified emission limits.

NOTE: *EPA engine is certified to EPA emission legislation.*

No one is permitted to adjust the fuel flow rate more than the max figure of submitting for power setting.

Adjustment only made by New Holland Area Service Managers, due to EPA emission regulations.

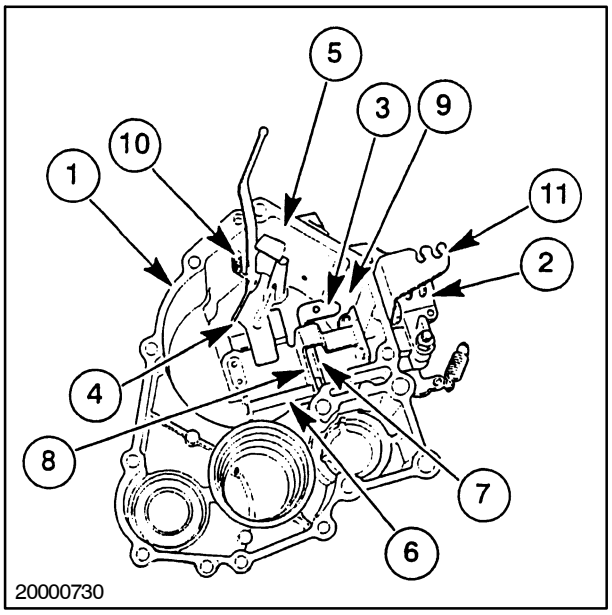
Contact New Holland representative for adjustment of fuel setting, 1, or high speed idle, 2.



42

GOVERNOR

The governor assembly is mounted on the forward end of the camshaft.



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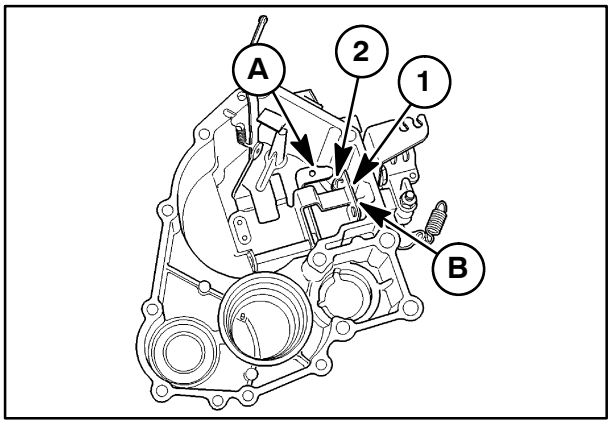
1. Timing Gear Cover
2. Lever
3. Arm
4. Lever
5. Arm Assembly
6. Shaft
7. Spring Holder
8. Washer
9. Spring
10. Spring
11. Stay

As the engine speed increases, the throttle arm, 1, contacts the fuel screw adjuster at contact point “A” and the high-speed idle stop screw at “B”. During the engine speed increase, tension is placed on the governor spring, 2.



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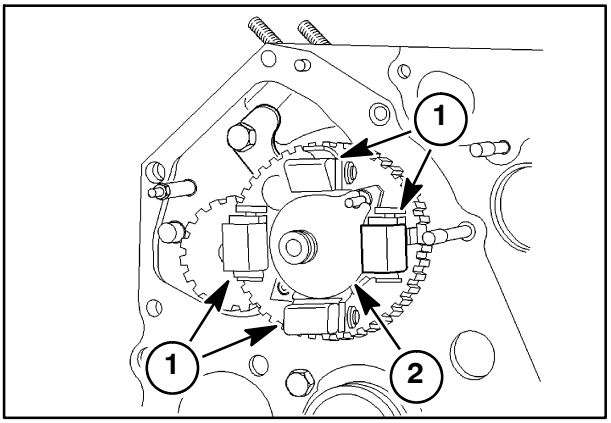
As the engine speed increases the four governor weights, 1, pivot outward and push the slider cone, 2. The weights and the slider cone are located on the end of the camshaft.



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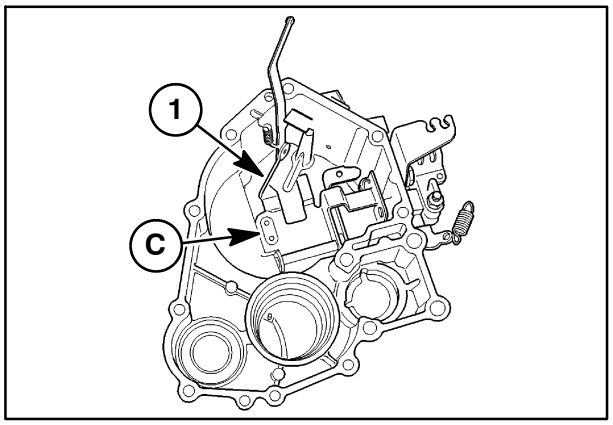
The slider cone, 2, Figure 47, contacts the governor linkage arm, 1, at contact pad “C”. As the cone moves forward it pushes the linkage arm, 1, forward, which is connected to the injection pump rack assembly. When the injection pump rack moves forward the fuel delivery is decreased and the engine speed decreases.



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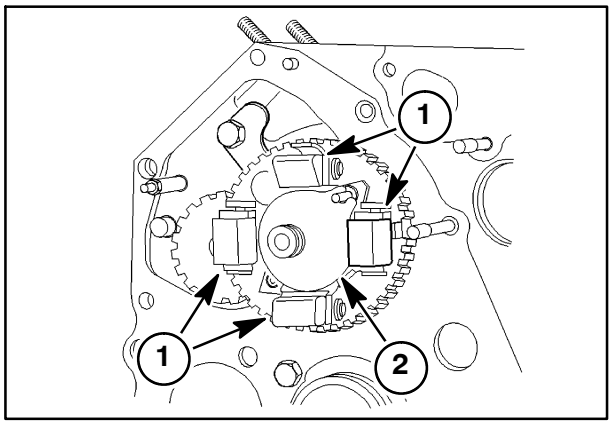
As the engine speed decreases the governor weights, 1, pivot inward allowing the slider cone, 2, to move rearward.



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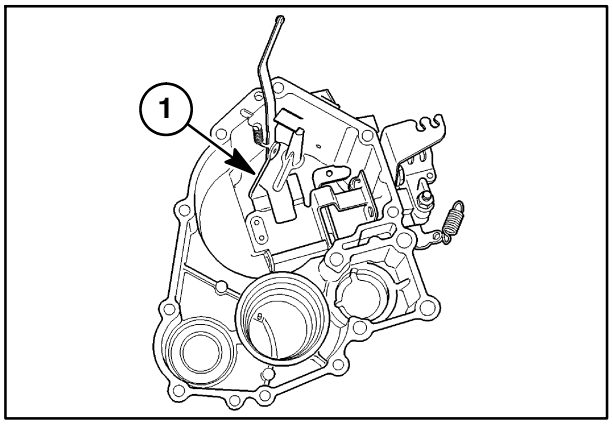
As the slider cone moves rearward, the governor linkage arm, 1, allows the fuel injection pump rack to move rearward to the full fuel position and the engine speed increases.

Engine speed depends upon several factors. The throttle setting determined by governor spring tension. The pressure exerted by the slider cone on the governor linkage, and positioning of the injection pump rack.

All governor linkage parts are located inside the timing gear cover. To inspect or replace any of the governor linkage parts, the timing gear case and the injection pump must be removed from the engine as discussed earlier in this section.



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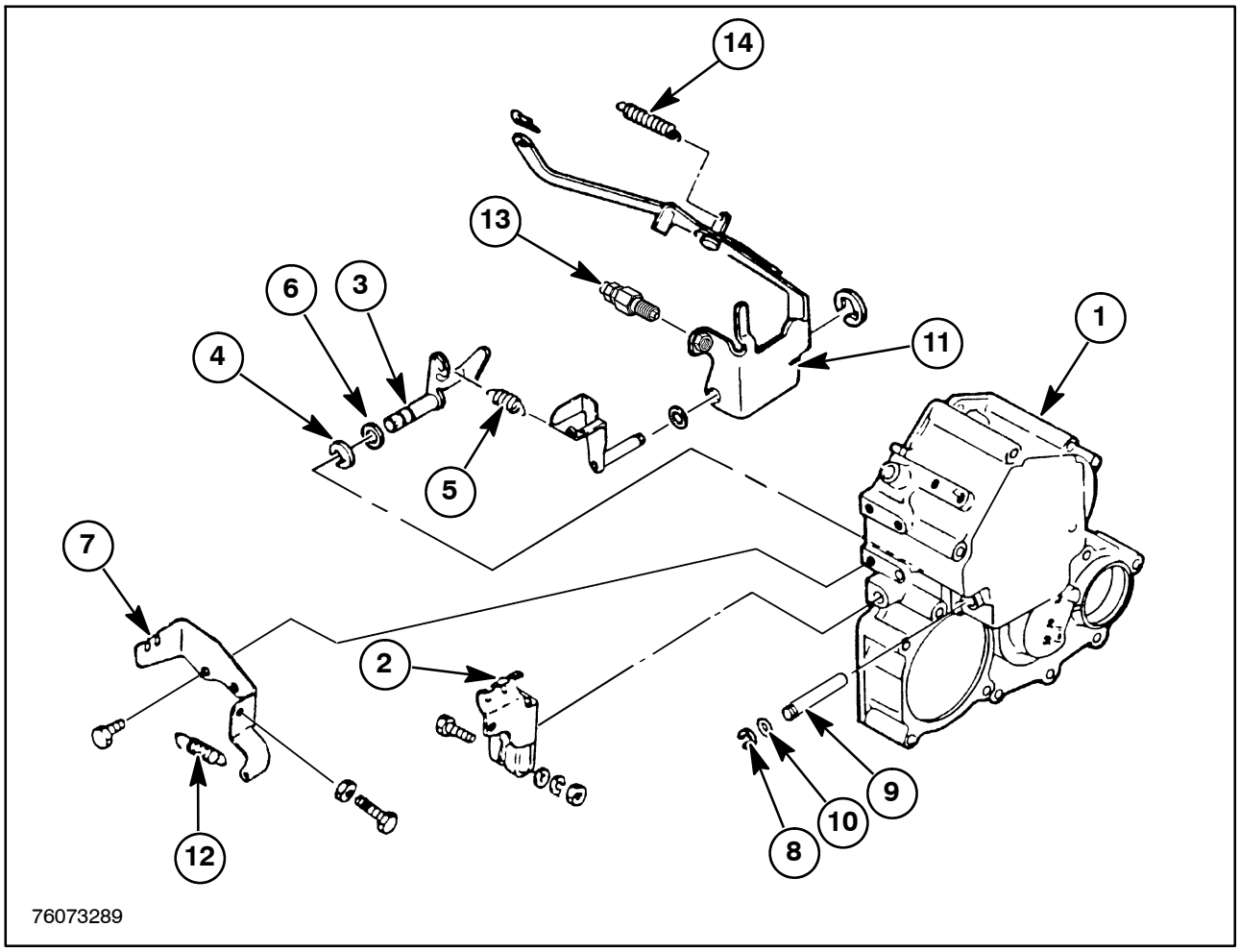

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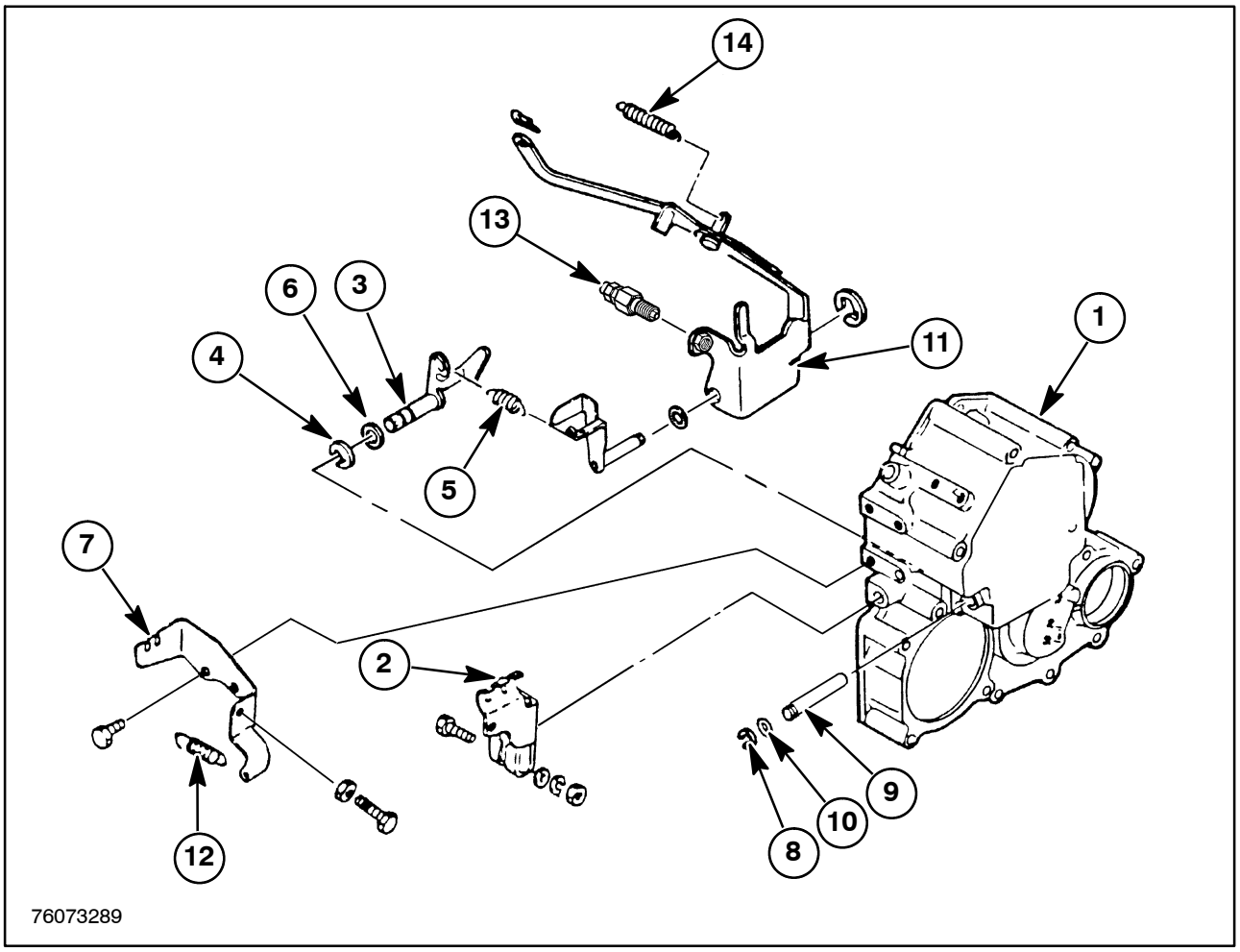
1. Timing Gear Cover
2. Throttle Lever
3. Throttle Arm
4. E Ring
5. Governor Spring
6. O Ring
7. Throttle Cable Stay
8. E Ring
9. Pivot Shaft
10. O Ring
11. Linkage Arm Assembly
12. Spring
13. Angleich Set Assembly
14. Dampener Spring

Disassembly

1. Remove the injection pump and timing gear case from the engine as discussed earlier in this section.
2. Remove the timing case, 1, from the front of the engine. Remove the throttle lever, 2, from the outside end of throttle arm, 3.
3. Remove the E ring, 4, from throttle arm, 3. Push throttle arm into the timing case until there is enough space to remove governor spring, 5. Remove governor spring, 5, from throttle arm, 3. Remove throttle arm from timing case. Inspect O ring, 6, and replace if damaged.
4. Remove throttle cable stay, 7, from timing gear cover, 1.
5. Remove E ring, 8, from the outside end of linkage pivot shaft, 9. Pull pivot shaft, 9, out of the timing case. Inspect O ring, 10, on shaft. Replace if damaged.
6. Remove linkage arm assembly, 11, from the timing case, 1. Remove governor spring. Check all pivot points, slot, and pin locations for wear. Replace the linkage assembly, 11, if wear is present. Check throttle arm, 3, making sure it pivots freely.



50

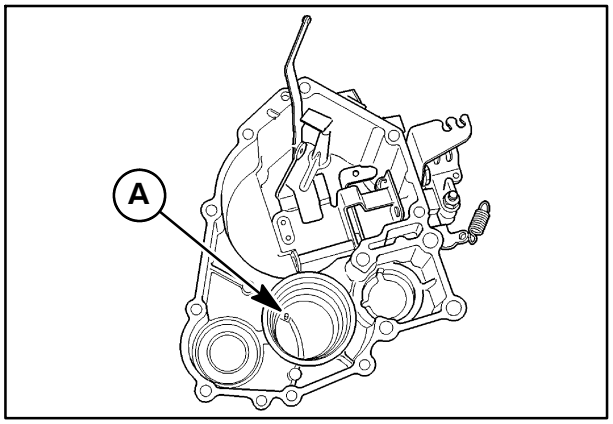
1. Governor Spring
2. Throttle Arm
3. Linkage Arm Assembly
4. O Ring
5. Pivot Shaft
6. Timing Gear Cover
7. E Ring
8. O Ring
9. E Ring
10. Throttle Cable Stay
11. Throttle Lever
12. Spring
13. Angleich Set Assembly
14. Dampener Spring

Assembly

NOTE: *Align pin, "A", with oil pump cover when the case is assembled onto the engine.*

1. Install governor spring, 1, onto linkage arm assembly, 2.

NOTE: *Spring is installed onto front spring holder arm with spring inserted from the inside of the arm.*



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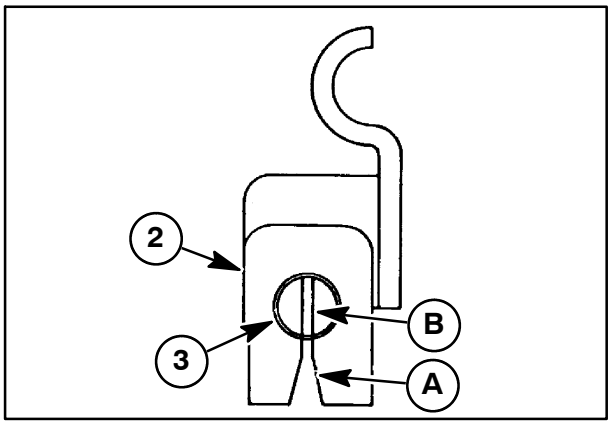
2. Place linkage arm assembly, 3, into case.

   The shaft is oriented with tapered end towards outside of case. With O ring, 4, installed and the shaft lubricated, insert pivot shaft, 5, into case. Install shaft through linkage arm assembly, 3, until O ring is in the case, 6. Install E ring, 7, onto shaft, then push shaft into case until E ring touches case.

3. Install throttle arm, 2, with O ring from the inside of the case, until the O ring engages into the case. Install other end of governor spring, 1, into the slotted hole of the throttle arm. Once the spring is installed, push the rest of the throttle arm into the case. Insert E ring, 9, into the groove of the throttle arm.

4. Install the throttle cable stay, 10, onto the timing gear cover, 6. Install throttle lever, 11, onto throttle arm, 3. Align the slot “A” in the throttle lever with groove “B” of the throttle arm. Retain lever to arm by tightening clamp bolt and nut. After the clamp bolt is tightened, pivot throttle lever back and forth to check if all the linkage pivots freely. Install throttle return spring, 12, to throttle lever, 11, and stay, 10.

NOTE: *The aligning of the slot in the lever with the groove in the arm properly indexes the lever and attaching cables to the internal linkage.*



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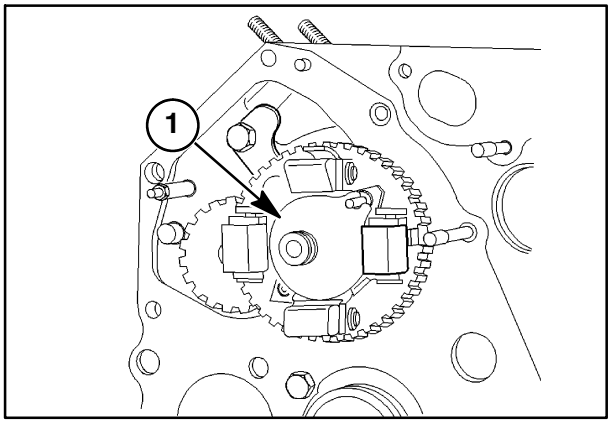
5. Install the dampener spring, 14, (FigureNO TAG) onto the linkage arm assembly and timing case. The long leg of the spring is inserted into the timing case.

NOTE: *When installing timing case onto engine block, make sure dampener spring stays in retaining hole of case.*

6. Check that the cone, 1, slides freely on the end of camshaft and guide pin. Lubricate nose cone with never seize compound.



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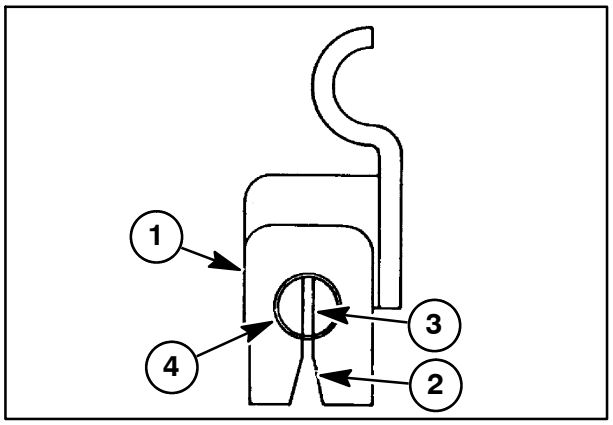
Adjustments

The governor assembly is mounted on the forward end of the engine block. To remove and install the governor assembly, see “Engine Timing Gear Cover, Timing Gears, and Cam Shaft”, discussed earlier in this section.

If the governor linkage has been disassembled, reassemble the linkage in the timing gear cover as discussed earlier in this section.

1. Adjust the governor lever, 1, by aligning the slot, 2, in the lever with the groove, 3, in the governor arm, 4.



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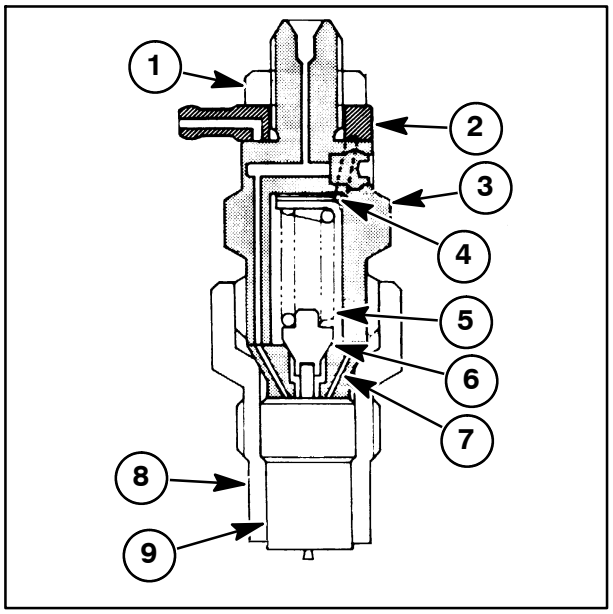
INJECTORS

Throttle-type injectors are used in all engine applications. The injectors have a 1.0 mm (0.040″) single orifice and are set at 146 bar (2117 psi). The pressure adjustment is made by adding or deleting shims from the top of the injector pressure adjusting spring. The injectors have an injection angle of 4°. The injector pipes are of the same length for each cylinder to help keep the injection intervals in time.

The engine injection function is to inject fuel into a pressurized cylinder in a fully atomized condition, which provides efficient combustion with minimum amount of smoke. Each injector assembly consists of a nozzle assembly containing a needle valve, a nozzle holder assembly, and injector needle valve regulating spring.



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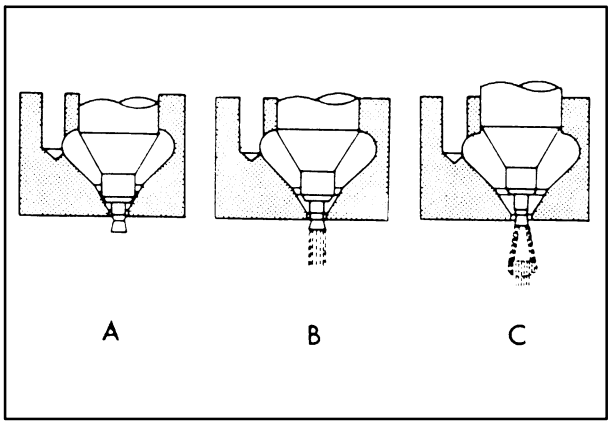
1. Nut
2. Nipple Joint
3. Body
4. Shim
5. Spring
6. Push Rod
7. Distance Piece
8. Nozzle Nut
9. Nozzle Assembly

Fuel from the injection pump enters the injector inlet and passes down through a drilling in the nozzle holder and body to the needle valve seat. The fuel pressurized by the injection pump, lifts the needle valve off the seat against the action of the spring pressure. The fuel is then forced, in the atomized state, through the 1.0 mm (0.040″) orifice in the nozzle tip. When pressure from the injection pump drops, the needle valve snaps back onto its seat under pressure from the spring.

To provide lubrication of the injector, a small amount of fuel is permitted to leak up between the needle valve and the nozzle body. The excess fuel rises to the top of the injector and returns to the fuel tank through the injection leak-offline.



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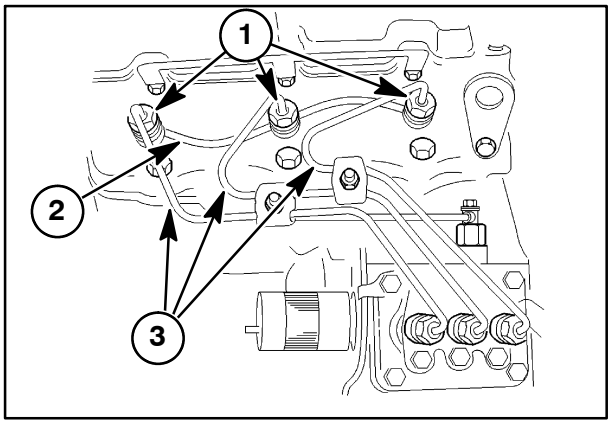
A. Nozzle Closed
B. Nozzle Initial Opening
C. Nozzle Fully Opened

Removal

1. Clean all dirt, oil, and grease from the injectors, 1, and surrounding areas.
2. Disconnect the fuel leak-off lines, 2, and injector lines, 3, from the injectors.



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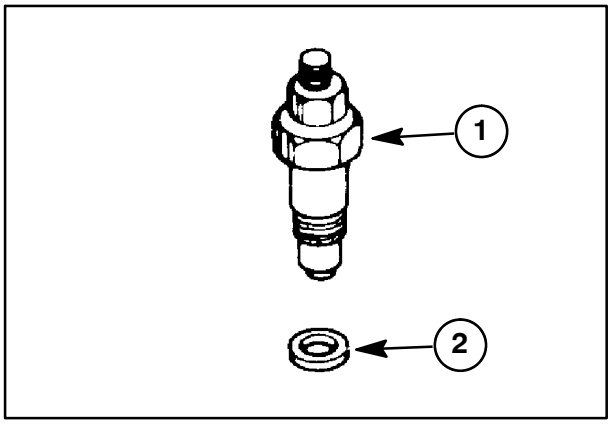
3. Remove the injectors, 1, and sealing washers, 2, from the cylinder head.



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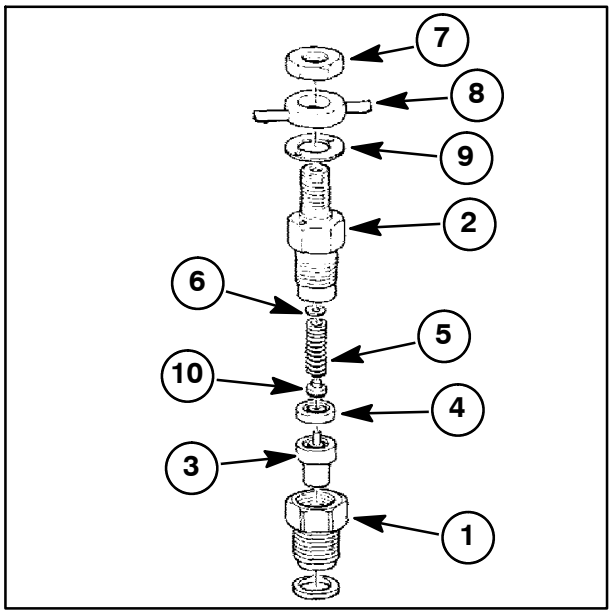
Disassembly

1. Loosen and remove the nozzle nut, 1, from the injector body, 2, being careful not to drop or damage the nozzle.
2. Remove the nozzle assembly, 3, spacer, 4, spring, 5, and shim (s), 6.
3. Clean the nozzle body and the needle valve. Check the nozzle for any burn or score marks. Check the needle seat for evidence of fuel leakage or carbon deposits.
4. Correct fuel leakage at the seat using a polishing stick and polish the seat area.
5. Inspect the upper and lower contact surfaces of the nozzle holder for a clean contact surface area.
6. Check the contact area between the push rod and spring seat.



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1. Nozzle Nut
2. Injector Body
3. Nozzle Assembly
4. Spacer
5. Spring
6. Shims
7. Nut
8. Leak-Off Line
9. Washer
10. Rod

Assembly/Adjustment

NOTE: *Clean all parts in clean fuel oil and assemble while still wet.*

1. Install the shim(s), 6, spring, 5, spacer, 4, and nozzle assembly, 3, in the injector body, 2.
2. Install the nozzle nut, 1, and tighten to 39 – 44 N·m (29 – 33 ft-lbs).
3. Check and adjust the injector pressure setting using injector tester No. FNH01721 and adapter fitting No. 23622. Adjust the pressure setting to 146 bar (2117 psi).

SECTION 10 - ENGINE

Chapter 3 - Turbocharger

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The 2410/2420 are equipped with the N844L-T turbocharged engine.

SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATIONS
Turbocharger	Lubrication	Pressure-fed from external source
Turbine	Axial-flow turbine max. continuous permissible speed (rpm)	180000 rpm
Blower	Centrifugal blower dry weight kg (lbs.)	3.2 kg (7.0 lbs.)

TROUBLESHOOTING

TURBOCHARGER IS SLUGGISH IN PICKING UP SPEED

POSSIBLE CAUSE	CORRECTION
The sealed part of turbine wheel is heavily carboned, causing the rotor to offer much resistance to turning	Change oil (engine oil) Disassemble and clean
Incomplete fuel combustion in the engine, due to a faulty condition in the fuel injection system	Disassemble and clean Check the injection system for cause, and repair
Lack of lubrication during cold weather startup	Warm up below 1500 rpm for three minutes on startup and allow to run at low idle for one minute before shutdown

EXCESSIVE OR ABNORMAL VIBRATION

POSSIBLE CAUSE	CORRECTION
A loose pipe connection at the turbine or blower side or at the bearing	Tighten and repair
Bearing failure causing the rotor to run rough	Disassemble and repair
Turbine wheel or blower wheel has broken vanes caused by entry of metal or solid objects	Disassemble and repair damaged parts
Loss of dynamic balance in the rotor	Disassemble and repair damaged parts

DIRTY EXHAUST SMOKE

POSSIBLE CAUSE	CORRECTION
Not enough intake air	A clogged element in the air cleaner, clean or replace element
	Closed air intake inlet, open inlet
	Air leakage from a connection, check and repair
The turbocharger is not running	Gum or sludge formation in the turbine-side seal, causing the turbine to resist turning, Check the oil quality and change Disassemble and clean
	Seized bearings, disassemble and clean Disassemble and repair
	Oil temperature too high, change engine oil
	Dynamic imbalance in the rotor, clean and/or replace rotor parts
	Turbine wheel or blower wheel rubbing or broken, disassemble and repair(remove foreign matter, if any, and check air cleaner and engine to locate the cause)
Not enough gas pressure	Gas leakage through a connection on upstream side of turbine, check and repair A large constriction in the exhaust line, due to distorted gas passages, check and repair

WHITE EXHAUST SMOKE

POSSIBLE CAUSE	CORRECTION
Oil return pipe is clogged or distorted, causing the lube oil to leak into turbine and blower	Repair or replace the pipe
Seal rings are abnormally worn or broken due to worn-down bearings	Disassemble and repair

ABNORMALLY HIGH OIL CONSUMPTION

POSSIBLE CAUSE	CORRECTION
Seal rings are abnormally worn or broken due to worn-down bearings	Disassemble and repair

ENGINE LACKS OUTPUT POWER

POSSIBLE CAUSE	CORRECTION
Gas leakage in the exhaust line	Check and repair
Air leakage in the blower outlet side, resulting in reduced boost pressure	Check and repair
A clogged element in the air cleaner	Clean or replace
The turbocharger is internally fouled with foreign matter or its running parts are damaged	Disassemble and repair or replace damaged parts

ABNORMAL RUNNING NOISE

POSSIBLE CAUSE	CORRECTION
Restrictions in exhaust gas passage, particularly due to the nozzle ring approaching a clogged condition	Disassemble and clean
Restrictions in the air outlet side of the blower, causing the air to surge at the blower wheel when the engine accelerates	Disassemble and clean
The casing is being rubbed by turbine wheel or blower wheel	Disassemble and repair or replace damaged parts

LUBRICATION

The turbocharger used on the diesel engine may not receive adequate lubrication on cool/cold weather (below 5°C, 41°F) start-up, leading to turbocharger bearing failure.

The following procedure must be used to ensure adequate lubrication oil is supplied to the turbocharger bearings before high-speed engine operation:

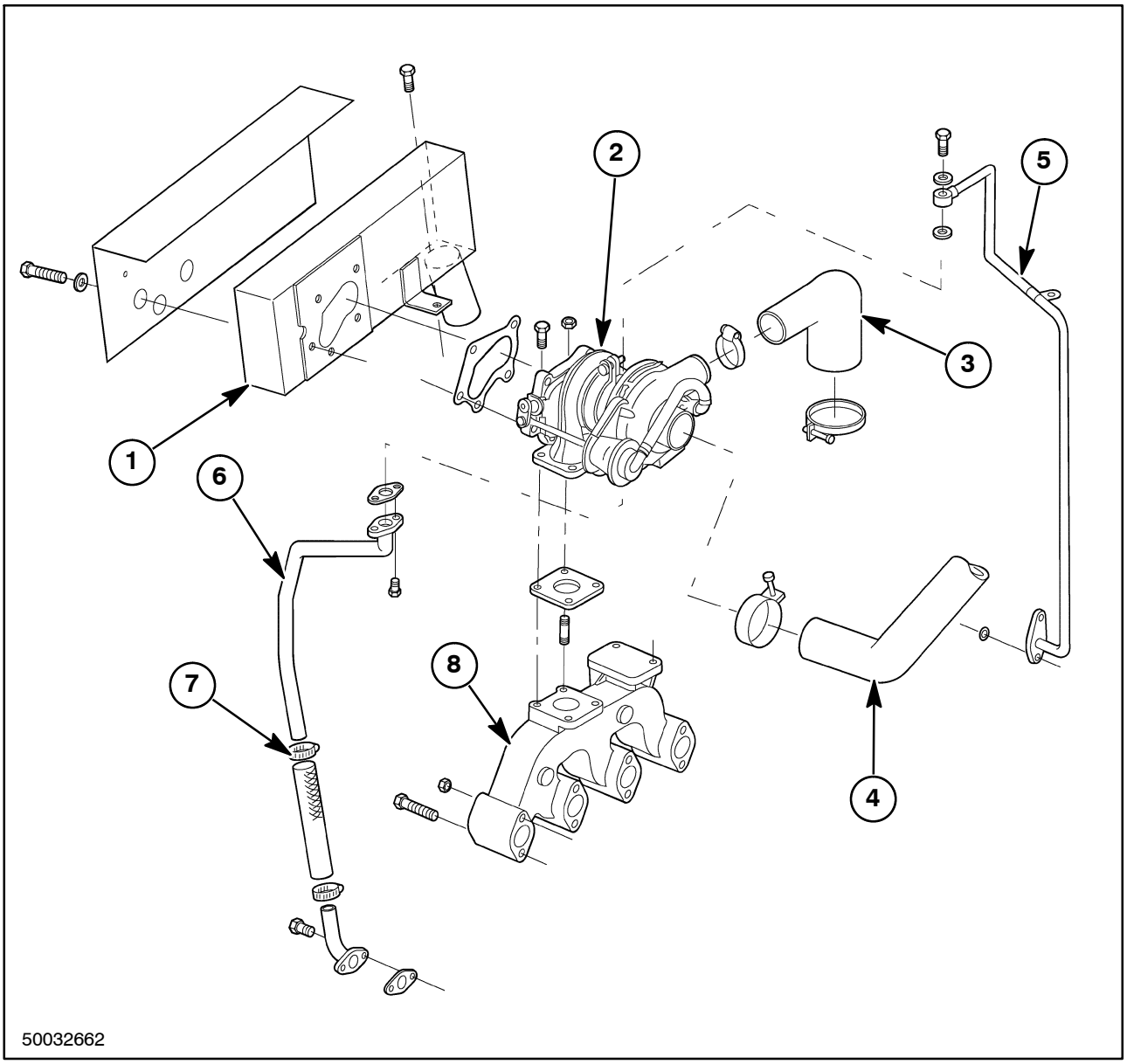
1. Set the engine throttle at 1/3 speed.
2. Turn the ignition switch and allow the automatic glow plug timer to preheat the engine.
3. Start the engine, but DO NOT OPERATE ABOVE 1,500 rpm for three minutes to allow for adequate oil flow at the turbocharger.

After full load operation, allow the engine to run at low idle for one minute before engine shutdown.

TURBOCHARGER

Removal

1. Remove the hood and support brackets from the tractor (see Platform Section 90).
2. Remove the bolts that fasten the muffler, 1, to the turbocharger assembly, 2. Remove the muffler.
3. Remove the air tube, 3, connecting the turbo to the intake manifold.
4. Disconnect the air intake tube, 4, from the turbo.
5. Remove the turbocharger oil pressure line, 5, at the block and at the turbo housing.
6. Remove the turbocharger oil return line, 6, at the top hose clamp, 7.
7. Disconnect the turbo from the exhaust manifold, 8.



1

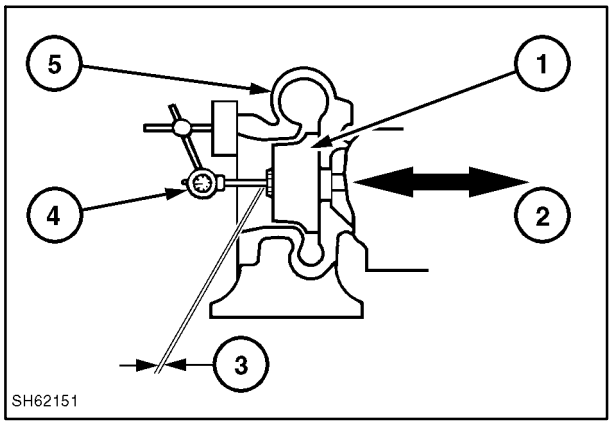
Inspection Before Disassembly

Visually check the running clearances of the turbine and blower wheels for evidence of contact between the vanes and casing. Spin the rotor by hand to see if it rotates smoothly.

Check for turbine fin and housing clearance, intake and exhaust.

Check to ensure the rotor and shaft turns smoothly with no bearing roughness or binding.

Using a dial indicator, measure the end play movement of the turbine and shaft,1, by placing a dial indicator on the end of the shaft at 2.

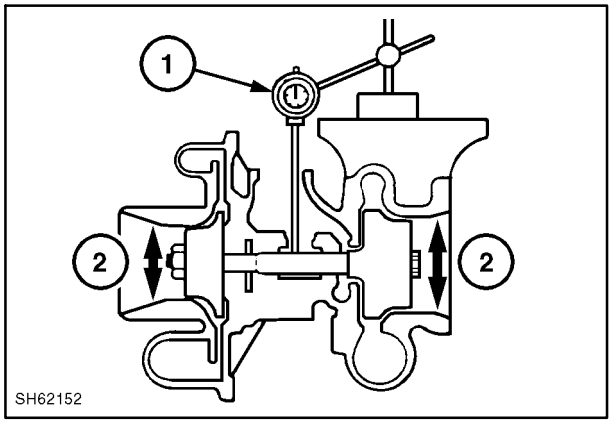


2

End play movement

Standard dimension	Allowable Limit
0.045 mm	0.09 mm
(0.0018″)	(0.0035″)

Check the radial movement in the turbine shaft by placing a dial indicator through the oil outlet in the turbo housing at, 1. Move the right and left side of the turbine shaft toward the radial, 2, simultaneously and take a reading.



3

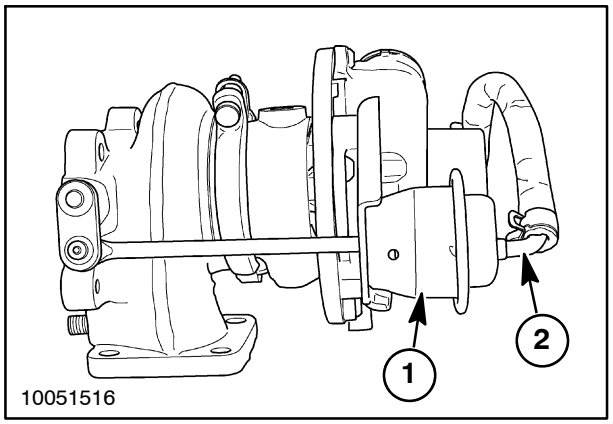
Radial movement

Standard dimension	Allowable Limit
0.082 mm	0.16 mm
(0.003″″)	(0.0063″)

Disassembly

NOTE: *Before separating the casings (turbine, bearing and blower), be sure to mark across each component and seam so they will be joined together in proper sequence.*

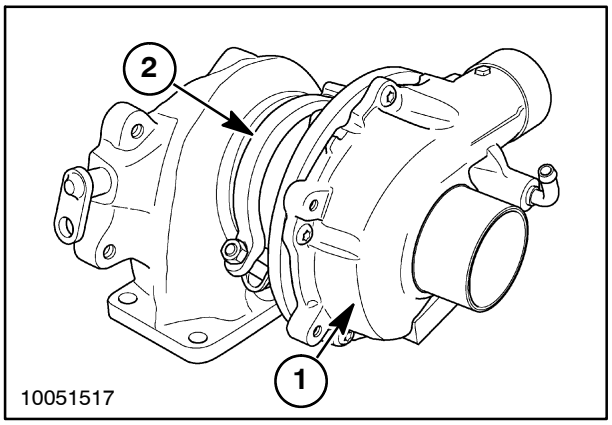
1. Remove the waste gate controller assembly, 1. This can be accomplished with compressed air of about 1 bar (14 psi) applied to the control air inlet at 2.



4

2. Separate the blower housing, 1.

NOTE: *Remove the housing carefully and be sure not to damage the blower vanes.*

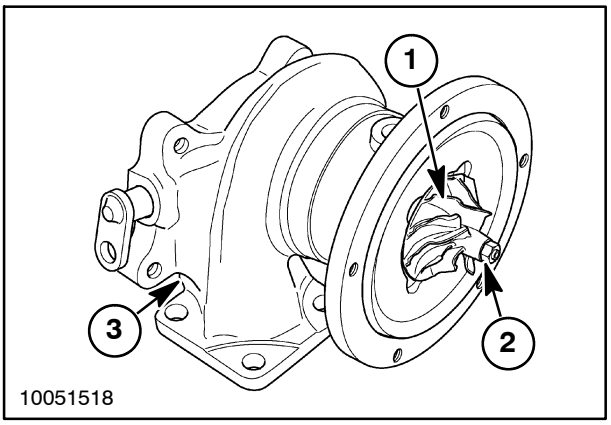


5

3. Remove the blower wheel, 1, by removing the shaft end nut, 2.

NOTE: *The shaft end nut has left-hand screw threads; loosen it by turning clockwise.*

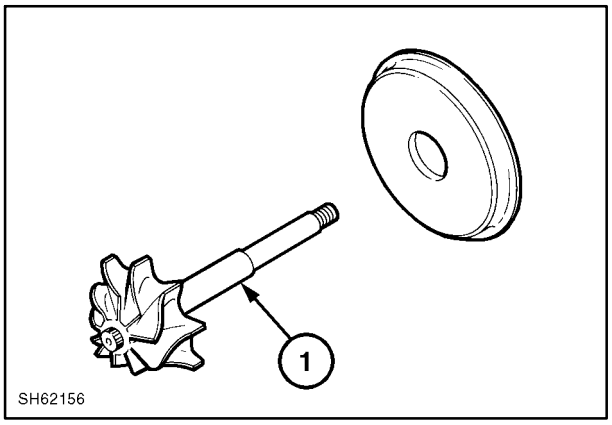
4. Remove clamp, 2, (fig. 5) securing blower to the turbine housing. Separate the turbine housing, 3.



6

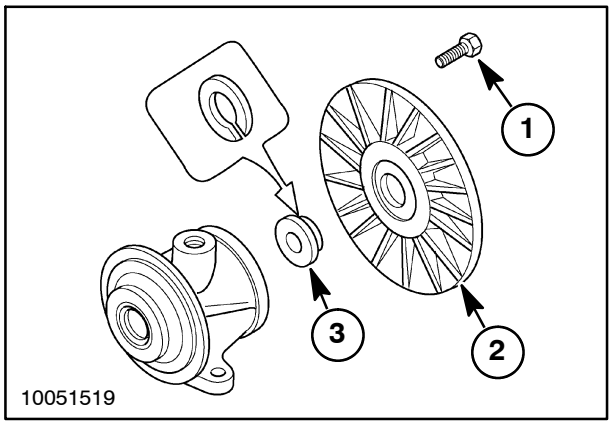
5. Pull out the turbine shaft, 1.

NOTE: *If the shaft will not come off easily, you may drive on the shaft end with a wooden mallet; be sure to lightly tap on the end of the shaft.*



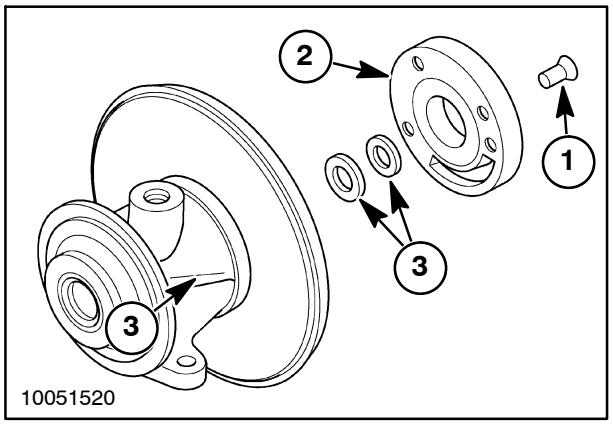
7

6. Remove four screws, 1, and the seal plate, 2. Use caution, oil slinger, 3, will come out with seal plate.



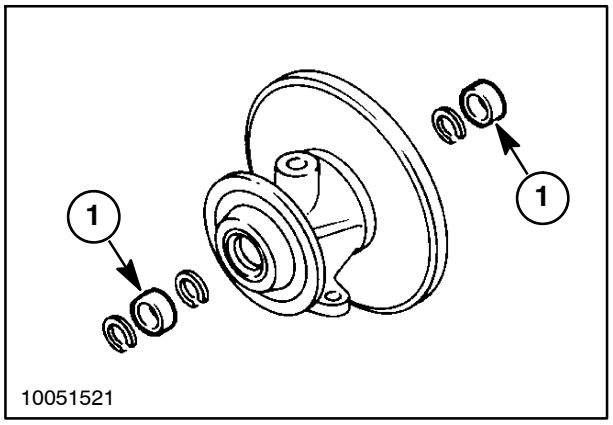
8

7. Remove the three screws, 1, and thrust bearing, 2.
8. Remove the thrust washers, 3.



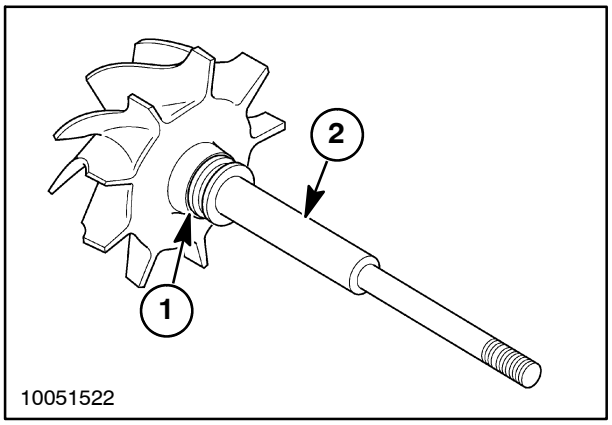
9

9. Remove floating bearings, 1, and spacers.



10

10. Remove the seal ring, 1, from the turbine shaft, 2.

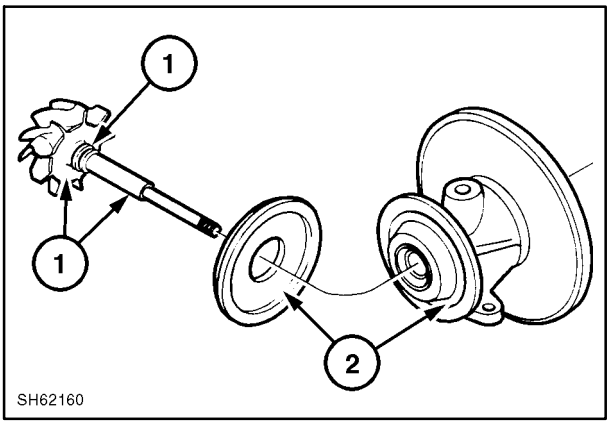


11

Inspection

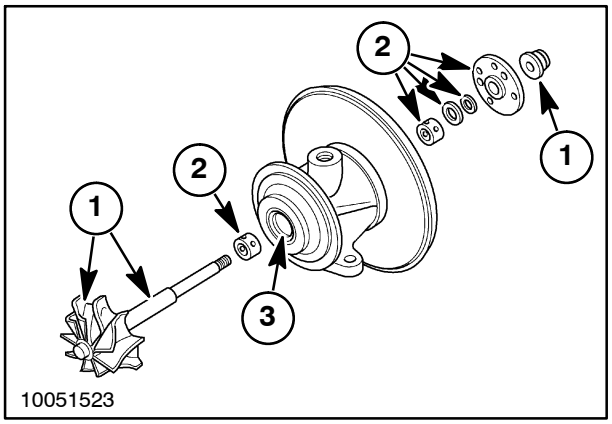
Before washing the disassembled parts clean, visually inspect each part thoroughly:

1. For carbon deposit.
   - Turbine shaft, turbine-side seal ring , and back of turbine wheel, 1.
   - Bearing casing, mating face of shield plate, and bearing casing bore, 2.



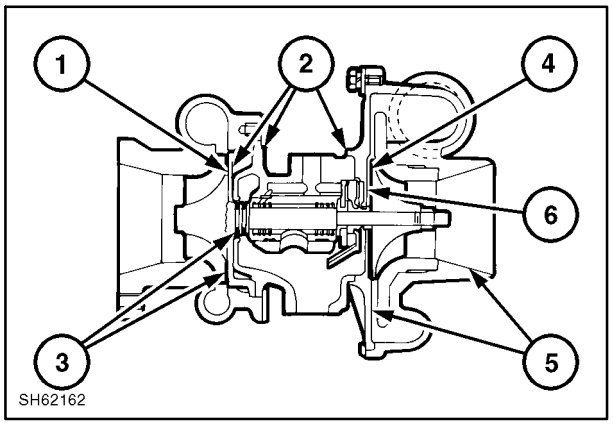
12

2. For effects of lubrication (wear, burning, sign of seizure).
   - Shaft journal, thrust bushing, and oil slinger, 1.
   - Floating bearings, thrust washers and thrust bearing, 2.
   - Those portions of bearing casing bore holding the floating bearings, 3.



13

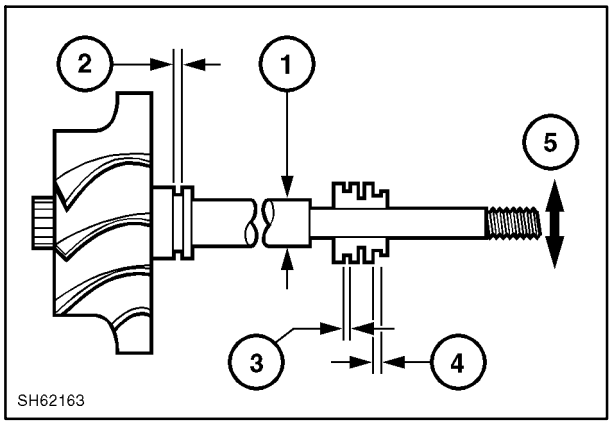
3. For oil leakage.
   - Inner walls of turbine casing.
   - Outer surface of bearing casing and mating face of shield plate.
   - Seal-ring part of rotor shaft at turbine side, and back of turbine wheel.
   - Back of blower wheel.
   - Inner walls off blower casing.
   - Seal plate surface and hole (for admitting seal rings).



14

Turbine shaft

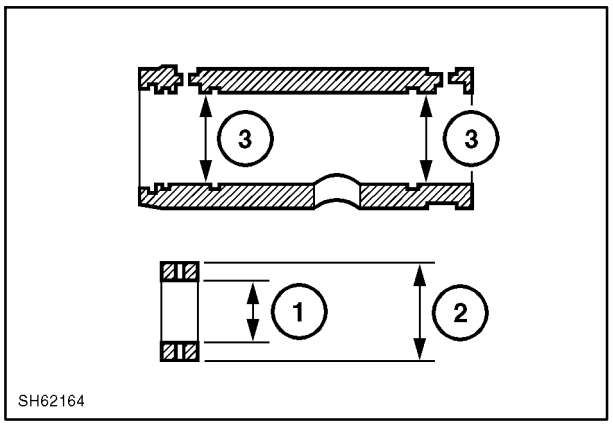
	Item	Standard Value	Service Limit
1.	Journal OD	7.99 – 8.00 mm (0.3146″ – 0.3149″)	7.98 mm (0.3142″)
2.	Groove width in turbine-side seal ring	1.25 – 1.28 mm (0.0492″ – 0.0504″)	1.29 mm (0.0508″)
3.	Sealing groove width, blower side	1.22 – 1.23 mm (0.0480″ – 0.0484″)	1.31 mm (0.0516″)
4.	Groove width in blower-side seal ring	1.02 – 1.03 mm (0.0402″ – 0.0405″)	1.11 mm (0.0437″)
5.	Shaft deflection	0.0 – 0.01 mm (0.0″ – 0.0004″)	0.011 mm (0.00043″)



15

Bearings and associated parts

	Item	Standard Value	Service Limit
1.	Floating bearing ID	8.01 – 8.03 mm (0.315″ – 0.316″)	8.04 mm (0.3165″)
2.	Floating bearing OD	12.32 – 12.33 mm (0.485″ – 0.4854″)	12.31 mm (0.4846″)
3.	Bearing casing bore diameter	12.40 – 12.41 mm (0.488″ – 0.4886″)	12.42 mm (0.48898″)



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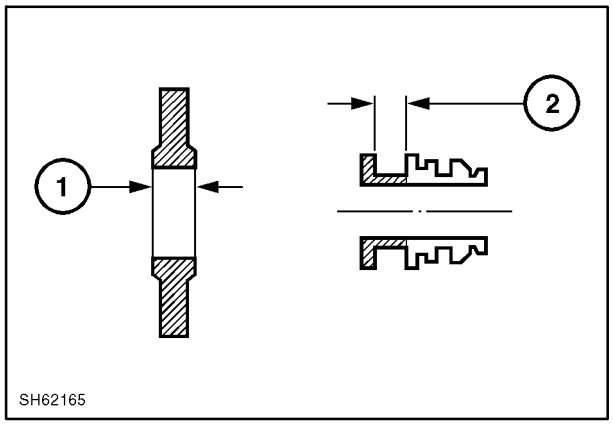
Thrust bearing

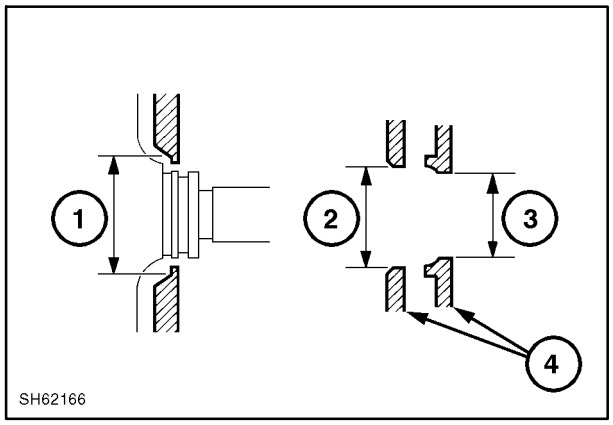
Item	Standard Value	Service Limit
1. Thrust bearing width	3.99 – 4.01 mm (0.157″ – 0.1578″)	3.98 mm (0.1567″)
2. Groove width in thrust bushing	4.04 – 4.05 mm (0.159″ – 0.1594″)	4.07 mm (0.160″)



17

Holes for admitting seal ring

Item	Standard Value	Service Limit
1. Turbine-side hole diameter (bearing casing)	15.00 – 15.02 mm (0.590″ – 0.591″)	15.05 mm (0.5925″)
2. Blower-side hole diameter (in seal plate)	12.40 – 12.42 mm (0.488″ – 0.4889″)	12.45 mm (0.4901″)
3. Blower-side hole diameter (in seal plate)	10.00 – 10.02 mm (0.3937″ – 0.3945″)	10.05 mm (0.3957″)



18

Turbocharger reassembly

Installing the floating bearings

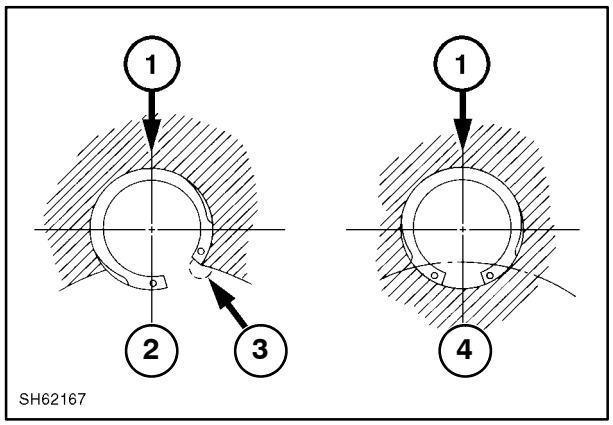
Fit the R-shaped round snap ring to the bore in bearing casing, and then the floating bearing.

NOTE: *When fitting the R-shaped snap ring, be sure to locate its ring gap in the manner shown.*

Bring the rounded-edge side of the snap ring to the bearing side.

Oil the bearing just before fitting it, use engine oil.

Align the snap rings in relation to the lube oil inlet, 1. For the ring closest to the turbine, 2, match the ring end as shown, 3. For the other snap rings, align as shown, 4.



19

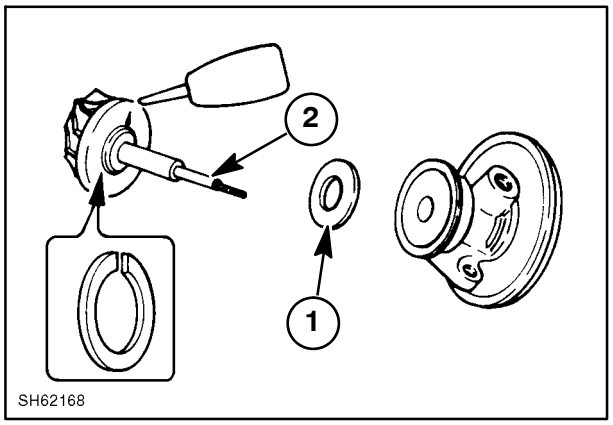
Inserting the shaft into bearing casing
Insert the seal ring, 1, into the turbine shaft, 2.

Attach the shield plate to the bearing casing.

Oil the shaft journal, and insert the shaft into the bearing casing.

NOTE: *Insert the shaft slowly, taking care not to damage the floating bearings in the bore.*

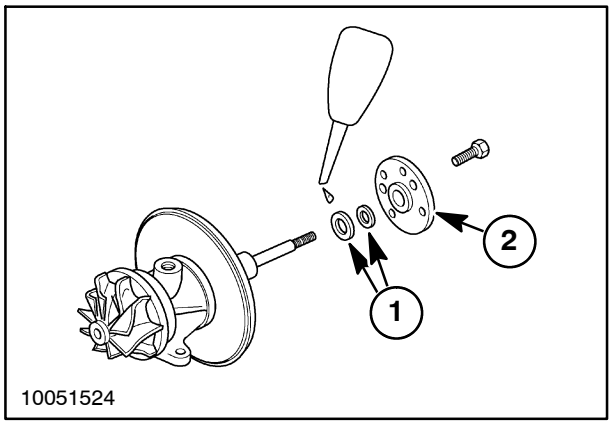
When installing the seal ring, align it to the shaft and insert it with its gap meeting the lube oil inlet.



20

Installing the thrust bearing
Run the thrust washers, 1, onto the turbine shaft.

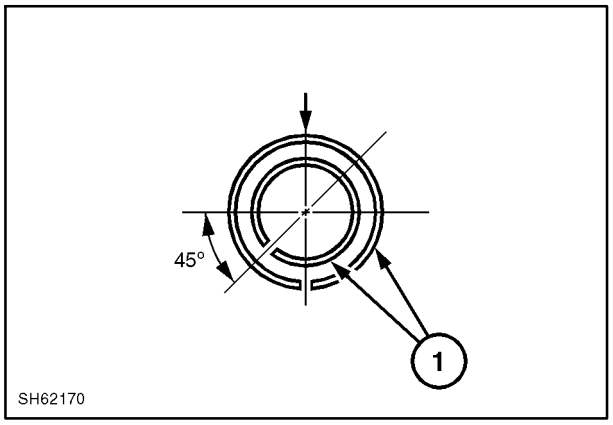
Oil the thrust bearing, 2, and fit it to the bearing casing, securing it by tightening its retaining bolts.



21

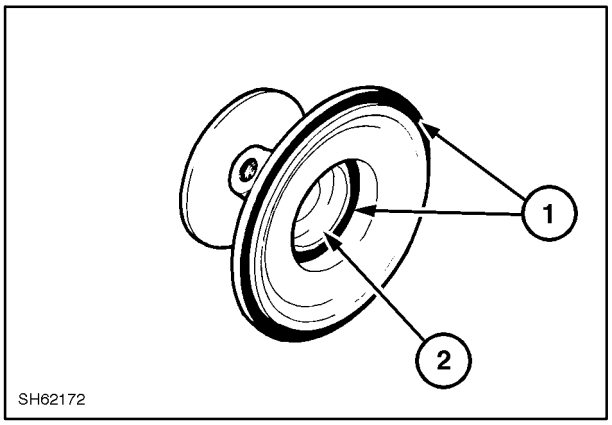
Installing the seal plate
Insert seal rings, 1, into the oil slinger. The figure shows the seal rings as seen from the front end.

NOTE: *Be sure to stagger the gaps of the seal rings relative to the position of the lube oil inlet.*



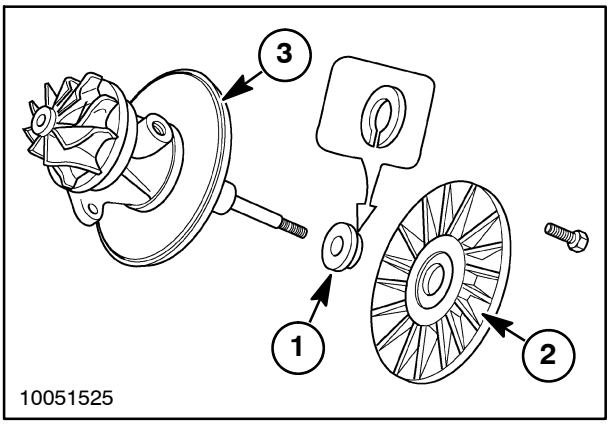
22

Apply the liquid gasket (Loctite® Gasket eliminator 518) to the blower side face of the bearing casing on which the seal plate is to seat. Apply liquid gasket, 1, in a thickness of 0.2 mm (0.01″). Keep the inner bore, 2, free of liquid gasket.



23

Insert the oil slinger,1, into the seal plate, 2. Fit the bearing case, 3, to the seal plate and secure with the retaining hardware. Tighten to 3.9 – 4.9 N·m (34.5 – 43.4 in-lbs).

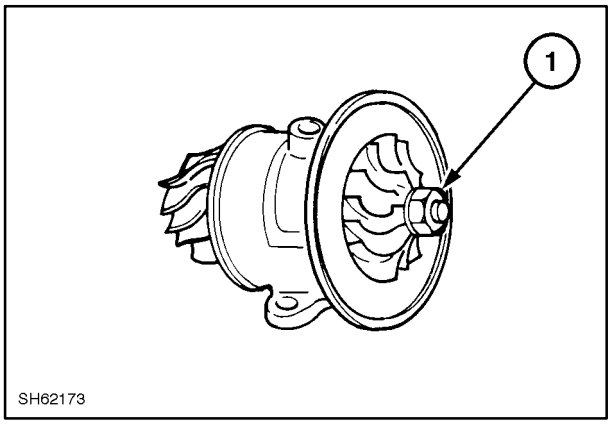


24

Installing the blower wheel

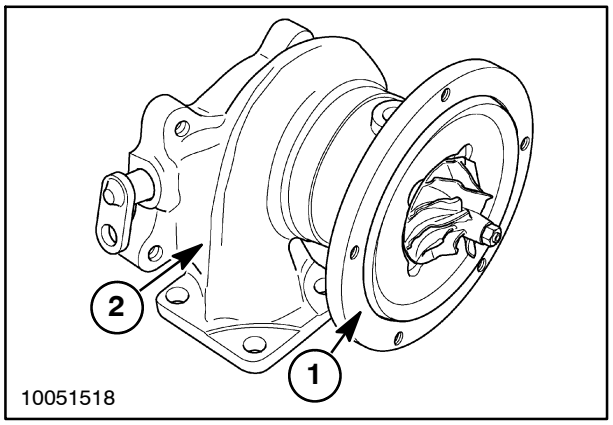
Slide the wheel onto the turbine shaft, and retain it by running the shaft-end nut down the shaft end. Tighten nut, 1.

NOTE: *The shaft end note has left-hand screw threads; tighten it by turning counterclockwise.*



25

Securing the turbine casing
Fit the turbine casing, 1, to the support, 2, bringing the previous aligning marks into alignment, and reattach clamp, fastening the two pieces together.

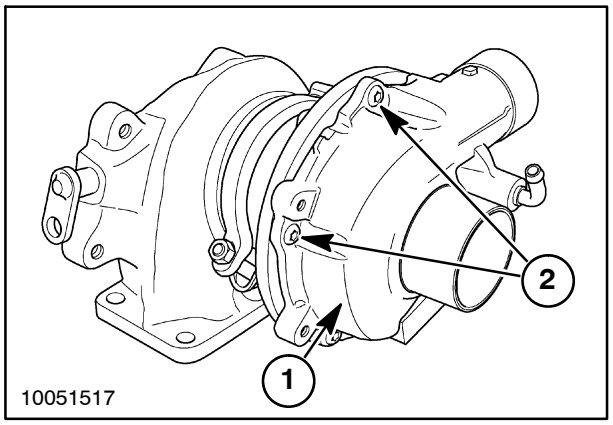


26

Securing the blower casing to the bearing casing
Fit the blower casing, 1, in the original angular position by aligning the marks, and secure it in place by tightening the torx head screws, 2, to 3.9 – 4.9 N·m (34.5 – 43.4 in-lbs) torque.

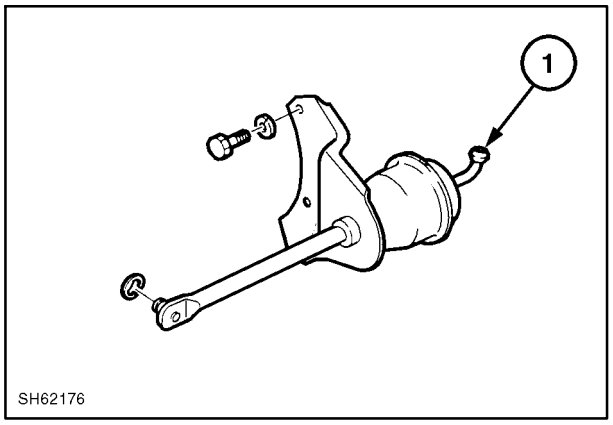
NOTE: *Apply the antiseize compound to the thread of each torx head screws before installing into the casing.*

NOTE: *Apply the liquid gasket (Loctite Gasket eliminator 518) to the mating face, 1, of the bearing casing just before fitting the blower casing to it. The coat thickness of liquid gasket should be 0.1 mm – 0.2 mm (0.004″ – 0.008″).*



27

Installing the waste gate controller assembly
Install the assembly while applying compressed air of about 1 bar (14 psi) to the controller air inlet, 1.



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CHECKING THE ROTOR FOR MOVEMENT

Measure the axial (end movement) and radial (up and down movement) of the rotor in the reassembled turbocharger, as described earlier in “Inspection Before Disassembly.”

Make sure the movement readings are within the following specifications:

Axial movement of rotor – 0.114 mm (0.0045″).

Radial movement of rotor – 0.082 mm (0.0032″).

NOTE: *A movement reading not coming into the above specification means the turbocharger has been reassembled improperly and must be taken apart and rebuilt again.*

Preliminary steps for installing the turbocharger on the engine:

Attach the turbocharger and adapter assembly to the exhaust manifold and support with the hardware previously removed.

START-UP LUBRICATION

Oil the lubricated parts by pouring clean engine oil into the oil inlet and by rotating the turbine shaft by hand. This will wet the journal, floating bearings, thrust bearing, and other surfaces.

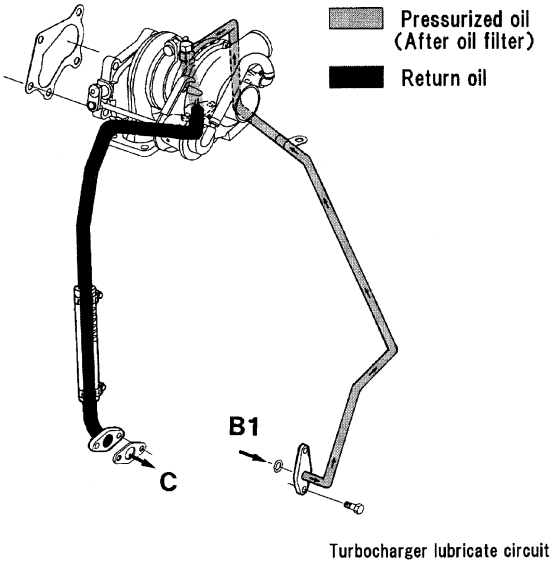
Thoroughly clean the oil inlet pipe and outlet pipe by flushing, making sure the pipes are absolutely free of foreign particles. Be sure the pipes have no restrictions due to denting or bending.

When installing the pipes between the turbocharger and engine, be sure to make each connection leak free.

INTAKE AIR SYSTEM

Clean the parts conveying the intake air, making sure each part is absolutely free of foreign particles.

When connecting the turbocharger to the air cleaner and air duct tube, be sure that each joint is leak free.



Turbocharger lubricate circuit

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EXHAUST SYSTEM

1. Make sure the exhaust gas passages are perfectly clean and free of foreign particles.
2. The bolts and nuts used on the joints of the exhaust line are of heat-resistant material; never use ordinary bolts and nuts instead of the heat-resistant hardware. Apply the antiseize compound to the threads of bolts and nuts just before installing them.
3. Secure each connection good and tight, making it perfectly leak free.

INITIAL START OF TURBOCHARGER AFTER INSTALLATION

1. Disconnect the wire to the fuel stop solenoid to insure that the engine will not start. Prime the lubrication circuit of the turbocharger by cranking the engine with the starting motor for ten seconds at a time. After the first ten seconds of cranking, pause for thirty seconds and then crank the engine again. Repeat the process until the oil warning lamp goes out.

NOTE: *Cranking the engine longer than ten seconds at a time is very hard on the battery and may cause damage to the starter motor. Limit each cranking to ten seconds, and pause at least thirty seconds after each cranking to allow the starter motor to cool down.*

2. Reconnect wire to the fuel stop solenoid. Move the hand throttle lever to the low, 1/3 throttle position.
3. Operate the engine at no more than 1500 rpm for two to three minutes to insure lubrication oil is getting to the turbo.

NOTE: *Listen to the turbocharger to be sure that it is running smoothly without making any abnormal noise.*

4. Inspect the oil pipes and connections for any sign of oil leakage.
5. Operate the engine normally.
6. Stopping the engine, move the engine speed control lever to the low idle position. After full load operation, idle the engine for one minute to allow components to cool.

⚠ CAUTION ⚠

Never stop the engine when it is running at high speed. Doing so may cause serious engine damage.

The high operating speed of the turbocharger makes it essential that adequate lubrication is ensured when the engine is started.

SECTION 18 - CLUTCH

Chapter 1 - Clutch

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SPECIFICATIONS

CLUTCH PLATES	T2410/T2420
Facing:	
Outside Diameter	275 mm (10.827 in)
Inside Diameter	180 mm (7.087 in)
Thickness	3.5 mm (0.1378 in)
Clearance between drive shaft and clutch disc	0.2-0.5 mm (0.008-0.020 in)
Allowable clearance limit	0.6 mm (0.0236 in)
Clearance between drive shaft and clutch disc in the rotation direction	0.050-0.1 mm (0.002-0.004 in)
Allowable clearance limit	0.25 mm (0.010 in)
Clearance between retainer and release hub	0.025-0.1 mm (0.010-0.004 in)
Allowable clearance limit	0.8 mm (0.031 in)
Length of release hub return spring	35 mm (1.38 in)
Thickness of clutch disc	8.0 mm (0.315 in)
Minimum thickness allowable	6.8 mm (0.268 in)
Depth of clutch disc rivets	1.3-1.9 mm (0.0512-0.0748 in)
Minimum depth allowable	0.5 mm (0.02 in)
Deflection of clutch disc	Max. 0.7 mm (0.0276 in)
Standard clutch pedal freeplay	19~30 mm (3/4 in~1-3/16 in)
Max. Allowable freeplay	30 mm (1-3/16 in)
Max. Clutch pedal travel	160 mm (6.3 in)
Standard flywheel thickness	55 mm (2.16 in)
Max. Allowable flywheel surface removal	1.27 mm (0.050 in)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

BOLT TORQUES

Flywheel Mounting Bolts . . . . . 13.7 N·m (10 ft-lbs)

Pressure Plate Bolts . . . . . 22 - 28 N·m (16 - 21 ft-lbs)

External Buckle-Up Bolts and Nuts . . . . . 79 N·m (58 ft-lbs)

SPECIAL TOOLS

Clutch Alignment Arbor . . . . . # 380001606

DESCRIPTION OF OPERATION

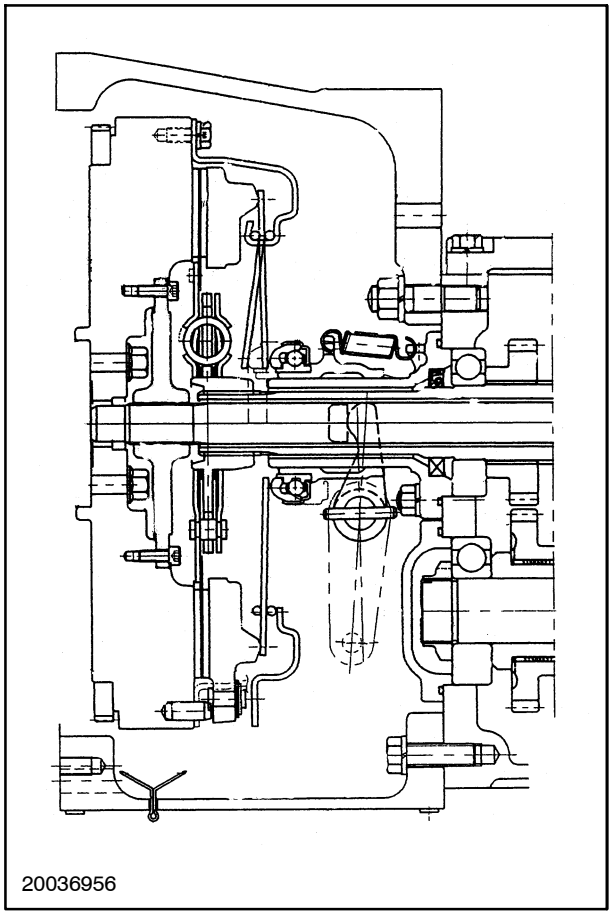
The tractors are equipped with a standard single clutch with the 12 x 12 Synchronized Shuttle Shift transmission.

The clutch assembly consists of a clutch pressure plate, clutch disc, flywheel, release bearing, return spring, and hub.

The clutch disc is a dry organic type assembly, 275 mm (10.8 in) which is mechanically operated. The clutch disc is installed between the flywheel, and the pressure plate assembly. The clutch pressure plate is attached to the flywheel with six bolts.

When engaged, the spring loaded pressure plate applies pressure to the clutch disc, pushing it against the flywheel. The flywheel than drives the clutch disc, which is connected to the transmission drive shaft.

NOTE: *Tractors equipped with a EHSS transmission, have no clutch disc within the clutch housing.*



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1

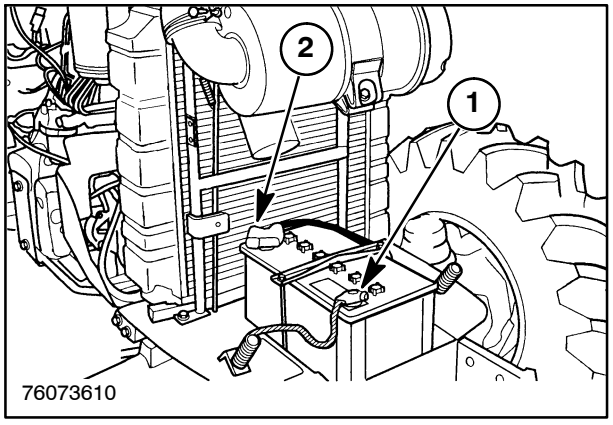
TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Excessive clutch pedal free play or loss of adjustment reserve.	Worn clutch disc.	Replace disc. Refer to “Clutch Overhaul”.
	Clutch linkage out of adjustment.	Adjust linkage. Refer to “Adjustments”.
Clutch noisy when free.	Defective release bearing.	Replace bearing.
Clutch slipping.	Incorrect pedal free travel.	Replace bearing.
	Worn disc facings.	Replace bearing.
	Clutch pressure springs weak from overheating.	
Clutch fails to engage smoothly.	Defective clutch disc.	Replace disc Refer to “Clutch Overhaul”.
	Defective pressure plate assembly.	Replace pressure plate assembly. Refer to “Clutch Overhaul”.
	Worn clutch pilot bearing.	Replace bearing.
	Defective flywheel.	Refer to Part 1, “Engine System” for removal and installation.
Difficulty in engaging gears.	Pedal free travel out of adjustment.	Refer to “Adjustments” to adjust the pedal free travel.
	Damaged or out of adjustment release levers.	Adjust assembly. Refer to “Adjustments”.
Pedal will not return completely to release position.	Broken clutch pedal return spring.	Install a new spring.

OVERHAUL

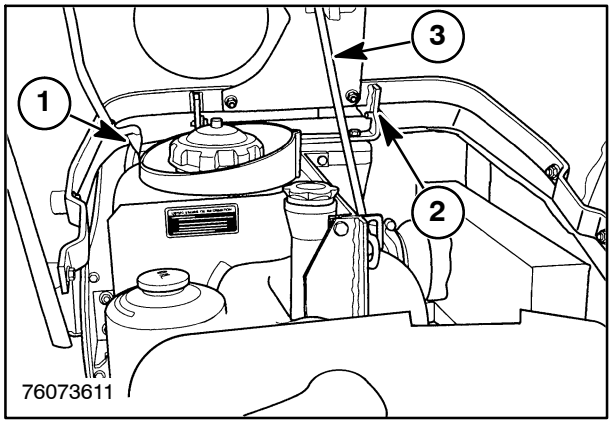
SEPARATING THE TRACTOR AT CLUTCH HOUSING/ENGINE

1. Disconnect the negative (-) battery cable, 1, and positive (+) battery cable, 2, from the battery.
2. Drain all of the hydraulic fluid from the transmission and differential into a suitable container.



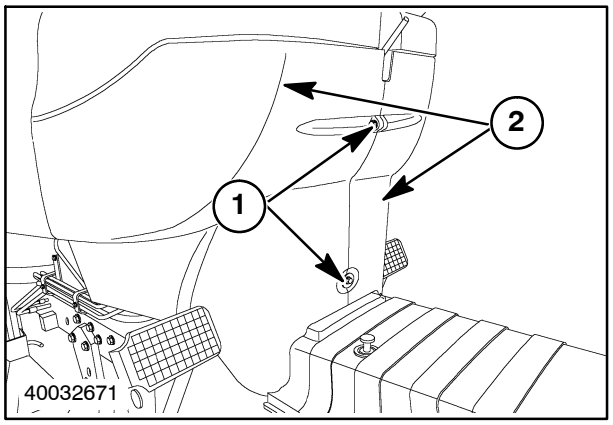
2

3. Disconnect the headlight wire harness plug, 1.
4. Remove the clips, 2, from each side of the hood bracket.
5. Remove the support rod, 3, and remove the hood from the tractor.



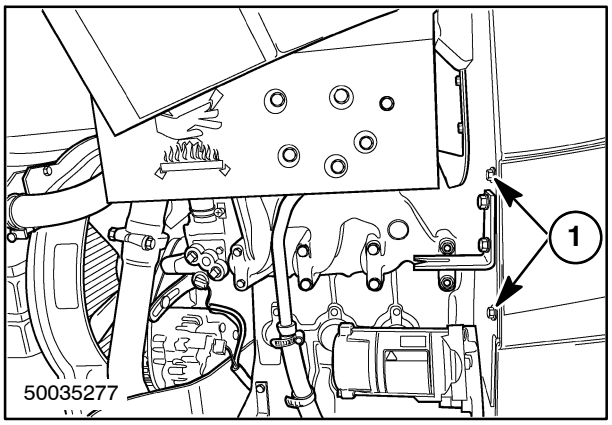
3

6. Remove the two bolts, 1, from the rear hood panels, 2.



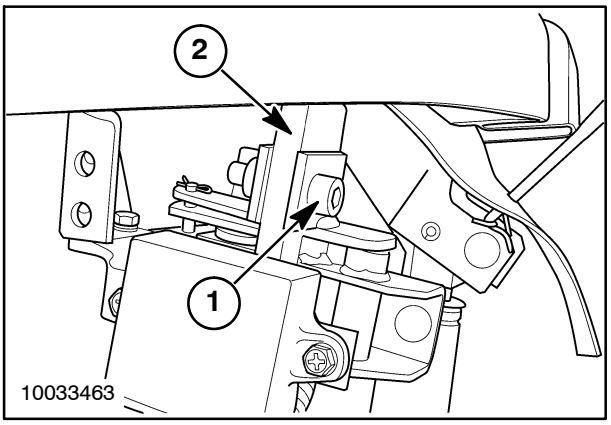
4

7. Loosen and remove the two bolts, 1, that attach the rear hood panel to the firewall. Repeat for opposite side.
8. Disconnect the ignition switch from the wire harness to allow the panel to be removed.



5

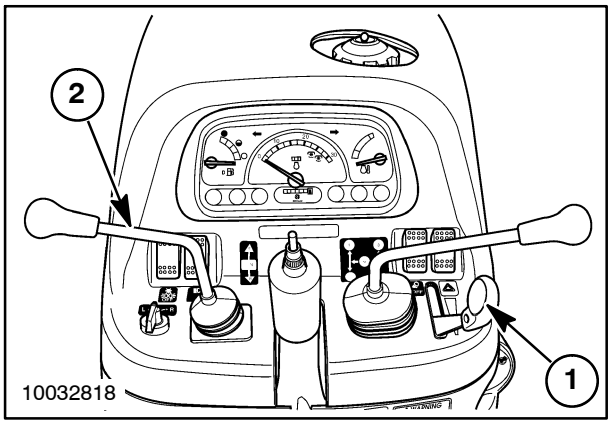
9. Remove the bolt, 1, securing the Shuttle control lever, 2, to the control linkage.



6

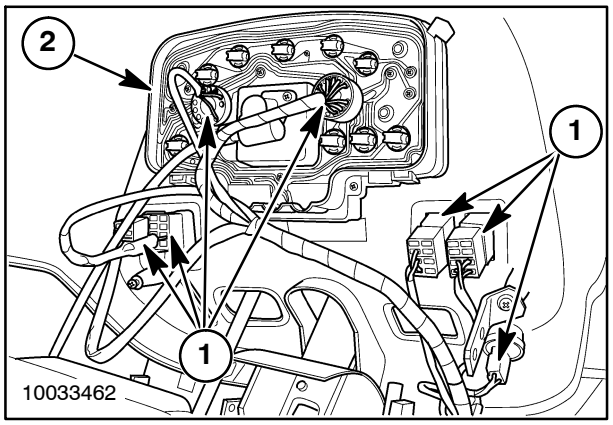
10. Remove the throttle control knob, 1, from the throttle control lever.
11. Remove the shuttle control lever, 2, from the steering column and the dash panel.

NOTE: *Steering wheel removed in picture for clarity.*



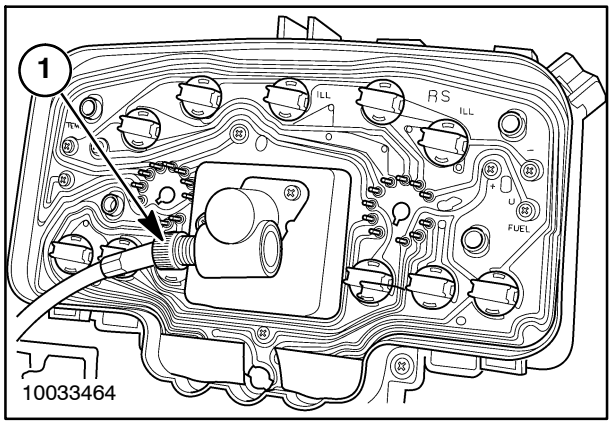
7

12. Remove the bolts securing the dash panel to the tractor.
13. Disconnect the wire harness plugs, 1, from the rear of the instrument panel, 2.



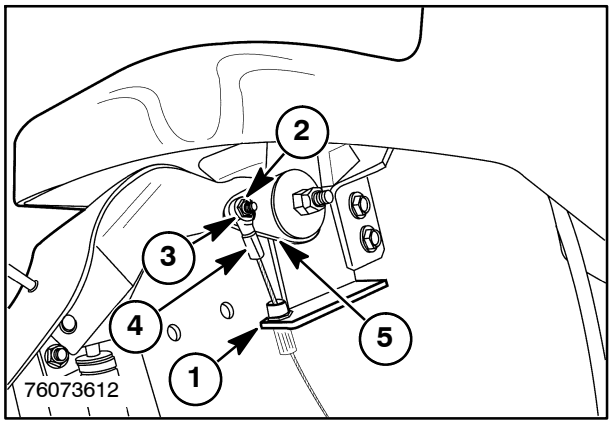
8

14. Disconnect the tachometer cable, 1, from the instrument panel.
15. Remove the dash throttle control assembly, and instrument panel from the tractor as an assembly.



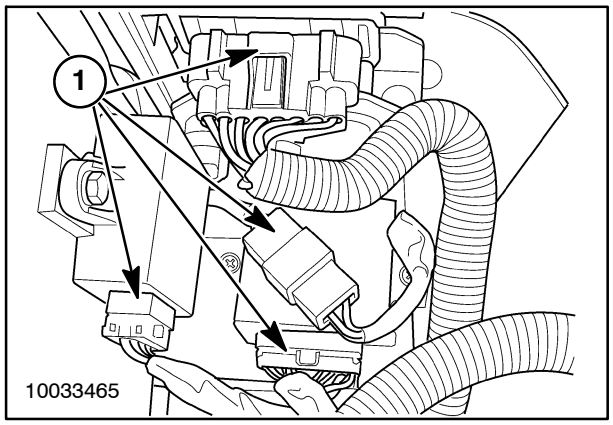
9

16. Remove the clip, 1, from the throttle cable and cotter pin, 2, washer, 3, that secures the cable, 4, to the throttle lever, 5. Remove the throttle cable assembly from the lever.



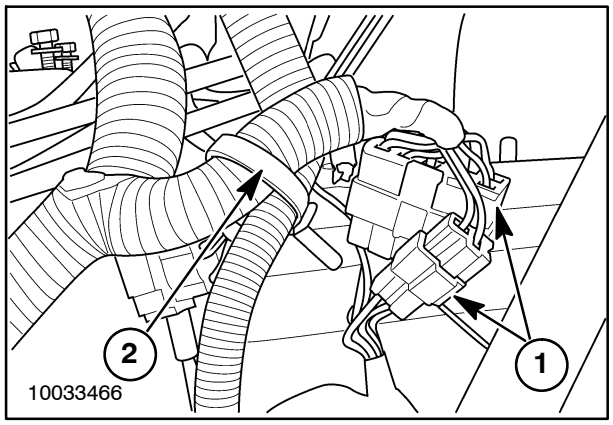
10

17. Disconnect the main wiring harness connectors, 1, from the left side of the steering column.



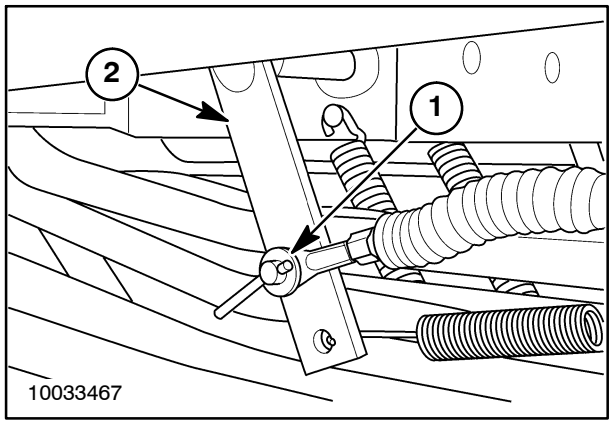
11

18. Disconnect the three harness connectors, 1, located at the left side of the transmission.
19. Remove the plastic wire ties, 2, from the wire harness.



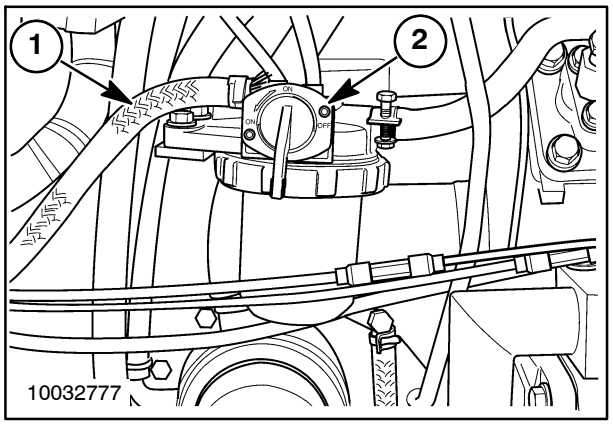
12

20. Disconnect the throttle cable, 1, from the foot throttle, 2.



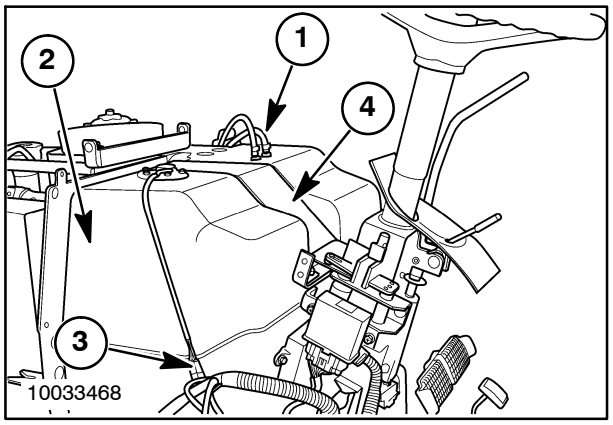
13

21. Disconnect the fuel supply line, 1, from the fuel shut-off valve, 2.
22. Drain the fuel tank into a suitable, clean container. Cap and plug all lines and fittings.



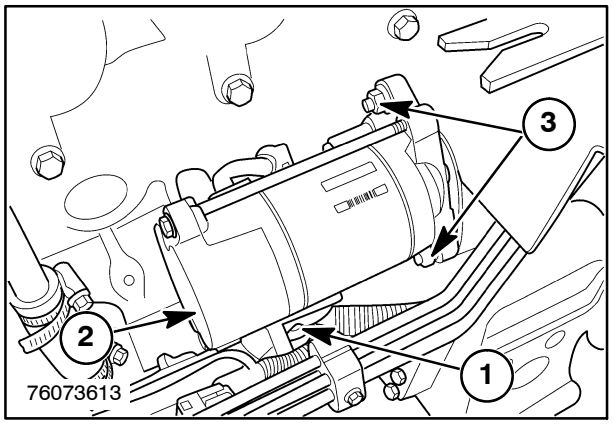
14

23. Disconnect the two fuel return lines, 1, from the top of the fuel tank, 2.
24. Disconnect the fuel level gauge wire connectors, 3.
25. Remove the fuel tank hold down bracket, 4, and remove the fuel tank from the tractor.



15

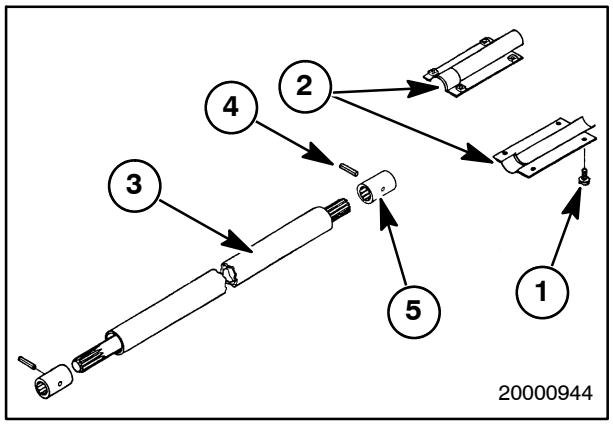
26. Disconnect the wiring, 1, from the starter motor, 2.
27. Remove the nuts, 3, and remove the starter from the tractor.



16

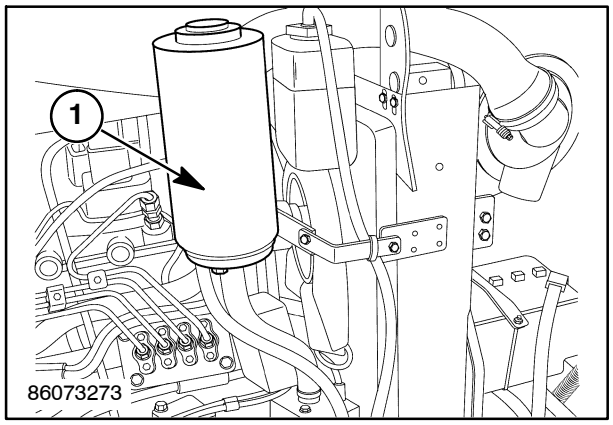
28. Loosen and remove the retaining bolts, 1, and the covers, 2, from the drive shaft, 3.
29. Drive out the roll pin, 4, from the rear coupler, 5.
30. Slide the coupler forward onto the drive shaft.

NOTE: *The drive shaft cannot be completely removed from the tractor due to the oil pan. After the tractor is split the drive shaft should be removed.*



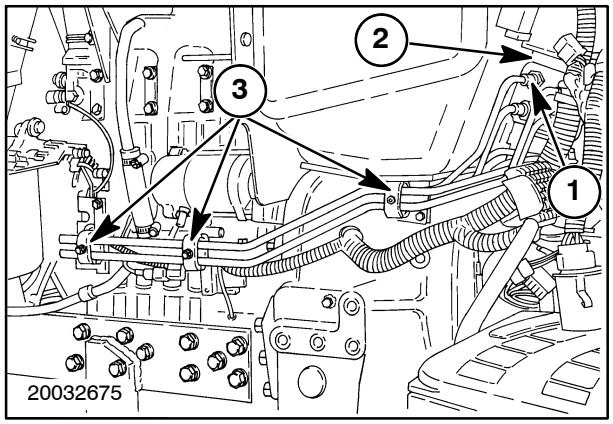
17

31. Drain the power steering reservoir, 1, into a clean suitable container.



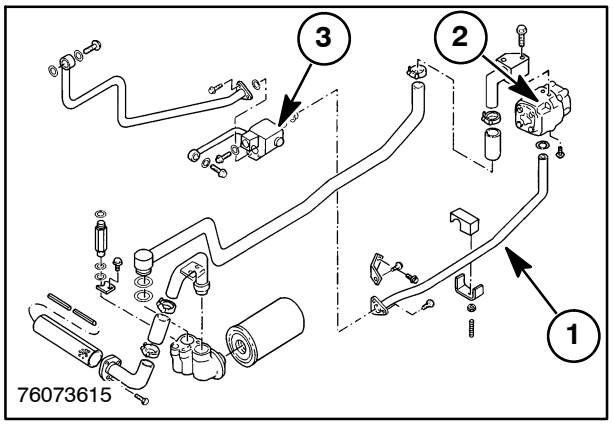
18

32. Disconnect the power steering tubes, 1, from the steering motor, 2. Cap and plug the openings.
33. Loosen and remove the three steering tube clamp, 3.



19

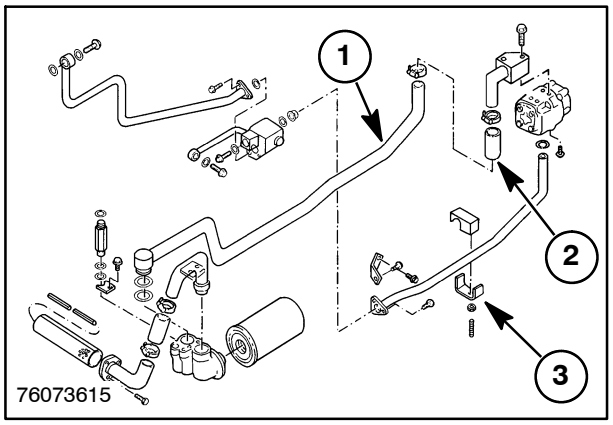
34. Disconnect the pressure tube, 1, from the main hydraulic pump, 2.
35. Disconnect the pressure tube from the relief valve manifold, 3. Cap and plug the openings.



20

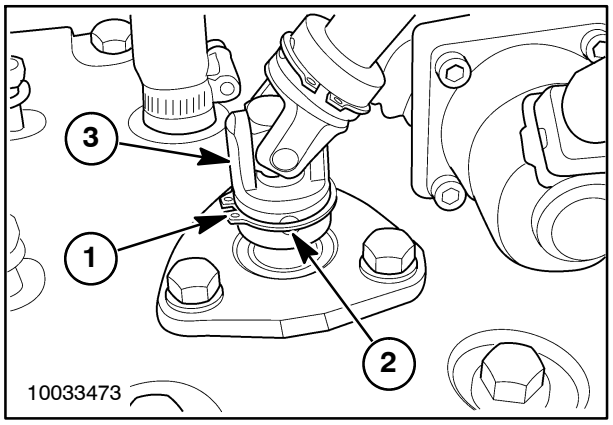
36. Disconnect the hydraulic suction tube, 1, from the rubber hose connector, 2.
37. Loosen the tube clamp, 3, and rotate the suction tube away from the pump.

IMPORTANT: *Use care when removing snap ring from joint groove. Do not expand ring more than 24 mm (1.0 in). If snap ring is expanded excessively, the snap ring will not stay tight in the groove and retaining pin may work loose.*



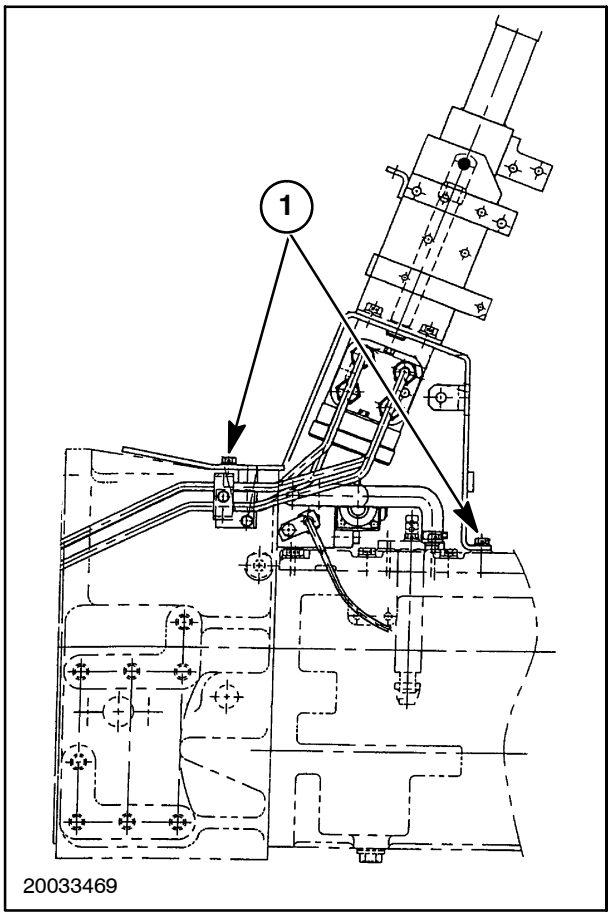
21

38. Remove the snap ring, 1, and drive the pin, 2, from the main transmission shift shaft universal joint, 3.
39. Disconnect the universal joint, 3, from the shaft.
40. Repeat steps for the shuttle shift shaft on the right side of the tractor.



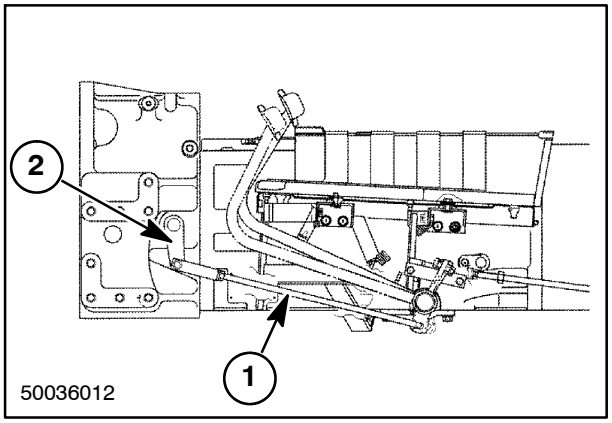
22

41. Remove the four bolts, 1, attaching the steering column assembly to the clutch housing. Remove the steering column and shift linkage as an assembly.



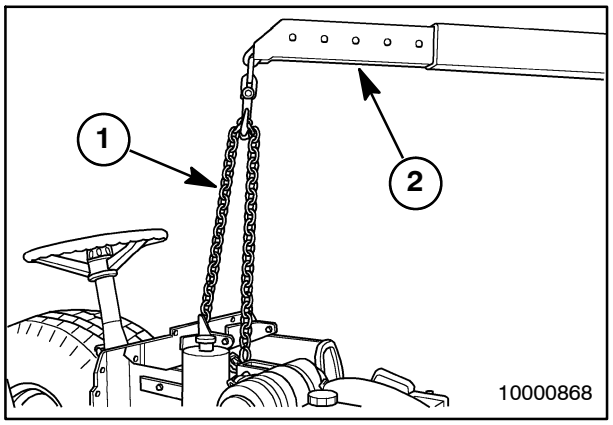
23

42. Remove the clutch rod, 1, from the clutch arm, 2, located on the left side of the tractor.



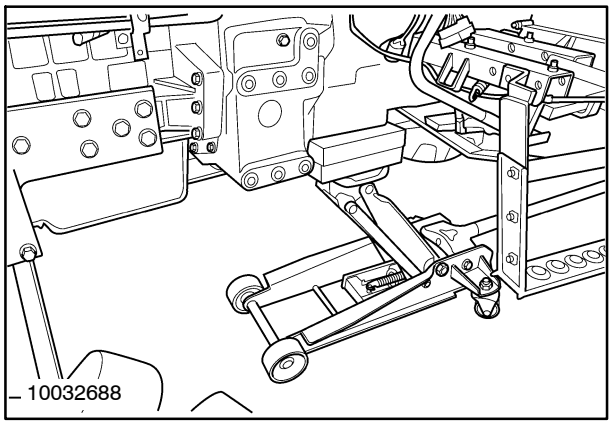
24

43. Attach a chain sling, 1, to the engine lifting eyes, located at the left rear and right front of the engine.
44. Attach a secure lifting device, 2, to the chain sling to support the front of the tractor.



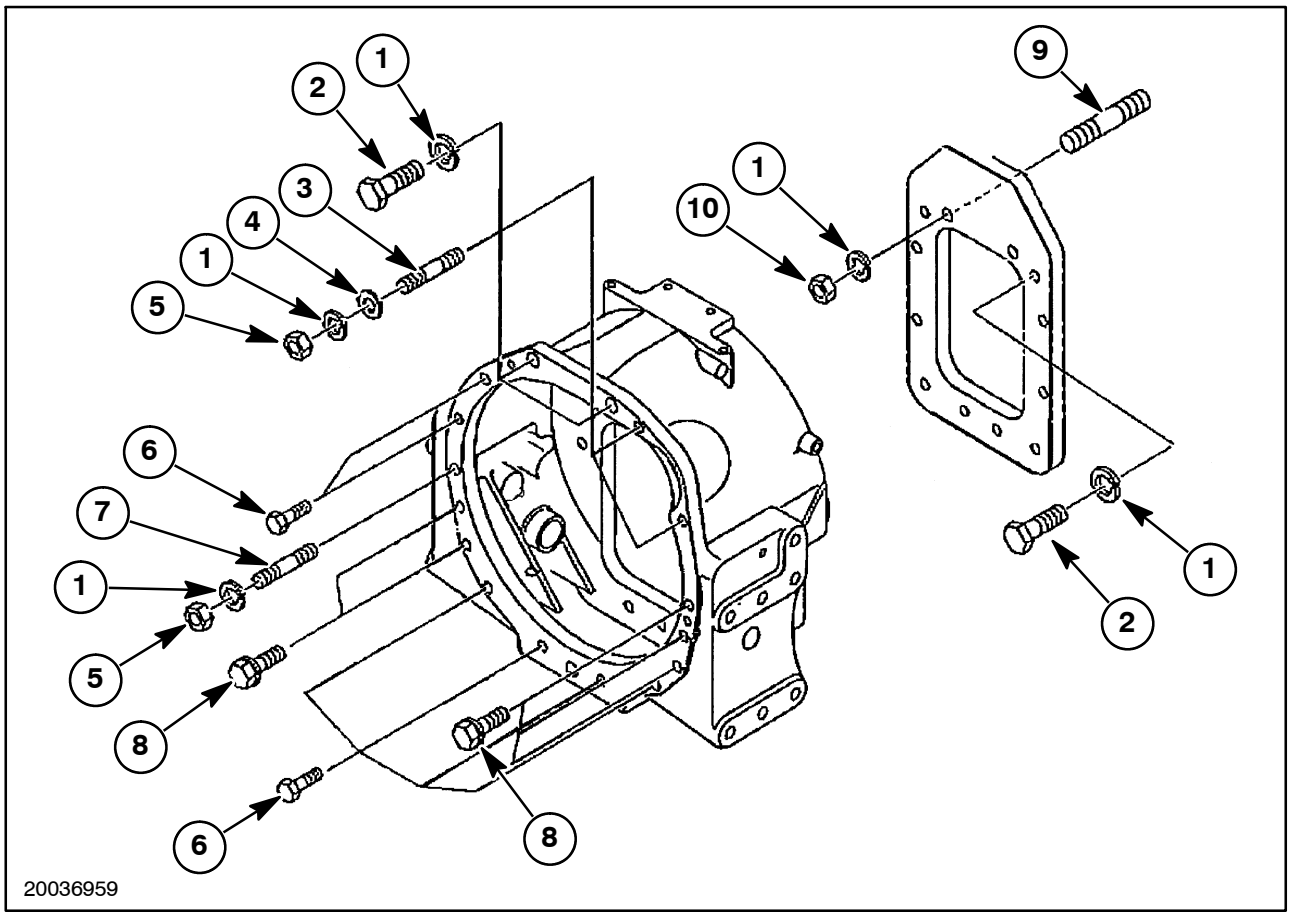
25

45. Place a suitable floor jack under the transmission from the rear of the tractor. Raise the jack just enough to support the transmission.



26

46. Loosen and remove all of the external buckle-up bolts between the engine and clutch housing.
47. Gently separate the engine from the clutch housing while rolling the floor jack towards the rear of the tractor.
48. When separating operation is complete, place jack stands under each unit.



27

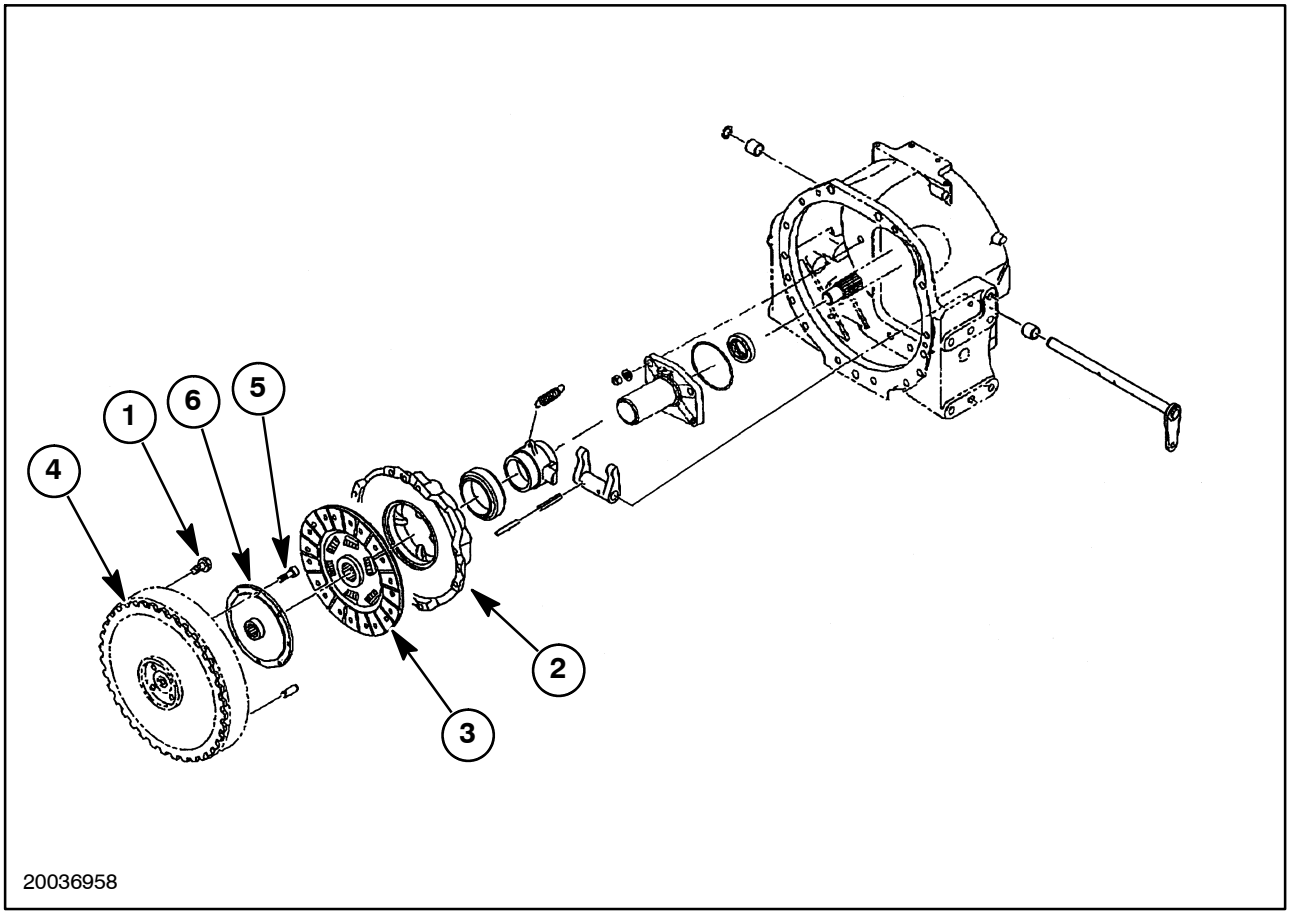
Item	Description	Qty.
1	Lock Washer	5
2	M12 x 50 Bolt	2
3	M10 x 45 Stud	2
4	Washer	2
5	M10 Nut	3
6	M10 x 15 Bolt	6
7	M10 x 55 Stud	1
8	M10 x 50 Bolt	5
9	M12 x 55 Stud	1
10	M12 Nut	1

CLUTCH

Removal

The single clutch is serviced as a complete assembly only. Overhaul of the single clutch is limited to resurfacing the flywheel, and replacement of the clutch assembly.

NOTE: *To prevent distorting the pressure plate assembly, loosen the pressure plate retaining bolts gradually and evenly.*

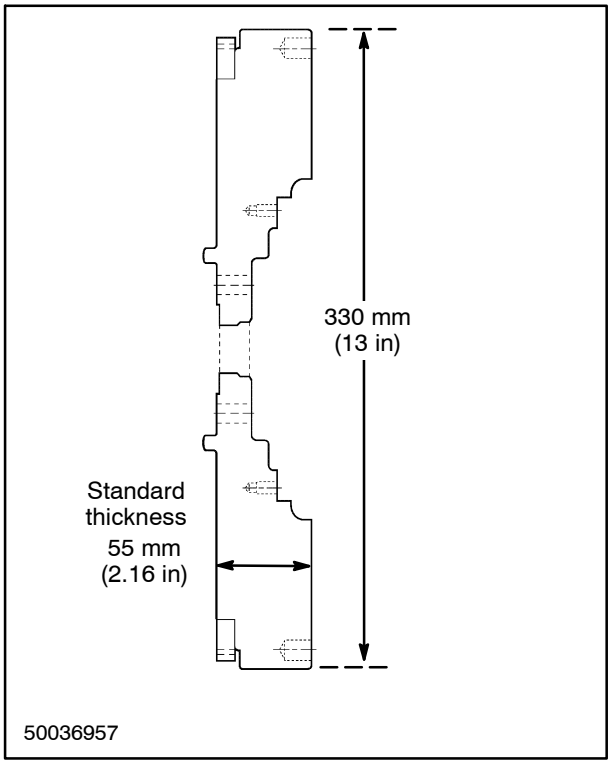


28

1. Remove the pressure plate retaining bolts, 1. Remove the clutch pressure plate, 2, and clutch disc, 3, from the flywheel, 4.
2. Remove the eight retaining bolts, 5, from the PTO drive disc, 6, and remove it from the flywheel.

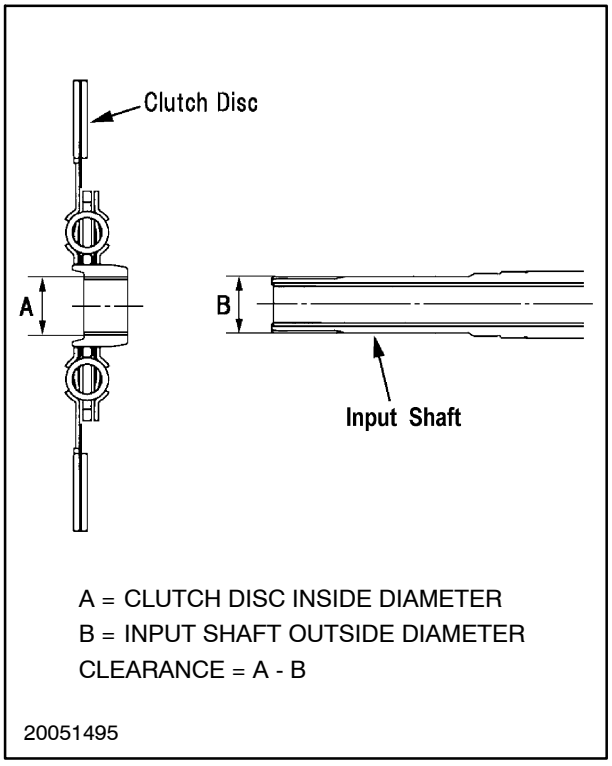
Inspection

3. Inspect the flywheel for scoring or warping of the clutch surface. Measure the flywheel thickness, to determine the amount of surface that can be removed.
4. Inspect the pressure plate face for scoring, cracks, and signs of overheating. Minor imperfections may be removed by resurfacing the pressure plate face. Inspect the diaphragm spring for wear or damage.
5. Replace the pressure plate if damaged.



29

6. Inspect the clutch disc lining for excessive wear. Replace the clutch disc if the lining is worn to less than 0.5 mm (0.02 in) from the top of the rivet head.
7. Inspect the clutch disc and input shaft splines for excessive wear. Replace the clutch disc if clearance is greater then 0.6 mm (0.0236 in).

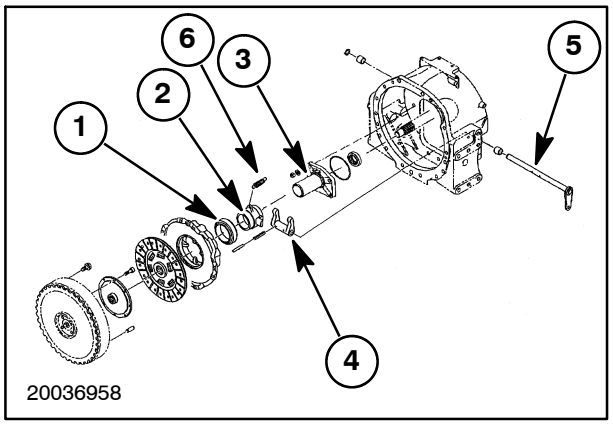


30

CLUTCH RELEASE BEARING

The clutch release bearing, 1, is a pre-lubricated ball bearing and is mounted on a slide hub, 2, which is supported on the front input shaft retainer, 3. A fork, 4, mounted on the cross shaft, 5, engages the bearing and hub assembly.

Pushing on the clutch pedal causes the cross shaft to turn the fork, this applies pressure to the slide hub. The bearing is then pushed into the diaphragm spring releasing the pressure form the clutch disc.



31

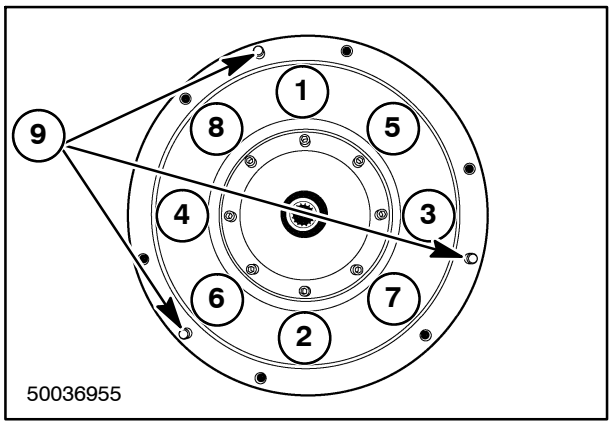
Inspection

1. Inspect bearing for roughness and wear.
2. Inspect bearing hub for excessive play.
3. Inspect the hub return spring, 6, replace if spring length is greater than 35 mm (1.38 in).
4. Replace bearing if roughness or wear is found.

CLUTCH

Installation

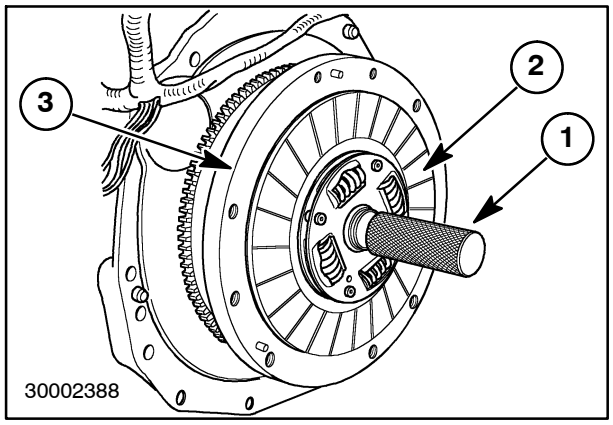
1. Install the PTO drive disc into the flywheel.
2. Use Loctite 271 thread locker, on the eight, M6 x 16 Allen-head bolts.
3. Install the bolts into the flywheel and tighten in specified order to ensure an even fit.
4. Torque bolts 13.7 N·m (10 ft-lb).
5. If replacing the flywheel, be sure to install new dowel pins, 9, into the flywheel.



32

IMPORTANT: *When installing a new pressure plate assembly, the pressure plate friction surface must be wiped clean with a suitable solvent to remove the protective film.*

1. Lightly lubricate the hub splines of the transmission-input shaft with a high temperature lubricant.
2. Use the special tool No. (380001606) clutch alignment arbor, 1, to position the clutch disc, 2, onto the flywheel, 3.

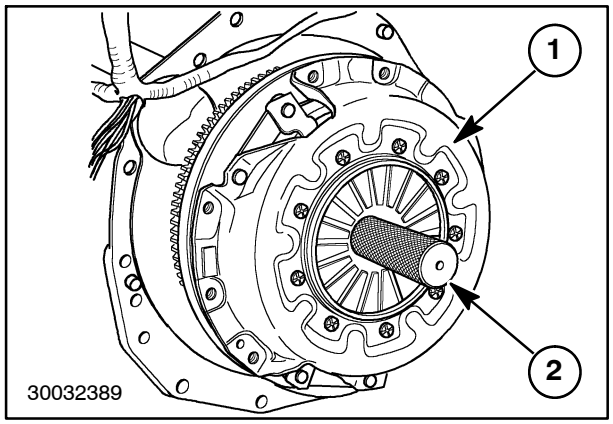


33

3. Install the pressure plate, 1, over the clutch alignment arbor, 2, and align the dowel pins and the mounting holes.
4. Install the six M8 x 16 retaining bolts to secure the pressure plate to the flywheel.

IMPORTANT: *Tighten the pressure plate retaining bolts evenly and gradually to prevent distorting the pressure plate assembly*.

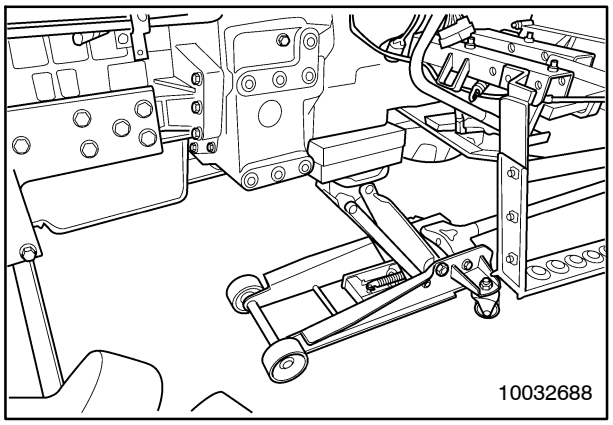
5. Torque the pressure plate retaining bolts 22 - 28 N·m (16 - 21 ft-lb).



34

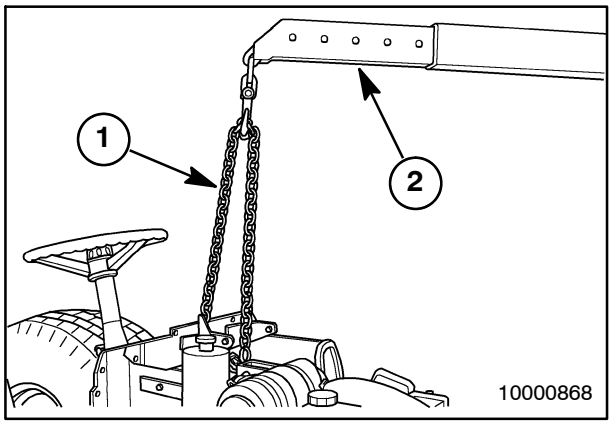
ATTACHING THE TRACTOR AT CLUTCH HOUSING/ENGINE

1. Place a suitable floor jack under the transmission from the rear of the tractor. Raise the jack just enough to support the transmission.
2. Remove jackstands.



35

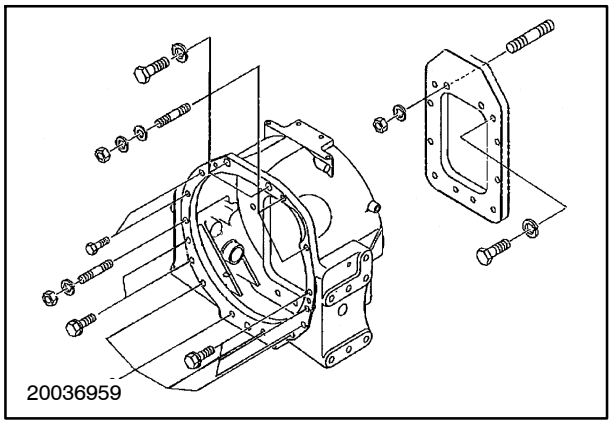
3. Attach a chain sling, 1, to the engine lifting eyes located at the left rear and right front of the engine.
4. Attach a secure lifting device, 2, to the chain sling to support the front of the tractor.
5. Remove jackstands.
6. Roll the floor jack towards the engine. Carefully align and attach the clutch housing/transmission to the engine while rotating the transmission gears to allow the transmission input shaft to mesh with the coupler on the engine crankshaft.



36

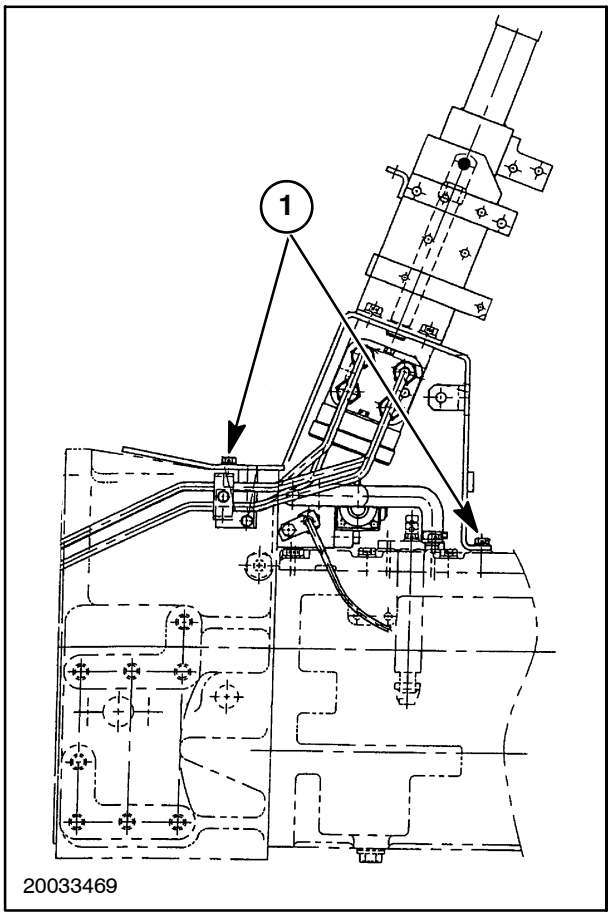
7. Apply Loctite 242 thread locker to the nuts and bolts. Install the external buckle up bolts and nuts to secure the clutch housing to the engine. Tighten buckle up bolts and nuts to:

   M10 Hardware . . . . . 50 N·m (37 ft-lb)
   M12 Hardware . . . . . 74 N·m (55 ft-lb)



37

8. Install the steering column and shift linkage as an assembly. Install the four bolts, 1, attaching the steering column assembly to the clutch housing. DO NOT tighten the bolts at this time.

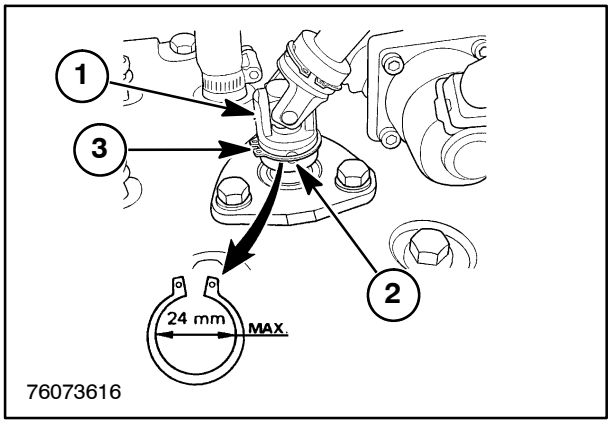


38

9. Connect the universal joints, 1, to the transmission.
10. Install the drive pin, 2, through the main transmission shift shaft and universal joint, 1.

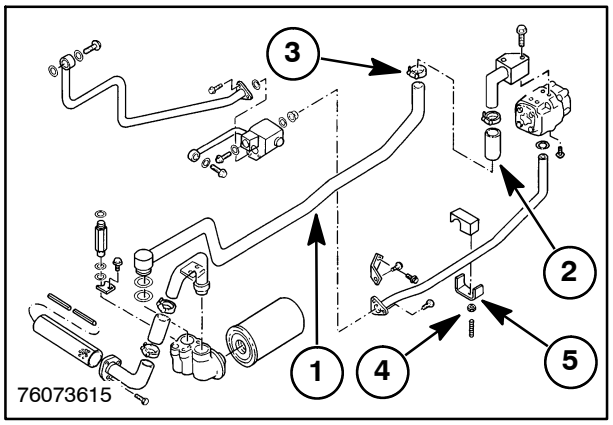
IMPORTANT: *Use care when removing snap ring from joint groove. Do not expand ring more than 24 mm (1.0 in). If snap ring is expanded excessively, the snap ring will not stay tight in the groove and retaining pin may work loose.*

11. Secure the pin with the snap ring, 3,



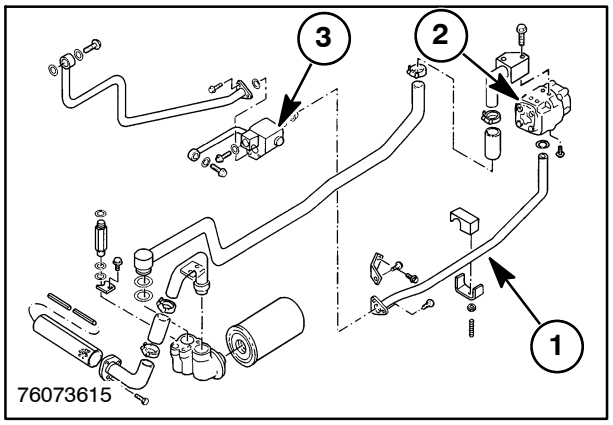
39

12. Connect the hydraulic suction tube, 1, to the rubber hose connector, 2.
13. Tighten the hose clamp, 3, on the rubber connector, 2.
14. Tighten the nut, 4, on the tube clamp, 5.



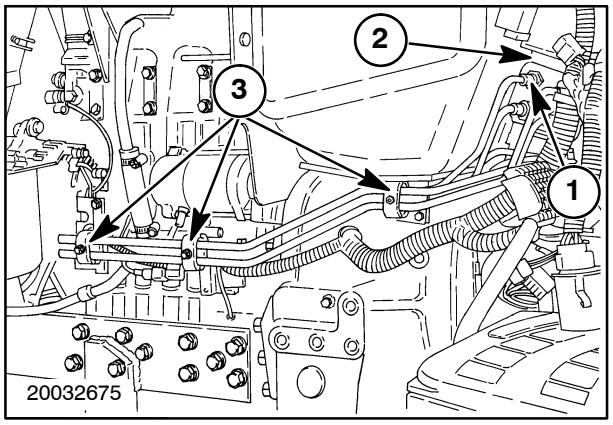
40

15. Remove any caps or plugs and connect the pressure tube, 1, to the main hydraulic pump, 2.
16. Connect the opposite end of the pressure tube to the relief valve manifold, 3.



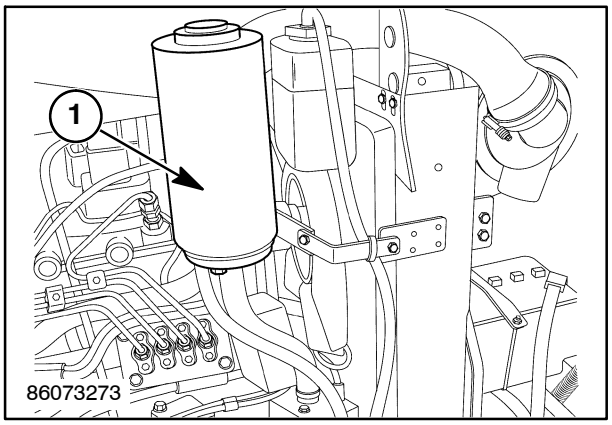
41

17. Remove the caps and plugs from the steering tubes and steering motor. Connect the power steering tubes, 1, to the steering motor, 2. Tighten the steering tubes securely.
18. Attach the steering tube clamps, 3, to the tractor, and tighten.
19. Tighten the four bolts securing the steering column to the transmission.



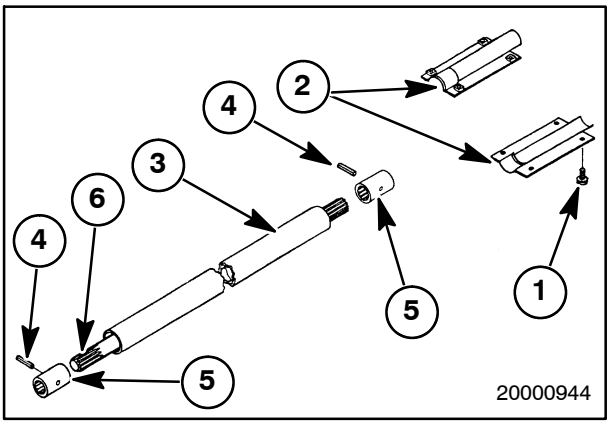
42

20. Fill the power steering reservoir with the proper fluid.



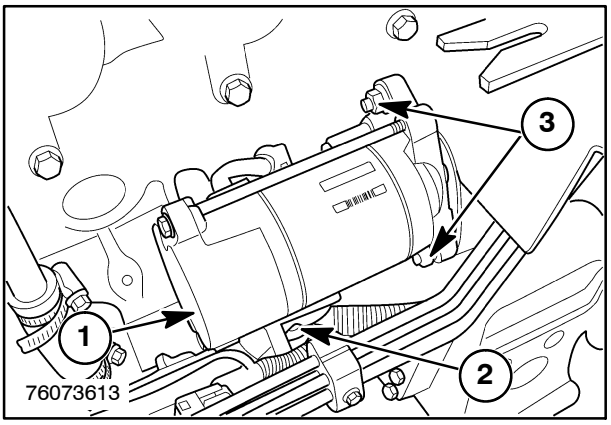
43

21. Slide the couplers, 5, on the splines of the drive shaft, 6, and install the shaft and tube, 3, as an assembly.
22. Slide the tube, 3, to the rear and Install the roll pin, 4, into the front coupler, 5.
23. Slide the tube, 3, forward and install the roll pin, 4, through the rear coupler, 5.
24. Install the covers, 2, and tighten the cover bolts, 1, onto the FWD drive shaft.



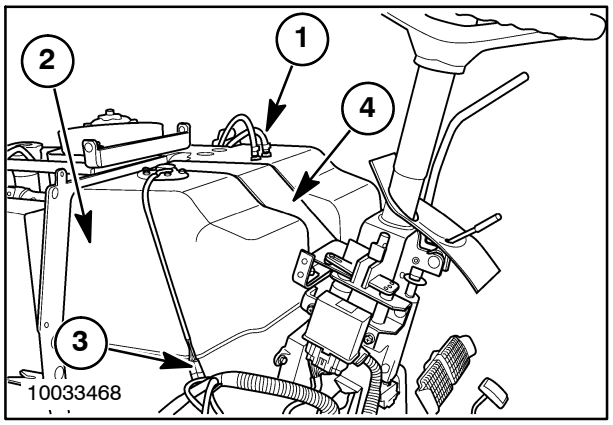
44

25. Install the starter on the tractor. Install and tighten the nuts, 3,
26. Connect the wiring, 2, to the starter motor, 1.



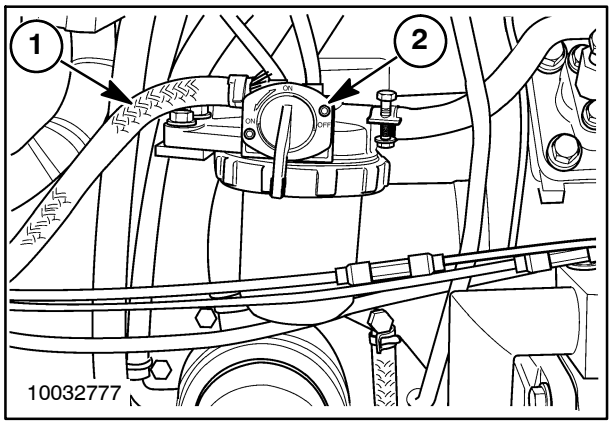
45

27. Install the fuel tank, 2.
28. Connect the fuel level gauge wire connectors, 3.
29. Connect the two fuel return lines, 1, on top of the fuel tank.
30. Install the fuel tank hold down bracket, 4.



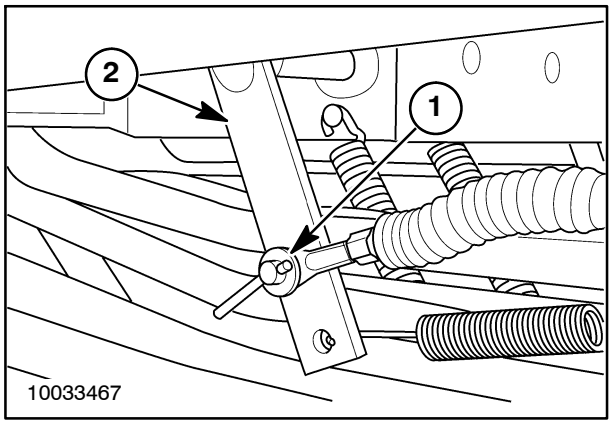
46

31. Remove the caps and plugs from fuel lines and fittings.
32. Connect the fuel supply line, 1, to the fuel shut-off valve, 2.



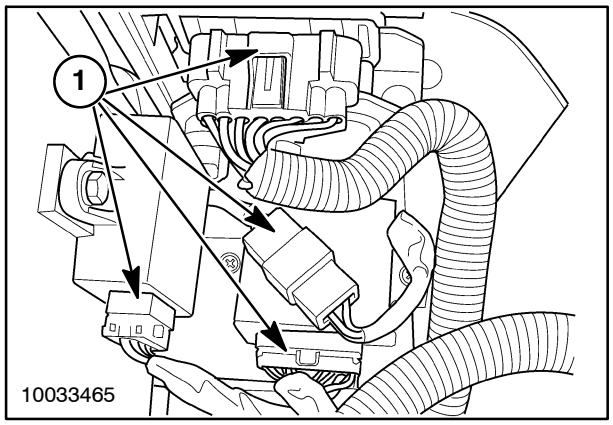
47

33. Connect the throttle cable, 1, to the foot throttle, 2.



48

34. Connect the main wiring harness connectors, 1, to the left side of the steering column.



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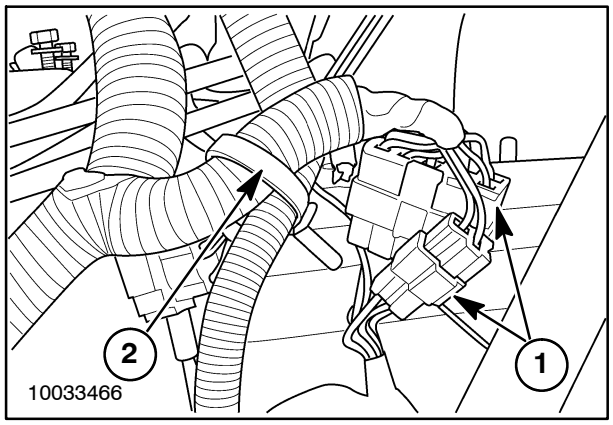
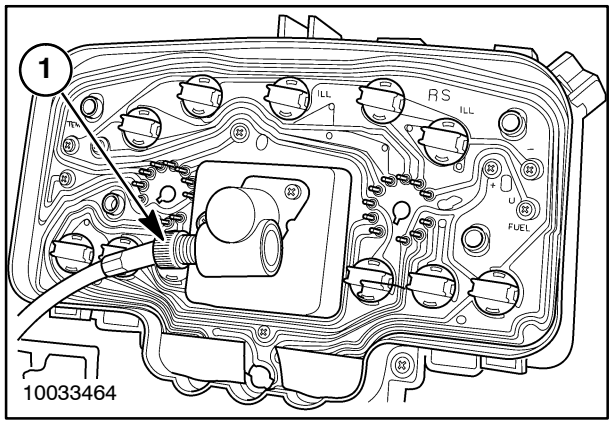
35. Connect the three harness connectors, 1, located at the left side of the transmission.
36. Install the plastic wire ties, 2, to the wire harness.



50

37. Position the dash and instrument panel on the tractor as an assembly.
38. Connect the tachometer cable, 1, to the instrument panel.



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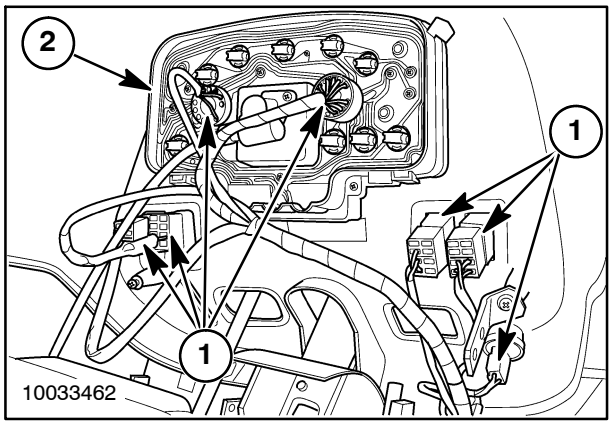
39. Connect the wire harness plugs, 1, to the rear of the instrument panel, 2.
40. Install and tighten the bolts securing the dash panel to the tractor.



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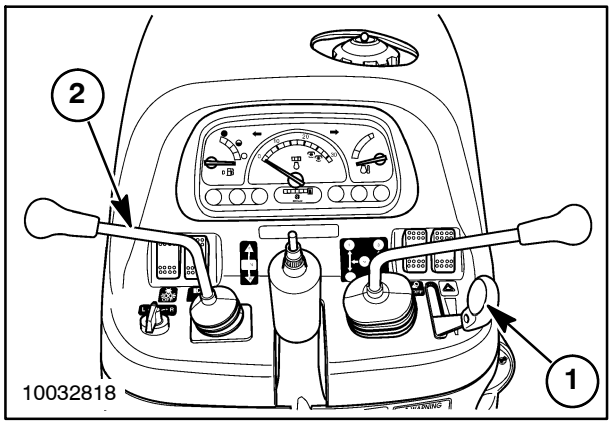
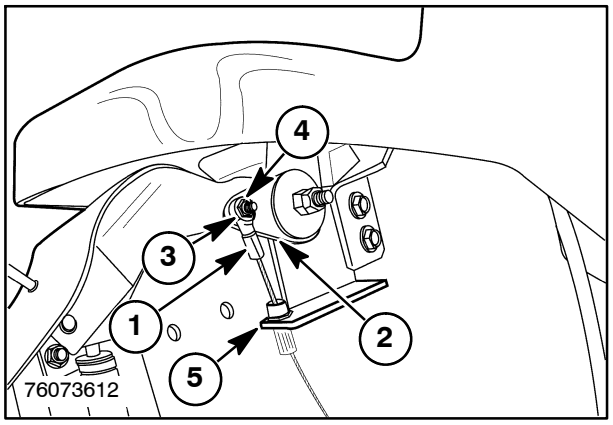
41. Install the throttle control knob, 1, on the throttle control lever. Tighten the screw.
42. Position the shuttle control lever, 2, through the dash, onto the steering column.

NOTE: *Steering wheel removed in picture for clarity.*



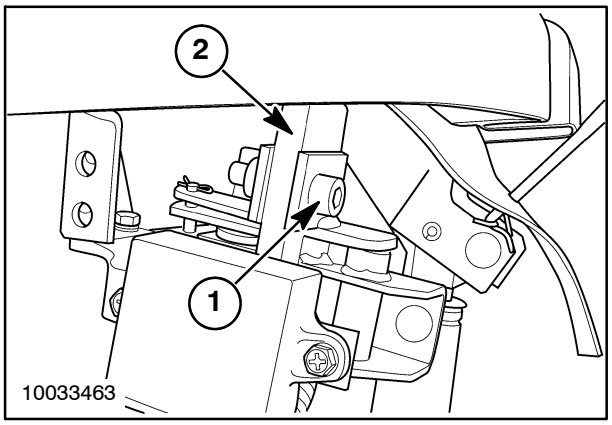
53

43. Install the throttle cable, 1, onto the throttle lever, 2. Secure cable with washer, 3, and cotter pin, 4. Install clip, 5, onto throttle cable body.



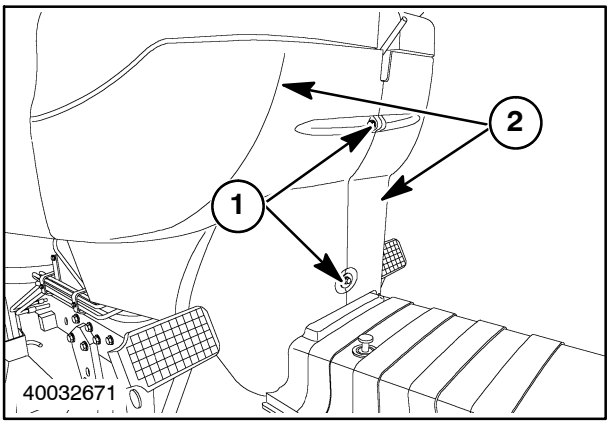
54

44. Install and tighten the bolt, 1, securing the Shuttle control lever, 2, to the control linkage.



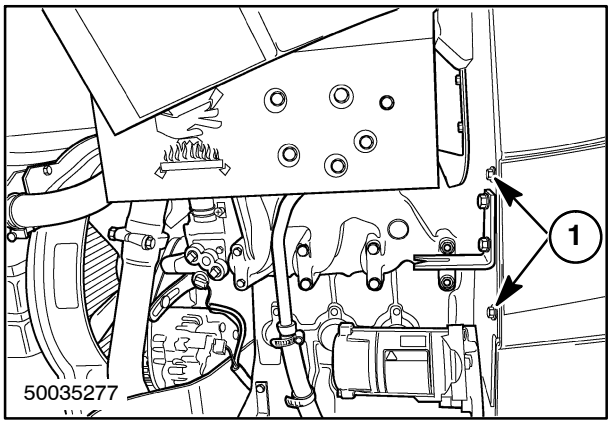
55

45. Connect the ignition switch to the wire harness as the rear hood panels, 2, are put on.
46. Install and tighten the two bolts, 1, on the rear hood panels, 2.



56

47. Install and tighten the two bolts, 1, that attach the rear hood panels to the firewall.



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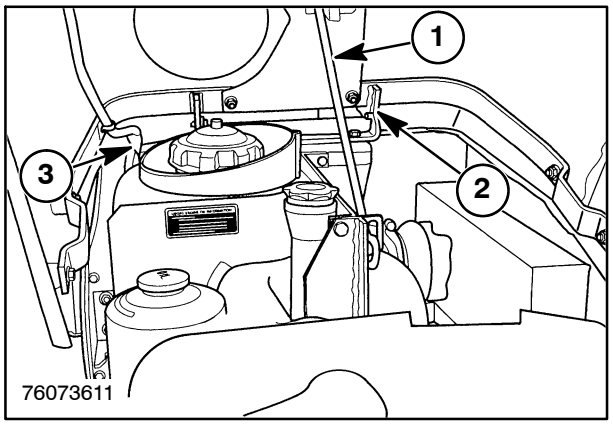
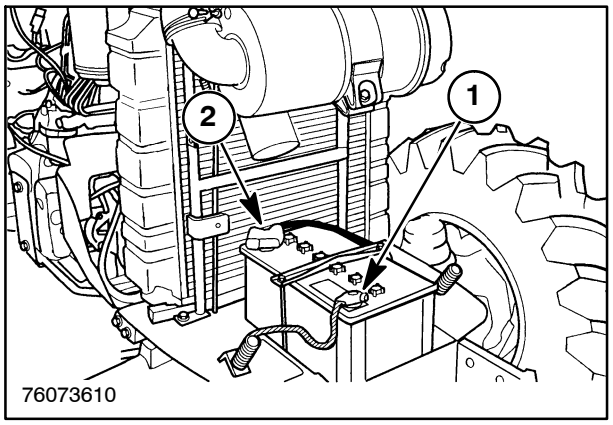
48. Install the hood onto the tractor. Connect the support rod, 1.
49. Install the pins and clips, 2, from each side of the hood bracket.
50. Connect the headlight wire harness plug, 3.

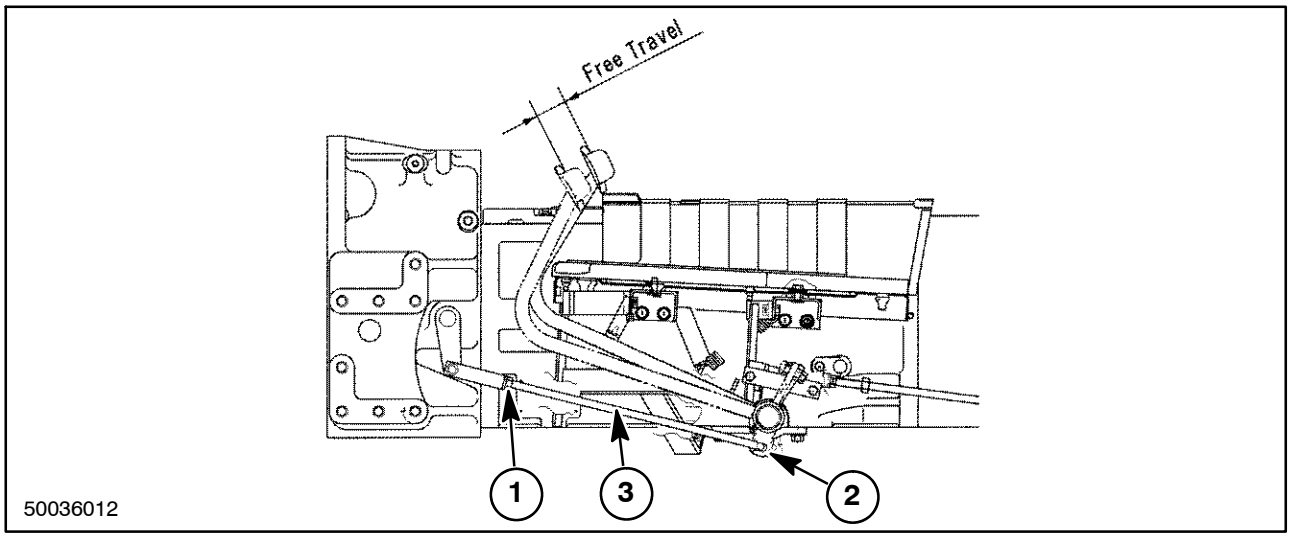


58

51. Connect the negative (-) battery cable, 1, and positive (+) battery cable, 2, to the battery.
52. Fill the transmission and differential with the proper type and amount of hydraulic fluid.



59



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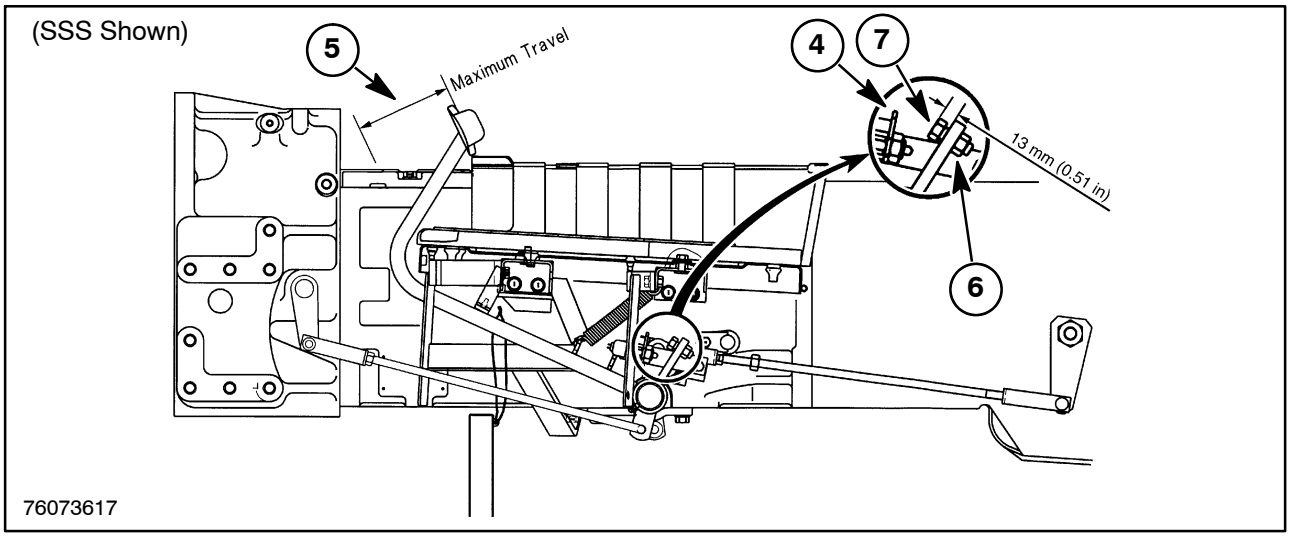
CLUTCH PEDAL ADJUSTMENT

NOTE: *Check clutch pedal free travel after every 50 hours of operation.*

Clutch pedal free travel should be maintained at 19 - 30 mm (3/4 - 1-3/16 in).

To adjust the clutch pedal:

1. Loosen jam nut,1.
2. Remove cotter pin, 2, and remove rod, 3, from pedal bracket.
3. Lengthen rod, 3, to decrease pedal free travel or shorten to increase.



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CLUTCH PEDAL MAXIMUM TRAVEL ADJUSTMENT (SSS TRANSMISSION)

The clutch pedal linkage has a mechanical stop, 4, to prevent damage to the clutch components due to over travel.

Maximum clutch pedal travel, 5, is set to: 160 mm (6.3 in). To adjust, loosen jam nut, 6, and increase bolt length, 7, to decrease pedal travel and shorten bolt length to increase pedal travel. Tighten jam nut after adjustment is complete.

NOTE: *Initial stop bolt length is 13 mm (0.51 in) from plate to top of bolt.*

SECTION 21 – TRANSMISSION

Chapter 1 – EHSS Transmission

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SPECIFICATIONS

Main Transmission

Gear backlash	0.1 mm (.004″)
Allowable Backlash	0.3 mm (.012″)
Clearance Between Slide Gear and Shift Fork	0.1 – 0.3 mm (.004 – .012″)
Allowable Clearance Limit	1.0 mm (.040″)
Clearance Between Synchronizer Ring and Gear	1.5 mm (.060″)
Allowable Clearance Limit	0.5 mm (.020″)
Gear End Play	0.0 mm (0.0″)
Top Shaft End-Play	0.0 mm (0.0″)

Hydraulic Shuttle Clutch Assembly

Clutch Disc Thickness (Friction)	1.98 mm (0.078)
Wear Limit	1.78 mm (0.070)

Control Valve For EHSS Clutch Assembly

System Relief Pressure	23 bar (333 psi)

Hydraulic Pump For EHSS Transmission

Type	Gear Pump
Pump Capacity	12.8 lpm (3.4 gpm) @ 2700 engine rpm
Pump Speed	3664 rpm (pump) @ 2700 engine rpm

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot-Pounds	Newton Meters	Pitch (mm)	Foot-Pounds	Newton-Meters
M5	4T, 4.8	0.70	2.8 – 4.0	3.8 – 5.4	------	------	------
	7T, 8T, 8.8		4.9 – 6.9	6.9 – 9.3			
	10T, 10.9, 11T		6.7 – 9.4	9.0 – 12.7			
M6	4T, 4.8	1.0	3.6 – 5.1	4.9 – 6.9	------	------	------
	7T, 8T, 8.8		6.1 – 8.3	8.3 – 11.3			
	10T, 10.9, 11T		8.7 – 11.6	11.8 – 15.7			
M8	4T, 4.8	1.25	9.4 – 12.3	12.7 – 16.7	1.0	11.2 – 14.8	15.2 – 20.1
	7T, 8T, 8.8		16.6 – 21.0	22.6 – 28.4		19.5 – 25.3	26.5 – 34.3
	10T, 10.9, 11T		21.0 – 26.8	28.4 – 36.2		22.4 – 29.7	30.4 – 40.2
M10	4T, 4.8	1.5	18.8 – 24.6	25.5 – 33.3	1.25	21.0 – 26.8	28.4 – 36.3
	7T, 8T, 8.8		32.5 – 41.2	44.1 – 55.9		36.2 – 46.3	49.0 – 62.8
	10T, 10.9, 11T		39.8 – 51.4	53.9 – 69.9		42.7 – 54.2	57.9 – 73.5
M12	4T, 4.8	1.75	27.5 – 34.7	37.3 – 47.1	1.25	31.8 – 40.5	43.1 – 54.9
	7T, 8T, 8.8		48.5 – 61.5	65.7 – 83.4		55.0 – 69.4	74.5 – 94.1
	10T, 10.9, 11T		68.0 – 85.4	92.9 – 116		73.1 – 93.3	99.0 – 127
M14	4T, 4.8	2.0	46.3 – 59.3	62.8 – 80.4	1.5	51.4 – 64.4	69.6 – 87.3
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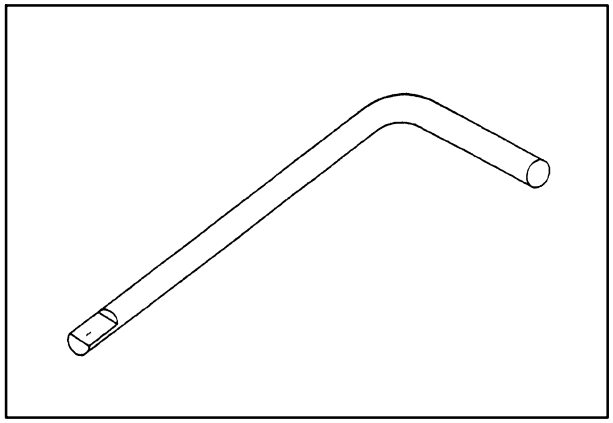
M20	4T, 4.8	2.5	106 – 132	144 – 179	1.5	127 – 156	172 – 211
	7T, 8T, 8.8		177 – 213	240 – 289		203 – 246	275 – 333
	10T, 10.9, 11T		268 – 325	363 – 441		293 – 358	397 – 485

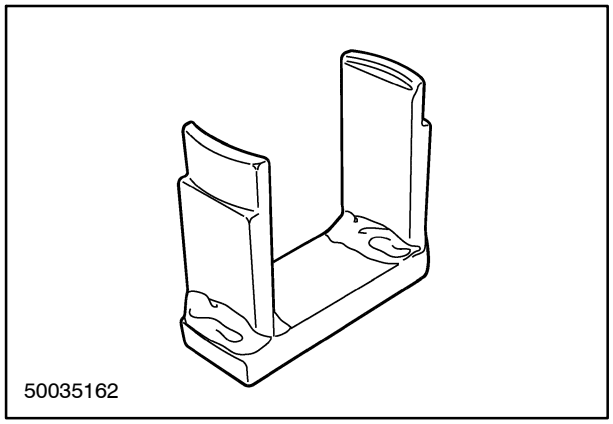
SPECIAL TOOLS

Detent Ball Retaining Tool FNH00081



1

EHSS Clutch Press Tool 380001352



2

12-1/2″ long piece of 3/32″ brazing rod (Procure Locally)

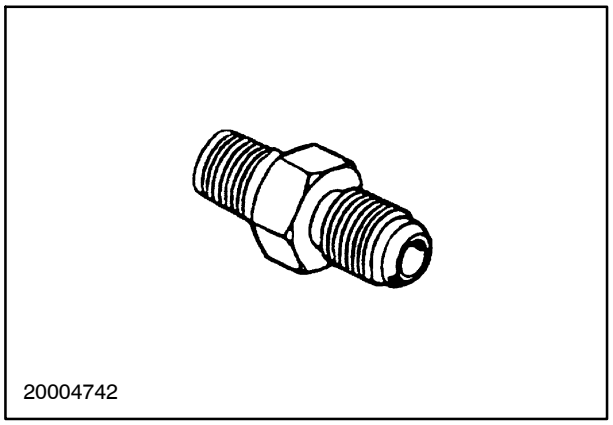
13″ long piece of 3/16″ brake tubing (Procure Locally)

500 psi Pressure Gauge

1/2″ ID (Nominal) Hose Clamp (Procure Locally)

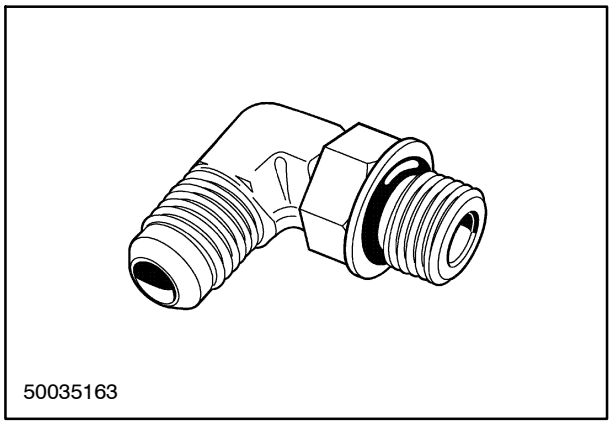
Hydraulic Test Fitting FNH00011

(1/8″ BSPT x 7/16-20 UNF)



3

7/16″–20 – JIC x 7/16″–20 O ring Boss
90° Elbow Test Fitting 380001600



4

DESCRIPTION OF OPERATION

The EHSS transmission provides 12 forward and 12 reverse speeds which are controlled by three shift levers.

The EHSS transmission is driven by a single flex plate which transmits power from the engine to the input shaft in the transmission.

The forward and reverse functions of the transmission are controlled by two hydraulic clutch packs in the transmission housing. The three control levers, Forward and Reverse, 1, Main Gears, 2, and Range Gears, 3 (figure 6), control the electronic signal to the EHSS controller. The controller then sends the signal to a solenoid operated hydraulic valve which determines hydraulic flow to the clutch packs.

NOTE: *The following procedures have to be performed, after starting the tractor, to allow the EHSS controller to be activated and transmission able to operate.*

- Operator in the seat.
- Inching pedal, 4 (figure 7), cycled

The hydraulic fluid is sent to the clutch packs, pressurized by a separate tandem type oil pump, located on the right side, of the rear transmission housing. The oil is supplied from the common reservoir of the transmission and differential housing.

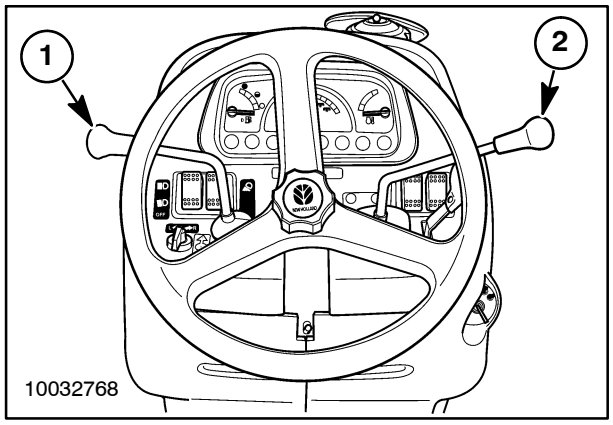
If no forward or reverse direction is signaled, pressurized fluid opens a relief valve and the fluid is returned to the reservoir, through the oil cooler. A portion of the fluid is sent through the clutch pack assembly for lubrication purposes.

The transmission is divided into three compartments. The front compartment contains the shuttle clutch packs and the forward and reverse gears. The center compartment contains the synchronized main gears, 1st through 4th, while the rear compartment contains the range gears, Low, Medium and High.

The main transmission gear shift lever is mounted on the dash panel to the right of the steering column. The shuttle shift lever is located on the dash panel to the left of the steering column. The range gear shift lever is located on the left fender, next to the operators seat.

While the main transmission gears are synchronized, the range gears are not. The range gears are changed through sliding gears located in the rear compartment of the transmission.

The oil level dipstick is located on the transmission top cover.



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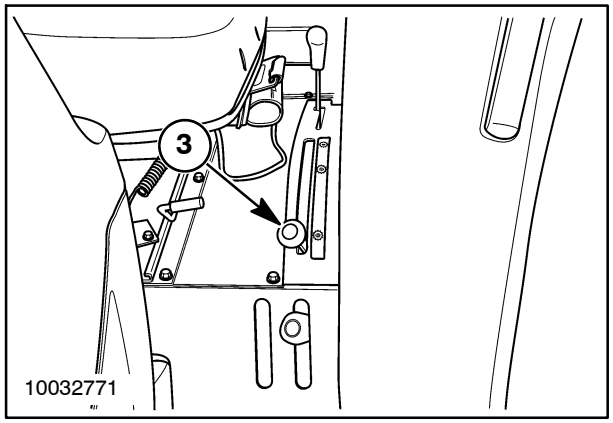

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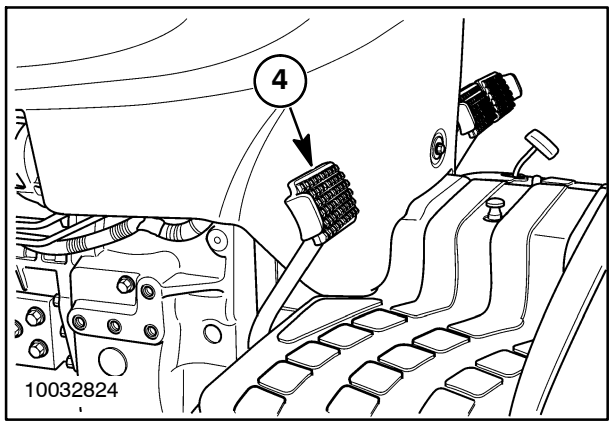

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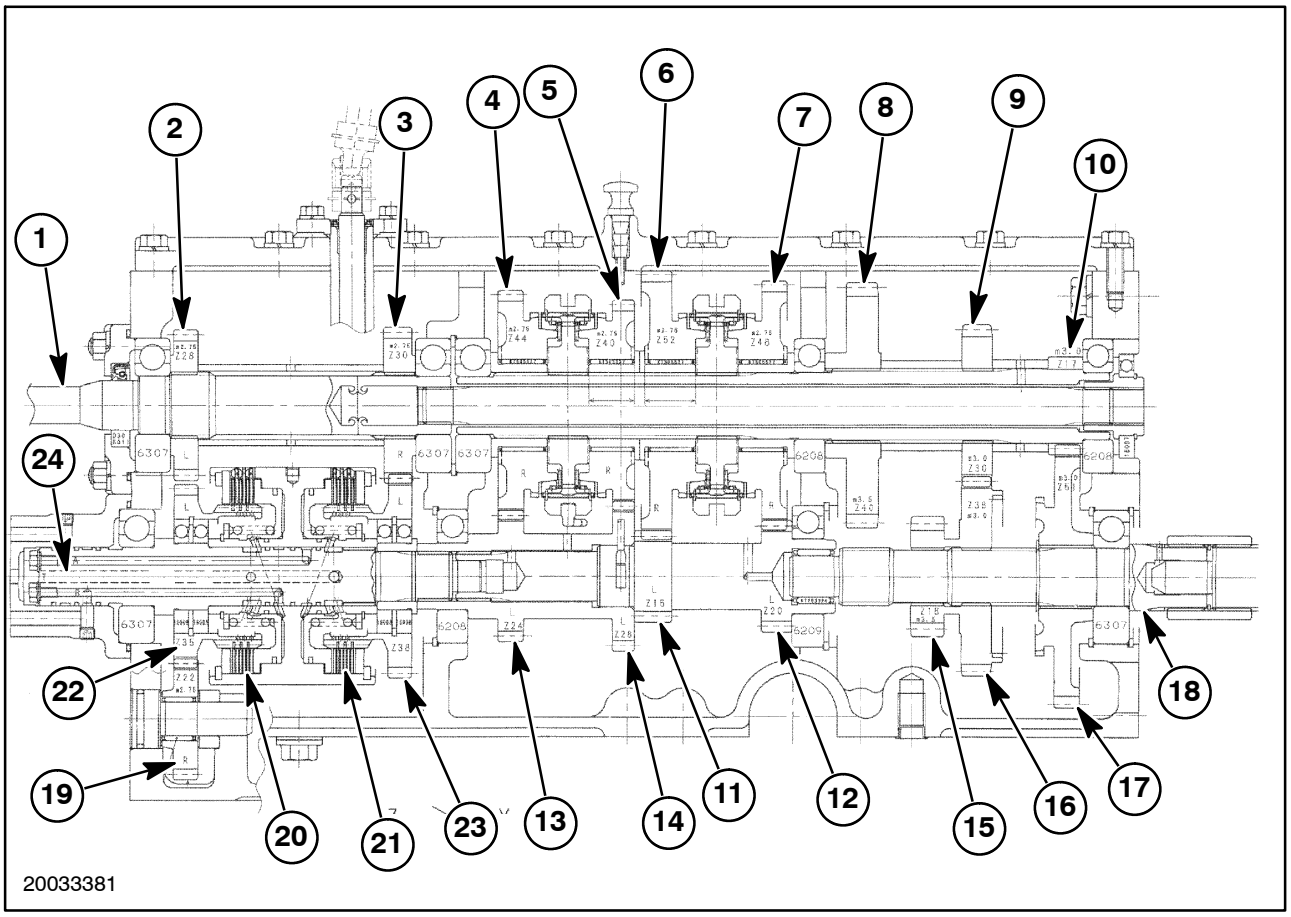
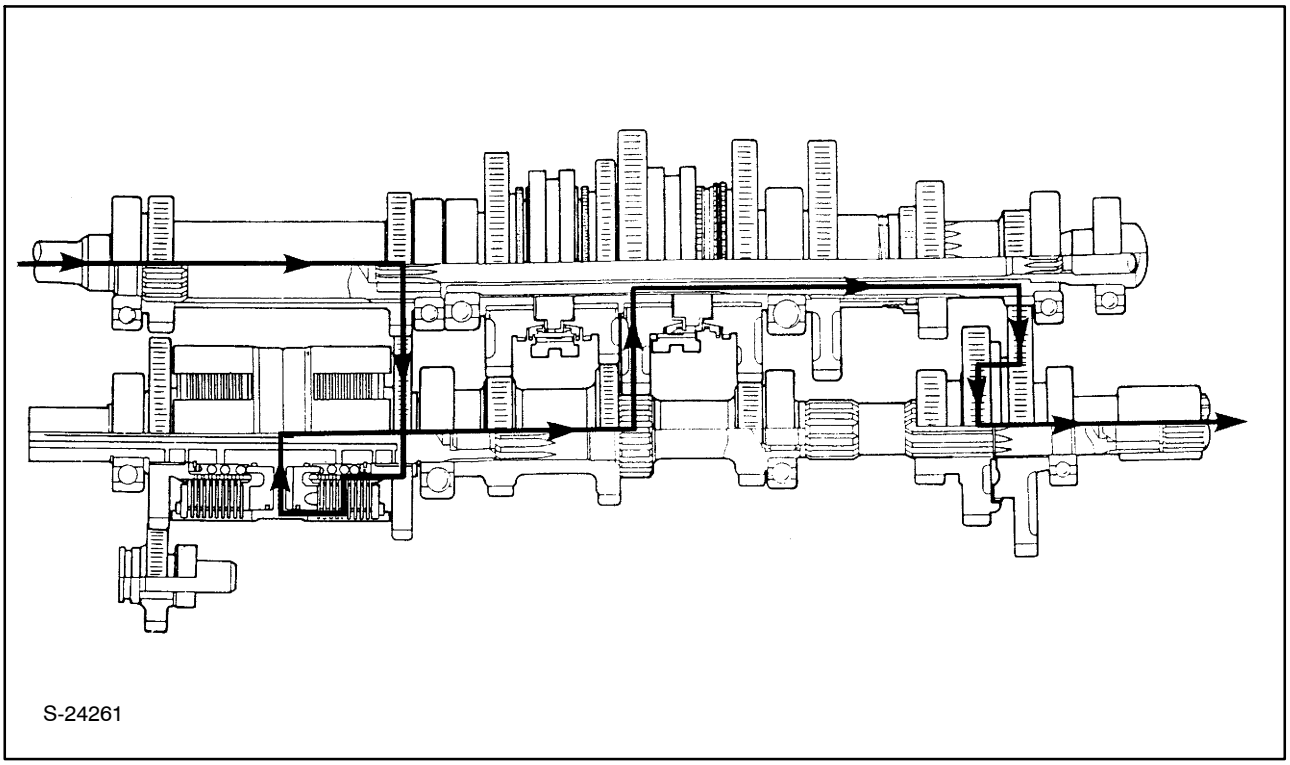


8

Cross Section Drawing of Transmission with Gear List

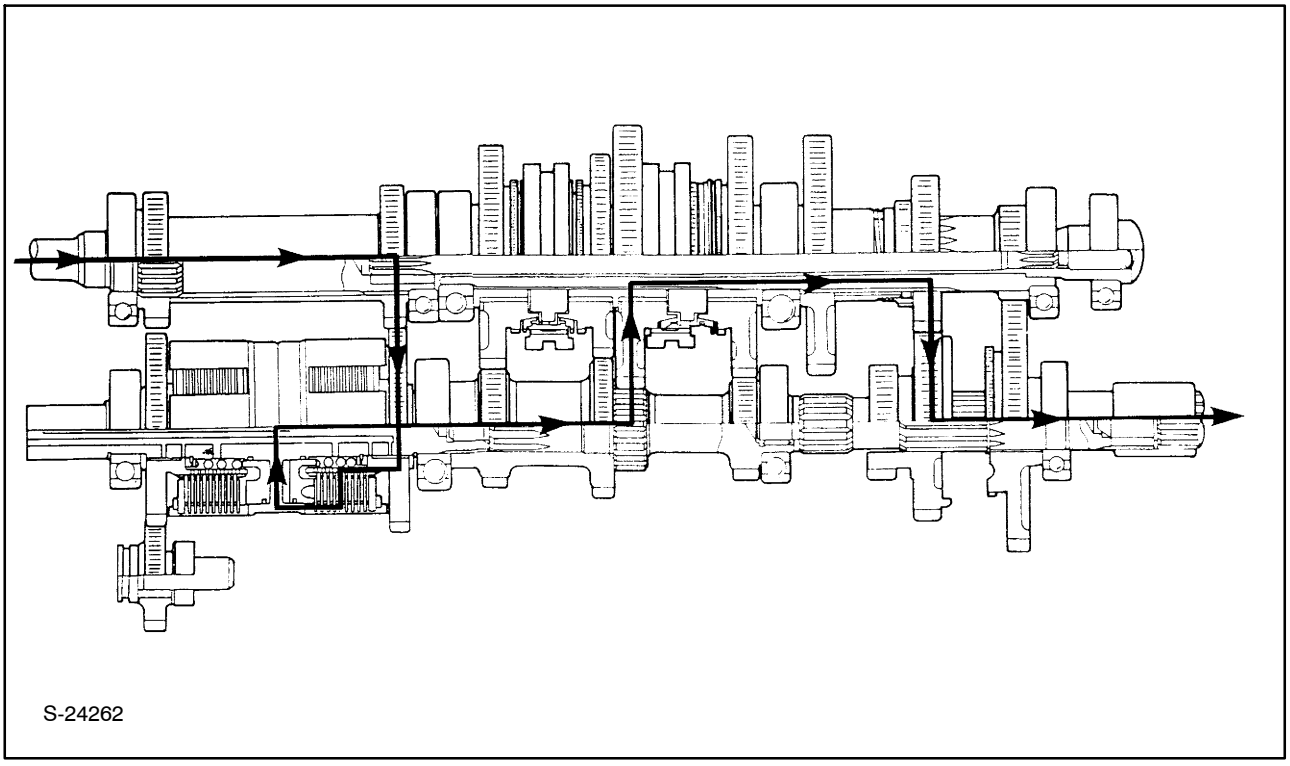
1. Transmission Drive Input Shaft
2. Fixed Gear (Reverse) 28T
3. Fixed Gear (Forward) 30T
4. 3rd Main Counter Gear 44T
5. 4th Main Counter Gear 40T
6. 1st Main Counter Gear 52T
7. 2nd Main Counter Gear 48T
8. Hi Range Fixed Gear 40T
9. Middle Range Fixed Gear 26T
10. Countershaft/Low Range Gear 16T
11. Countershaft/Main Gear (1st) 16T
12. Countershaft/Main Gear (2nd) 20T
13. Main Gear (3rd) Fixed 24T
14. Main Gear (4th) Fixed 28T
15. Range Gear (High) Sliding 18T
16. Range Gear (Middle) Sliding 32T
17. Range Gear (Low) Fixed 51T
18. Rear Main Shaft
19. Reverse Idler Gear 22T
20. Reverse Clutch Assembly
21. Forward Clutch Assembly
22. Reverse Counter Gear 35T
23. Forward Counter Gear 38T
24. Shuttle Clutch Shaft

POWERFLOW (ALL DIAGRAMS SHOWN WITH FORWARD CLUTCH PACK ENGAGED)



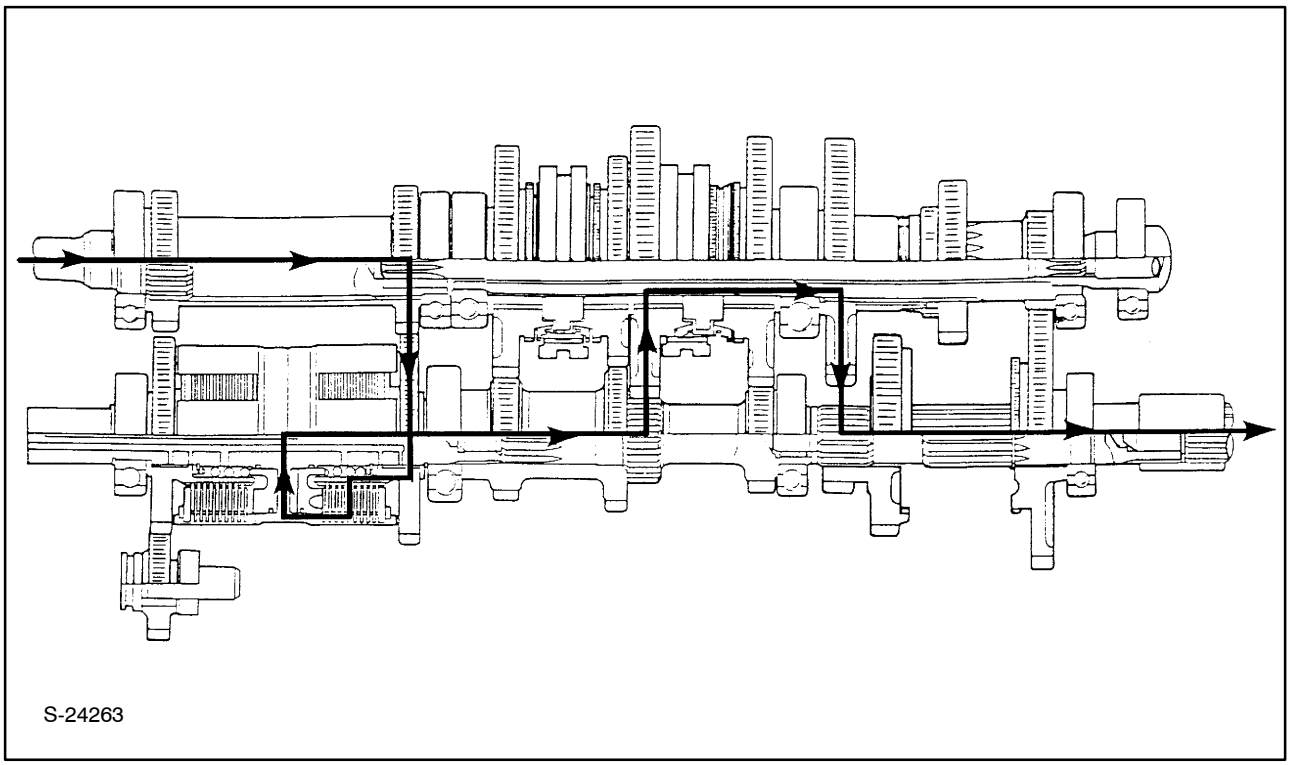
9

Power Flow - Speed 1 (R1) - 1st Main - Low Range



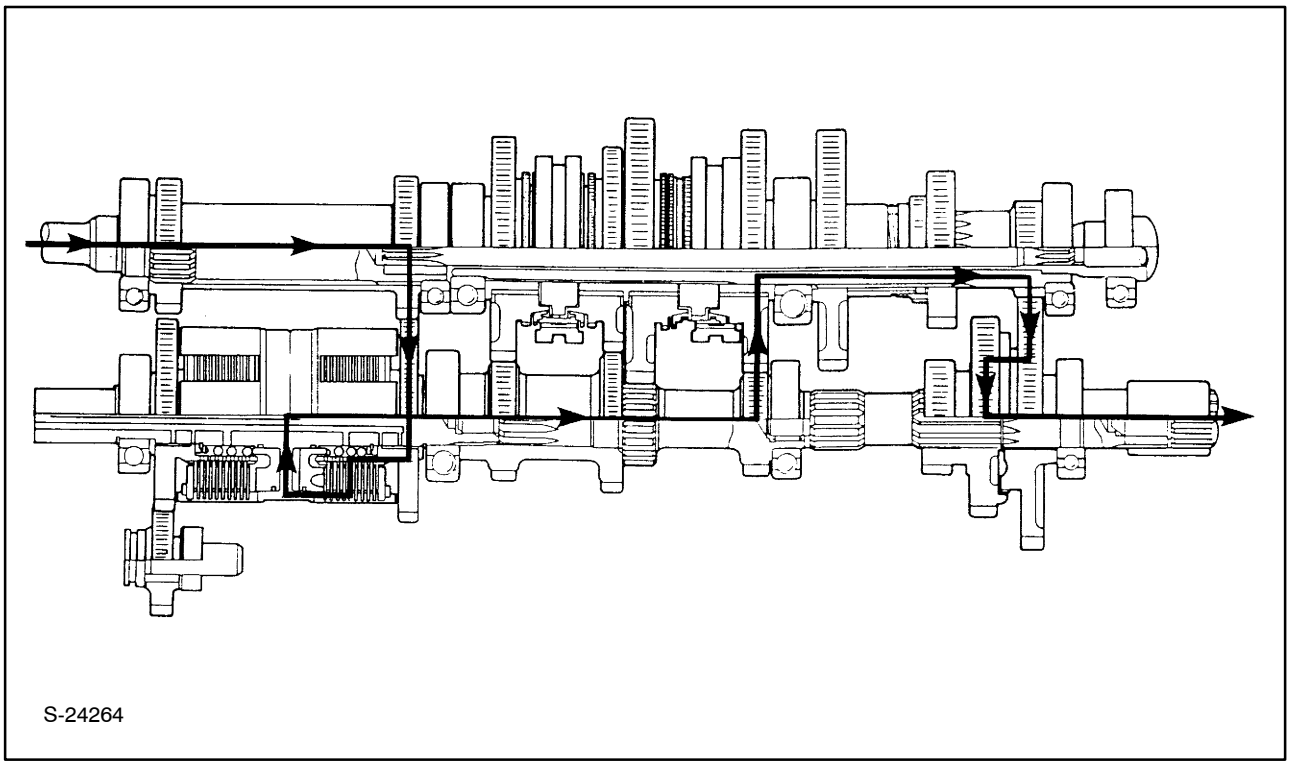
10

Power Flow - Speed 5 (R5) - 1st Main - Middle Range



11

Power Flow - Speed 9 (R9) - 1st Main - High Range



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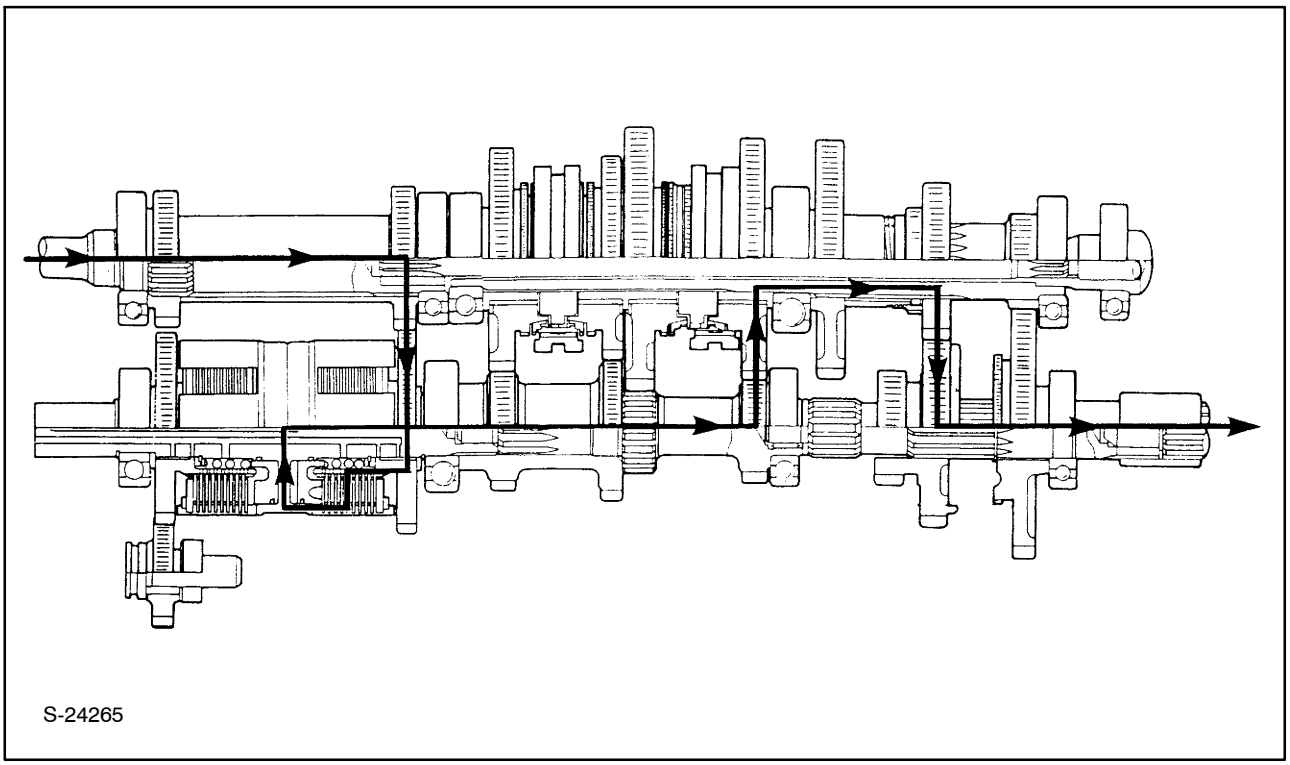
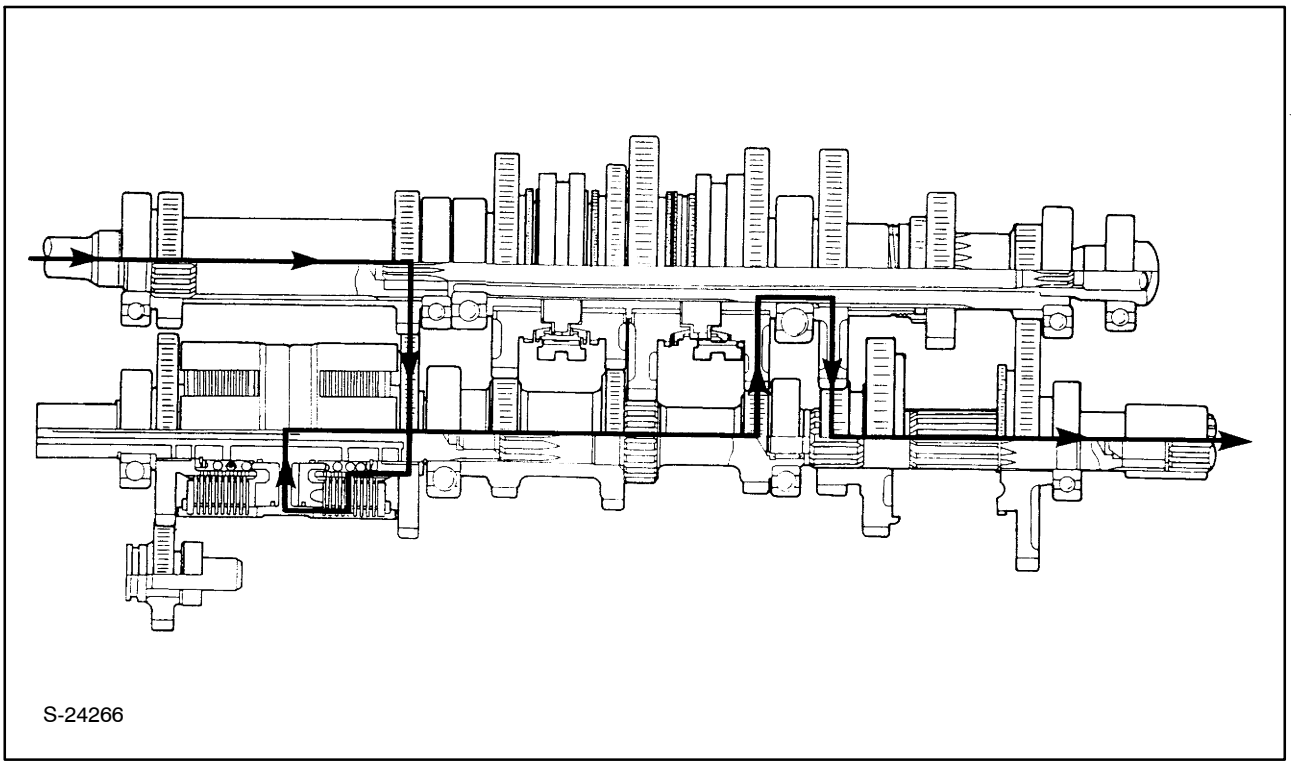
Power Flow - Speed 2 (R2) - 2nd Main - Low Range



13

Power Flow - Speed 6 (R6) - 2nd Main - Middle Range



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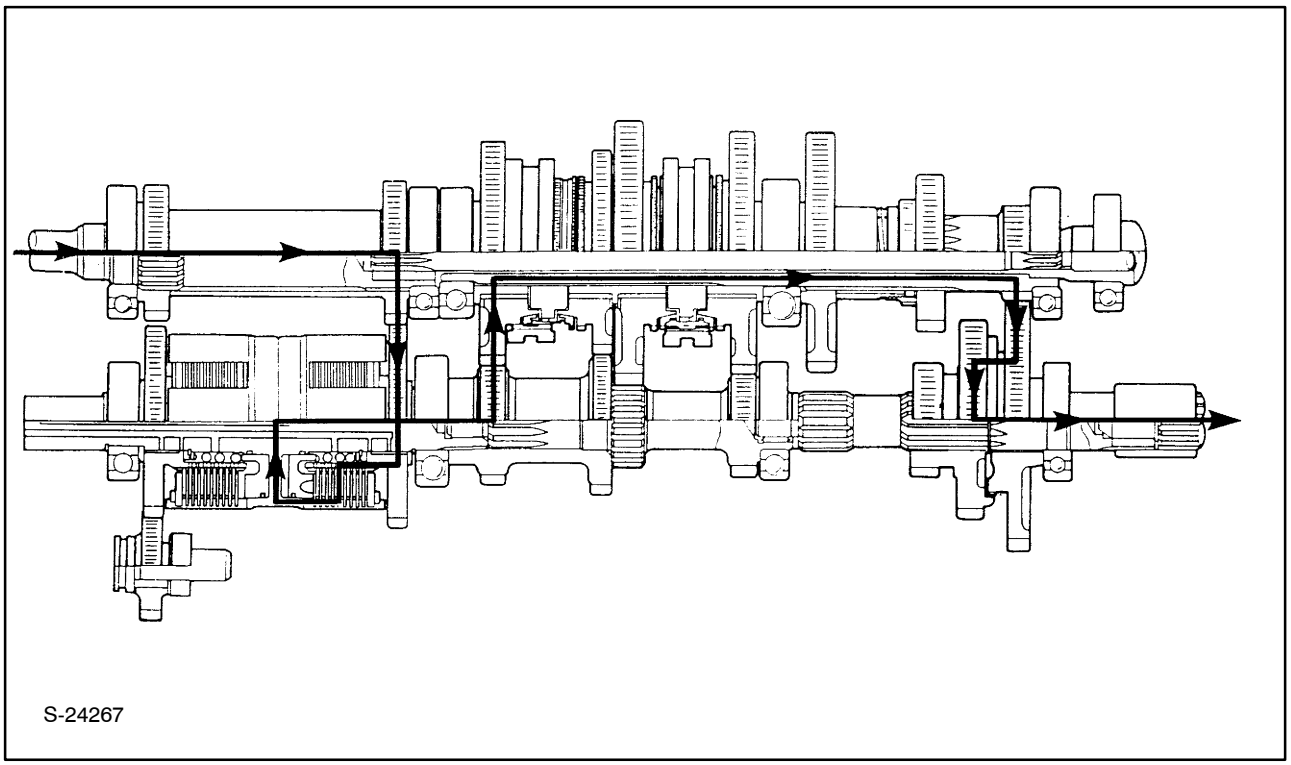
Power Flow - Speed 10 (R10) - 2nd Main - High Range



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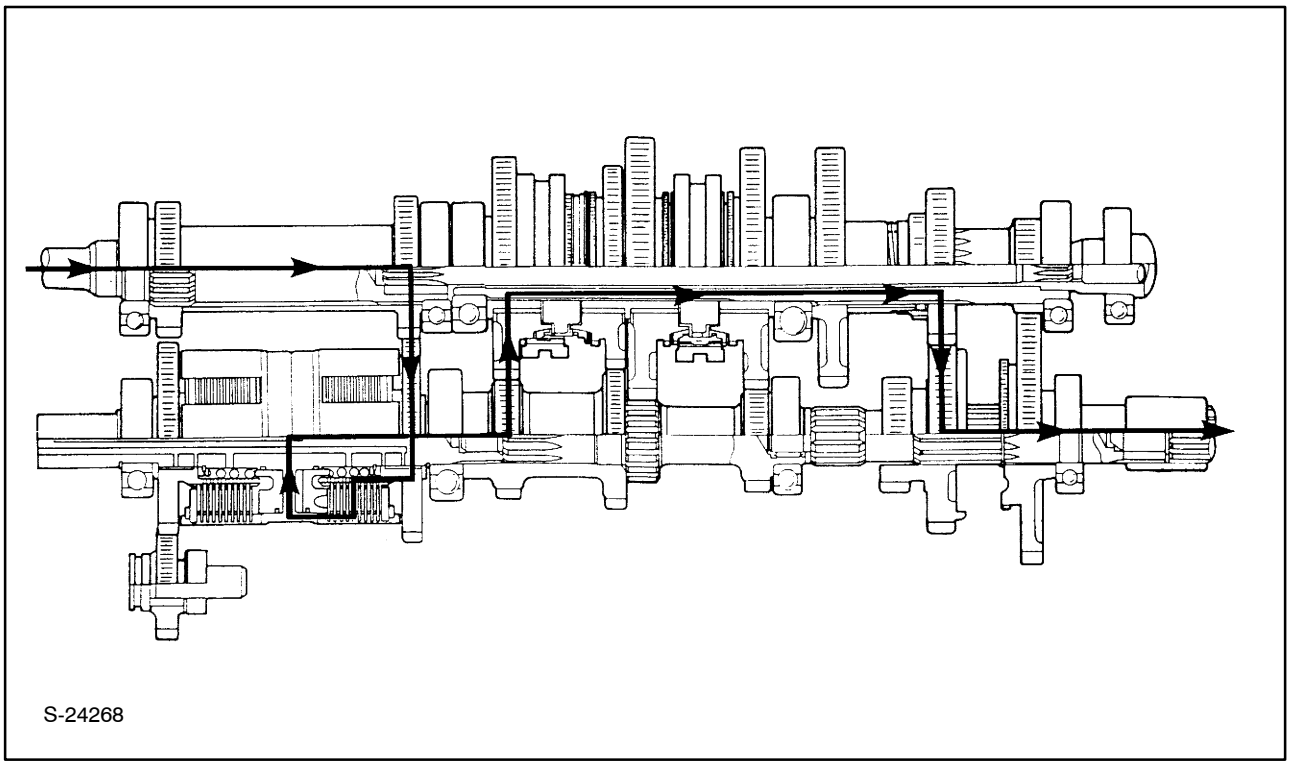
Power Flow - Speed 3 (R3) - 3rd Main - Low Range



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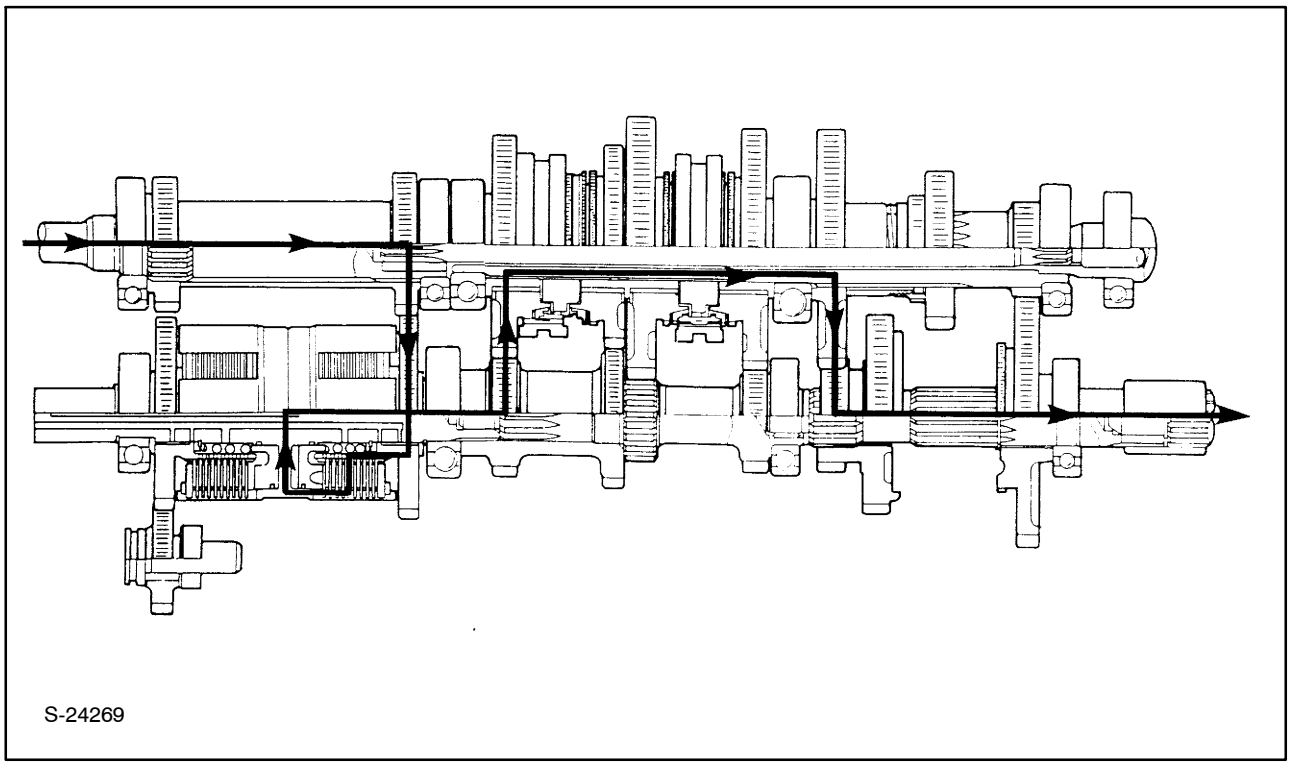
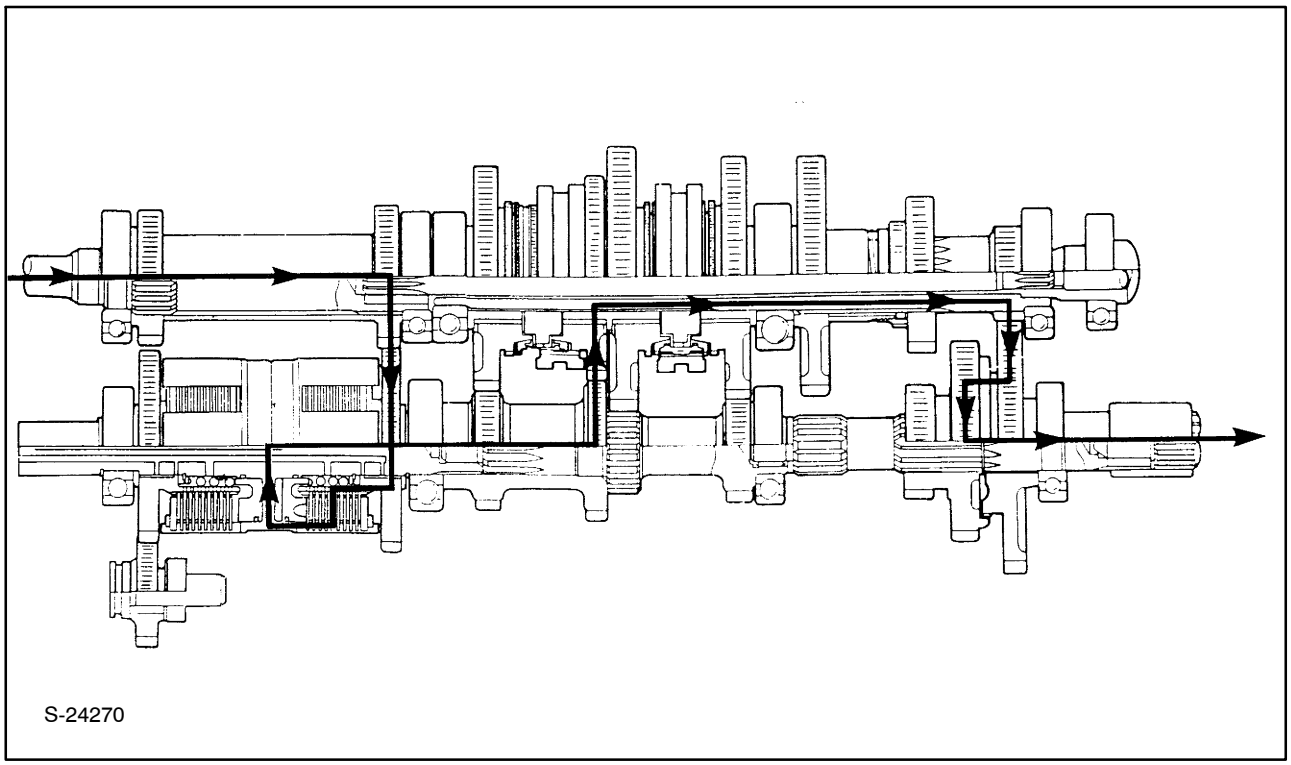
Power Flow - Speed 7 (R7) - 3rd Main - Middle Range



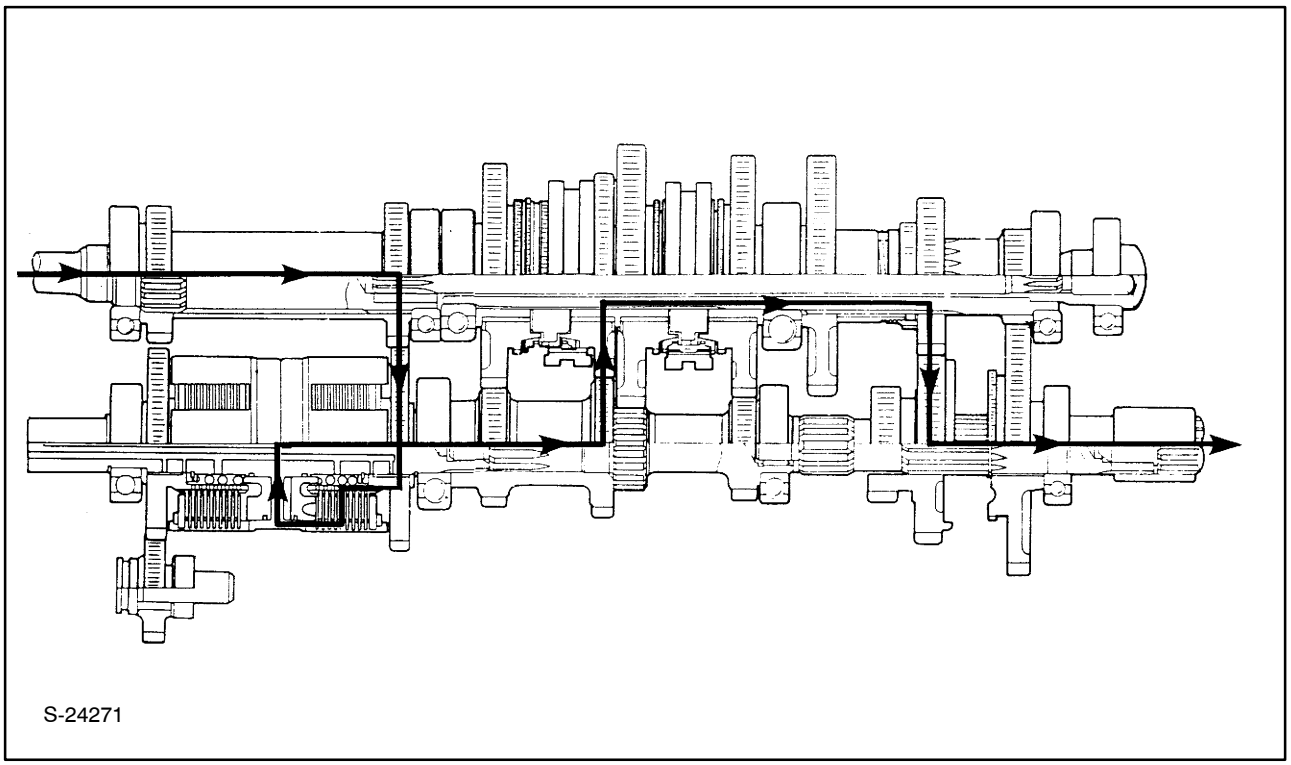
17

Power Flow - Speed 11 (R11) - 3rd Main - High Range



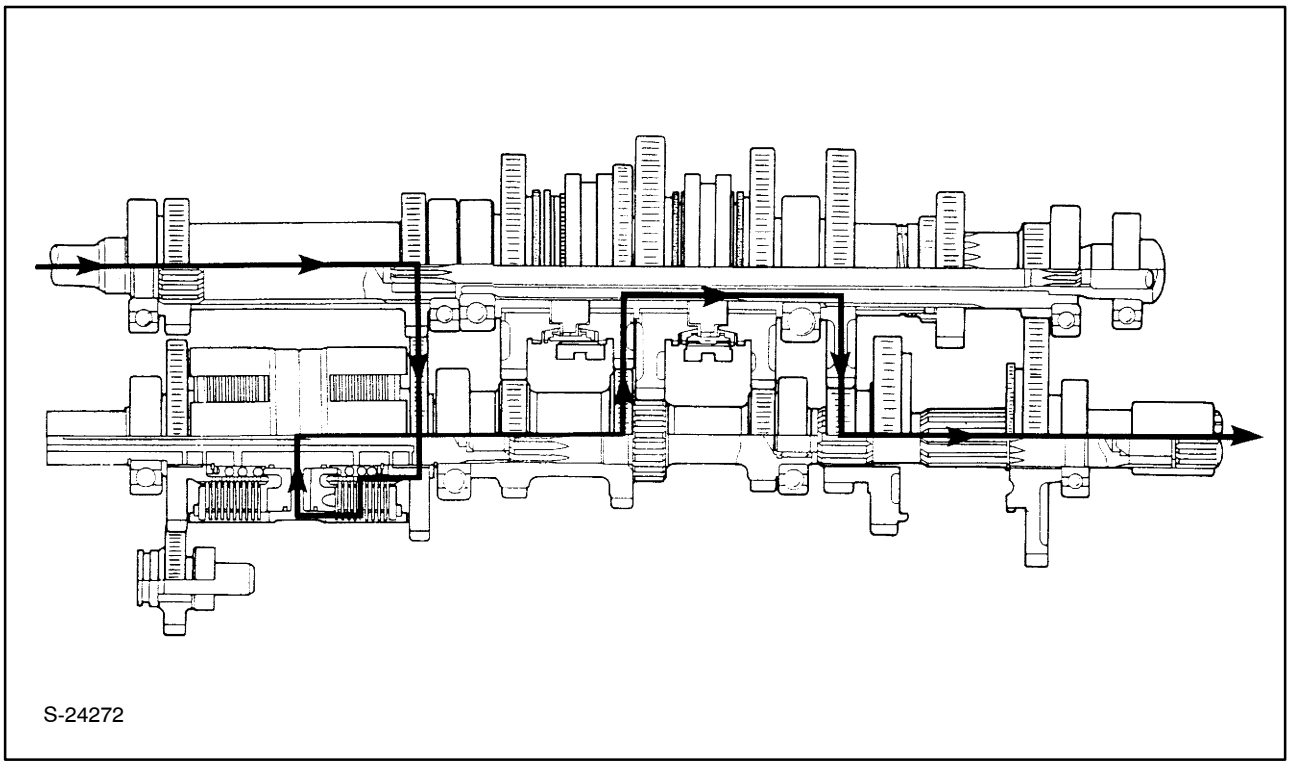
18

Power Flow - Speed 4 (R4) - 4th Main - Low Range



19

Power Flow - Speed 8 (R8) - 4th Main - Middle Range



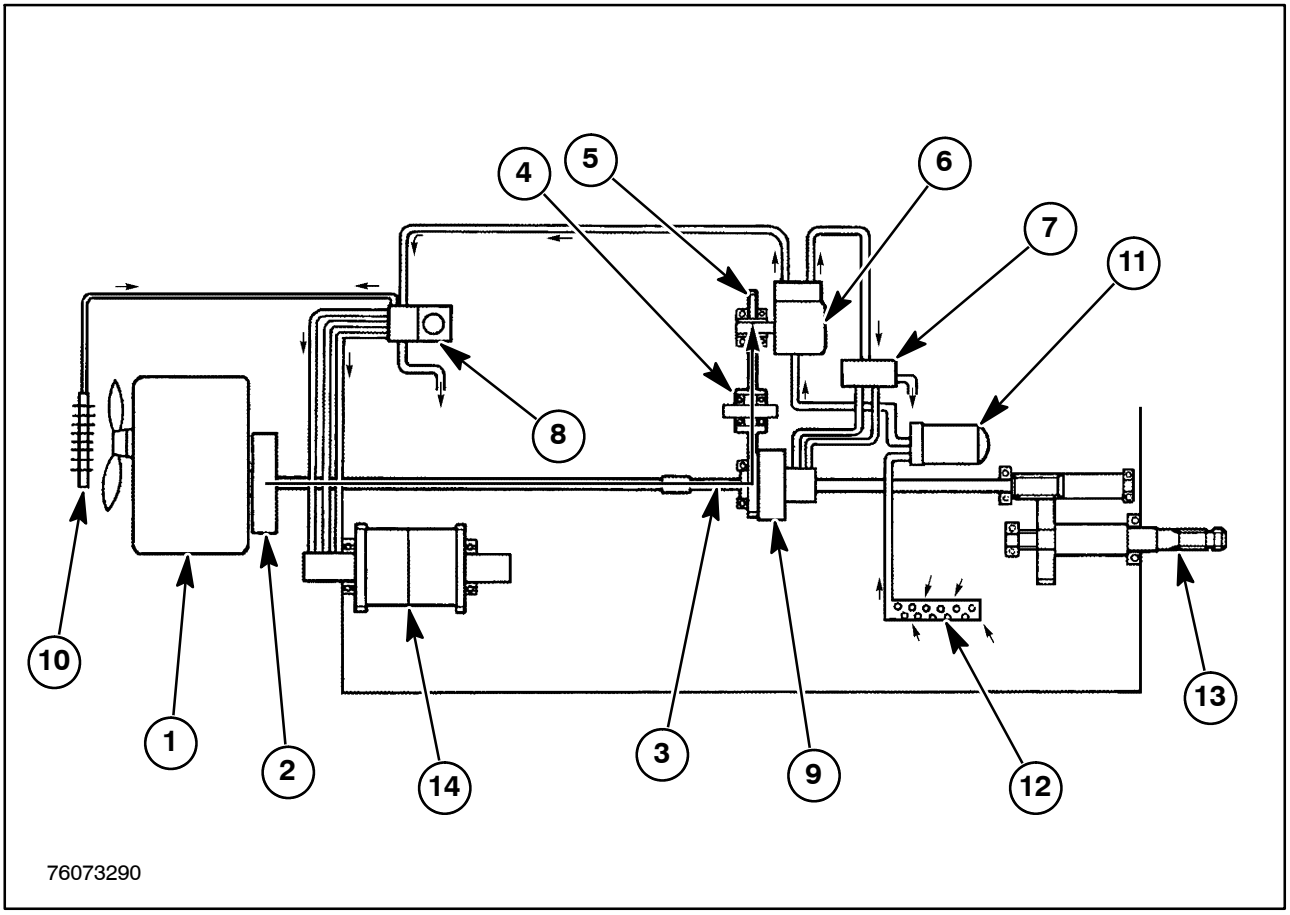
20

Power Flow - Speed 12 (R12) - 4th Main - High Range

HYDRAULIC FLOW DIAGRAMS

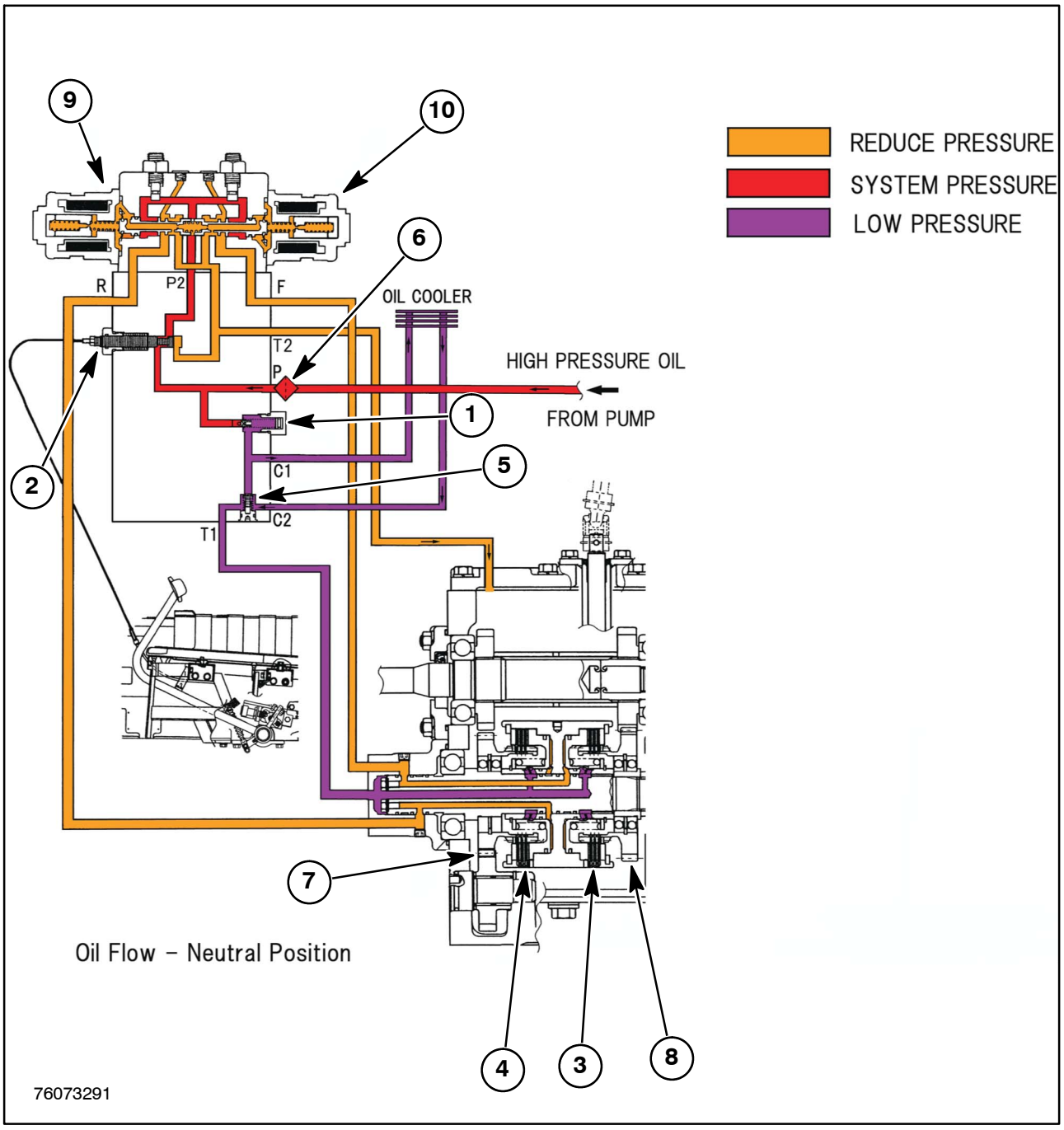
OIL PUMP FOR EHSS AND PTO CLUTCH

The oil pump for the EHSS and PTO clutch is located on the center housing in front of the right wheel shaft housing. When the engine is running, power flows to the oil pump gear (30T), 5, by means of the idle gear (42T), 4, and the gear (38T), 3, on the PTO shaft, from the flywheel. The oil pump gear and oil pump are connected with splines. The oil pump supplies 12.8 lpm (3.4 gpm) of oil to the EHSS control valve while engine is running at 2900 rpm.



21

1. Engine
2. Flywheel
3. PTO shaft with fixed gear (38T)
4. Idler gear (42T)
5. Oil pump gear (30T)
6. Tandem type oil pump
   - Front side: For PTO Clutch 6.08 lpm (1.61 gpm)
   - Rear side: For EHSS13 lpm (3.43 gpm)
7. PTO Clutch control valve
8. EHSS control valve
9. PTO clutch package
10. Oil cooler
11. Oil filter
12. Strainer
13. Rear PTO shaft
14. EHSS clutch pack



22

2410 and 2420

Neutral Position

1. System Pressure Relief Valve
2. F/R Clutch Cutoff Valve
3. Forward Clutch Assembly
4. Reverse Clutch Assembly
5. Check Valve
6. Oil Filter
7. Reverse Counter Gear
8. Forward Counter Gear
9. Reverse Solenoid
10. Forward Solenoid

Neutral Position

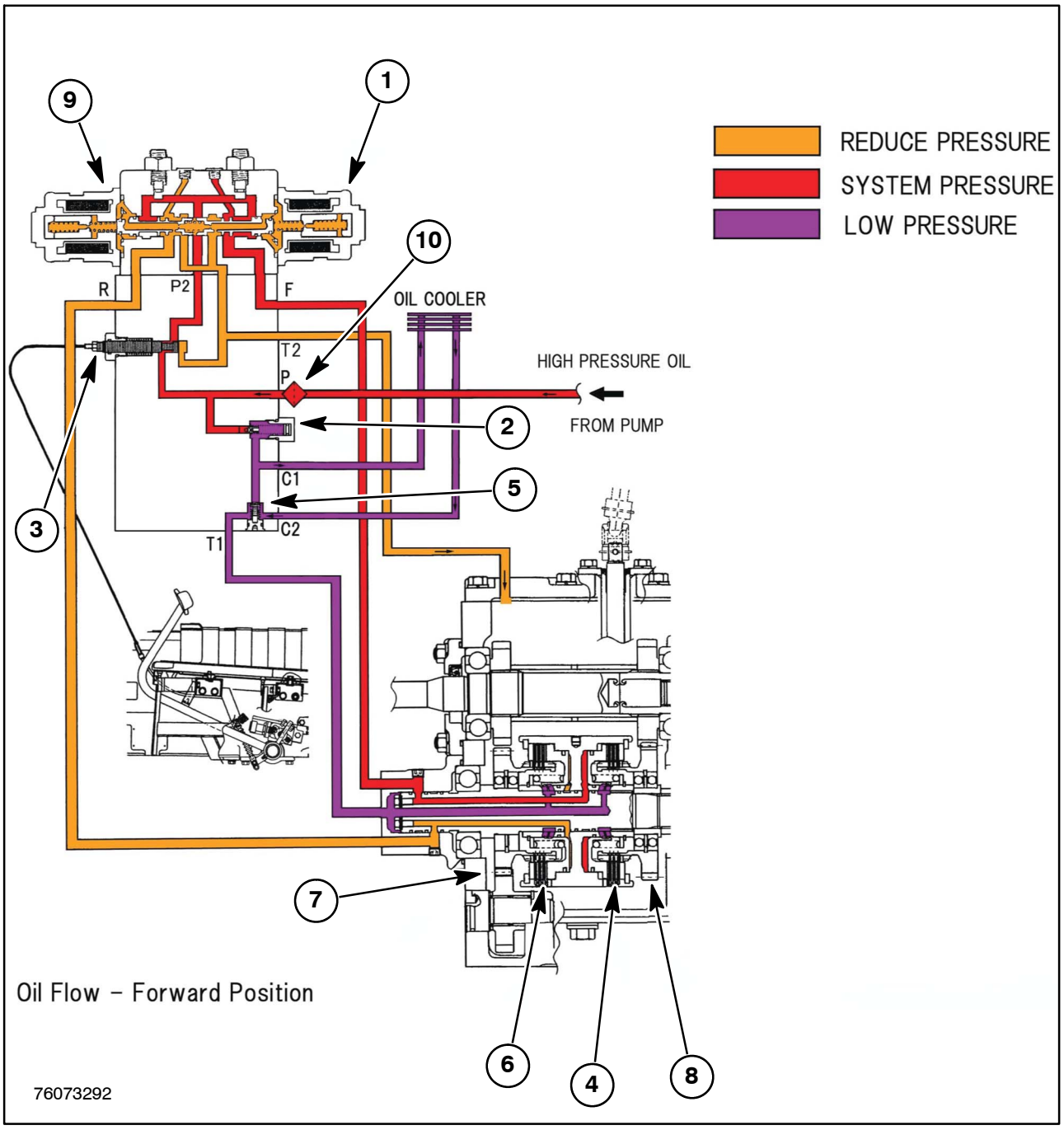
Oil Flow – Neutral diagram neither the forward or reverse solenoids are energized and the inching pedal is up.

Flow from the pump enters the EHSS manifold valve at port P. The system relief valve, 1, regulates the system pressure to 22.7 bar (330 psi). Oil passes through the F/R clutch cutoff valve, 2, to the EHSS solenoid valve assembly. Neither solenoid valve is energized by the EHSS controller, leaving the passages to both clutches closed.

Once 22.7 bar (330 psi) is developed in the circuit, the system relief valve poppet, 1, unseats and permits fluid flow, out of port C1, to the oil cooler.

The forward and reverse clutch packs, 3 and 4, can vent through the check valve, 5.

The lubrication circuit oil, in C2, enters the clutch packs for lubrication.



23

2410 and 2420

Forward Position

1. Forward Solenoid
2. System Pressure Relief Valve
3. F/R Clutch Cutoff Valve
4. Forward Clutch Assembly
5. Check Valve
6. Reverse Clutch Assembly
7. Reverse Counter Gear
8. Forward Counter Gear
9. Reverse Solenoid
10. Oil Filter

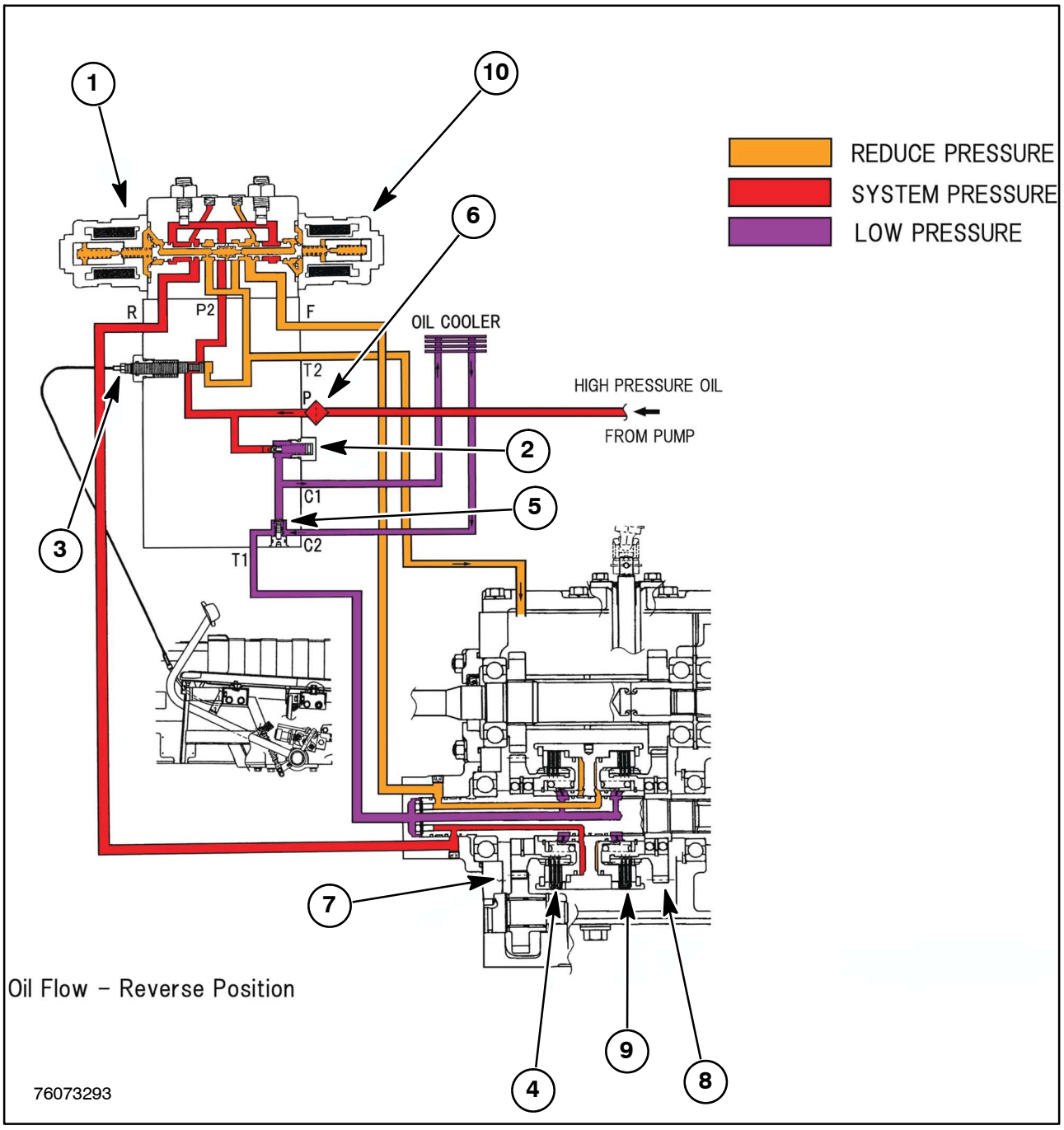
Forward Position

Oil Flow – Forward diagram, the main inching pedal is up and the shuttle lever is in the forward position, energizing the forward solenoid, 1, and moving the valve to forward.

Flow from the pump enters the EHSS manifold valve at port P. The system relief valve, 2, regulates the system pressure to 22.7 bar (330 psi). Oil continues through the F/R clutch cutoff valve, 3, to the EHSS solenoid valve.

Pressurized oil in the solenoid valve is directed across the spool and into the forward clutch line, F. The pressurized oil applies the forward clutch, 4.

Once the forward clutch circuit, F, reaches a pressure of 330 psi, excess flow is flow directed to port C1. The oil goes through the cooler and into the lubrication circuit, via port T1. If the pressure in the cooler and lubrication circuit exceeds 10 bar (145 psi), oil will pass through the oil cooler check valve, 5, and through the clutch packs.



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2410 and 2420

Reverse Position

1. Reverse Solenoid
2. System Pressure Relief Valve
3. F/R Clutch Cutoff Valve
4. Reverse Clutch Assembly
5. Check Valve
6. Oil Filter
7. Reverse Counter Gear
8. Forward Counter Gear
9. Forward Clutch Assembly
10. Forward Solenoid

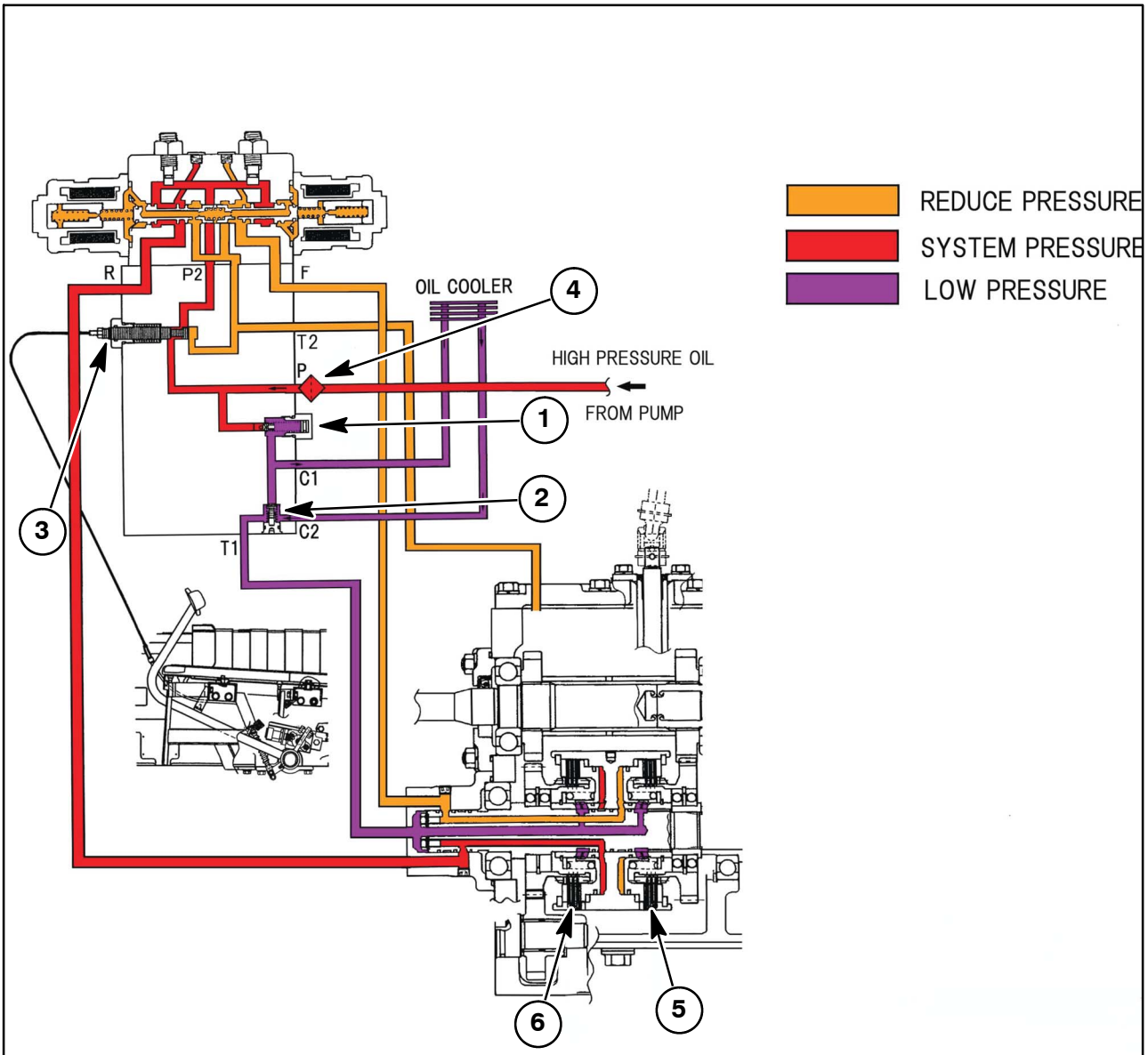
Reverse Position

Oil Flow – Reverse diagram the inching pedal is up and the shuttle lever is in reverse, energizing the reverse solenoid, 1, moving the valve to reverse.

Flow from the pump enters the EHSS manifold valve at port P. The system relief valve, 2, regulates the system pressure to 22.7 bar (330 psi). Oil continues through the F/R clutch cutoff valve, 3, to the EHSS solenoid valve.

Pressurized oil in the solenoid valve is directed across the spool and into the reverse clutch line, R. The pressurized oil applies the reverse clutch, 4.

Once the reverse clutch circuit, R, reaches a pressure of 22.7 bar (330 psi), excess flow is directed to port C1. From here the oil goes through the cooler and into the lubrication circuit. If the pressure in the cooler and lubrication circuit exceeds 10 bar (145 psi), oil will pass through the oil cooler check valve, 5, and through the clutch packs.



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2410 and 2420

Reverse Position - Inching Pedal Depressed

1. System Pressure Relief Valve
2. Oil Cooler Check Valve
3. Lube Cut-off Valve
4. Oil Filter
5. Forward Clutch Assembly
6. Reverse Clutch Assembly

LUBE CUTOFF VALVE OPERATION

Inching Pedal Depressed

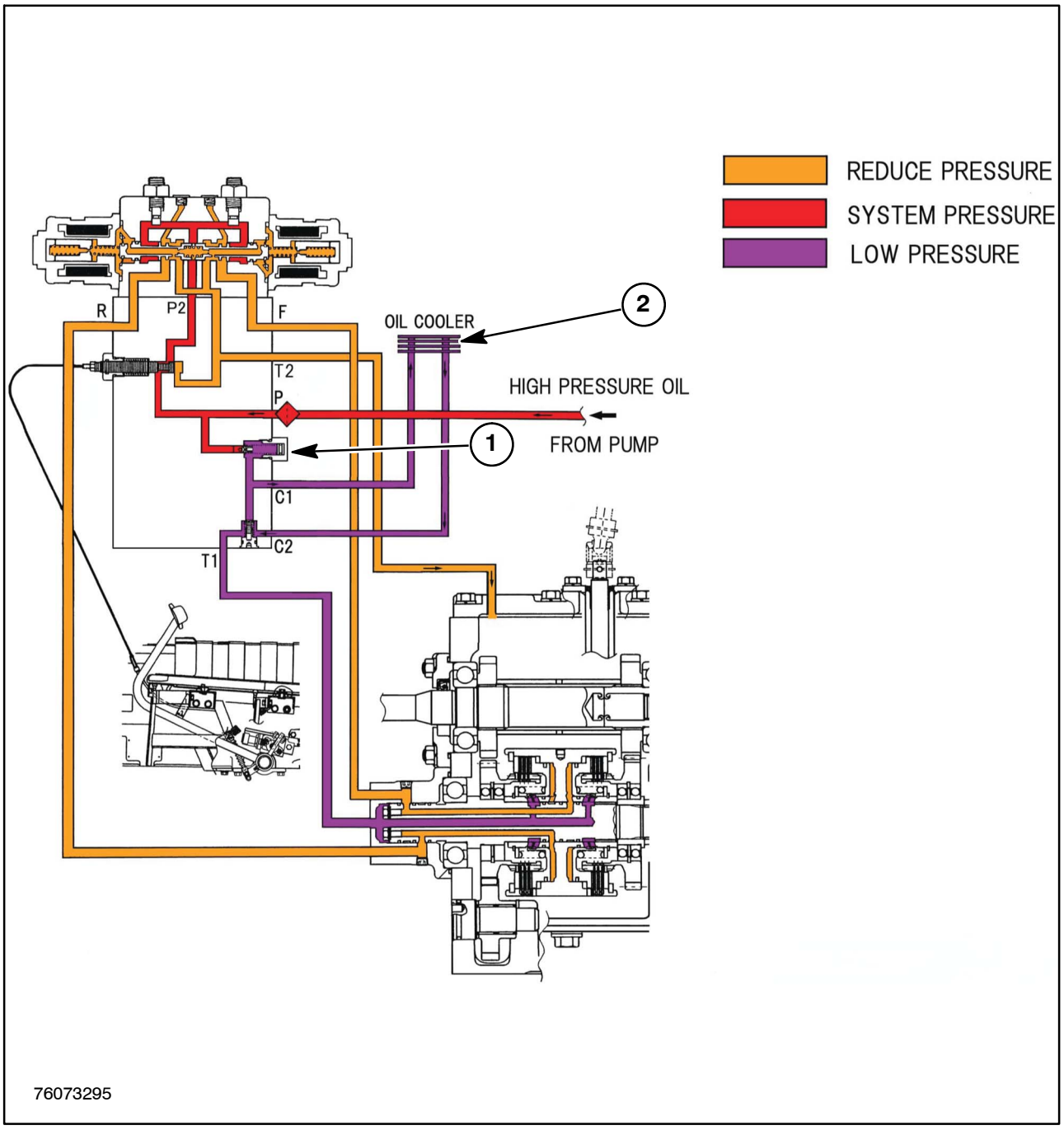
After system pressure is developed, the system relief valve, 1, diverts all remaining flow to the lubrication circuit via port C1. Oil flows from the EHSS manifold valve port C1 to the oil cooler, returns to the EHSS manifold valve port C2 and is routed internally to the transmission lubrication circuit port T1.

If the pressure in the oil cooler and lubrication circuit is greater than 5 bar (72.5 psi), the oil cooler check valve poppet, 2, unseats and allows flow through the oil cooler check valve and through the clutch packs.

Oil Flow – Reverse, Inching Pedal Down diagram represents the EHSS hydraulic system response when the reverse solenoid is energized and the main clutch pedal is fully depressed.

Flow from the pump enters the EHSS manifold valve at port P. The system relief valve, 1, regulates the system pressure to 22.7 bar (330 psi).

The lube cutoff valve, 3, is closed and the pressurized oil is cut off from the solenoid valve. The reverse clutch is disengaged. Oil is directed through the system relief valve and into the oil cooler and lubrication circuit.



26

2410 and 2420

System Relief Valve Assembly

1. System Pressure Relief Valve

2. Oil Cooler

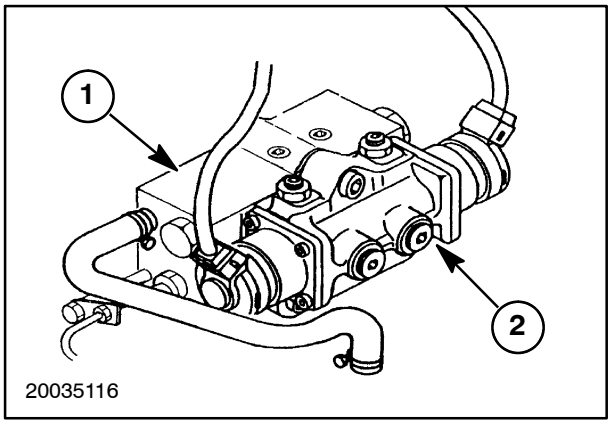
SYSTEM RELIEF VALVE ASSEMBLY OPERATION

The system relief valve, 1, is spring loaded and maintains a set pressure for proper operation of the forward and reverse clutch packs. The valve is adjustable and the adjustment is accessible on the outside of the valve body. The system relief valve is set at 22.7 bar (330 psi) pressure.

When the relief valve activates, the fluid relieved flows back to the reservoir via the oil cooler, 2, passage T1 and through the clutch packs.

EHSS MANIFOLD VALVE

The manifold valve, 1, is mounted between the transmission and EHSS solenoid valve, 2. The manifold valve receives oil from the pump and controls oil flow to the EHSS solenoid valve, the oil cooler, and lubrication circuit.



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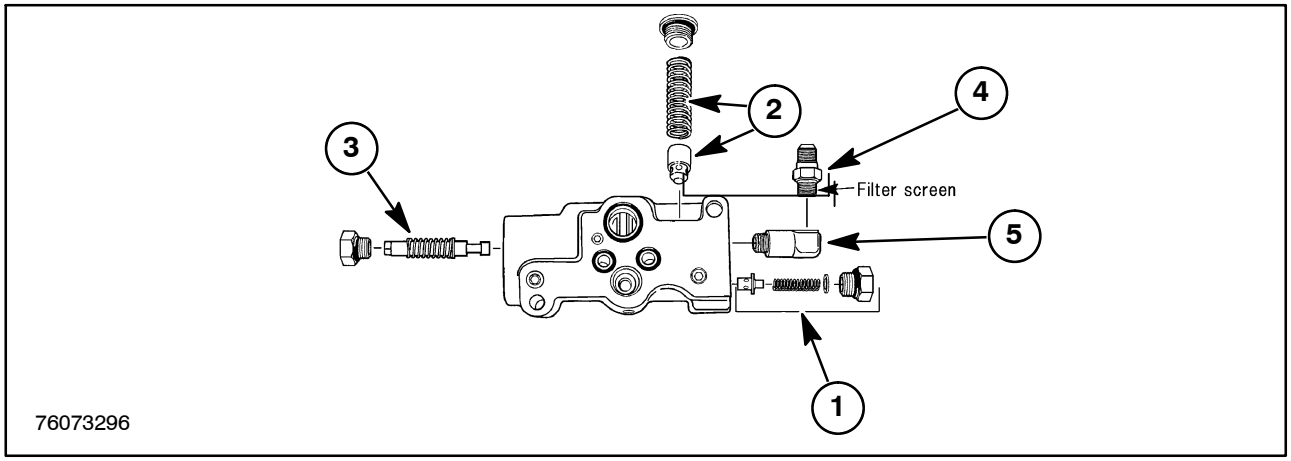
The manifold valve and fitting contains the following components:



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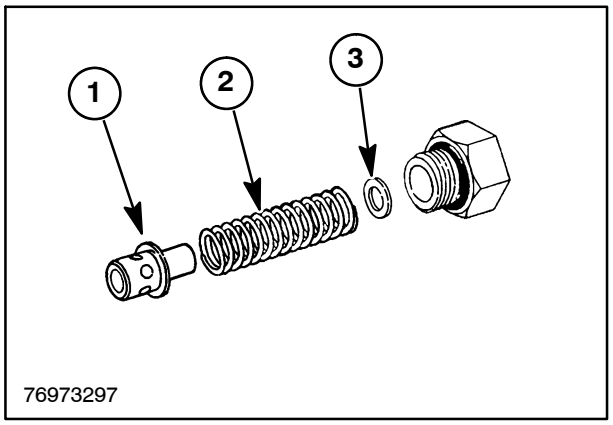
1. System Relief Valve
2. Check Valve
3. Forward/Reverse (F/R) Clutch Cutoff Valve
4. Pump Inlet Fitting with Internal Filtering Screen
5. Adapter

SYSTEM RELIEF VALVE

The system relief valve, 1, spring, 2, and shim, 3, set the maximum F/R clutch circuit pressure at 22.7 bar (330 psi).

Once system pressure builds to 22.7 bar (330 psi), a poppet in the system relief valve is unseated. After system pressure is developed, oil is diverted to the oil cooler and lubrication circuit.



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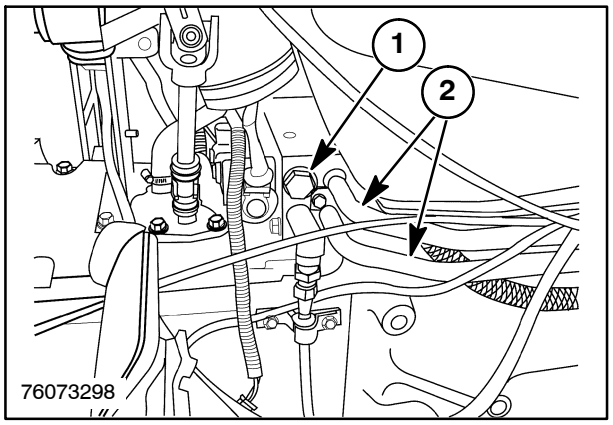
OIL COOLER RELIEF VALVE

The oil cooler check valve, 1, limits the maximum pressure in the oil cooler lines, 2, and lubrication circuit to 5 bar (72.5 psi). If the pressure in the circuit exceeds 5 bar (72.5 psi), the pressurized oil unseats the oil cooler check valve poppet, and is directed to the reservoir through the return line.

NOTE: *Not adjustable. Check for contamination in oil cooler check valve if pressure values are not within specification.*



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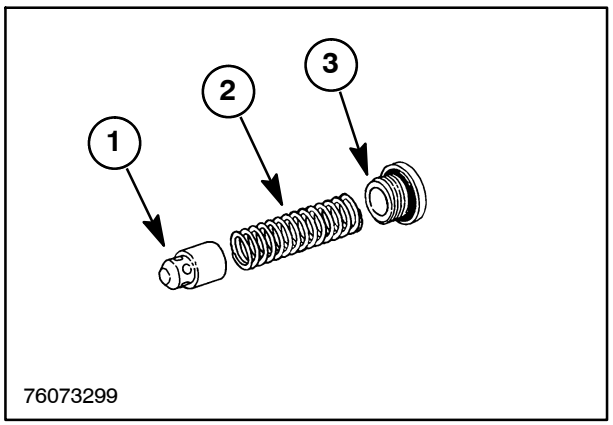
OIL COOLER RELIEF VALVE COMPONENTS

1. Poppet
2. Spring
3. Cap



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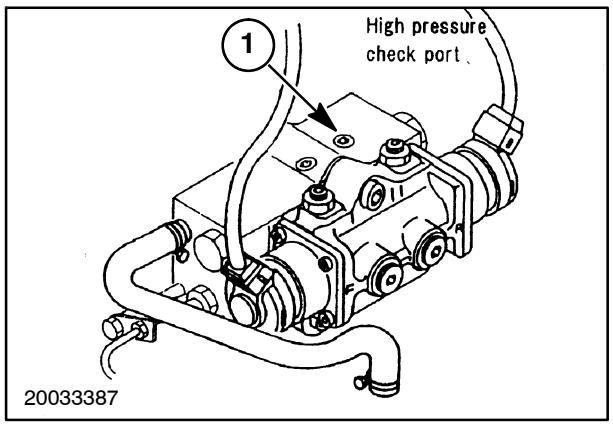
ADJUSTMENT

EHSS – SYSTEM RELIEF VALVE

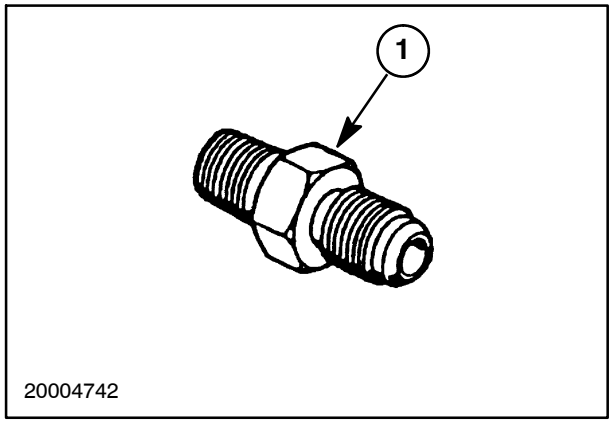
IMPORTANT: *Be sure to have the tractor drive wheels off the ground when performing relief valve adjustment.*

1. Raise and support the tractor with suitable jackstands.
2. Place all three gear change levers in the neutral position.
3. Remove the plug, 1, from the high pressure test port of the EHSS clutch valve.



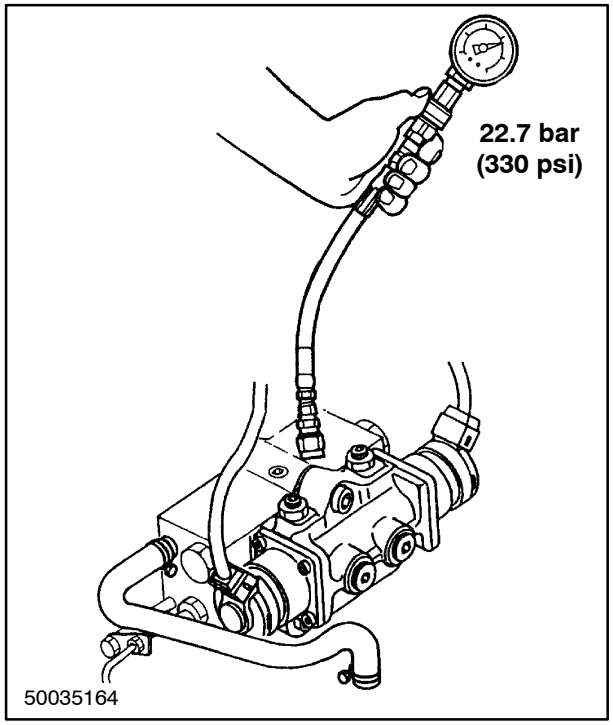
32

4. Install test fitting FNH00011, 1, in the port where the plug was removed.



33

5. Procure or manufacture a test hose with a 7/16 JIC, female, straight fitting, on one end, and a quick coupler for the pressure gauge on the opposite end.
6. Connect the straight, 7/16 JIC, female hose end to the FNH00011 fitting.
7. Connect a pressure gauge (0 – 500 psi) in the quick coupler on the opposite end of the hose.
8. Start the engine and set the throttle speed to 2700 rpm.
9. Read the maximum pressure on the gauge. The gauge should read 22.7 bar (330 psi) if adjustment is correct.



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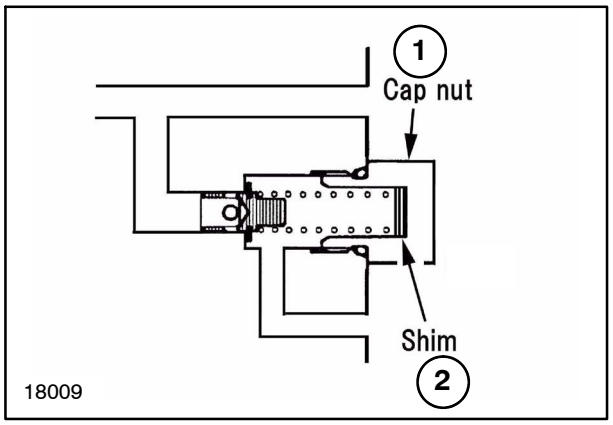
10. If system relief pressure needs to be adjusted, remove the relief valve cap, 1, and insert shim(s), 2, between the cap and spring.

NOTE: *One shim will change the relief pressure setting as follows:*

SHIM THICKNESS	PRESSURE CHANGE
0.1 mm (0.004″)	Approx. 0.2 bar (3.0 psi)
0.5 mm (0.020″)	Approx. 1 bar (14.5 psi)

11. Tighten the cap and recheck the pressure as in step 9.
12. Continue until pressure is set correctly.



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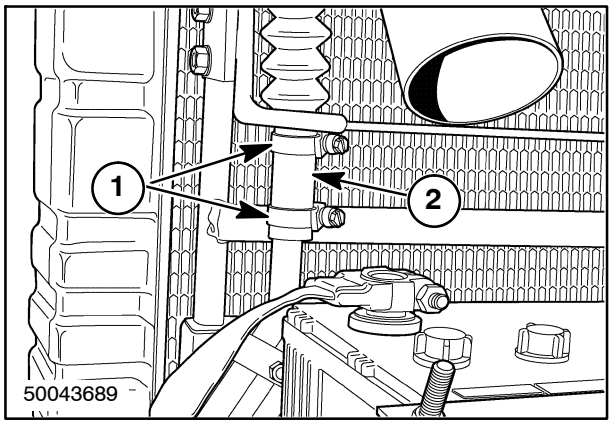
OIL COOLER AND LUBRICATION CIRCUIT PRESSURE TEST

1. With the engine off, move the shuttle lever to the neutral position and set the parking brake.
2. Remove the hose clamps, 1.
3. Remove the hose, 2, between the oil cooler and the cooler line.



36

4. Construct test hose as follows:

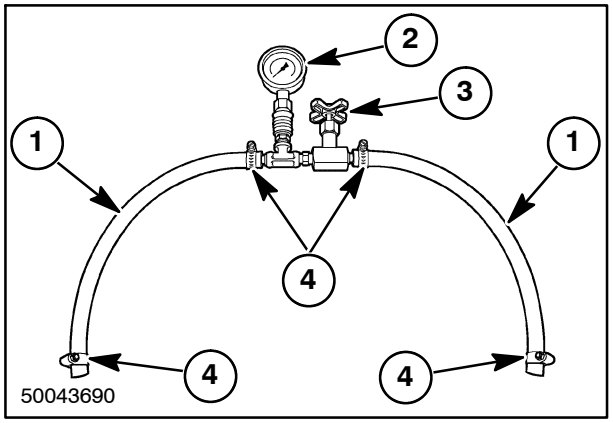
The pressure gauge and needle valve tool, is made up of:

Two sections of 1/2″ 300 psi rated hose, 1.

0 – 600 psi gauge, 2.

Needle type restriction valve, 3.

4 hose clamps, 4.



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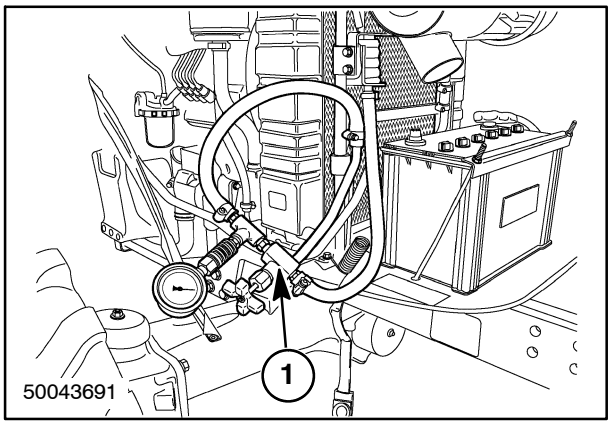
5. Place the pressure gauge and needle valve tool, 1, in series with the oil cooler and oil cooler line, on the inlet side of the oil cooler.

NOTE: *Make sure the valve arrow points with the direction of the flow. The pressure gauge should be installed in front of the restriction valve for this test.*

6. Ensure the valve is open, start the tractor, and set the rpm to 2700. Allow the oil to warm up to operating temperature. With the needle valve open, the gauge will read the pressure required for oil to pass through the cooler and lubrication circuit. This pressure should be less than the 4–6 bar (58–87 psi) setting of the relief valve.
7. Slowly close the gate valve until the pressure stops increasing, indicating the relief valve setting.
8. The pressure specification of the relief valve is 4–6 bar (58–87 psi).

NOTE: *Do not adjust pressure with shims. This is a safety relief valve only. Check for contamination if pressure values are not within specification.*



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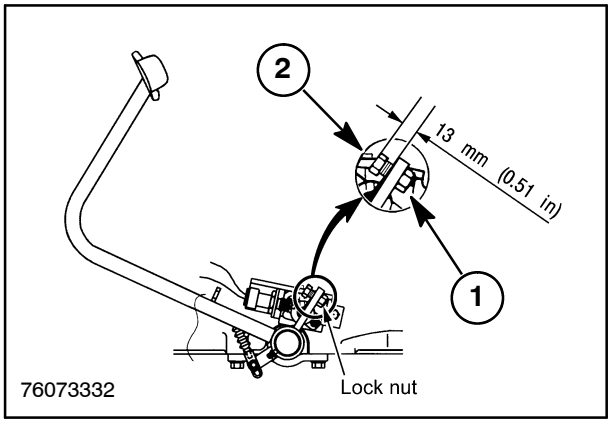
EHSS INCHING PEDAL POTENTIOMETER

IMPORTANT: *Before adjusting the Potentiometer, the pedal stop bolt and oil flow stop cable must be adjusted.*

1. Loosen the lock nut, 1, and adjust the inching pedal stop bolt, 2, to 13 mm (0.51 in).



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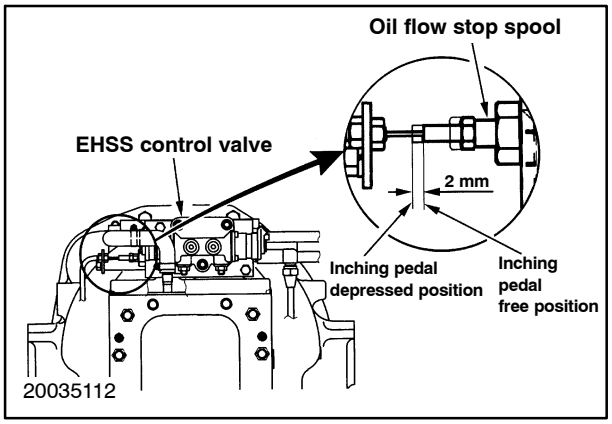
2. If necessary, remove the left side, rear lower hood panel to gain access to the control valve.

Depress the inching pedal fully and hold.

3. Turn the cable adjuster on the oil flow stop cable until 2 mm (0.078″) of free travel exists.



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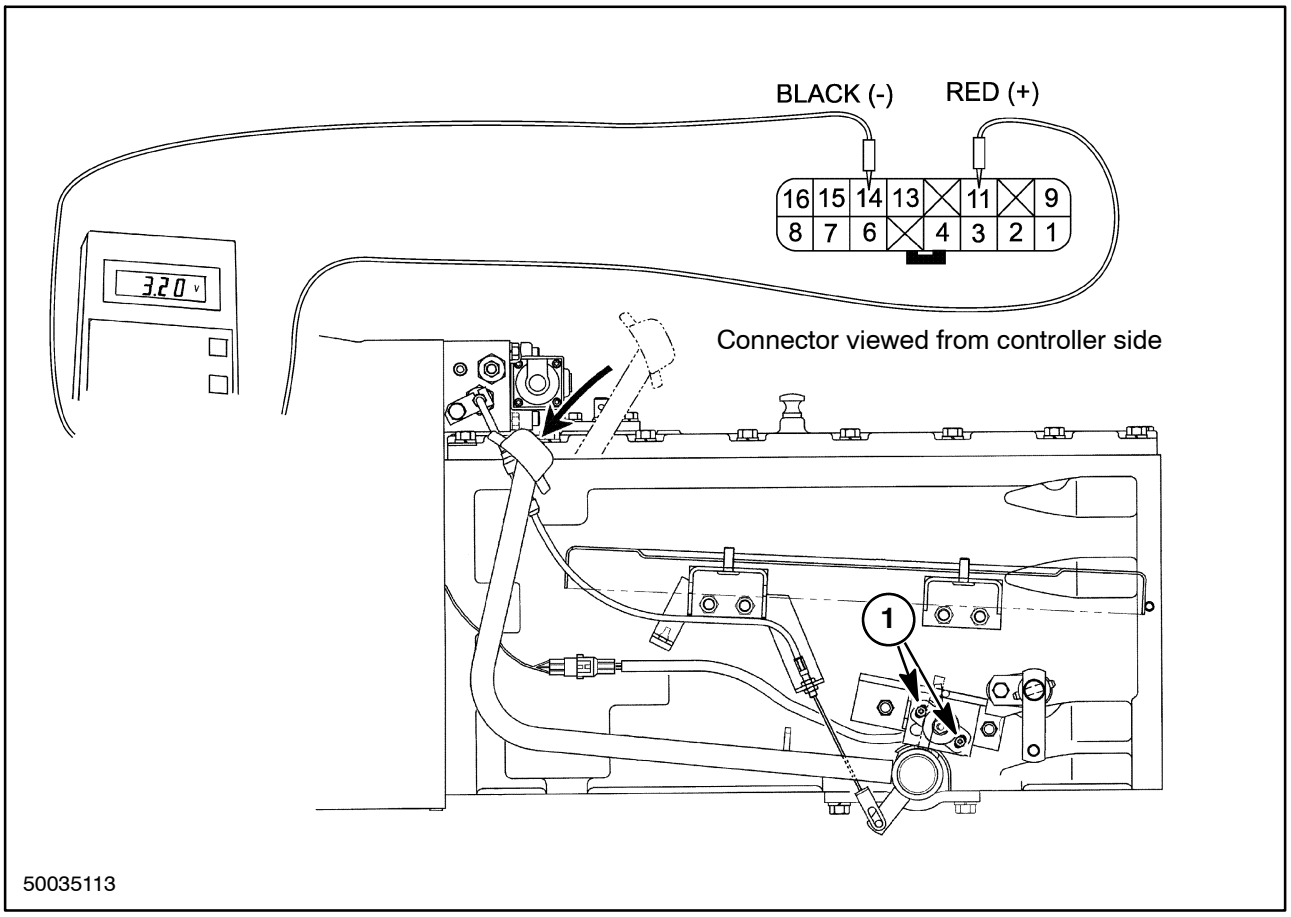

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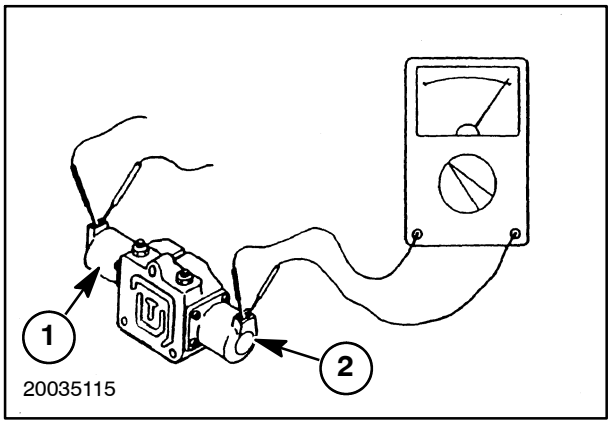
4. Attach a voltmeter lead to the EHSS controller connector at Pins 11 and 14.
5. Turn the key switch to the “ON” position.
6. The voltmeter should read 3.2 volts, **with the inching pedal fully depressed**. If a reading other than 3.2 volts is found, proceed to step 8.
7. Loosen the screws, 1, for the potentiometer.
8. Turn the potentiometer until the voltmeter reading is 3.2 volts with the inching pedal fully depressed.
9. Tighten the screws, 1, for the potentiometer.
10. Turn the key switch to the “OFF” position.

EHSS CONTROL VALVE SOLENOID

Solenoid Test

1. Disconnect the wire connectors from the forward solenoid, 1, and reverse solenoid, 2.
2. Connect the ohmmeter leads to the solenoid terminals and observe the ohmmeter reading.



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Test Results

7 – 9 ohms = good

6.9 ohms or less = short in the coil; replace solenoid.

High resistance reading = Open in the coil; replace solenoid.

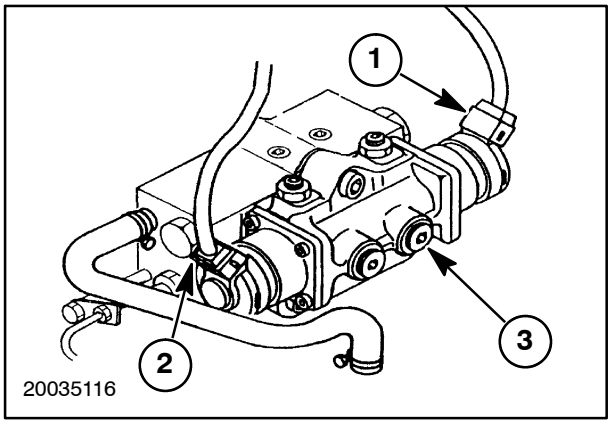
Flow Test

The hydraulic fluid flow rate for the system, as used by the EHSS control valve should be a total of 5.0 liters/min (1.3 gal/min). The EHSS control valve is designed to use 5.0 liters/min (1.3 gal/min) for engagement flow.

Neutral and Forward

IMPORTANT: *Be sure to have the tractor drive wheels off the ground when performing flow test.*

1. Raise and support the tractor with suitable jackstands.
2. Remove the two rear engine hood side panels.
3. Place the three (shuttle, main and range) shift levers in the neutral position.
4. Disconnect the forward, 1, and reverse, 2, solenoid wire connectors from both solenoids.



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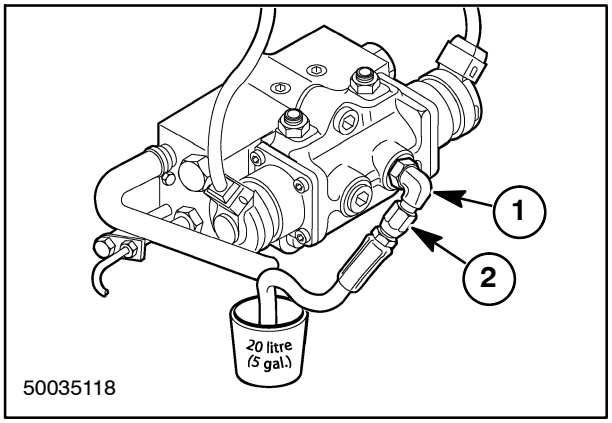
5. Remove the plug, 3, (figure 43), from the forward port on the solenoid valve body.
6. Install the 7/16″–JIC x 7/16″–20 O ring boss 90° test fitting, (#380001600), 1, into the forward port on the solenoid valve.
7. Connect a hose, 2, to the 90° test fitting. Be sure the hose is long enough to reach a 20 liter (5 gal) bucket. Place the hose into the bucket.
8. Reconnect the solenoid wires.
9. Start the engine and warm the transmission oil to operating temperature.
10. Set the engine to 2700 rpm.



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11. Perform the following tests:

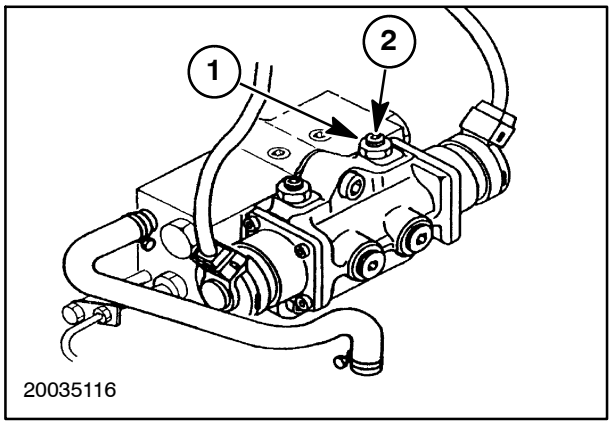
    - **Shuttle change lever in the neutral position:**
      - Oil flow to the container = Faulty solenoid valve

        Replace valve.
      - No oil flow to the container = Good solenoid valve

        Proceed to next test.
    - **Shuttle change lever in the forward position for one minute and return to neutral:**
      - Oil quantity less than 5.0 liters (1.3 gal) in container = Faulty solenoid or restricted opening in control valve.

        Loosen jam nut, 1, and turn adjusting screw, 2, counterclockwise for increased flow.
      - Oil quantity 5.0 liters (1.3 gal) in container = Good solenoid.

        Proceed to next test.



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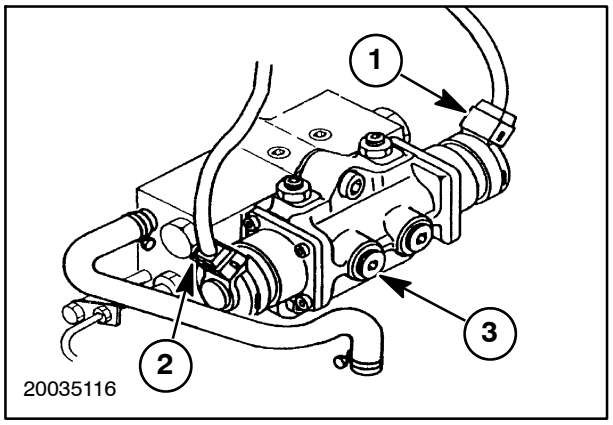
Reverse

IMPORTANT: *Be sure to have the tractor drive wheels off the ground when performing flow test.*

1. Raise and support the tractor with suitable jackstands.
2. Remove the two rear engine hood side panels.
3. Place the three (shuttle, main and range) shift levers in the neutral position.
4. Disconnect the forward, 1, and reverse, 2, solenoid wire connectors from both solenoids.
5. Remove the plug, 3, from the reverse port on the solenoid valve body.



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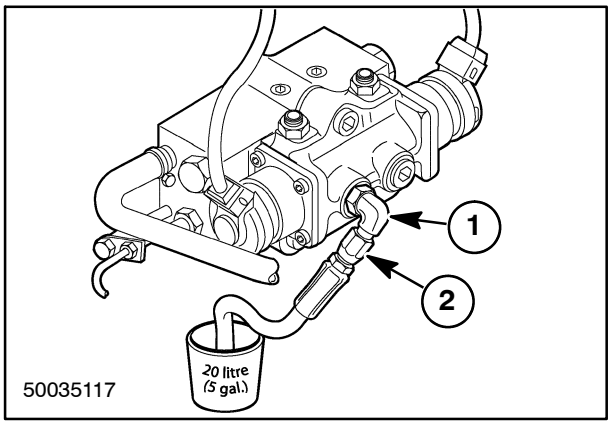
6. Install the 7/16″–JIC x 7/16–20 O ring boss, 90° test fitting (#380001600), 1, into the reverse port on the solenoid valve.
7. Connect a hose, 2, to the 90° test fitting. Be sure the hose is long enough to reach a 20 liter (5 gal) bucket. Place the hose into the bucket.
8. Reconnect the solenoid wires.



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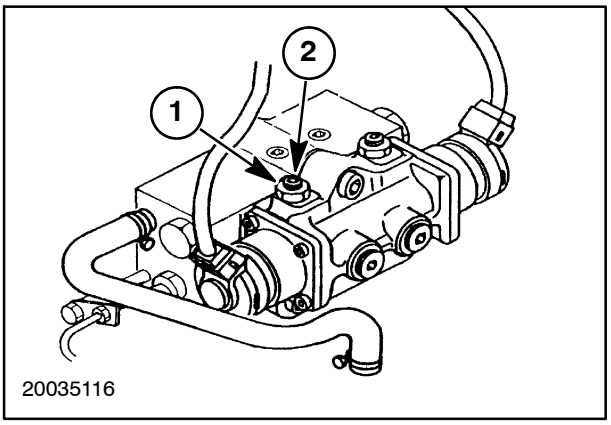
9. Start the engine and warm the transmission oil to operating temperature.
10. Set the engine to 2700 rpm.
11. Perform the following test:
    - **Shuttle change lever in the reverse position for one minute and return to neutral:**
      - Oil quantity less than 5.0 liters (1.3 gal) in container = Faulty solenoid or restricted opening in control valve.

        Loosen jam nut, 1, and turn adjusting screw, 2, counterclockwise for increased flow.
      - Oil quantity 5.0 liters (1.3 gal) in container = Good solenoid.



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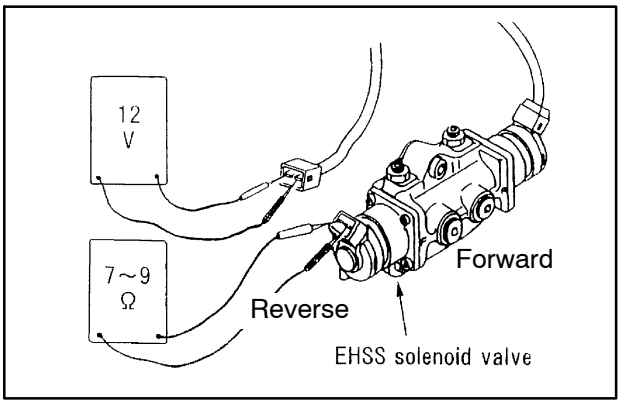
TROUBLESHOOTING

1. The EHSS clutch is slipping or disengaged.

Is the output voltage from the EHSS controller to the EHSS solenoid valve terminals 12 volts, when the shuttle change lever is in the “F” or “R” positions?

NOTE: The output voltage from controller to solenoid valve can be checked after the inching pedal is fully depressed and then returned to its free position.

NOTE: WAIT APPROXIMATELY 4 SECONDS AFTER a directional shift before checking output voltage.



No

1. Check solenoid connector for damaged wires or improper connection. **Repair as needed.**
2. Blown 10 amp fuse. **Replace 10 amp fuse.**
3. Improper ground. **Check ground location point at steering column mount.**
4. Shuttle lever switch not operating correctly. **Check shuttle switch for proper operation and replace if necessary.**
5. EHSS controller malfunction. **Check controller for proper operation in “Forward” or “Reverse” modes. If not properly functioning, replace controller.**

Yes

Is the resistance of EHSS solenoid valve 7 to 9 ohms?

No

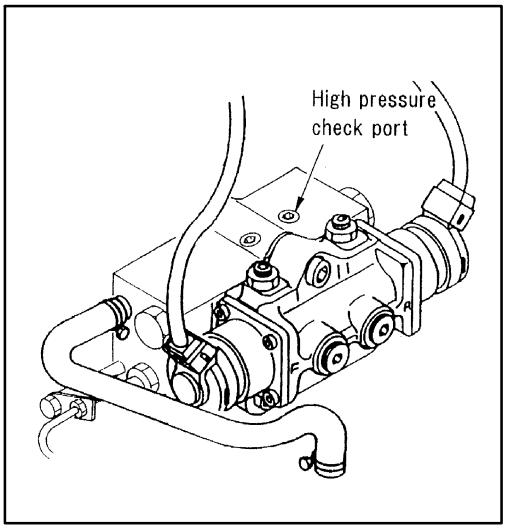
1. Defective solenoid valve **Replace solenoid valve**

Yes

Is the relief pressure 22.7 bar (330 psi) at 2700 engine rpm, with the shuttle change lever at any position?

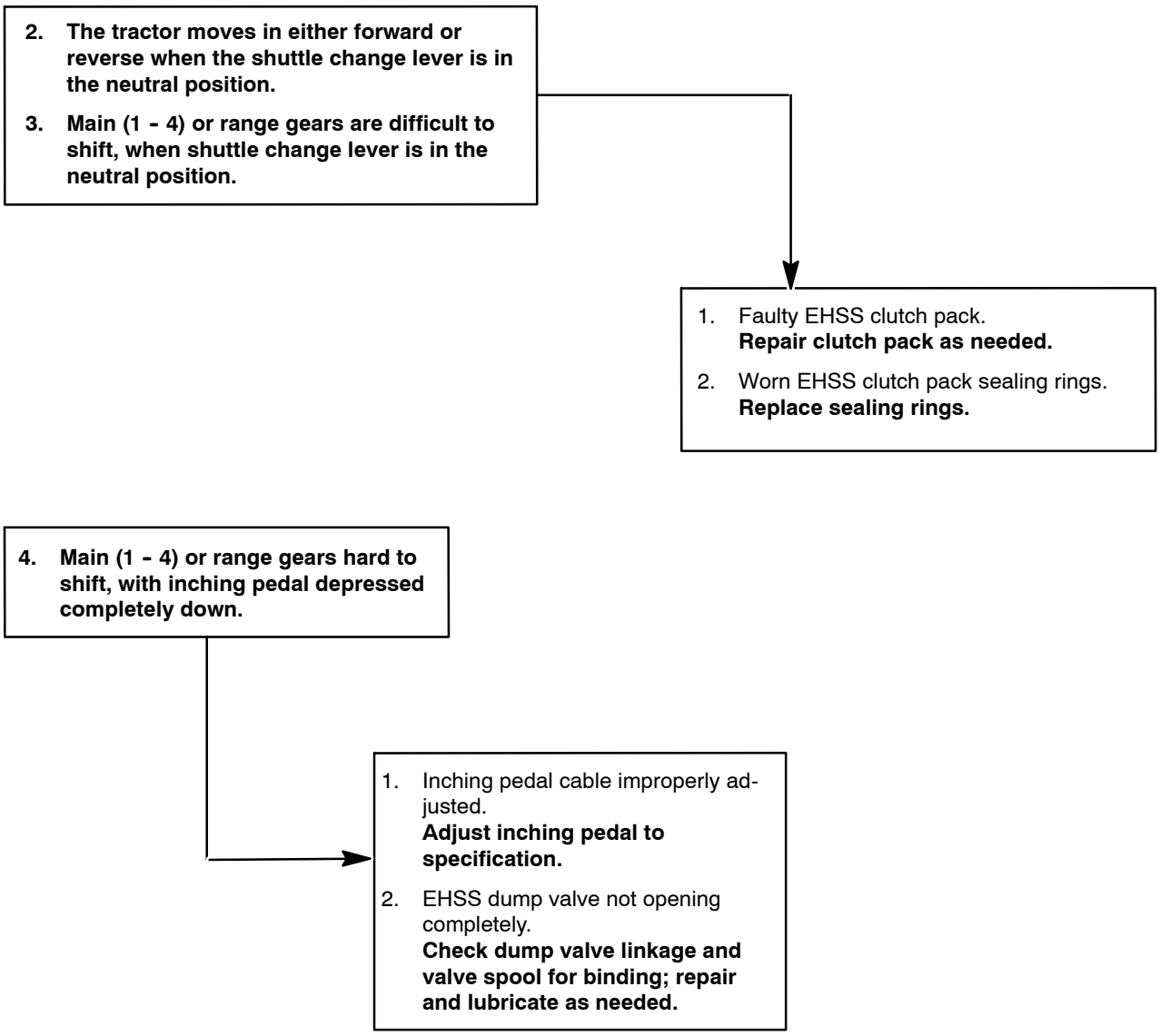
No

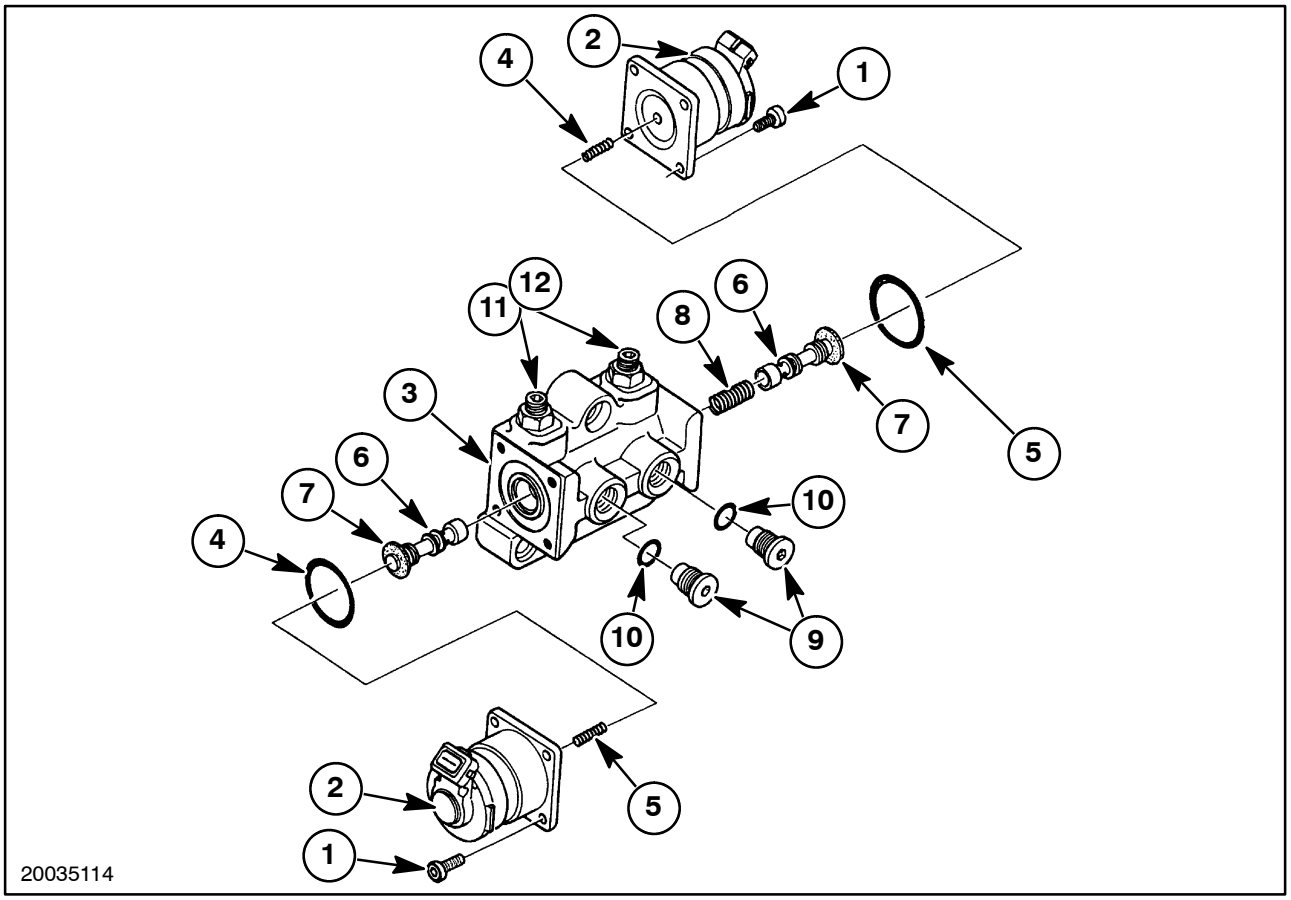
1. Adjust relief valve setting to 22.7 bar (330 psi).
2. Possible worn EHSS hydraulic pump. Check pump for proper flow. **If not proper flow, replace pump.**
3. Filter screen is clogged in adapter.
4. Defective flow, check priority valve or oil pipe for PTO clutch control valve.
5. Check pump drive gear for damaged splines. **If splines are damaged, replace drive gear.**



Yes

1. Worn clutch discs. **Replace clutch discs.**
2. Defective clutch shaft sealing rings. **Replace seal rings.**
3. Inching pedal cable not adjusted properly. **Adjust inching pedal cable to specifications.**


2. The tractor moves in either forward or reverse when the shuttle change lever is in the neutral position.
3. Main (1 – 4) or range gears are difficult to shift, when shuttle change lever is in the neutral position.
1. Faulty EHSS clutch pack.
Repair clutch pack as needed.
2. Worn EHSS clutch pack sealing rings.
Replace sealing rings.
4. Main (1 – 4) or range gears hard to shift, with inching pedal depressed completely down.
1. Inching pedal cable improperly adjusted.
Adjust inching pedal to specification.
2. EHSS dump valve not opening completely.
Check dump valve linkage and valve spool for binding; repair and lubricate as needed.



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EHSS CONTROL VALVE SOLENOID

Disassembly

1. Loosen and remove the socket head bolts, 1, securing the solenoid, 2, to the control valve, 3.

IMPORTANT: *During solenoid removal, be sure not to lose the spring, 4, from the solenoid.*

2. Remove the solenoid, 2, and O ring, 5, from the control valve, 3.
3. Repeat steps 1 and 2 for the opposite side of the control valve.
4. Remove the spools, 6, with the diaphragms, 7, from both sides of the control valve, 3.
5. Remove the spring, 8, from the valve body.
6. Remove the plugs, 9, and O rings, 10, from the valve body.

IMPORTANT: *Never remove the two jam nuts, 11, and adjustment screws, 12, from the valve body. These are preset and removal may cause a change in flow.*

Inspection

1. Clean all parts in a suitable solvent and allow to air dry.
2. Inspect both spools and valve body for wear and/or damage.
3. Replace all O rings with new ones.
4. If any wear or damage is found, replace the solenoid control valve assembly.

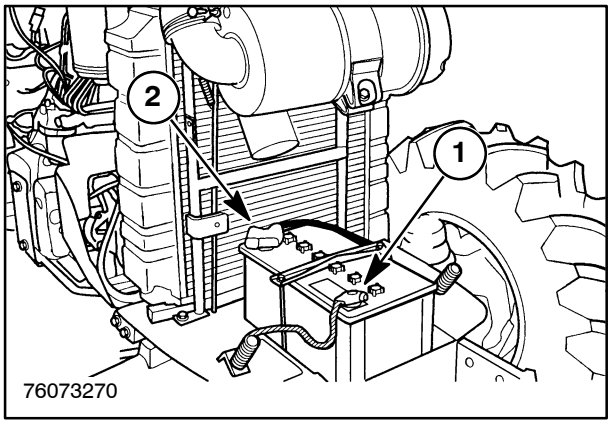
Assembly

1. Lubricate and install new O rings, 10, onto the plugs, 9.
2. Install and tighten the plugs, 9, in the control valve housing. Torque the plugs to 12.8 – 16.7 N·m (9.4 – 12.2 ft-lbs).
3. Lubricate and install the spool, 6, (without spring) and diaphragm, 7, into the valve body.
4. Lubricate and install a new O ring, 4.
5. Install the solenoid, 2, and secure with the socket head bolts, 1. Tighten bolts to 1.4 – 4.9 N·m (1 – 4 ft-lbs).
6. Install spring, 8, spool, 6, and diaphragm, 7, into valve body. Spool should have a sliding fit with finger pressure and no binding.
7. Lubricate and install a new O ring, 4.
8. Install the solenoid, 2, and secure with the socket head bolts, 1. Tighten bolts to 1.4 – 4.9 N·m (1 – 4 ft-lbs).

EHSS TRANSMISSION

Removal – Separating the Tractor at Clutch Housing/Engine

1. Disconnect the negative (–) battery cable, 1, and positive (+) battery cable, 2, from the battery.
2. Drain all of the hydraulic fluid from the transmission and differential into a suitable container.



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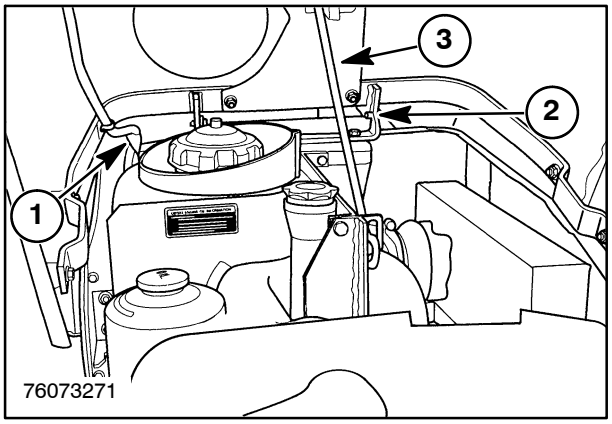
3. Disconnect the headlight wire harness plug, 1.
4. Remove the clips and pins, 2, from each side of the hood bracket.
5. Remove the support rod, 3, and remove the hood from the tractor.



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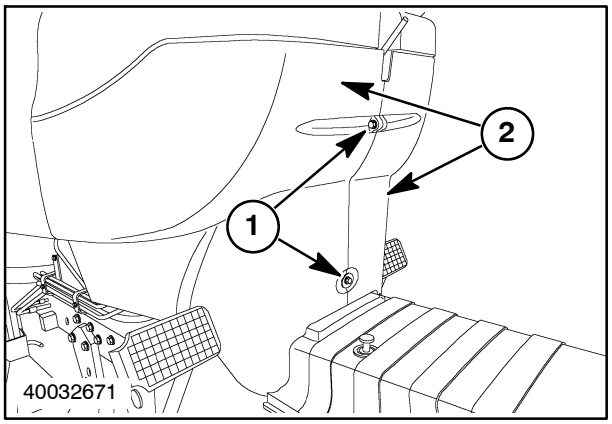
6. Remove the two bolts, 1, from the rear hood panels, 2.
7. Remove both rear hood panels, 2.



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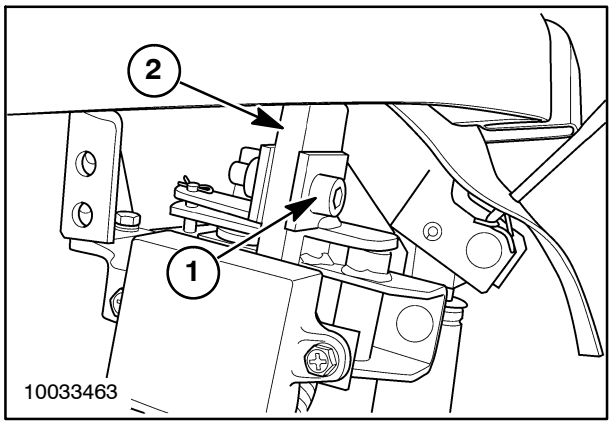
8. Remove the bolt, 1, securing the Shuttle control lever, 2, to the control linkage.



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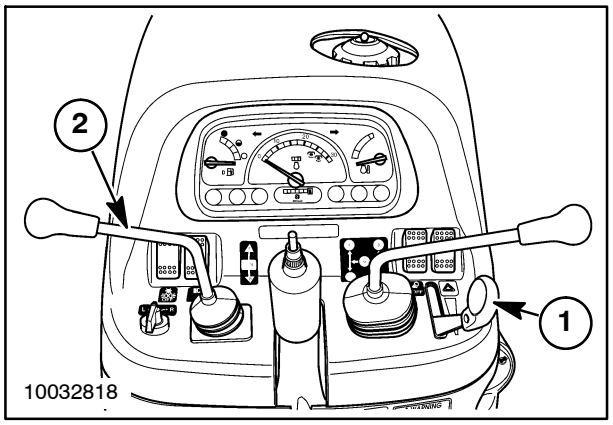
9. Remove the throttle control knob, 1, from the throttle control lever.
10. Remove the shuttle control lever, 2, from the steering column and the dash panel.

NOTE: *Steering wheel removed in picture for clarity.*



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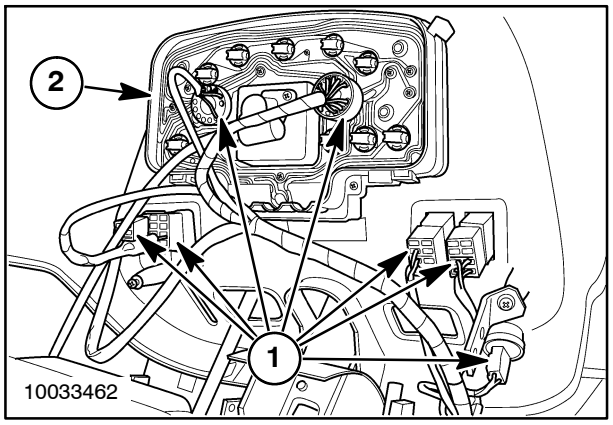
11. Remove the bolts securing the dash panel to the tractor.
12. Disconnect the wire harness plugs, 1, from the rear of the instrument panel, 2.



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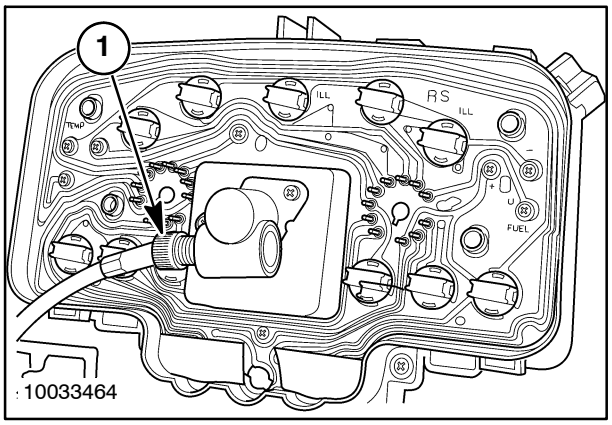
13. Disconnect the tachometer cable, 1, from the instrument panel.
14. Remove the dash and instrument panel from the tractor as an assembly.



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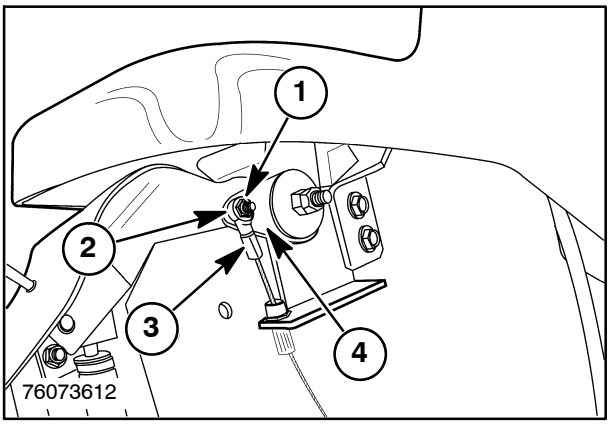
15. Remove the cotter pin, 1, and washer, 2, securing the throttle cable, 3, to the lever, 4. Remove the throttle cable.



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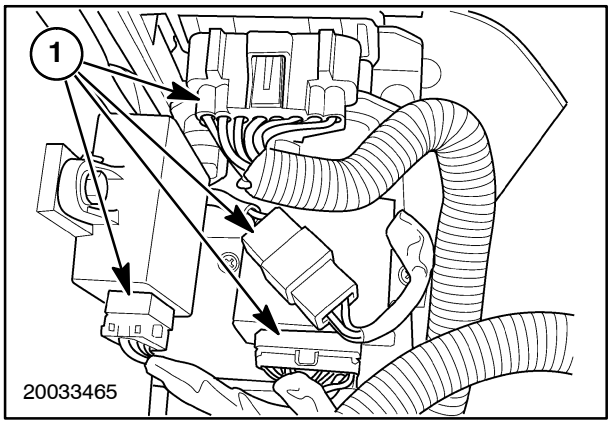
16. Disconnect the main wiring harness connectors, 1, from the left side of the steering column.



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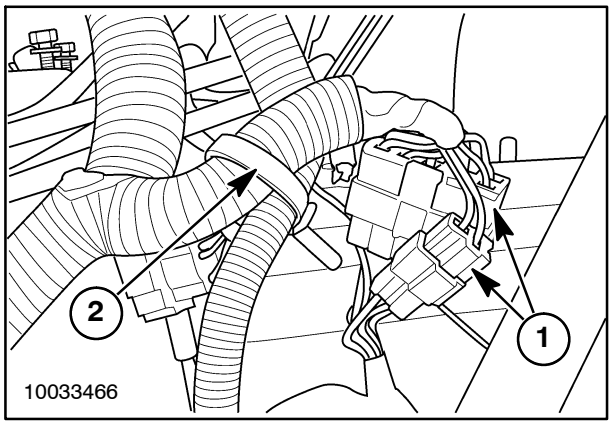
17. Disconnect the three harness connectors, 1, located at the left side of the transmission.
18. Remove the plastic wire ties, 2, from the wire harness.



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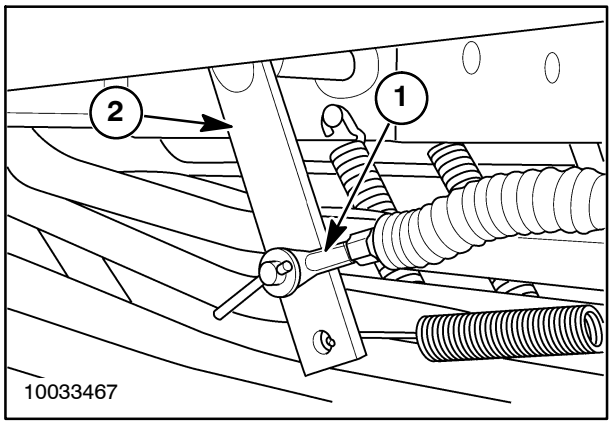
19. Disconnect the throttle cable, 1, from the foot throttle, 2.



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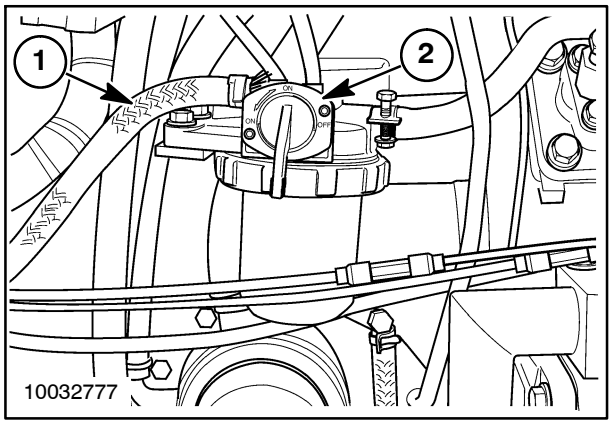
20. Disconnect the fuel supply line, 1, from the fuel shut-off valve, 2.
21. Drain the fuel tank into a suitable, clean container. Cap and plug all lines and fittings.



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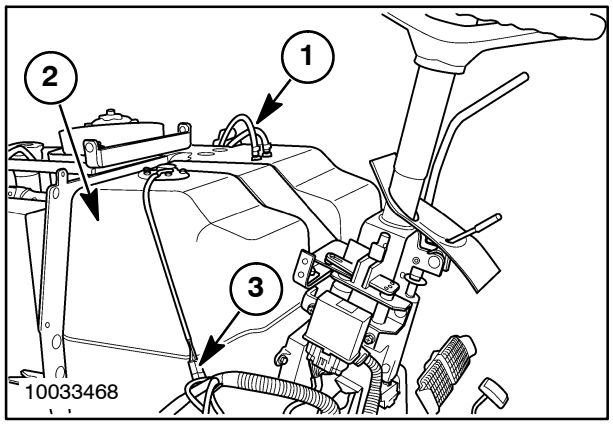
22. Disconnect the two fuel return lines, 1, from the top of the fuel tank, 2.
23. Disconnect the fuel level gauge wire connectors, 3.
24. Remove the fuel tank from the tractor.



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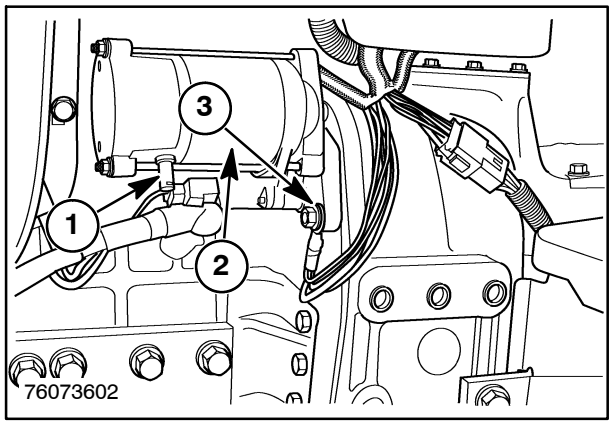
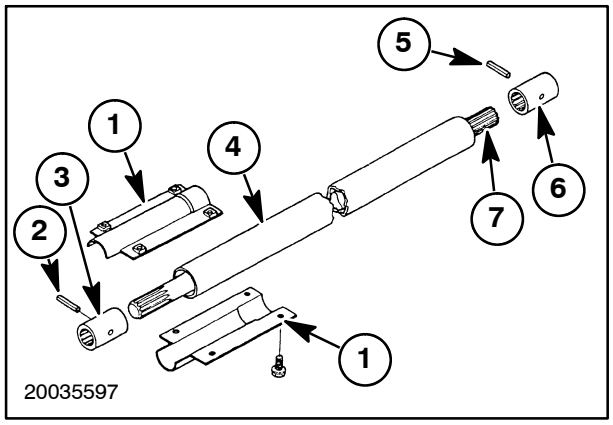
25. Disconnect the wiring, 1, from the starter motor, 2.
26. Remove the nuts, 3, and remove the starter from the tractor.



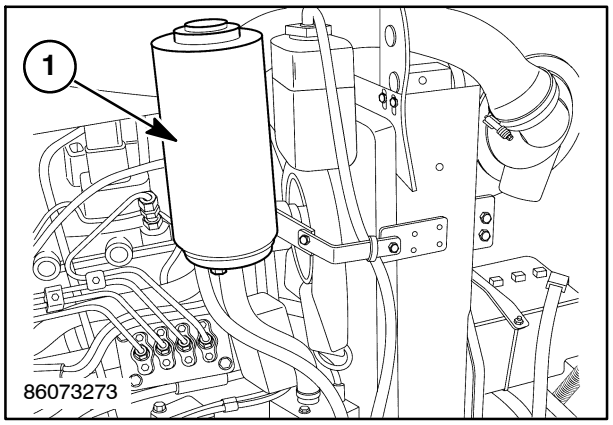
63

27. Remove the covers, 1, from the FWD driveshaft.
28. Drive the roll pin, 2, from the front coupler, 3.
29. Slide the tube, 4, forward and drive out the roll pin, 5, from the rear coupler, 6.
30. Slide the coupler off the splines and remove the drive shaft, 7, and tube, 4, as an assembly.



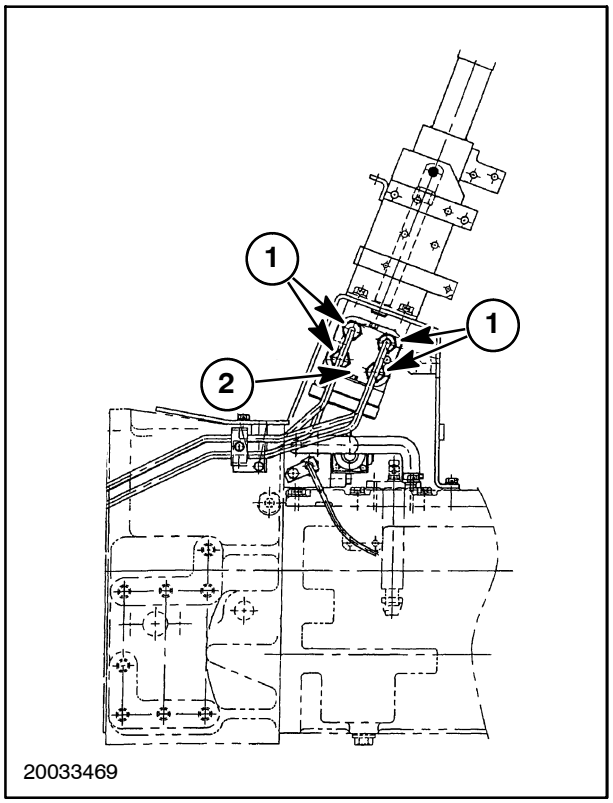
64

31. Drain the power steering reservoir, 1, into a clean suitable container.



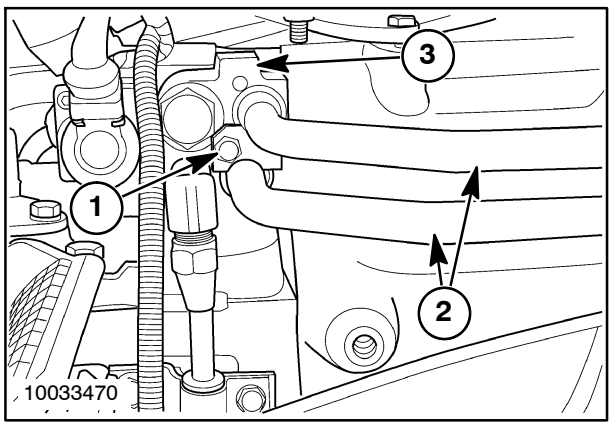
65

32. Disconnect the power steering tubes, 1, from the steering motor, 2. Cap and plug the openings.



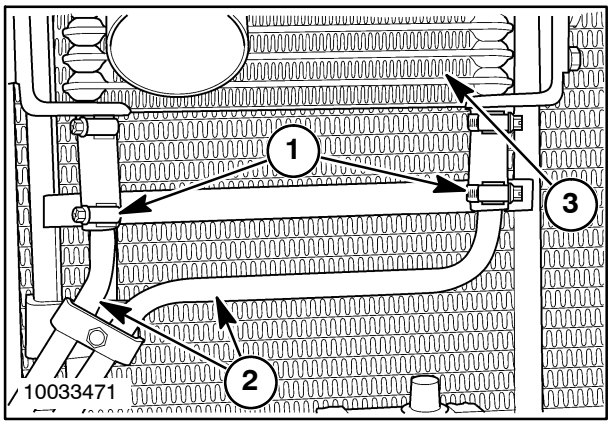
66

33. Loosen and remove the bolt, 1, and disconnect the hydraulic tubes, 2, from the EHSS valve, 3.



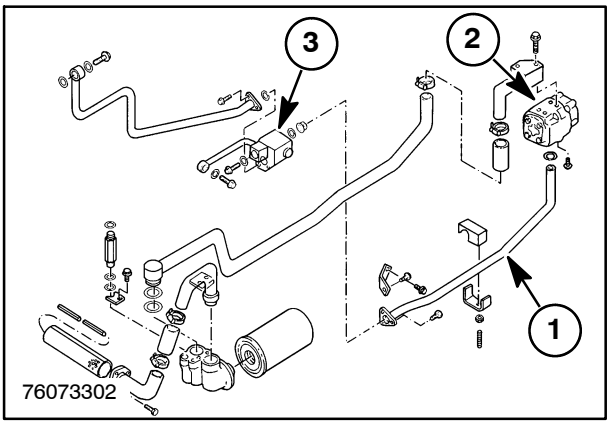
67

34. Loosen the hose clamps, 1, and disconnect the opposite ends of the tubes, 2, from the oil cooler, 3. Remove the tubes.



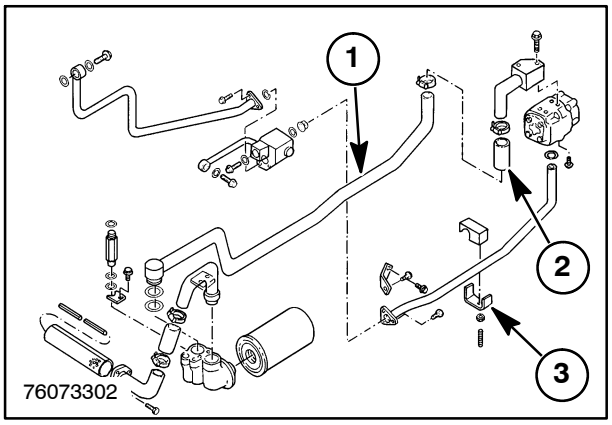
68

35. Disconnect the HPL pressure tube, 1, from the main hydraulic pump, 2.
36. Disconnect the pressure tube from the relief valve manifold, 3. Cap and plug the openings.



69

37. Disconnect the hydraulic suction tube, 1, from the rubber hose connector, 2.
38. Loosen the tube clamp, 3, and rotate the suction tube away from the pump.

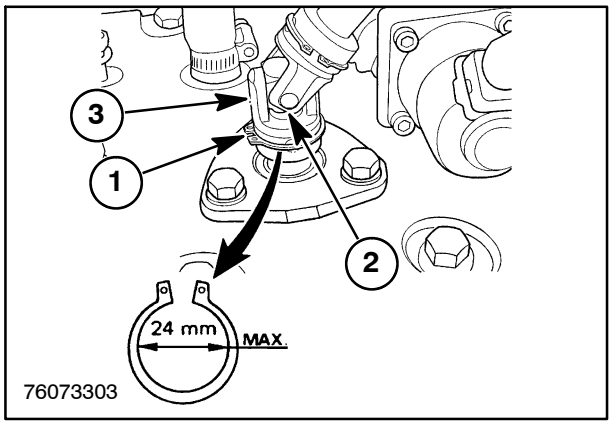


70

39. Remove the snap ring, 1, and drive the pin, 2, from the main transmission shift shaft universal joint, 3.

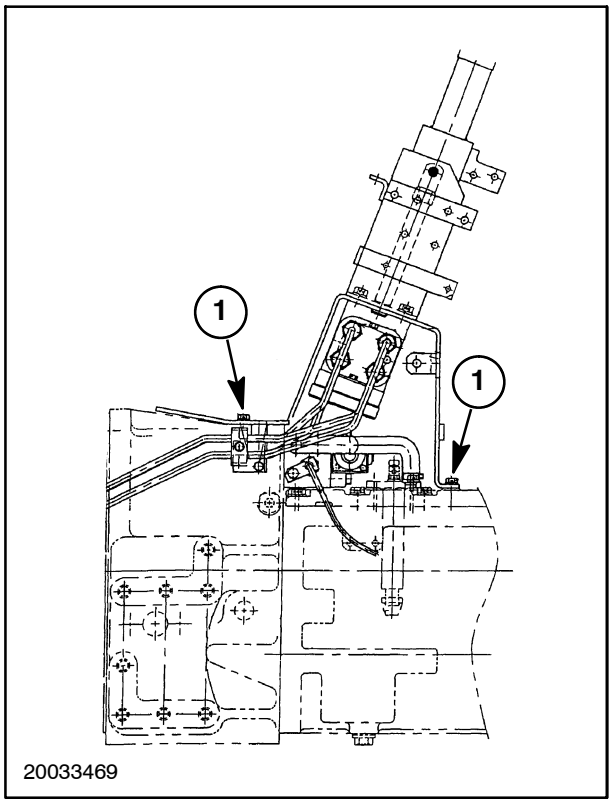
NOTE: *When removing or installing snap ring, do not expand ring to more than 24 mm (0.94″) ID or retention force is decreased. If expanded to more than 24 mm (0.94″), replace with new snap ring.*

40. Disconnect the universal joint, 3, from the transmission.



71

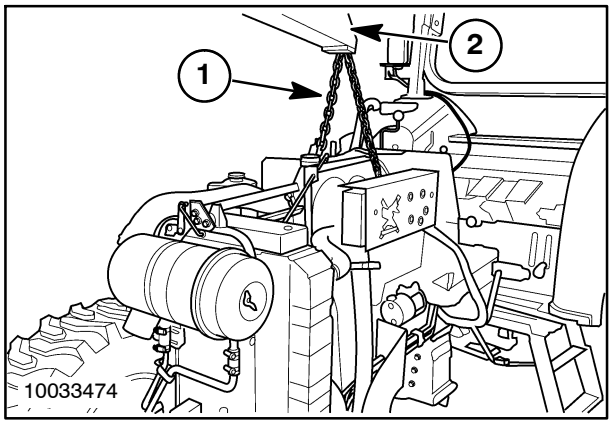
41. Remove the four bolts, 1, attaching the steering column assembly to the clutch housing. Remove the steering column and shift linkage as an assembly.



72

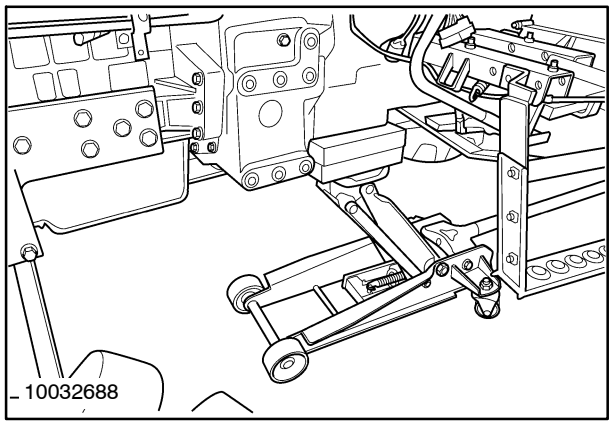
42. Attach a chain sling, 1, to the engine lifting eyes, located at the left rear and right front of the engine.

43. Attach a secure lifting device, 2, to the chain sling to support the front of the tractor.



73

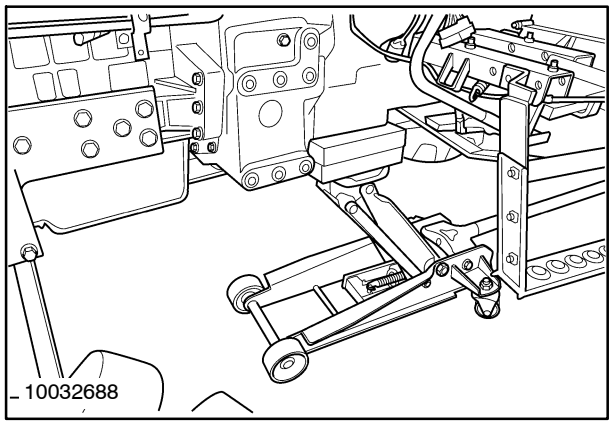
44. Place a suitable floor jack under the transmission from the rear of the tractor. Raise the jack just enough to support the transmission.
45. Loosen and remove all of the external buckle-up bolts between the engine and clutch housing.
46. Gently separate the engine from the clutch housing while rolling the floor jack towards the rear of the tractor.
47. When separating operation is complete, place jack stands under each unit.



74

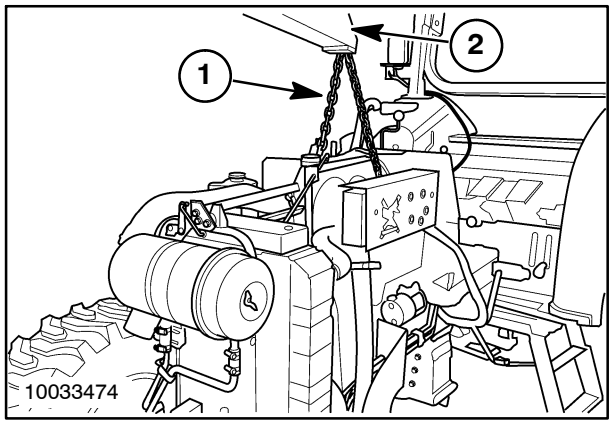
Installation - Attaching the Tractor at Clutch Housing/Engine

1. Place a suitable floor jack under the transmission from the rear of the tractor. Raise the jack just enough to support the transmission.
2. Remove jackstands.



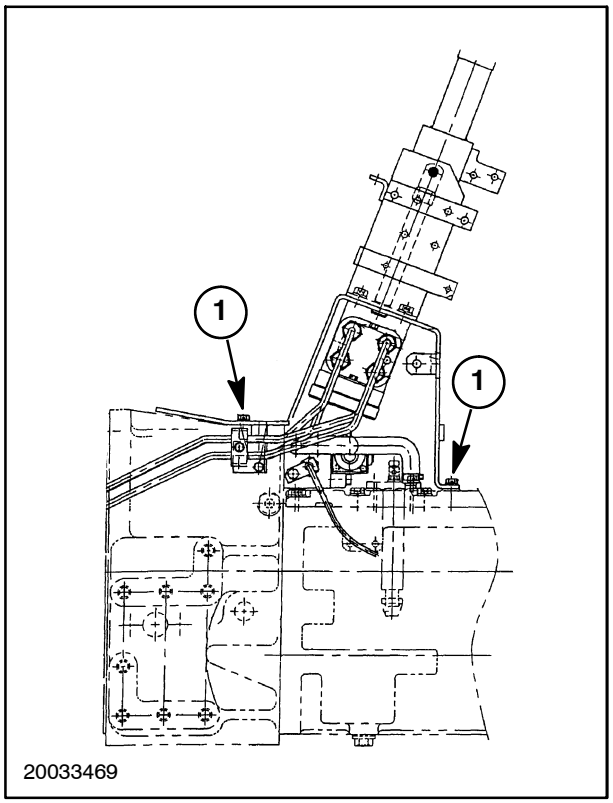
75

3. Attach a chain sling, 1, to the engine lifting eyes located at the left rear and right front of the engine.
4. Attach a secure lifting device, 2, to the chain sling to support the front of the tractor.
5. Remove jackstands.
6. Roll the floor jack towards the engine. Carefully align and attach the clutch housing/transmission to the engine while rotating the transmission gears to allow the transmission input shaft to mesh with the coupler on the engine crankshaft.
7. Install the external buckle up bolts and nuts to secure the clutch housing to the engine. Tighten buckle up bolts and nuts to 79 N·m (58 ft-lbs).



76

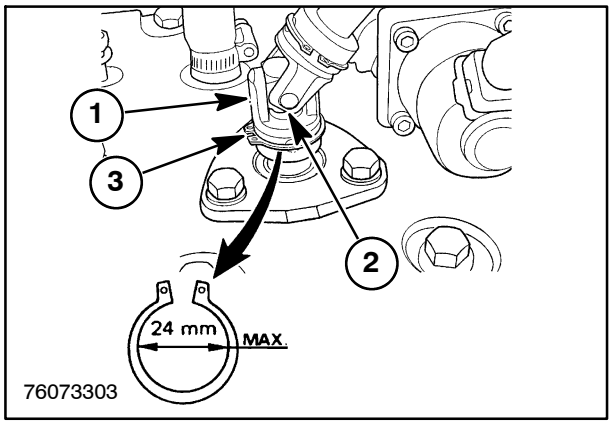
8. Install the steering column and shift linkage as an assembly. Install the four bolts, 1, attaching the steering column assembly to the clutch housing. DO NOT tighten the bolts at this time.



77

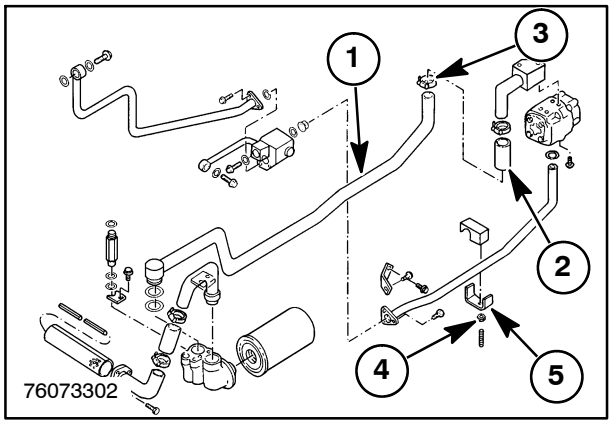
9. Connect the universal joint, 1, to the transmission.
10. Install the drive the pin, 2, through the main transmission shift shaft and universal joint, 1.
11. Secure the pin with the snap ring, 3.

NOTE: *When removing or installing snap ring, do not expand ring to more than 24 mm (0.94″) ID or retention force is decreased. If expanded to more than 24 mm (0.94″), replace with new snap ring.*



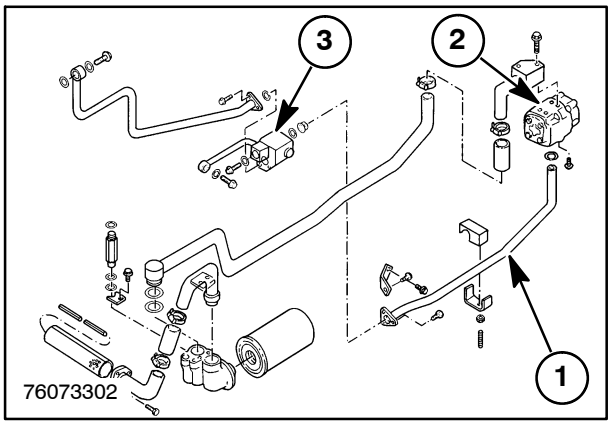
78

12. Connect the hydraulic suction tube, 1, to the rubber hose connector, 2.
13. Tighten the hose clamp, 3, on the rubber connector, 2.
14. Tighten the nut, 4, on the tube clamp, 5.



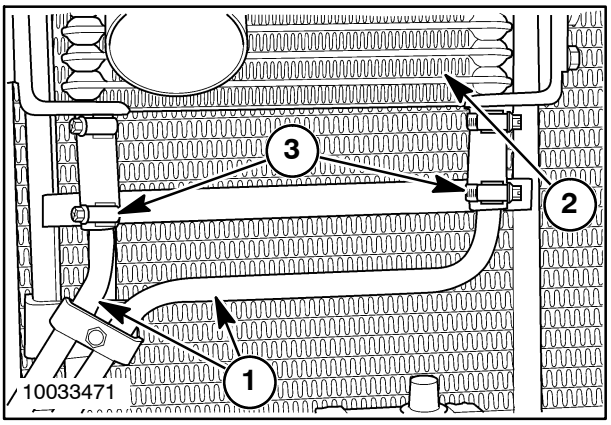
79

15. Remove any caps or plugs and connect the HPL pressure tube, 1, to the main hydraulic pump, 2.
16. Connect the opposite end of the pressure tube to the relief valve manifold, 3.



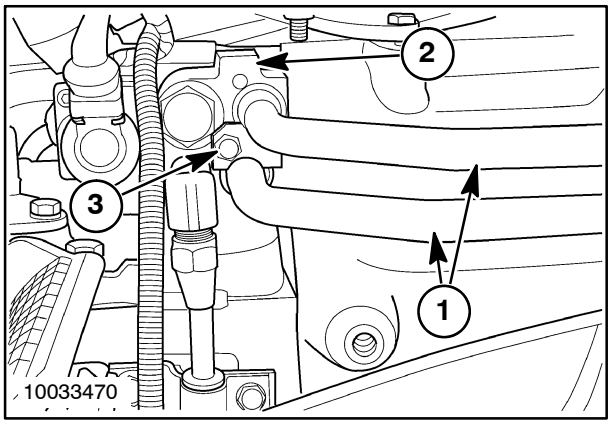
80

17. Connect the hydraulic oil cooler tubes, 1, to the oil cooler, 2. Tighten the hose clamps, 3.



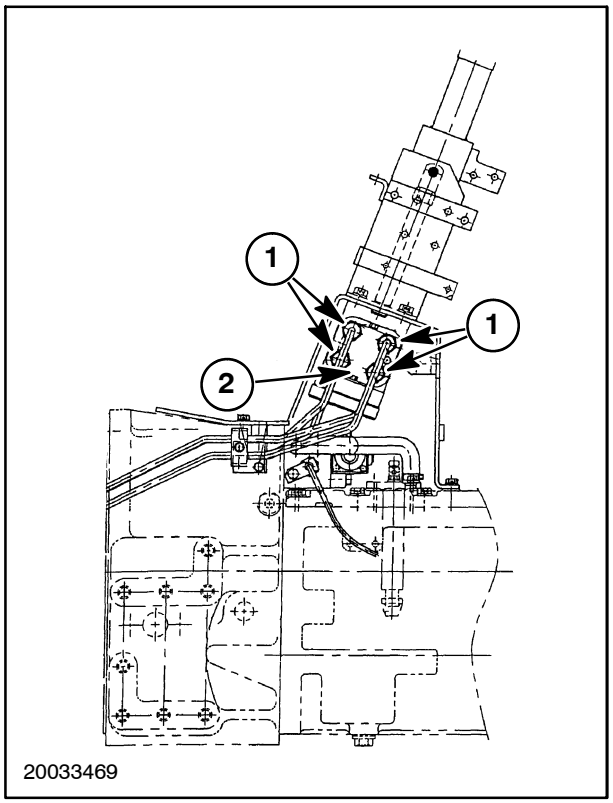
81

18. Connect the opposite ends of the hydraulic tubes, 1, to the EHSS valve, 2. Install and tighten the bolt, 3.



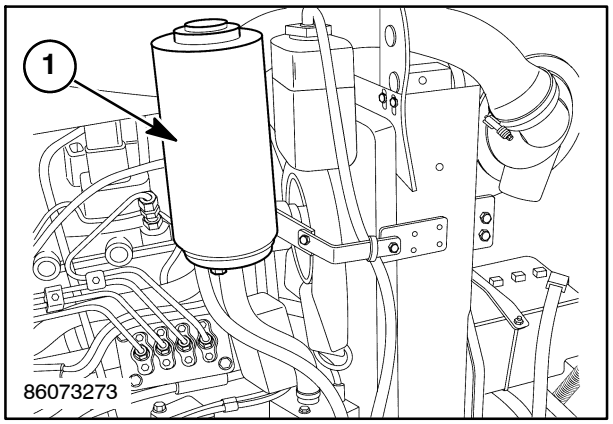
82

19. Remove the caps and plugs from the steering tubes and steering motor. Connect the power steering tubes, 1, to the steering motor, 2. Tighten the steering tubes securely.
20. Tighten the four bolts securing the steering column to the transmission.



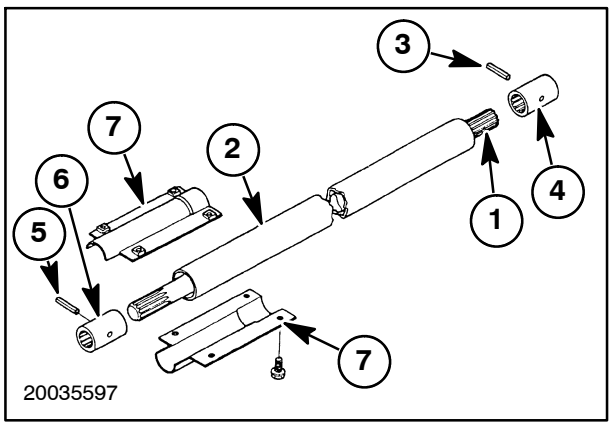
83

21. Fill the power steering reservoir, 1, with the proper fluid.



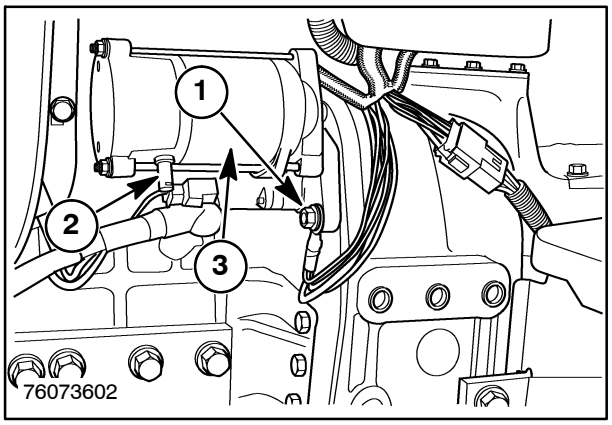
84

22. Slide the coupler on the splines of the drive shaft, 1, and install the shaft and tube, 2, as an assembly.
23. Slide the tube, 2, forward and install the roll pin, 3, through the rear coupler, 4.
24. Install the roll pin, 5, into the front coupler, 6.
25. Install and tighten the covers, 7, onto the FWD driveshaft.



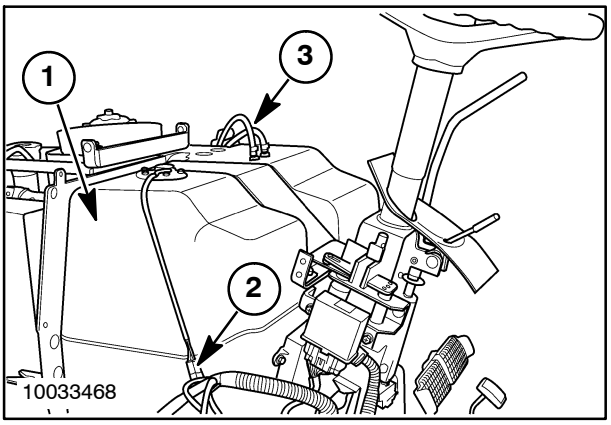
85

26. Install the starter on the tractor. Install and tighten the nuts, 1.
27. Connect the wiring, 2, from the starter motor, 3.



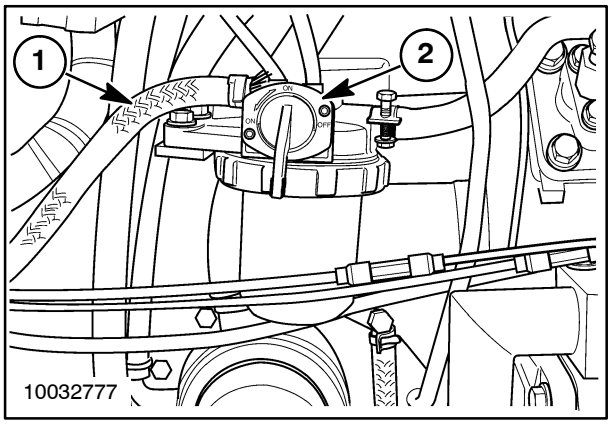
86

28. Install the fuel tank, 1.
29. Connect the fuel level gauge wire connectors, 2.
30. Connect the two fuel return lines, 3, on top of the fuel tank.



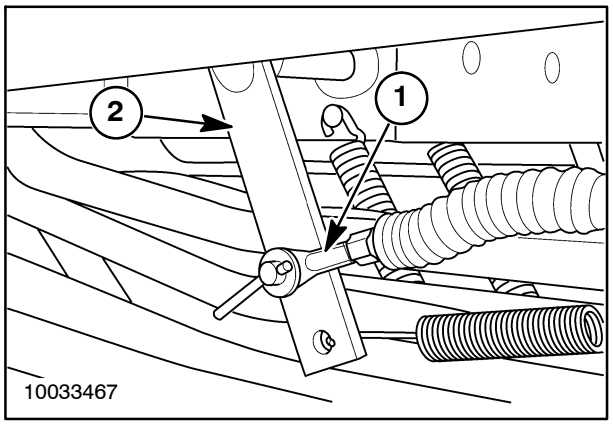
87

31. Remove the caps and plugs from fuel lines and fittings.
32. Connect the fuel supply line, 1, to the fuel shut-off valve, 2.



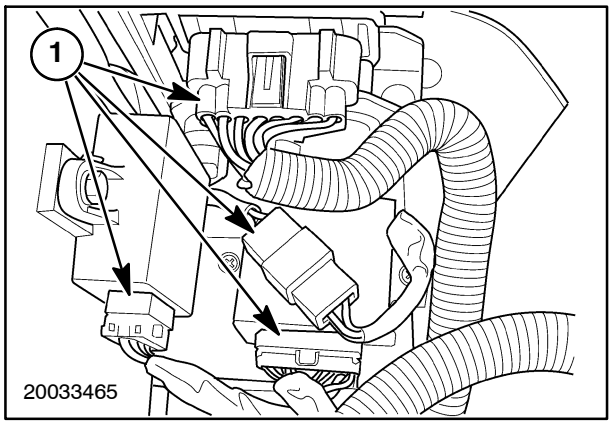
88

33. Connect the throttle cable, 1, to the foot throttle, 2.



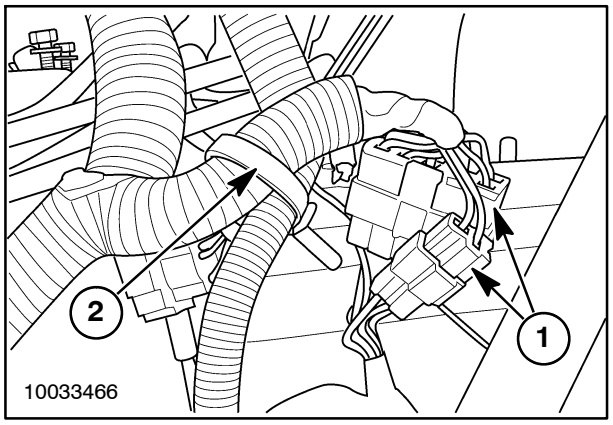
89

34. Connect the main wiring harness connectors, 1, to the left side of the steering column.



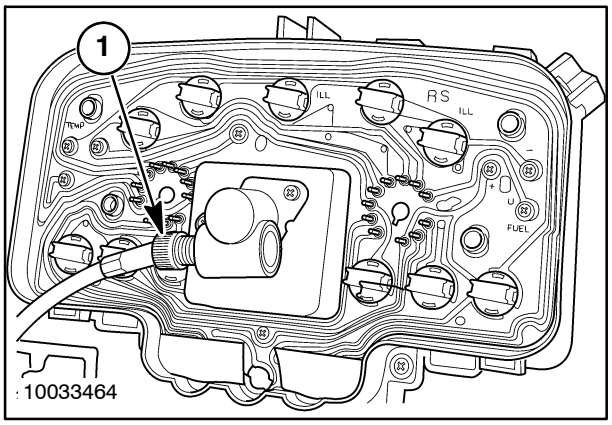
90

35. Connect the three harness connectors, 1, located at the left side of the transmission.
36. Install the plastic wire ties, 2, to the wire harness.



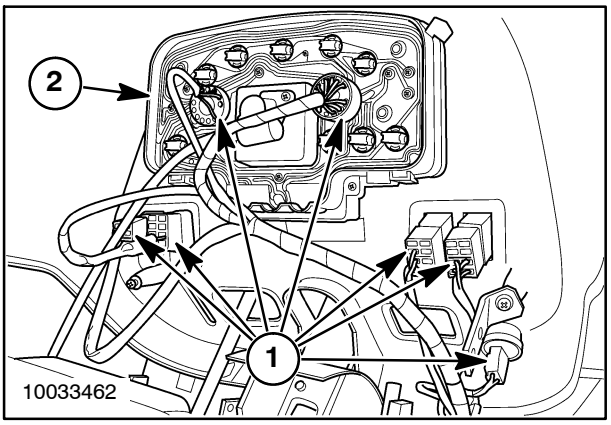
91

37. Position the dash and instrument panel on the tractor as an assembly.
38. Connect the tachometer cable, 1, to the instrument panel.



92

39. Connect the wire harness plugs, 1, to the rear of the instrument panel, 2.
40. Install and tighten the bolts securing the dash panel to the tractor.

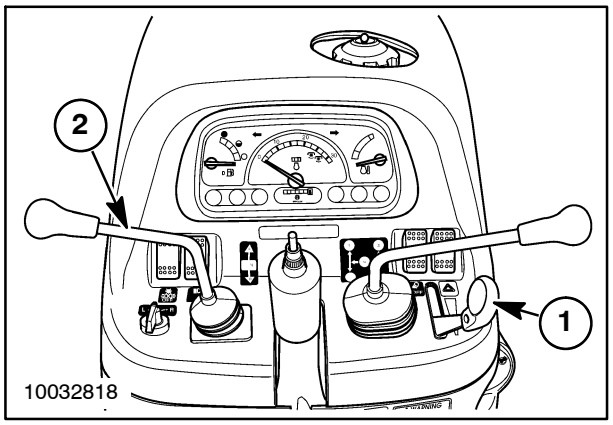


93

41. Install the throttle control knob, 1, on the throttle control lever. Tighten the screw.
42. Position the shuttle control lever, 2, through the dash, onto the steering column.

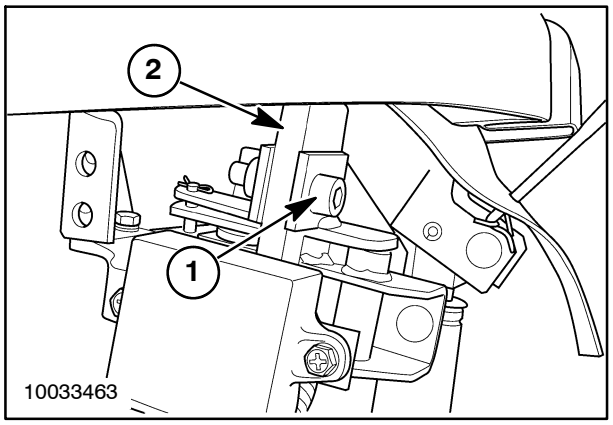
NOTE: *Steering wheel removed in picture for clarity.*

43. Install the throttle cable to the throttle lever assembly.



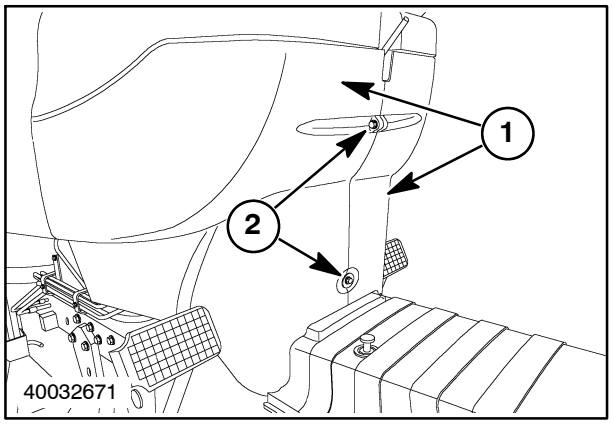
94

44. Install and tighten the bolt, 1, securing the Shuttle control lever, 2, to the control linkage.



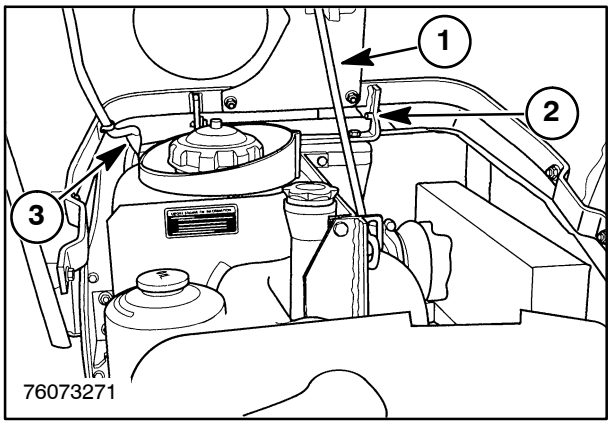
95

45. Install both rear hood panels, 1.
46. Install and tighten the two bolts, 2, on the rear hood panels, 2.



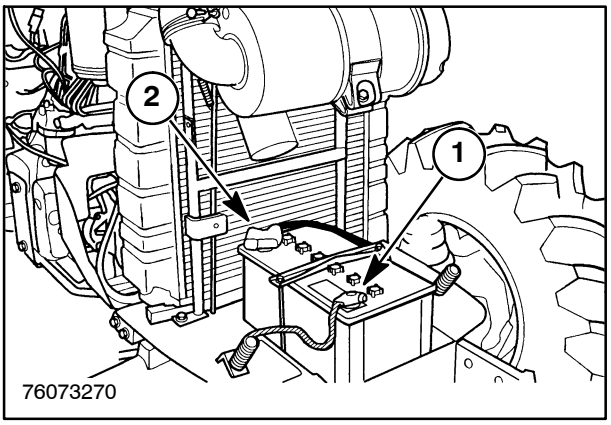
96

47. Install the hood onto the tractor. Connect the support rod, 1.
48. Install the pins and clips, 2, from each side of the hood bracket.
49. Connect the headlight wire harness plug, 3.



97

50. Connect the negative (–) battery cable, 1, and positive (+) battery cable, 2, to the battery.
51. Fill the transmission and differential with the proper type and amount of hydraulic fluid.



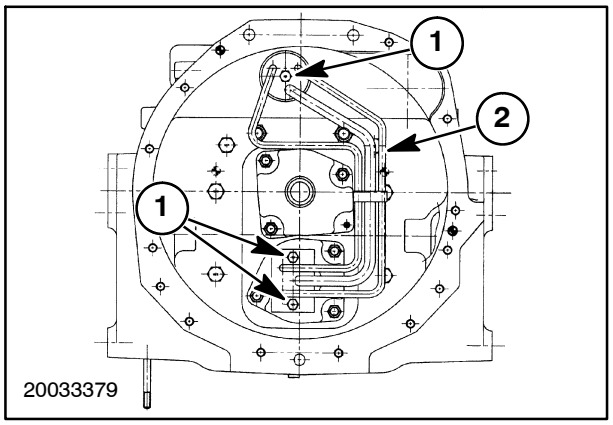
98

CLUTCH HOUSING

Disassembly

IMPORTANT: *During pressure tube removal be sure not to lose the six O rings between the tube assembly and the clutch housing.*

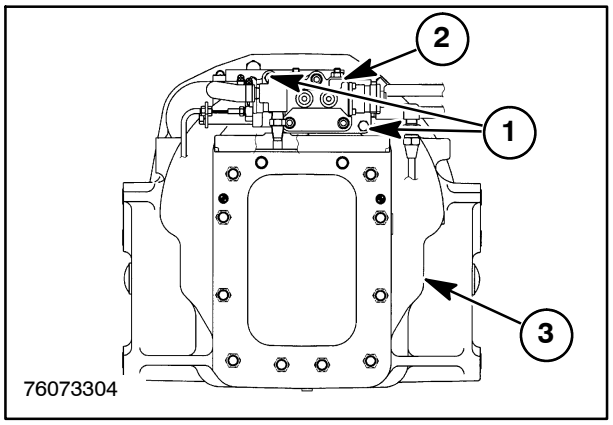
1. Remove the three bolts, 1, securing the pressure tubes, 2, to the transmission. Remove the pressure tubes as an assembly.



99

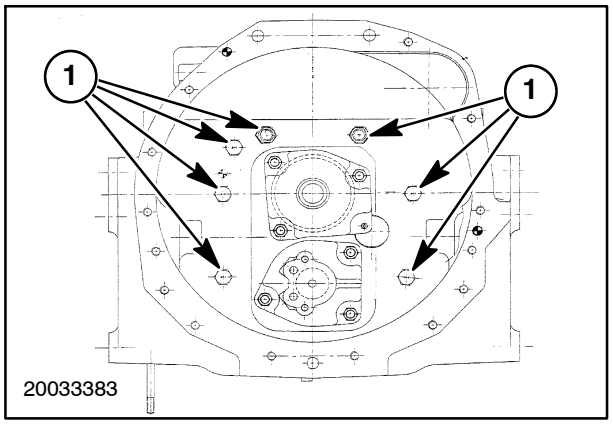
IMPORTANT: *During control valve removal be sure not to lose the three O rings between the valve assembly and the clutch housing.*

2. Remove the two bolts, 1, securing the lube cut-off valve and control valve assembly, 2, to the clutch housing, 3. Remove the valve assembly from the clutch housing.



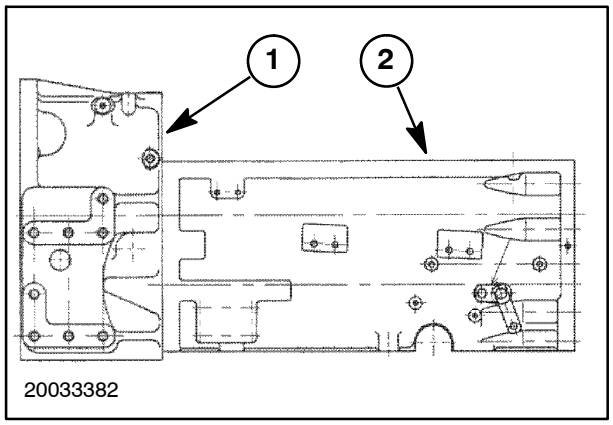
100

3. Remove the clutch housing bolts, 1.



101

4. Separate the clutch housing, 1, from the transmission, 2.



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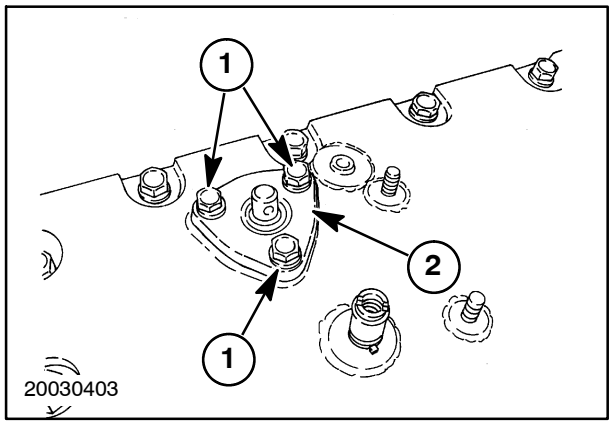
MAIN TRANSMISSION

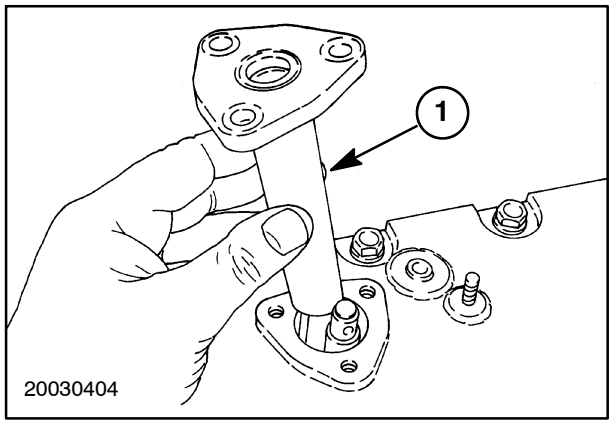
Disassembly - Separating the Transmission/Differential

1. Remove the three bolts, 1, from the shift arm cover, 2.



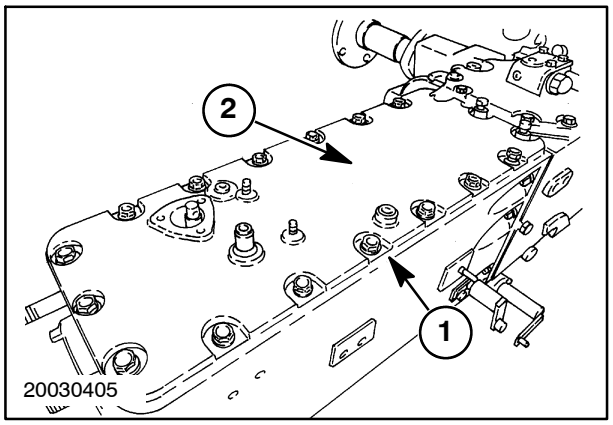
103

2. Remove the shift arm cover, 1, from the transmission cover.



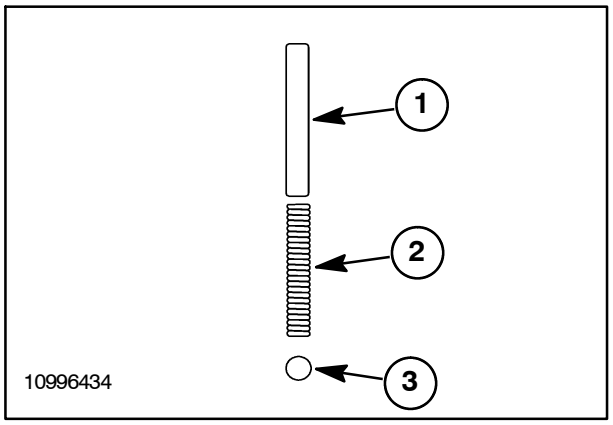
104

3. Remove the retaining bolts, 1, from the transmission cover, 2.
4. Remove the transmission cover, 2, from the transmission housing.



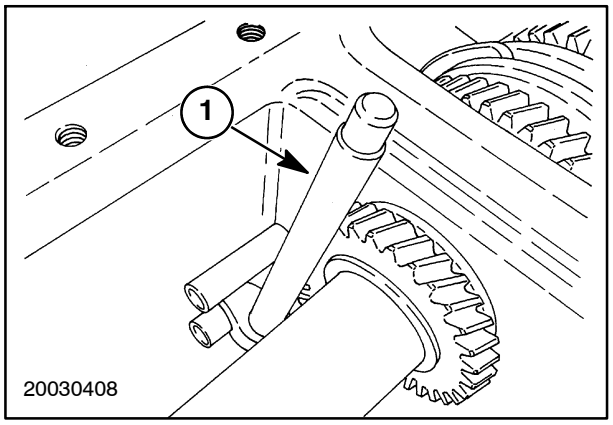
105

5. Remove the detent pin, 1, spring, 2, and ball, 3, from the transmission housing.



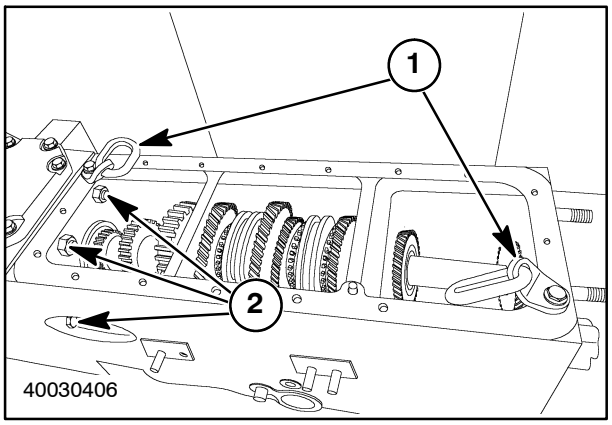
106

6. Remove the shift arm, 1, from the transmission.



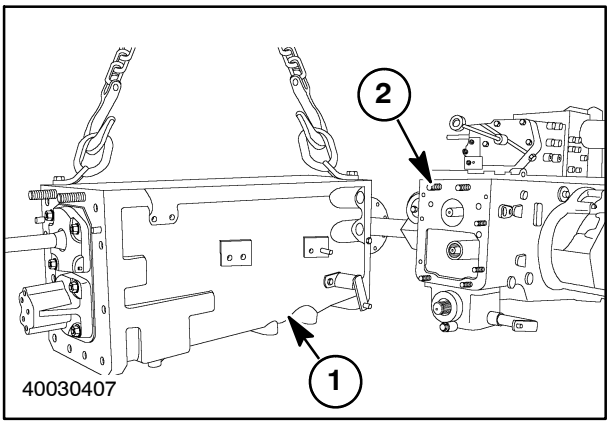
107

7. Attach two suitable lifting eyes, 1, to opposite corners of the transmission housing.
8. Attach a chain sling to the lift eyes and a suitable hoist.
9. Remove the buckle up bolts and nuts, 2, securing the transmission to the differential housing.



108

10. Carefully separate the transmission, 1, from the differential housing, 2.
11. Lower the transmission onto a suitable workbench. Use wood blocks between the transmission and workbench.

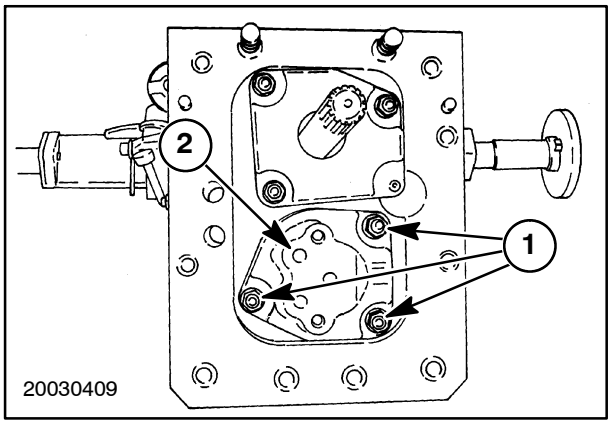


109

Shuttle Clutch Adapter/Input Shaft Retainer

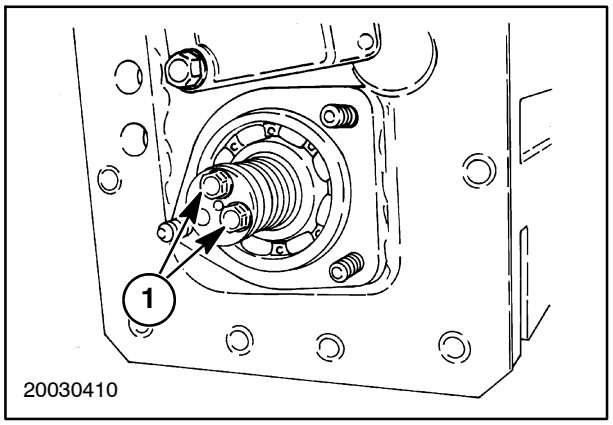
1. Remove the three nuts and washers, 1, from the adapter, 2.
2. Remove the adapter.

NOTE: *Use caution not to lose the O ring on the back of the adapter during removal.*



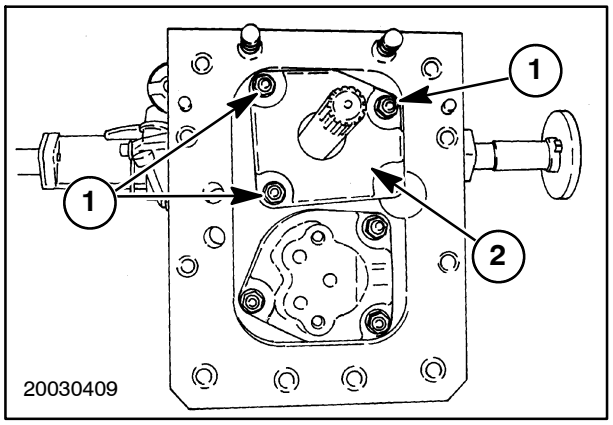
110

IMPORTANT: *Do not remove the two bolts, 1, from the end of the shuttle clutch shaft. These bolts are used to plug cross-drilled holes for fluid ports.*



111

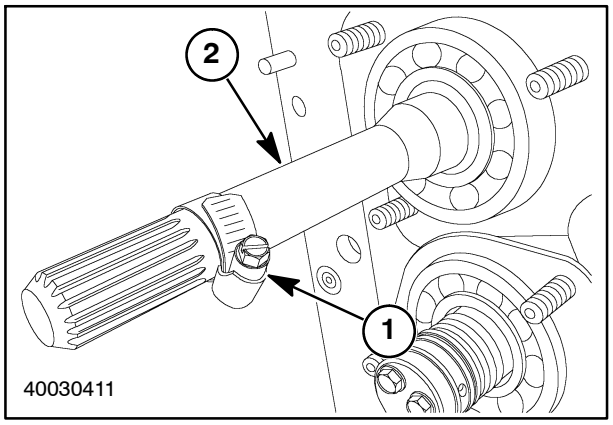
3. Remove the three nuts and washers, 1, from the input shaft retainer, 2.
4. Remove the retainer.
5. ***NOTE:*** Use caution not to lose the O ring on the back of the input shaft retainer during removal.



112

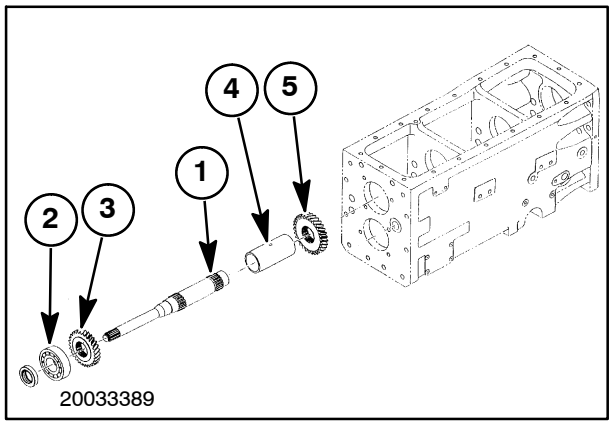
Input Shaft

1. Place a 1/2″ ID (Nominal) hose clamp, 1, on the input shaft, 2. Tighten the hose clamp.
2. Gently tap the hose clamp toward the front of the shaft to free the input shaft from the housing.



113

3. Remove the input shaft, 1, bearing, 2, reverse gear, 3, collar, 4, and forward gear, 5, from housing.

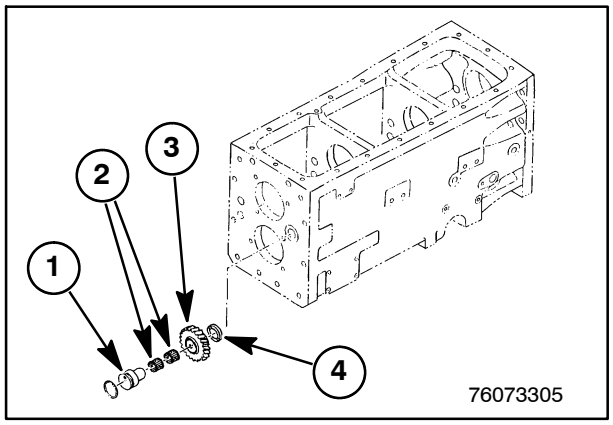


114

Reverse Idler Shaft and Gear

IMPORTANT: *Pay attention to the orientation of parts contained in the reverse idler assembly for proper assembly later. The large flange on the gear faces toward the rear of the housing. The oil grooves on the spacer face toward the idler gear.*

1. Gently tap the reverse idler shaft, 1, toward the front of the housing, from the inside.
2. Remove the reverse idler shaft, 1, needle bearings, 2, idler gear, 3, and spacer, 4.

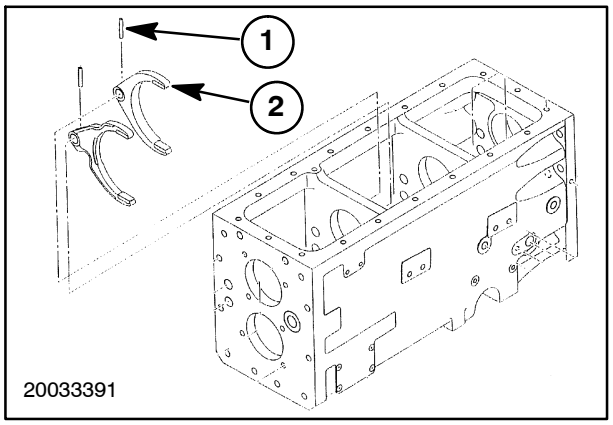


115

Shift Rails

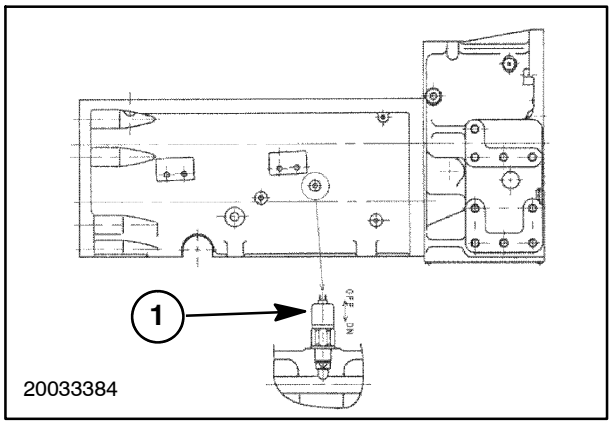
IMPORTANT: *Shift rails must be removed prior to countershaft removal, to allow shift fork removal to gain clearance for main transmission gears and synchronizers to be removed from housing.*

1. Drive the roll pin, 1, from the upper shift fork, 2, (1st and 2nd gear).



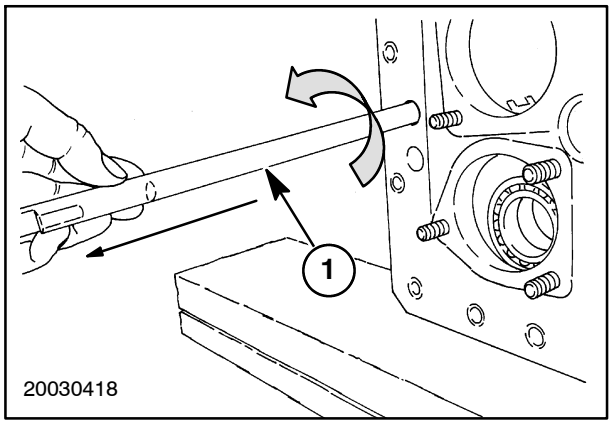
116

2. Remove the modulation switch, 1, from the right side of the transmission housing.



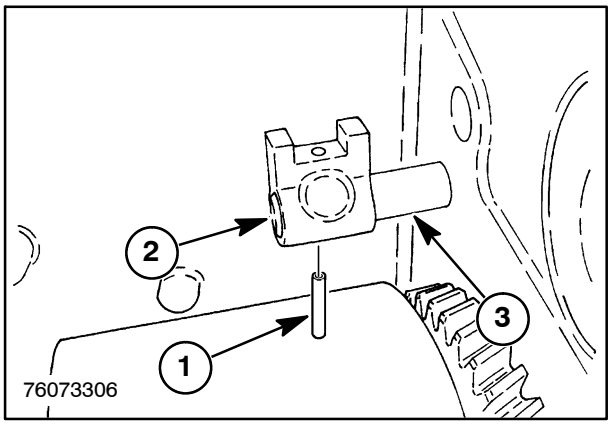
117

3. Rotate the upper shift rail, 1, 90° to clear the balk pin.
4. Pull the upper shift rail forward and out, through the front of the housing.



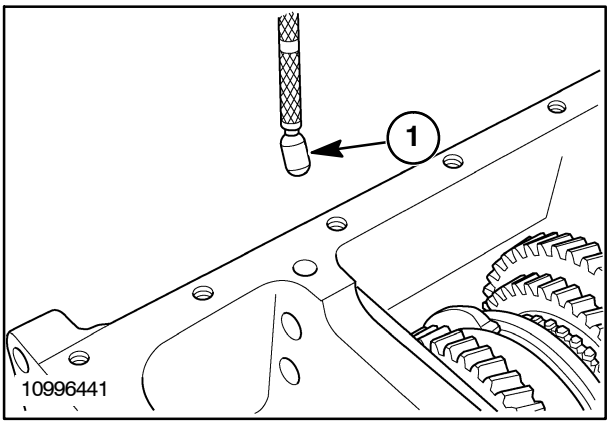
118

5. Drive roll pin, 1, out from the shifter boss, 2.
6. Remove the shift boss, 2, from the lower shift rail, 3.



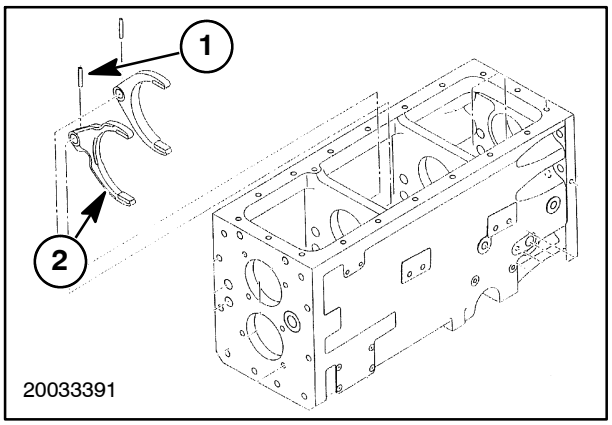
119

7. Use a long magnet to remove the balk pin, 1, from the housing.



120

8. Drive the roll pin, 1, from the lower shift fork, 2, (3rd and 4th gear).

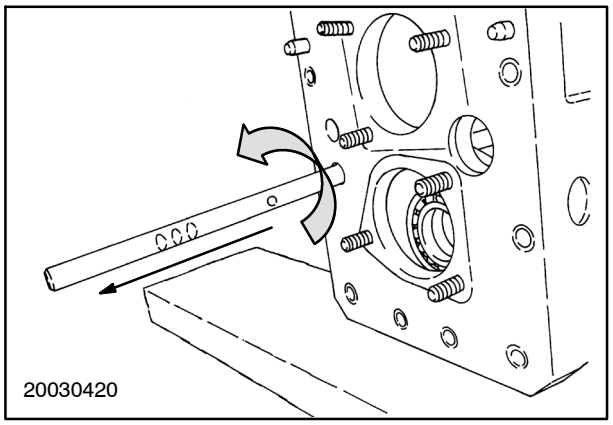


121

⚠ CAUTION ⚠

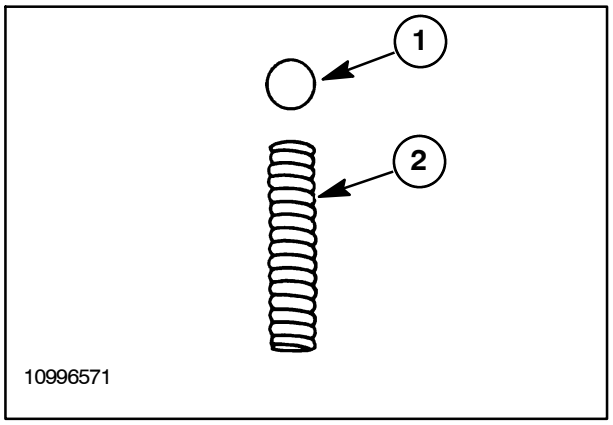
Use care when removing the lower shift rail. Cover the detent hole in the housing with a shop rag. The detent ball and spring could be expelled with force when the lower shift rail is removed.

9. Rotate the lower shift rail 90° to clear the detent ball.
10. Pull the lower shift rail forward and out, through the front of the housing.



122

11. Use a long magnet to remove the detent ball, 1, and spring, 2, from the housing.

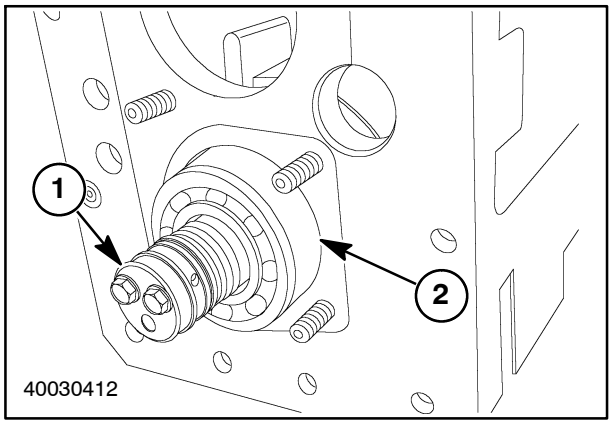


123

Shuttle Clutch and Shaft

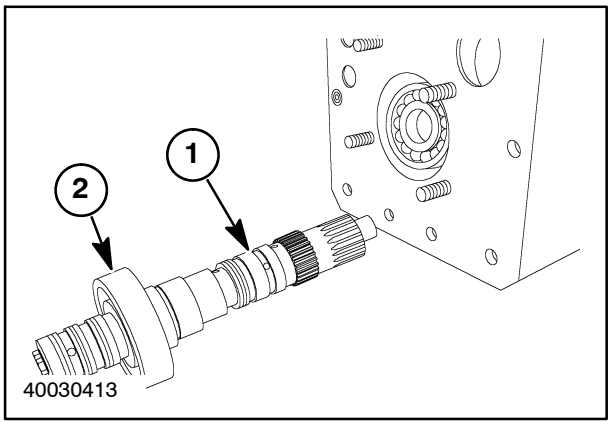
IMPORTANT: *Shift rails must be removed prior to shuttle clutch removal to gain clearance for shuttle clutch assembly to be removed from housing.*

1. Gently pry the shuttle clutch shaft, 1, forward until front bearing, 2, is released from housing.



124

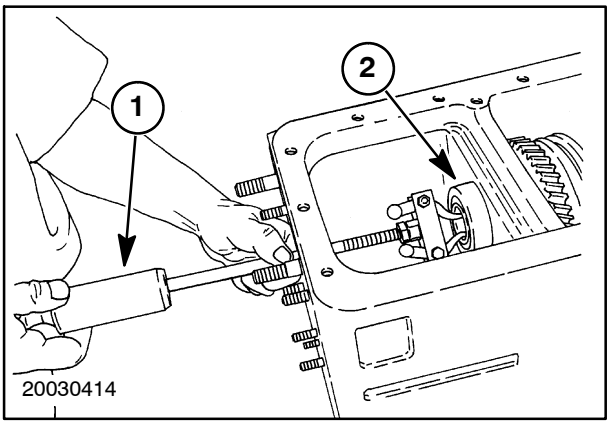
2. Remove shaft, 1, and bearing, 2, from housing.



125

3. Use a slide hammer, 1, to remove the rear, input shaft bearing, 2.

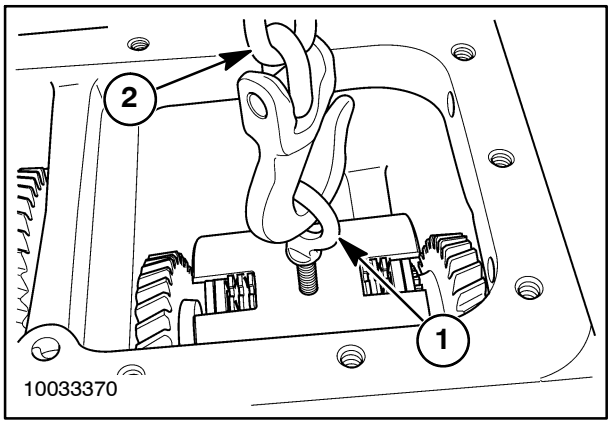
NOTE: *The rear, input shaft bearing must be removed to allow enough clearance to the case to remove the shuttle clutch assembly.*



126

IMPORTANT: *Pay close attention to the orientation of the shuttle clutch before removing from the housing. The forward and reverse gears on either end of the shuttle clutch are of different sizes and tooth counts.*

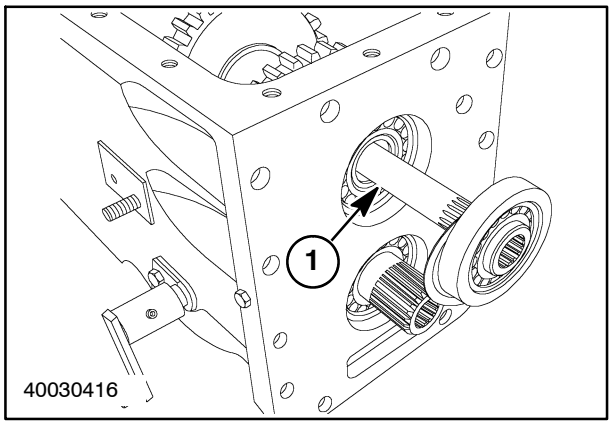
4. Install a threaded eye-bolt, 1, into the hole in the shuttle clutch and attach a lifting chain, 2, to the eye-bolt.
5. Carefully lift the shuttle clutch assembly from the housing using the chain.



127

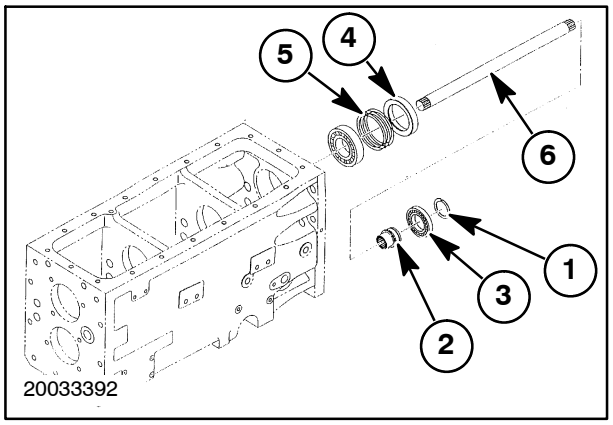
PTO Shaft

1. Pull the PTO shaft, 1, rearward, from the countershaft and housing.



128

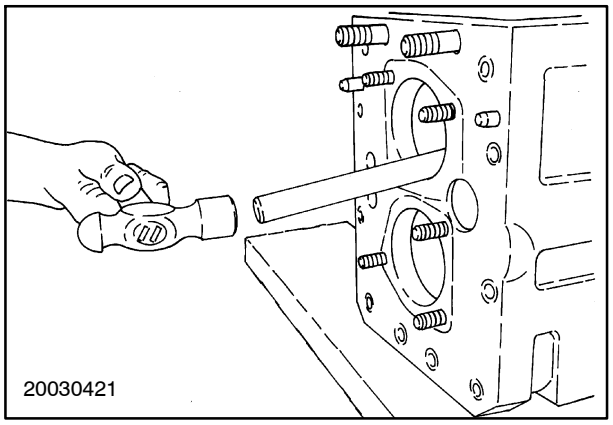
2. Remove the snap ring, 1, from the coupler, 2.
3. Remove the bearing, 3, bearing holder, 4, shims, 5, (if used) and coupler, 2, from the PTO shaft, 6.



129

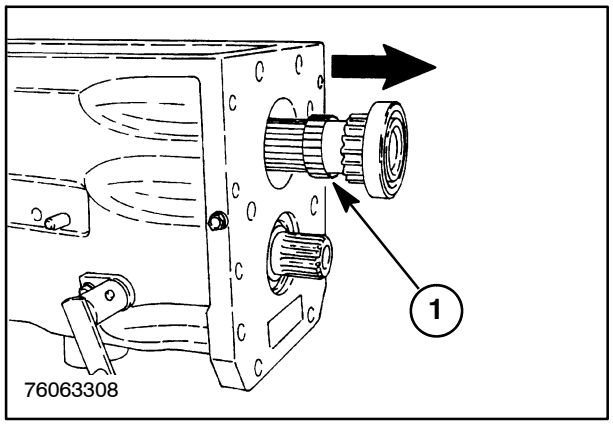
Countershaft

1. Use an aluminum drift and a hammer to lightly tap the countershaft rearward.



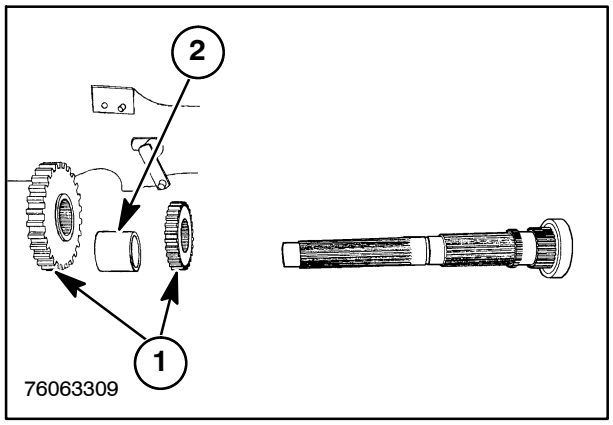
130

2. Pull the countershaft, 1, out through the rear of the housing.



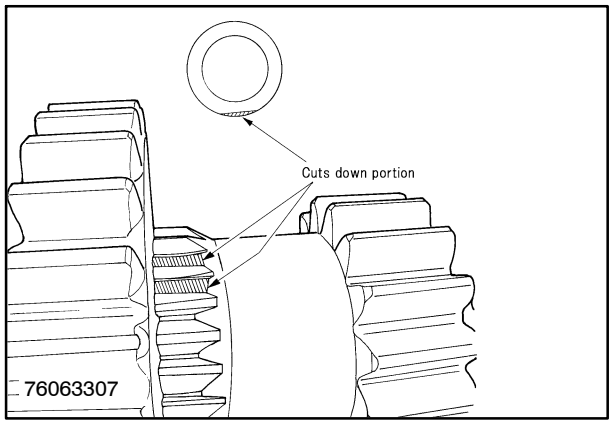
131

3. Remove the range gears, 1, and spacers, 2, from the rear compartment of the housing.



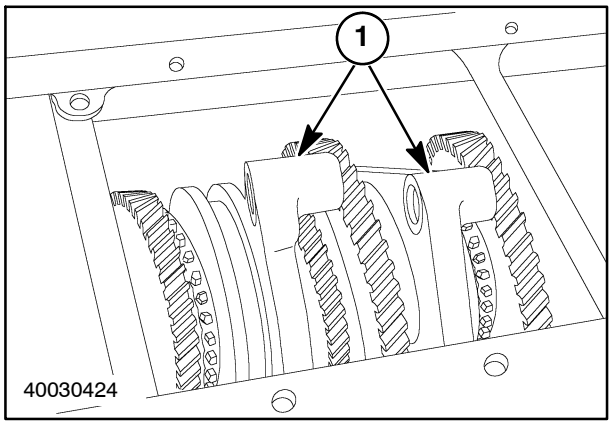
132

IMPORTANT: *The cut portion of the countershaft needs to be turned downward to the six o'clock position to prevent interference with the low range fixed gear (51T) on the rear main shaft.*



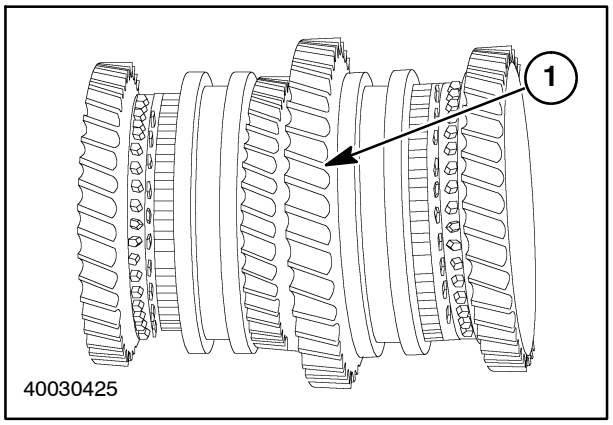
133

4. Rotate the shift forks, 1, to the top of the synchronizer collars.
5. Use a paint pen to mark the forks “FRONT” and “REAR”. Also take note of the orientation of the forks on the collars for proper assembly.



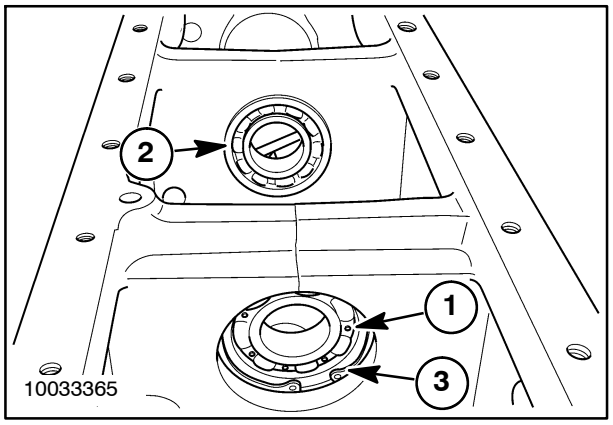
134

6. Carefully lift the main transmission gears and synchronizers, 1, up and out of the housing as an assembly.



135

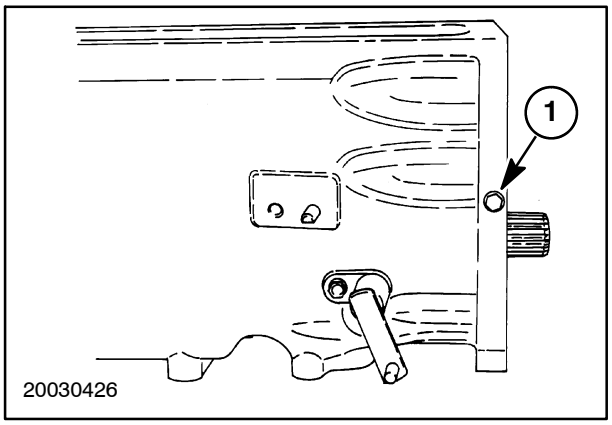
7. Remove the front bearing, 1, and rear bearing, 2, from the housing.
8. Remove the snap ring, 3, from the bearing web of the housing.



136

Main Shaft

1. Remove the shift rail lock bolt, 1, and seal washer from the housing.

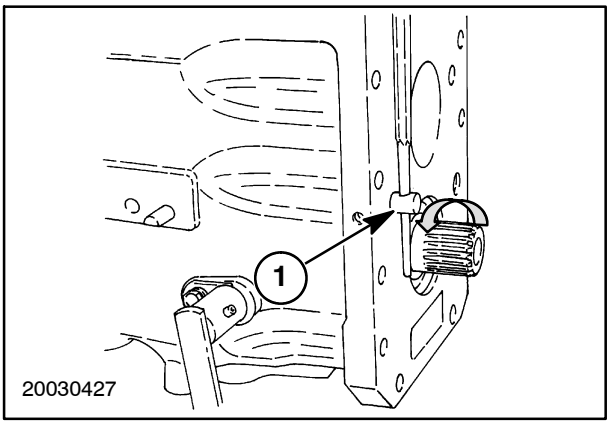


137

2. Push the shift rail, 1, partway out of the rear of the housing.
3. Insert a punch through the hole in the shift rail.
4. Rotate the shift rail 90° to clear the detent.

⚠ CAUTION ⚠

Use care when removing the shift rail. Cover the detent hole in the shift fork with a shop rag. The detent ball and spring could be expelled with force when the shift rail is removed.



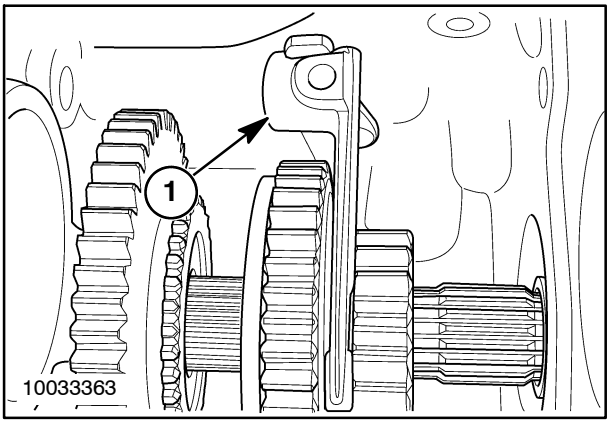
138

5. Cover the detent hole in the shift fork and use the punch to pull the shift rail out of the housing.

IMPORTANT: *Pay attention to the orientation of the shift fork on the shift rail for proper assembly.*

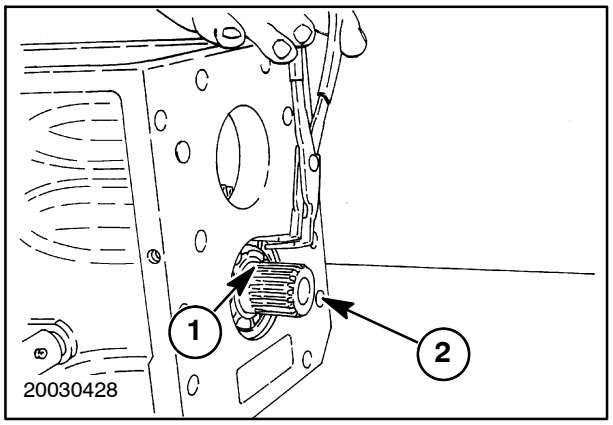
6. Remove the range shift fork, 1, from the housing.

NOTE: *Use care not to lose the detent ball and spring while removing the shift fork.*



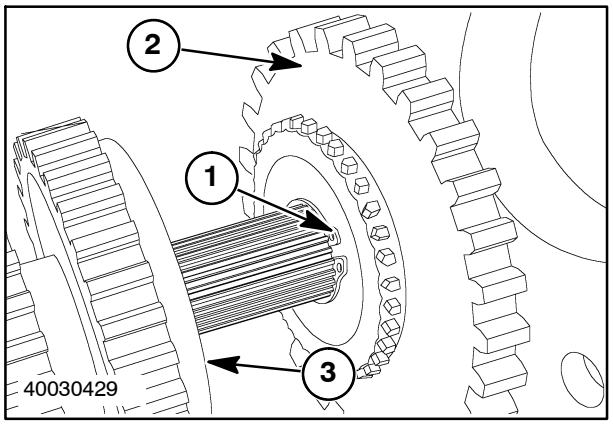
139

7. Remove the rear snap ring, 1, from the main shaft, 2.



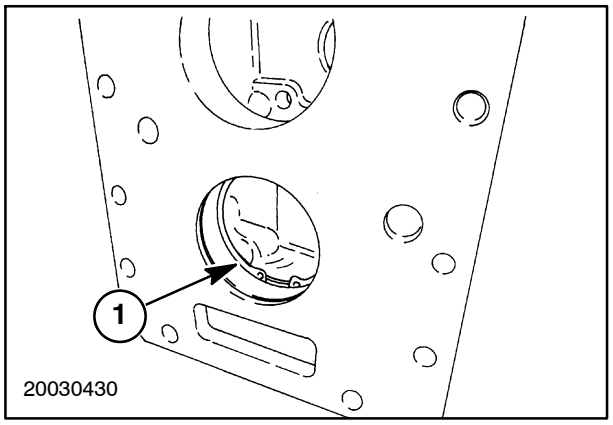
140

8. Remove the small snap ring, 1, in front of the rear gear, 2.
9. Slide the snap ring towards the front of the shaft.
10. Pull the shaft towards the rear of the housing.
11. Remove the gears, 2 and 3, and snap ring,1.



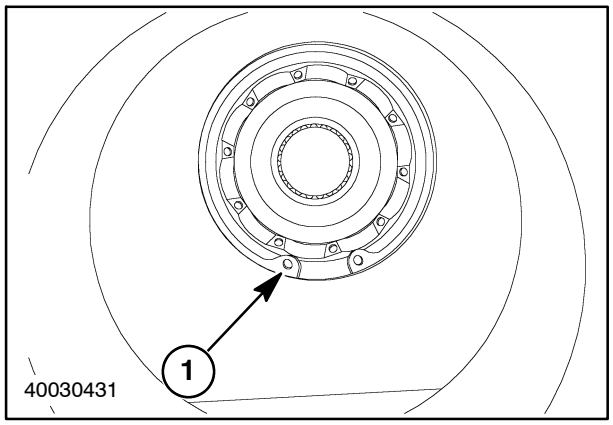
141

12. Remove the inner snap ring, 1, from the bearing web in rear of housing.



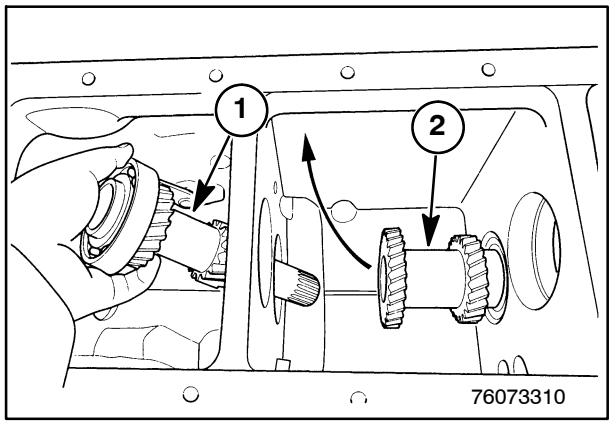
142

13. Remove rear snap ring, 1, from housing. (rear of front main shaft).



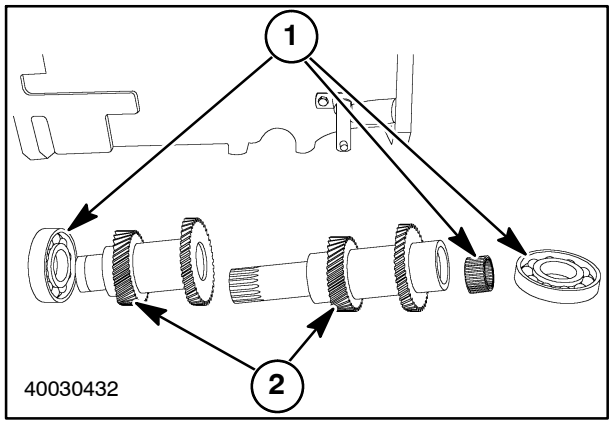
143

14. Use an aluminum drift to gently tap the rear main shaft assembly, 1, towards the rear of the housing.
15. Remove the front main shaft assembly, 2, from the housing.



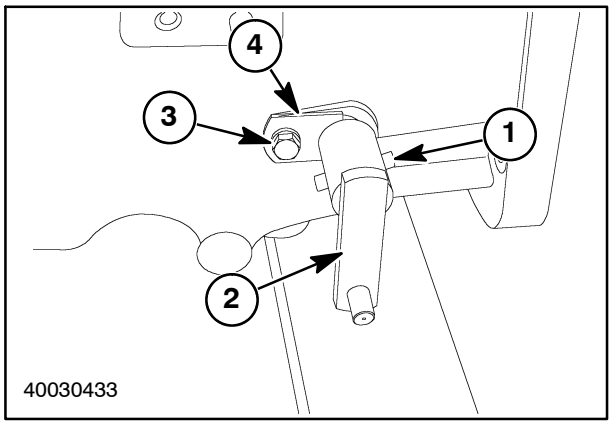
144

16. Remove the bearings, 1, from both main shafts, 2.



145

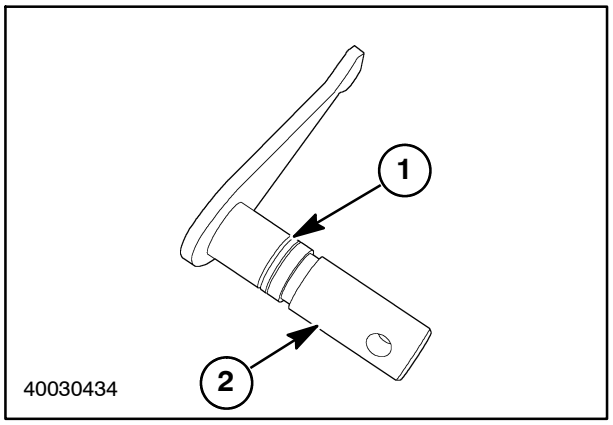
17. Drive the roll pin, 1, from the range gear shift lever, 2. Remove the shift lever.
18. Remove the bolt, 3, and retainer, 4.
19. Remove the shift arm from the housing from the inside of the housing.



146

IMPORTANT: *Pay close attention to the location of the O ring on the shift arm. The O ring is placed in the groove towards the inside end of the arm.*

20. Remove the O ring, 1, from the shift arm, 2.



147

Inspection

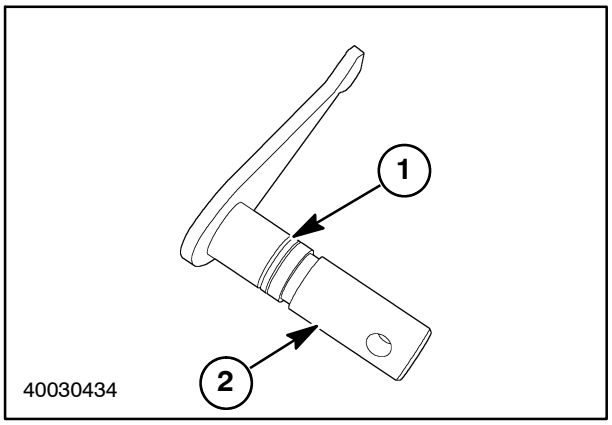
1. Wash all parts in a suitable cleaning solution and allow to air dry.
2. Inspect all bearings for excess wear, score marks, discoloration from overheating or other damage. Rotate the bearings by hand and check for roughness while turning the inner and outer races. Replace as necessary.
3. Lubricate all bearings with clean hydraulic fluid before assembly.
4. Inspect the transmission housing for cracks, worn or damaged bearing bores or other damage. Replace as necessary.
5. Check all detent springs for wear, chipped or weak spring tension. Replace as necessary.
6. Inspect the detent balls and balk pins for excess wear or damage. Replace as necessary.
7. Inspect the detent grooves in the shift rails for excess wear. Replace as necessary.
8. Inspect all gears for excess wear, chipped gear teeth, cracks or any other damage. Replace as necessary.
9. Inspect shift forks for wear or damage. Replace as necessary. (See “Specifications”)

Assembly

Range Gear Shifter

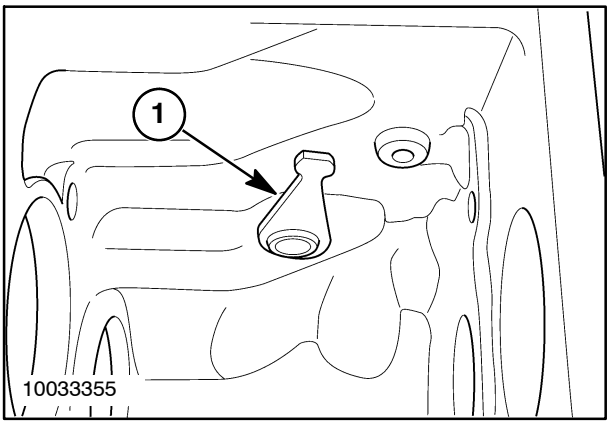
IMPORTANT: *O ring is to be installed in groove closest to shift arm lever.*

1. Lubricate a new O ring, 1, with petroleum jelly and install on the shift arm, 2.



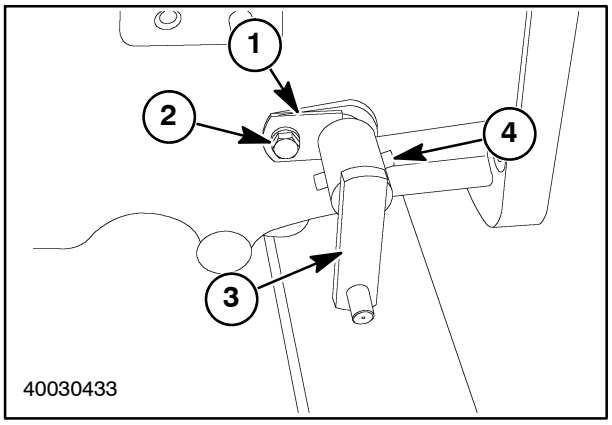
148

2. Install the shift arm, 1, into the transmission housing from the inside.



149

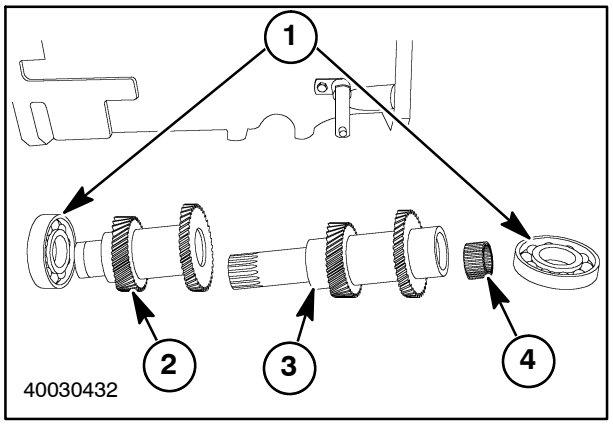
3. Install retainer, 1, and secure with bolt, 2.
4. Install range gear shift lever, 3, and secure to shift arm with roll pin, 4.



150

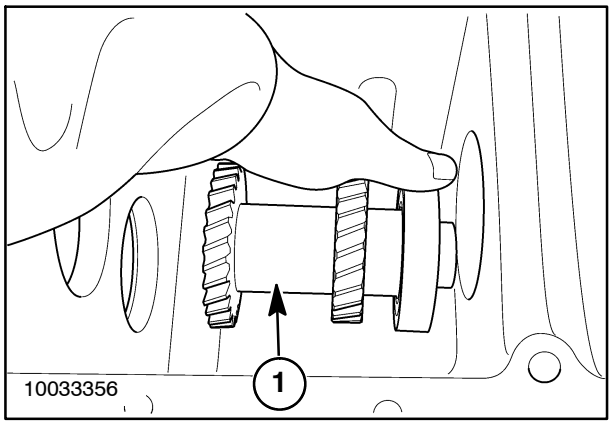
Main Shaft

1. Install bearings, 1, on front, 2, and rear, 3, main shafts.
2. Install needle bearing, 4, into the end of the rear main shaft, 3.



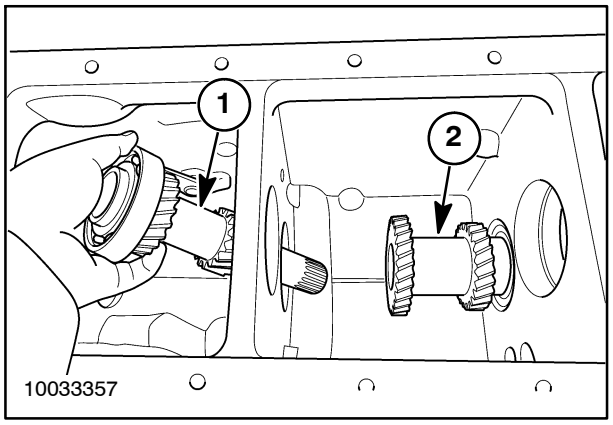
151

3. Install front main shaft assembly, 1, into the center compartment of the transmission housing, through the lower bearing hole, with the bearing facing toward the front of the housing.



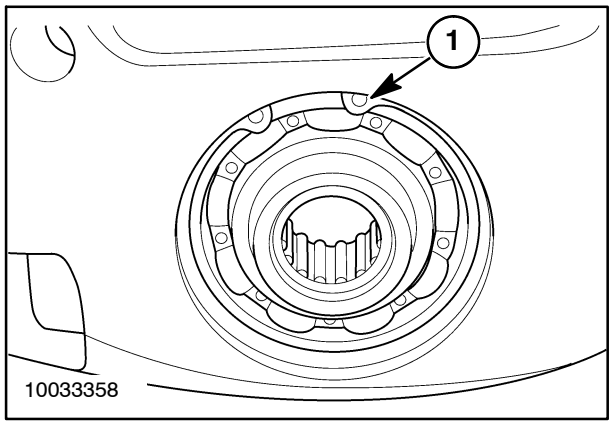
152

4. Install rear main shaft assembly, 1, through the bearing hole and into the front main shaft, 2.



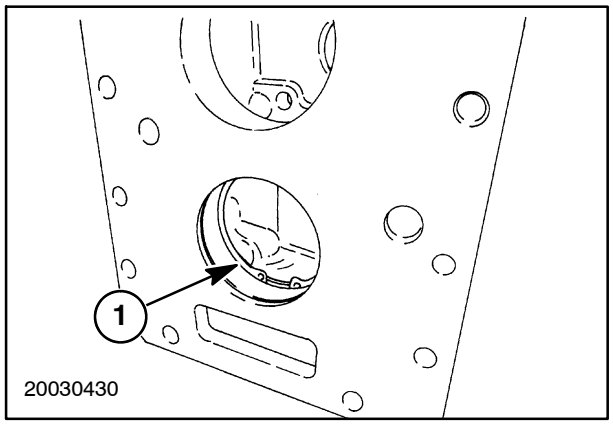
153

5. Install snap ring, 1, to secure main shaft assembly.



154

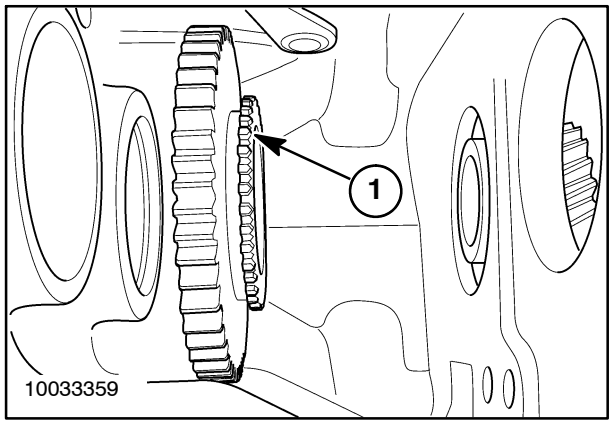
6. Install the inner snap ring, 1, in the rear main shaft bearing web of the housing.



155

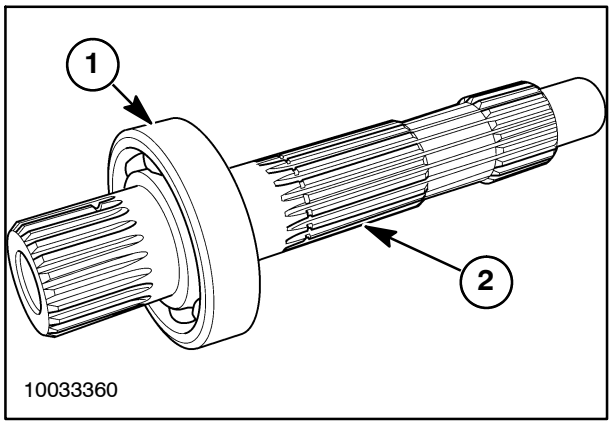
IMPORTANT: *Lubricate the bushing in the large gear with clean hydraulic fluid prior to assembly.*

7. Place the large gear, 1, in the housing, with the flange containing the engagement teeth facing the front of the housing.



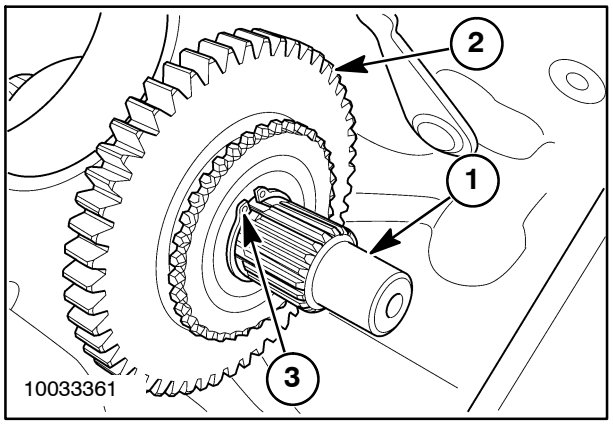
156

8. Install the bearing, 1, on the main shaft, 2.



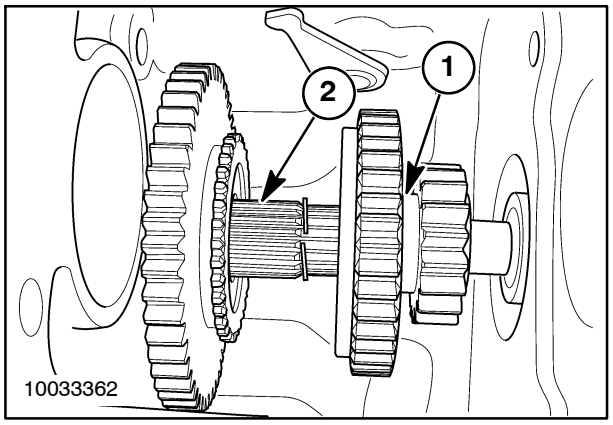
157

9. Insert the main shaft, 1, partially into the housing from the rear, through the large gear, 2.
10. Slide the small snap ring, 3, over the end of the main shaft, 1, and position towards the rear of the shaft.



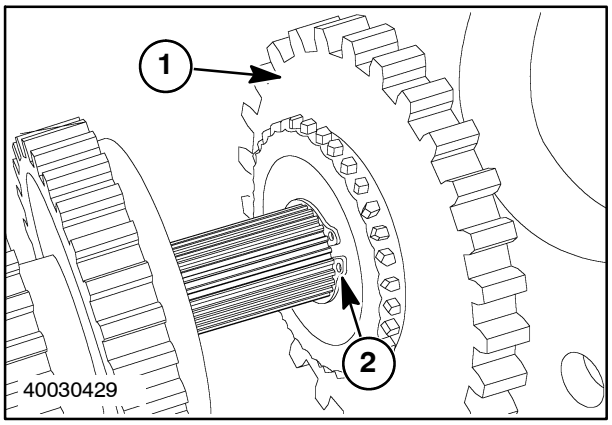
158

11. Install the sliding, smaller double gear, 1, onto the main shaft, 2, while inserting the main shaft into the housing.



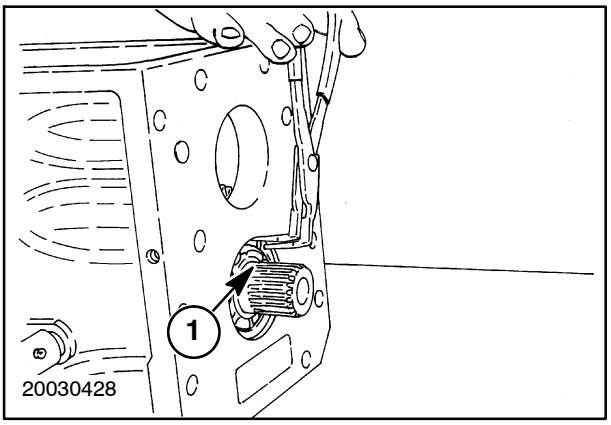
159

12. Fully insert the main shaft until the rear bearing bottoms against the snap ring.
13. Slide the large gear, 1, rearward and install small snap ring, 2, in groove on shaft to retain large gear.



160

14. Install snap ring, 1, in rear groove of housing to retain main shaft.

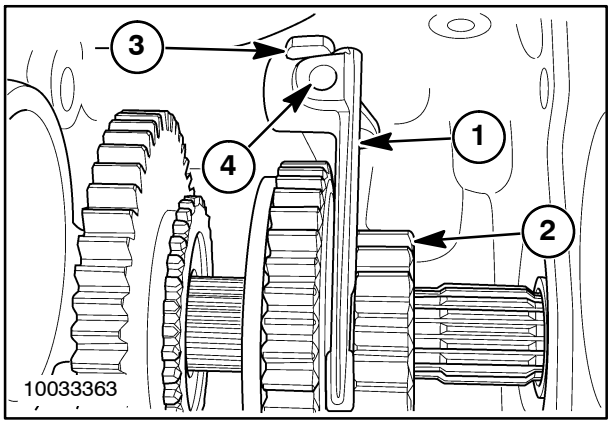


161

Range Gear Shift Fork

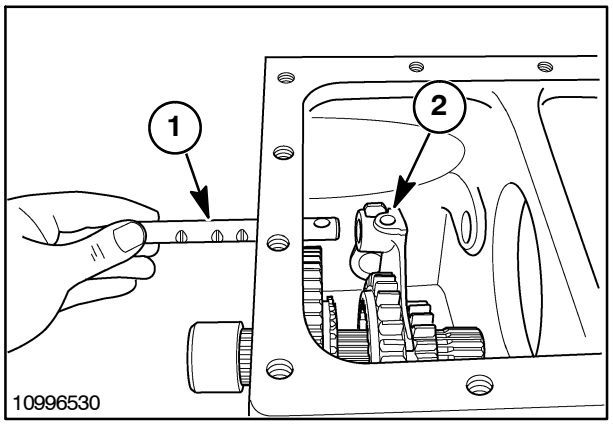
IMPORTANT: *The orientation of the shift fork must be correct during installation. The larger part of the shift rail bore faces the rear of the housing.*

1. Install the range gear shift fork, 1, onto the sliding gear, 2. Be sure to engage the shift arm, 3, in the shift fork.
2. Install the detent spring and ball in the detent hole, 4, in the shift fork.



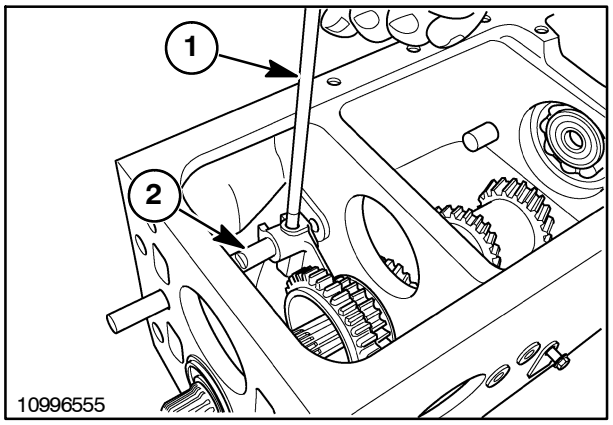
162

3. Temporarily slide the shift rail, 1, through the rear of the housing, into the shift fork, 2.
4. Position the shift rail, 1, with the detent grooves as shown while installing into the shift fork.



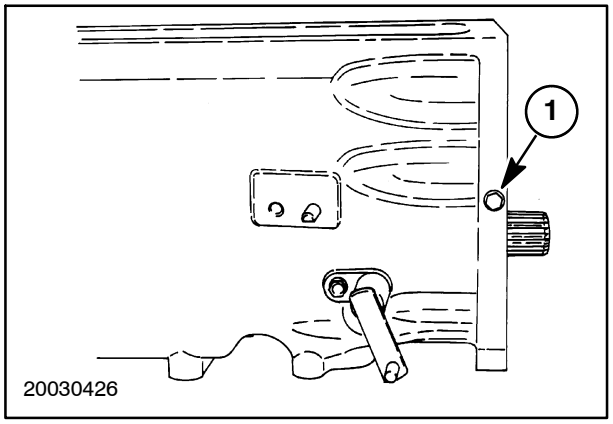
163

5. Use special detent tool #FNH00081, 1, to compress the detent spring and ball.
6. Insert a suitable size socket or round stock into the front of the shift fork bore while compressing the detent spring and ball.
7. Carefully remove the detent tool while pushing the socket into the bore, over top of the detent ball. (This will hold the detent ball and spring in place while the shift rail is inserted.)
8. Insert the range gear shift rail, 2, through the housing and into the shift fork, until the socket is pushed from the shift fork.
9. Rotate the shift rail 90° to align the lock hole in the shift rail with the lock hole in the side of the housing.



164

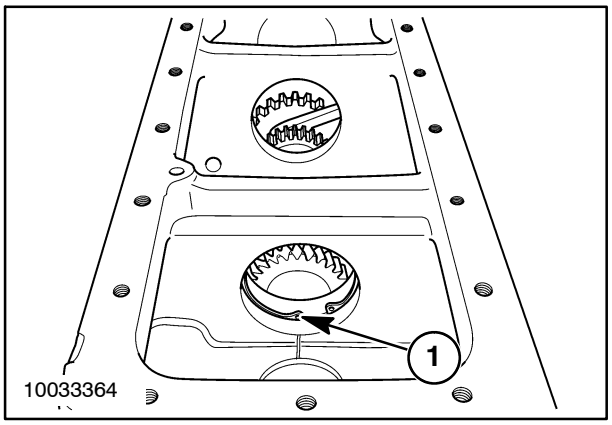
10. Install a new seal washer. Install and tighten the lock bolt, 1.



165

Countershaft

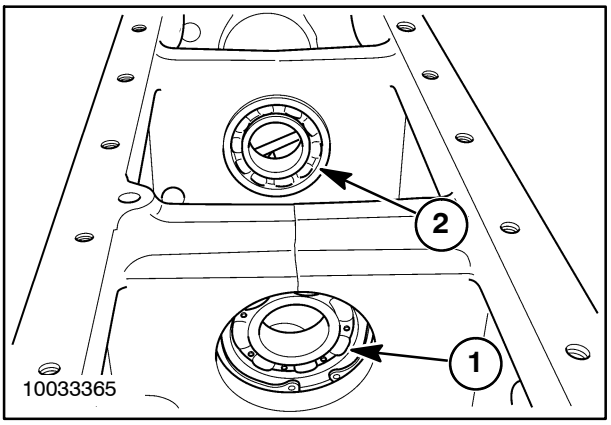
1. Install the snap ring, 1, into the groove in the housing to retain the front countershaft bearing.



166

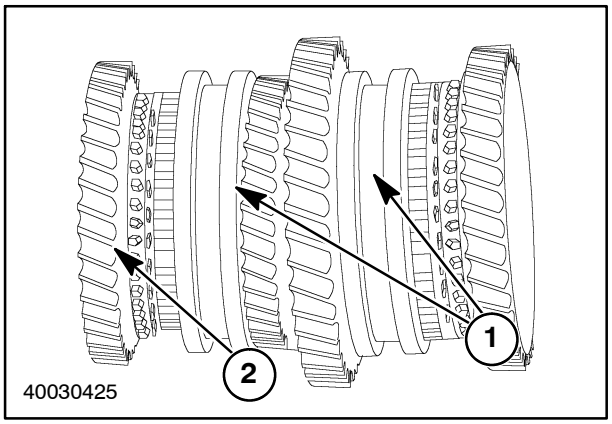
IMPORTANT: *The front bearing, 1, is marked 6307 and has a smaller I.D. than the rear bearing. The rear bearing is marked 6208 and has the larger I.D. of the two bearings. DO NOT install bearings in the wrong position.*

2. Install the front bearing, 1, and rear bearing, 2, into the housing.



167

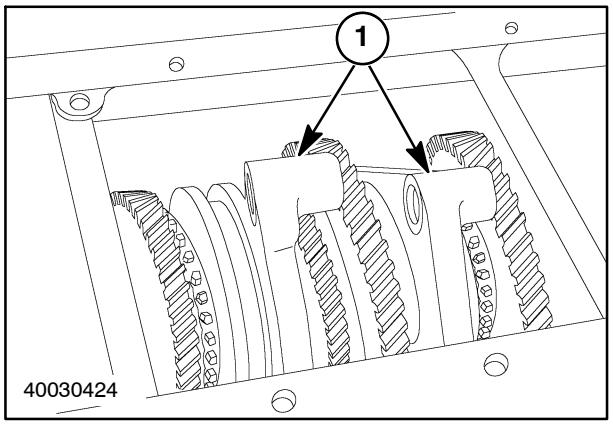
3. Place the main gear/synchronizer assembly, 1, into the center compartment of the transmission housing, with the 44T gear, 2, facing towards the front of the housing.



168

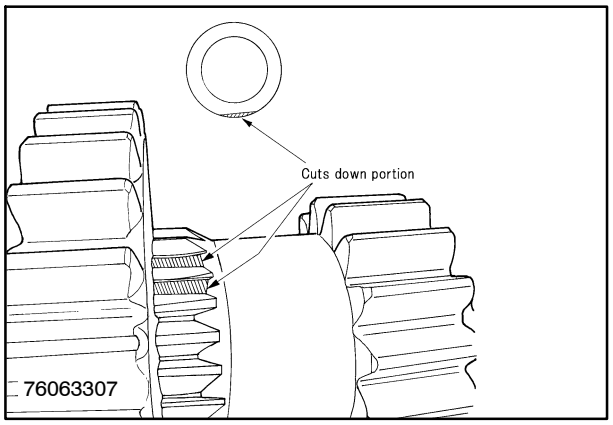
IMPORTANT: *Be sure to install shifts forks to corresponding synchronizers using paint marks made during disassembly. The longer part of the shift rail boss in the shift fork will face rearward when installed properly.*

4. Install the shift forks, 1, onto the synchronizers.
5. Rotate the shift forks to the normal position for installation of the shift rails at a later time.



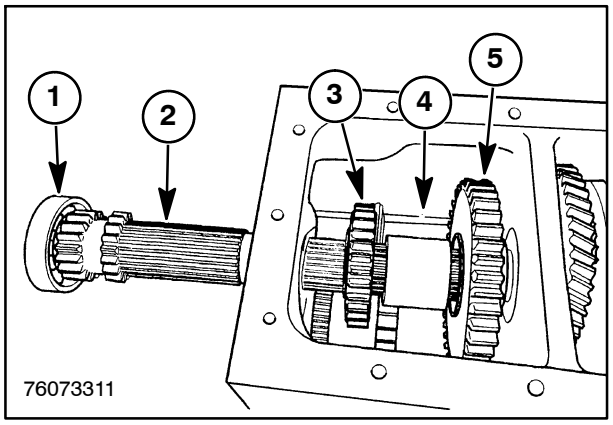
169

IMPORTANT: *The cut portion of the countershaft needs to be turned downward to the six o'clock position to prevent interference with the low range fixed gear (51T) on the rear main shaft.*



170

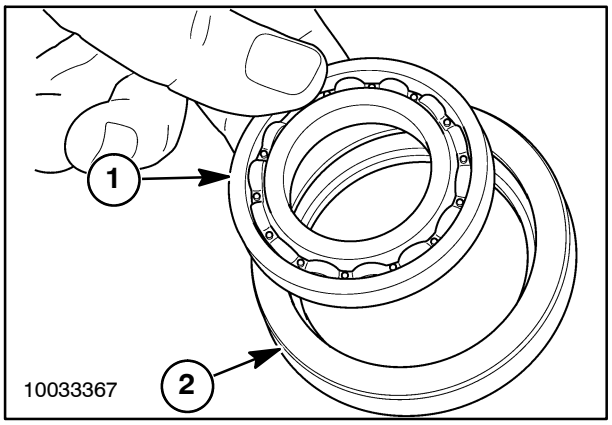
6. Install the bearing, 1, on the countershaft, 2.
7. Install the countershaft, 2, through the rear of the housing while installing 26T gear, 3, collar, 4, and 40T gear, 5. (Be sure flange side of gear, 5, is facing toward front of housing.)
8. Continue to insert countershaft through main gears/synchronizers until fully seated.



171

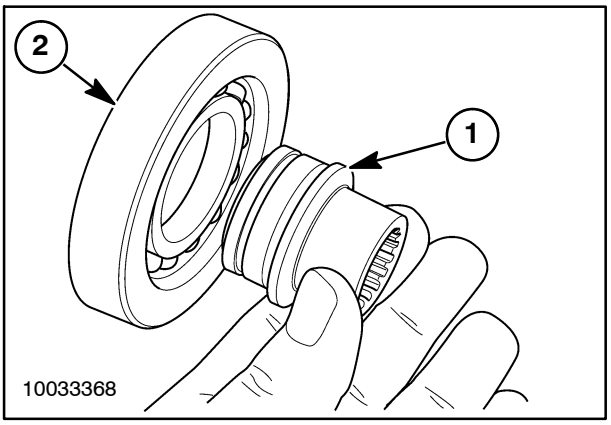
PTO Shaft

1. Install the rear PTO shaft bearing, 1, into the bearing holder, 2, until fully seated.



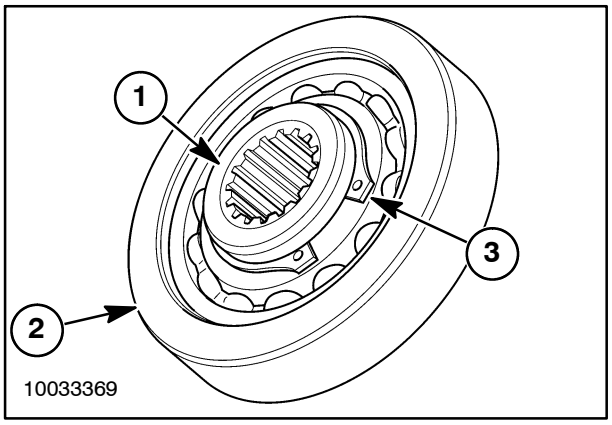
172

2. Install the coupler, 1, into the bearing assembly, 2, as shown. Be sure to install the snap ring side of the coupler through the front of the bearing.



173

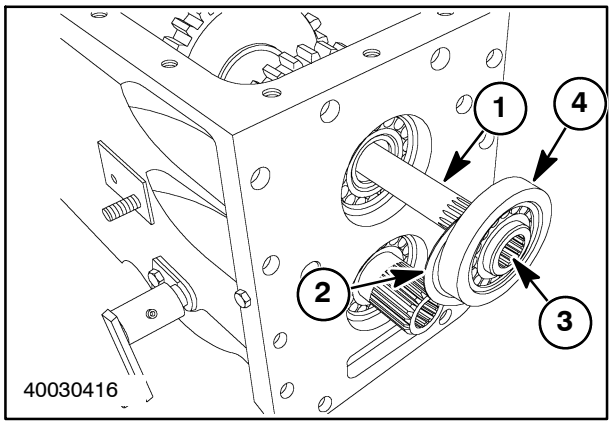
3. Secure the coupler, 1, to the bearing, 2, with a new snap ring, 3.



174

IMPORTANT: *Shims, 2, may be necessary to allow bearing holder, 4, to be flush with mating surface of transmission housing.*

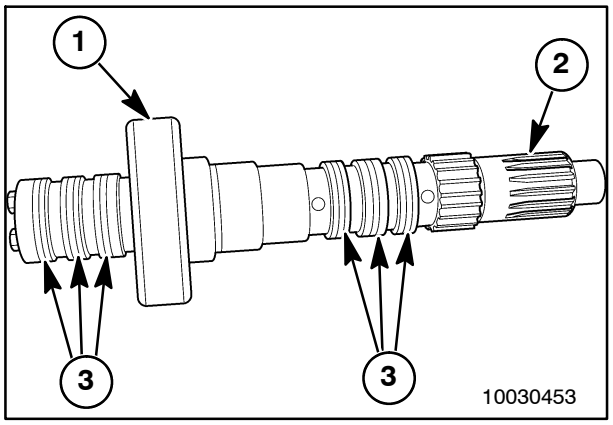
4. Insert the PTO shaft, 1, and shim(s), 2, (if necessary) into the coupler, 3.
5. Install the PTO shaft assembly through the countershaft, seating the bearing holder, 4, in the housing.
6. Check bearing holder for flush fit to housing mating surface. If necessary, remove PTO shaft and install/remove shims as necessary. Reinstall PTO shaft.



175

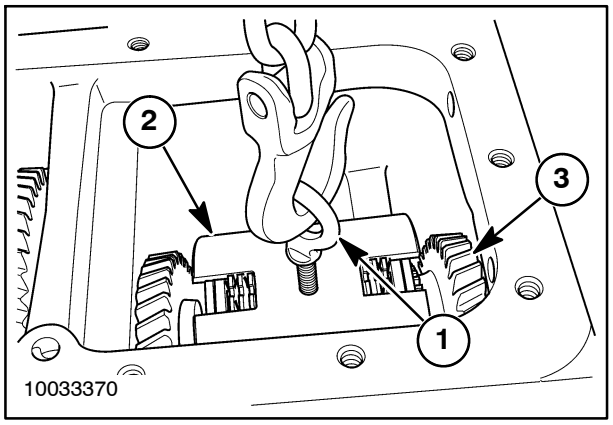
Shuttle Clutch

1. Install bearing, 1, on shuttle clutch shaft, 2.
2. Install six new seal rings, 3, on shuttle clutch shaft, 2.



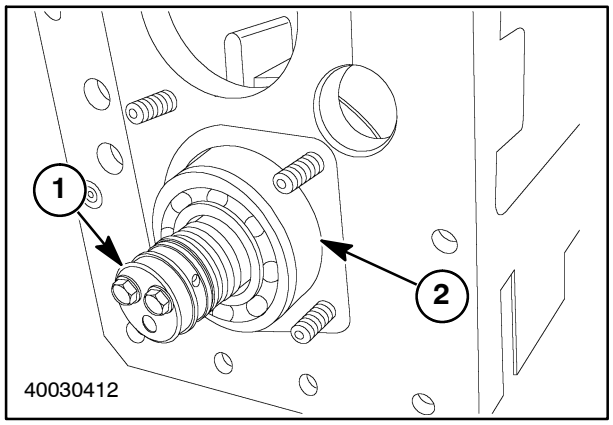
176

3. Use a threaded eye bolt, 1, and chain to lower the shuttle clutch assembly, 2, into the housing. Be certain to position shuttle clutch assembly, with 35T gear, 3, towards the front of the housing.



177

4. Lubricate the shuttle clutch shaft, 1, with clean hydraulic fluid and install through the front of the housing, through the shuttle clutch assembly, into the main shaft.
5. Gently tap the shuttle clutch shaft to fully seat the bearing, 2, in the housing.

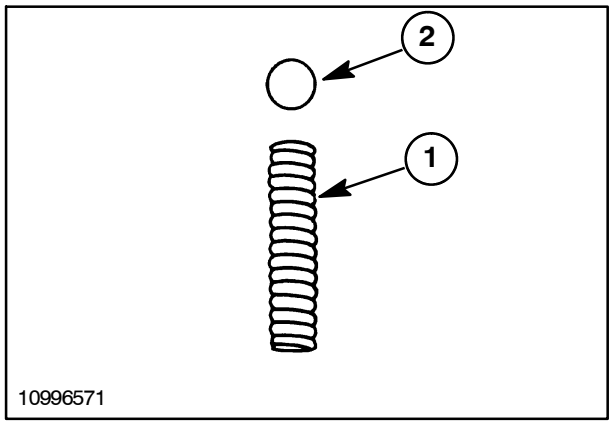


178

Shift Rails

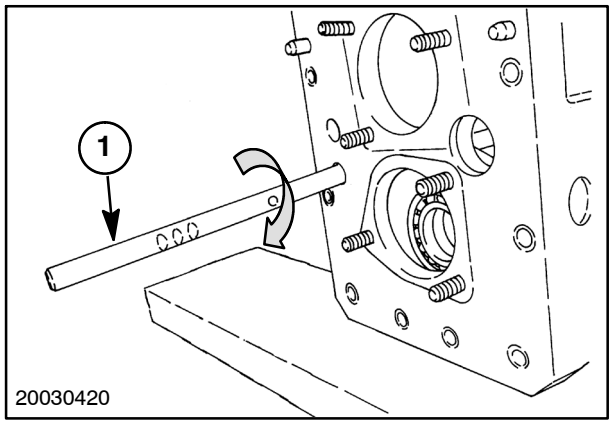
IMPORTANT: *Use a dab of petroleum jelly on the end of the detent spring to retain the detent ball during assembly.*

1. Insert detent spring, 1, and detent ball, 2, into the detent hole in the housing.



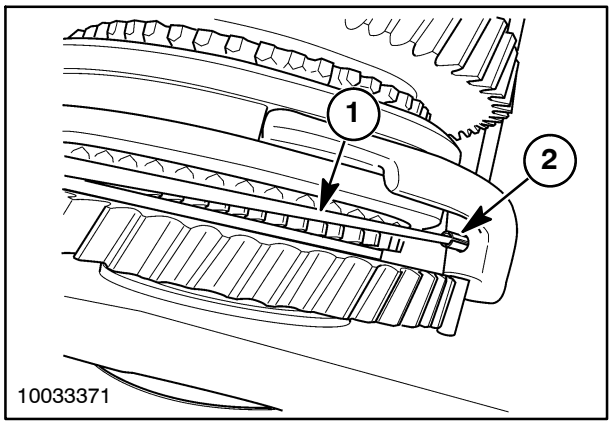
179

2. Insert lower shift rail, 1, as shown, partially into housing and shift fork.
3. Use detent tool #FNH00081 to compress detent ball and spring while inserting lower shift rail through shift fork.
4. Rotate shift rail 90° to position three detent grooves on bottom of shift rail.



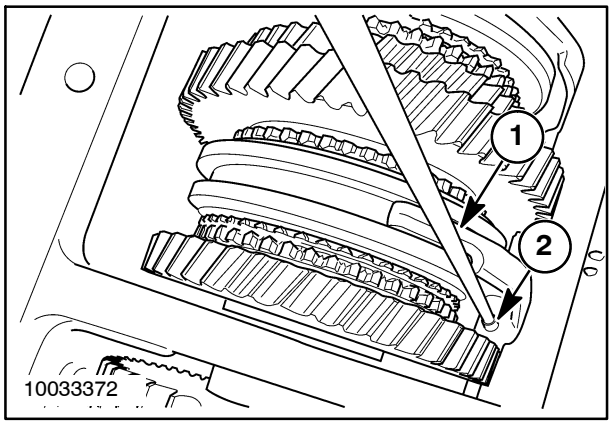
180

5. With lower shift rail inserted into shift fork, align roll pin holes in shift rail and shift fork.
6. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 1, into the shift fork and shift rail roll pin holes.
7. Slide roll pin, 2, over the brazing rod until it rests on the shift fork, over the hole.



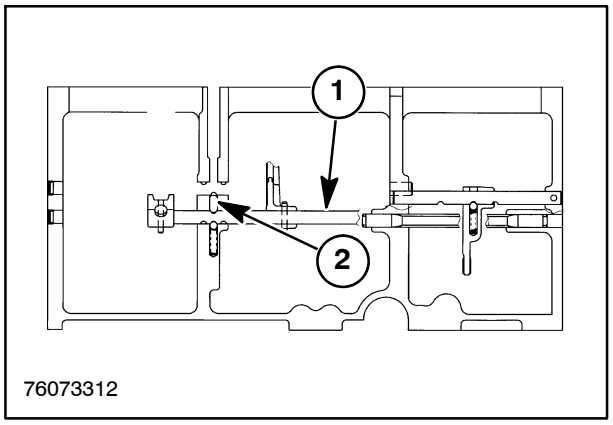
181

8. Slide a 13′ long piece of 3/16″ brake tubing, 1, over the brazing rod until it contacts the roll pin, 2.
9. Lightly tap the brake tubing to start the roll pin in the holes. When the roll pin is through the shift fork and is started into the shift rail, remove the tubing and brazing rod.
10. Finish inserting the roll pin using a punch.



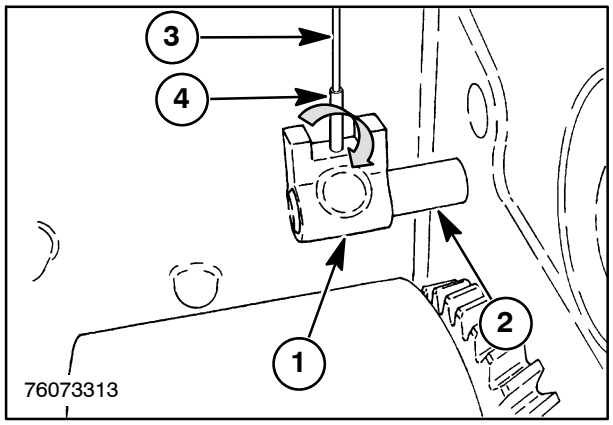
182

11. Place lower shift rail, 1, in the neutral position.
12. Install the balk pin, 2, into the detent hole.



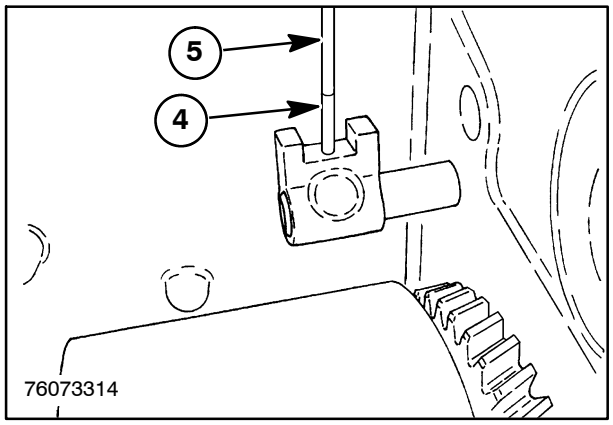
183

13. Install shift rail boss, 1, onto the lower shift rail, 2.
14. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 3, into the shift rail boss and shift rail roll pin holes.
15. Slide roll pin, 4, over. Add the brazing rod until it rests on the shift rail boss, over the hole.



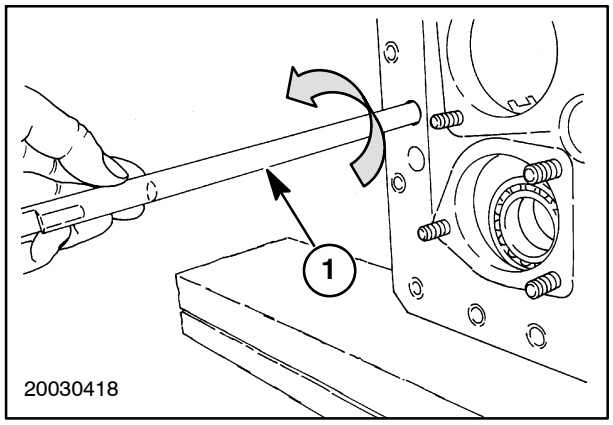
184

16. Slide a 13″ long piece of brake tubing, 5, over the brazing rod until it makes contact with the roll pin, 4.
17. Lightly tap the brake tubing to start the roll pin in the hole. When the roll pin is through the shift rail boss and is started into the shift rail, remove the brake tubing and brazing rod.
18. Finish driving the roll pin through the shift rail using a punch.



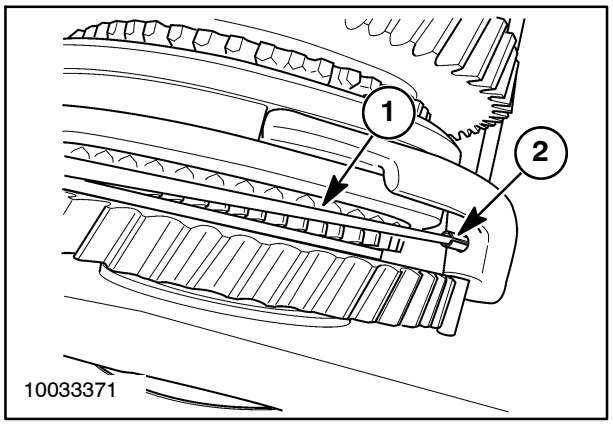
185

19. Insert upper shift rail, 1, as shown, partially into the housing over the balk pin and into the shift fork.
20. Rotate the shift rail 90° to position three detent grooves on top of the shift rail.



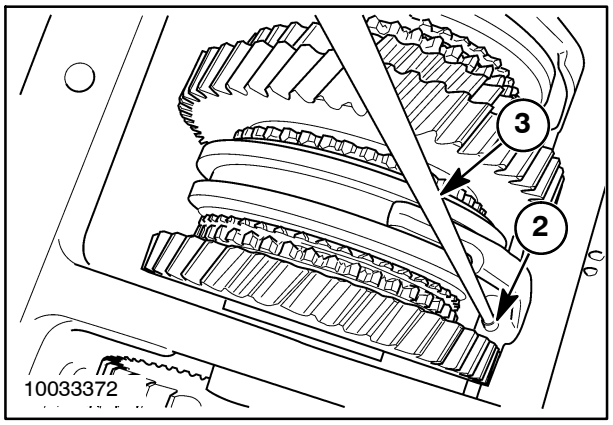
186

21. With upper shift rail inserted into shift fork, align roll pin holes in shift rail and shift fork.
22. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 1, into the shift fork and shift rail roll pin holes.
23. Slide roll pin, 2, over the brazing rod until it rests on the shift fork, over the hole.



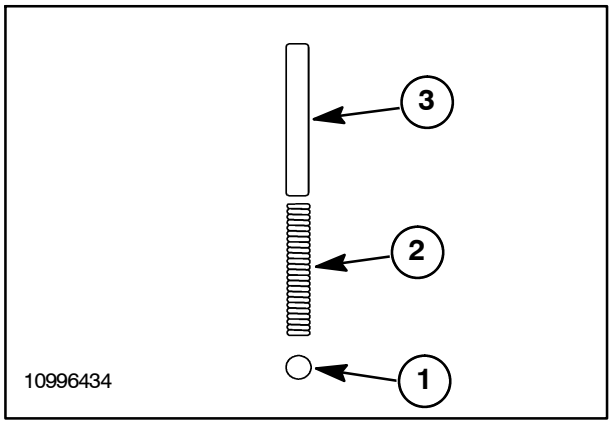
187

24. Slide a 13′ long piece of 3/16″ brake tubing, 3, over the brazing rod until it contacts the roll pin, 2.
25. Lightly tap the brake tubing to start the roll pin in the holes. When the roll pin is through the shift fork and is started into the shift rail, remove the tubing and brazing rod.
26. Finish inserting the roll pin using a punch.



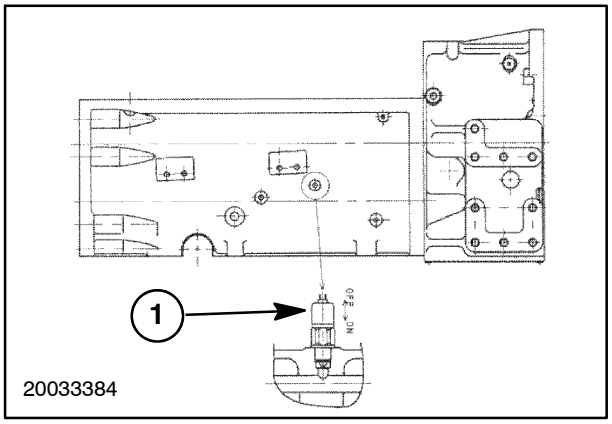
188

27. Insert detent ball, 1, spring, 2, and pin, 3, into detent hole.



189

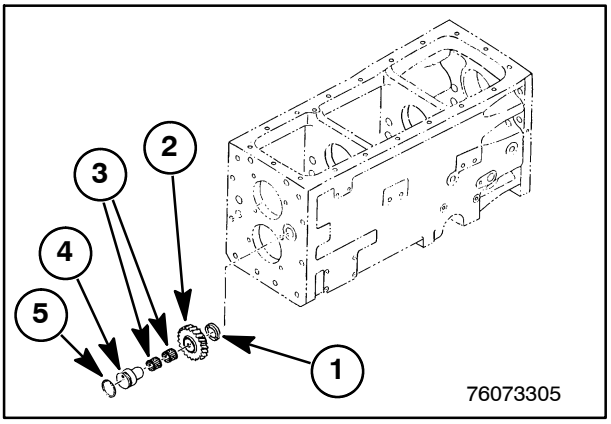
28. Install the modulation switch, 1, into the right side of the transmission housing.



190

Reverse Idler

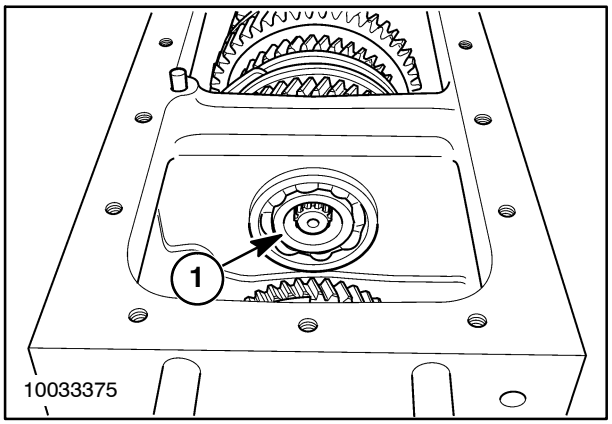
1. Install the spacer, 1, with the oil grooves facing forward, and 22T gear, 2, with large flange facing rearward, into the housing.
2. Lubricate the needle bearings, 3, with clean hydraulic oil and install on the reverse idler shaft, 4.
3. Lubricate a new O ring, 5, with petroleum jelly and install on the idler shaft, 4.
4. While holding the gear and spacer in place in the housing, install the reverse idler shaft through the front of the housing, through the gear and spacer, until fully seated in the housing.



191

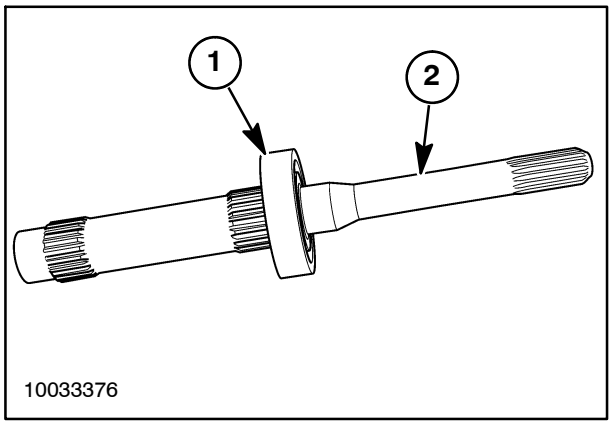
Input Shaft

1. Install the rear input shaft bearing, 1, in the housing.



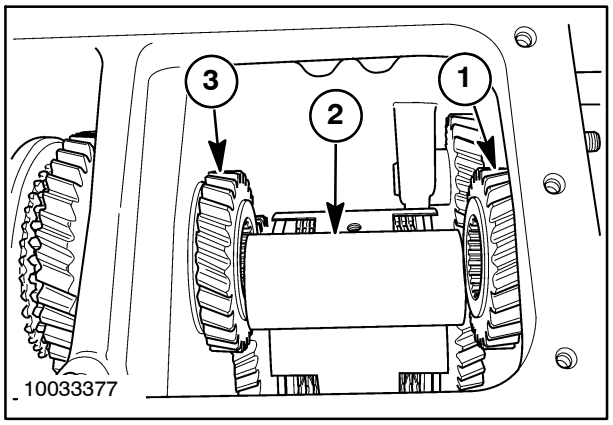
192

2. Install the front input shaft bearing, 1, on the input shaft, 2.



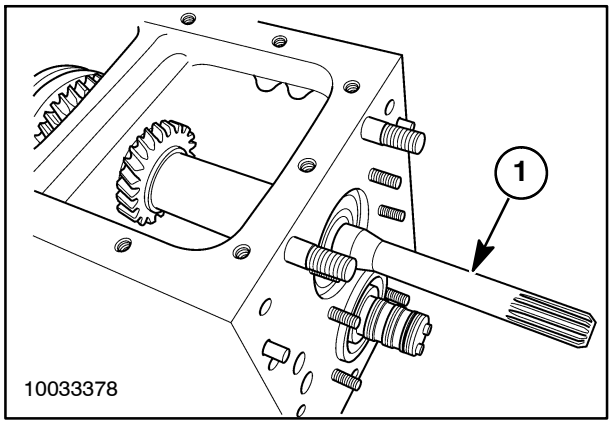
193

3. Position the 28T gear, 1, (flange facing forward), spacer, 2, and 30T gear, 3, (flange facing rearward) in the housing.



194

4. Install the input shaft, 1, through the front of the housing.
5. Insert the input shaft through the gears and collar until the front bearing is fully seated in the housing.

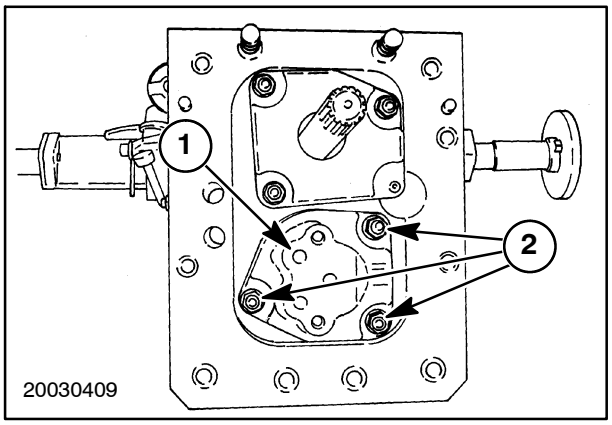


195

Shuttle Clutch Adapter/Input Shaft Retainer

IMPORTANT: *Use caution not to lose the O ring on the back of the adapter during installation.*

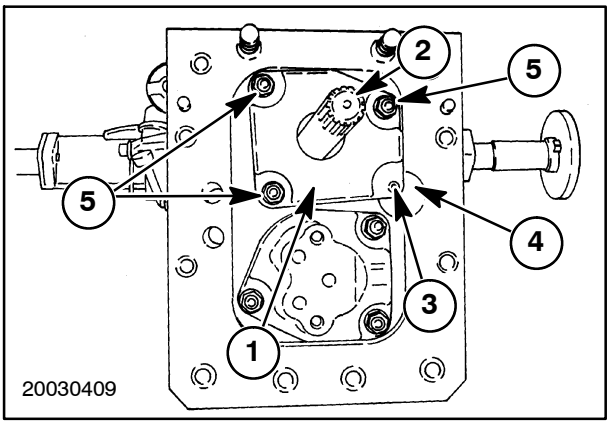
1. Lubricate a new O ring with petroleum jelly and install in the groove on the back side of the adapter, 1.
2. Install the adapter, 1, onto the housing, over the shuttle clutch shaft.
3. Install and tighten the three nuts and washers, 2, to secure the adapter, 1.



196

IMPORTANT: *Use caution not to lose the O ring on the back of the input shaft retainer during installation.*

4. Lubricate a new O ring with petroleum jelly and install in the groove on the back side of the input shaft retainer, 1.
5. Install the input shaft retainer, 1, onto the housing, over the input shaft, 2.
6. Locate the hole in the input shaft retainer over the roll pin, 3, in the reverse idler shaft, 4.
7. Install and tighten the three nuts and washers, 5, to secure the input shaft retainer, 1.



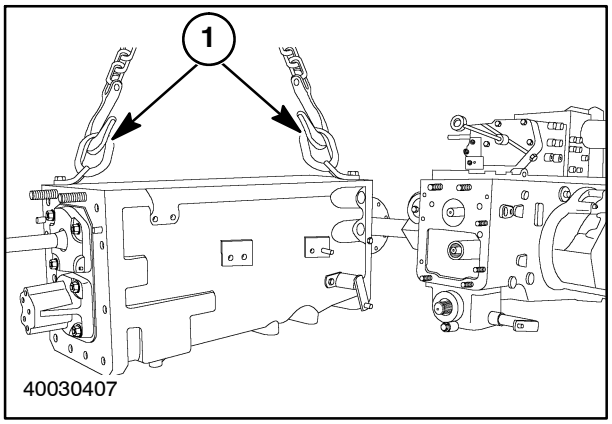
197

Attaching The Transmission/Differential

1. Attach two suitable lifting eyes, 1, to opposite corners of the transmission housing.
2. Attach a chain sling to the lift eyes and a suitable hoist.
3. Place Loctite gasket eliminator® 518 on the rear transmission housing.

IMPORTANT: Do not use silicone sealer.

4. Carefully attach the transmission to the differential housing, making sure to align all shafts, splines and locating pins.



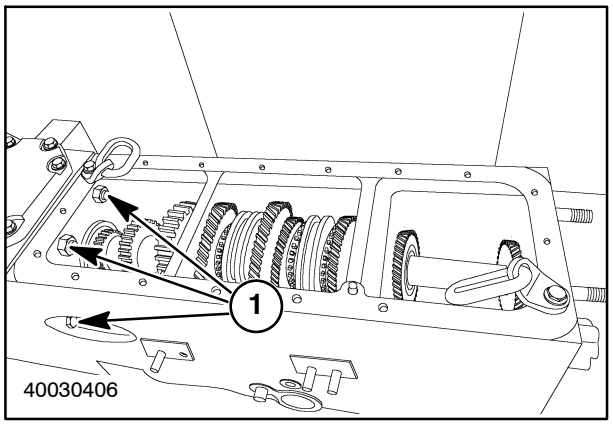
198

5. Secure transmission to differential housing with buckle-up bolts and nuts, 1.
6. Tighten and torque buckle-up bolts and nuts evenly to:

   M12 – 120 N·m (88 ft-lbs)

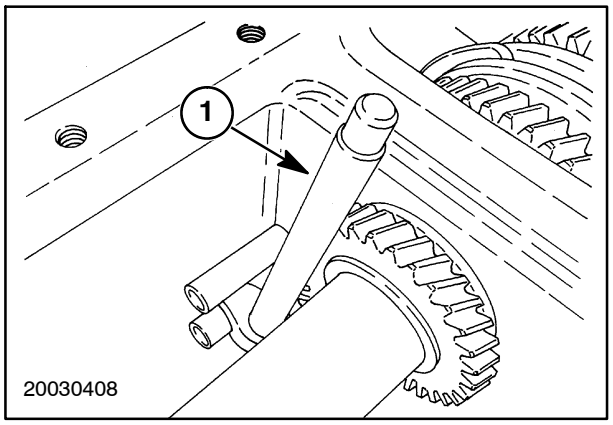
   M14 – 145 N·m (107 ft-lbs)

7. Remove lifting eyes.



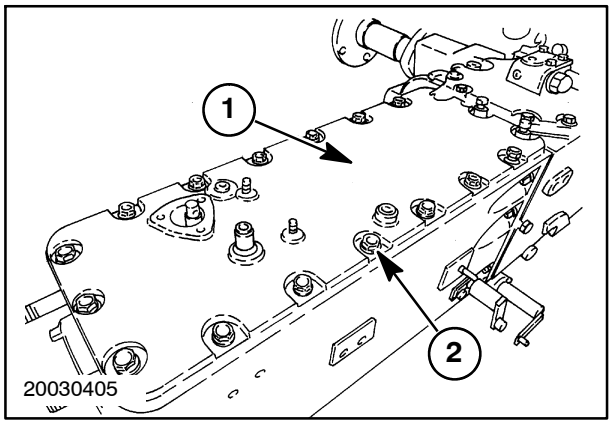
199

8. Install the shift arm, 1, into the transmission, between the upper and lower shift rail.



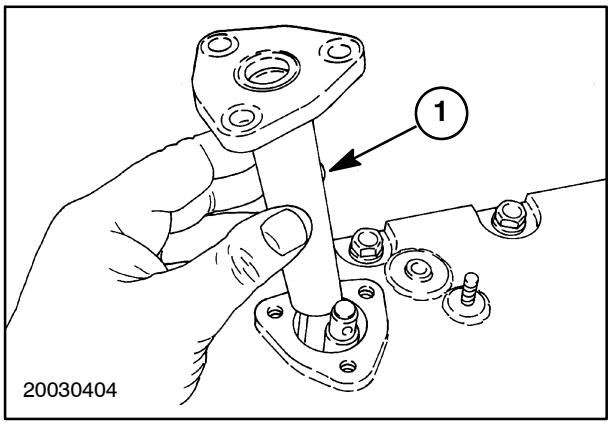
200

9. Place Loctite gasket eliminator® 518 on transmission case surface.
10. Install the transmission cover, 1, on the transmission housing.
11. Tighten and torque the retaining bolts, 2, to 55 N·m (40 ft-lbs). Secure the transmission cover to the housing.



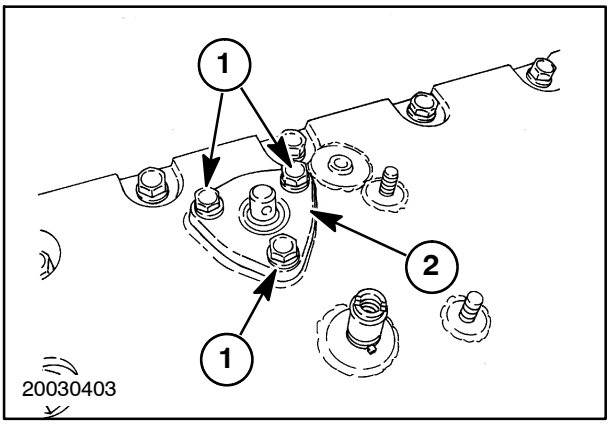
201

12. Install the shift arm cover, 1, over the shift arm and onto the transmission cover.



202

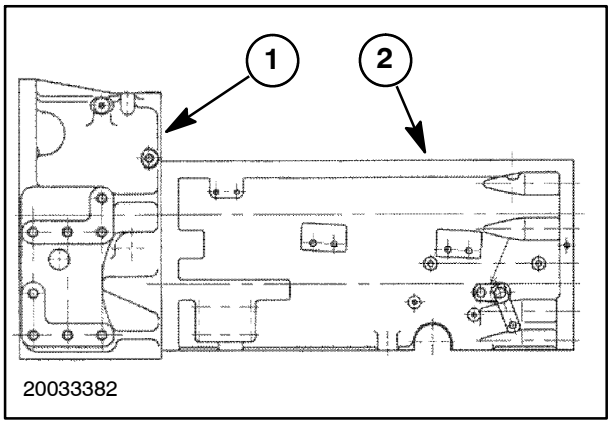
13. Install and tighten the three bolts, 1, to secure the shift arm cover, 2, to the transmission cover.



203

Clutch Housing

1. Attach the clutch housing, 1, to the transmission, 2.

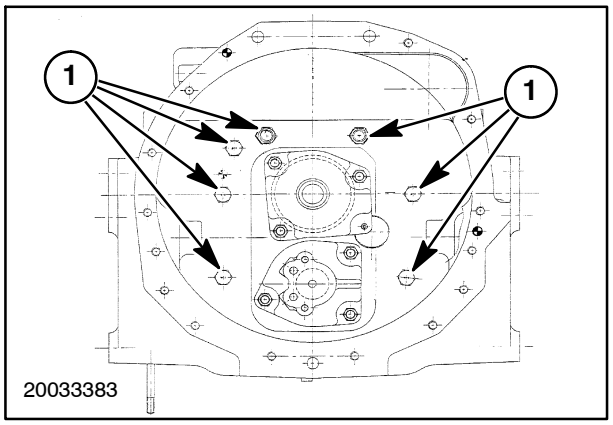


204

2. Install and torque the clutch housing bolts, 1, to:

   M12 – 120 N·m (88 ft-lbs)

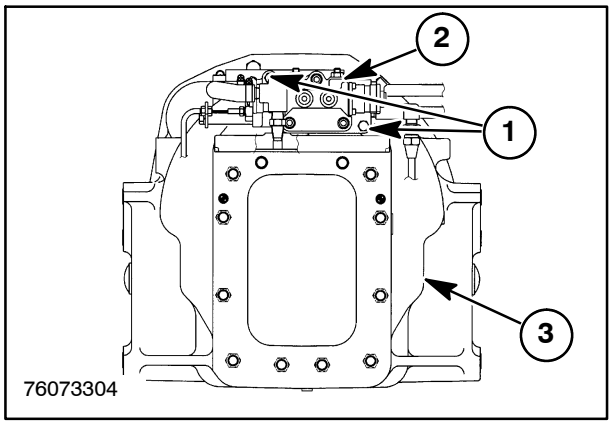
   M14 – 145 N·m (107 ft-lbs)



205

IMPORTANT: *During control valve Installation be sure not to lose the three O rings between the valve assembly and the clutch housing.*

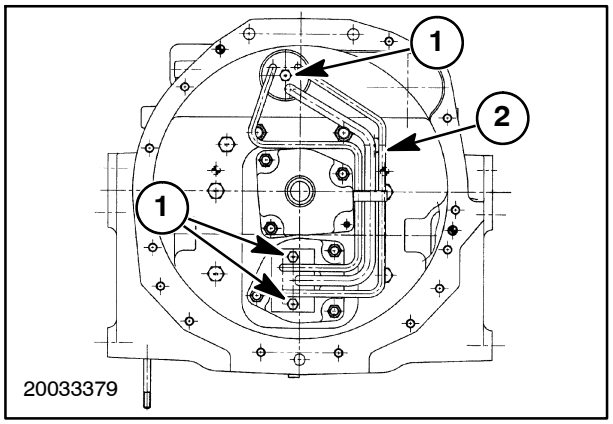
3. Lubricate three new O rings with petroleum jelly and install on the back of the lube cut-off valve.
4. Install the valve assembly to the clutch housing.
5. Install the two bolts, 1, securing the lube cut-off valve and control valve assembly, 2, to the clutch housing, 3. Tighten bolts to 25 N·m (18 ft-lbs).



206

IMPORTANT: *During pressure tube installation be sure not to lose the six O rings between the tube assembly and the clutch housing.*

6. Lubricate six new O rings with petroleum jelly and install on the back of the pressure tubes.
7. Install the pressure tubes as an assembly.
8. Install the bolts, 1, securing the pressure tubes, 2, to the transmission. Tighten bolts to 25 N·m (18 ft-lbs).

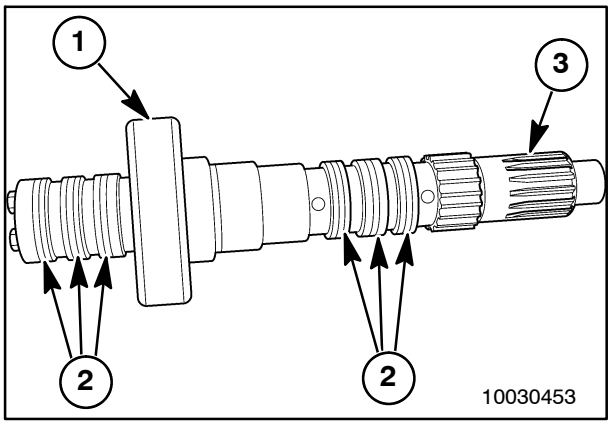


207

SHUTTLE CLUTCH

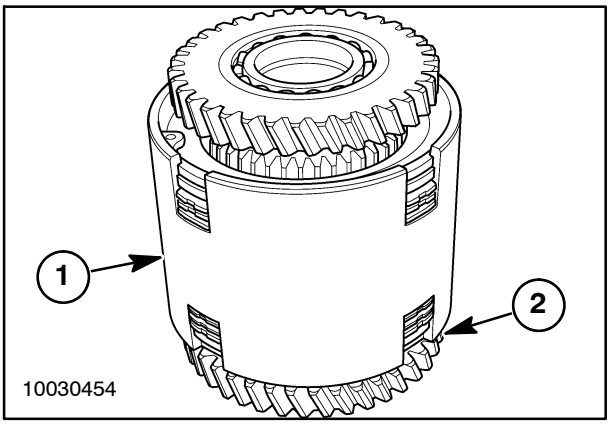
Disassembly

1. Remove the bearing, 1, and six seal rings, 2, from the shuttle clutch input shaft, 3.



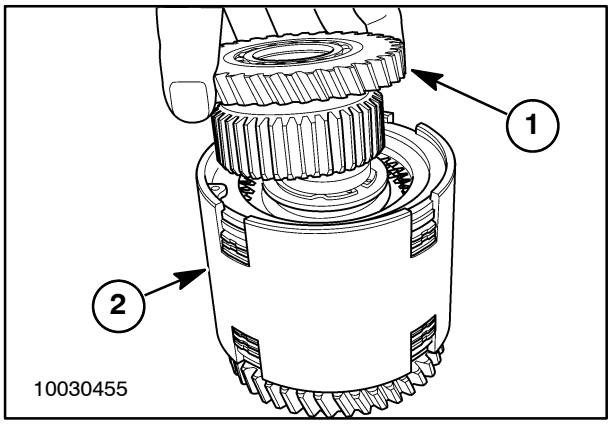
208

2. Place the shuttle clutch assembly, 1, on the workbench, resting on the forward gear (38T), 2.



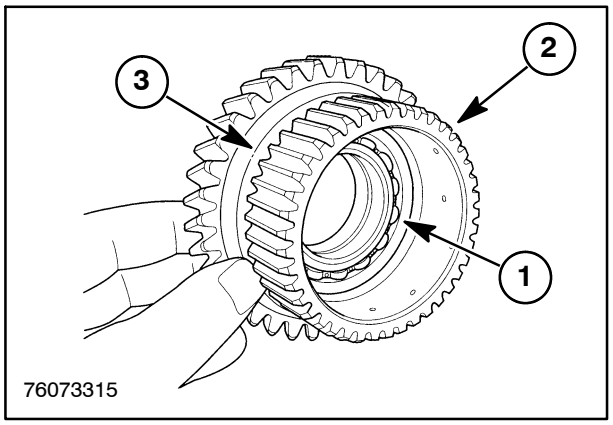
209

3. Remove the reverse gear (35T), 1, from the shuttle clutch assembly, 2.



210

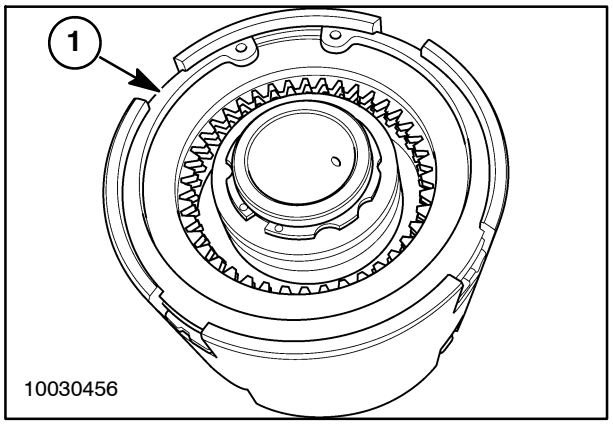
4. Remove the bearing, 1, from the reverse gear, 2. If necessary, remove the seal ring, 3, from the reverse gear, 2.



211

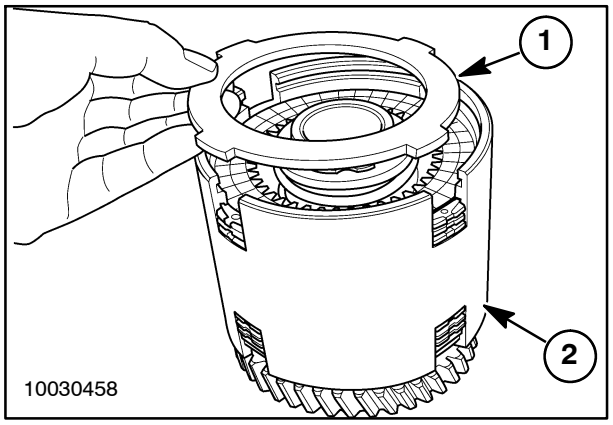
IMPORTANT: *Note the orientation of the opening in the snap ring to the housing for proper assembly later. The opening of the snap ring should NOT be positioned at any of the clutch disc slots.*

5. Remove the snap ring, 1, from the shuttle clutch assembly.



212

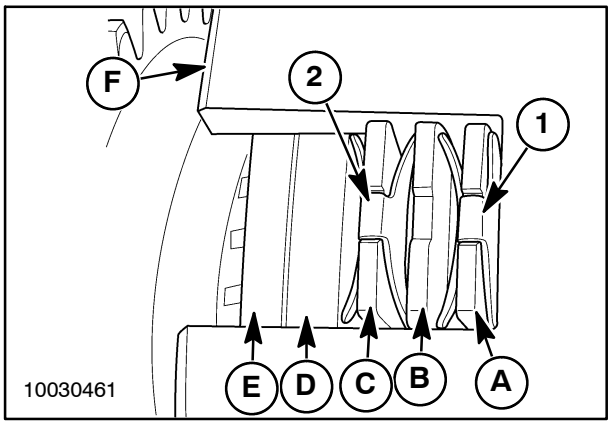
6. Remove the large thrust plate, 1, from the shuttle clutch housing, 2.



213

NOTE: *Take special note of the order of the steel clutch stators during removal. The inner stator, (A), has two-prong, springs, 1, on all four locator tabs, The center stator, (B), has no springs and the outer stator, (C) has four-prong, springs, 2, on all four locator tabs.*

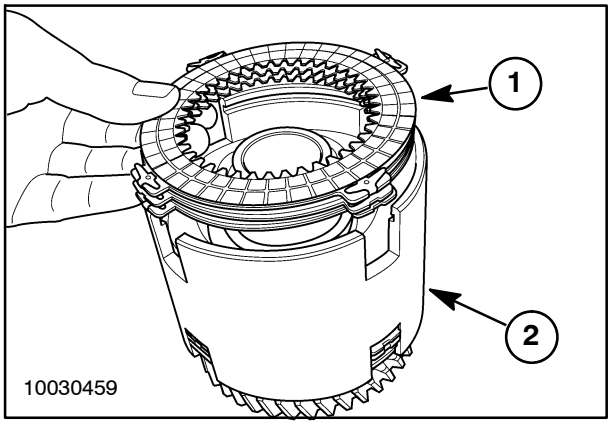
- (A) – Inner Stator
- (B) – Center Stator
- (C) – Outer Stator
- (D) – Thrust Plate
- (E) – Snap Ring
- (F) – Shuttle Clutch Housing



214

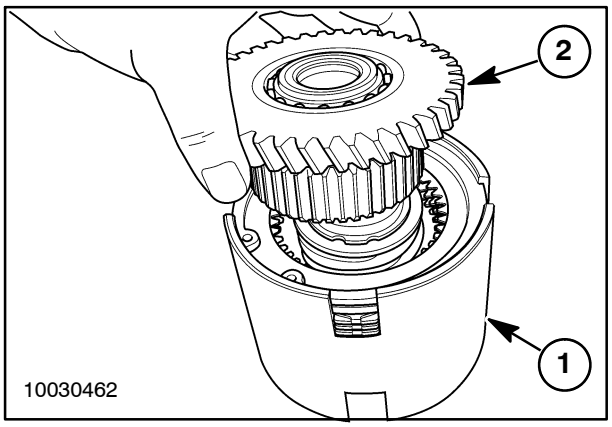
7. Remove the clutch discs, 1, from the housing, 2, in the following order:

- Fiber
- *Four-spring* Stator
- Fiber
- *No-spring* Stator
- Fiber
- *Two-spring* Stator



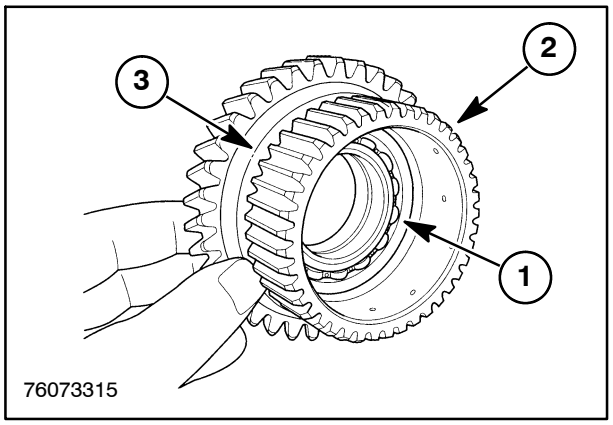
215

8. Turn the shuttle clutch assembly, 1, over and remove the forward gear (38T), 2, from the shuttle clutch assembly.



216

9. Remove the bearing, 1, from the forward gear, 2.
10. Repeat disassembly steps 5 through 7 for this side of the shuttle clutch. If necessary, remove the seal ring, 3, from the forward gear, 2.

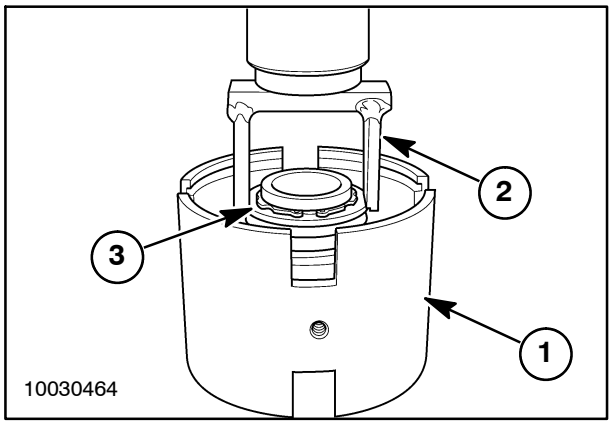


217

⚠ WARNING ⚠

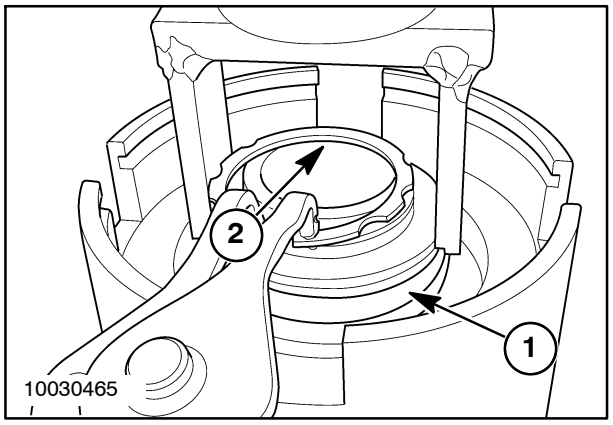
Special tool #380001352 MUST be used to compress the spring and thrust washer to avoid personal injury during snap ring removal.

11. Place the shuttle clutch housing, 1, in a suitable press with the special clutch tool #380001352, 2, placed on the thrust washer, 3.



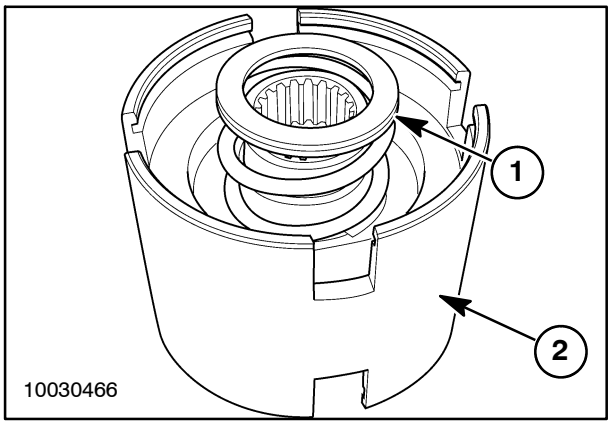
218

12. Use the press to carefully apply downward pressure on the special tool, compressing the spring, 1.
13. Remove the snap ring, 2, from the clutch housing.
14. Slowly release the pressure on the spring.
15. Remove the clutch housing from the press.



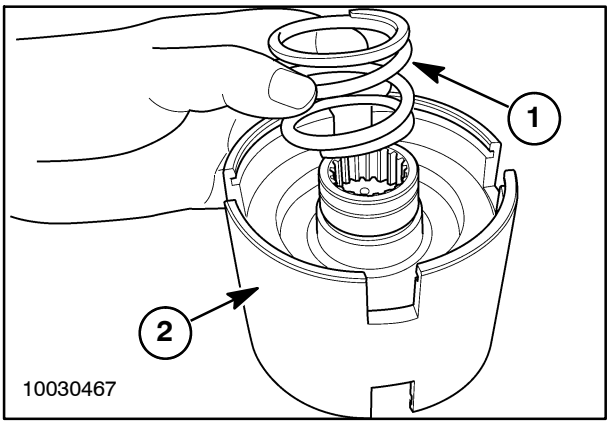
219

16. Remove the thrust washer, 1, from the housing, 2.



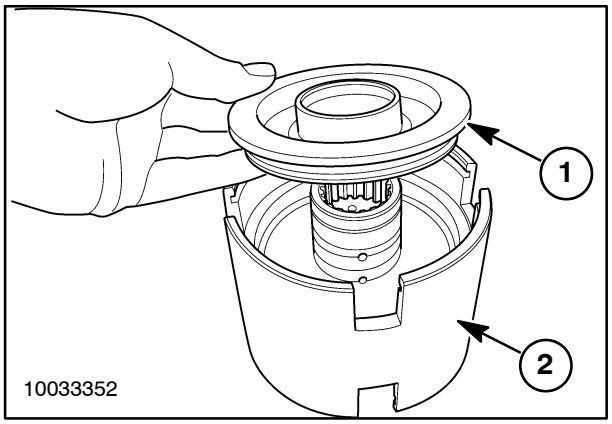
220

17. Remove the spring, 1, from the housing, 2.



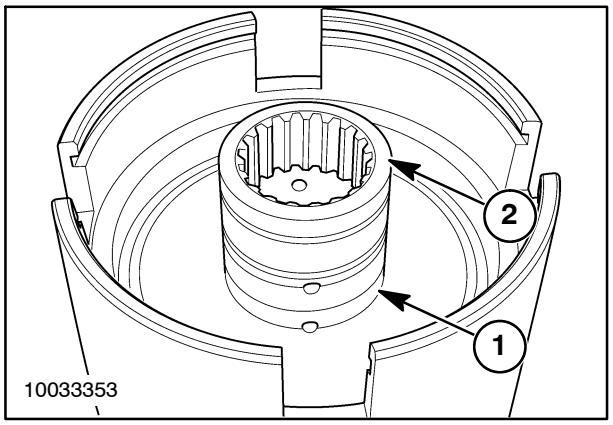
221

18. Carefully remove the piston, 1, from the clutch housing, 2.



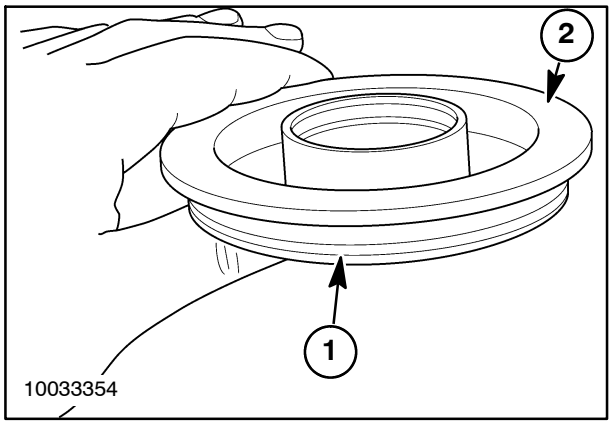
222

19. Remove the seal ring, 1, from the housing, 2.



223

20. Remove the seal ring, 1, from the shuttle clutch piston, 2.
21. Turn the shuttle clutch, housing assembly over and repeat steps 11 through 20 for the opposite side.



224

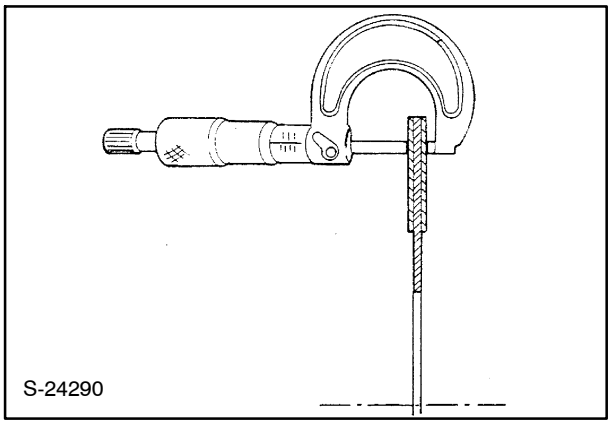
Inspection

1. Wash all parts in a suitable solvent and allow to air dry.
2. Inspect all bearings for excess wear, score marks, discoloration from overheating and roughness or binding during rotation. Replace as necessary.

NOTE: *Do not use compressed air to spin bearings. Damage to bearing will result. Clean and test bearings using hand rotation only.*

3. Lubricate all bearings thoroughly with clean hydraulic fluid before assembly.
4. Check the springs for wear, damage or weak spring tension. Replace as necessary.
5. Inspect the clutch housing and piston for excess wear, scratches or damage to machined sliding surfaces.
6. Inspect the fiber clutch discs for excess wear, score marks, discoloration from overheating. Measure the thickness of the clutch disc on the fiber surface.

ORIGINAL THICKNESS	WEAR LIMIT
2 mm (0.078″)	1.8 mm (0.070″)



225

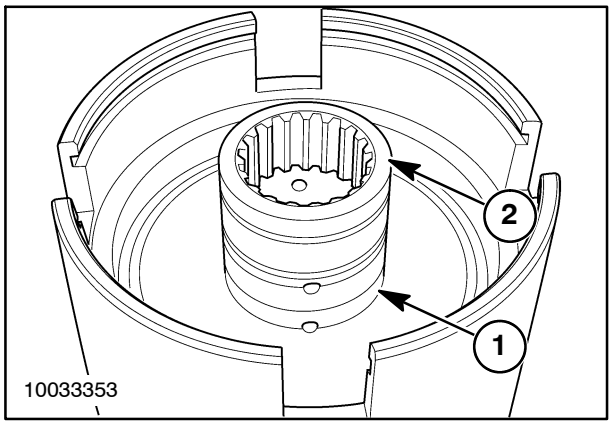
7. Inspect the steel, driven clutch discs for excess wear, score marks, and discoloration from overheating. Inspect the springs on disc ears on the discs containing springs.
8. Remove the springs from the steel disc and lay the disc on a flat piece of glass to check for warpage. Replace as necessary.

NOTE: *If clutch disc replacement is necessary, always replace steel and fiber discs as a set.*

Assembly

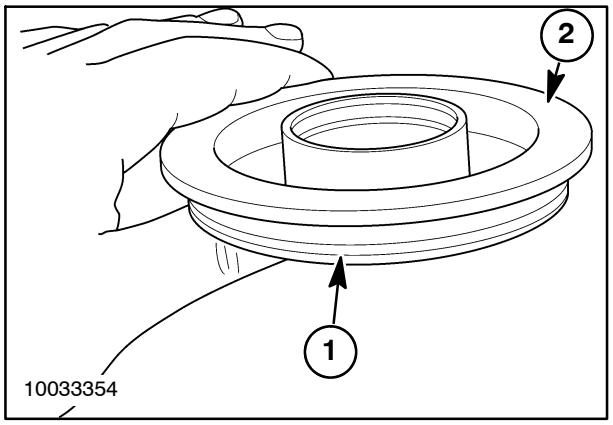
IMPORTANT: *Prior to assembly of the shuttle clutch, be sure to soak the clutch plates and seal rings in clean hydraulic fluid for a minimum of one hour.*

1. Install a new seal ring, 1, into the housing, 2.



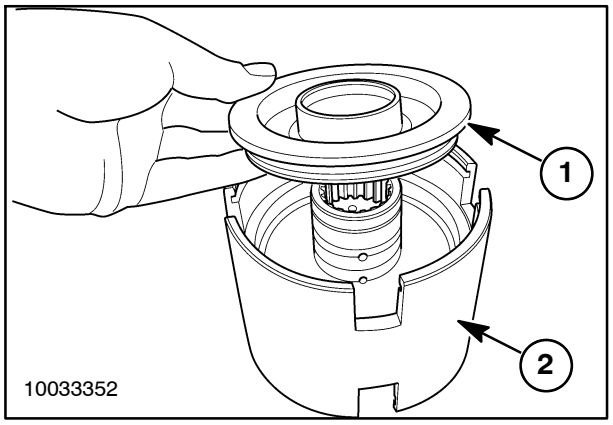
226

2. Install a new seal ring, 1, onto the shuttle clutch piston, 2.



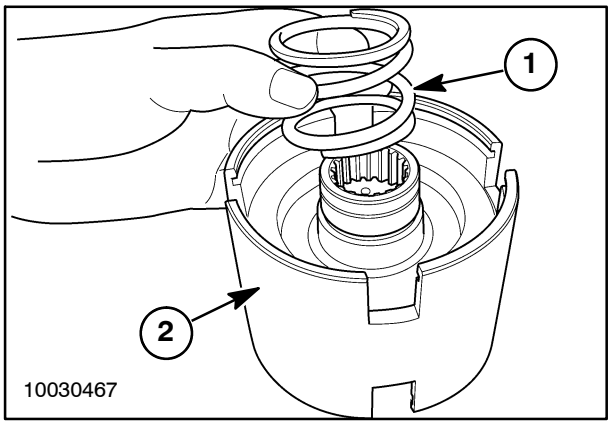
227

3. Lubricate the piston, seal ring and inside of clutch housing with clean hydraulic fluid.
4. Carefully install the piston, 1, into the clutch housing, 2.



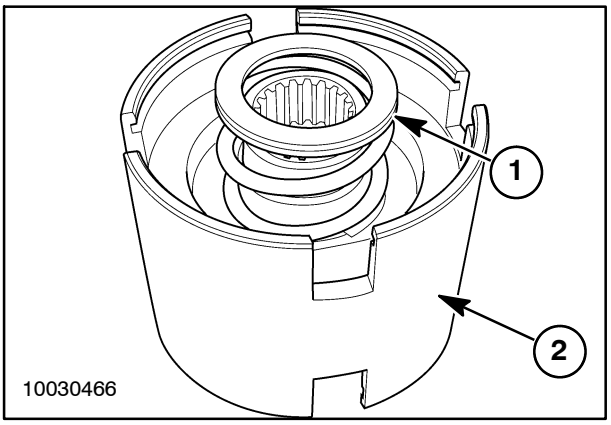
228

5. Install the spring, 1, into the housing, 2.



229

6. Place the thrust washer, 1, on top of the spring, 2, in the housing, 3.

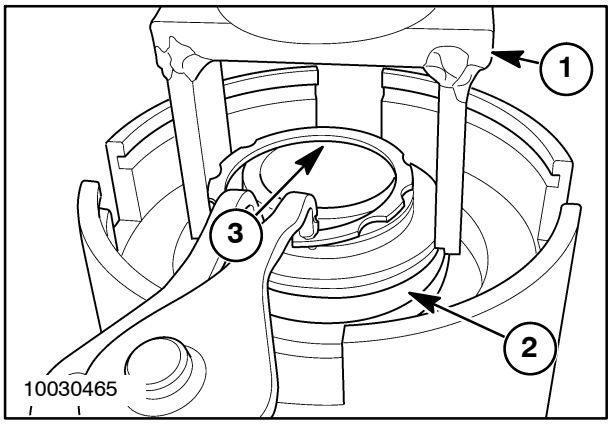


230

⚠ WARNING ⚠

Special tool #380001352 MUST be used to compress the spring and thrust washer to avoid personal injury during snap ring removal.

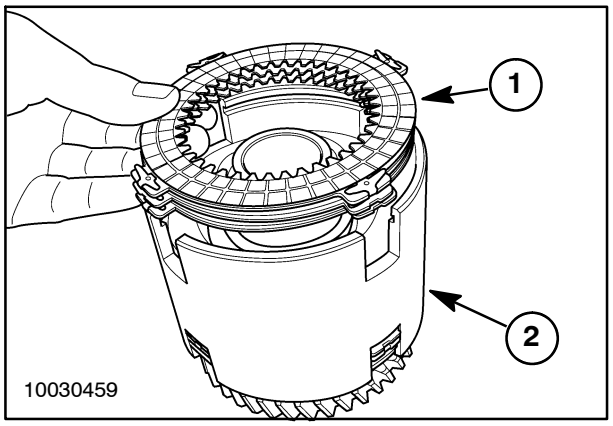
7. Place the housing in a suitable press and use the press to carefully apply downward pressure on the special tool, 1, compressing the thrust washer and spring, 2.
8. Install the snap ring, 3, on the clutch housing.
9. Slowly release the pressure on the spring.
10. Remove the clutch housing from the press.
11. Turn the shuttle clutch housing over and repeat steps 1 through 9 for the opposite side.



231

12. Install the clutch discs, 1, into the housing, 2, in the following order:

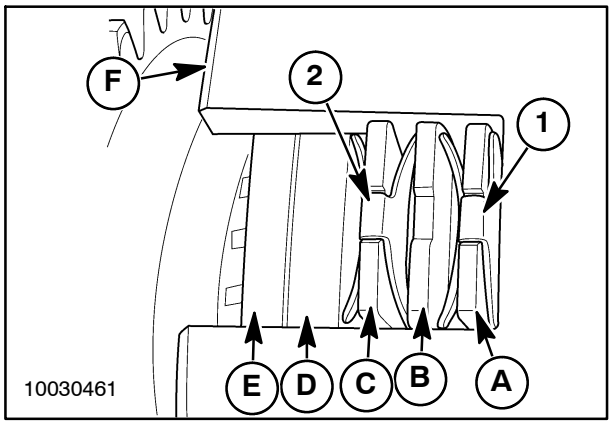
- Two-spring Stator
- Fiber
- No-spring Stator
- Fiber
- Four-spring Stator
- Fiber



232

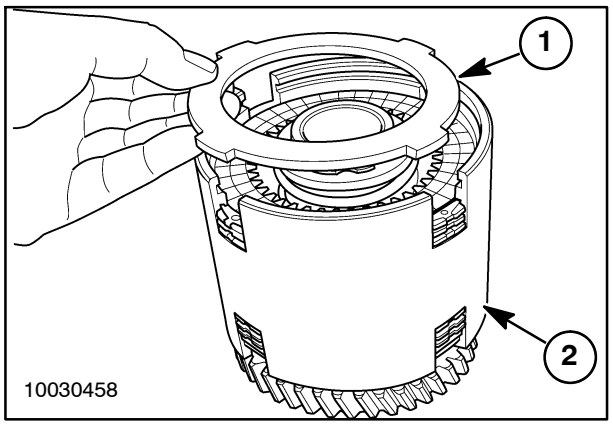
NOTE: *Take special note of the order of the steel clutch stators during installation. The inner stator, (A), has two-prong, springs, 1, on all four locator tabs, The center stator, (B), has no springs and the outer stator, (C) has four-prong, springs, 2, on all four locator tabs.*

- (A) – Inner Stator
- (B) – Center Stator
- (C) – Outer Stator
- (D) – Thrust Plate
- (E) – Snap Ring
- (F) – Shuttle Clutch Housing



233

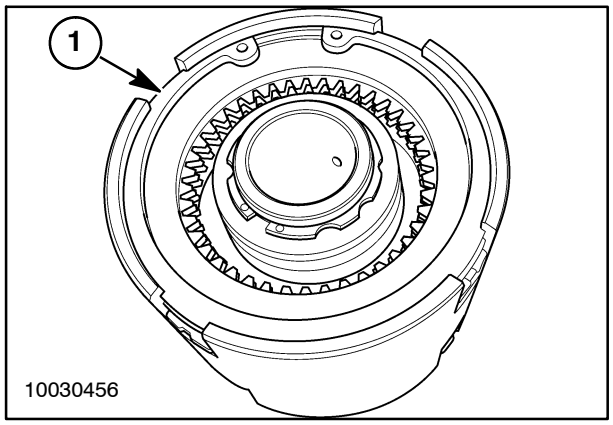
13. Install the large thrust plate, 1, into the shuttle clutch housing, 2.



234

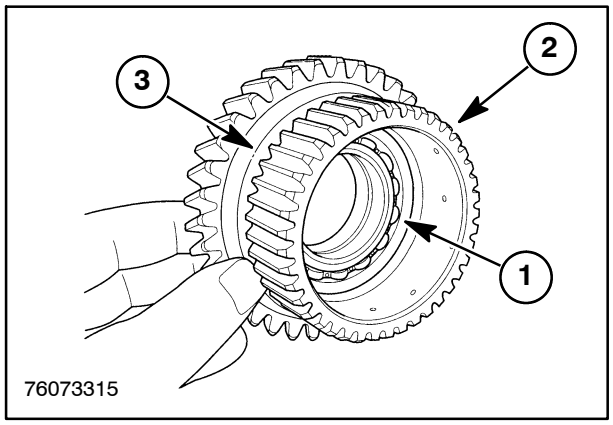
IMPORTANT: *Note the orientation of the opening in the snap ring, to the housing for proper assembly. The opening of the snap ring must NOT be positioned at any of the clutch disc slots.*

14. Install the snap ring, 1, to secure the clutch assembly.
15. Turn the clutch housing over and repeat assembly steps 11 through 13 for the opposite side of the clutch.



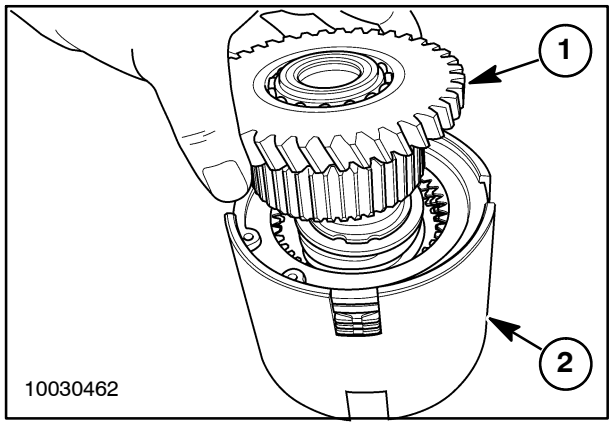
235

16. Install the bearing, 1, into the forward gear (38T), 2. If removed, install the seal ring, 3, onto the forward gear, 2.



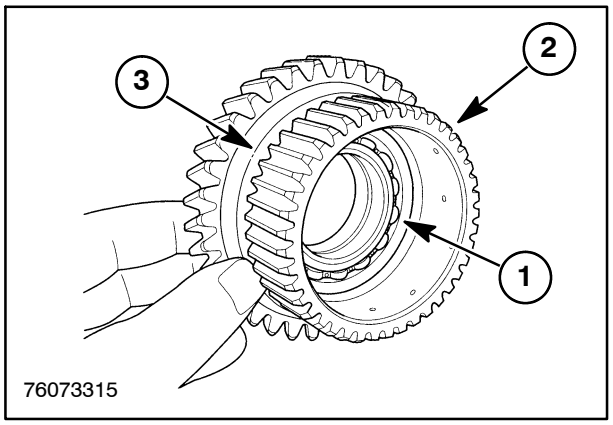
236

17. Install the forward gear (38T), 1, into the shuttle clutch assembly, 2.



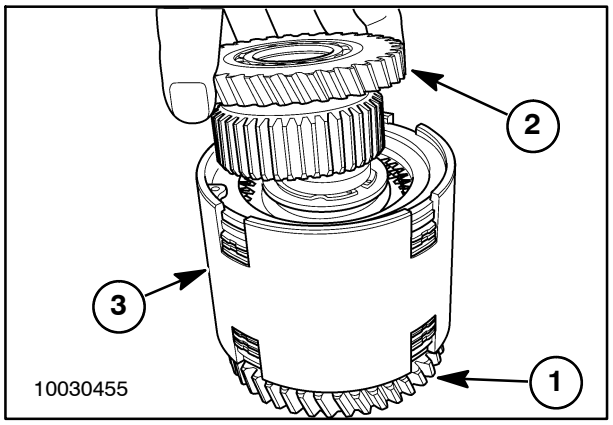
237

18. Install the bearing, 1, into the reverse gear, 2. If removed, install the seal ring, 3, onto the reverse gear, 2.



238

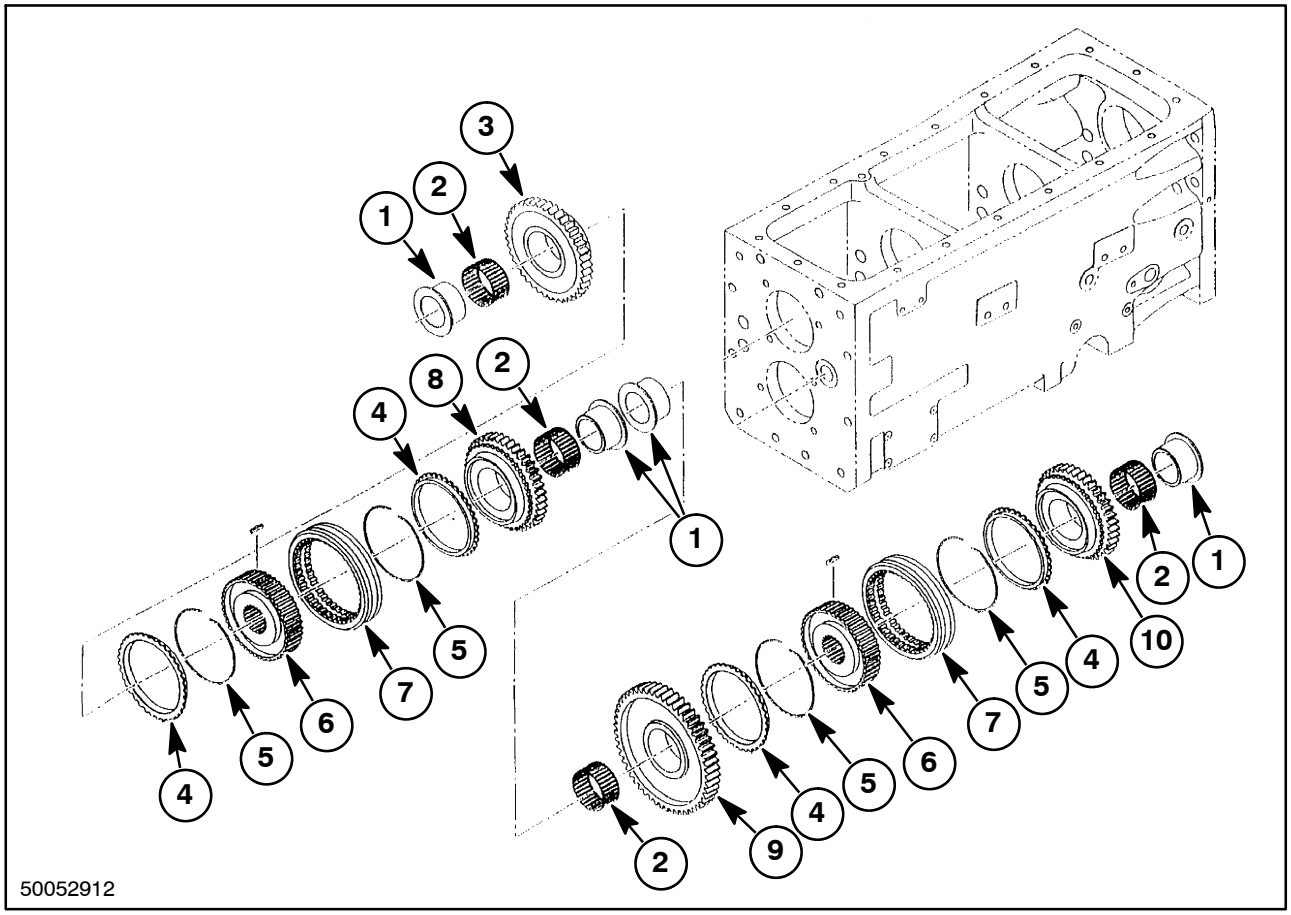
19. Turn the shuttle clutch assembly over to rest on the installed forward gear, 1.
20. Install the reverse gear (35T), 2, into the shuttle clutch assembly, 3.



239

SYNCHRONIZERS

The main transmission gears and synchronizers, may be disassembled, checked for wear or damage, and reassembled with new parts if necessary. Do not separate the assembly before reading the disassembly procedure.



240

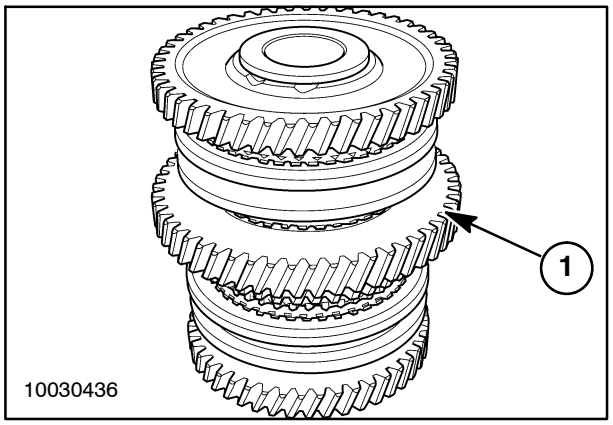
Ref. #	Part Description	Qty.
1	Collar	4
2	Needle Bearing	4
3	Counter Gear 44T (3rd)	1
4	Synchronizer Ring	4
5	Spring Retainer	4
6	Synchronizer Gear (w/keys)	2
7	Synchronizer Coupling (Sliding)	2
8	Counter Gear 40T (4th)	1
9	Counter Gear 52T (1st)	1
10	Counter Gear 48T (2nd)	1

Disassembly

Main Transmission Gears/Synchronizer

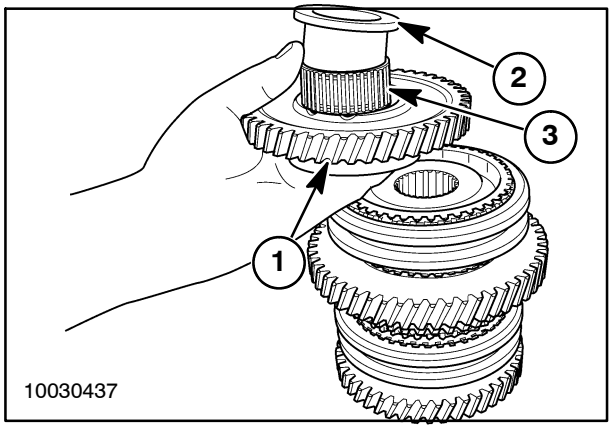
IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to applying matching marks on gears and couplers.*

1. Place the main transmission gear/synchronizer assembly, 1, on a workbench as shown.



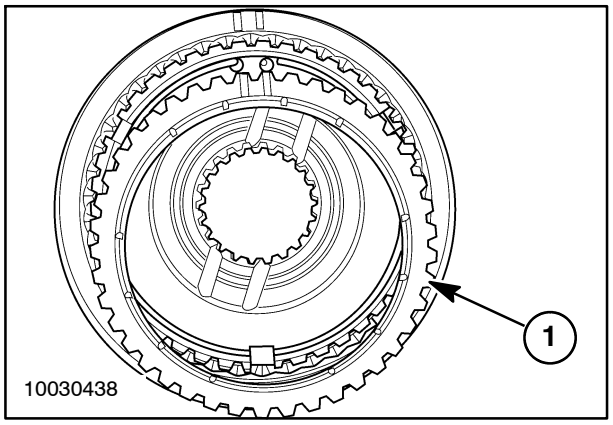
241

2. Remove the 48T counter gear (2nd), 1, collar, 2, and needle bearing, 3.



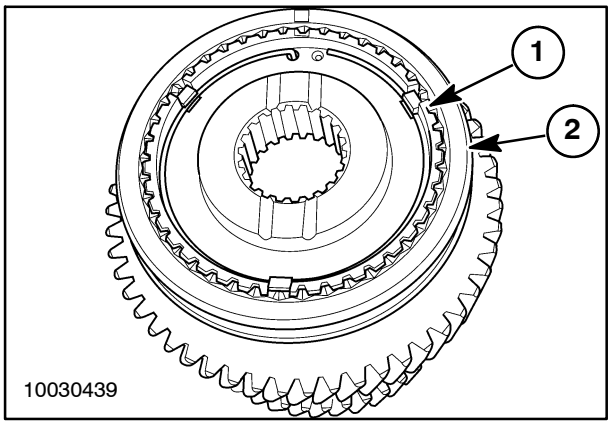
242

3. Remove the synchronizer ring, 1.



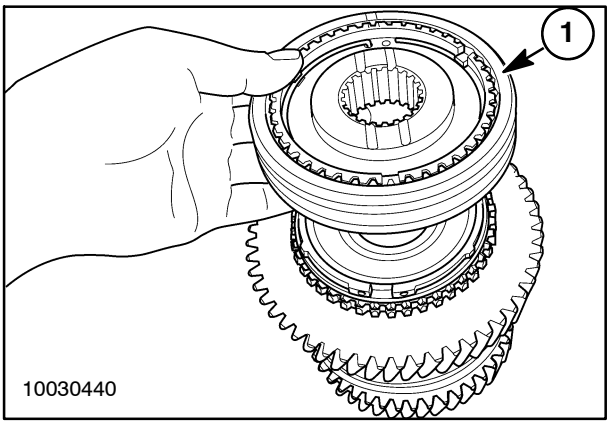
243

4. Use a paint pen to mark the synchronizer gear, 1, and coupling, 2, for proper alignment during assembly.



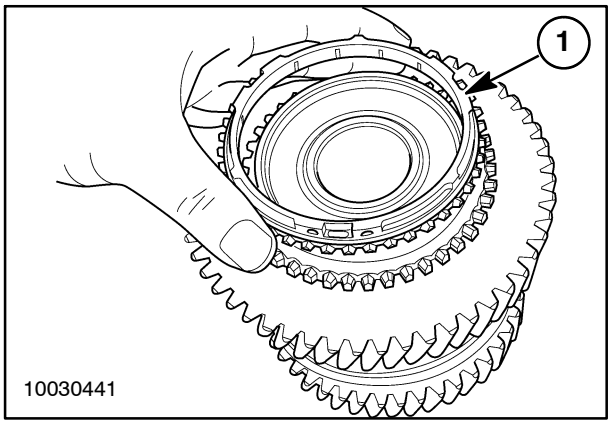
244

5. Carefully remove the synchronizer gear and coupler assembly, 1.



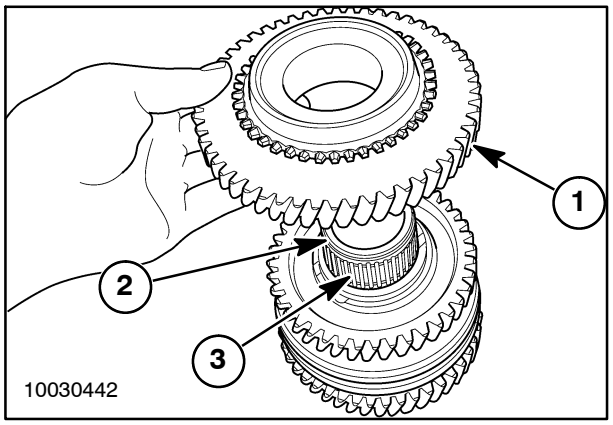
245

6. Remove the synchronizer ring, 1.



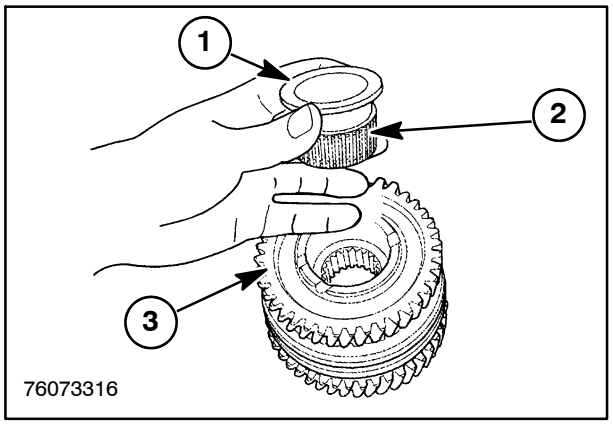
246

7. Remove the 52T counter gear (1st), 1, collar, 2, and needle bearing, 3.



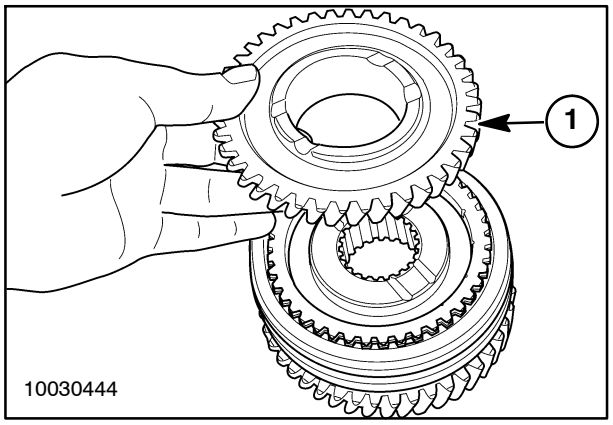
247

8. Remove the collar, 1, needle bearing, 2, and 40T counter gear, 3.



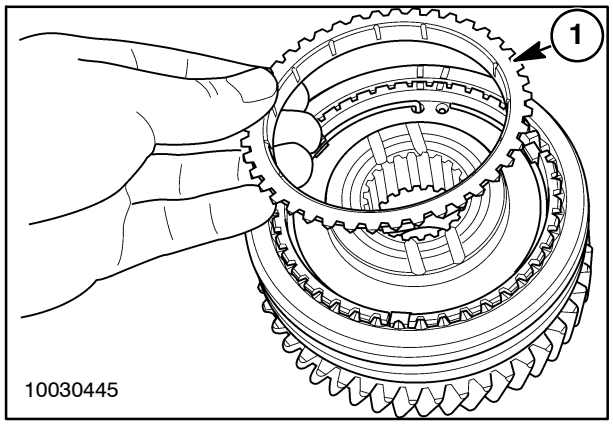
248

9. Remove the 40T counter gear (4th), 1.



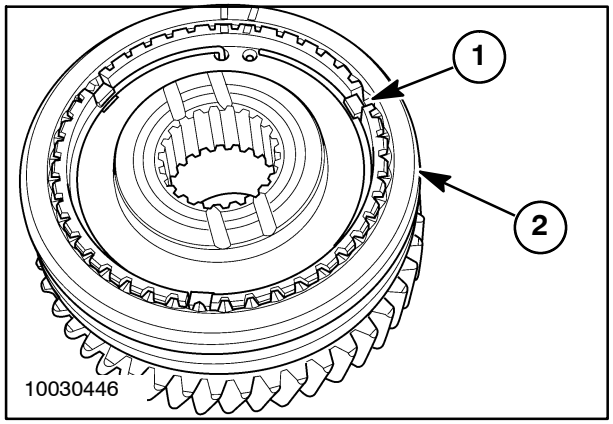
249

10. Remove the synchronizer ring, 1.



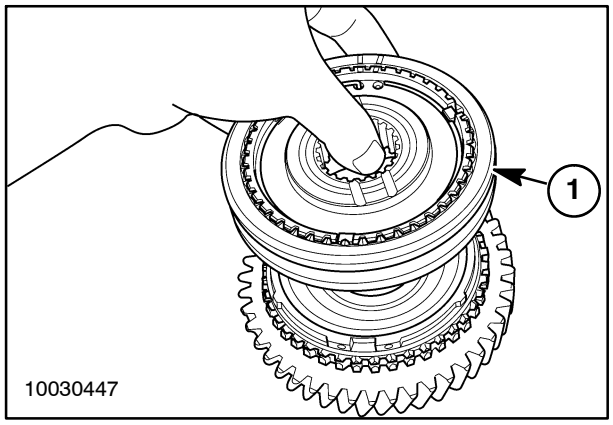
250

11. Use a paint pen to mark the synchronizer gear, 1, and coupling, 2, for proper alignment during assembly.



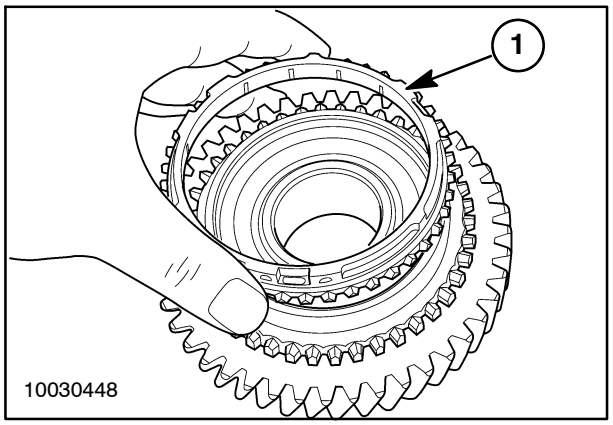
251

12. Carefully remove the synchronizer gear/coupling assembly, 1.



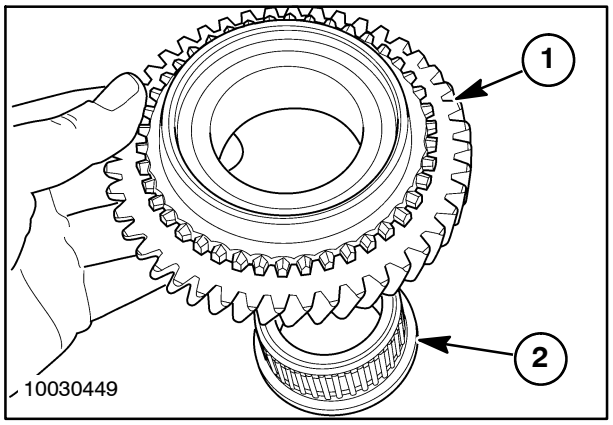
252

13. Remove the synchronizer ring, 1.



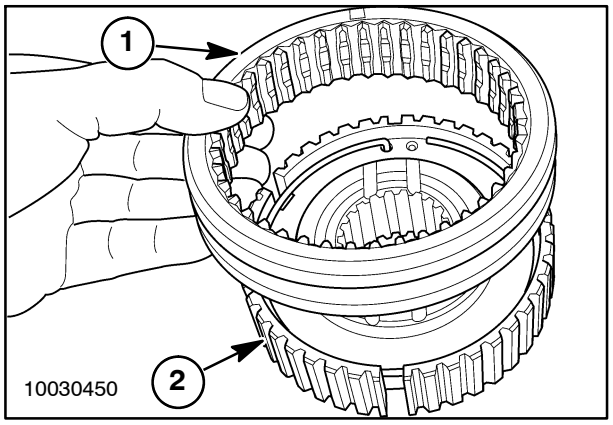
253

14. Remove the 44T counter gear (3rd), 1, from the collar and needle bearing, 2.
15. Separate the needle bearing from the collar.



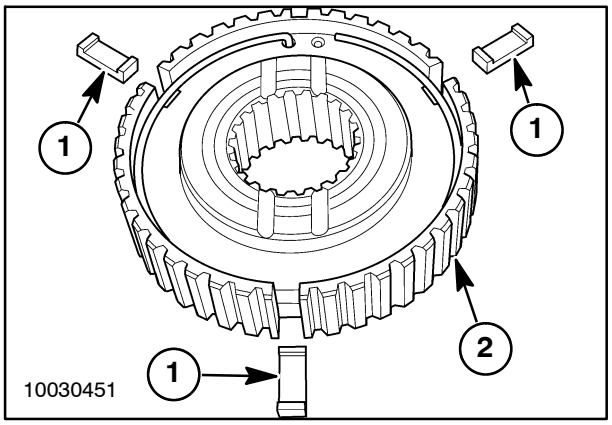
254

16. Carefully remove the sliding coupling, 1, from the synchronizer gear, 2.



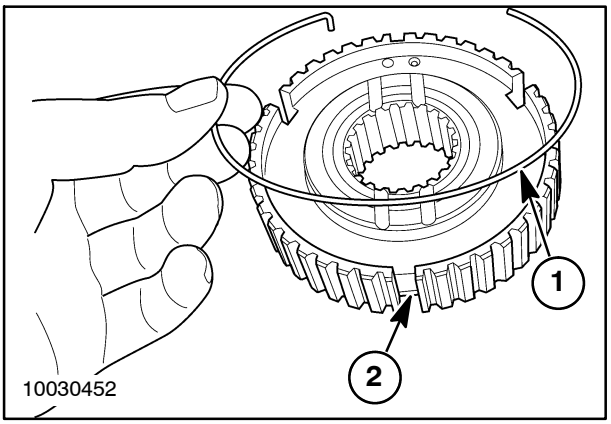
255

17. Remove the three keys, 1, from the synchronizer gear, 2.



256

18. Remove the spring retainer, 1, from each side of the synchronizer gear, 2.
19. Repeat steps 16 – 18 for the second synchronizer gear assembly.

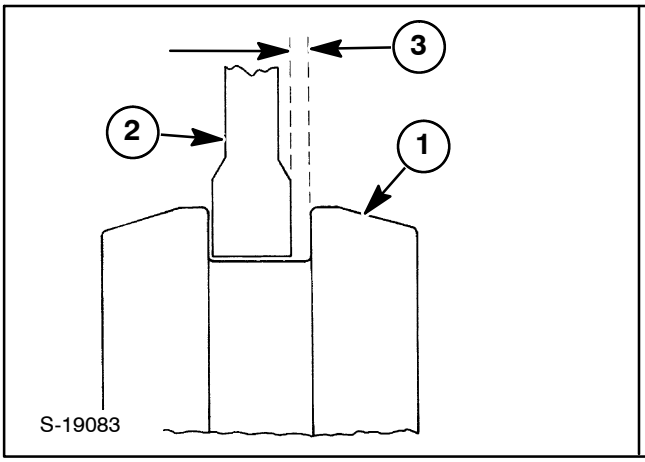


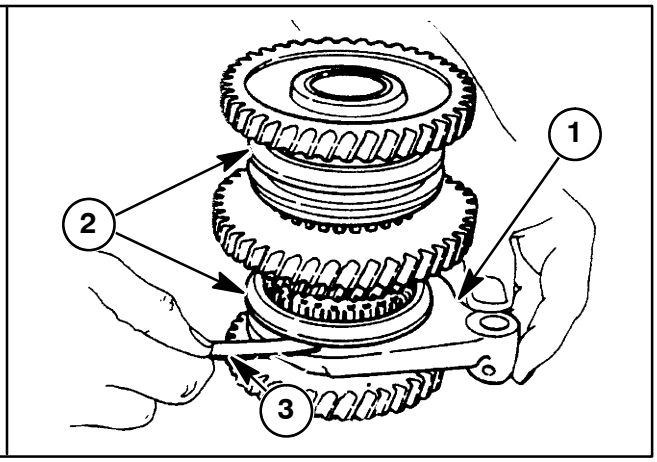
257

Inspection

1. Inspect the synchronizer parts for excessive wear, chipped or worn teeth, damaged splines and other damage.
2. Place the synchronizer/gear assembly on the workbench and insert the shift fork, 1, into the sliding collar, 2.
3. Use a feeler gauge, 3, to measure the side clearance between the collar and fork.

STANDARD CLEARANCE	ALLOWABLE CLEARANCE LIMIT
0.2 – 0.4 mm (0.008 – 0.016″)	1.0 mm (0.039″)

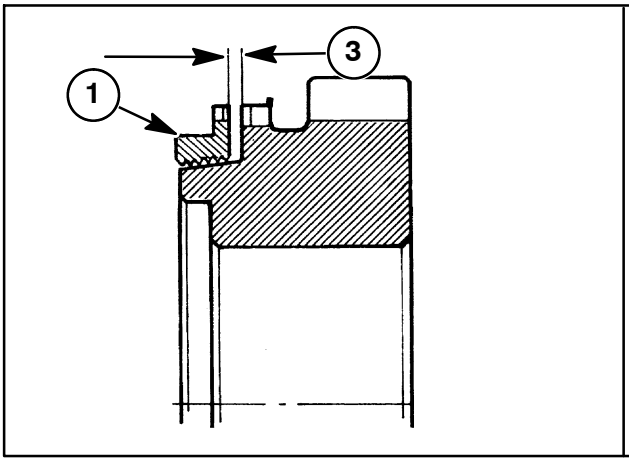


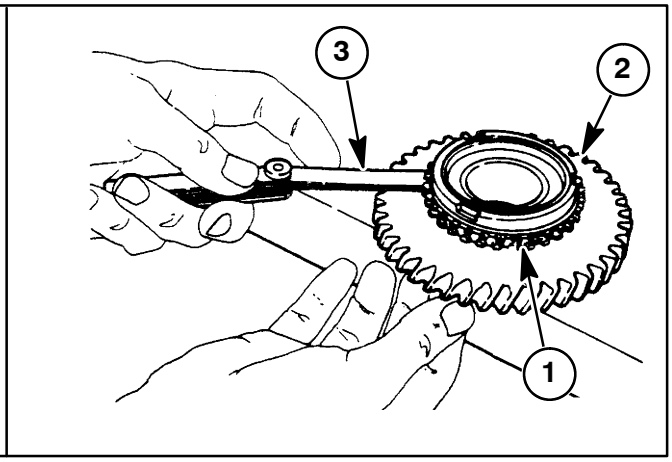


258

4. Place the synchronizer rings, 1, on the synchronizer gears, 2, and use a feeler gauge, 3, to measure the clearance to determine cone wear.
5. Use matching marks to check all synchronizer/ gear assembly parts for damage or rough operation.
6. Inspect shift forks for bent or other damage in addition to clearance inspection.

MINIMUM CLEARANCE
0.8 mm (0.031″)

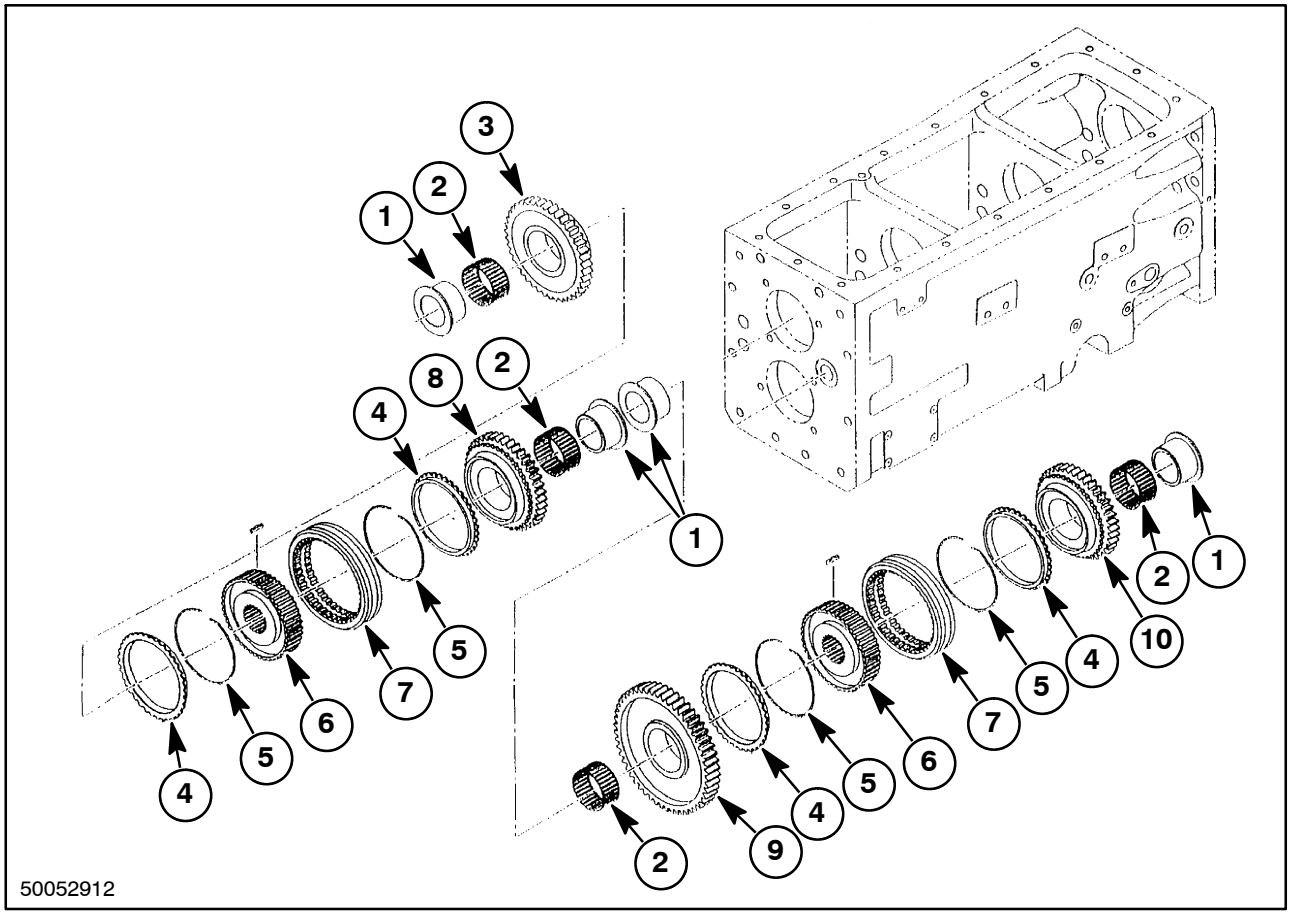




259

Synchronizers

The main transmission gears and synchronizers, are assembled and installed into the transmission as an assembly.



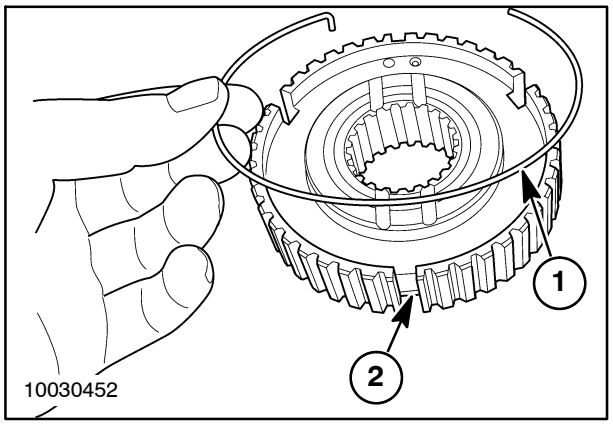
260

Ref. #	Part Description	Qty.
1	Collar	4
2	Needle Bearing	4
3	Counter Gear 44T (3rd)	1
4	Synchronizer Ring	4
5	Spring Retainer	4
6	Synchronizer Gear (w/keys)	2
7	Synchronizer Coupling (Sliding)	2
8	Counter Gear 40T (4th)	1
9	Counter Gear 52T (1st)	1
10	Counter Gear 48T (2nd)	1

Assembly

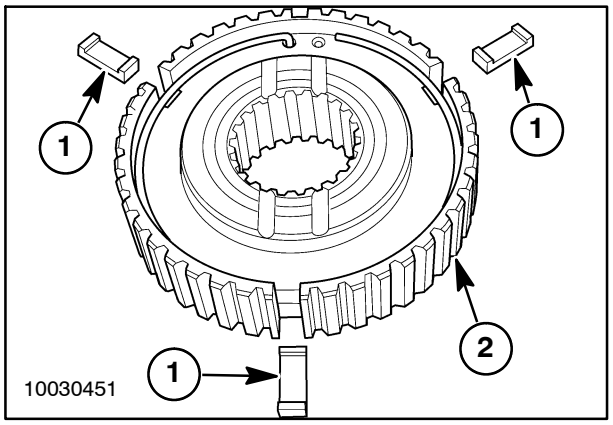
IMPORTANT: *Lubricate all parts with clean hydraulic oil before assembly.*

1. Install the spring retainer, 1, on each side of the synchronizer gear, 2.



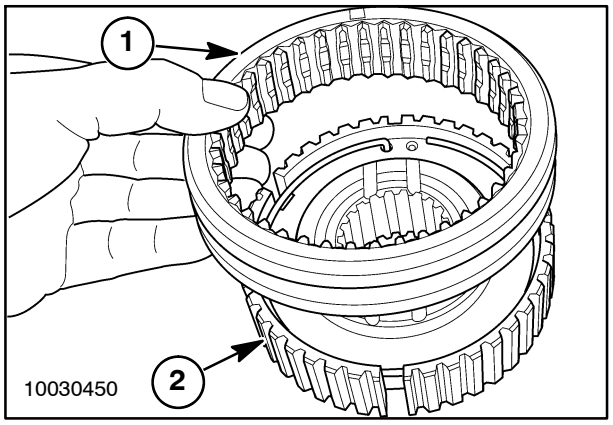
261

2. Install the three keys, 1, on the synchronizer gear, 2.



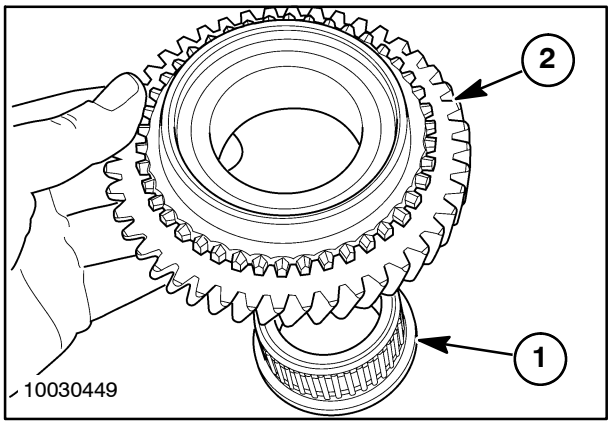
262

3. Carefully install the sliding coupling, 1, on the synchronizer gear, 2, aligning the matching marks made prior to disassembly.
4. Repeat step 1 – 3 for the second, synchronizer gear assembly.



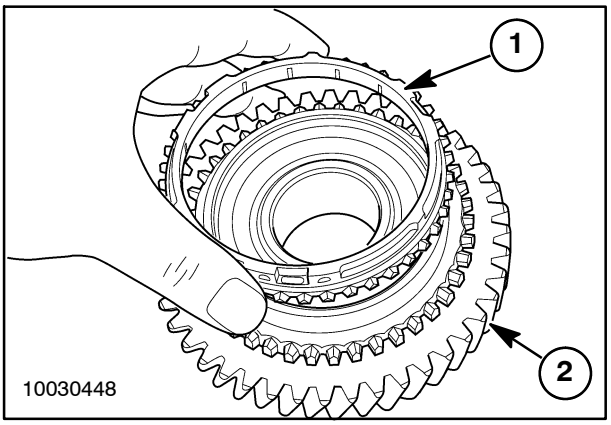
263

5. Install the needle bearing on the collar, 1.
6. Install the 44T counter gear (3rd), 2, on the collar and needle bearing, 1.



264

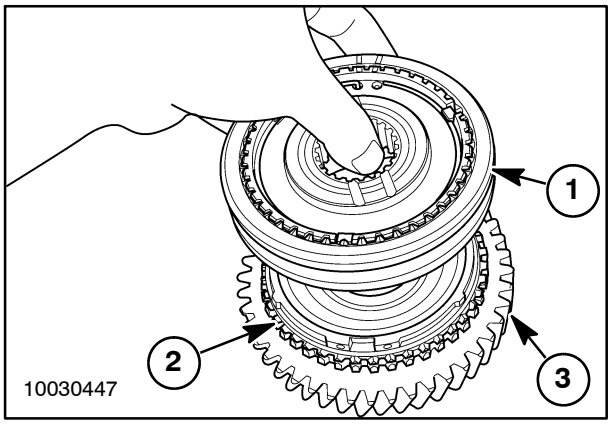
7. Install the synchronizer ring, 1, on the 44T counter gear (3rd), 2.



265

8. Carefully install the synchronizer gear/coupling assembly, 1, on the synchronizer ring, 2, and 44T counter gear (3rd), 3.

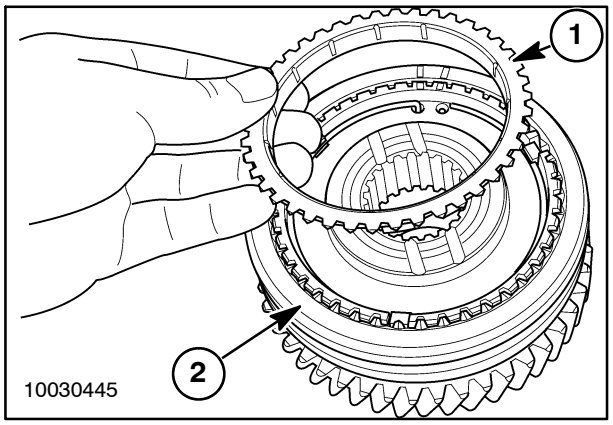
NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



266

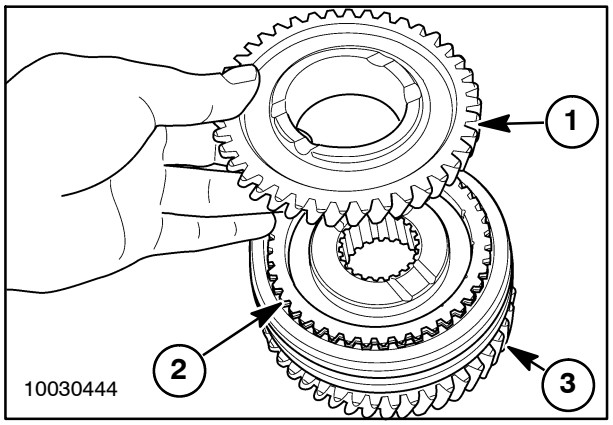
9. Install the synchronizer ring, 1, on the synchronizer gear/coupling assembly, 2.

NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



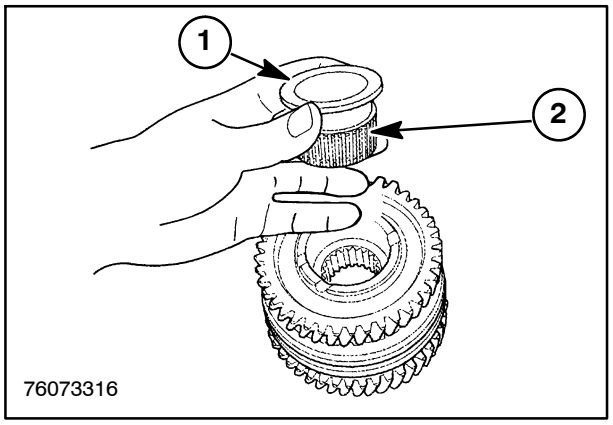
267

10. Install the 40T counter gear (4th), 1, on the synchronizer ring, 2, and the synchronizer gear/coupling assembly, 3.



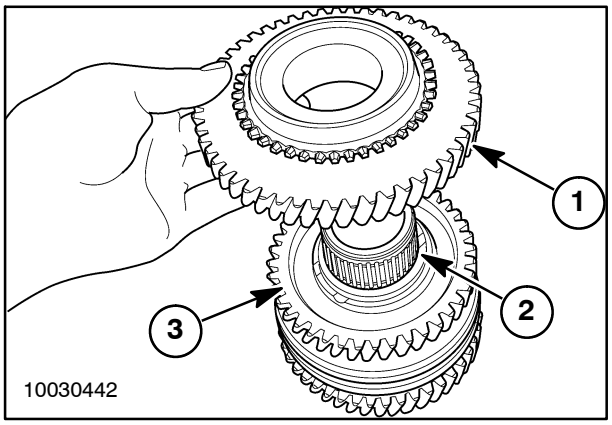
268

11. Install the collar, 1, and needle bearing, 2.



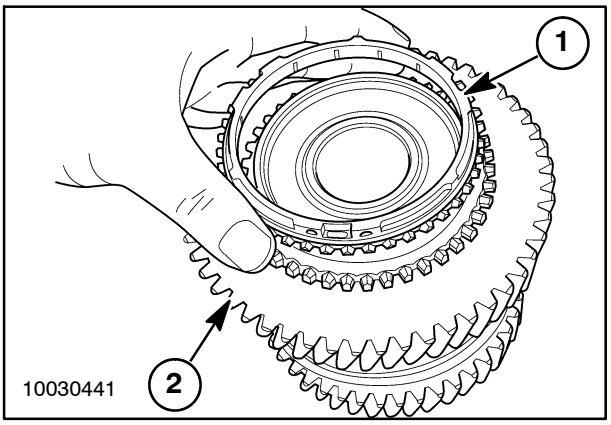
269

12. Install the 52T counter gear (1st), 1, on the center collar and needle bearing, 2, on the 40T counter gear, 3.



270

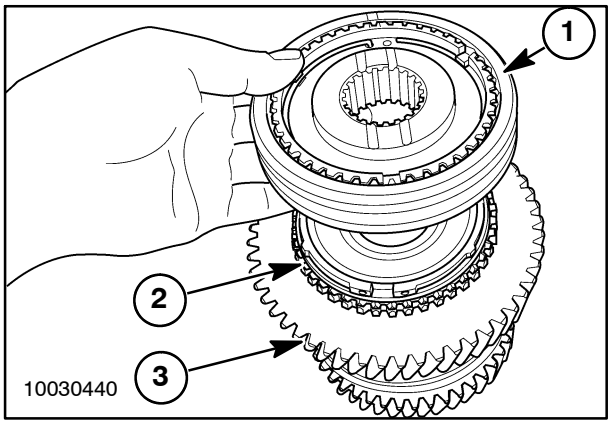
13. Install the synchronizer ring, 1, on the 52T counter gear (1st), 2.



271

14. Carefully install the synchronizer gear and coupler assembly, 1, on the synchronizer ring, 2, and 52T counter gear (1st), 3.

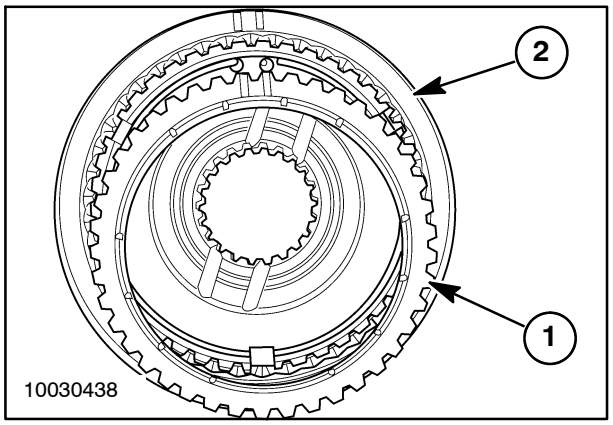
NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



272

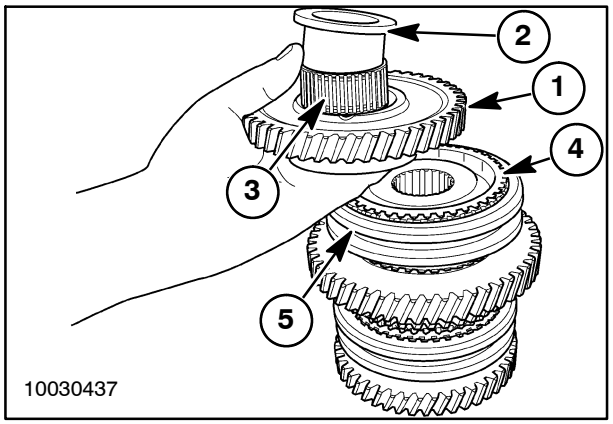
15. Install the synchronizer ring, 1, on the synchronizer gear/coupling assembly, 2.

NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



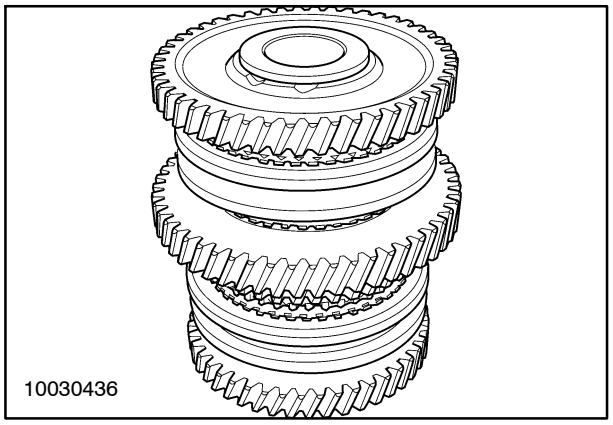
273

16. Install the 48T counter gear (2nd), 1, collar, 2, and needle bearing, 3, the synchronizer ring, 4, on the synchronizer gear/coupling assembly, 5.



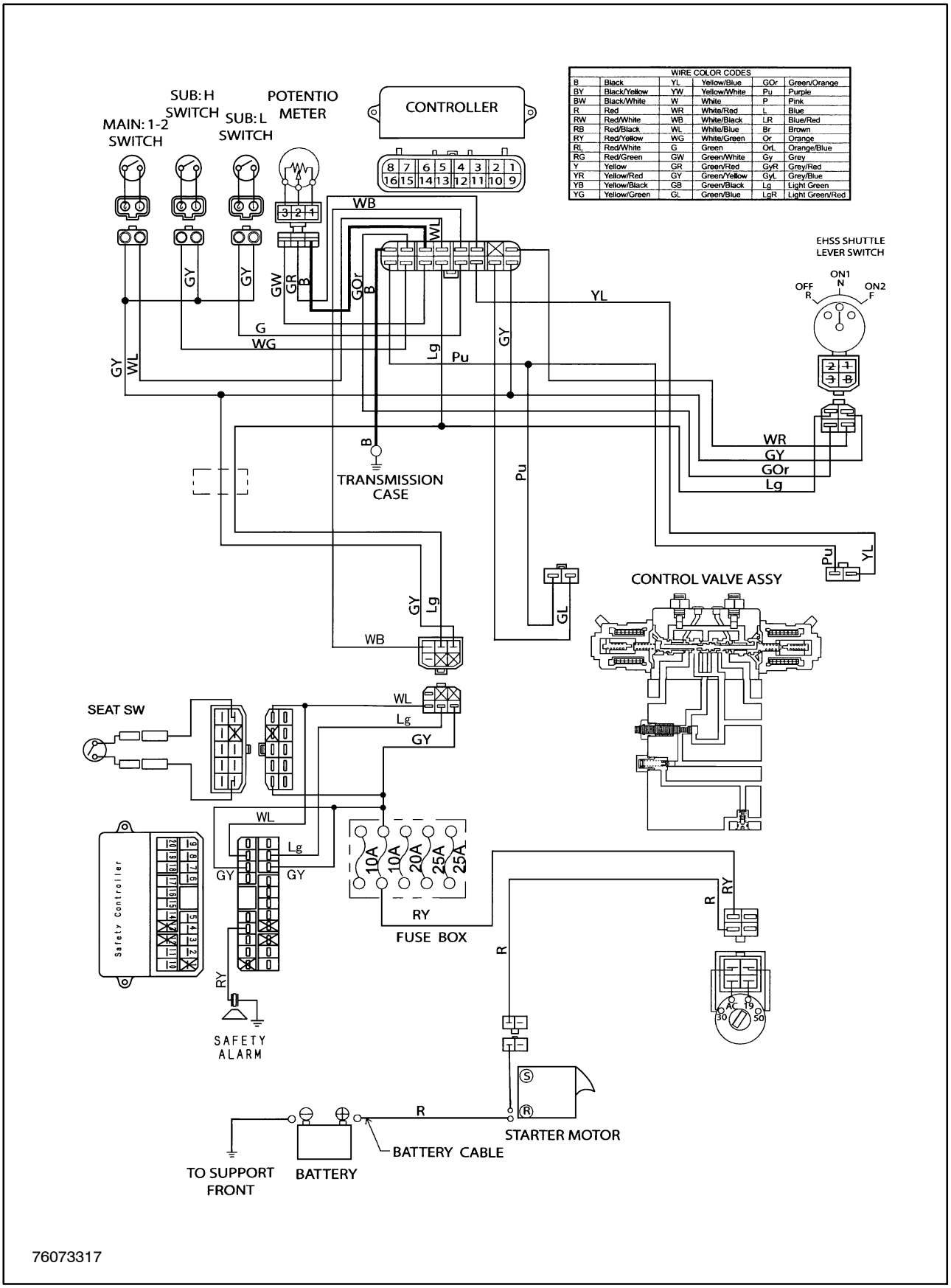
274

IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to assembly into the transmission housing.*

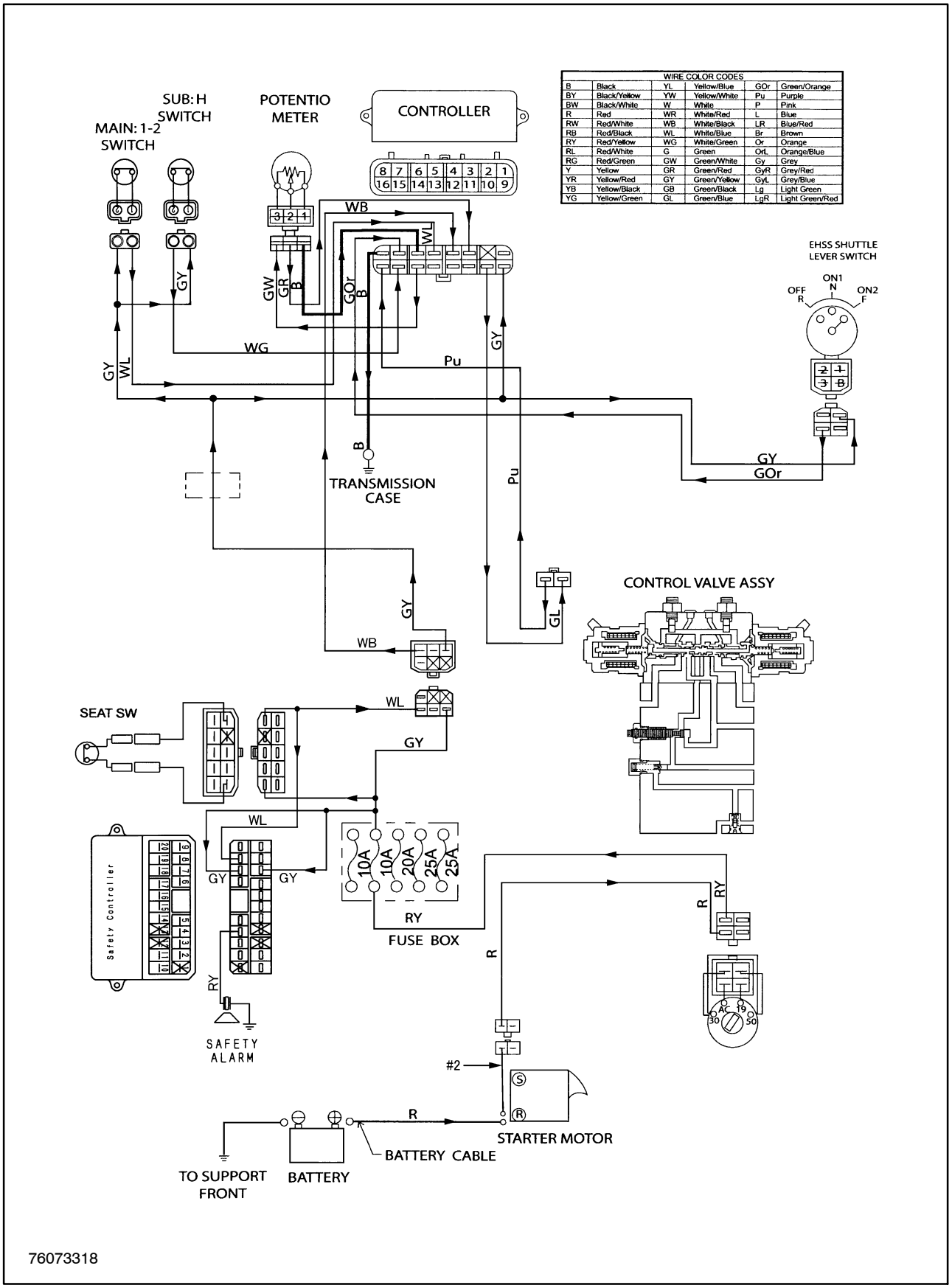


275

COMPLETE EHSS SCHEMATIC



1ST OR 2ND GEAR, HIGH AND FORWARD SCHEMATIC



1ST OR 2ND GEAR ENGAGED HIGH AND FORWARD ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub H Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 1st or 2nd gear, main 1-2 switch closes sending current to the #13 terminal of the controller.

When the transmission is placed in "HIGH" range the Sub H switch closes sending current to the #7 terminal of the controller.

When the transmission is placed in the forward position current is transferred from the "B" terminal to the #2 terminal of the shuttle switch. From the #2 terminal of the shuttle switch current is sent to the #15 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve only after inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

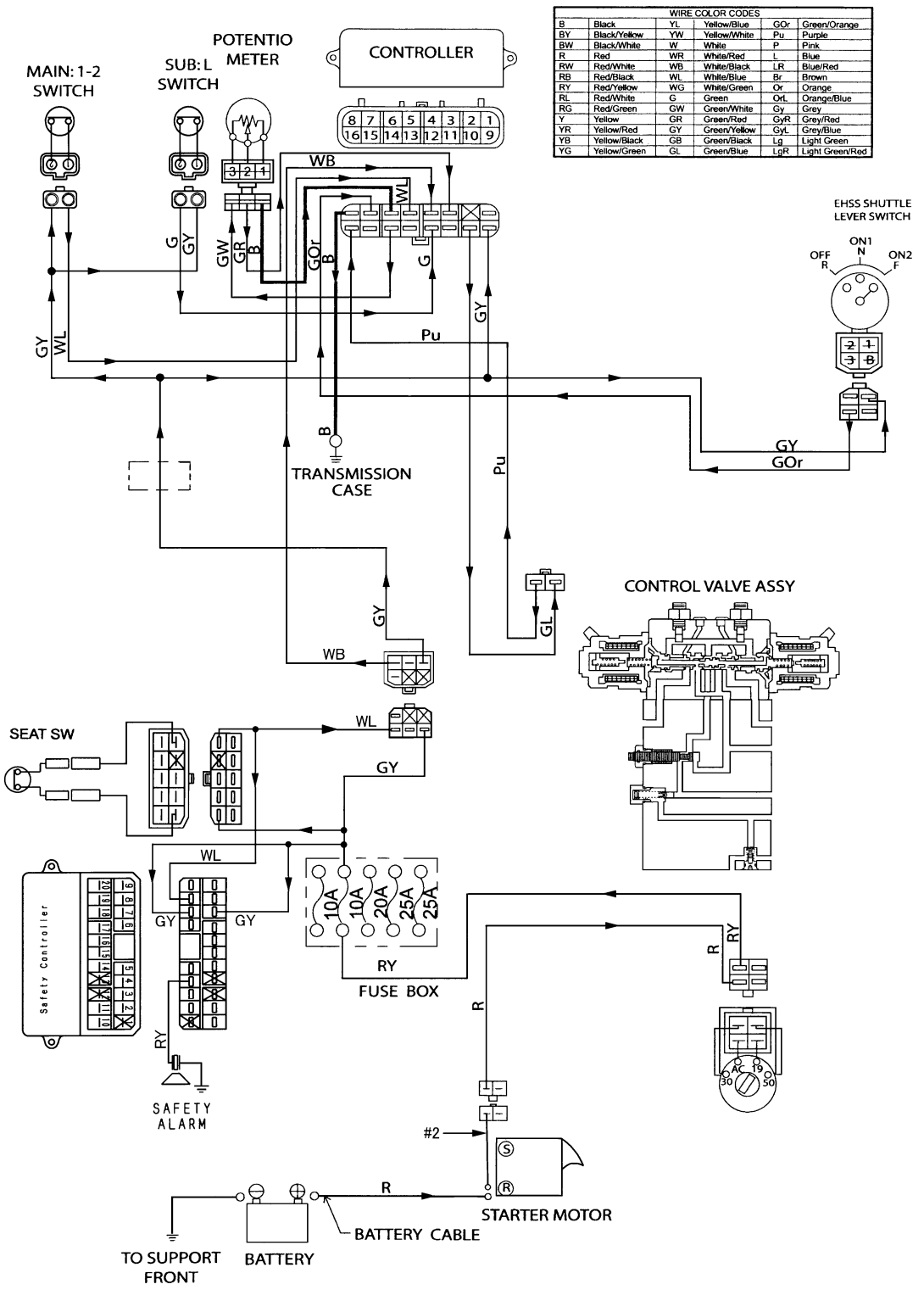
Current travels out of #2 terminal to the forward solenoid of the control valve assembly and the solenoid is energized.

When the forward solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

1ST OR 2ND GEAR, LOW AND FORWARD SCHEMATIC



76073319

1ST OR 2ND GEAR ENGAGED LOW AND FORWARD ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub L Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 1st or 2nd gear, main 1-2 switch closes sending current to the #13 terminal of the controller.

When the transmission is placed in "LOW" range the Sub L switch closes sending current to the #4 terminal of the controller.

When the transmission is placed in the forward position current is transferred from the "B" terminal to the #2 terminal of the shuttle switch. From the #2 terminal of the shuttle switch current is sent to the #15 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve only after inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

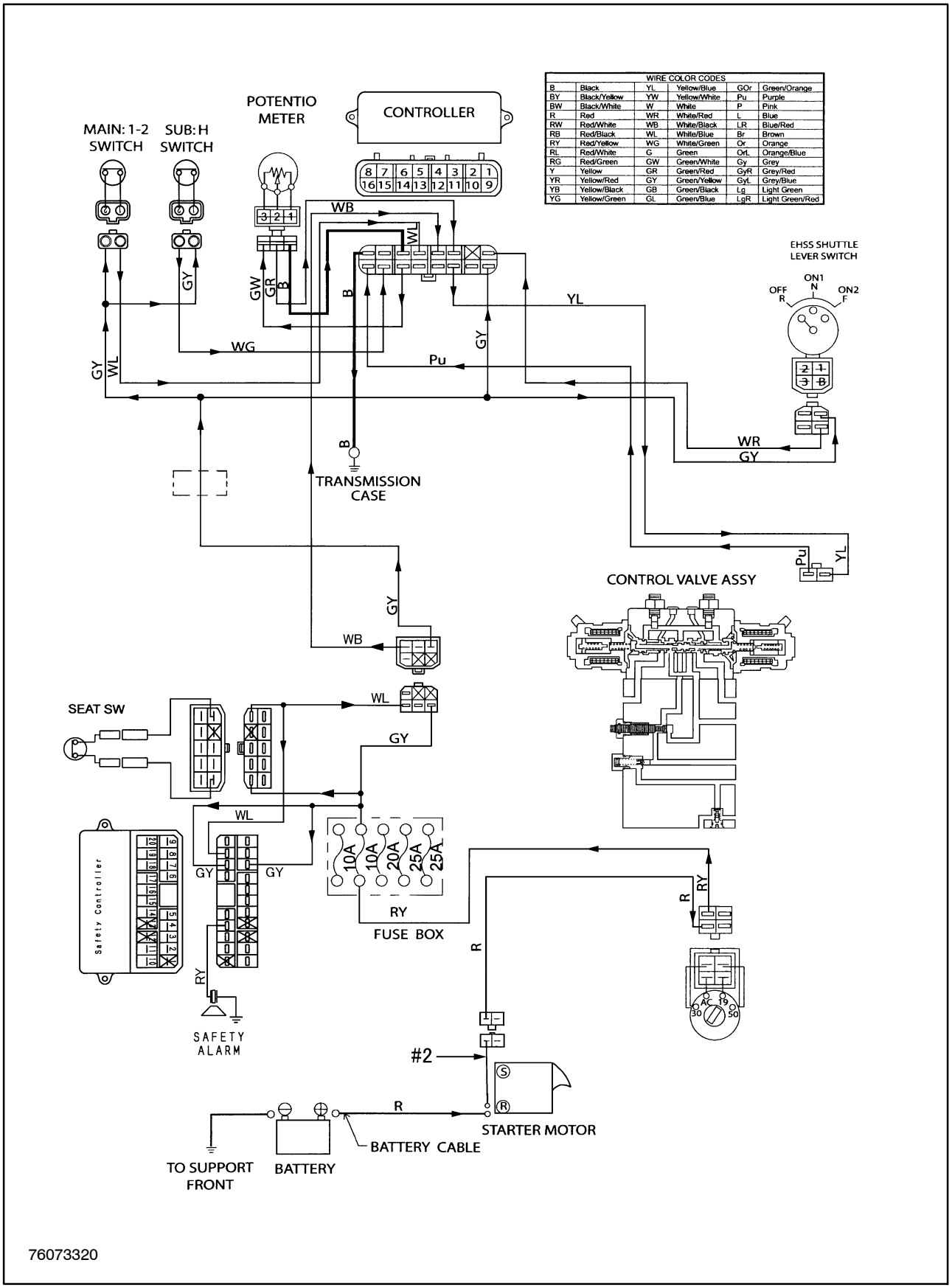
Current travels out of #2 terminal to the forward solenoid of the control valve assembly and the solenoid is energized.

When the forward solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

1ST OR 2ND GEAR, HIGH AND REVERSE SCHEMATIC



1ST OR 2ND GEAR ENGAGED HIGH AND REVERSE ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub H Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 1st or 2nd gear, main 1-2 switch closes sending current to the #13 terminal of the controller.

When the transmission is placed in "HIGH" range the Sub H switch closes sending current to the #7 terminal of the controller.

When the transmission is placed in the reverse position current is transferred from the "B" terminal to the #1 terminal of the shuttle switch. From the #1 terminal of the shuttle switch current is sent to the #9 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve only after inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

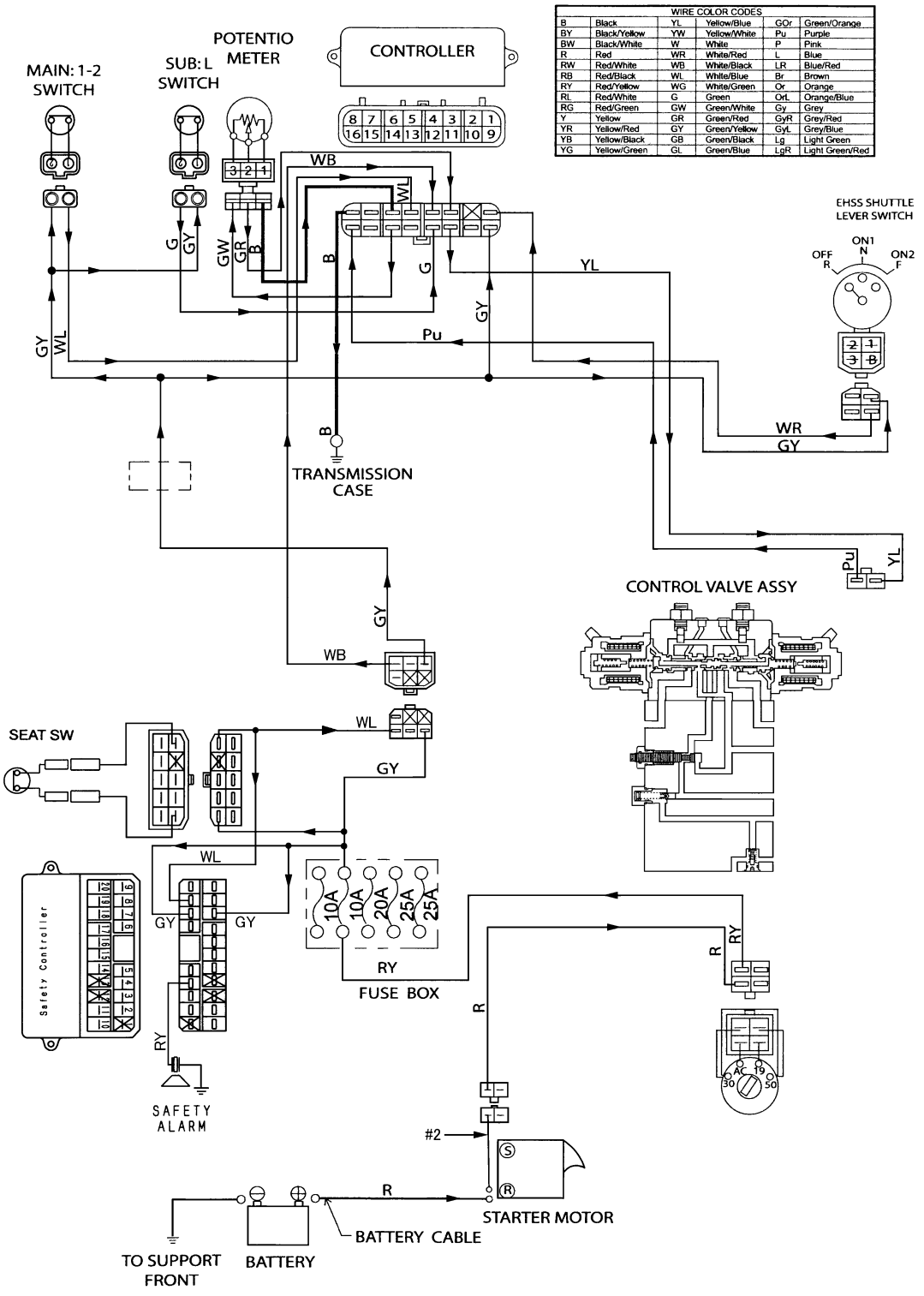
Current travels out of #3 terminal to the reverse solenoid of the control valve assembly and the solenoid is energized.

When the reverse solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

1ST OR 2ND GEAR, LOW AND REVERSE SCHEMATIC



76073321

1ST OR 2ND GEAR ENGAGED LOW AND REVERSE ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub L Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 1st or 2nd gear, main 1-2 switch closes sending current to the #13 terminal of the controller.

When the transmission is placed in "LOW" range the Sub L switch closes sending current to the #4 terminal of the controller.

When the transmission is placed in the reverse position current is transferred from the "B" terminal to the #1 terminal of the shuttle switch. From the #1 terminal of the shuttle switch current is sent to the #9 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve is only available after the inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

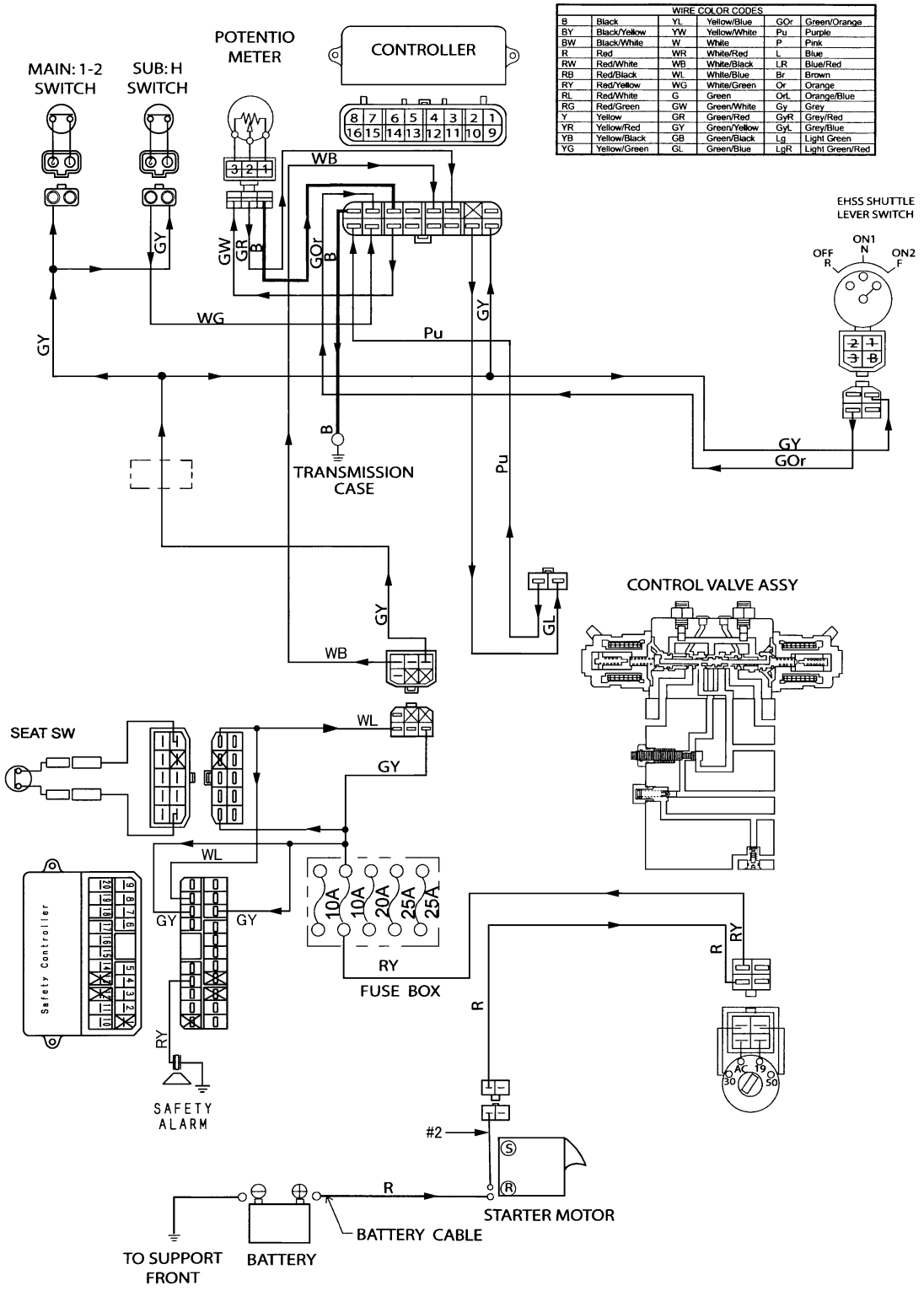
Current travels out of #3 terminal to the reverse solenoid of the control valve assembly and the solenoid is energized.

When the reverse solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

3RD OR 4TH GEAR, HIGH AND FORWARD SCHEMATIC



76073322

3RD OR 4TH GEAR ENGAGED HIGH AND FORWARD ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub H Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 3rd or 4th gear, main 1-2 switch opens.

When the transmission is placed in "HIGH" range the Sub H switch closes sending current to the #7 terminal of the controller.

When the transmission is placed in the forward position current is transferred from the "B" terminal to the #2 terminal of the shuttle switch. From the #2 terminal of the shuttle switch current is sent to the #15 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve is only available after the inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

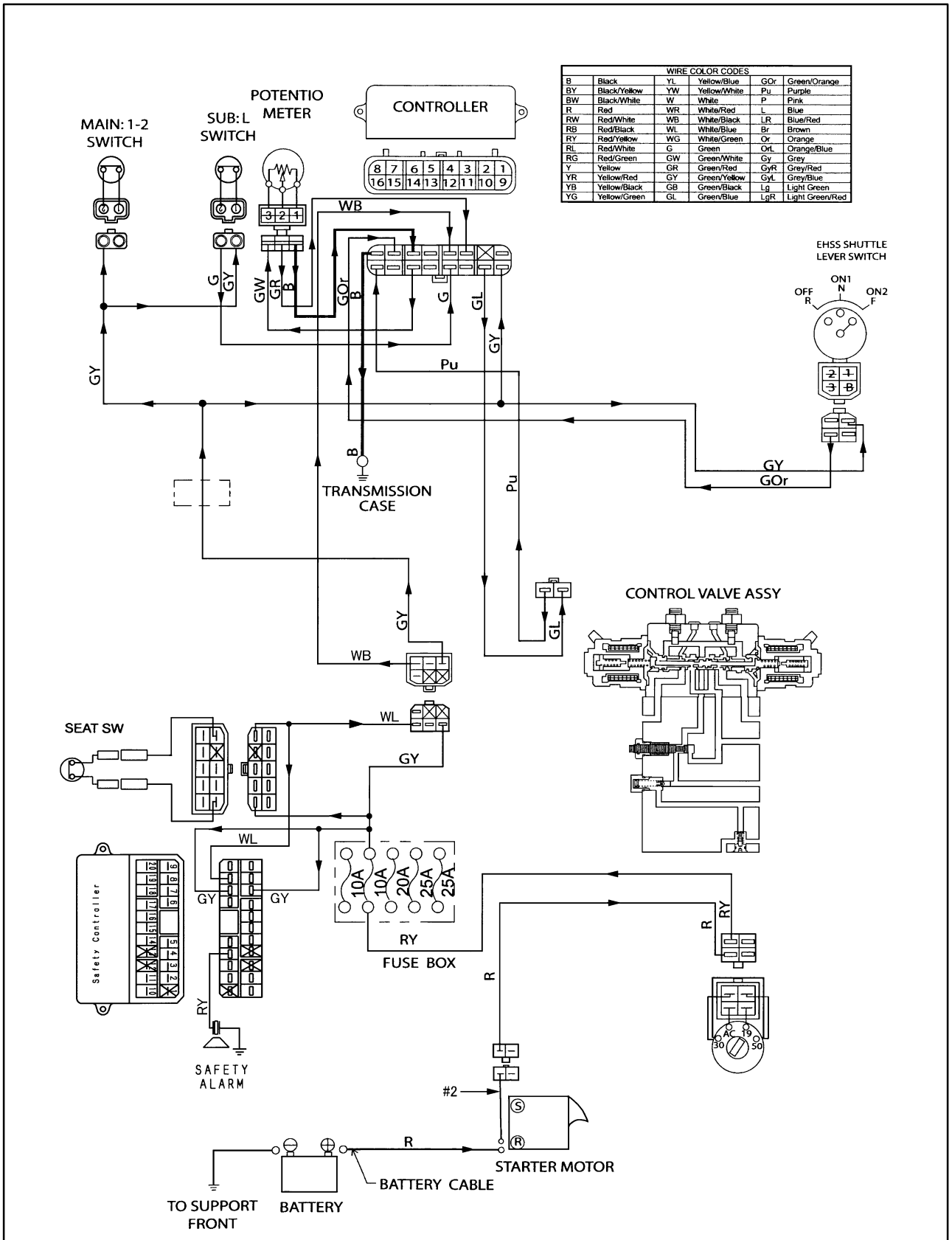
Current travels out of #2 terminal to the forward solenoid of the control valve assembly and the solenoid is energized.

When the forward solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

3RD OR 4TH GEAR, LOW AND FORWARD SCHEMATIC



76073323

3RD OR 4TH GEAR ENGAGED LOW AND FORWARD ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub L Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 3rd or 4th gear, main 1-2 switch opens.

When the transmission is placed in "LOW" range the Sub L switch closes sending current to the #4 terminal of the controller.

When the transmission is placed in the forward position current is transferred from the "B" terminal to the #2 terminal of the shuttle switch. From the #2 terminal of the shuttle switch current is sent to the #15 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve is only available after the inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

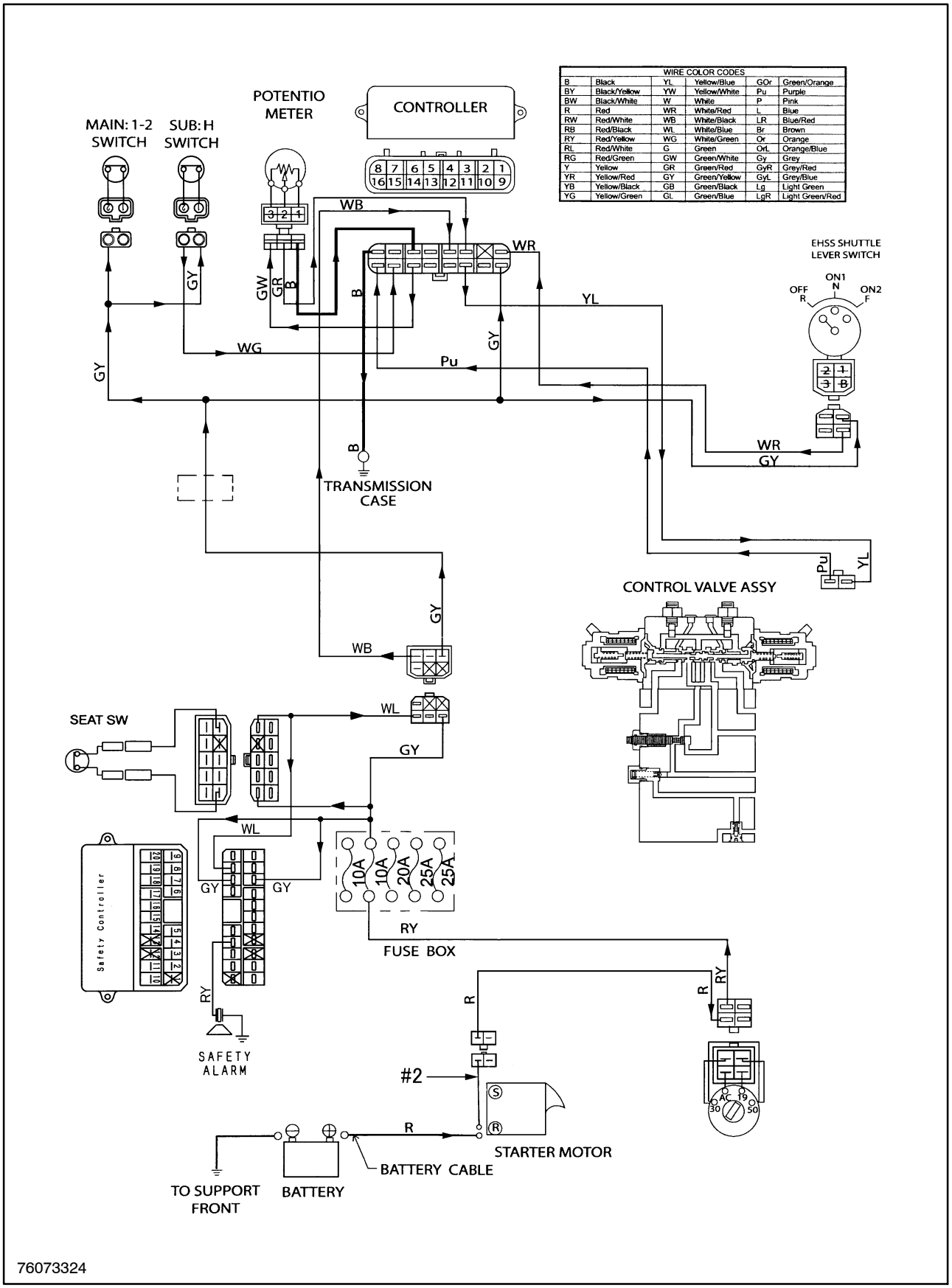
Current travels out of #2 terminal to the forward solenoid of the control valve assembly and the solenoid is energized.

When the forward solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

3RD OR 4TH GEAR, HIGH AND REVERSE SCHEMATIC



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3RD OR 4TH GEAR ENGAGED HIGH AND REVERSE ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key Switch Placed in "RUN/ACC" position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub H Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 3rd or 4th gear, main 1-2 switch opens.

When the transmission is placed in "HIGH" range the Sub H switch closes sending current to the #7 terminal of the controller.

When the transmission is placed in the reverse position current is transferred from the "B" terminal to the #1 terminal of the shuttle switch. From the #1 terminal of the shuttle switch current is sent to the #9 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the Inching Pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve is only available after the inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

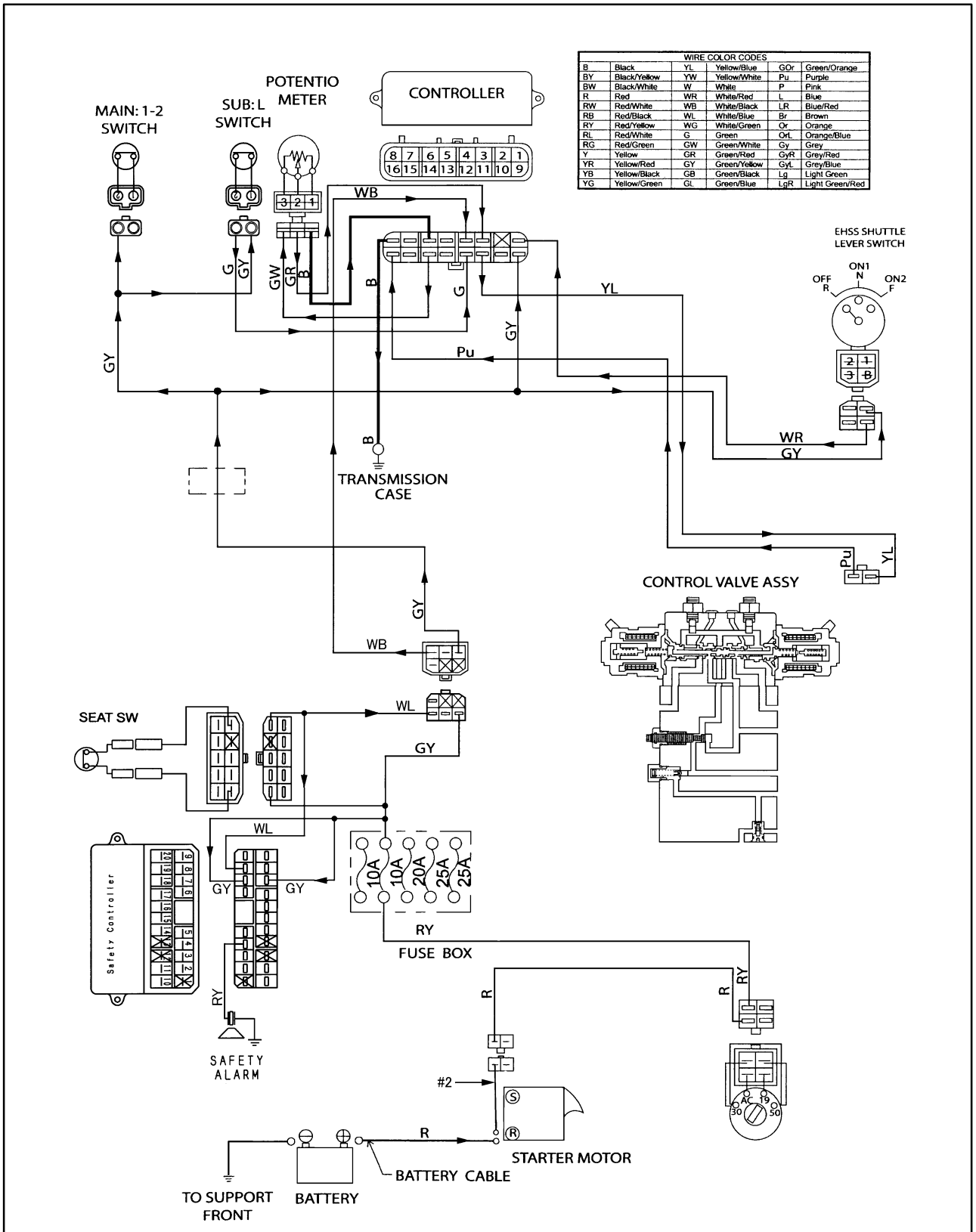
Current travels out of #3 terminal to the reverse solenoid of the control valve assembly and the solenoid is energized.

When the reverse solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

3RD OR 4TH GEAR, LOW AND REVERSE SCHEMATIC



76073325

3RD OR 4TH GEAR ENGAGED LOW AND REVERSE ENGAGED

Current Flow

- Battery
- Fusible link #2
- #30 terminal of key switch

Key switch placed in "RUN/ACC" position

- ACC terminal of key switch
- #2 (10 amp) fuse
- Main 1-2 switch, Sub L Switch, #1 terminal of controller, "B" terminal of shuttle switch
- Seat switch
- Terminals #7 and #18 of the safety controller

When transmission is placed either in 3rd or 4th gear, main 1-2 switch opens.

When the transmission is placed in "LOW" range the Sub L switch closes sending current to the #4 terminal of the controller.

When the transmission is placed in the reverse position current is transferred from the "B" terminal to the #1 terminal of the shuttle switch. From the #1 terminal of the shuttle switch current is sent to the #9 of the controller.

When the key switch is placed in the "RUN/ACC" position, current flows from the seat switch to terminal #12 of the controller and terminal #8 of the safety controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

POTENTIOMETER

With the inching pedal (not depressed)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of potentiometer.

CONTROLLER CURRENT OUTPUT

NOTE: *Current is sent from the controller to the solenoid valve is only available after the inching pedal is depressed and returned to the free position.*

The engine must be running and operator must be present in the seat.

Current travels out of #3 terminal to the reverse solenoid of the control valve assembly and the solenoid is energized.

When the reverse solenoid is deenergized current leaves the solenoid windings and travels to the #8 terminal of the controller.

GROUND SOURCES

- Transmission case
- #16 terminal of controller

EHSS CONTROLLER ACTIVATION

Current Flow

- Battery
- #30 terminal of key switch
- Fusible link

Key Switch Placed in “RUN/ACC” Position

- ACC terminal of key switch
- #2 (10 amp) fuse
- #1 terminal of controller, “B” terminal of shuttle switch

When the key switch is placed in the “RUN/ACC” position, current flows from the seat switch to terminal #12 of the controller (when the operator is present in the seat) completing the transmission part of the safety circuit.

CONTROLLER ACTIVATION

IMPORTANT: *To activate the EHSS controller after the tractor is started:*

- The engine must be running and the operator must be present in the seat
- The inching pedal is cycled

POTENTIOMETER

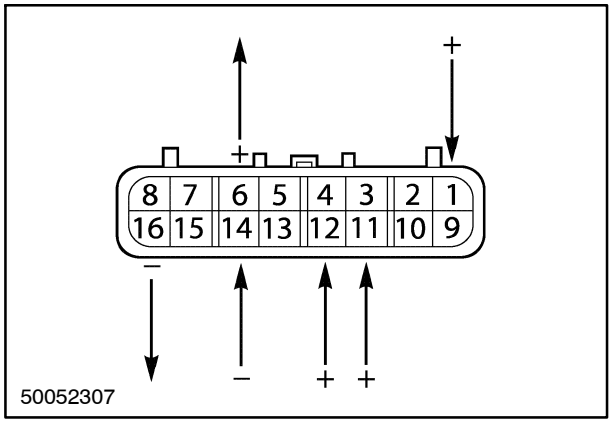
IMPORTANT: *The inching pedal has to be cycled with the operator in the seat, after starting the tractor to activate the EHSS controller.*

With the Inching Pedal (free position)

- Input current travels from #6 terminal of controller to #3 terminal of potentiometer
- Output current travels from #2 terminal of potentiometer to the #11 terminal of the controller.
- Ground source for potentiometer is provided by terminal #14 of controller, to terminal #1 of the potentiometer.

GROUND SOURCES

- Transmission case
- #14 terminal of controller
- #16 terminal of controller



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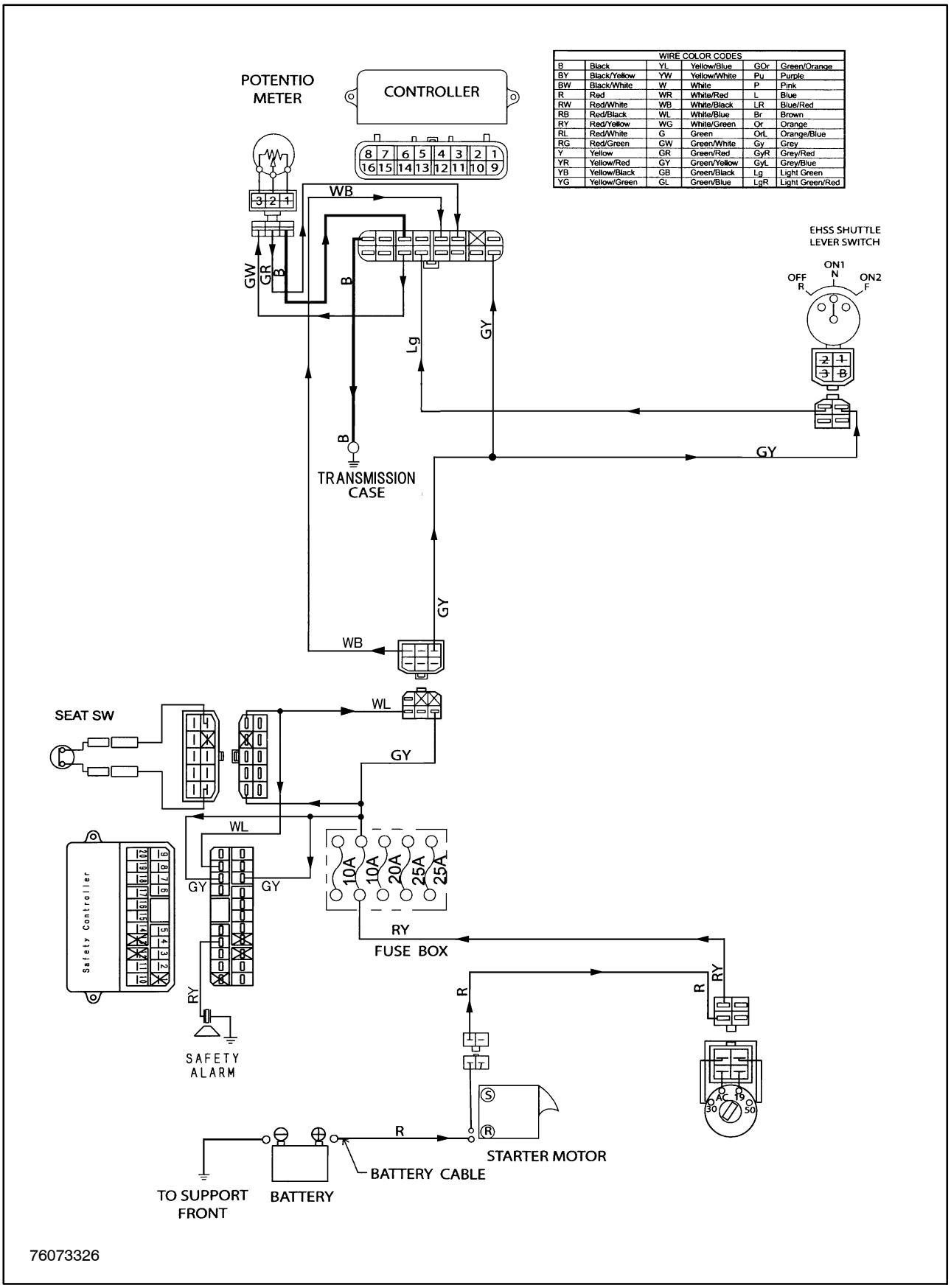

WIRE COLOR CODES
B Black
BY Black/Yellow
BW Black/White
R Red
RW Red/White
RB Red/Black
RY Red/Yellow
RL Red/White
RG Red/Green
Y Yellow
YR Yellow/Red
YB Yellow/Black
YG Yellow/Green
YL Yellow/Blue
YW Yellow/White
W White
WR White/Red
WB White/Black
WL White/Blue
WG White/Green
G Green
GW Green/White
GR Green/Red
GY Green/Yellow
GB Green/Black
GL Green/Blue
GOr Green/Orange
Pu Purple
P Pink
L Blue
LR Blue/Red
Br Brown
Or Orange
OrL Orange/Blue
Gy Grey
GyR Grey/Red
GyL Grey/Blue
Lg Light Green
LgR Light Green/Red
POTENTIO METER
CONTROLLER
EHSS SHUTTLE LEVER SWITCH
ON1
N
OFF
R
ON2
F
TRANSMISSION CASE
SEAT SW
Safety Controller
10A
10A
20A
25A
25A
RY
FUSE BOX
SAFETY ALARM
STARTER MOTOR
BATTERY CABLE
TO SUPPORT FRONT
BATTERY
WB
GW
GR
B
Lg
GY
WL
R
76073326

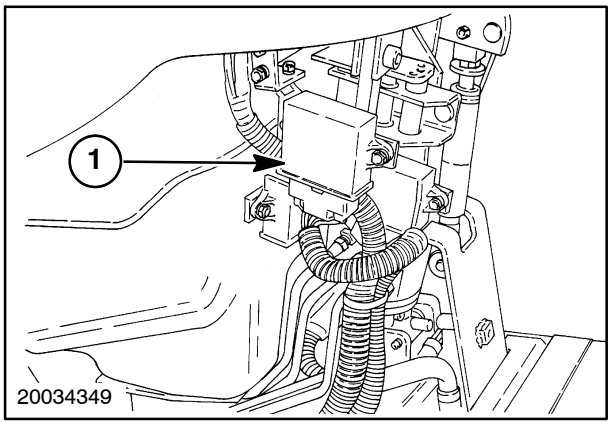
MODULATION TIME CHART

Measured time is the voltage increase from initial(zero voltage) F-N-R switch activation (F-N-R lever moved to F or R from N) to full transmission engagement (peak voltage).

RANGE SELECTION	GEAR SELECTION	TIME TO PEAK VOLTAGE
LOW	1 & 2	3.5 Seconds
LOW	3 & 4	3.75 Seconds
MID	1 & 2	4.0 Seconds
MID	3 & 4	4.25 Seconds
HIGH	1 & 2	4.0 Seconds
HIGH	3 & 4	3.5 Seconds

EHSS CONTROLLER

The EHSS controller, 1, is located on the left side of the steering column. This controller coordinates the shift modulations and directs current to the forward or reverse solenoids during a shift function.



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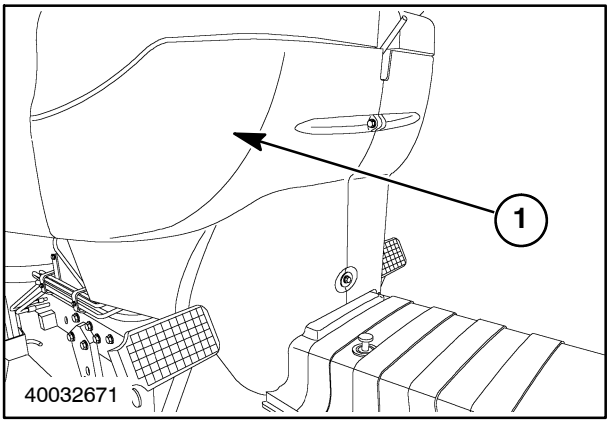
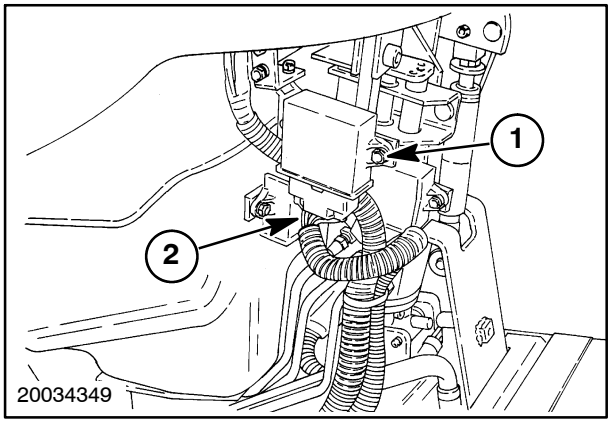
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the left side steering column shroud, 1.



288

3. Remove the two mounting screws, 1, from the controller and disconnect controller from the tractor wire harness, 2.

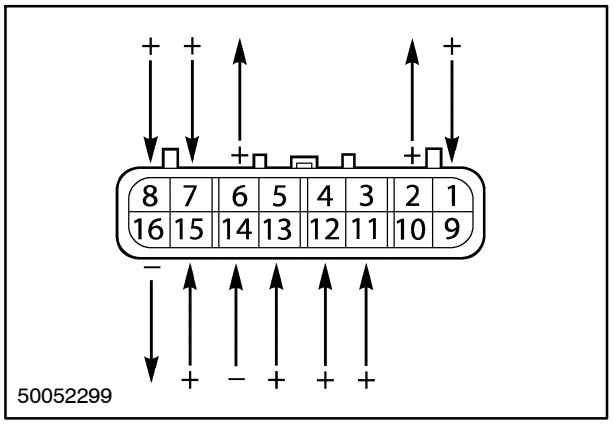


289

EHSS CONTROLLER TESTING

1st or 2nd Gear, High and Forward Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

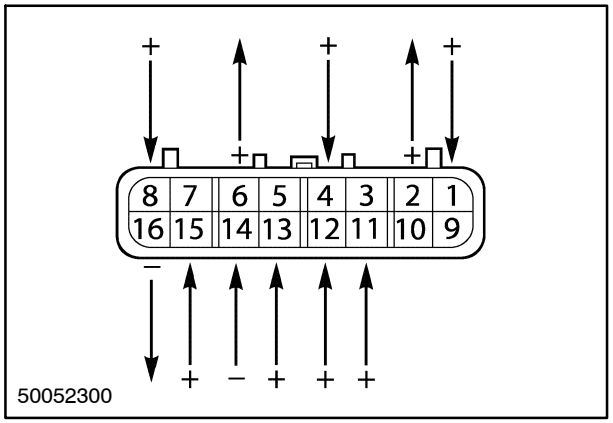
Input (+)	Terminal #s 1, 7, 8, 11, 12, 13, 15
Ground (–)	Terminal #16
Output (+)	Terminal #s 2, 6
Input (–)	Terminal #14



290

1st or 2nd Gear, Low and Forward Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

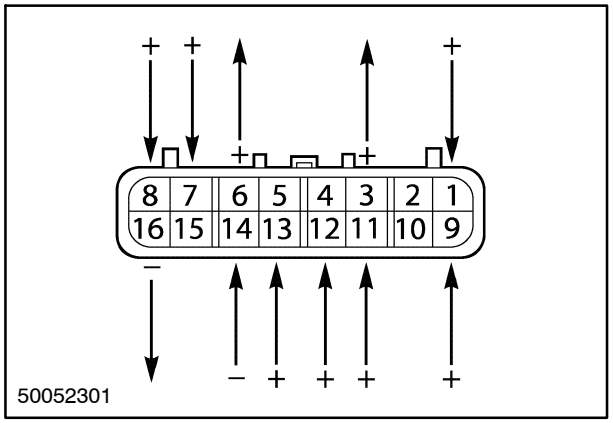
Input (+)	Terminal #s 1, 4, 8, 11, 12, 13, 15
Ground (–)	Terminal #16
Output (+)	Terminal #s 2, 6
Input (–)	Terminal #14



291

1st or 2nd Gear, High and Reverse Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

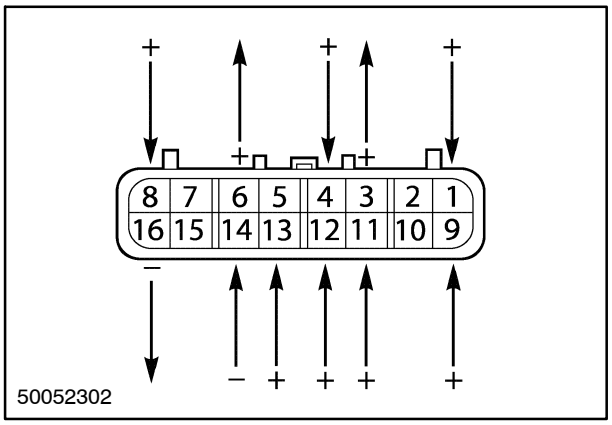
Input (+)	Terminal #s 1, 7, 8, 9, 11, 12, 13
Ground (–)	Terminal #16
Output (+)	Terminal #s 3, 6
Input (–)	Terminal #14



292

1st or 2nd Gear, Low and Reverse Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

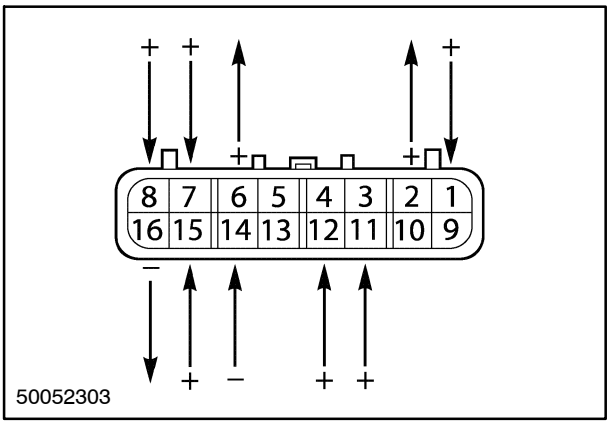
Input (+)	Terminal #s 1, 4, 8, 9, 11, 12, 13
Ground (–)	Terminal #16
Output (+)	Terminal #s 3, 6
Input (–)	Terminal #14



293

3rd or 4th Gear, High and Forward Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

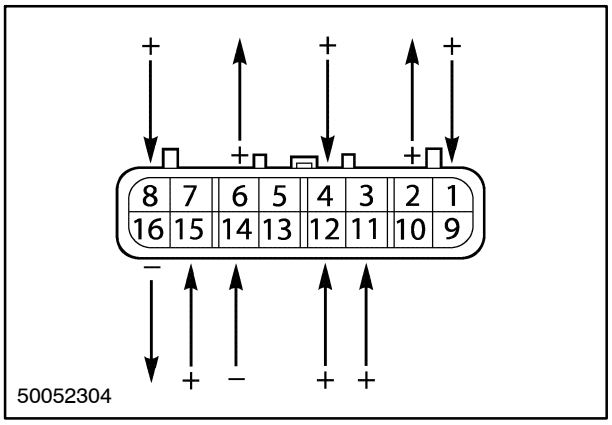
Input (+)	Terminal #s 1, 7, 8, 11, 12, 15
Ground (–)	Terminal #16
Output (+)	Terminal #s 2, 6
Input (–)	Terminal #14



294

3rd or 4th Gear, Low and Forward Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

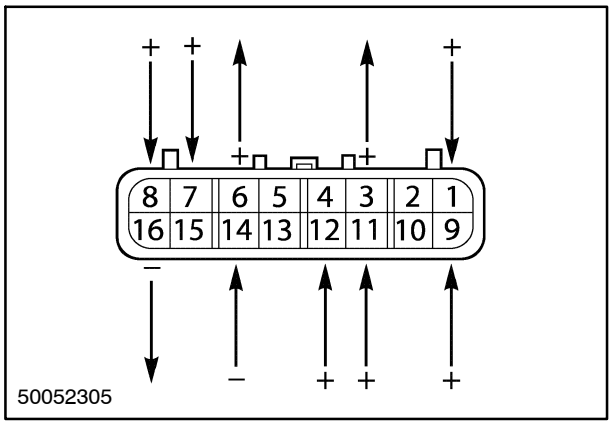
Input (+)	Terminal #s 1, 4, 8, 11, 12, 15
Ground (–)	Terminal #16
Output (+)	Terminal #s 2, 6
Input (–)	Terminal #14



295

3rd or 4th Gear, High and Reverse Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

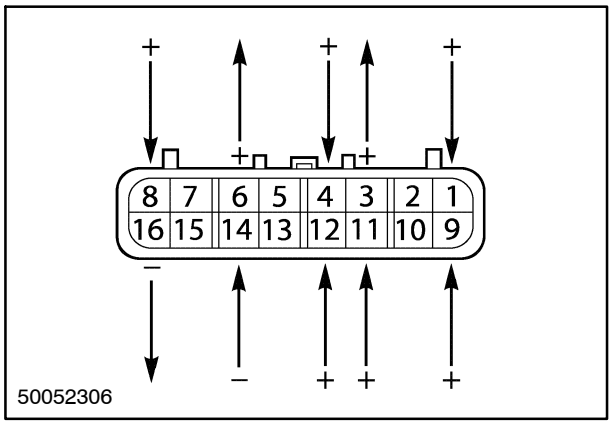
Input (+)	Terminal #s 1, 7, 8, 9,11, 12,
Ground (–)	Terminal #16
Output (+)	Terminal #s 3, 6
Input (–)	Terminal #14



296

3rd or 4th Gear, Low and Reverse Circuit
Using a 12 volt supply and ohm meter, test output current at indicated terminals.

Input (+)	Terminal #s 1, 4, 8, 9, 11, 12,
Ground (–)	Terminal #16
Output (+)	Terminal #s 3, 6
Input (–)	Terminal #14

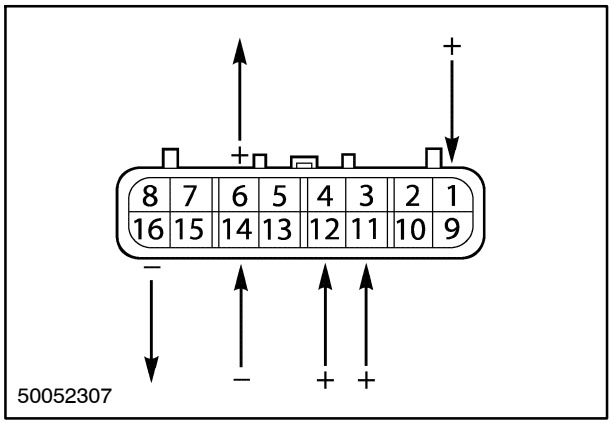


297

ACTIVATION CIRCUIT

Using a 12 volt supply and ohm meter, test output current at indicated terminals.

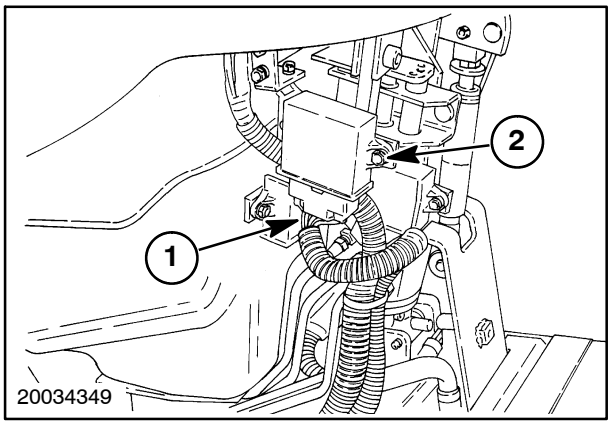
Input (+)	Terminal #s 1, 11, 12,
Ground (–)	Terminal #16
Output (+)	Terminal #6
Input (–)	Terminal #14



298

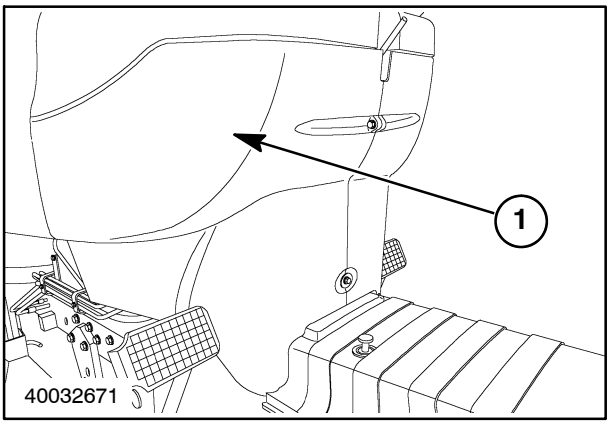
Installation

1. Connect controller to the tractor wire harness, 1. and install the two mounting screws, 2, to the controller.



299

2. Install the left side steering column shroud, 1.
3. Connect the negative (–) battery cable from the negative (–) battery terminal.



300

SHUTTLE SWITCH (FORWARD/REVERSE)

The shuttle switch, 1, located underneath the dash area, on the shuttle lever linkage. This switch is used to engage the EHSS transmission either in the neutral, forward or reverse modes.

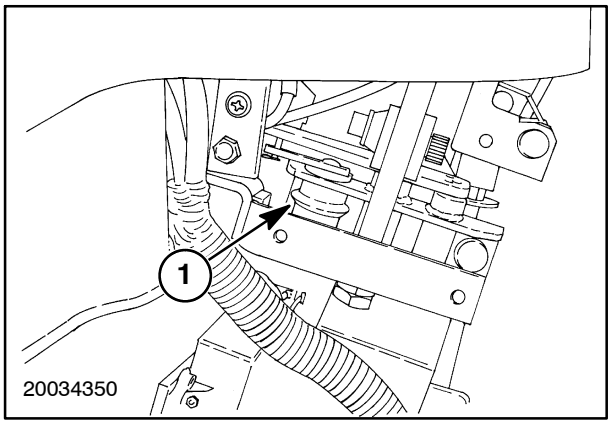
The shuttle switch is also part of the tractor's safety start system. The switch has to be in the "NEUTRAL" position to allow the tractor to start.

The switch has three positions:

NEUTRAL

FORWARD

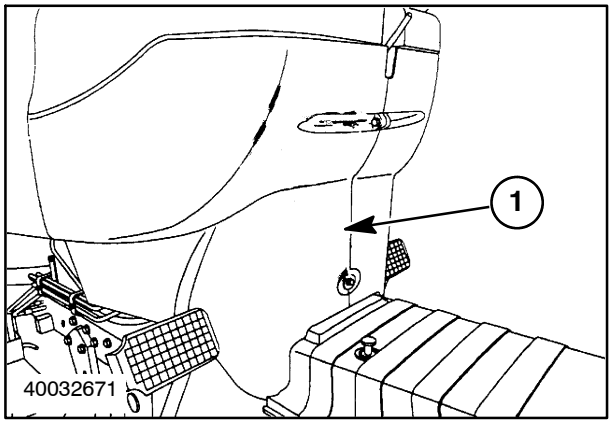
REVERSE



301

Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Disconnect the switch from the tractor wire harness.



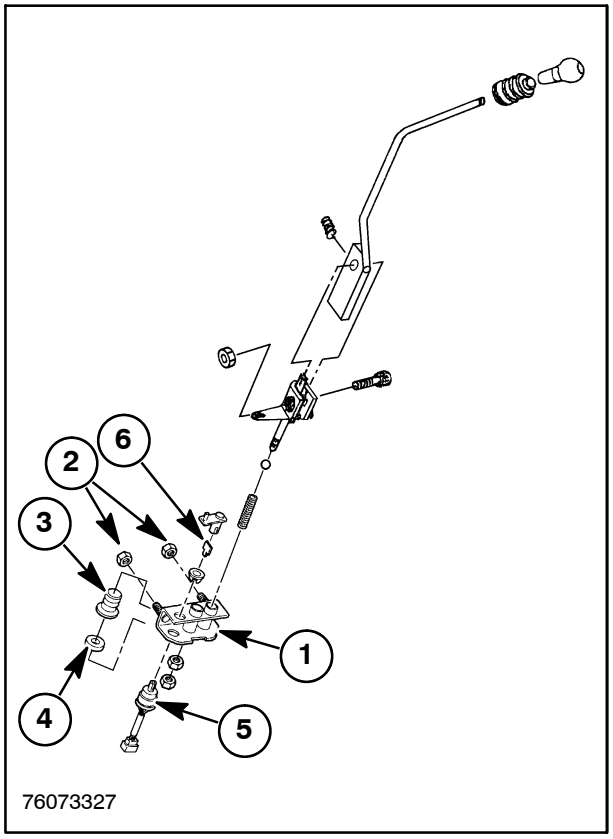
302

4. Remove the switch mounting bracket, 1, by removing the two retaining nuts, 2.

NOTE: *Removing the switch, mounting bracket and shift lever as an assembly. This will make removing and installing the switch easier.*

5. Remove rubber boot, 3, from top of switch, unscrew switch retaining nut, 4, and remove switch, 5, from bracket.

NOTE: *Pay attention not to lose spade, 6, that connects switch to shift linkage.*



303

Testing

Use an ohmmeter to test the switch for electrical continuity.

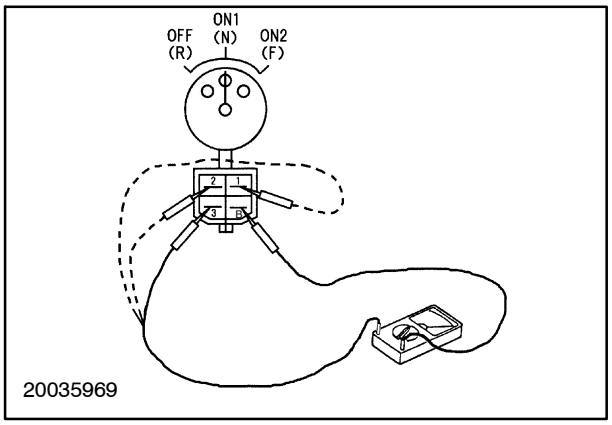
All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

Terminal wire leads identification:

1. Blue/White
2. Blue
3. Red

B. Black/White



304

"NEUTRAL" Position

Continuity in terminals: B and 3

"FORWARD" Position

Continuity in terminals: B and 2

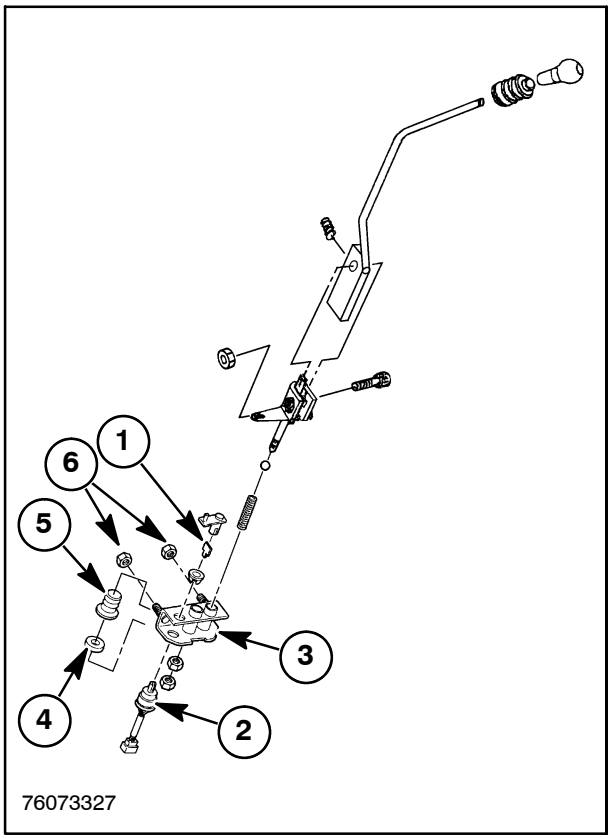
"REVERSE" Position

Continuity in terminals: B and 1

If any other test results are found the switch is defective and should be replaced.

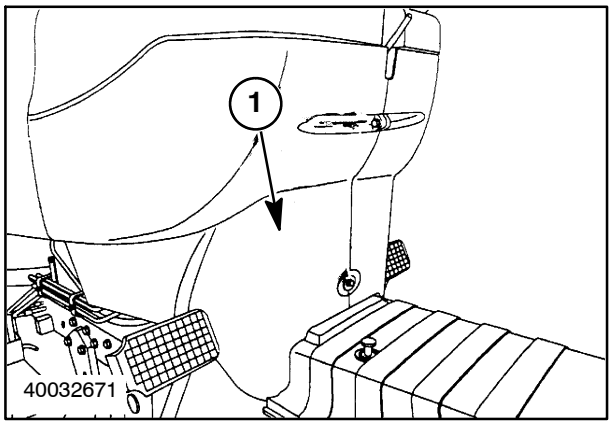
Installation

1. Install spade, 1, into the slot of the switch post.
2. Install switch, 2, (aligning spade that is in post of switch into slot of shift linkage) into mounting bracket, 3, insert tab of switch into slot in mounting bracket, secure with switch retaining nut, 4, and place rubber boot, 5 on top of switch.
3. Install switch and mounting bracket assembly onto steering column and secure with the two nuts, 6.
4. Connect the switch to the tractor wire harness.



305

5. Install the left side steering column shroud, 1.
6. Connect the negative (–) battery cable from the negative (–) battery terminal.

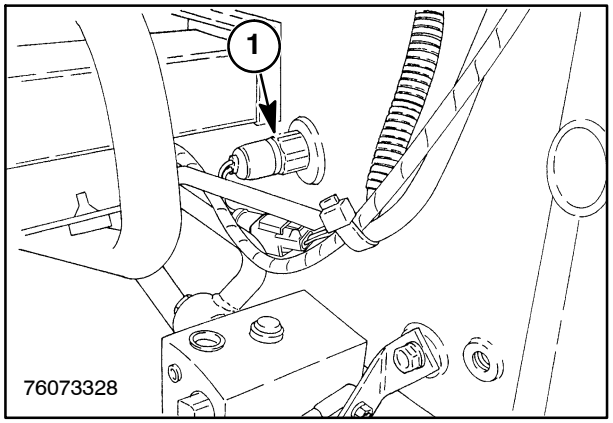


306

TRANSMISSION MODULATION SWITCHES

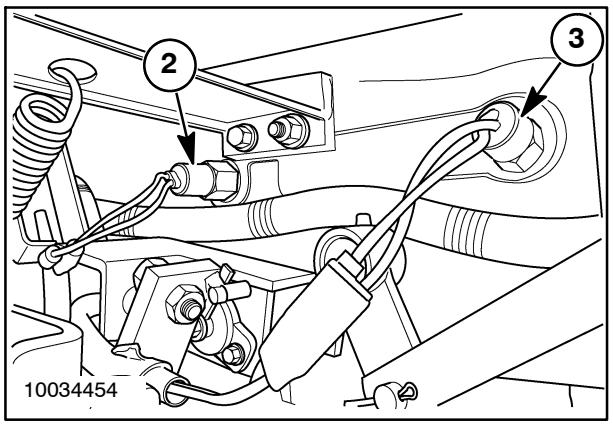
There are three transmission modulations switches on the EHSS transmission. Single- pole push button type switch that is externally mounted on transmission case, but internally actuated.

1. Main transmission 1-2 (right front of transmission)



307

2. High Range (left rear of transmission)
3. Low Range (left rear of transmission)



308

The purpose of these switches, is to supply current to the EHSS control module when the transmission is in 1st or 2nd gear and when either in “HIGH” or “LOW” range gears, so that the controller can supply different modulations during a shuttle shift.

Removal (ALL switches)

NOTE: *Place shift lever in either in 1st or 2nd gear to aid in switch removal and installation.*

Main 1-2 Switch (ball located behind switch)

1. Unplug wire leads from the switch to the wire harness.
2. Unscrew switch from transmission housing.

Testing

Use an ohmmeter between the leads of switch to test both positions of the switch.

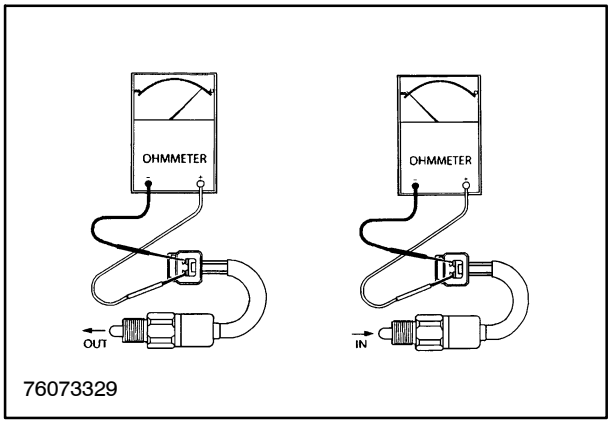
MAIN 1-2 Switch

1st or 2nd gear – switch closed – continuity

3 or 4th gear – switch open – no continuity

EXTENDED POSITION – Continuity

RETRACTED POSITION – No Continuity



309

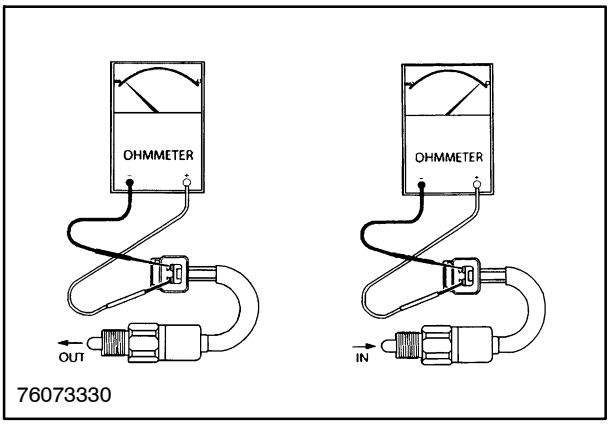
"HIGH" and "LOW" Range Switches

High or Low in engaged position – switch closed - continuity

EXTENDED POSITION – No continuity

RETRACTED POSITION – Continuity

If any other test results are found the switch is defective and should be replaced.



310

Installation (ALL switches)

1. Thread switch into transmission housing, make sure there is a sealing washer installed on end of switch.

NOTE: *On Main 1-2 switch, install ball into housing before installing switch.*

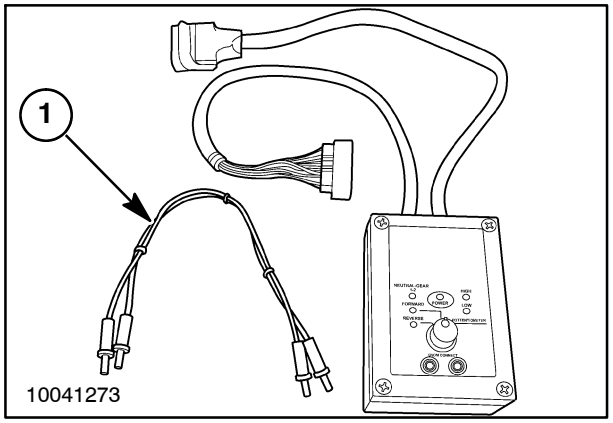
2. Connect wire leads from switch to wire harness.
3. Connect the negative (–) battery cable from the negative (–) battery terminal.

TROUBLESHOOTING SHIFTABILITY

DESCRIPTION OF OPERATION

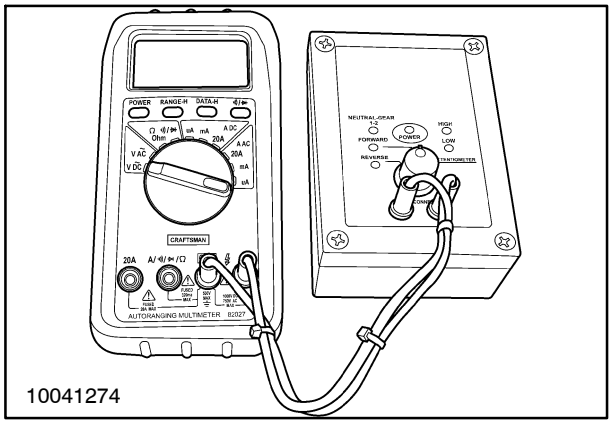
The EHSS breakout box (#380001351) is used to diagnose circuit faults within the transmission control circuit on the EHSS transmission used on the 2410 and 2420 Compact tractors.

***NOTE**: The double banana leads, 1, are included with the breakout box.*



311

This tool is used in conjunction with a volt/ohmmeter to troubleshoot transmission malfunction, starting with the electrical control circuit. This effectively allows a technician to identify a faulty switch, controller or potentiometer, prior to more involved mechanical troubleshooting. The suspected component is subsequently tested for continuity to determine if replacement of the component is necessary.



312

The tool can be used in three different test conditions:

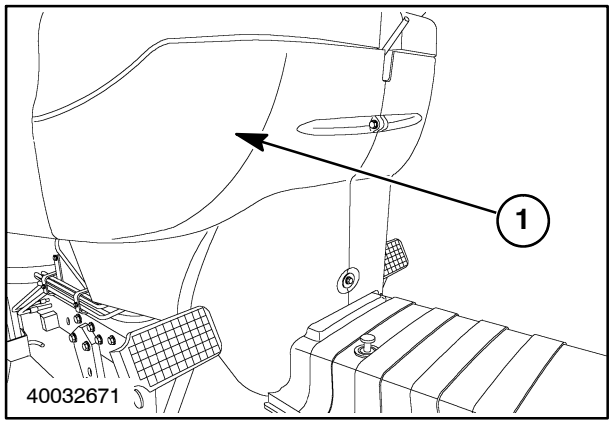
1. Tractor in static mode (engine not running, key switch on).
2. Tractor in Run mode (engine running, key switch on, tractor on jack stands with drive wheels off the ground).
3. Operational mode (engine running, key switch on, tractor operating).

The EHSS Breakout box performs the following functions:

1. Indicates position of “Forward/Reverse” shuttle switch.
2. Indicates position of “High and Low” range switches.
3. Indicates position of “Main Gear” selector switch (Neutral, 1–2, 3–4).
4. Indicates “Inching pedal” potentiometer voltage output (w/attached volt/ohmmeter).
5. Indicates modulation time for each switch (w/attached volt/ohmmeter).

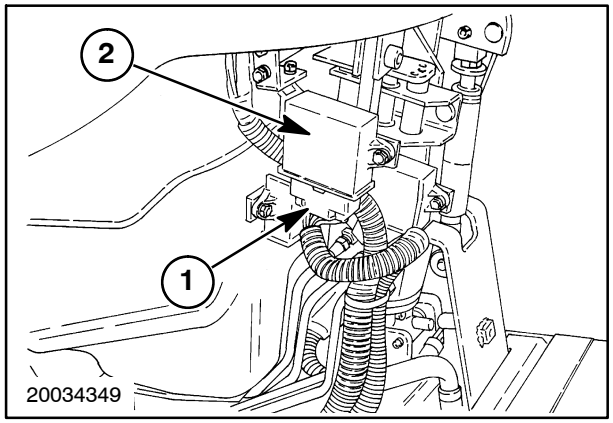
BREAKOUT BOX CONNECTION TO TRACTOR

1. Remove the left, rear hood panel, 1, from the tractor.



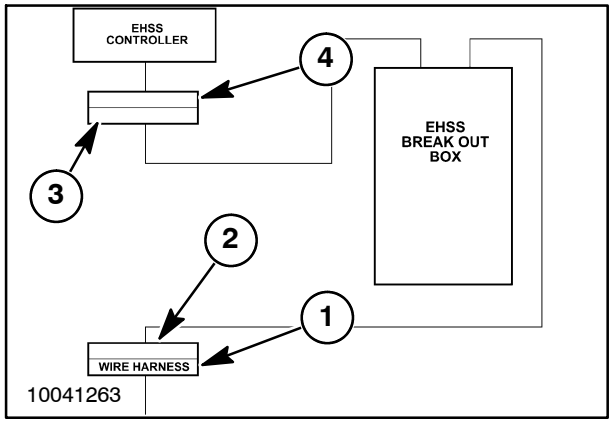
313

2. Disconnect the harness plug, 1, from the controller, 2.



314

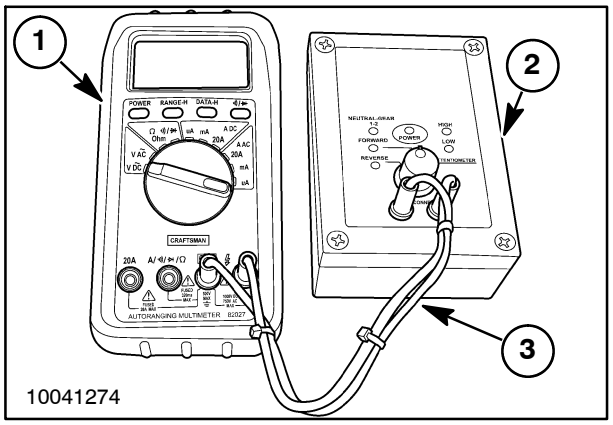
3. Connect the harness plug, 1, to the corresponding connector, 2, on the breakout box.
4. Connect the remaining breakout box connector, 3, to the controller, 4.



315

5. Connect a digital volt/ohmmeter, 1, to the breakout box, 2, using the supplied leads, 3.

***NOTE**: Digital volt/ohmmeter is not included with the breakout box and must be procured locally. The breakout box may be used with an analog volt/ohmmeter, but use of a digital instrument is suggested.*



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TEST PROCEDURES – SWITCHES

***NOTE**: Volt/ohmmeter does not need to be connected to the breakout box for initial switch tests. Use volt/ohmmeter for continuity check, following initial test with breakout box.*

***NOTE**: In the event of a High or Low switch failure, the controller will default the transmission to the Mid range.*

High Range Switch

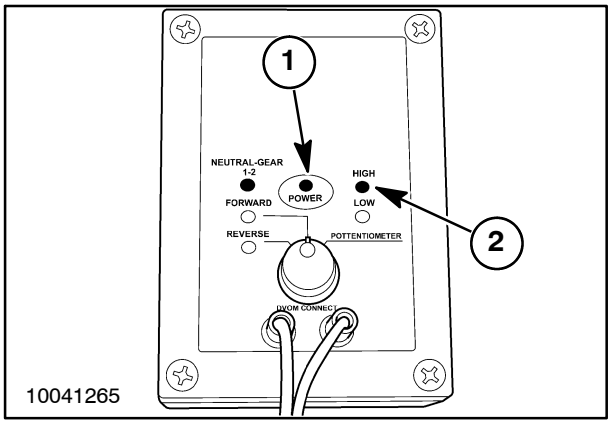
1. Connect the breakout box to the tractor.

***NOTE**: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

2. Turn the key switch to “ON”.
3. “POWER” indicator light, 1, will illuminate.

***NOTE**: If “POWER” indicator light does not illuminate, check the 10 amp fuse on the tractor.*

4. Place the shuttle control lever in “NEUTRAL”.
5. Place the main gear selector in “NEUTRAL”.
6. Move the range control lever to “HIGH” (H).
7. Observe the breakout box indicator lights. The “HIGH” indicator light, 2, should be on.
8. If the indicator light for the “HIGH” range switch does not light, turn the key switch to “OFF”.
9. The high range modulation switch, 1, is located on the left side of the transmission housing, directly above the inching pedal/brake shaft.
10. Disconnect the two wires to the “HIGH” range switch.



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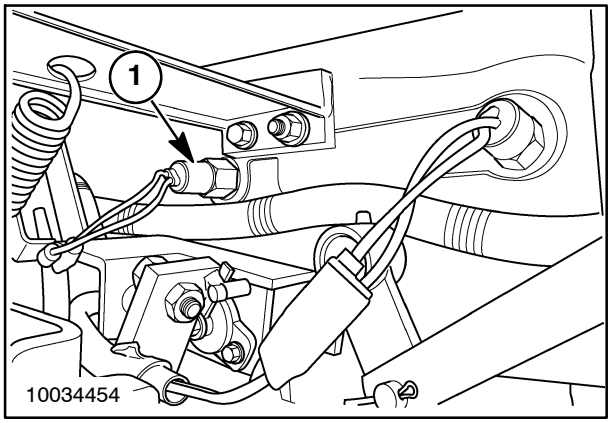
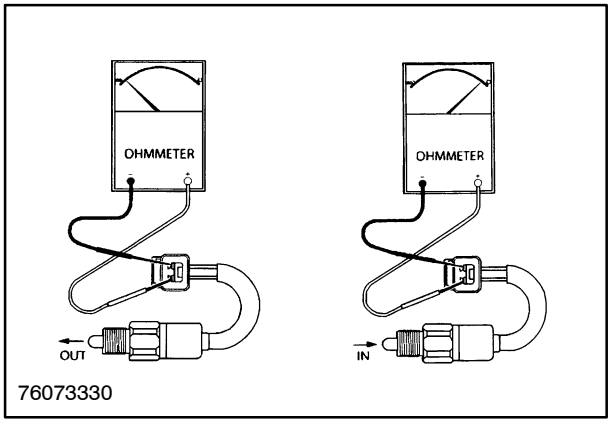


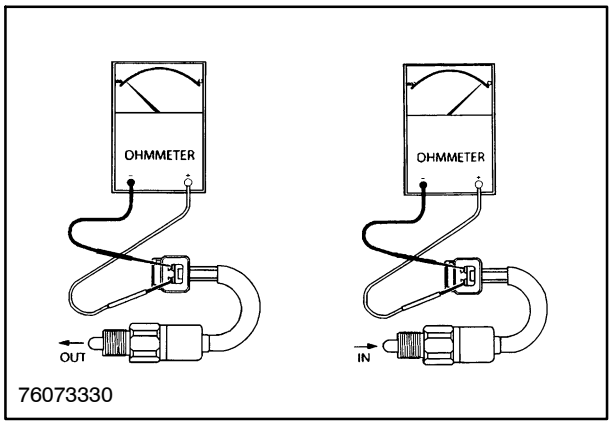
318

11. Place the range control lever in “HIGH”. Check the switch for continuity using an ohmmeter.
12. The switch should be retracted (closed) in this position, and should show continuity.



319

13. Place the range control lever in “MID” or “LOW”. Check the switch for continuity.
14. The switch is extended (open) in each of these positions, and should show no continuity.
15. If switch does not pass both continuity checks, replace the switch.



320

Low Range Switch

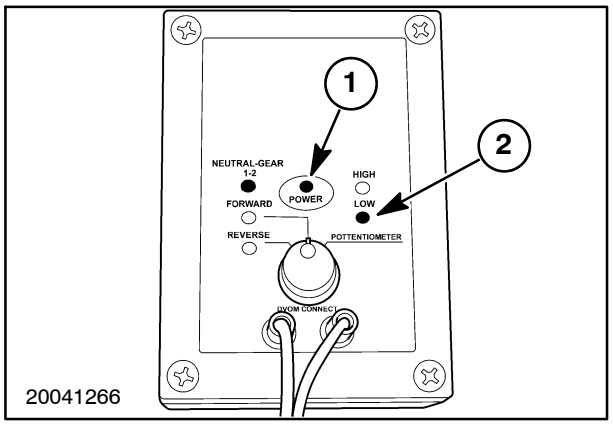
1. Connect the breakout box to the tractor.

***NOTE**: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

2. Turn the key switch to “ON”.
3. “POWER” indicator light, 1, will illuminate.

***NOTE**: If “POWER” indicator light does not illuminate, check the 10 amp fuse on the tractor.*

4. Place the shuttle control lever in “NEUTRAL”.
5. Place the main gear selector in “NEUTRAL”.
6. Move the range control lever to “LOW” (L).
7. Observe the breakout box indicator lights. The “LOW” indicator light, 2, should be on.
8. If the indicator light for the “LOW” range switch does not light, turn the key switch to “OFF”.
9. The low range modulation switch, 1, is located on the left side of the transmission housing, directly above the range shift lever.
10. Disconnect the two wires to the “LOW” range switch.



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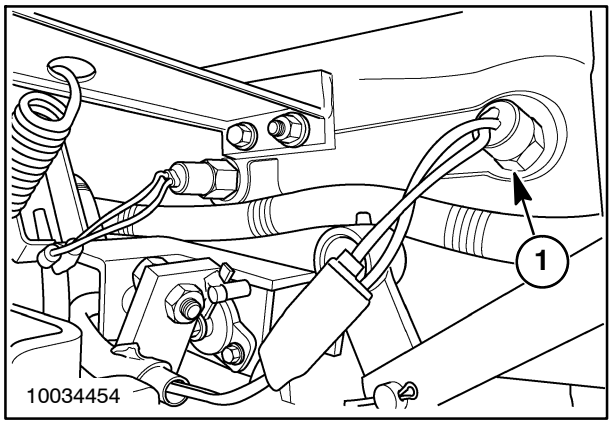
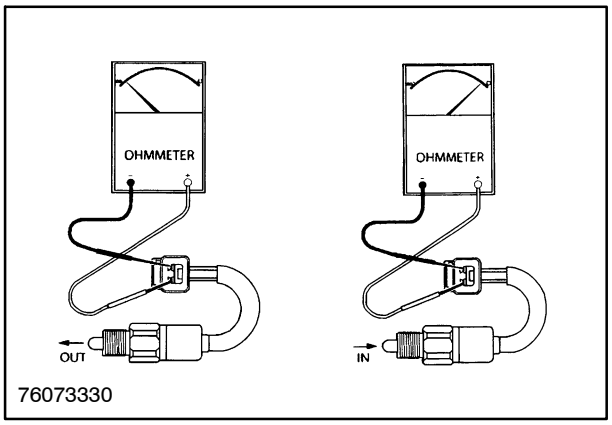


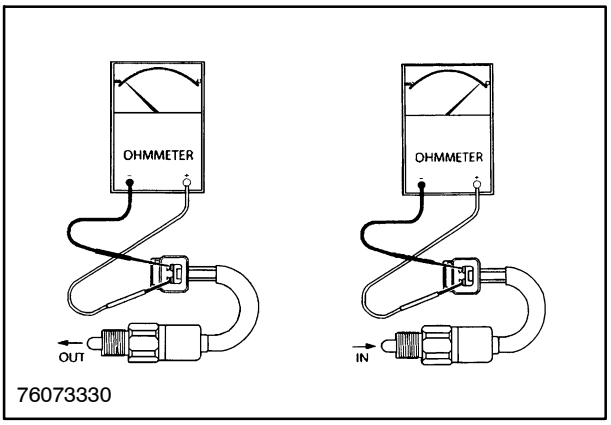
322

11. Place the range control lever in “LOW”. Check the switch for continuity using an ohmmeter.
12. The switch should be retracted (closed) in this position, and should show continuity.



323

13. Place the range control lever in “MID” or “HIGH”. Check the switch for continuity.
14. The switch is extended (open) in each of these positions, and should show no continuity.
15. If switch does not pass both continuity checks, replace the switch.



324

Neutral, 1st and 2nd Gear Switch

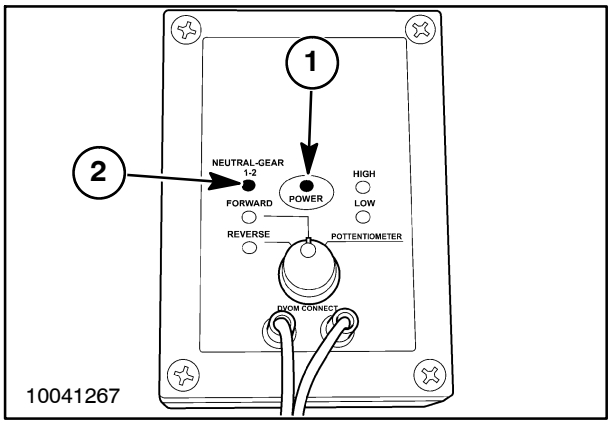
1. Connect the breakout box to the tractor.

NOTE*: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

2. Turn the key switch to “ON”.
3. “POWER” indicator light, 1, will illuminate.

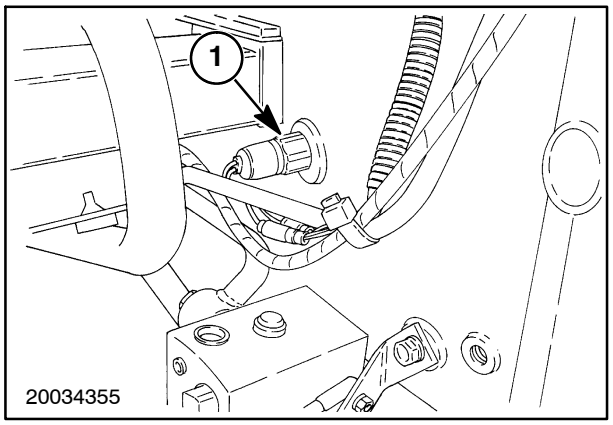
NOTE*: If “POWER” indicator light does not illuminate, check the 10 amp fuse on the tractor.*

4. Place the shuttle control lever in “NEUTRAL”.
5. Place the main gear selector in “NEUTRAL”, “1st” or “2nd” gear position.
6. Observe the breakout box indicator lights. The “NEUTRAL”, “1st” or “2nd” indicator light, 2, should be on.
7. If the indicator light for the “NEUTRAL”, “1st” or “2nd” switch does not light, turn the key switch to “OFF”.



325

8. The modulation switch, 1, for 1st and 2nd gear is located on the right side of the transmission housing, above the combination diverter/relief valve.
9. Disconnect the two wires to the “NEUTRAL”, “1st” or “2nd” range switch, 1.



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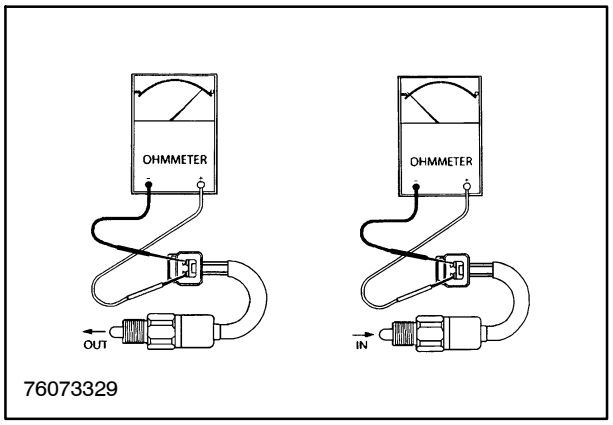
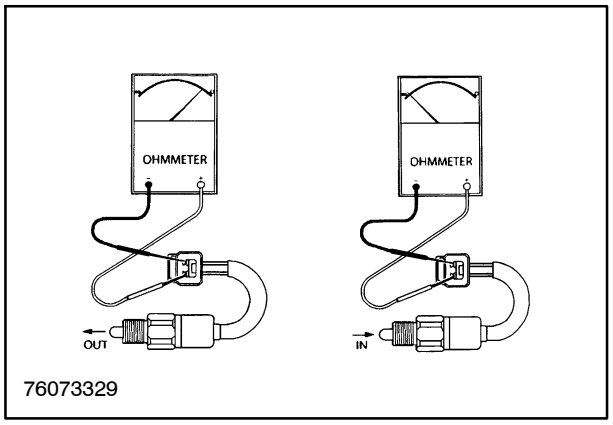
10. Place the main gear selector in “NEUTRAL”, “1st” or “2nd” gear position. Check the switch for continuity using an ohmmeter.
11. The switch should be extended (closed) in this position, and should show continuity.



327

12. Place the main, gear selector lever in “3rd”, or “4th”. Check the switch for continuity.
13. The switch is retracted (open) in each of these positions, and should show no continuity.
14. If switch does not pass both continuity checks, replace the switch.



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Shuttle Switch (F-N-R)

1. Connect the breakout box to the tractor.

***NOTE**: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

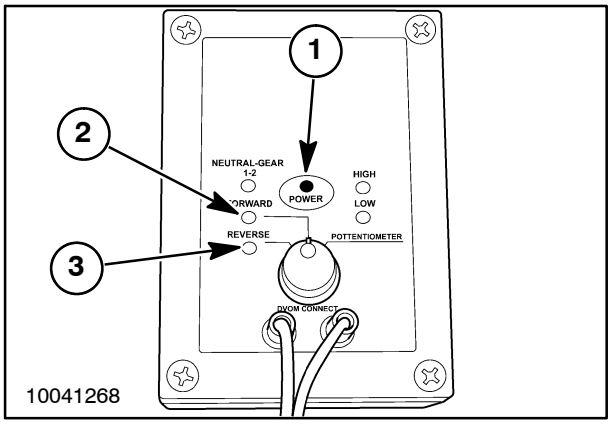
2. Turn the key switch to “ON”.
3. “POWER” indicator light, 1, will illuminate.

***NOTE**: If “POWER” indicator light does not illuminate, check the 10 amp fuse on the tractor.*

4. Place the shuttle control lever in “NEUTRAL”.
5. Observe the breakout box indicator lights. The “FORWARD”, 2, and “REVERSE”, 3, indicator lights should not be on.

***IMPORTANT:** The following step must be done for the diagnostics to be completed properly.*

6. Depress inching pedal to fully depressed position, then release pedal to full up position.
7. Move the shuttle control lever to the “FORWARD” position. The “FORWARD” light, 1, on the breakout box should be on.



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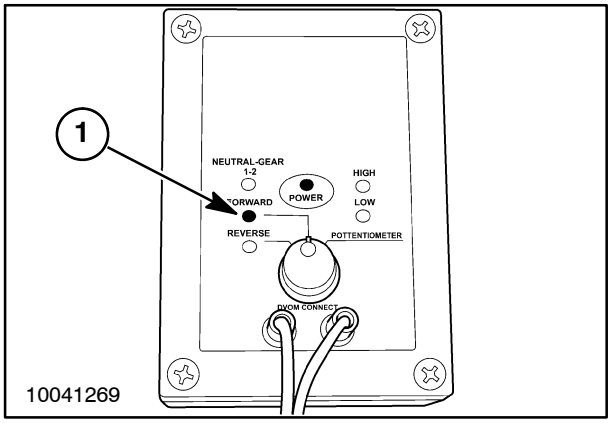

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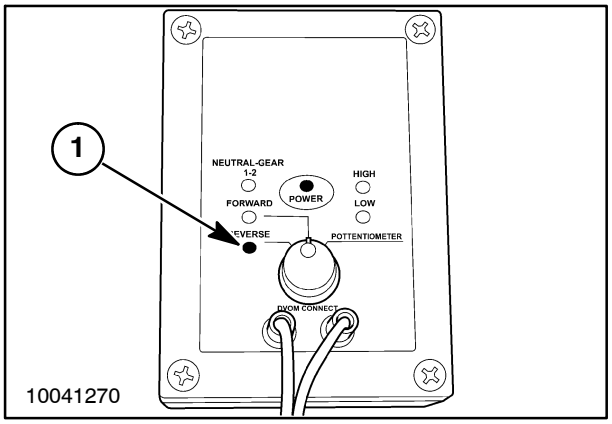
8. Move the shuttle control lever to the “REVERSE” position. The “REVERSE” light, 1, on the breakout box should be on.
9. If the indicator lights on the breakout box do not light properly, turn the key switch to “OFF”.



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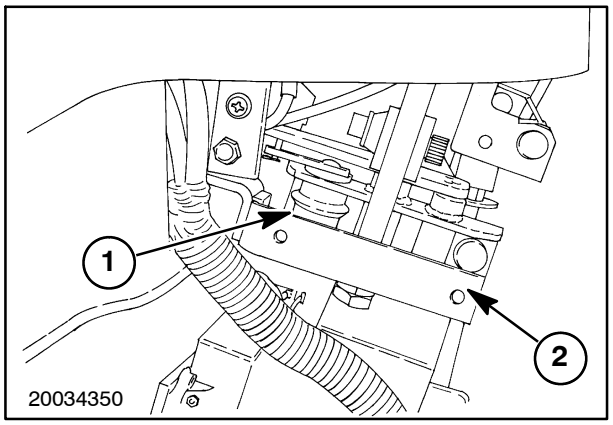
10. The forward/reverse shuttle switch, 1, is located on the left side of the steering column, mounted behind the controller bracket, 2. (Controller removed from picture for clarity)



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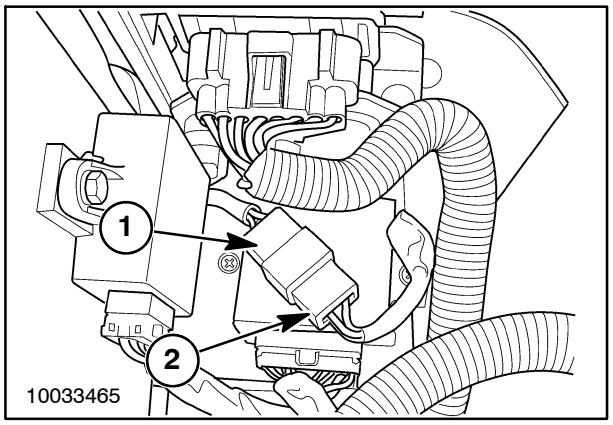
11. Disconnect the shuttle switch connector, 1, from the harness, 2, to perform continuity tests on the shuttle switch.



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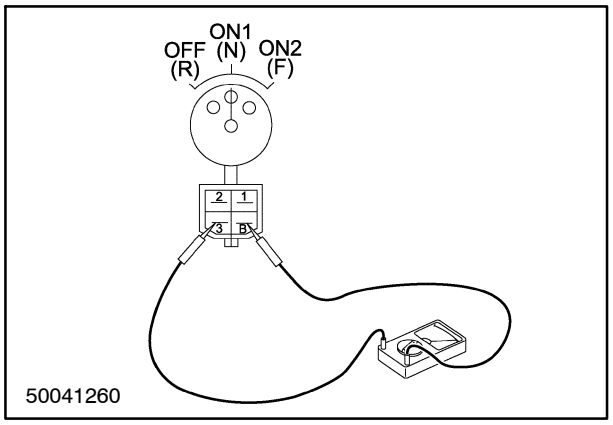
Neutral Test

12. Use a volt/ohmmeter and connect the leads to switch terminal “B” and “3”.
13. Move the shuttle control lever to the “NEUTRAL” position and observe the ohmmeter reading.
    - No continuity = Faulty switch, replace
    - Continuity = Good, proceed to next test
14. Move the shuttle control lever to the “FORWARD” and “REVERSE” positions while observing the ohmmeter reading.
    - No continuity = Good, proceed to next test
    - Continuity = Faulty switch, replace



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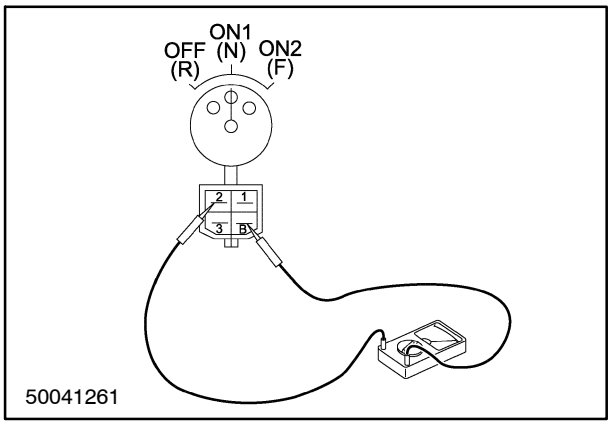
Forward Test

15. Use a volt/ohmmeter and connect the leads to switch terminal “B” and “2”.
16. Move the shuttle control lever to the “FORWARD” position and observe the ohmmeter reading.
    - No continuity = Faulty switch, replace
    - Continuity = Good, proceed to next test
17. Move the shuttle control lever to the “NEUTRAL” and “REVERSE” positions and observe the ohmmeter reading.
    - No continuity = Good, proceed to next test
    - Continuity = Faulty switch, replace



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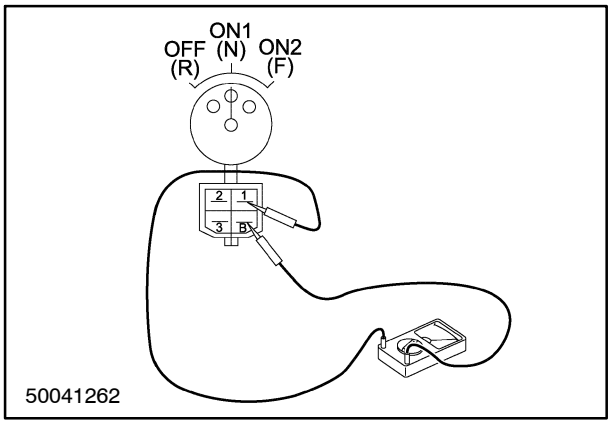
Reverse Test

18. Use a volt/ohmmeter and connect the leads to switch terminal “B” and “1”.
19. Move the shuttle control lever to the “REVERSE” position and observe the ohmmeter reading.
    - No continuity = Faulty switch, replace
    - Continuity = Good, proceed to next test
20. Move the shuttle control lever to the “NEUTRAL” and “FORWARD” positions and observe the ohmmeter reading.
    - No continuity = Good
    - Continuity = Faulty switch, replace



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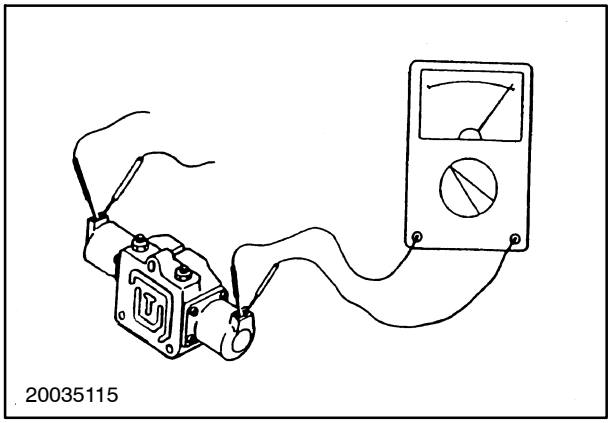
After all switch tests are completed, and all switches found to be functioning properly, perform an ohm test on the EHSS solenoids.

***NOTE**: The solenoid test is not performed by the breakout box.*

Solenoid Test-EHSS Control Valve

1. Disconnect the wire connector plugs from the solenoid valve.
2. Connect the ohmmeter leads to the solenoid terminals and observe the ohmmeter reading.
    - 7-9 ohms = Good
    - Less than 6.9 ohms = Short in the coil, replace solenoid.
    - High resistance reading = Open in the coil, replace solenoid



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POTENTIOMETER FUNCTION

The function of the potentiometer on the inching pedal, is to allow a controlled, timed engagement or disengagement of the power flow to the forward and reverse clutch packs. This is done by varying the voltage signal from the potentiometer, to the EHSS controller. The varying voltage permits the hydraulic spools in the EHSS control valve to shift at a slower pace while transferring fluid flow from the clutch packs to the lubrication circuit. The potentiometer is the device that controls the speed in which the valve spools shift. The result of the slower shift in the spools is a smoother engagement or disengagement of drive power through the clutches, reducing the torque load on transmission and drive line components as well as ease of operation.

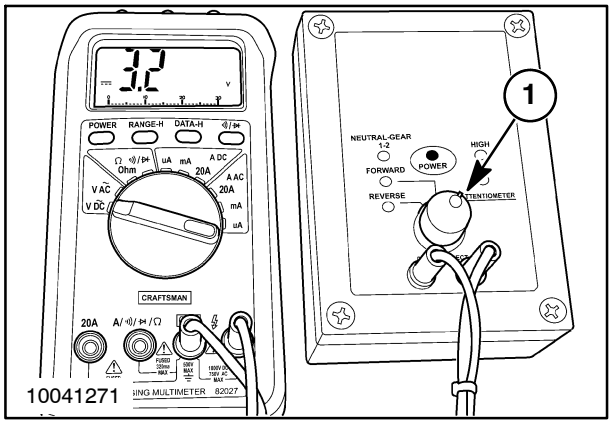
1. Connect the breakout box to the tractor. Connect a digital volt/ohmmeter lead to the breakout box.

***NOTE**: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

2. Turn the volt/ohmmeter power to “ON”.
3. Set the volt/ohmmeter to V-DC.
4. Set the selector knob, 1, on the breakout box to “Potentiometer”.
5. Turn the key switch to the “ON” position. The “POWER” light on the breakout box will light.

***NOTE**: If the “POWER” light does not illuminate, check the 10 amp fuse on the tractor.*

6. **Depress the inching pedal fully.** The voltmeter should read 3.2 volts, when the inching pedal is fully depressed. If a reading other than 3.2 volts is found, proceed to step 11.



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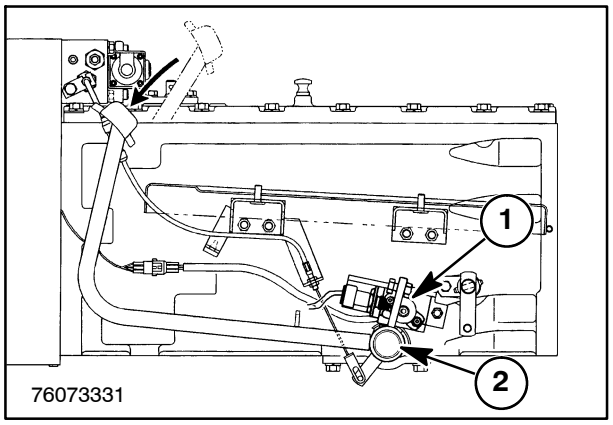
ADJUSTMENT – EHSS INCHING PEDAL LINKAGE

***IMPORTANT**: Before adjusting the Potentiometer, the pedal stop bolt and oil flow stop cable must be adjusted.*

7. The inching pedal potentiometer, 1, is located on the left side of the transmission, mounted just above the inching pedal/brake shaft, 2.



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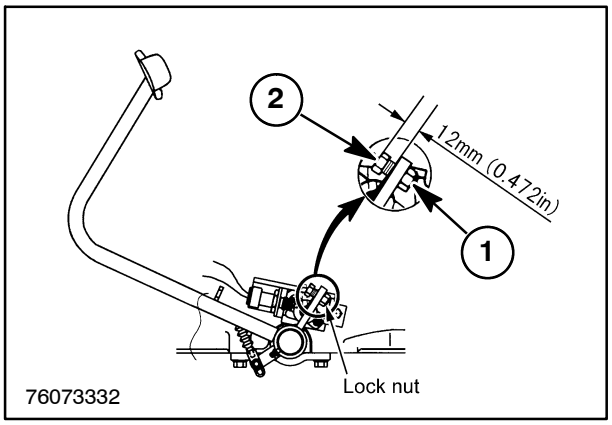
8. Loosen the lock nut, 1, and adjust the inching pedal stop bolt, 2, to 12 mm (0.472″).



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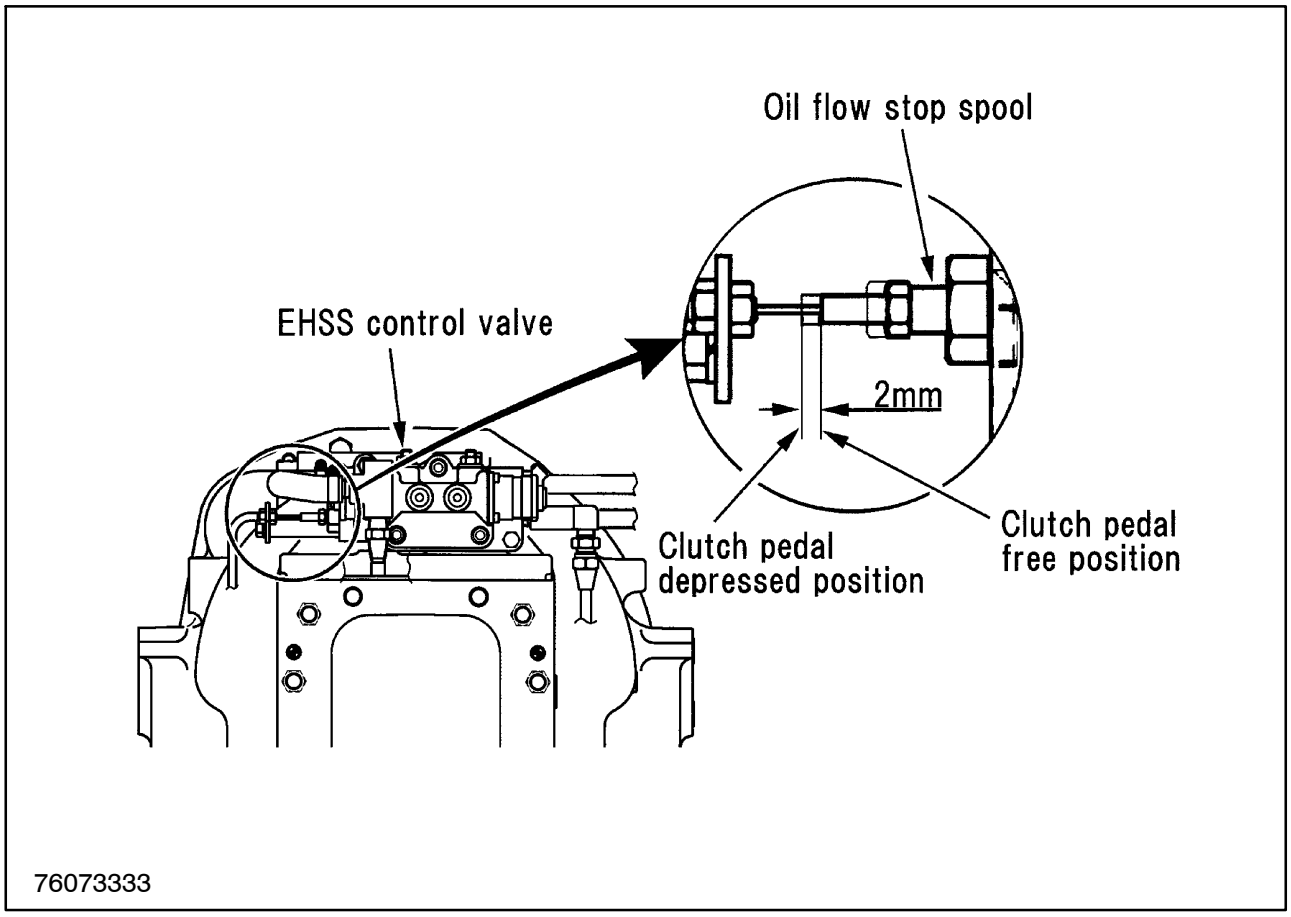

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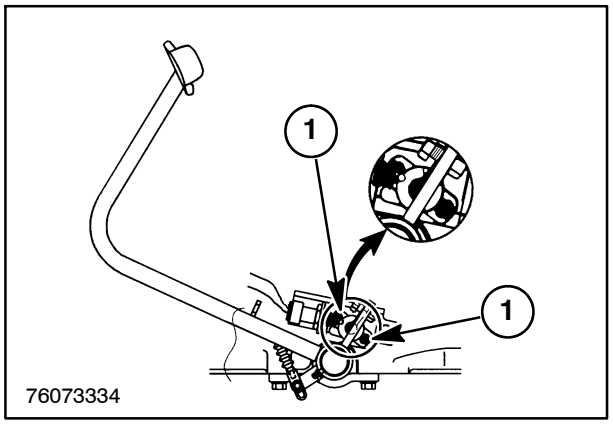
9. If necessary, remove the left side, rear lower hood panel to gain access to the control valve.
10. Depress the inching pedal fully and hold.
11. Turn the cable adjuster on the oil flow stop cable until 2 mm (0.078″) of free travel exists.

ADJUSTMENT – POTENTIOMETER

12. Loosen the screws, 1, for the potentiometer.
13. Turn the potentiometer until the voltmeter reading is 3.2 volts with the inching pedal fully depressed.
14. Tighten the screws for the potentiometer.
15. Turn the key switch to the “OFF” position.



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MODULATION EXPLANATION

Modulation is the time period from switch activation by mechanical means, to the full result of the action, as signaled by the switch, and measured by the controller.

EXAMPLE:

The selection of main gears 1-2 or 3-4, and range gear Low, medium or high opens or closes electrical switches that affect transmission engagement time (Modulation).The EHSS controller determines the speed of the solenoids as they engage the EHSS control valve spools. By controlling the engagement speed of the solenoids/valve spools, the oil flow to the transmission clutch packs is reduced momentarily. This allows the shift to take place under a minimal load to the transmission and drive line components, effecting a smoother shift.

Modulation Time Chart

Measured time is the voltage increase from initial(zero voltage) F-N-R switch activation (F-N-R lever moved to F or R from N) to full transmission engagement (peak voltage).

RANGE SELECTION	GEAR SELECTION	TIME TO PEAK VOLTAGE
LOW	1 & 2	3.5 Seconds
LOW	3 & 4	3.75 Seconds
MID	1 & 2	4.0 Seconds
MID	3 & 4	4.25 Seconds
HIGH	1 & 2	4.0 Seconds
HIGH	3 & 4	3.5 Seconds

Modulation Time-Test Procedure

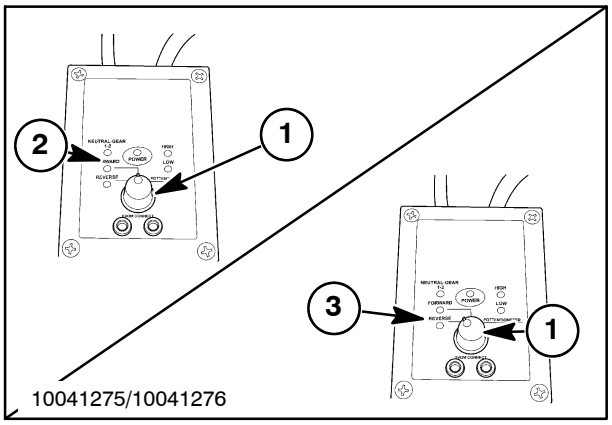
1. Connect the breakout box and volt/ohmmeter as described earlier. Set the volt/ohmmeter to V-DC, (correct range on voltmeter).

***NOTE**: To perform diagnostics using breakout box, operator must be present in the seat to complete safety circuit.*

2. Turn the key switch to the “ON” position.
3. Place the range lever and the main, gear selection lever in the positions shown on the Modulation time Chart.

***IMPORTANT:** The following step must be done for the diagnostics to be completed properly.*

4. Depress inching pedal to fully depressed position, then release pedal to full up position.
5. Place switch, 1, on breakout box to either the “Forward”, 2, or “Reverse”, 3, position. The switch has to be in the “Forward” position to read “Forward” modulations and “Reverse” to read “Reverse” modulations.
6. Watch the volt/ohmmeter as the F-N-R control lever is moved from “Neutral” to “Forward” or “Reverse”. The voltage as read on the volt/ohmmeter will start to rise to the peak voltage reading, for the particular combination of gear and range, as shown on the Modulation Chart. This fluctuation in voltage determines how quickly the transmission changes engagement when shifted.
7. Record the time from initial gear selection (zero voltage reading) to full transmission engagement (peak voltage).
8. Repeat steps 3-6 for the remaining combinations in the chart.
9. If times differ from the chart, check switches for proper function or possible malfunctioning EHSS controller.



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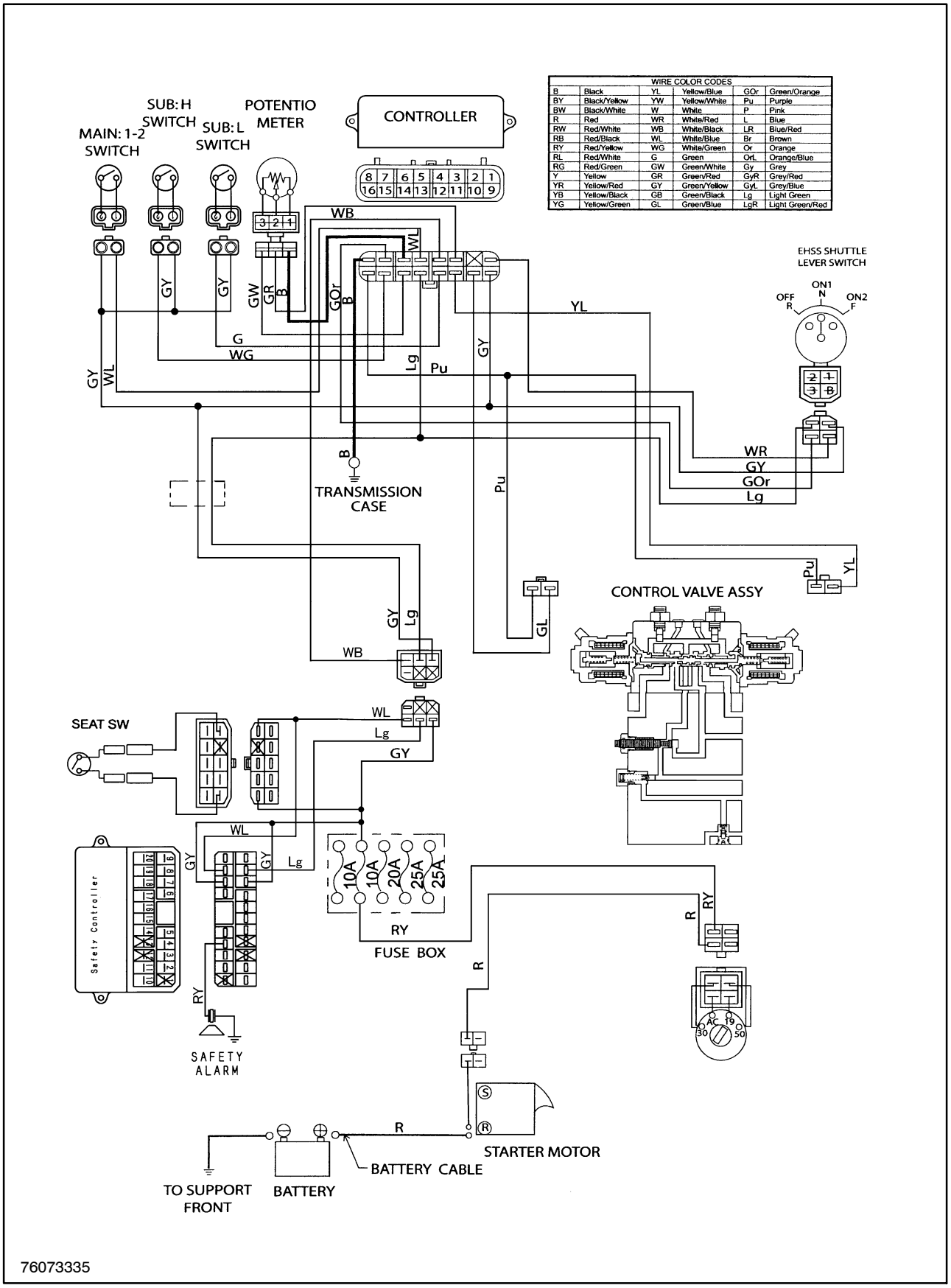
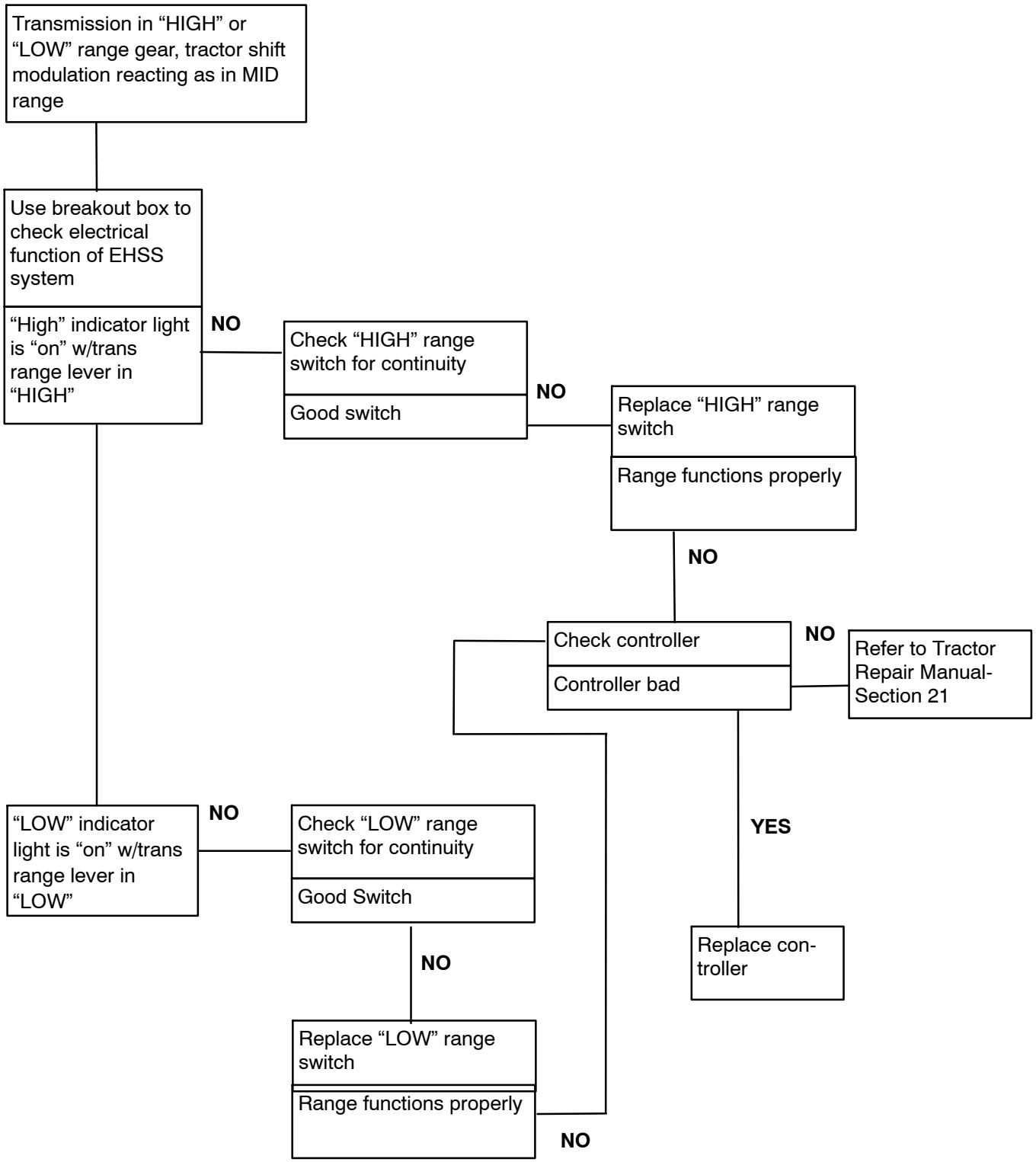
WIRING DIAGRAM - EHSS CIRCUIT

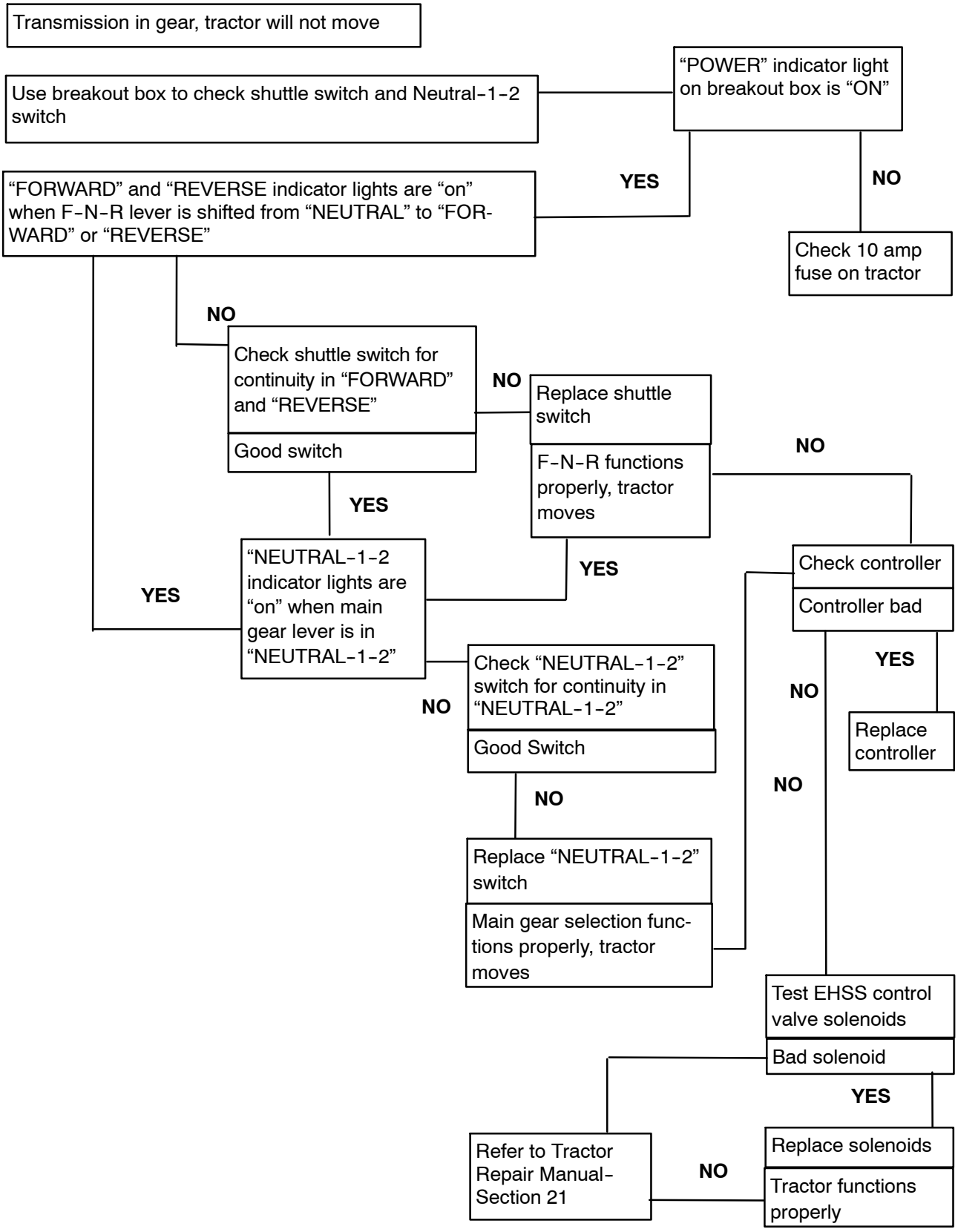


GENERAL OVERALL TROUBLESHOOTING

EHSS ELECTRICAL TROUBLESHOOTING (RANGE)

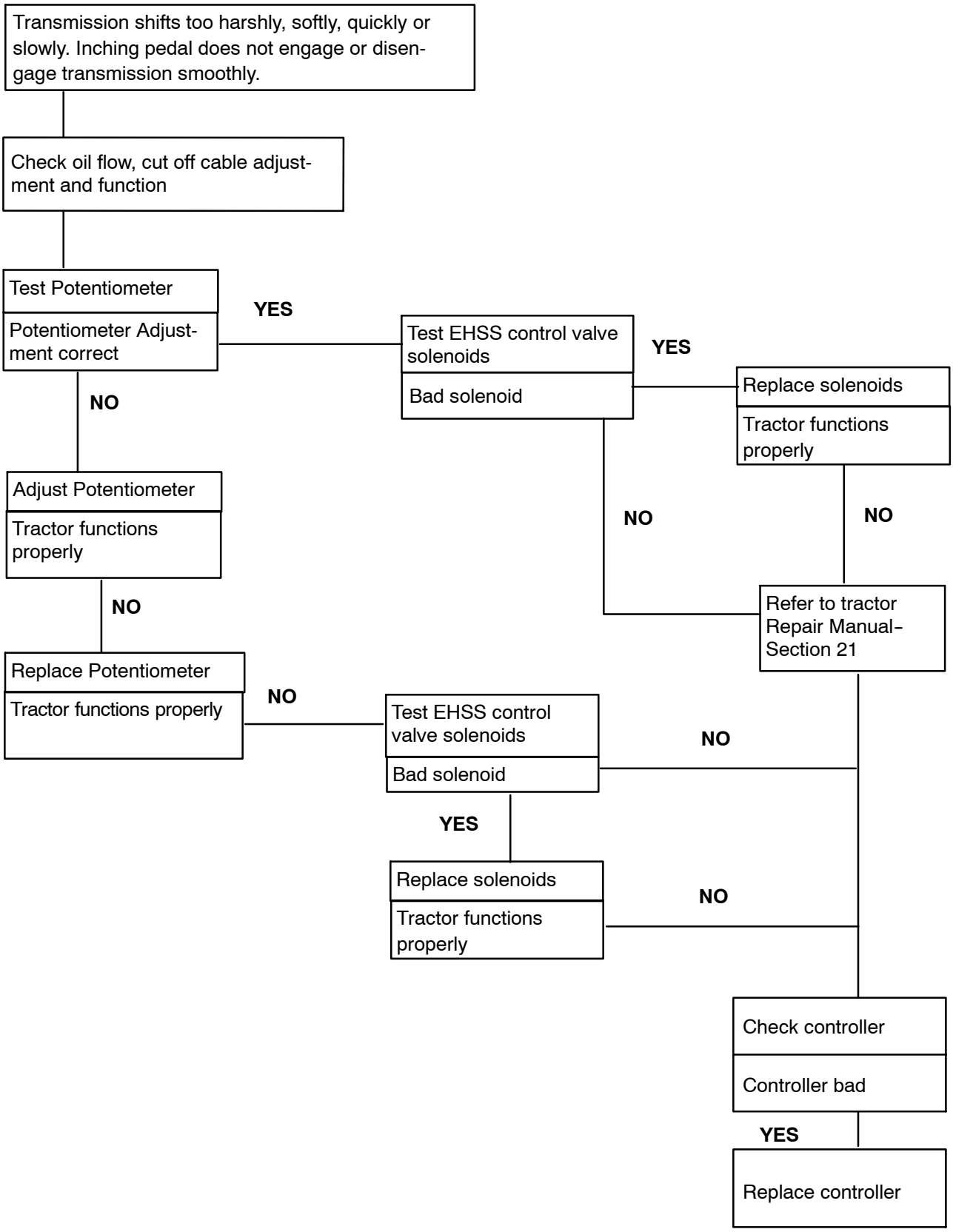


EHSS ELECTRICAL TROUBLESHOOTING (MAIN GEAR AND SHUTTLE)



EHSS ELECTRICAL TROUBLESHOOTING (POTENTIOMETER)

6. EHSS SOLENOID VALVE FLOW _____gpm



EHSS CONCERN REPORT

This concern report must be completed prior to contacting Dealer Support. Please have all information available to aid support personnel.

Dealer Code _____

Date of Report _____

Name of Owner _____

Model # _____

Serial # _____

Hours _____

Attachments On Tractor _____

_____

_____

_____

Type Of Tires: ☐ **AG** ☐ **TURF** ☐ **INDUSTRIAL**

Rear Tires Loaded: ☐ **YES** ☐ **NO**

Ambient Temperature: _____

Description of Concern _____

_____

_____

_____

Refer to repair manual for items 5 and 6.

1. SWITCH FUNCTIONS **CORRECT**

N-1-2	_____
High	_____
Low	_____
Forward/Reverse	_____

2. POTENTIOMETER FUNCTION

3.2 volts when inching pedal fully depressed

☐ **YES** ☐ **NO**

3. MODULATION CONCERN

	Position Of Switches	
N-1-2	☐ **ON**	☐ **OFF**
High	☐ **ON**	☐ **OFF**
Low	☐ **ON**	☐ **OFF**
Forward	☐ **ON**	☐ **OFF**
Reverse	☐ **ON**	☐ **OFF**

4. TYPE OF MODULATION CONCERN

Fast	_____
Slow	_____
Harsh	_____
Soft	_____

5. EHSS PRESSURE SETTINGS

System Relief Pressure	_____ **psi**
Low Pressure Relief	_____ **psi**

Test fitting required #FNH00011 or CAS2791

6. EHSS SOLENOID VALVE FLOW _____ **gpm**

Test fitting required #380001600

7. EHSS SOLENOIDS

Resistance Check _____ **ohms**

SECTION 21 - TRANSMISSION

Chapter 2 - SSS 12x12 Gear Transmission

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SPECIFICATIONS

SSS GEAR TRANSMISSION

Maximum Gear Backlash . . . . . 0.6 mm (0.024″)

Clearance Between Synchronizer Sleeve and Shift Fork . . . . . 0.2 - 0.4 mm (0.008 - 0.016″)
Allowable Clearance Limit . . . . . 1.0 mm (0.039″)

Synchronizer Ring to Gear Clearance . . . . . Minimum 0.8 mm (0.031″)

Input Shaft End Float . . . . . 0.0 - 0.3 mm (0.0 - 0.012″) end float with no bearing preload

Input Shaft Shims . . . . . 0.1, 0.2, 0.5 mm (0.004, 0.008, 0.020″)

Top Countershaft End Float . . . . . 0.0 - 0.1 mm (0.0 - 0.004″) end float with no bearing preload

Top Countershaft Shims . . . . . 0.1, 0.2, 0.5 mm (0.004, 0.008, 0.020″)

Bottom Countershaft End Float . . . . . 0.0 - 0.3 mm (0.0 - 0.012″) end float with no bearing preload

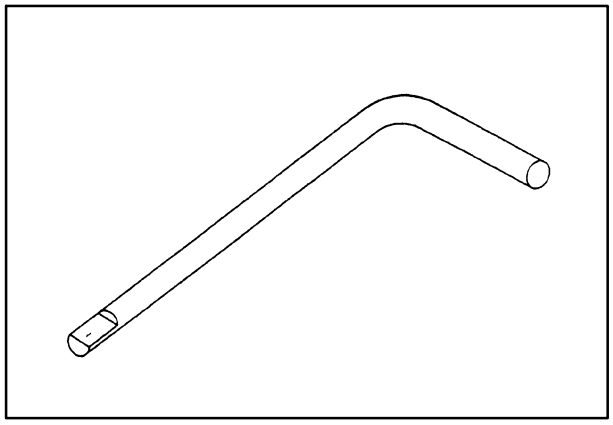
Bottom Countershaft Shims . . . . . 0.1, 0.2, 0.5 mm (0.004, 0.008, 0.020″)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot-Pounds	Newton Meters	Pitch (mm)	Foot-Pounds	Newton-Meters
M5	4T, 4.8	0.70	2.8 - 4.0	3.8 - 5.4	------	------	------
	7T, 8T, 8.8		4.9 - 6.9	6.9 - 9.3			
	10T, 10.9, 11T		6.7 - 9.4	9.0 - 12.7			
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9	------	------	------
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 10.9, 11T		8.7 - 11.6	11.8 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.8	15.2 - 20.1
	7T, 8T, 8.8		16.6 - 21.0	22.6 - 28.4		19.5 - 25.3	26.5 - 34.3
	10T, 10.9, 11T		21.0 - 26.8	28.4 - 36.2		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.4 - 36.3
	7T, 8T, 8.8		32.5 - 41.2	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 10.9, 11T		39.8 - 51.4	53.9 - 69.9		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.7	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.4		55.0 - 69.4	74.5 - 94.1
	10T, 10.9, 11T		68.0 - 85.4	92.9 - 116		73.1 - 93.3	99.0 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.6 - 87.3
	7T, 8T, 8.8		76.7 - 96.9	104 - 131		86.1 - 109	117 - 148
	10T, 10.9, 11T		102 - 129	139 - 175		108 - 137	147 - 186
M16	4T, 4.8	2.0	63.6 - 81.0	83.3 - 110	1.5	67.3 - 84.6	91.3 - 115
	7T, 8T, 8.8		110 - 136	149 - 184		116 - 142	157 - 192
	10T, 10.9, 11T		152 - 188	206 - 255		163 - 199	221 - 270
M20	4T, 4.8	2.5	106 - 132	144 - 179	1.5	127 - 156	172 - 211
	7T, 8T, 8.8		177 - 213	240 - 289		203 - 246	275 - 333
	10T, 10.9, 11T		268 - 325	363 - 441		293 - 358	397 - 485

SPECIAL TOOLS

Detent ball retaining tool # FNH00081

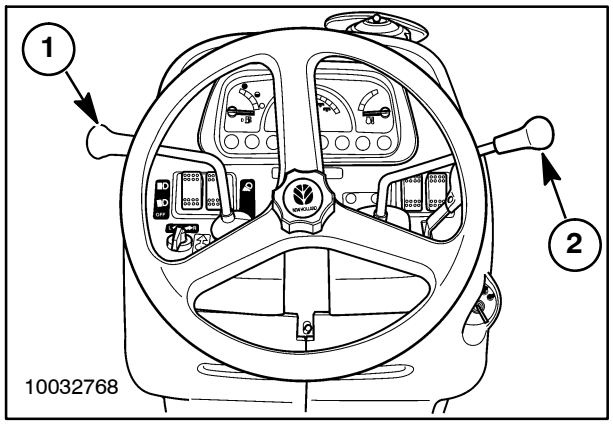


1

DESCRIPTION OF OPERATION

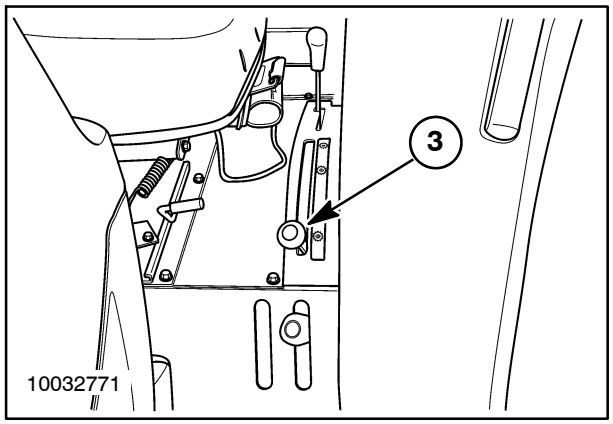
The SSS 12 x 12 transmission provides 12 forward and 12 reverse speeds, which are manually controlled by three shift levers. The SSS transmission is driven by a single disc clutch.

The shuttle shift lever, 1, controls forward and reverse, while the main transmission shift lever, 2, controls the four gear speeds in the main transmission.



2

The range lever, 3, controls the three transmission range gears.



3

The transmission case consists of three compartments. The forward compartment, 1, contains the forward and reverse shuttle transmission gears. The shuttle gears are designed for synchronized shifting and are controlled by a column mounted shift lever.

The center compartment, 2, contains the main transmission gears consisting of four gear speeds. These gears are designed for synchronized shifting and are controlled by a column mounted shift lever.

The rear compartment, 3, contains the range gears which provide three speed ratios for each of the main transmission speeds for a total of 12 forward and 12 reverse speeds. The range gears are not synchronized and are controlled by a lever located by the left side of the operator's seat.

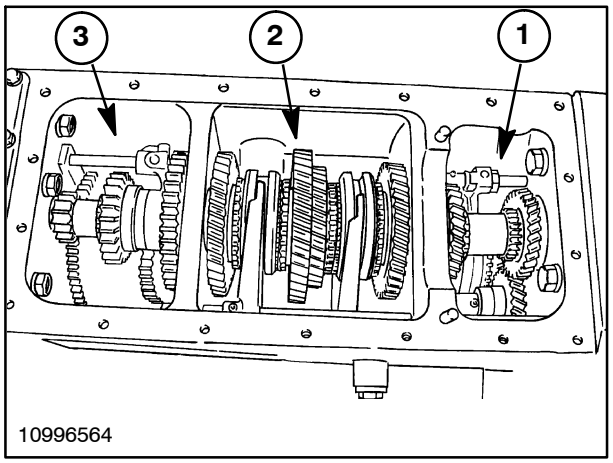
The shuttle gears and main transmission gears are in constant mesh. Shifting is accomplished by engaging and disengaging three synchronizer assemblies located in the front and center transmission compartments.

The range gears are not synchronized. Shifting is accomplished by engaging sliding gears located in the rear transmission compartment

The transmission housing serves as a common fluid reservoir for the final drive assembly, the transmission, and the hydraulic system. The fluid used is Ambra Multi G 134.

The fluid fill plug, 1, is located on the top of the hydraulic lift cover.

The fluid level dipstick, 2, is located on the operators platform.



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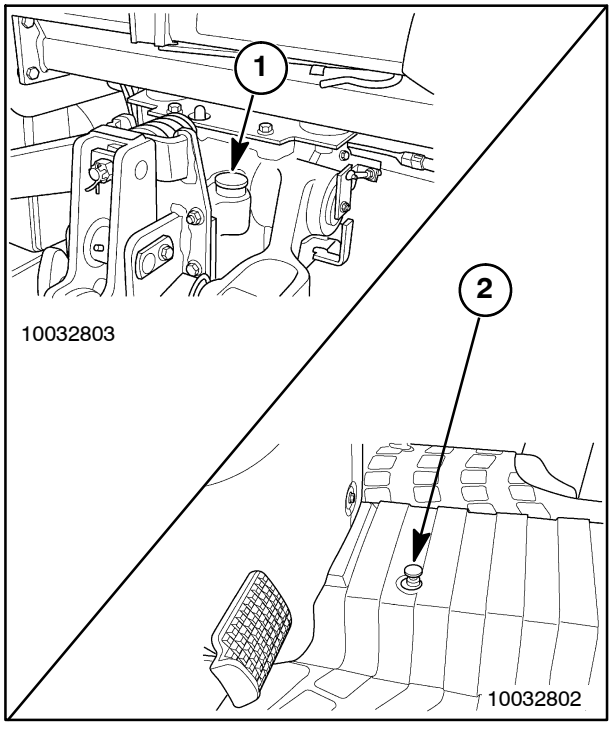

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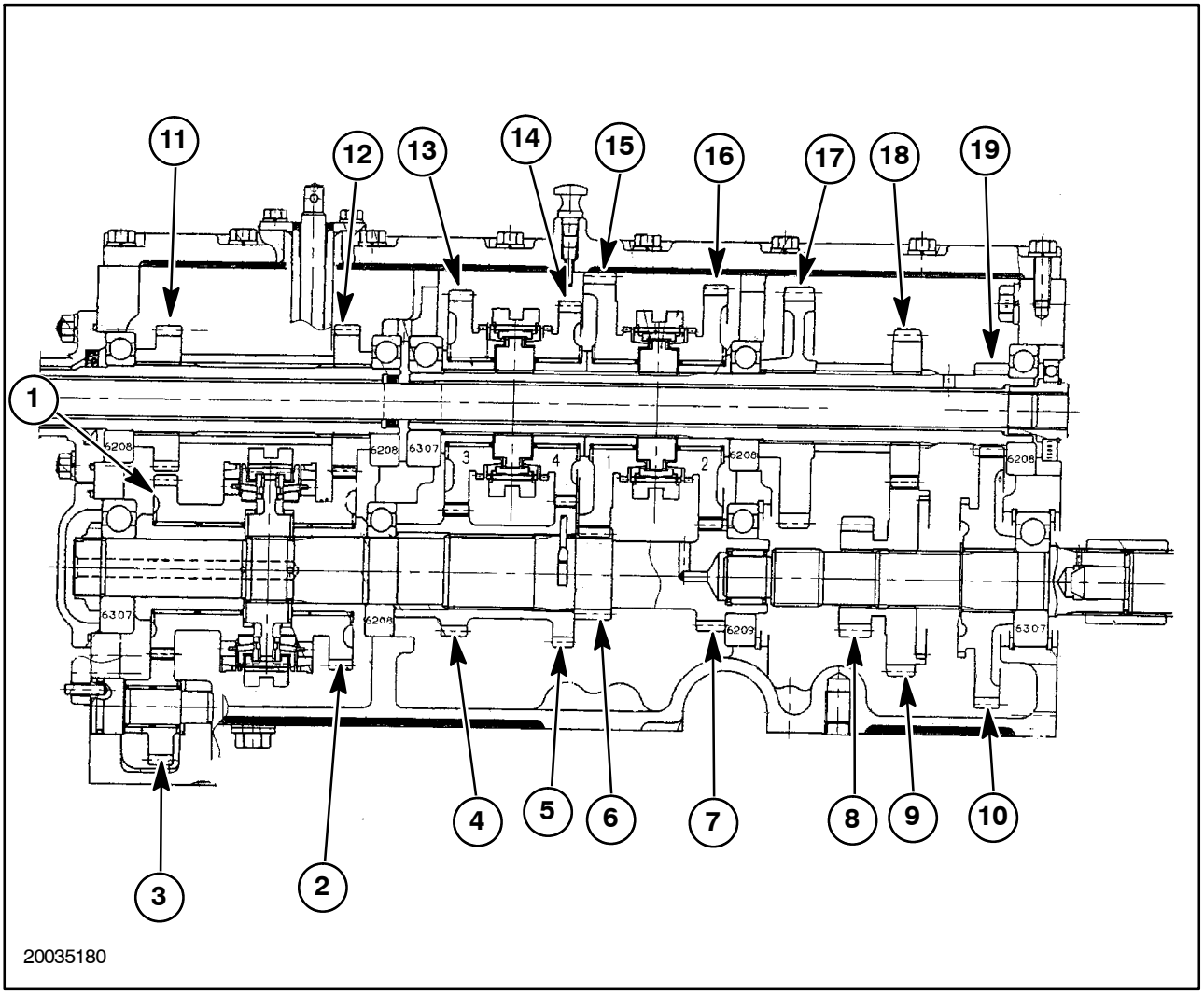


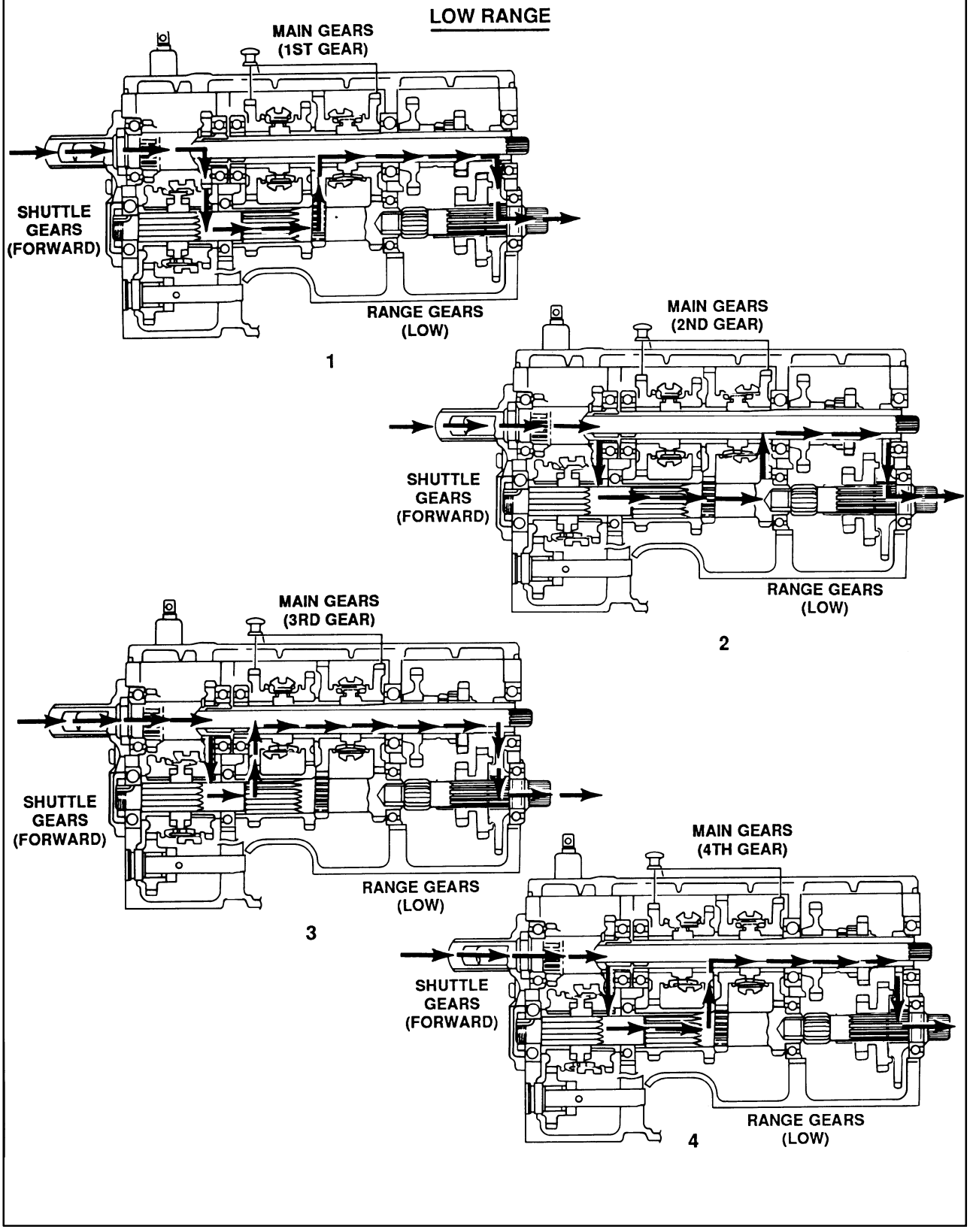
6

Cross Section - SSS Transmission

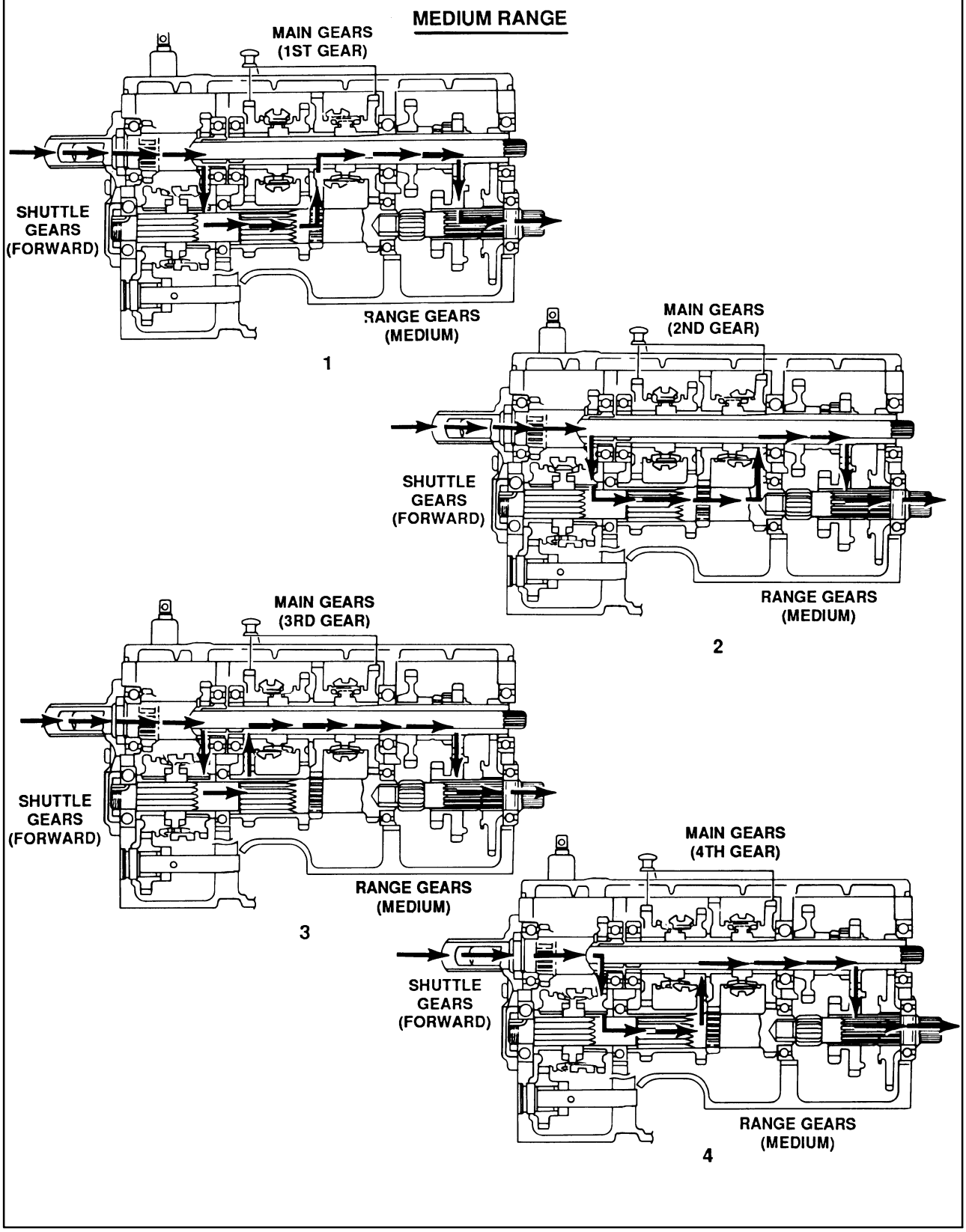
1. Reverse Shuttle gear (35T)
2. Shuttle gear (39T)
3. Reverse idler gear (22T)
4. Fixed gear (24T)
5. Fixed gear (28T)
6. Fixed gear (16T)
7. Fixed gear (20T)
8. Sliding range gear (18T)
9. Sliding range gear (38T)
10. Fixed range gear (51T)
11. Fixed shuttle gear (28T)
12. Fixed shuttle gear (29T)
13. Third gear (44T)
14. Fourth gear(40T)
15. First gear (52T)
16. Second gear (48T)
17. Fixed range gear (40T)
18. Fixed range gear (26T)
19. Fixed range gear (16T)

POWERFLOW

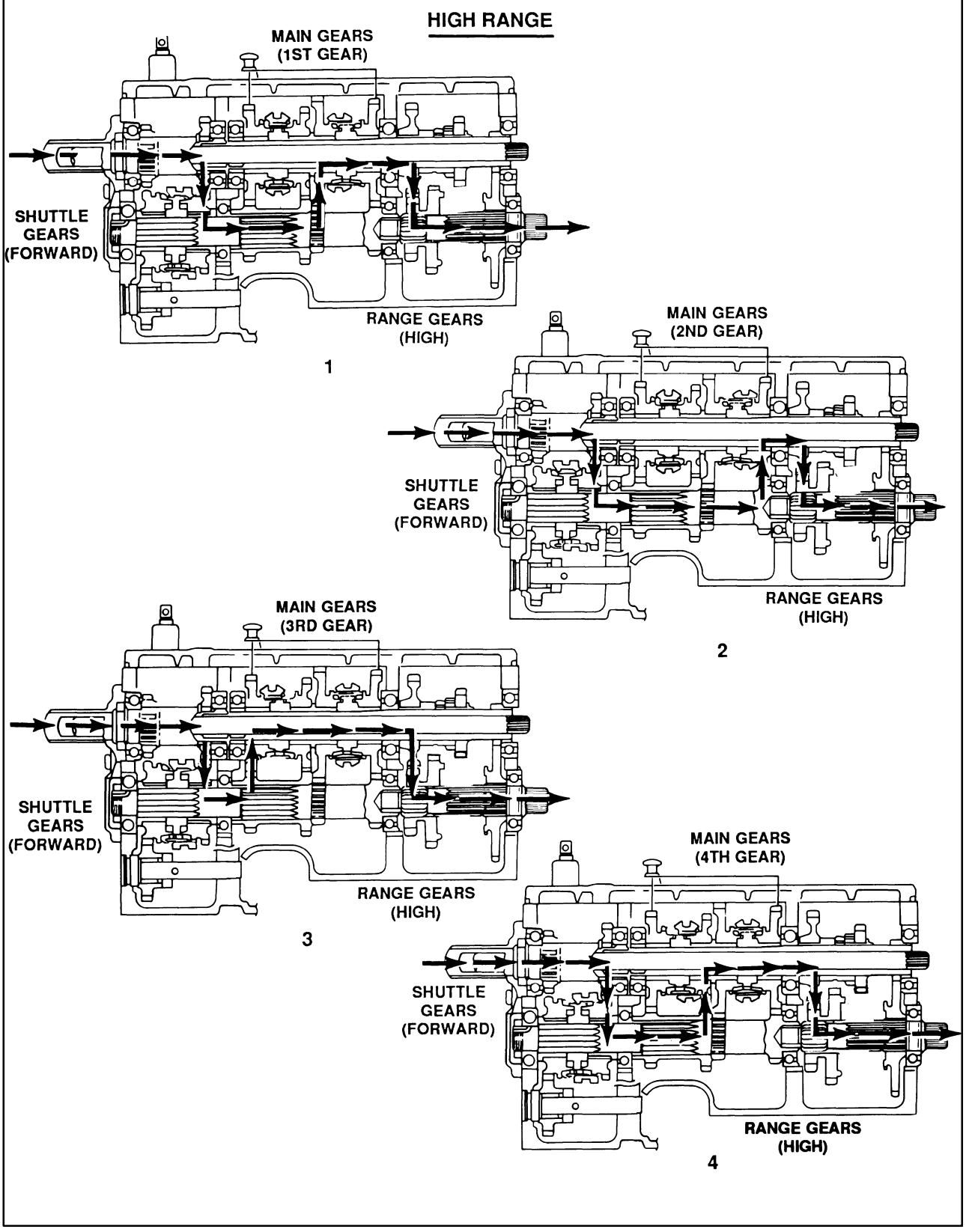
The transmission input shaft relays power to the main countershaft by way of the synchronizers for the forward and reverse gears. Power from the main countershaft is relayed to the main shaft by the synchronizers for first, second, third, and fourth gears. The PTO shaft runs through the center of the main shaft to relay power to the rear PTO. From the main shaft, power proceeds to the rear of the transmission by way of the range gears. These consist of three fixed gears on the main shaft and two sliding gears and one fixed gear on the countershaft.


LOW RANGE
MAIN GEARS
(1ST GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(LOW)
1
MAIN GEARS
(2ND GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(LOW)
2
MAIN GEARS
(3RD GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(LOW)
3
MAIN GEARS
(4TH GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(LOW)
4

7


MEDIUM RANGE
MAIN GEARS
(1ST GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(MEDIUM)
1
MAIN GEARS
(2ND GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(MEDIUM)
2
MAIN GEARS
(3RD GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(MEDIUM)
3
MAIN GEARS
(4TH GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(MEDIUM)
4

8


HIGH RANGE
MAIN GEARS
(1ST GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(HIGH)
1
MAIN GEARS
(2ND GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(HIGH)
2
MAIN GEARS
(3RD GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(HIGH)
3
MAIN GEARS
(4TH GEAR)
SHUTTLE
GEARS
(FORWARD)
RANGE GEARS
(HIGH)
4

9

TROUBLESHOOTING

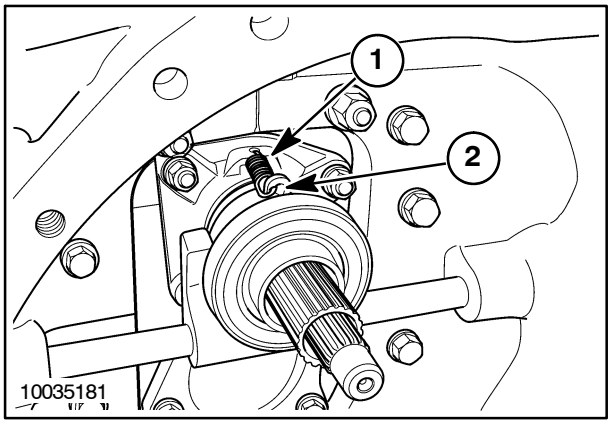
PROBLEM	POSSIBLE CAUSE	CORRECTION
Oil leakage	1. Hydraulic oil is over full 2. Loose bolts 3. Worn oil seals or O rings 4. Defective or torn gaskets 5. Cracked transmission housing	1. Adjust transmission oil level 2. Retorque bolts 3. Replace seal or O ring 4. Replace gasket 5. Replace the transmission housing
Abnormal noise	1. Worn bearing 2. Excessive gear backlash 3. Worn gears 4. Gears improperly engaged 5. Oil level low	1. Inspect and replace 2. Adjust or replace 3. Replace 4. Adjust or replace 5. Adjust oil level
Gears will not engage	1. Clutch is not disengaged 2. Damaged shift lever 3. Bent or damaged shift fork or shift rail 4. Top main shaft adjusting collar adjusted too tight	1. Refer to “Clutch” section 2. Replace 3. Repair or replace 4. Refer to “Main Shaft End Float” in this section
Gears disengage	1. Damaged detent spring 2. Worn detent grooves on shift rail 3. Uneven gear wear 4. Worn detent ball	1. Replace 2. Replace 3. Replace 4. Replace
Gears difficult to disengage	1. Bent shift rod 2. Foreign material in synchronizer 3. Clutch drags	1. Replace 2. Disassemble and clean 3. Adjust clutch or replace

OVERHAUL

CLUTCH HOUSING

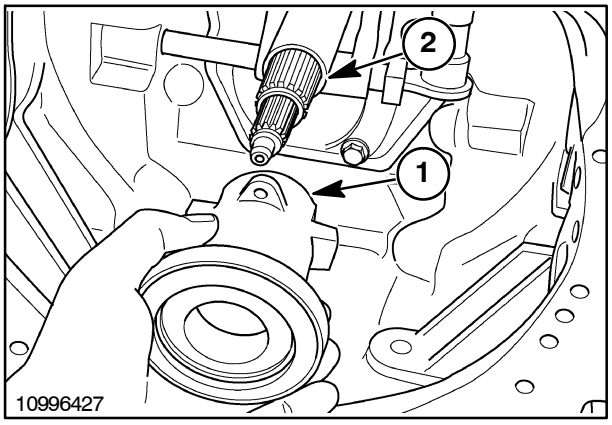
Disassembly

1. Separate the engine from the clutch housing (seer “Section 18 – Clutch” for separating procedure).
2. Remove the clutch hub return spring, 1, from the clutch hub, 2.



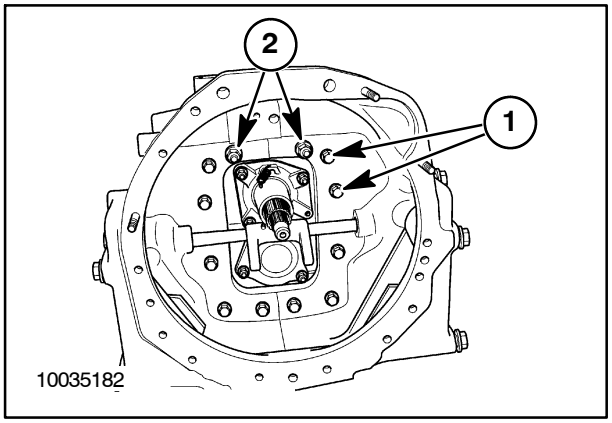
10

3. Remove the clutch hub and bearing, 1, from the input shaft, 2.



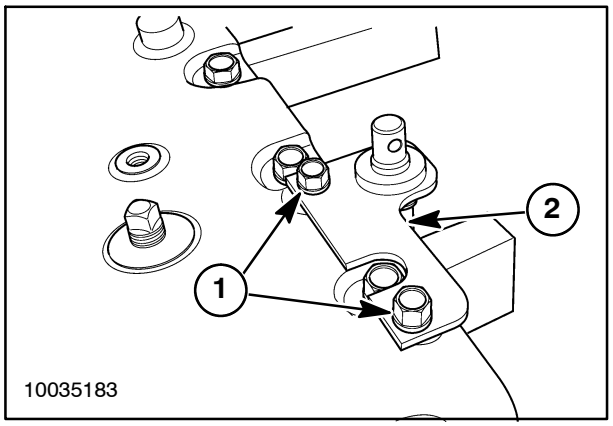
11

4. Remove the bolts, 1, and buckle-up nuts, 2, securing the clutch housing to the transmission.
5. Remove the clutch housing from the transmission.



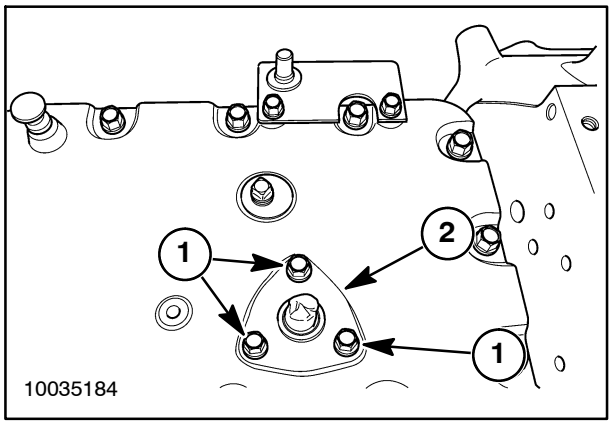
12

6. Remove the two bolts, 1, from the shuttle selector shaft retaining plate, 2. Remove the retaining plate.



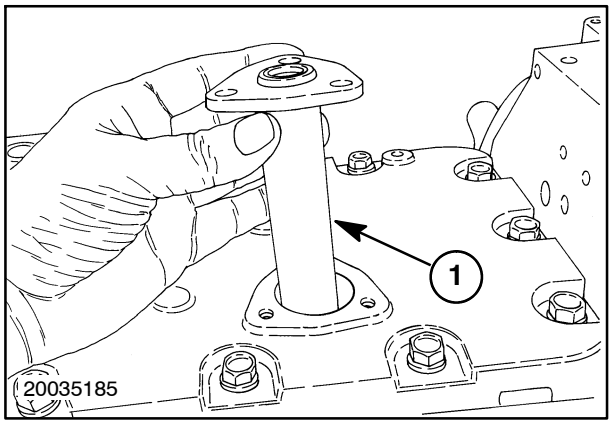
13

7. Remove the three bolts, 1, securing the main gear selector shaft retainer, 2, to the transmission cover.



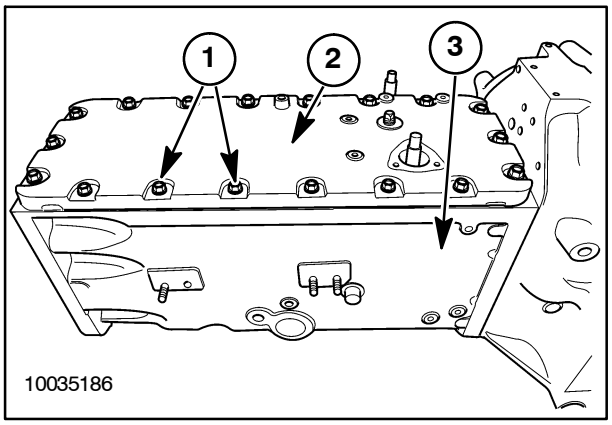
14

8. Remove the retainer, 1.
9. Remove the transmission dipstick from the cover.



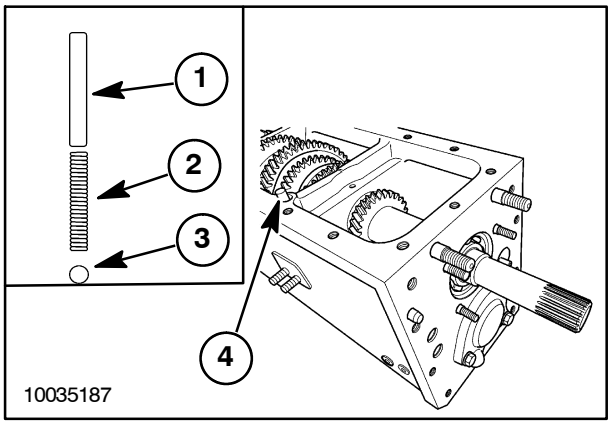
15

10. Loosen and remove the transmission cover bolts, 1.
11. Remove the transmission cover, 2, from the transmission housing, 3.



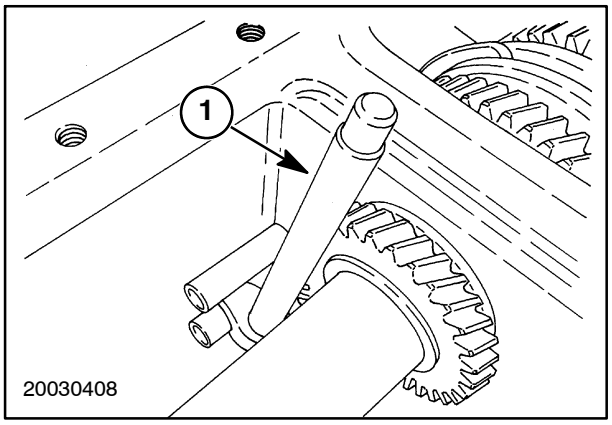
16

12. Remove the pin, 1, spring, 2, and the detent ball, 3, from the main gear detent hole, 4, in the transmission housing.



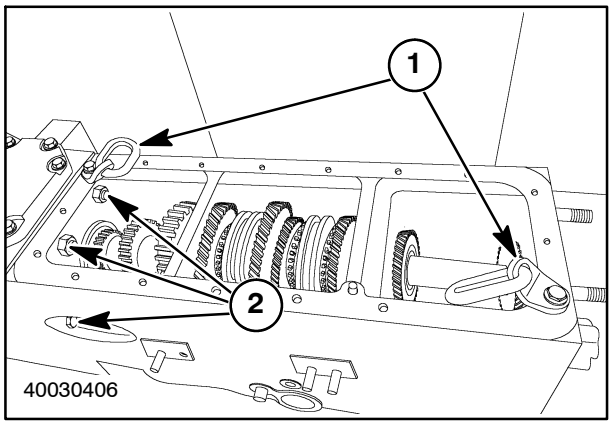
17

13. Remove the shift arm, 1, from the transmission.



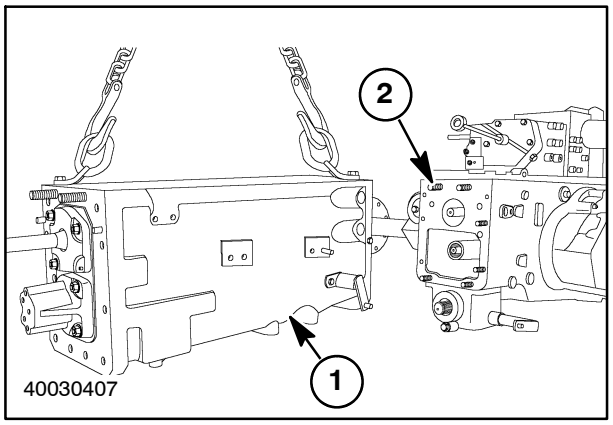
18

14. Attach two suitable lifting eyes, 1, to opposite corners of the transmission housing.
15. Attach a chain sling to the lift eyes and a suitable hoist.
16. Remove the buckle up bolts and nuts, 2, securing the transmission to the differential housing.



19

17. Carefully separate the transmission, 1, from the differential housing, 2.
18. Lower the transmission onto a suitable workbench. Use wood blocks between the transmission and workbench.



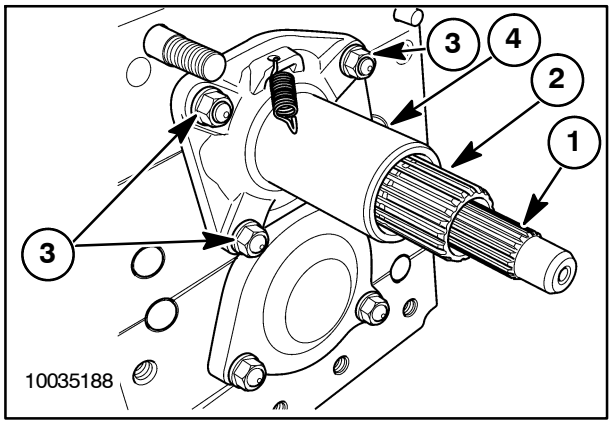
20

MAIN TRANSMISSION INPUT SHAFT RETAINER

Disassembly

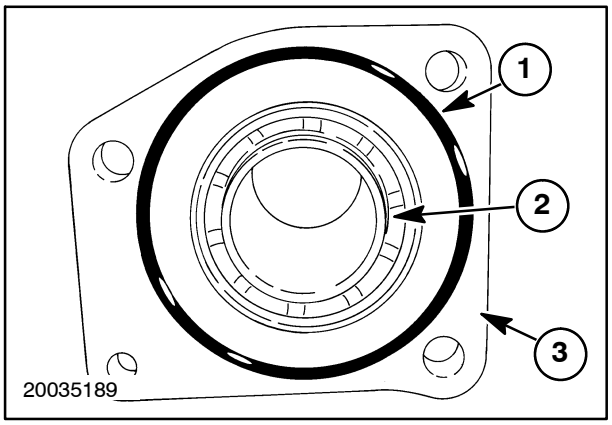
1. Remove the PTO shaft, 1, that is housed in the main shaft, 2.
2. Remove the three nuts and washers, 3, from the adapter, 4.
3. Remove the adapter.

NOTE: *Use caution not to lose the O ring on the back of the adapter during removal. Note any shims used between the input shaft retainer and input shaft front bearing, during retainer removal.*



21

4. Remove the O ring, 1, and input shaft seal, 2, from the retainer, 3.

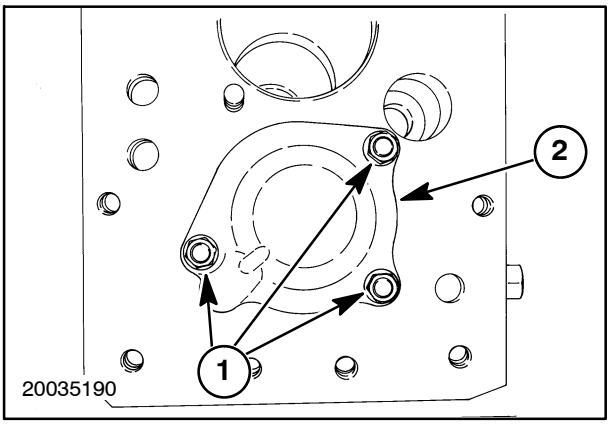


22

SHUTTLE SHAFT RETAINER

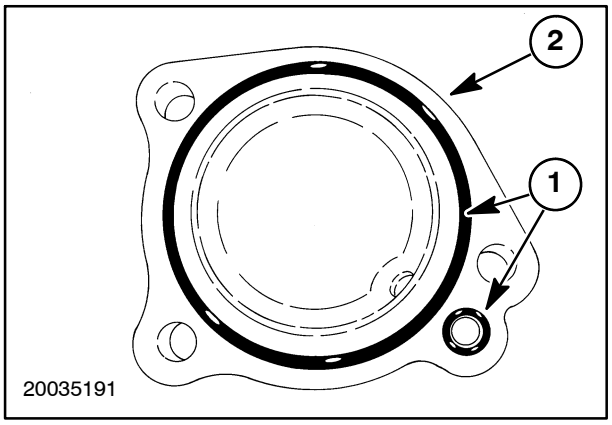
1. Remove the three nuts and washers, 1, from the shuttle shaft retainer, 2.
2. Remove the retainer.

NOTE: *Use caution not to lose the O rings on the back of the shuttle shaft retainer during removal. Note any shims used between the shuttle shaft retainer and shuttle shaft front bearing, during retainer removal.*



23

3. Remove the O rings, 1, from the back side of the shuttle shaft retainer, 2.

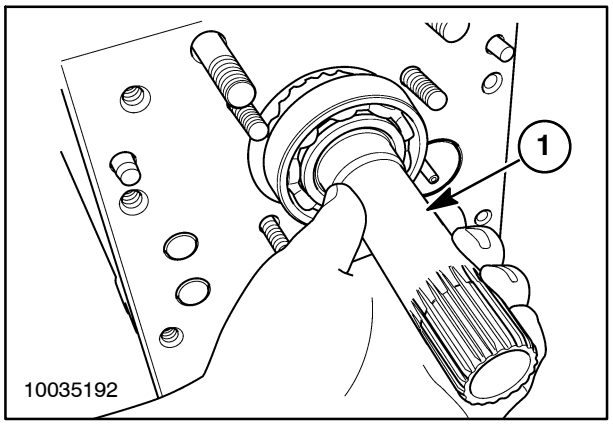


24

INPUT SHAFT

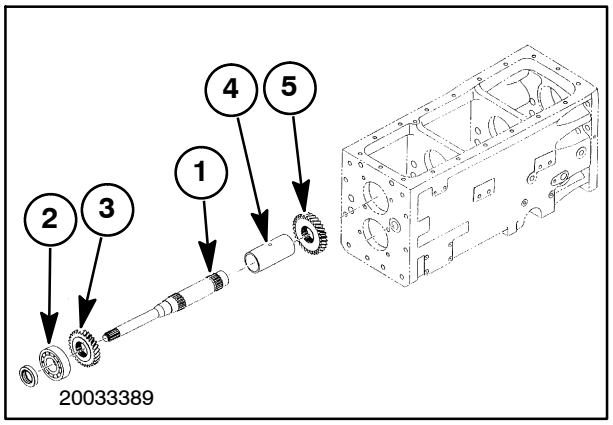
Disassembly

1. Pull the input shaft, 1, out of the transmission housing.



25

2. Remove the input shaft, 1, bearing, 2, reverse gear (28T), 3, collar, 4, and forward gear (29T), 5, from housing.



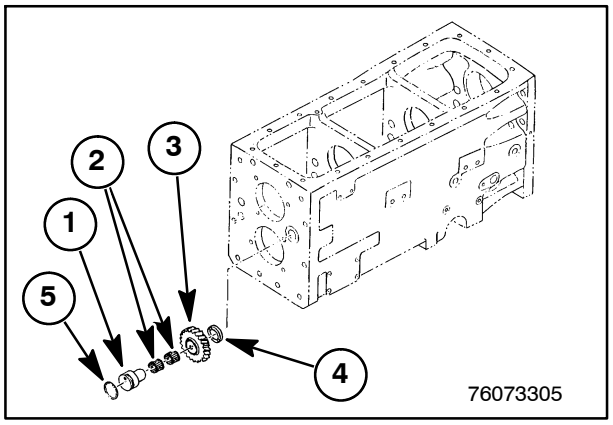
26

REVERSE IDLER SHAFT AND GEAR

Disassembly

IMPORTANT: *Pay attention to the orientation of parts contained in the reverse idler assembly for proper assembly later. The flange on the gear faces toward the front of the housing. The oil grooves on the spacer face toward the idler gear.*

1. Gently tap the reverse idler shaft, 1, toward the front of the housing, from the inside.
2. Remove the reverse idler shaft, 1, needle bearings, 2, idler gear (22T), 3, and spacer, 4.
3. Remove the O ring, 5, from the shaft, 1.



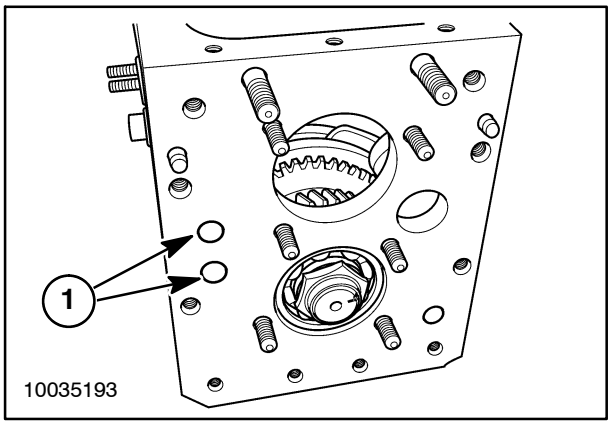
27

SHIFT RAILS

Disassembly

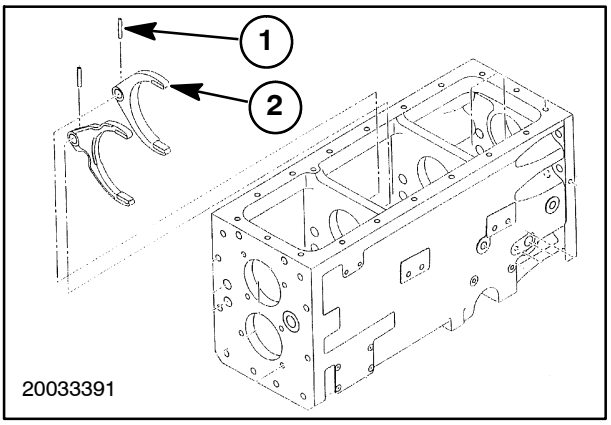
IMPORTANT: *Shift rails must be removed prior to countershaft removal, to allow shift fork removal to gain clearance for main transmission gears and synchronizers to be removed from housing.*

1. Remove the two plug seals, 1, from the shift rail bores.



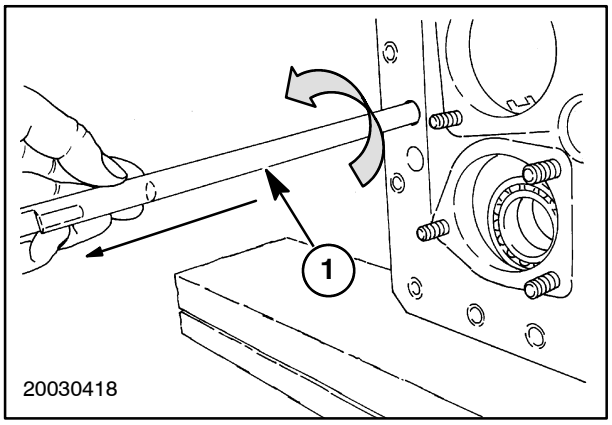
28

2. Drive the roll pin, 1, from the upper shift fork, 2, (1st and 2nd gear).



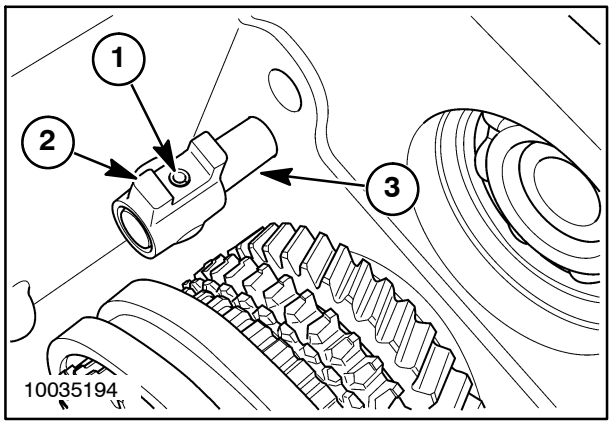
29

3. Rotate the upper shift rail, 1, 90° to clear the balk pin.
4. Pull the upper shift rail forward and out, through the front of the housing.



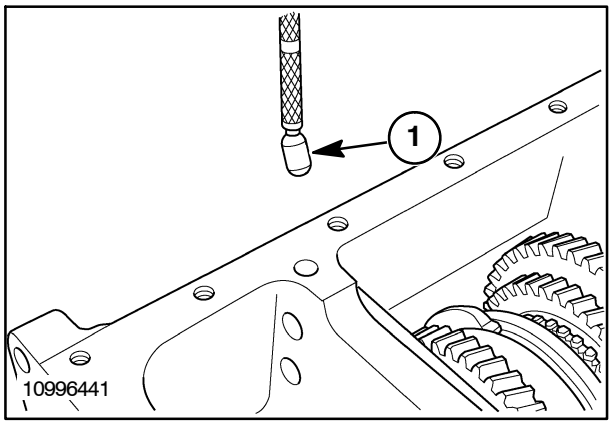
30

5. Drive the roll pin, 1, from the shift boss, 2, and lower shift rail, 3.
6. Remove the shift boss, 2, from the lower shift rail, 3.



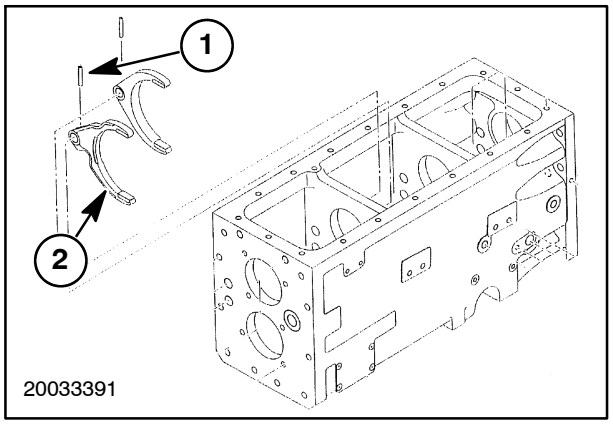
31

7. Use a long magnet to remove the balk pin, 1, from the housing.



32

8. Drive the roll pin, 1, from the lower shift fork, 2, (3rd and 4th gear).

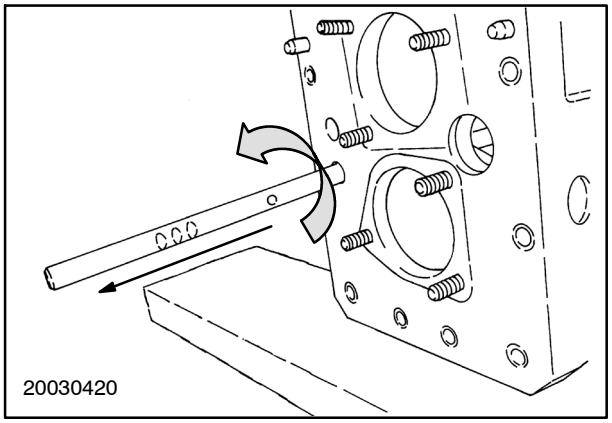


33

⚠ CAUTION ⚠

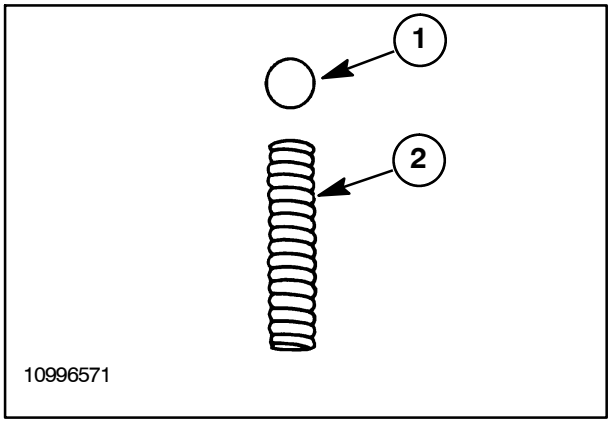
Use care when removing the lower shift rail. Cover the detent hole in the housing with a shop rag. The detent ball and spring could be expelled with force when the lower shift rail is removed.

9. Rotate the lower shift rail 90° to clear the detent ball.
10. Pull the lower shift rail forward and out, through the front of the housing.



34

11. Use a long magnet to remove the detent ball, 1, and spring, 2, from the housing.

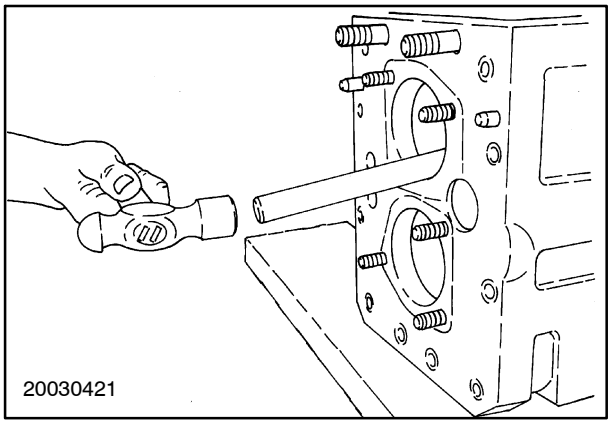


35

COUNTERSHAFT

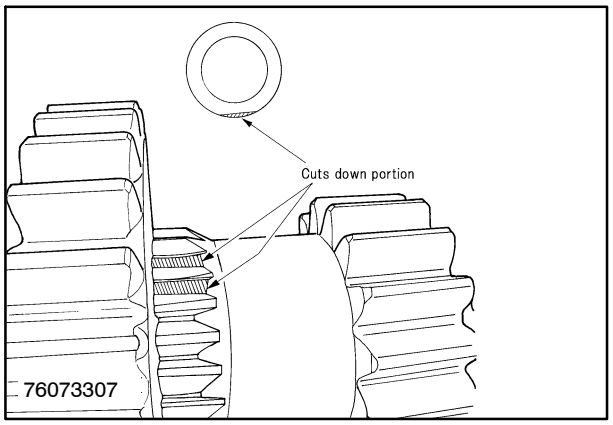
Disassembly

1. Use an aluminum drift and a hammer to lightly tap the countershaft rearward.



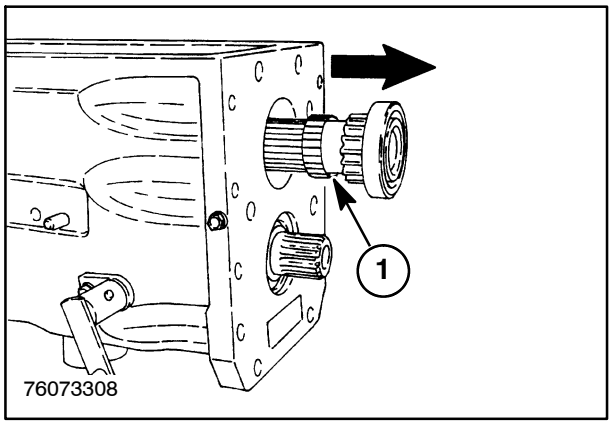
36

IMPORTANT: *The cut portion of the countershaft needs to be turned downward to the six o'clock position to prevent interference with the low range fixed gear (51T) on the rear main shaft.*



37

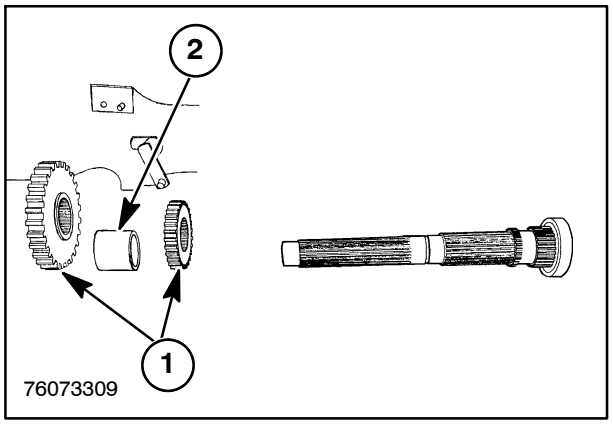
2. Pull the countershaft, 1, out through the rear of the housing.



38

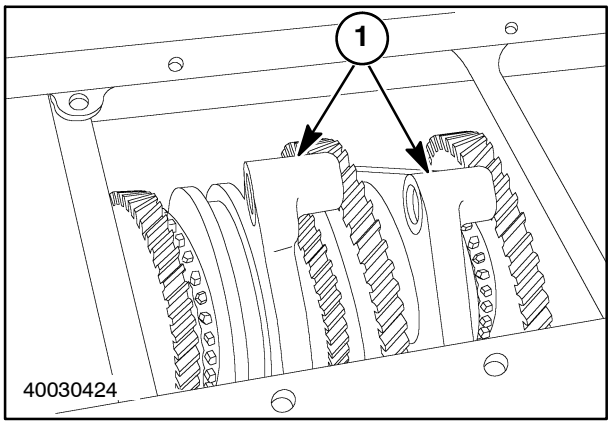
3. Remove the range gears (26T and 40T), 1, and spacer, 2, from the rear compartment of the housing.

NOTE: *The flange on the 40T range gear faces towards the front of the transmission housing.*



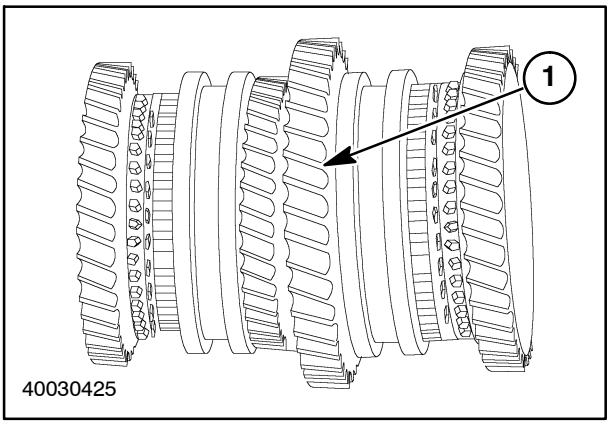
39

4. Rotate the shift forks, 1, to the top of the synchronizer collars.
5. Use a paint pen to mark the forks “FRONT” and “REAR”. Also take note of the orientation of the forks on the collars for proper assembly.



40

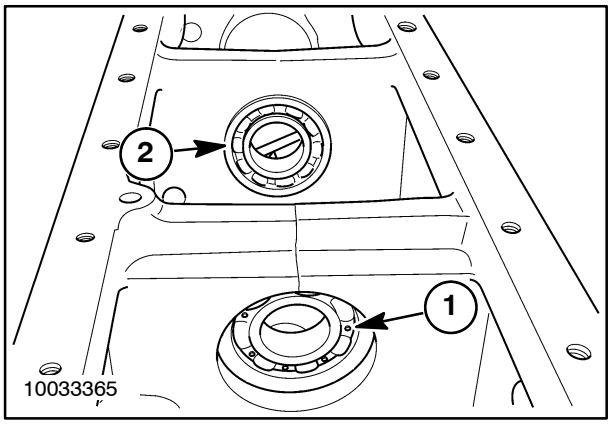
6. Carefully lift the main transmission gears and synchronizers, 1, up and out of the housing as an assembly.



41

7. Remove the front bearing, 1, and rear bearing, 2, from the housing.

NOTE: *Front bearing (6207) is wider than rear bearing and has a smaller ID. Rear bearing (6208) is narrower than front bearing and has a larger ID.*

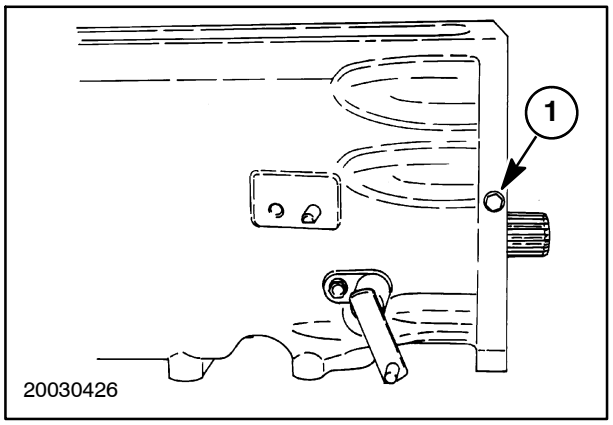


42

MAIN SHAFT

Disassembly

1. Remove the shift rail lock bolt, 1, and seal washer from the housing.



43

2. Push the shift rail, 1, partway out of the rear of the housing.
3. Insert a punch through the hole in the shift rail.
4. Rotate the shift rail 90° to clear the detent.

⚠ CAUTION ⚠

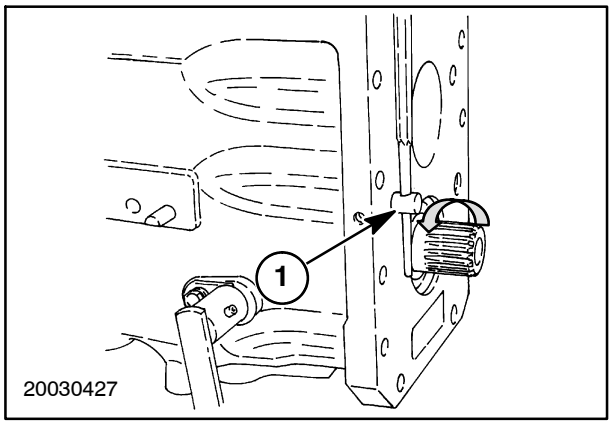
Use care when removing the shift rail. Cover the detent hole in the shift fork with a shop rag. The detent ball and spring could be expelled with force when the shift rail is removed.

5. Cover the detent hole in the shift fork and use the punch to pull the shift rail out of the housing.

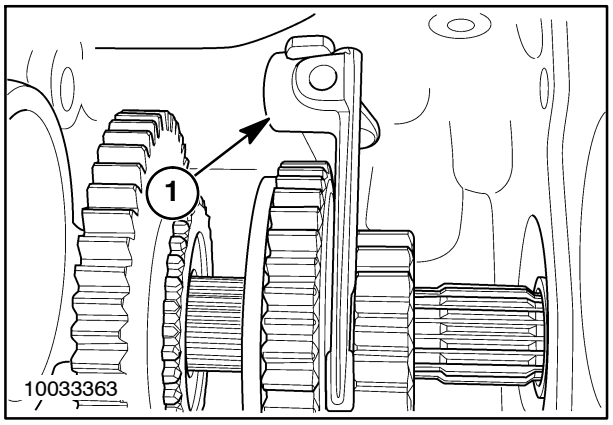
IMPORTANT: *Pay attention to the orientation of the shift fork on the shift rail for proper assembly.*

6. Remove the range shift fork, 1, from the housing.

NOTE: *Use care not to lose the detent ball and spring while removing the shift fork.*

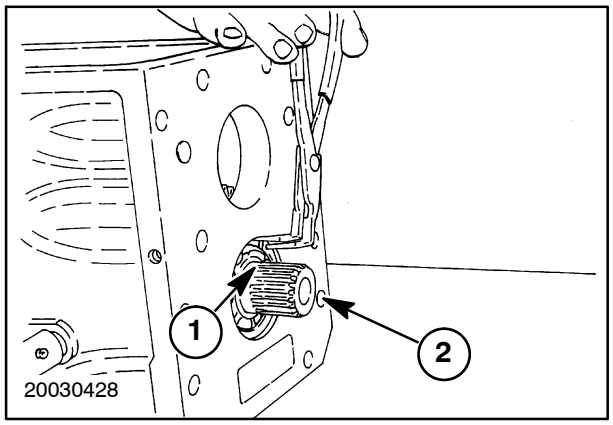


44



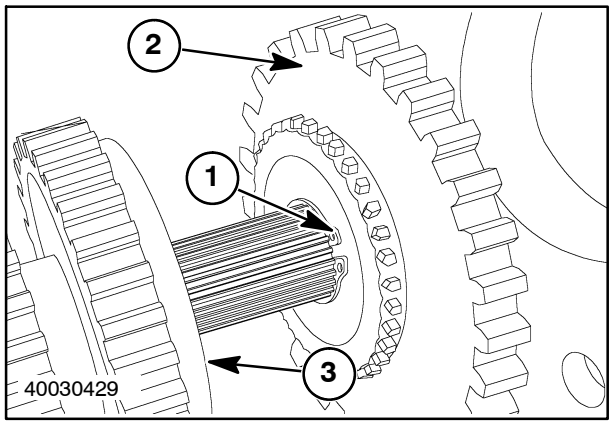
45

7. Remove the rear snap ring, 1, from the main shaft, 2.



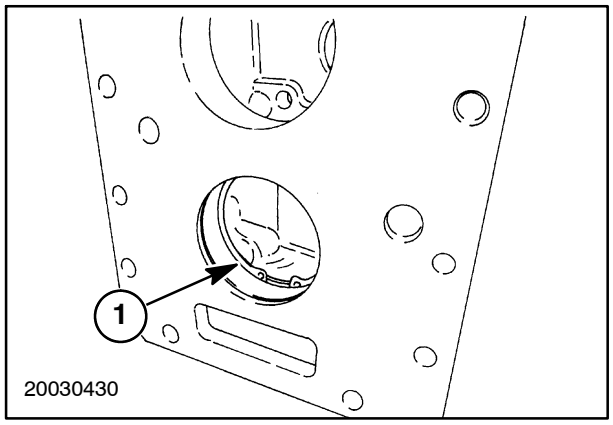
46

8. Remove the small snap ring, 1, in front of the rear gear, 2.
9. Slide the snap ring towards the front of the shaft.
10. Pull the shaft towards the rear of the housing.
11. Remove the gears, 2 and 3, and snap ring,1.



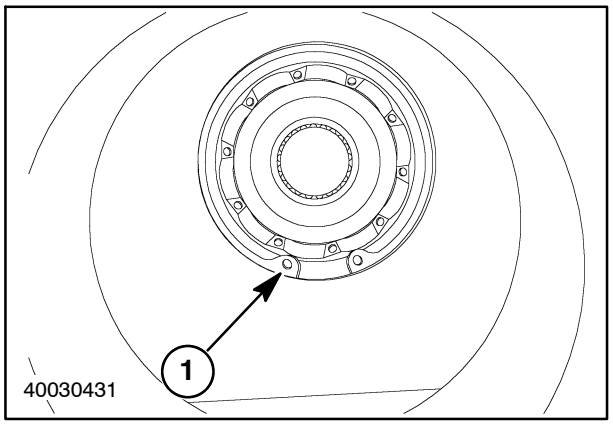
47

12. Remove the inner snap ring, 1, from the bearing web in rear of housing.



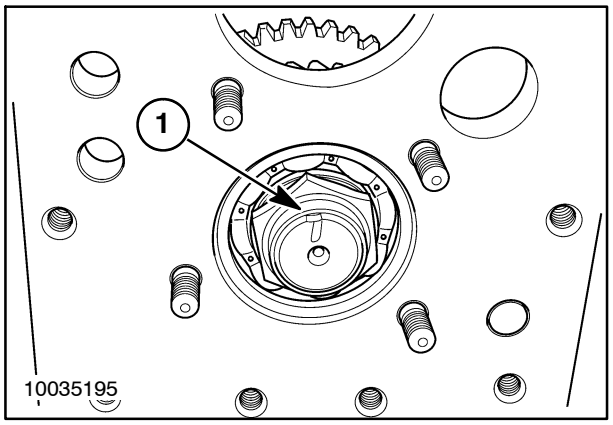
48

13. Remove rear snap ring, 1, from housing. (rear of front main shaft).



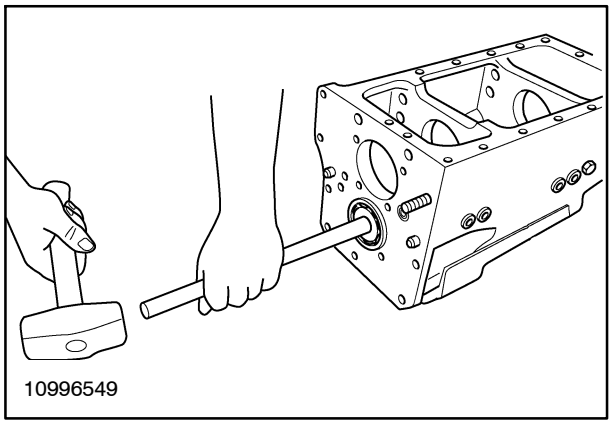
49

14. Unstake the nut, 1, on the front of the main shaft.
15. Remove the nut.



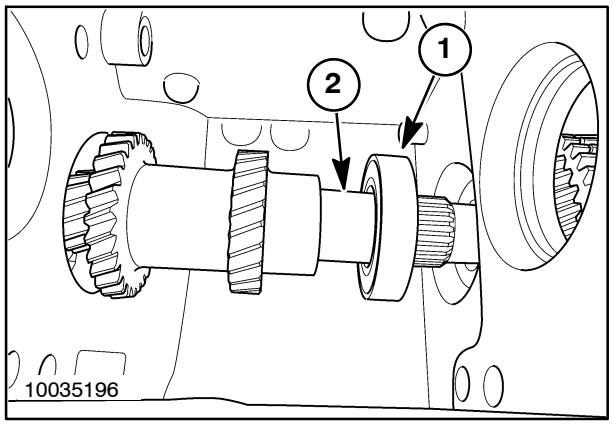
50

16. Use an aluminum drift to gently, tap the main shaft towards the rear of the housing.



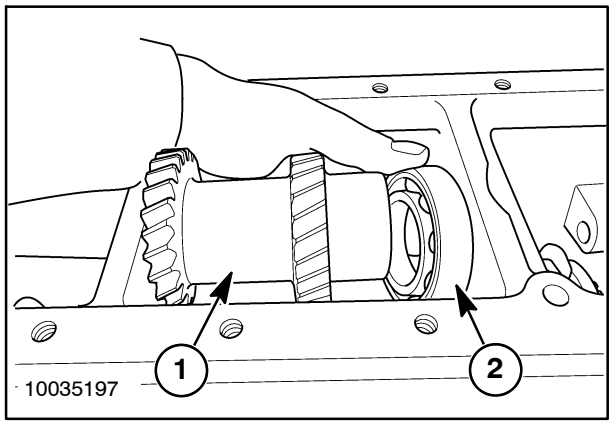
51

17. With the main shaft loose, tap the bearing, 1, in the center section of the housing, front until it is free from the main shaft.
18. Remove the main shaft, 2, through the rear of the housing.



52

19. Remove the 24T-28T gear set, 1, and bearing, 2, from the center section of the housing.

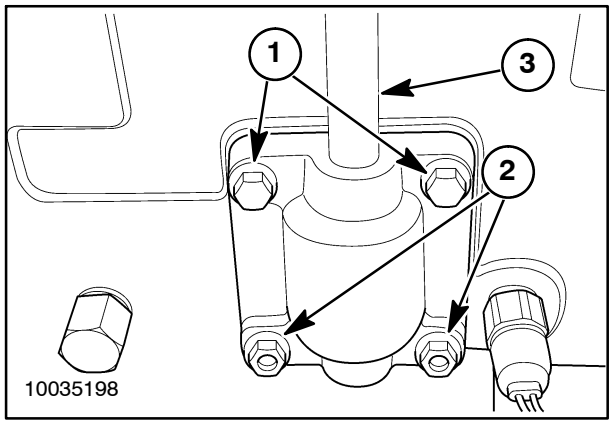


53

SHUTTLE GEARS

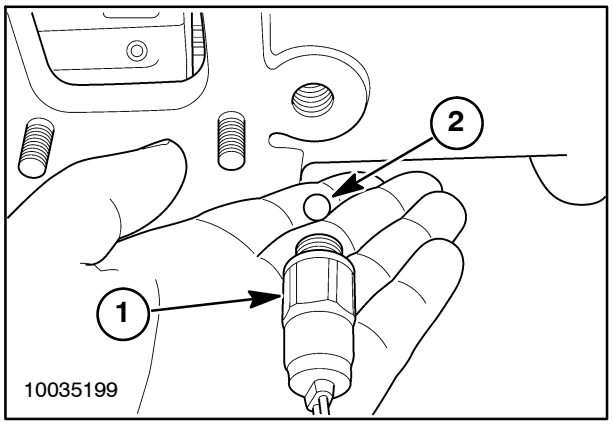
Disassembly

1. Remove the two bolts, 1, and nuts, 2, securing the shuttle gear shift arm and shift shaft, 3, to the housing.
2. Remove the shift shaft and shift arm assembly from the housing.



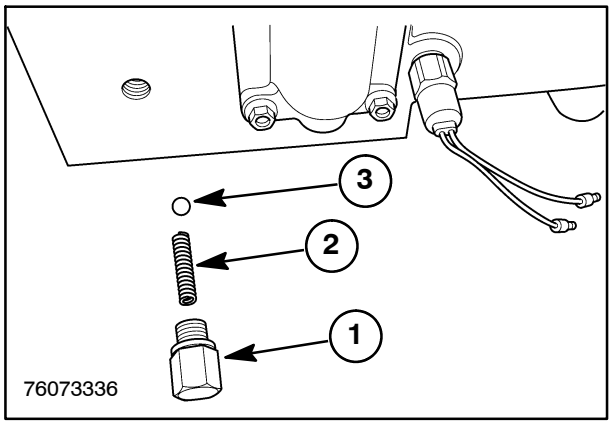
54

3. Remove the neutral safety switch, 1, and detent ball, 2, from the housing.



55

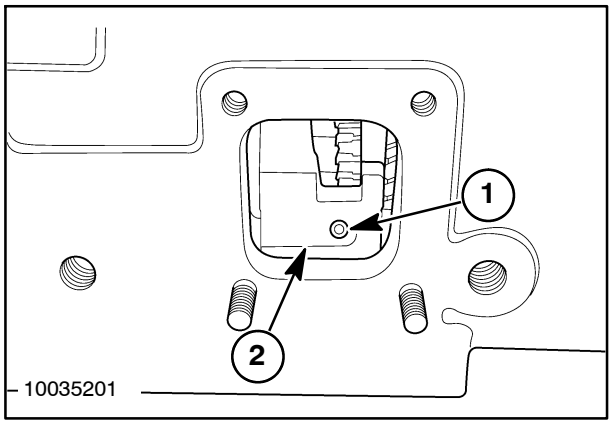
4. Remove the cap, 1, spring, 2, and detent ball, 3, from the shuttle detent hole in the housing.



56

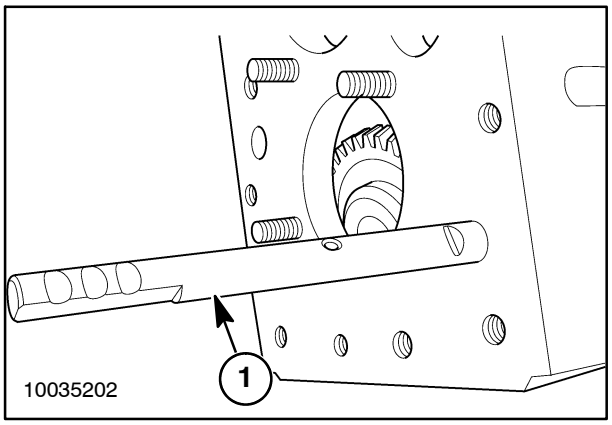
5. Drive the roll pin, 1, from the shuttle shift fork, 2, and shift rail.

NOTE: *Do not forget to retrieve the roll pin from the housing following removal of shuttle gears.*



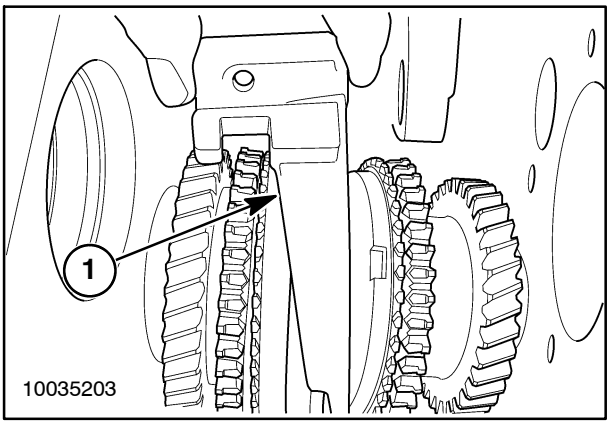
57

6. Remove the shuttle shift rail, 1, through the front of the housing.



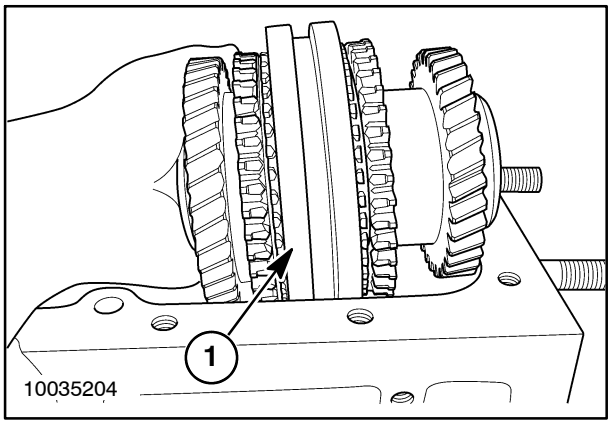
58

7. Remove the shuttle shift fork, 1, from the housing.



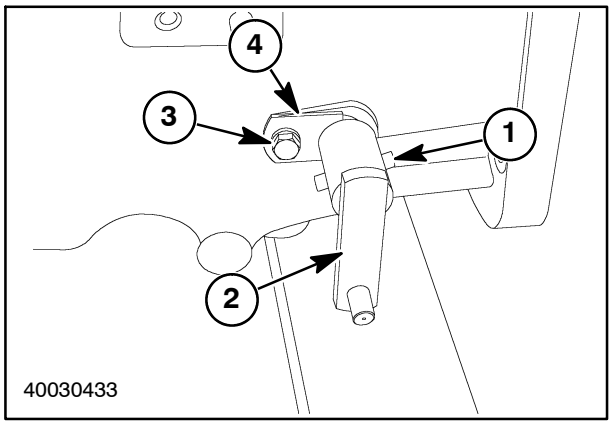
59

8. Carefully lift the shuttle gear/synchronizer assembly, 1, from the front section of the housing.
9. Retrieve the roll pin removed from the shuttle shift fork.
10. Remove the front, main shaft bearing from the housing.



60

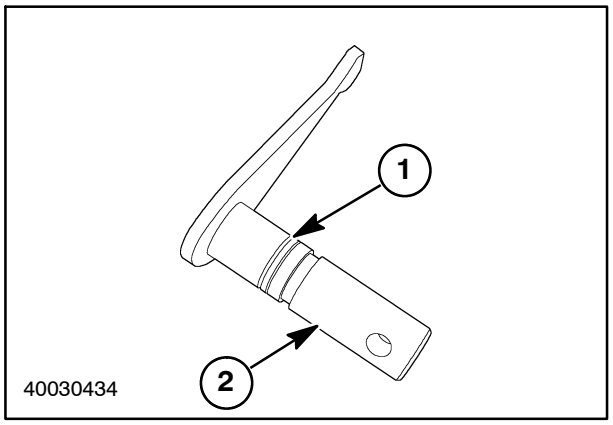
11. Drive the roll pin, 1, from the range gear shift lever, 2. Remove the shift lever.
12. Remove the bolt, 3, and retainer, 4.
13. Remove the shift arm from the housing from the inside of the housing.



61

IMPORTANT: *Pay close attention to the location of the O ring on the shift arm. The O ring is placed in the groove towards the inside end of the arm.*

14. Remove the O ring, 1, from the shift arm, 2.



62

Inspection

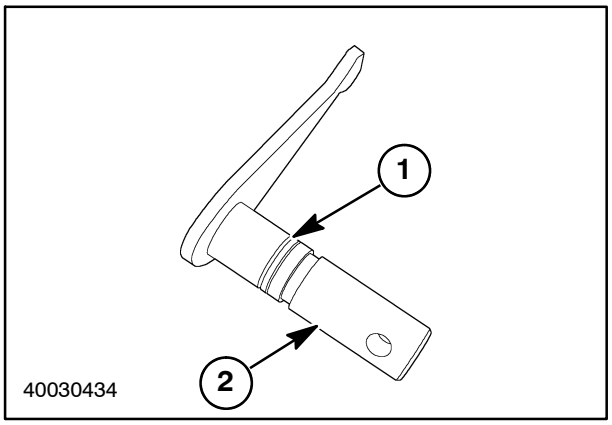
1. Wash all parts in a suitable cleaning solution and allow to air dry.
2. Inspect all bearings for excess wear, score marks, discoloration from overheating or other damage. Rotate the bearings by hand and check for roughness while turning the inner and outer races. Replace as necessary.
3. Lubricate all bearings with clean hydraulic fluid before assembly.
4. Inspect the transmission housing for cracks, worn or damaged bearing bores or other damage. Replace as necessary.
5. Check all detent springs for wear, chipped or weak spring tension. Replace as necessary.
6. Inspect the detent balls and balk pins for excess wear or damage. Replace as necessary.
7. Inspect the detent grooves in the shift rails for excess wear. Replace as necessary.
8. Inspect all gears for excess wear, chipped gear teeth, cracks or any other damage. Replace as necessary.
9. Inspect shift forks for wear or damage. Replace as necessary. (See “Specifications”)

MAIN TRANSMISSION RANGE GEAR SHIFTER

Assembly

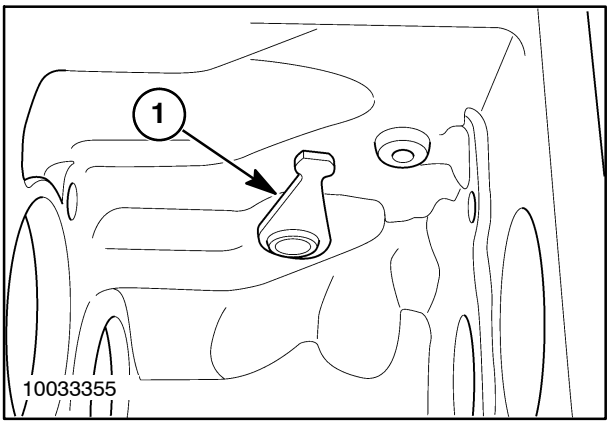
IMPORTANT: *O ring is to be installed in groove closest to shift arm lever.*

1. Lubricate a new O ring, 1, with petroleum jelly and install on the shift arm, 2.



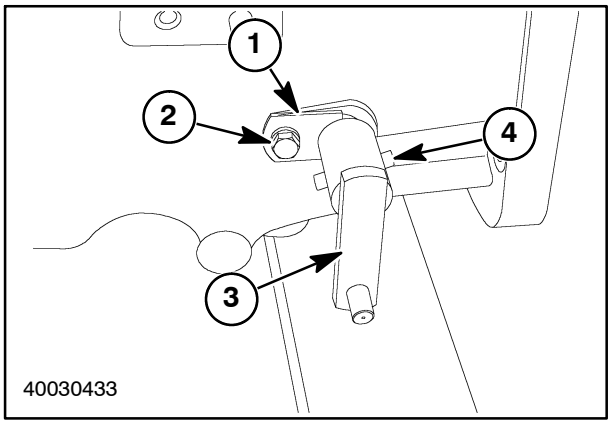
63

2. Install the shift arm, 1, into the transmission housing from the inside.



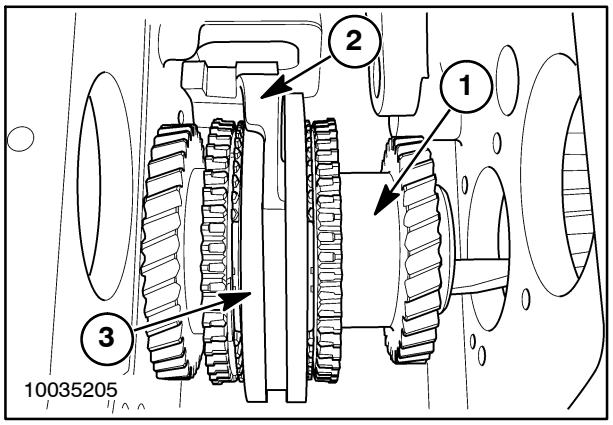
64

3. Install retainer, 1, and secure with bolt, 2.
4. Install range gear shift lever, 3, and secure to shift arm with roll pin, 4.



65

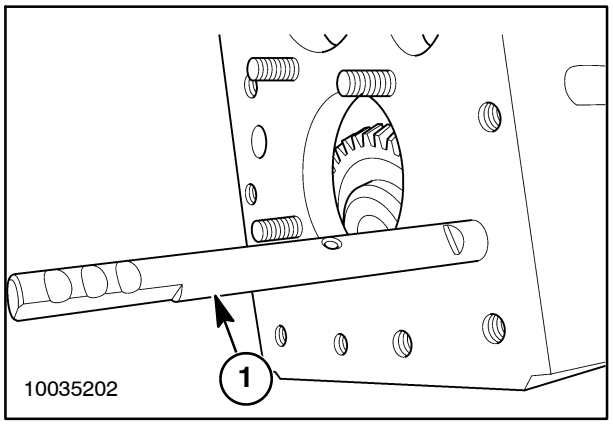
5. Carefully place the shuttle gear/synchronizer assembly, 1, into the transmission housing with the 35T gear(reverse) towards the front of the housing.
6. Position the shift fork, 2, onto the sliding coupler, 3.



66

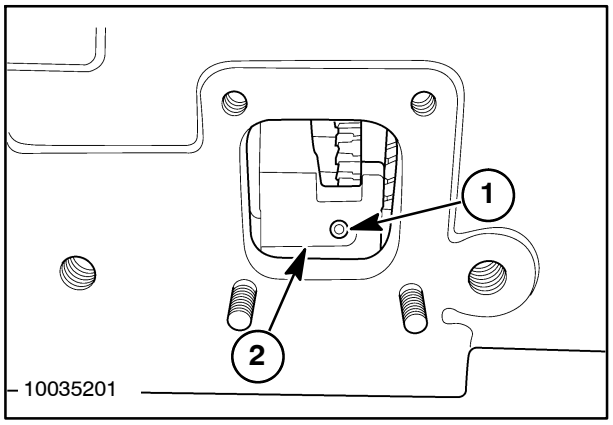
7. Install the shuttle shift rail, 1, into the housing, through the shuttle shift fork.

NOTE: *The three detent slots must face towards the outside of the transmission housing, to engage the detent ball.*



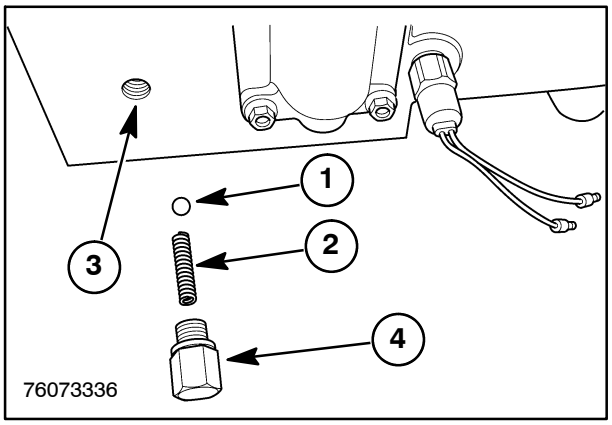
67

8. Align the roll pin hole in the shift fork with the hole in the shift rail.
9. Install roll pin, 1, through the fork, 2, and shift rail.



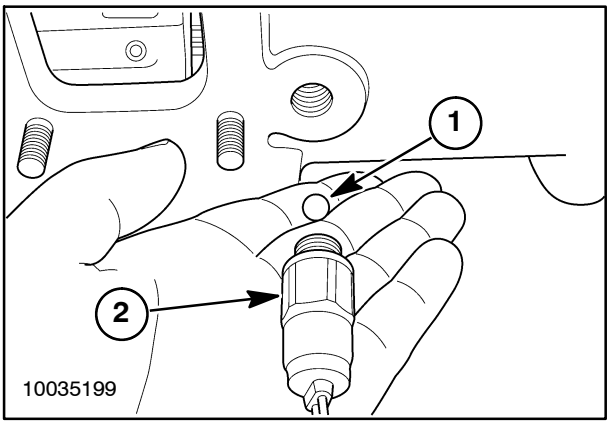
68

10. Install the detent ball, 1, and spring, 2, into the shuttle rail detent hole, 3.
11. Install a new seal washer on the detent cap, 4.
12. Install and tighten detent cap to secure spring and ball.



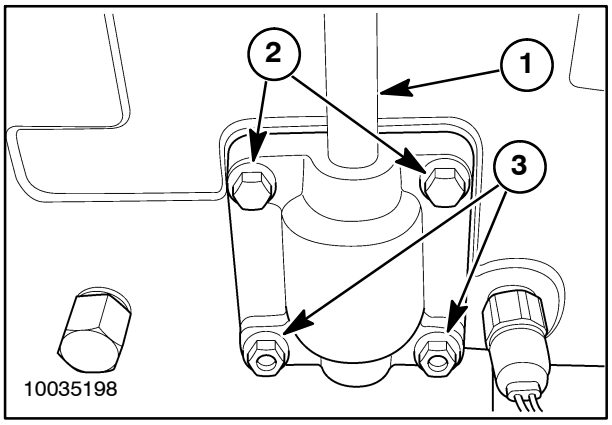
69

13. Install the detent ball, 1, and neutral safety switch, 2, in the housing.
14. Tighten the neutral safety switch.



70

15. Place a light bead of Loctite® 518 gasket eliminator sealant around the mating face of the shuttle shift arm housing.
16. Install the shift shaft and shift arm assembly, 1, onto the housing. Be sure to engage the shift arm in the shift fork.
17. Secure the shaft and arm assembly to the housing with two bolts, 2, and two nuts, 3. Tighten bolts and nuts securely.



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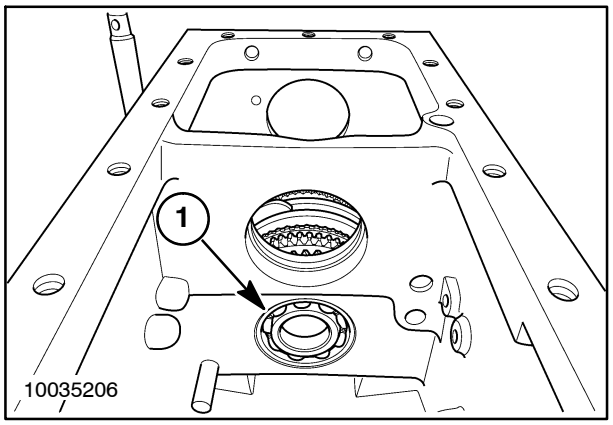
MAIN SHAFT

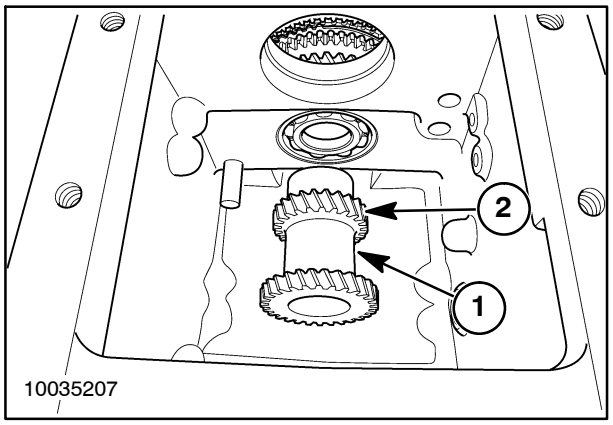
Assembly

1. Install the bearing (6208), 1, into the transmission housing.



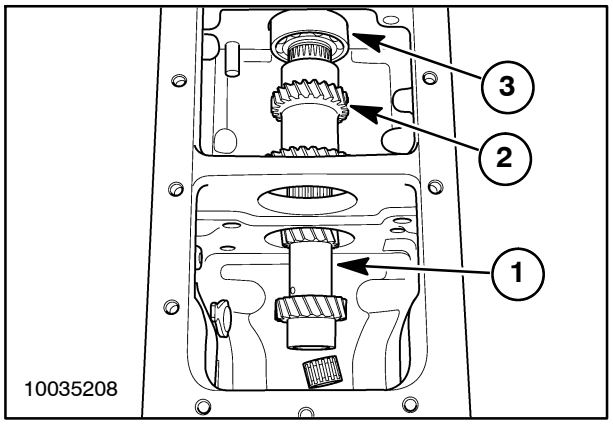
72

2. Place the 24T–28T gear set, 1, into the center compartment of the housing, with the 24T gear, 2, facing forward.



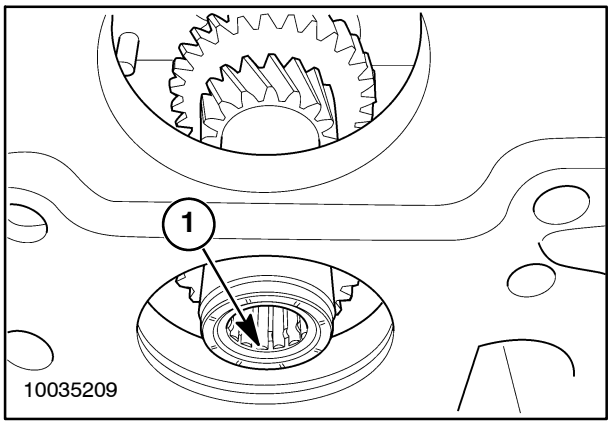
73

3. Insert the main shaft, 1, from the rear of the housing, through the 24T–28T gear set, 2, bearing (6307), 3, and shuttle gear assembly. Tap the shaft forward, lightly until seated.



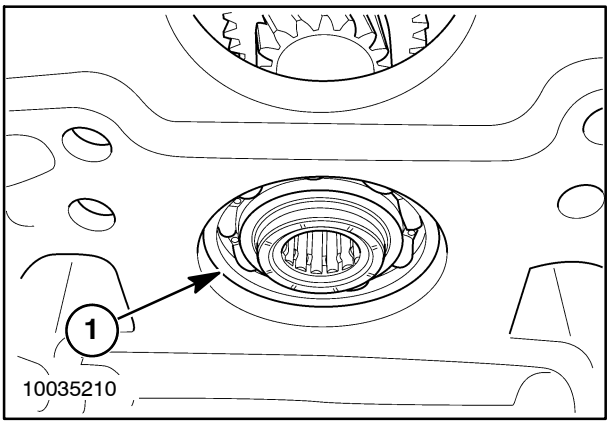
74

4. Insert the needle bearing, 1, into the end of the main shaft.



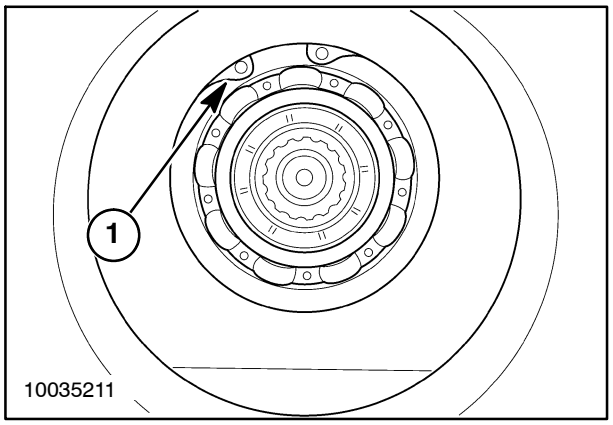
75

5. Install the rear main shaft bearing (6209), 1, into the housing, over the main shaft until seated.



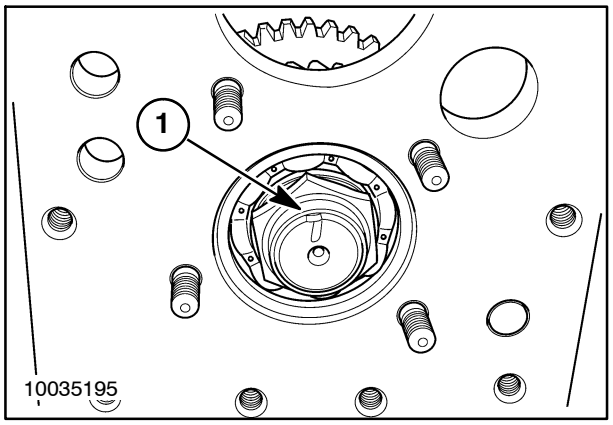
76

6. Secure the rear bearing with a snap ring, 1.



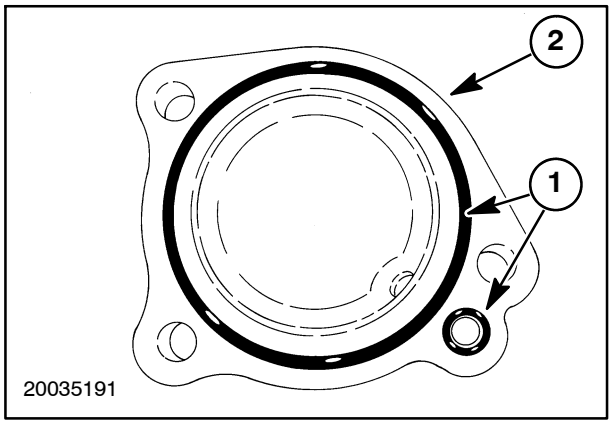
77

7. Install a new stake nut, 1, on the front end of the main shaft. Tighten the nut to 83.3-89 N·m (61.4-65.7 ft. lbs.).
8. Stake the nut using a punch or chisel.



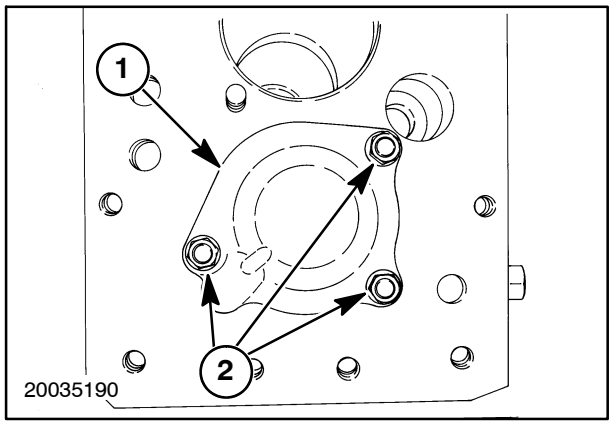
78

9. Install new O rings, 1, on the shaft retainer, 2.



79

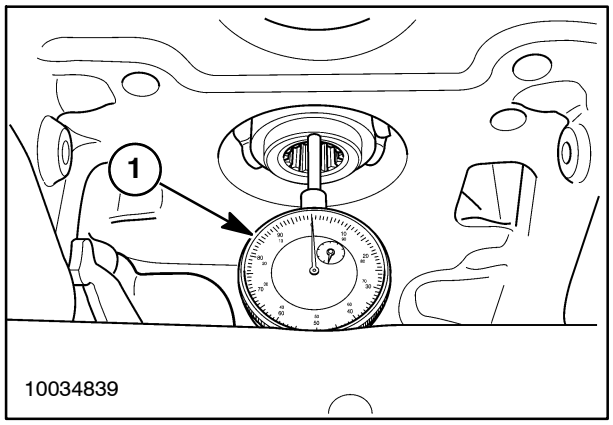
10. Install the shaft retainer, 1, onto the housing and secure with three nuts, 2, and lock washers. Tighten nuts securely.



80

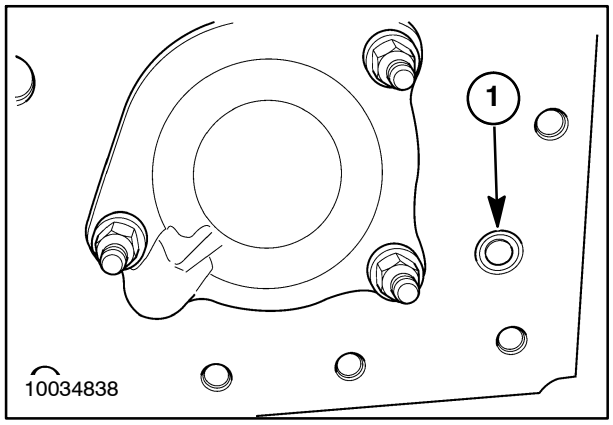
11. Use a dial indicator, 1, to check axial end play (end float) of the main shaft. Axial end play should be 0.0–0.3 mm (0.0–0.012″).
12. If axial end play is greater than be 0.0–0.3 mm (0.0–0.012″), remove retainer and install shims between shaft retainer and front bearing.

NOTE: *Shims are available in 0.1, 0.2, 0.5 mm (0.004, 0.008, 0.020″).*



81

13. Re-install shaft retainer and tighten nuts securely. Re-check axial end play.
14. Install a new plug seal, 1, into the shuttle shift rail bore.

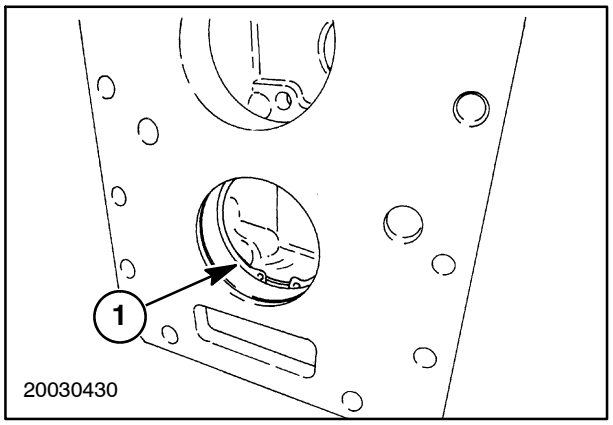


82

RANGE GEARS

Assembly

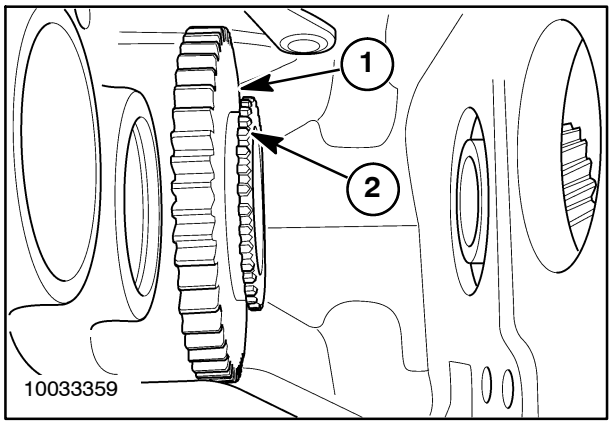
1. Install the inner snap ring, 1, in the rear main shaft bearing web of the housing.



83

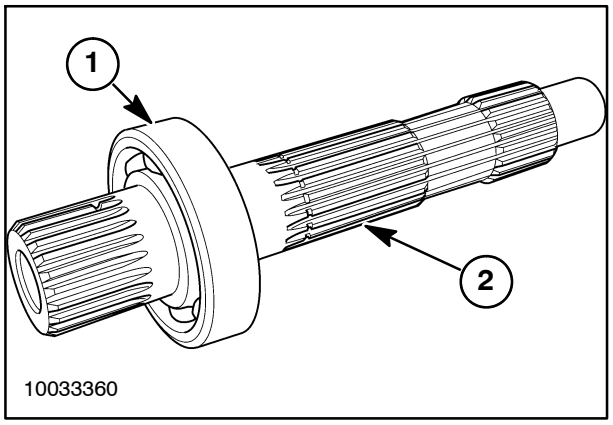
IMPORTANT: *Lubricate the bushing in the large gear with clean hydraulic fluid prior to assembly.*

2. Place the large 51T gear, 1, in the housing, with the flange containing the engagement teeth, 2, facing the front of the housing.



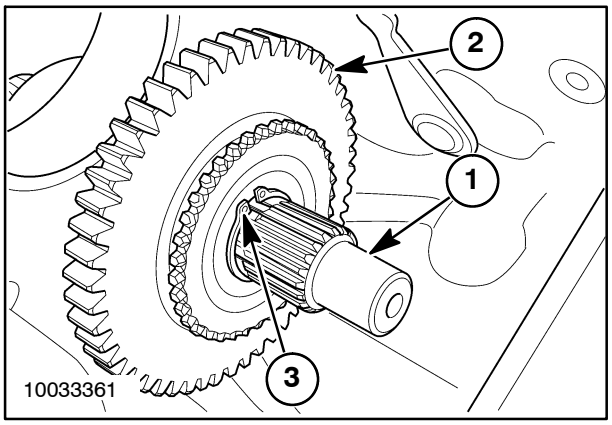
84

3. Install the bearing, 1, on the main shaft, 2.



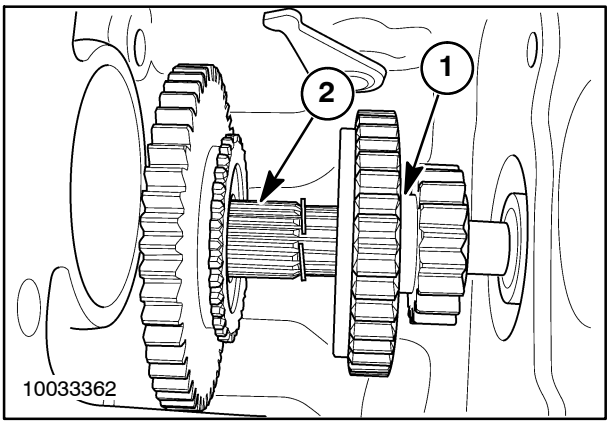
85

4. Insert the main shaft, 1, partially into the housing from the rear, through the large gear, 2.
5. Slide the small snap ring, 3, over the end of the main shaft, 1, and position towards the rear of the shaft.



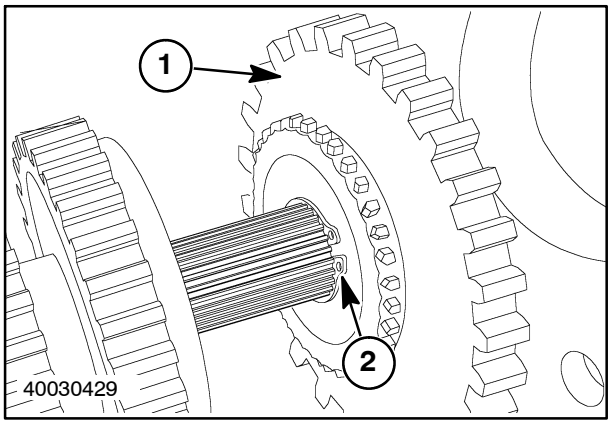
86

6. Install the sliding, smaller 18/38T double gear, 1, onto the main shaft, 2, while inserting the main shaft into the housing.



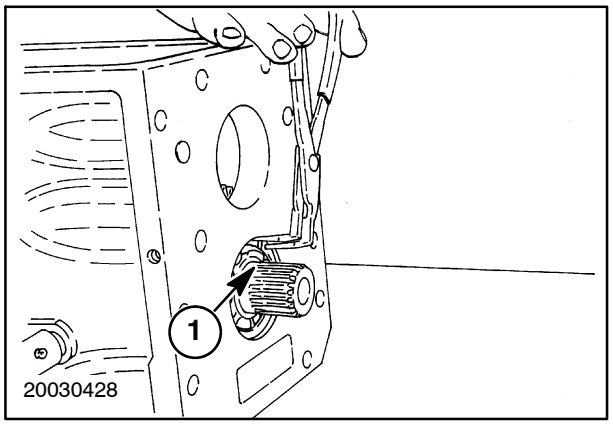
87

7. Fully insert the main shaft until the rear bearing bottoms against the snap ring.
8. Slide the large gear, 1, rearward and install small snap ring, 2, in groove on shaft to retain large gear.



88

9. Install snap ring, 1, in rear groove of housing to retain main shaft.



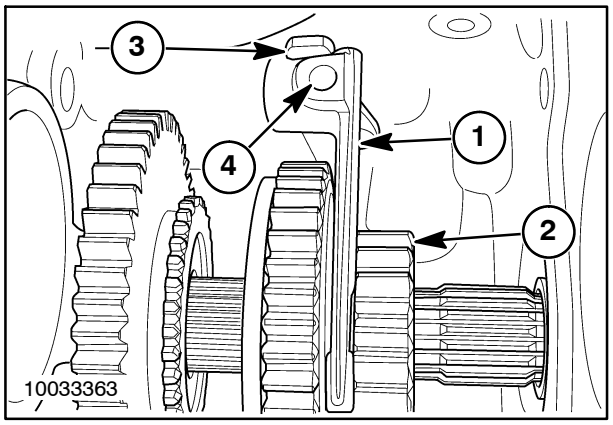
89

RANGE GEAR SHIFT FORK

Assembly

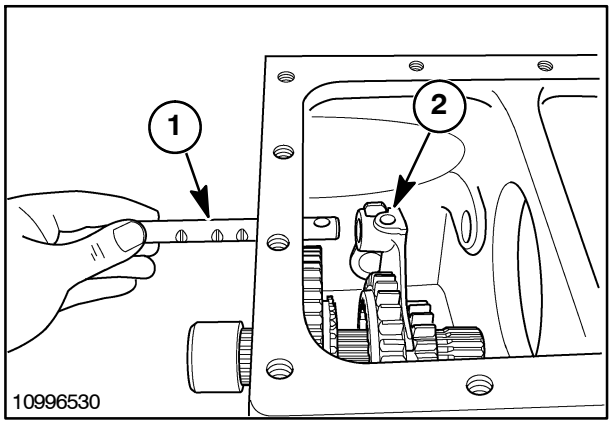
IMPORTANT: *The orientation of the shift fork must be correct during installation. The larger part of the shift rail bore faces the rear of the housing.*

1. Install the range gear shift fork, 1, onto the sliding gear, 2. Be sure to engage the shift arm, 3, in the shift fork.
2. Install the detent spring and ball in the detent hole, 4, in the shift fork.



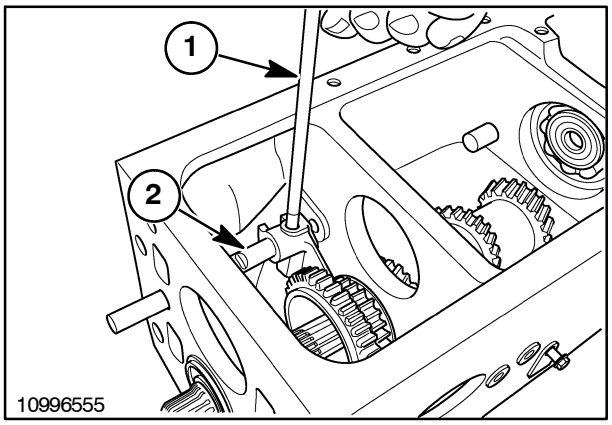
90

3. Temporarily slide the shift rail, 1, through the rear of the housing, into the shift fork, 2.
4. Position the shift rail, 1, with the detent grooves as shown while installing into the shift fork.

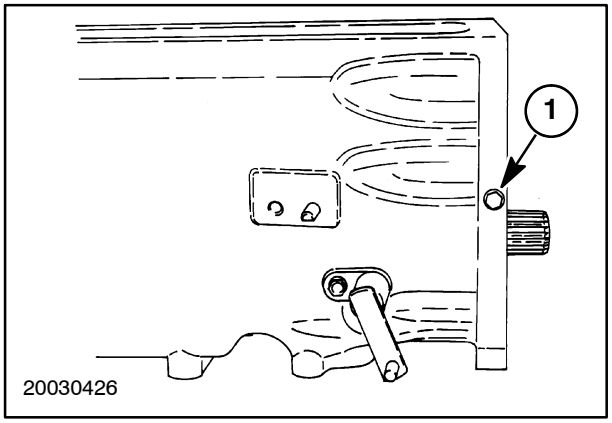


91

5. Use special detent tool #FNH00081, 1, to compress the detent spring and ball.
6. Insert a suitable size socket or round stock into the front of the shift fork bore while compressing the detent spring and ball.
7. Carefully remove the detent tool while pushing the socket into the bore, over top of the detent ball. (This will hold the detent ball and spring in place while the shift rail is inserted.)
8. Insert the range gear shift rail, 2, through the housing and into the shift fork, until the socket is pushed from the shift fork.
9. Rotate the shift rail 90° to align the lock hole in the shift rail with the lock hole in the side of the housing.
10. Install a new seal washer. Install and tighten the lock bolt, 1.



92



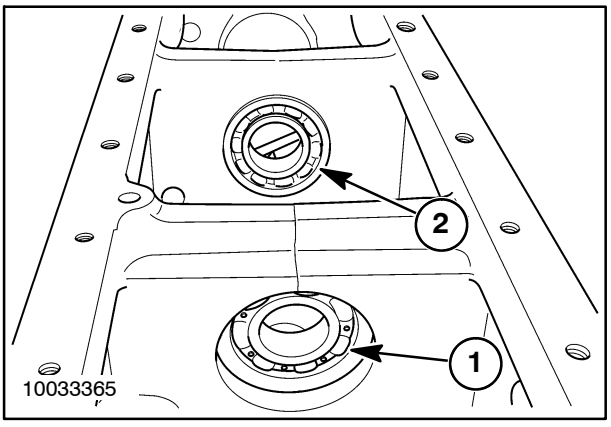
93

COUNTERSHAFT

Assembly

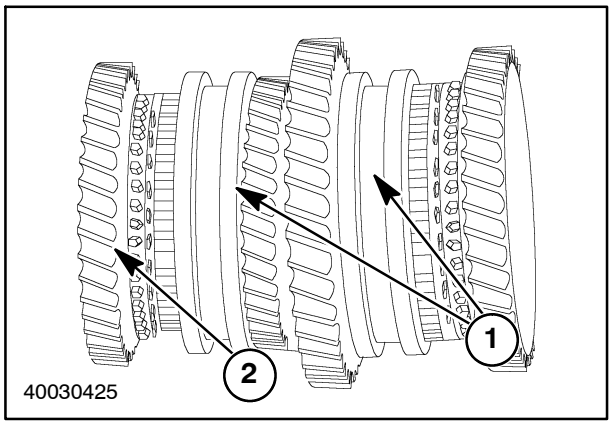
IMPORTANT: *The front bearing, 1, is marked 6307 and has a smaller I.D. than the rear bearing. The rear bearing, 2, is marked 6208 and has the larger I.D. of the two bearings. DO NOT install bearings in the wrong position.*

1. Install the front bearing, 1, and rear bearing, 2, into the housing.



94

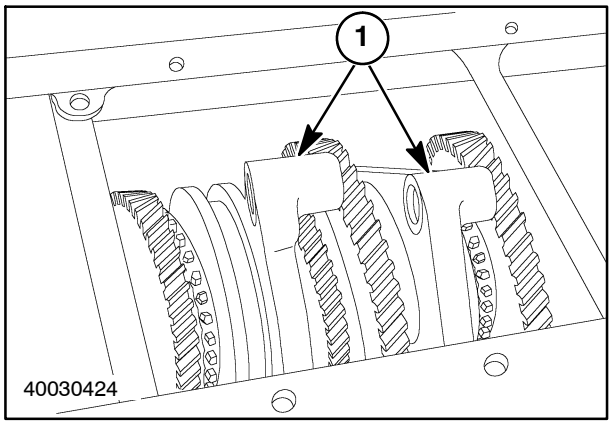
2. Place the main gear/synchronizer assembly, 1, into the center compartment of the transmission housing, with the 44T gear, 2, facing towards the front of the housing.



95

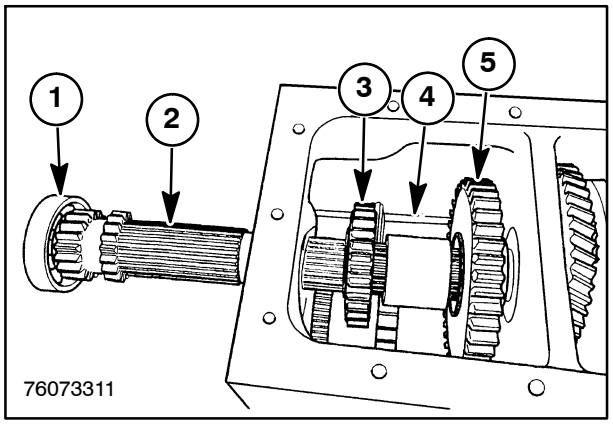
IMPORTANT: *Be sure to install shifts forks to corresponding synchronizers using paint marks made during disassembly. The longer part of the shift rail boss in the shift fork will face rearward when installed properly.*

3. Install the shift forks, 1, onto the synchronizers.
4. Rotate the shift forks to the normal position for installation of the shift rails at a later time.



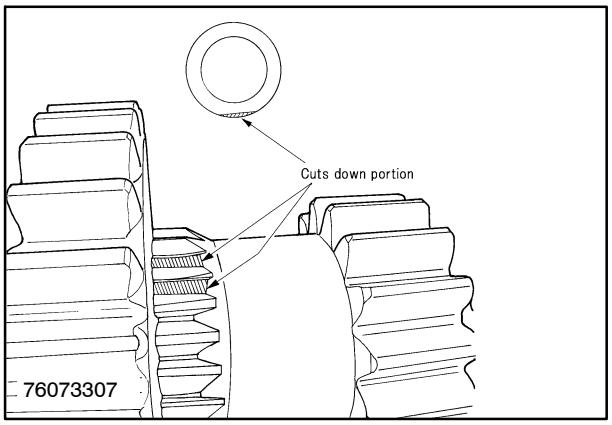
96

5. Install the bearing, 1, on the countershaft, 2.
6. Install the countershaft, 2, through the rear of the housing while installing the 22T gear, 3, collar, 4, and 40T gear, 5. (Be sure flange side of gear, 6, is facing toward front of housing with chamfer on I.D. of gear, 5, against collar, 4. Be sure to position chamfered side of small gear, 3, towards collar, 4.)
7. Continue to insert countershaft through main gears/synchronizers until fully seated.



97

IMPORTANT: *The cut portion of the countershaft needs to be turned downward to the six o'clock position to prevent interference with the low range fixed gear (51T) on the rear main shaft.*

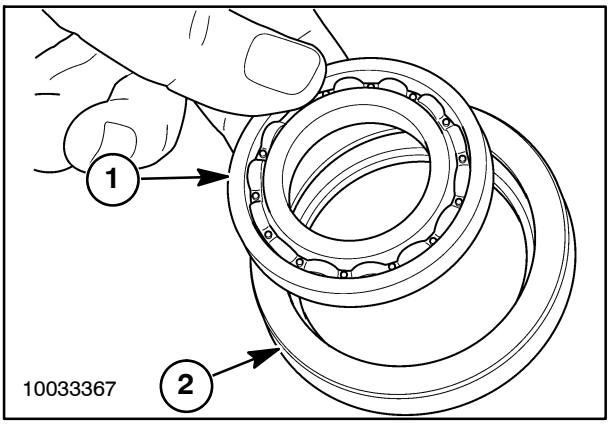


98

PTO SHAFT

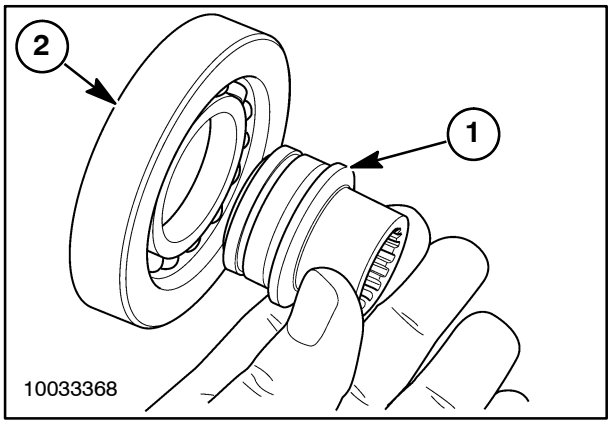
Assembly

1. Install the rear PTO shaft bearing, 1, into the bearing holder, 2, until fully seated.



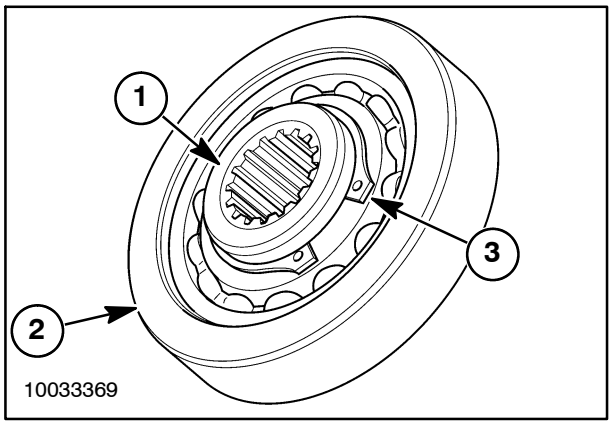
99

2. Install the coupler, 1, into the bearing assembly, 2, as shown. Be sure to install the snap ring side of the coupler through the front of the bearing.



100

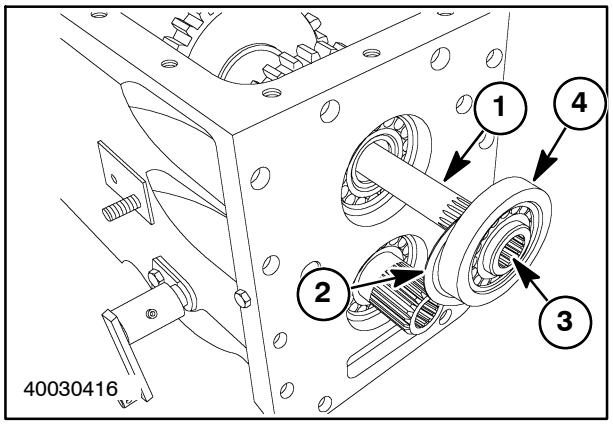
3. Secure the coupler, 1, to the bearing, 2, with a new snap ring, 3.



101

IMPORTANT: *Shims, 2, may be necessary to allow bearing holder, 4, to be flush with mating surface of transmission housing.*

4. Insert the PTO shaft, 1, and shim(s), 2, (if necessary) into the coupler, 3.
5. Install the PTO shaft assembly through the countershaft, seating the bearing holder, 4, in the housing.
6. Check bearing holder for flush fit to housing mating surface. If necessary, remove PTO shaft and install/remove shims as necessary. Reinstall PTO shaft.



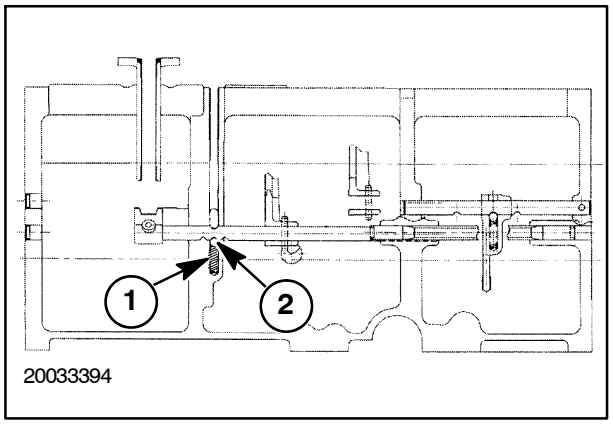
102

SHIFT RAILS

Assembly

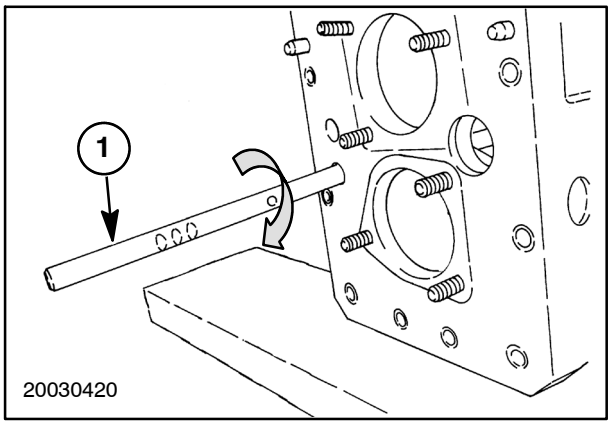
IMPORTANT: *Use a dab of petroleum jelly on the end of the detent spring to retain the detent ball during assembly.*

1. Insert detent spring, 1, and detent ball, 2, into the detent hole in the housing.



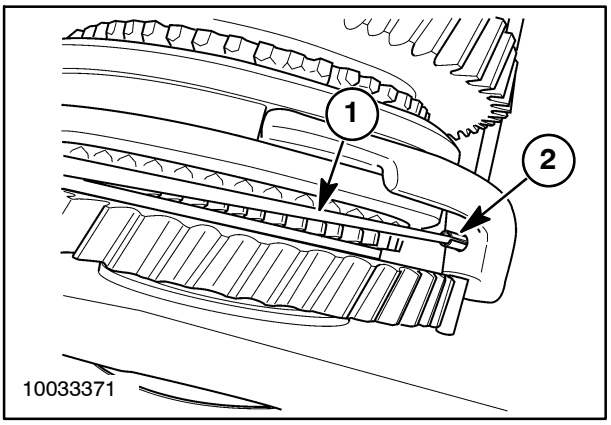
103

2. Insert lower shift rail, 1, as shown, partially into housing and shift fork.
3. Use detent tool #FNH00081 to compress detent ball and spring while inserting lower shift rail through shift fork.
4. Rotate shift rail 90° to position three detent grooves on bottom of shift rail.



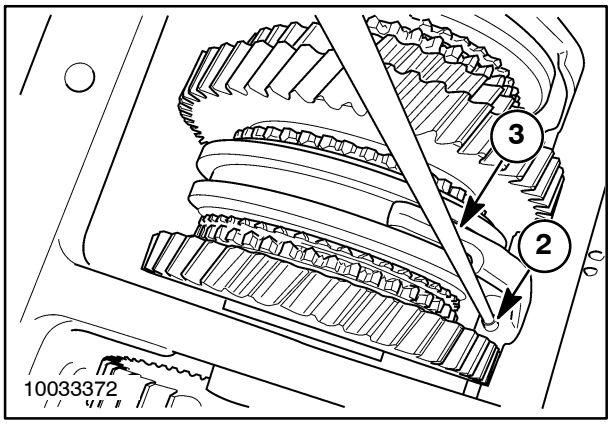
104

5. With lower shift rail inserted into shift fork, align roll pin holes in shift rail and shift fork.
6. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 1, into the shift fork and shift rail roll pin holes.
7. Slide roll pin, 2, over the brazing rod until it rests on the shift fork, over the hole.



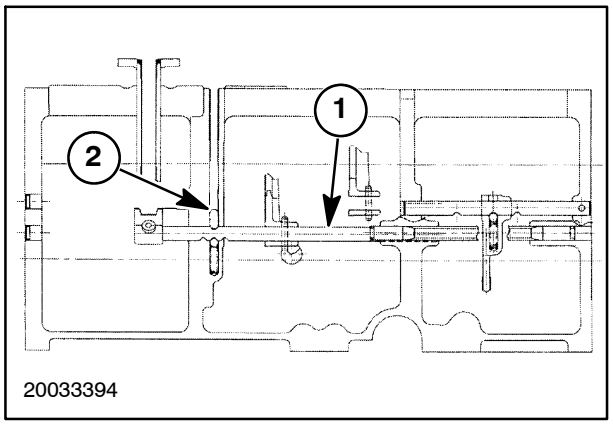
105

8. Slide a 13′ long piece of 3/16″ brake tubing, 3, over the brazing rod until it contacts the roll pin, 2.
9. Lightly tap the brake tubing to start the roll pin in the holes. When the roll pin is through the shift fork and is started into the shift rail, remove the tubing and brazing rod.
10. Finish inserting the roll pin evenly using a punch.



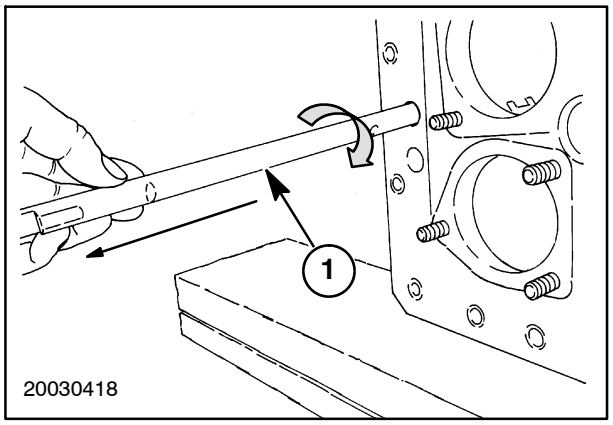
106

11. Place lower shift rail, 1, in the neutral position.
12. Install the balk pin, 2, into the detent hole.



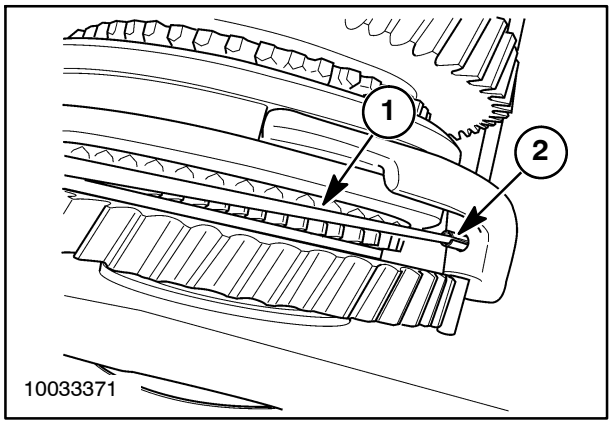
107

13. Insert upper shift rail, 1, as shown, partially into housing, over the balk pin and into shift fork.
14. Rotate shift rail 90° to position three detent grooves on top of shift rail.



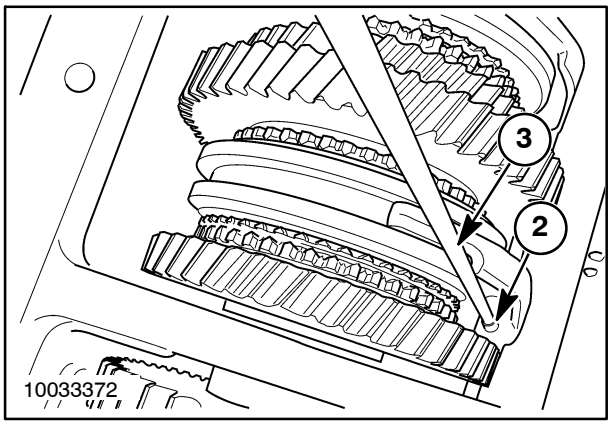
108

15. With upper shift rail inserted into shift fork, align roll pin holes in shift rail and shift fork.
16. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 1, into the shift fork and shift rail roll pin holes.
17. Slide roll pin, 2, over the brazing rod until it rests on the shift fork, over the hole.



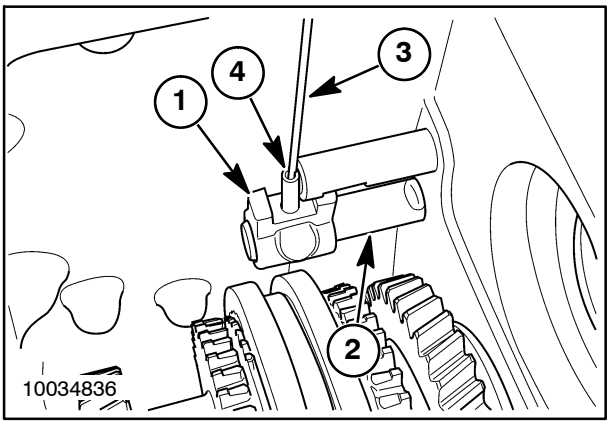
109

18. Slide a 13′ long piece of 3/16″ brake tubing, 3, over the brazing rod until it contacts the roll pin, 2.
19. Lightly tap the brake tubing to start the roll pin in the holes. When the roll pin is through the shift fork and is started into the shift rail, remove the tubing and brazing rod.
20. Finish inserting the roll pin using a punch.



110

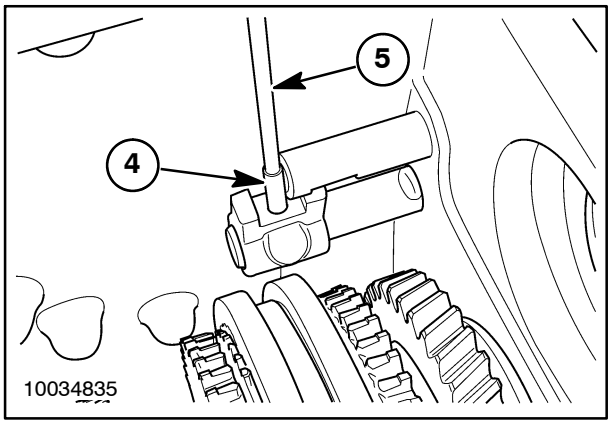
21. Move the lower shift rail forward.
22. Move the upper shift rail rearward.
23. Install shift rail boss, 1, onto the lower shift rail, 2.
24. Insert a 12-1/2″ long piece of 3/32″ brazing rod, 3, into the shift rail boss and shift rail roll pin holes.
25. Slide roll pin, 4, over the brazing rod until it rests on the shift rail boss, over the hole.



111

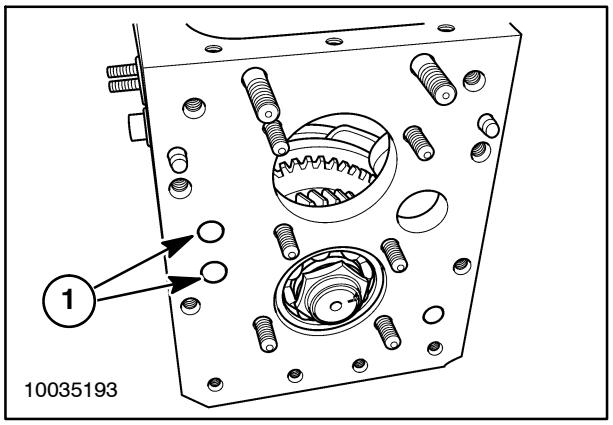
26. Slide a 13′ long piece of 3/16″ brake tubing, 5, over the brazing rod until it contacts the roll pin, 4.
27. Lightly tap the brake tubing to start the roll pin in the holes. When the roll pin is through the shift rail boss and is started into the shift rail, remove the tubing and brazing rod.
28. Finish inserting the roll pin using a punch.

NOTE: *Insert roll pin until flush with machined surface of shift boss.*



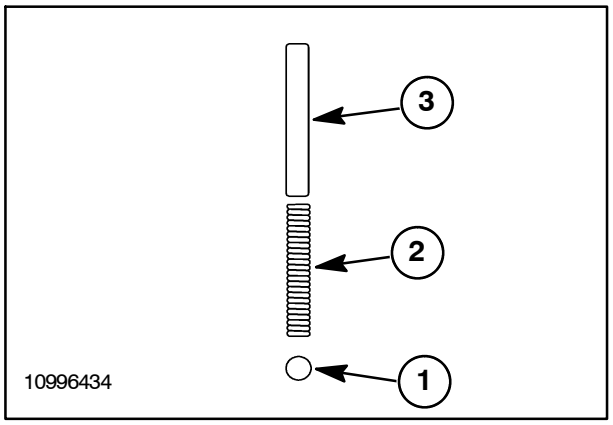
112

29. Install two new seal plugs, 1, into the shift rail bores.



113

30. Insert detent ball, 1, spring, 2, and pin, 3, into detent hole.

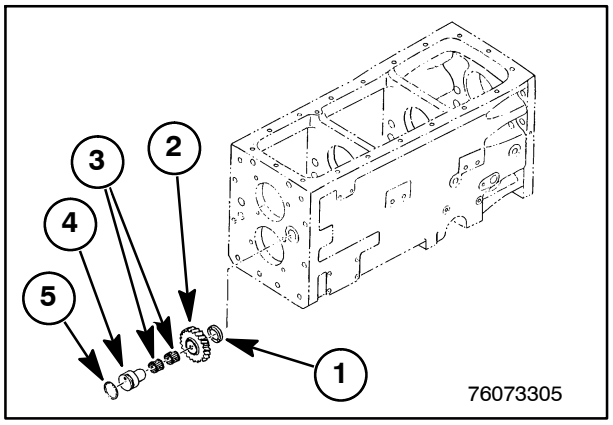


114

REVERSE IDLER

Assembly

1. Install the spacer, 1, with the oil grooves facing forward towards the gear, and 22T gear, 2, with flange facing forward, into the housing.
2. Lubricate the needle bearings, 3, with clean hydraulic oil and install on the reverse idler shaft, 4.
3. Lubricate a new O ring, 5, with petroleum jelly and install on the idler shaft, 4.
4. While holding the gear and spacer in place in the housing, install the reverse idler shaft through the front of the housing, through the gear and spacer, until fully seated in the housing.

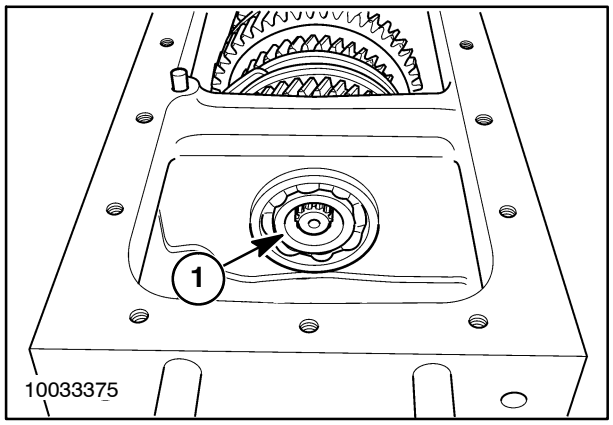


115

INPUT SHAFT

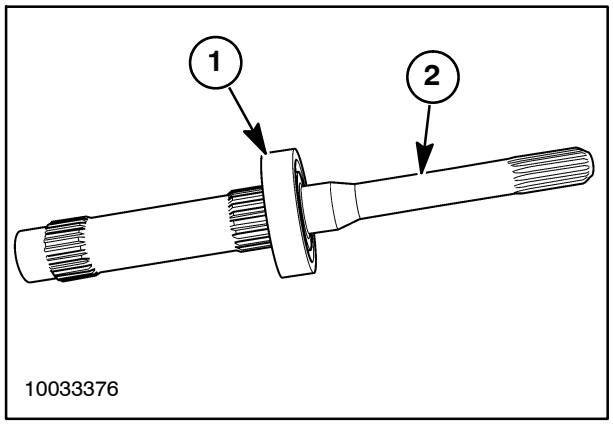
Assembly

1. Install the rear input shaft bearing (6208), 1, in the housing.



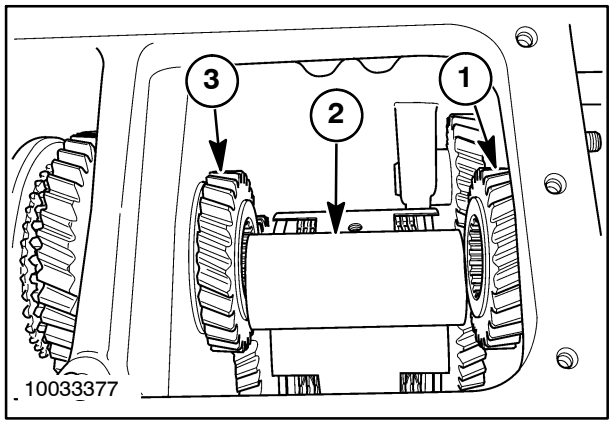
116

2. Install the front input shaft bearing, 1, on the input shaft, 2.



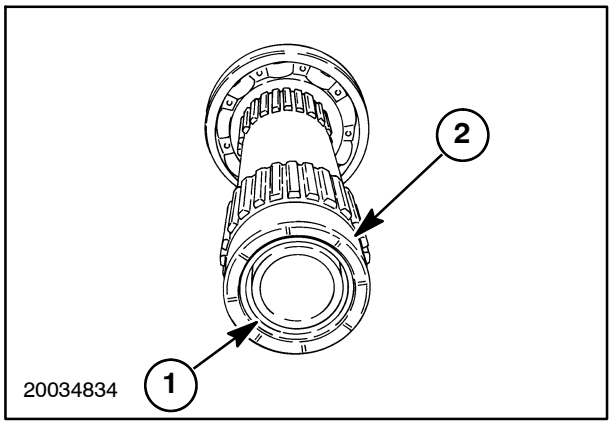
117

3. Position the 28T gear, 1, (flange facing forward), spacer, 2, and 29T gear, 3, (flange facing rearward) in the housing.



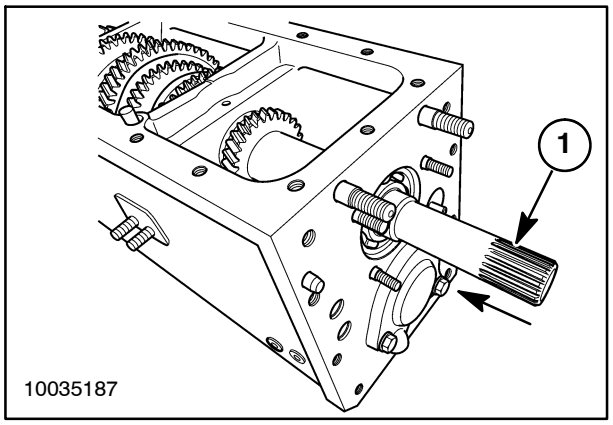
118

4. Install a new oil seal, 1, in the end of the input shaft, 2.
5. Lubricate the I.D. of the oil seal, 1.



119

6. Install the input shaft, 1, through the front of the housing.
7. Insert the input shaft through the gears and collar until the front bearing is fully seated in the housing.



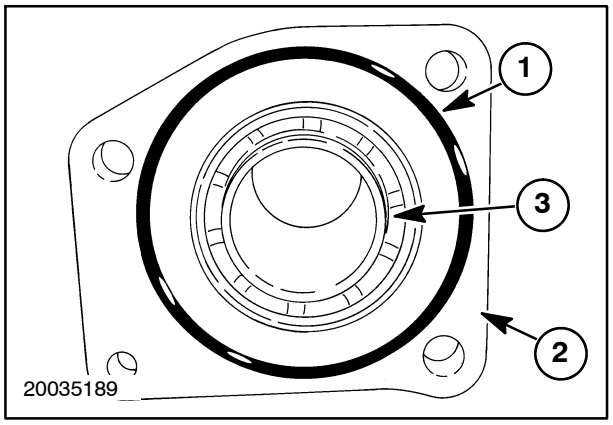
120

INPUT SHAFT RETAINER

Assembly

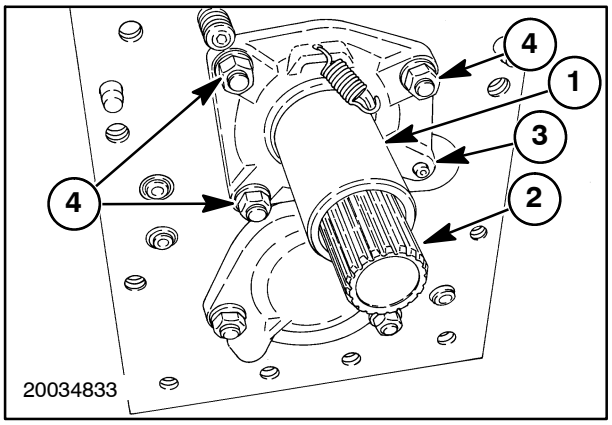
IMPORTANT: *Use caution not to lose the O ring on the back of the retainer during installation.*

1. Lubricate a new O ring, 1, with petroleum jelly and install in the groove on the back side of the retainer, 2.
2. Install a new input shaft seal, 3, in the retainer.
3. Lubricate the I.D. of the shaft seal.



121

4. Install the input shaft retainer, 1, onto the housing, over the input shaft, 2.
5. Locate the hole in the input shaft retainer over the roll pin, 3, in the reverse idler shaft.
6. Install and tighten the three nuts and washers, 4, to secure the input shaft retainer, 1.

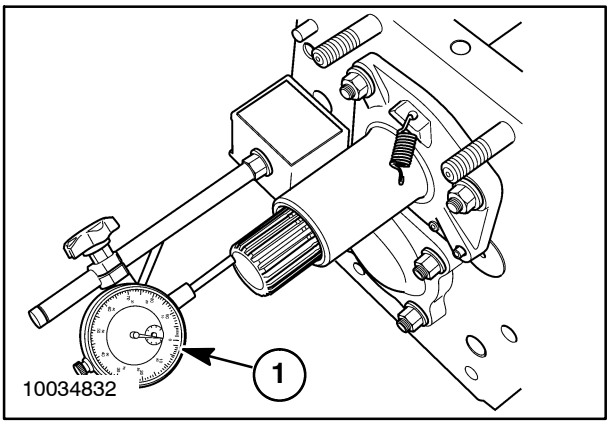


122

7. Use a dial indicator, 1, to measure input shaft axial end play. If axial end play is greater than 0.0 - 0.3 mm (0.0 - 0.012″), remove the input shaft retainer and insert shim(s).

NOTE: *Shims are available in sizes: 0.1, 0.2, 0.5 mm (0.004, 0.008, 0.020″).*

8. With appropriate shim(s) installed, re-install input shaft retainer and measure axial end play. Repeat steps 7 and 8 until within tolerance.



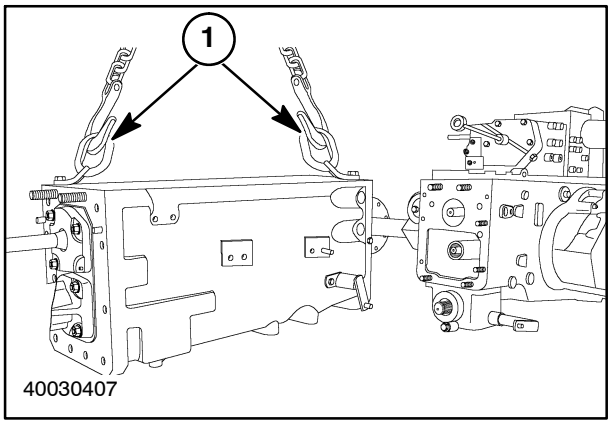
123

ATTACHING THE TRANSMISSION / DIFFERENTIAL

1. Attach two suitable lifting eyes, 1, to opposite corners of the transmission housing.
2. Attach a chain sling to the lift eyes and a suitable hoist.
3. Place Loctite gasket eliminator® 518 on the rear mating surface of the transmission housing.

NOTE: *Do not use silicone sealer.*

4. Carefully attach the transmission to the differential housing, making sure to align all shafts, splines and locating pins.

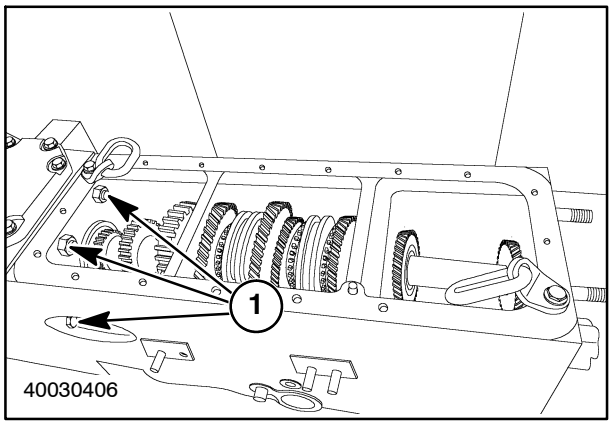


124

5. Secure transmission to differential housing with buckle-up bolts and nuts, 1.
6. Tighten and torque buckle-up bolts and nuts evenly to:

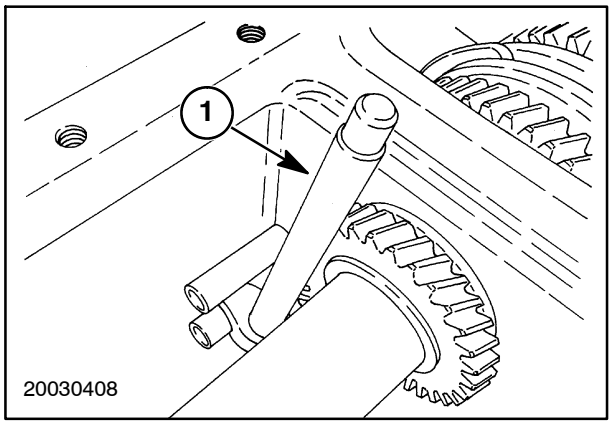
   M12 - 120 N·m (88 ft. lbs.)

   M14 - 145 N·m (107 ft. lbs.)
7. Remove lifting eyes.



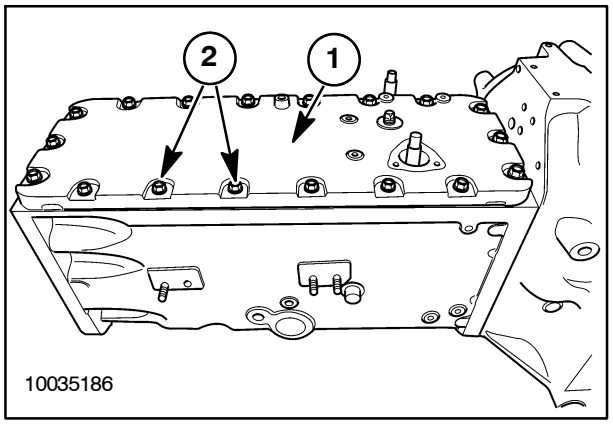
125

8. Install the shift arm, 1, into the transmission, between the upper and lower shift rail.



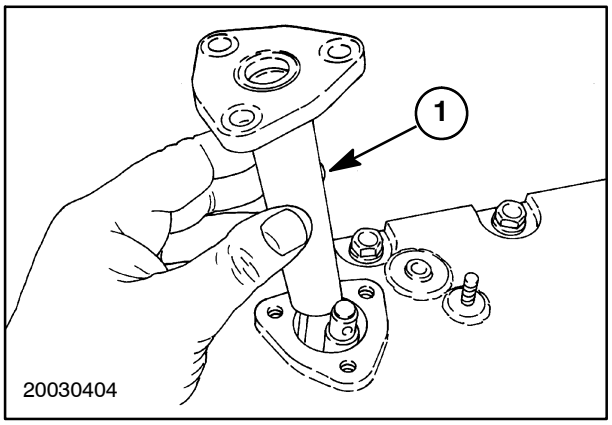
126

9. Place Loctite gasket eliminator® 518 on transmission case surface.
10. Install the transmission cover, 1, on the transmission housing.
11. Tighten and torque the retaining bolts, 2, to 55 N·m (40 ft. lbs.).



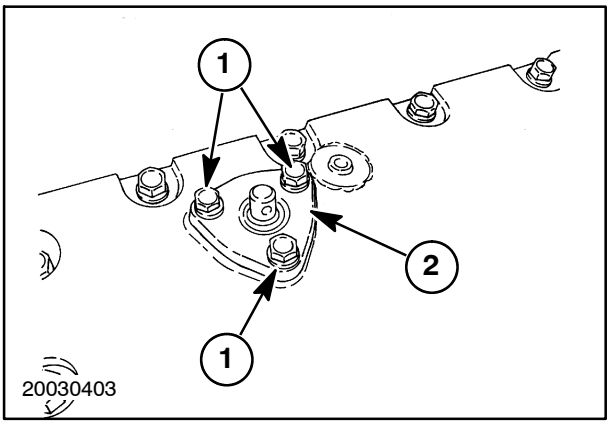
127

12. Install the shift arm cover, 1, over the shift arm and onto the transmission cover.



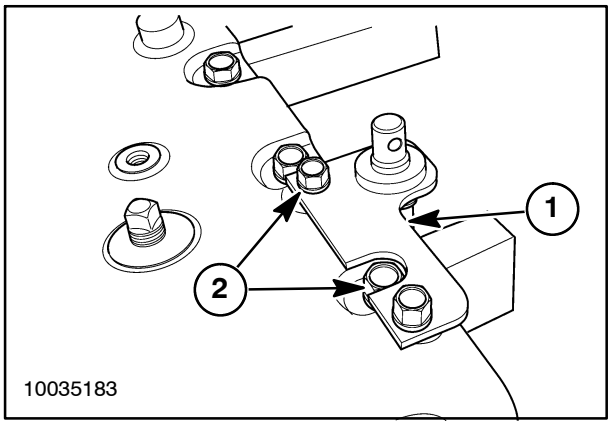
128

13. Install and tighten the three bolts, 1, to secure the shift arm cover, 2, to the transmission cover.



129

14. Install the shuttle shift arm retainer, 1, over the shift arm and secure with two bolts, 2. Tighten bolts securely.

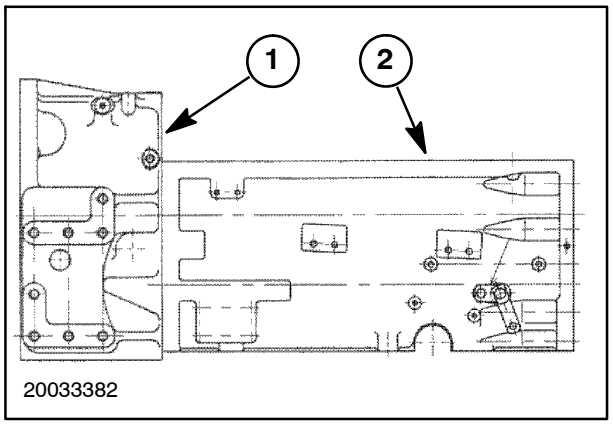


130

CLUTCH HOUSING

Assembly

1. Attach the clutch housing, 1, to the transmission, 2.

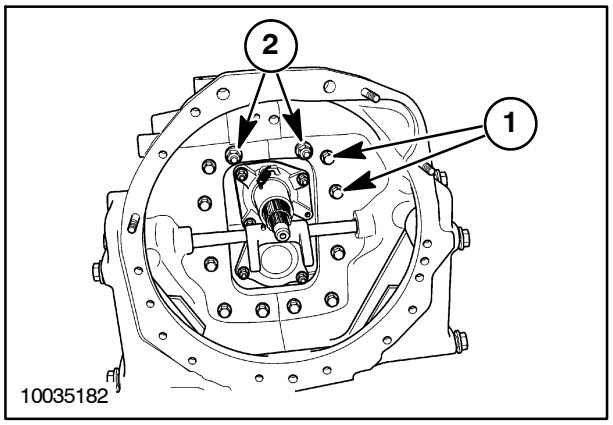


131

2. Install and torque the clutch housing bolts, 1, and nuts, 2, to:

   M12 - 120 N·m (88 ft. lbs.) - Bolts

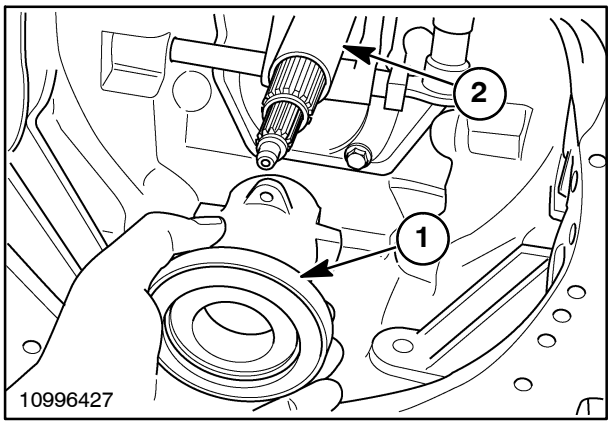
   M14 - 145 N·m (107 ft. lbs.) - Nuts



132

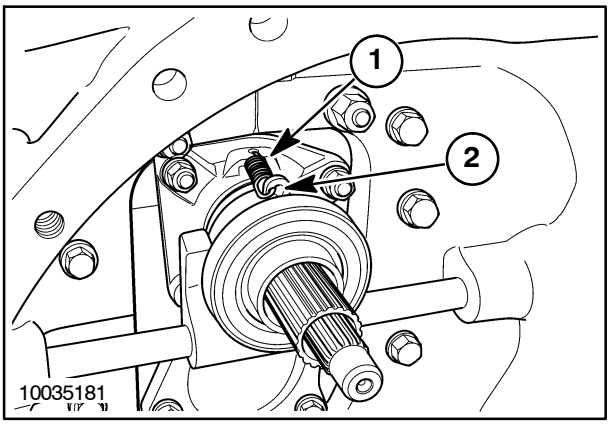
3. Install the clutch hub and bearing, 1, onto the input shaft, 2.

NOTE: *Lightly coat outer surface of input shaft with a never seize compound.*



133

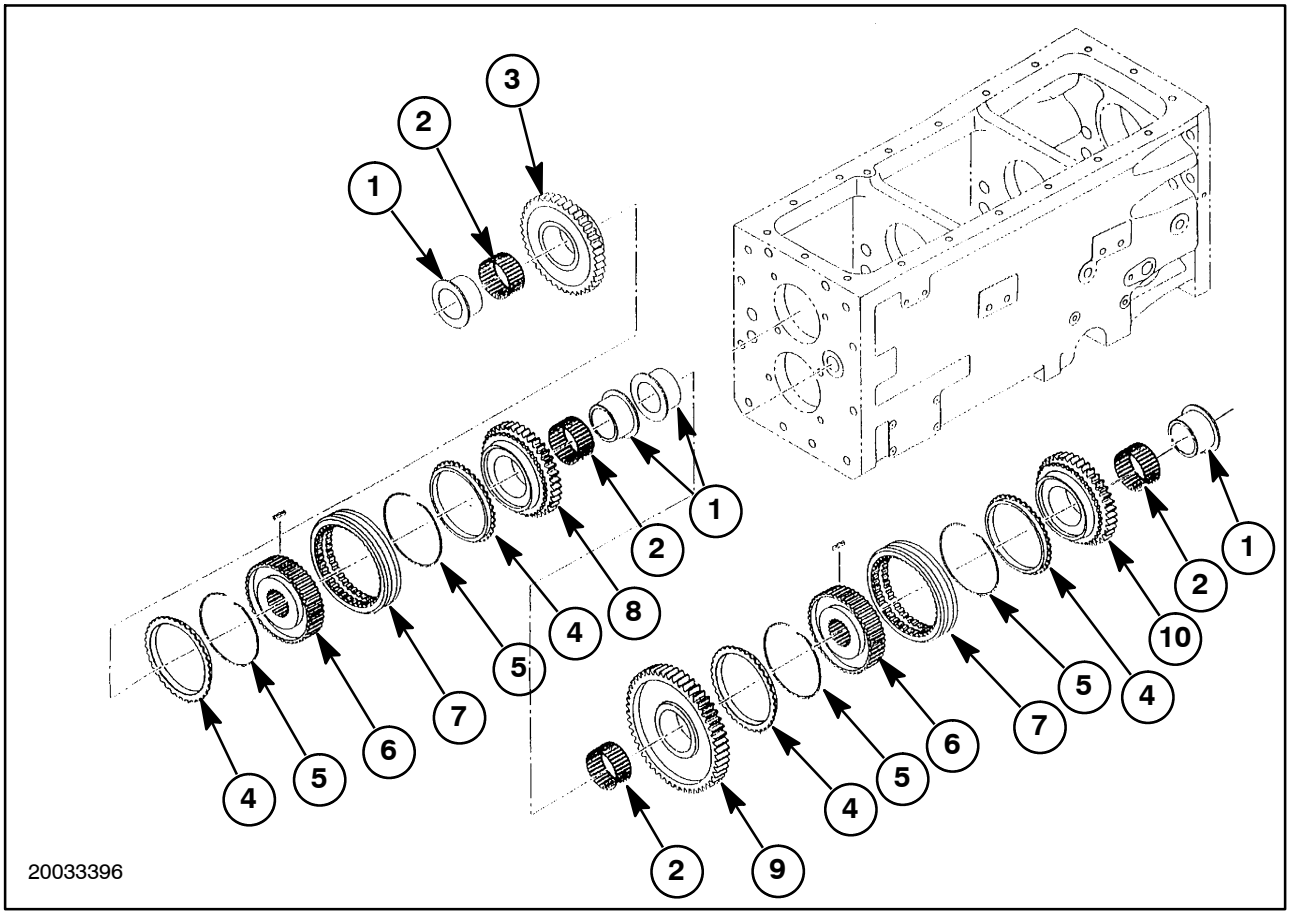
4. Connect the clutch hub return spring, 1, to the clutch hub, 2.



134

SYNCHRONIZERS - MAIN GEARS

The main transmission gears and synchronizers, may be disassembled, checked for wear or damage, and reassembled with new parts if necessary. Do not separate the assembly before reading the disassembly procedure.



135

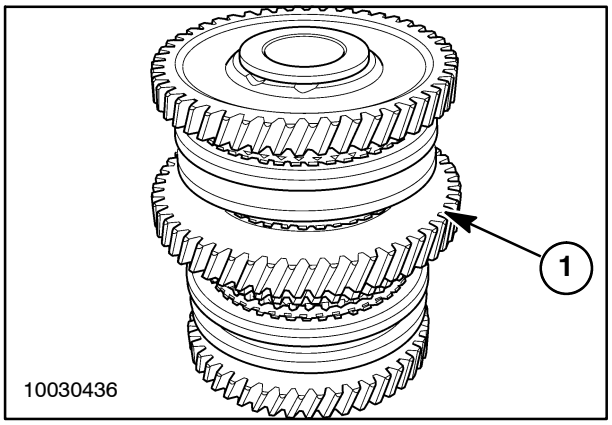
REF. #	PART DESCRIPTION	QTY.
1	Collar	4
2	Needle Bearing	4
3	Counter Gear 44T (3rd)	1
4	Synchronizer Ring	4
5	Spring Retainer	4
6	Synchronizer Gear (w/keys)	2
7	Synchronizer Coupling (Sliding)	2
8	Counter Gear 40T (4th)	1
9	Counter Gear 52T (1st)	1
10	Counter Gear 48T (2nd)	1

MAIN TRANSMISSION GEARS/ SYNCHRONIZER

Disassembly

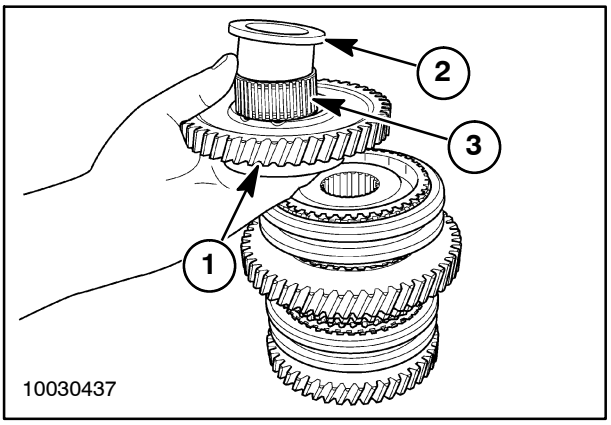
IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to applying matching marks on gears and couplers.*

1. Place the main transmission gear/synchronizer assembly, 1, on a workbench as shown.



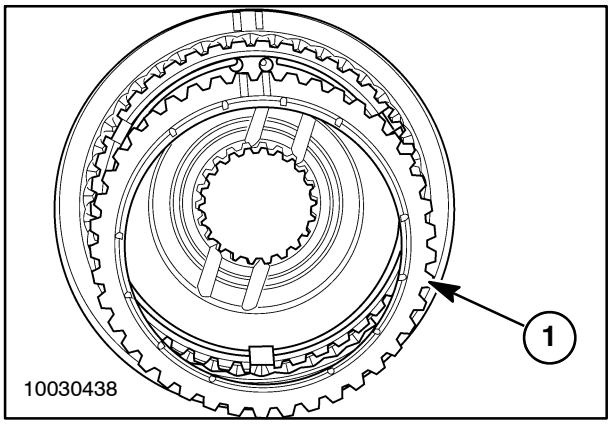
136

2. Remove the 48T counter gear (2nd), 1, collar, 2, and needle bearing, 3.



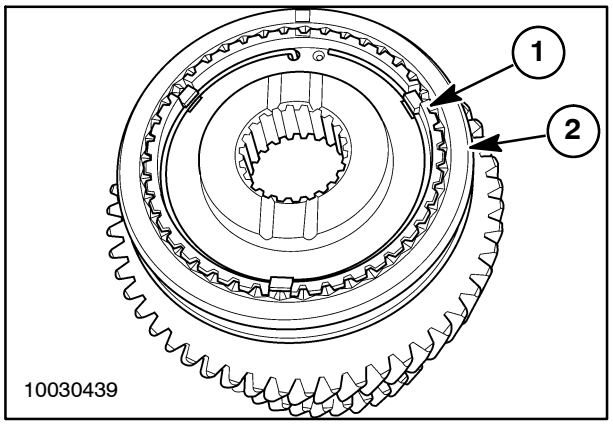
137

3. Remove the synchronizer ring, 1.



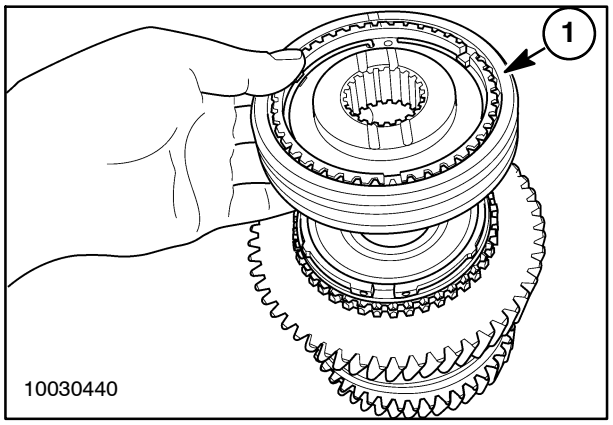
138

4. Use a paint pen to mark the synchronizer gear, 1, and coupling, 2, for proper alignment during assembly.



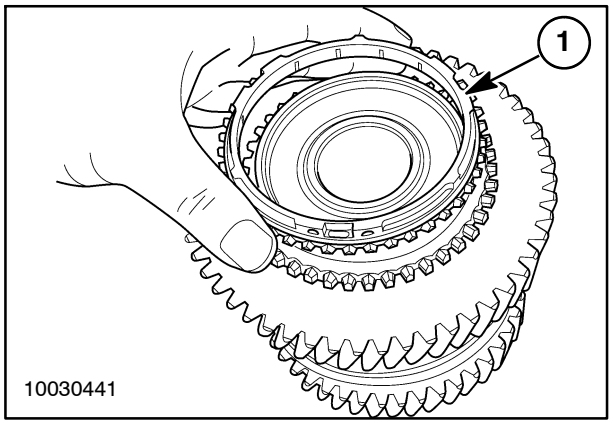
139

5. Carefully remove the synchronizer gear and coupler assembly, 1.



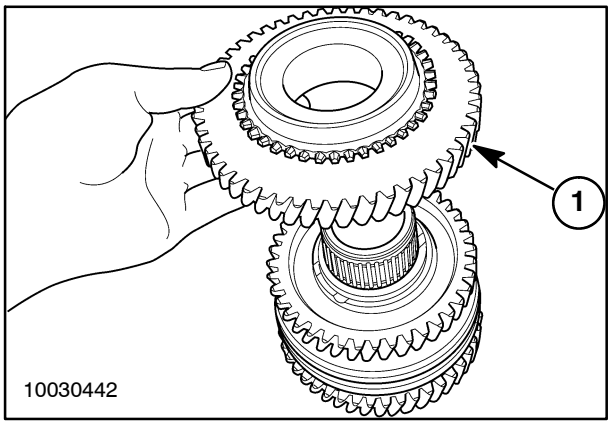
140

6. Remove the synchronizer ring, 1.



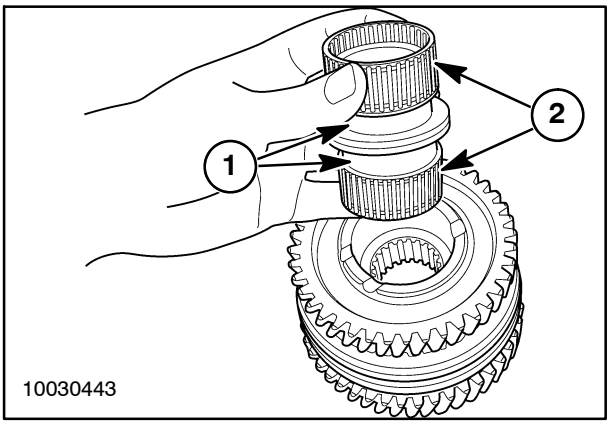
141

7. Remove the 52T counter gear (1st), 1.



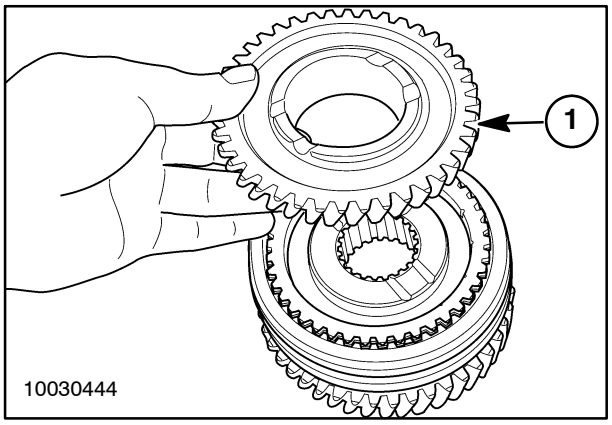
142

8. Remove the collars, 1, and two needle bearings, 2.



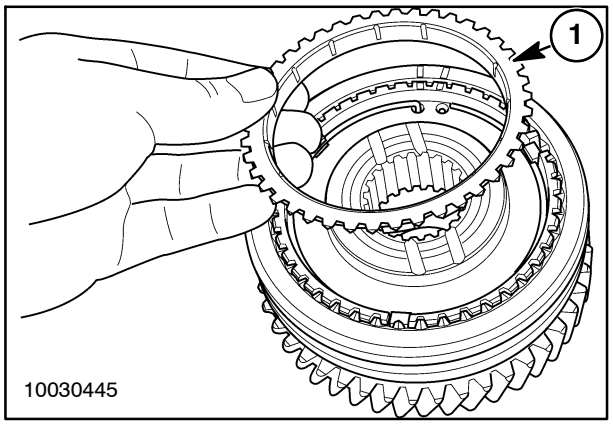
143

9. Remove the 40T counter gear (4th), 1.



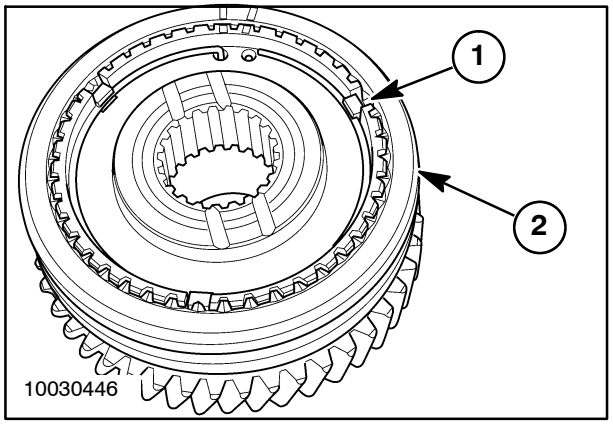
144

10. Remove the synchronizer ring, 1.



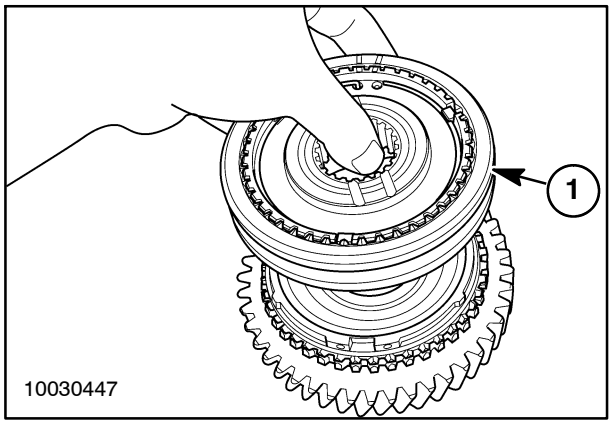
145

11. Use a paint pen to mark the synchronizer gear, 1, and coupling, 2, for proper alignment during assembly.



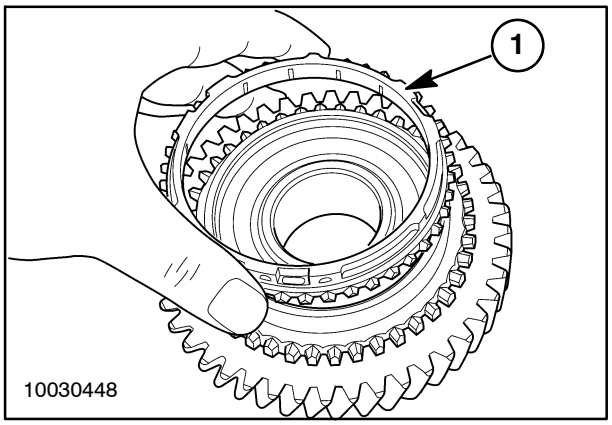
146

12. Carefully remove the synchronizer gear/coupling assembly, 1.



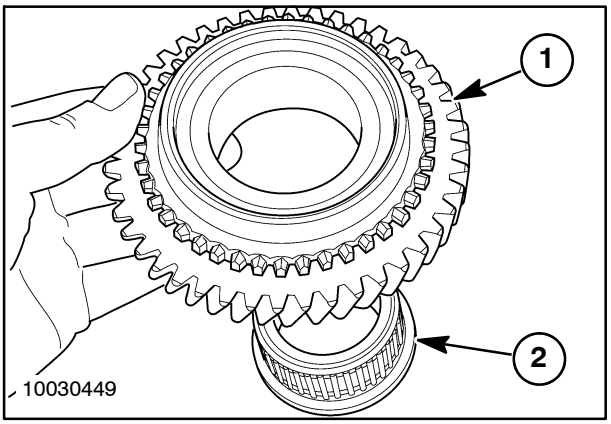
147

13. Remove the synchronizer ring, 1.



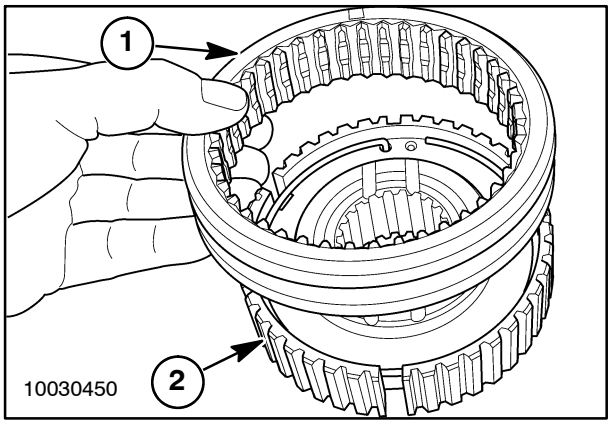
148

14. Remove the 44T counter gear (3rd), 1, from the collar and needle bearing, 2.
15. Separate the needle bearing from the collar.



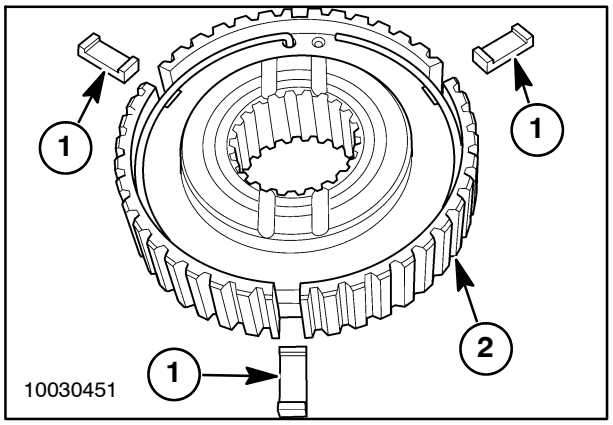
149

16. Carefully remove the sliding coupling, 1, from the synchronizer gear, 2.



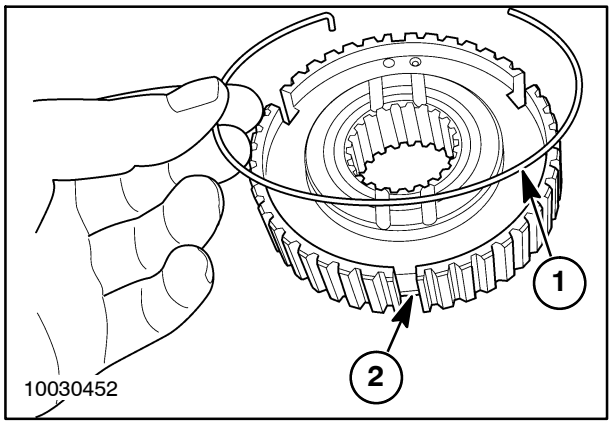
150

17. Remove the three keys, 1, from the synchronizer gear, 2.



151

18. Remove the spring retainer, 1, from each side of the synchronizer gear, 2.
19. Repeat steps 16 - 18 for the second synchronizer gear assembly.



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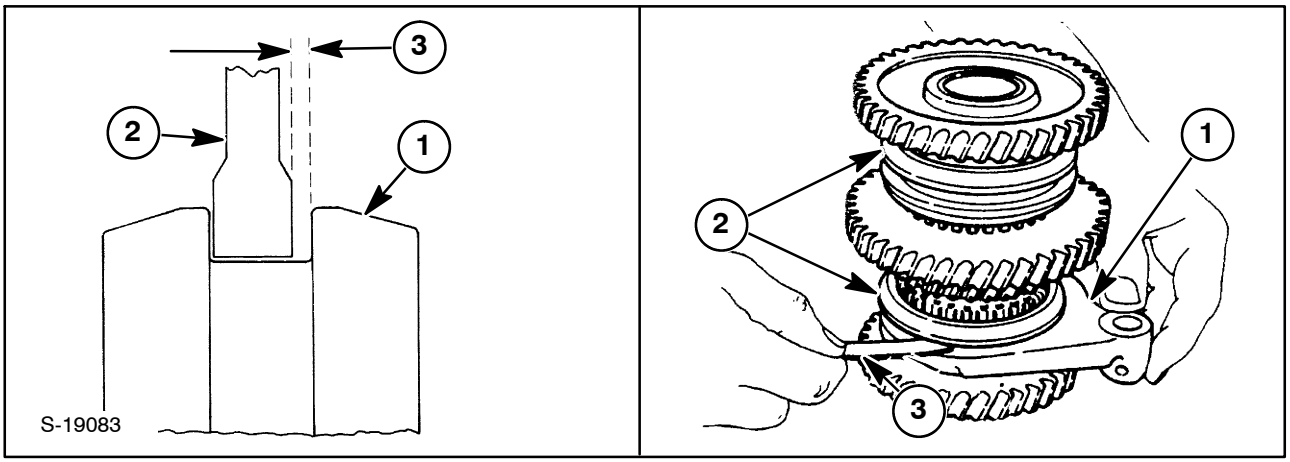
SYNCHRONIZERS

Inspection

1. Inspect the synchronizer parts for excessive wear, chipped or worn teeth, damaged splines and other damage.
2. Place the synchronizer/gear assembly on the workbench and insert the shift fork, 1, into the sliding collar, 2.
3. Use a feeler gauge, 3, to measure the side clearance between the collar and fork.

STANDARD CLEARANCE	ALLOWABLE CLEARANCE LIMIT
0.2 - 0.4 mm (0.008 - 0.016″)	1.0 mm (0.039″)

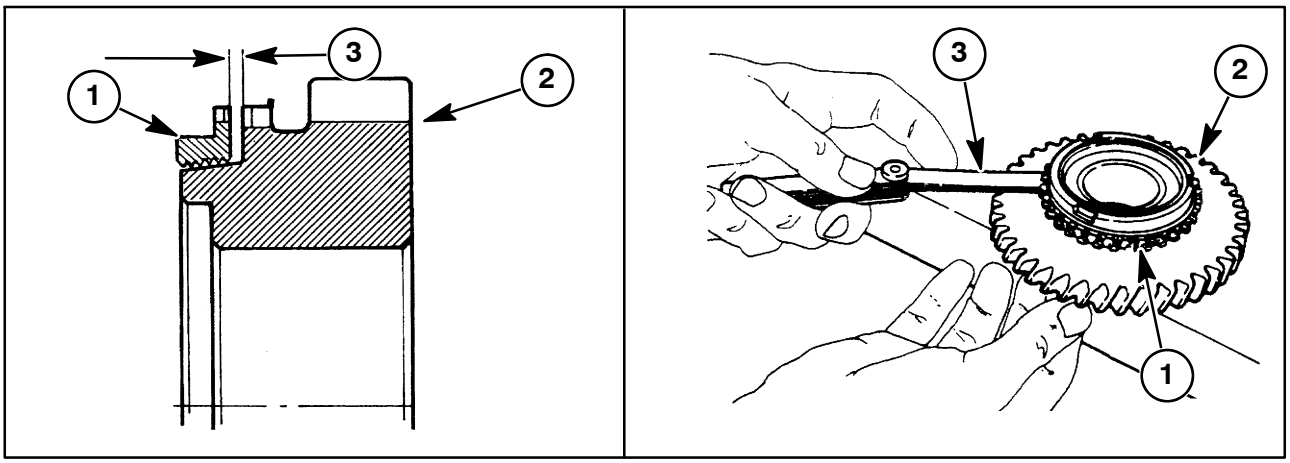


153

4. Place the synchronizer rings, 1, on the synchronizer gears, 2, and use a feeler gauge, 3, to measure the clearance to determine cone wear.

MINIMUM CLEARANCE
0.8 mm (0.031″)

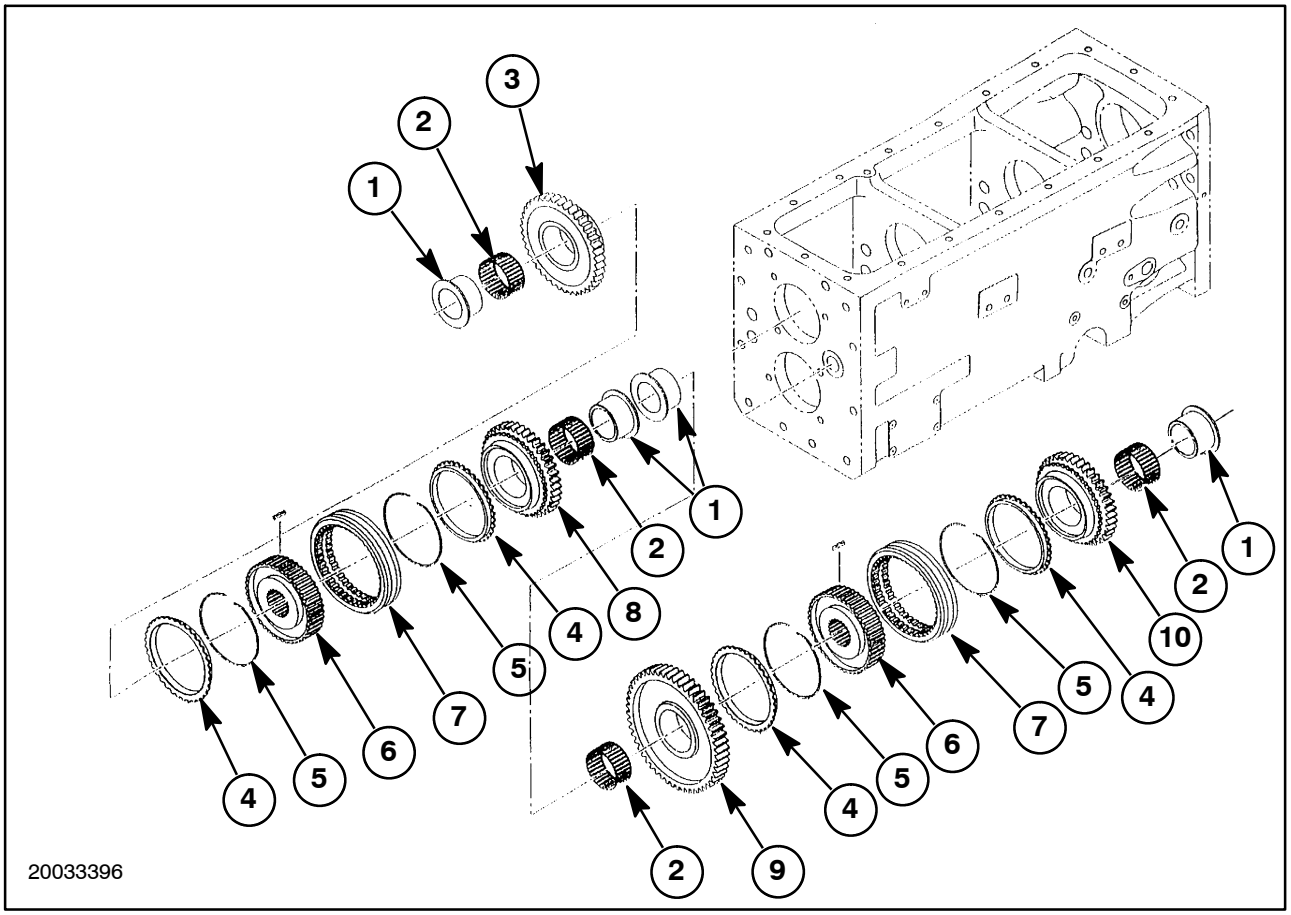
5. Use matching marks to check all synchronizer/gear assembly parts for damage or rough operation.
6. Inspect shift forks for bent or other damage in addition to clearance inspection.



154

Synchronizers - Main Gears

The main transmission gears and synchronizers, are assembled and installed into the transmission as an assembly.



155

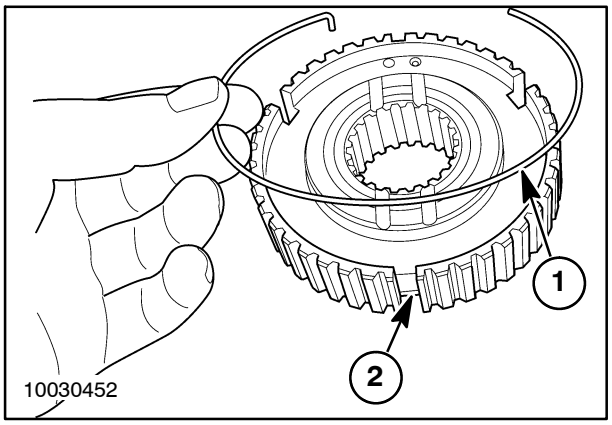
REF. #	PART DESCRIPTION	QTY.
1	Collar	4
2	Needle Bearing	4
3	Counter Gear 44T (3rd)	1
4	Synchronizer Ring	4
5	Spring Retainer	4
6	Synchronizer Gear (w/keys)	2
7	Synchronizer Coupling (Sliding)	2
8	Counter Gear 40T (4th)	1
9	Counter Gear 52T (1st)	1
10	Counter Gear 48T (2nd)	1

MAIN TRANSMISSION GEARS/ SYNCHRONIZER

Assembly

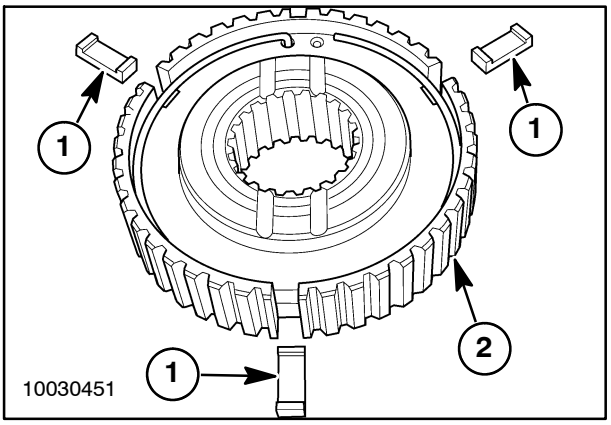
IMPORTANT: *Lubricate all parts with clean hydraulic oil before assembly.*

1. Install the spring retainer, 1, on each side of the synchronizer gear, 2.



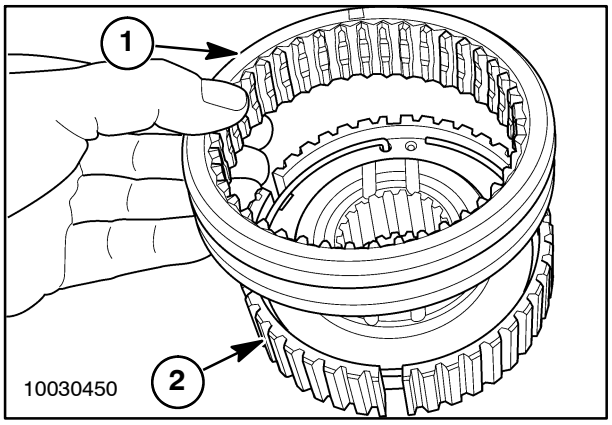
156

2. Install the three keys, 1, on the synchronizer gear, 2.



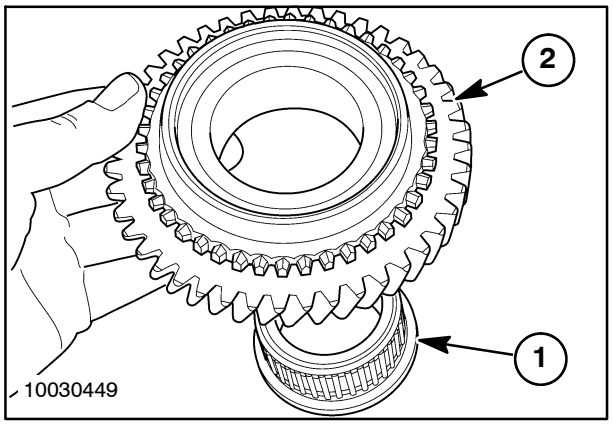
157

3. Carefully install the sliding coupling, 1, on the synchronizer gear, 2, aligning the matching marks made prior to disassembly.
4. Repeat step 1 - 3 for the second, synchronizer gear assembly.



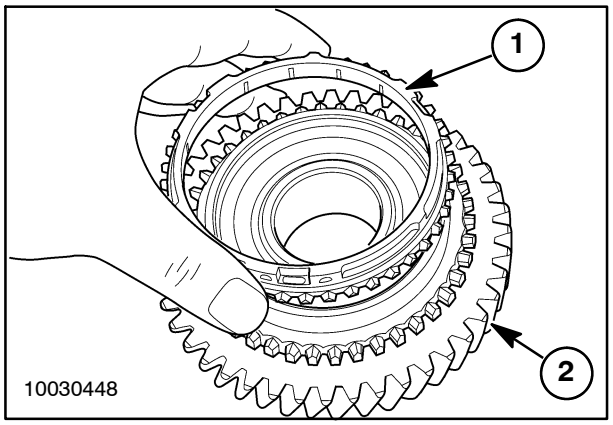
158

5. Install the needle bearing on the collar, 1.
6. Install the 44T counter gear (3rd), 2, on the collar and needle bearing, 1.



159

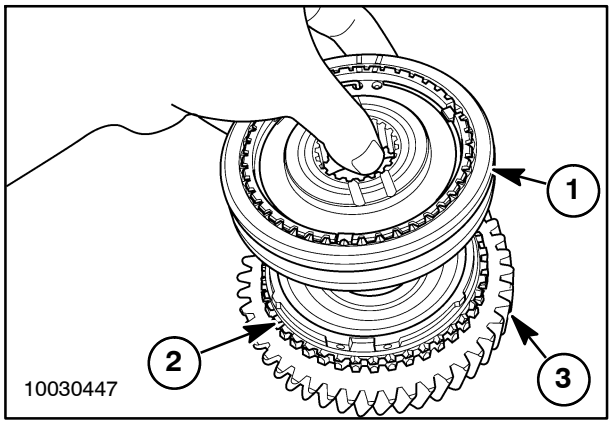
7. Install the synchronizer ring, 1, on the 44T counter gear (3rd), 2.



160

8. Carefully install the synchronizer gear/coupling assembly, 1, on the synchronizer ring, 2, and 44T counter gear (3rd), 3.

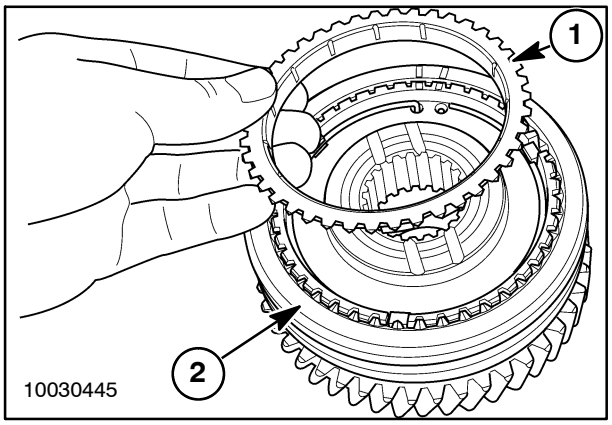
NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



161

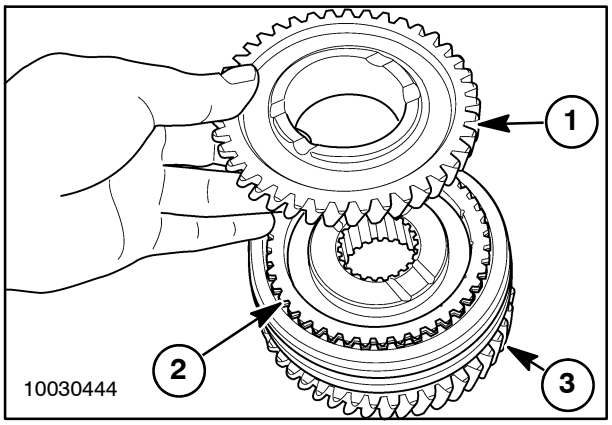
9. Install the synchronizer ring, 1, on the synchronizer gear/coupling assembly, 2.

NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



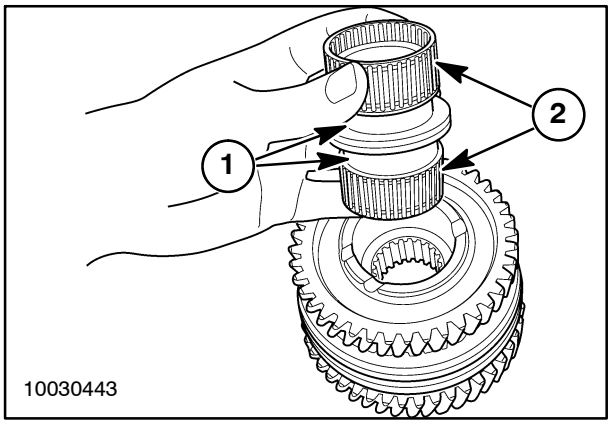
162

10. Install the 40T counter gear (4th), 1, on the synchronizer ring, 2, and the synchronizer gear/coupling assembly, 3.



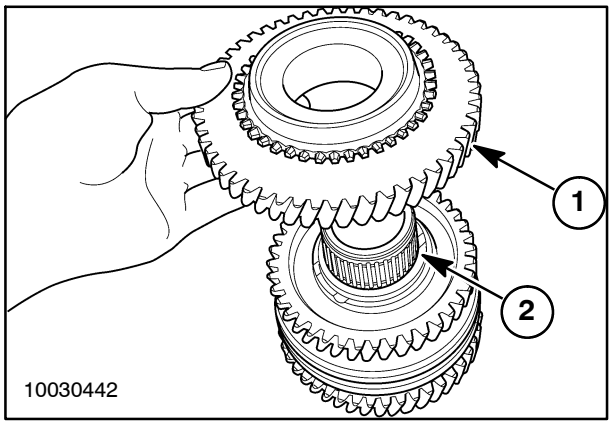
163

11. Install the collars, 1, and two needle bearings, 2.



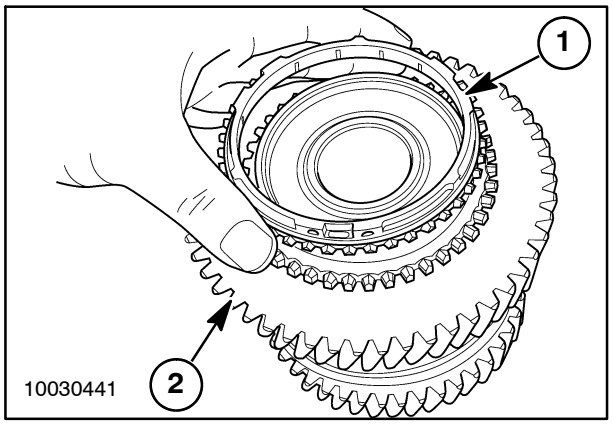
164

12. Install the 52T counter gear (1st), 1, on the center collar and needle bearing, 2.



165

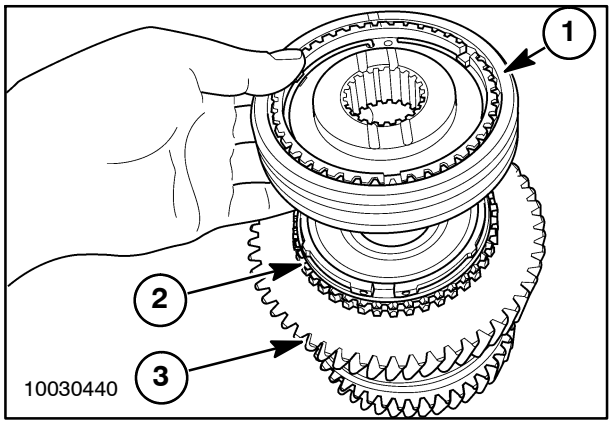
13. Install the synchronizer ring, 1, on the 52T counter gear (1st), 2.



166

14. Carefully install the synchronizer gear and coupler assembly, 1, on the synchronizer ring, 2, and 52T counter gear (1st), 3.

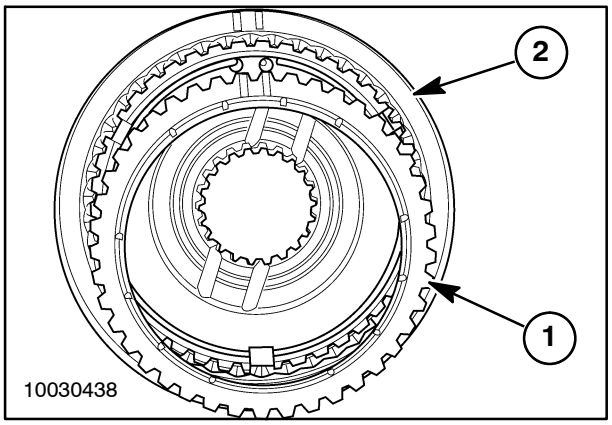
NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



167

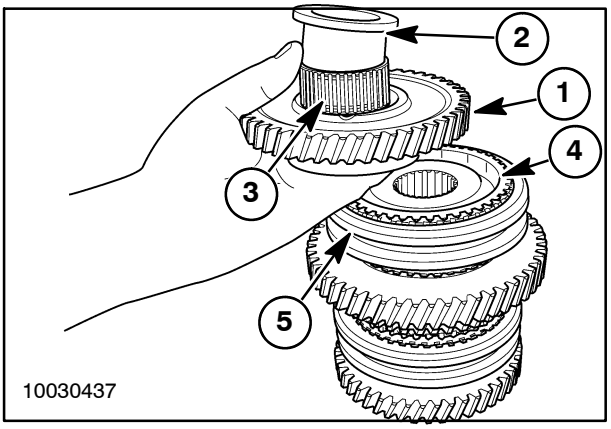
15. Install the synchronizer ring, 1, on the synchronizer gear/coupling assembly, 2.

NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



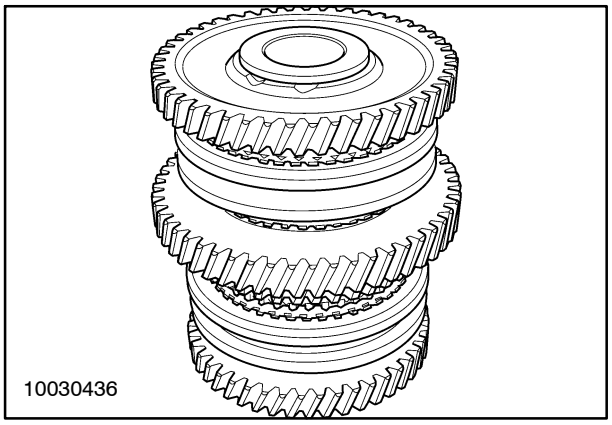
168

16. Install the 48T counter gear (2nd), 1, collar, 2, and needle bearing, 3, the synchronizer ring, 4, on the synchronizer gear/coupling assembly, 5.



169

IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to assembly into the transmission housing.*



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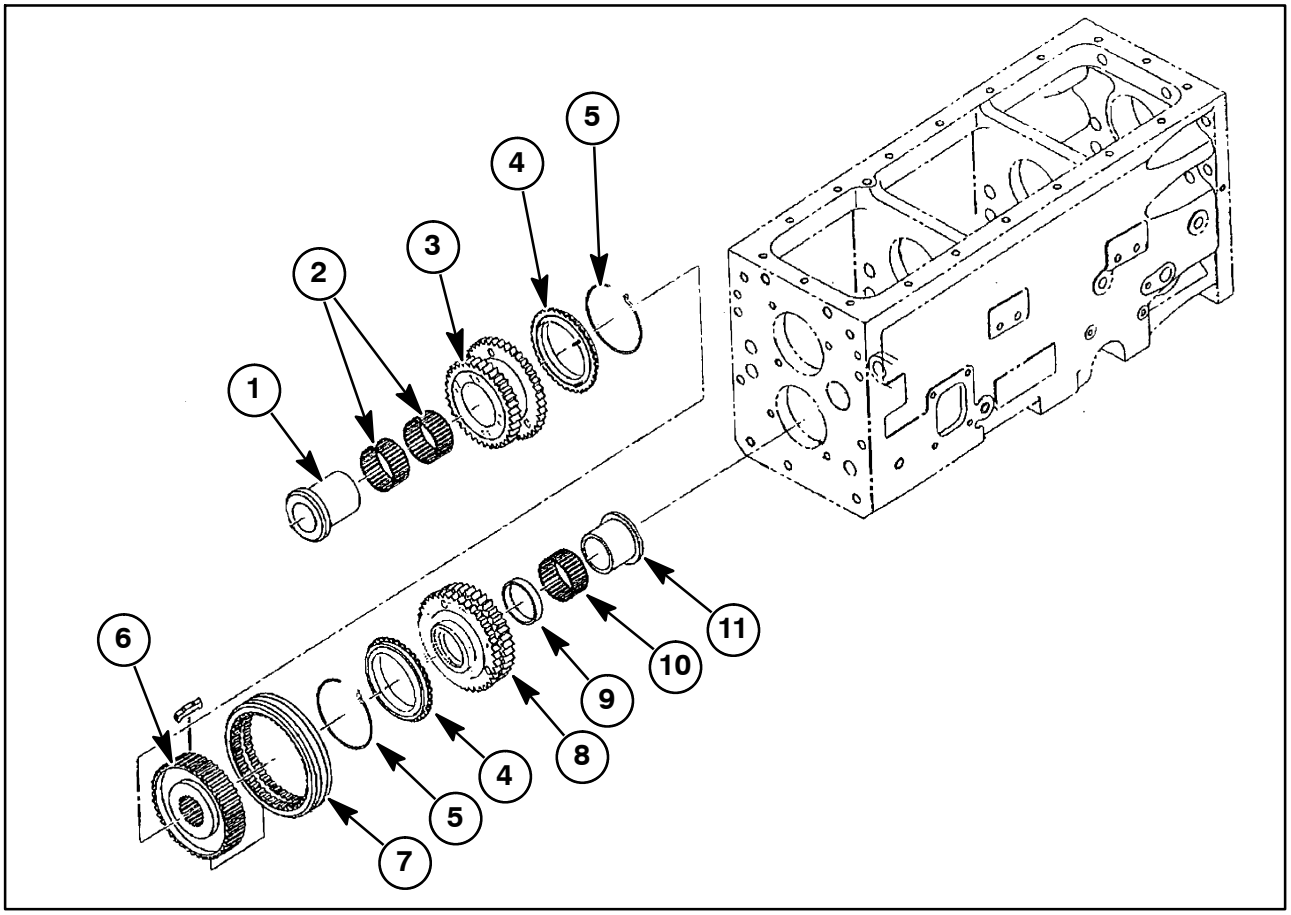
SYNCHRONIZERS - SHUTTLE GEARS

The transmission shuttle gears and synchronizers, may be disassembled, checked for wear or damage, and reassembled with new parts if necessary. Do not separate the assembly before reading the disassembly procedure.



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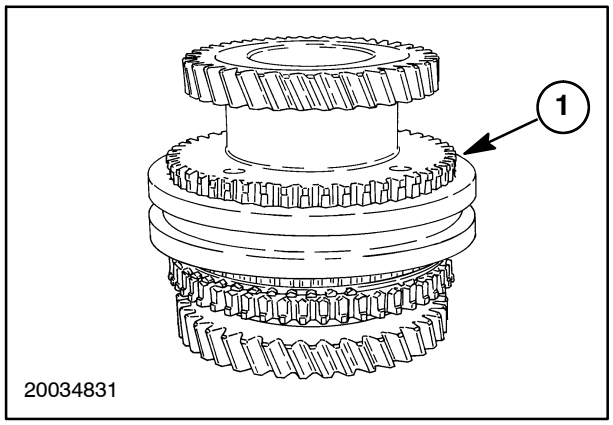
REF. #	PART DESCRIPTION	QTY.
1	Collar	1
2	Needle Bearing	2
3	Counter Gear 35T (Reverse)	1
4	Synchronizer Ring (3 pieces)	2
5	Spring Retainer	2
6	Synchronizer Gear (w/keys)	1
7	Synchronizer Coupling (Sliding)	1
8	Counter Gear 39T (Forward)	1
9	Spacer	1
10	Needle Bearing	1
11	Collar	1

TRANSMISSION SHUTTLE GEARS/ SYNCHRONIZER

Disassembly

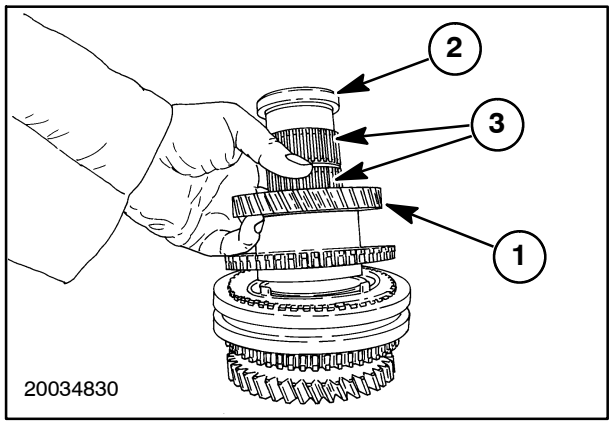
IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to applying matching marks on gears and couplers.*

1. Place the main transmission shuttle gear/ synchronizer assembly, 1, on a workbench as shown.



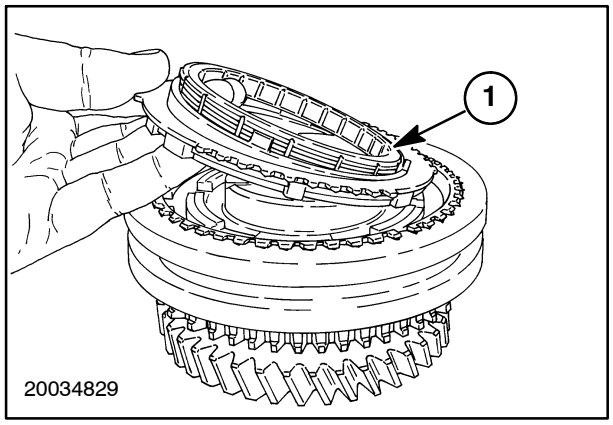
172

2. Remove the 35T counter gear (reverse), 1, collar, 2, and needle bearings, 3.



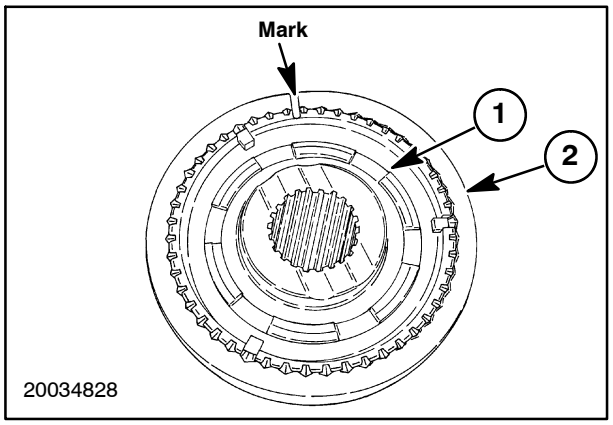
173

3. Remove the synchronizer ring (3 pieces), 1.



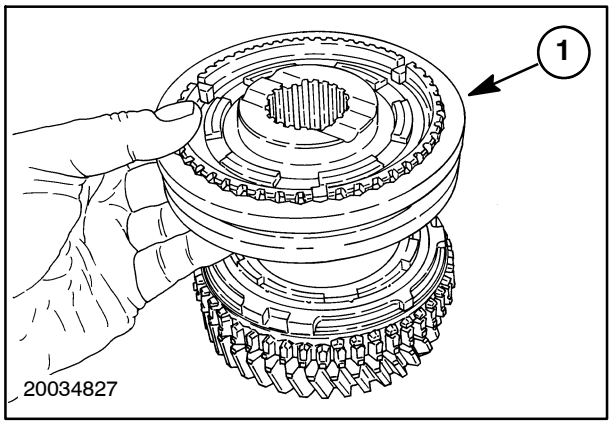
174

4. Use a paint pen to mark the synchronizer gear, 1, and coupling, 2, for proper alignment during assembly.



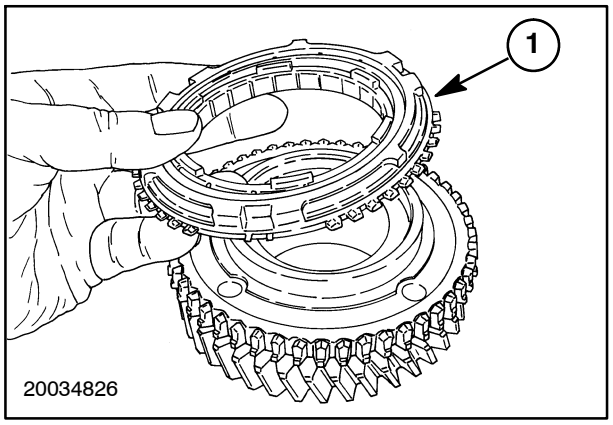
175

5. Carefully remove the synchronizer gear and coupler assembly, 1.



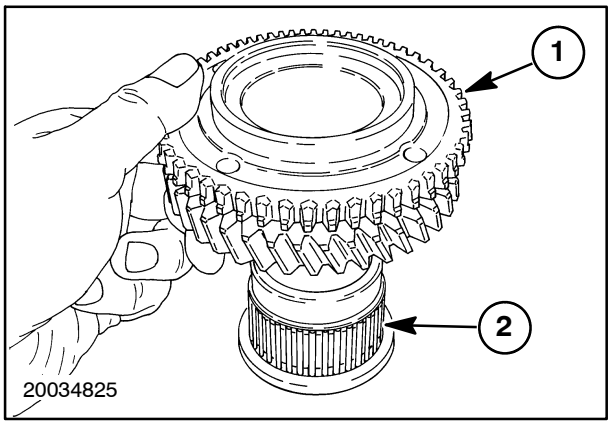
176

6. Remove the synchronizer ring, 1, (3 pieces).



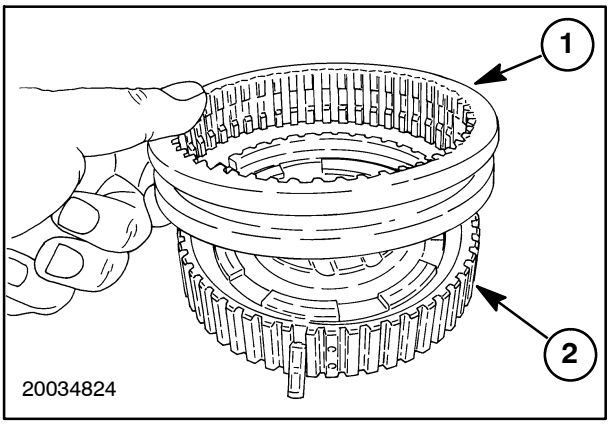
177

7. Remove the 39T counter gear (forward), 1, from the collar and needle bearing, 2.
8. Separate the needle bearing from the collar.



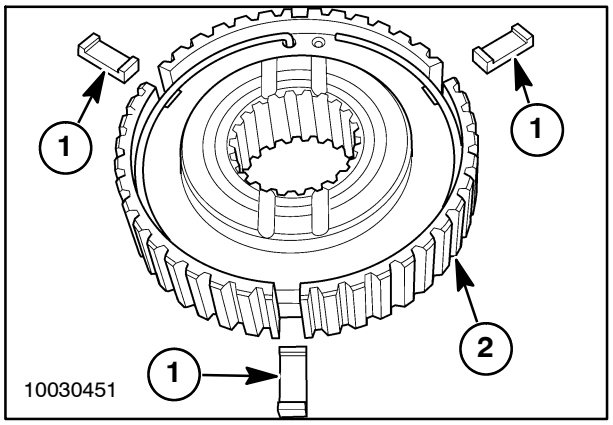
178

9. Remove the synchronizer ring, 1, from the synchronizer gear, 2.



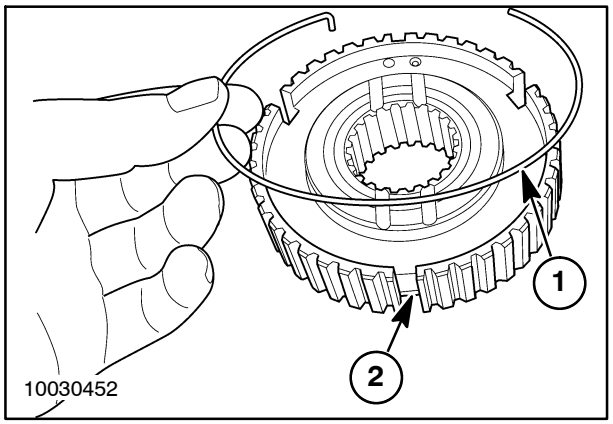
179

10. Remove the three keys, 1, from the synchronizer gear, 2.



180

11. Remove the spring retainer, 1, from each side of the synchronizer gear, 2.



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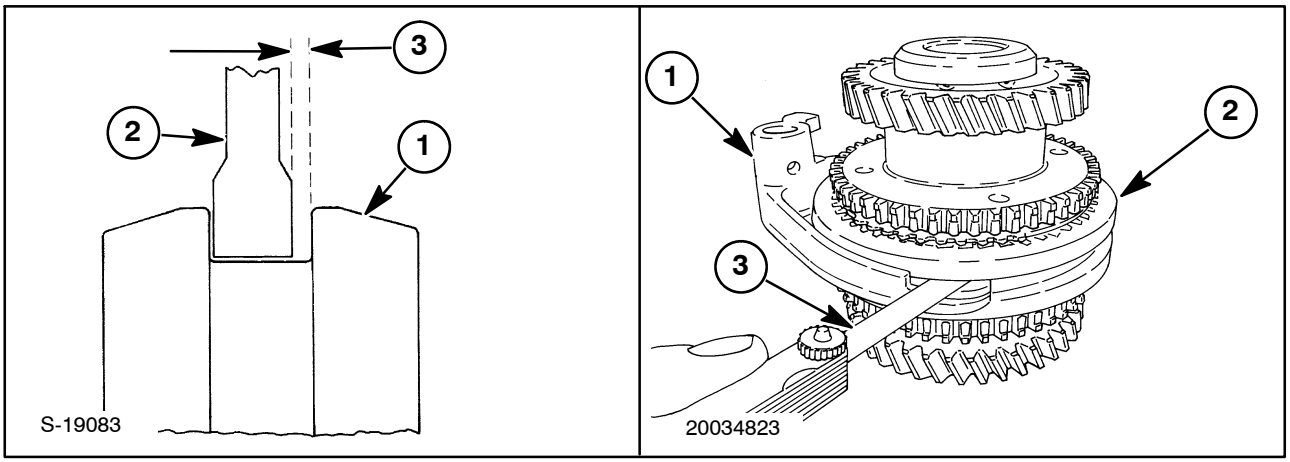
SYNCHRONIZERS

Inspection

1. Inspect the synchronizer parts for excessive wear, chipped or worn teeth, damaged splines and other damage.
2. Place the synchronizer/gear assembly on the workbench and insert the shift fork, 1, into the sliding collar, 2.
3. Use a feeler gauge, 3, to measure the side clearance between the collar and fork.

STANDARD CLEARANCE	ALLOWABLE CLEARANCE LIMIT
0.2 - 0.4 mm (0.008 - 0.016″)	1.0 mm (0.039″)



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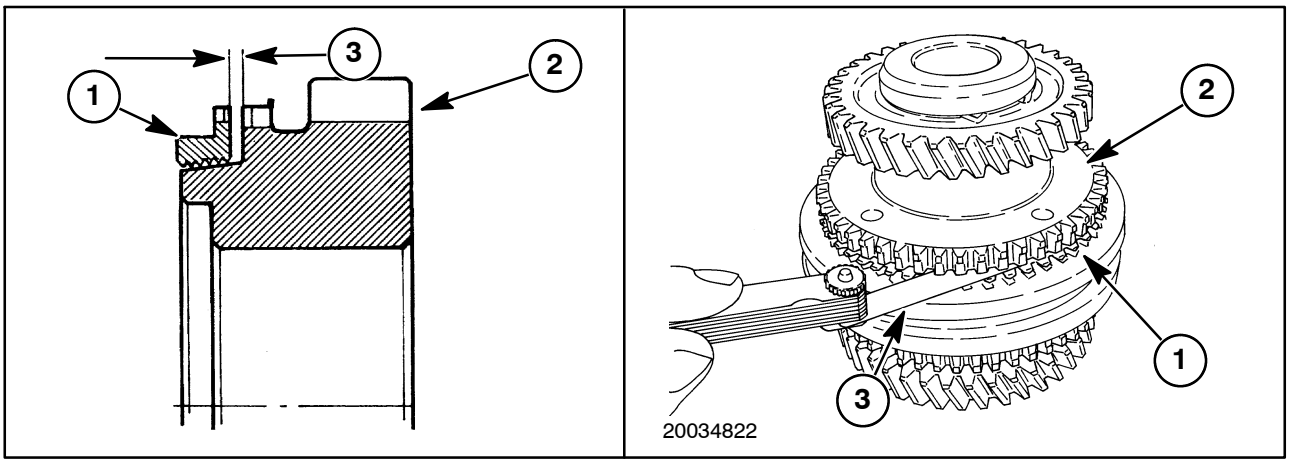
4. Place the synchronizer rings, 1, on the synchronizer gears, 2, and use a feeler gauge, 3, to measure the clearance to determine cone wear.

MINIMUM CLEARANCE
0.8 mm (0.031″)

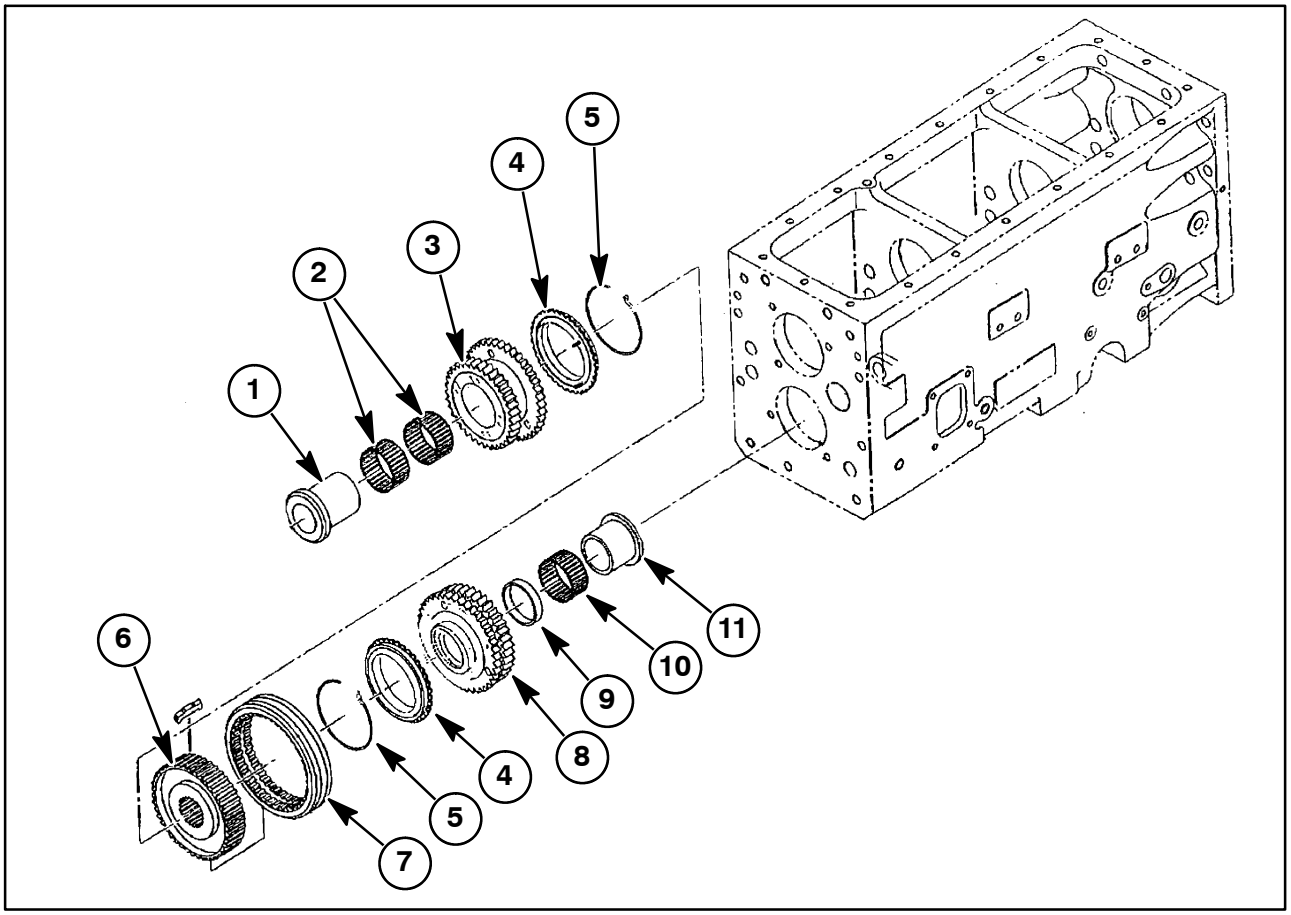
5. Use matching marks to check all synchronizer/gear assembly parts for damage or rough operation.
6. Inspect shift forks for bent or other damage in addition to clearance inspection.



183

Synchronizers - Shuttle Gears

The transmission shuttle gears and synchronizers, are assembled and installed into the transmission as an assembly.



184

REF. #	PART DESCRIPTION	QTY.
1	Collar	1
2	Needle Bearing	2
3	Counter Gear 35T (Reverse)	1
4	Synchronizer Ring (3 pieces)	2
5	Spring Retainer	2
6	Synchronizer Gear (w/keys)	1
7	Synchronizer Coupling (Sliding)	1
8	Counter Gear 39T (Forward)	1
9	Spacer	1
10	Needle Bearing	1
11	Collar	1

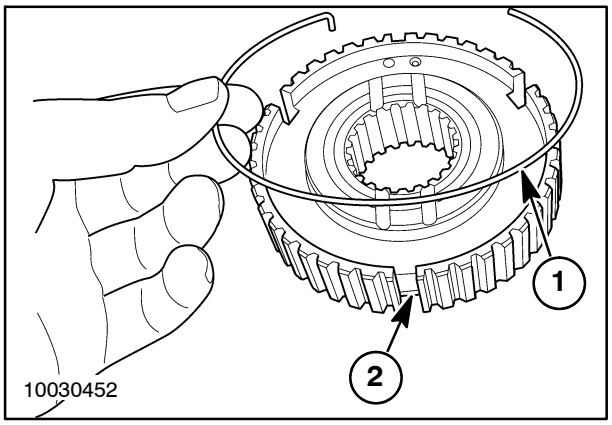
MAIN TRANSMISSION GEARS/ SYNCHRONIZER

Assembly

IMPORTANT: *Lubricate all parts with clean hydraulic oil before assembly.*

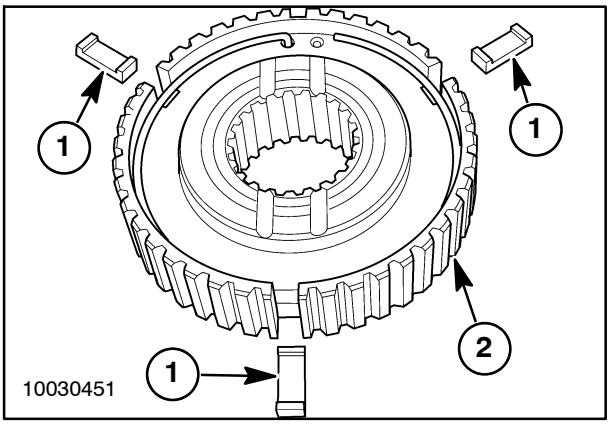
1. Install the spring retainer, 1, on each side of the synchronizer gear, 2.

NOTE: *Be sure spring retainer covers all three of the key slots when positioning retainer for installation.*



185

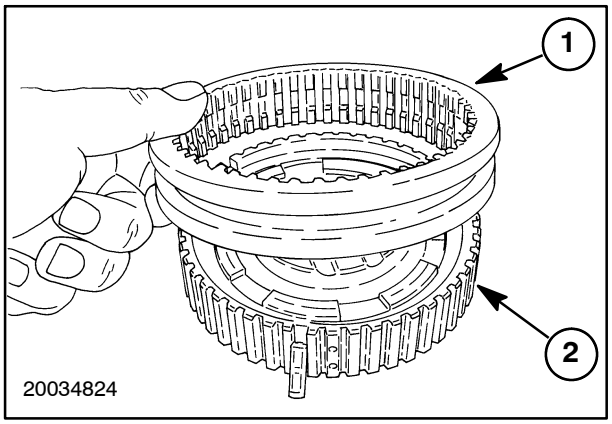
2. Install the three keys, 1, on the synchronizer gear, 2.



186

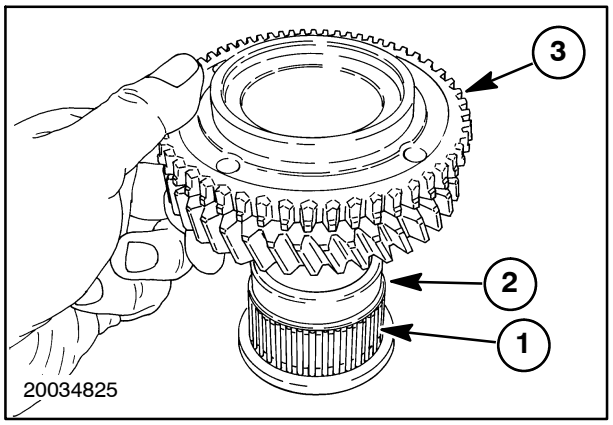
3. Carefully install the synchronizer coupling, 1, on the synchronizer gear, 2, aligning the matching marks made prior to disassembly.

NOTE: *Push keys toward gear while sliding the coupling onto the gear.*



187

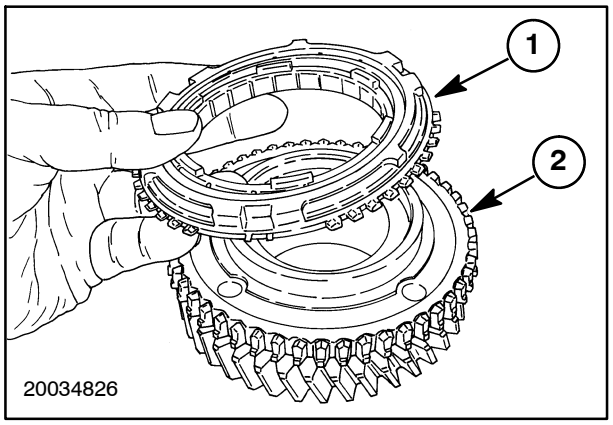
4. Install the needle bearing, 1, on the collar, 2.
5. Install the 39T counter gear (forward), 3, on the collar, 2, and needle bearing, 1.



188

6. Install the synchronizer ring (3 piece), 1, on the 39T counter gear (forward), 2.

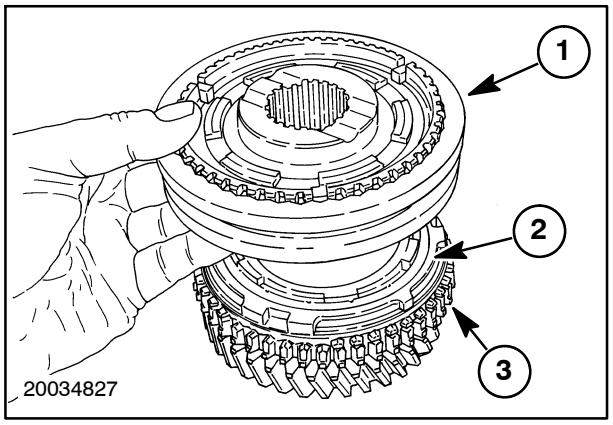
NOTE: *Be certain to align the four tabs on the center synchronizer ring, with the holes in the forward gear.*



189

7. Carefully install the synchronizer gear/coupling assembly, 1, on the synchronizer ring, 2, and 39T counter gear (reverse), 3.

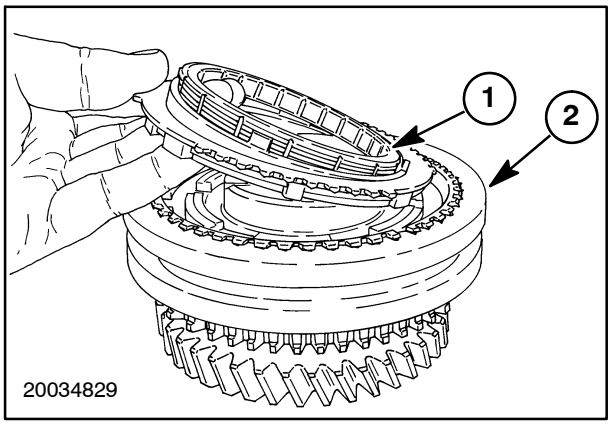
NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly. Align marks made during disassembly.*



190

8. Install the synchronizer ring, 1, on the synchronizer gear/coupling assembly, 2.

NOTE: *Be sure to align notches in synchronizer ring with keys in synchronizer gear assembly.*



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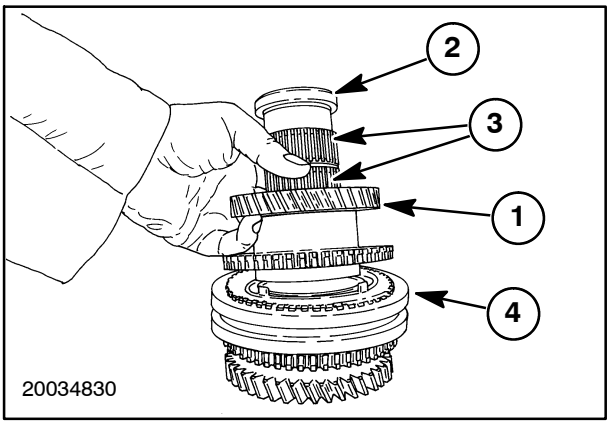
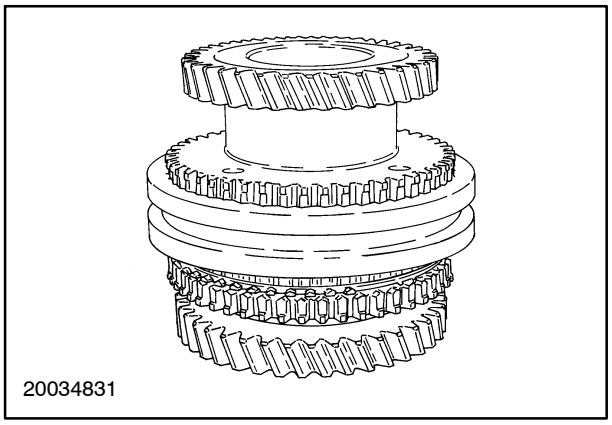
9. Install the 35T counter gear (reverse), 1, collar, 2, and needle bearings, 3, on the synchronizer gear/coupling assembly, 4.

NOTE: *Be certain to align the four tabs on the center synchronizer ring, with the holes in the reverse gear.*



192

IMPORTANT: *Use care when handling the gear/synchronizer assembly. It is very important to avoid having the assembly separate prior to assembly into the transmission housing.*



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SECTION 23 - FWD DRIVELINE

Chapter 1 - FWD Driveline

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	Front Wheel Gearbox	4
	Removal	4
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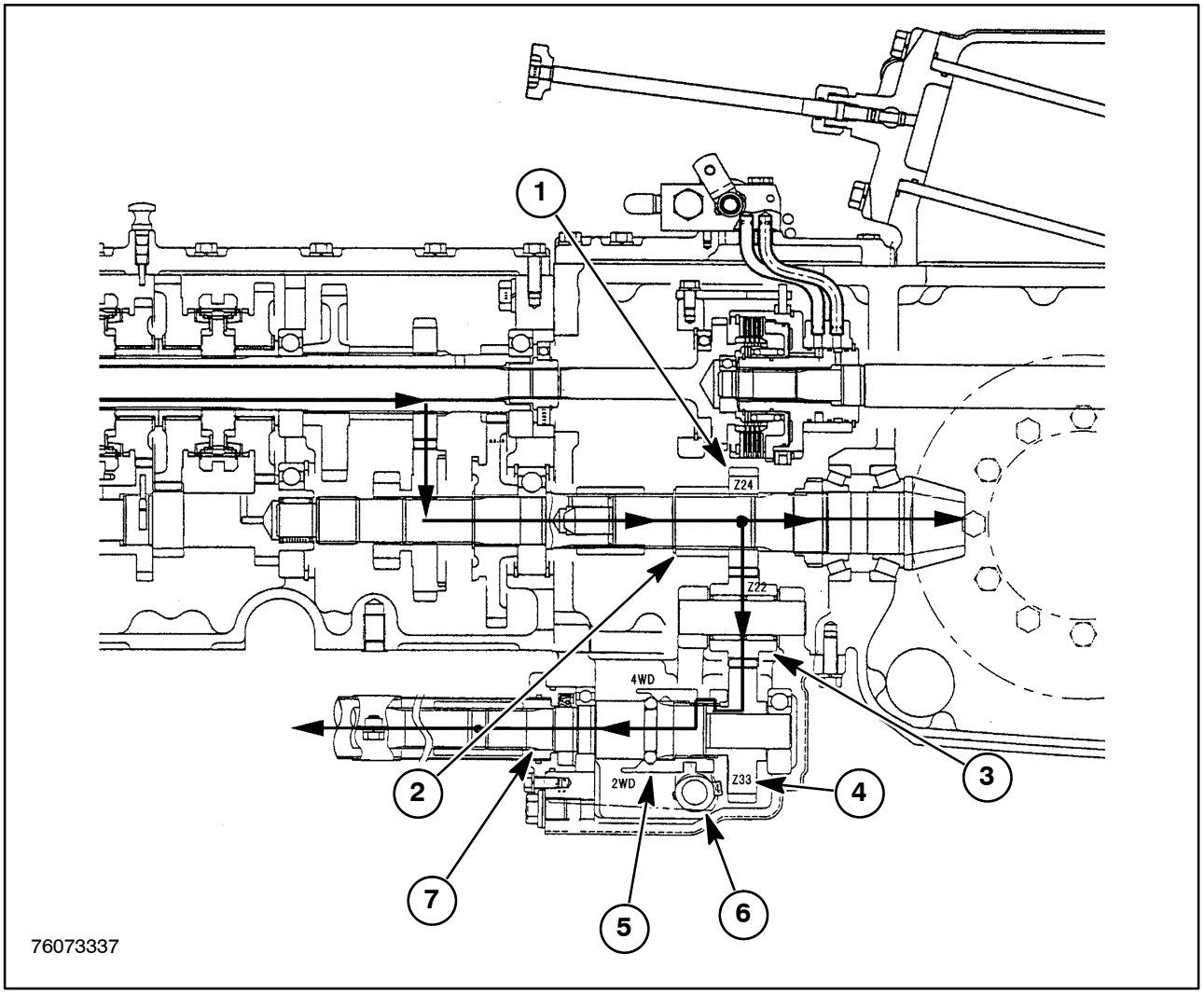
	Counter Gear Removal	5
	Disassembly	5
	Inspection	5
	Assembly	6
	Counter Gear	6
	Installation	6

DESCRIPTION OF OPERATION - FRONT WHEEL DRIVE GEARBOX

The front wheel drive gearbox is mounted under the rear differential housing. The gearbox is driven by a 24T fixed gear, 1, on the final drive pinion shaft, 2, and consists of one 22T counter gear, 3, one 33T drive gear, 4, a slide gear, 5, shift fork, 6, and an output shaft, 7.

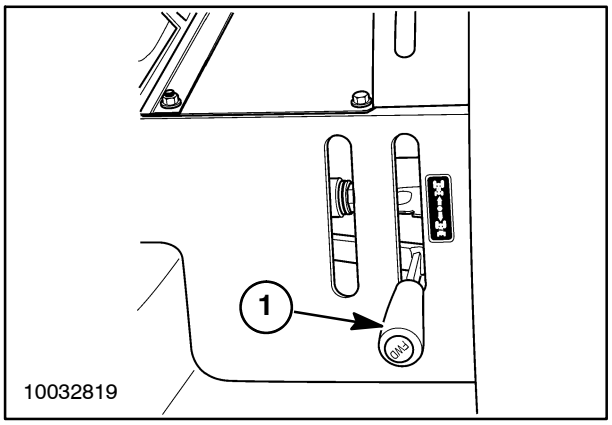
When the operator's lever is moved to engage the front wheel drive, the shift fork moves the slide gear, engaging it to the drive gear, which powers the output shaft. The power is then transferred to the front wheel drive shaft, which connects and drives the FWD axle.



1

The front wheel drive option is operator controlled by a lever, 1, located on the lower left-hand side of the operator's platform.

To engage the front wheel drive take off gear box, move the lever upwards. To disengage, move the lever downward.



2

LUBRICATION

The driveline must be lubricated every 50 hours, or sooner if necessary. The hydraulic oil in the differential case lubricates the front wheel drive gearbox. Use AMBRA MULTI G134 hydraulic oil for lubrication of the driveline.

TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Driveline vibration	1. Dry drive shaft couplings 2. Worn couplings 3. Bent drive shaft	1. Lubricate 2. Replace couplings 3. Replace driveshaft
FWD will not stay engaged	1. Control lever out of adjustment 2. Worn shift fork pins 3. Worn gear teeth 4. Detent spring broken 5. FWD ratio not correct	1. Adjust lever linkage 2. Replace shift fork pins 3. Replace worn gear 4. Replace detent spring 5. Check the rolling radius of front and rear tires

OVERHAUL

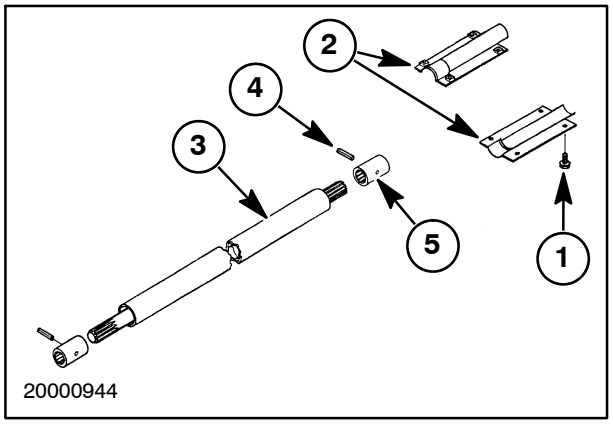
FRONT WHEEL GEARBOX

Removal

1. Loosen and remove the retaining bolts, 1, and the covers, 2, from the drive shaft, 3.
2. Drive out the roll pin, 4, from the rear coupler, 5.

NOTE: *The drive shaft cannot be completely removed from the tractor due to the oil pan.*

3. Slide the coupler forward onto the drive shaft.



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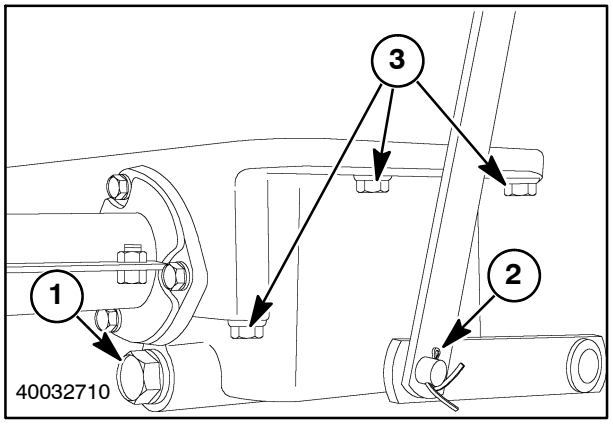
NOTE: *The EHSS transmission housing holds 46L (12.2 gals) and the SSS transmission housing holds 38L (10.0 gals) of oil, use caution when draining the hydraulic oil.*

4. Loosen and remove the drain bolt, 1, from the gearbox and drain the hydraulic fluid into a large suitable container.
5. Remove the cotter pin, 2, from the shift lever, and detach the shifter lever from the bracket.
6. Loosen and remove the seven mounting bolts, 3, from the gearbox. Remove the gearbox from the differential housing.



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FRONT WHEEL GEARBOX

Counter Gear Removal

1. Drive the roll pin, 1, out of the housing using a punch and hammer.
2. Carefully drive the gear shaft, 2, out of the housing.
3. Remove the counter gear, 3, thrust washers, 4, and bearings, 5.

Disassembly

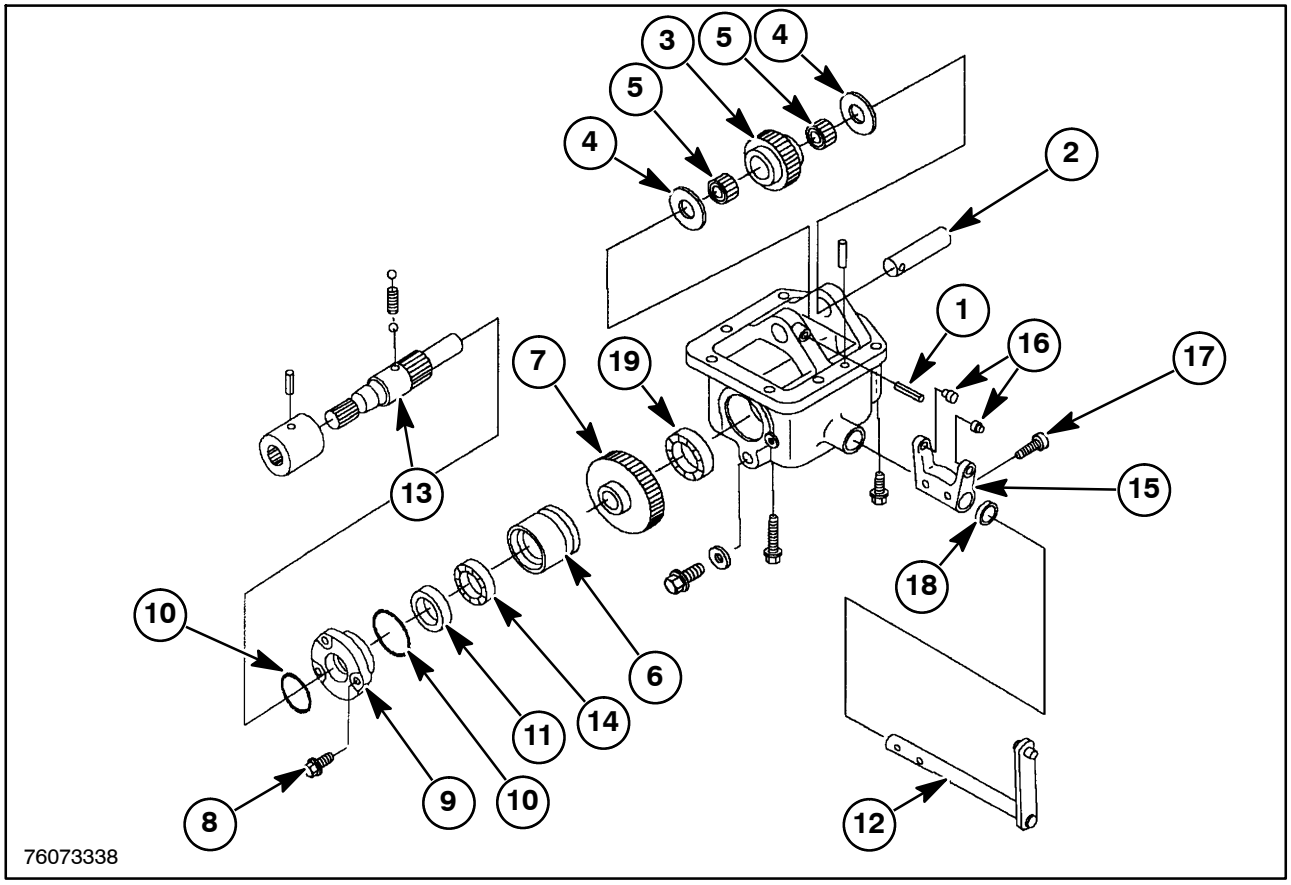
1. Position the slide gear, 6, (using the shift lever) so that it is disengaged from the drive gear, 7, (2WD POSITION).
2. Loosen and remove the three bolts, 8, from the seal cover, 9.
3. Remove the seal cover, 9, and remove the rubber O rings, 10, and seal, 11, from the cover.
4. Use the shift lever, 12, to push the shaft, 13, and the front bearing, 14, out through the front of the housing. The shift fork, 15, will move forward to gain enough clearance for removal of the shaft, 13.
5. Remove the drive gear, 7, through the top of the housing.
6. Remove the two pins, 16, from the shift fork, 15.

IMPORTANT: *Apply heat to the shift fork allen bolts, 17, to loosen the thread locker that is applied during assembly.*

7. Loosen and remove the two allen bolts, 17, that attach the shift fork to the shift lever, and slide the shift lever, 12, and seal, 18, out of the housing.
8. Remove the shift fork, 15, through the top of the housing.
9. Remove the bearing, 19, from the rear of the housing.

Inspection

1. Clean all parts in a suitable solvent and air dry.
2. Inspect the gears for excess wear or damage.
3. Rotate the bearings by hand to check for roughness. Replace if necessary.
4. Inspect all parts for excess wear and damage. Replace as necessary.



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Assembly

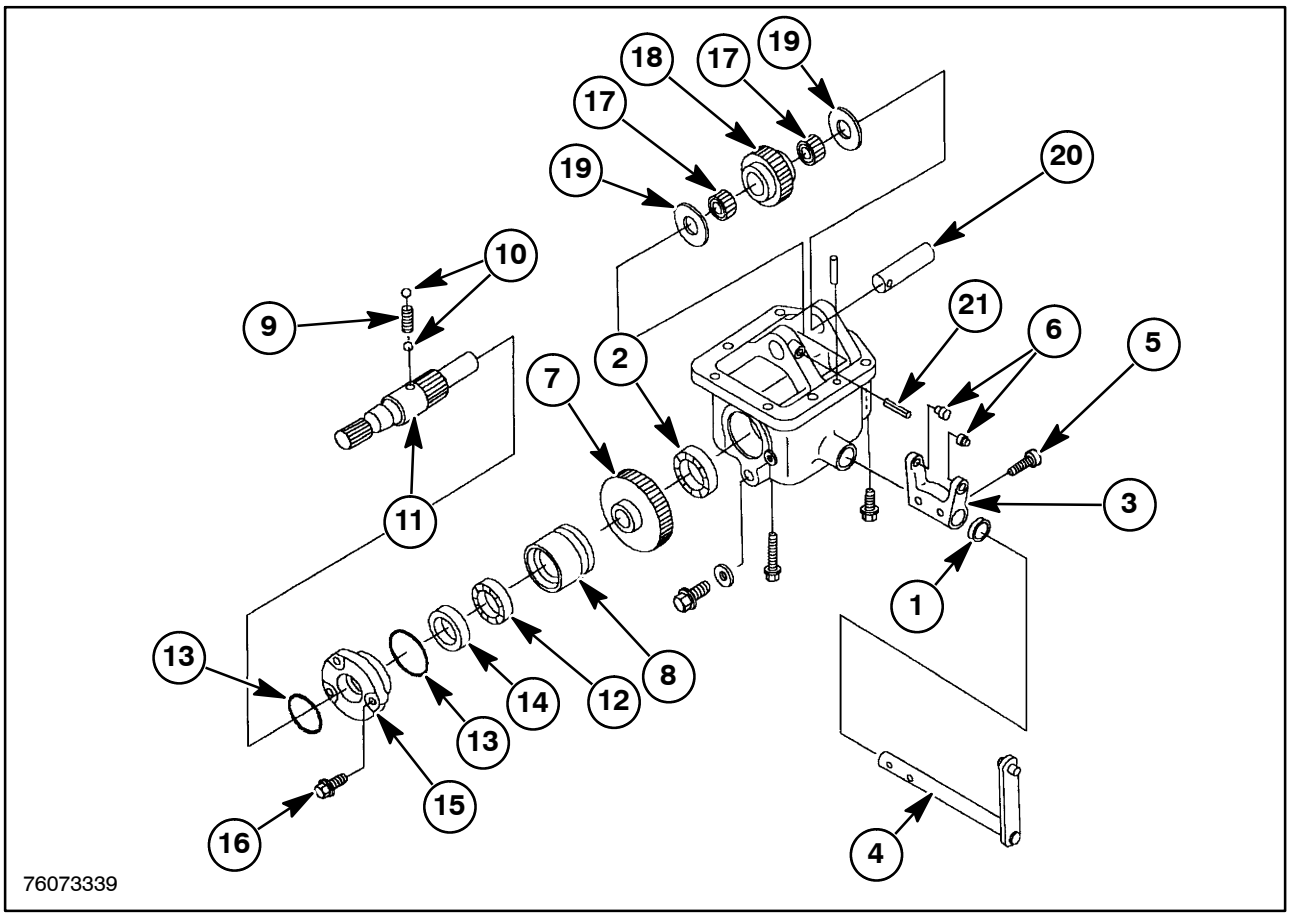
1. Replace the shift fork lever seal, 1, on the side of the housing.
2. Install the rear bearing, 2, into the gearbox housing.
3. Place the shift fork, 3, in the housing and install the shift lever, 4, through the side and into the shift fork. Line up the bolt holes, apply Locktite 271 thread locker on the two allen head bolts, 5. Install the bolts and tighten.
4. Install the pins, 6, into the shift fork.
5. Install the drive gear, 7, into the housing, with the transfer gear facing front.
6. Install the slide gear, 8, onto the shaft. Depress the detent spring, 9, and detent balls, 10, to mount the slide gear into the 2WD position.
7. Slide the shaft, 11, through the front of the housing, through the drive gear, 7.
8. Maneuver the shift fork, 3, into the groove on the slide gear, 8, while installing the shaft into the rear bearing.
9. Install the front bearing, 12, into the front of the housing.
10. Lightly lubricate and install the O rings, 13, and seal, 14, in to retaining cover, 15.
11. Install the retaining cover onto the front of the housing. Install and tighten the three fastening bolts, 16.

COUNTER GEAR

Installation

NOTE: *When installing the counter gear make sure the oil grooves on the thrust washers are installed facing the bearing.*

1. Install the needle bearings, 17, into the counter gear, 18.
2. Position the counter gear, 18, and thrust washers, 19, into place, holding the thrust washers from dropping into the housing.
3. Slide the shaft, 20, through the counter gear and line up the hole for the roll pin, 21.
4. Carefully drive the roll pin into the housing to secure the shaft.



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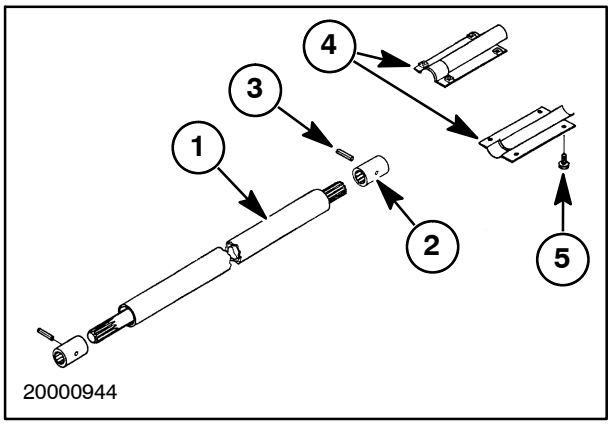
NOTE: *Make sure the collar is on the drive shaft before attaching the gearbox to the rear differential housing.*

1. Use Locktite 518 Gasket Eliminator® on the gearbox mounting surface to seal it to the axle housing.
2. Position the gearbox and install and torque the seven mount bolts, 90 N·m (66 ft. lbs.).
3. Attach the shift lever to the shift arm, and insert new cotter pin.
4. Slide the drive shaft, 1, coupling, 2, back over the output shaft, and install the roll pin, 3.
5. Position the cover plates, 4, onto the shaft, install the bolts, 5, and tighten.



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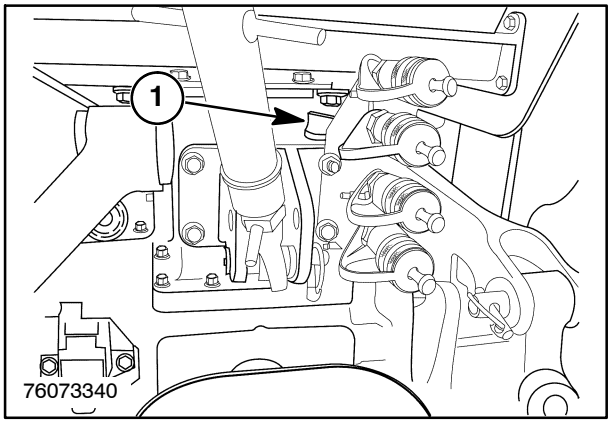
6. Install the drain plug and seal washer into the FWD gearbox housing, and tighten.
7. Remove the fill cap, 1, for the rear differential housing.

Capacity: EHSS Transmission 46L (12.2 gal) and SSS Transmission 38L (10.0 gal)

8. Fill with AMBRA MULTI G134 hydraulic oil. The transmission is filled to the correct level when the oil registers lower the oil level mark on the dipstick. “DO NOT FILL ABOVE THE DIPSTICK FULL LINE.”
9. Reinstall the dipstick and filler plug.



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SECTION 25 - FWD FRONT AXLE

Chapter 1 - FWD Front Axle

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SPECIFICATIONS

Power Steering Pump Flow @ 2700 rpm, FWD gpm (20.1 lpm)	20.1 lpm (5.44 gpm)
Power Steering Type	Full Hydraulic
Relief Valve Pressure FWD	142 - 149 bar (2059 - 2160 psi) at 16 gpm
Reservoir Capacity Oil	1.4 L (1.5 US qts) NH 134
Maximum Turning Angle FWD	56°
Power Steering Hose Fittings	29.4 - 39.2 N·m (22 - 29 ft-lbs)
Front to Rear Axle Ratio	1.5908 : 1
Front Axle Ring and Pinion Tooth Count	Ring Gear - 33 Pinion Gear - 8

FRONT TO REAR AXLE RATIO

T2410 - T2420

IMPORTANT: *On tractors equipped with FWD (Front Wheel Drive) the front to rear axle ratio* ***(1.5908:1, with an acceptable range of 1.56 - 1.62:1)****, is critical and must be maintained for safe and efficient use of the tractor. This ratio applies to all available tire options. Following is a list of problems that may occur if the front to rear axle ratio is not maintained:*

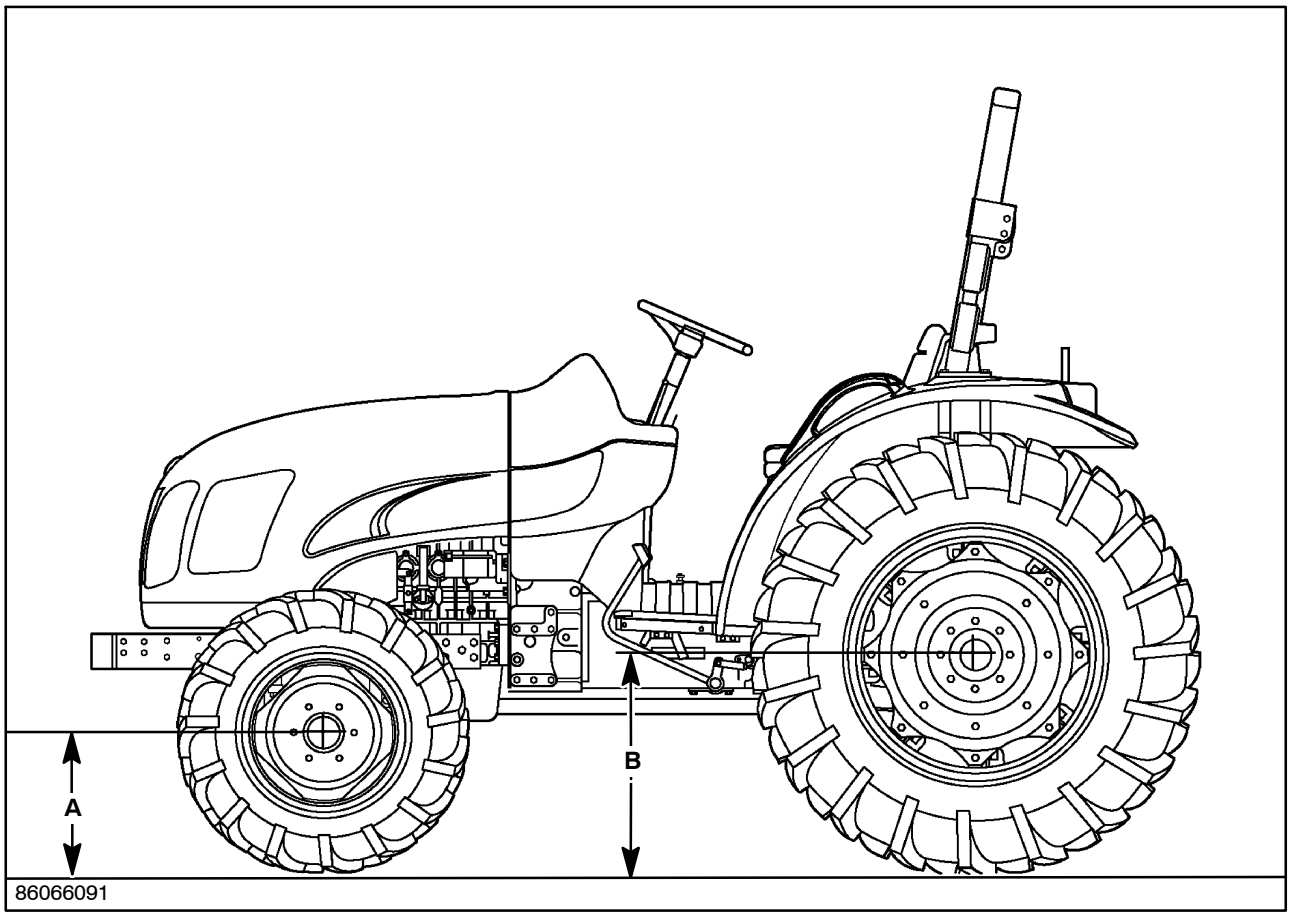
- Engine will lug down or stall when operating on hard surfaces.
- The front wheel drive lever will not remain in the engaged position, or is difficult to disengage.
- Failure of the driveline gears.
- Failure of the front axle, ring and pinion gears.
- Premature tire wear.

To calculate the front to rear axle ratio, use method 1 or method 2.

Method 1:

1. Obtain a measurement from the center of the front axle to the ground (Distance A), and center of the rear axle to the ground (Distance B).
2. Divide Distance B by Distance A to calculate the front to rear axle ratio. (“B” ÷ “A” = Front to rear ratio.)
3. To change the front to rear ratio, increase or decrease the tire inflation pressure.

NOTE: *Do not exceed the tire inflation pressures recommended in the Operators Manual. Consult the Operators Manual for the available tire sizes for a specific tractor.*



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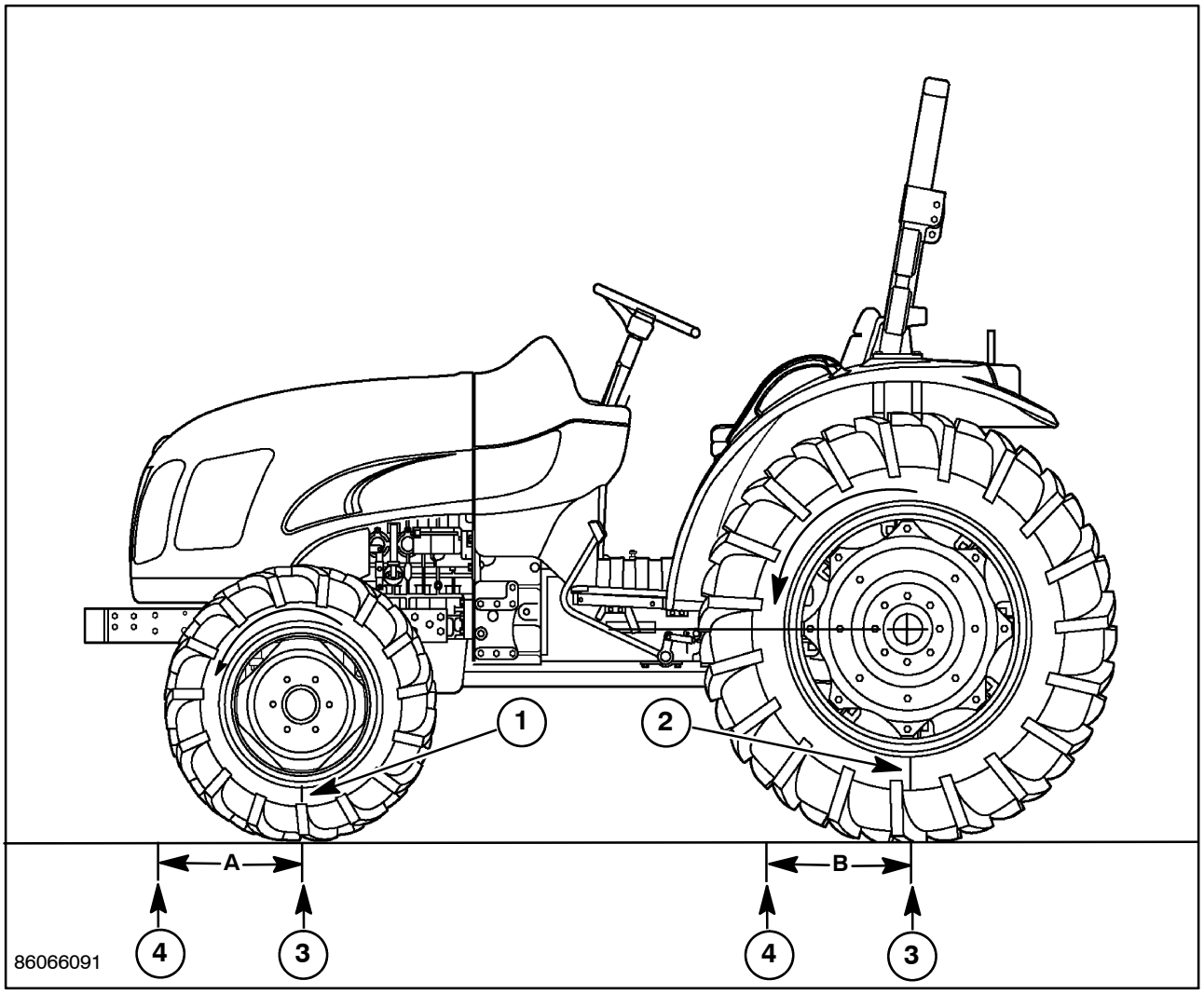
Method 2: Rolling Test

1. Make a mark on the front tire, 1, and the rear tire, 2.
2. Make a corresponding mark, 3, on the ground at each tire.
3. Slowly roll the tractor forward until the marks on the tires, 1 and 2, make one full revolution.
4. Make a second mark, 4, on the ground as in step 2.
5. Measure the distance between the marks on the ground for each tire.
6. Divide the distance B by the distance A to calculate the front to rear ratio.
7. To change the front to rear ratio, increase or decrease the tire inflation pressure, or check the rear counterbalance weights.

NOTE: *Do not exceed the tire inflation pressures recommended in the Operators Manual. Consult the Operators Manual for the available tire sizes and inflation pressures for a specific tractor.*



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METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

SPECIAL TOOLS

	Tool No.
Detent Tool	FNH00081
Seal Driver Set	FNH00293
Includes:	27488 Handle 27515 Drive Plate 27530 Drive Plate

DESCRIPTION OF OPERATION - FWD FRONT AXLE

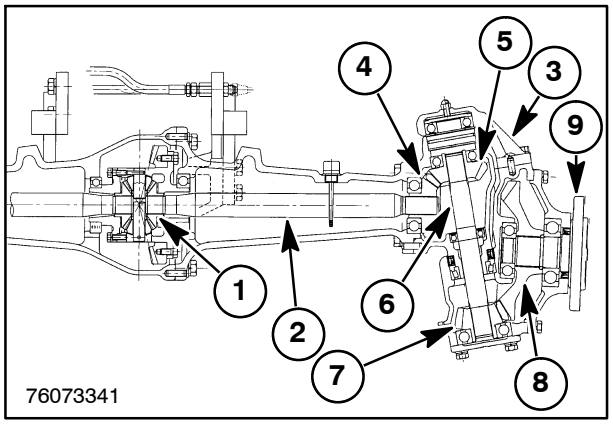
The four-wheel drive front axle is a factory installed.

The FWD front axle on the T2410 and T2420 consists of a center axle member, and two outer axle sections. The center member is mounted centrally to the frame by a pivot shaft. The axle rotates on the pivot shaft, there by maintaining the tractor chassis in a level position, and ensuring stable operation even on irregular ground. Each outer axle section is attached to the center axle section by four bolts. The front axle tread is a fixed type. The front wheel tie rod assembly is adjustable for toe-in adjustments.

Power to the front axle flows from the final drive pinion gear, in the rear differential, through a take off box attached to the underside of the rear axle center housing. The take off box transmits power to the front axle drive pinion through a drive shaft.

Power to the front wheels flows from the front axle differential side gear, 1, and axle shaft, 2, to the front wheel reduction drop box, 3, assembly.

A pinion gear, 4, on the axle shaft, 2, drives an idler pinion, 5, and an idler shaft, 6, in the drop box. A final drive pinion, 7, on the idler shaft, 6, drives a bevel gear, 8, which is splined to the wheel hub and shaft assembly, 9.



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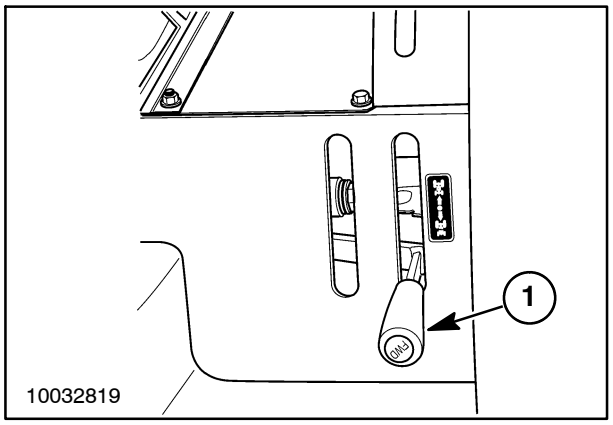
The front wheel drive is controlled by a lever, 1, located on the left hand side lower floor panel.



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TROUBLESHOOTING

Most malfunctions in the steering system can usually be traced to dirt or foreign matter in the system. Dirt can cause such things as stickiness, erratic operation, or hard steering.

Before considering the procedures below, follow these suggested steps:

1. Check the pump for proper relief valve action. See “Pressure Testing,” discussed later in this section.
2. Jack the front end of the tractor off the ground and cycle the steering from stop to stop to check for front axle binding.
3. Be sure the hydraulic hoses from the pump-to-motor and from the motor-to-cylinder are hooked up correctly.

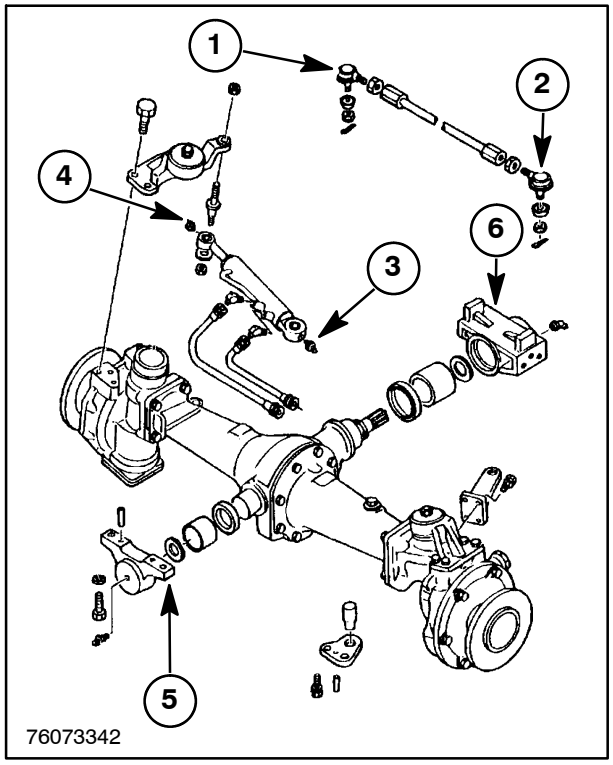
CONDITION	POSSIBLE CAUSE	REMEDY
Hard Steering.	1. Control valve unit.	
	Control valve unit not aligned to steering column.	Reposition Control valve unit. (If loosening its mounting bolts lightens the handwheel, it means that Control valve unit was in misalignment).
	Spool-and-sleeve combination is seized because of foreign matter.	Replace.
	Over tightening of the end cap bolts.	Re-tighten to the specified torque limit.
	2. Oil pump.	
	The pump is stuck and will not work.	Replace oil pump.
	The pump is worn down.	Replace oil pump.
	Pumping performance inadequate.	Test pump performance and, if necessary, remove the pump. Disassemble the pump and inspect the internal seals. Refer to the pump seal kit repair section.
	3. Relief valve.	
	The valve is damaged because of internal deterioration.	Replace control valve assembly.
	Pressure setting is too low.	Adjust relief pressure.
Steering wheel will not return to neutral or will turn by itself.	1. Control valve unit.	
	Spool and sleeve combination is stuck and will not rotate.	Replace control valve assembly.
	Control valve unit not aligned to steering column.	Re-align.

CONDITION	POSSIBLE CAUSE	REMEDY
Cylinder will not follow steering wheel rotation or will respond sluggishly.	1. Control valve unit. Control valve unit has been improperly rebuilt, resulting in valve mistiming. 2. Steering cylinder. Air is trapped in the cylinder. Internal oil leakage because of damaged piston seal.	 Repair. Bleed air out. Replace the seal.
Steering wheel will “kick back”.	1. Control valve unit. Control valve unit has been improperly rebuilt, resulting in valve mistiming 2. Piping. Pipes are improperly connected to the four ports of Control valve unit.	 Repair. Correct the pipe connections.
Oil leakage. 1. From the splined connection of column to spool. 2. From mated face joints (valve body, spacer plate, Control valve unit, end cap).	 1. Leaky oil seal. Dirty hydraulic oil. 2. Damaged O-ring.	 Replace the seal. Change the oil. Replace.
Front wheel shimmy.	1. Worn pivot shaft and/or bushings. 2. Loose tie-rod. 3. Loose spindle arm.	Replace pivot shaft and/or bushings. Tighten tie-rod. Tighten spindle arm.
Loose spindle.	1. Worn bushing. 2. Worn spindle shaft. 3. Worn or damaged thrust bearing.	Replace bushing. Replace spindle shaft. Replace thrust bearing.
Hard steering.	1. Faulty power steering system.	Inspect and repair power steering system.

MAINTENANCE

LUBRICATE EVERY 50 HOURS - STANDARD FWD

1. Tie rod - right side
2. Tie rod - left side
3. Steering cylinder - barrel end
4. Steering cylinder - rod end
5. Front bearing holder
6. Rear bearing holder



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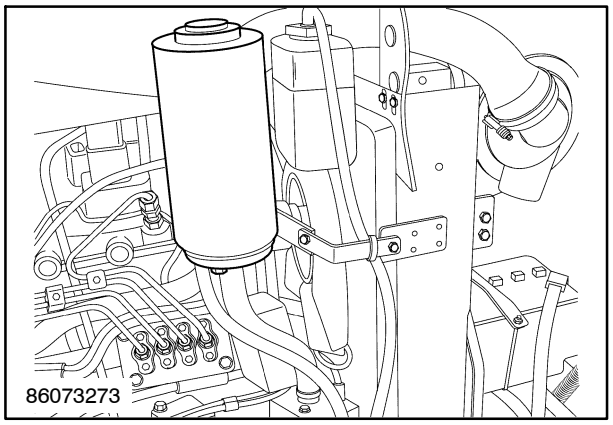
OVERHAUL

FWD AXLE

Removal

1. Drain the power steering fluid from the reservoir into a suitable clean container.
2. Remove the steering hoses from the steering cylinder. Mark the hoses to ensure correct placement during installation.



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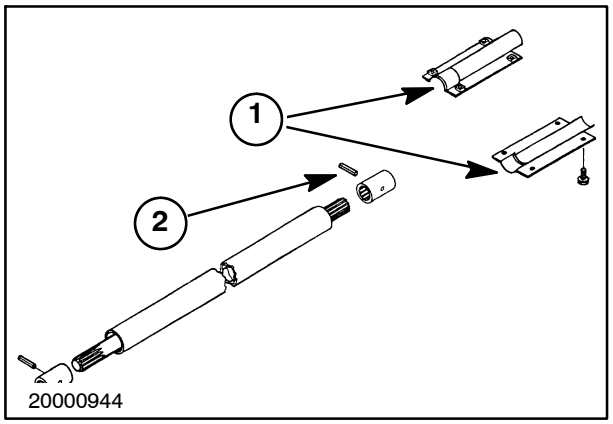
3. Loosen and remove the drive shaft cover bolts, and remove the covers, 1. Remove the drive shaft by using a punch and hammer to drive the roll pin, 2, out of the rear coupler link.

***NOTE**: the drive shaft cannot be completely removed due to the oil pan.*



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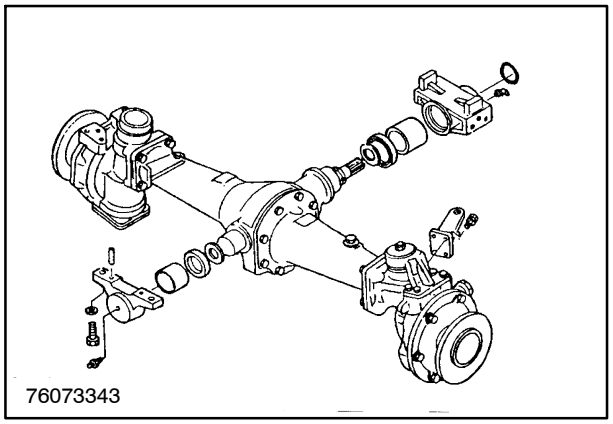
4. Lift the front of the tractor with a suitable lifting device, such as a hoist or crane. Place jack stands under the transmission for safety.
5. Place a floor jack under the center of the axle to support the weight of the axle.
6. Loosen the pivot mounts from the tractor frame, and carefully remove the bolts.
7. Carefully lower the FWD axle assembly.
8. Remove the drive shaft after the FWD axle is lowered.
9. With the jack supporting the axle, roll it out from the front of the tractor.
10. Remove the front and rear pivot bearing mounts from the axle.



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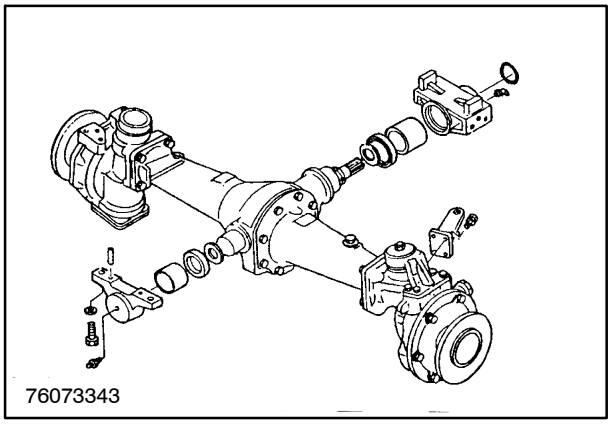
Installation

1. Attach a suitable lifting devise to the front of the tractor. Place jackstands under the transmission for safety.
2. Use a floor jack to support the axle, and roll the axle under the front of the tractor.
3. Install the drive shaft onto the front axle. Slide the cover over the axle. Slide the rear coupler onto the drive shaft.
4. Lift the axle into place using the floor jack. Install the mount bolts in the front and rear pivot mounts, tighten six rear bolts to 122 - 143 N·m, (90 to 106 ft-lbs), two front bolts to 162 - 187 N·m, (120 - 138 ft-lbs).



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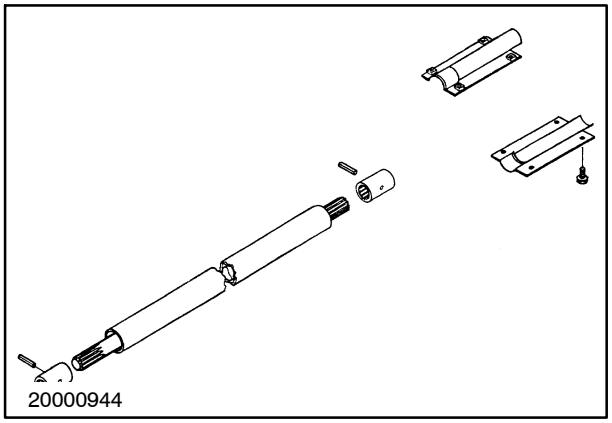
5. Align the rear of the drive shaft, slide the coupler back and install roll pin.
6. Install the hoses to the steering cylinder, observe the placement of the hoses.
7. Remove the jack from under the tractor and lower the front of the tractor.



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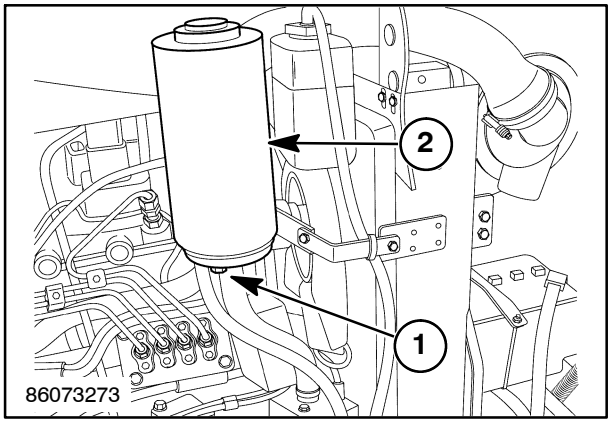
8. With the drain plug, 1, tightened, replace the power steering fluid into the reservoir, 2.



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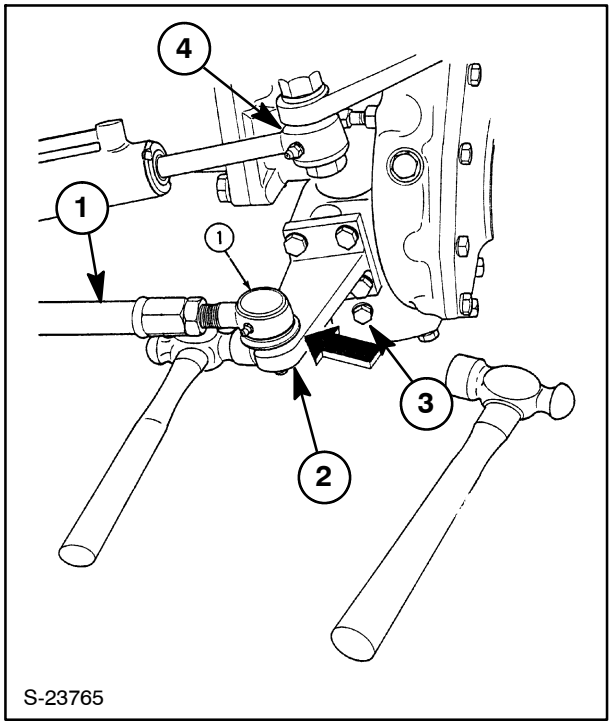
GEAR REDUCTION DROP BOX

Disassembly

NOTE: *These procedures apply to both the right and left front axle component assemblies. Repeat the procedure for the opposite side component to be disassembled or repaired.*

1. Remove the front-wheel hub bolts and remove the front wheels.
2. Remove the tie rod, 1, from the steering arm, 2. Tap the ball joint with a hammer to loosen the ball joint.
3. Remove the drain plug, 3, from the drop box case, and drain the oil into a clean suitable container.
4. Remove the steering cylinder, 4, from the steering arm, and the front axle.



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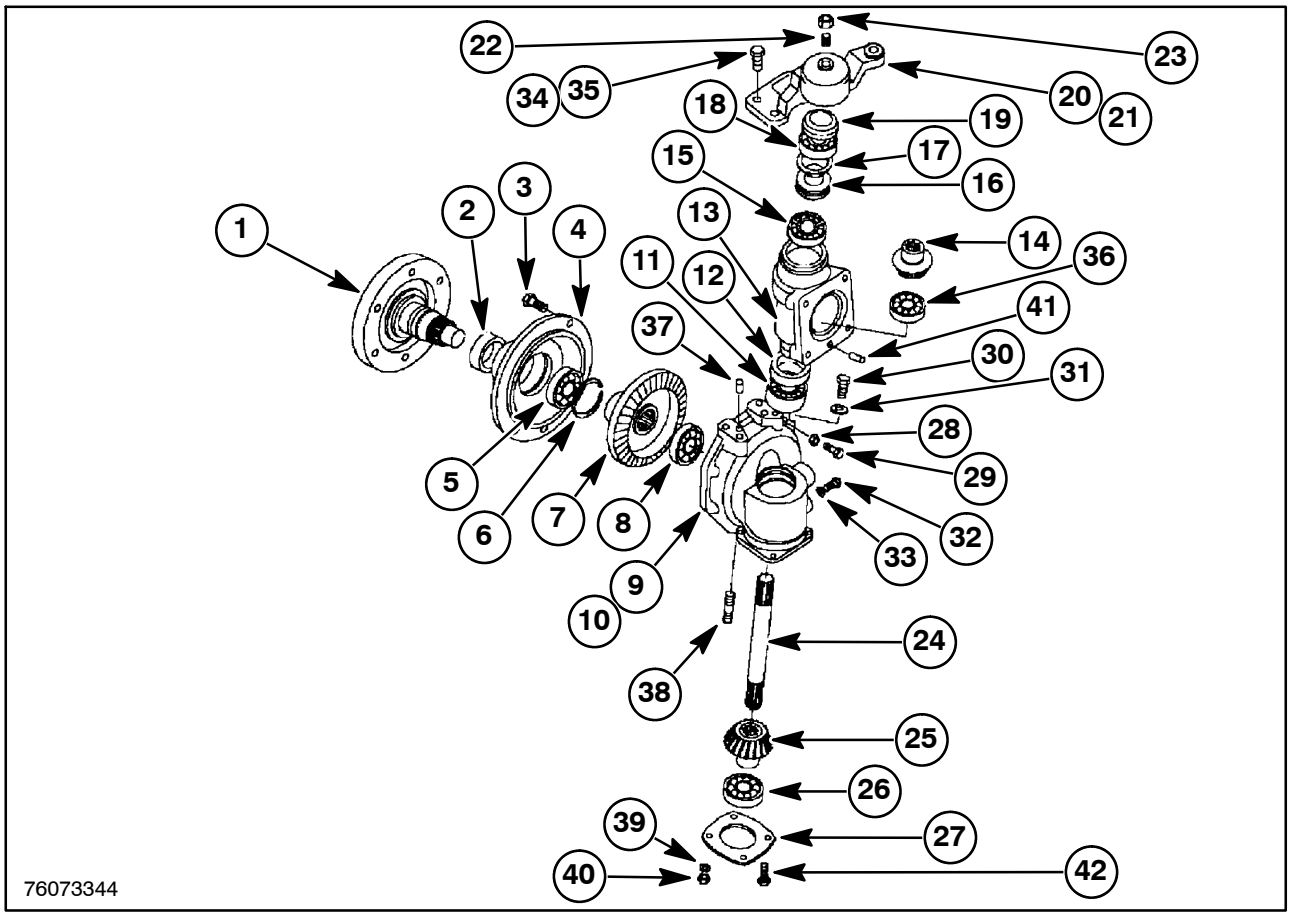


13

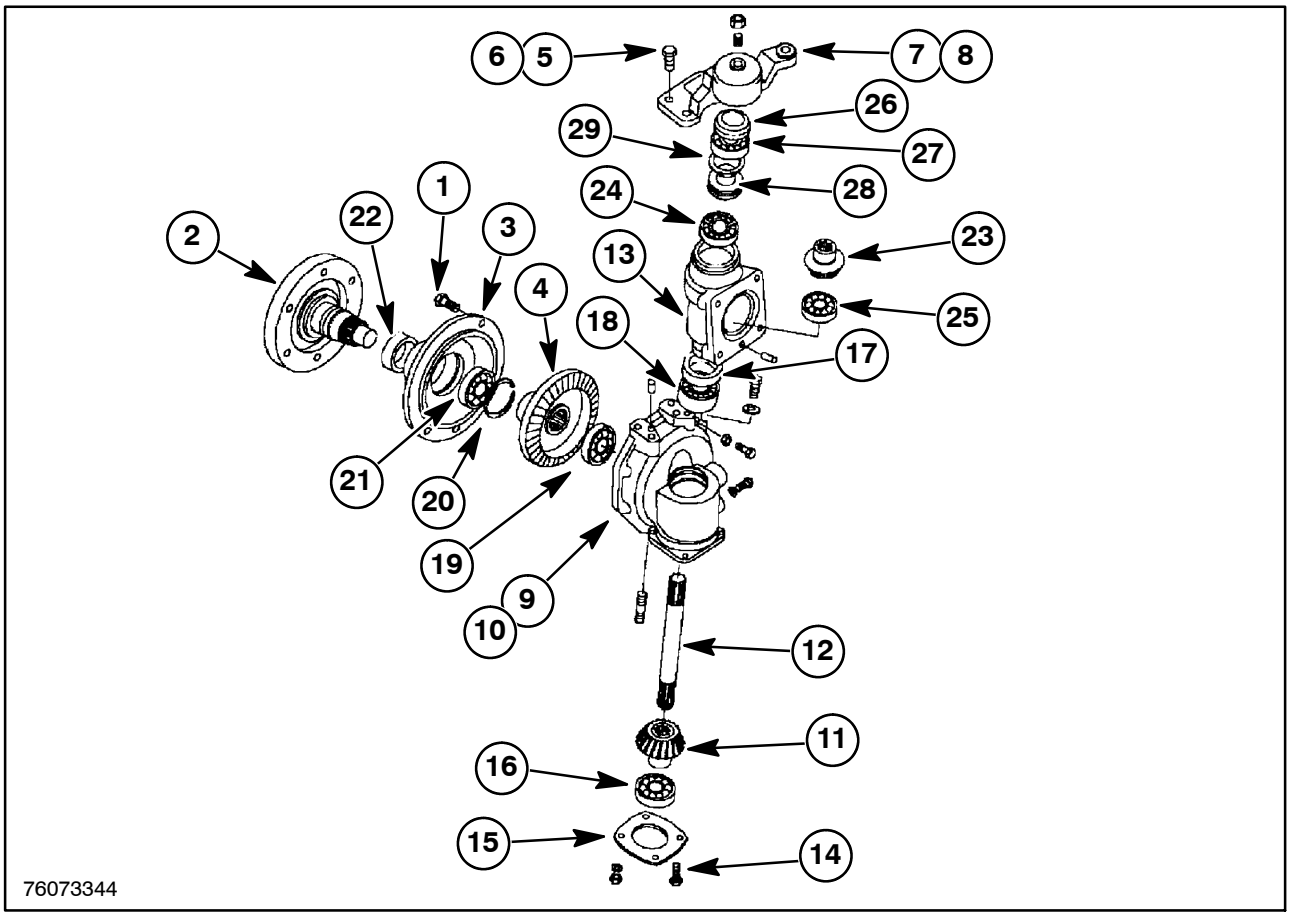
1. Wheel Hub and Shaft
2. Oil Seal
3. Bolt, M10 x 30
4. Case Cover
5. Ball Bearing
6. Clip
7. Final Drive Bevel Gear
8. Ball Bearing
9. L.H. Drop Box Casing Assembly
10. R.H. Drop Box Casing Assembly
11. Tapered Roller Bearing
12. Oil Seal
13. Idler Casing Assembly
14. Idler Pinion Gear
15. Ball Bearing
16. Kingpin
17. O-ring
18. Ball Bearing
19. Spacer
20. L.H. Steering Arm
21. R.H. Steering Arm
22. Adjuster Screw
23. Nut Cap
24. Idler Shaft
25. Final Drive Pinion Gear
26. Ball Bearing
27. Cover
28. Nut
29. Bolt, M12 x 40
30. Plug
31. Seal Washer
32. Drain Bolt
33. Seal Washer
34. Left Side Bolt, M12 x 35
35. Right Side Bolt, M12 x 40
36. Ball Bearing
37. Dowel Pin
38. Stud
39. Spring Washer
40. Nut
41. Dowel Pin
42. Bolt, M10 x 30

5. Remove the case cover bolts, 1, and remove the wheel hub, 2, cover, 3, and final bevel gear, 4, as an assembly.

⚠ WARNING ⚠

The drop box, 9 or 10, is free to disengage and fall away from the idler gear case, 13, when the steering arm, 7 or 8, bolts, 5 and 6, are removed. Use care to avoid accidental disengagement of the components. Uncontrolled dropping of the components may cause personal injury.

6. Remove the four retaining bolts, 5 and 6, from the steering arms, 7 or 8.
7. Remove the drop box case, 9 or 10, the final drive pinion gear, 11, and the final drive shaft, 12, as an assembly from the idler case, 13.
8. Remove the four bolts, 14, from the final drive pinion cover, 15. Remove the final drive pinion gear, 11, the bearing, 16, the cover, 15, and the shaft, 12, as an assembly from the drop box, 9 or 10.
9. Remove the idler case, 13, from the front axle.
10. Remove the oil seal, 17, and the tapered roller bearing, 18, from the drop box, 9 or 10.
11. Remove the wheel hub shaft inner bearing, 19, from the wheel hub shaft, 2, and remove the final drive bevel gear, 4.
12. Remove the split ring, 20, and gently drive the wheel hub shaft assembly, 2, from the cover, 3.
13. Remove the bearing, 21, and the oil seal, 22, from the cover, 3.
14. Remove the idler pinion gear, 23, and the bearings, 24 and 25, from inside the idler case, 13.
15. Remove the axle drive pinion gear and O-ring seal from the front axle housing.
16. Remove the spacer, 26, the bearing, 27, the kingpin, 28, and the O-ring, 29, from the idler case, 13.

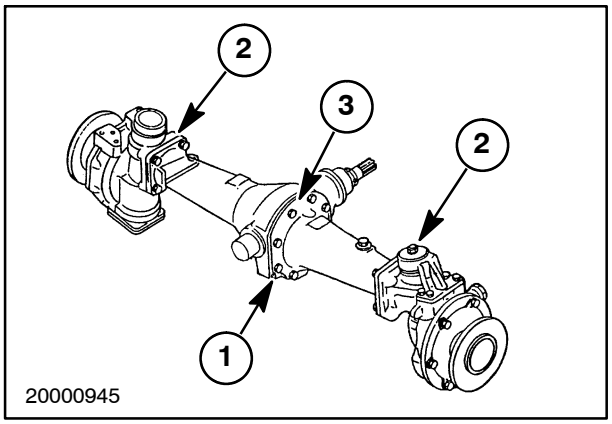


14

FRONT AXLE AND DIFFERENTIAL

Disassembly

1. Remove the drain plug, 1, and drain the oil from the FWD axle into a suitable container.
2. Remove the idler housings, 2, from both ends of the axle.
3. Slide the axle shafts out of the ends of the FWD axle.
4. Remove the left axle housing retaining bolts, 3, and separate the axle housings.



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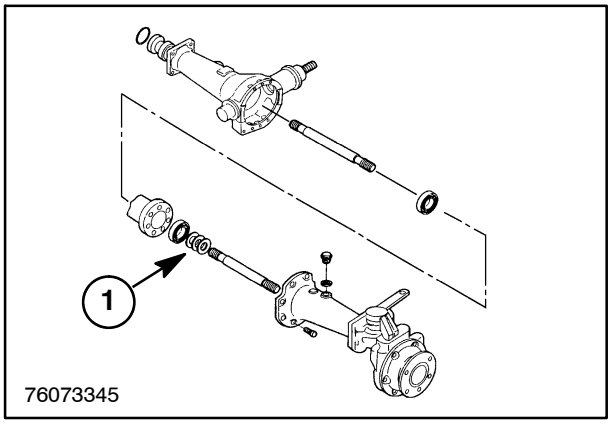
5. Remove the differential assembly and differential carrier bearings from the axle housing.

***NOTE**: Observe the quantity and the size of the shims between the axle shaft inner bearing and the axle housing. Shims, 1, sizes are 0.1 mm, 0.2 mm, and 0.5 mm.*

6. Check the differential side gear to pinion backlash. Replace the gears if back lash exceeds 0.3 mm.



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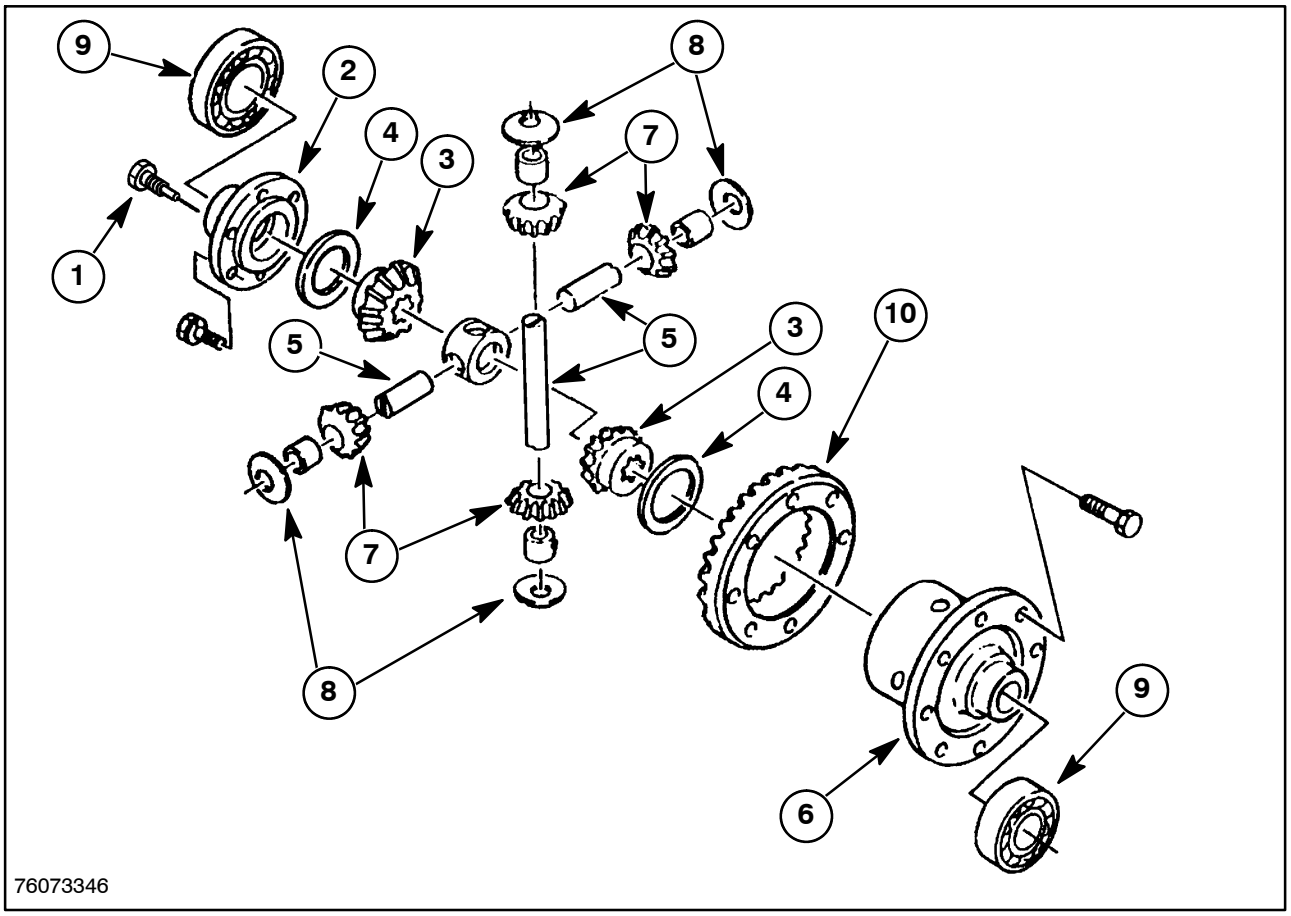
7. Remove the bolts, 1, from the differential case cover, 2.
8. Remove the differential side gear, 3, and the thrust washer, 4.
9. Remove the pinion shafts, 5, out of the case, 6.
10. Remove the four pinion gears, 7, and thrust washers, 8.
11. Remove the differential side gear, 3, and the thrust washer, 4.
12. Remove the support bearings, 9 and the ring gear, 10, from the case, 6.



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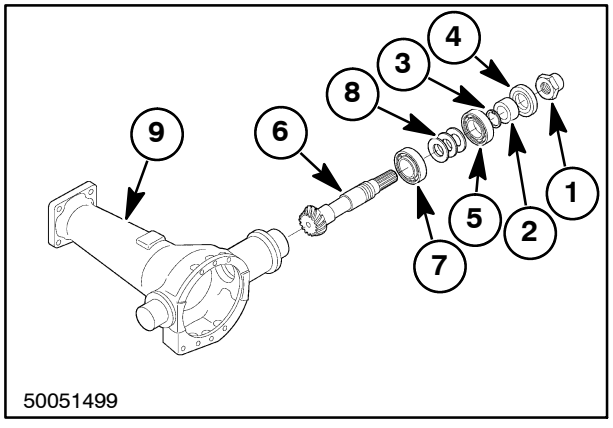
DRIVE PINION

Disassembly

1. Remove the drive pinion locknut, 1.
2. Remove the collar, 2, the O-ring, 3, the oil seal, 4, and the bearing, 5.
3. Gently drive the pinion shaft, 6, inward, and remove the pinion assembly with the bearing, 7, and the shims, 8, from the case, 9.

NOTE: *Observe the quantity and the size of the shims used on the pinion shaft. Shim sizes are 0.1 mm (0.004) and 0.2 mm (0.008 ″).*

4. Remove the bearing, 7, and the shims, 8, from the pinion shaft, 6.



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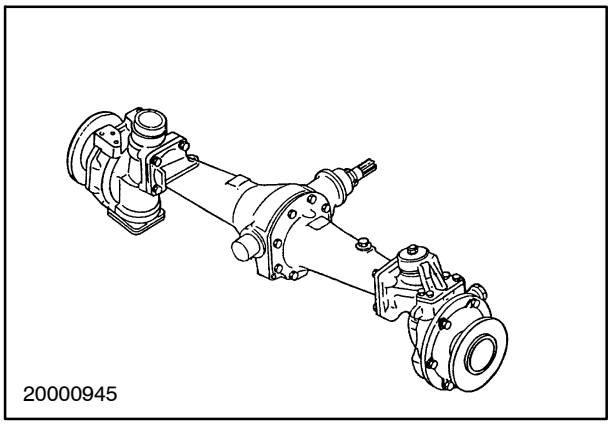
DIFFERENTIAL

Inspection

1. Wash all parts in a suitable solvent and air dry.
2. Using a telescoping gauge and micrometer, measure the pinion gear bore and the pinion shaft to determine the bore to shaft clearance. Replace the gear and/or shaft if the clearance exceeds 0.1 mm (0.004 in).
3. Measure the differential to side gear thrust washer thickness. Replace the thrust washers if the thickness is less than 1.8 mm (0.071″).

NOTE: *If the thrust washers are replaced, recheck the side gear to pinion gear backlash during assembly. Refer to backlash check made during disassembly.*

4. Inspect all gear teeth for excess wear or damage. Replace gears if teeth are damaged or wear is excessive.



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GEAR REDUCTION DROP BOX

Inspection

1. Wash all parts in a suitable solvent and air dry.
2. Inspect the gears for excess wear or damage. Replace gears that show excessive wear or damage. See “Assembly”, for gear backlash checks.
3. Inspect the splines on the pinion gears, idler shaft, and axle shaft for excess wear or damage.
4. Check the bearings for wear or roughness. Rotate the bearings by hand and replace as required.
5. On assembly, check the bevel gear and pinion backlash. See “Gear Reduction-Drop Box Assembly”, discussed later in this section.

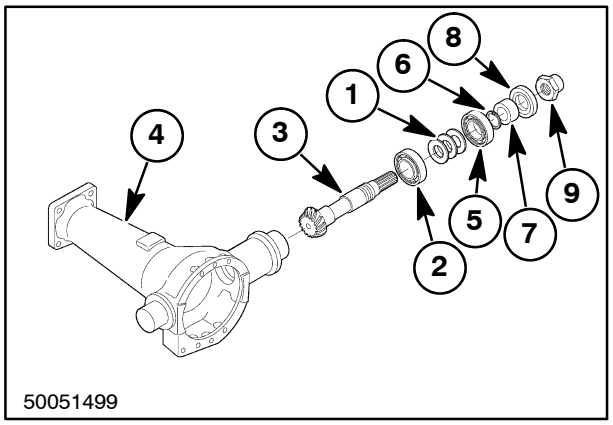
DRIVE PINION

Assembly

1. Install the shims, 1, and the front pinion bearing, 2, on the drive pinion, 3.

NOTE: *Observe the quantity and the size of the shims used on the pinion shaft. Shim sizes are 0.1 mm (0.004 ") and 0.2 mm (0.008 ").*

2. Insert the drive pinion, 3, in the differential housing, 4.
3. Install the outer bearing, 5, on the pinion shaft, 3, in the differential housing, 4.
4. Install the O-ring, 6, and the collar, 7, on the pinion shaft, 3. Using a suitable driver, install the oil seal, 8.
5. Install the pinion locknut, 9, and tighten to obtain the correct bearing preload as follows:
   - Wrap a strong cord, 1, around the pinion shaft, 2. Using a pull scale, 3, measure the pounds pull required to rotate the pinion shaft.
   - Tighten or loosen the locknut as necessary to obtain a preload of 12 - 14.6 kg (26.4 - 32.1 lbs) pull.



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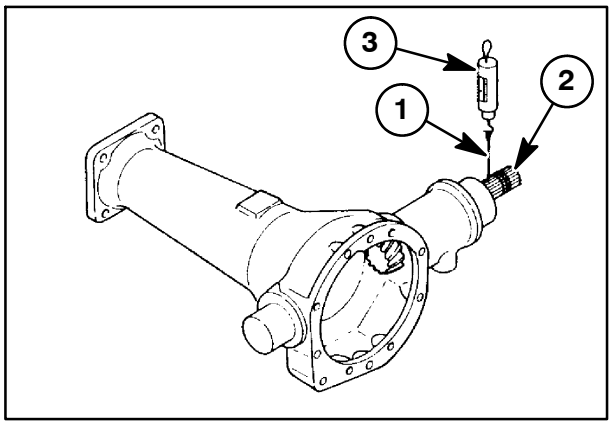

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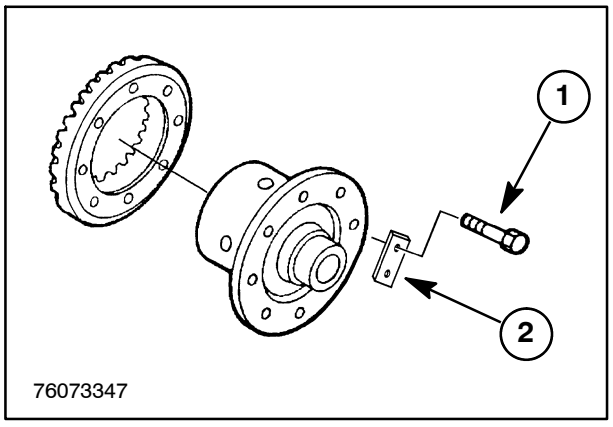
DIFFERENTIAL GEAR

Assembly

NOTE: *The ring gear is tightened with coated bolts (without washers) before being shipped from the factory. Bolts and lock washers are available as service parts, to be used during reassembly after repair.*

1. Replace the ring gear mounting bolts, 1, with new ones, and use locking plates, 2, to secure the bolts and prevent loosening or tightening. Torque the M10 bolts, 1, to 49-63 N·m (36-46 ft-lbs).



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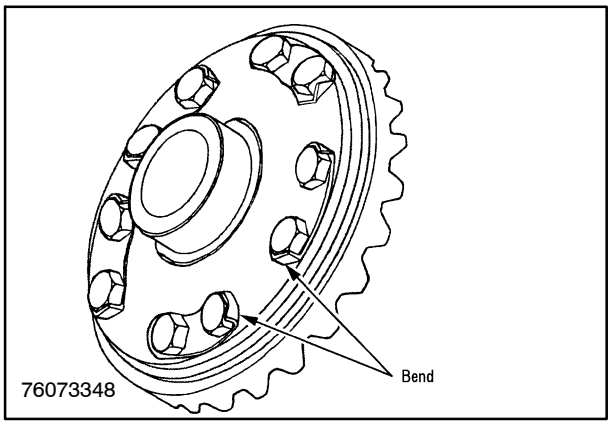
2. Bend the lock plate tabs, 1, around bolt sides.



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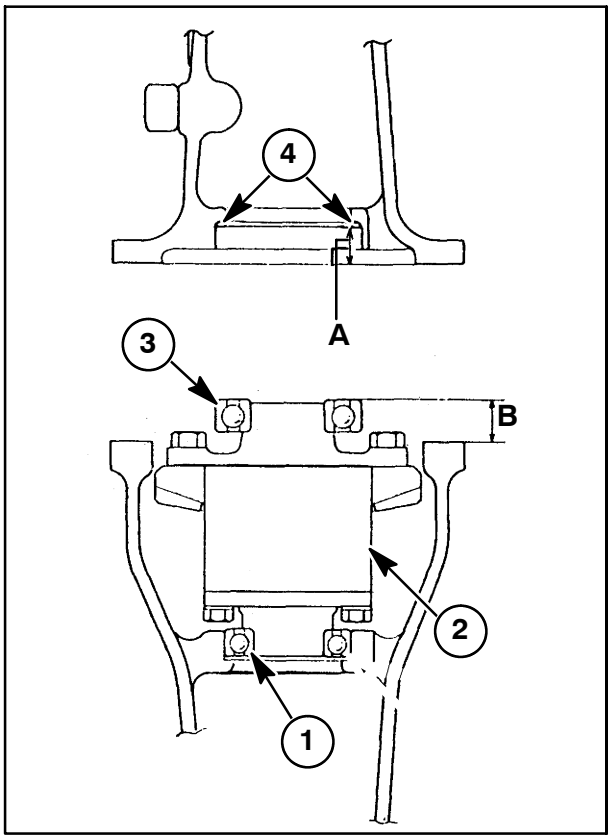
RING GEAR-TO-PINION BACKLASH CHECK AND ADJUSTMENT

1. Position the differential carrier bearing, 1, in place in the right differential axle housing.
2. Place the differential assembly, 2, in the housing, being sure the differential assembly is fully seated inside the bearing, 1.
3. Position the left differential case bearing, 3, on the differential assembly, 2, being sure it is fully seated.
4. Measure the distance “A” and measure the distance “B”. Add or subtract shims, 4, from the shim pack so that the measurements “A” - “B” = 0.15 mm (0.006 in).
5. Ring gear to pinion backlash can be set as mentioned above.



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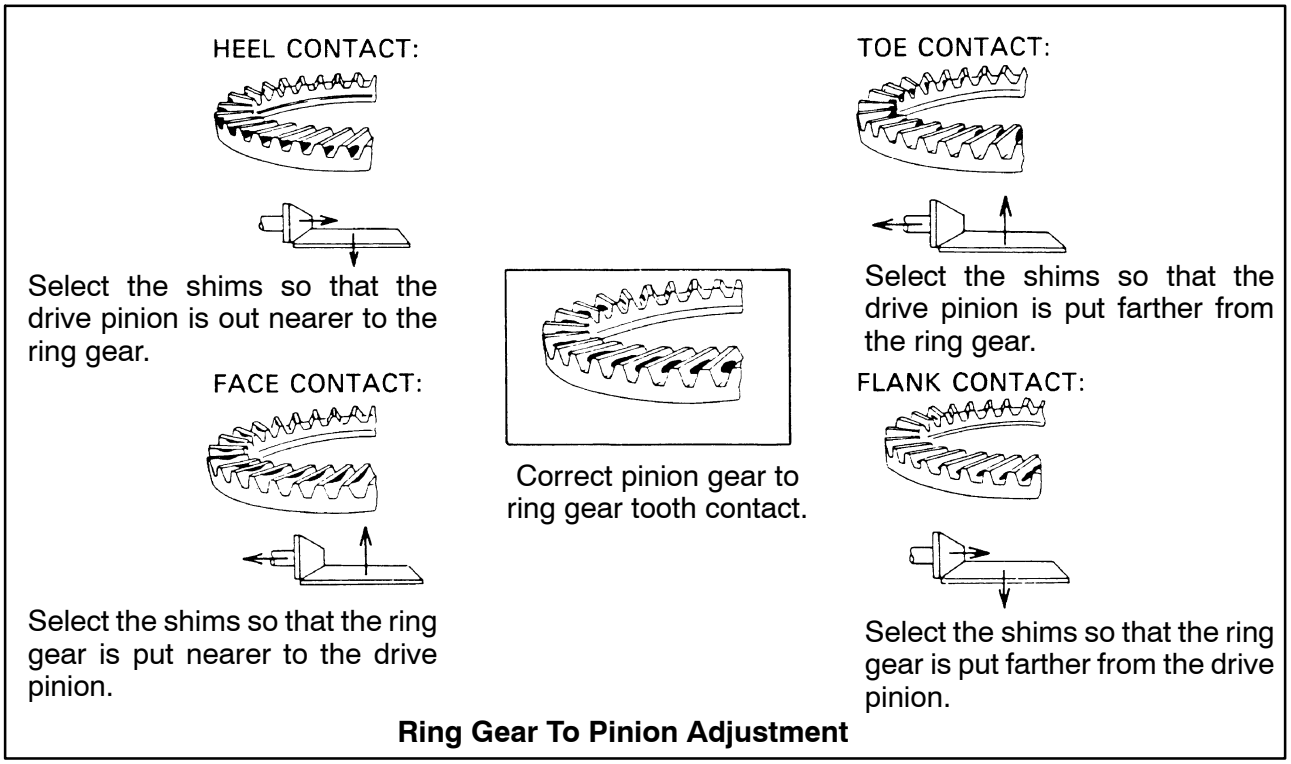
6. Apply Prussian blue to the pinion shaft gear teeth.
7. Rotate the pinion until the ring gear has rotated one complete revolution.
8. Inspect the gear tooth markings. If the markings are incorrect, adjust the pinion gear assembly as required to obtain the correct pattern as shown.



Ring Gear To Pinion Adjustment

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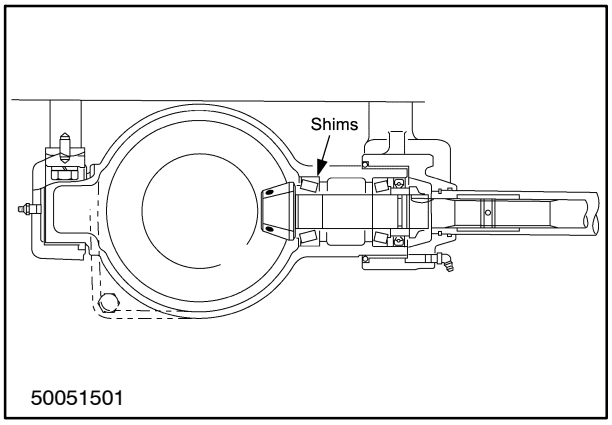
NOTE: *Ring and pinion markings may show substantial toe contact, under non-load conditions, (fig. 26). However, under-load conditions will show normal markings as in fig. 27.*



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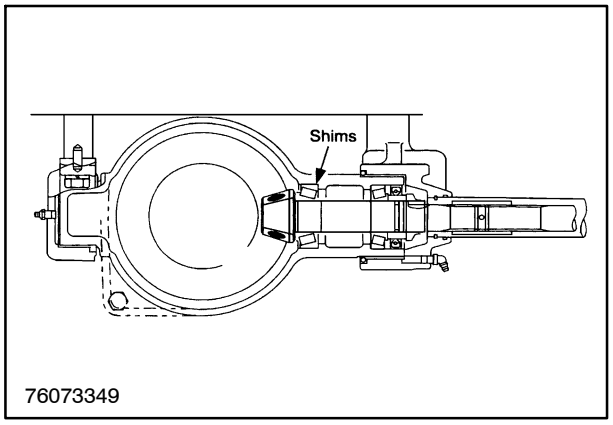

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AXLE AND DIFFERENTIAL

Assembly

If any of the following components are not being replaced, assemble the front axle using the original components.

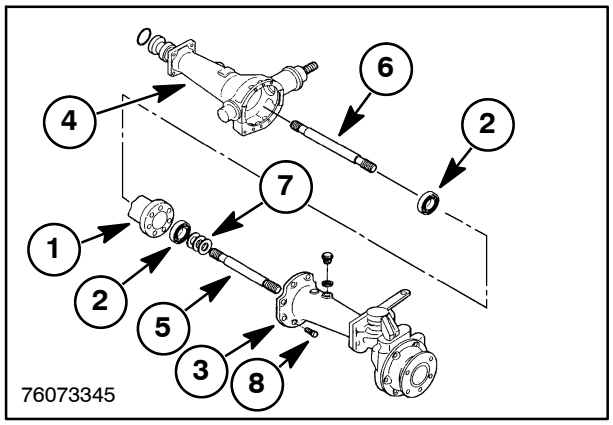
Differential assembly, 1.

Differential case carrier bearings, 2.

Axle housing, 3 and 4.

Axle shaft, 5 and 6.

Shim Pack, 7.



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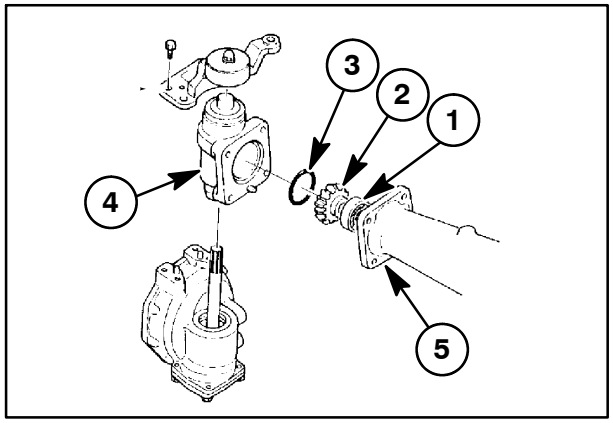
1. Install the shim pack, 7, in the differential axle housing, 3.

NOTE: *Observe the quantity and the size of the shims used on the pinion shaft. Shim sizes are 0.1 mm (0.004 ″), 0.2 mm (0.008 ″), and 0.5 mm (0.020 ″).*

2. Install the differential carrier bearings onto the differential assembly.
3. Position the differential assembly, 1, in the housing.
4. Apply liquid gasket to the left axle housing mating surface and align the right and left axle housings together.
5. Install the axle housing retaining bolts M14 x 45 x 1.5 (fine thread), 8, and tighten to 135 N·m (100 ft-lbs) torque.

NOTE: *The differential carrier bearing preload and ring gear backlash must be checked and adjusted if the differential case bearings, axle shaft inner bearings, or axle shaft have been replaced.*

6. Install the axle shaft into the FWD housing with the shorter splines of the shaft into the differential. Install outer bearing, 1, and pinion gear, 2, onto the axle shaft. Install the O-ring, 3, and attach the idler case, 4, onto the axle. Install the four M16 x 45 bolts, 5, and torque to 163 N·m (120 ft-lbs).



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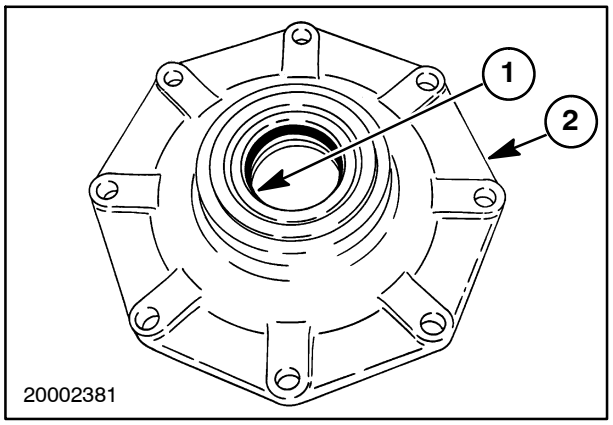
GEAR REDUCTION BOX

Assembly

IMPORTANT: *The oil seal, 1, is a cassette type seal and must be installed in the hub cover, 2, using the proper tools. If the proper tools are not used the seal may fail prematurely.*

NOTE: *Seal orientation is: metal side of seal faces outwards, away from the oil.*



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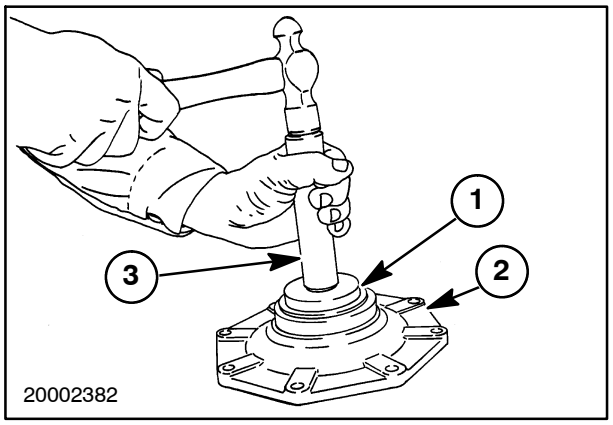
1. Lightly lubricate a new seal, 1, and install into the hub cover, 2, using the special tool, 3, No. NH00293.

NOTE: *Seal driver set No. NH00293 includes different sizes of drive plates. For this application use the following:*

- 27515 Drive Plate
- 27530 Drive Plate
- 27488 Handle



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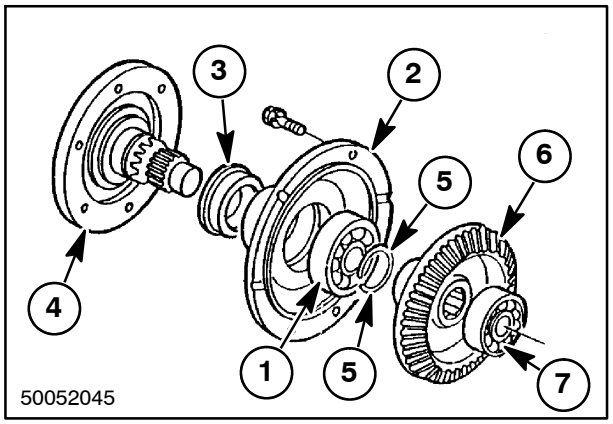
2. Position the wheel shaft outer bearing, 1, in the cover, 2.
3. Install the seal, 3, and the hub and shaft assembly, 4, in the cover, 2.
4. Position the two-piece locking ring, 5, in the shaft groove.
5. Install the bevel gear, 6, on the shaft, making certain that the bevel gear counterbore hub fits down fully over the locking ring, 5.
6. Install the inner bearing, 7, on the shaft.



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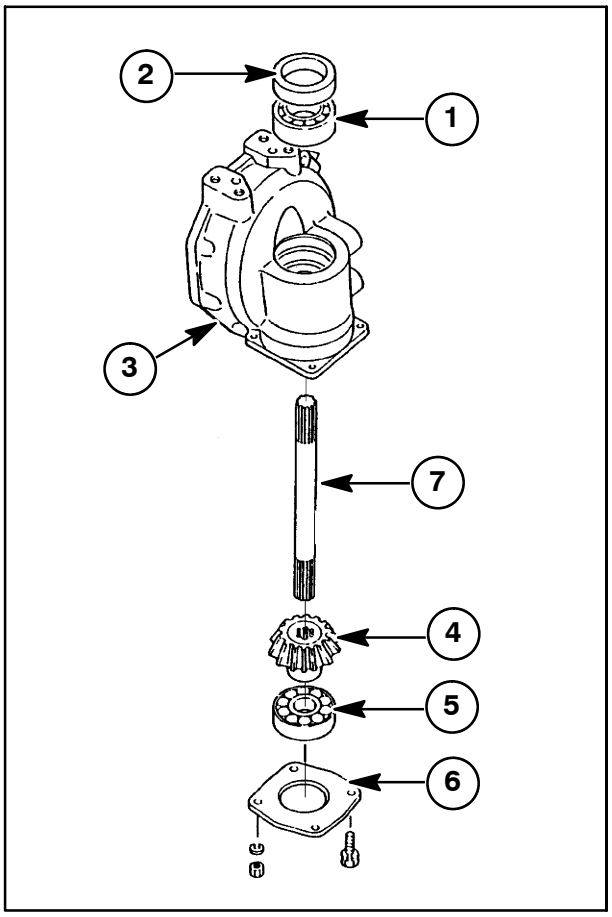
7. Install the idler gear bearing, 1, and seal, 2, in the drop box case, 3.
8. Install the final drive pinion gear, 4, bearing, 5, and cover, 6, in the bottom of the drop box case, 3.
9. Install the final pinion shaft, 7, from the top.



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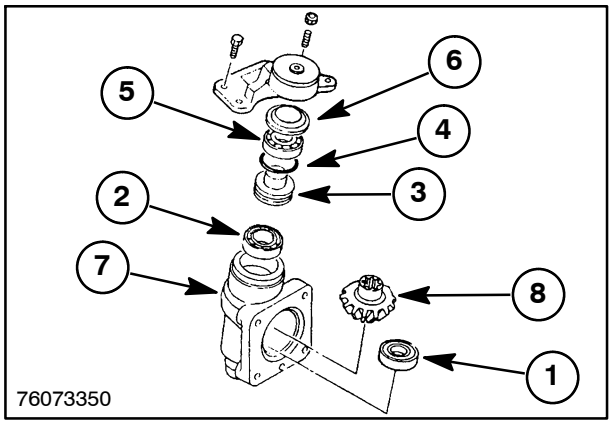
10. Install the bearings, 1 and 2, kingpin, 3, O-ring, 4, bearing, 5, and spacer, 6, into the idler case, 7.
11. Position the idler gear, 8, inside the idler case, 7.



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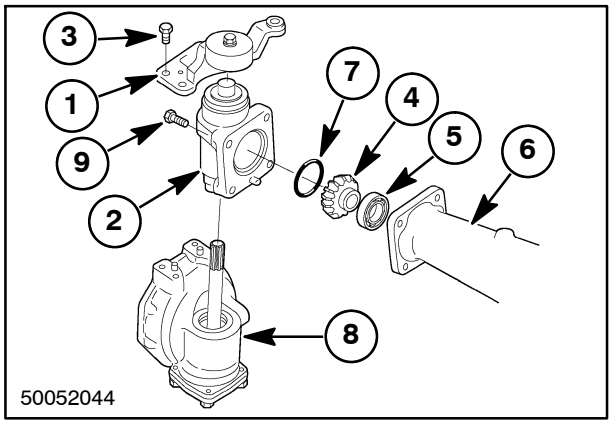
12. Install the steering arm assembly, 1, onto the idler gear case, 2.
13. Install the M12 x 35 retaining bolts, 3, and tighten to 81 N·m (60 ft-lbs) torque.
14. Install the pinion gear, 4, and bearing, 5, on the axle shaft. Apply liquid gasket to the mating surface of the axle housing, 6, and the idler gear case, 2.
15. Lightly grease and position, the O-ring, 7, in place on the axle housing, 6, and install the drop box assembly, 8, 2, and 1, to the axle housing, 6.
16. Install the drop box to axle housing retaining M16 x 45 bolts, 9, and tighten to 163 N·m (120 ft-lbs) torque.
17. Apply liquid gasket to the drop box cover mating surface, 10, and install the cover and hub assembly to the drop box case.
18. Install the M10 x 30 retaining bolts, 11, and tighten to 54 N·m (40 ft-lbs) torque.



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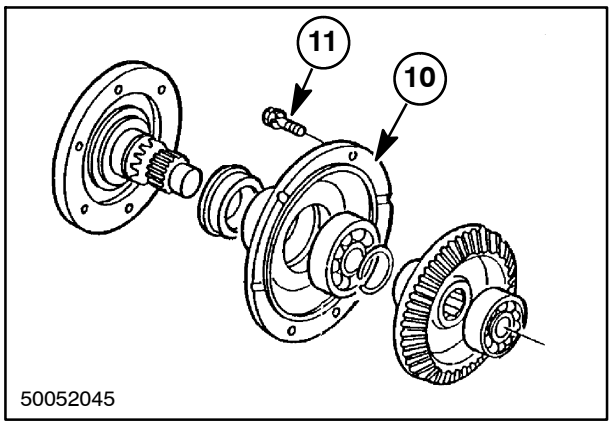

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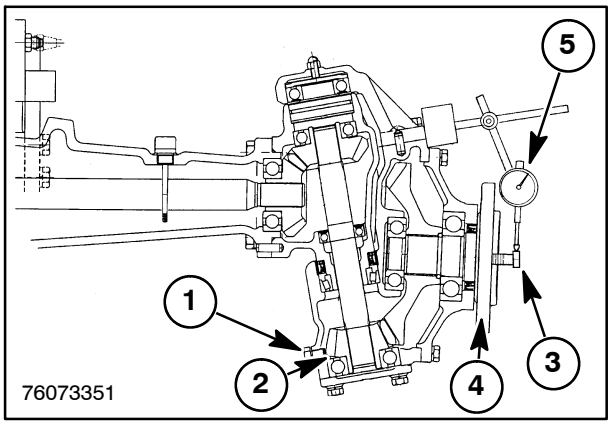
BEVEL GEAR-TO-PINION BACKLASH CHECK

With the front wheels removed and the front end of the tractor supported, use the following steps to determine the bevel gear-to-pinion gear backlash.

1. Remove the oil drain plug from the drop box case and drain the oil into a suitable container.
2. Install a long bolt, 1, into the drain plug hole, until it makes contact with the pinion gear, 2, and prevents it from rotating.
3. Install a bolt, 3, in the wheel hub flange, 4, and attach a dial indicator, 5.
4. Rotate the hub back and forth and observe the dial indicator reading. Replace the bearings and/or gears if the backlash exceeds 0.5 mm (0.020 in).



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SECTION 27 - DIFFERENTIAL, REAR AXLE

Chapter 1 - Differential

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SPECIFICATIONS

Differential Pinion Gear to Shaft Clearance

Std. . . . . 0.1 mm (.004″)

Max. . . . . 0.5 mm (.020″)

Differential Pinion Gear Thrust Washer Thickness

Std. . . . . 1.2 mm (.047″)

Min. . . . . 0.9 mm (.035″)

Differential Gear Thrust Washer Thickness (Side Gears)

Std. . . . . 2.0 mm (.079″)

Min. . . . . 1.7 mm (.067″)

Drive Pinion Pre-load . . . . . 17.5 - 20.0 Kgf (38.5 - 44 lbs)

Drive Pinion and Ring Gear Backlash . . . . . 0.15 - 0.20 mm (0.006 - 0.008″)

0.4 mm (0.16″) MAX.

Differential Side Gear to Pinion Gear Backlash . . . . . 0.1 - 0.15 mm (004″ - .006″)

0.4 mm (0.16″) MAX.

Rear Axle Diameter . . . . . 70 mm (2.76″)

BOLT TORQUE SPECIFICATIONS

Ring Gear Bolts . . . . . 56 N·m (41 ft-lbs)

Ring Gear Case End Plate Bolts . . . . . 25.5 N·m (19 ft-lbs)

Bearing Carrier Bolts . . . . . 50 N·m (37 ft-lbs)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

SPECIAL TOOLS

Seal Driver Set FNH00293

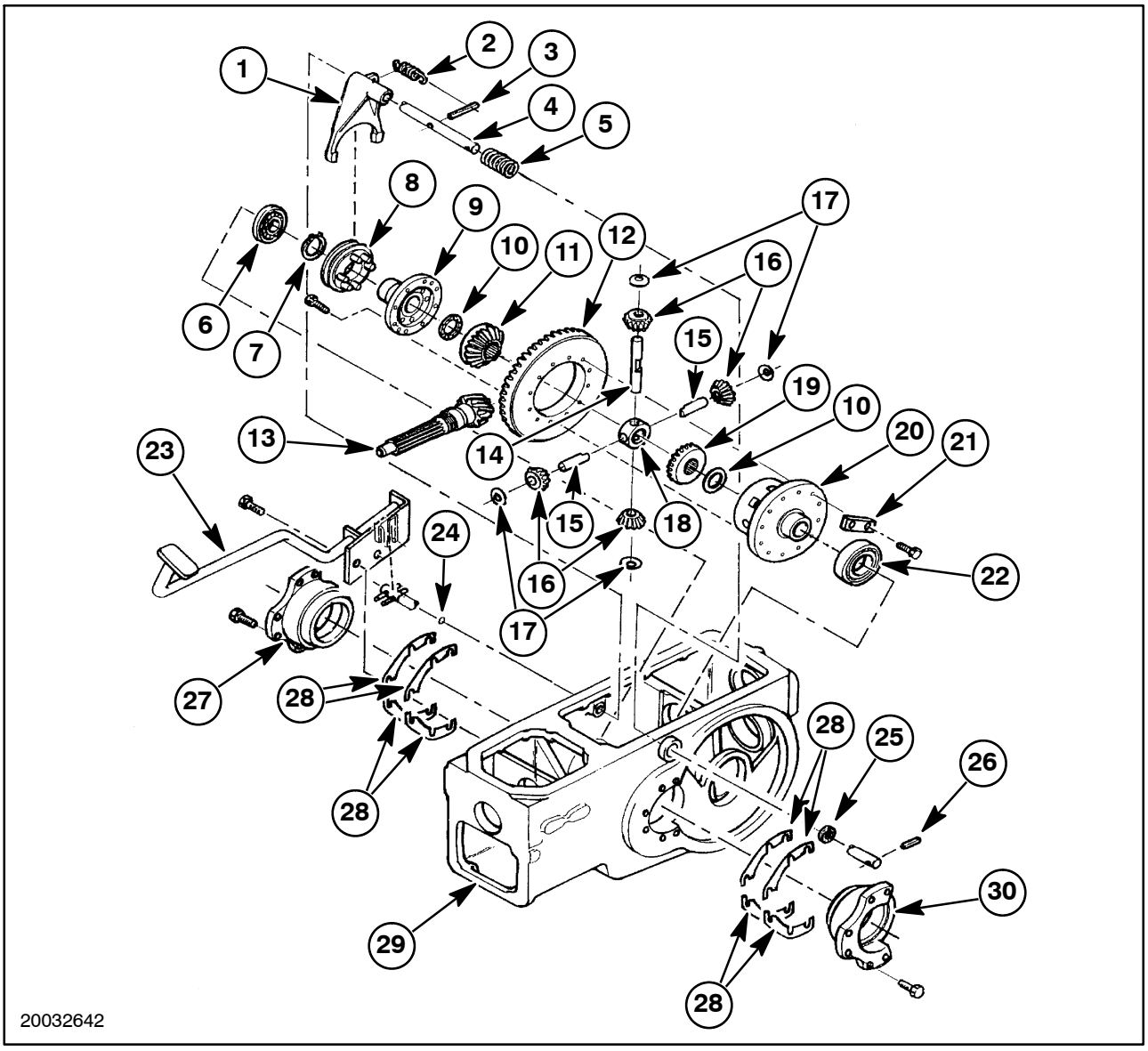
Included in this set:

Drive plates . . . . . 27542 (3-11/16″), 27527 (2-3/4″)

Handle 27488

Nut un-stake chisel 380000660

DESCRIPTION OF OPERATION - DIFFERENTIAL AND REAR AXLE



1

1. Differential Lock Fork
2. Tension Spring
3. Inner Roll Pin
4. Differential Lock Shaft
5. Return Spring
6. RH Differential Side Bearing
7. Retaining Ring
8. Differential Lock Clutch
9. Differential Gear Case End Plate
10. Thrust Washer
11. Side Gear, RH
12. Drive Ring Gear
13. Drive Pinion
14. Differential Pinion Shaft, Long
15. Differential Pinion Shaft, Short
16. Pinion Gear
17. Thrust Washer
18. Pinion Shaft Joint
19. Side Gear, LH
20. Differential Gear Case
21. Lock Plate
22. LH Differential Side Bearing
23. Differential Lock Pedal
24. O-ring
25. Differential Lock Shaft Oil Seal
26. Roll Pin
27. RH Bearing Carrier
28. Shims (as required)
29. Differential Housing
30. LH Bearing Carrier

DIFFERENTIAL

The differential assembly consists of a drive pinion, a ring gear, differential pinion gears, axle side gears, and a differential lock, contained in the differential housing. Power is transferred from the transmission to the differential drive pinion and ring gear. The ring gear is bolted to the differential case, which contains the differential pinion gears and the axle side gears.

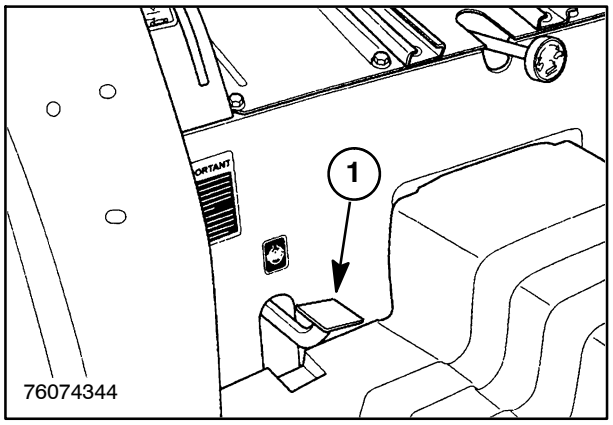
As the differential case rotates, the differential pinion gears rotate and drive the two axle side gears. The final drive pinions are splined to the side gears and mesh with the final drive gear. As the final drive pinions rotate with the differential assembly, power is transmitted to the final drive gears and rear axles.

A front wheel drive output dropbox assembly is mounted to the bottom of the differential housing on tractors equipped with the front wheel drive option. The front wheel drive gears and the output shaft are driven by a pinion gear located on the pinion shaft. The front wheel drive is operated by a control lever located to the left of the seat.

DIFFERENTIAL LOCK

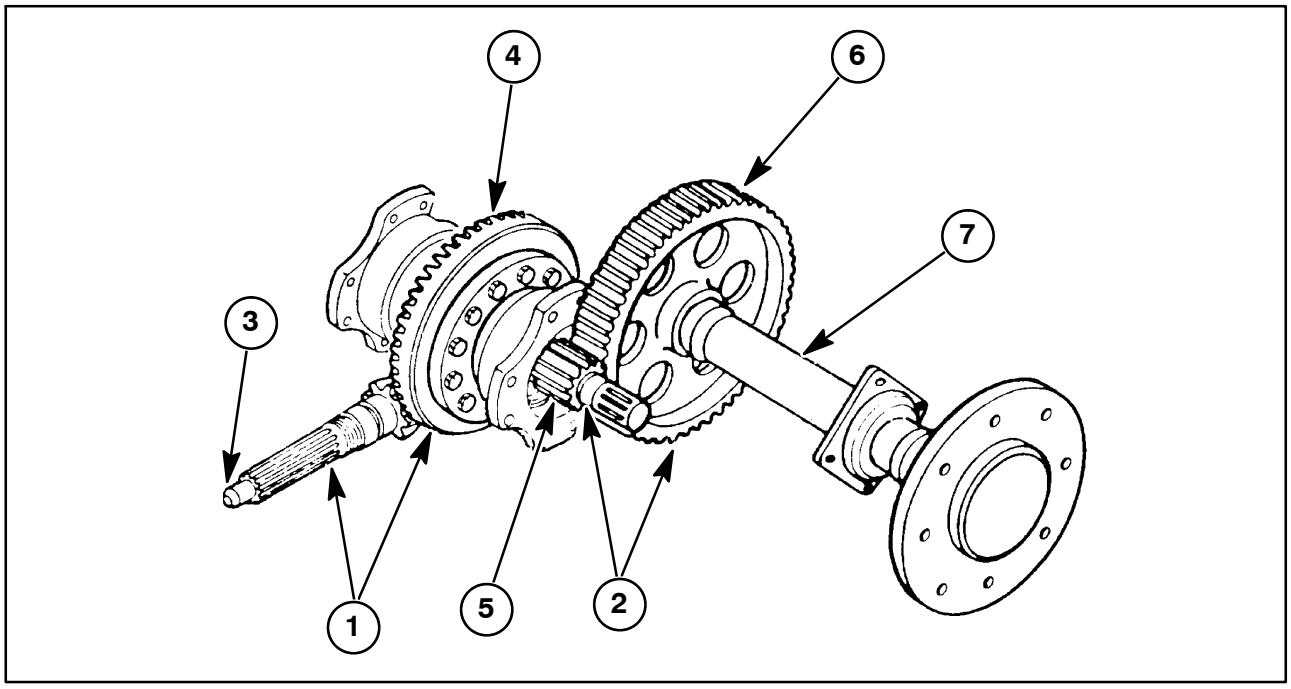
A differential lock is provided to lock the differential system, so that both rear wheels are driven by the differential gears, even when one wheel loses traction. The differential lock control pedal, 1, is foot-operated and is located on the RH side of the deck.

Depressing the pedal rotates the shaft and drives the differential lock shaft, and attached lock fork, toward the differential assembly, compressing the return spring. This causes the differential lock clutch to move toward the differential gear case. A pattern of lugs on the lock clutch slides through a matching pattern of holes on the gear case end plate, and engages the RH differential side gear. Continued pressure on the foot pedal functionally locks the side gear to the differential case. When the foot pedal is released, the return spring moves the lock fork and the lock clutch away from the differential case, disengaging the differential lock.



2

REAR AXLE



3

1. Ring Gear and Pinion- Primary Reduction
2. Final Drive Pinion and Gear- Secondary Reduction
3. Differential Pinion
4. Differential Ring Gear
5. Final Drive Pinion
6. Final Drive Gear
7. Rear Axle Shaft

The rear axle used on the T2410 and T2420 is a double reduction type, consisting of a conventional ring gear and pinion for primary reduction, and a final drive pinion and gear for secondary reduction. The axle case encloses the brake discs and stators. The rear axle and differential components are lubricated by the common hydraulic oil reservoir.

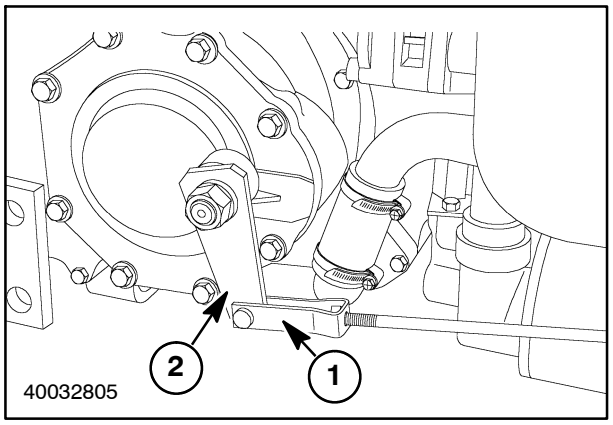
OVERHAUL

DIFFERENTIAL

Removal

To remove the differential assembly from the differential housing, the hydraulic PTO clutch and shafts must first be removed. To accomplish this, the differential housing must be separated from the transmission. See Section 21 for separating the EHSS and 12 x 12 transmission. For removal of the PTO clutch and shafts, see “PTO”, Section 31.

1. Remove the lower lift links from the rear axles.
2. Disconnect the brake control rods, 1, from the brake control levers, 2.



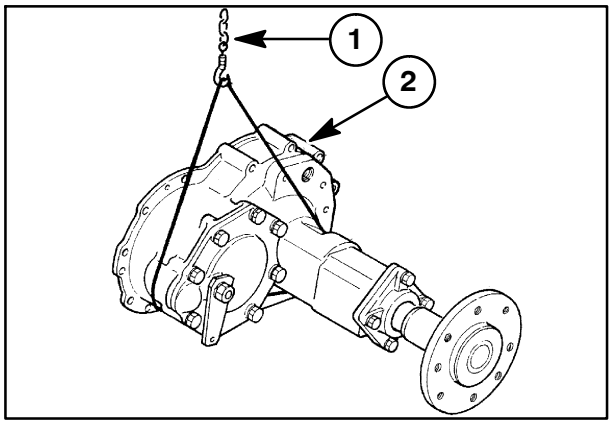
4

3. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and remove the axle case retaining bolts.

⚠ WARNING ⚠

The axle housing is difficult to balance. Use caution during removal to avoid personal injury.

4. Separate the axle assembly from the differential housing and use the lifting device to move the axle assembly out and away from the differential housing.
5. Repeat steps 3 and 4 from the opposite side of the tractor.
6. Remove the hydraulic lift cover from the differential housing. See “Hydraulics”, Section 35.



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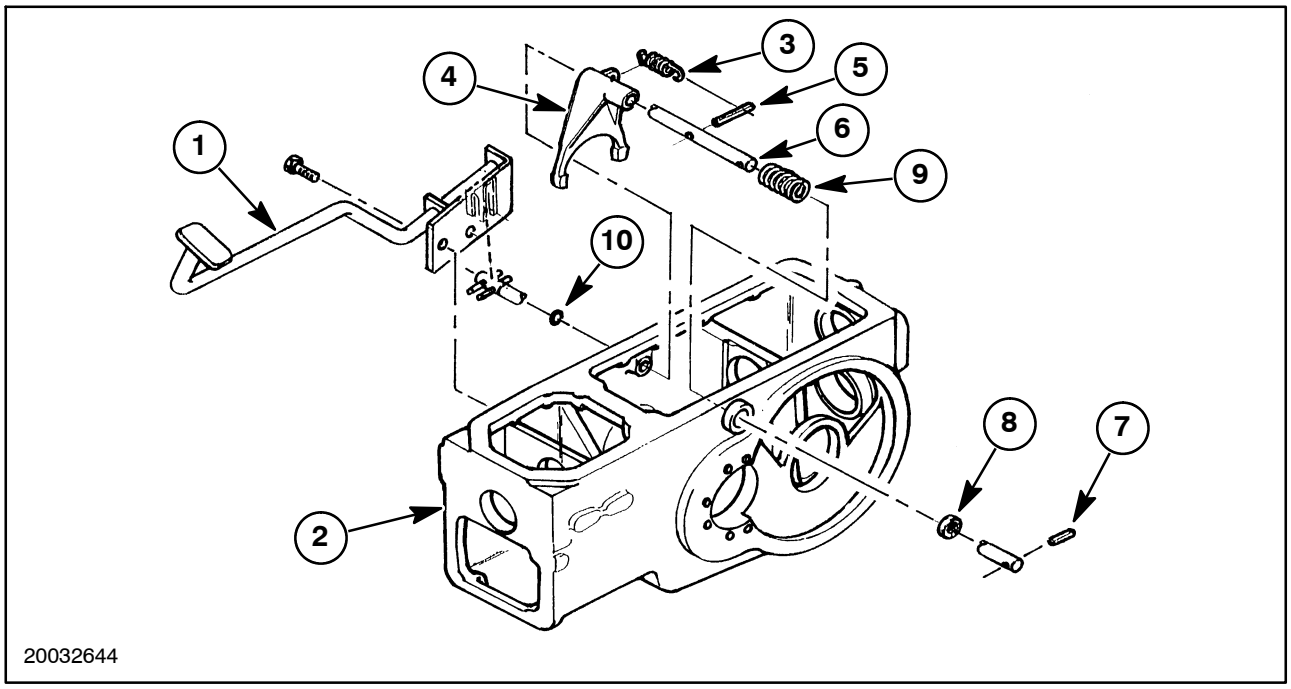
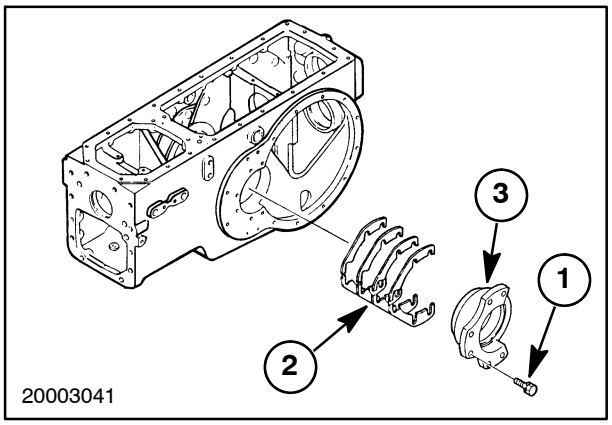


6

7. Remove the differential lock pedal, 1, from the differential housing, 2.
8. Remove the tension spring, 3, from the differential lock fork, 4, and the long roll pin, 5.
9. Remove the long roll pin, 5, from the differential lock shaft, 6.
10. Remove the retaining roll pin, 7, from the differential lock shaft, 6.
11. Using a hammer and a brass or aluminum drift, carefully drive the differential lock shaft, 6, free of the oil seal, 8, in the LH side of the differential housing, 2.
12. Slide the lock shaft, 6, free of the return spring, 9, and remove the return spring.
13. Slide the lock shaft, 6, free of the lock fork, 4, and out the RH side of the differential housing, 2, and remove the lock fork.
14. Remove and discard the lock shaft oil seal, 8, and O-ring, 10, from the LH side of the differential housing, 2.
15. Remove the PTO clutch and shafts from the differential housing to gain access to the differential assembly. See “PTO”, Section 31, for removal procedure.

16. Loosen and remove the six retaining bolts, 1, securing the LH differential bearing carrier, 3, to the differential housing. Remove the shims found between the bearing carrier, 3, and the differential housing, noting the number and thickness of the shims for ease of assembly. Remove the bearing carrier, 3, from the differential housing. Repeat for the right side.
17. Using pry bars, carefully remove the side bearings from the differential assembly, and set the bearings aside with their respective bearing carriers.

NOTE: *The side bearings are NOT identical. The RH side bearing has an integral retaining ring, used to locate the bearing axially, while the outer case of the LH bearing is plain.*

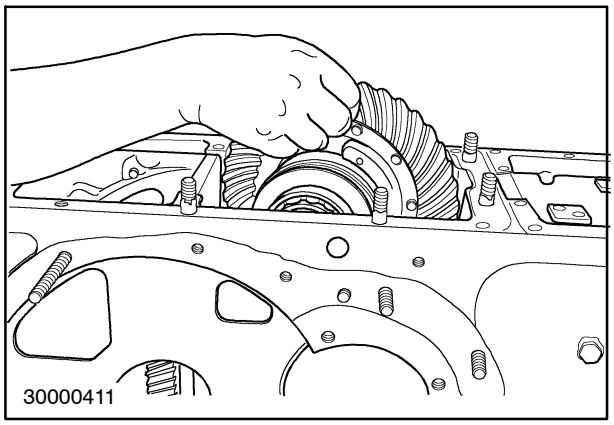


7

18. Carefully lift the differential assembly from the top of the differential housing.

⚠ CAUTION ⚠

The differential assembly is heavy, and slippery with hydraulic oil. Use both hands to carefully lift the assembly straight up and out of the differential housing.



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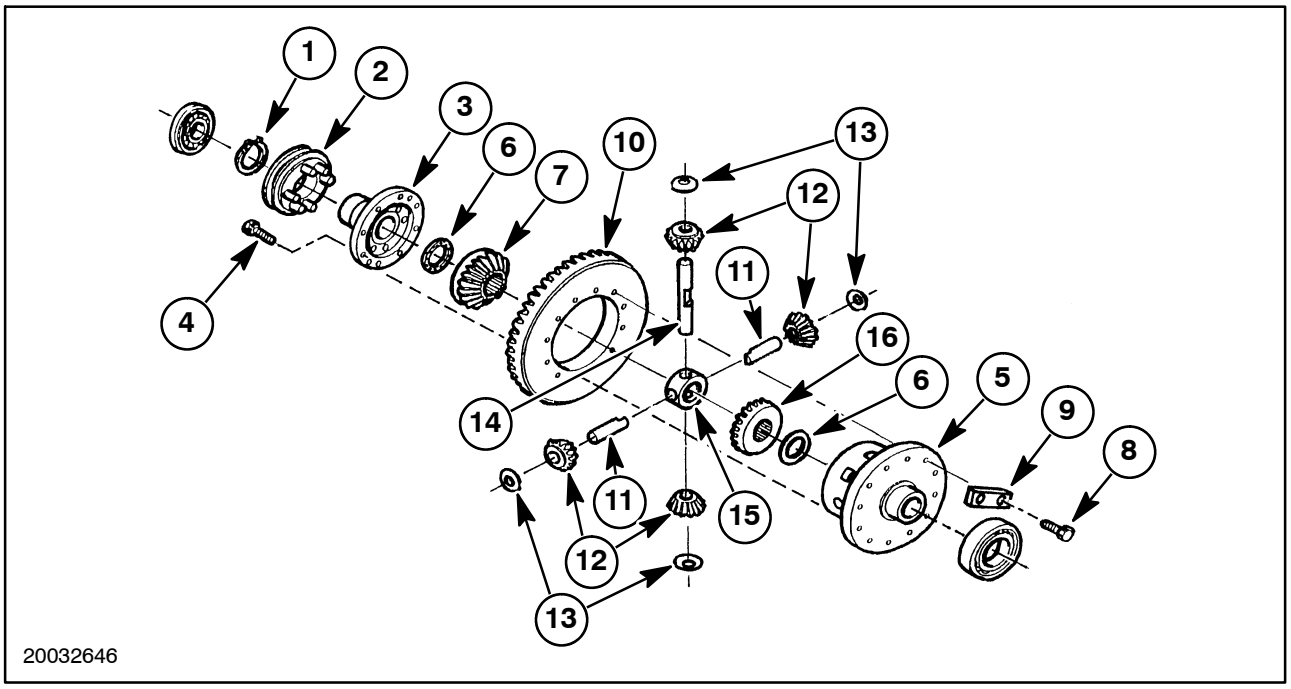


9

1.	Retaining Ring	9.	Lock Plate
2.	Differential Lock Clutch	10.	Drive Ring Gear
3.	Differential Case End Plate	11.	Short Pinion Shaft
4.	Retaining Bolt	12.	Differential Pinion Gear
5.	Differential Gear Case	13.	Thrust Washer
6.	Thrust Washer	14.	Long Pinion Shaft
7.	RH Side Gear	15.	Pinion Joint
8.	Retaining Bolt	16.	LH Side Gear

Disassembly

1. Remove the retaining ring, 1, securing the differential lock clutch, 2, to the differential gear case end plate, 3.
2. Remove the differential lock clutch, 2.
3. Loosen and remove the eight gear case end plate retaining bolts, 4.
4. Separate the end plate, 3, from the differential gear case, 5.
5. Remove the thrust washer, 6, and RH differential side gear, 7, from the gear case, 5.

NOTE: *Observe the dissimilarity between the RH and LH differential side gears, 7 and 14. The RH gear, 7, has a pattern of six clearance holes which receive the locking pins on the differential lock clutch, 2.*

6. Remove the twelve bolts, 8, and six lock plates, 9, securing the ring gear, 10, to the gear case, 5.

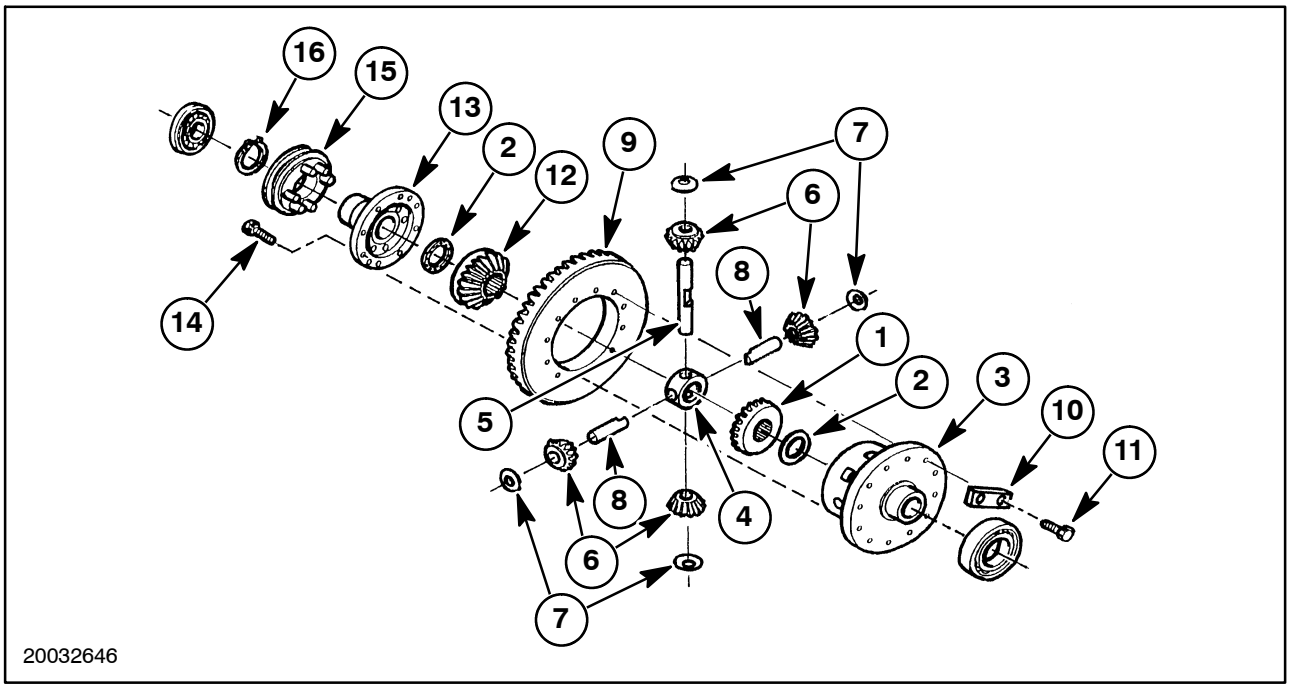
NOTE: *The original manufacturer uses a commercial thread sealant on the retaining bolts, instead of the lock plates. All service assembly should use the lock plates.*

7. Remove the two short pinion shafts, 11, and their associated pinion gears, 12, and thrust washers, 13, from the gear case, 5. (Slide the shafts straight out through the walls of the gear case.)
8. Remove the long pinion shaft, 14, pinion joint, 15, and the remaining two pinion gears, 12, and thrust washers, 13, from the gear case, 5. (Slide the shaft straight out either wall of the gear case.)
9. Remove the remaining (LH) side gear, 16, and thrust washer, 6, from the gear case, 5.

Inspection

1. Clean all parts in a suitable solvent and allow to air dry.
2. Inspect side gear teeth for excessive wear or damage.
3. Measure the thickness of the differential gear thrust washer. Referencing the specifications at the beginning of this section, replace any washers that measure less than the minimum thickness.
4. Inspect the differential pinion gears and shafts for excessive wear or damage.
5. Inspect the differential gear case and end plate for wear or damage.

NOTE: *If removing the drive pinion at this time, proceed to that section before re-installing the differential assembly.*



10

Assembly

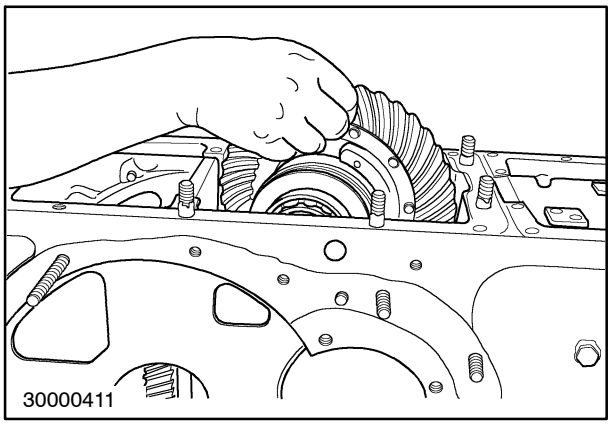
1. Install the LH side gear, 1, and thrust washer, 2, into the differential gear case, 3.
2. Assemble the pinion joint, 4, long pinion shaft, 5, two pinion gears, 6, and two thrust washers, 7, into the gear case, 3.
3. Install the two remaining pinion gears, 6, and thrust washers, 7, into the gear case, 3.
4. Slide the two short pinion shafts, 8, in through the outer wall of the gear case, 3, through the thrust washers and pinion gears, and into the pinion joint, 4.

NOTE: *The short pinion shafts each have a step on one end, which must locate against the flat in the center of the long pinion shaft to fully seat the short shafts.*

5. Install the ring gear, 9, against the mounting flange on the gear case, 3. Secure the ring gear with six lock plates, 10, and twelve retaining bolts, 11.
6. Torque bolts to 56 N·m (41 ft-lbs), and bend lock plates over head of bolt.
7. Install the remaining (RH) side gear, 12, and thrust washer, 2, into the gear case, 3.
8. Install the gear case end plate, 13, on the gear case, 3, and secure with eight retaining bolts, 14.
9. Torque bolts to 25.5 N·m (19 ft-lbs).
10. Slide the differential lock clutch, 15, onto the gear case end plate, 13, engaging the six locking lugs on the clutch with the pattern of holes on the end plate.
11. Install the retaining ring, 16, to secure the lock clutch, 15, to the gear case end plate, 13.

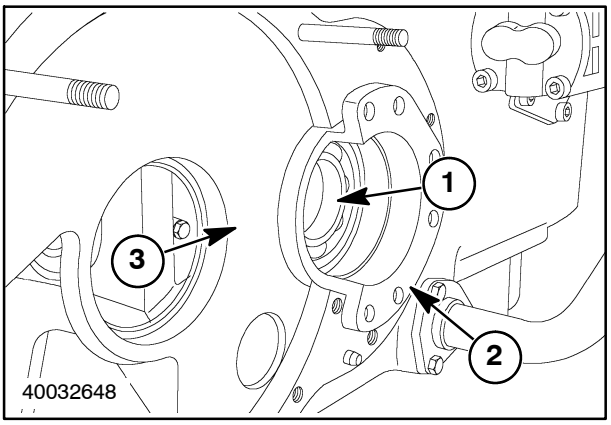
Installation

1. Carefully lower the differential assembly into the differential housing.



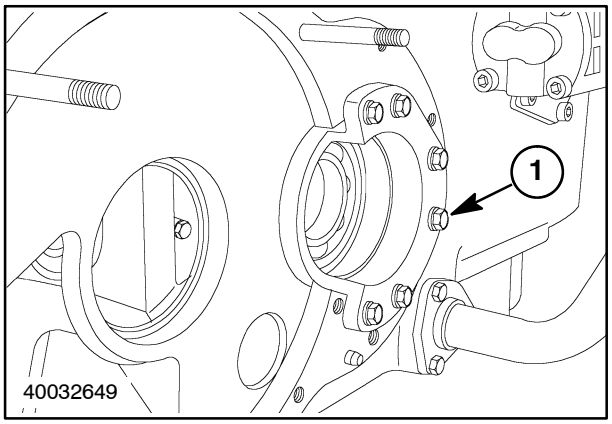
11

2. Install both differential side bearings, 1, and their respective bearing carriers, 2, into the differential housing, 3. (Do not install the shims at this stage.)



12

3. Lift the differential assembly up to align its centerline with the RH bearing. Using a hammer and brass or aluminum drift, carefully tap the bearing carrier to start the bearing onto the protruding hub on the differential gear case end plate.
4. Start, but do not fully install, the six bearing carrier retaining bolts, 1.
5. Similarly start the LH bearing onto the hub on the LH side of the differential assembly, and partially install the mounting bolts on that side of the differential housing.
6. Tighten both sets of mounting bolts until approximately 3.0 mm (0.12″) space remains between the bearing carriers and the sides of the differential housing.

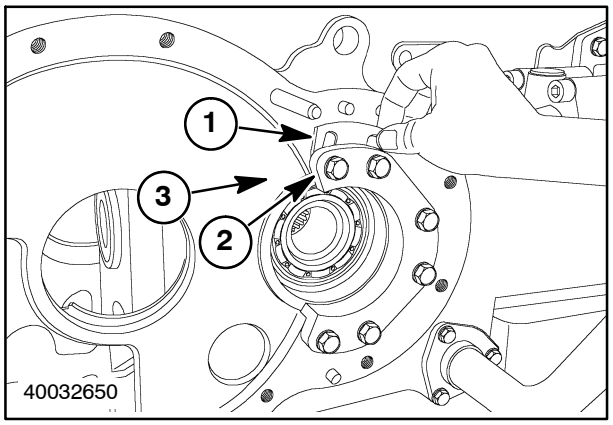


13

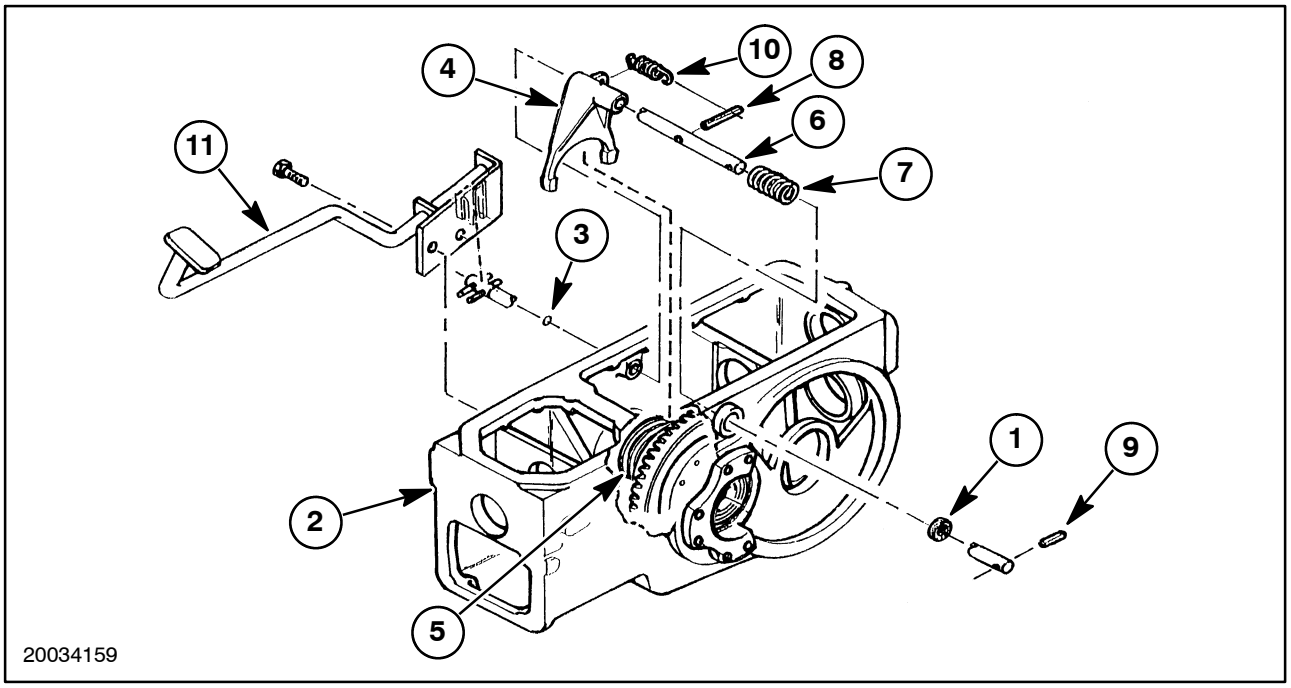
7. Carefully place the shims, 1, in position between the bearing carriers, 2, and the sides of the differential housing, 3, and tighten the bolts.

NOTE: *Ensure that the shims are replaced in exactly the same position and orientation in which they were removed. The shims establish the correct contact between the drive pinion and ring gear.*

8. Torque all of the bearing carrier mounting bolts to 50 N·m (37 ft-lbs).
9. Install the PTO clutch and any PTO shafts that were removed to gain access to the differential. See Section 31, “PTO”, for the installation procedure.



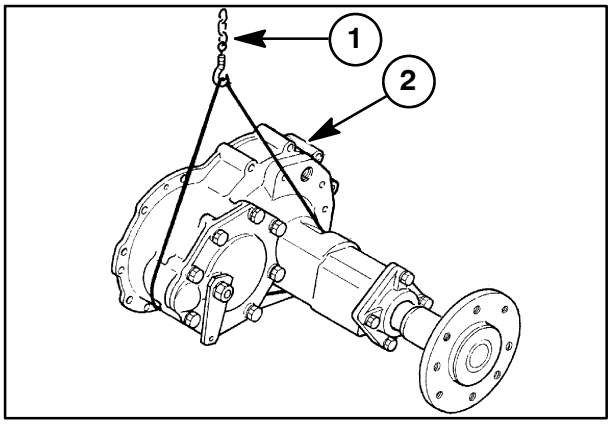
14



15

10. Lubricate a new differential lock shaft oil seal, 1, with petroleum jelly, and install in the LH side of the differential housing, 2.
11. Visually inspect the O-ring, 3, on the fork end of the differential lock shaft, and replace if damaged.
12. Install the arms of the differential lock fork, 4, into the groove in the differential lock clutch, 5.
13. Slide the differential lock shaft, 6, in through the RH side of the differential housing and through the differential lock fork, 4.
14. Install the return spring, 7, and slide the lock shaft, 6, through the spring and out through the oil seal, 1, in the RH side of the differential housing.
15. Compress the return spring, 7, and install the long roll pin, 8, into the lock shaft, 6, between the return spring and the lock fork, 4.
16. Install the outer roll pin, 9, into the differential lock shaft, 6, outboard of the oil seal, 1.
17. Install the tension spring, 10, onto the lock fork, 4, and the long roll pin, 8.
18. Engage the fork end of the differential lock pedal, 11, with the two roll pins in the fork end of the differential lock shaft, 6, and secure the lock pedal mounting bracket to the RH side of the differential housing, 2, with two bolts.

19. Install the hydraulic lift cover onto the differential housing. See Section 35, “Hydraulics”.
20. Apply a thin bead of silicone-based gasket material to the differential housing, on the surface that receives the axle case.
21. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and position the axle case on the differential housing. Be sure to align the mounting holes and the final gear and final pinion with the housing.



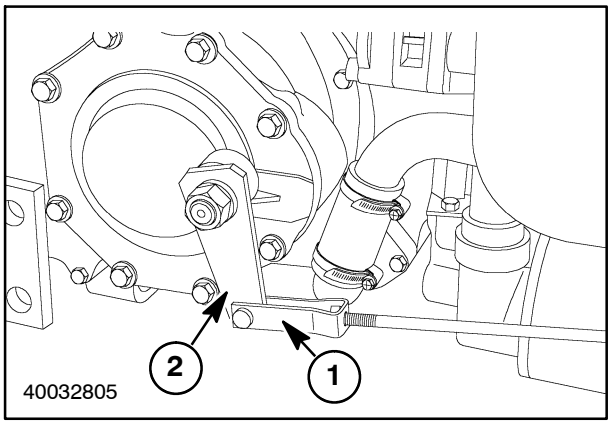
16

⚠ WARNING ⚠

The axle housing is difficult to balance.

Use caution during installation to avoid personal injury.

22. Install and tighten the axle case retaining bolts.
23. Install the wheels and the fenders onto the tractor.
24. Connect the brake control rods, 1, to the brake control levers, 2.
25. Connect the lower lift links to the rear axles.
26. Fill the combined transmission, rear axle, and hydraulic reservoir with clean AMBRA MULTI G134 hydraulic oil.
27. Install the ROPS onto the tractor.



17

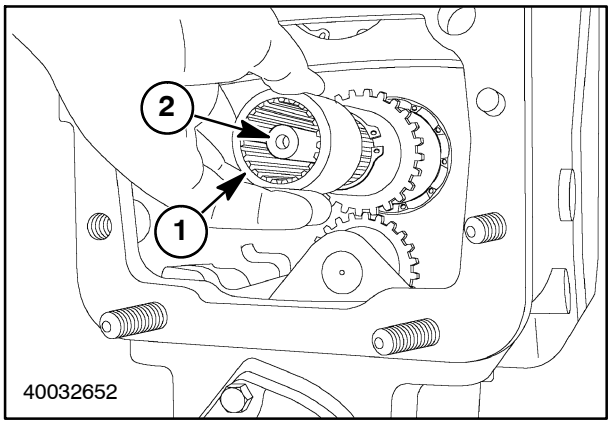
DRIVE PINION

Removal

NOTE: *See “Differential Overhaul - Removal” for the procedure to remove the differential, to allow access to the drive pinion.*

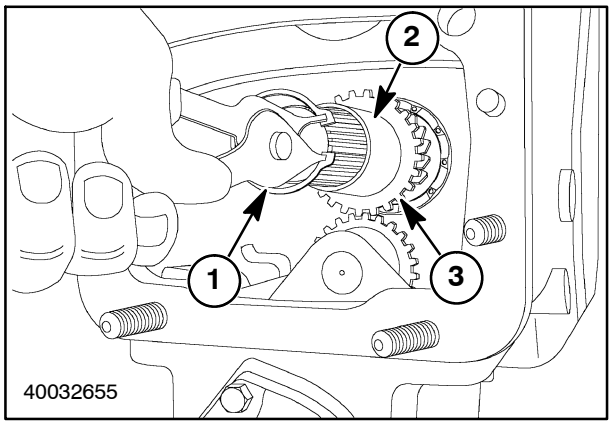
Disassembly

1. Remove the transmission shaft coupling, 1, from the drive pinion shaft, 2.



18

2. Remove the retaining ring, 1, holding the spacer, 2, against the fixed gear, 3.



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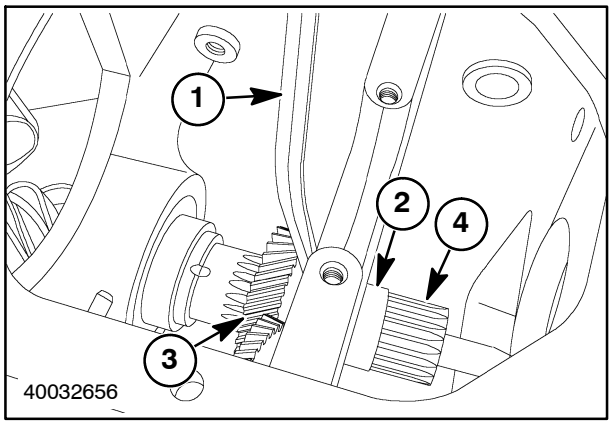
3. Use a prybar, 1, to loosen and remove the spacer, 2, and fixed gear, 3, from the drive pinion shaft, 4.



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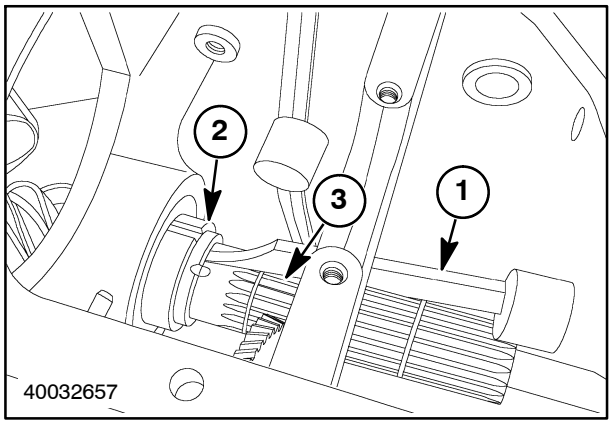
4. Use a hammer and special unstaking tool, 1, 380000660 to loosen the locking collar, 2, from the keyway in the pinion shaft, 3.

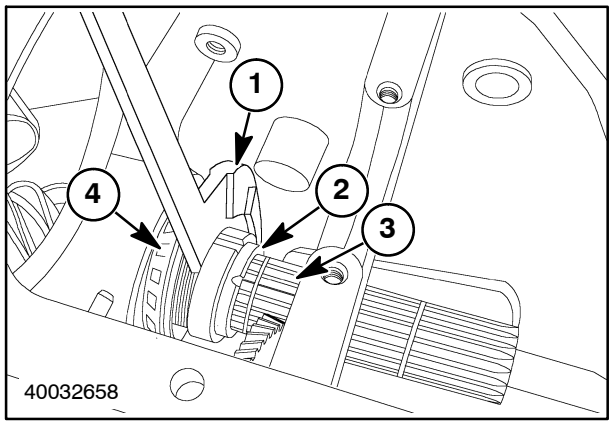


21

5. Use a spanner wrench, 1, to remove the locking collar, 2, from the pinion shaft, 3.

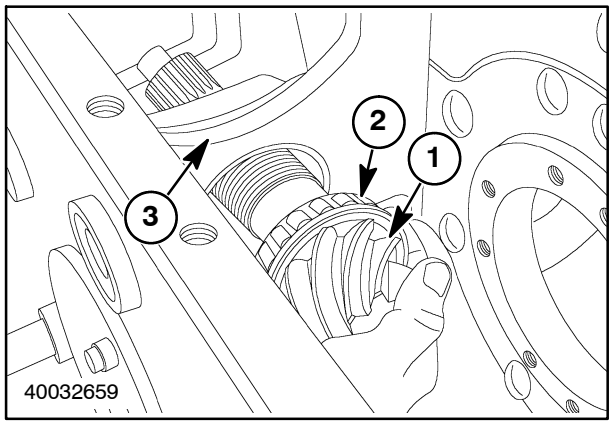
NOTE: *Discard the locking collar and use a new collar for re-installation. Never re-use the locking collar after it has been staked to the shaft and removed.*

6. Remove the forward tapered roller bearing, 4, from the pinion shaft, 3.



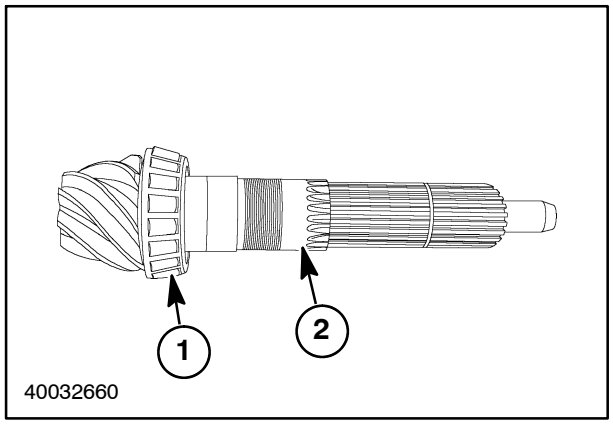
22

7. Pull the pinion shaft, 1, with rear tapered roller bearing, 2, straight rearward out of the differential housing, 3.



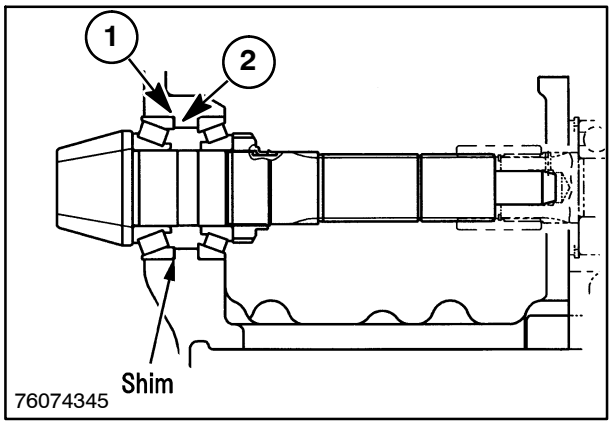
23

8. Using a hammer and a brass or aluminum drift, carefully tap the rear tapered roller bearing, 1, free of the pinion shaft, 2, and remove the bearing.
9. Remove the rear roller bearing from the center housing.



24

10. Remove and retain any shims found between the roller bearing outer race, 1, and the center housing.



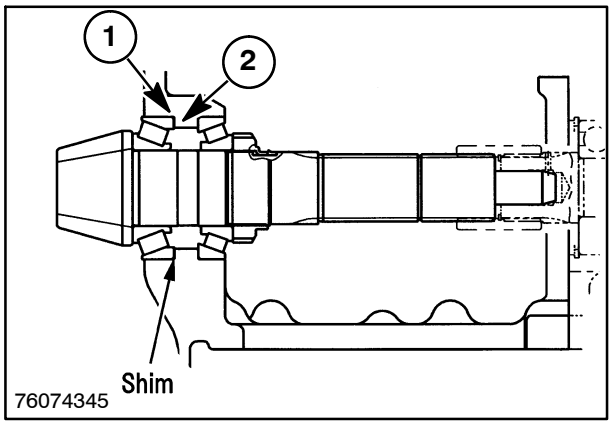
25

Inspection

1. Clean all parts in a suitable cleaning solvent and allow to air dry.
2. Turn the tapered roller bearings by hand to check for roughness. Replace as necessary.
3. Inspect the drive pinion shaft for excessive wear, nicks, chips, or other damage. Replace as necessary.
4. Inspect the fixed gear for excessive wear, nicks, chips, or other damage. Replace as necessary.

Assembly

1. Install any required shims, and the tapered roller bearing outer race, 1, in the center housing, 2, and carefully seat the bearing with a hammer and drift.
2. Install rear tapered roller bearing on the drive pinion shaft.



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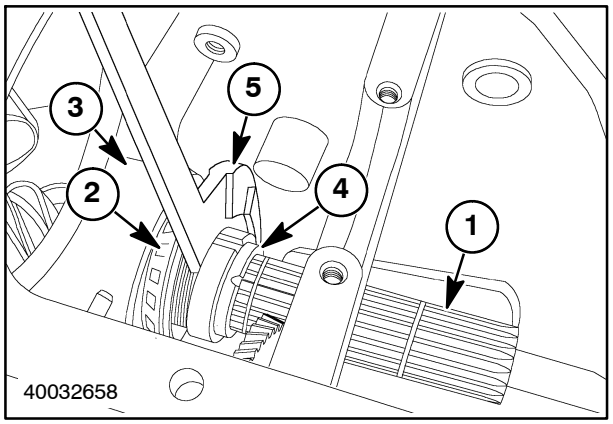
3. Install the drive pinion shaft, 1, from the rear of the differential housing. Slide the forward tapered roller bearing, 2, onto the shaft and into its bore in the bulkhead, 3.
4. Thread the locking collar, 4, onto the pinion shaft and tighten with a spanner wrench, 5.



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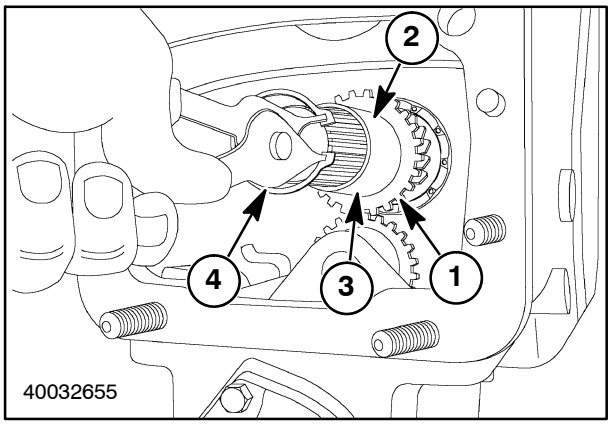
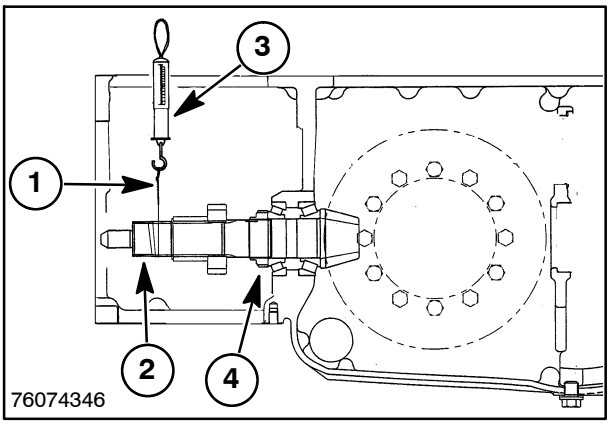
5. Slide the fixed gear, 1, and spacer, 2, onto the pinion shaft, 3, and secure with retaining ring, 4.
6. Lubricate with hydraulic oil and rotate the drive pinion shaft several times by hand before proceeding with the pull-scale test.



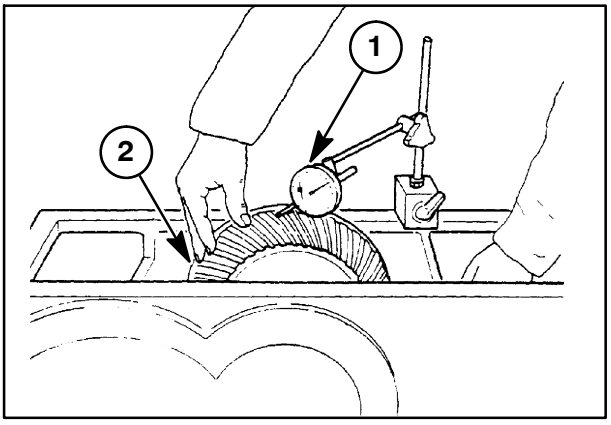
28

7. Adjust the pinion bearing preload (rolling torque) by wrapping a strong cord, 1, around the pinion shaft, 2.
8. Attach the opposite end of the cord to a pull scale, 3.
9. Tighten the locking collar, 4, while pulling on the pull scale, until a constant pull of 17.5 - 20.0 Kgf (38.5 - 44.0 lbs) is required to rotate the drive pinion shaft, 2.
10. When the proper rolling torque is achieved, stake the locking collar, 4, to the keyway in the pinion shaft, 2, to maintain the adjustment.
11. Install the differential into the differential housing and secure with the RH and LH bearing carriers. See “Differential Overhaul - Installation”.
12. If new differential components are used, adjust the backlash, and the ring gear contact pattern as follows:



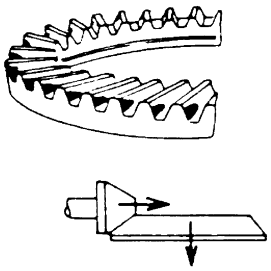
29

- Place a dial indicator, 1, at a right angle to the top of one ring gear tooth, 2.
- Rock the ring gear, 2, back and forth and observe the reading on the dial indicator, 1.
- Adjust the shims to obtain the correct backlash, to 0.15 - 0.20 mm (0.006″ - 0.008″).



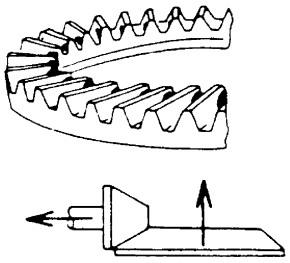
30

HEEL CONTACT:

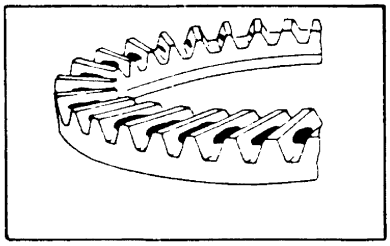


Select the shims so that the drive pinion is out nearer to the ring gear.

TOE CONTACT:

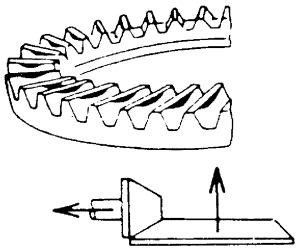


Select the shims so that the drive pinion is put farther from the ring gear.



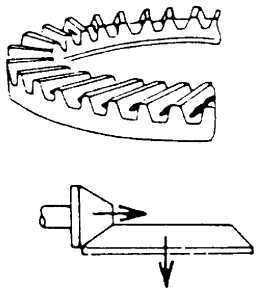
Correct pinion gear to ring gear tooth contact.

FACE CONTACT:



Select the shims so that the ring gear is put nearer to the drive pinion.

FLANK CONTACT:



Select the shims so that the ring gear is put farther from the drive pinion.

31

- Using Prussian Blue on the pinion gear teeth, rotate the pinion gear, and check the gear tooth contact pattern.
- Adjust the pinion shims and the differential shims to obtain the correct tooth contact pattern.

13. See “Differential Overhaul - Installation” for the remainder of the differential installation.

SECTION 27 - DIFFERENTIAL, REAR AXLE

Chapter 2 - Rear Axle

CONTENTS

Section	Description	Page
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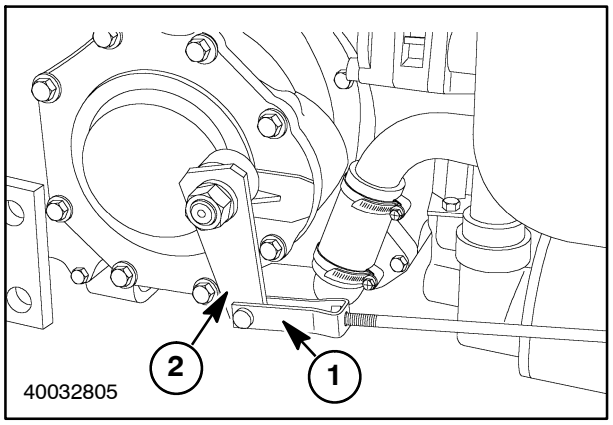
OVERHAUL

REAR AXLE

Removal

1. Remove the ROPS from the tractor.
2. Remove the wheels and the fenders from the tractor.
3. Drain the oil from the combined transmission, rear axle, and hydraulic reservoir into a suitable container.
4. Remove the lower lift links from the rear axles.
5. Disconnect the brake control rods, 1, from the brake control levers, 2.



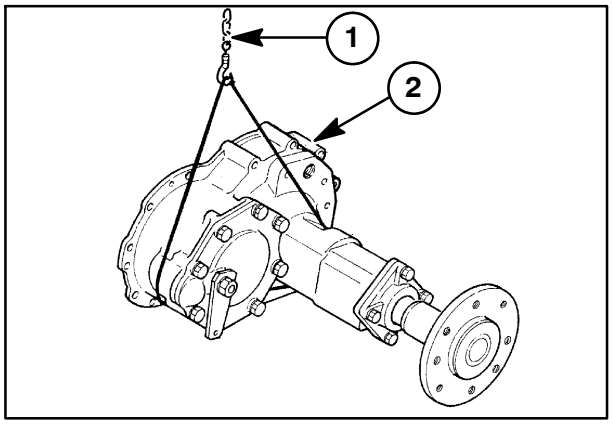
1

6. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and remove the axle housing retaining bolts.

⚠ WARNING ⚠

The axle housing is difficult to balance. Use caution during removal to avoid personal injury.

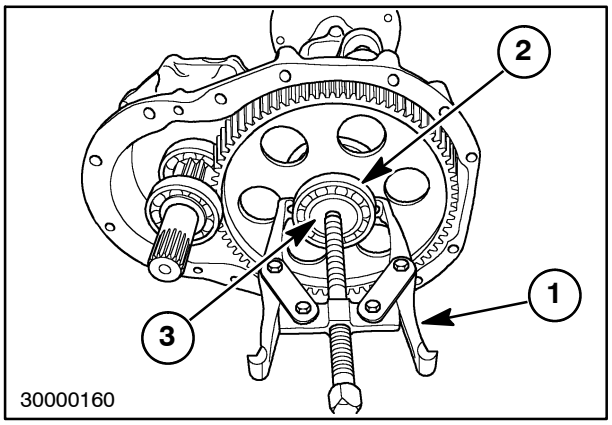
7. Separate the axle assembly from the differential housing and use the lifting device to move the axle assembly out and away from the differential housing.



2

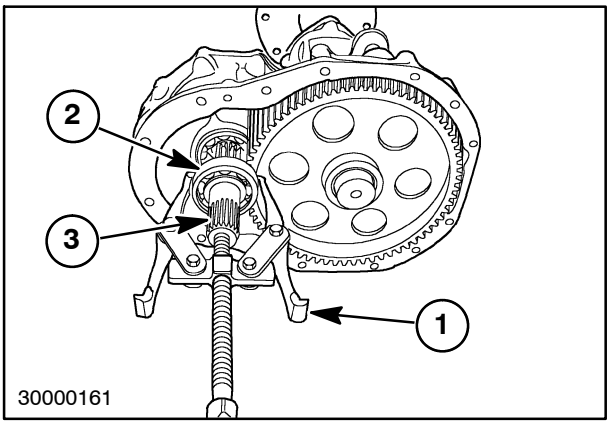
Disassembly

1. Use a suitable puller, 1, to remove the inner axle bearing, 2, from the axle, 3.



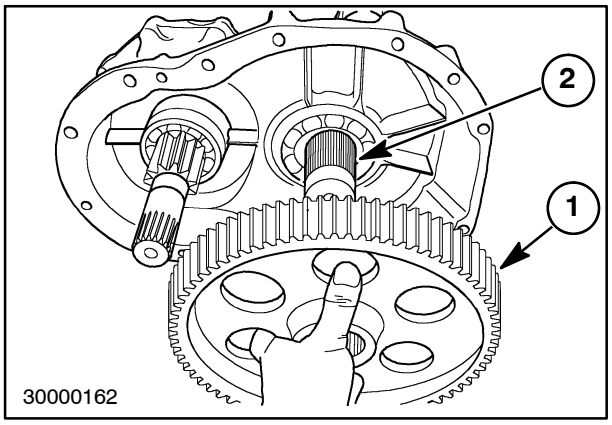
3

2. Use a suitable puller, 1, to remove the inner final pinion bearing, 2, from the pinion shaft.



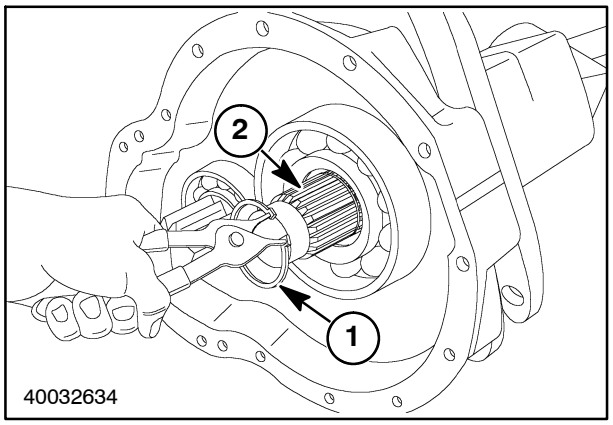
4

3. Remove the large final gear, 1, from the axle shaft, 2.



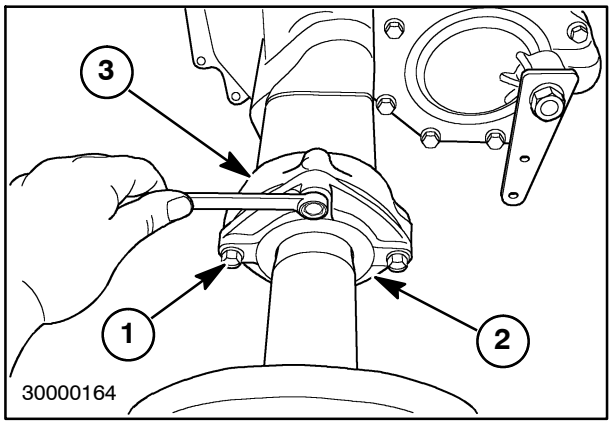
5

4. Remove the retaining ring, 1, from the axle shaft, 2.



6

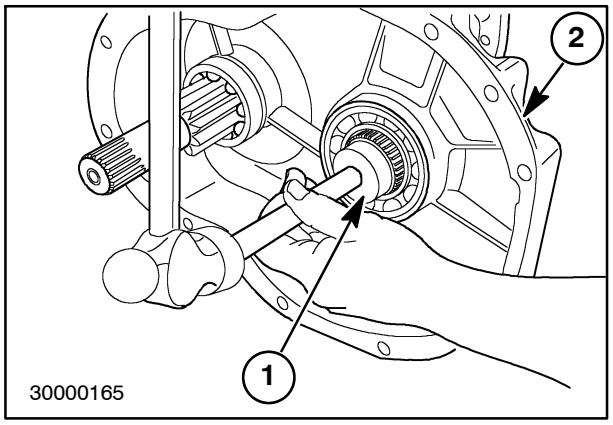
5. Loosen and remove the four retaining bolts, 1, holding the axle shaft retainer, 2, to the axle case, 3.



7

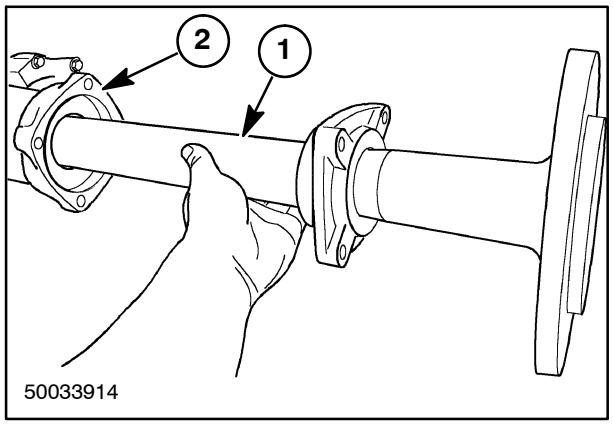
6. Use a hammer and an aluminum or brass drift to tap the axle shaft, 1, free of the middle axle shaft bearing in the axle case, 2.

NOTE: *It may be necessary to use a press to remove the axle shaft from the axle case.*



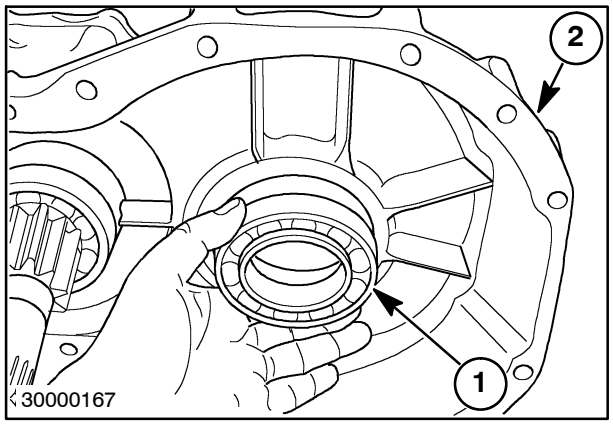
8

7. Remove the axle shaft, 1, from the axle case, 2.



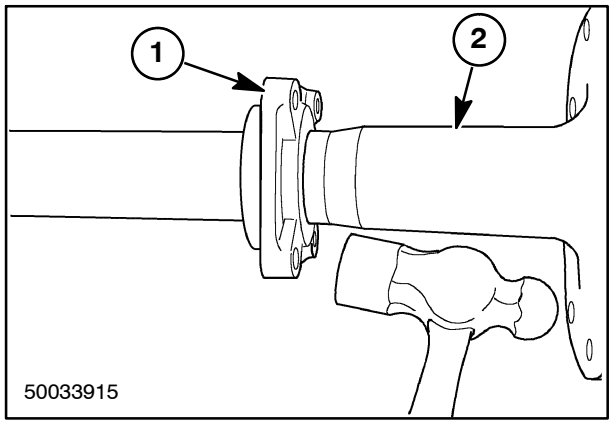
9

8. Remove the middle axle shaft bearing, 1, from the axle case, 2.



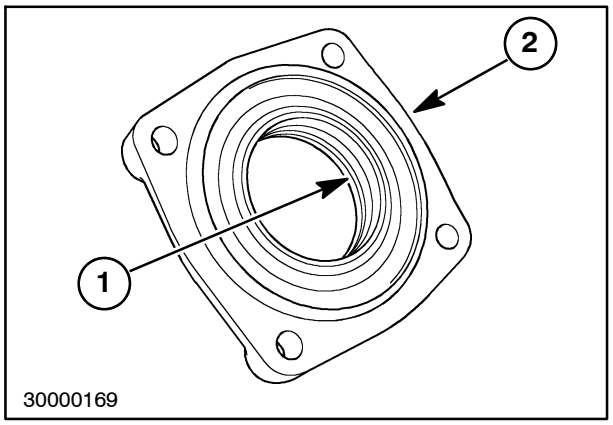
10

9. Using a non-marring hammer, tap the outer axle shaft bearing and the axle shaft retainer, 1, off of the axle shaft, 2.



11

10. Remove and discard the oil seal, 1, from the axle shaft retainer, 2.



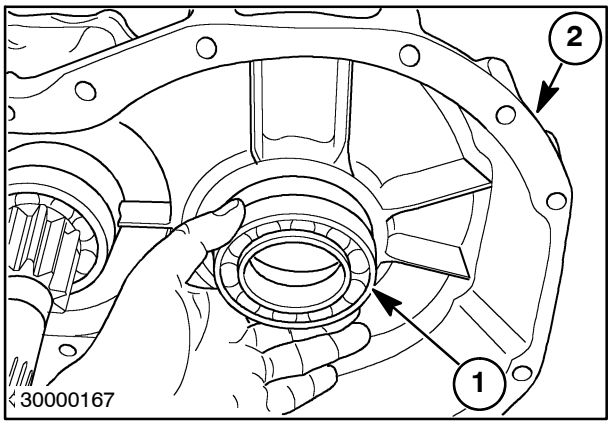
12

Inspection

1. Clean the axle components with a suitable solvent and air dry.
2. Rotate the bearings by hand to check for roughness or binding. Check the bearings for excessive wear or damage, and replace if necessary.
3. Inspect the final reduction gear teeth for excess wear or damage. Repair or replace as necessary.
4. Inspect the axle shaft for nicks, scratches or other damage. Repair or replace as necessary.
5. Inspect the axle case for cracks or other damage.
6. Remove any loose or peeling gasket material from the mating surfaces on the differential housing, axle case, and axle shaft retainer. Clean the surfaces with a suitable solvent and allow the parts to air dry.
7. Inspect and clean all bearing and seal seating bores.

Assembly

1. Install the middle axle shaft bearing, 1, into the axle case, 2.

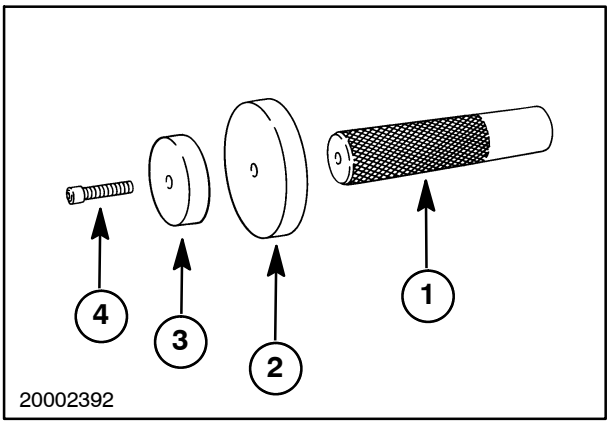


13

2. Assemble the special installation tool, from the seal installer kit #FNH00293. Use handle, 1, Drive plate, 2, Drive plate, 3, and secure with the supplied retaining screw, 4.

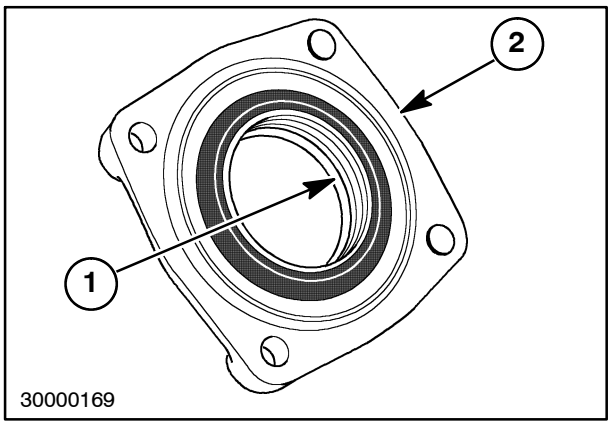
TOOL CHART

Tool No.	Size
1. Handle 27488	
2. Plate 27542	3.96 inch dia.
3. Plate 27527	2.75 inch dia.
4. Socket Head Screw 10020	1/4-201.5″



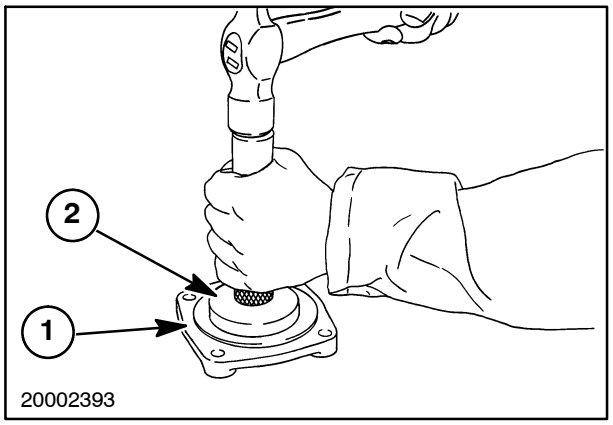
14

NOTE: *The orientation of the axle seal, 1, in the axle shaft retainer, 2, is such that the metal side of the seal is seated in the bore in the axle shaft retainer and the rubber side of the seal faces inward toward the axle case and differential housing.*



15

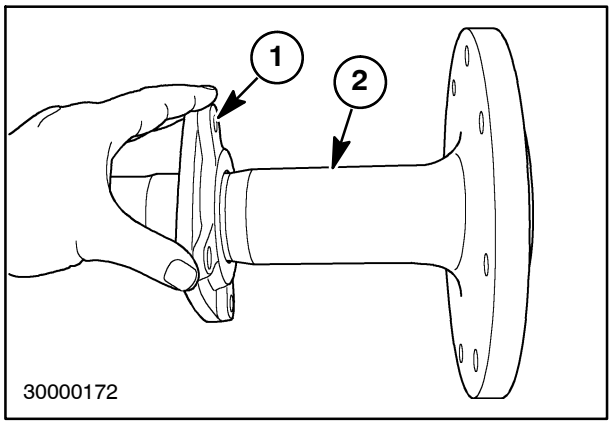
3. Install a new axle seal into the axle shaft retainer, 1, using the special seal driver tool, 2.



16

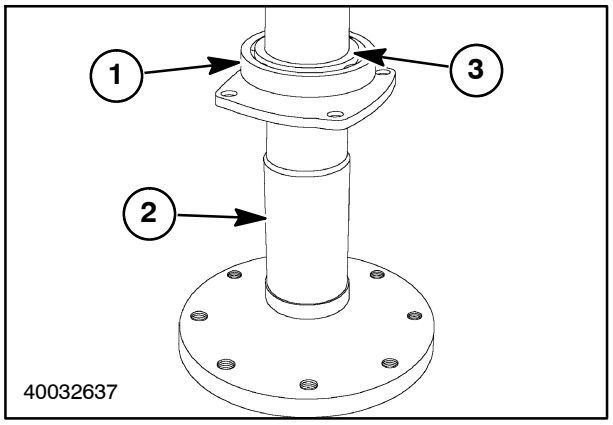
4. Lubricate the new seal with petroleum jelly and slide the axle shaft retainer, 1, onto the axle, 2.

NOTE: *A hard ring of rust may have formed on the axle in the area where the axle seal seats. Use emory cloth, or a suitable solvent and a non-abrasive scrubbing pad, to remove any rust buildup from this area before re-installing the axle shaft retainer.*



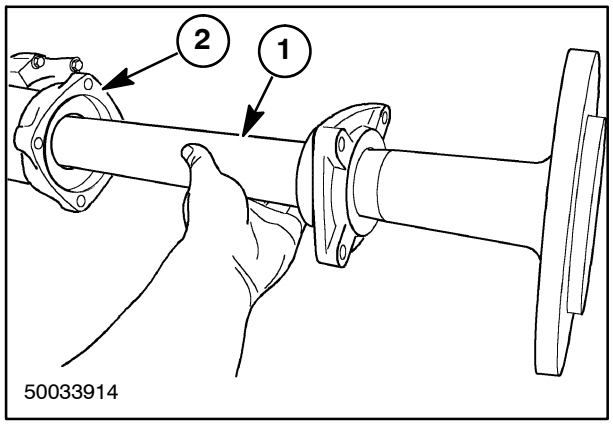
17

5. Slide the outer axle shaft bearing, 1, onto the axle shaft, 2. Using a hammer and a brass or aluminum drift, carefully drive the inner race of the shaft bearing onto the bearing journal until the shoulder of the journal, 3, is just visible above the top of the bearing inner race. (The top of the inner race will be approximately 412 mm (16.2″) from the splined end of the axle shaft.
6. Apply a thin bead of silicone-based gasket material to the axle case on the surface that receives the axle shaft retainer.



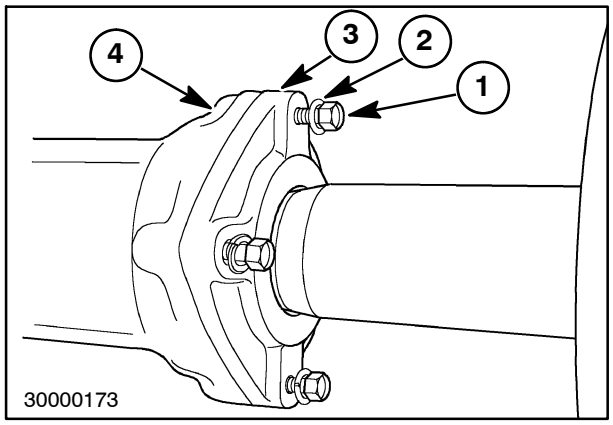
18

7. Slide the axle shaft, 1, into the axle case, 2, seating the outer axle shaft bearing in the case.



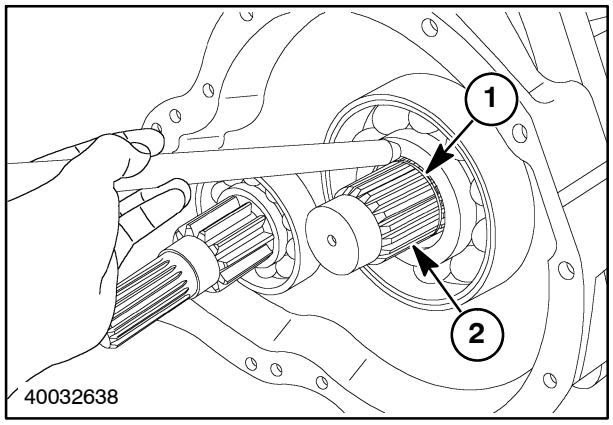
19

8. Install the four retaining bolts, 1, and lock washers, 2, through the axle shaft retainer, 3, and into the axle case, 4. Finger-tighten, but do not torque, the bolts at this stage.



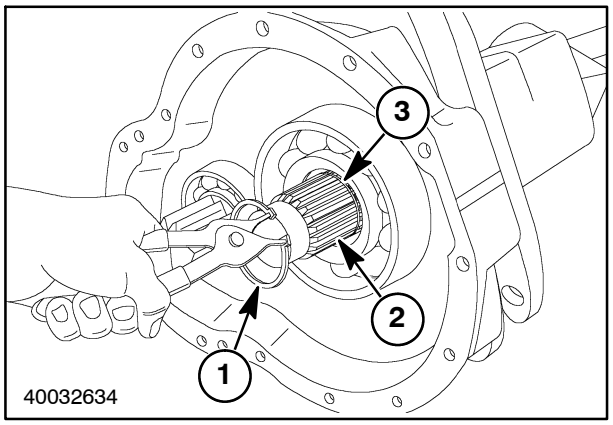
20

9. Using a hammer and a brass or aluminum drift, carefully drive the inner race of the middle axle shaft bearing, 1, onto the axle shaft, 2, until the bearing is fully seated in the axle case.
10. Fully tighten the four bolts securing the axle shaft retainer to the axle case.
11. If necessary, use a hammer and a brass or aluminum drift to drive the inner race of the middle axle shaft bearing further onto the axle shaft until the retaining ring slot is exposed.



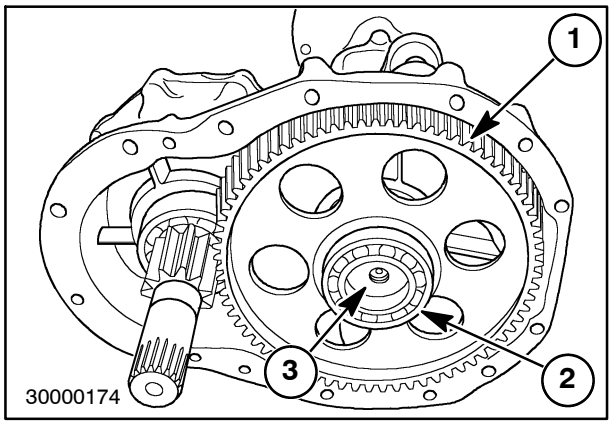
21

12. Install the retaining ring, 1, onto the axle shaft, 2, against the inner race of the middle axle shaft bearing, 3.



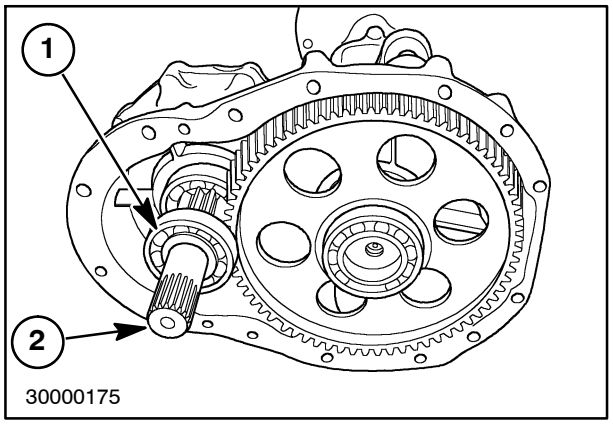
22

13. Install the final reduction gear, 1, onto the axle shaft, 3.
14. Install the inner axle bearing, 2, onto the axle shaft, 3.



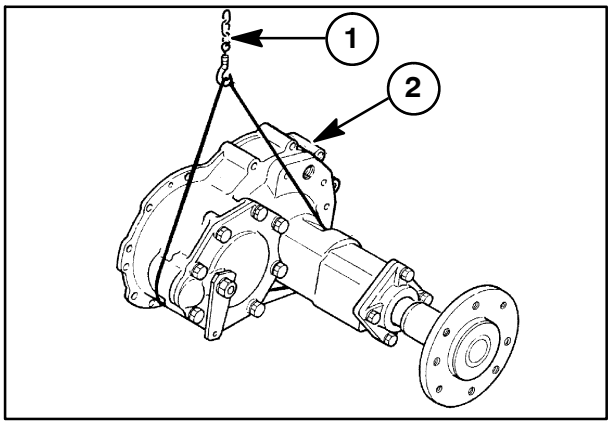
23

15. Install the final pinion bearing, 1, onto the pinion shaft, 2.
16. Apply a thin bead of silicone-based gasket material to the differential housing, on the surface that receives the axle case.



24

17. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and position the axle housing on the differential housing. Be sure to align the mounting holes and the final gear and the final pinion with the housing.

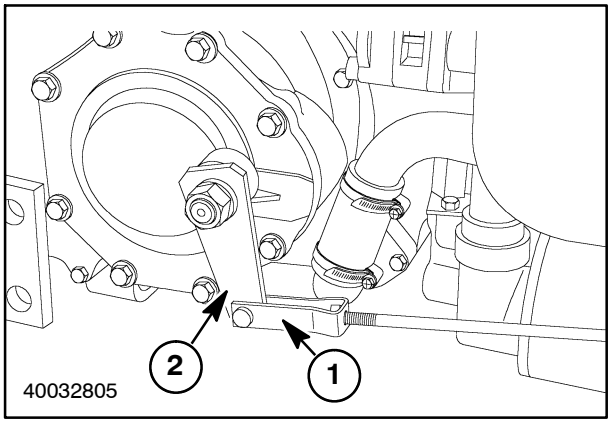


25

⚠ WARNING ⚠

The axle housing is difficult to balance. Use caution during installation to avoid personal injury.

18. Install and tighten the axle housing retaining bolts.
19. Install the wheels and the fenders onto the tractor.
20. Connect the brake control rods, 1, to the brake control levers, 2.
21. Install the lower lift links to the rear axles.
22. Fill the combined transmission, rear axle, and hydraulic reservoir with clean AMBRA MULTI G134 hydraulic oil.
23. Install the ROPS onto the tractor.

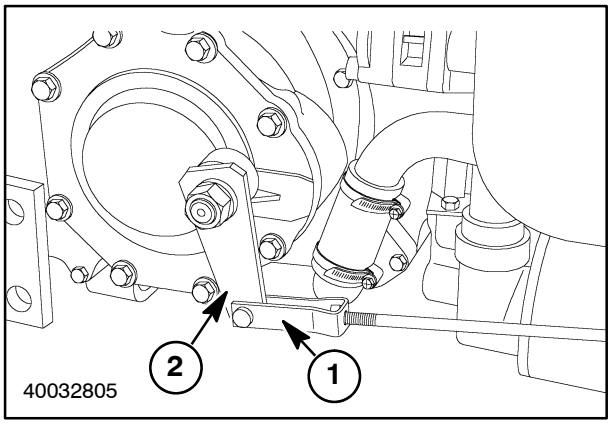


26

FINAL PINION

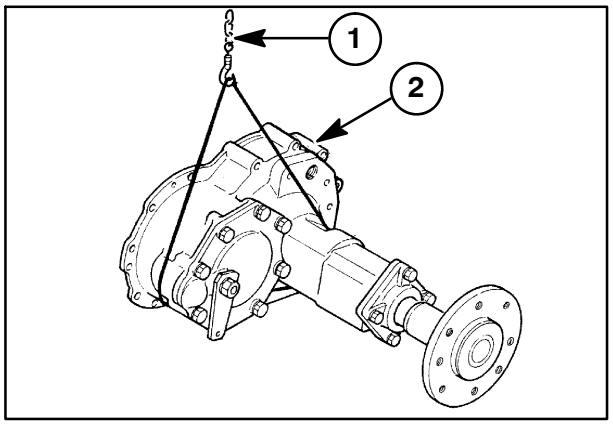
Removal

1. Remove the ROPS from the tractor.
2. Remove the wheels and the fenders from the tractor.
3. Drain the oil from the combined transmission, rear axle, and hydraulic reservoir into a suitable container.
4. Remove the lower lift links from the rear axles.
5. Disconnect the brake control rods, 1, from the brake control levers, 2.



27

6. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and remove the axle case retaining bolts.



28

⚠ WARNING ⚠

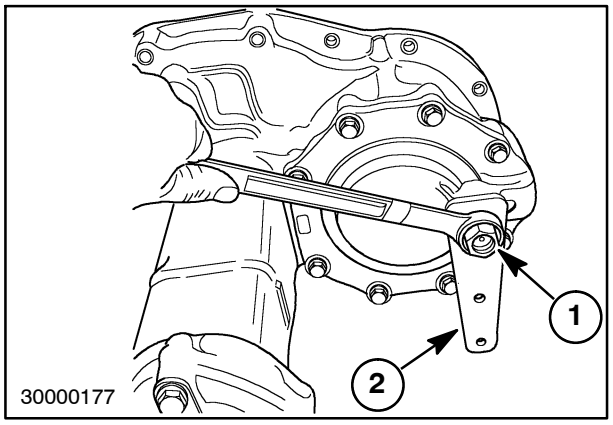
The axle housing is difficult to balance. Use caution during removal to avoid personal injury.

7. Separate the axle assembly from the differential housing and use the lifting device to move the axle assembly out and away from the differential housing.

Disassembly

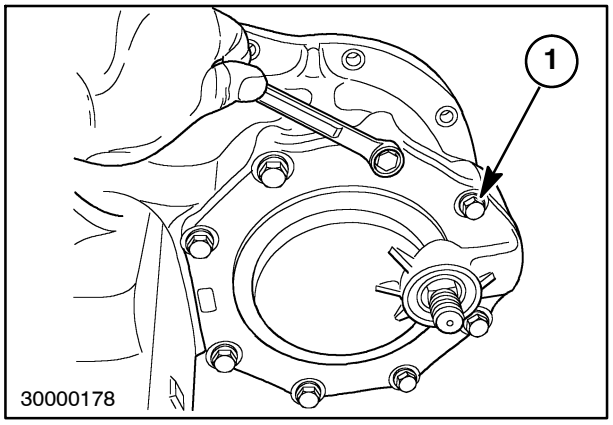
NOTE: *The brakes may be serviced with the axle case attached to the differential housing, but if final pinion service is required, the axle case must be removed from the differential housing.*

1. Loosen and remove the retaining nut, 1, on the brake lever, 2. Remove the brake lever, 2, and lock washer from the brake cam.



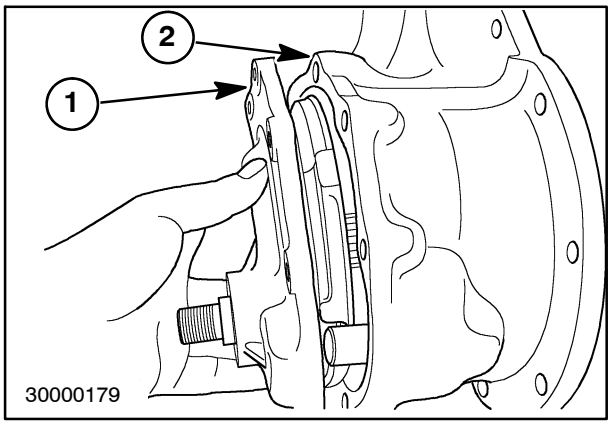
29

2. Loosen and remove the brake cover retaining bolts, 1.



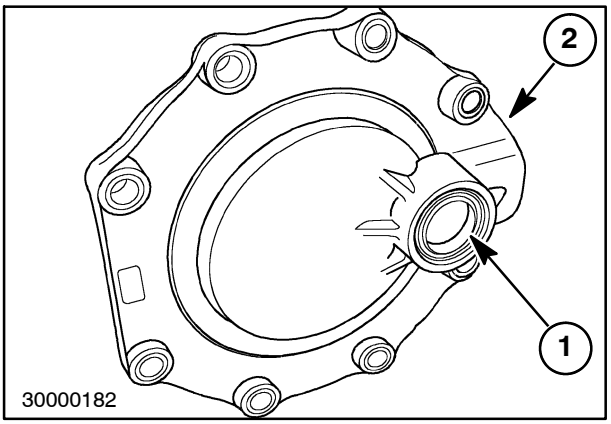
30

3. Remove the brake cover assembly, 1, from the axle case, 2.



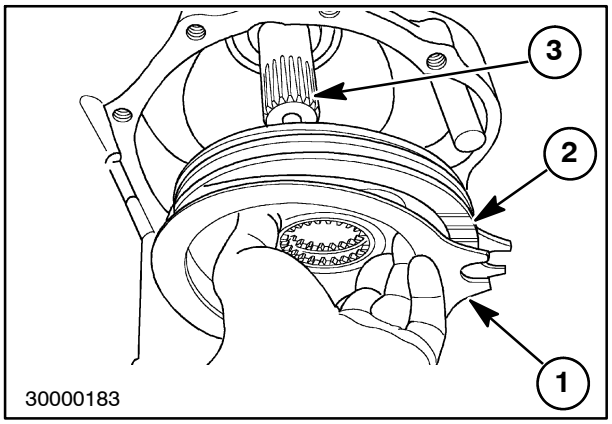
31

4. Remove and discard the brake cam oil seal, 1, from the brake cover, 2.



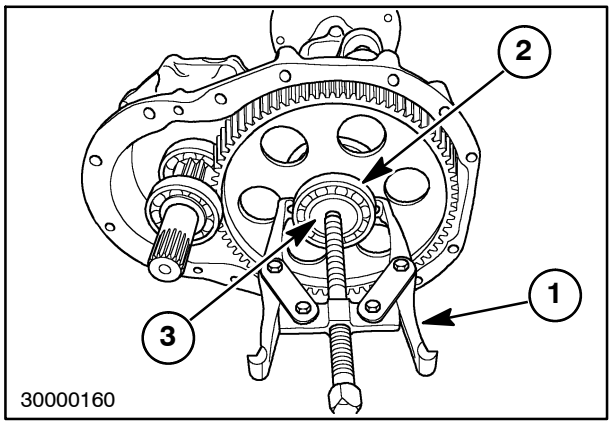
32

5. Remove the stators, 1, and the brake discs, 2, from the final pinion shaft, 3.



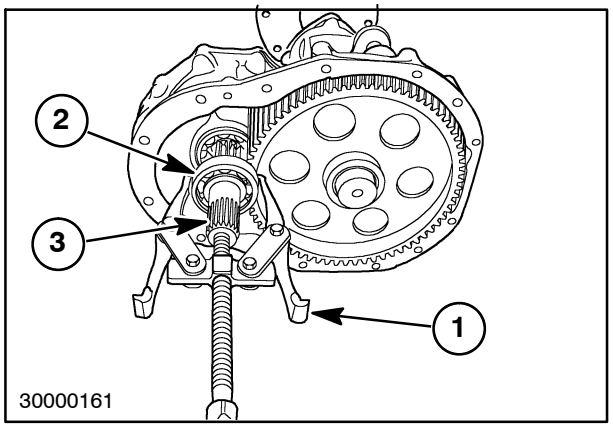
33

6. Use a suitable puller, 1, to remove the inner axle bearing, 2, from the axle, 3.



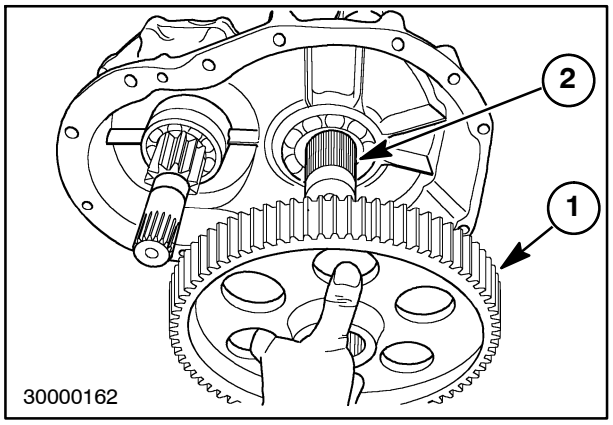
34

7. Use a suitable puller, 1, to remove the inner final pinion bearing, 2, from the pinion shaft, 3.



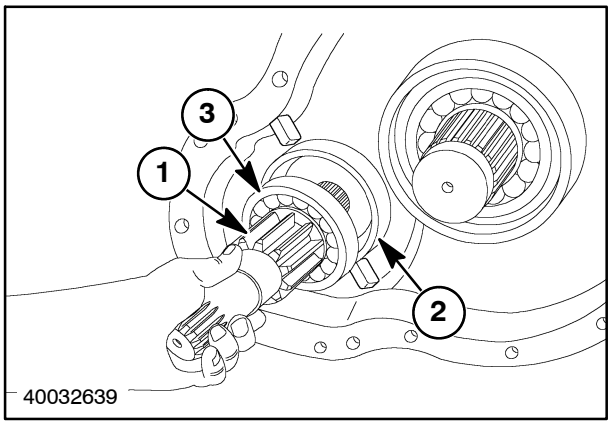
35

8. Remove the large final gear, 1, from the axle shaft, 2.



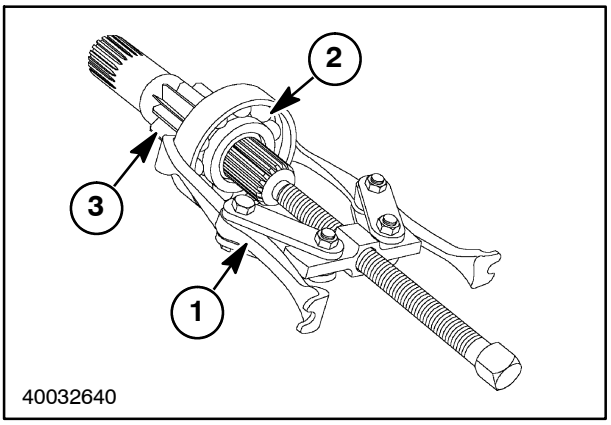
36

9. Pull the final pinion shaft, 1, out of the axle case, 2, with the outer final pinion support bearing, 3, attached.



37

10. Use a suitable gear puller, 1, to remove the outer final pinion support bearing, 2, from the final pinion shaft, 3.



38

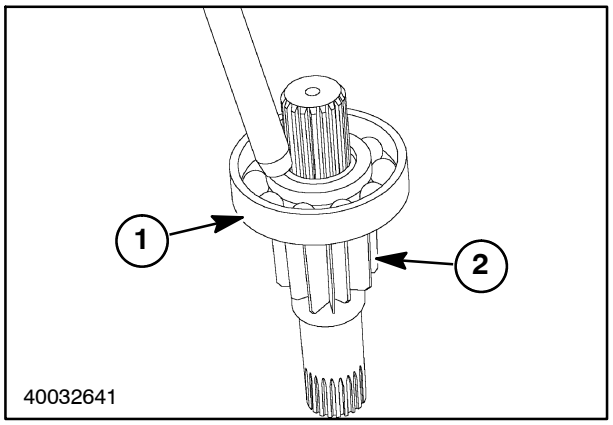
Inspection

1. Clean all parts in a suitable solvent and allow to air dry.
2. Inspect the bearings for roughness by turning them by hand. Replace if necessary.
3. Inspect the final pinion shaft for marks or other damage. Replace if necessary.
4. Inspect the brake cover for damage or cracks. Repair or replace as necessary.

Assembly

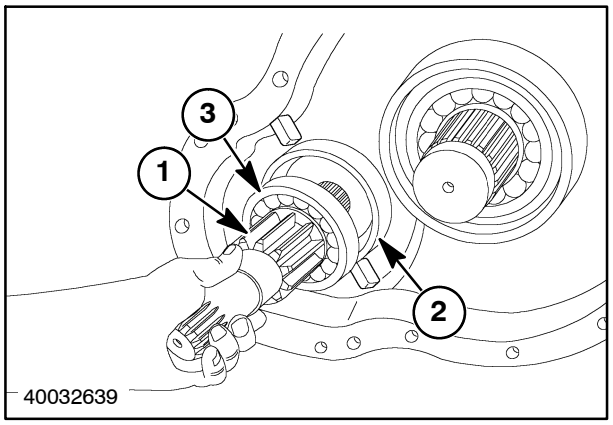
1. Using a hammer and a brass or aluminum drift, carefully seat the outer final pinion support bearing, 1, onto the final pinion shaft, 2.

NOTE: *Ensure that the outer support bearing is installed on the end of the pinion shaft that extends a shorter distance outboard of the pinion gear section. The longer end of the pinion shaft must extend past the large final gear, facing the open side of the axle case.*



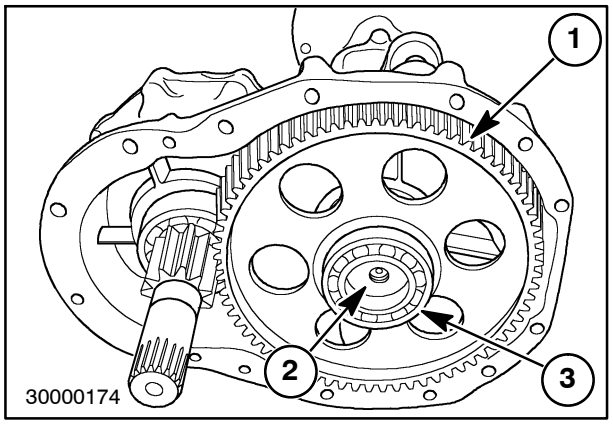
39

2. Carefully slide the final pinion shaft, 1, into the axle case, 2, seating the outer final pinion support bearing, 3, in its bore in the axle case.



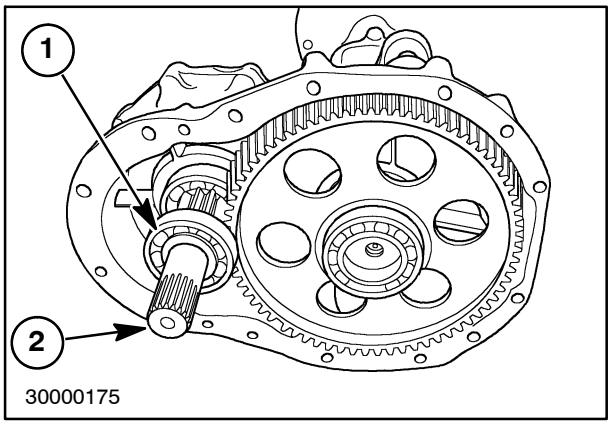
40

3. Install the large final reduction gear, 1, onto the axle shaft, 2.
4. Using a hammer and a brass or aluminum drift, carefully install the inner axle shaft bearing, 3, onto the axle shaft, 2.



41

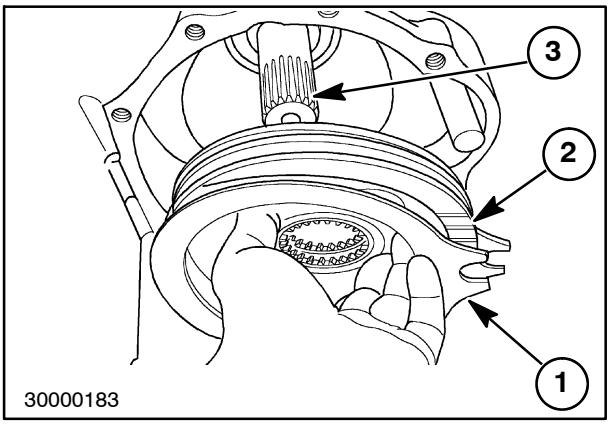
5. Using a hammer and a brass or aluminum drift, carefully install the inner final pinion support bearing, 1, onto the final pinion shaft, 2.



42

6. Install the stators, 1, and the brake discs, 2, onto the final pinion shaft, 3.

NOTE: *When re-installing the four stators and four brake discs, always begin with a stator. Alternate stator/brake disc, until the last brake disc is installed.*



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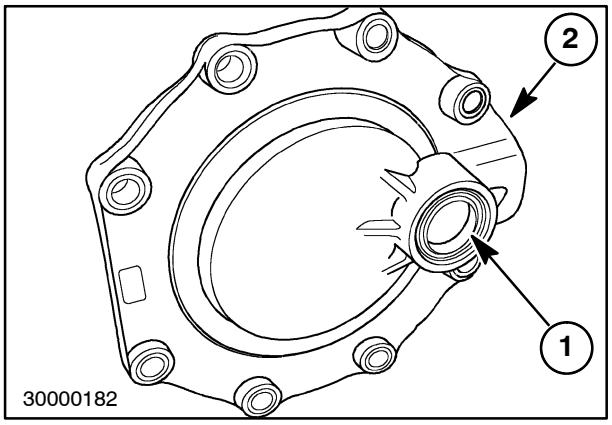
7. Lubricate a new brake cam oil seal, 1, with petroleum jelly, and install into the brake cover, 2.
8. Inspect the brake cover gasket. If damaged, remove all of the remaining gasket material from the surfaces of the axle case and the brake cover. Clean both surfaces with a suitable solvent and allow to air dry. Apply a thin bead of silicone-based gasket adhesive to the axle case and carefully place the new gasket in position.



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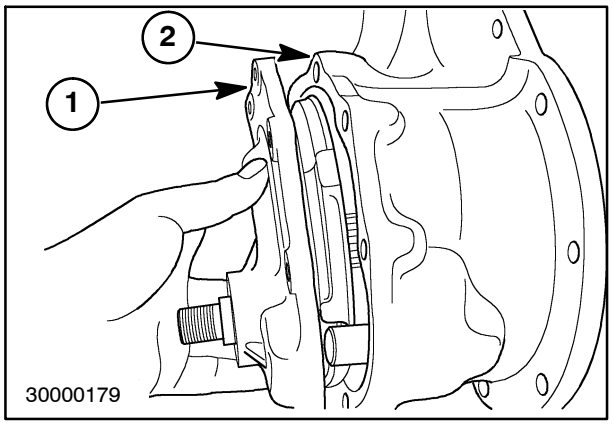
9. Install the brake cover assembly, 1, onto the axle case, 2.



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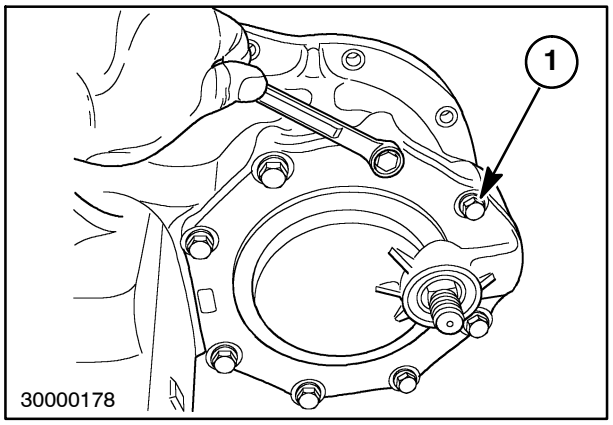
10. Install and tighten the brake cover retaining bolts, 1.



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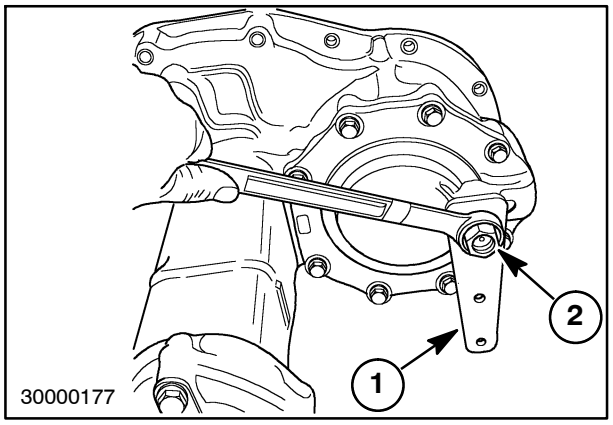
11. Install the brake lever, 1, onto the brake cam, and secure with the retaining nut, 2, and lock washer. Tighten the retaining nut, 2.



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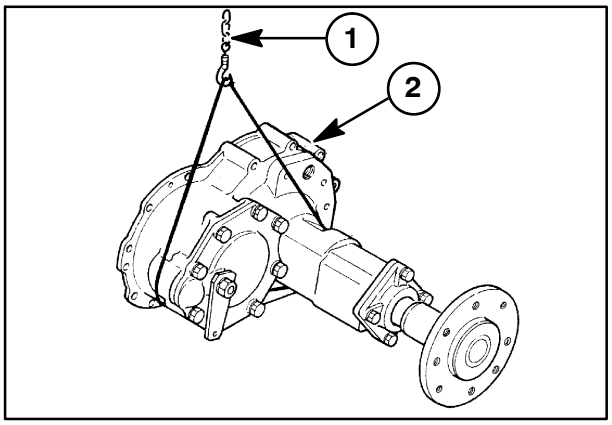
Installation

1. Apply a thin bead of silicone-based gasket material to the differential housing, on the surface that receives the axle case.
2. Attach a suitable overhead lifting device, 1, to the rear axle assembly, 2, and position the axle case on the differential housing. Be sure to align the mounting holes and the final gear and the final pinion with the housing.



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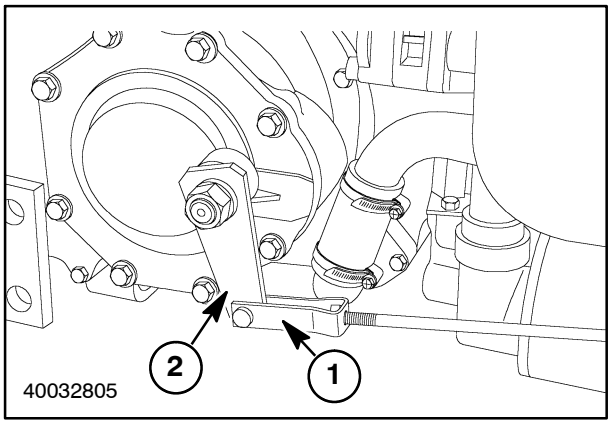
⚠ WARNING ⚠

The axle housing is difficult to balance. Use caution during installation to avoid personal injury.

3. Install and tighten the axle case retaining bolts.
4. Install the wheels and the fenders onto the tractor.
5. Connect the brake control rods, 1, to the brake control levers, 2.
6. Install the lower lift links to the rear axles.
7. Fill the combined transmission, rear axle, and hydraulic reservoir with clean AMBRA MULTI G134 hydraulic oil.
8. Install the ROPS onto the tractor.



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SECTION 31 - POWER TAKE-OFF (PTO)

Chapter 1 - Power Take-Off (PTO)

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SPECIFICATIONS

PTO Hydraulic System

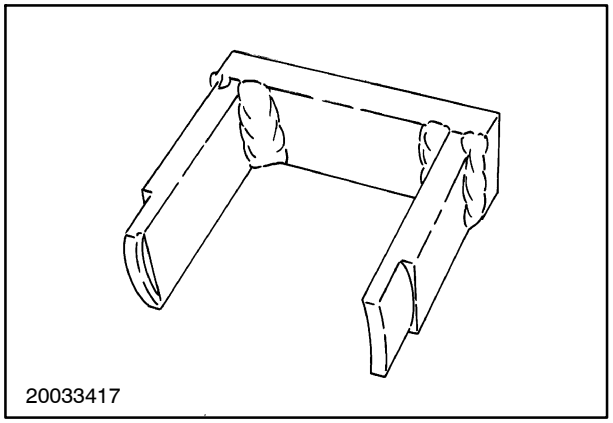
Type	Independent (Live)
Clutch Type	Wet
Clutch Material	Asbestos Free
Clutch Plate Quantity	4
Clutch Plate Diameter	100 mm (3.937″)
Clutch Plate Surface Area	3553 mm^2 (5.507″^{2})
Minimum Clutch Plate Thickness	1.80 mm (0.071″)
Actuation	Manual Lever
Rear PTO Shield Type	Flip-up
Number of Splines (PTO Output Shaft)	6
Shaft Size	35 mm (1.378″)
Number of Shafts	1
Power SSS Transmission	T2410 - 35.0 Kw (47 Hp) T2420 - 38.0 Kw (51 Hp)
EHSS Transmission	T2410 - 34.3 Kw (46 Hp) T2420 - 37.3 Kw (50 Hp)
Engine Speed (@ 540 rpm PTO speed)	(T2410) 2475 rpm
	(T2420) 2475 rpm
Relief Valve Pressure Setting	18 bar (260 psi)
Air Gap	1.5 mm - 2.5 mm (0.059 - 0.098″)
Minimum Brake Disc Thickness	2.35 mm (0.093″)
Brake Disc Diameter	118.7 mm (4.673″)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

SPECIAL TOOLS

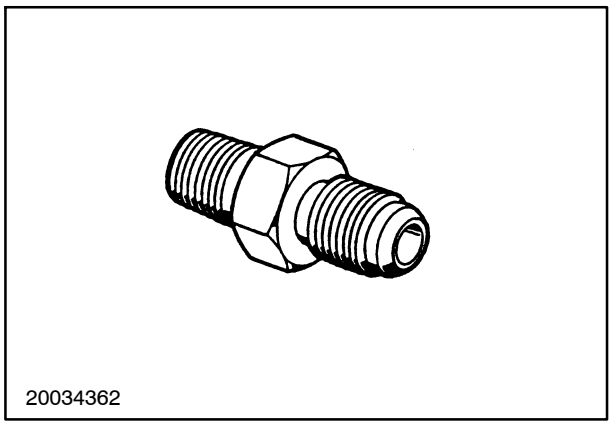
PTO Clutch Pack Press Tool . . CNH299009



1

PTO Clutch Pack Pressure
Test Fitting CNH299008A

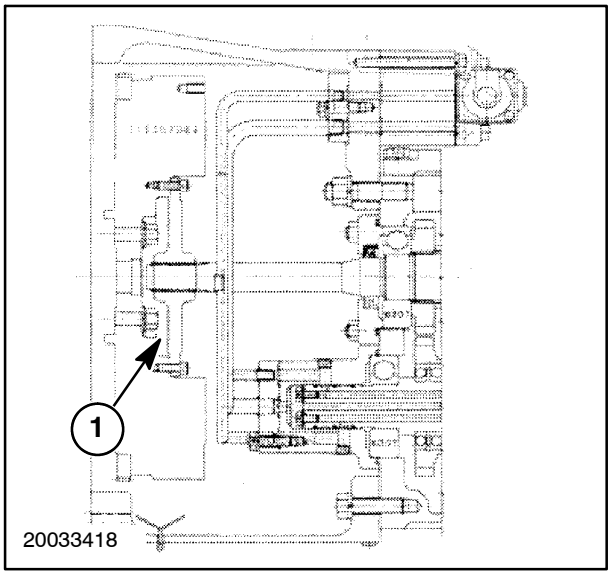
1/4 BSPT x 7/16-20UNF-37° Flare



2

DESCRIPTION OF OPERATION

Rear live power take-off is a standard feature on all T2410 and T2420 tractors. The PTO system is independent of the tractor driveline. A flex plate, 1, attached to the engine flywheel is coupled to the PTO input shaft in the EHSS transmission by a splined coupling. The direct splined coupler allows the PTO input shaft to rotate at all times while the engine is running.

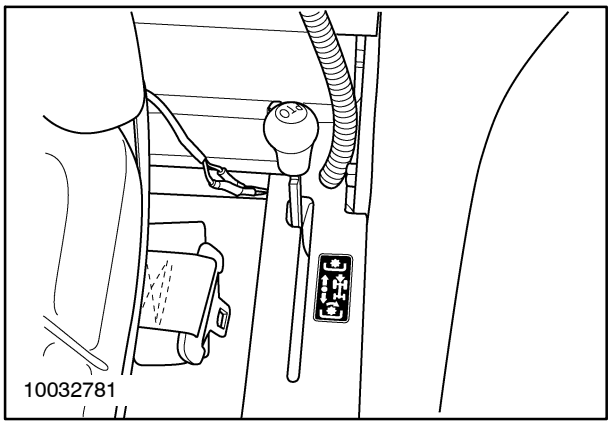


3

With the PTO components rotating, the PTO output shaft will not turn until the operator engages the PTO control lever, located to the left of the operators seat on the platform.

On tractors equipped with an SSS transmission, hydraulic oil is pressurized by a gear pump and sent to the PTO clutch control valve by means of the diverter valve. From the PTO control clutch valve hydraulic oil flows to the HPL control valve at a rate of 3 L/min (0.79 gal/min).

On tractors equipped with an EHSS transmission, pressurized hydraulic fluid supplied from a gear pump located on the right side of the differential housing, flows through a tube, to the PTO clutch hydraulic control valve. The PTO clutch hydraulic control valve is mounted on the PTO clutch cover located on top of the differential housing, below the seat platform.



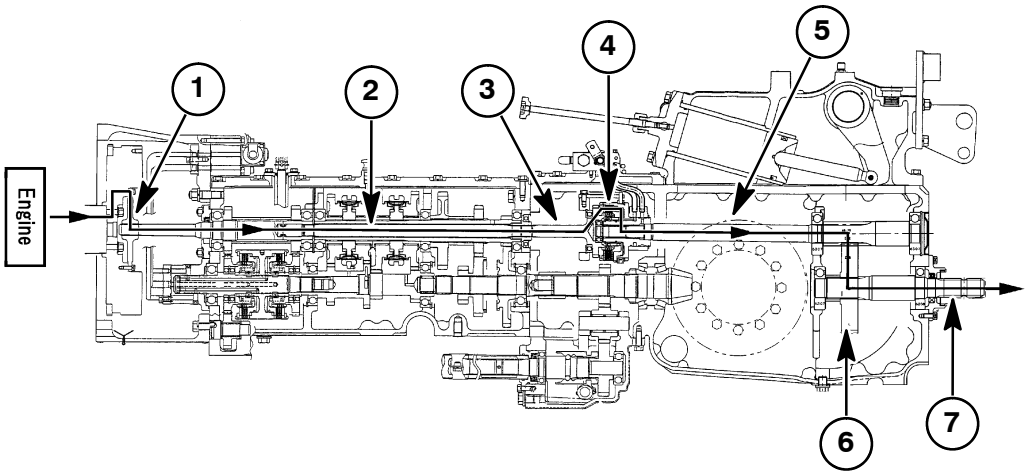
4

With the control lever in the “ON” position (PTO engaged), the control linkage from the lever operates a spool in the control valve, allowing pressurized hydraulic fluid to pass through the control valve to the PTO clutch pack. When pressurized, the friction plates in the clutch pack allow rotation of the PTO countershaft. A helical cut gear on the PTO countershaft drives a gear on the PTO output shaft, causing the output shaft to rotate. Any attachment connected to the output shaft will then begin to rotate.

REAR PTO - POWER FLOW DIAGRAM

On tractors equipped with the EHSS and SSS transmissions, power flows from the engine through a flex-plate, 1, through the transmission via the PTO drive shaft, 2, to a PTO input shaft, 3. The PTO input shaft, 3, is connected to the PTO clutch, 4. When the operator engages the PTO, power flows through the PTO clutch, 4, to the PTO countershaft, 5. Power is then transferred from the PTO countershaft, 5, to a fixed 55-tooth gear, 6. The gear, 6, turns the rear PTO shaft, 7, when the PTO is engaged.

NOTE: *With the tractor shut off, the rear PTO output shaft, 7, can be rotated slightly, to aid in connection to implement drive shaft, but cannot be rotated in a complete revolution, due to the PTO driven gear, 6, being constantly engaged with the power train.*



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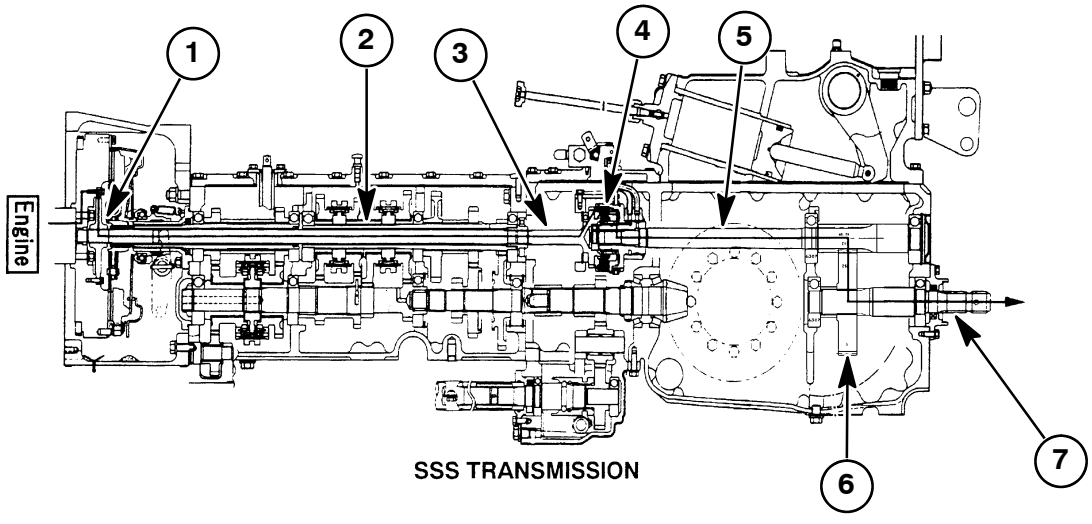
EHSS TRANSMISSION

5



SSS TRANSMISSION

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6

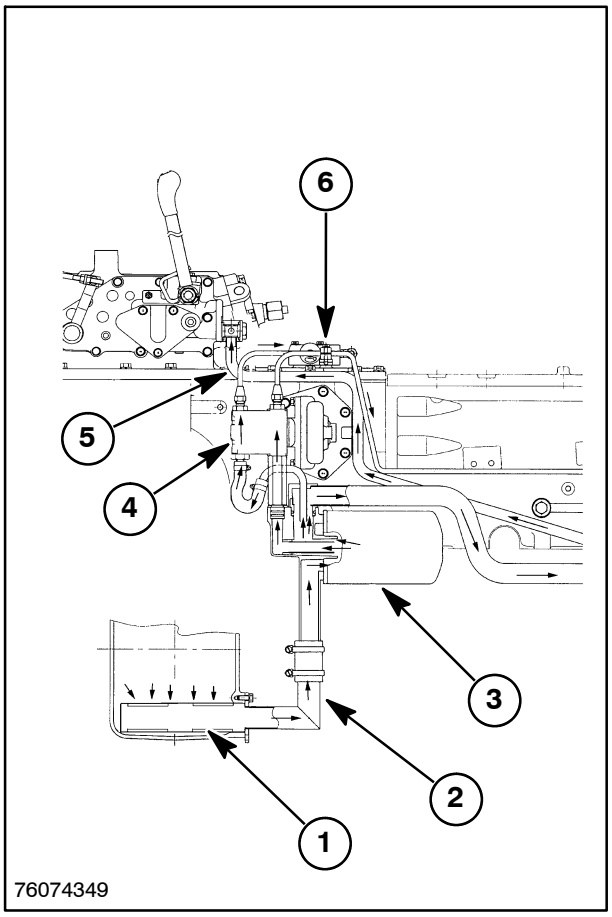
EHSS TRANSMISSION - HYDRAULIC FLUID FLOW TO THE PTO CLUTCH ASSEMBLY

On tractors equipped with an EHSS transmission, hydraulic oil is pressurized by a suction type oil pump. Oil is drawn through the strainer by means of a suction pipe, through the filter and to the PTO clutch control valve at a rate of 6 L/min (1.58 gal/min) at an engine speed of 2900 rpm.

With the PTO clutch control lever in the engaged position the hydraulic oil flows at a rate of 6 L/min (1.58 gal/min) to the PTO clutch piston and the PTO clutch is engaged.

When the hydraulic oil pressure exceeds 18 bar (260 psi) the oil is returned to the sump via the relief valve.

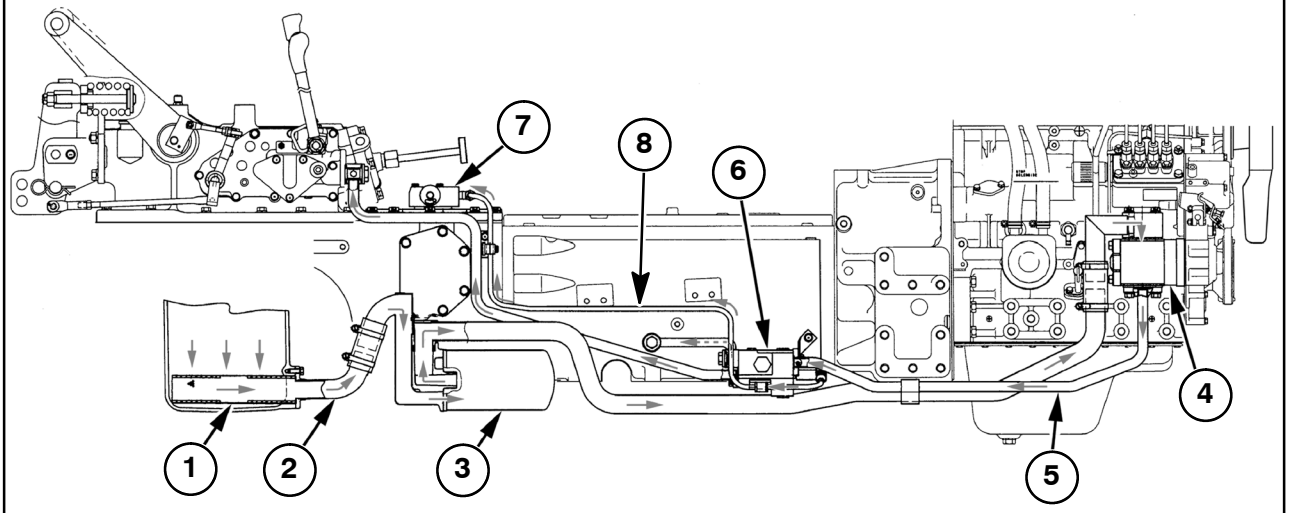
The hydraulic oil flows to the sump via PTO control clutch valve when the PTO control lever is in the neutral position.



7

1. Strainer
2. Suction Pipe
3. Filter
4. EHSS and PTO Clutch Oil Pump
5. Delivery Pipe
6. PTO Clutch Control Valve

SSS TRANSMISSION - HYDRAULIC FLOW TO THE PTO CLUTCH ASSEMBLY



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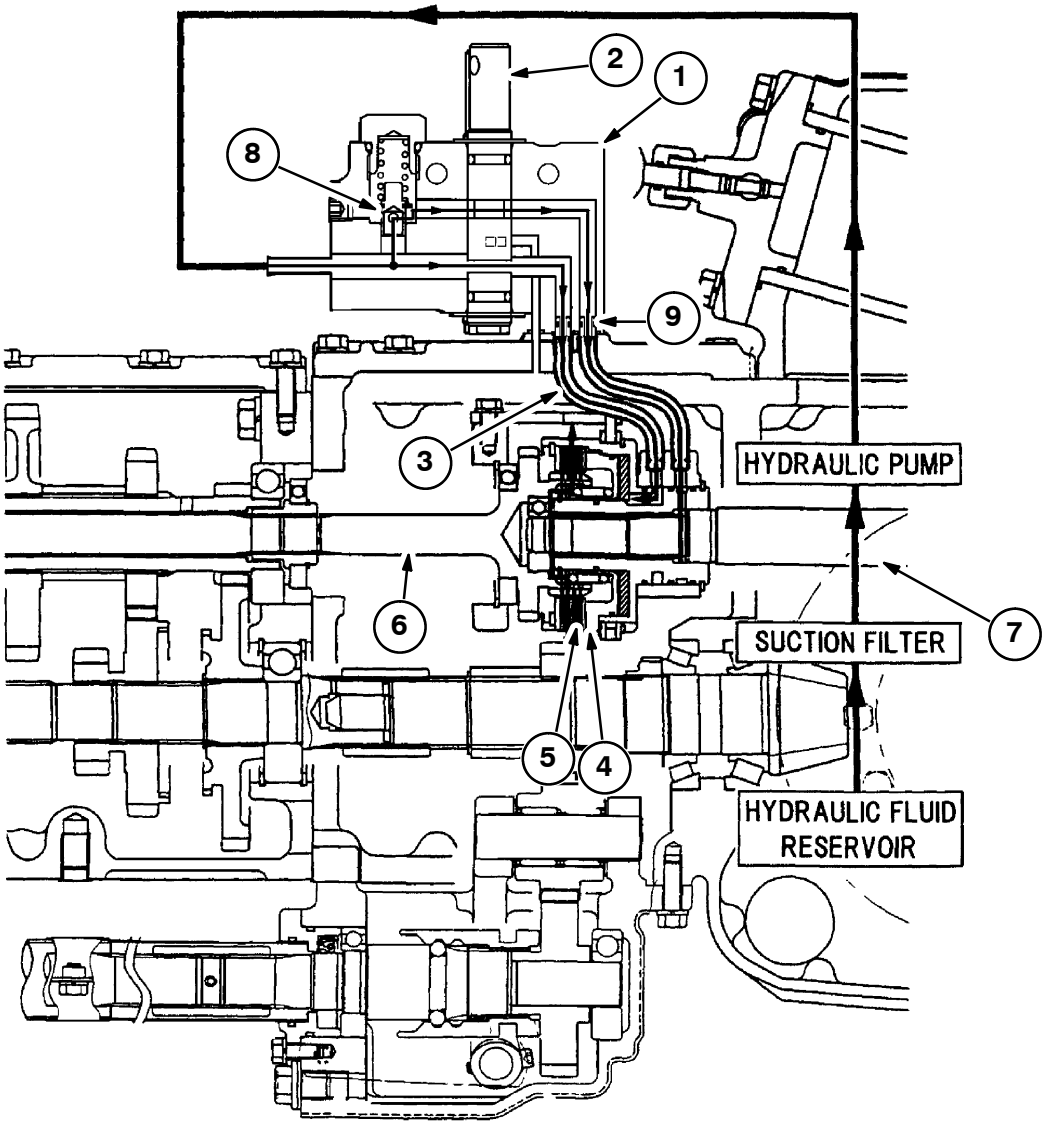
SSS TRANSMISSION

8

The PTO clutch engages and disengages by using hydraulic fluid from the tractor sump. Hydraulic fluid is pumped from the sump, 1, through a suction tube, 2, and filter, 3, to the hydraulic pump, 4. The hydraulic pump pressurizes the fluid and then is pumped through a hydraulic line, 5, to the PTO diverter valve, 6. The diverter valve diverts 2.5 - 3.5 lpm (0.66 - 0.92 gpm) of its 45.49 lpm (12.03 gpm) capacity to the PTO system. The remaining flow is utilized by the tractor's hydraulic system. From the diverter valve, the hydraulic fluid is transferred to the clutch control valve, 7, through the PTO system hydraulic line, 8. The clutch control valve controls whether the PTO system clutch is engaged or disengaged, as determined by the position of the PTO control lever.



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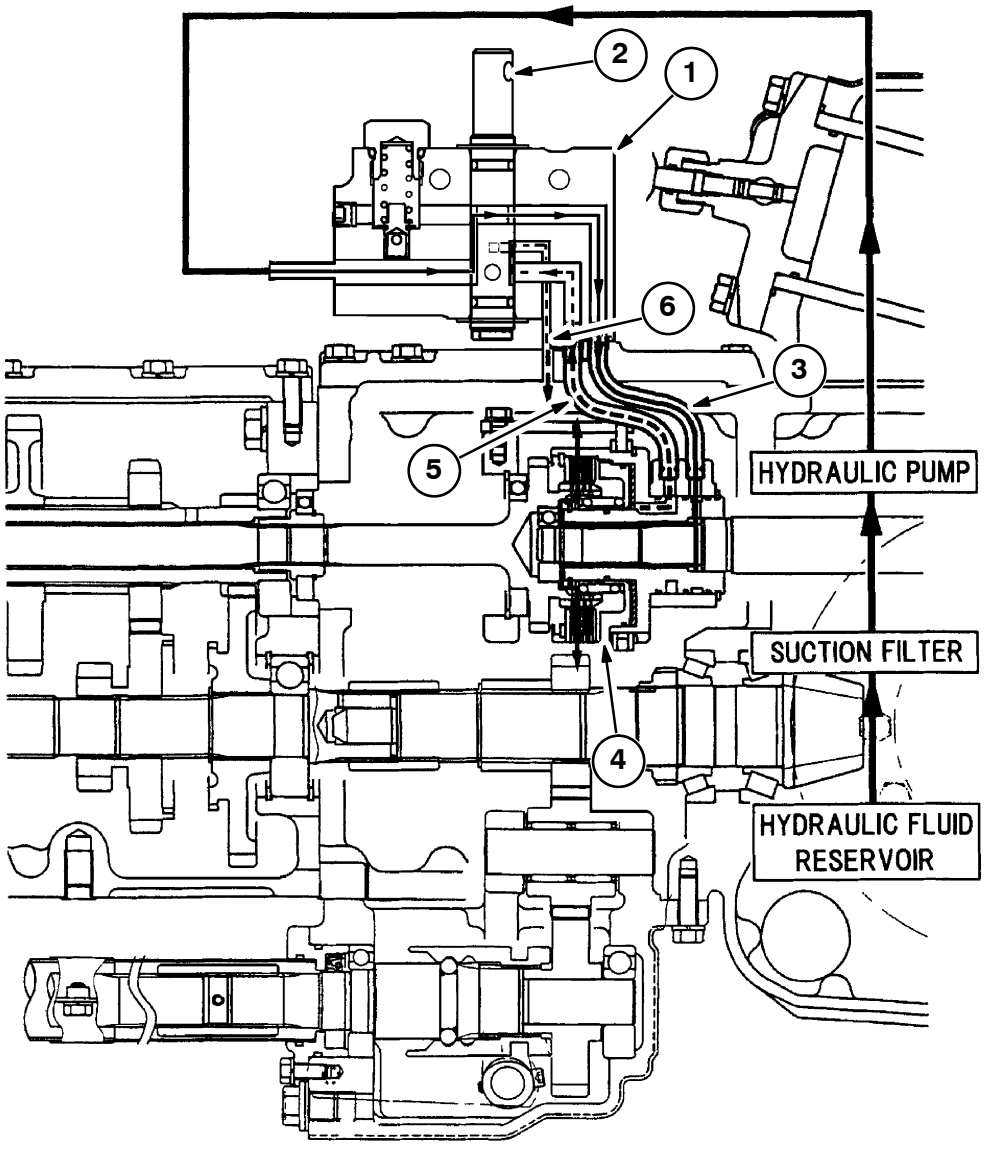
9

PTO CLUTCH ENGAGED

With the PTO control lever set to the engage position, pressurized hydraulic fluid flows at a rate of 2.5 - 3.5 l/pm (0.66 - 0.92 gal/min) from the hydraulic gear pump, into the PTO clutch control valve, 1, through the valve spool, 2, and clutch piston supply tube, 3. The pressurized hydraulic fluid pushes against the clutch piston, 4, which pushes the clutch discs, 5, together. Power is then transferred from the rotating PTO input shaft, 6, through the clutch assembly to the PTO counter-shaft, 7. When the hydraulic fluid pressure exceeds 18 bar (260 psi), the relief valve poppet, 8, opens and hydraulic fluid is allowed to flow through the clutch lubrication tube, 9, to the clutch assembly for lubrication. The fluid exits the clutch and returns to the hydraulic fluid reservoir.



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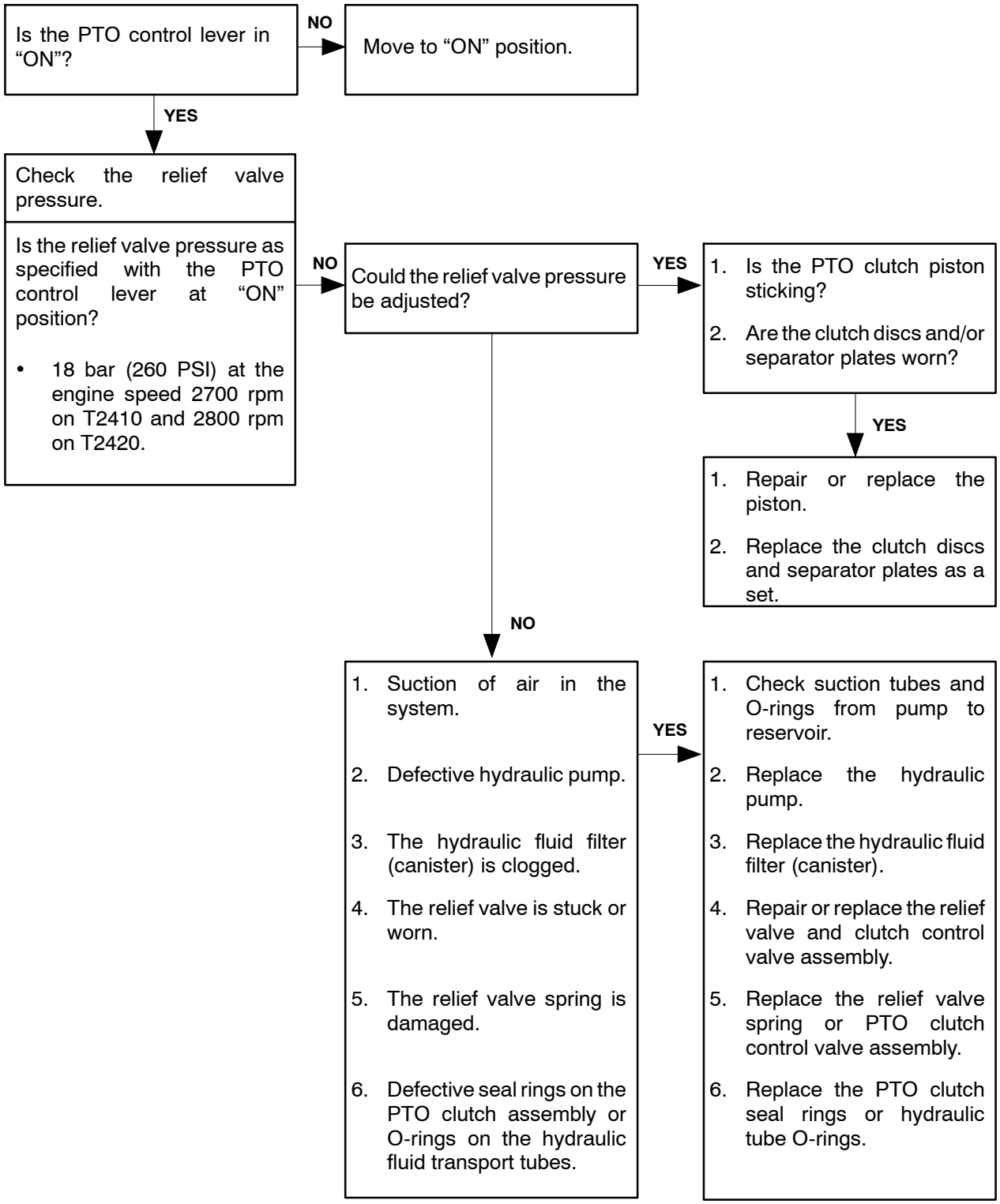
10

PTO CLUTCH DISENGAGED

With the PTO control lever in the disengage position, the hydraulic fluid flows into the PTO clutch control valve, 1, through the valve spool, 2, and directly to the clutch lubrication tube, 3. Hydraulic fluid flows through the tube and into the clutch assembly, lubricating the clutch components. Since no hydraulic pressure is being supplied to the clutch piston, 4, any hydraulic fluid remaining in the clutch piston is pushed back through the clutch piston supply tube, 5, to the clutch control valve spool, 2. The valve spool diverts the hydraulic fluid back into the hydraulic fluid reservoir through a clutch bleed back port, 6, in the valve body.

TROUBLESHOOTING

1. Cannot rotate the PTO shaft with PTO control lever at “ON” position.



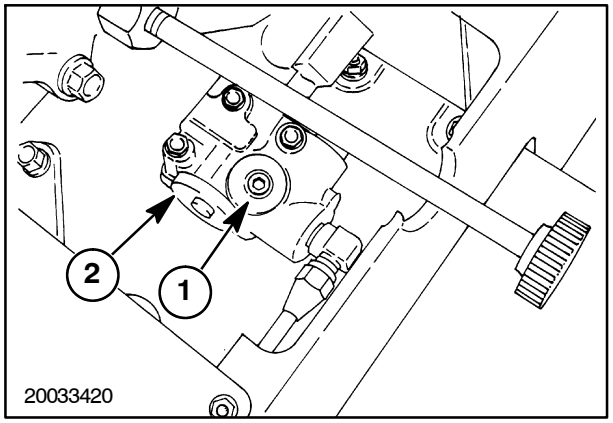
PRESSURE TESTING

The hydraulic operating pressure of the PTO clutch is set by the relief valve, which is located on the PTO clutch control valve. If the relief pressure is too low, the PTO clutch will not engage completely causing the clutch discs to slip. This will cause premature wear of the clutch discs and separator plates. If the relief pressure is too high, the PTO clutch components may be damaged from the excess pressure.

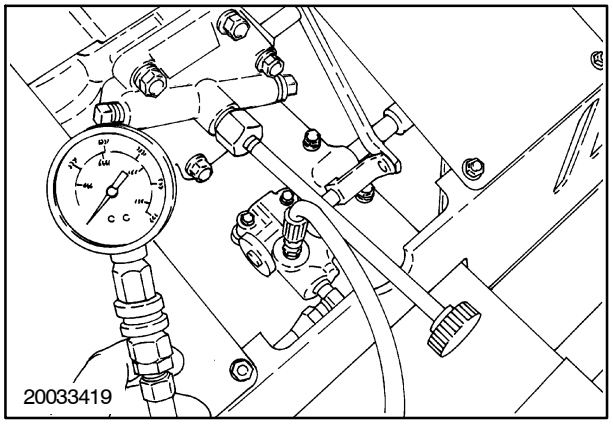
Test Procedure

1. Remove the seat and seat brackets from the tractor.
2. Remove the 6mm hex head plug, 1, from the PTO clutch control valve, 2. Using special tool # CNH299008A, install a 0 - 60 bar (0 - 600 PSI) pressure gauge and line into this port.
3. Start the engine and operate the hydraulic system to warm the hydraulic fluid to operating temperature.
4. Set the engine rpm to full throttle (T2410, 2700 rpm - T2420, 2800 rpm).
5. Observe the reading on the pressure gauge. The pressure indication should be:

Model	Pressure Reading
T2410, T2420	18 ± 1 bar (260 ± 15 psi)



11

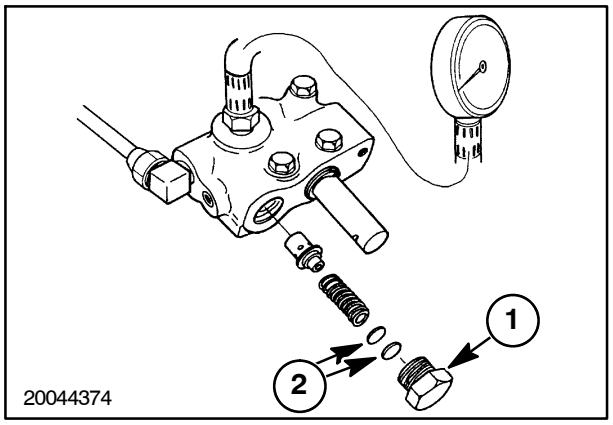


12

Adjustment

If required, shut the tractor off and adjust the relief pressure by removing the plug, 1, on the clutch control relief valve by adding or removing the 1 mm (0.039 in) adjusting shims, 2.

The pressure will raise or lower approximately 1.21 bar (17.5 psi), for each shim added or removed.

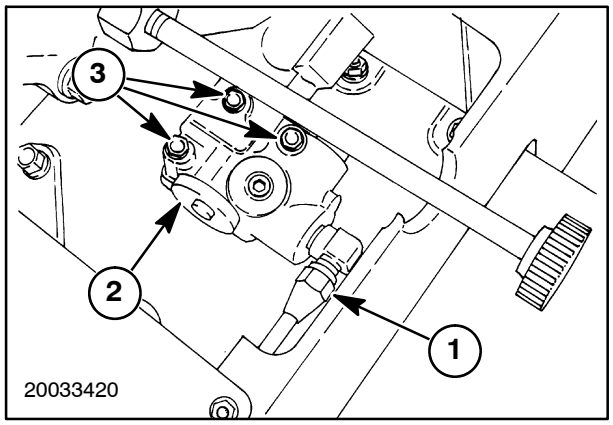


13

PTO CLUTCH CONTROL VALVE

Removal

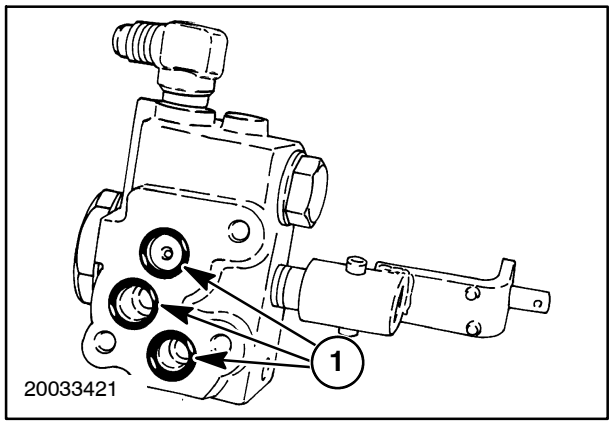
1. Remove the seat and seat brackets.
2. Disconnect the PTO system hydraulic line, 1, from the clutch control valve, 2.
3. Remove the cotter pin securing the control lever linkage to the control valve. Remove the linkage.
4. Remove the three bolts, 3, that secure the clutch control valve, 2, to the clutch cover.



14

NOTE: *The O-rings, 1, used on the hydraulic fluid transport tubes will need to be replaced before installing the valve back onto the differential housing.*

5. Remove the clutch control valve from the clutch cover.



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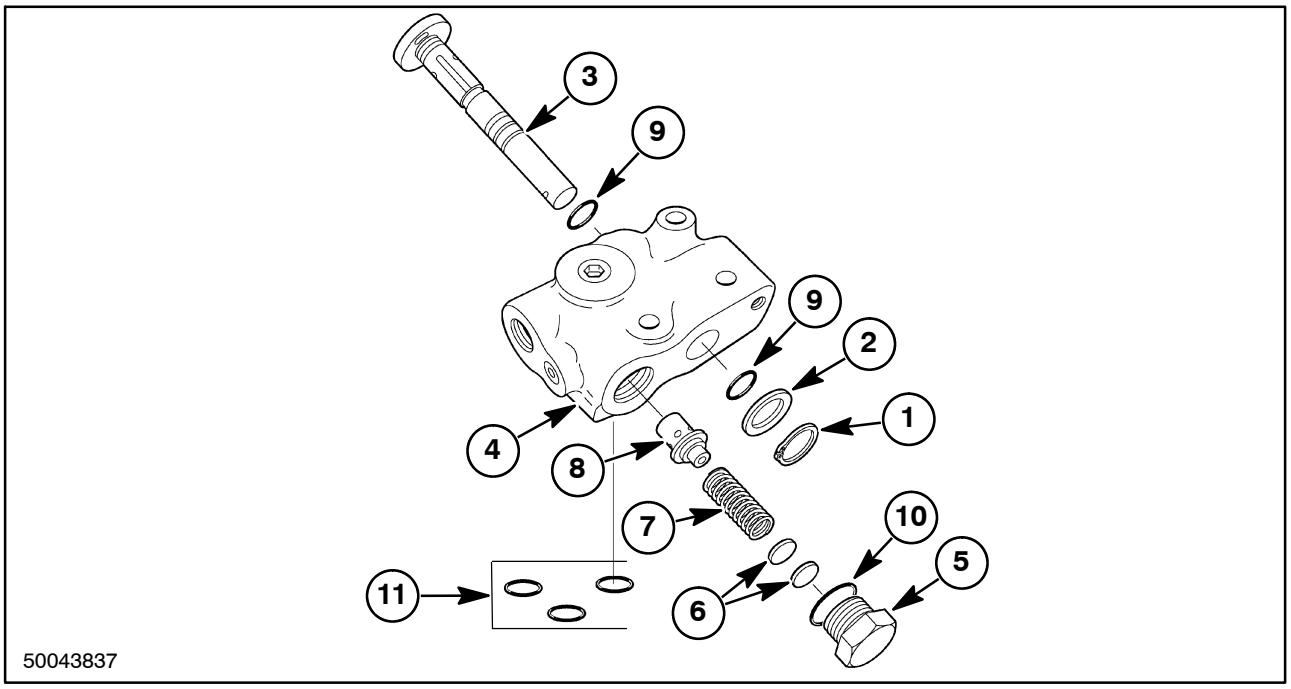


16

1. Snap Ring
2. Spacer
3. Valve Spool
4. Valve Body
5. Plug
6. Shims
7. Spring
8. Poppet
9. O-Ring
10. O-Rings
11. O-Rings

Disassembly

1. Remove the snap ring, 1, spacer, 2, securing the valve spool, 3, in the valve body, 4.
2. Using a brass drift, gently tap the valve spool, 3, out of the valve body, 4.
3. Remove the plug, 5, shims, 6, spring, 7, and poppet, 8, from the valve body, 4.

NOTE: *Shims, 6, are installed between spring and plug. Confirm their thickness and quantity.*

Inspection

1. Remove and discard all O-rings, 9, 10 and 11.
2. Clean and inspect the valve spool and the spool bore for pitting, scratches, or excess wear. If found to be defective, replace the clutch control valve assembly.
3. Clean and inspect the poppet and the poppet bore for pitting, scratches, or excessive wear. If found to be defective, replace the clutch control valve assembly.
4. Inspect the spring for any distortion replace the valve if found to be defective.

Assembly

1. Sparingly lubricate new O-rings, 9, (Figure 16) with petroleum jelly and install them onto the valve spool, 3 (Figure 16).

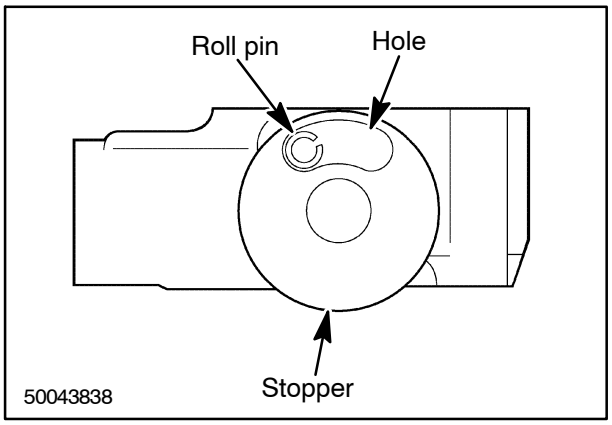
NOTE: *Align the roll pin with the stopper's hole of the spool.*

2. Lubricate the spool bore with clean hydraulic fluid.

⚠ CAUTION ⚠

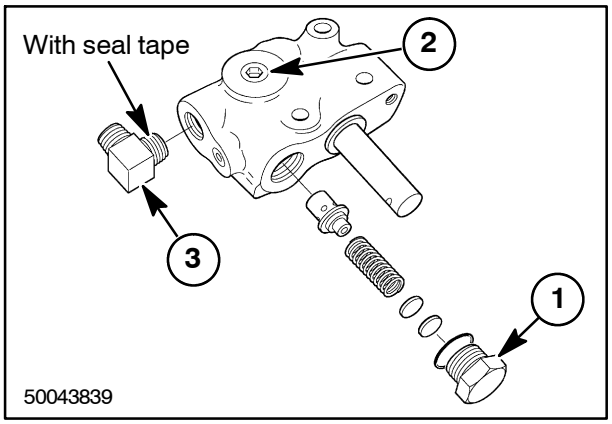
Due to minimal diameter tolerances between the valve spool bore and the valve spool, it is necessary to chill the valve spool in a freezer or other cooling device prior to inserting the valve spool into spool bore. Failure to do so may result in damage to the valve spool, valve body, or O-rings.

3. Install the valve spool, 3, into the valve body, 4. (Figure 16).
4. Install the spacers, 2, snap ring, 1, (Figure 16) onto the valve spool.
5. Check that the spool moves freely in the spool bore. If it does not, replace the clutch control valve assembly.
6. Install the poppet, 8, spring, 7, shims, 6, and plug, 5, (Figure 16).



17

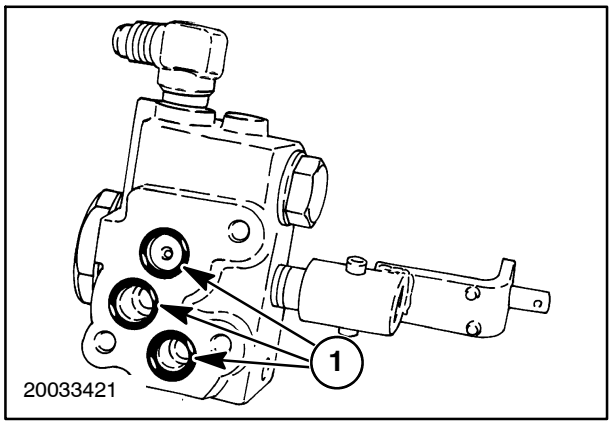
Tightening Torque		N·m (ft-lbs)
1	Plug	29 (21)
2	Plug	15 (11)
3	Adapter	15 (11)



18

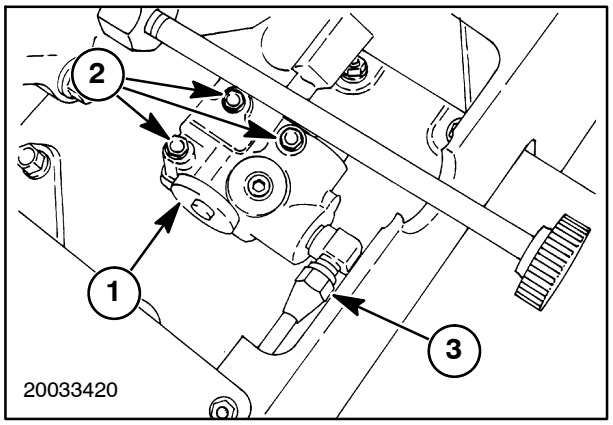
Installation

1. Discard and replace all O-rings, 1, which seal the clutch control valve to the clutch cover.



19

2. Install the control valve, 1, onto the clutch cover. Install the three bolts, 2, that secure the control valve, 1, to the clutch cover. Do not tighten at this time.
3. Connect the PTO system hydraulic line, 3, to the clutch control valve, 1.
4. Align the scribe marks previously made on the valve body and spool. Connect the PTO control lever linkage onto the control valve. Install a new cotter pin to secure linkage.
5. Tighten the bolts, 2, which secure the valve, 1, to the clutch cover. Torque bolts to 11 N·m (100 in-lbs).
6. Install the seat brackets and seat onto the tractor.



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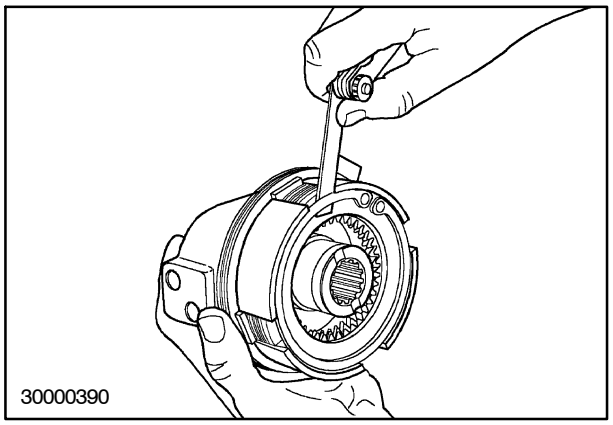
PTO CLUTCH

Removal

See “PTO System - Removal” for PTO clutch removal procedure. Remove PTO clutch assembly from differential housing.

Disassembly

1. Prior to disassembly, use a feeler gauge to check the air gap between the clutch backing plate and the snap ring that retains the clutch pack in place. Air gap specification: 1.5 - 2.5 mm (0.059 - 0.098″).

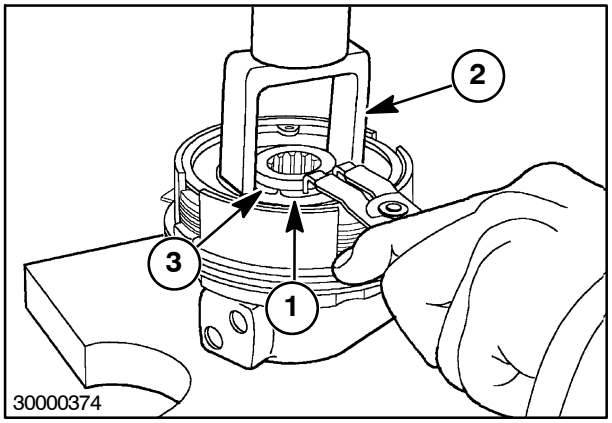


21

⚠ WARNING ⚠

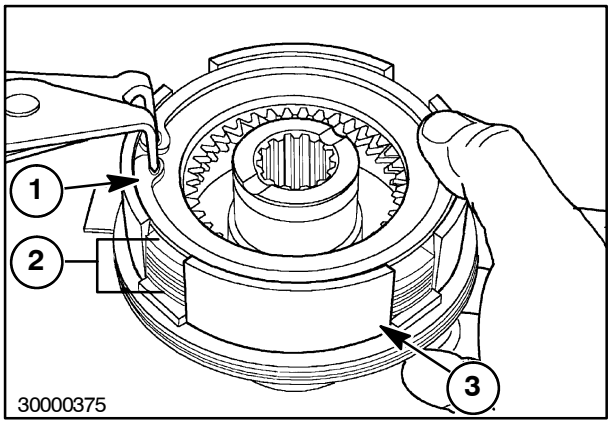
Special tool #CNH299009 must be used to compress the piston spring and backing washer, otherwise bodily injury may occur when removing the snap ring.

2. Place the clutch assembly in a hydraulic press; apply pressure to the spring backing washer, 1, and piston spring using special tool, 2. (tool #CNH299009) While pressure is being applied to the washer and spring, remove the snap ring, 3 from the clutch housing. Slowly relieve pressure from the backing washer and spring.



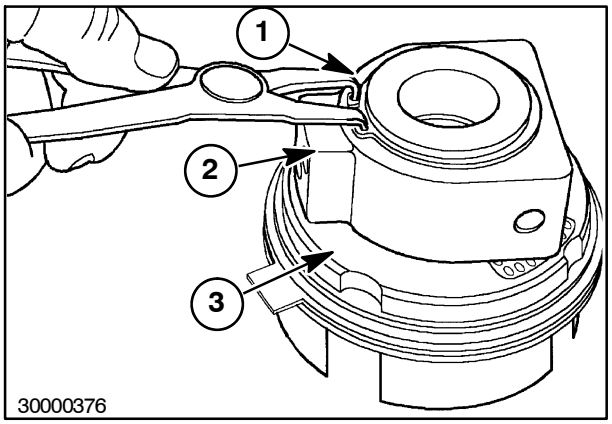
22

3. Remove the snap ring, 1, retaining the clutch pack and piston, 2, in the PTO clutch housing, 3. Slide the clutch pack and piston off of the clutch housing.



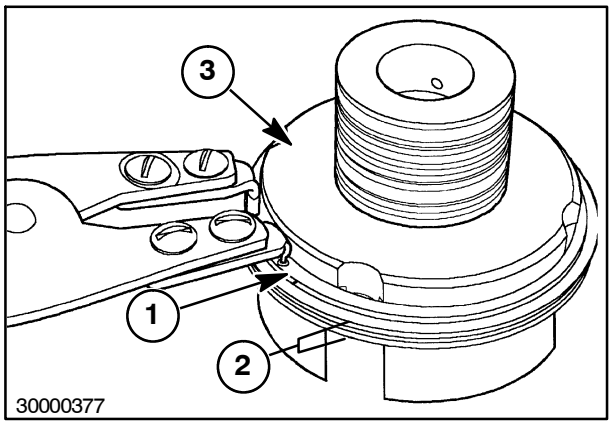
23

4. Remove the snap ring, 1, which secures the hydraulic fluid distribution block, 2 to the PTO clutch housing, 3, and slide the block off of the clutch housing.



24

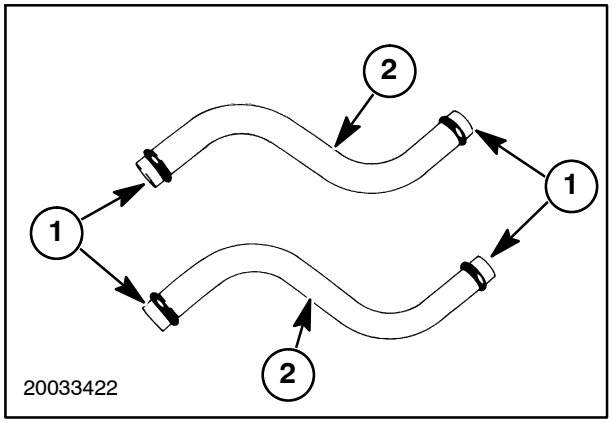
5. Remove the snap ring, 1, retaining the brake disc and brake pressure plates, 2, to the clutch housing, 3.



25

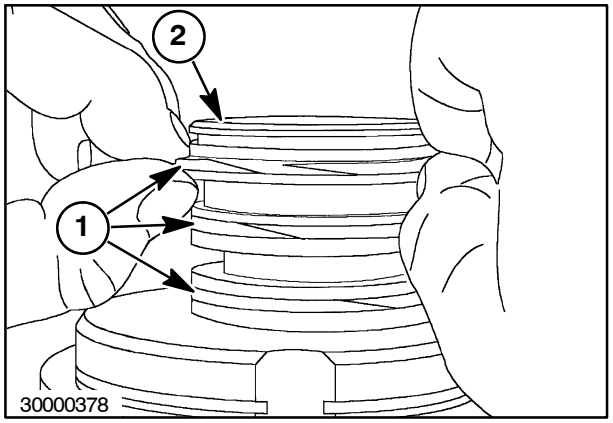
Inspection

1. Remove and discard all O-rings, 1, on each hydraulic fluid transport tube, 2, and replace with new O-rings.



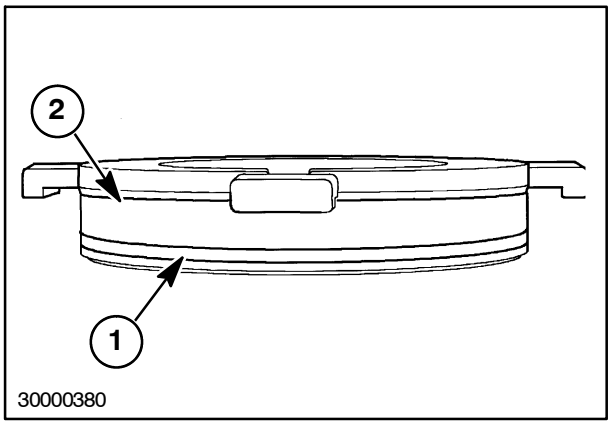
26

2. Remove the seal rings, 1, from the clutch housing, 2, and inspect them for excess wear and damage. Replace as needed.



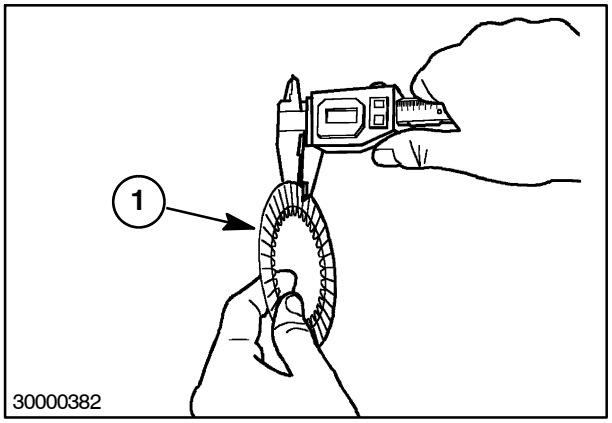
27

3. Remove the seal ring, 1, from the clutch piston, 2, and inspect the ring for excess wear and damage. Replace as needed.



28

4. Inspect each clutch disc, 1, for thickness, damage, or excess wear. Replace if the thickness of the discs is less than 1.8 mm (0.071″).
5. Lay each clutch disc separator plate and the clutch backing on a plate of glass or other flat surface and inspect them for any warpage, excess wear, or damage. Replace as needed.



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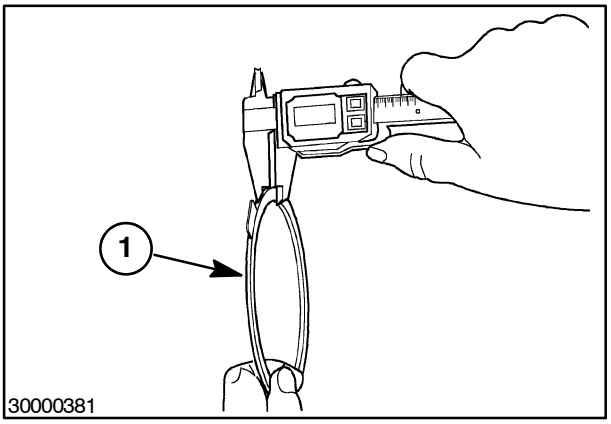
6. Inspect the clutch brake disc, 1, thickness and replace the brake disc if damaged or if the thickness is less than 1.8 mm (0.071″).
7. Inspect the brake pressure plates for warpage, excess wear, or damage. Replace as needed.
8. Clean and inspect the clutch housing, piston, spring, and distribution block for excess wear or damage. Replace the clutch assembly if any of these are found to be damaged or show excess wear.

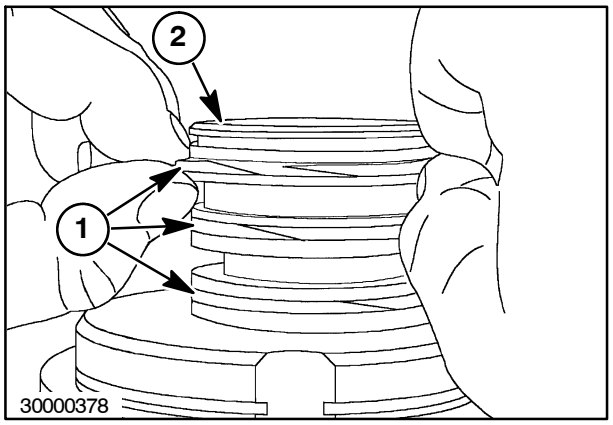


30

Assembly

NOTE: *Prior to assembly of the PTO clutch, soak the clutch discs, brake disc, and seal rings in clean hydraulic fluid for a minimum of one hour.*

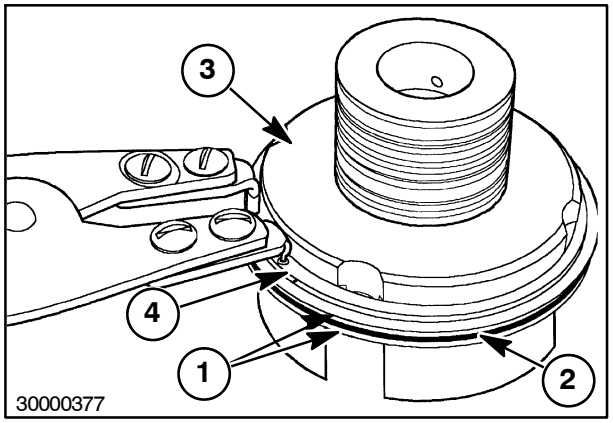
1. Install the seal rings, 1, onto the clutch housing, 2.



31

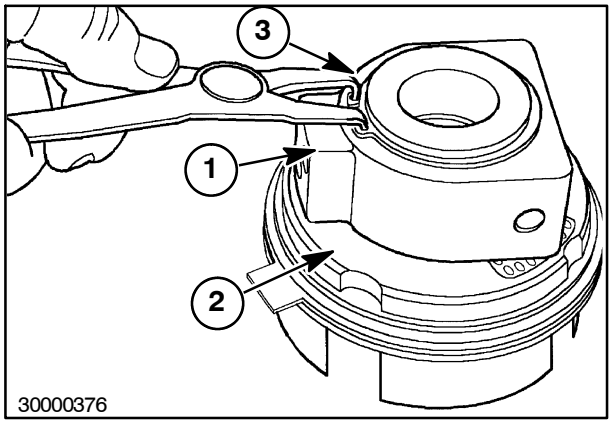
NOTE: *When installing the snap ring that secures the PTO brake components, make sure that the gap in the snap ring is 45° from brake pressure plate recesses in the clutch housing.*

2. Place a brake pressure plate, 1, and brake disc, 2, onto the clutch housing, 3. Place the remaining brake pressure plate, 1, on top of the brake disc. Secure the plates and disc with the snap ring, 4.



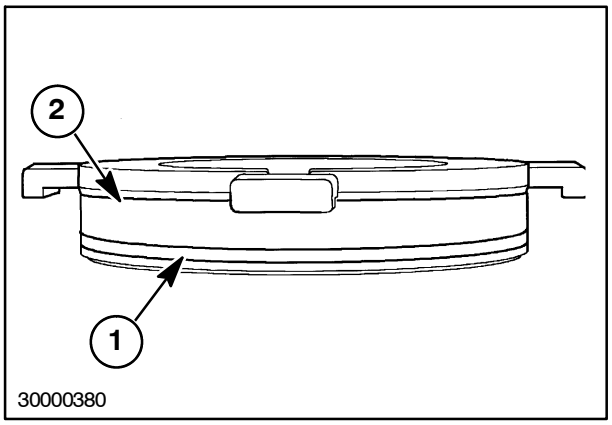
32

3. Slide the distribution block, 1, over the clutch housing, 2, and retain the block with the snap ring, 3.



33

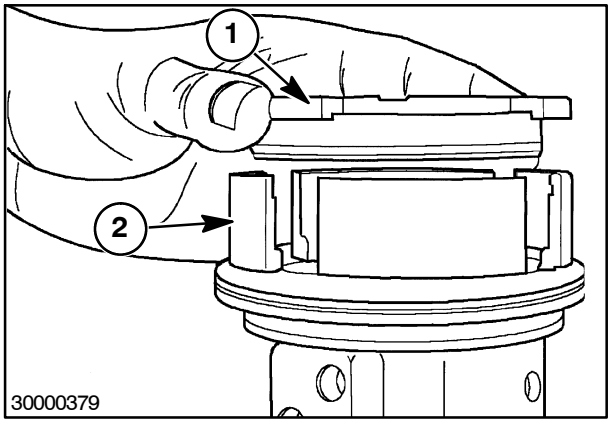
4. Install the seal ring, 1, onto the clutch piston, 2.



34

NOTE: *When installing the clutch piston, the side of the clutch piston with the seal ring is installed into the clutch housing first.*

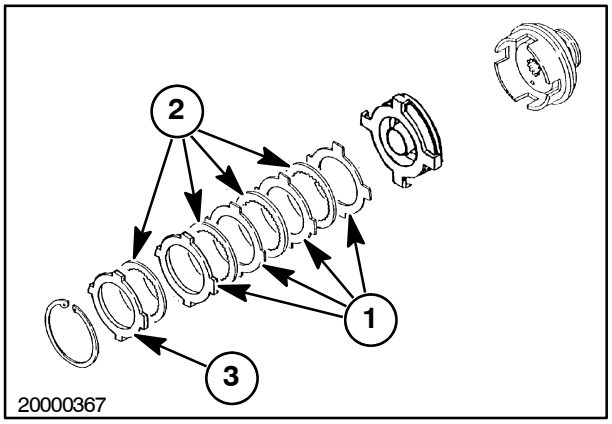
5. Slide the clutch piston, 1, onto the clutch housing, 2.



35

NOTE: *When installing the clutch discs and separator plates onto the clutch housing, install the thick backing plate last (on top).*

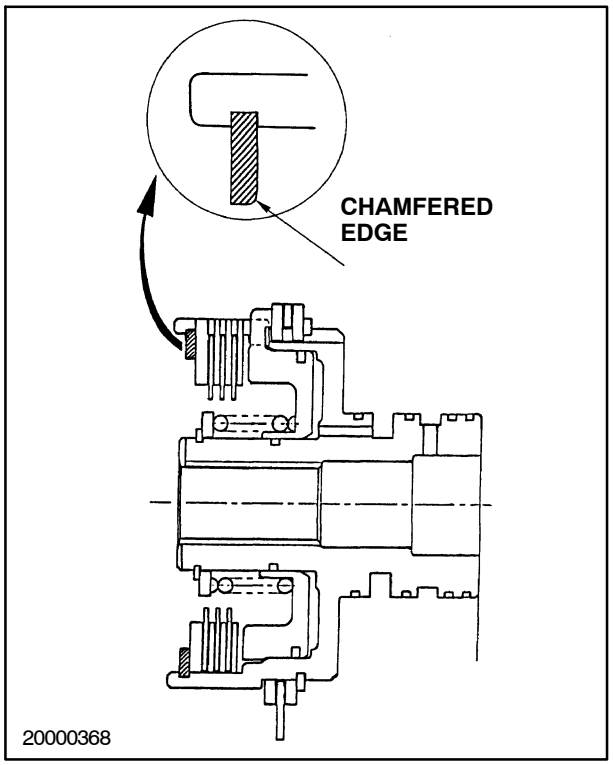
6. Install clutch separator plates, 1, and clutch discs, 2, on top of the clutch piston. Start with a separator plate and alternate the clutch discs with the separator plates until all plates and discs are installed. Install thick backing plate, 3, last.



36

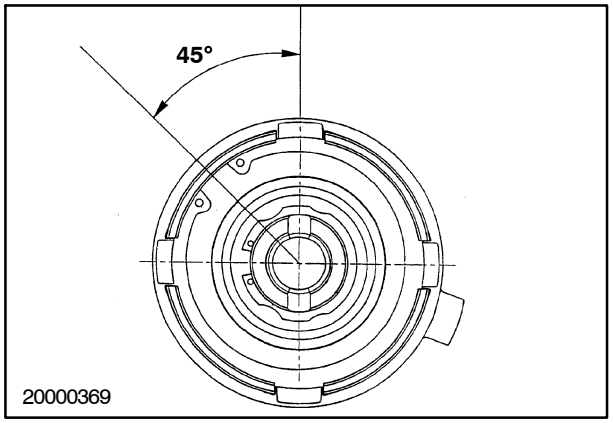
1. Separator Plate
2. Clutch Disc
3. Backing Plate

NOTE: *The snap ring that secures the clutch pack to the clutch housing is chamfered on one inside edge. Install this edge to the inside of the clutch assembly.*



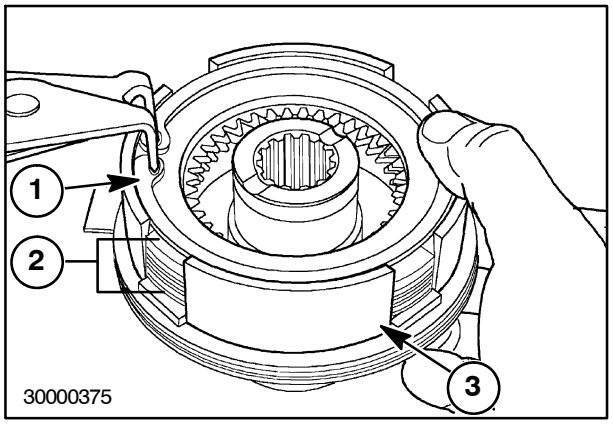
37

NOTE: *When installing the snap ring that secures the clutch pack to the clutch housing, place the gap in the snap ring 45 ° from a clutch piston relief in the clutch housing.*



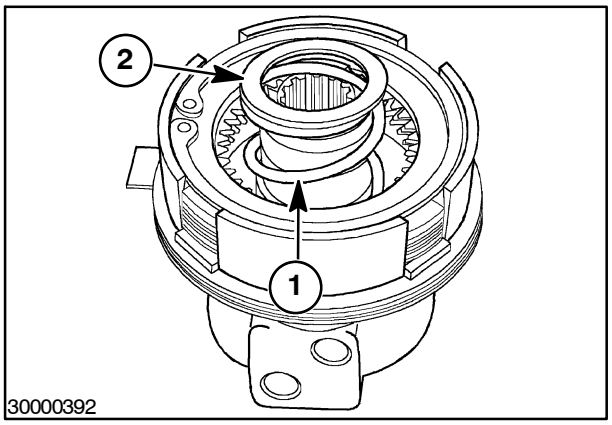
38

7. Install the snap ring, 1, that retains the clutch pack and piston, 2, in the PTO clutch housing, 3.



39

8. Place the piston spring, 1, and backing washer, 2, onto the clutch housing.

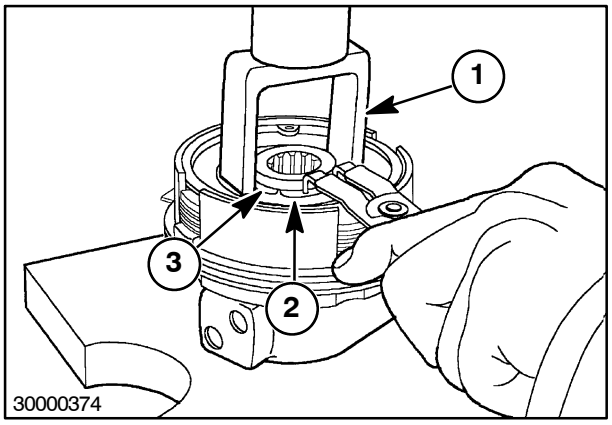


40

⚠ WARNING ⚠

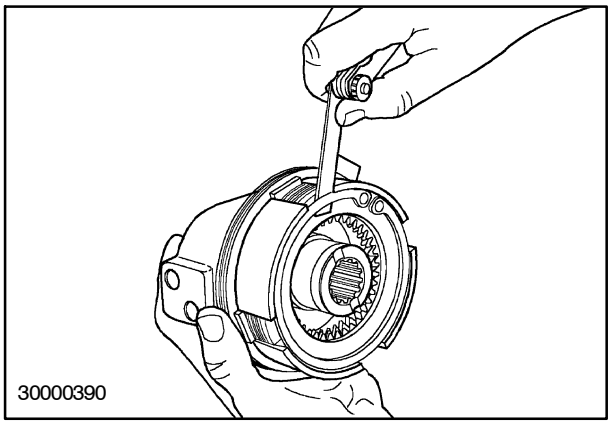
Special tool #CNH299009 must be used to compress the piston spring and backing washer, otherwise bodily injury may occur when installing the snap ring.

9. Place the clutch assembly in a hydraulic press and using special tool #CNH299009, 1, apply pressure to the spring and backing washer, 2. Install the snap ring, 3, that retains the spring and washer to the clutch housing.



41

10. Use a feeler gauge to check the air gap between the clutch backing plate and the snap ring that retains the clutch pack in place. Air gap specification: 1.5 - 2.5 mm (0.059 - 0.098″).
11. See “PTO System - Installation” for PTO clutch installation procedure. Install PTO clutch assembly into differential housing.



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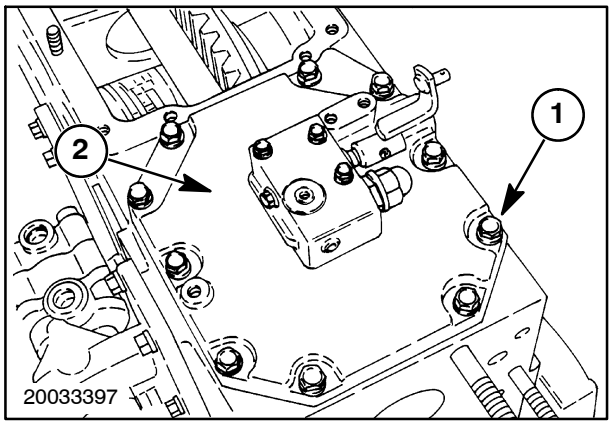
PTO SYSTEMS

Removal

1. It is not necessary to separate the transmission from the differential housing to service the PTO system only. For differential or drive pinion service, the transmission must be separated from the differential housing. Refer to Section 27, “Rear Axle”.
2. Remove the ten bolts, 1, securing the PTO clutch cover, 2, to the differential housing and lift the cover off.



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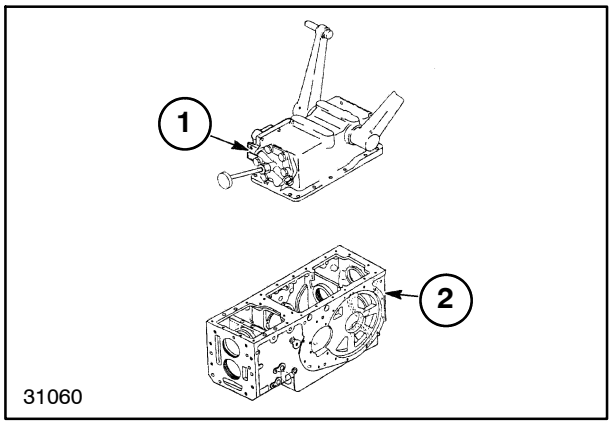
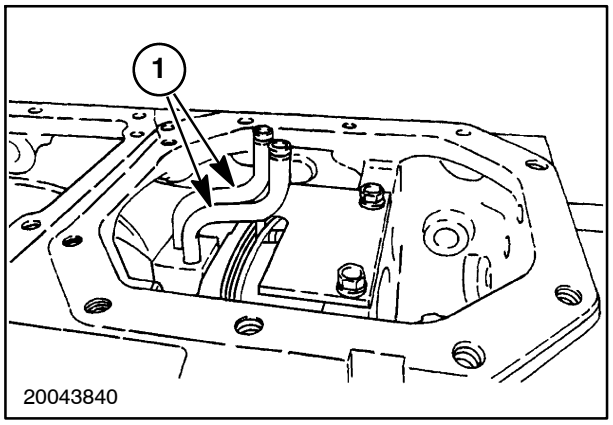
3. Remove the sixteen nuts and bolts securing the lift cover, 1, to the rear differential housing, 2. Use a suitable lifting device to lift and remove the cover from the housing.



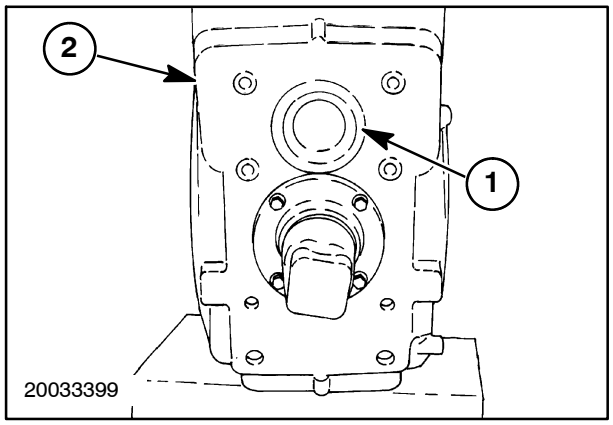
44

4. Remove the hydraulic transport tubes, 1, from the hydraulic fluid distribution block of the clutch assembly.



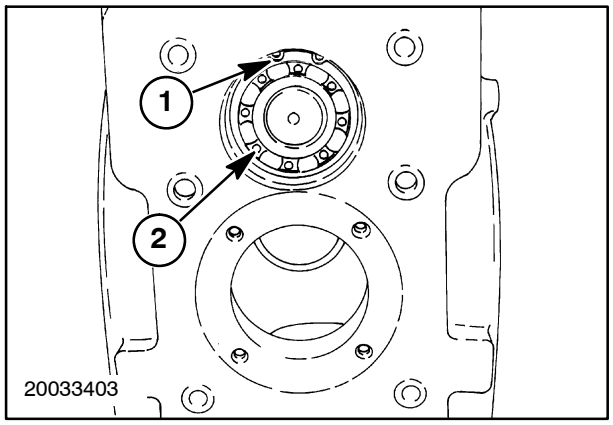
45

5. Remove the rear PTO countershaft bearing seal, 1, from the rear differential housing, 2.



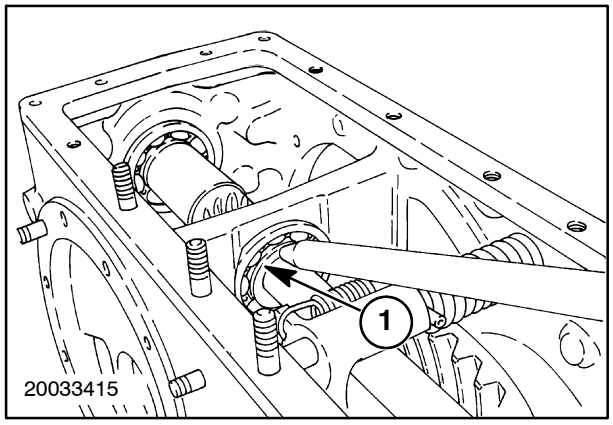
46

6. Remove the snap ring, 1, securing the rear PTO countershaft bearing, 2, in the rear differential housing.



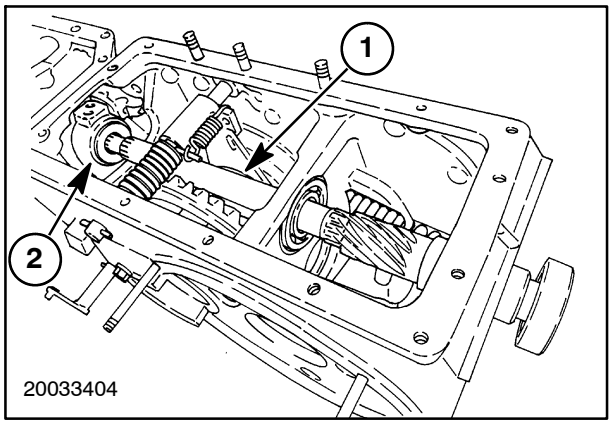
47

7. Using a hammer and an aluminum drift, gently tap against the inner race of the front countershaft bearing, 1, to disengage the PTO countershaft from the PTO clutch.



48

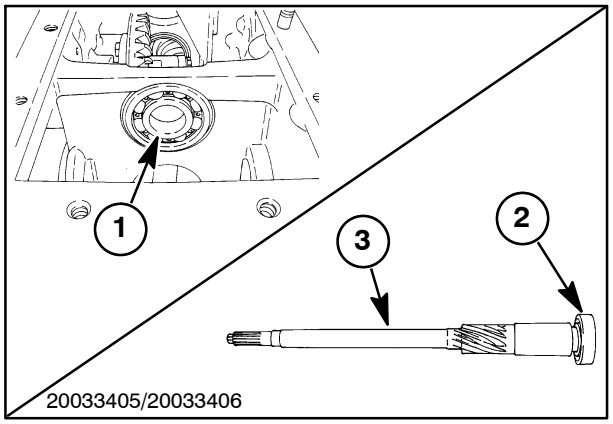
8. Once the countershaft, 1, is free from the PTO clutch, 2, slide the countershaft rearward, and remove from the back of the housing.



49

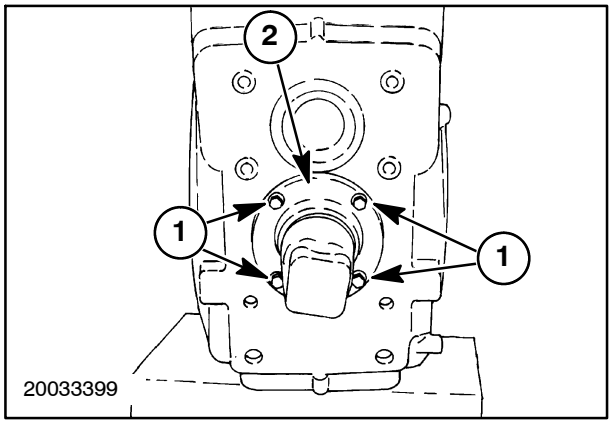
9. Remove the front bearing, 1, from the housing.
10. Remove the rear bearing, 2, from the countershaft, 3.

NOTE: *Observe the difference and orientation of the countershaft bearings. While both bearings are marked 6307, the front bearing has a location ring attached while the rear bearing uses a separate snap ring for location.*



50

11. Remove the four bolts, 1, securing the rear PTO shaft cover and oil seal housing, 2, to the differential housing.
12. Remove the cover and the oil seal.

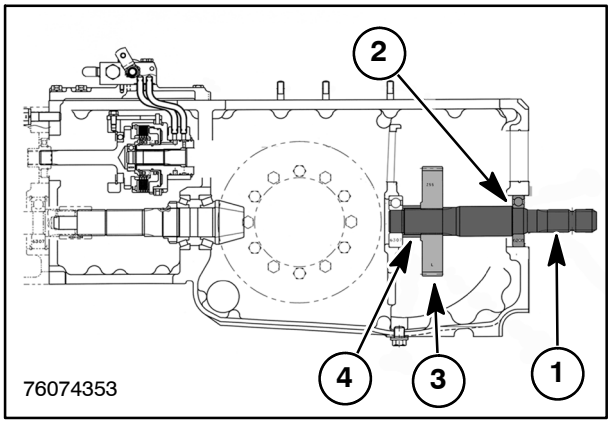


51

13. Drive the output shaft, 1, and bearing, 2, out the rear of the housing.

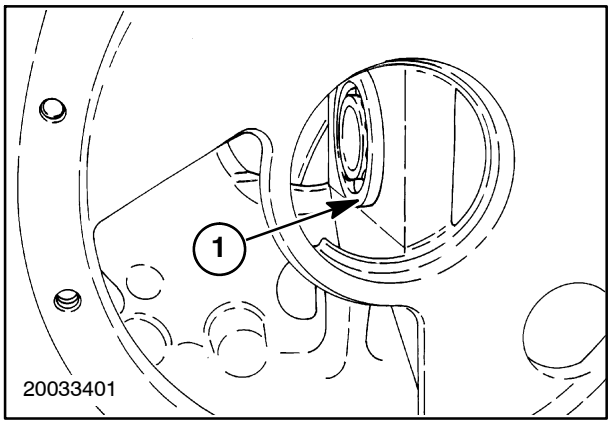
NOTE: *Observe the orientation of the 55T gear, 3, during disassembly. The shoulder on the gear must face towards the front of the housing.*

14. Remove the 55T gear, 3, and the collar, 4, from the housing.



52

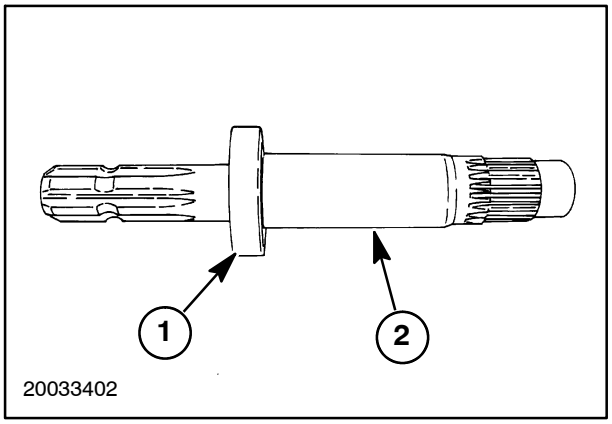
15. Remove the front PTO output shaft bearing, 1, from the housing.



53

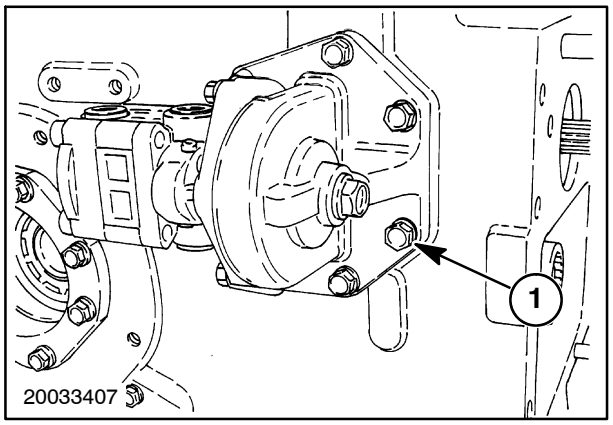
16. Remove the rear PTO output shaft bearing, 1, from the shaft, 2.

NOTE: *The front and rear bearings are different sizes. The front bearing is marked 6307, while the rear bearing is marked 6208.*



54

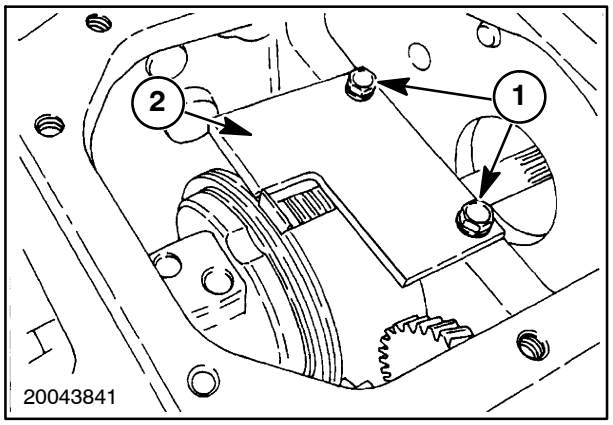
17. Remove the retaining bolts, 1, securing the hydraulic gear pump to the differential housing.
18. Remove the gear pump to gain access to the right side clutch retaining bolt.



55

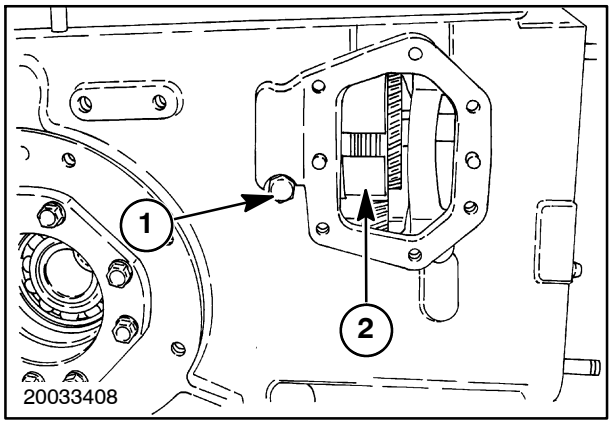
19. Remove the two bolts, 1, securing the PTO clutch brake stopping plate, 2, to the differential housing.

NOTE: *The PTO clutch stopping plate retaining bolts are secured with a thread-locking compound. Do not attempt to remove the bolts without heating them prior to removal. Use a propane torch to heat the bolts and soften the thread-locking compound.*



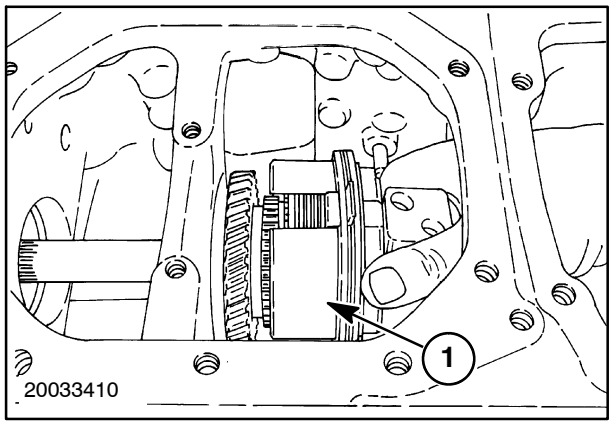
56

20. Remove the two bolts, 1, (one each side) retaining the clutch assembly, 2, to the inside of the differential housing.



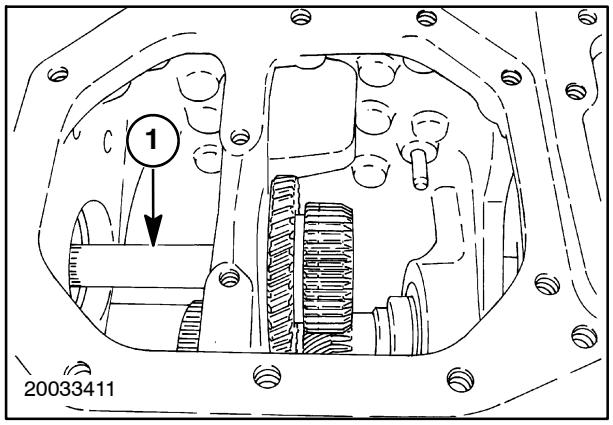
57

21. Slide the PTO clutch, 1, rearward in the differential housing and lift the clutch assembly out of the housing.



58

22. Move the input shaft, 1, towards the rear of the housing and upward, to remove from the housing.



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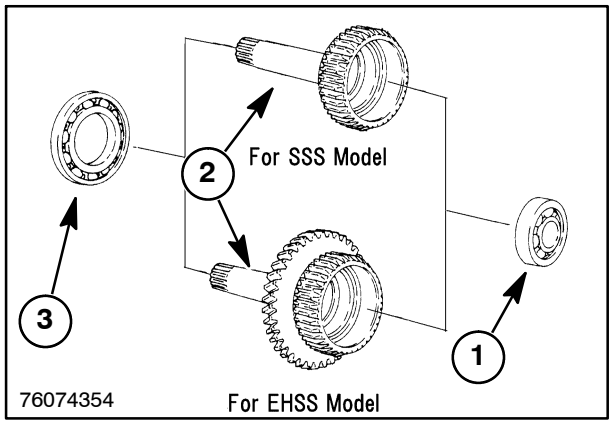
23. Remove the small bearing, 1, from inside the input shaft, 2.
24. Remove the large bearing, 3, from the outside of the input shaft, 2.



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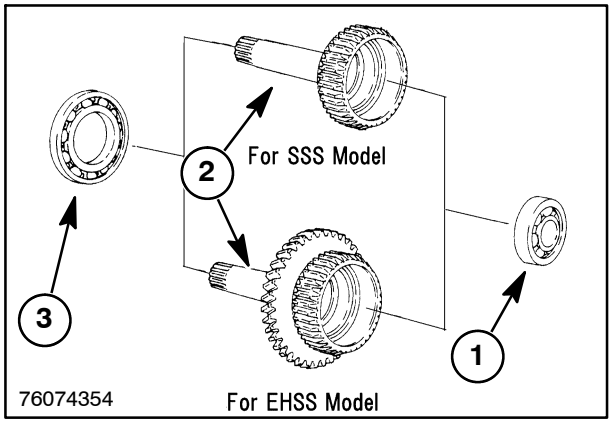
Inspection

1. Wash all parts in a suitable cleaning solution and allow to air dry.
2. Inspect all bearings for excess wear, score marks, discoloration from overheating or other damage. Rotate the bearings by hand and check for roughness while turning the inner and outer races. Replace as necessary.
3. Lubricate all bearings with clean hydraulic fluid before assembly.
4. Inspect the differential housing for cracks, worn or damaged bearing bores or other damage. Replace as necessary.
5. Inspect all gears for excess wear, chipped gear teeth, cracks or any other damage. Replace as necessary.

Installation

1. Install the small bearing, 1, in the inside of the PTO input shaft, 2, at the gear end.
2. Install the large bearing, 3, on the outside of the input shaft, 2.



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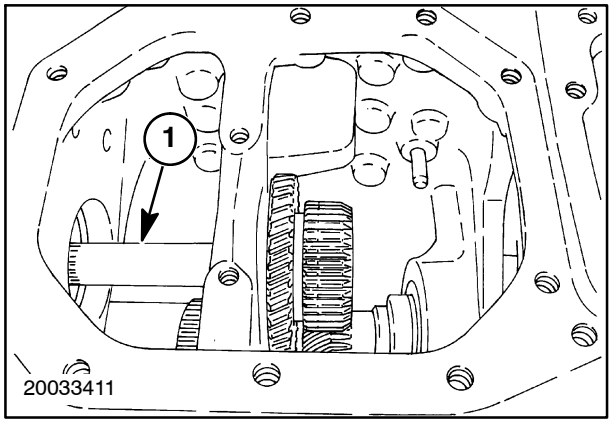
3. Install the input shaft, 1, into the housing.



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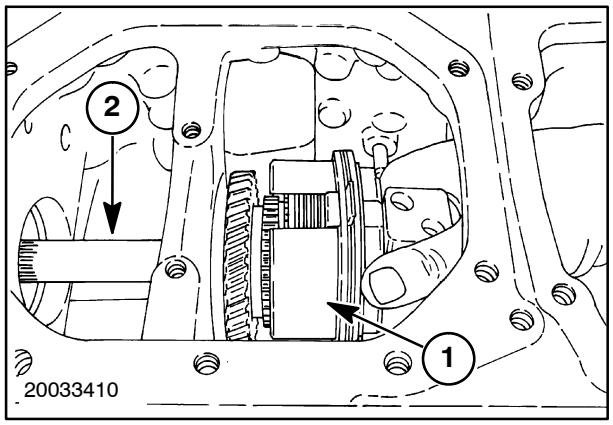
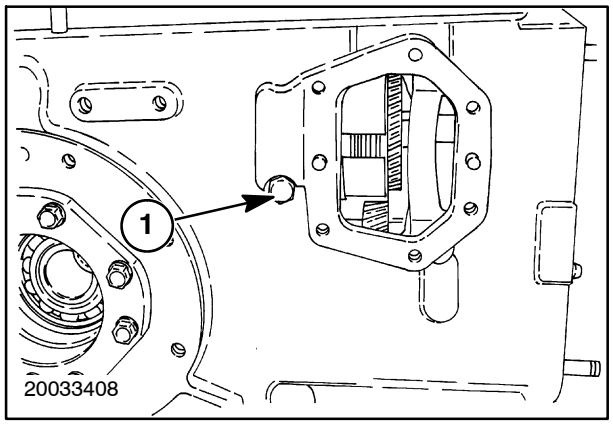
4. Position the PTO clutch, 1, into the differential housing and engage the clutch teeth with the splines of the PTO input shaft, 2. Be certain that all four clutch discs are engaged with the input shaft.



63

5. Install and tighten the two bolts, 1, (one each side) to secure the clutch assembly to the inside of the differential housing.



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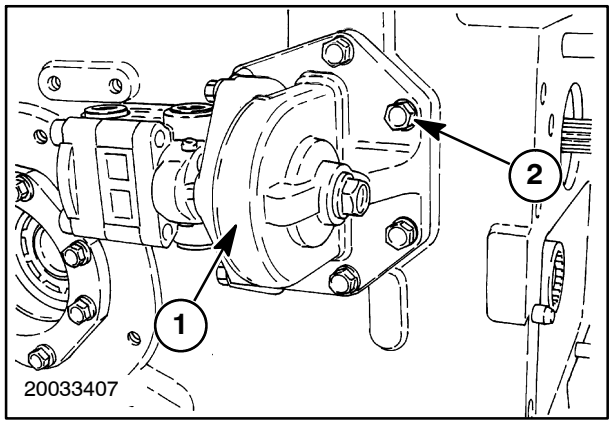
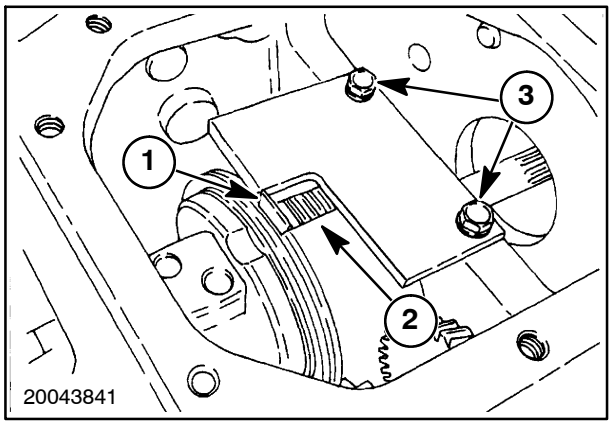
6. Install the hydraulic gear pump, 1, on the right side of the housing.
7. Install and tighten the retaining bolts, 2.



65

NOTE: *Remove the oil stain from the threaded hole and bolt threads, apply thread sealant to the bolt prior to installation.*

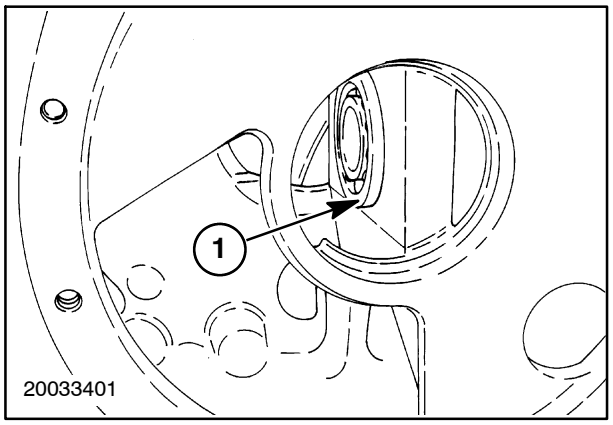
8. Align the brake disc tab, 1, with the notch in the brake disc stopping plate, 2, and install the two bolts, 3, securing the plate to the housing. Tighten the bolts securely.



66

9. Install the front PTO output shaft bearing, 1, into the housing.

NOTE: *The front and rear bearings are different sizes. The front bearing is marked 6307, while the rear bearing is marked 6208.*



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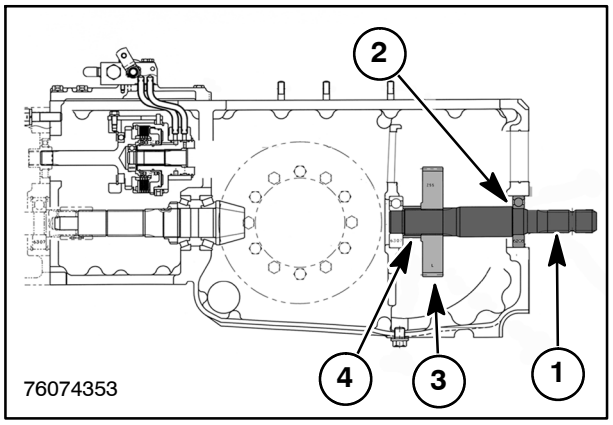
IMPORTANT: *Pay close attention to the orientation of the 55T gear during installation. The shoulder on the gear must face towards the front of the housing.*

10. Install the rear PTO output shaft bearing, 1, onto the end of the output shaft, 2.
11. Place the 55T gear, 3, into the housing, shoulder facing forward.
12. Install the PTO output shaft, 2, through the housing through the rear.
13. Slide the 55T gear, 3, onto the output shaft in the housing.
14. Place the collar, 4, to the front of the 55T gear and slide the output shaft through the gear.



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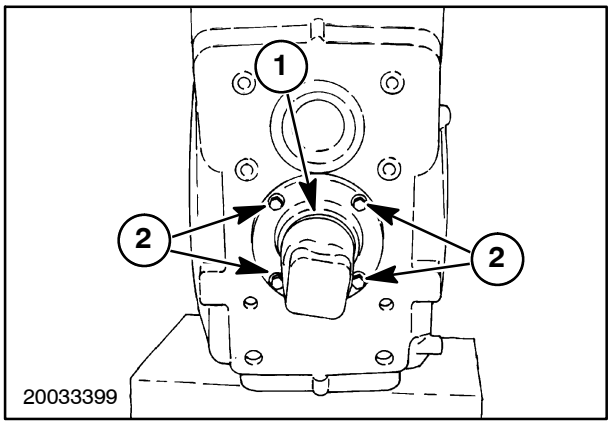
15. Lightly tap the output shaft forward until it is fully seated into both bearings.
16. When fully seated, the PTO output shaft should have 0.0-0.3 mm (0.0-0.012″) of end play.
17. Lubricate a new PTO output shaft seal with petroleum jelly and install in the shaft cover, 1.
18. Install the shaft cover, 1, over the PTO output shaft and secure with four bolts, 2.



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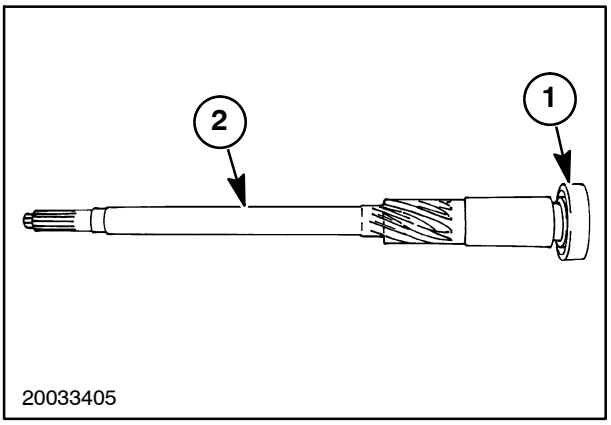
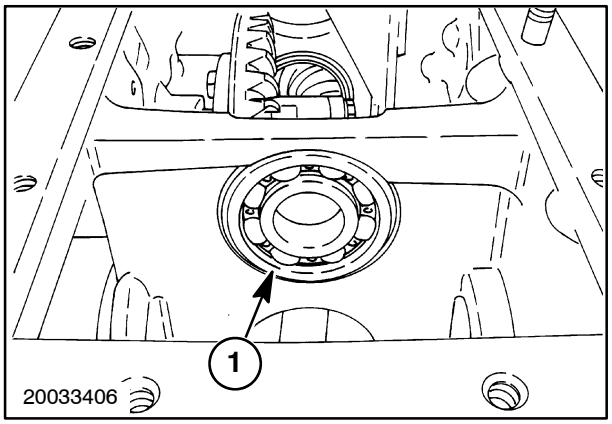
19. Install the rear PTO countershaft bearing, 1, on the countershaft, 2.



70

20. Install the front PTO countershaft bearing, 1, into the housing.
21. If necessary, gently tap the bearing with an aluminum drift to seat the bearing in the bore.



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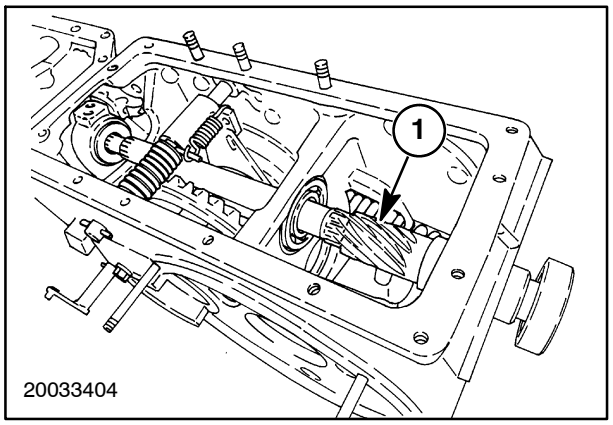
22. Slide the PTO countershaft, 1, into the housing, through the front bearing and into the PTO clutch assembly.
23. WIth the countershaft and clutch splines aligned, use a hammer and aluminum drift to gently tap the countershaft forward until countershaft is fully seated in the housing and bearings.



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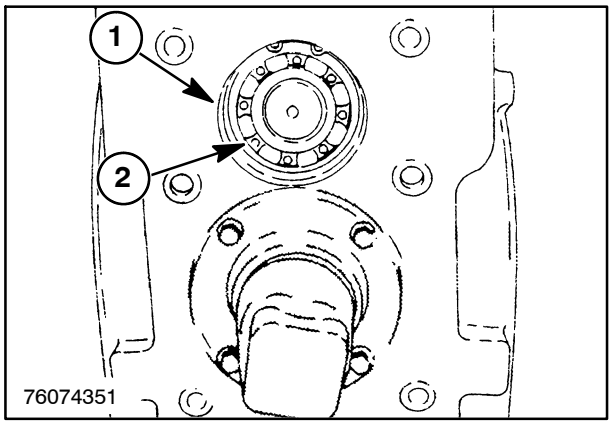
24. Install the snap ring, 1, securing the rear PTO countershaft bearing, 2, in the differential housing.



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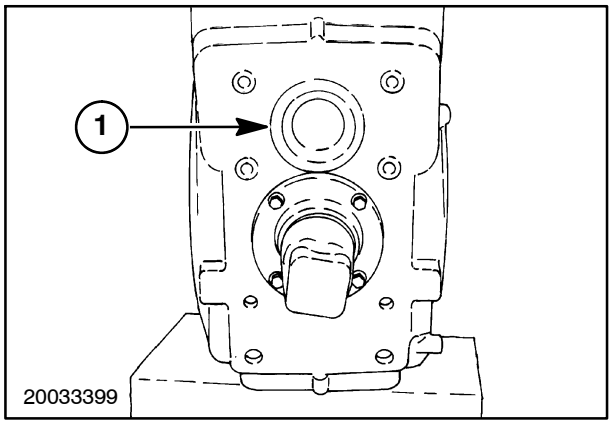
25. Install a new bearing seal, 1, into the differential housing.



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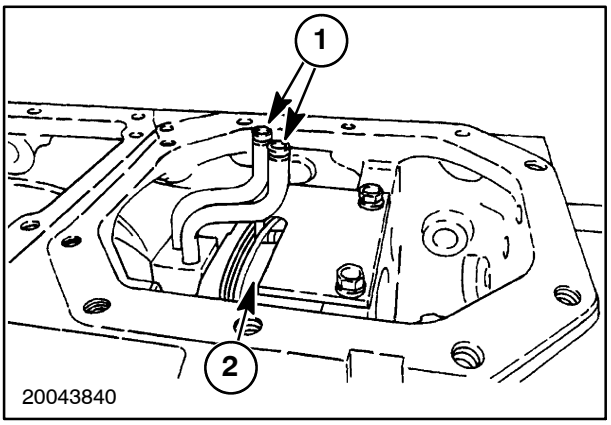
26. Install new O-rings on the fluid transport tubes.
27. Lightly coat the O-rings with petroleum jelly, prior to installation.
28. Install the hydraulic fluid transport tubes, 1, into the fluid distribution block, 2, of the clutch assembly.



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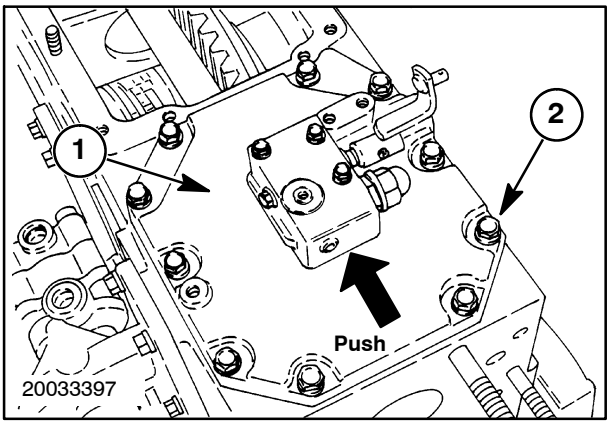
29. Apply a small bead of Loctite® RTV silicone gasket maker to the clutch cover, 1.
30. Align the fluid transport tubes in the holes, in the clutch cover.
31. Install the clutch cover onto the differential housing with bolts, 2. Tighten and torque the bolts to 54 N·m (40 ft-lbs) while pushing the clutch cover rearward with hand.



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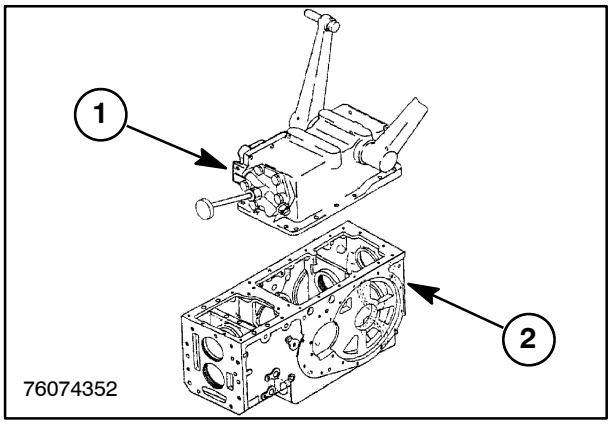
32. Apply a small bead of Loctite® RTV silicone gasket maker to the lift cover, 1, and differential housing, 2.
33. Install the lift cover to the housing, securing it with sixteen bolts and nuts. Tighten and torque the bolts and nuts to 54 N·m (40 ft-lbs).



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SECTION 33 - BRAKES

Chapter 1 - Brakes

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SPECIFICATIONS

BRAKE DISCS

No. of Brake Discs	4
Disc ID	143 mm (5.6 in)
Disc OD	175 mm (6.9 in)
Total Brake Surface	12.8 sq in
Total Brake Disc Thickness	4 mm (0.158 in)
Standard Lining Groove Depth	0.3 mm (0.012 in)
Allowable Limit (Minimal Groove Depth)	0.05 mm (0.002 in)

STATORS

No. of Stators	4
Stator Thickness	3.2 mm (0.126 in)
Level Difference-Allowable Limit	0.1 mm (0.004 in)
Clearance of Pedal Shaft and Bushing	0.05 - 0.35 mm (0.002 - 0.014 in)
Allowable Limit	1.0 mm (0.039 in)
Brake Pedal Free-Play	35 - 45 mm (1.38 - 1.77 in)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

TROUBLESHOOTING

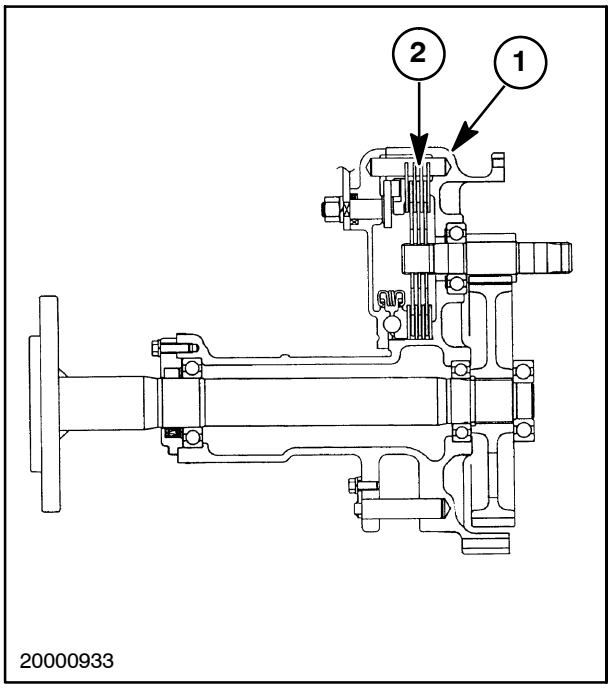
CONDITION	POSSIBLE CAUSE	REMEDY
Brakes will not slow or stop the tractor.	1. Incorrect brake adjustment. 2. Worn brake discs. 3. Worn stator plates. 4. Incorrect counterbalance with loader installation.	1. Adjust brakes. 2. Replace brake discs. 3. Replace stator plates. 4. Install adequate rear counterbalance.
Brakes will not release after applying brake pedal.	1. Worn or broken return springs in axle housing. 2. Worn or broken return springs on brake pedal.	1. Replace springs. 2. Replace springs.
Brakes grab or pull to one side.	1. Incorrect brake adjustment. 2. Worn actuator plate. 3. Dirty or contaminated hydraulic fluid. 4. Worn brake discs. 5. Worn stator plates.	1. Adjust brakes. 2. Replace actuator plate. 3. Change the hydraulic fluid. 4. Replace brake discs. 5. Replace stator plates.
Parking brake will not hold the tractor.	1. Worn engagement pawl on left brake pedal. 2. Worn brake lock teeth on parking brake engagement assembly. 3. Worn brake discs.	1. Replace left brake pedal. 2. Replace parking brake engagement assembly. 3. Replace brake discs.

DESCRIPTION OF OPERATION - BRAKES

The rear axle used on the T2410 and T2420 is a double reduction type, consisting of a conventional ring gear and pinion for primary reduction, and a final drive pinion and gear for secondary reduction.

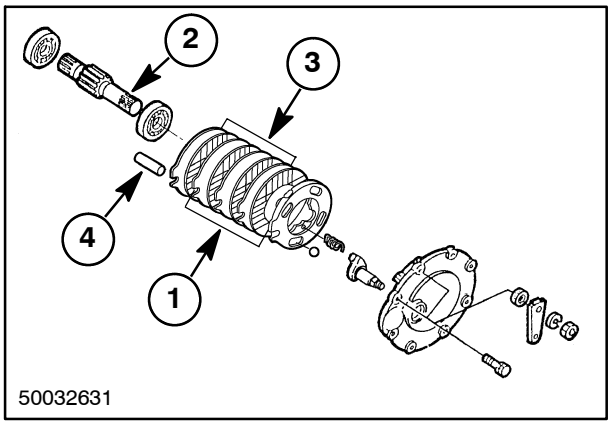
The axle housing, 1, encloses the brake discs and stators, 2. The rear axle and differential components are lubricated by the common hydraulic oil reservoir.

The brakes are a mechanically actuated, wet disc type. The brakes are located outside of the differential housing and are enclosed in the front portion of the axle housing. The brake housing cover seals the brakes from contaminants and moisture.



1

The brake discs, 1, are splined to the final drive pinion shaft, 2, and turn at the same speed as the differential assembly. The stators, 3, are kept in position by a locating pin, 4, in the axle housing.



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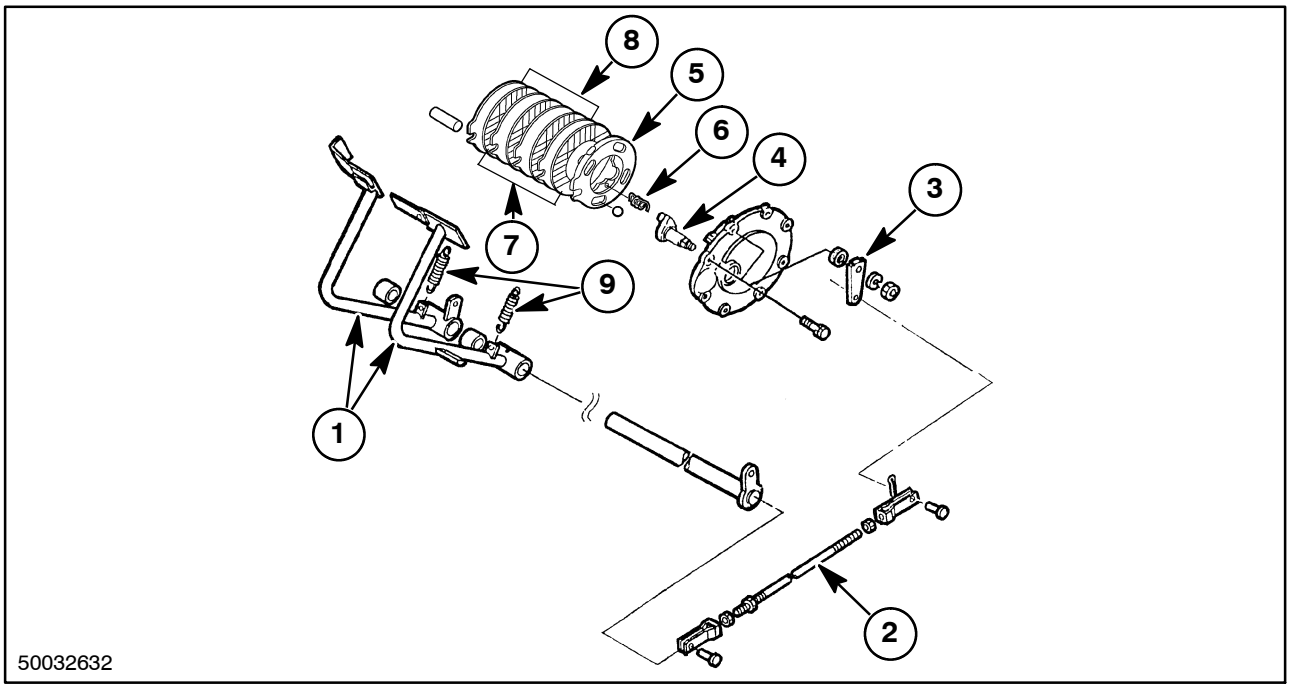


3

BRAKE OPERATION

NOTE: *The brake pedals are located on the right side of the tractor. The inner (LH) pedal operates the parking brake and the brake on the LH axle. The outer (RH) pedal operates the brake on the RH axle. The two pedals are usually mechanically linked to function as one actuator.*

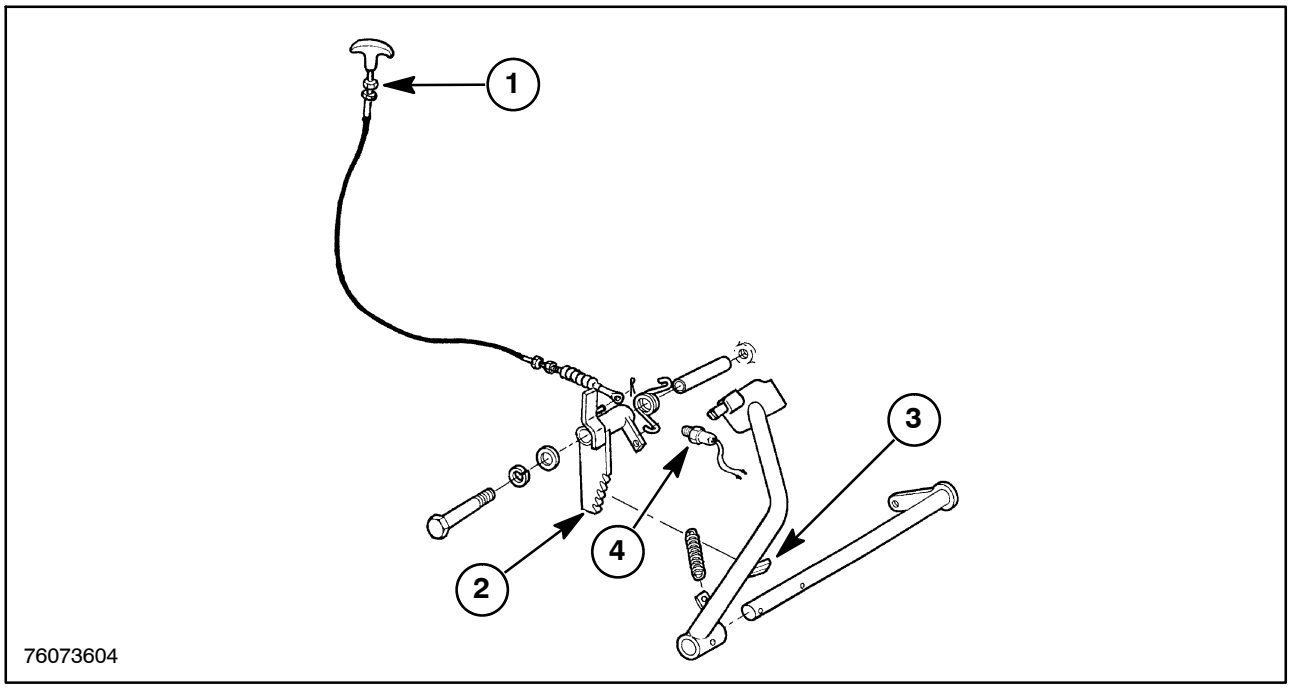
Although only one linkage is shown, the brake components described in this section (except for the pedals) are duplicated on both sides of the tractor.

Depressing the brake pedal, 1, actuates the brake rod, 2, which is connected to the brake lever, 3.

The brake lever, 3, is connected to the brake cam, 4, which rotates against the actuator plate, 5. The actuator plate, 5, then overcomes the tension in the actuator return springs, 6, and forces the rotating brake discs, 7, and the non-rotating stators, 8, against each other creating friction to slow the rotation of the axles.

Releasing the brake pedal, 1, allows the pedal return spring, 9, to pull the brake lever, 3, back to its original position, which allows the brakes to release.

When the brake lever, 3, returns to its original position, the brake cam, 4, releases the actuator plate, 5, and allows the actuator return springs, 6, to release the pressure on the brake discs, 7, and stators, 8, allowing the axles to rotate freely.

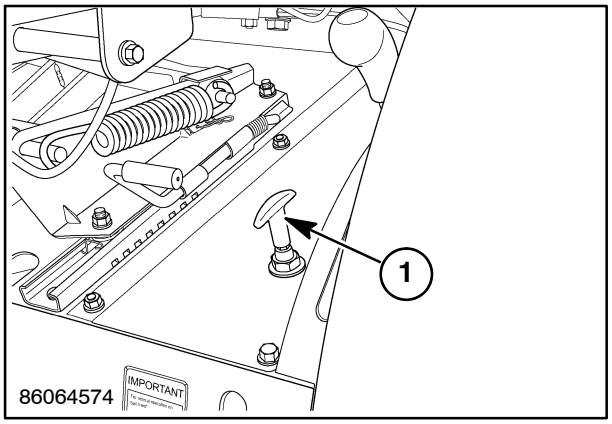


4

PARK BRAKE

A park brake is provided to hold the brakes in a locked position when the park brake handle, 1, is locked. The park brake cable, 1, holds the teeth, 2, in a locked position with the engagement pawl, 3, on the inner (LH) brake pedal.

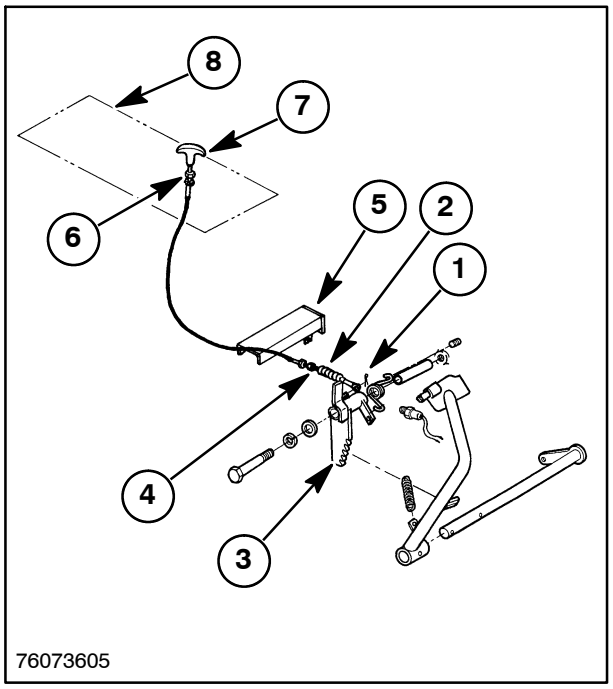
The park brake handle, 1, is located on the left side of the seat deck.



5

Removal

1. Remove the cotter pin, 1, and disconnect the park brake cable end, 2, from the park brake lock, 3.
2. Loosen the lock nut, 4, and remove cable from the support, 5.
3. Remove nut, 6, from the handle end of the cable and remove cable assembly, 7, from the seat plate, 8.



6

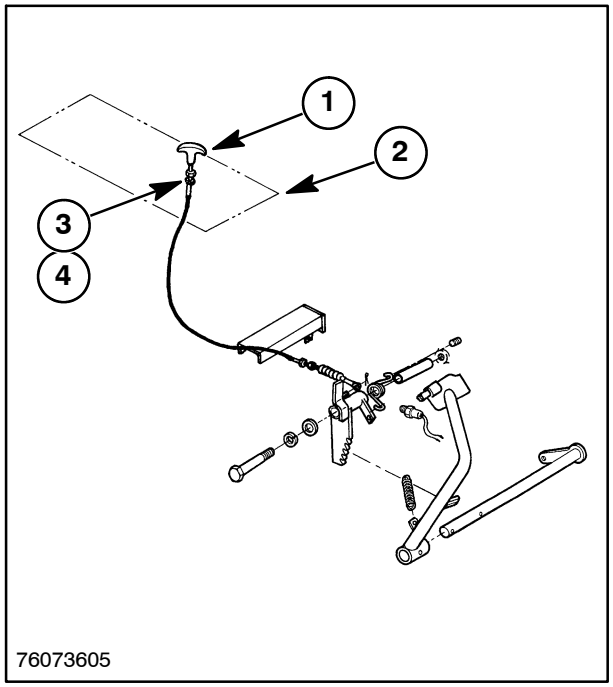
Inspection

1. Inspect the cable assembly for corrosion or damage.
2. Replace the cable assembly, if any corrosion or damage is found.
3. Check engagement pawl on the left brake pedal for wear or damage, replace left brake pedal assembly if pawl is worn or damaged.

Assembly and Adjustment

Note: *Installation and adjustment of the park brake cable will be made easier if the right side floor mat and step plate are removed.*

1. Install the cable assembly,1, through the hole in the seat plate, 2.
2. Install lock washer, 3, and nut, 4, onto the cable. Adjust the handle's direction so it is parallel with the tractor and tighten nut, 4, to the underside of seat plate.



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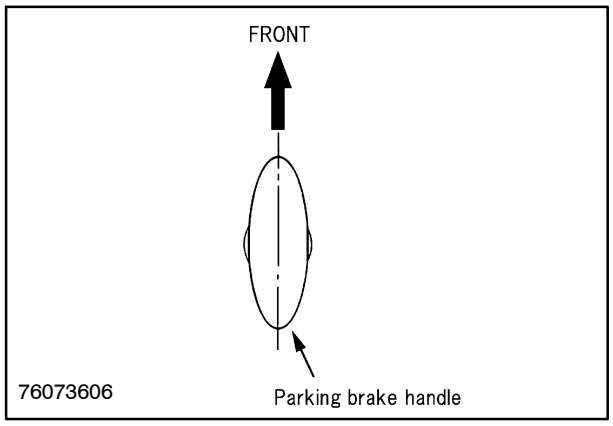
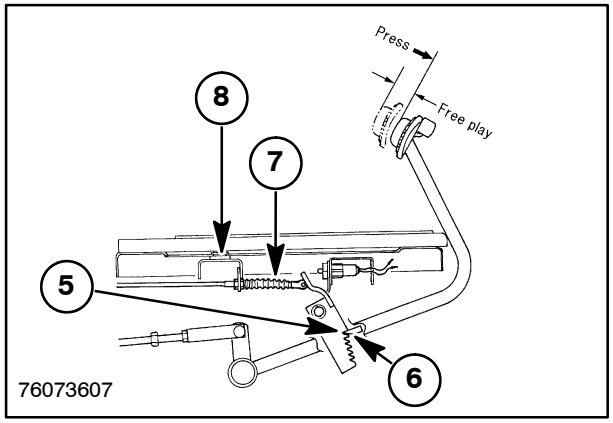


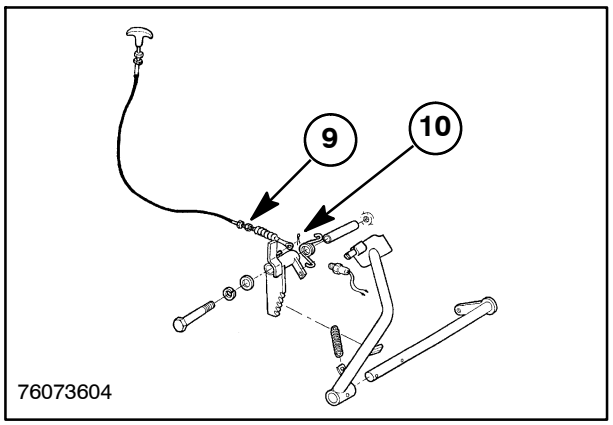
8

3. Press down on the brake left brake pedal until the end of the brake pedal free play is obtained. Engage the park brake lock first notch, 5, into pawl,6, on the left pedal.
4. Install the cable adjuster,7, to the step support, 8.



9

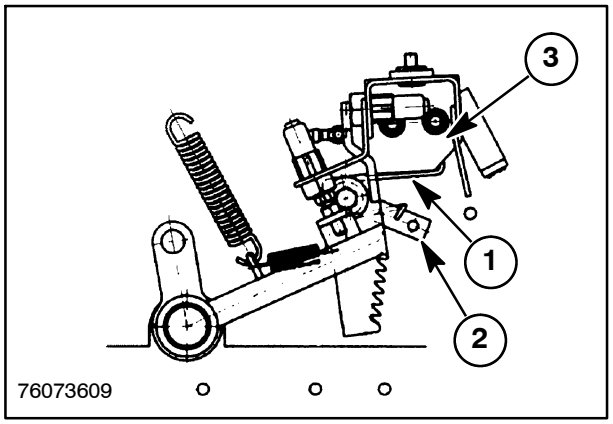
5. With the pawl on the left brake pedal latched in the first notch of the brake lock, adjust nuts,9,on cable adjuster until the slack is removed from the cable and the cable end just fits over the pin on the brake lock.
6. Tighten nuts,9, on adjuster and install cotter pin, 10, to secure cable to brake lock.



10

Park Brake Return Spring

1. The clutch pedal return spring, 1, is installed and tensioned by placing the short leg of the spring, with sharp bend, on top of the arm on the brake lock, 2, and the long leg of the spring, forward, underneath the step support, 3.



11

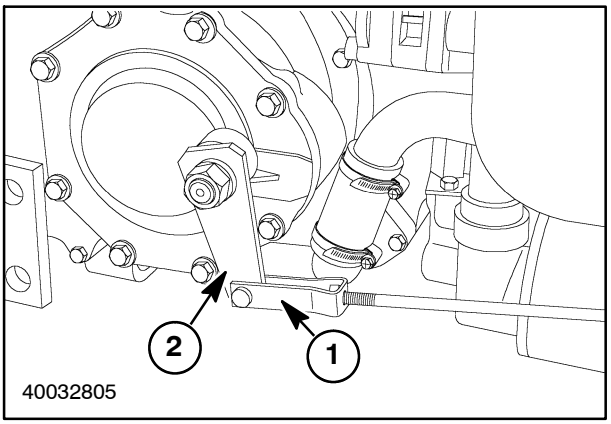
OVERHAUL

BRAKES

Removal and Disassembly

NOTE: *The brakes may be serviced with the axle case attached to the differential housing, but if final pinion service is required, the axle case must be removed from the differential housing.*

1. Disconnect the brake rod clevis, 1, from the brake arm, 2.



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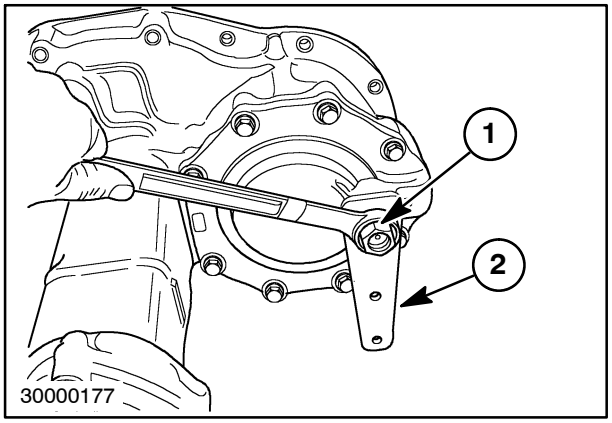
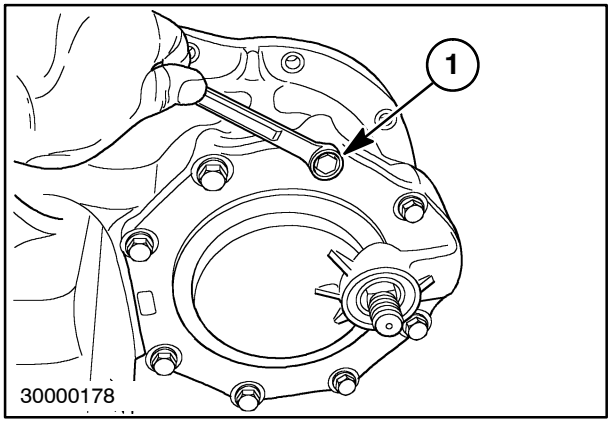
2. Loosen and remove the retaining nut, 1, and lock washer on the brake lever, 2. Remove the brake lever, 2, from the brake cam.



13

3. Loosen and remove the brake cover retaining bolts, 1.



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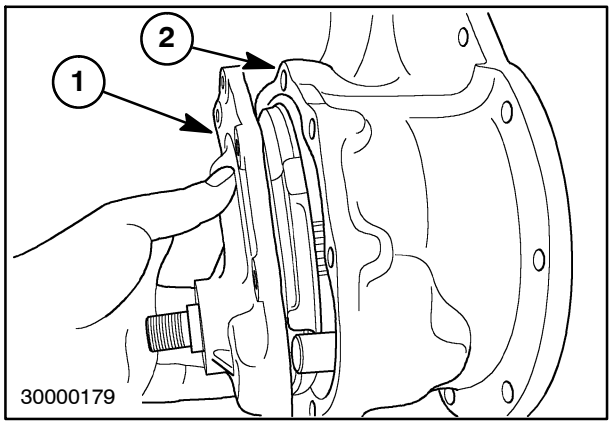
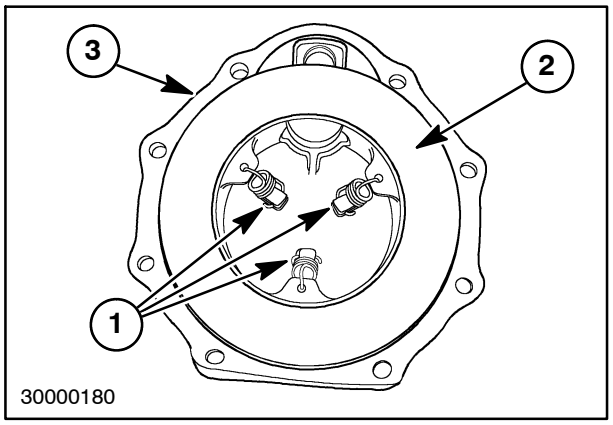
4. Remove the brake cover assembly, 1, from the differential housing, 2



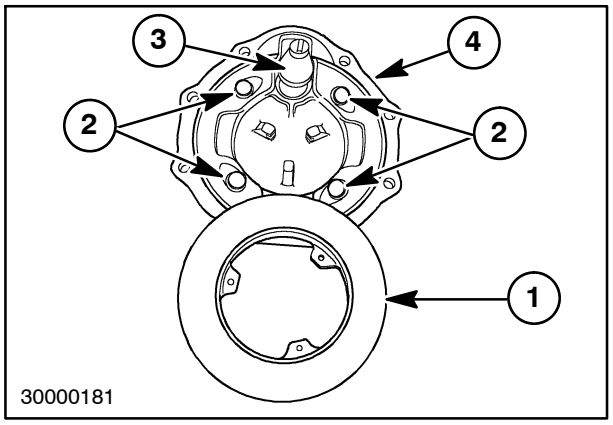
15

5. Remove the three springs, 1, that secure the brake actuator plate, 2, to the brake cover, 3.



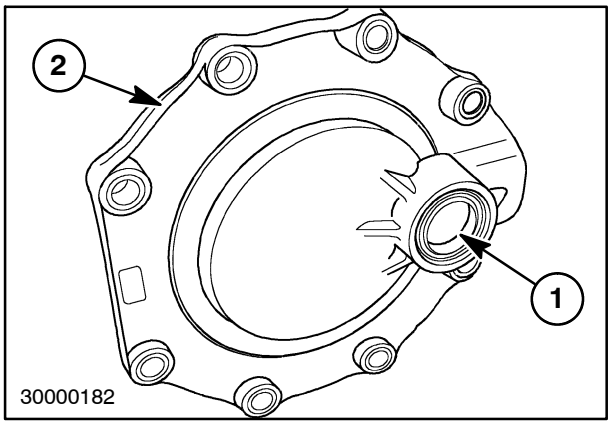
16

6. Remove the brake actuator plate, 1, steel balls, 2, and brake cam, 3, from the brake cover, 4.



17

7. Remove and discard the brake cam oil seal, 1, from the brake cover, 2.



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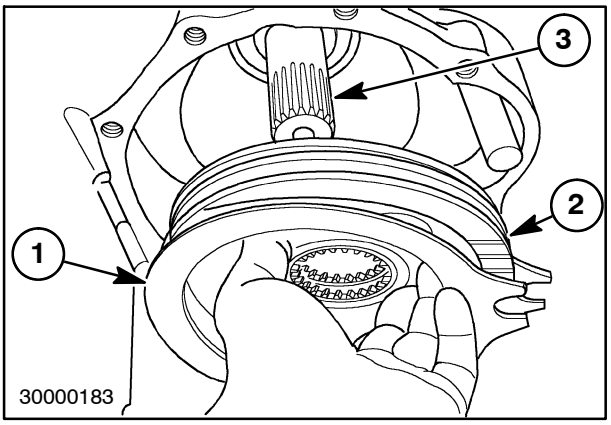
8. Remove the stators, 1, and the brake discs, 2, from the final pinion shaft, 3.



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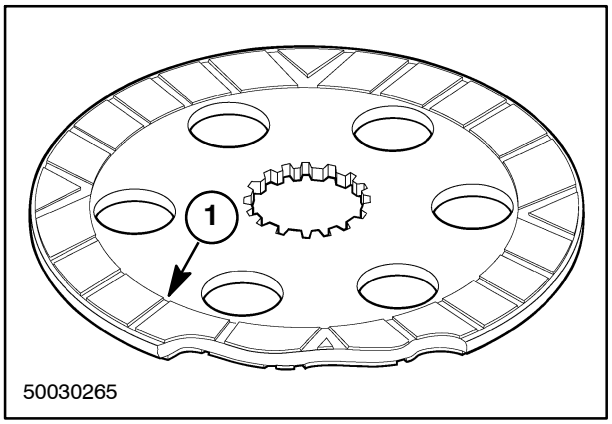
Inspection

NOTE: *See "SPECIFICATIONS" for wear values. If proper measuring equipment is not available, replace the brake discs as a set, when the grooves in the disc lining are no longer visible.*

1. Clean all parts with a suitable brake cleaner and allow to air dry.
2. Inspect the brake discs for excess wear or damage. Replace discs if the lining groove depth, 1, is not within the allowable limit, 0.05 mm (0.002 in) allowable, 0.3 mm (0.012 in) normal.

NOTE: *If replacing the brake discs, soak the new discs in clean hydraulic oil before installing them.*

3. Inspect the stators for excessive wear or damage. Replace stators that differ in measurement by 0.1 mm (0.004 in) or more.
4. Inspect the brake cam, steel balls, and the springs for excessive wear or damage. Replace as necessary.
5. Inspect the brake cover for damage or cracks. Repair or replace as necessary.
6. Inspect the brake cover gasket. If damaged, remove all of the remaining gasket material from the surfaces of the differential housing and the brake cover. Clean both surfaces with a suitable solvent and allow to air dry. Apply a a thin bead of silicone-based gasket adhesive to the differential housing and carefully place a new gasket in position.



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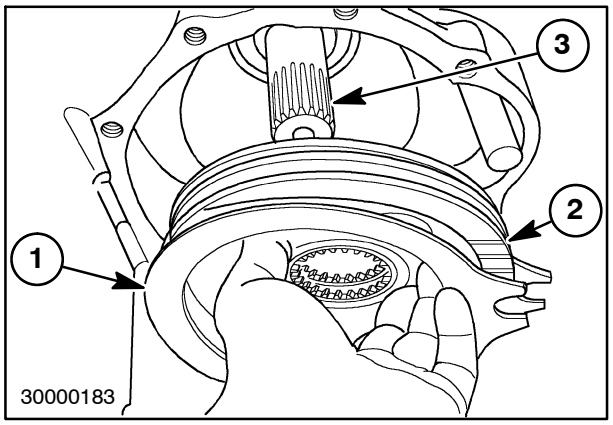
Assembly and Installation

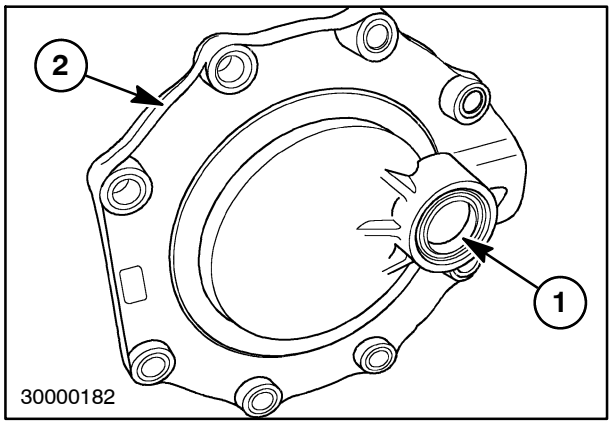
1. Install the stators, 1, and the brake discs, 2, onto the final pinion shaft, 3.

NOTE: *When re-installing the four stators and four brake discs, always begin with a stator. Alternate stator/brake disc until the last brake disc is installed.*



21

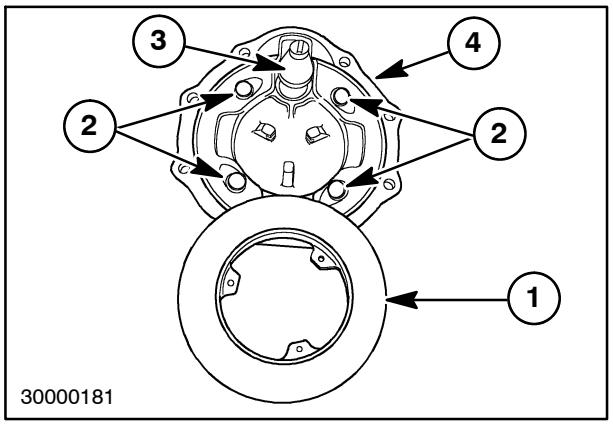
2. Lubricate a new brake cam oil seal, 1, with petroleum jelly, and install into the brake cover, 2.



22

3. Install the brake cam, 3, steel balls, 2, and the brake actuator plate, 1, into the brake cover, 4.

NOTE: *The three spring mounting lugs on the brake cover must line up directly with the three corresponding flanges on the brake actuator plate. This will correctly align the brake cam with its drive slot on the inner surface of the actuator plate.*



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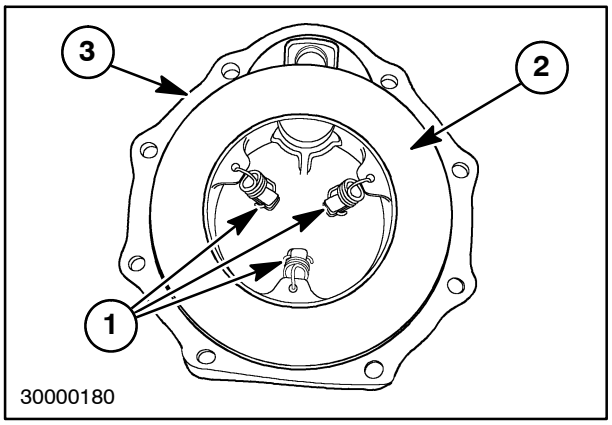
4. Install the three springs, 1, securing the brake actuator plate, 2, to the brake cover, 3.



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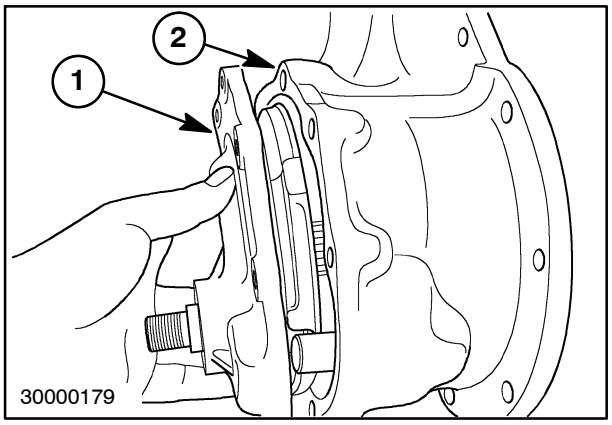
5. Install the brake cover assembly, 1, onto the differential housing, 2.



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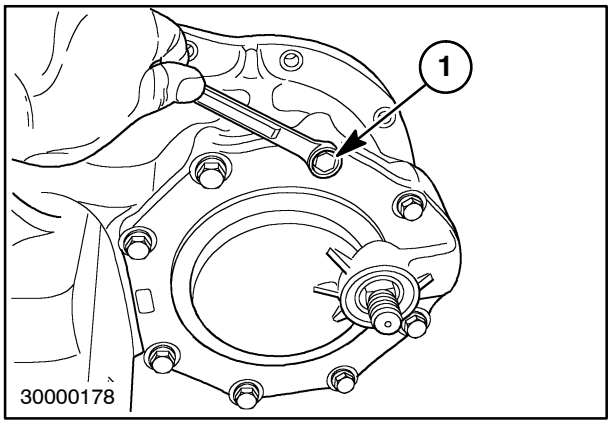
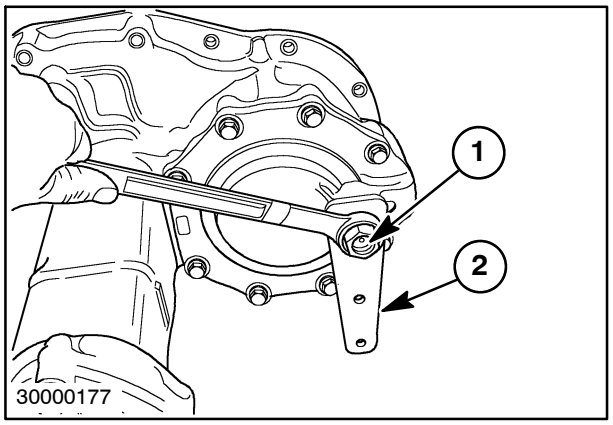
6. Install and tighten the brake cover retaining bolts, 1.



26

7. Install the brake lever, 2, onto the brake cam, and secure with the lock washer and retaining nut, 1. Tighten the retaining nut, 1.



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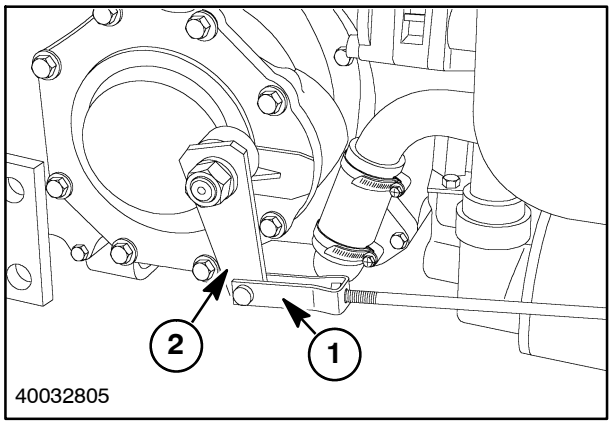
8. Connect the brake rod clevis, 1, to the brake arm, 2.



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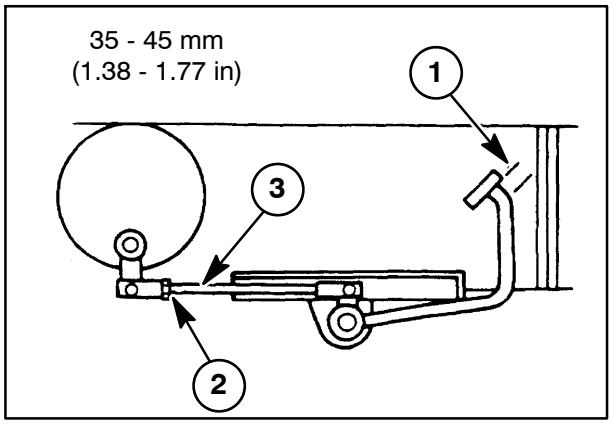
Adjustment

1. Measure the brake pedal free travel, 1.
2. If adjustment is required, loosen the locknut, 2, on the brake rod, 3. Turn the brake rod, 3, and remeasure the pedal free travel, 1. When correct free travel of 35 - 45 mm (1.38 - 1.77 in) is achieved, tighten the locknut, 2.

IMPORTANT: *Be sure to test drive the tractor to make sure the braking action on both rear wheels is equal. If necessary, adjust the outer brake rod to equalize the free travel.*



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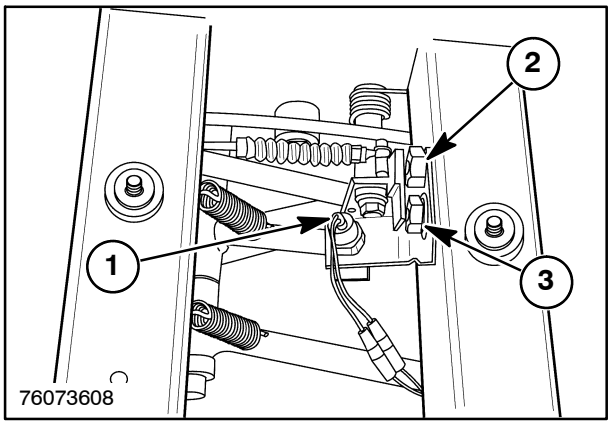
Brake Switches

There are three switches used with the brake system:

1. **Brake Light Switch** - When brakes are applied, the switch closes allowing rear brake lights to illuminate.
2. **Park Brake Safety Switch** - When the park brake is applied the switch closes allowing the park brake indicator light, located in the instrument panel to illuminate.
3. **Park Brake** / **Brake Light Interlock Switch** - When the park brake is applied this switch is open interrupting the current flow to the brake light switch, not allowing the brake lights to illuminate, with the park brake applied.



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SECTION 35 - HYDRAULIC SYSTEM

Chapter 1 - Hydraulic System

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SPECIFICATIONS

Main Hydraulic Pump
- Type ..... Gear
- Pump Capacity @ Rated Engine Speed
  - T2410 ..... 43.9 lpm (11.6 gpm)
  - T2420 ..... 45.5 lpm (12.0 gpm)

Pump Speed (rpm):
- T2410 ..... 2285 rpm
- T2420 ..... 2369 rpm

Hydraulic Flow at Manifold Block or Remote Valves @ Rated Engine Speed
- T2410 EHSS ..... 43.9 lpm (11.6 gpm)
- T2410 SSS ..... 40.9 lpm (10.8 gpm)
- T2420 EHSS ..... 45.5 lpm (12.0 gpm)
- T2420 SSS ..... 42.5 lpm (11.2 gpm)

Rated Engine Speed (rpm):
- T2410 ..... 2700 rpm
- T2420 ..... 2800 rpm

System Relief Valve Setting
- T2410, T2420 ..... 172 bar (2500 psi)

Lift Cylinder Diameter ..... 80 mm (3.155 in)

Rear 3-Point Hitch
- Maximum Lift Capacity
- @ Hitch
  - T2410, T2420 ..... 1975 kg (4355 lbs)
- @24″
  - T2410, T2420 ..... 1571 kg (3465 lbs)

Safety Valve Setting ..... 245 ± 20 bar (3555 ± 290 psi)

Reservoir Capacity
- SSS ..... 38 L (10.0 gal)
- EHSS ..... 46 L (12.2 gal)

Recommended Hydraulic Oil ..... AMBRA MULTI G134
- Cold Weather Option NHF200

PTO/EHSS Hydraulic Pump
- Type ..... Tandem Gear
- Pump Capacity,
  - PTO @ Engine Speed 2900 RPM ..... 6.08 lpm (1.61 gpm) 20 bar (290 psi)
  - EHSS @Engine Speed 2900 RPM ..... 13.0 lpm (3.43 gpm) 23 bar (333 psi)

METRIC BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot-Pounds	Newton Meters	Pitch (mm)	Foot-Pounds	Newton-Meters
M5	4T, 4.8	0.70	2.8 - 4.0	3.8 - 5.4	------	------	------
	7T, 8T, 8.8		4.9 - 6.9	6.9 - 9.3			
	10T, 10.9, 11T		6.7 - 9.4	9.0 - 12.7			
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9	------	------	------
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 10.9, 11T		8.7 - 11.6	11.8 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.8	15.2 - 20.1
	7T, 8T, 8.8		16.6 - 21.0	22.6 - 28.4		19.5 - 25.3	26.5 - 34.3
	10T, 10.9, 11T		21.0 - 26.8	28.4 - 36.2		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.4 - 36.3
	7T, 8T, 8.8		32.5 - 41.2	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 10.9, 11T		39.8 - 51.4	53.9 - 69.9		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.7	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.4		55.0 - 69.4	74.5 - 94.1
	10T, 10.9, 11T		68.0 - 85.4	92.9 - 116		73.1 - 93.3	99.0 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.6 - 87.3
	7T, 8T, 8.8		76.7 - 96.9	104 - 131		86.1 - 109	117 - 148
	10T, 10.9, 11T		102 - 129	139 - 175		108 - 137	147 - 186
M16	4T, 4.8	2.0	63.6 - 81.0	83.3 - 110	1.5	67.3 - 84.6	91.3 - 115
	7T, 8T, 8.8		110 - 136	149 - 184		116 - 142	157 - 192
	10T, 10.9, 11T		152 - 188	206 - 255		163 - 199	221 - 270
M20	4T, 4.8	2.5	106 - 132	144 - 179	1.5	127 - 156	172 - 211
	7T, 8T, 8.8		177 - 213	240 - 289		203 - 246	275 - 333
	10T, 10.9, 11T		268 - 325	363 - 441		293 - 358	397 - 485

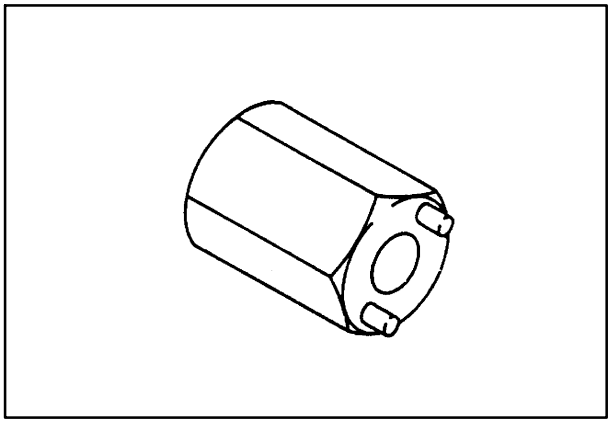
Flow Control - Cylinder Head Retainers . . . . . 65.7 - 83.4 N·m (48.5 - 61.5 ft-lbs)

Hydraulic Pump Retainers . . . . . 22 - 28 N·m (16 - 20 ft-lbs)

SPECIAL TOOLS

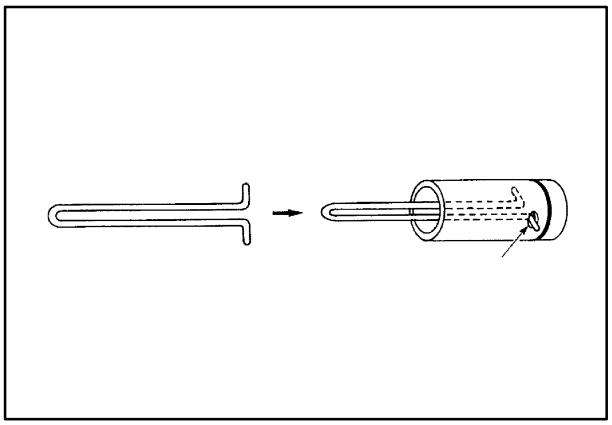
Description	Tool No.
Hose 7/16″ - 20 FJIC SE x Disconnect Fitting	FNH2106
Gauge 0-5000 psi	FNH2028
Test Fitting, male 7/16″ JIC x male 3/8″ BS PP	FNH07560

Lowering Valve Seat Removal Tool FNH00357.



1

Check Valve Seat Removal Tool - Fabricate Using 2 - 3 mm (0.080″ - 0.120″) Dia. Wire.



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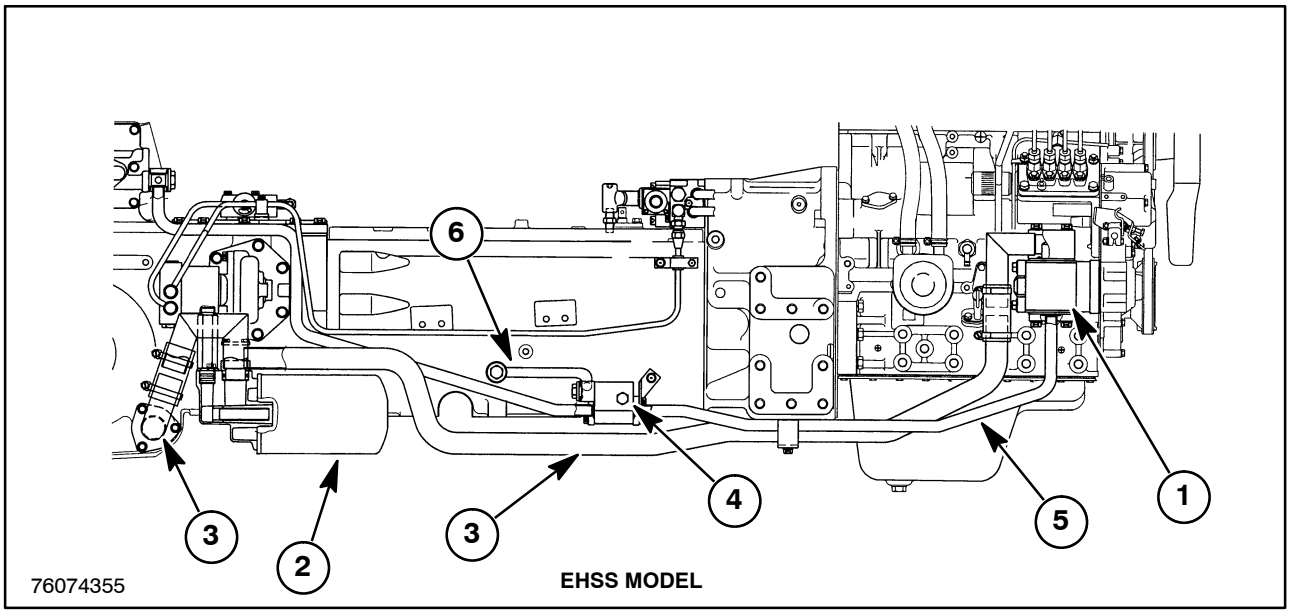


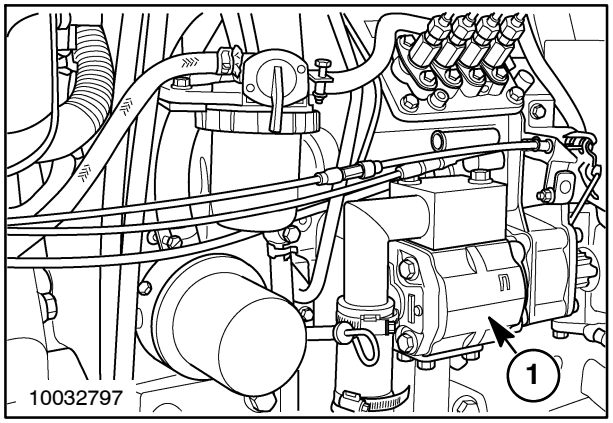
3

DESCRIPTION OF OPERATION - HYDRAULIC SYSTEMS

Hydraulic position control is standard equipment on all T2410, T2420 tractors. The open center hydraulic system consists essentially of a fluid reservoir, hydraulic pump, lift cylinder and piston, control valve and lift links.

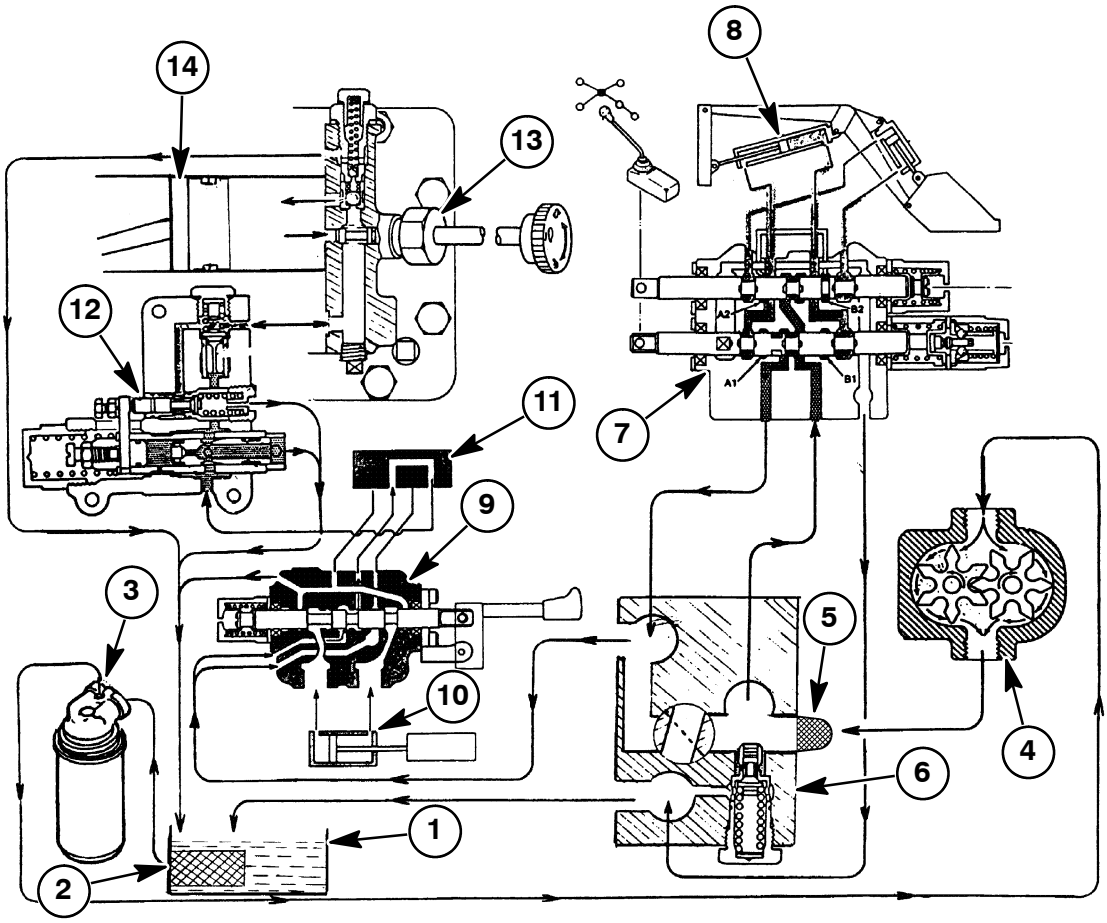
The rear axle and transmission housing serve as a common hydraulic fluid reservoir and supply fluid to the hydraulic pump, 1, through the filter, 2, and suction tubes, 3. The hydraulic pump supplies hydraulic fluid to the system control valve through the combination relief/diverter valve manifold, 4, and the high pressure line, 5. The control valve, when operated, affects raise, neutral, or lowering action of the lift arms. Hydraulic fluid is returned to the reservoir through line, 6.

The hydraulic pump, 1, is mounted on the right side of the engine and is driven by the engine oil pump gear located on the front of the engine block.



4

FLOW PRIORITY



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5

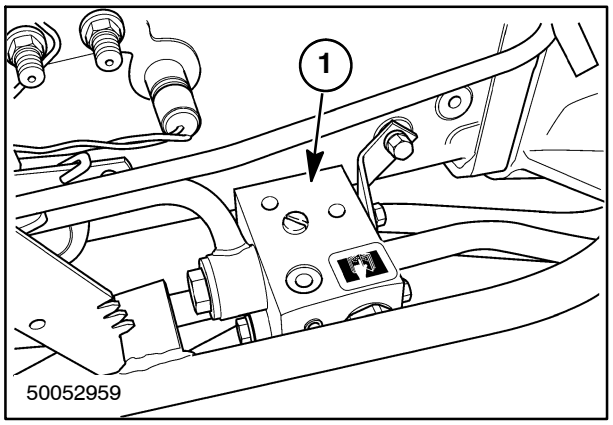
Hydraulic Flow Diagram/Component Description

1. Hydraulic Fluid Reservoir
2. Sump Screen Filter
3. Hydraulic Fluid Filter
4. Hydraulic Pump
5. Screen
6. Relief/Diverter Valve
7. Front Double Spool Remote Valve
8. Front Boom Lift Cylinder
9. Rear Single Spool Remote Valve
10. Rear Remote Lift Cylinder
11. Rear Remote Endcap (Attached to HPL Valve)
12. HPL Valve (Control Valve)
13. Drop Rate Control Valve
14. 3 Point Hitch Lift Piston

This diagram shows hydraulic oil flow priority within the tractor's hydraulic system.

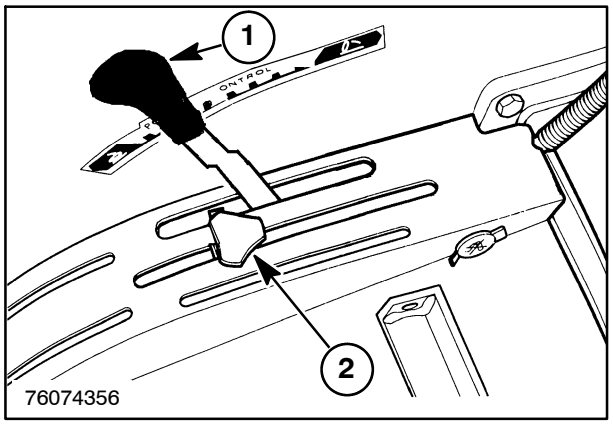
HYDRAULIC SYSTEM

The hydraulic fluid is pressurized by the hydraulic pump and flows through the combination system relief-diverter valve, 1, to the control valve. The hydraulic pump and relief valve are located on the right side of the tractor. The control valve is located inside the hydraulic lift cover assembly.



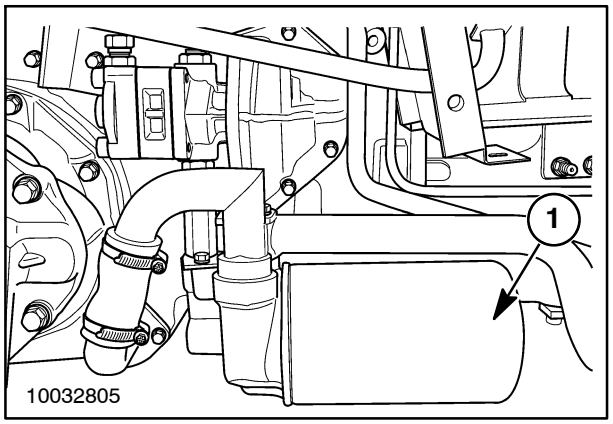
6

The hydraulic system is controlled by a position control lever, 1, and an adjustable stop, 2, for returning the float control lever to a preset position.



7

The suction filter, 1, is a canister-type filter. The filter should be replaced after 300 hours of use.



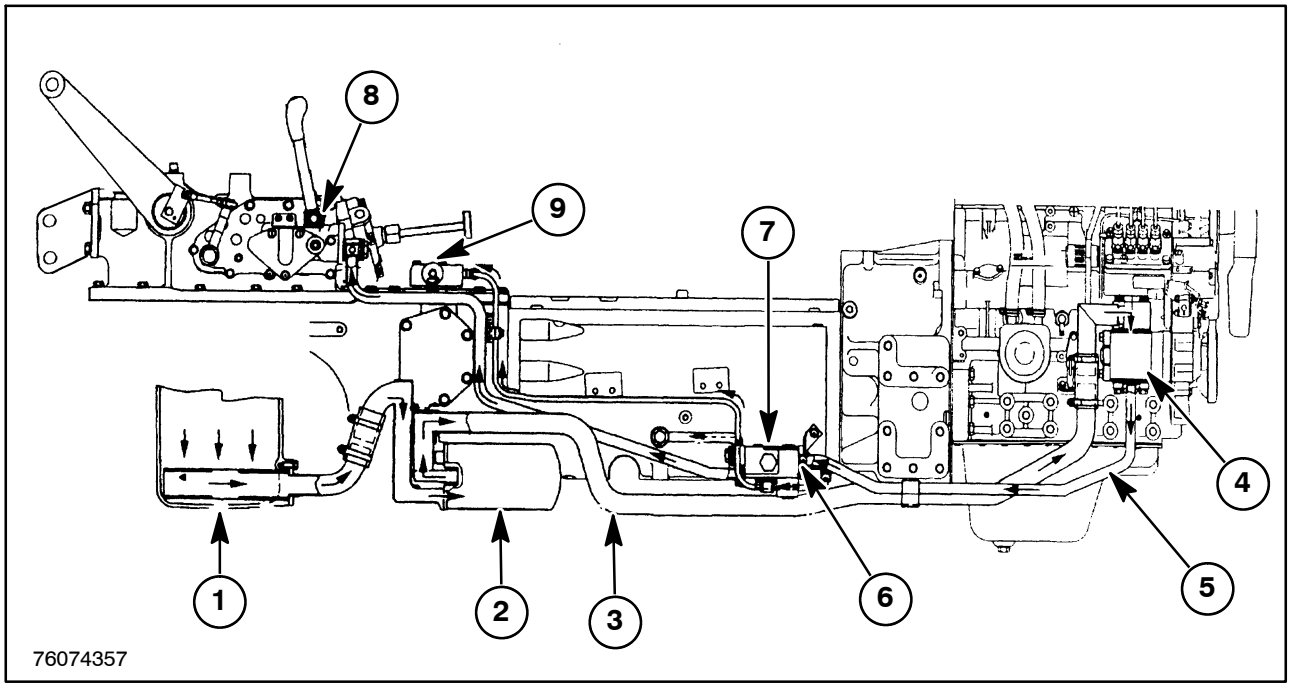
8

HYDRAULIC FLUID FILTER

- The oil filter is a canister-type filter, located between the strainer and the oil pump(s).
- The filter consists of a filter element and a bypass (relief) valve.
- The bypass (relief) valve is opened when the pressure is produced within the suction circuit, by high oil viscosity when cold or filter element is clogged.
- If the filter element becomes clogged, the bypass (relief) valve opens and the oil flows directly to the hydraulic oil pump.
- Hydraulic oil and filters must be changed on regular intervals to remove contaminates from the hydraulic system, refer to the Operator's Manual for a recommended maintenance schedule.

If hydraulic system contains contaminated oil:

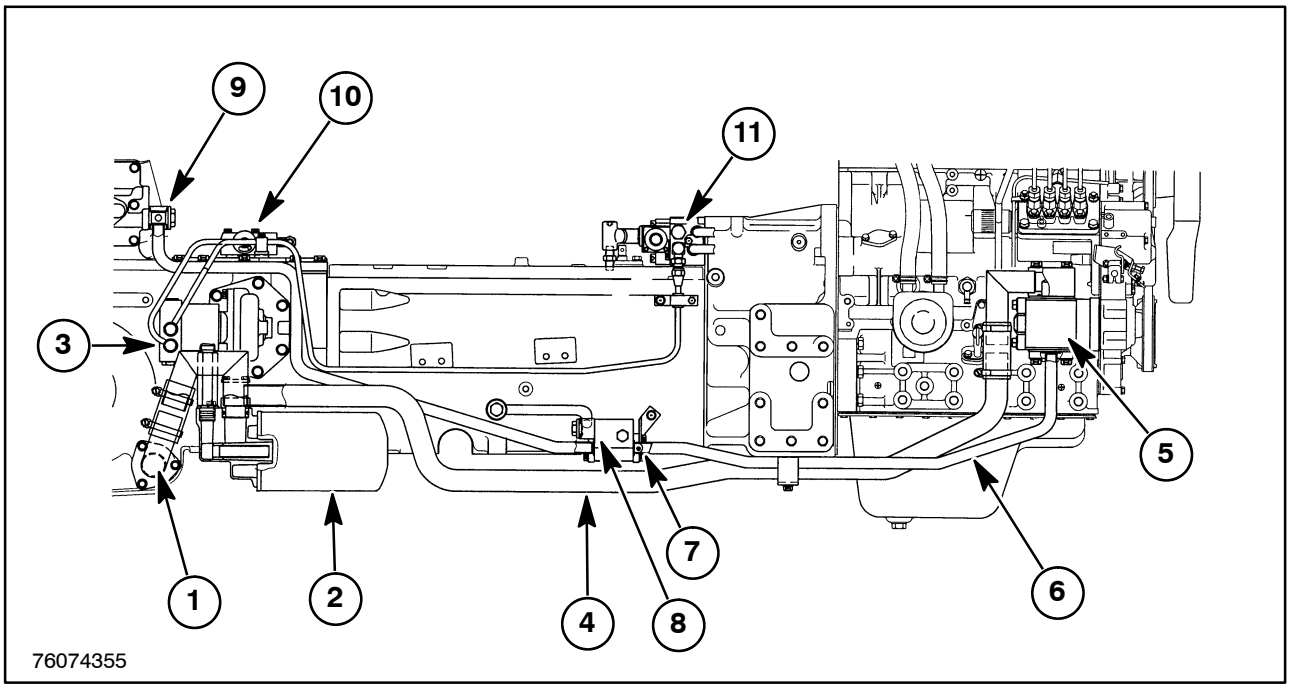
1. Filter may become clogged, causing damage to the oil pump.
2. Defective operation of the flow priority valve (SSS Models only). This could result in defective operation of the PTO clutch and / or damage to the oil pump.
3. Defective operation of the relief valve. This could result in uncontrollable relief valve pressure, and / or leaking of oil.
4. Defective operation of the hydraulic control valve. Cycling the lift arms up and down could cause damage to the HPL piston seals.
5. Defective operation of the PTO clutch control valve.
6. Defective operation of the EHSS control valve (EHSS Models only).



9

SSS TRANSMISSION

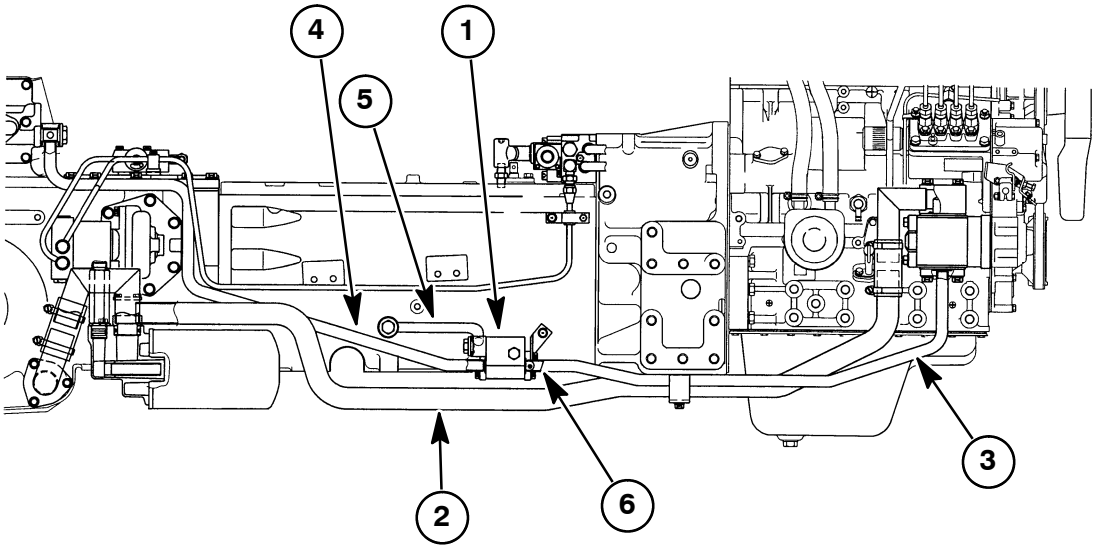
1. Sump Strainer
2. Oil Filter
3. Supply Line
4. Hydraulic Oil Pump
5. HPL High Pressure Line
6. Filtering Screen
7. Diverter Valve with Flow Priority Valve
8. HPL Control Valve
9. PTO Control Valve



10

EHSS TRANSMISSION

1. Sump Strainer
2. Oil Filter
3. Oil Pump for EHSS and PTO Systems
4. Supply Line
5. Hydraulic Oil Pump
6. HPL High Pressure Line
7. Filtering System
8. Diverter Valve
9. HPL Control Valve
10. PTO Clutch Control Valve
11. EHSS Control Valve



11

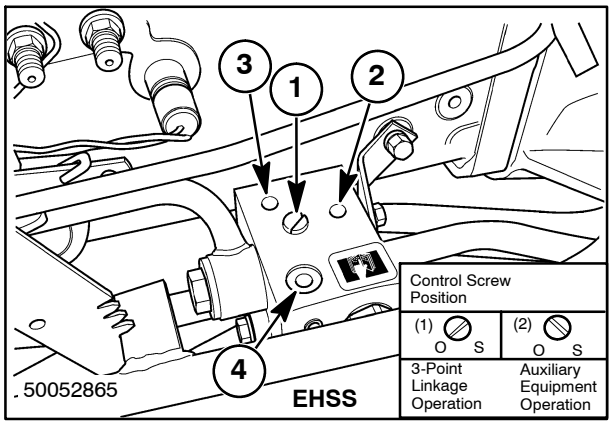
COMBINATION SYSTEM RELIEF - DIVERTER VALVE MANIFOLD ASSEMBLY (EHSS MODEL)

The combination system relief-diverter valve manifold, 1, is located in the high-pressure line on the right side of the tractor. A supply line, 2, supplies the pump with hydraulic fluid from the hydraulic fluid reservoir. A high pressure line, 3, supplies fluid from the pump to the manifold. The control valve line, 4, supplies the hydraulic powered lift valve (control valve). The pressure relief line, 5, provides a return path back to the reservoir for hydraulic fluid.

NOTE: *A filtering screen, 6, is located between high pressure line, 3, and diverter valve manifold, 1. The screen filters out any large pieces of contaminates from the hydraulic oil, before they reach the control valves. The filtering screen should be cleaned or changed every 300 hours.*

NOTE: *The diverter valve spool should turn with little effort. If not refer to "Combination System Relief Valve and Diverter Valve Assembly" section for disassembly, inspection and assembly procedures and check spool for contaminates.*

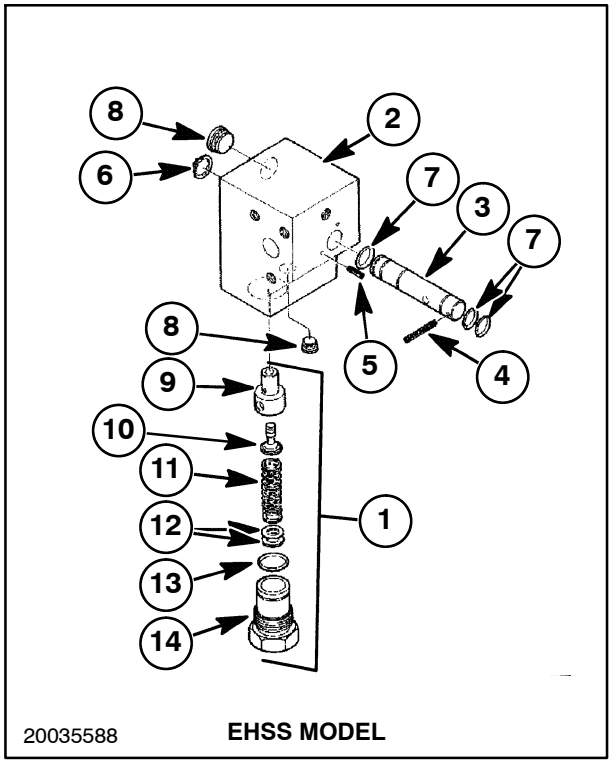
The diverter valve, 1, can be turned with a blade screwdriver. In the 1 o'clock position, hydraulic fluid is directed to the H.P.L. valve and rear remotes (optional). When a front two-spool remote valve is plumbed to the three ports - (pressure out, 2, pressure return, 3, and sump or tank, 4), the diverter valve must be turned counterclockwise to 11 o'clock position for hydraulic fluid flow to the front remote valve and then to the H.P.L. valve and rear remote valve (optional).



12

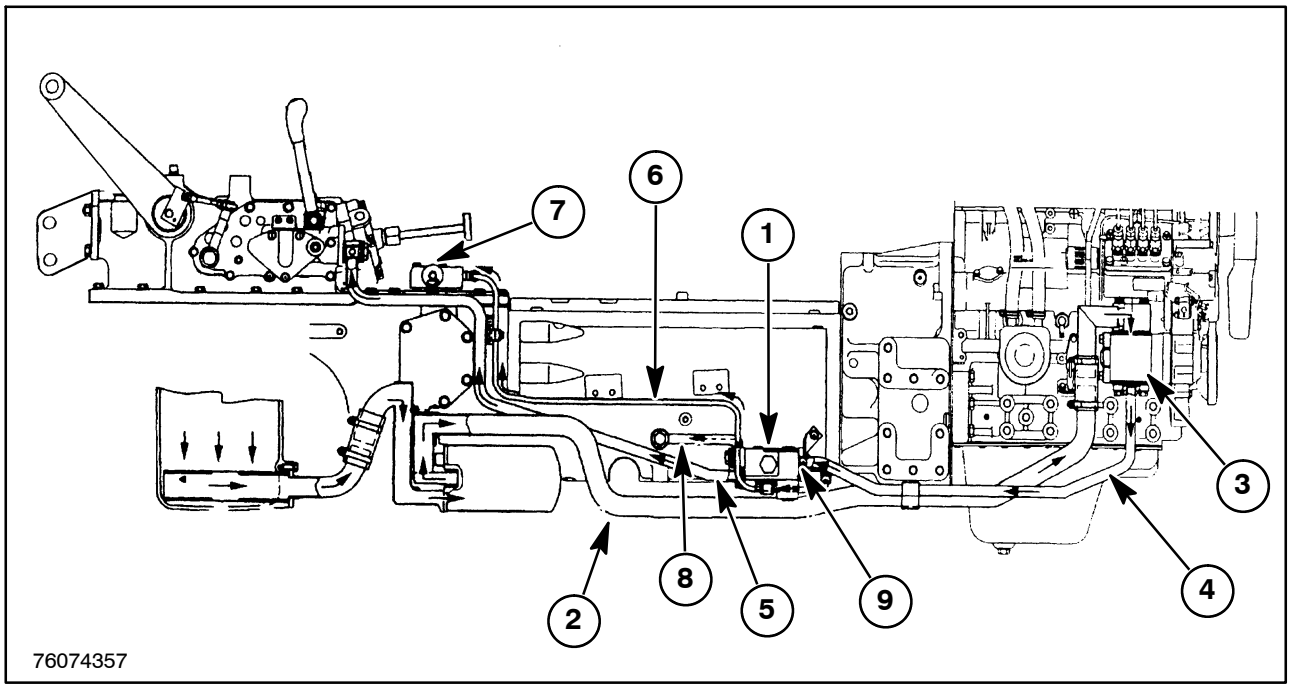
NOTE: *The PTO valve, EHSS valve and power steering always receives hydraulic flow independent of the manifold block diverter setting.*

The valve assembly contains the system relief valve,1, which protects the hydraulic pump from overload conditions. The valve body, 2, also serves as a manifold, containing hose connection ports for use with auxiliary hydraulic equipment, such as loaders. The diverter valve spool, 3, permits the operator to select operation of either the auxiliary hydraulic lift system circuits or the hydraulic lift system by rotating the diverter valve spool to the desired position.



13

1. System Relief Valve Assembly
2. Valve Body
3. Diverter Valve Spool
4. Roll Pin
5. Roll Pin
6. Snap Ring
7. O-rings
8. Plug
9. Valve Seat
10. Poppet
11. Spring
12. Shim (0.1 mm)
13. O-ring
14. Cap Plug



14

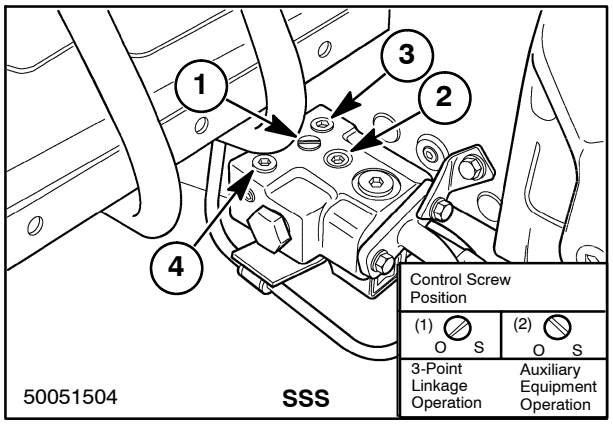
COMBINATION SYSTEM RELIEF - PRIORITY/DIVERTER VALVE MANIFOLD ASSEMBLY (SSS MODELS)

The combination system relief-priority/diverter valve manifold, 1, is located in the high pressure line on the right side of the tractor. A supply line, 2, supplies the pump, 3, with hydraulic fluid from the reservoir. A high pressure line, 4, supplies fluid from the pump to the manifold. A control valve line, 5, supplies the hydraulic powered lift valve (control valve). A second control valve line, 6, supplies 3 lpm (0.8 gpm) hydraulic fluid to the PTO clutch control valve, 7. The pressure relief line, 8, provides a return path back to the reservoir for hydraulic fluid.

NOTE: *A filtering screen, 9, is located between high pressure line, 4, and the diverter valve manifold, 1. The screen filters out any large pieces of contaminates from the hydraulic oil before they reach the control valves. The filtering screen should be cleaned or changed every 300 hours.*

NOTE: *The Diverter Valve spool should turn with little effort. If not, refer to "Combination System Relief and Diverter Valve Assembly" later in this section for Disassembly, Inspection and Assembly procedures, and check the spool for contaminates.*

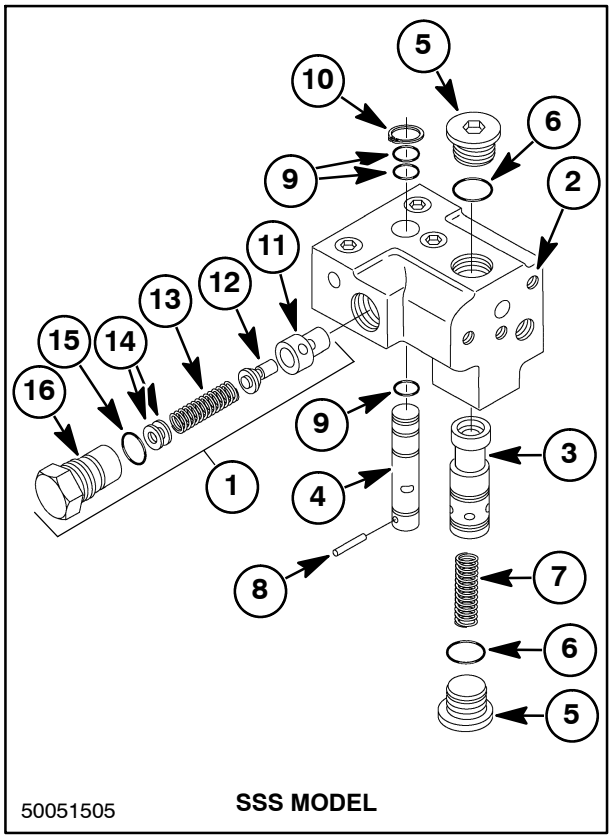
The diverter valve, 1, can be turned with a screwdriver blade. In the 1 o'clock position, hydraulic fluid is directed to the HPL valve and rear remotes (optional). When a front two spool remote valve is plumbed to the three ports – (pressure out, 2, pressure return, 3, and sump or tank, 4), the diverter valve must be turned counterclockwise to the 11 o'clock position for the hydraulic fluid to flow to the front remote valve and then to the HPL valve and rear remotes (optional).



15

The diverter valve assembly contains the system relief valve, 1, which protects the hydraulic pump from overload conditions. The valve body, 2, also serves as a manifold, containing hose connection ports for the use of auxiliary hydraulic equipment. The valve body also houses a priority valve, 3, which directs oil to the PTO control valve first, then sends remaining oil to the HPL valve and rear remotes (optional). The diverter valve spool, 4, permits the operator to select operation of either the auxiliary hydraulic lift system circuits or the hydraulic lift system by rotating the diverter spool to the desired position.

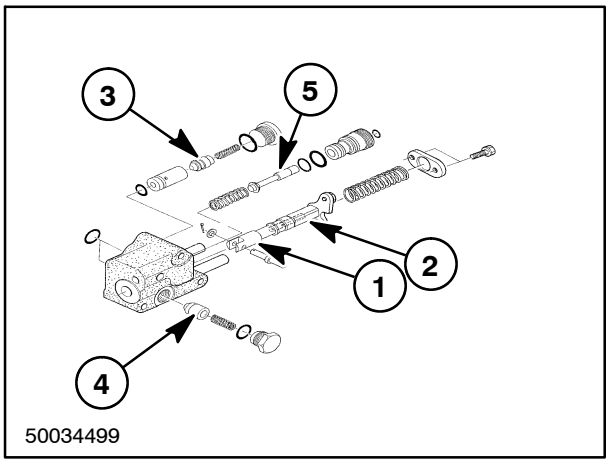
1. System Relief Valve Assembly
2. Valve Body
3. Priority Valve
4. DIverter Valve Spool
5. Plug
6. O-ring
7. Spring
8. Roll Pin
9. O-ring
10. Snap Ring
11. Valve Seat
12. Poppet
13. Spring
14. Shims 0.1 - 0.3 mm (0.004 - 0.012 in)
15. O-ring
16. Plug



16

CONTROL VALVE ASSEMBLY (HPL)

The control valve assembly is located inside the hydraulic lift cover and contains the control valve spool, 1, bypass spool, 2, check valve, 3, unload valve, 4, and lowering valve, 5.



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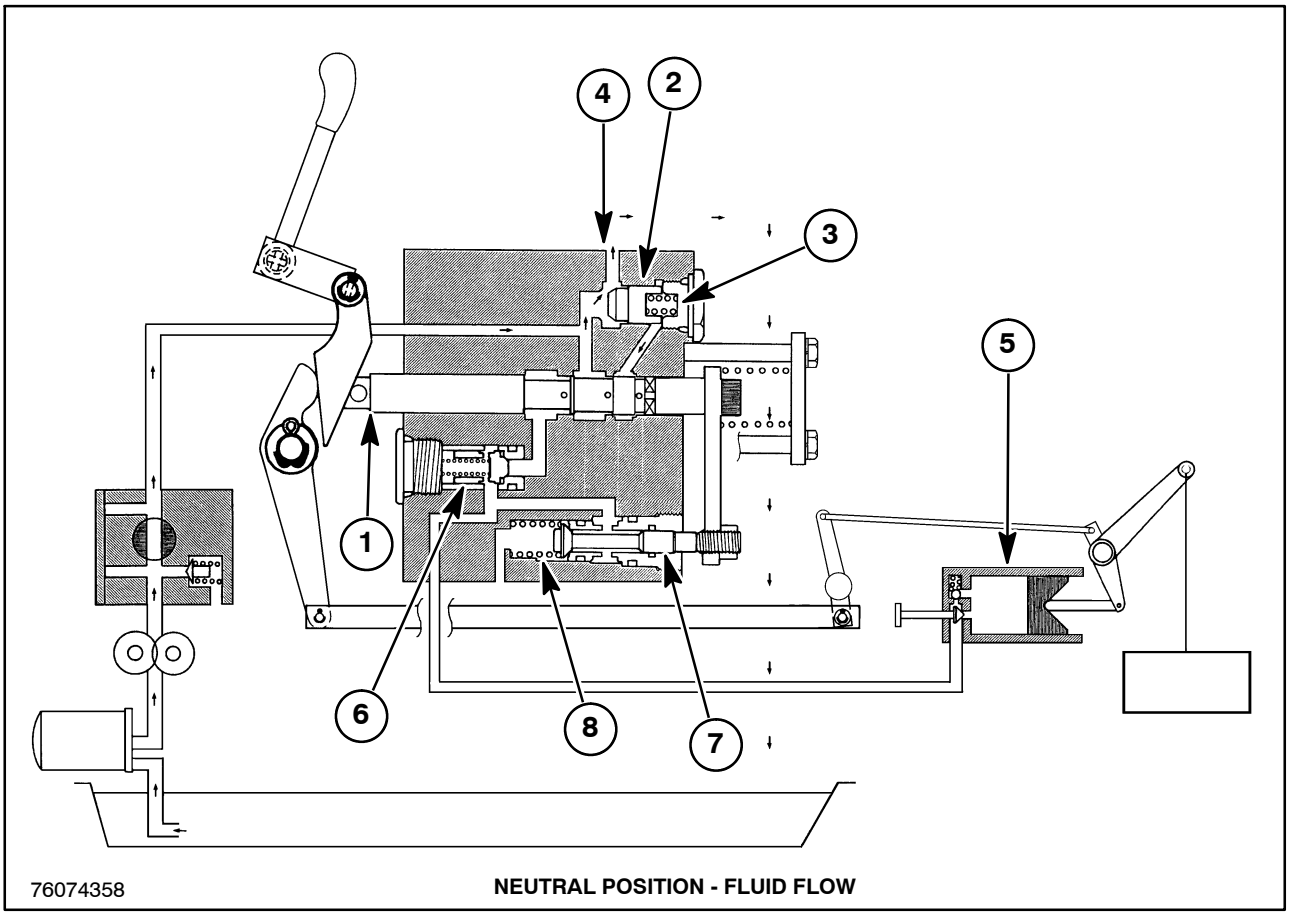


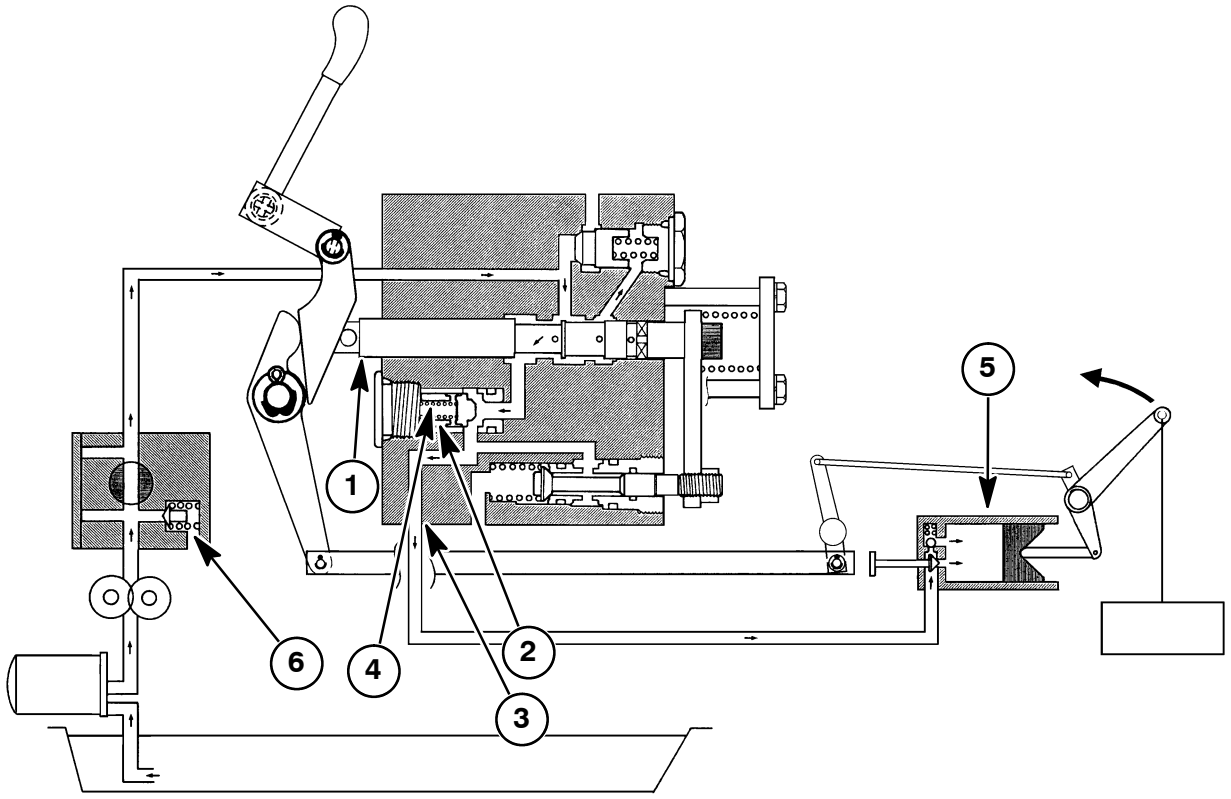
NEUTRAL POSITION - FLUID FLOW

18

NEUTRAL POSITION - FLUID FLOW

In the neutral position, the control valve spool, 1, is centered in the valve body. As fluid from the hydraulic pump is directed to the valve body, the fluid pressure moves the unload valve, 2, and compresses the spring, 3. This opens the passages, 4, to the sump. Fluid then flows from the pump to these passages and returns to the sump.

Fluid trapped in the lift cylinder, 5, under weight caused by the implement on the lift arms, exerts pressure on the cylinder side of the check valve, 6. This holds it in a closed position. The lowering valve spool, 7, positioned by the spring, 8, retains the fluid in the lift cylinder and maintains the implement in a fixed position.



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RAISING POSITION - FLUID FLOW

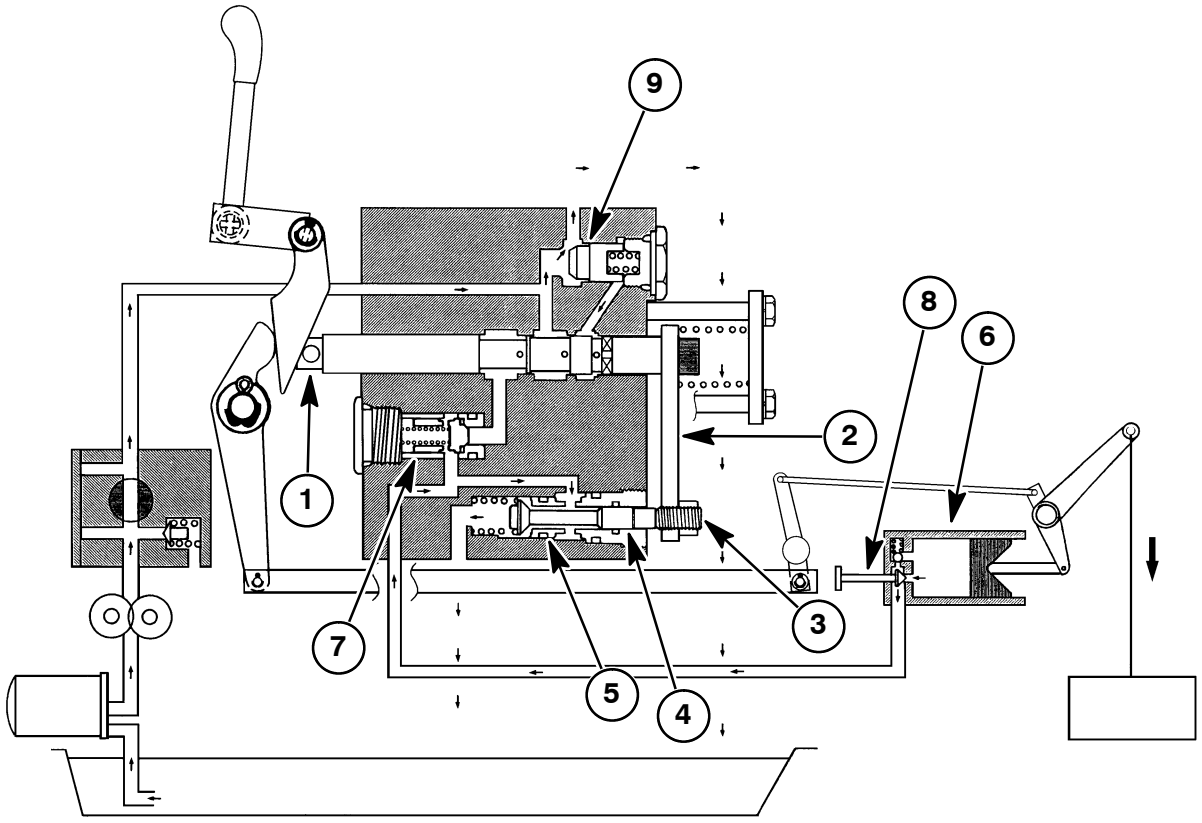
19

RAISING POSITION - FLUID FLOW

When the position control lever is moved to the raise position, the control valve spool, 1, is moved inward (rearward). The fluid passages in the control valve are opened, and fluid flows to the check valve, 2, through the check valve fluid passage, 3.

Fluid pressure against the check valve overcomes the check valve spring, 4, and the lift cylinder fluid static pressure on the check valve. This raises the check valve off its seat, allowing fluid to flow to the lift cylinder, 5, to raise the implement. When the fluid pressure exceeds 170 bar (2465 psi), the relief valve, 6, opens and fluid is returned to the sump.

A high pressure safety valve in the lift cylinder head protects against shock loads by opening at pressures exceeding 250 ± 20 bar (3625 ± 290 psi), returning fluid to sump.



76074360 **LOWERING POSITION - FLUID FLOW**

20

LOWERING POSITION - FLUID FLOW

When the position control lever is moved to the lowering position, the control valve spool, 1, is moved forward (outward). The plate, 2, and adjusting bolt, 3, attached to the control valve spool, also move forward, making contact with the lowering valve spool, 4, and pushing it off its seat, 5.

Fluid from the sump flows through the passages in the control valve spool and plunger and returns to the sump in the same manner as in the neutral position.

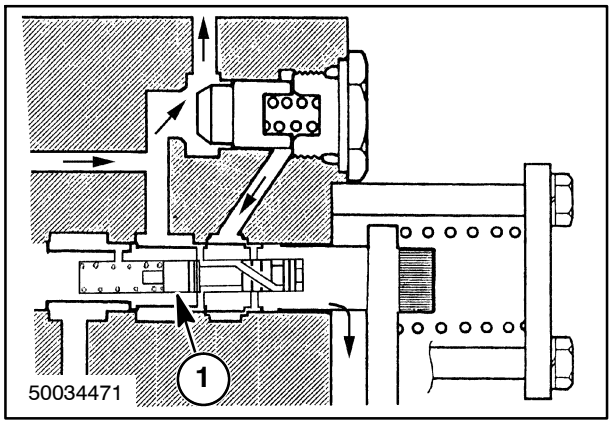
Fluid in the lift cylinder, 6, flows through the passage past the check valve, 7, to the lowering valve spool and seat and returns to the sump, permitting the implement to lower.

The HPL drop rate control valve, 8, can be adjusted to limit flow returning from lift cylinder to HPL valve.

The unload valve, 9, opens, allowing the hydraulic oil flow from the pump to flow to sump.

BYPASS SPOOL - FLUID FLOW

The bypass spool and spring, 1, are located in the control valve spool. The bypass spool and spring work to reduce the shock when the lift control lever is moved to the lifting position or the lifting action is stopped.



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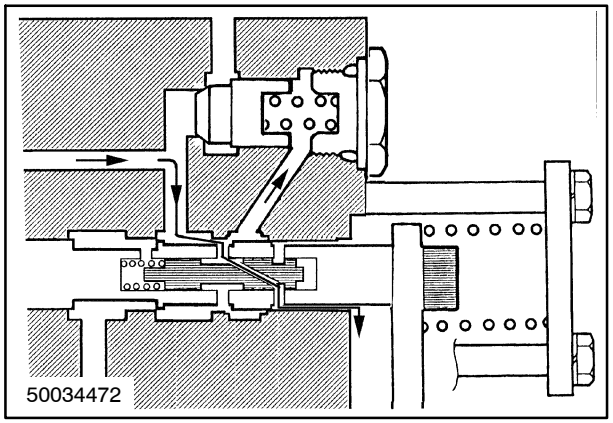
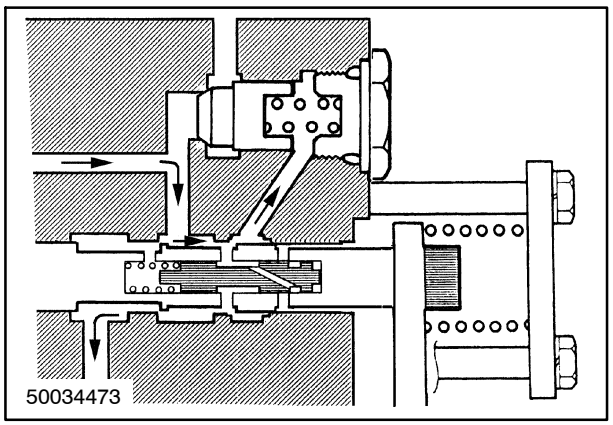
When the control lever is moved to the raise position, the control valve spool moves to the right, and the bypass spool moves to the left by fluid pressure. Fluid pressure flows behind the unload valve and fluid flows to the the reservoir via the bypass spool.



22

The fluid pressure gradually flows to the cylinder passage and prevents lifting shock.

When raise action is stopped, the spool is moved to the left by spring pressure while the bypass spool is moved to the left by fluid pressure. While the fluid flows to the reservoir via the bypass spool, fluid pressure is reduced, and prevents the shock to the lift stop by opening the bypass spool.



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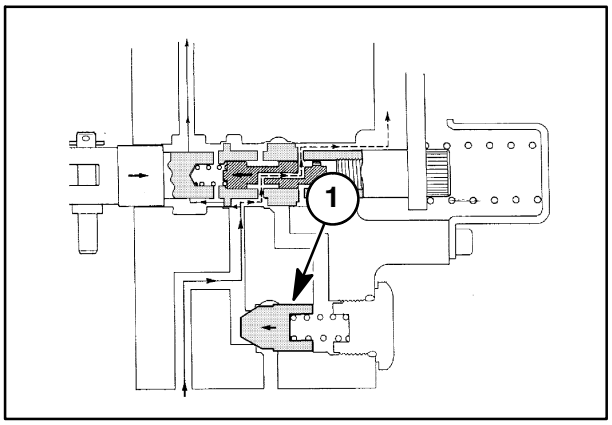
UNLOAD VALVE

When the control valve is in the neutral or lowering position, the unload valve, 1, opens and routes all the pump oil flow to sump. When the control valve is in the raise position the unload valve closes, allowing the pump oil flow to be routed to the lift cylinder.



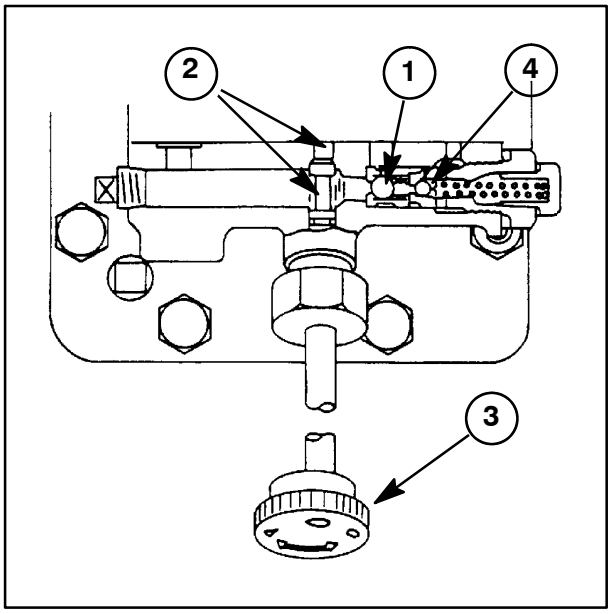
24

DROP RATE CONTROL VALVE

Fluid flow from the pump enters the lift cylinder through the check ball, 1, and the flow control valve needle and seat, 2. When the needle valve is closed or severely restricted, fluid pressure opens the check valve and flows to the lift cylinder during the raising cycle. The one-way check valve prevents fluid from returning to the lift cylinder, and the lift arms remain at their set height.

During the lowering cycle, the fluid being exhausted from the lift cylinder must return to the reservoir via the needle valve and seat. The needle valve control knob, 3, must be adjusted to obtain the desired rate of drop.

The high-pressure safety valve, 4, located in the flow control valve body, protects the lift cylinder against shock loads. When cylinder pressure exceeds 245 ± 20 bar (3555 ± 290 psi), the safety valve opens and allows the cylinder fluid to escape to the sump.



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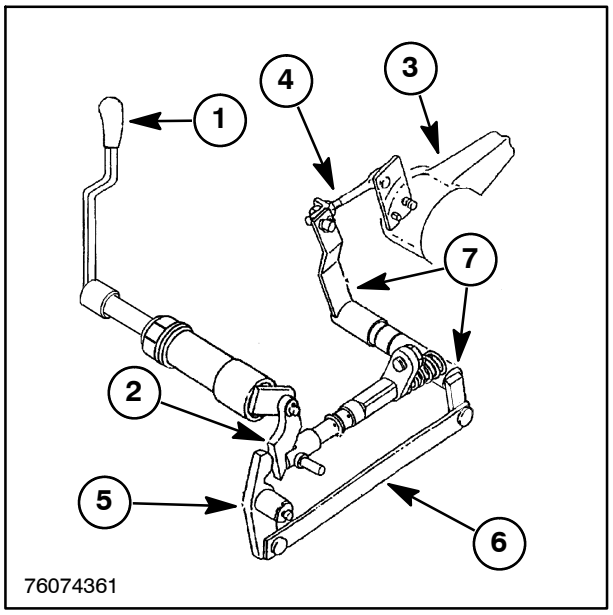
LINKAGE OPERATION - POSITION CONTROL

The single-lever hydraulic system uses a single-quadrant control lever, 1, which is connected to the control valve spool by internal linkage, 2, to maintain mounted implements at a constant height relative to the tractor.

When the control lever, 1, is moved, the internal linkage, 2, and control valve spool activate the hydraulic system, and the lift arms, 3, respond to the movement of the control lever, 1, by either raising, lowering, or remaining in neutral condition. The rod, 4, which is connected to the lift arm, actuates the feedback links, 5, 6 and 7, to move the control valve spool to the neutral position when the desired height is reached.



26

POSITION CONTROL OPERATION - NEUTRAL POSITION TO RAISE

When the position control lever, 1, is moved to the raise position, the cam, 2, is rotated between the cam, 3, and the control valve spool, 4, forcing the control valve inward into a raise position. Pump fluid then flows to the lift cylinder, and the lift arms raise.

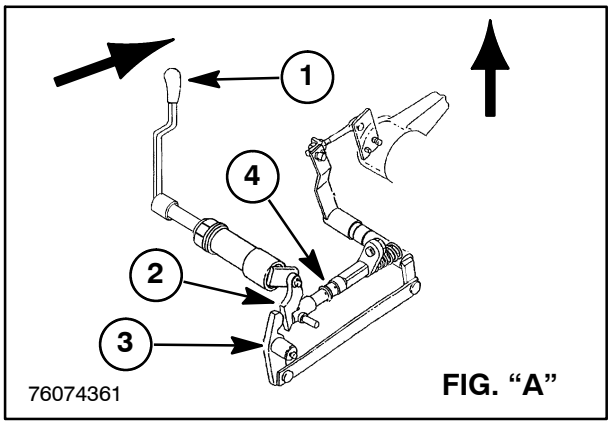


FIG. "A"

27

POSITION CONTROL OPERATION - RAISE POSITION TO NEUTRAL POSITION

When the lift arms, 1, raise, the feedback link, 2, moves forward allowing the spring-loaded control valve spool, 3, to move forward (outward) to the neutral position. Pump fluid flow is redirected to the sump, and the lift arms stop raising.

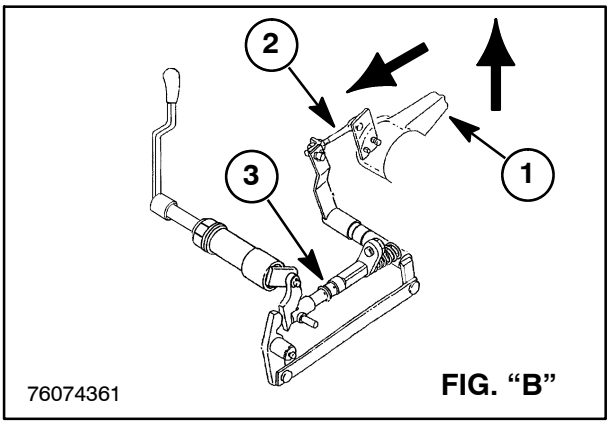


FIG. "B"

28

POSITION CONTROL OPERATION - NEUTRAL POSITION TO LOWERING POSITION

When the control lever, 1, is moved to the lowering position, the cam, 2, is moved upward, reducing the pressure on the control valve spool, 3. The spring, 4, then moves the control valve spool forward (outward) and pump fluid flow is directed to the sump. The lowering arm and screw, 5, moves toward the lowering valve spool (not shown) pushing it off its seat. This allows the cylinder fluid to exhaust to the sump via the flow control valve and lowers the lift arms.

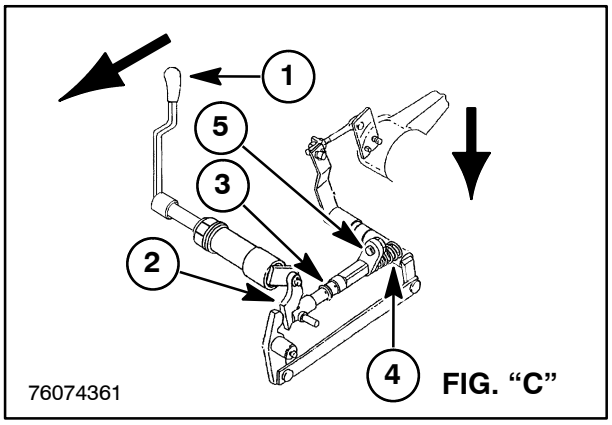


FIG. "C"

29

TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Implement fails to lift when lever is in raised position.	Linkage out of adjustment.	Adjust external and internal linkage.
	Relief valve setting too low.	Perform system relief valve pressure test.
	Faulty safety valve.	Repair or replace safety valve.
	O-ring failure (control valve body to cover, safety valve, relief valve).	Repair as required.
	Excessive oil leakage past lift cylinder piston seal.	Replace seal, piston, or cylinder as required.
	Restricted supply line screen filter.	Replace or clean as required.
	Restricted suction filter.	Replace.
	Restricted sump screen filter.	Replace or clean as required.
	Unload valve does not close.	Check unload valve operation.
	Lowering valve remains open.	Check poppet valve adjustment and operation.
Lift arms cycle up and down when lever is in neutral position.	Faulty lowering valve and seat.	Repair or replace as required.
	Faulty check valve and seat.	Replace.
	Faulty O-rings (lowering valve and seat, valve cover, unload valve plug).	Inspect and repair as required.
	Lowering valve out of adjustment.	Adjust to proper clearance.
Implement settles too fast when engine is stopped.	Faulty check valve seat.	Replace.
	Damaged piston seal.	Replace piston seal.

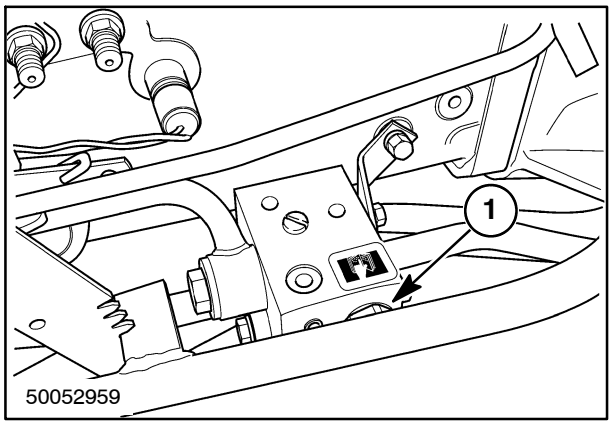
CONDITION	POSSIBLE CAUSE	REMEDY
Implement rises too slowly.	Restricted supply line screen filter.	Replace or clean as required.
	Restricted suction filter.	Replace.
	Restricted sump screen filter.	Clean or replace as required.
	Pump capacity too low.	Perform flow test and replace pump as required.
	Faulty relief valve.	Repair or replace as required.
	Excessive leakage past piston seal.	Inspect cylinder and piston. Repair as required.
	Faulty safety valve.	Repair or replace as required.
	Leaking O-rings (relief valve, safety valve).	Repair as required.
	Extreme cold weather operation.	Change hydraulic fluid to F200.
Implement will not lower.	Lowering valve out of adjustment.	Adjust lowering valve clearance.
	Flow control valve in closed position.	Open flow control valve.
Implement does not raise to full height.	Position control rod out of adjustment.	Adjust position control rod.
Hydraulic fluid overheats.	Restricted supply line screen filter.	Replace or clean as required.
	Faulty pump.	Replace pump.
	Restricted suction filter.	Replace.
	Restricted sump screen filter.	Clean or replace as required.
Relief valve operates when implement is in full raise position.	Position control rod out of adjustment.	Adjust position control rod.
Control levers move to lowering position automatically while tractor is operating.	Control lever tension set too low.	Adjust control lever tension nut.

PRESSURE TESTING

MAIN SYSTEM RELIEF VALVE

NOTE: *The hydraulic system is equipped with one system relief valve, 1. This setup gives several options for checking the system relief pressure. If equipped, the hydraulic system relief pressure may be checked using the front (double spool) remote valve kit. If the tractor is not equipped with this feature, the system relief pressure must be tested using the combination relief/diverter valve.*

NOTE: *Relief valve test cannot be performed at rear remote couplers because of a lower kick back pressure.*



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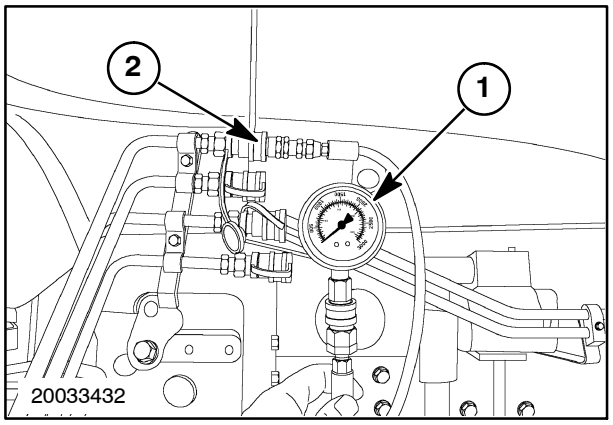
1. If equipped with a front (double spool) valve kit, connect a 0 - 207 bar (0 - 3000 psi) pressure gauge, 1, to the top high pressure hydraulic line, 2, located on the right side of the tractor. Proceed to step 4.



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2. If the tractor is not equipped with a front remote valve kit, remove the power out (P) manifold plug, 1, from the diverter valve and install a 0 - 207 bar (0 - 3000 psi) pressure gauge, 2, into the power out port.
3. Start the tractor engine and operate the hydraulic system to warm the hydraulic fluid to normal operating temperature.
4. Set the engine rpm to full throttle (T2410 - 2700 rpm, T2420 - 2800 rpm).
5. If using the front remote valve, move the valve control lever to the bucket raise position and observe the pressure indication on the gauge.

Model	Pressure Reading
T2410 T2420	172 bar (2500 psi)

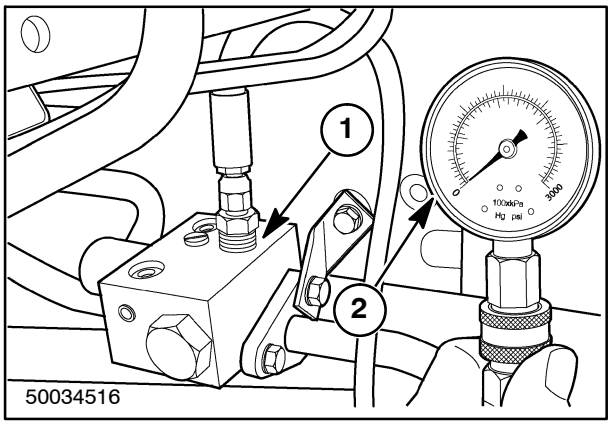
6. If using the combination relief/diverter valve, set the diverter valve, 1, from the 1 o'clock position to the 10 o'clock position, and observe the pressure indication on the gauge, 2.

Model	Pressure Reading
T2410 T2420	172 bar (2500 psi)

7. If required, adjust the relief pressure setting by adding or removing shims from the relief valve. One shim, 0.3 mm (0.012 in.) thickness, will change the relief pressure setting approximately 10 bar (145 psi).

NOTE: *Shim kit SBA340293825 (SSS Models) contains three 0.3 mm (0.012 in) and three 0.1 mm (0.004 in) shims.*

NOTE: *Shim kit SBA340293230 (EHSS Models) contains two 0.1 mm (0.004 in) shims.*



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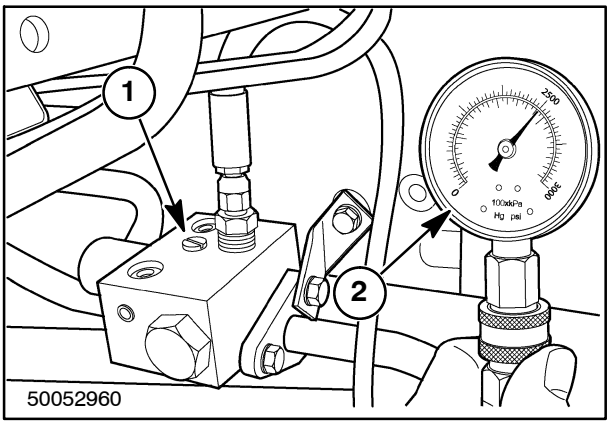

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INLET RESTRICTION TEST

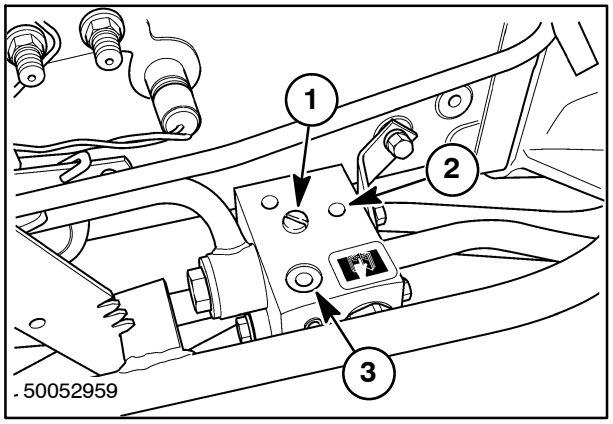
Perform the inlet restriction test to check for the hydraulic lines and filter for damage, obstructions, or air leaks. A hydraulic flow meter is required to perform the inlet restriction test.

⚠ WARNING ⚠

Leaks of pressurized hydraulic fluid can penetrate the skin and cause severe injuries. Tighten all of the connectors before starting the engine. If hydraulic fluid has penetrated the skin, seek medical assistance immediately.

NOTE: *Inlet restriction test cannot be performed at the rear remote couplers, because of a reduced pressure reading.*

1. Make sure the diverter valve adjuster screw, 1, is in the 10 o'clock position.
2. Remove the manifold plug, 2, from the diverter valve.
3. Connect a hydraulic line from the "Power Out" ('P') port of the diverter valve to the "Inlet" port of the flow meter.
4. Remove the manifold plug, 3, from the diverter valve.
5. Connect a hydraulic line from the "Tank" port ('T') to the "Return" port of the flow meter.



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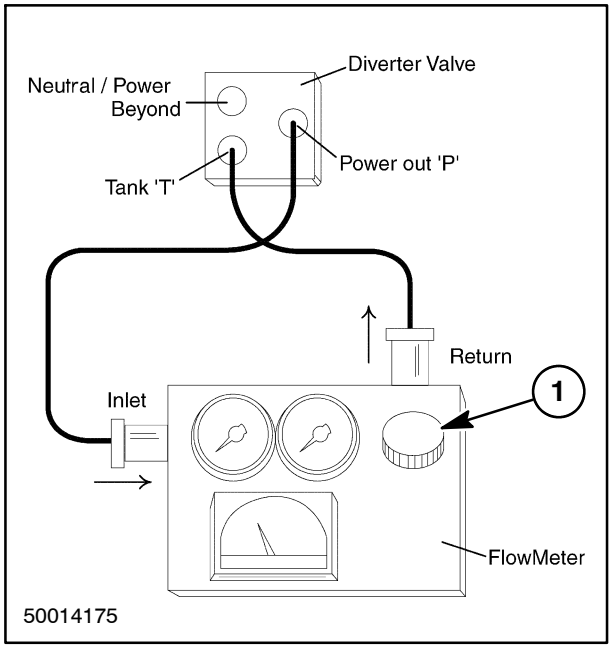
6. Start the engine and operate the hydraulic system to warm the hydraulic fluid to normal operating temperature.
7. Open the restrictor valve, 1, to allow full flow through the flow meter.
8. Run the engine at 1350 rpm - T2410 and 1400 rpm - T2420 and record the flow meter reading.
9. Run the engine at full throttle (T2410 - 2700 rpm, T2420 - 2800 rpm) and read the flow meter. The reading should indicate that the flow has doubled. If the meter reading is low, check the hydraulic lines, and filter for damage, clogs, or air leaks. If there are no problems with the hydraulic lines or the hydraulic filter, the hydraulic pump may require replacement. Use the Pump Efficiency Test described below to further inspect the hydraulic pump.



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PUMP EFFICIENCY TEST

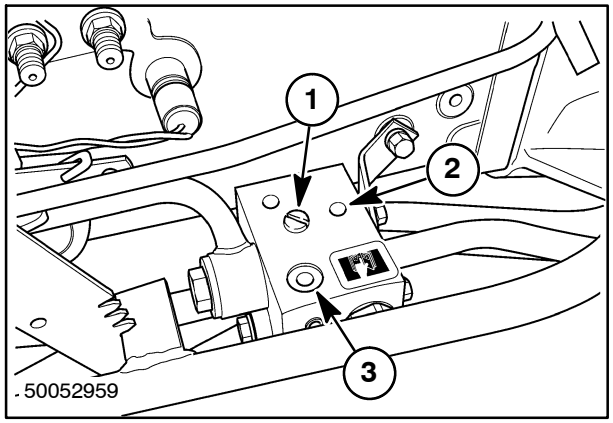
The pump efficiency test measures the hydraulic pump output to determine if the pump is excessively worn or damaged. Perform the pump efficiency test only after the inlet restriction test has been completed. A hydraulic flow meter is required to perform the pump efficiency test.

⚠ WARNING ⚠

Leaks of pressurized hydraulic fluid can penetrate the skin and cause severe injuries. Tighten all of the connectors before starting the engine. If hydraulic fluid has penetrated the skin, seek medical assistance immediately.

NOTE: *Pump efficiency test cannot be performed at the rear remote couplers, because of a reduced pressure reading.*

1. Make sure the diverter valve adjuster screw, 1, is in the 10 o'clock position.
2. Remove the manifold plug, 2, from the diverter valve.
3. Connect a hydraulic line from the "Power Out" ('P') port of the diverter valve to the "Inlet" port of the flow meter.
4. Remove the manifold plug, 3, from the diverter valve.
5. Connect a hydraulic line from the "Tank" port ('T') to the "Return" port of the flow meter.



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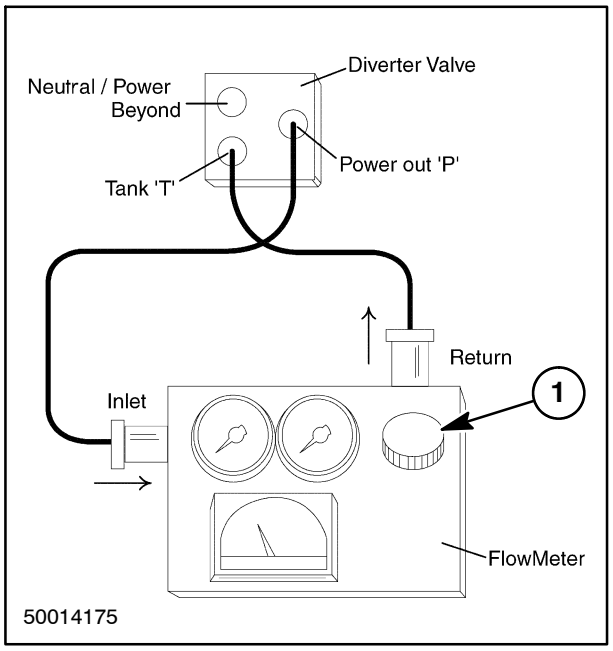
6. Start the engine and operate the hydraulic system to warm the hydraulic fluid to normal operating temperature.
7. Operate the tractor engine at full rpm. Observe the flow meter reading. See chart below for the no load pressure readings.
8. Tighten the flow restrictor valve, 1, on the flow meter until the system pressure is 131 - 138 bar (1900 - 2000 psi).
9. Observe the flow meter reading, the results should be approximately 80% of the no-load flow. Minimum flow rating are shown below. If testing shows the hydraulic pump output is low, the pump requires replacement.



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EHSS Model	T2410	T2420
Pump Capacity @ Rated Engine Speed	43.9 lpm (11.6 gpm)	45.5 lpm (12.0 gpm)
RPM @ Half Throttle	1350	1400
Pump Flow @ Half Throttle	21.9 lpm (5.8 gpm)	22.7 lpm (6.0 gpm)
Rated Engine RPM	2700	2800
Pump Flow @ Rated Speed	43.9 lpm (11.6 gpm)	45.5 lpm (12.03 gpm)
Minimum Flow Rating (80% of the No-load Flow)	35.1 lpm (9.28 gpm)	36.4 lpm (9.62 gpm)

SSS Model	T2410	T2420
Pump Capacity @ Rated Engine Speed	40.9 lpm (10.8 gpm)	42.5 lpm (11.2 gpm)
RPM @ Half Throttle	1350	1400
Pump Flow @ Half Throttle	20.5 lpm (5.4 gpm)	21.3 lpm (5.6 gpm)
Rated Engine RPM	2700	2800
Pump Flow @ Rated Speed	40.9 lpm (10.8 gpm)	42.5 lpm (11.2 gpm)
Minimum Flow Rating (80% of the No-load Flow)	32.7 lpm (8.6 gpm)	34.0 lpm (9.0 gpm)

NOTE: *The SSS transmission tractors have a lower hydraulic output because the PTO priority flow valve located in the manifold block diverters 3.0 lpm (0.8 gpm) to the PTO control valve.*

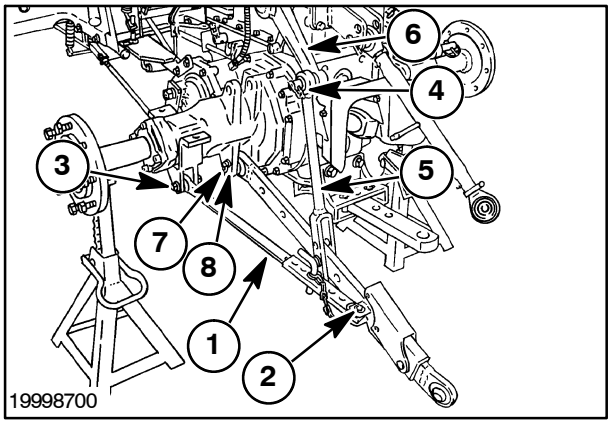
OVERHAUL - LIFT CYLINDER

LIFT CYLINDER

Removal

1. Before removing the lift cover assembly, discharge the fluid from the lift cylinder by lowering the lift links to their lowest position.
2. Remove position control rod sway bar, 1, by removing the clevis pin, 2, and removing the bolt, 3, that connects the opposite end of the sway bar to the ROPS. Repeat for the opposite side
3. Disconnect the position control rod assemblies from the tractor by removing the clevis pin, 4, that connects the control rod, 5, to the lift arm, 6. Remove the bolt, 7, and the retaining pin, 8, which holds the lower link of the control rod assembly to the rear axle. Repeat for the opposite side.

NOTE: *Tractor wheels have been removed for figure.*



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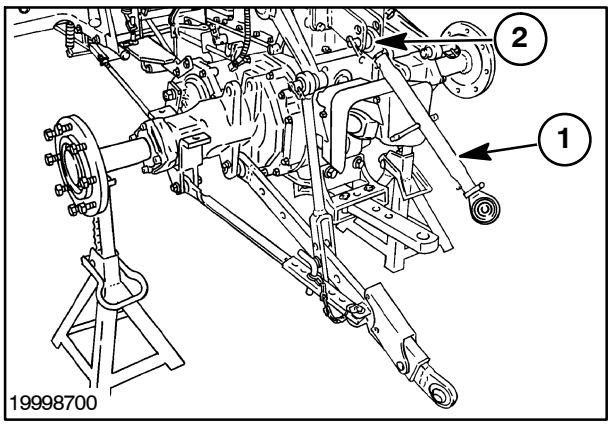
4. Disconnect the top link, 1, from the lift cover by removing the clevis pin, 2.
5. Remove the left and right fenders.
6. Remove the seat.
7. Remove the Roll Over Protection System (ROPS).



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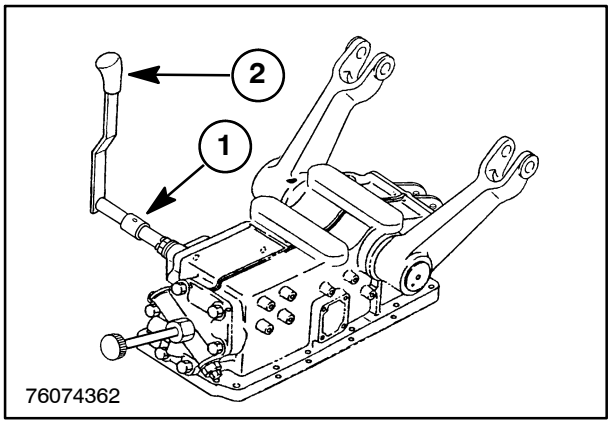
8. Drive out roll pin, 1, and remove position control lever, 2, from the HPL pivot shaft.



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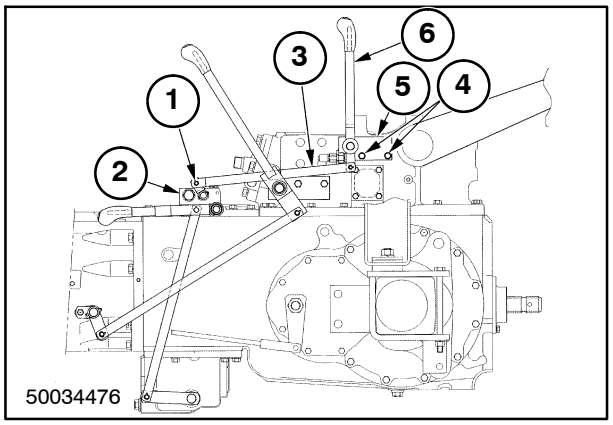
9. Remove the cotter pin, 1, from the PTO control valve, 2, and disconnect the shift plate, 3, from the PTO control valve. Remove the bolts, 4, shift guide, 5, and PTO control lever, 6, from cylinder housing.



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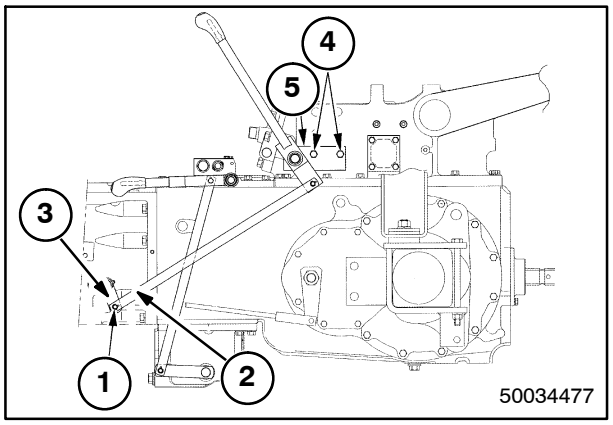
10. Remove the cotter pin, 1, and disconnect the shift plate, 2, from the range change lever, 3.
11. Remove the two bolts, 4, range shift guide, 5, from the cylinder housing.



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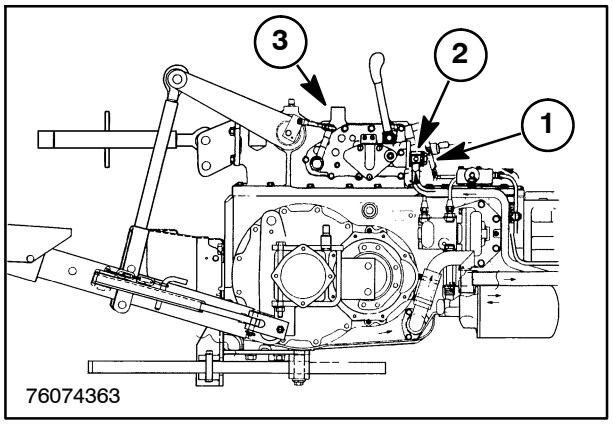
12. Remove the high pressure line banjo bolt, 1, that secures the high pressure hydraulic line, 2, to the lift cover, 3.



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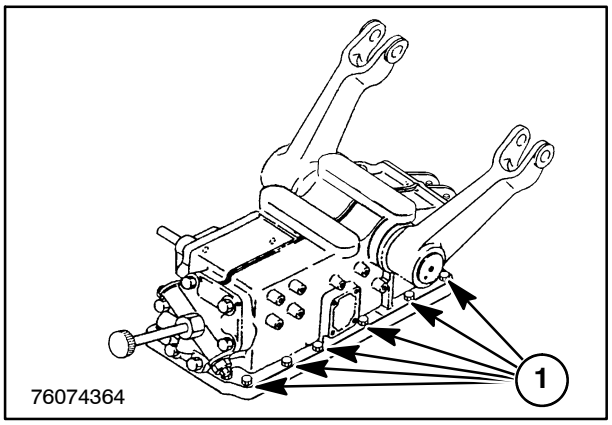
13. Remove the sixteen nuts and bolts, 1, securing the lift cover to the differential case.
14. Separate the lift cover from the differential case.



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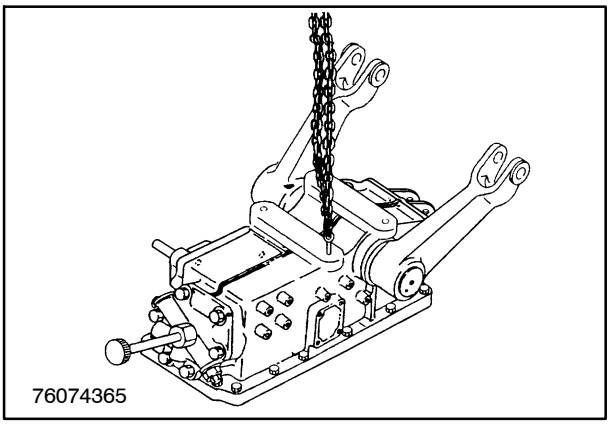
15. Using a suitable hoist or lift, remove the lift cover from the differential housing.



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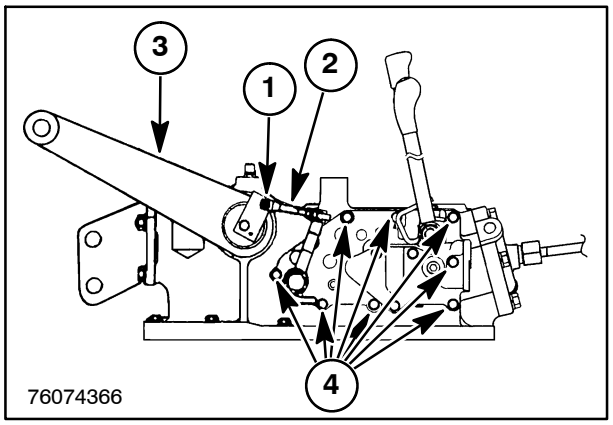
Disassembly

1. Remove the pin, 1, and remove the position control rod, 2, from the lift arm, 3.
2. Remove the cover bolts, 4, and remove the cover and valve as an assembly.



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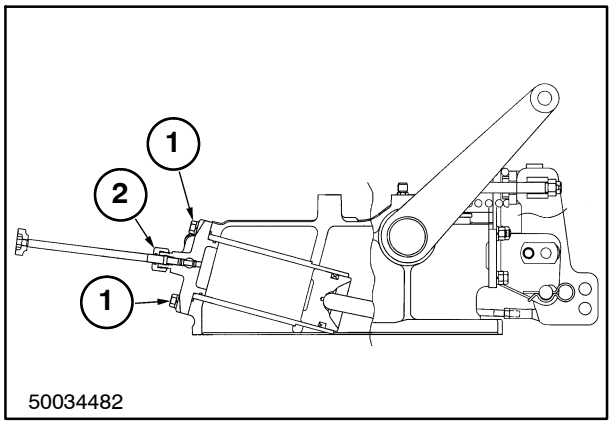
3. Remove the drop rate control valve attaching bolts and nuts, 1, and remove the valve and cover, 2, as an assembly.

NOTE: *Cylinder liner may come off with cover and valve.*



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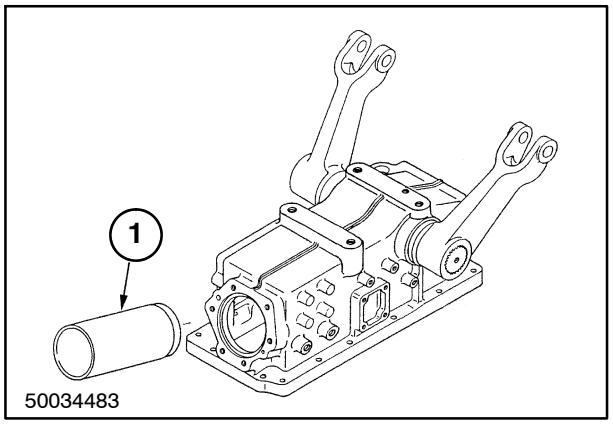
4. Remove the cylinder liner, 1, through the front of the cover assembly.
5. Using a wood dowel, push the piston out of the liner through the head end.



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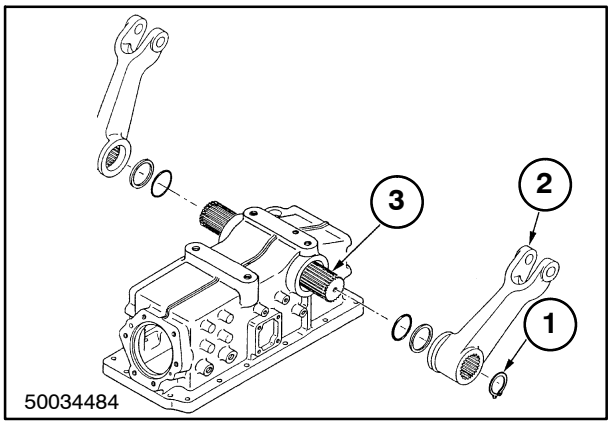
6. Remove the feedback link, from the cross shaft.
7. Remove the snap rings, 1, holding the lift arms, 2, on the cross shaft, 3, from each side.
8. Scribe a mark on the cross shaft, 3, and lift arm, 2, for assembly purposes, and remove the lift arms using a suitable puller.



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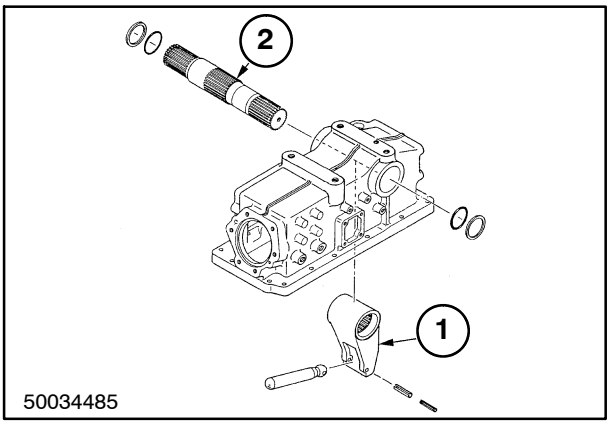
9. Scribe a mark on the ram arm, 1, and cross shaft, 2, for assembly purposes.
10. Slide the ram arm back on the shaft, 2, while pulling the cross shaft out the left side of the housing.



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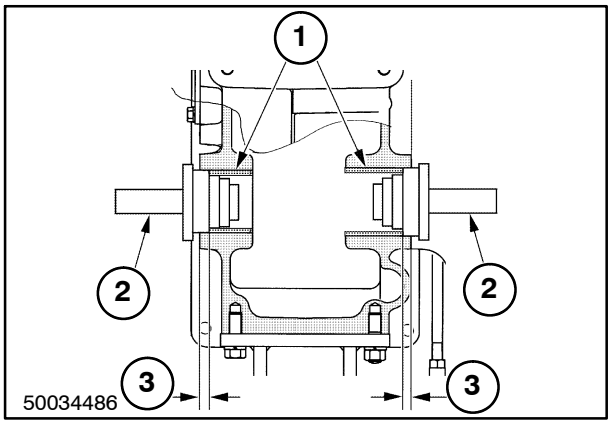
Inspection and Repair

1. Check the piston and cylinder for excessive wear or damage. Replace if necessary.
2. Check the cross shaft bushings, 1, for excessive wear or damage. Replace the bushings if necessary using a suitable driver, 2.

NOTE: *Be sure to install the bushings to the correct depth as shown.*

Bushing depth, 3; 7 mm (0.276″).



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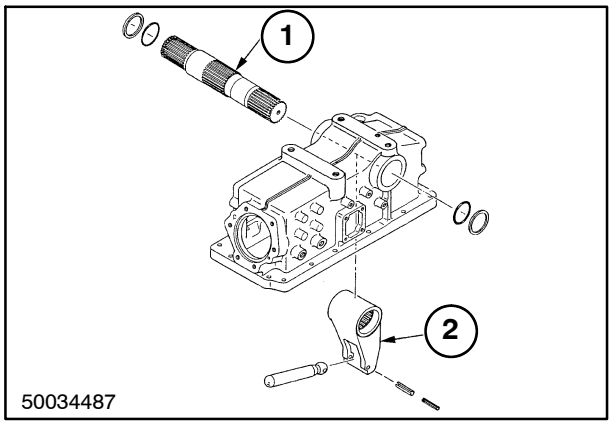
Assembly

1. Clean all parts in a suitable solvent and air dry.
2. Apply clean hydraulic fluid to all parts, including O-rings and seals, during assembly.
3. Install the cross shaft, 1, in the cover while aligning the ram arm, 2, to the scribe marks made during disassembly.



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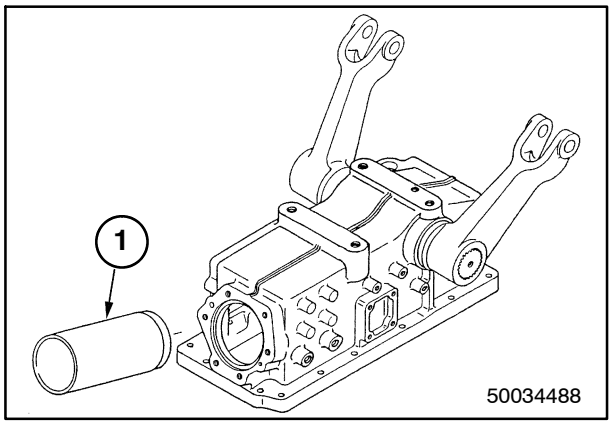
4. Install the cylinder liner, 1, in the lift cover housing. Be sure to position the piston rod inside the liner during installation.



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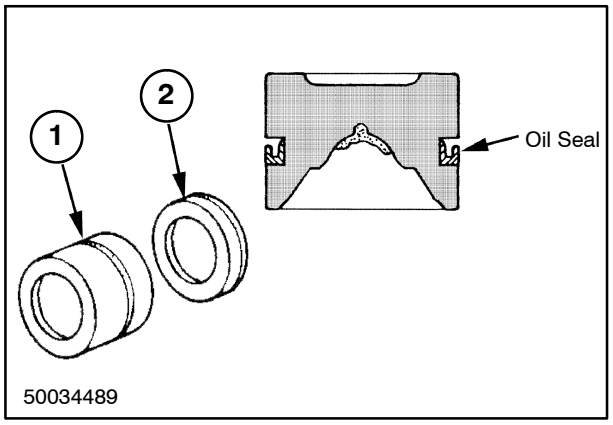
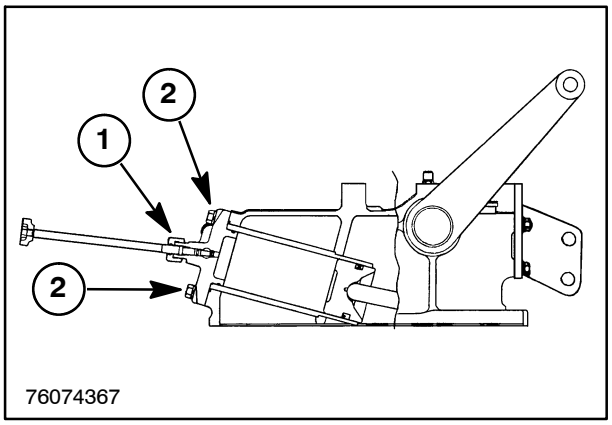
5. Install the oil seal, 2, on the piston, 1, and carefully install the piston in the cylinder.

***NOTE**: Use care to position the oil seal groove toward the piston head during installation.*



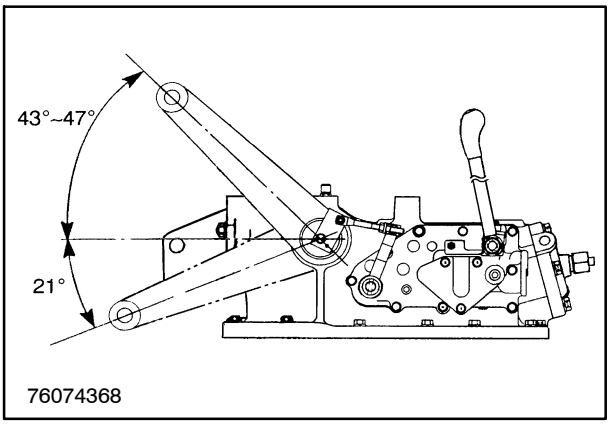
54

6. Using a new O-ring and gasket, install the drop rate control valve assembly, 1, and tighten the nuts and bolts, 2, to 65.7 - 83.4 N·m (48.5 - 61.5 ft-lbs).



55

NOTE: *Be sure to align the reference marks scribed at time of disassembly. If no scribe marks are present, install the lift arms positioned as shown.*



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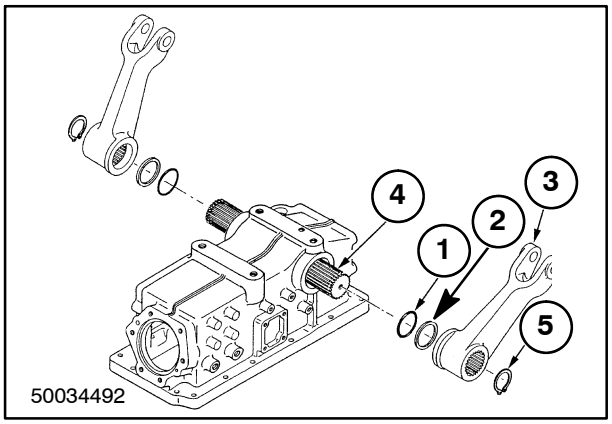
7. Install a new O-ring, 1, spring washers, 2, and lift arms, 3, on each side of the cross shaft, 4. Secure in place with snap rings, 5.



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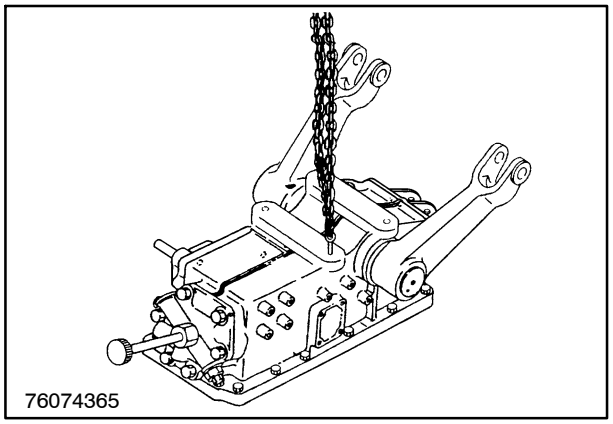
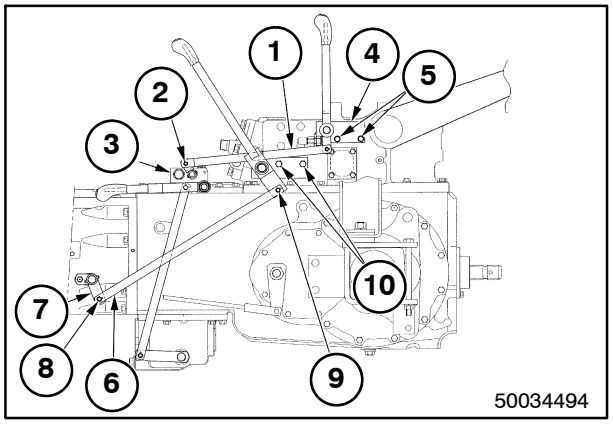
Installation

1. Using a suitable hoist or lift, install the lift cover onto the differential housing.
2. Replace the cover nuts and bolts and tighten to torque specifications listed in this section.
3. Using new O-rings, install the high pressure line and banjo bolt onto the lift cover.



58

4. Install the PTO linkage, 1, to the lift cover and secure with cotter pin, 2, on to PTO control valve, 3. Install shift guide, 4, using two bolts, 5.
5. Install range shift linkage, 6, onto the range input shaft, 7, and secure the linkage with cotter pin, 8. Install shift guide, 9, using two bolts, 10.



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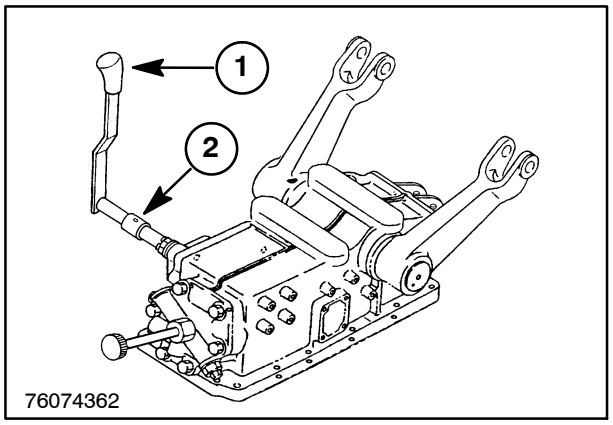
6. Align the 3-point position control lever, 1, onto the HPL pivot shaft and install the roll pin, 2, to secure the lever.
7. Install the Roll Over Protection System (ROPS), seat, LH and RH fenders.



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DROP RATE CONTROL VALVE

Removal

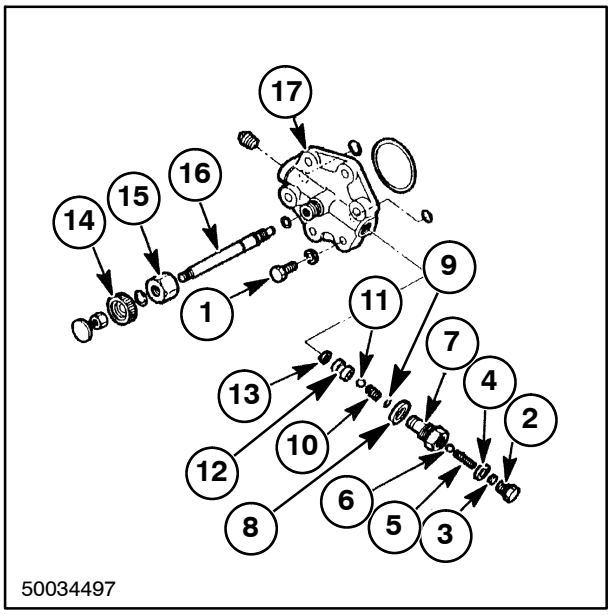
1. Remove the cylinder head-retaining bolts, and nut, 1.
2. Carefully remove the cylinder head assembly.

Disassembly

1. Remove the safety valve guide bolt, 2, and the shims, 3, sealing washer, 4, spring, 5, and ball, 6.

NOTE: *Observe the quantity of shims, 3, used between the spring and guide bolt.*

2. Remove the check valve body, 7, seal, 8, O-ring, 9, spring, 10, ball, 11, guide, 12, and gasket, 13.
3. Remove the knob, 14, and nut, 15, and then screw the valve stem, 16, out of the body, 17.



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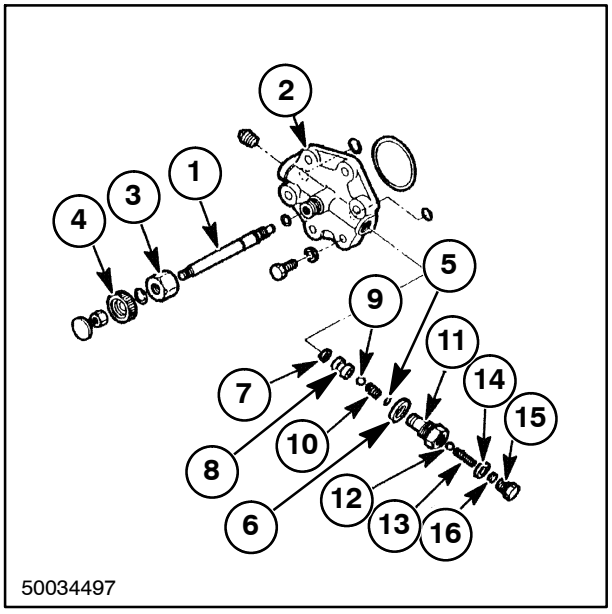
Inspection

1. Wash the components in a suitable solution and air dry.
2. Inspect the valve seat for excess wear or damage.
3. Inspect the flow control valve stem (seat) and the two balls for excess wear or damage.
4. Inspect the springs for excess wear or chipping.

Assembly

1. During assembly, apply clean hydraulic fluid to all components.
2. Screw the valve stem, 1, into the body, 2.
3. Install the nut, 3, and valve knob, 4, on the guide.
4. Using new O-ring, 5, seal, 6, and gasket, 7, install the guide, 8, ball, 9, spring, 10, and check valve body, 11.
5. Install the ball, 12, spring, 13, sealing washer, 14, and valve guide bolt, 15, using the same amount of shims, 16, removed during disassembly.



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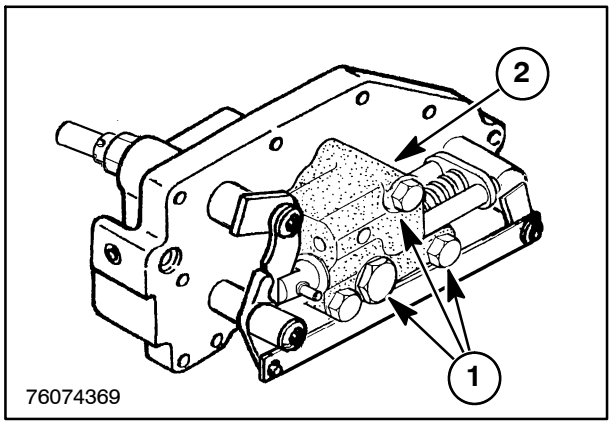
HYDRAULIC CONTROL VALVE

Removal

See “Lift Cover Assembly”, discussed earlier in this section.

Disassembly

1. Remove the valve to cover-retaining bolts, 1, and remove the valve, 2, from the cover.



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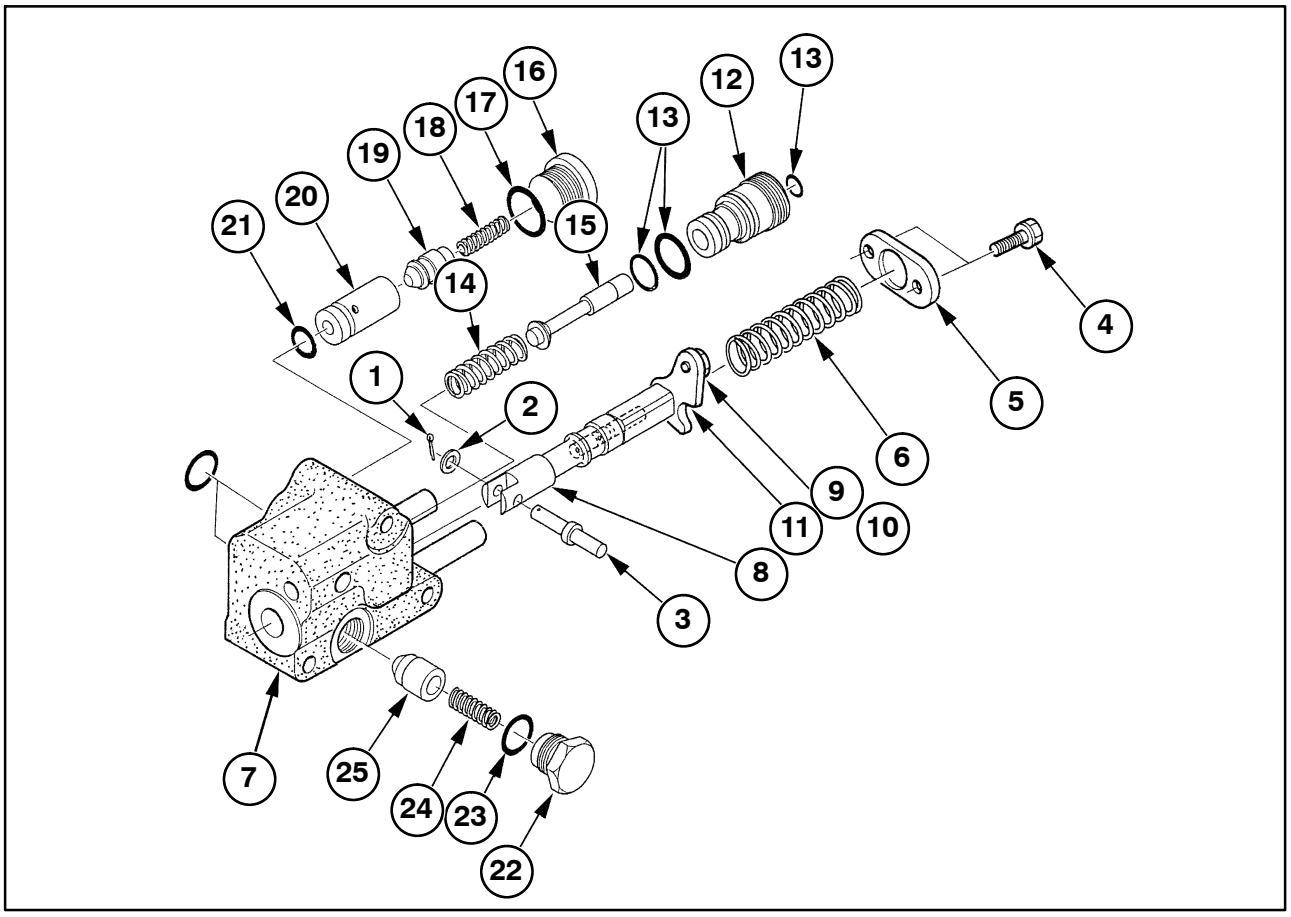

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2. Remove the cotter pin, 1, washer, 2, and pin, 3, from the control valve spool.
3. Loosen the bolt, 4, and remove plate, 5, and spring, 6, from the control valve body, 7.
4. Remove the control valve spool, 8, from the valve body, 7.

NOTE: *Do not remove the adjusting screw, 9, nut, 10, plate, 11, bolt, bypass spool, and spring from the control valve spool, 8, unless required, as this affects the valve adjustment setting.*

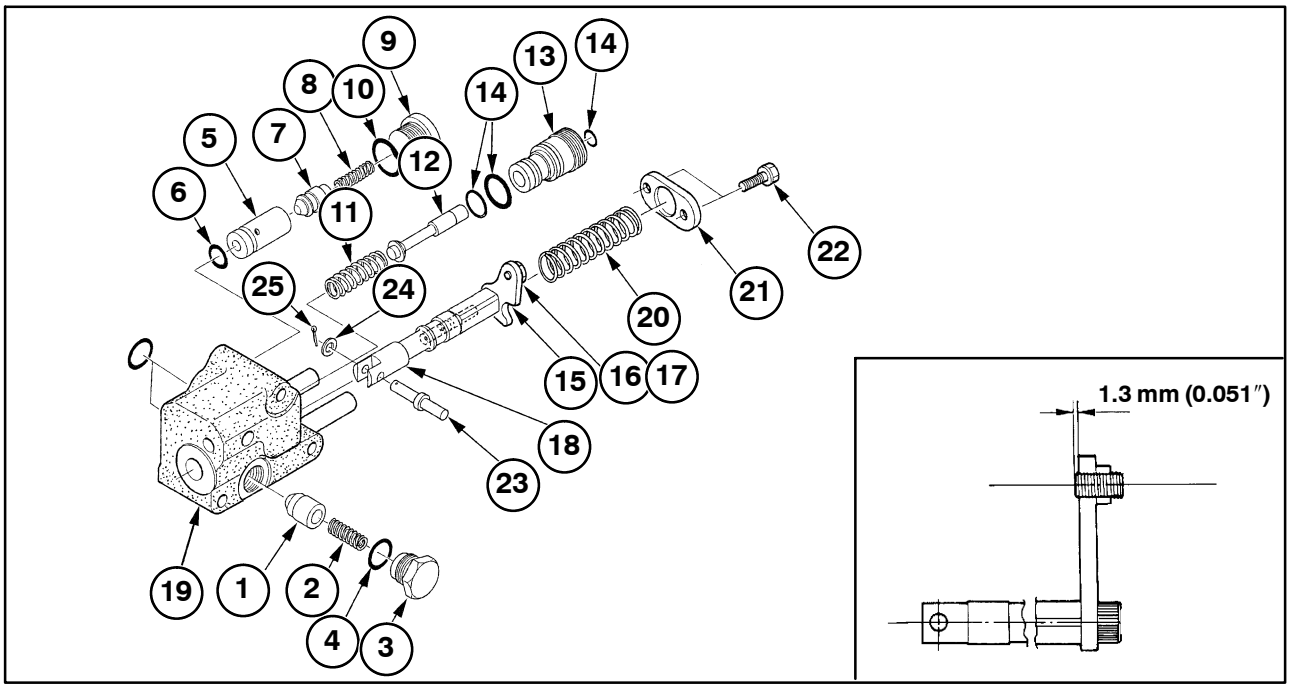
5. Using special tool #FNH00357, remove the lowering valve seat, 12, with O-rings, 13, spring, 14, and lowering valve spool, 15, from the valve body.
6. Remove the check valve plug, 16, with O-ring, 17, spring, 18, check valve, 19, and seat, 20, with O-ring, 21, from the valve body.
7. Remove the plug, 22, with O-ring, 23, spring, 24, and unload valve, 25, from the valve body.

Inspection

1. Clean all components in a suitable solvent and air dry.
2. Inspect the valve spool and bore for excessive wear, scratches, or other damage.

NOTE: *The control valve assembly and the body must be replaced as a matched set only.*

3. Inspect the check valve seat and bushing seat area for uneven wear or other damage. Replace the valve and bushing as a set if required.
4. Inspect the unload valve and valve seat area for uneven wear or damage. Replace the valve and valve seat as a set if required.
5. Inspect the shutoff valve and valve seat area for uneven wear or damage. Replace the valve and valve seat as a set if required.
6. Inspect all O-ring grooves for nicks or burrs.



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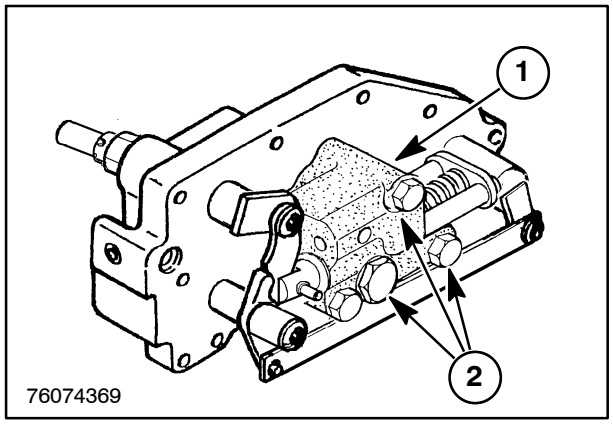
Assembly

1. Apply clean hydraulic fluid to all components, including O-rings and seals, during assembly.
2. Replace all O-rings, gaskets, and seals using new parts.
3. Install the unload valve, 1, spring, 2, and plug, 3, with O-ring, 4, in the valve body. Tighten the plug to 98 - 117.6 N·m (72 - 87 ft-lbs).
4. Install seat, 5, with O-ring, 6, check valve, 7, spring, 8, and plug, 9, with O-ring, 10, in the valve body. Tighten the plug to 58 - 68 N·m (43 - 50 ft-lbs).
5. Install the spring, 11, lowering valve spool, 12, and lowering valve seat, 13, with O-rings, 14, in the valve body. Tighten the lowering valve seat to 79 N·m (58 ft-lbs).
6. If removed, assemble the bolt, plate, bypass spool and spring, as follows:
   - Remove the oil from the threads of the bolt, and valve spool, and apply thread sealant to them.
   - Insert the spring, and bypass spool, into the valve spool.
7. Install the plate, 15, in position from the pin center and tighten the bolt to 10 - 15 N·m (7.4 - 11 ft-lbs).
8. Install the screw, 16, until it projects 1.3 mm (0.051″) from the plate, and tighten the nut, 17, to 18 - 22 N·m (13 - 16 ft-lbs) torque.
9. Install the control valve spool, 18, into the valve body, 19.
10. Install spring, 20, plate, 21, and secure with bolts, 22. Tighten the bolts to 7 - 10 N·m (5.2 - 7.3 ft-lbs).
11. Install pin, 23, through the control valve and secure in place with washer, 24, and split pin, 25.

Installation

1. Using new O-rings, install the control valve, 1, to the cover. Install and tighten three bolts, 2.



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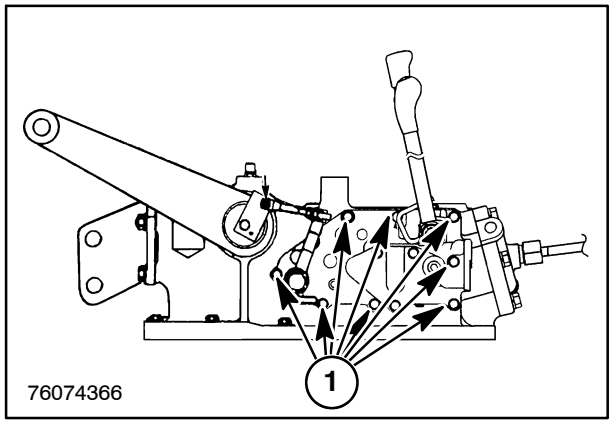
2. Install the handles to the cover. Position the control valve and cover assembly with a new gasket on the lift cover assembly and install the attaching bolts, 1. Tighten the attaching bolts to 54 N·m (40 ft-lbs).
3. Install the guides and handle grips. Install the position control link and adjust as described in this section.



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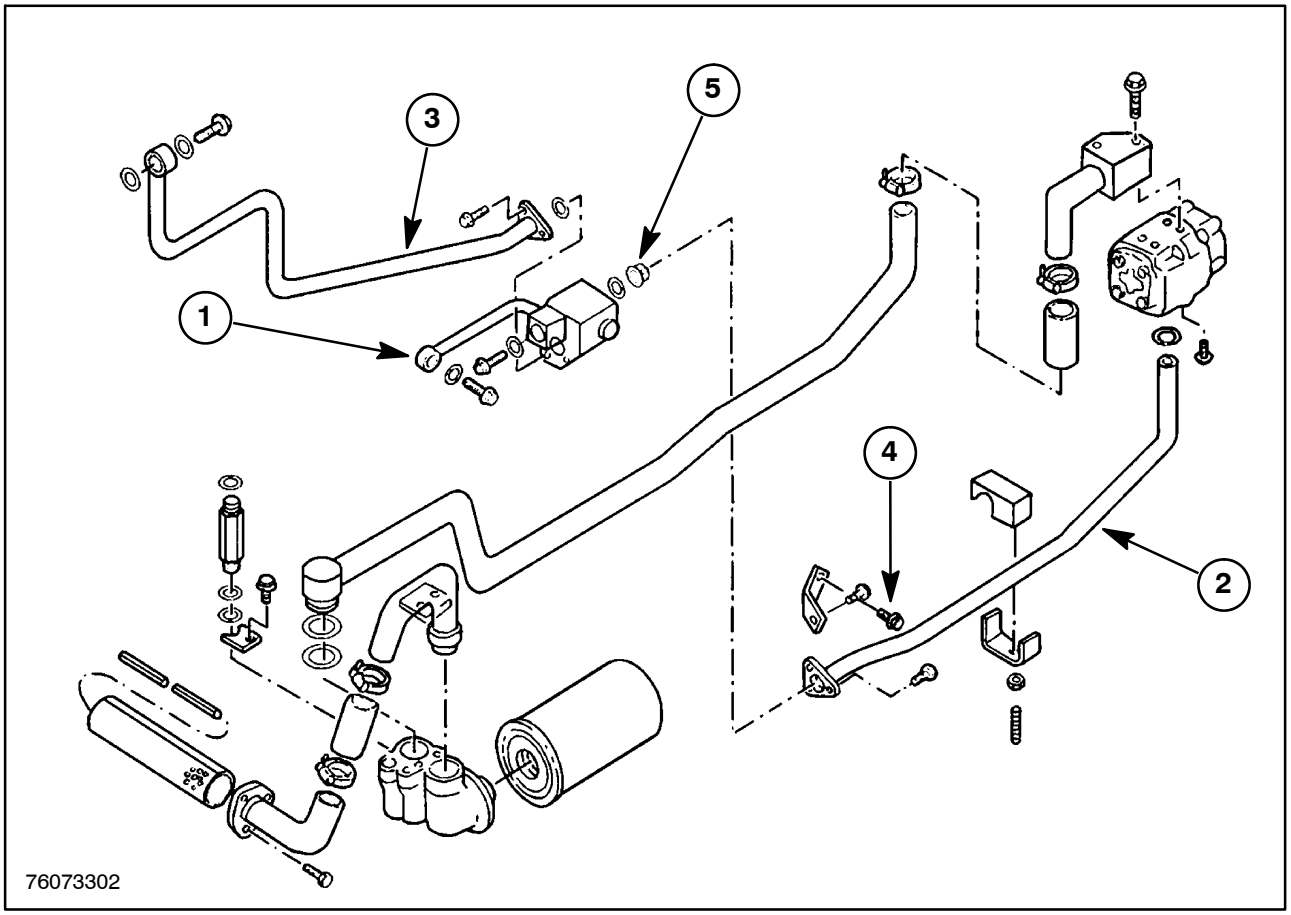
COMBINATION SYSTEM RELIEF VALVE AND DIVERTER VALVE ASSEMBLIES



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Removal

NOTE: *Removal and installation procedures shown are for tractors equipped with EHSS transmissions. Tractors with SSS transmissions will have an additional pressure line, from the diverter valve to the PTO clutch control valve.*

1. Disconnect the relief valve to sump return line, 1, at the valve body fitting.
2. Remove the bolts securing the pump pressure line, 2, and the HPL pressure line, 3, to the control valve at the valve assembly.
3. Remove the bolt, 4, securing the valve assembly to the tractor. Cap and plug all openings.
4. Remove the filtering screen, 5, from the pump pressure line, 2.

NOTE: *If a hydraulic pump flow problem has been noticed, first check filterings screen, 5, for debris. The screen should be cleaned or changed every 300 hours.*

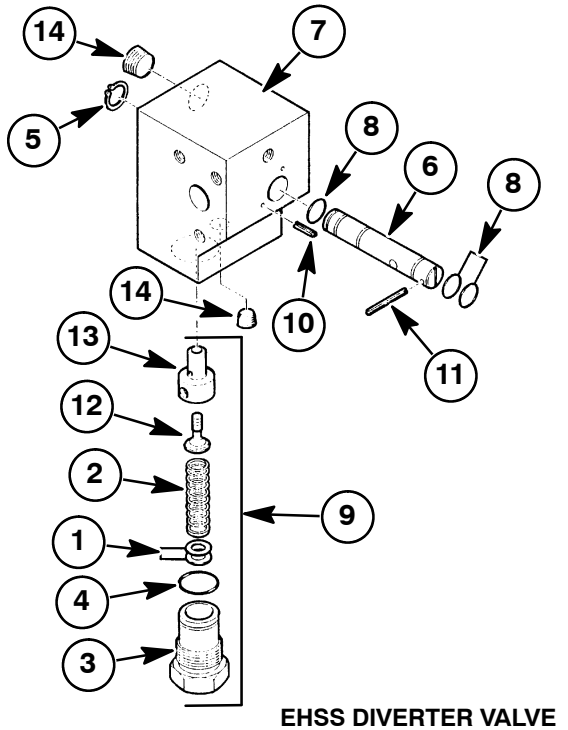
Disassembly

NOTE: *When removing the relief valve plug, make note of the quantity of shims, 1, if used, between the spring, 2, and plug, 3. Retain the shims for use during assembly.*

1. Remove the relief valve plug, 3, with the O-ring, 4.
2. Remove the snap ring, 5, from the diverter valve spool, 6, and withdraw the spool from the valve body, 7.

Inspection

1. Inspect the relief valve seat and guide for excess wear or score marks.
2. Inspect the diverter valve spool and valve body for excess wear or score marks.
3. Inspect the spring for wear or damage.
4. Replace the relief/diverter valve as an assembly if found to be damaged.
5. Inspect the filter for damage, and clean.



EHSS DIVERTER VALVE

50035611

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1. Shims
2. Spring
3. Plug
4. O-Ring
5. Snap Ring
6. Diverter Valve Spool
7. Valve Body
8. O-Rings
9. System Relief Valve Assembly
10. Roll Pin
11. Roll Pin
12. Poppet
13. Valve Seat
14. Plugs
15. Priority Valve (fig. 70)

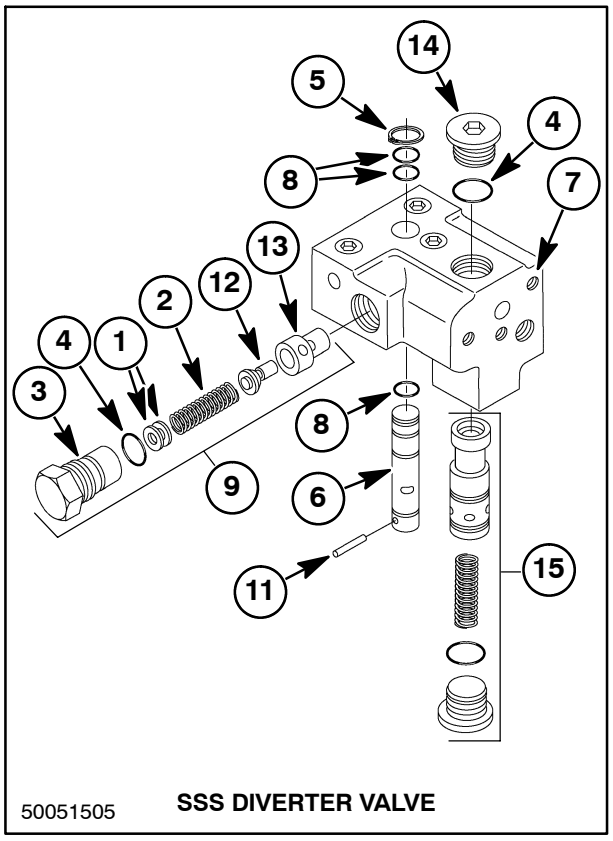
Assembly

1. Using new O-rings, 8, install the diverter valve spool, 6, into the valve body, 7, and install snap ring, 5.

NOTE: *On SSS Models, one shim, 0.3 mm (0.012″) thickness, will change the pressure setting approximately 10 bar (145 psi). While one shim 0.1 mm (0.004″) thickness will change the pressure setting approximately 3.3 bar (48 psi).*

On EHSS Models, one shim 0.1 mm (0.004″) thickness will change the pressure setting approximately 3.3 bar (48 psi).

2. Install the relief valve assembly, 9, with a new O-ring, 4, into the valve body, 7. Be sure to use the correct number of shims, if necessary, when installing the relief valve assembly.



50051505 **SSS DIVERTER VALVE**

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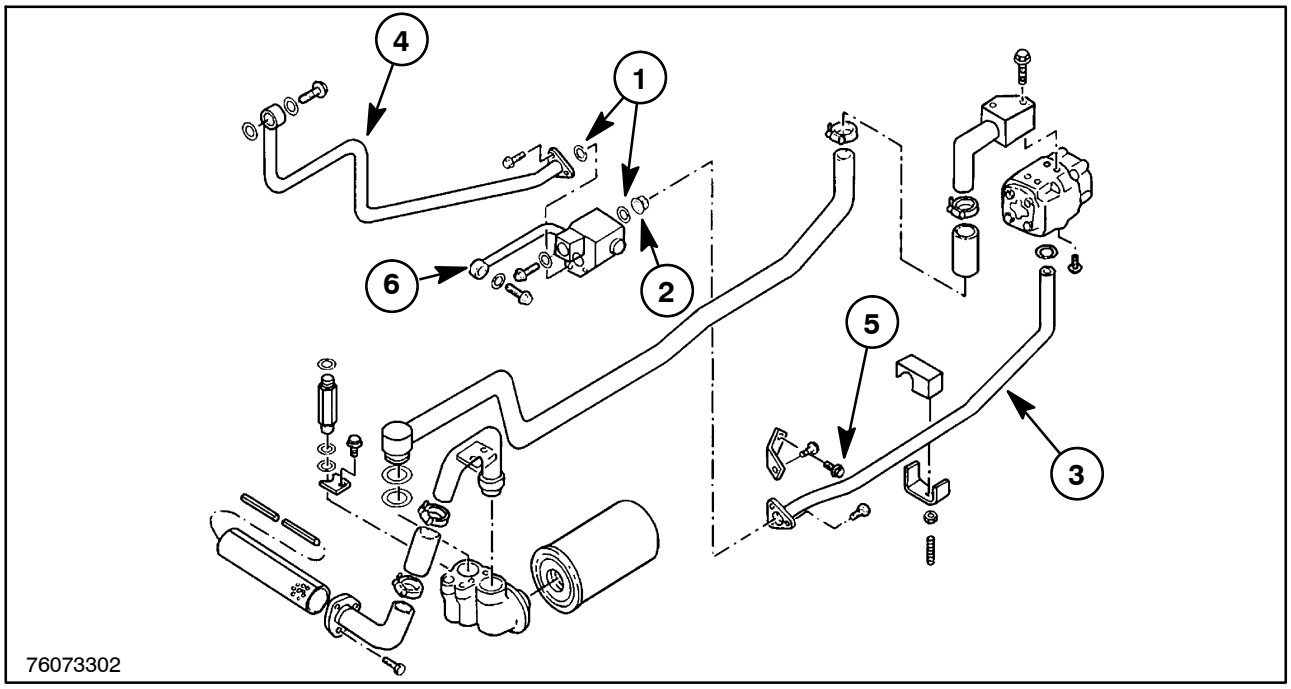

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Installation

1. Install new O-rings, 1, and filtering screen, 2, on the pump pressure line, 3, and the pressure line, 4, to control valve.
2. Install the bolt, 5, which secures the combination system to the tractor. Do not tighten bolt at this time.
3. Install the relief valve to sump tube, 6, on the relief valve and secure with banjo bolt.
4. Install the bolts securing the pump pressure line, 3, and the HPL pressure line, 4, to control valve to the valve assembly.
5. Tighten all loose bolts and fittings at this time.

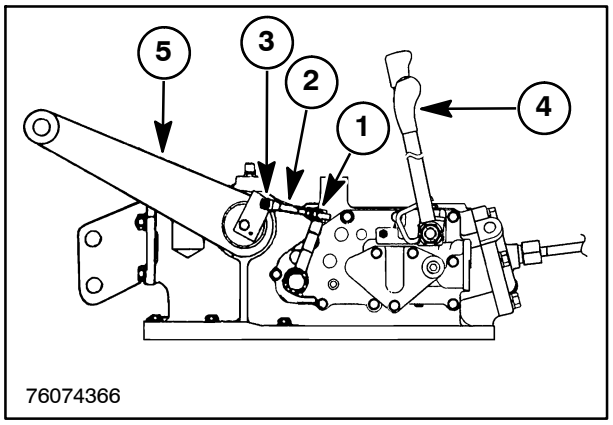
ADJUSTMENTS

HPL LINKAGE

The length of the position control rod is critical and careful adjustment must be observed for proper operation. If the control rod is adjusted too short, the control valve spool will remain in the raised position when the lift arms have reached their maximum height and the system relief valve will open. If the control rod is too long, the control valve spool will return to neutral before the lift arms reach their full height. The position control rod should be adjusted any time the link is disconnected for service to the hydraulic system, or any time the relief valve operation is noticed while the lift arms are at the full raise position.

Adjustment Procedure

1. Loosen the locknut, 1, on the position control rod, 2, and remove the pin, 3, from the link.
2. Set the control lever, 4, to the highest position, but not in the notch of the upper stop.
3. Start the engine and set at low idle speed. The lift arms, 5, should raise and the relief valve should operate.
4. Move the control lever down until the relief valve ceases operation.
5. Adjust the length of the position control rod and clevis to align the pin holes. Then lengthen the rod one additional turn and install the pin. Tighten the locknut.
6. Check the operation. The relief valve should not operate when the HPL control lever, 4, is in the fully raised position.
7. Confirm that the lift arms have 2 degree = 10 mm (0.40 in) of end play, at the top of the lift arms when the HPL control lever, 1, is at its highest position, against the upper stop.



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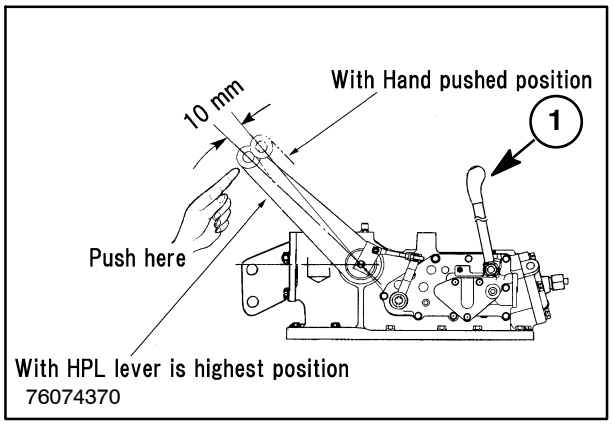

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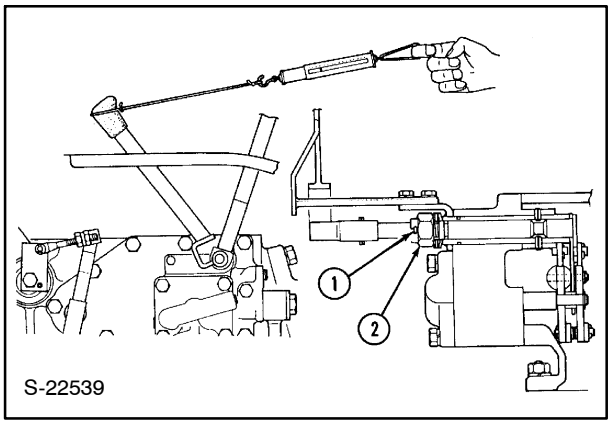
CONTROL LEVER

Adjustment Procedure

1. The control lever should not move from vibration of the tractor. if adjustment is required, remove the cotter pin, 1, and adjust the nut, 2, to require 2-3 kg (4-7 lbs) of pull force is at the lever knob is necessary to move the control lever. Use a suitable pull scale for measurement of control lever resistance.



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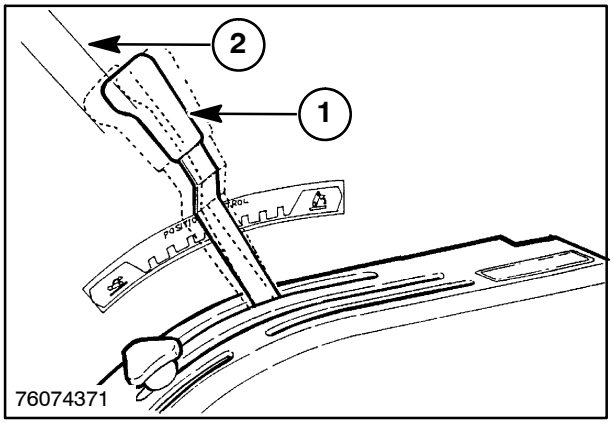
1. Cotter Pin
2. Adjusting Nut

CONTROL LEVER NEUTRAL

Adjustment Procedure

With the engine running at 1000 - 1500 rpm, check the position control lever neutral adjustment as follows:

1. Place the position control lever, 1, in the neutral position.
2. Measure the lever travel, 2, required from the start of a continuous raise position to start lowering. The travel distance, 2, should be 10 mm (0.4″).



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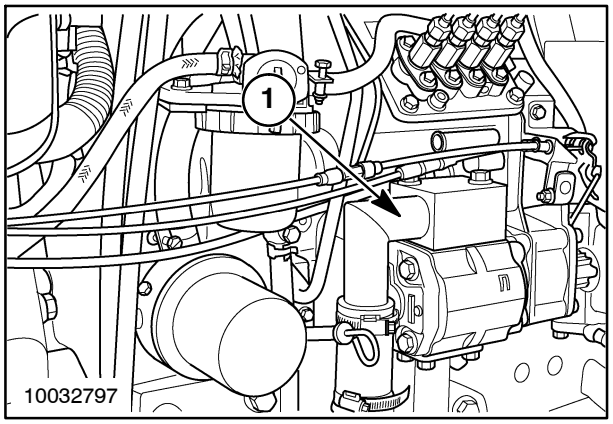
1. Position Control Lever
2. Neutral Travel

DESCRIPTION OF OPERATION - HYDRAULIC PUMP AND FILTER

The hydraulic pump, 1, is mounted on the right side of the engine and is driven by the engine oil pump gear mounted on the front of the engine block.

The hydraulic pump is a gear type pump and, with exception of replacing the seals, is not serviceable.



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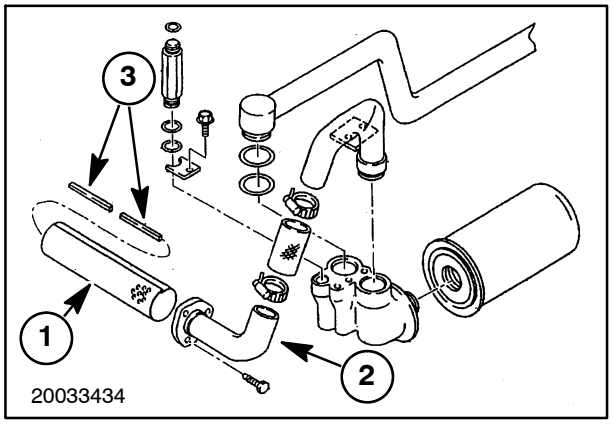
A screen-type sump strainer, 1, is housed inside the rear differential case and is accessed by draining the hydraulic fluid from the differential case and removing the sump screen tube, 2, from the right side of the differential housing.

The screen type sump filter has six magnetic bars, 3, in the filter to catch any metallic particles in the oil.



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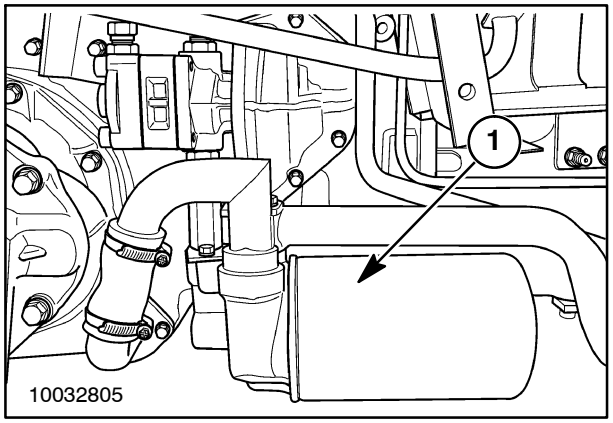
A suction type filter, 1, is located in the inlet line on the right side of the tractor, near the rear axle differential case. The filter is serviced by replacing the complete canister assembly. The filter should be replaced after the first 50 hours of use and every 300 hours of use thereafter.



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HYDRAULIC PUMP

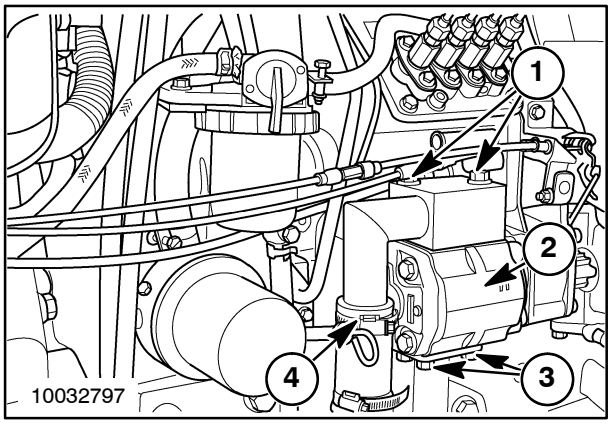
The only parts serviced on the hydraulic pump are the shaft seal and internal O-rings. If troubleshooting indicates a faulty pump, replace the pump with a new assembly.

Pump Flow	lpm (gpm)
T2410 T2420	43.9 lpm (11.6 gpm) 45.5 lpm (12.0 gpm)

NOTE: *Difference in pump flows are due to different rated engine SPEEDS.*

Removal

1. Remove the two suction tube bolts, 1, from the pump, 2.
2. Remove the four high pressure tube bolts, 3, from the pump, 2.
3. Loosen the hose clamp, 4, on the suction tube. This is to allow the suction tube to be rotated out of the way for pump removal.



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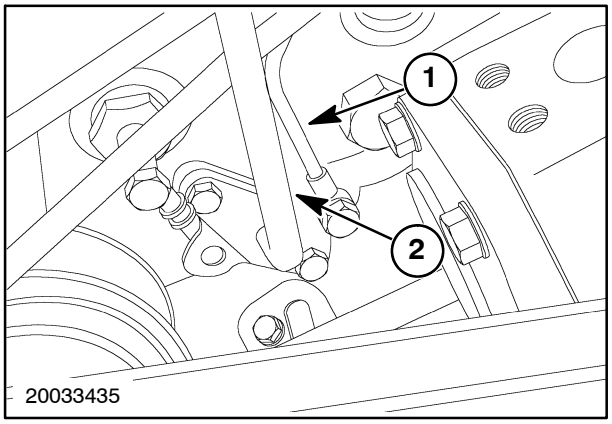
4. Remove the oil pressure line, 1.
5. Remove the turbocharger oil line, 2.



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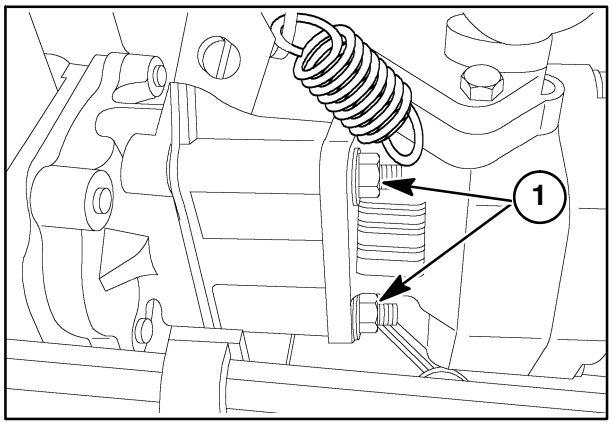
6. Remove the four pump mounting bolts and nuts, 1, securing the pump to the mounting flange.



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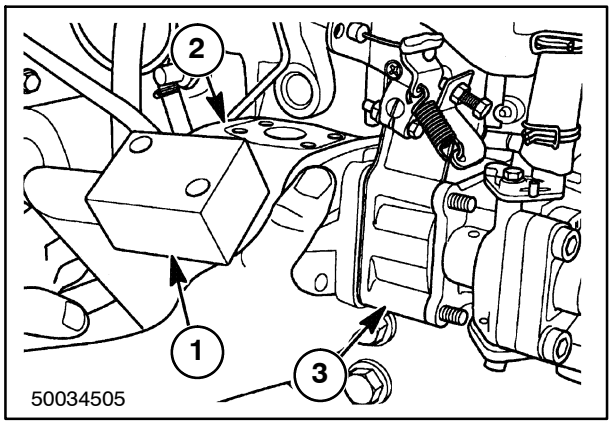
7. Carefully pull the suction tube, 1, out of the way while removing the pump, 2, from the front mounting flange, 3.



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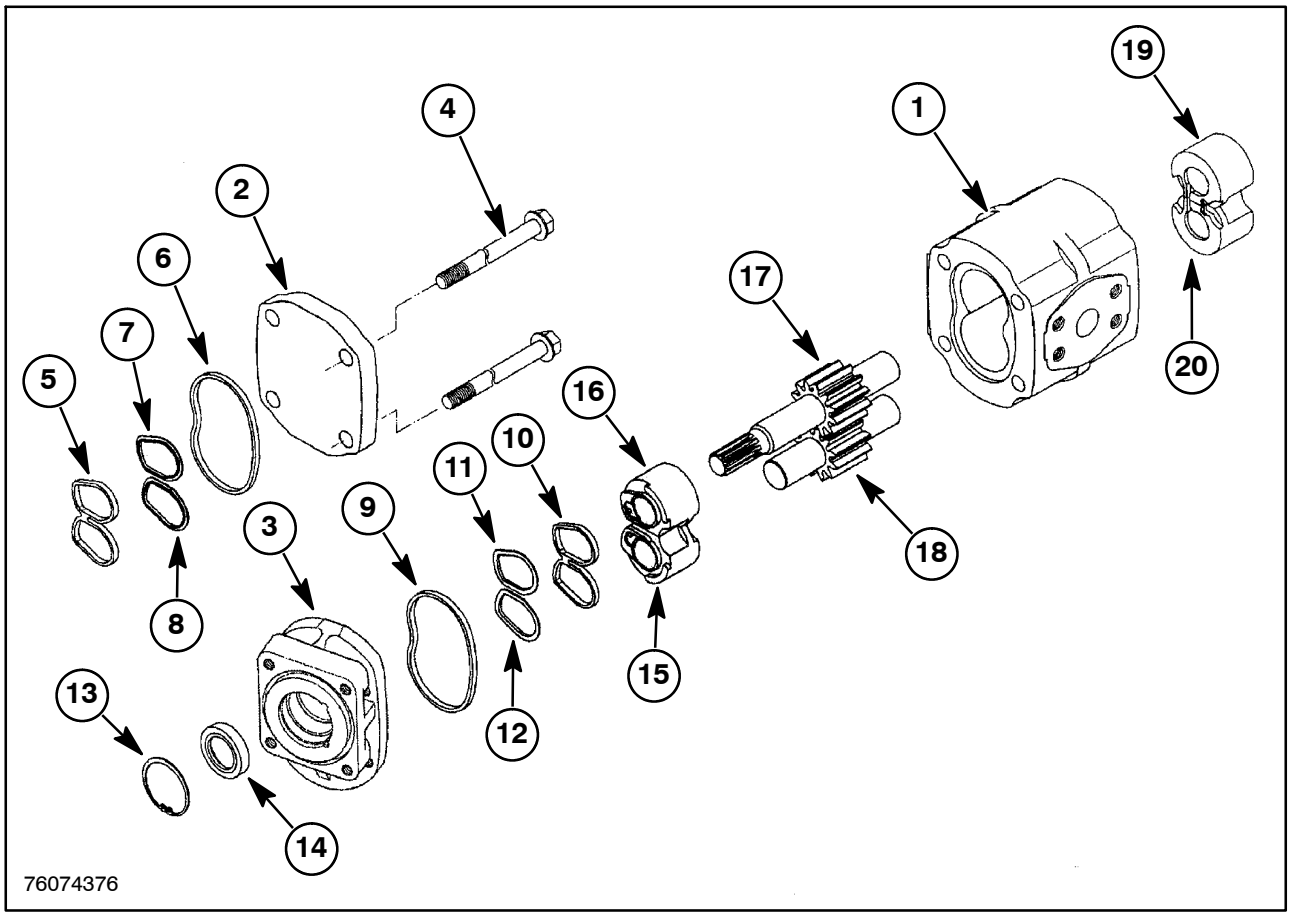

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Disassembly

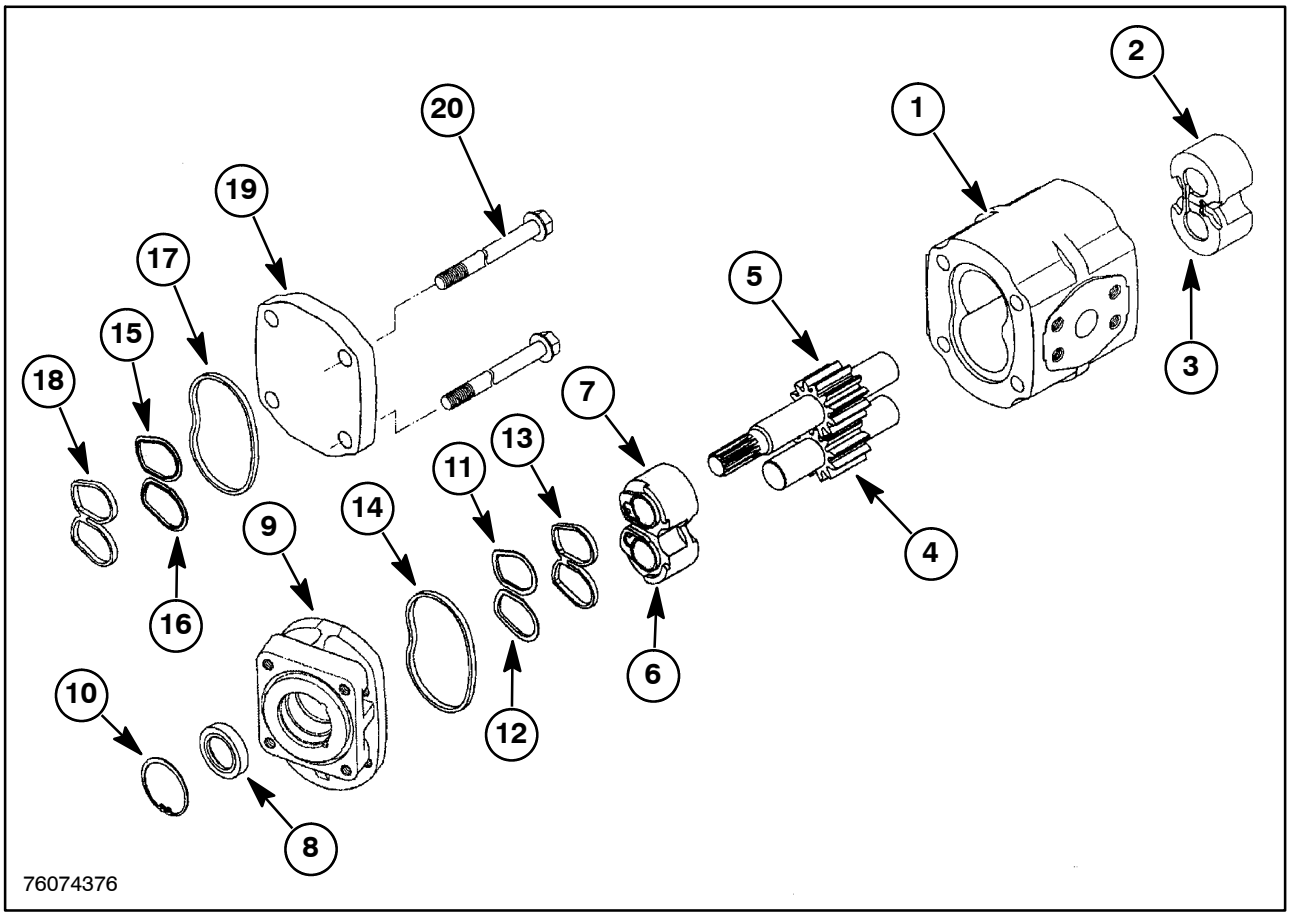
1. Place the oil pump body, 1, in a vise with soft jaws.
2. Scribe lines in the pump body, 1, and end covers, 2 and 3, for ease of assembly.
3. Remove the four bolts, 4, that secure the covers, 2 and 3, to the body.
4. Remove the rear cover, 2, from the pump body, 1.
5. Remove the rubber seals, 5 and 6, and the back up rings, 7 and 8.
6. Remove the pump body, 1, from the vise.
7. Remove the front cover, 3, from the pump body, 1.
8. Remove the rubber seals, 9 and 10, and the back up rings, 11 and 12.
9. Using snap ring pliers, remove the snap ring, 13.
10. Remove the shaft seal, 14, from the front cover, 3.

NOTE: *The front wear blocks, 15 and 16, will come out with the drive shaft, 17. Be sure to note the location of each wear block, as they are each different.*

11. Using a brass drift and hammer, tap the rear of the pump drive shaft, 17, and remove the drive shaft from the pump body.
12. Using a brass drift and hammer, tap the rear of the pump gear, 18, and remove the pump gear from the pump body, 1.
13. Using a brass drift and hammer, remove the rear wear blocks, 19 and 20, noting the orientation of each, for ease of assembly.

Inspection and Repair

1. Wash all parts in clean solvent and air dry.
2. Discard all seals and back up rings.
3. Inspect the gears, wear blocks, and pump bore for excess wear and scoring. If necessary, replace the pump.



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Assembly

1. Lubricate all parts during assembly with clean hydraulic fluid, and place the pump body, 1, on a level table.
2. Place the rear wear blocks, 2 and 3, into the pump body, 1. Be sure that the blocks are oriented correctly.
3. Install the pump gear, 4, into the pump body, 1.
4. Install the drive shaft, 5, in to the pump body, 1.
5. Place the front wear blocks, 6 and 7, into the pump body, 1. Again, be sure that the blocks are oriented correctly.
6. Using a seal driver, install a new shaft seal, 8, into the front cover, 9.
7. Install the snap ring, 10, into the end of the front cover, 9.
8. Install new back up rings, 11 and 12, and seal rings, 13 and 14.
9. Carefully place the front cover, 9, onto the pump body, 1, aligning the scribe marks made previously during disassembly.
10. Install new back up rings, 15 and 16, and seal rings, 17 and 18, into the rear of the pump body, 1.
11. Carefully place the rear cover, 19, onto the pump body, 1, aligning the scribe marks, made previously during disassembly.
12. Secure the covers, 9 and 19, to the pump body, 1, with the four bolts, 20. Torque the bolts to 22 - 28 N·m (16 - 20 ft-lbs).

Break-in Procedure

IMPORTANT: *Check the pump body and oil temperature while during the break–in period. If the temperature is too high or pump is noisy, stop immediately and inspect pump for possible causes.*

After the oil pump has been overhauled, it needs a trial run as follows:

1. Remove the plug from the diverter valve and install fitting #FNH07560 into the Power out (P) port. Connect a 0-207 bar (0-3000 PSI) pressure gauge #OEM1462 and hose 7/16″-20 PJIC x female quick connect x 16.25″ in length to the fitting.
2. Start the engine and operate at low idle (1000 RPM) while the control valve is in the neutral position, for approximately ten minutes.
3. Increase the engine speed to 2000 RPM and maintain these conditions for another ten minutes.
4. Read the oil pressure gauge and gradually increase the pressure at increments of 30 bar (435 PSI) by rotating the diverter valve counter clockwise. Allow engine to operate approximately five minutes between increases, as indicated on the chart below.

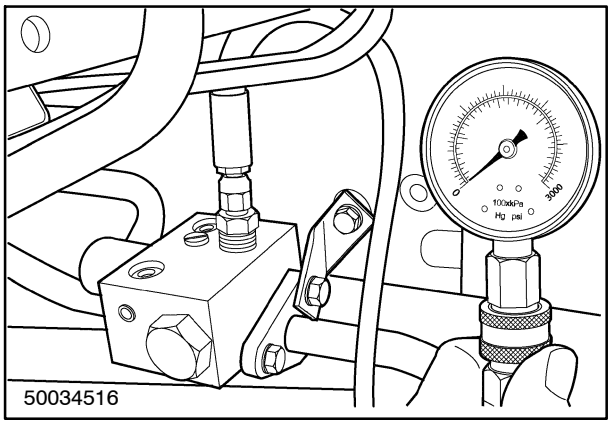
STEP	PRESSURE	ENGINE SPEED (RPM)	MINUTES
1	10 bar (145 PSI)	1000	10
2	10 bar (145 PSI)	2000	10
3	30 bar (435 PSI)	2000	5
4	60 bar (870 PSI)	2000	5
5	90 bar (1305 PSI)	2000	5
6	120 bar (1740 PSI)	2000	5
7	150 bar (2175 PSI)	2000	5

5. Move the diverter valve to the 10 o'clock position after 'the oil pump trial run.
6. If required, adjust the pressure by adding or removing shims from the relief valve. One shim, 0.3 mm (0.012″) in thickness, will change the pressure setting approximately 10.0 bar (145 PSI).

NOTE: *Shim kit SBA340293230 (EHSS Models) contains two 0.1 mm (0.004 in) shims.*

or

Shim kit SBA340293825 (SSS Models) contains three 0.3 mm (0.012 in), and three 0.1 mm (0.004 in) shims.



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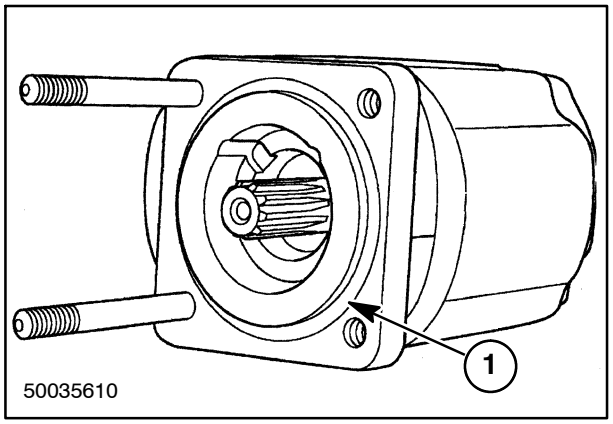
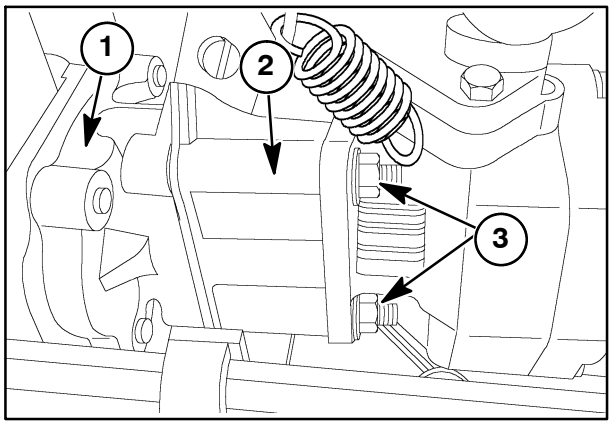
Installation

1. Scrape any remaining O-ring sealant material from the pump mounting flange. Apply a small amount of silicone sealer to the pump mounting flange.
2. Install a new O-ring, 1, on the front cover of the hydraulic pump.



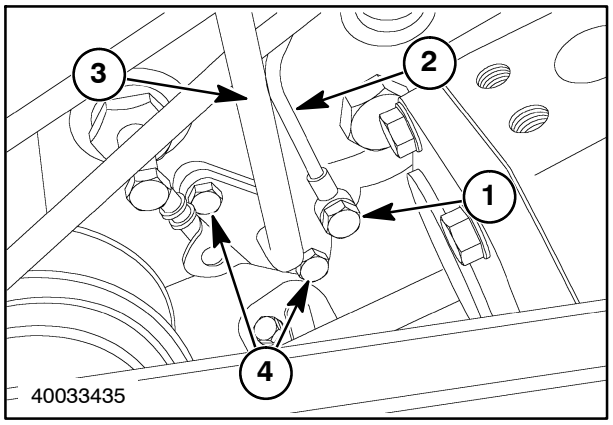
86

3. Carefully install the pump, 1, onto the pump mounting flange, 2, and secure it with the four nuts and bolts, 3.



87

4. Install the banjo bolt, 1, which secures the oil line, 2, to the engine block.
5. Install the turbocharger oil line, 3, with two bolts, 4.



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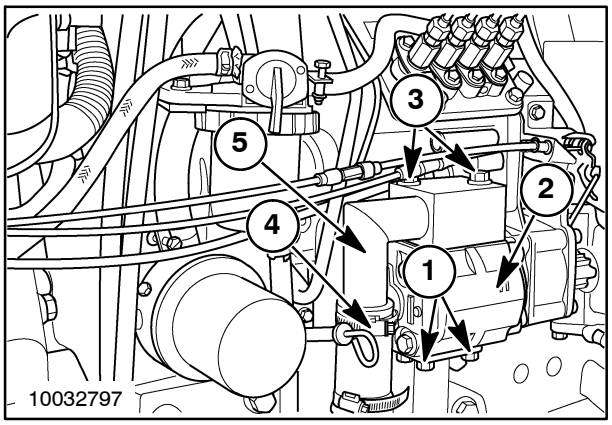
6. Use a new O-ring between the pump and the hydraulic tube and install the four bolts, 1, that secure the high pressure tube to the pump, 2.
7. Use a new O-ring between the pump and the hydraulic tube and install the two bolts, 3, that secure the suction tube to the pump, 2.
8. Tighten the hose clamp, 4, on the opposite end of the suction tube, 5.
9. Tighten all nuts and bolts at this time.



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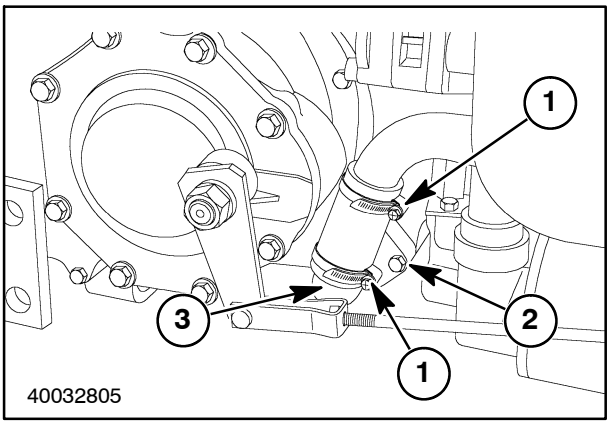
SUMP TUBE AND STRAINER

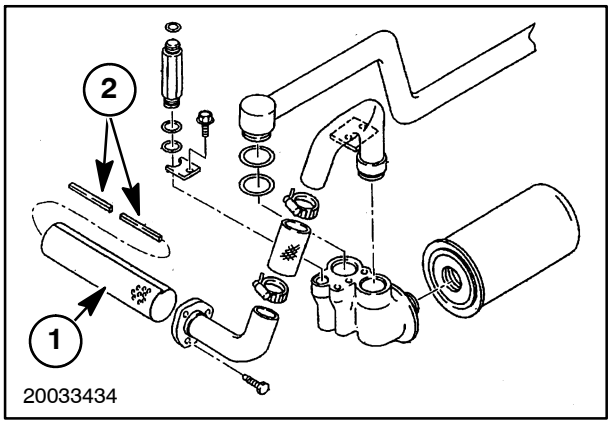
Removal

1. Drain the hydraulic fluid from the differential case into a suitable container.
2. Loosen the two hose clamps, 1, on the hose connecting the upper and lower sump hydraulic lines.
3. Remove the three bolts, 2, securing the lower part of the sump hydraulic line, 3, to the differential case. Remove the lower hydraulic line.



90

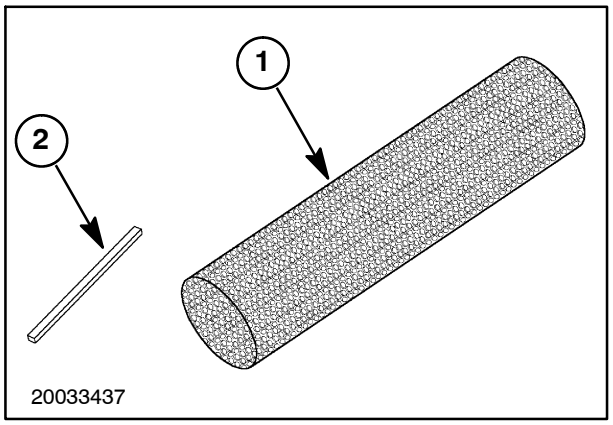
4. Remove the strainer, 1, and six magnets, 2, out of the differential case.



91

Inspection

1. Visually inspect the strainer, 1, and the six magnet bars, 2, for damage and/or excessive debris. Replace or clean with appropriate solvent as necessary.
2. If the screen filter and magnets are being reused, be sure that the filter and magnets are clean and dry before assembly.



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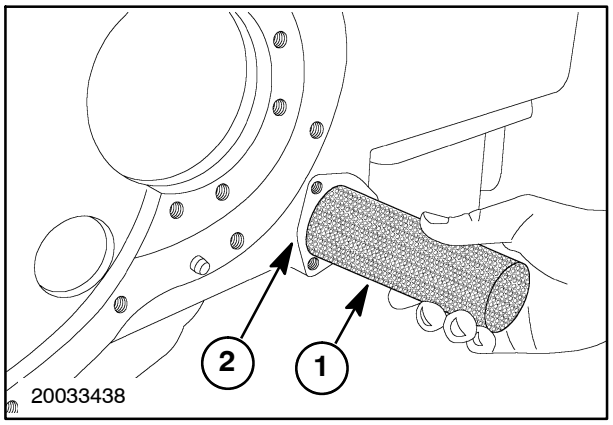
Assembly

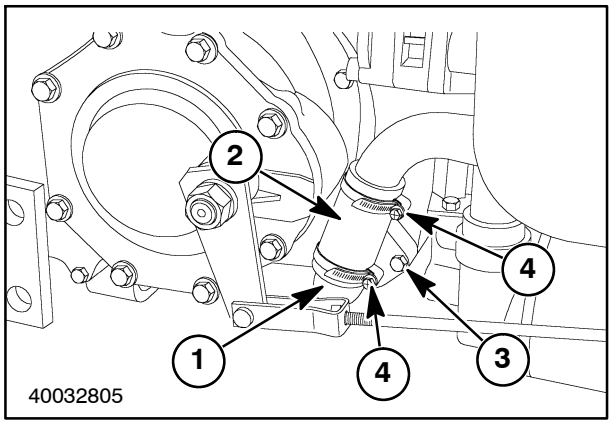
1. Install the magnet bars inside the metal screen filter.
2. Install the strainer, 1, in the housing.
3. Install a new gasket, 2, on the housing.

***NOTE**: Axle housing is removed for clarity. It is not necessary to remove the axle housing to service the screen filter.*



93

4. Install the lower sump hydraulic line, 1, into the connector hose, 2.
5. Position the lower sump hydraulic line, 1, against the housing aligning the bolt holes.
6. Install the three bolts, 3, securing the lower sump line to the housing.
7. Tighten hose clamps, 4, on the connector hose, 2.



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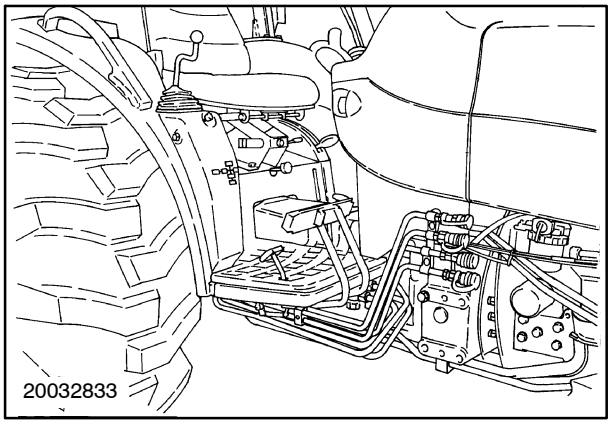
DESCRIPTION OF OPERATION - REMOTE VALVES

The T2410 and T2420 tractors can be equipped with a two spool, front remote valve with float, used primarily for hydraulic function control of the optional 18LA or 270TL loader. The front remote, valve assembly with controls is offered as a dealer installed accessory (DIA).



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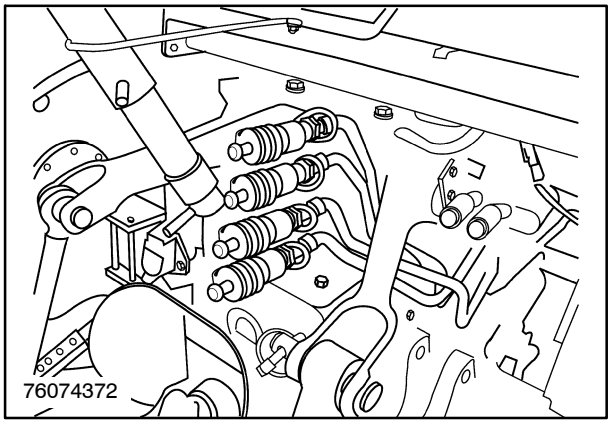
A rear remote option is offered as a dealer installed accessory. The rear remote option may be configured several different ways to accommodate a wide range of implements and attachments.

Two, single spool remote valves are offered.

- A single spool, three position, spring loaded detent valve is used for single and double acting cylinders. The three position valve is a self centering valve which operates within extend, retract and neutral positions. After releasing the control lever, the self centering valve springs return the spool to the neutral position, leaving the cylinder in the position selected by the operator.
- A single spool, four position, mechanical detent (with auto kick-out feature), and float capability is used for single and double acting cylinders. The four position valve operates within extend, retract, neutral and float positions. The four position remote valves with the auto kick-out contain a mechanical detent, which holds the control lever in the position selected by the operator (extend or retract). On double acting cylinder applications, the auto kick-out mechanism returns the control lever to the neutral position when the cylinder reaches the end of its travel in extend or retract. When pressure at the remote valve reaches the 140 - 145 bar (2030 - 2100 psi) range, the auto kick-out feature is activated. On single acting cylinders, the auto kick-out feature only works in the extend position.



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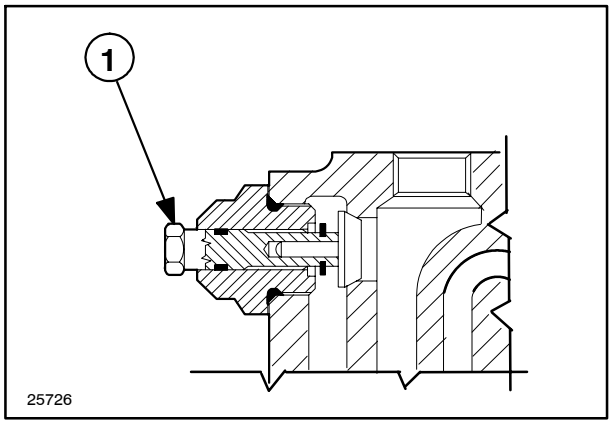
NOTE: *The four position valve is only available for #1 and #2 valves. #3 valve is only a three position valve.*

SWITCHING BETWEEN SINGLE AND DOUBLE ACTING CYLINDERS

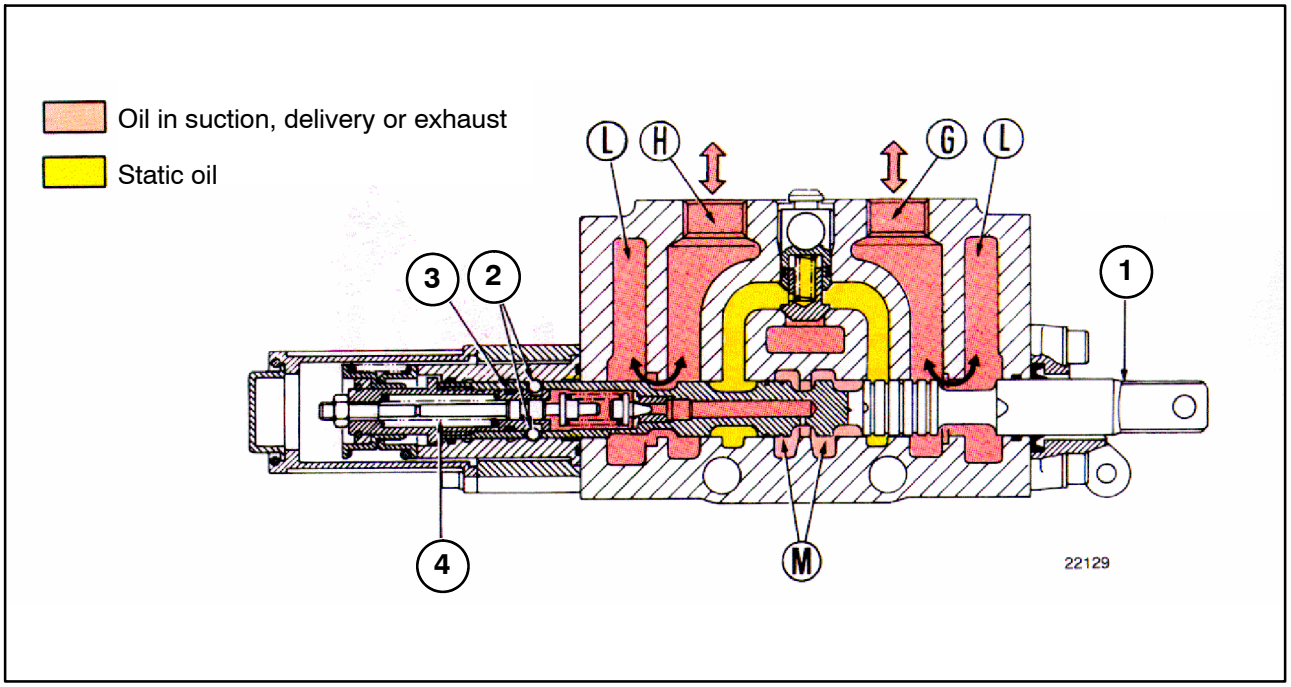
To switch a single acting cylinder to a double acting cylinder, tighten the switching valve adjustment screw, 1, completely. To switch a double acting cylinder to a single acting cylinder, unscrew the adjusting screw, 1.

NOTE: *The switching valve is on both detented and non-detented valves.*



97

REAR REMOTE FLUID FLOW DIAGRAMS

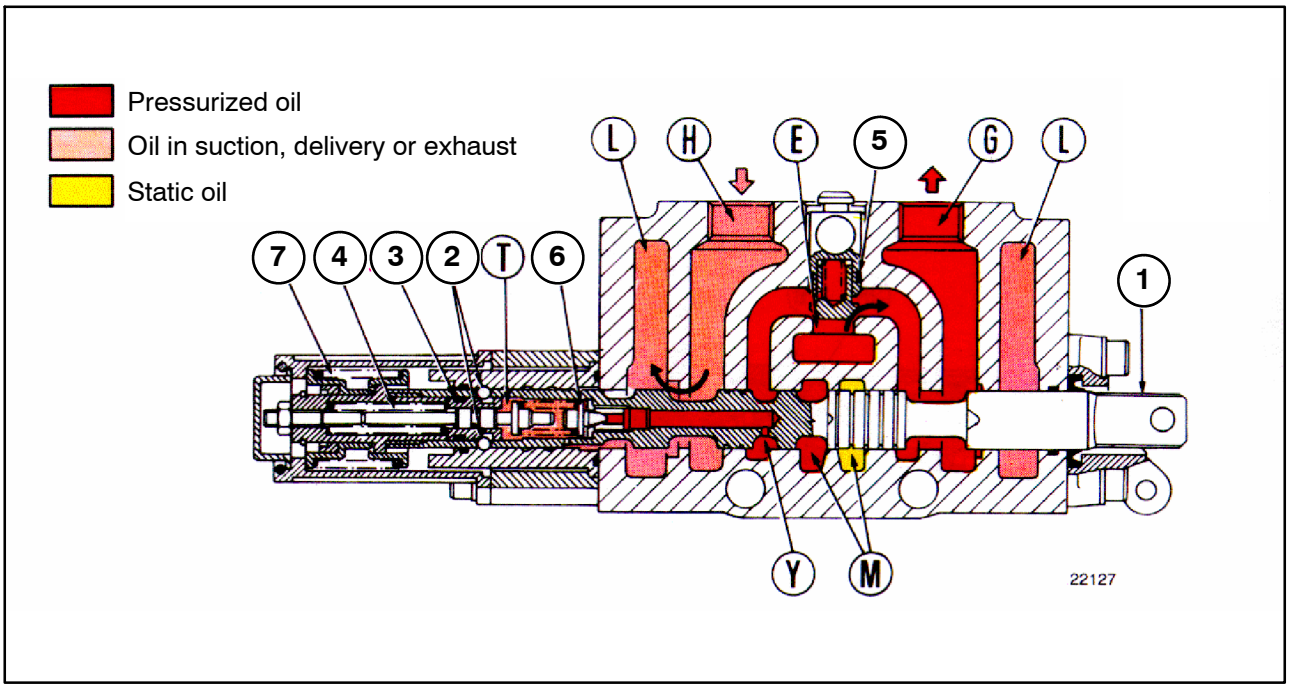


98

FOUR POSITION, SINGLE SPOOL REAR REMOTE VALVE WITH DETENT AUTO KICK-OUT AND FLOAT

Float

Movement of the control lever full forward transmits to the auxiliary control valve spool, 1, via mechanical linkage. As the control valve spool shifts, the detent balls, 2, engage right-hand grooves and lock in place by a support, 3, and spring, 4. The position of the spool allows all pump pressure to flow out port (M) to the lift control valve. In addition, ports (G & H) connect to ports (L), which allows oil to exhaust from the upper and lower chambers of the lift cylinder. In the float position the hydraulic lift will operate, however, the only force acting on the attached implement exists from the weight of the implement itself. Because the auxiliary valve contains no pressure in this position, the function of automatic detent release will not take place.

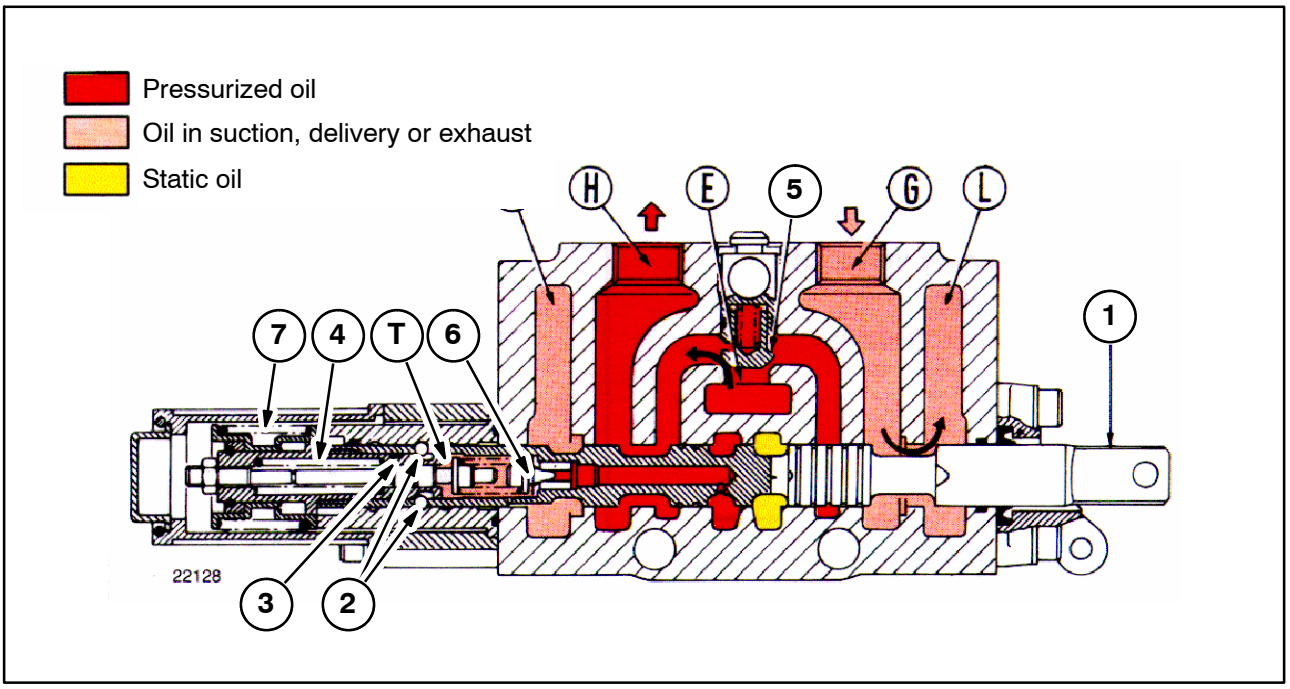


99

Lift

Movement of the control lever rearward transmits to the auxiliary control valve spool, 1, via mechanical linkage. As the control valve spool shifts, the detent balls, 2, engage left-hand grooves and lock in place by a support, 3, and spring, 4. The position of the spool allows oil from the upper chamber of the lift cylinder to enter port (H) and exhaust through port (L). The pressure in port (E) exits through port (G) by way of the check valve, 5, to the lower chamber of the lift cylinder.

When the lifting movement stops, oil pressure increases to 140 - 145 bar (2030 - 2100 psi) within chamber (Y) and overcomes the resistance of the needle valve, 6. Oil pressure increases inside chamber (T) and overcomes the resistance of the support, 3, and spring, 4. The support moves and the detent balls, 2, drop onto the support to release the spool. The spring, 7, returns the unlocked spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.



100

Lower

Movement of the control lever forward transmits to the auxiliary control valve spool, 1, via mechanical linkage. As the control valve spool shifts, the detent balls, 2, engage central grooves and lock in place by a support, 3, and spring, 4. The position of the spool allows oil from the lower chamber of the lift cylinder to enter port (G) and exhaust through port (L). The pressure in port (E) exits through port (H) by way of the check valve, 5, to the upper chamber of the lift cylinder.

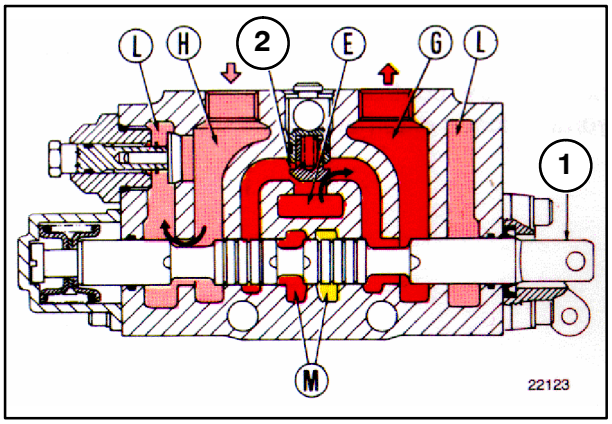
When the lowering movement stops, oil pressure increases to 140 - 145 bar (2030 - 2100 psi) within chamber (Y) and overcomes the resistance of the needle valve, 6. Oil pressure increases inside chamber (T) and overcomes the resistance of the support, 3, and spring, 4. The support moves and the detent balls, 2, drop onto the support to release the spool. The spring, 7, returns the unlocked spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.

DOUBLE-ACTING, THREE POSITION, SINGLE SPOOL REAR REMOTE VALVE (W/O KICK-OUT OR FLOAT)

Lift

Movement of the control lever rearward transmits to the auxiliary control valve spool, 1, via mechanical linkage. The position of the spool allows oil from the upper chamber of the lift cylinder to enter port (H) and exhaust through port (L). The pressure in port (E) exits through port (G) by way of the check valve, 2, to the lower chamber of the lift cylinder.

Keeping the control lever pulled back extends the cylinder through a full stroke. On releasing the lever, the spool return spring automatically returns the spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.

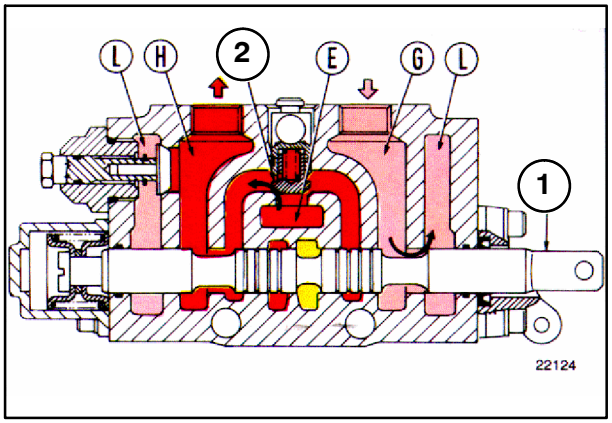


101

Lower

Movement of the control lever forward transmits to the auxiliary control valve spool, 1, via mechanical linkage. The position of the spool allows oil from the upper chamber of the lift cylinder to enter port (G) and exhaust through port (L). The pressure in port (E) exits through port (H) by way of the check valve, 2, to the upper chamber of the lift cylinder.

Keeping the control lever pushed forward retracts the cylinder through a full stroke. On releasing the lever, the spool return spring automatically returns the spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.



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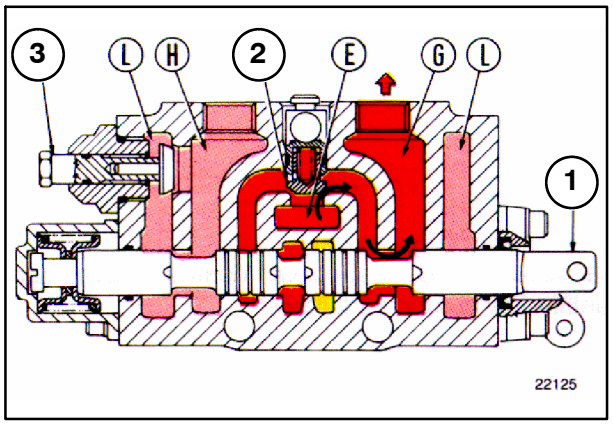
Pressurized oil

Oil in suction, delivery or exhaust

Static oil

SINGLE-ACTING, THREE POSITION, SINGLE SPOOL REAR REMOTE VALVE (W/O KICK-OUT OR FLOAT)

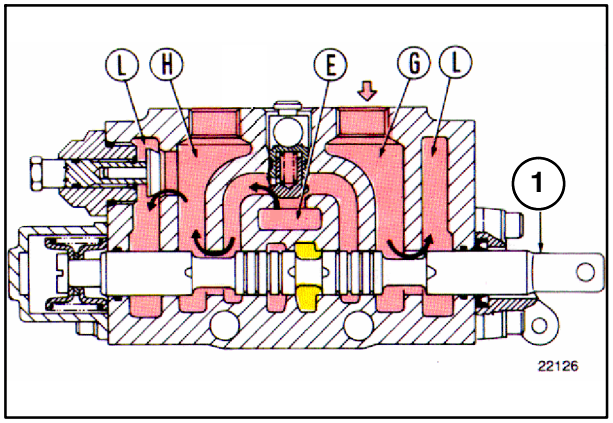


103

Lift

Movement of the control lever rearward transmits to the auxiliary control valve spool, 1, via mechanical linkage. The position of the spool allows oil pressure in port (E) to exit through port (G) by way of the check valve, 2, to the lift cylinder. In the single-acting actuator, exhaust port (H) permanently connects to port (L) by the open position of the switching valve, 3. The switching valve converts a single-acting actuator to a double-acting actuator when necessary.

Keeping the control lever pulled back extends the cylinder through a full stroke. On releasing the lever, the spool return spring automatically returns the spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.



104

Lower

Movement of the control lever forward transmits to the auxiliary control valve spool, 1, via mechanical linkage. The position of the spool allows oil pressure in ports (E), (G) and (H) to exit through ports (L). In the lowering position, the weight of the implement forces the oil through the control valve.

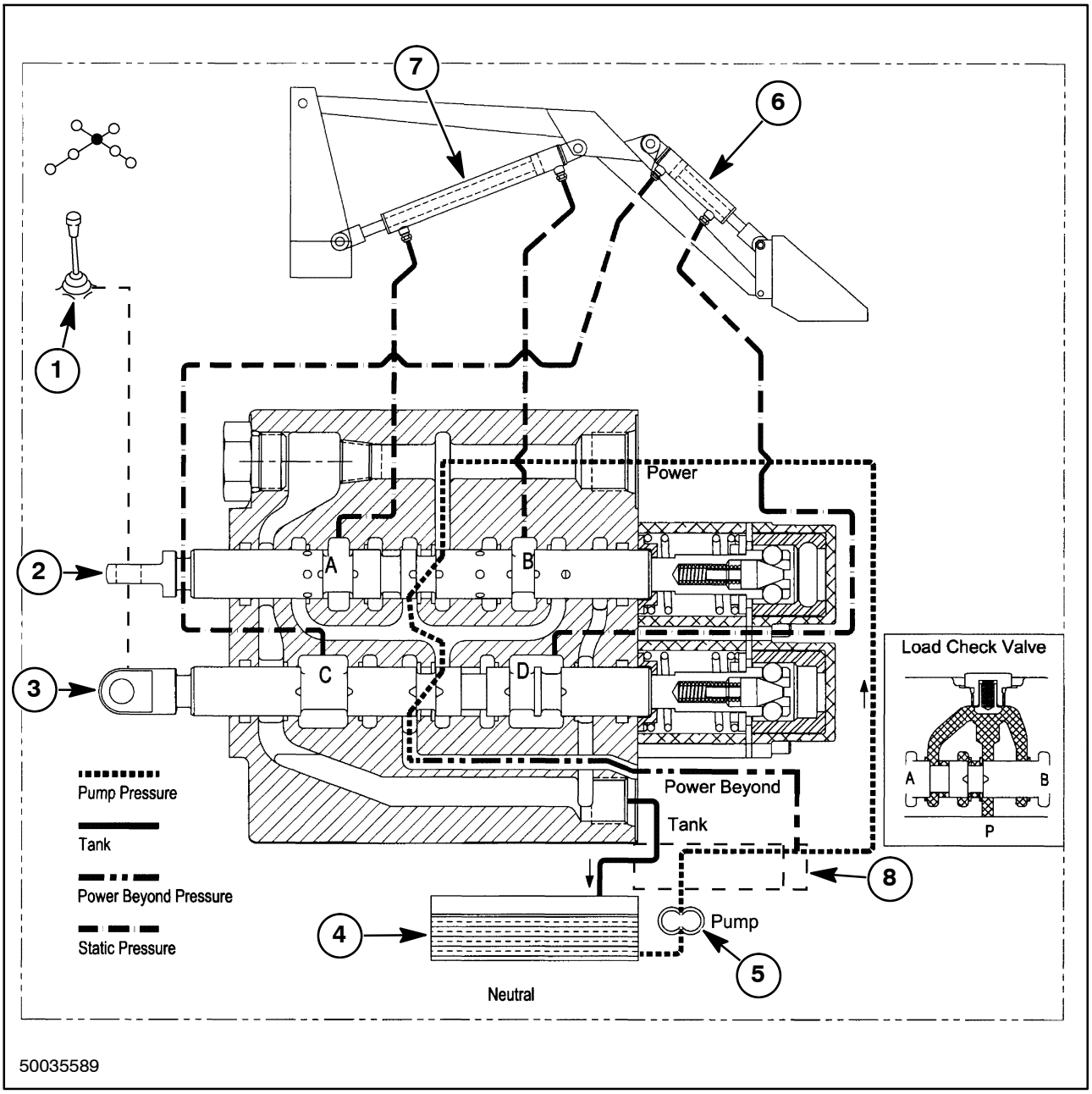
Keeping the control lever pulled back extends the cylinder through a full stroke. On releasing the lever, the spool return spring automatically returns the spool to the neutral position, which allows all oil from the pump to flow through port (M) and on to the lift control valve.

Pressurized oil

Oil in suction, delivery or exhaust

Static oil

FRONT REMOTE (TWO SPOOL) LOADER CONTROL VALVE FLUID FLOW DIAGRAMS



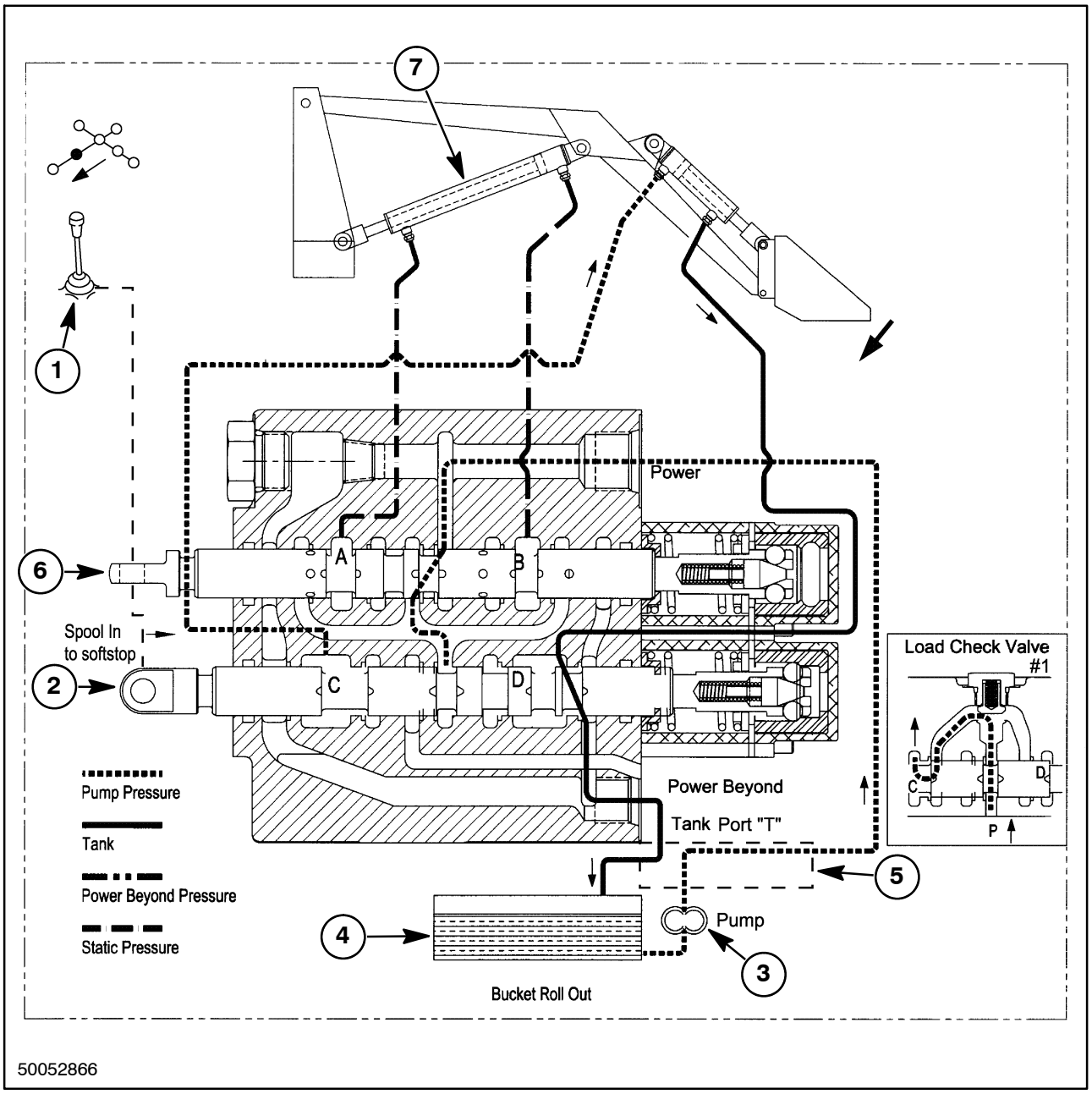
105

BUCKET CONTROL

Neutral/Lift Control - Neutral

When the control lever, 1, is in the neutral position, both control spools, 2 and 3, are centered in the valve body. Fluid is suctioned from the hydraulic reservoir, 4, by the hydraulic pump, 5, and is directed through the relief/diverter manifold, through port “P”, to the center of the two control spools. In this position, the spool lands block the work passages to the loader cylinders. Since there is no hydraulic fluid flowing through either spool, both check valves in the valve body remain closed. Fluid contained in the bucket control cylinders, 6, and lift control cylinders, 7, is trapped by the spools, keeping the cylinders in a fixed position.

When both spools are in the neutral position, the passages to the power beyond (PB) port are open and hydraulic fluid flows through the valve body to the relief/diverter manifold, 8, and then to the main hydraulic control valve. If the hydraulic fluid is not used by the main hydraulic system, it is returned to the hydraulic reservoir, 4.

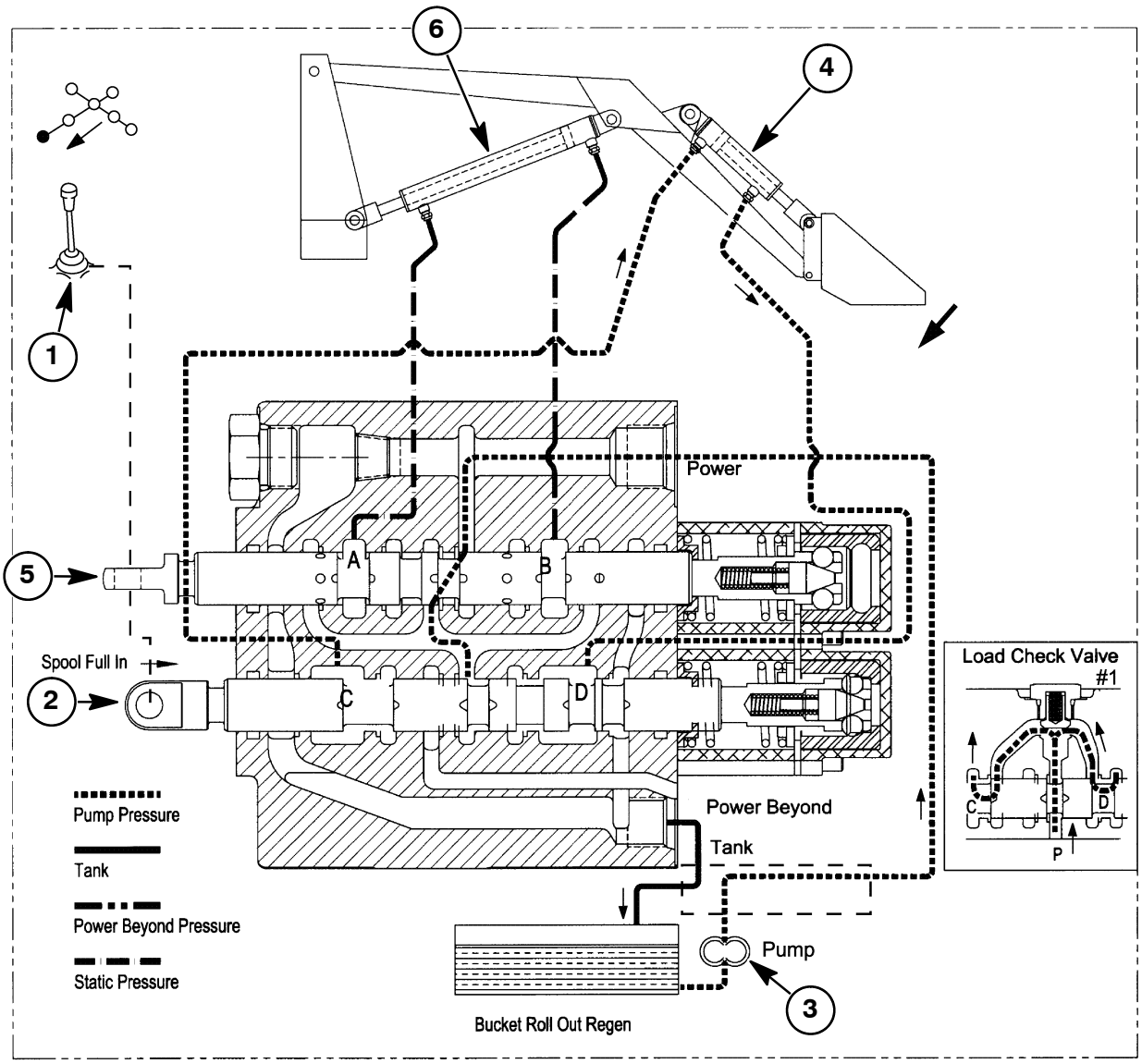


106

Bucket Control - Dumping/Lift Control - Neutral

When the control lever, 1, is moved to the dumping position, the bucket control spool, 2, is moved inward. Fluid flow from the hydraulic pump, 3, is directed into the valve body, opening check valve #1, to passage “C”. From passage “C”, fluid is directed to the piston side of the bucket cylinder, this pressurized oil will extend the bucket cylinder and allow the bucket to dump. Hydraulic fluid contained on the rod side of the bucket cylinder flows out of the cylinder, through passage “D”, and exits the valve body through the tank port, “T”. Hydraulic fluid is then returned to the hydraulic fluid reservoir, 4, through the relief/diverter valve manifold, 5.

Since the lift control spool, 6, remains in neutral, the lift control cylinders, 7, remain in a fixed position.



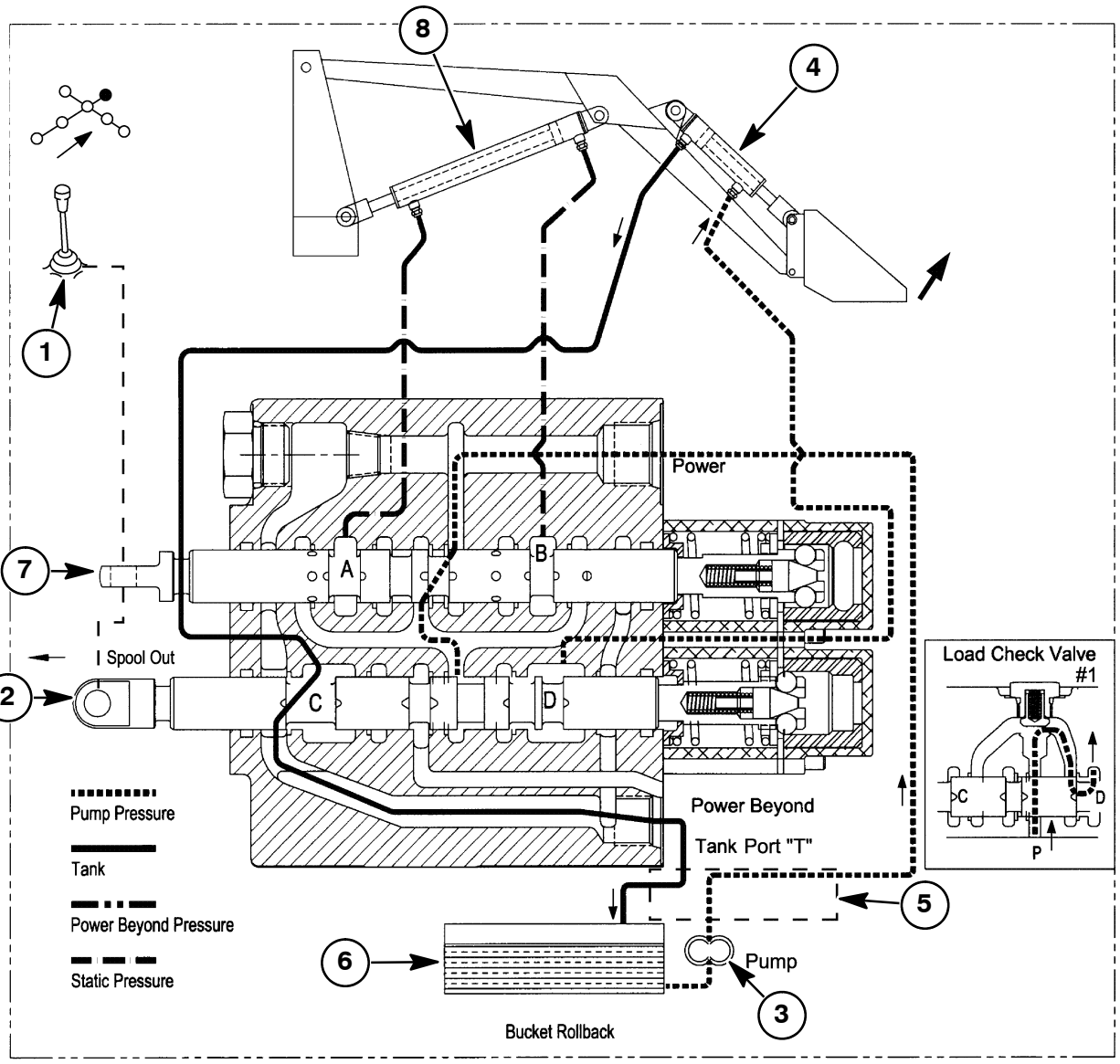
107

Bucket Control - Dumping Regen/Lift Control - Neutral

When the control lever, 1, is moved to the regen position, the bucket control spool, 2, is moved completely inward. Fluid flow from the hydraulic pump, 3, is directed to the bucket control spool through check valve #1, and to passage “C”. Hydraulic fluid is then directed to the piston side of the bucket control cylinder, 4. Hydraulic fluid on the rod side of the bucket cylinder flows through passage “D”, and to the “C” passage where it is combined with the hydraulic pump flow and directed to the piston side of the bucket cylinder. This allows faster bucket tipping action and prevents hydraulic fluid cavitation caused by heavier loads.

Since the lift control spool, 5, remains in neutral, the lift control cylinders, 6, remain in a fixed position.

***NOTE**: Regen position does not work for hydraulic motors or single acting cylinders.*

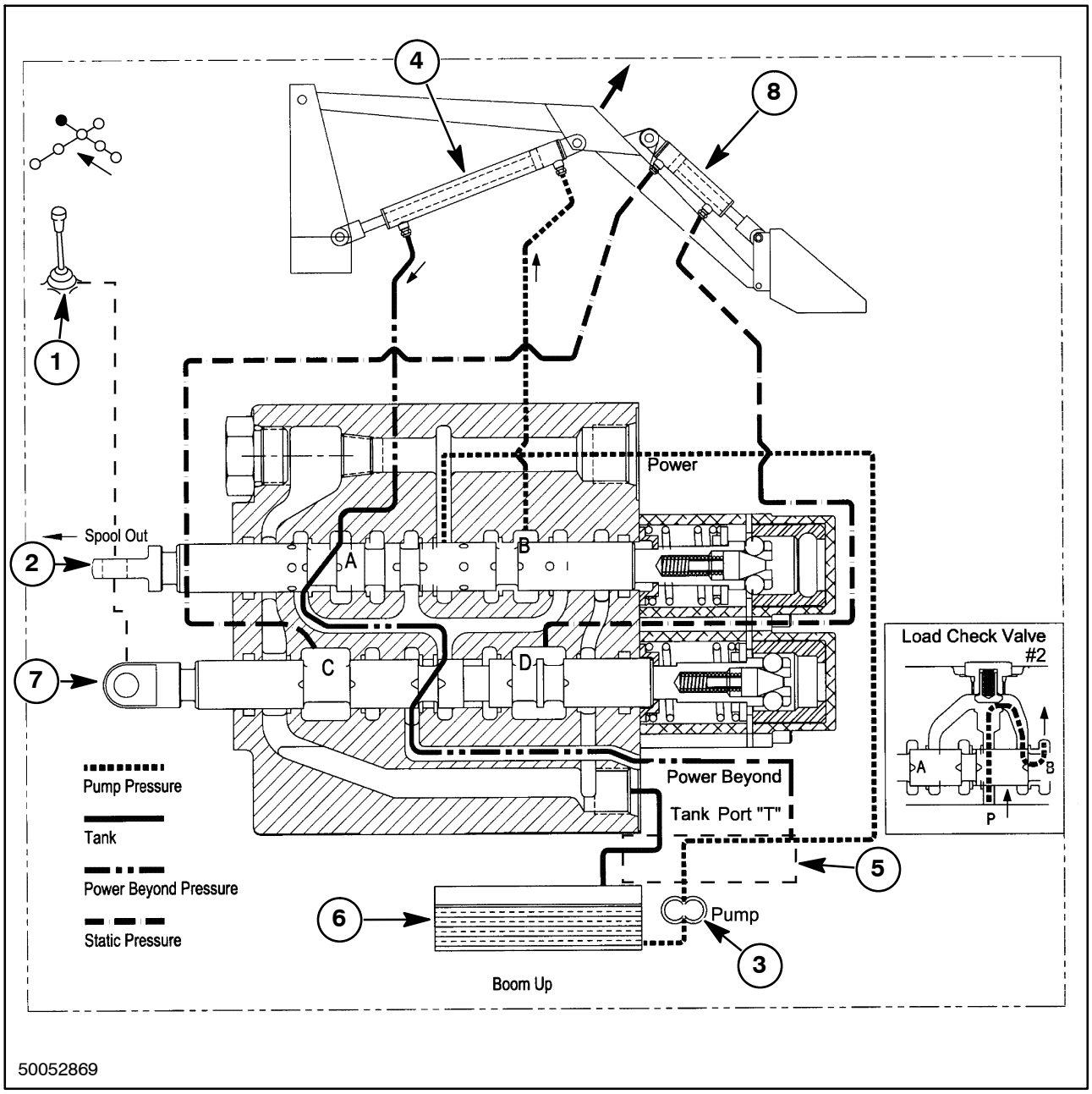


108

Bucket Control - Roll Back/Lift Control - Neutral

When the control lever, 1, is moved to the roll back position, the bucket control spool, 2, is moved outward. Fluid flow from the hydraulic pump, 3, is directed to the bucket control spool, through check valve #1, and to passage “D”. From there hydraulic fluid is directed to the rod side of the bucket control cylinder, 4. As the bucket is being rolled back, the fluid from the piston side of the bucket control cylinder flows through passage “C” and exits the valve at port “T”, back to the relief/diverter valve manifold, 5. Fluid is then returned to the hydraulic fluid reservoir, 6.

Since the lift control spool, 7, remains in neutral, the lift control cylinders, 8, remain in a fixed position.

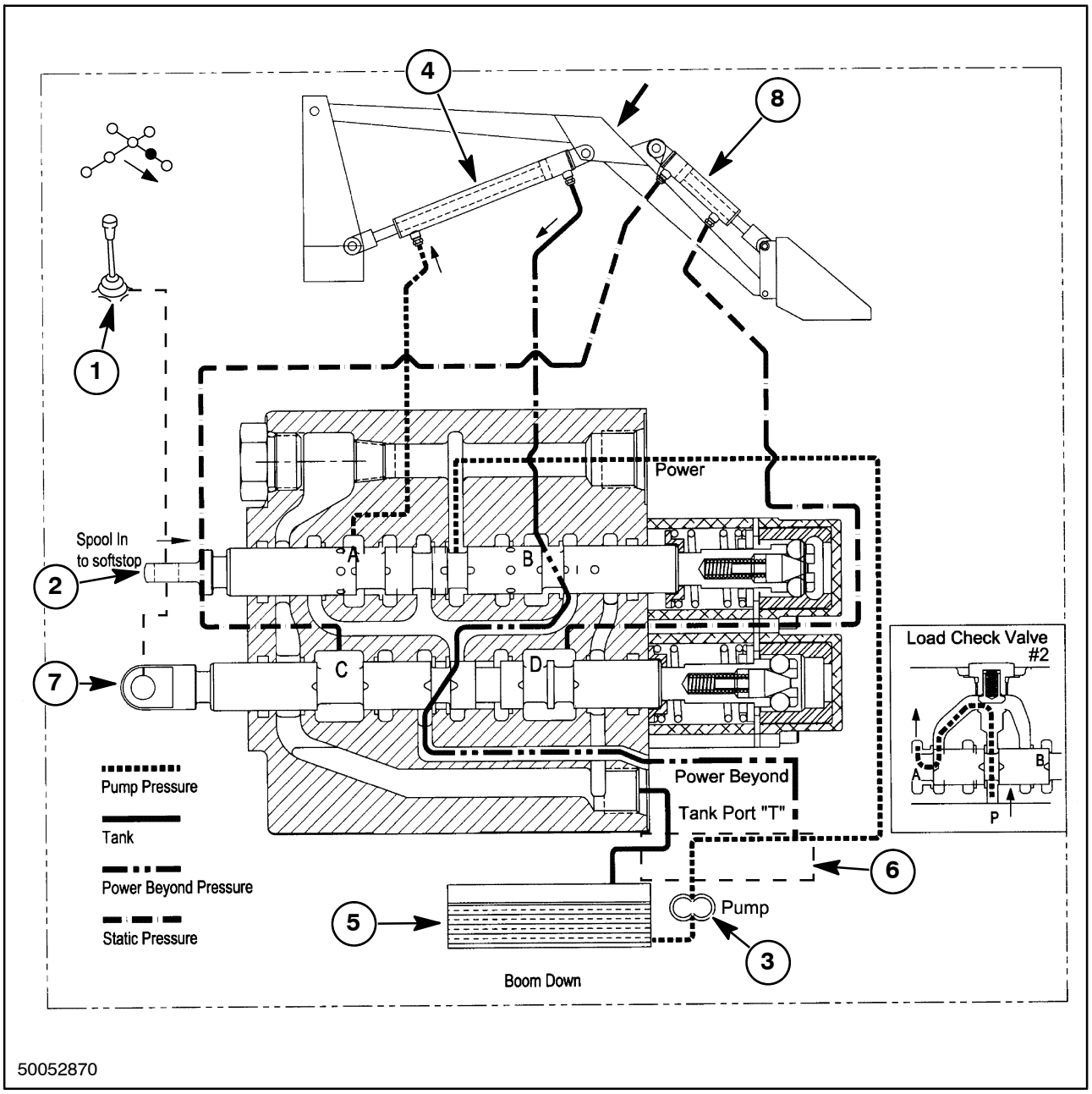


109

Bucket Control - Neutral/Lift Control - Raising

When the control lever, 1, is moved to the raising position, the lift control valve spool, 2, is moved outward. Fluid flows from the hydraulic pump, 3, opens check valve #2, and is directed through passage “B”. Fluid is then directed to the piston side of the lift control cylinder, 4. The hydraulic fluid on the rod side of the lift cylinder flows out of the cylinder to the “A” passage. The fluid then exits the valve body through the “T” port, to the relief/diverter manifold, 5, and then to the hydraulic fluid reservoir, 6. This allows the implement boom to raise.

Since the bucket control spool, 7, remains in the neutral position, the bucket control cylinder, 8, remains in a fixed position.

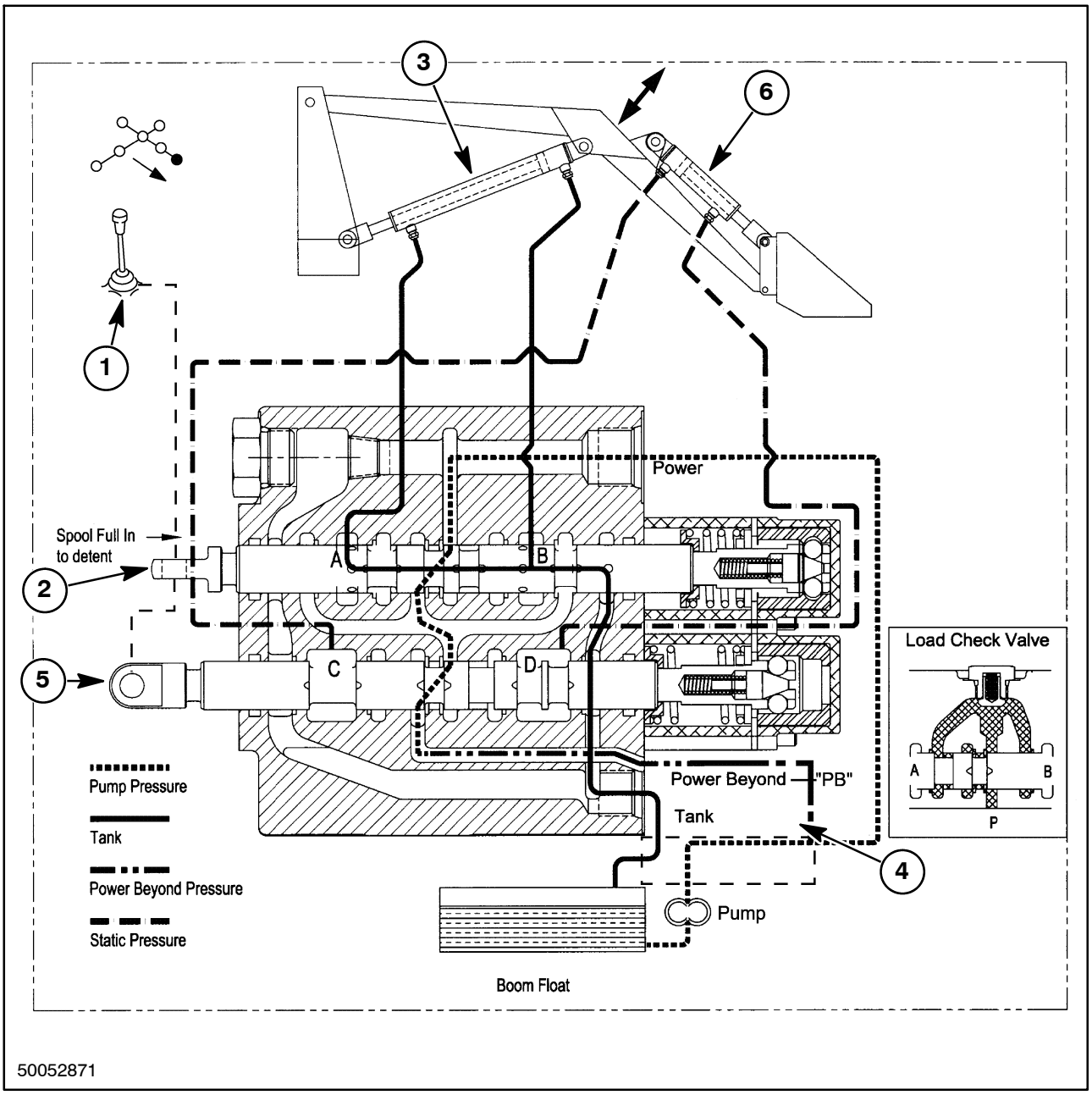


110

Bucket Control - Neutral/Lift Control - Lowering

When the control lever, 1, is moved to the lowering position, the lift control spool, 2, is moved inward. Fluid flow from the hydraulic pump, 3, opens check valve #2, and fluid flows through passage “A”, to the rod side of the lift control cylinder, 4. The hydraulic fluid on the piston side of the cylinder flows out of the cylinder, through passage “B”, and out of the valve body through port “T”. Fluid then returns to the hydraulic fluid reservoir, 5, through the relief/diverter manifold, 6. This action allows the implement boom to lower.

Since the bucket control spool, 7, remains in the neutral position, the bucket control cylinder, 8, remains in a fixed position.



111

Bucket Control - Neutral/Lift Control - Float

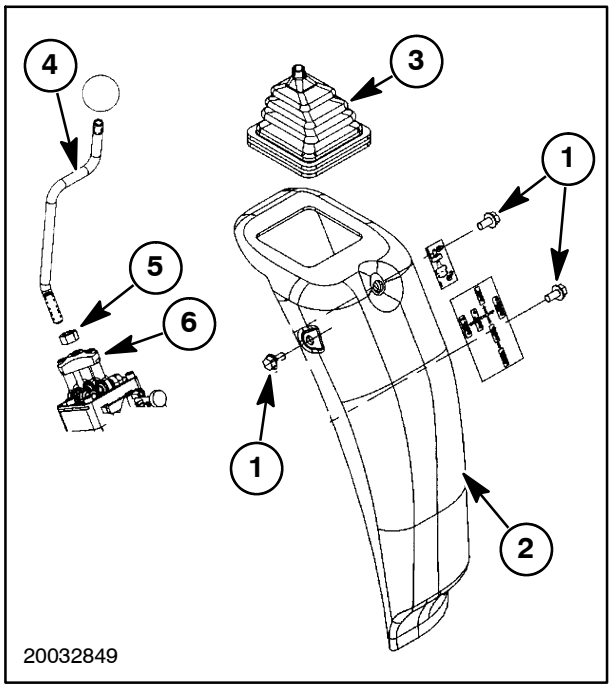
When the control lever, 1, is moved to the float position, the lift control spool, 2, is moved inward beyond the normal lowering position. In this position, passages “A” and “B” are interconnected, and fluid is free to move between the rod and piston sides of the lift control cylinder, 3. this allows the lift arms of the loader to move up and down as the loader bucket passes over uneven terrain. Hydraulic pump fluid pressure is directed out of the valve body through the power beyond (PB) port and to the relief/diverter manifold, 4, where it is then directed to the main hydraulic system.

Since the bucket control spool, 5, remains in the neutral position, the bucket control cylinder, 6, remains in a fixed position.

TWO SPOOL REMOTE VALVE

Removal

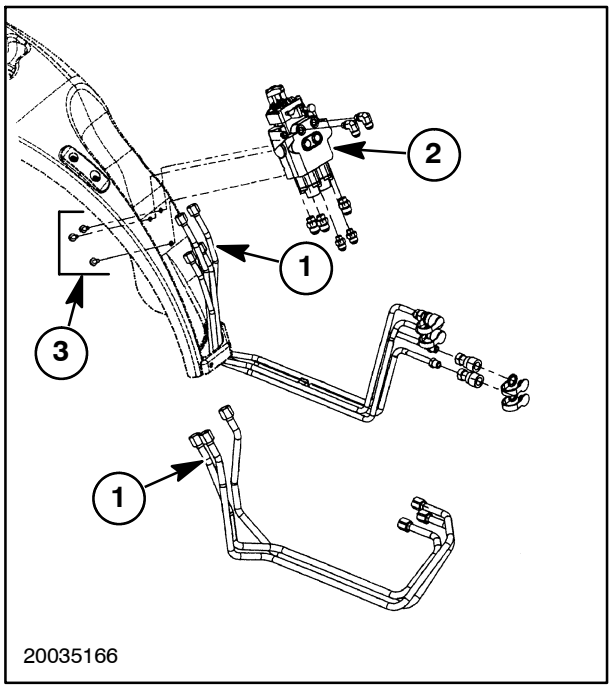
1. Remove the three bolts, 1, securing the control valve cover, 2, to the valve.
2. Slide the joystick boot, 3, towards the top of the joystick, 4.
3. Loosen the lock nut, 5, on the joystick, 4, and unscrew the joystick from the valve linkage, 6.
4. Remove the cover, 2.



112

IMPORTANT: *Before disconnecting or removing hydraulic lines from the control valve, label or mark each tube for proper re-assembly.*

5. Disconnect the hydraulic tubes, 1, from the control valve, 2. Cap and plug all openings. Remove the three bolts, 3, securing the valve, 2, to the fender. Remove the control valve.



113

Disassembly

1. Remove the three nuts, 1, that retain the joystick flange assembly to the control valve.
2. Remove the E clip, 2, that retains the lockout handle, 3, and spring, 4, in the clevis, 5.
3. Remove the cap screws, 6 and 7, which retain the clevis, 5, to the valve body.
4. Remove the float spool cap screws, 8, carefully pull the float spool end cap, 9, off of the valve body.

NOTE: *The valve spool detent balls, 10, are under pressure and may be expelled when the float detent sleeve, 11, is removed. Use a rag to catch the detent balls as the sleeve is being removed to avoid losing the detent balls.*

5. Carefully remove the float detent sleeve, 11, until the detent balls, 10, snap free.
6. Remove the poppet, 12, detent spring, 13, retainer, 14, and spacer, 15.

NOTE: *Be sure to make note of which valve spool bore each valve spool is removed from, as the float and regen spools are not interchangeable within the spool bores.*

7. Gently remove the float spool, 16, with the stop cup, 17, spring, 18, washer, 19, and detent retainer, 20, from the valve body. Remove O-ring, 21, on retainer, 20.
8. Remove the regen spool, 22, in the same manner as described for the float spool in steps 4 through 7.
9. Remove plugs, 23 and 24, from the valve body.
10. Remove each check plug, 25, spring, 26, and load check poppet, 27, from the check valve ports.

Inspection

1. Remove and discard all O-rings from the valve plugs and spool orifices in the valve body.
2. Inspect the valve spools and spool bores for pitting, scratches, or excess wear. If found to be defective, replace the remote control valve assembly.
3. Check that the float spool and regen spool move freely within their respective bores. If found to be defective, replace the remote control valve assembly.
4. Inspect all springs for distortion. Replace if found to be defective.

Assembly

1. Lightly lubricate and replace all O-rings on valve plugs and spool orifices.
2. Install each load check poppet, 27, spring, 26, and check plug, 25, into the load check ports. Torque the check plugs to 27 - 34 N·m (20 - 25 ft-lbs).
3. Install plugs, 23 and 24, into the valve body. Torque the plugs to 27 - 34 N·m (20 - 25 ft-lbs).
4. If the detent retainer, 20, washer, 19, spring, 18, and stop cup, 17, were removed from either spool, reassemble parts onto spool and torque to 7 - 10 N·m (5 - 7 ft-lbs).
5. Carefully install the regen spool, 22, into the spool's respective bore in the valve body.
6. Install the spacer, 15, and retainer, 14, over the spool assembly.

NOTE: *The float detent sleeve, 11, has a groove on the inside bore, the regen detent sleeve, 28, does not.*

7. Using a punch or other suitable device, compress the spring, 13, and poppet, 12, into the detent retainer, 20. Install the detent balls, 10, and regen detent sleeve, 28, over the detent retainer, 20.
8. Install the end cap, 9, onto the regen spool assembly. Secure the cap with cap screws, 8. Torque the cap screws to 11 - 15 N·m (8 - 11 ft-lbs).
9. Install the float spool assembly into the valve body following assembly steps 6 - 9.
10. Install the clevis, 5, onto the valve body and secure with cap screws, 7 and 6. Torque the cap screws to 11 - 15 N·m (8 - 11 ft-lbs).
11. Install the lockout handle, 3, and spring, 4, into the clevis, 5, and secure with E-clip, 2.
12. Install the joystick flange assembly onto control valve. Apply LocTite 680 to the threads of the rod end assembly, 29, and to the spool stud, 30. Secure with the three nuts, 1, and torque to 10 N·m (7 ft-lbs).

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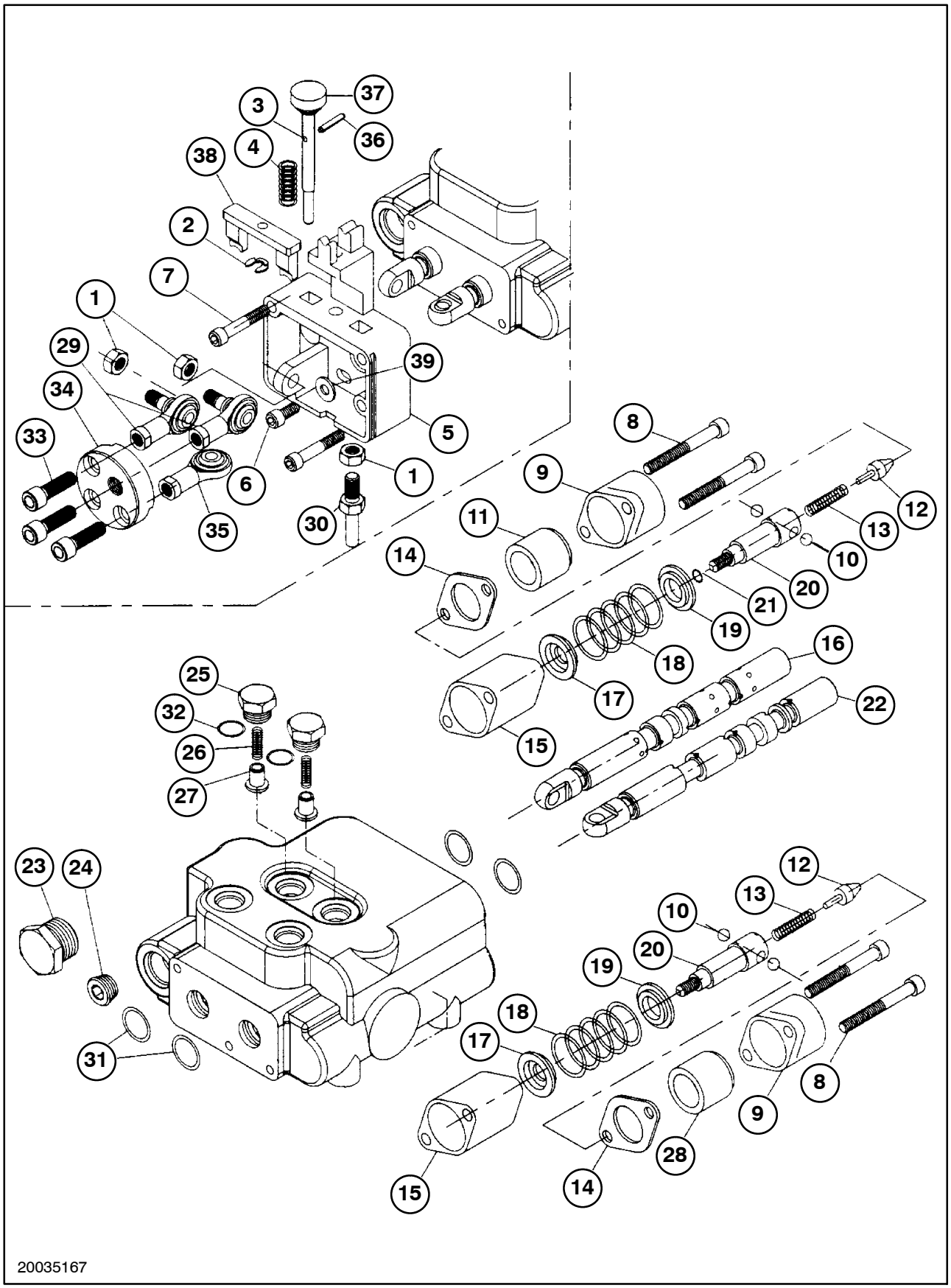
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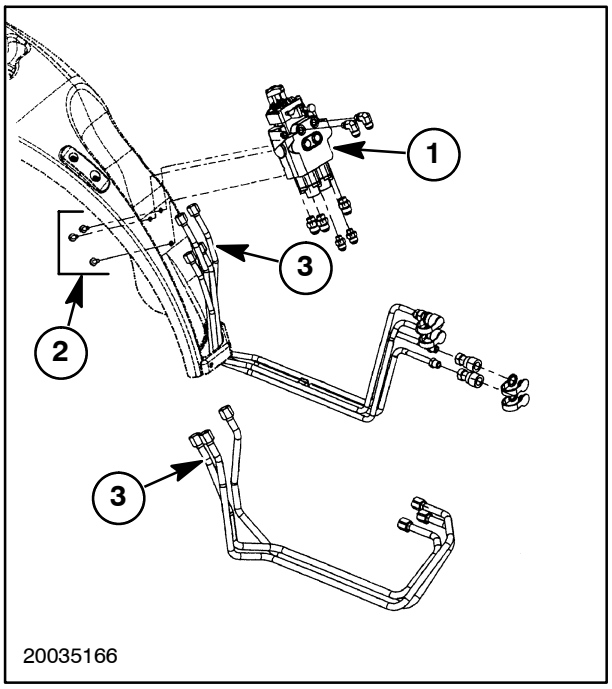
114

1. Nut 5/16″ - N. F.
2. E-Clip
3. Lockout Handle
4. Clevis Spring
5. Clevis
6. Cap Screw, Socket Head 1/4″ x 3/4″ NC
7. Cap Screw, Socket Head 1/4″ x 1-3/4″ NC
8. Cap Screw, Socket Head 1/4″ x 2″ NC
9. End Cap
10. Detent Balls
11. Float Sleeve
12. Poppet
13. Detent Spring
14. Retainer
15. Spacer
16. Float Spool
17. Stop Cup
18. Spring
19. Washer
20. Detent Retainer
21. O-Ring
22. Regen Spool
23. Plug
24. Pipe Plug
25. Check Plug
26. Spring
27. Load Check Poppet
28. Regen Sleeve
29. Rod End Assembly
30. Spool Stud
31. O-Ring
32. O-Ring
33. Cap Screw, Socket Head 5/16″ x 3/4″ - N. F.
34. Flange
35. Rod End
36. Roll Pin
37. Knob
38. Lock
39. Washer

Installation

1. Install the control valve, 1, onto the right fender using three M8 x 16 bolts, 2. Do not tighten bolts at this time.
2. Connect the hydraulic lines, 3, to the control valve, 1, using reference marks made earlier for proper assembly.
3. Tighten the hydraulic line fittings securely. Do not over tighten the tube fittings.
4. Tighten the three bolts, 2, securing the control valve to the fender.



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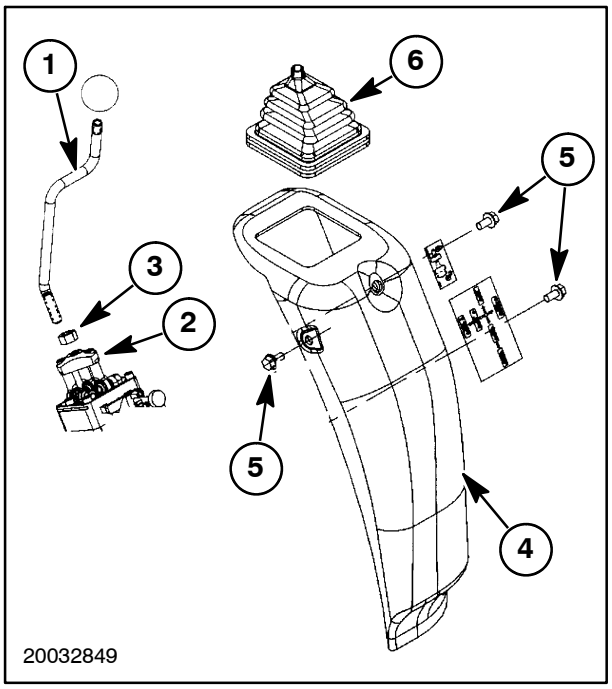
5. Install the joystick, 1, onto the control valve linkage, 2.
6. With joystick positioned properly, tighten the lock nut, 3, against the linkage, 2.
7. Install the control valve cover, 4, over the control valve and secure with the three bolts, 5. Tighten bolts securely.
8. Install the joystick boot, 6, into position if removed during disassembly.



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OVERHAUL - REAR REMOTE VALVE

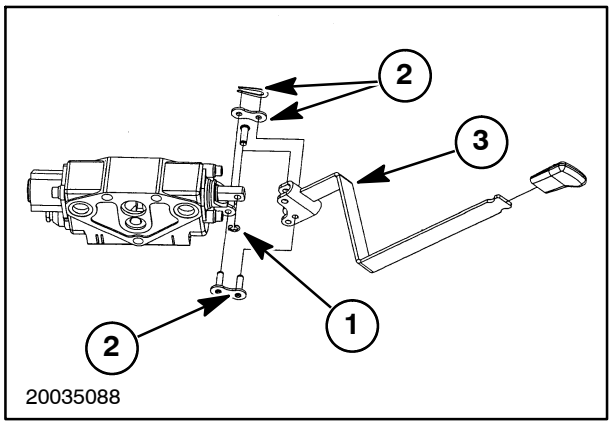
REAR REMOTE (THREE POSITION, SINGLE SPOOL) (NON-DETENT)

(Valve Stack Position #1)

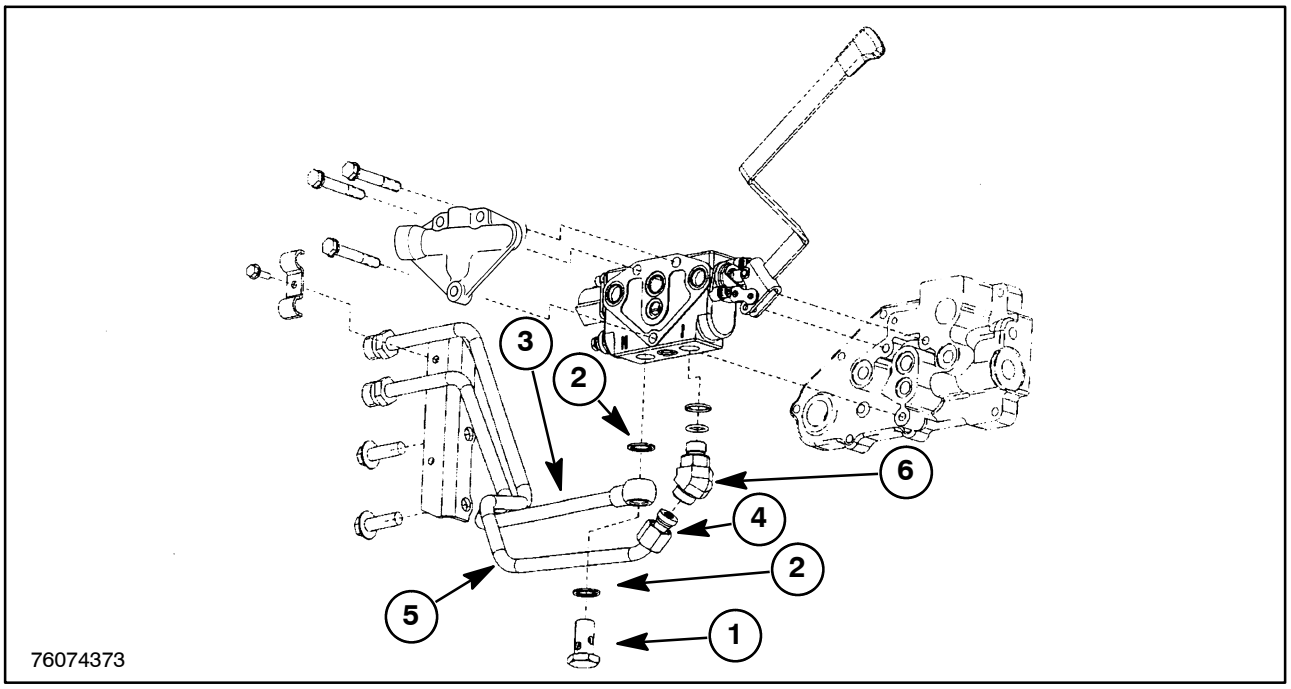
Removal

***NOTE**: If valve in position #1 is used with valves in the #2 and/or #3 position, see removal for #2 and/or #3 before removing valve in position #1.*

1. Thoroughly clean the area around the remote valve before removal.
2. Remove the E-clip, 1, and spring stop lock, 2, from the lever assembly, 3.
3. Disconnect the lever assembly, 3, from the valve spool and body.



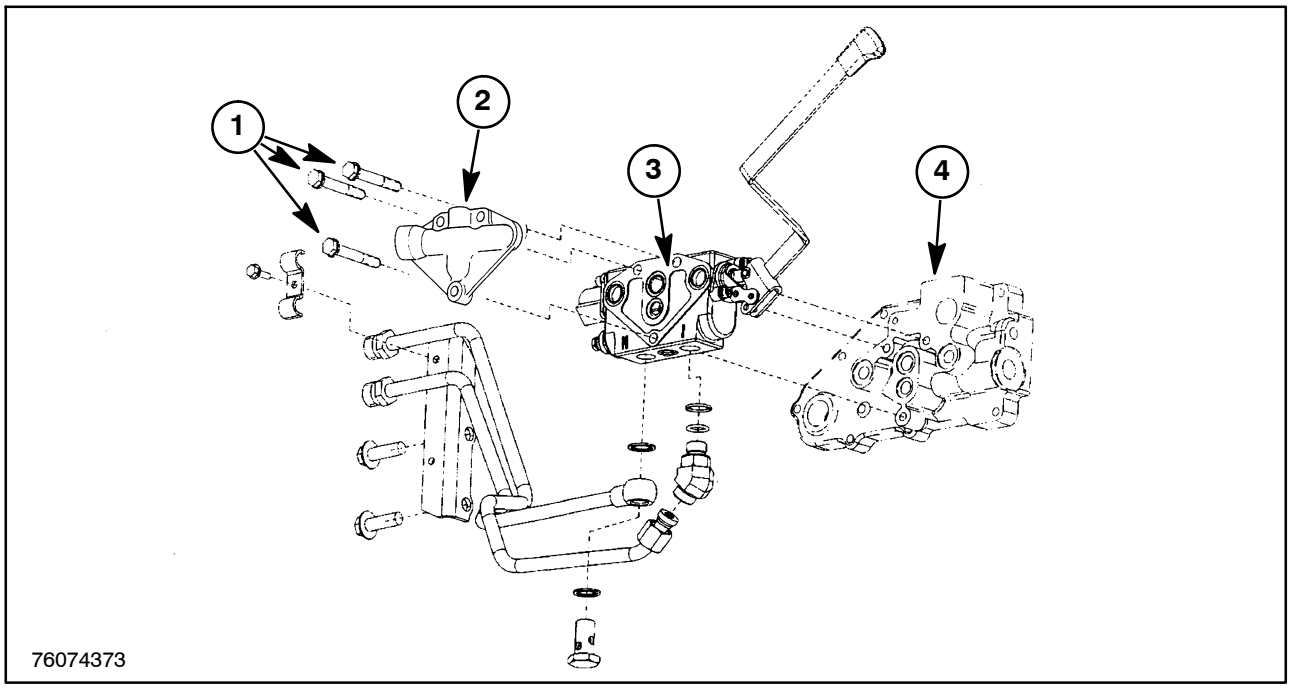
117



118

***NOTE**: Control lever shown for clarity only. Lever removed in prior steps.*

4. Loosen and remove banjo bolt, 1, and washers, 2, from rear remote tube, 3. Disconnect tube from valve body.
5. Loosen tube fitting, 4, and disconnect tube, 5, from 45° fitting, 6.



119

6. With control lever and remote tubes disconnected from valve body, loosen and remove three retaining bolts, 1, from cover, 2, and valve, 3.

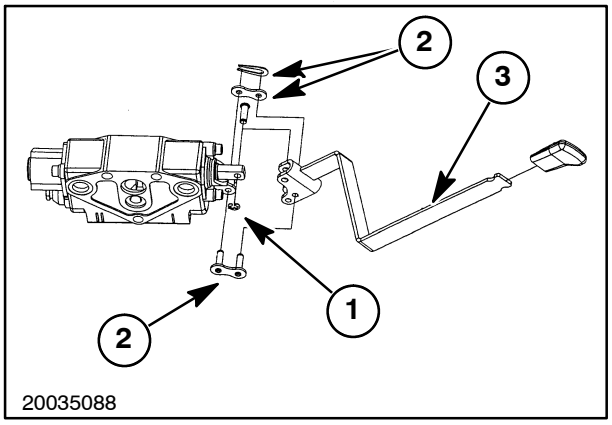
***IMPORTANT**: When separating control valve from lift cover, be very careful not to lose O-rings and backing rings from the three main ports on the valve.*

7. Carefully remove valve, 3, from lift cover housing, 4.

(Valve Stack Position #2)

***NOTE**: If valve in position #2 is used with valve in the #3 position, see removal for #3 before removing valve in position #2.*

1. Thoroughly clean the area around the remote valve before removal.
2. Remove the E-clip, 1, and spring stop lock, 2, from the lever assembly, 3.
3. Disconnect the lever assembly, 3, from the valve spool and body.



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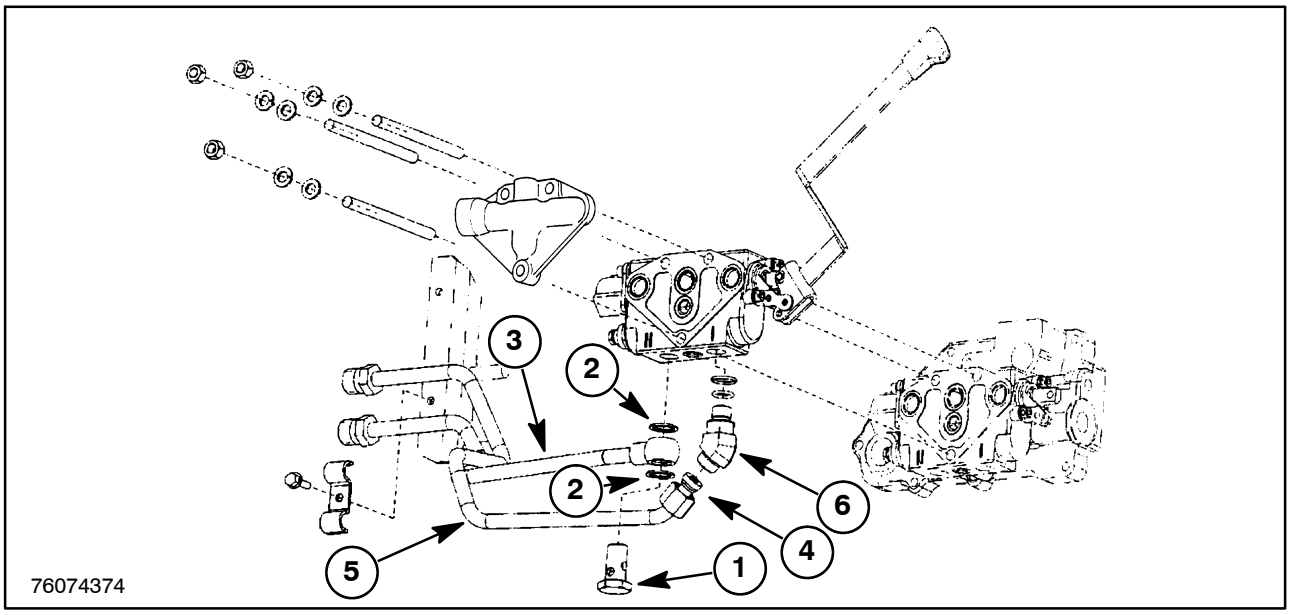
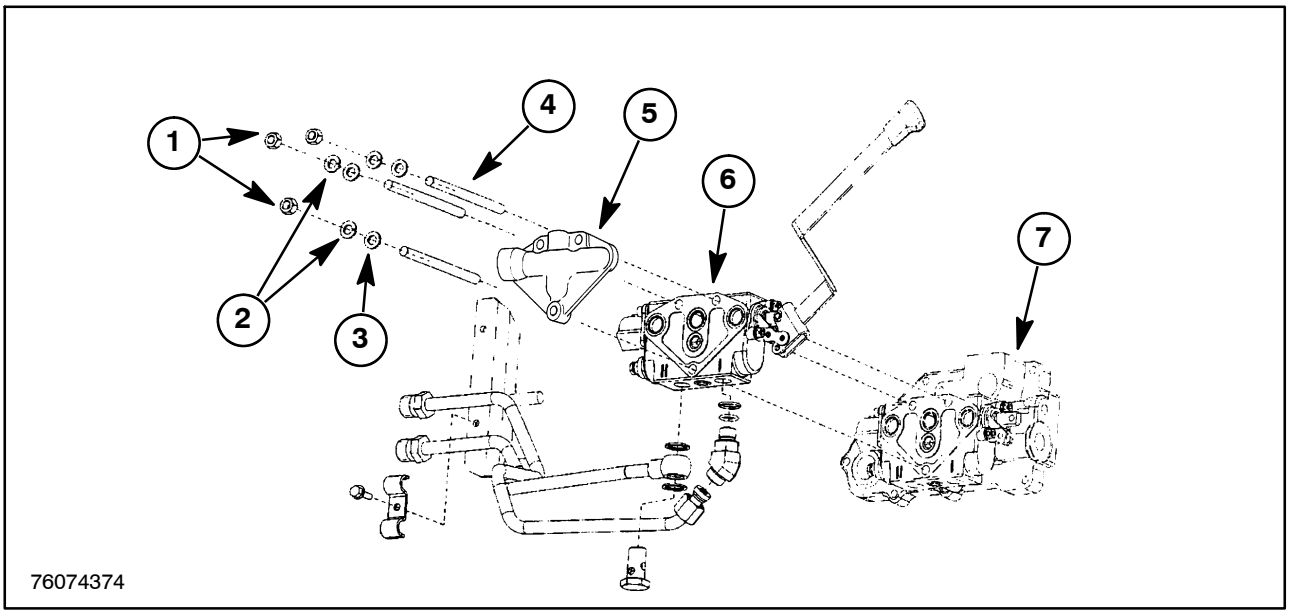


121

***NOTE**: Control lever shown for clarity only. Lever removed in prior steps.*

4. Loosen and remove banjo bolt, 1, and washers, 2, from rear remote tube, 3. Disconnect tube from valve body.
5. Loosen tube fitting, 4, and disconnect tube, 5, from 45° fitting, 6.



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6. With control lever and remote tubes disconnected from valve body, loosen and remove three retaining nuts, 1, lock washers, 2, and flat washers, 3, from studs, 4.

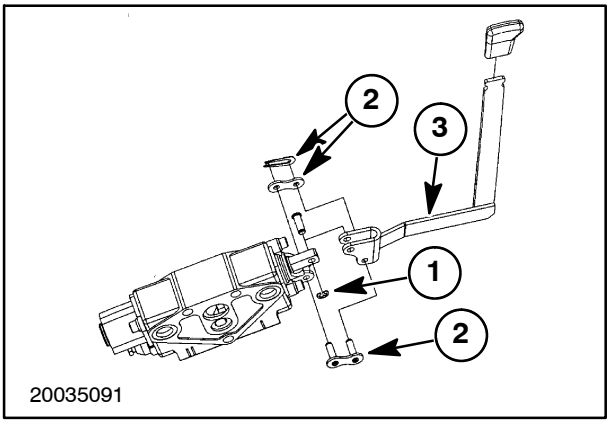
***NOTE**: Mounting studs must remain in position to secure the control valve in the #1 position.*

***IMPORTANT**: When separating the #2 control valve from the #1 control valve, be very careful not to lose O-rings and backing rings from the three main ports on the valves.*

7. Remove the cover, 5, from the valve, 6.
8. Carefully remove the #2 valve, 6, from the #1 valve, 7.

(Valve Stack Position #3)

1. Thoroughly clean the area around the remote valve before removal.
2. Remove the E-clip, 1, and spring stop lock, 2, from the lever assembly, 3.
3. Disconnect the lever assembly, 3, from the valve spool and body.



123

NOTE: *Control lever shown for clarity only. Lever removed in prior steps.*

4. Loosen and remove banjo bolt, 1, and washers, 2, from rear remote tube, 3. Disconnect tube from valve body.
5. Loosen tube fitting, 4, and disconnect tube, 5, from 45° fitting, 6.

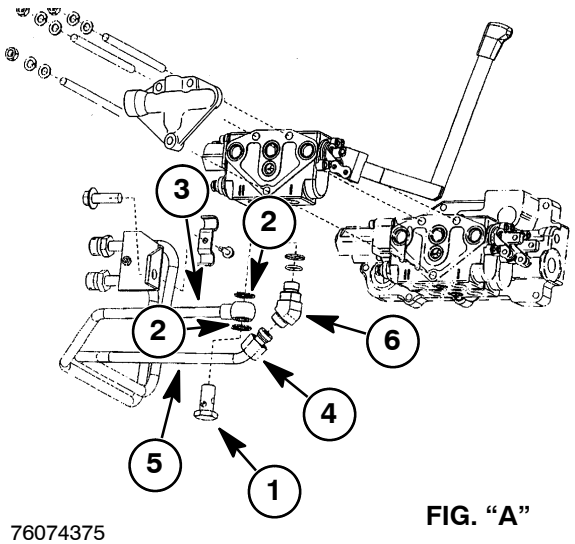


FIG. "A"

124

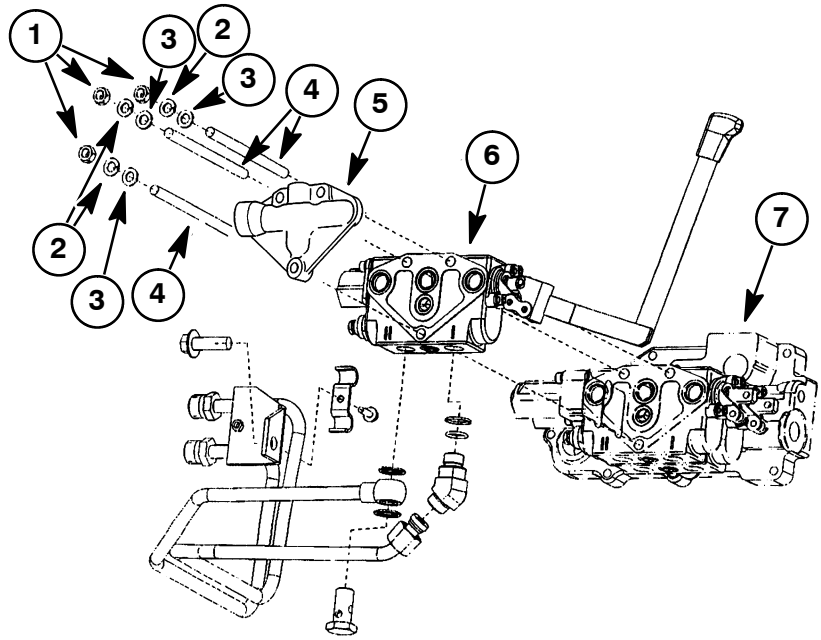


FIG. "B"

125

6. With control lever and remote tubes disconnected from valve body, loosen and remove three retaining nuts, 1, lock washers, 2, and flat washers, 3, from studs, 4.

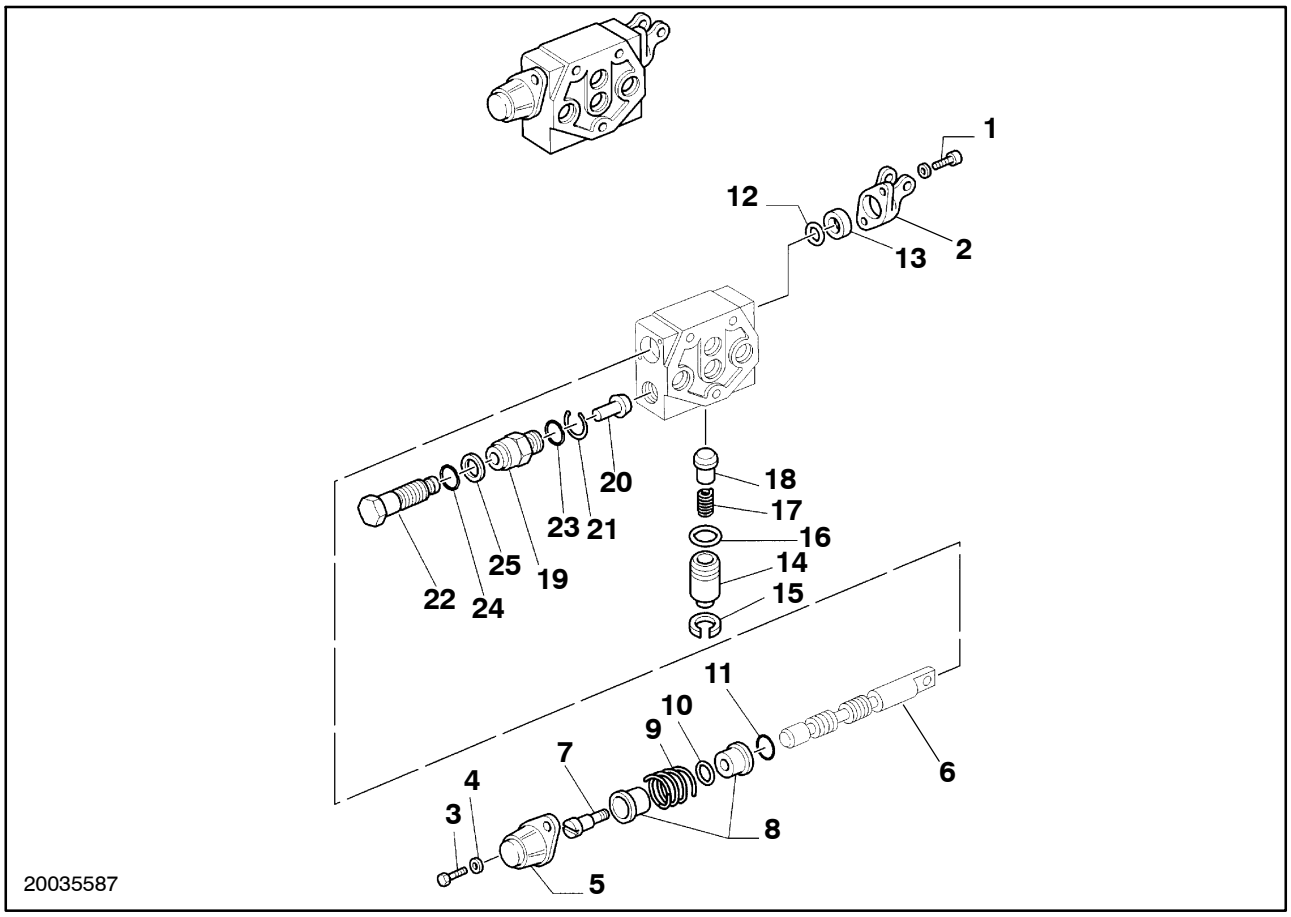
NOTE: *Mounting studs must remain in position to secure the control valve in the #1 and #2 position.*

IMPORTANT: *When separating the #3 control valve from the #2 control valve, be very careful not to lose O-rings and backing rings from the three main ports on the valves.*

7. Remove the cover, 5, from the valve, 6.
8. Carefully remove the #3 valve, 6, from the #2 valve, 7.

Disassembly (Non-detent Valve)

IMPORTANT: *During disassembly, inspection and assembly procedures, do not allow even the smallest dirt particles or foreign matter, to enter the valve body or valve parts. The slightest bit of dirt or foreign matter in the valve assembly can cause serious equipment damage and/or failure.*



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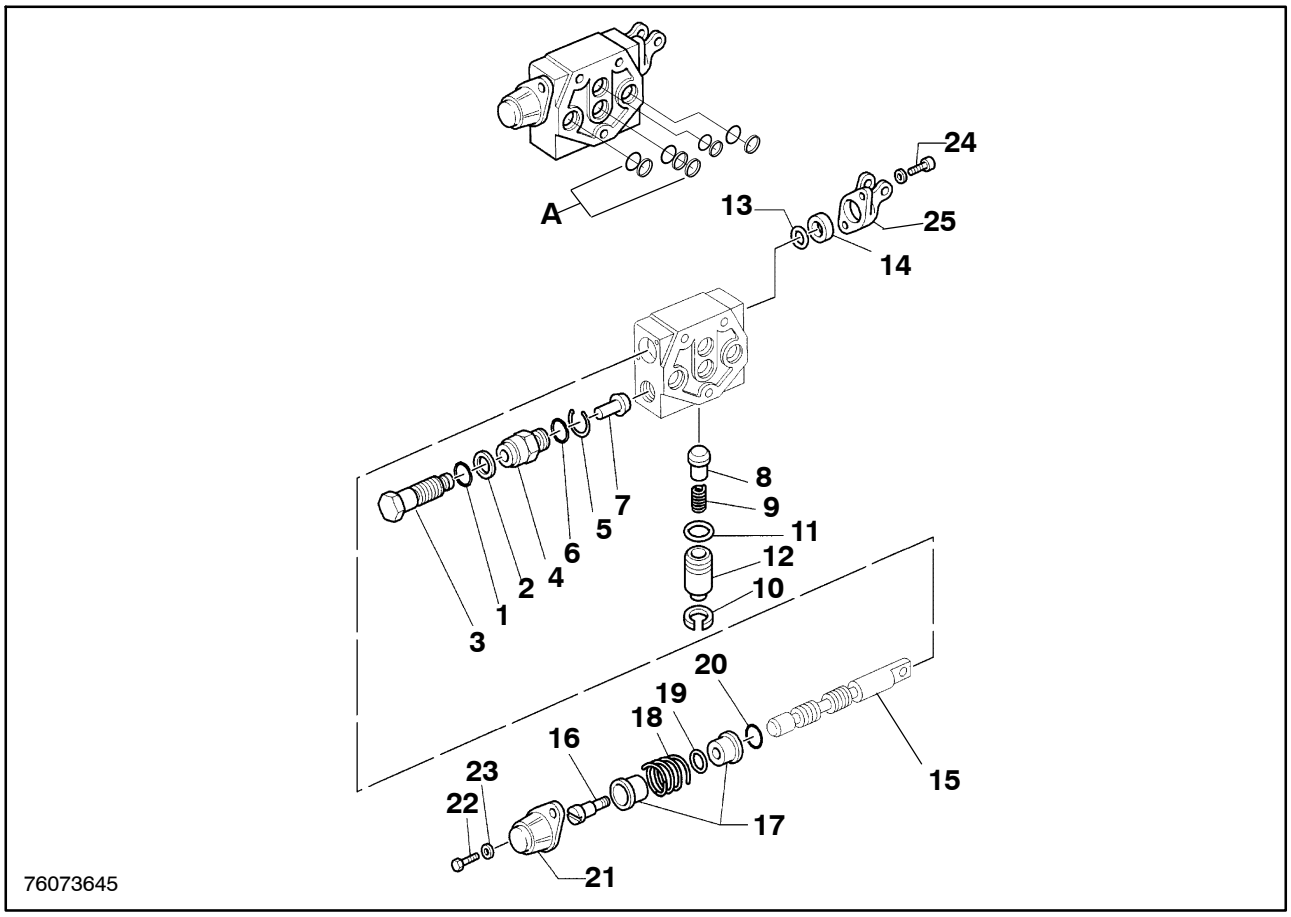
1. Remove the two bolts, 1, from the lever control support, 2, and remove the support from the valve body.
2. Remove the two bolts, 3, and lock washers, 4. Remove the cover, 5, from the body.
3. Remove the spool, 6, bolt, 7, spring cups, 8, spring, 9, spacer, 10 and O-ring, 11, as an assembly, from the valve body.
4. Remove the O-ring, 12, and wiper ring, 13, from the valve body.
5. Remove the check valve guide, 14, which contains the seal ring, 15, and O-ring, 16.
6. Remove the spring, 17, and valve, 18, from the valve body.
7. Remove the valve retaining plug, 19, from the valve body.
8. Remove the valve, 20, from the valve body.
9. Remove the E-clip, 21, from the switching valve, 22.
10. Remove the O-ring, 23, from the valve retaining plug, 19.
11. Unscrew the switching valve, 22, from the valve retaining plug, 19.
12. Remove the O-ring, 24, and seal ring, 25, from the switching valve, 22.

Inspection

Rear Remote (Three Position Valve) (Non-denten)

1. Clean all parts in a clean, suitable solvent. Allow to air dry.
2. Discard all O-rings and seals. Lubricate new O-rings and seals with clean hydraulic oil, prior to installation.
3. Inspect the spool bore in the valve body, for pitting, scratches or excessive wear. Inspect the valve spool for the same. If inspection reveals defects, replace the entire valve assembly.
4. Check that the spool moves freely in the spool bore. If spool sticks or is rough, replace the entire valve assembly.
5. Inspect all valve parts for wear or damage to seating surfaces. Replace as necessary.
6. Check springs for weakness or cracks. Replace as necessary.



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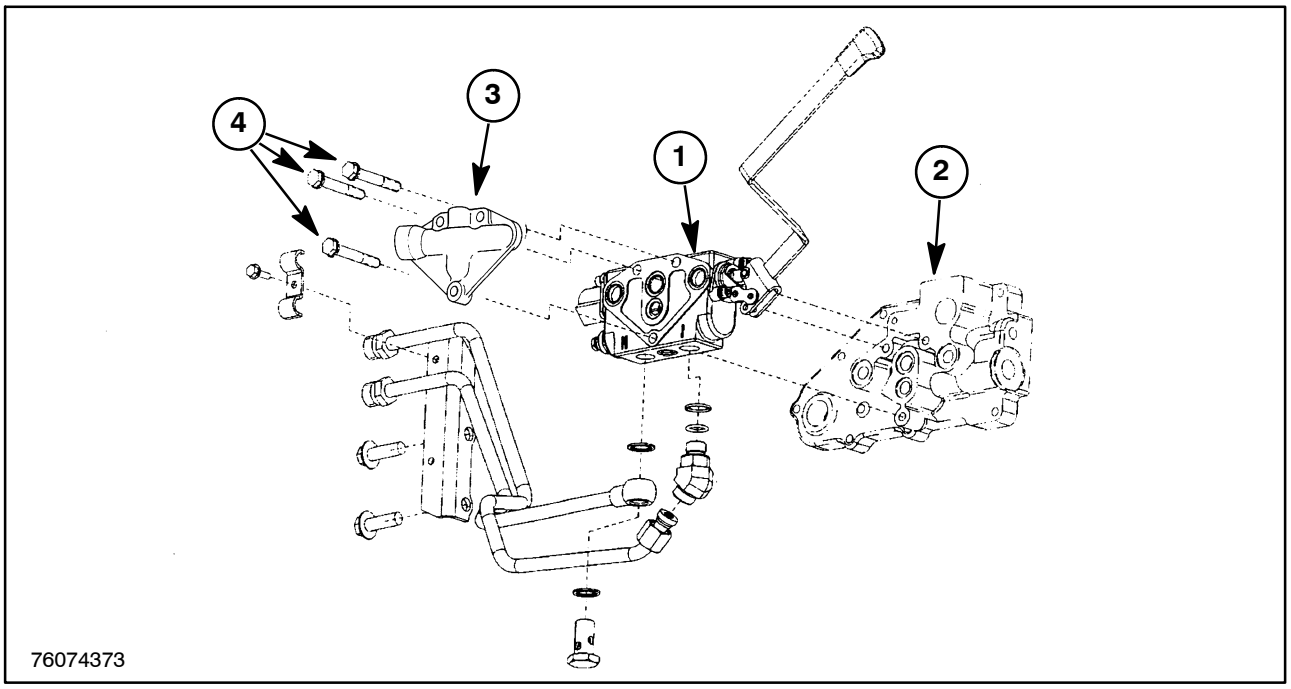
Assembly

1. Lubricate and install a new O-ring, 1, and new seal ring, 2, onto the switching valve, 3.
2. Install the switching valve, 3, into the valve retaining plug, 4.
3. Install the E-clip, 5, in the groove on the switching valve, 3.
4. Lubricate and install a new O-ring, 6, on the valve retaining plug, 4.
5. Lubricate and install the valve, 7, into the valve body.
6. Install the valve retaining plug assembly, 4, into the valve body. Tighten securely.
7. Install the valve, 8, and spring, 9, in the valve body.
8. Lubricate and install a new seal ring, 10, and new O-ring, 11, on the check valve guide, 12. Install the check valve guide, 12, into the valve body.
9. Lubricate and install a new O-ring, 13, and wiper ring, 14, in the valve body.
10. Lubricate and install the spool, 15, bolt, 16, spring cups, 17, spring, 18, spacer, 19 and new O-ring, 20, as an assembly, into the valve body.
11. Install the cover, 21, on the valve body. Install the two bolts, 22, and lock washers, 23. Tighten securely.
12. Install the lever control support on the valve body. Install the two bolts, 24, to secure the lever control support, 25, to the valve body. Tighten securely.

NOTE: *On the four valve face ports "A" each port has an O-ring and retaining ring. Only the lower middle port has a third anti-extrusion ring. Make sure all O-rings and retaining rings are in place before installing the valve assembly to the tractor.*



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Installation

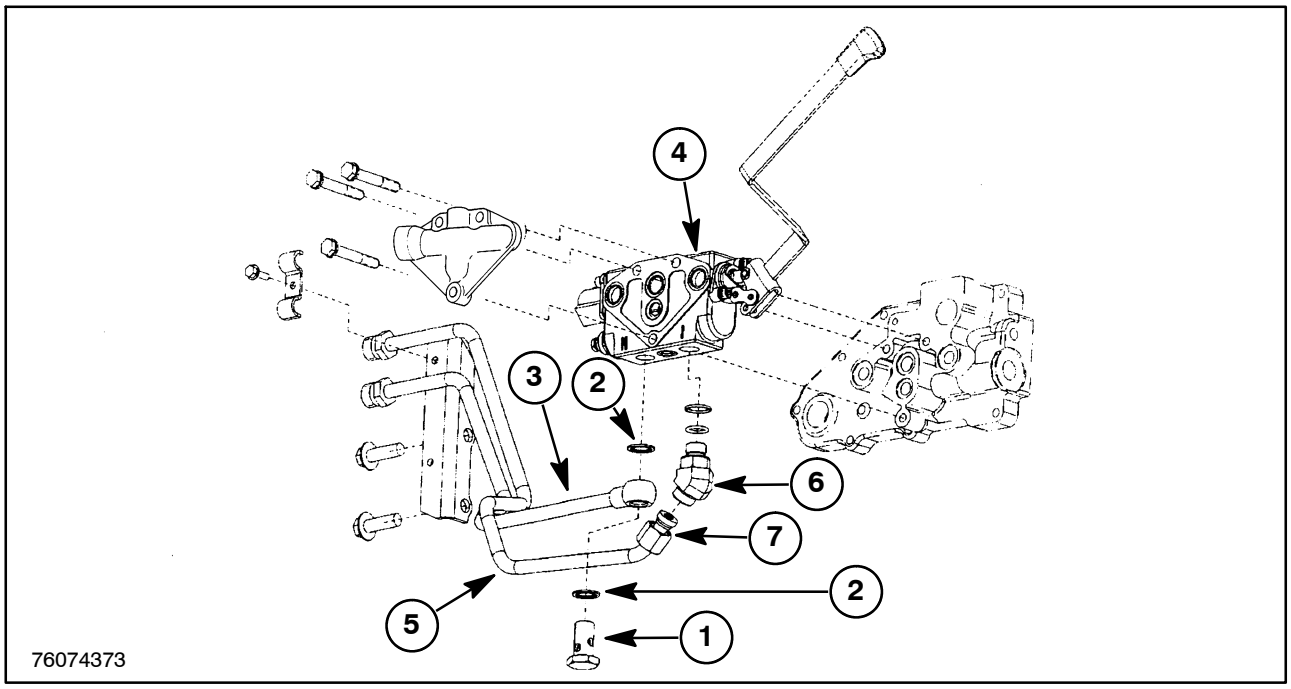
(Valve Stack Position #1)

IMPORTANT: *When installing control valve onto the lift cover, be very careful not to lose O-rings and backing rings from the four main ports on the valve.*

1. Lubricate all O-rings with clean hydraulic fluid and carefully install valve, 1, onto lift cover housing, 2.
2. Install cover, 3, onto control valve, 1.

NOTE: *If valve in position #1 is used with valves in the #2 and/or #3 position, see Installation for valves in #2 and/or #3.*

3. Install three retaining bolts, 4, through cover, 3, and valve, 1.
4. Tighten the three bolts evenly to 59 N·m (43.5 ft-lbs).



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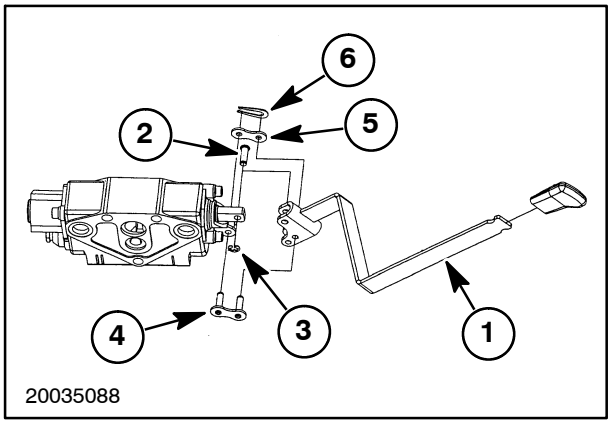
NOTE: *Control lever shown for clarity only. Lever installation is done later.*

IMPORTANT: *It may be necessary to loosen the tube retaining clamps to ease connection of tubes to valve.*

5. Place banjo bolt, 1, through washers, 2, rear remote tube, 3, and install into control valve, 4. Tighten banjo bolt.
6. Connect tube, 5, to 45° fitting, 6.
7. Tighten tube fitting, 7.
8. If loosened previously, tighten tube clamps.
9. Connect the lever assembly, 1, to the valve spool using pin, 2, and E-clip, 3.
10. Connect the remaining end of the lever assembly, 1, to the valve body using the double pin, 4, link, 5, and spring stop lock, 6.



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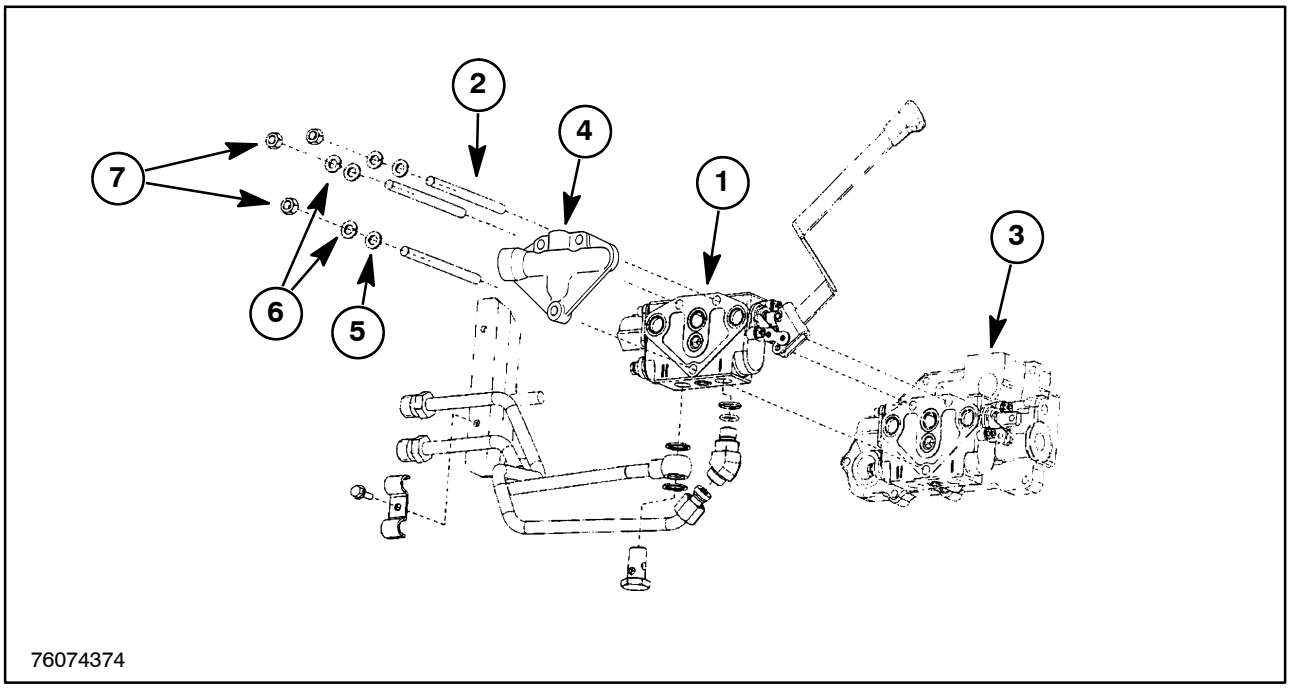


131

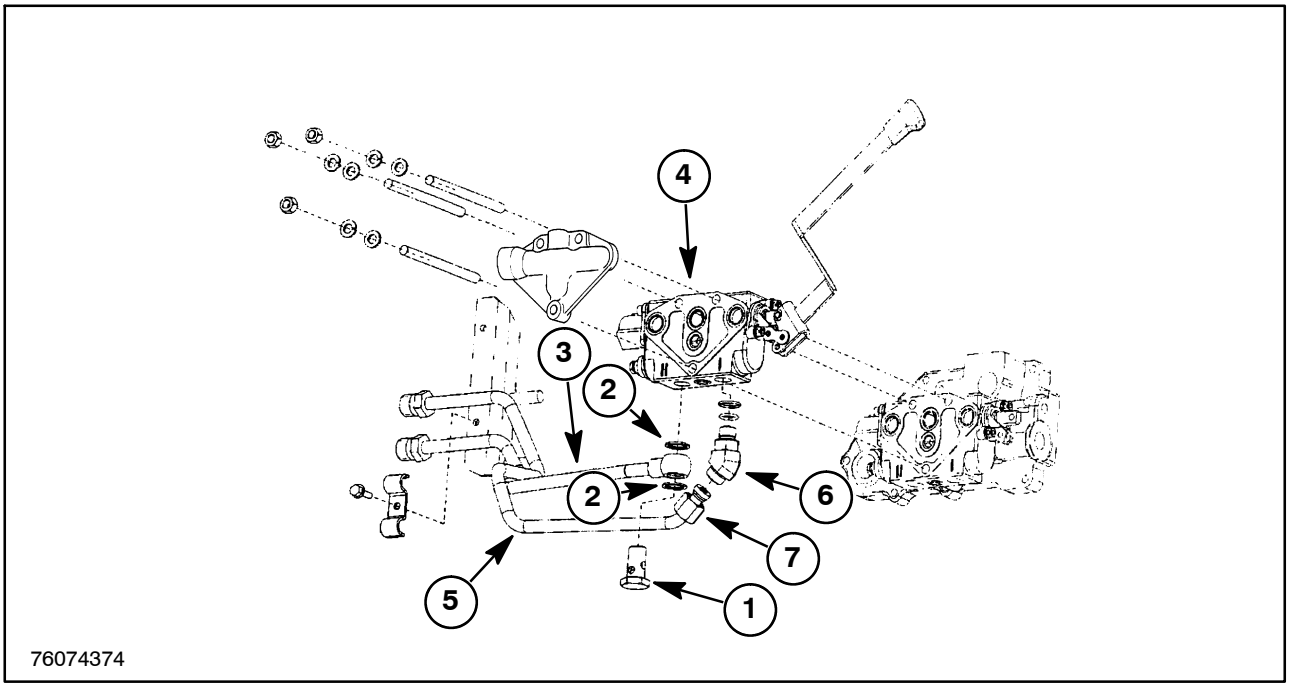
(Valve Stack Position #2)

IMPORTANT: *When installing #2 control valve onto #1 valve, be very careful not to lose O-rings and backing rings from the four main ports on the valves.*

11. Lubricate all O-rings with clean hydraulic fluid and carefully install valve #2, 1, over studs, 2, onto control valve #1, 3.
12. Install cover, 4, over studs, 2, onto control valve, 1.

NOTE: *If valve in position #2 is used with valve in the #3 position, see installation of valve #3.*

13. Install three flat washers, 5, lock washers, 6, and nuts, 7, onto studs, 2.
14. Tighten the three nuts, 7, evenly to 59 N·m (43.5 ft-lbs).



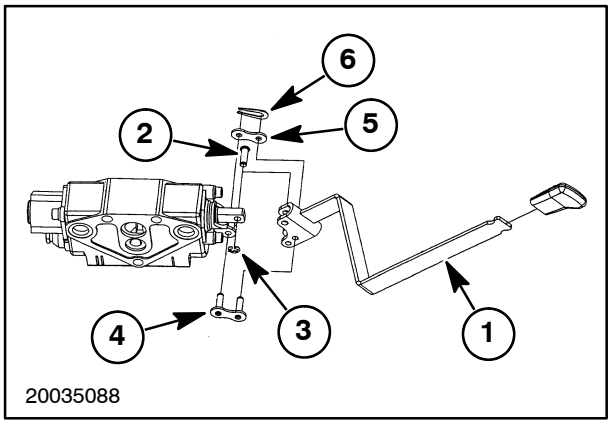
132

NOTE: *Control lever shown for clarity only. Lever installation is done later.*

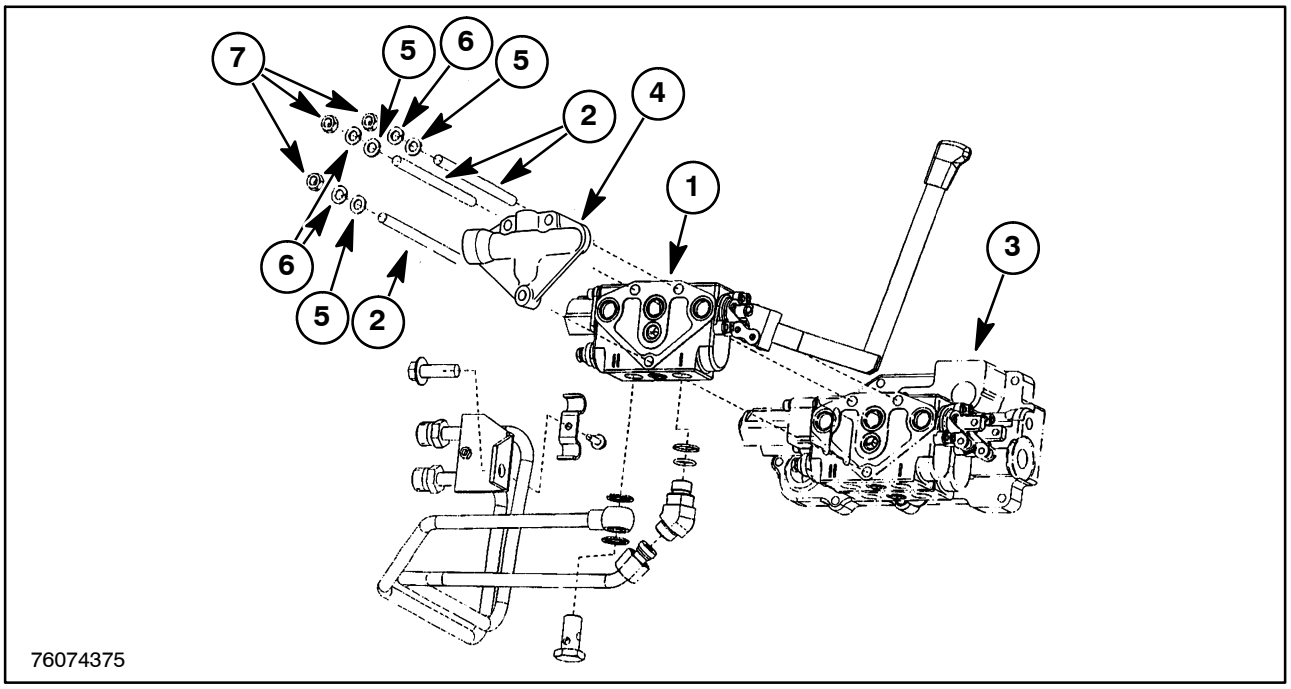
IMPORTANT: *It may be necessary to loosen the tube retaining clamps to ease connection of tubes to valve.*

15. Place banjo bolt, 1, through washers, 2, rear remote tube, 3, and install into control valve, 4. Tighten banjo bolt.
16. Connect tube, 5, to 45° fitting, 6.
17. Tighten tube fitting, 7.
18. If loosened previously, tighten tube clamps.

19. Connect the lever assembly, 1, to the valve spool using pin, 2,and E-clip, 3.
20. Connect the remaining end of the lever assembly, 1, to the valve body using the double pin, 4, link, 5, and spring stop lock, 6.



133



134

(Valve Stack Position #3)

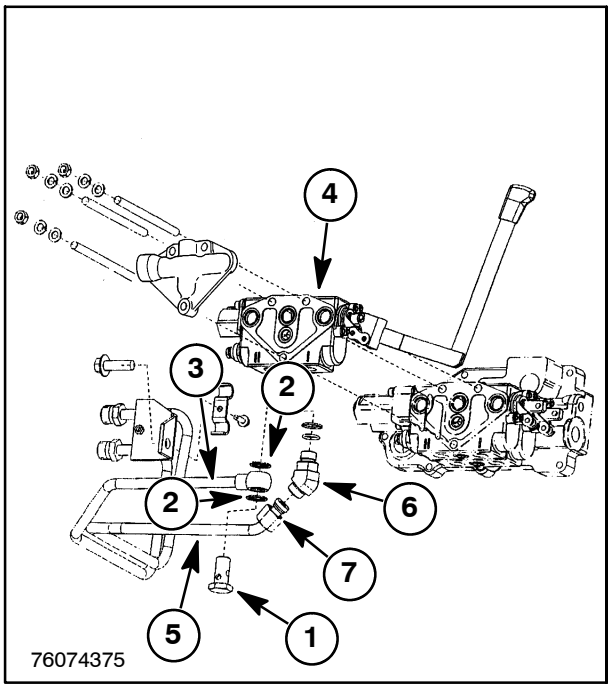
IMPORTANT: *When installing #3 control valve onto #2 valve, be very careful not to lose O-rings and backing rings from the four main ports on the valves.*

21. Lubricate all O-rings with clean hydraulic fluid and carefully install valve #3, 1, over studs, 2, onto control valve #2, 3.
22. Install cover, 4, over studs, 2, onto control valve, 1.
23. Install three flat washers, 5, lock washers, 6, and nuts, 7, onto studs, 2.
24. Tighten the three nuts, 7, evenly to 59 N·m (43.5 ft-lbs).

NOTE: *Control lever shown for clarity only. Lever installation is done later.*

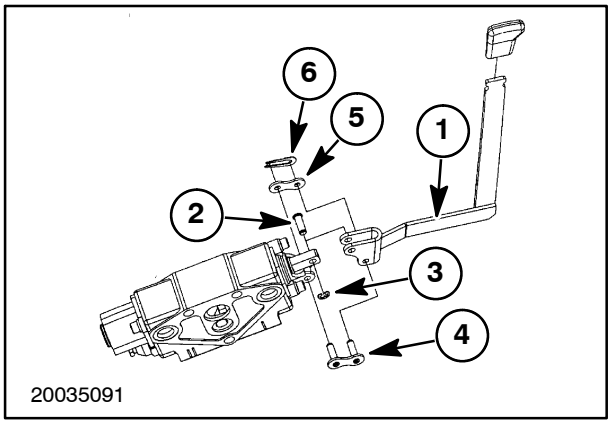
IMPORTANT: *It may be necessary to loosen the tube retaining clamps to ease connection of tubes to valve.*

25. Place banjo bolt, 1, through washers, 2, rear remote tube, 3, and install into control valve, 4. Tighten banjo bolt.
26. Connect tube, 5, to 45° fitting, 6.
27. Tighten tube fitting, 7.
28. If loosened previously, tighten tube clamps.



135

29. Connect the lever assembly, 1, to the valve spool using pin, 2,and E-clip, 3.
30. Connect the remaining end of the lever assembly, 1, to the valve body using the double pin, 4, link, 5, and spring stop lock, 6.



136

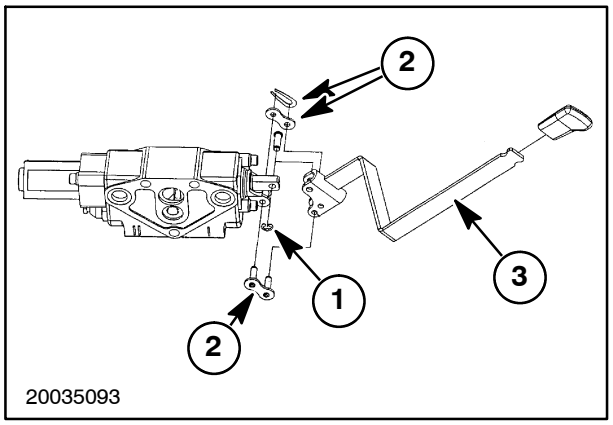
REAR REMOTE (FOUR POSITION, SINGLE SPOOL W/DETENT KICK-OUT AND FLOAT)

(Valve Stack Position #1)

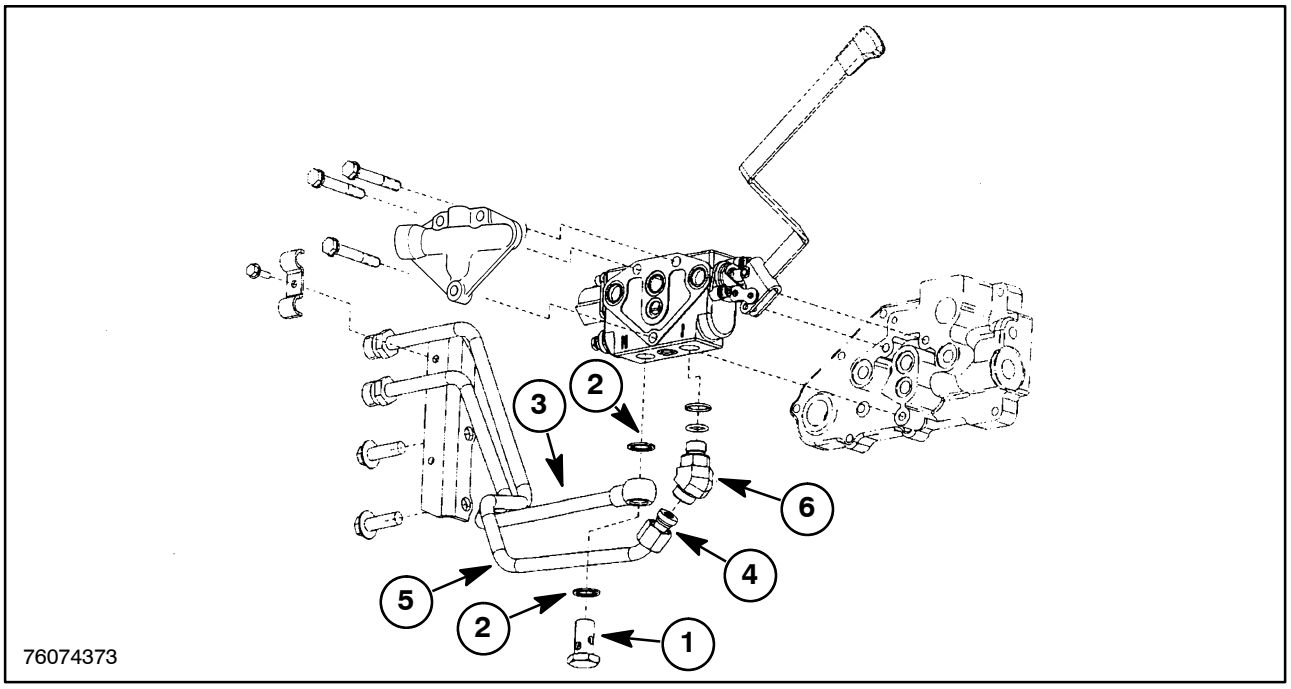
Removal

NOTE: *If valve in position #1 is used with valves in the #2 and/or #3 position, see removal for #2 and/or #3 before removing valve in position #1.*

1. Thoroughly clean the area around the remote valve before removal.
2. Remove the E-clip, 1, and spring stop lock, 2, from the lever assembly, 3.
3. Disconnect the lever assembly, 3, from the valve spool and body.



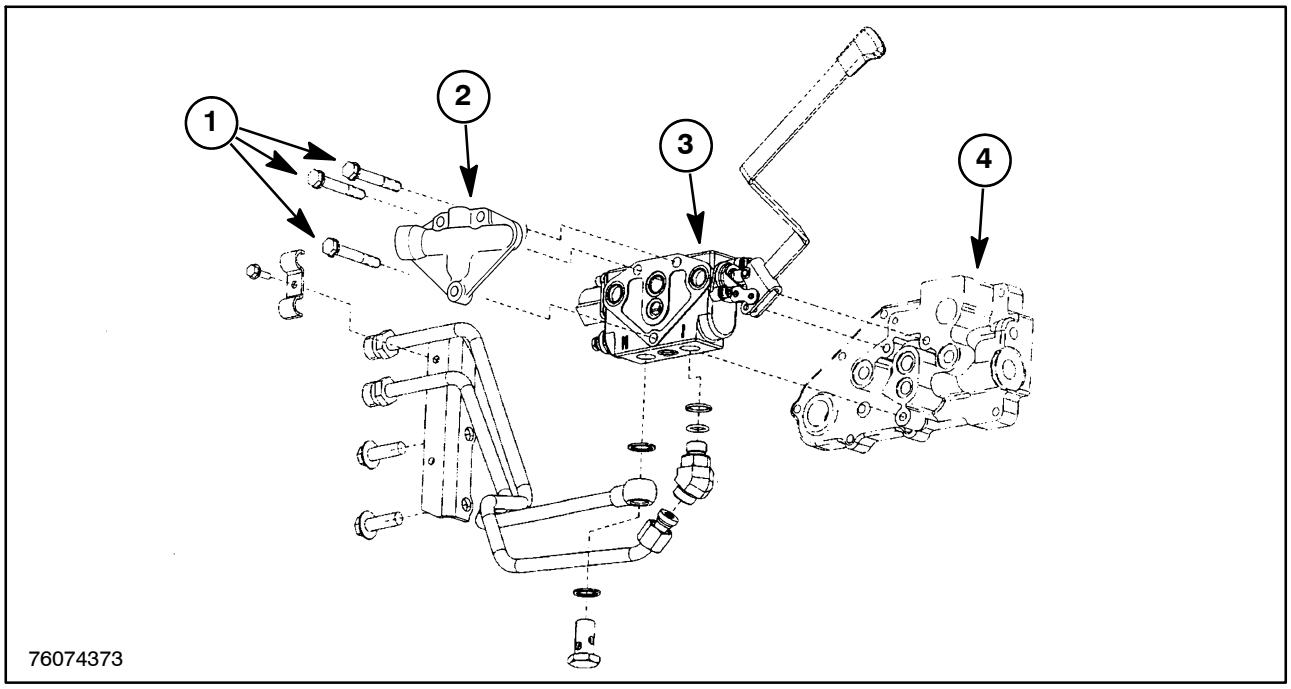
137



138

NOTE: *Control lever shown for clarity only. Lever removed in prior steps.*

4. Loosen and remove banjo bolt, 1, and washers, 2, from rear remote tube, 3. Disconnect tube from valve body.
5. Loosen tube fitting, 4, and disconnect tube, 5, from 45° fitting, 6.



139

6. With control lever and remote tubes disconnected from valve body, loosen and remove three retaining bolts, 1, from cover, 2, and valve, 3.

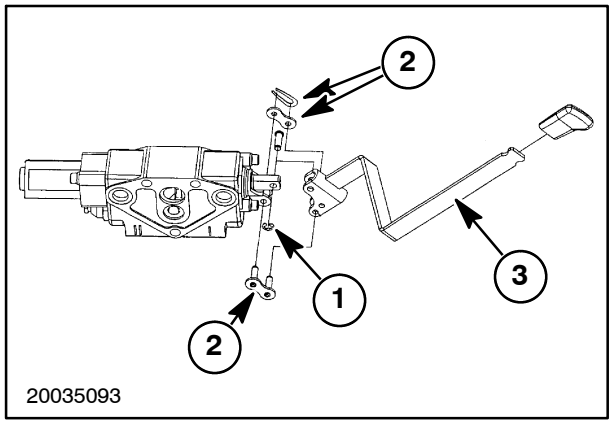
IMPORTANT: *When separating control valve from lift cover, be very careful not to lose O-rings and backing rings from the four main ports on the valve.*

7. Carefully remove valve, 3, from lift cover housing, 4.

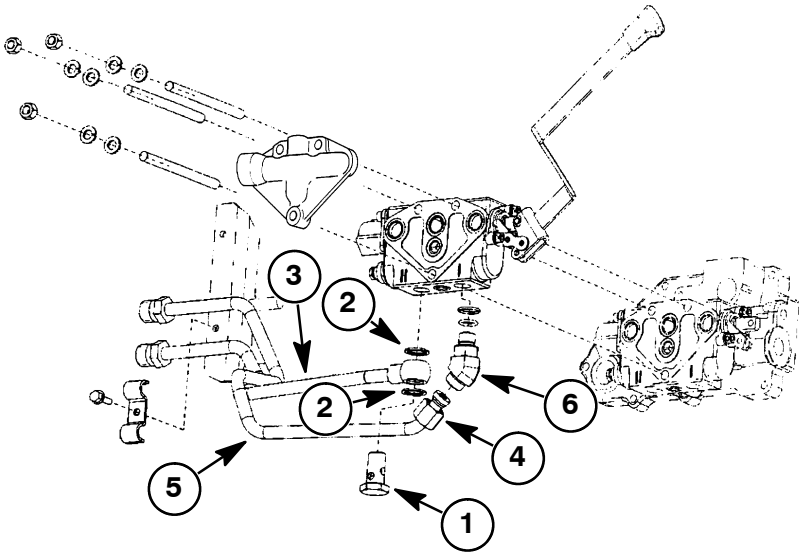
(Valve Stack Position #2)

NOTE: *If valve in position #2 is used with valve in the #3 position, see removal for #3 before removing valve in position #2.*

1. Thoroughly clean the area around the remote valve before removal.
2. Remove the E-clip, 1, and spring stop lock, 2, from the lever assembly, 3.
3. Disconnect the lever assembly, 3, from the valve spool and body.



140



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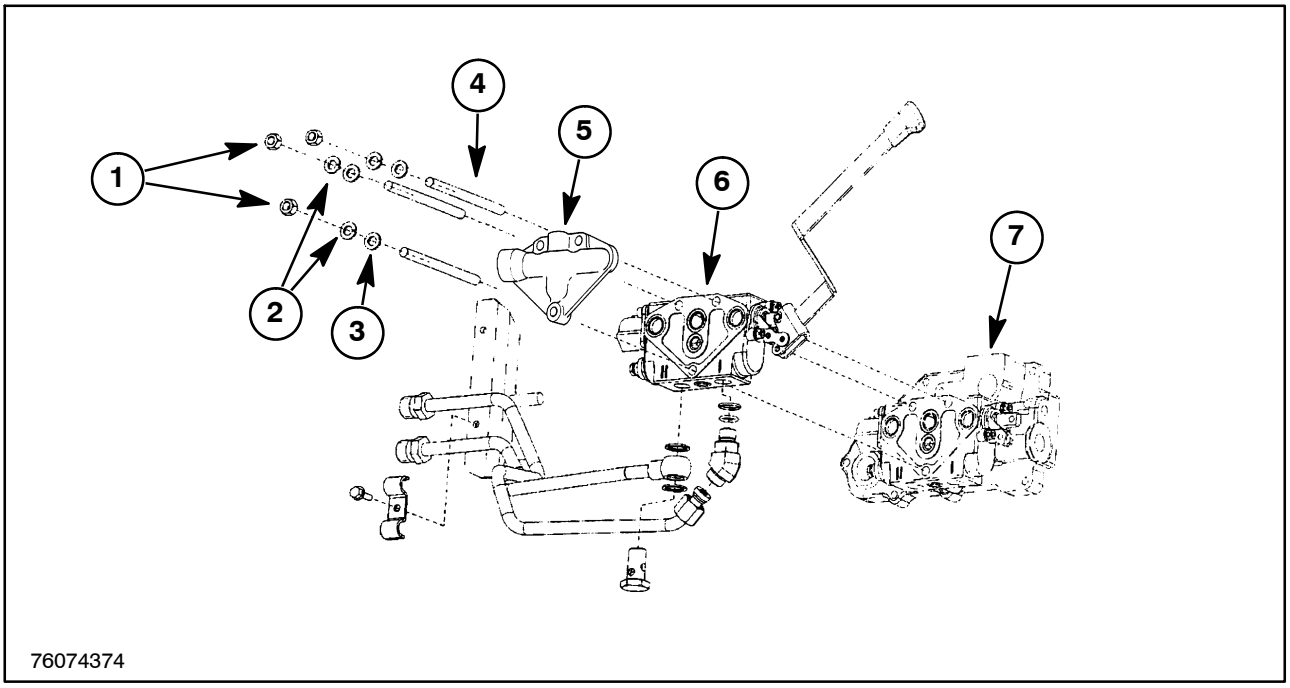
141

NOTE: *Control lever shown for clarity only. Lever removed in prior steps.*

4. Loosen and remove banjo bolt, 1, and washers, 2, from rear remote tube, 3. Disconnect tube from valve body.
5. Loosen tube fitting, 4, and disconnect tube, 5, from 45° fitting, 6.



142

6. With control lever and remote tubes disconnected from valve body, loosen and remove three retaining nuts, 1, lock washers, 2, and flat washers, 3, from studs, 4.

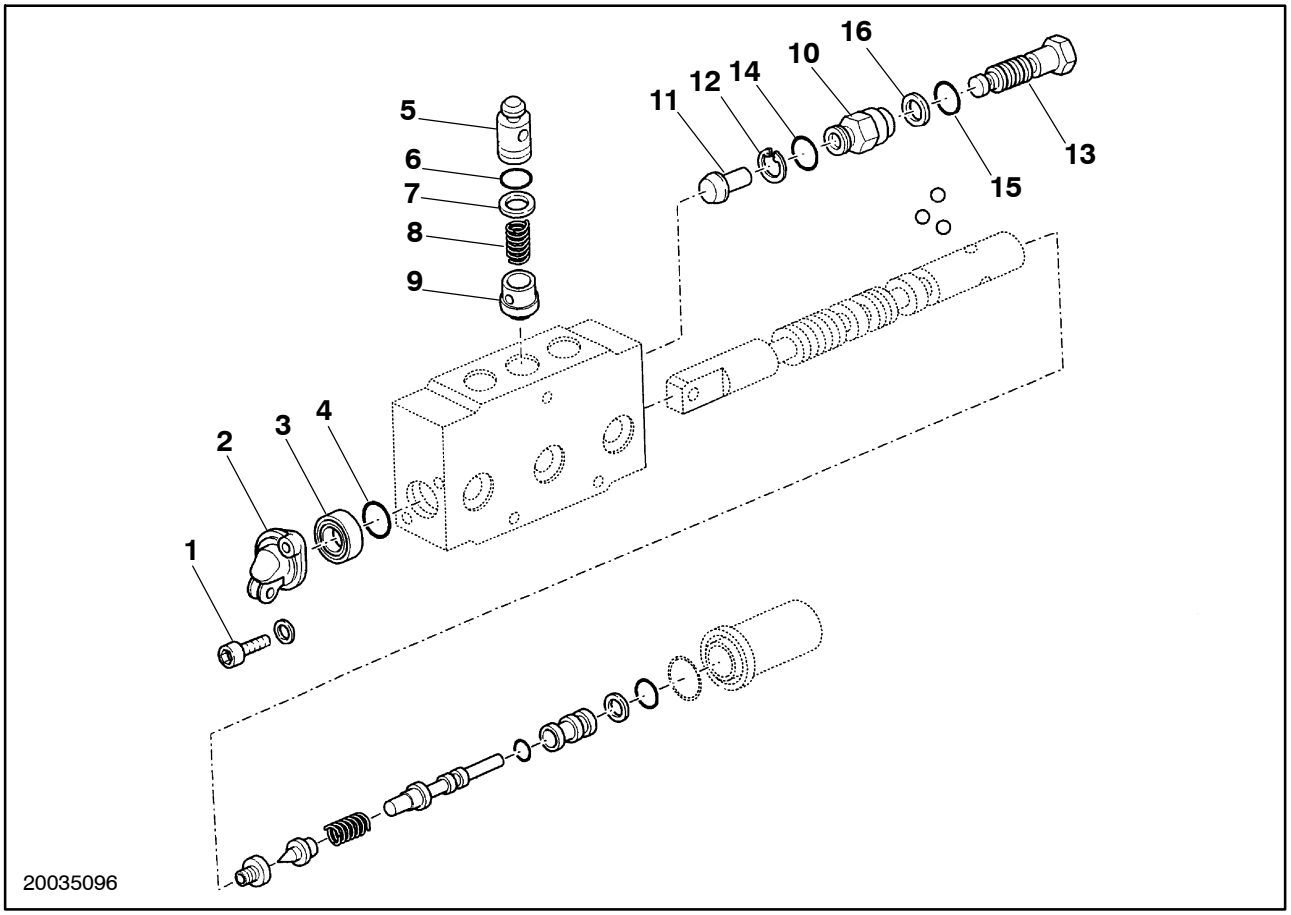
NOTE: *Mounting studs must remain in position to secure the control valve in the #1 position.*

IMPORTANT: *When separating the #2 control valve from the #1 control valve, be very careful not to lose O-rings and backing rings from the four main ports on the valves.*

7. Remove the cover, 5, from the valve, 6.
8. Carefully remove the #2 valve, 6, from the #1 valve, 7.

Disassembly
(Four Position Valve w/Detent and Float)

IMPORTANT: *During disassembly, inspection and assembly procedures, do not allow even the smallest dirt particles or foreign matter, to enter the valve body or valve parts. The slightest bit of dirt or foreign matter in the valve assembly can cause serious equipment damage and/or failure.*



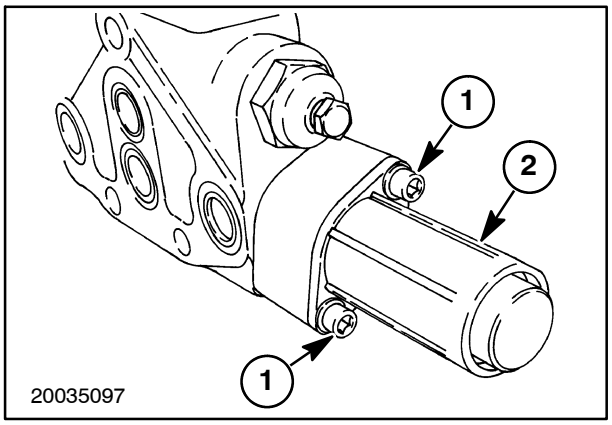
143

1. Remove the two bolts, 1, and lock washers from the lever control support, 2, and remove the support from the valve body.
2. Remove the wiper ring, 3, from the valve body.

NOTE: *O-ring, 4, is removed after spool removal.*

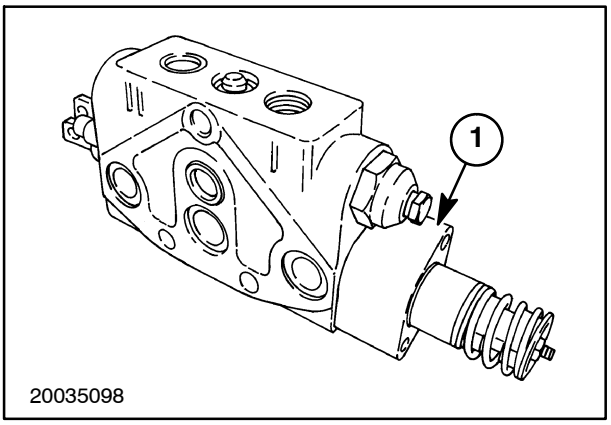
3. Remove the check valve guide, 5, which contains the O-ring, 6, and seal ring, 7.
4. Remove the spring, 8, and valve, 9, from the valve body.
5. Remove the valve retaining plug, 10, from the valve body.
6. Remove the valve, 11, from the valve body.
7. Remove the E-clip, 12, from the switching valve, 13.
8. Remove the O-ring, 14, from the valve retaining plug, 10.
9. Unscrew the switching valve, 13, from the valve retaining plug, 10.
10. Remove the O-ring, 15, and seal ring, 16, from the switching valve, 13.

11. Loosen and remove the two socket head bolts, 1, securing the flange cover, 2, to the valve body.
12. Remove the flange cover.



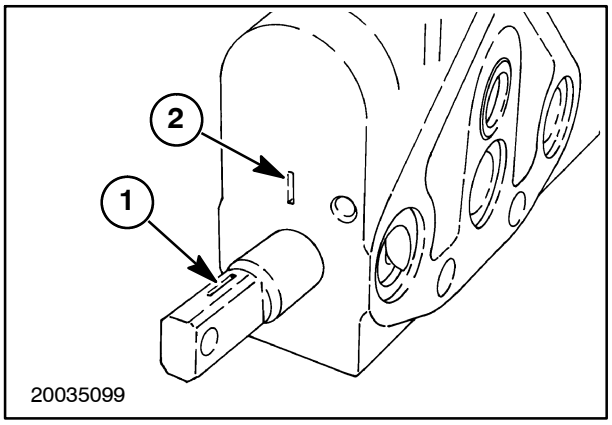
144

13. Remove the spacer, 1, from the valve body.



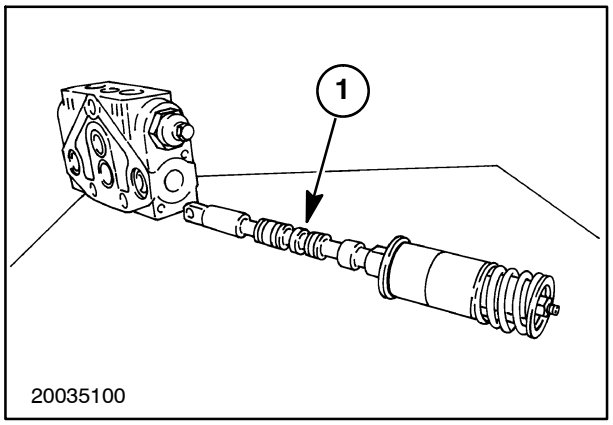
145

14. Mark the spool, 1, and valve body, 2, with a paint pen, for proper orientation upon assembly.



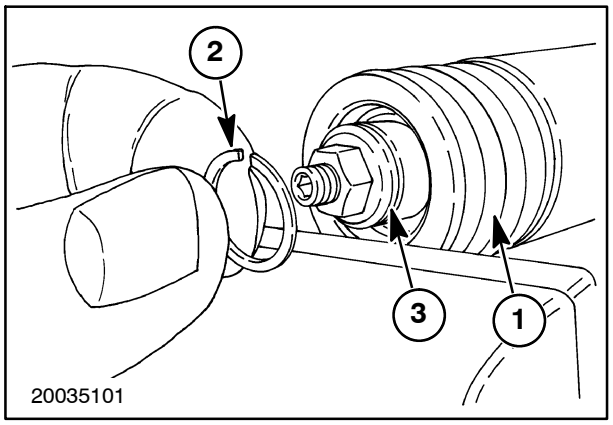
146

15. Carefully pull the spool assembly, 1, out of the valve body.



147

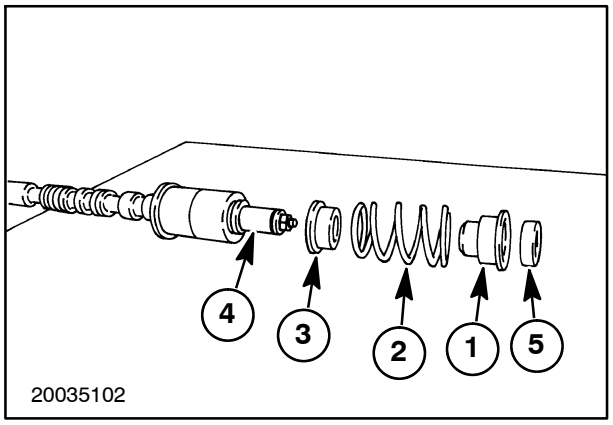
16. Place the spool in a vise to lightly compress the spring, 1, to reveal the retaining ring, 2.
17. Remove the retaining ring, 2, from the groove in the plug, 3.
18. Slowly and carefully release the jaws of the vise, using care not to allow the spring and cups to be expelled from the spool.



148

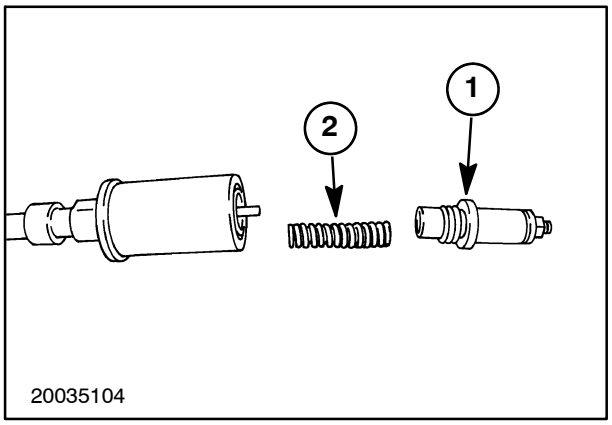
19. Remove the large cup, 1, spring, 2, and small cup, 3, from the spool, 4.
20. Remove the spacer, 5, from the large cup, 1.

NOTE: *Pay close attention to the orientation of the spacer, 5. The flat side goes against the cup while the grooved side faces outward.*



149

21. Loosen and unscrew the plug, 1, from the spool.
22. Remove the spring, 2, from the spool.

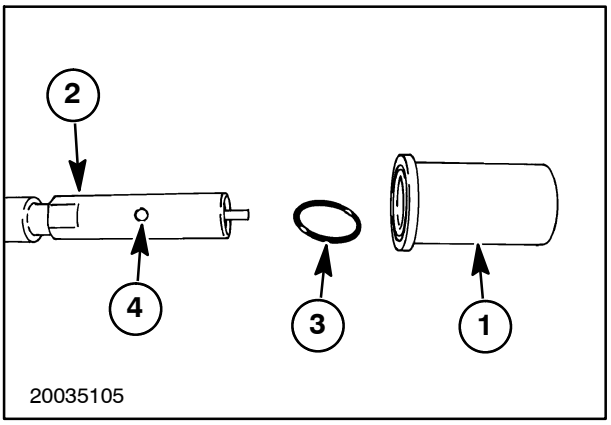


150

23. Slide the bushing, 1, off the spool, 2.
24. Remove the large O-ring, 3, from the flanged side of the bushing.

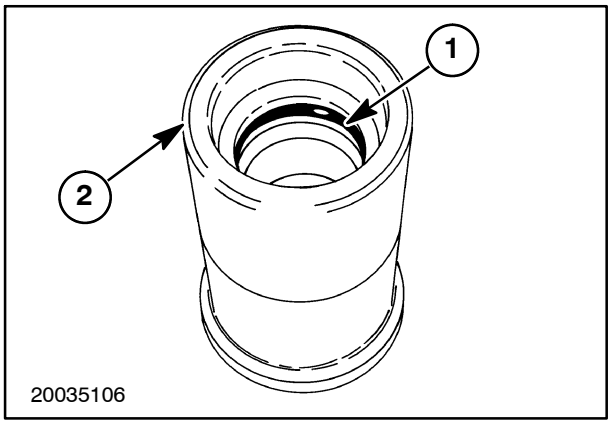
NOTE: *Use care not to lose the three check balls, 4, from the spool when removing the bushing, 1.*

25. Remove the three check balls, 4, from the spool, 2.



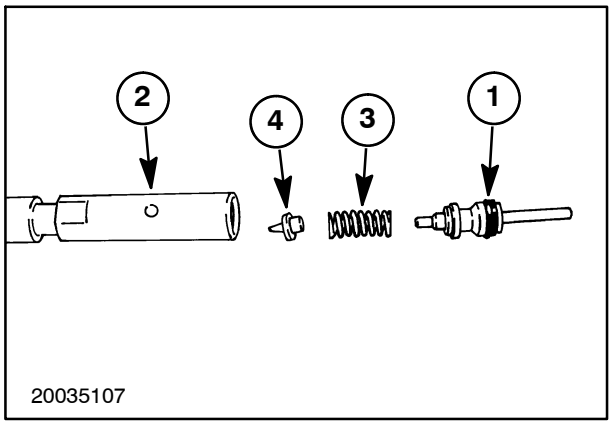
151

26. Remove the O-ring, 1, from the small end of the bushing, 2.



152

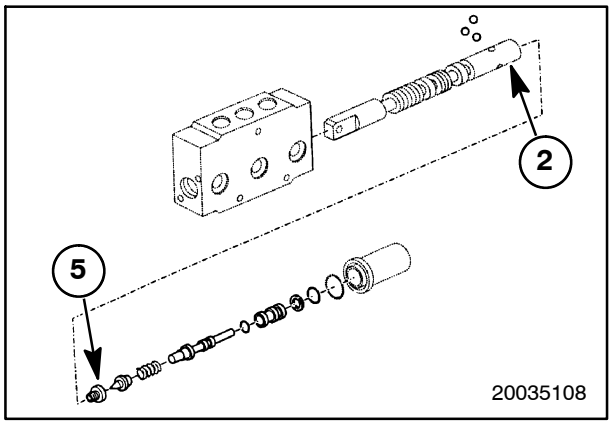
27. Pull the auto kick-out pin assembly, 1, from the spool, 2.
28. Remove the spring, 3, and poppet, 4, from the spool, 2.



153

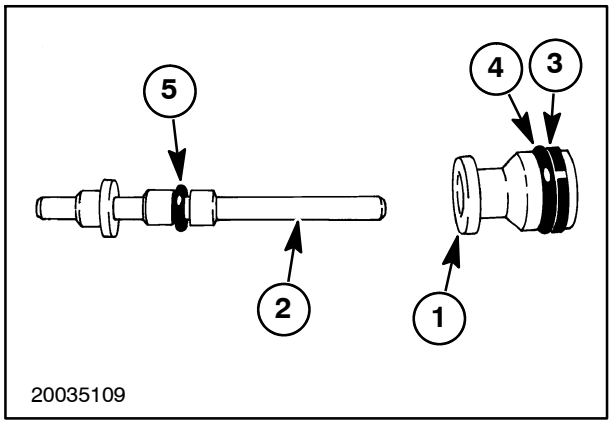
29. Remove the poppet seat, 5, from the spool, 2.

IMPORTANT: *When removing the poppet seat, do not force the seat if it will not break loose. Use a propane torch to apply a small amount of heat to the spool, in the area of the seat to loosen any thread-locking compound on the seat threads.*



154

30. Remove the bushing, 1, from the pin, 2.
31. Remove the seal ring, 3, and O-ring, 4, from the bushing, 1.
32. Remove the O-ring, 5, from the pin, 2.



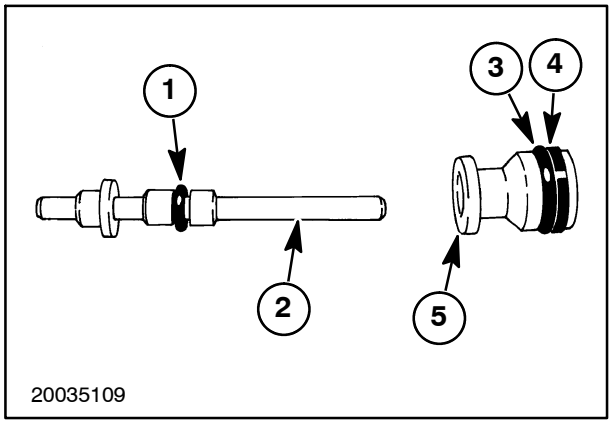
155

Inspection

1. Clean all parts in a clean, suitable solvent. Allow to air dry.
2. Discard all O-rings and seals. Lubricate new O-rings and seals with clean hydraulic oil, prior to installation.
3. Inspect the spool bore in the valve body, for pitting, scratches or excessive wear. Inspect the valve spool for the same. If inspection reveals defects, replace the entire valve assembly.
4. Check that the spool moves freely in the spool bore. If spool sticks or is rough, replace the entire valve assembly.
5. Inspect all valve parts for wear or damage to seating surfaces. Replace as necessary.
6. Check springs for weakness or cracks. Replace as necessary.

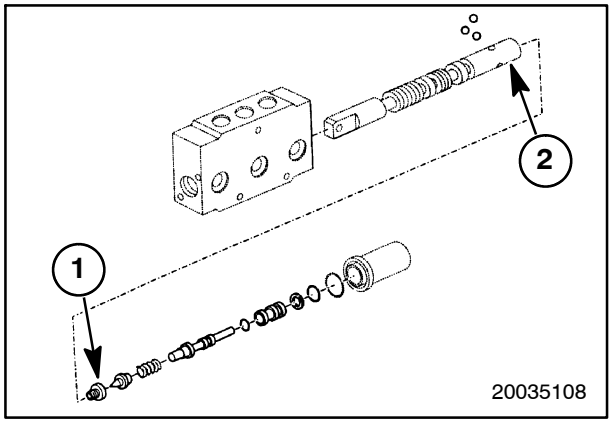
Assembly

1. Lubricate and install a new O-ring, 1, onto the pin, 2.
2. Lubricate and install a new O-ring, 3, and seal ring, 4, on the bushing, 5.
3. Install the bushing, 5, onto the pin, 2.



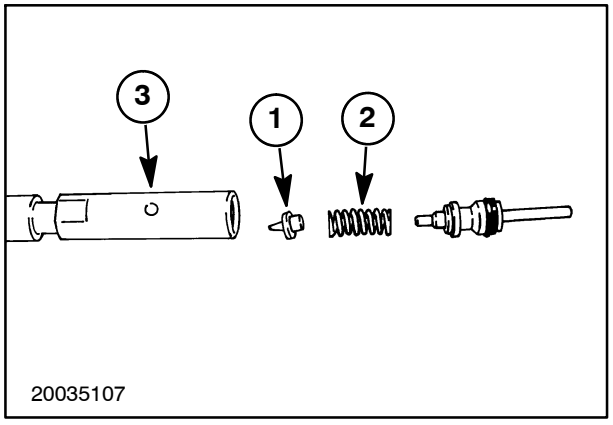
156

4. Install the poppet seat, 1, into the valve spool, 2. Tighten the seat securely.



157

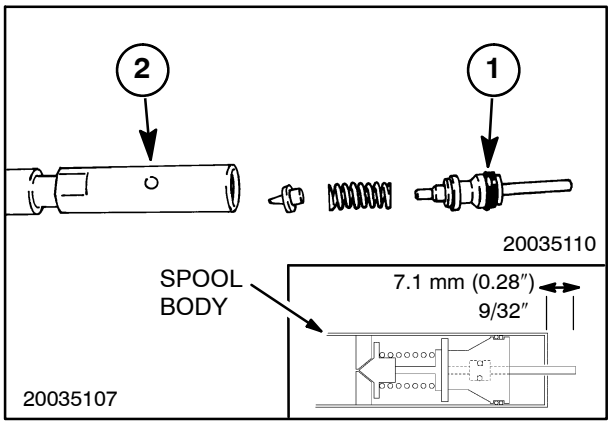
5. Install the poppet, 1, and spring, 2, into the spool, 3.



158

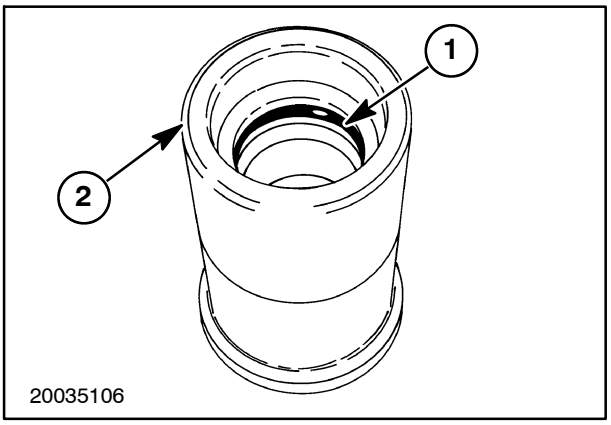
6. Lubricate and install the auto kick-out pin assembly, 1, into the spool, 2.

IMPORTANT: *Insert auto kick-out pin assembly into spool to a depth of 7.1 mm (9/32″) to allow for installation of check balls later. (See Inset)*



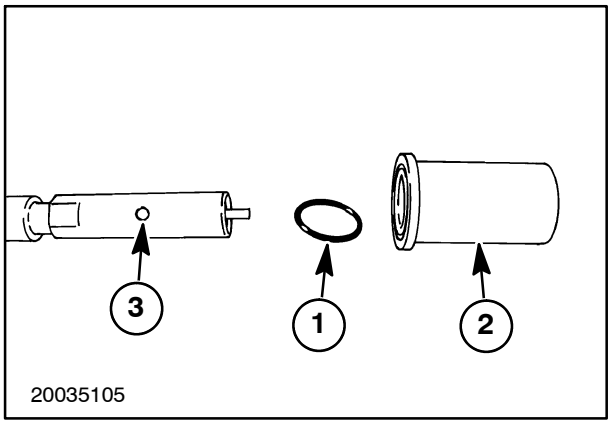
159

7. Lubricate and install a new O-ring, 1, in the groove, on the inside of the non-flanged end of the bushing, 2.



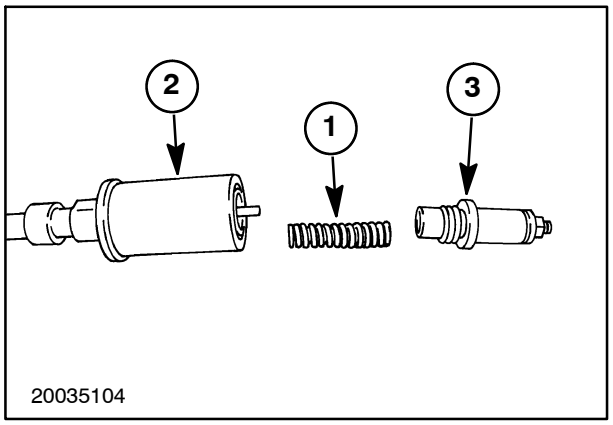
160

8. Lubricate and install a new O-ring, 1, in the flanged end of the bushing, 2.
9. Insert the three check balls, 3, into the three check holes in the spool. Use a small dab of petroleum jelly to keep the check balls in place.
10. Lubricate and slide the bushing, 2, onto the spool, over the check balls, 3, until the non-flanged end is even with the end of the spool.



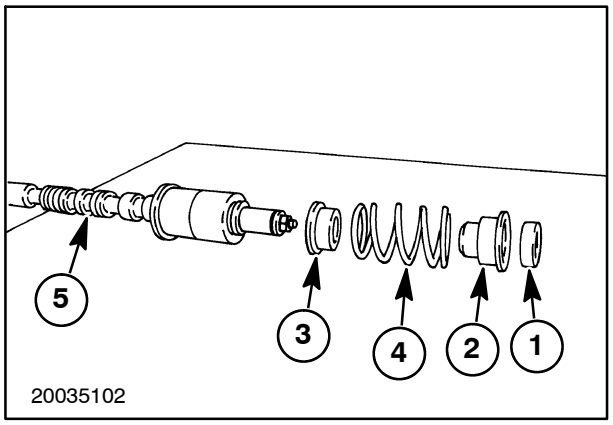
161

11. Insert the spring, 1, into the spool, 2.
12. Install the plug, 3, into the spool, 2. Tighten the plug securely.



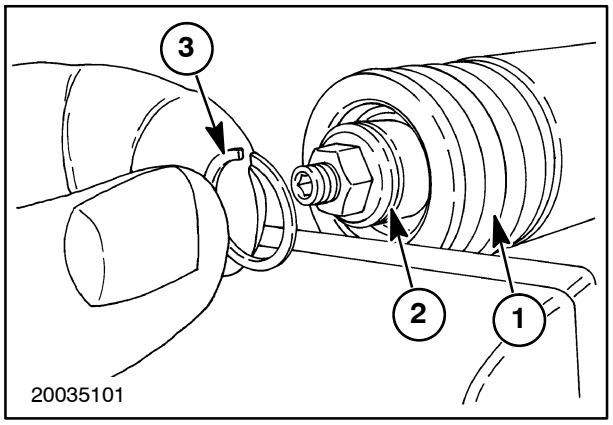
162

13. Install the spacer, 1, into the large end of the spring cup, 2. Be certain the grooved side of the spacer faces outward.
14. Install the small spring cup, 3, spring, 4, and large spring cup, 2, onto the spool, 5.



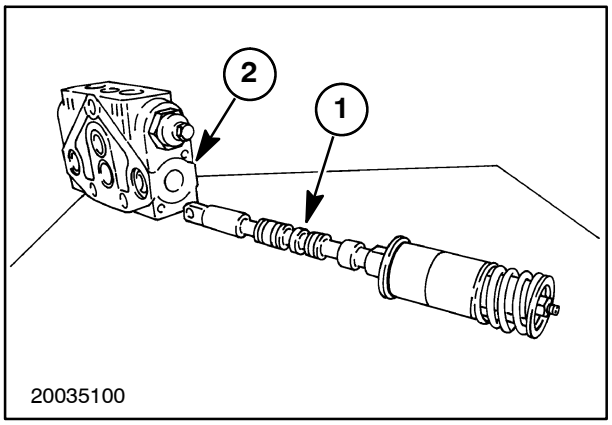
163

15. Place the spool in a vise to lightly compress the spring, 1, to reveal the retaining ring groove in the plug, 2.
16. Install the retaining ring, 3, in the groove on the plug, 2.
17. Slowly and carefully release the jaws of the vise and remove the assembled spool.



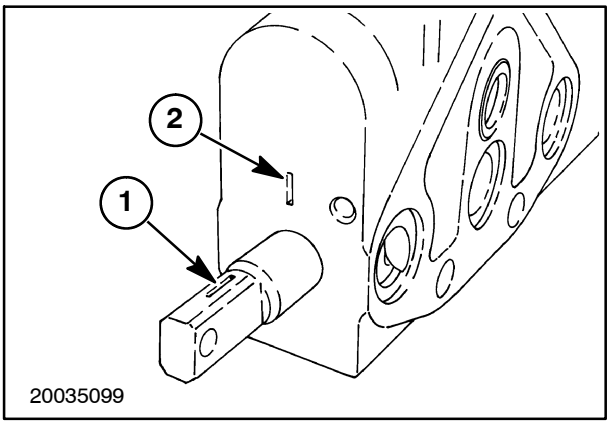
164

18. Lubricate the spool assembly, 1, with clean hydraulic fluid and install carefully, into the valve body, 2.



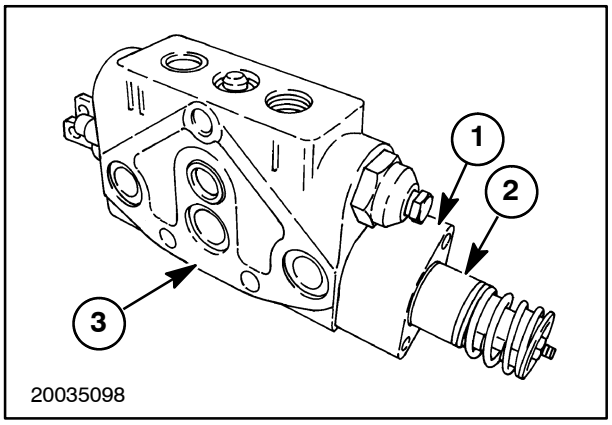
165

IMPORTANT: *Be certain to align marks on spool, 1, and valve body, 2, made during disassembly to ensure proper orientation of spool and valve body.*



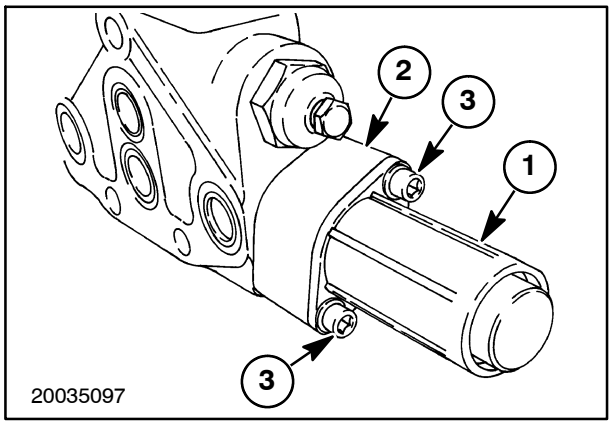
166

19. Install the spacer, 1, over the spool bushing, 2, and onto the valve body, 3.



167

20. Install the flange cover, 1, over the end of the spool, against the spacer, 2.
21. Install and tighten the two socket head bolts, 3, and lock washers to secure the flange and spacer to the valve body.



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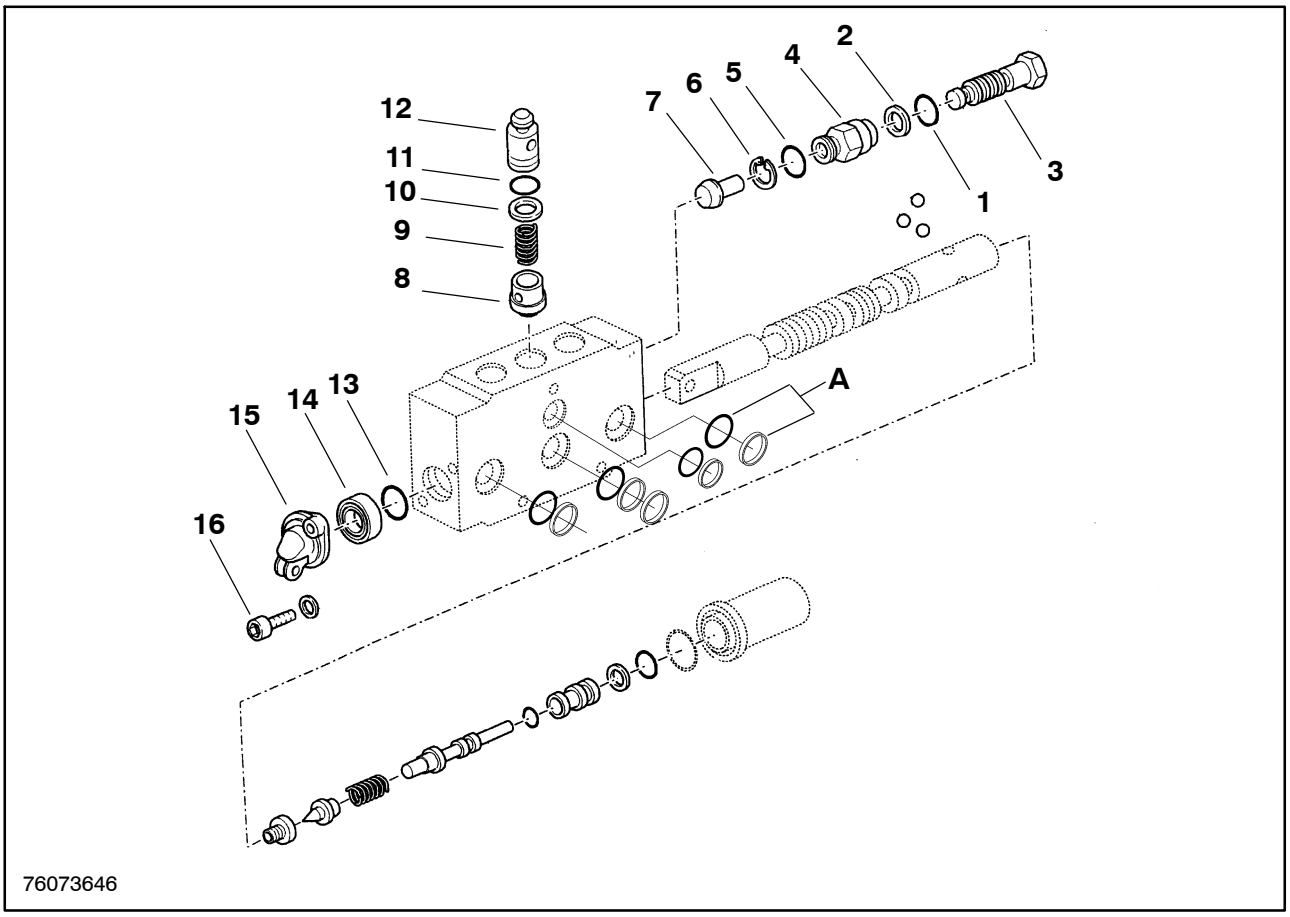

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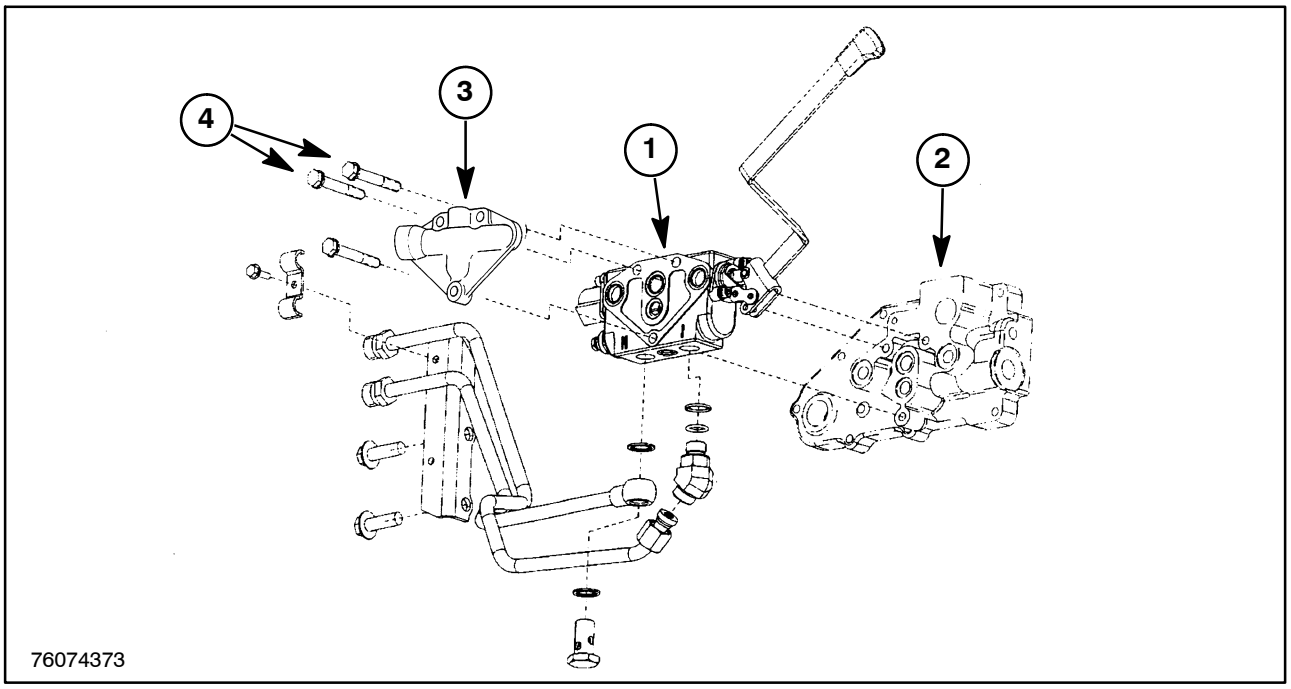
22. Lubricate and install a new O-ring, 1, and new seal ring, 2, onto the switching valve, 3.
23. Install the switching valve, 3, into the valve retaining plug, 4.
24. Lubricate and install a new O-ring, 5, on the valve retaining plug, 4.
25. Install the E-clip, 6, in the groove on the switching valve, 3.
26. Lubricate and install the valve, 7, into the valve body.
27. Install the valve retaining plug assembly, 4, into the valve body. Tighten securely.
28. Install the valve, 8, and spring, 9, in the valve body.
29. Lubricate and install a new seal ring, 10, and new O-ring, 11, on the check valve guide, 12. Install the check valve guide, 12, into the valve body.

NOTE: *O-ring, 13, was installed earlier during valve body and spool assembly.*

30. Lubricate and install the wiper ring, 14, in the valve body.
31. Install the lever control support, 15, on the valve body. Install the two bolts, 16, and lock washers to secure the lever control support to the valve body. Tighten securely.

NOTE: *On the four valve face ports "A" each port has an O-ring and retaining ring. Only the lower middle port has a third anti-extrusion ring. Make sure all O-rings and retaining rings are in place before installing the valve assembly to the tractor.*



170

(Valve Stack Position #1)

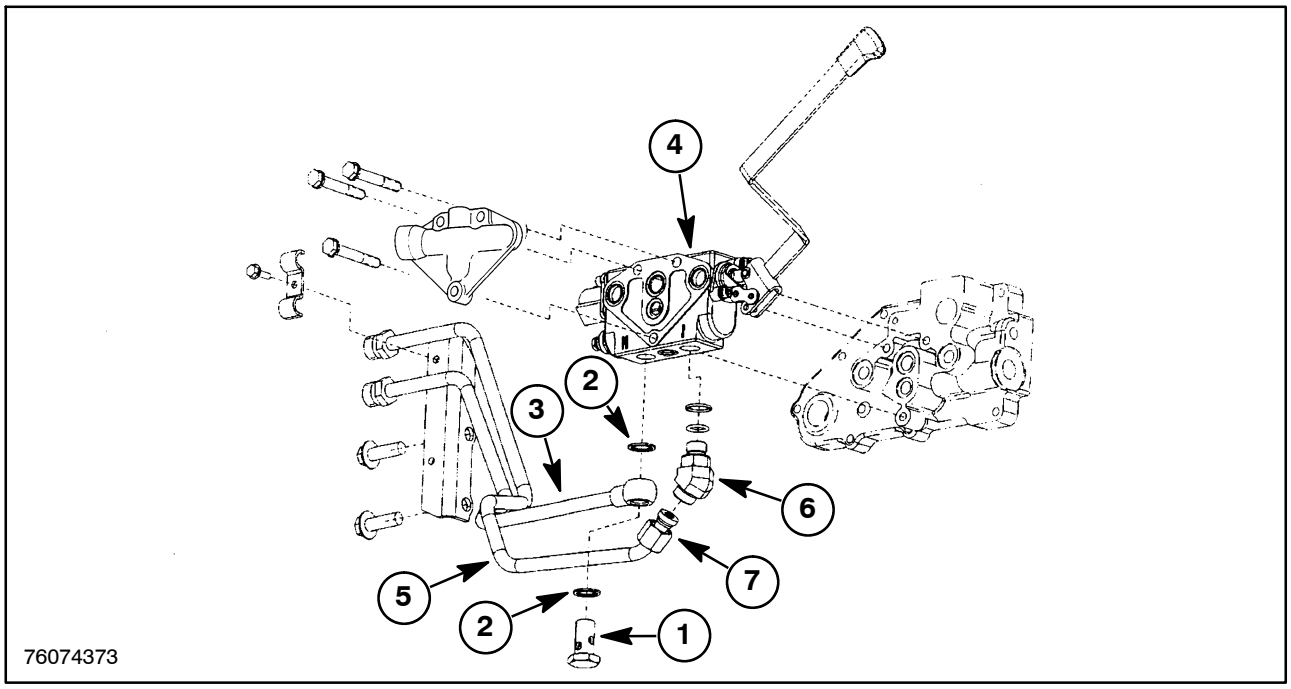
Installation

IMPORTANT: *When installing control valve onto the lift cover, be very careful not to lose O-rings and backing rings from the four main ports on the valve.*

1. Lubricate all O-rings with clean hydraulic fluid and carefully install valve, 1, onto lift cover housing, 2.
2. Install cover, 3, onto control valve, 1.

NOTE: *If valve in position #1 is used with valves in the #2 and/or #3 position, see Installation for valves in #2 and/or #3.*

3. Install three retaining bolts, 4, through cover, 3, and valve, 1.
4. Tighten the three bolts evenly to 59 N·m (43.5 ft-lbs).



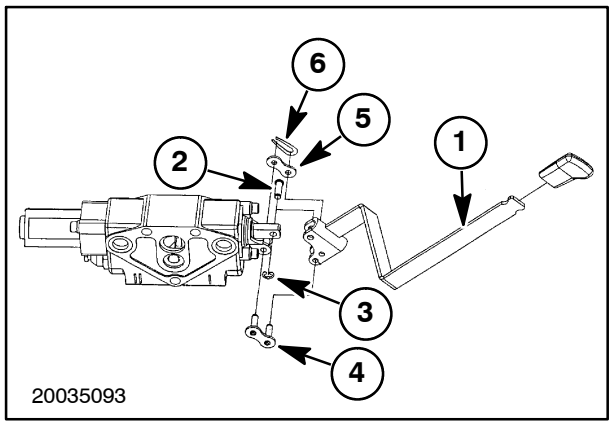
171

NOTE: *Control lever shown for clarity only. Lever installation is done later.*

IMPORTANT: *It may be necessary to loosen the tube retaining clamps to ease connection of tubes to valve.*

5. Place banjo bolt, 1, through washers, 2, rear remote tube, 3, and install into control valve, 4. Tighten banjo bolt.
6. Connect tube, 5, to 45° fitting, 6.
7. Tighten tube fitting, 7.
8. If loosened previously, tighten tube clamps.

9. Connect the lever assembly, 1, to the valve spool using pin, 2, and E-clip, 3.
10. Connect the remaining end of the lever assembly, 1, to the valve body using the double pin, 4, link, 5, and spring stop lock, 6.



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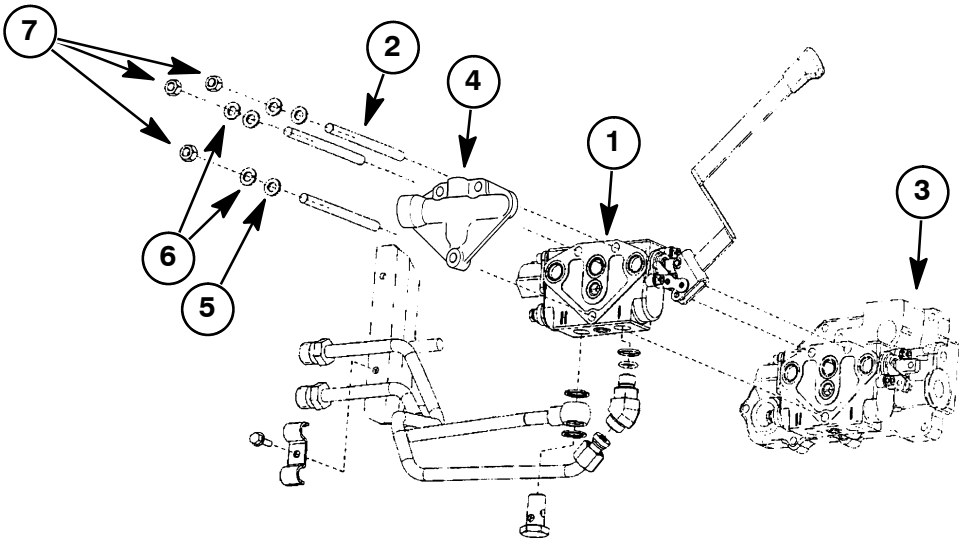


173

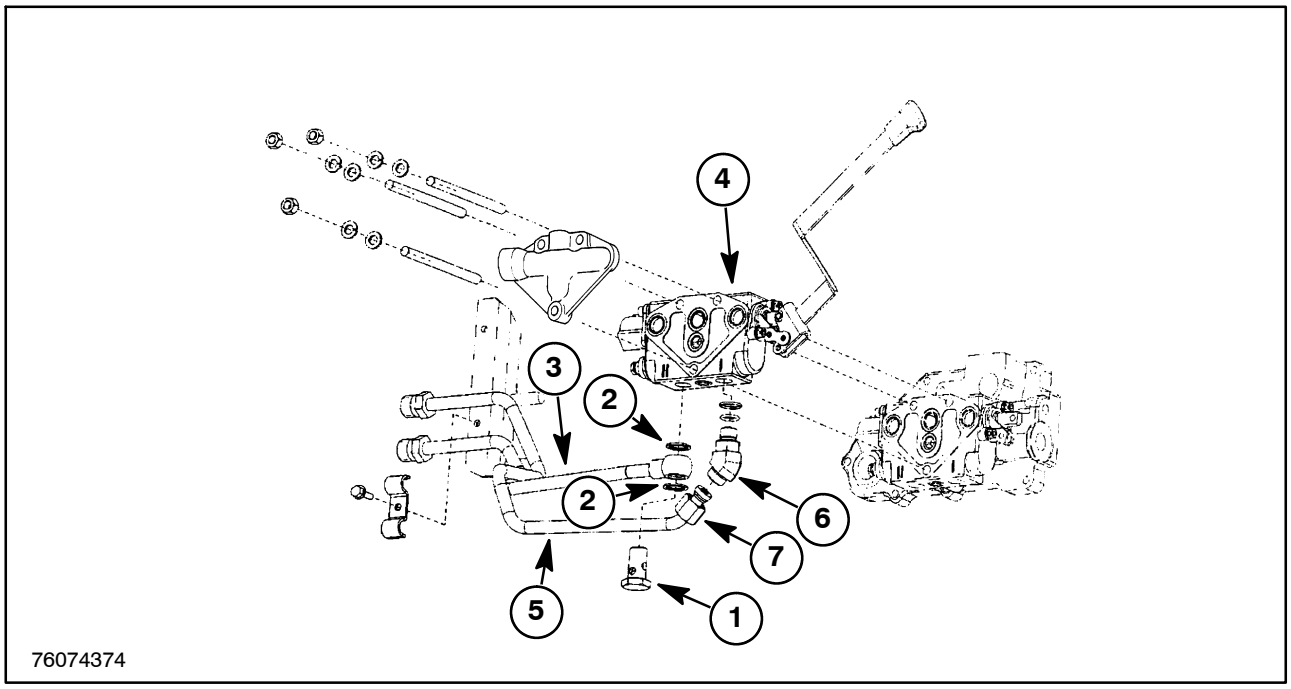
(Valve Stack Position #2)

IMPORTANT: *When installing #2 control valve onto #1 valve, be very careful not to lose O-rings and backing rings from the four main ports on the valves.*

11. Lubricate all O-rings with clean hydraulic fluid and carefully install valve #2, 1, over studs, 2, onto control valve #1, 3.
12. Install cover, 4, over studs, 2, onto control valve, 1.

NOTE: *If valve in position #2 is used with valve in the #3 position, see installation of valve #3.*

13. Install three flat washers, 5, lock washers, 6, and nuts, 7, onto studs, 2.
14. Tighten the three nuts, 7, evenly to 59 N·m (43.5 ft-lbs).



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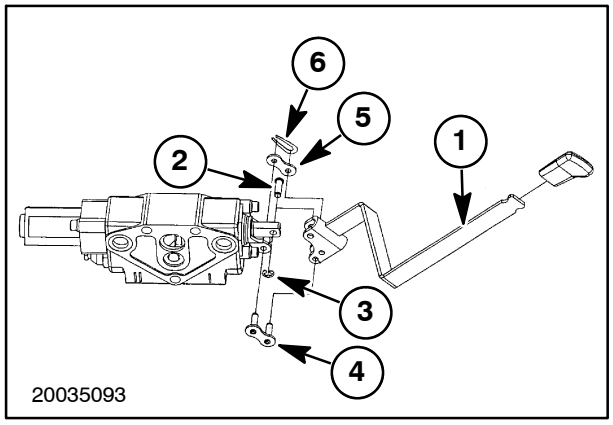
NOTE: *Control lever shown for clarity only. Lever installation is done later.*

IMPORTANT: *It may be necessary to loosen the tube retaining clamps to ease connection of tubes to valve.*

15. Place banjo bolt, 1, through washers, 2, rear remote tube, 3, and install into control valve, 4. Tighten banjo bolt.
16. Connect tube, 5, to 45° fitting, 6.
17. Tighten tube fitting, 7.
18. If loosened previously, tighten tube clamps.
19. Connect the lever assembly, 1, to the valve spool using pin, 2, and E-clip, 3.
20. Connect the remaining end of the lever assembly, 1, to the valve body using the double pin, 4, link, 5, and spring stop lock, 6.



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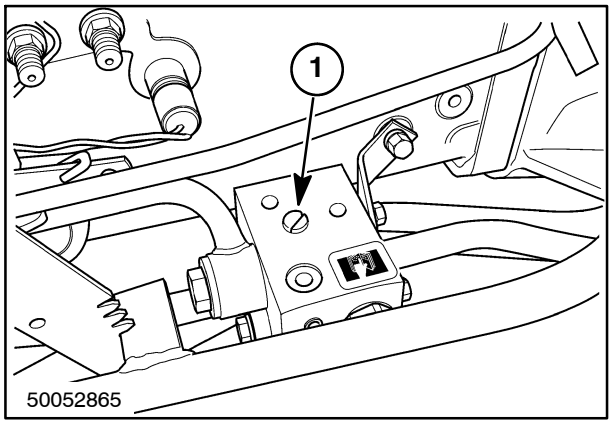
Detent Kick-Out Adjustment

When operating correctly, the adjustable detent release on the rear remotes will kick out at approximately 158 bar (2300 PSI). This will prevent pump failure due to continuous operation under high pressure, and ensure the remote valve lever returns to the neutral position. If needed, adjust the kick-out pressure using the following procedure. A hydraulic flow meter is required to perform this procedure.

1. Make sure the diverter valve adjuster screw, 1, is in the 2 o'clock position.



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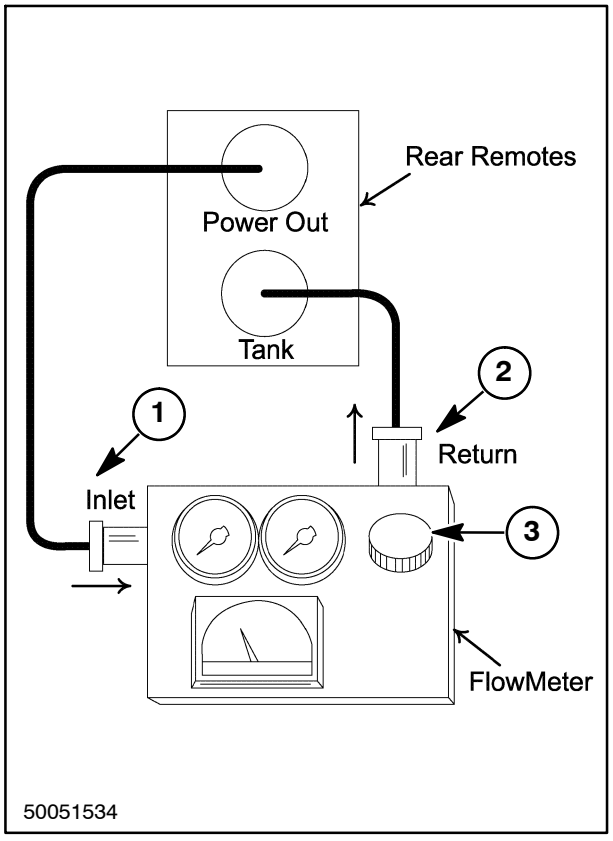
2. Connect a hydraulic line from the top rear remote coupler, 1, to the "Inlet" port of the flow meter.
3. Connect a hydraulic line from the lower rear remote coupler, 2, to the "Return" port of the flow meter.
4. Start the engine and operate the hydraulic system to warm the hydraulic fluid to normal operating temperature.
5. Place the rear remote valve control lever in the detent position.
6. Operate the engine at full RPM, gradually close the restrictor valve, 3, to restrict flow through the flow meter.
7. Observe the pressure gauge on the "Inlet" side of the flow meter.

NOTE: *Relief pressure for the T2410/T2420 is 172 bar (2500 PSI). The Detent Kick-Out Pressure should be approximately 13.8 bar (200 PSI) below this reading.*

8. When pressure reaches 158 bar (2300 PSI) the remote valve should kick-out into the neutral position. If pressure is above or below this reading, adjustment is required.



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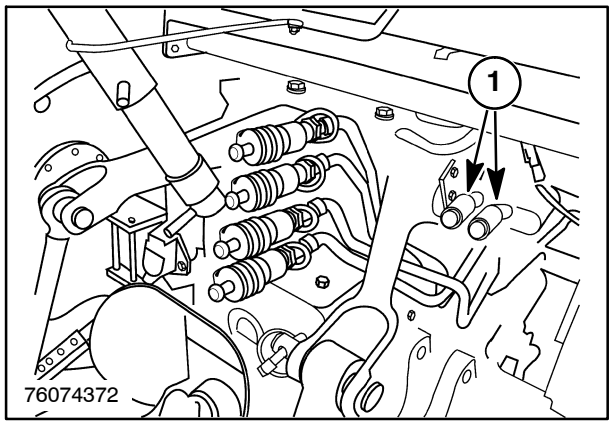
9. Locate rear remote valves, 1, underneath operator's seat.



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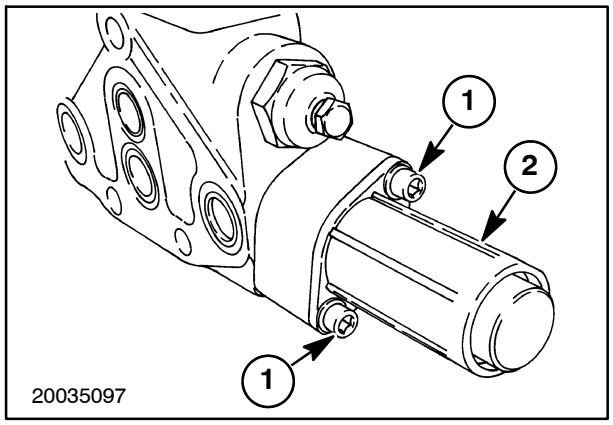
10. Loosen and remove the two socket head bolts, 1, securing the flange cover, 2, to the valve body.
11. Remove the flange cover.



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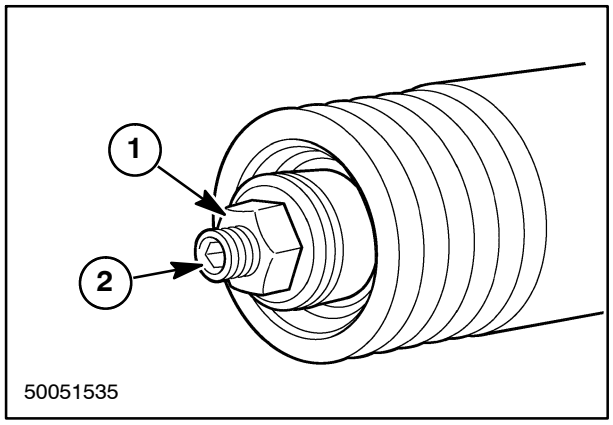
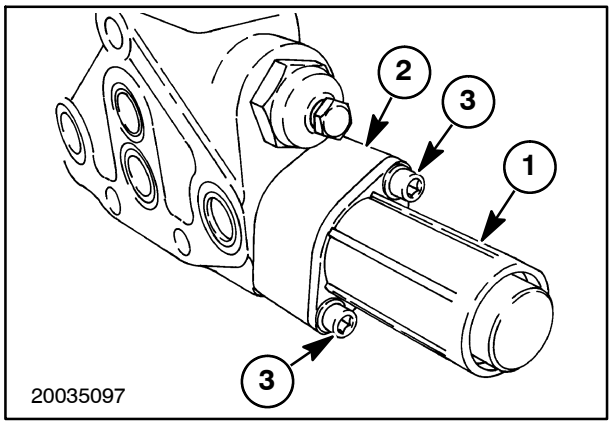
12. Loosen lock nut, 1. Use an allen wrench to turn the adjustment screw, 2, to change pressure. Turning the adjustment screw one half of a turn clockwise will increase the pressure approximately 13.8 bar (200 PSI), Turning the adjustment screw one half of a turn counter clockwise will decrease the pressure approximately 13.8 bar (200 PSI), After desired pressure has been obtained, tighten lock nut, 1.



180

13. Install the flange cover, 1, over the end of the spool, against the spacer, 2.
14. Install and tighten the two socket head bolts, 3, and lock washers to secure the flange and spacer to the valve body.



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SECTION 41 - STEERING

Chapter 1 - Steering

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SPECIFICATIONS

POWER STEERING SYSTEM

Power Steering Pump
- Flow @ 2700 rpm, FWD . . . . . 20.1 lpm (5.3 gpm)

Power Steering Type . . . . . Full Hydraulic

Steering Cylinder
- Stroke FWD . . . . . 225 mm (8.86 in)
- Bore FWD . . . . . 40 mm (1.57 in)

Relief Valve Pressure
- FWD . . . . . 145 - 152 bar (2062 - 2160 psi)

Reservoir
- Capacity . . . . . 1.4 L (1.5 US qts)
- Oil . . . . . AMBRA MULTI G134

Maximum Turning Angle
- FWD . . . . . 56°

Front to Rear Axle Ratio 1.5908:1

BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot Pounds	Newton Meters	Pitch (mm)	Foot Pounds	Newton Meters
M6	4T, 4.8	1.0	3.6 - 5.1	4.9 - 6.9			
	7T, 8T, 8.8		6.1 - 8.3	8.3 - 11.3			
	10T, 11T		8.6 - 11.6	11.7 - 15.7			
M8	4T, 4.8	1.25	9.4 - 12.3	12.7 - 16.7	1.0	11.2 - 14.9	15.2 - 20.2
	7T, 8T, 8.8		16.7 - 21.0	22.6 - 28.4		19.6 - 25.3	26.5 - 34.3
	10T, 11T		21.0 - 26.8	28.5 - 36.3		22.4 - 29.7	30.4 - 40.2
M10	4T, 4.8	1.5	18.8 - 24.6	25.5 - 33.3	1.25	21.0 - 26.8	28.5 - 36.3
	7T, 8T, 8.8		32.5 - 41.3	44.1 - 55.9		36.2 - 46.3	49.0 - 62.8
	10T, 11T		39.8 - 51.3	54.0 - 69.6		42.7 - 54.2	57.9 - 73.5
M12	4T, 4.8	1.75	27.5 - 34.8	37.3 - 47.1	1.25	31.8 - 40.5	43.1 - 54.9
	7T, 8T, 8.8		48.5 - 61.5	65.7 - 83.3		54.9 - 69.4	74.5 - 94.1
	10T, 11T		68 - 85.6	92 - 116		73.1 - 93.7	99 - 127
M14	4T, 4.8	2.0	46.3 - 59.3	62.8 - 80.4	1.5	51.4 - 64.4	69.7 - 87.3
	7T, 8T, 8.8		76.8 - 97.4	104 - 132		85.6 - 109	116 - 148
	10T, 11T		102.6 - 129	139 - 175		110 - 136	149 - 185
M16	4T, 4.8	2.0	63.5 - 81.2	86 - 110	1.5	67.2 - 84.9	91 - 115
	7T, 8T, 8.8		110 - 136.5	149 - 185		116 - 142	157 - 193
	10T, 11T		151.3 - 188	205 - 255		162 - 199	220 - 270
M18	4T, 4.8	2.0	83.4 - 104	113 - 141	1.5	96.7 - 120	131 - 163
	7T, 8T, 8.8		145 - 174	196 - 236		169 - 206	230 - 280
	10T, 11T		203 - 246	275 - 333		220 - 270	299 - 367
M20	4T, 4.8	2.5	106 - 133	144 - 180	1.5	126 - 155	171 - 211
	7T, 8T, 8.8		177 - 214	240 - 290		203 - 245	275 - 333
	10T, 11T		268 - 326	363 - 441		293 - 358	397 - 485

SPECIAL TOOLS

Tool No.

Gauge 0-3000 psi . . . . . OEM 1462

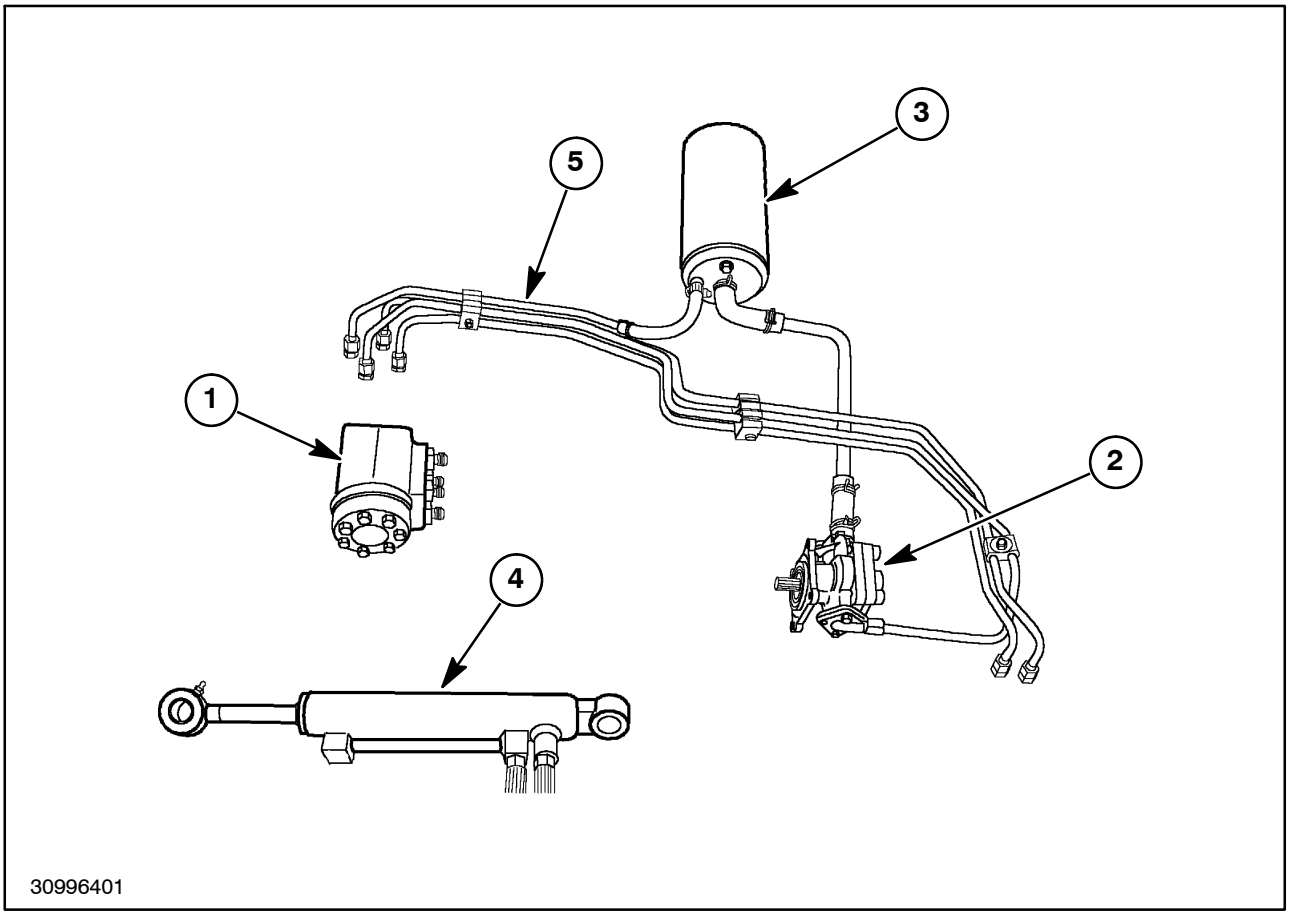
Hose . . . . . Procure Locally

Tee Fitting NH01412

Variseal Installation Tool 293955*

*Order thru New Holland Parts system.

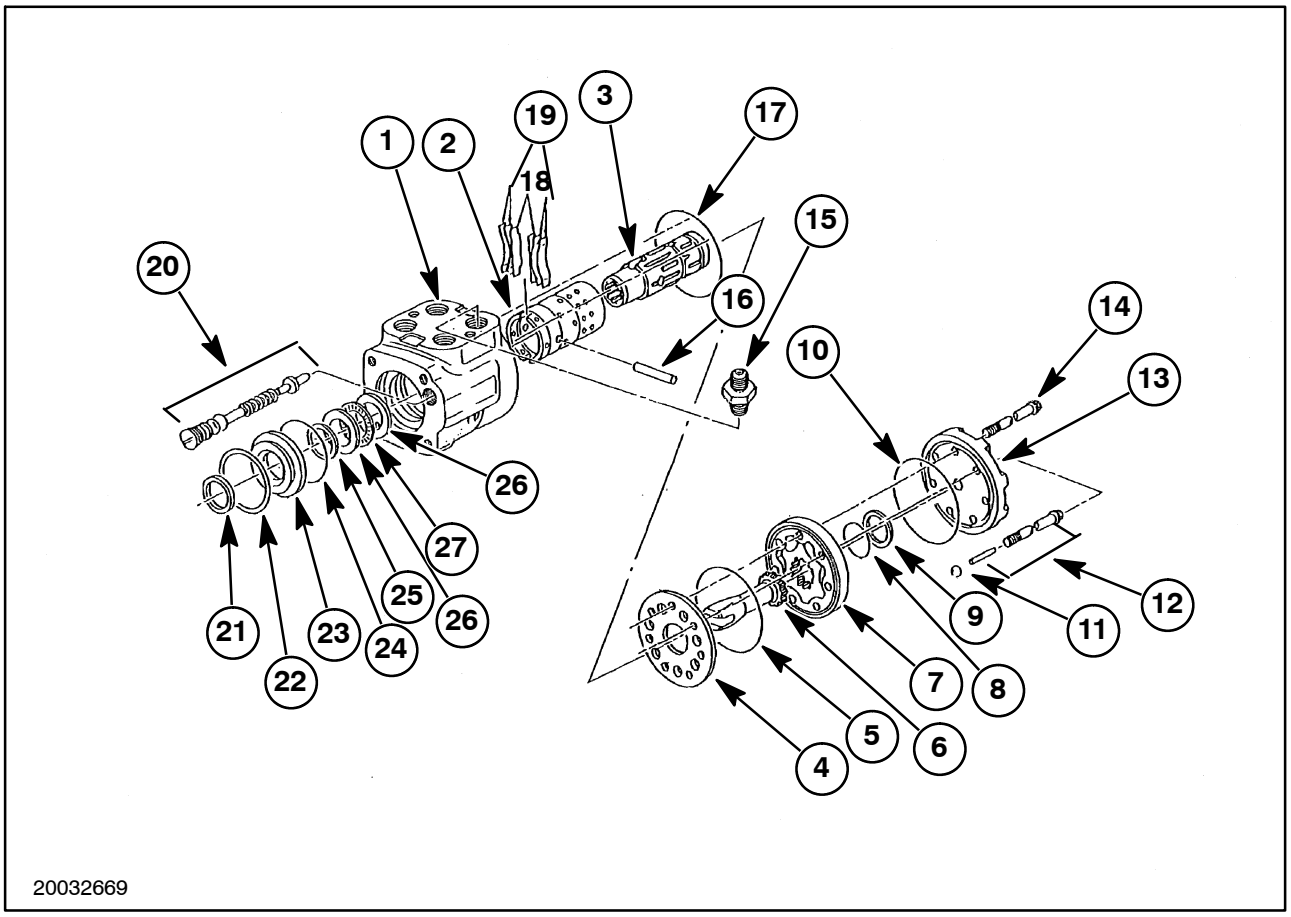
DESCRIPTION OF OPERATION



1

POWER STEERING

The power steering system consists of a power steering control motor, 1, a power steering pump, 2, a fluid reservoir, 3, a steering cylinder assembly, 4, and tubing, 5.



2

1. Steering case assembly
2. Rotary valve spool
3. Retaining valve sleeve
4. Thrust plate
5. O-ring
6. Rotor drive shaft
7. Rotor and fixed ring
8. O-ring
9. Plug
10. O-ring
11. Check valve ball
12. Screw
13. End cap
14. Retaining bolts
15. Connector
16. Rotor spool/sleeve trim pin
17. O-ring
18. Flat spring
19. Centering spring
20. Relief valve
21. Dust seal
22. Retaining clip
23. Seal gland bushing
24. O-ring
25. Oil seal
26. Bearing race
27. Bearing

POWER STEERING CONTROL MOTOR

Spool and Sleeve

1. The spool, 3, and sleeve, 2, Figure 2, constitute a rotary valve for selectively changing the fluid passage as well as the direction of the pressurized fluid flow. There are three forms of fluid passage. The first is for the NEUTRAL state, the second is for RIGHT turning, and the third is for LEFT turning.
2. The spool, 3, is fitted to rotate within the sleeve, 2, which is fitted into the bore of the valve body, 1. The leaf springs, 19, extend through the spool, 3, and sleeve, 2, and urge the spool to take the indicated position relative to the sleeve. This position corresponds to the NEUTRAL state, and persists as long as the steering wheel is at its center position, for straight-ahead driving.
3. A diametrically extended pin, 16, is loosely fitted to the drive shaft, 6, at the center, and to the sleeve, 2, with some clearance between the pin and the radial holes in the spool. When the drive shaft, spool, and sleeve are in the indicated positions, the sleeve and shaft are capable of as much as 10º movement in either direction (CW or CCW) relative to the spool. By this angular displacement, the fluid passage for RIGHT turning or LEFT turning is introduced.

Rotor and Fixed Ring

1. The rotor and fixed ring assembly, 7, in the pump, provides the system with a back-up device for steering, and operates as described later.

Check Valve

1. The check valve, 11, normally remains closed, preventing pressurized fluid flow from its “IN” side to its “OUT” side. If fluid pressure is not available, the check valve unseats, permitting fluid to be drawn from the reservoir to the “IN” side.

Drive Shaft

1. The pump drive shaft, 6, is slightly tilted off the spool axis, and is splined into the pump gear of the rotor and fixed ring pump assembly, 7, by its bottom end. As mentioned earlier, this shaft is connected to the pin, 16, by its top end.
2. In the event of a hydraulic fluid pressure loss, turning the steering wheel turns the drive shaft, 6, due to the spool and pin connection, to rotate the pump gear, 7. This enables the rotor and fixed ring, 7, to operate as a manually driven pump to produce hydraulic fluid pressure.

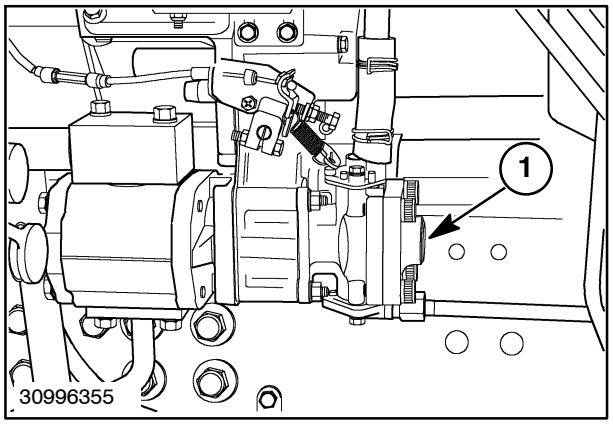
Pressure Relief Valve

1. The pressure relief valve, 20, prevents excess fluid pressure buildup within the steering pump and the circuit. This excess pressure may be due to the steering wheel being turned to its full travel and against its stops, or the front wheels being prevented from turning.

NOTE: *The pressure relief valve is adjustable. Turning the calibration adjustment screw clockwise increases pressure, and turning counterclockwise decreases pressure.*

POWER STEERING PUMP

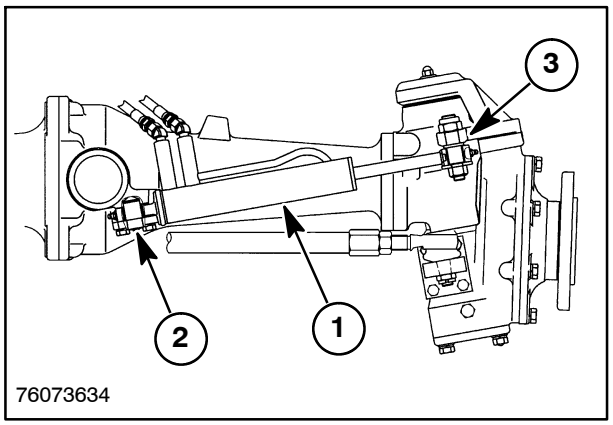
The power steering pump, 1, is mounted on the front right side of the engine and is driven by the engine oil pump gear. Other than replacing the pump seals, there is no maintenance for the pump. Should any of the pump components fail, the entire pump assembly must be replaced.



3

POWER STEERING CYLINDER

The power steering cylinder, 1, is mounted transversely under the tractor with the cylinder end, 2, pinned to the axle and the rod end, 2, pinned to the axle and the rod attached to the spindle arm, 3.



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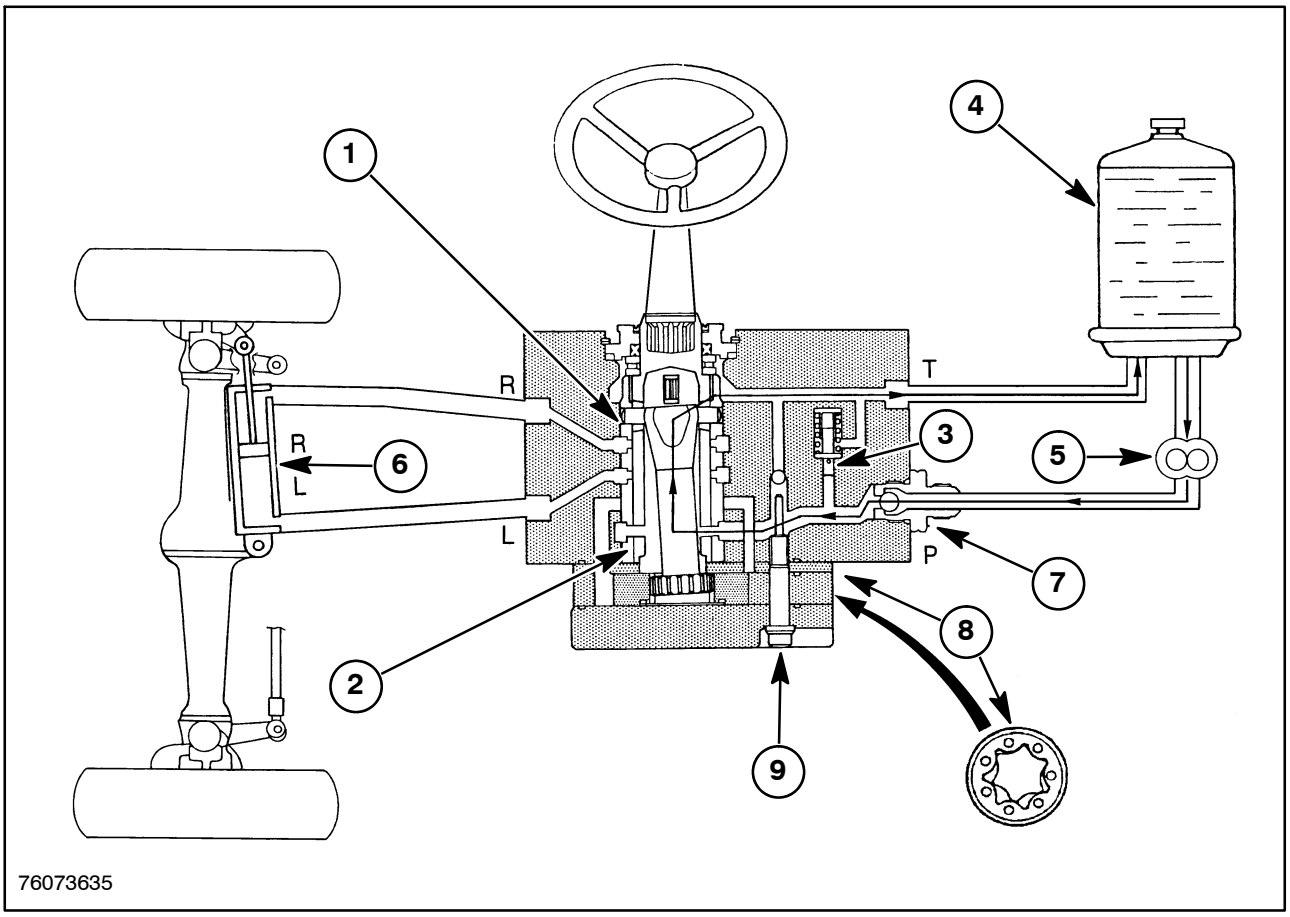


5

1. Sleeve
2. Spool
3. Relief Valve Assembly
4. Reservoir
5. P/S Pump
6. Cylinder
7. Check Valve Assembly
8. Gerotor Gear Pump
9. Kick Back Check Valve

POWER STEERING OPERATION

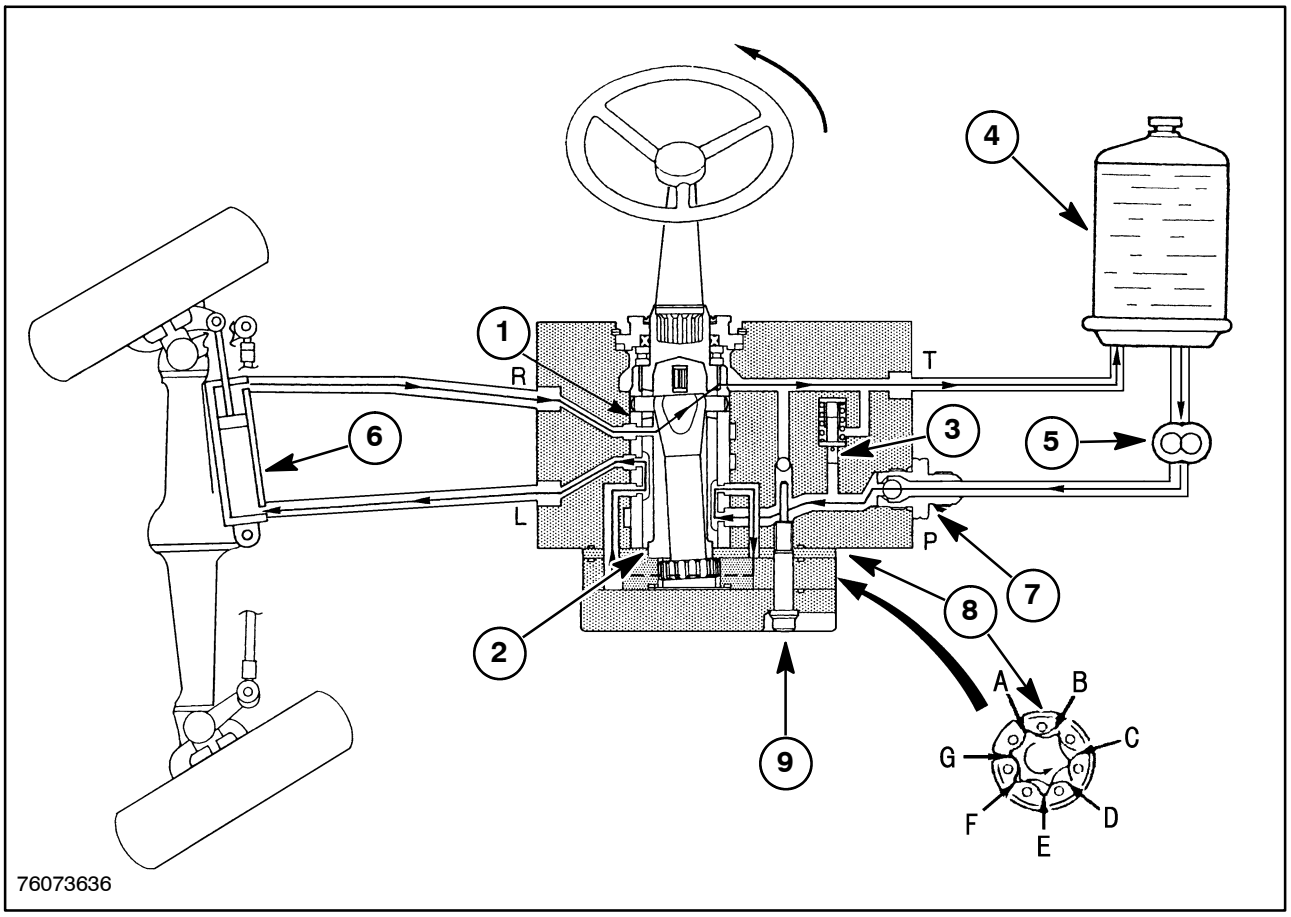
Fluid Flow - Neutral Position

Pressurized fluid from the power steering pump enters the valve body at port “P”. The fluid flows through the check valve, 7, past the relief valve, 3, and through radial holes in the sleeve, 1, to the center of the valve spool, 2.

NOTE: *There are 24 radial holes in the sleeve, 1, that index with 12 grooves provided in the spool.*

In the neutral position the fluid flows through the hollow spool and returns to the reservoir via port “T”.

Passage to ports “L” and “R,” leading to the cylinder, 6, are blocked by the second spool and sleeve. Fluid contained in the tubes and cylinder is trapped and the cylinder remains in a fixed position. In this position the front wheels hold at a straight ahead position. Because the system is fully hydraulic, there is no road feel or front wheel reaction transmitted to the steering wheel.



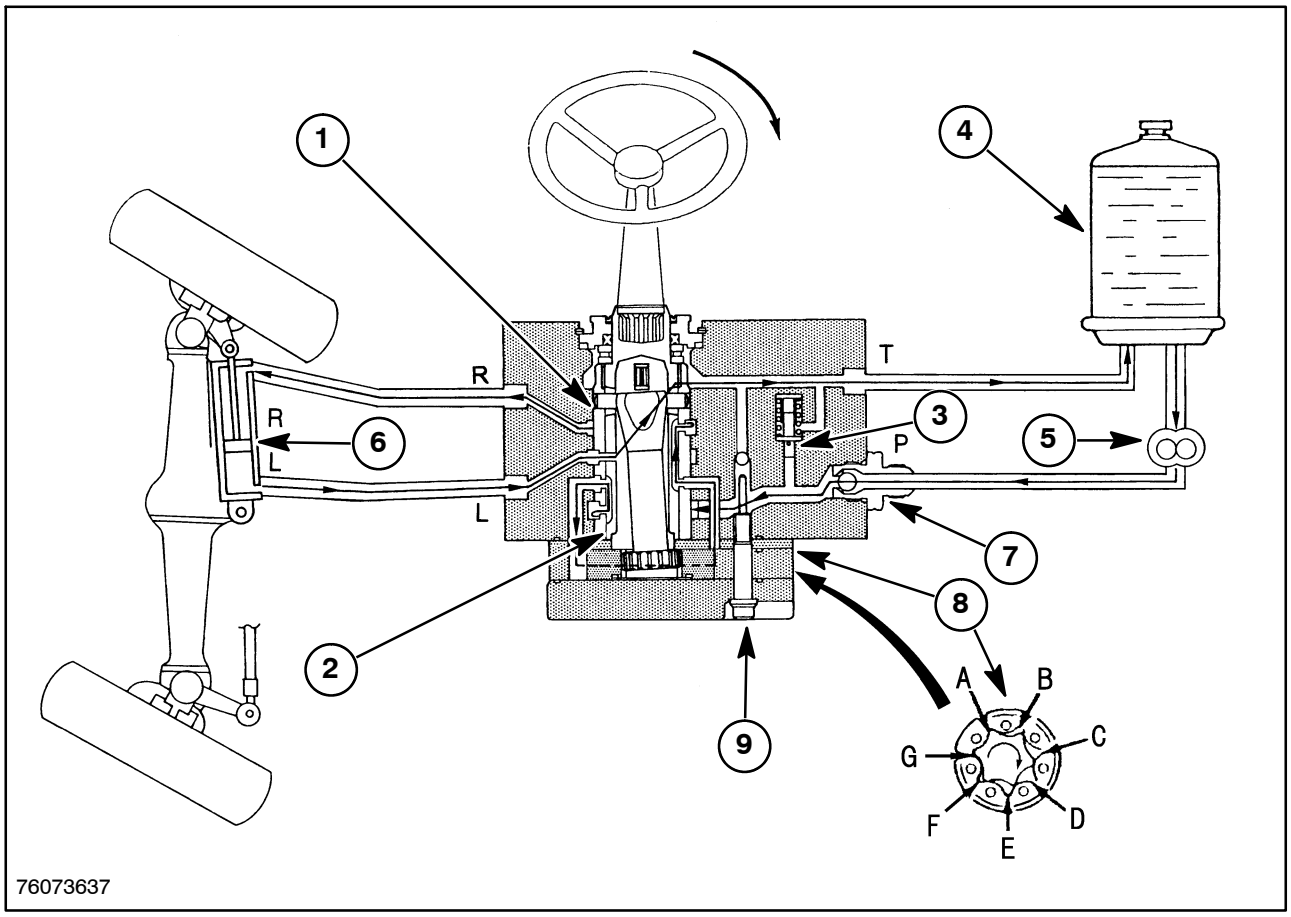
6

1. Sleeve
2. Spool
3. Relief Valve Assembly
4. Reservoir
5. P/S Pump
6. Cylinder
7. Check Valve Assembly
8. Gerotor Gear Pump
9. Kick Back Check Valve

Fluid Flow - Left Turn

Turning the steering wheel to the left rotates the valve spool and indexes grooves in the spool with holes in the sleeve allowing fluid flow to enter passages “F,” “E,” and “D” in the control valve gear pump. Because the gear pump is turning counterclockwise, the fluid flows through passages “C,” “B,” and “A,” to port “L” and to the power steering cylinder.

Fluid enters the cylinder barrel end of the cylinder and causes the front wheels to turn left. Fluid contained in the cylinder rod side returns to the control valve through port “R” and is directed back to the reservoir through port “T”.



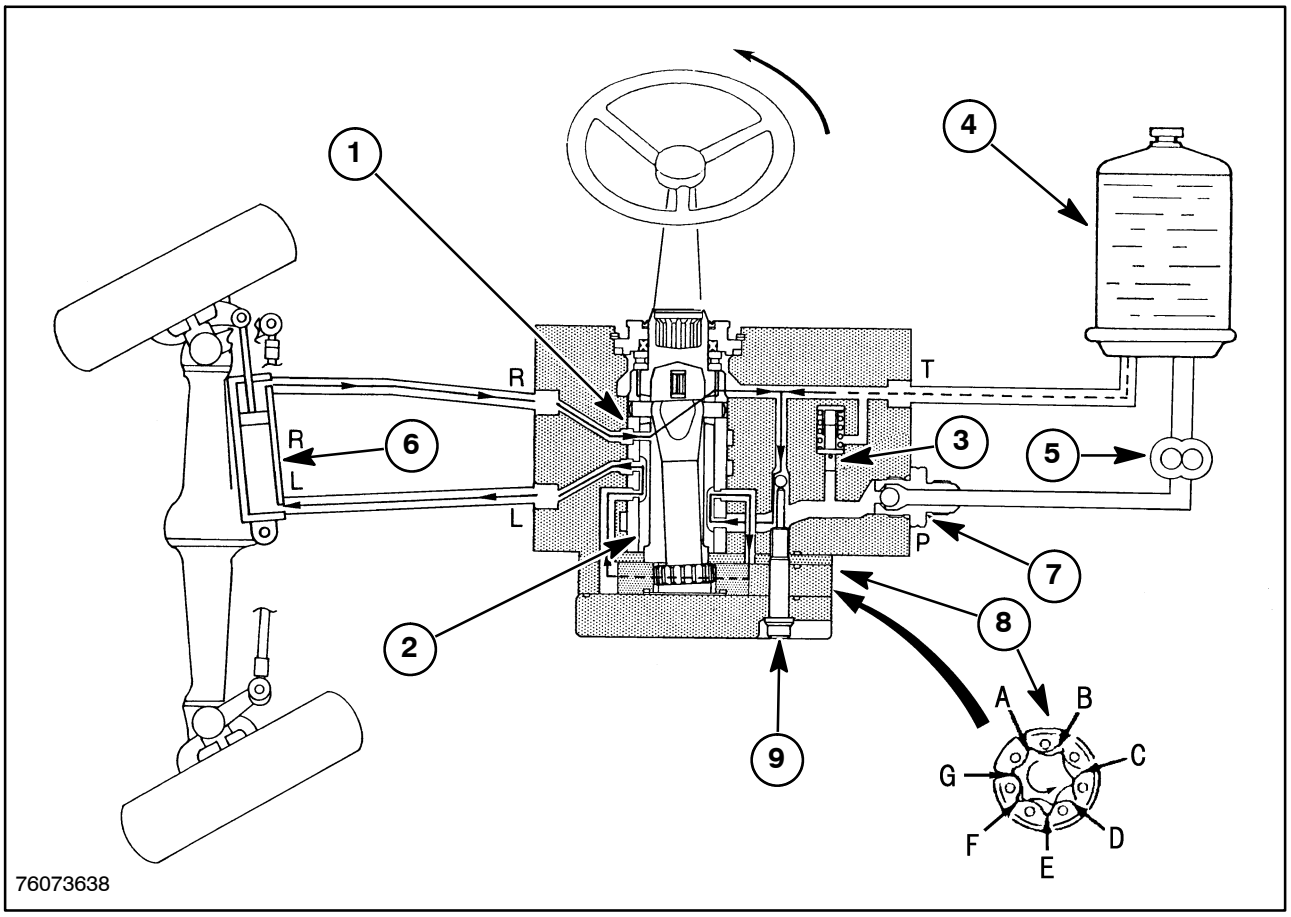
7

1. Sleeve
2. Spool
3. Relief Valve Assembly
4. Reservoir
5. P/S Pump
6. Cylinder
7. Check Valve Assembly
8. Gerotor Gear Pump
9. Kick Back Check Valve

Fluid Flow - Right Turn

Turning the steering wheel to the right (clockwise) rotates the spool clockwise and indexes the grooves in the spool with holes in the sleeve for right turn.

Fluid flow from the pump enters the gear pump passages “A,” “B,” and “C” and flows out passages “D,” “E,” and “F” to the valve port “R” to the cylinder. Fluid in the piston side of the cylinder returns to the control valve through port “L” and is directed back to the reservoir through port “T”.



8

1. Sleeve
2. Spool
3. Relief Valve Assembly
4. Reservoir
5. P/S Pump
6. Cylinder
7. Check Valve Assembly
8. Gerotor Gear Pump
9. Kick Back Check Valve

MANUAL OPERATION

In the event of a power steering pump failure or engine shut-down, the steering system can be operated manually.

Turning the steering wheel drives the rotor and fixed ring gear pump, 8, in the control valve assembly to force fluid to the power steering cylinder, 6, according to the direction that the steering wheel is being turned. Fluid from the opposite side of the cylinder returns to the control valve. A check valve, 9, located in the connecting passage between the “T” and “P” passages, unseats and allows the fluid and any reservoir fluid that may be required to flow through the check valve and connecting passage to the “P” port passage, supplying the fluid required for the pressure side of the system.

TROUBLESHOOTING

Most malfunctions in the steering system can usually be traced to dirt or foreign matter in the system. Dirt can cause such things as stickiness, erratic operation, or hard steering.

Before considering the procedures below, follow these suggested steps:

1. Check the pump for proper, relief valve action. See “Pressure Testing,” discussed later in this section.
2. Use a jack to raise the front end of the tractor off the ground, and cycle the steering from stop to stop to check for front axle binding.
3. Be sure the hydraulic hoses from the pump-to-the motor, and from the motor-to-cylinder, are connected correctly.

CONDITION	POSSIBLE CAUSE	REMEDY
Hard Steering	1. Control valve unit.	
	• Control valve unit not aligned to steering column.	Reposition control valve unit. (If loosening its mounting bolts lightens the handwheel, it means that control valve unit was in misalignment).
	• Spool-and-sleeve combination is seized because of foreign matter.	Replace.
	• Over tightening of the end cap bolts.	Re-tighten to the specified torque limit.
	2. Oil pump.	
	• The pump is stuck and will not work.	Replace oil pump.
	• The pump is worn down.	Replace oil pump.
	• Pumping performance inadequate.	Test pump performance, and if necessary, remove the pump. Disassemble the pump and inspect the internal seals. Refer to the pump seal kit repair section.
	3. Relief valve.	
	• The valve is damaged because of internal deterioration.	Replace control valve assembly.
	• Pressure setting is too low.	Adjust relief pressure.
	4. Faulty power steering system.	4. Inspect and repair power steering system.
	5. Excessive weight on front axle due to front end loader installation.	5. Install ballasting box. Refer to “Wheels and Tires” for counterbalance.

CONDITION	POSSIBLE CAUSE	REMEDY
Steering wheel will not return to neutral or will turn by itself	1. Control valve unit • Spool and sleeve combination is stuck and will not rotate. • Control valve unit not aligned to steering column.	Replace control valve assembly. Re-align.
Cylinder will not follow steering wheel rotation or will respond sluggishly.	1. Control valve unit • Control valve unit has been improperly rebuilt, resulting in valve mistiming. 2. Steering cylinder • Air is trapped in the cylinder. • Internal oil leakage because of damaged piston seal.	Repair. Bleed air out. Replace the seal.
Steering wheel will “kick back”	1. Control valve unit • Control valve unit has been improperly rebuilt, resulting in valve mistiming. 2. Piping • Pipes are improperly connected to the four ports of control valve unit.	Repair. Correct the pipe connections.
Oil leakage • From the splined connection of column to spool. • From mated face joints (valve body, spacer plate, control valve unit, end cap).	1. Leaky oil seal • Dirty hydraulic oil. 2. Damaged O-ring	Replace the seal. Change the oil. Replace.

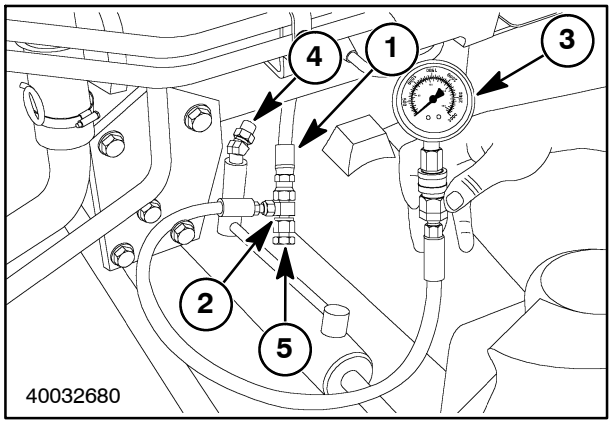
CONDITION	POSSIBLE CAUSE	REMEDY
Front wheel shimmy	1. Worn pivot shaft and/or bushings.	1. Replace pivot shaft and/or bushings.
	2. Loose tie-rod.	2. Tighten tie-rod.
	3. Loose spindle arm.	3. Tighten spindle arm.
	4. Worn king pin and/or bearing.	4. Replace king pin and/or bushing.
Loose spindle	1. Worn bushing.	1. Replace bushing.
	2. Worn spindle shaft.	2. Replace spindle shaft.
	3. Worn or damaged thrust bearing.	3. Replace thrust bearing.

PRESSURE TESTING

PUMP, STEERING MOTOR AND RELIEF VALVE

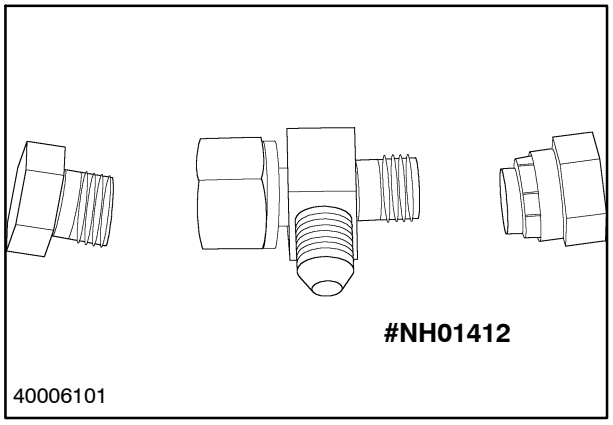
Test

1. With the tractor engine stopped, disconnect one of the hydraulic hoses, 1, that run to the steering cylinder.



9

2. Connect a tee fitting, Tool No. #NH01412, 2, and a 0 - 3000 psi pressure gauge, 3, to the end of the hose, 1, from the steering motor, and cap the tube, 4, on the steering cylinder.
3. Install a cap, 5, into the open end of the tee.
4. Start the tractor engine, and allow it to idle. Observe the pressure gauge, it should indicate 0 psi.
5. Turn the steering wheel so that the line that the gauge is connected to receives steering pump fluid pressure intended for the steering cylinder. For example, if the gauge is connected to the left side of the cylinder, as viewed from the operator's seat, turn the wheel to the left. Observe the gauge and the following:



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Test Results

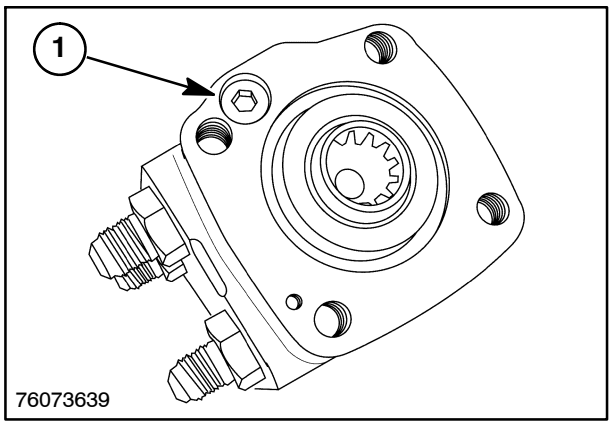
If the pressure gauge reading rises before the steering wheel is turned, it indicates that the steering motor will have to be disassembled and inspected.

If the pressure gauge reading is 145 - 152 bar (2100 - 2200 psi) standard FWD, when the steering wheel is turned, the steering pump relief valve is working properly.

If the pressure gauge reading is below the relief valve setting, it may indicate that the relief valve is not working properly, or the pump parts are worn.

6. Stop the tractor engine.

NOTE: *The steering system relief valve, 1, is located on the top side of the steering motor (the steering motor must be removed to change the setting). Rotate the relief valve cap clockwise to increase the pressure and counterclockwise to decrease the pressure. 1/4 turn on the relief valve equals approximately 5 bar (75 psi) change in pressure.*



11

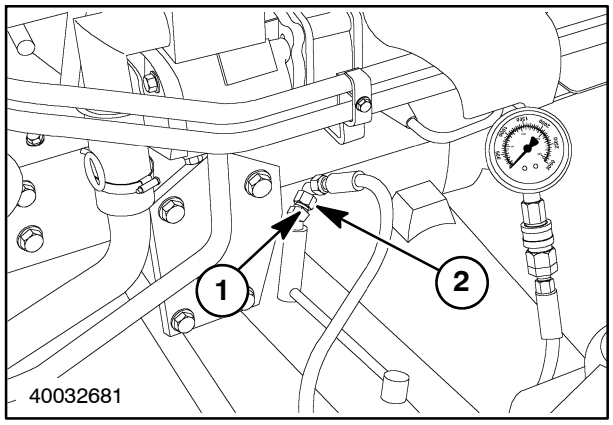
STEERING CYLINDER

Test

After testing the steering motor relief valve, set up the system as follows to test the steering cylinder:

NOTE: *Use same fittings (NH01412 tee fitting as used in Pump, Steering, Motor, and Relief Valve test).*

1. Remove the caps from the tee fitting, 2, and steering cylinder connections.
2. Attach the tee fitting, 2, to the steering cylinder connection, 1.
3. Start the tractor engine and turn the steering wheel so that the line which the gauge is connected to will receive the fluid pressure from the pump. Observe the gauge when the steering linkage reaches the limit of its travel.
4. Repeat the procedure for the other side of the cylinder. Observe the following:



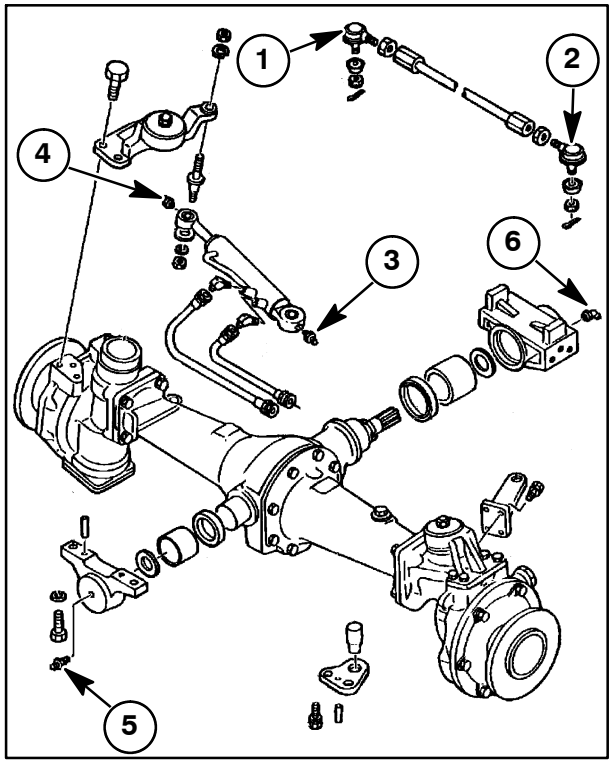
12

Test Results

If the pressure rises to the relief valve setting of 145 - 152 bar (2100 - 2200 psi) at both stops, it indicates that the system is operating properly.

Lubricate Every 50 Hours - FWD

1. Tie rod - right side
2. Tie rod - left side
3. Steering cylinder - barrel end
4. Steering cylinder - rod end
5. Front bearing holder
6. Rear bearing holder



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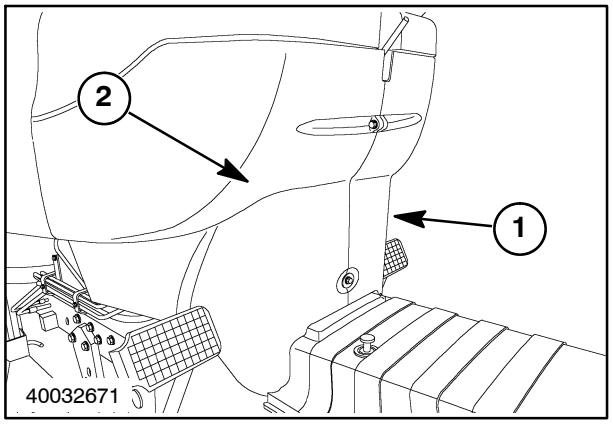
OVERHAUL

STEERING CONTROL MOTOR

Removal

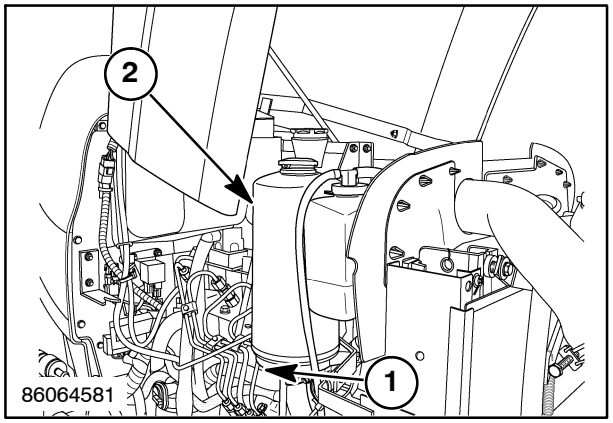
***IMPORTANT**: Cleanliness is extremely important when repairing hydraulic steering control motors. Work in a clean area. Before disconnecting the hydraulic lines, clean the port area of the control motor. Before disassembly, drain the oil from the control motor, plug or cap the ports and thoroughly clean the exterior of the control motor. During Disassembly, cleaning, repair and assembly use caution to protect machined surfaces.*

1. Remove the right, 1, and left, 2, rear hoods from the tractor. (See Platform Section 90).



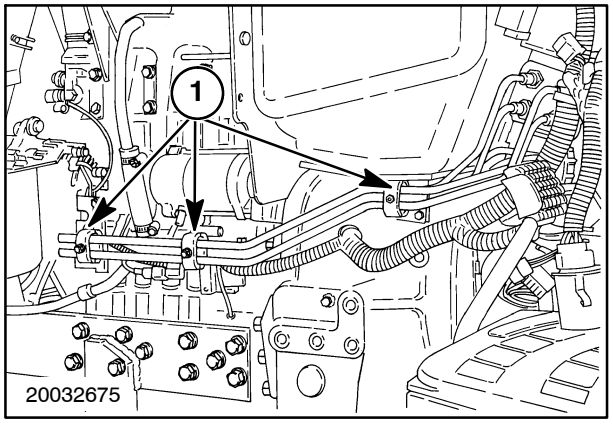
14

2. Loosen and remove the drain plug, 1, from the power steering reservoir, 2, and drain into a suitable container.



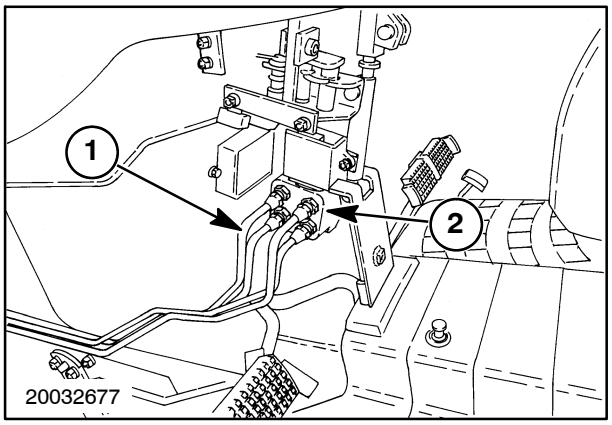
15

3. Remove the three steering line fasteners, 1, so the steering lines can be moved easily.



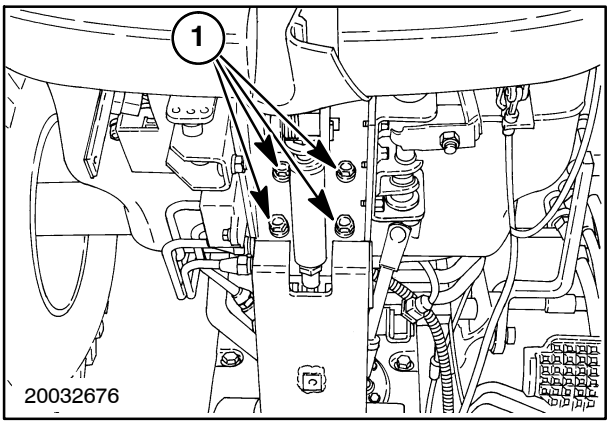
16

4. Disconnect the power steering tubes, 1, from the steering control motor, 2. Cap and plug all openings.



17

5. Remove the four mounting bolts, 1, and lower the steering control motor from the steering column.
6. Remove the steering motor from the tractor.



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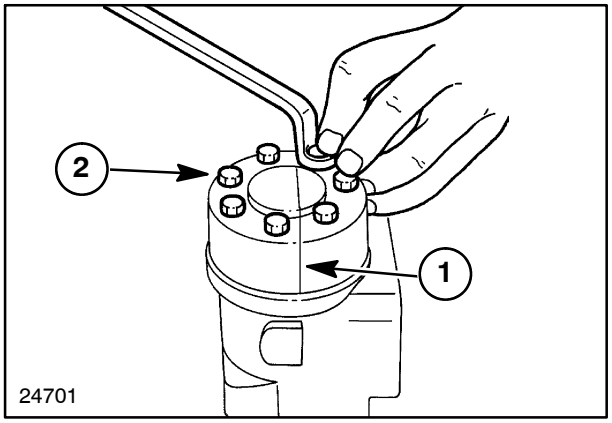
Disassembly

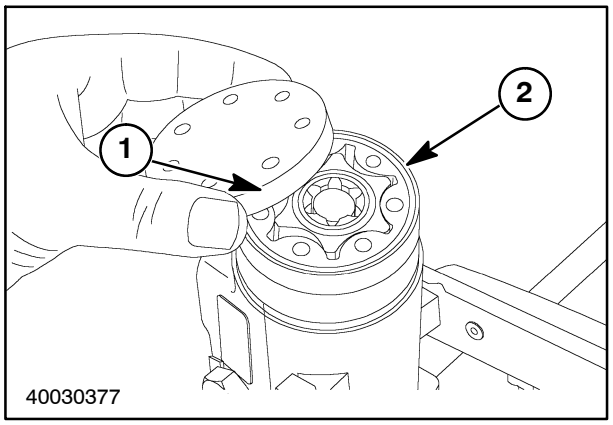
IMPORTANT*: Do not overtighten the motor in the vise. Housing damage may result.*

1. Clamp the steering control motor in a vise. Use just enough clamping force to hold the housing securely.
2. Use a paint pen to mark a line, 1, on the outside of the housing parts, for proper assembly at a later time.
3. Loosen and remove the seven bolts, 2, from the end cap.



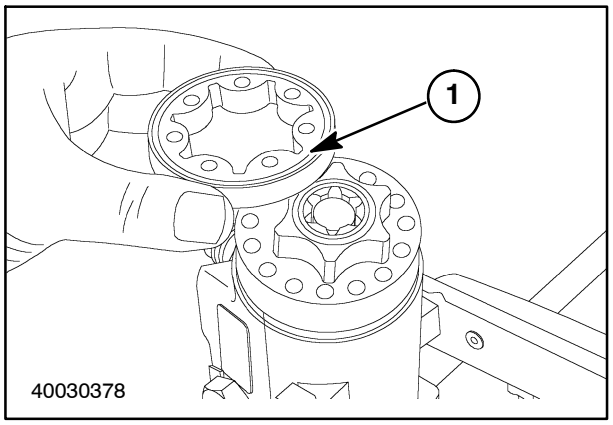
19

4. Remove the end cap, 1.
5. Remove and discard the O-ring, 2.



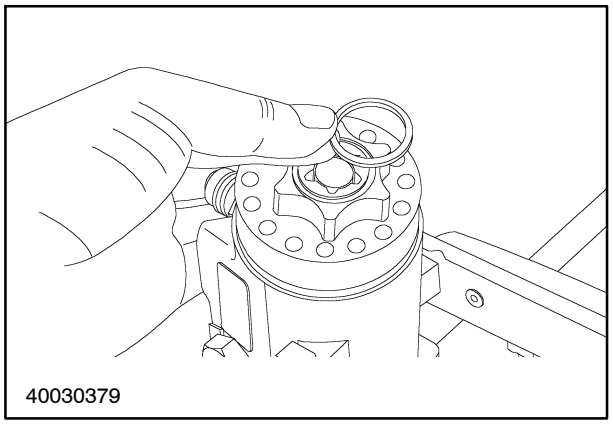
20

6. Remove the gerotor ring, 1.



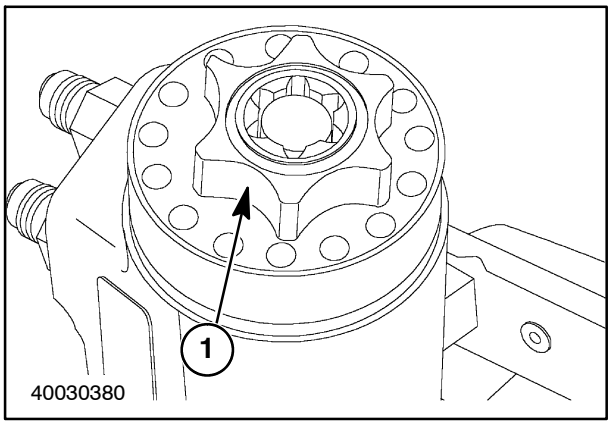
21

7. Remove the seal ring, and O-ring.



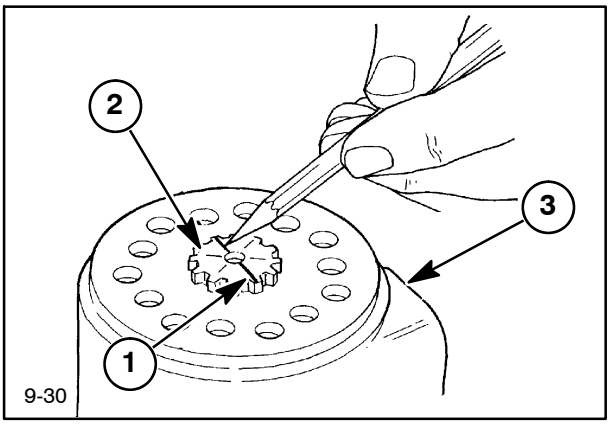
22

8. Remove the rotor, 1.



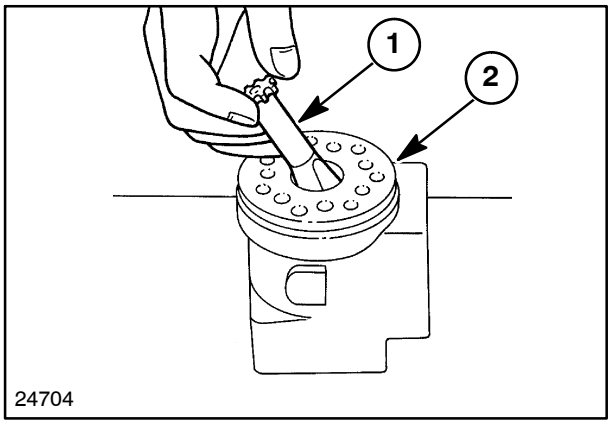
23

9. Mark a line, 1, on the top of the drive shaft, 2, parallel to the port face, 3, of the housing for proper re-assembly timing.



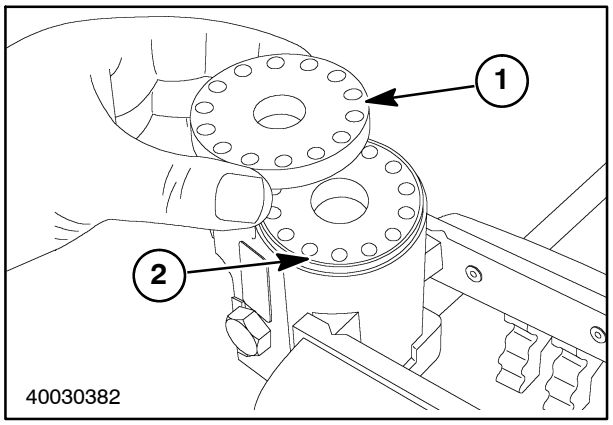
24

10. Remove the drive shaft, 1, from the housing, 2.



25

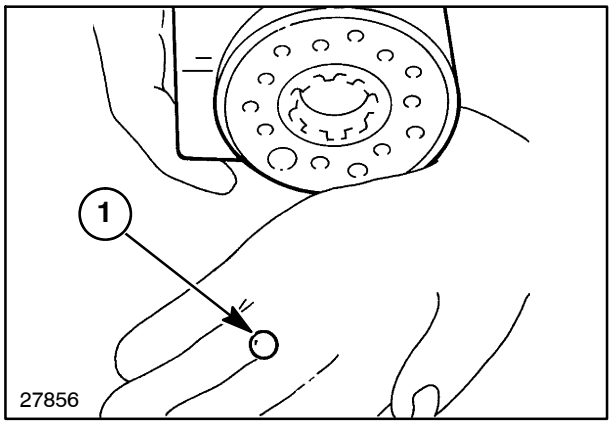
11. Remove the wear plate, 1, and O-ring, 2.



26

12. Rotate the control valve body and remove the check valve ball, 1.

NOTE: *The check ball, 1, is located in the deepest bolt hole. Mark the hole after removing the ball.*



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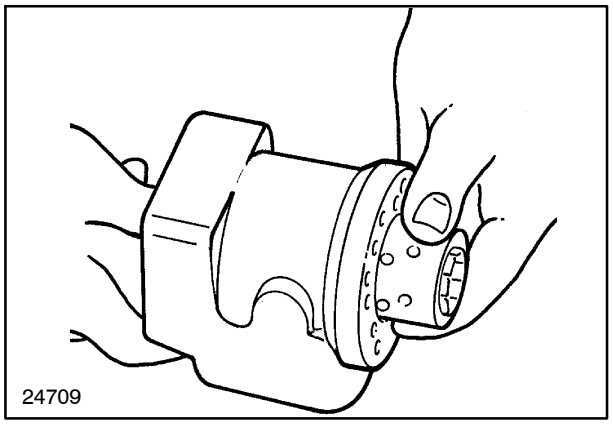
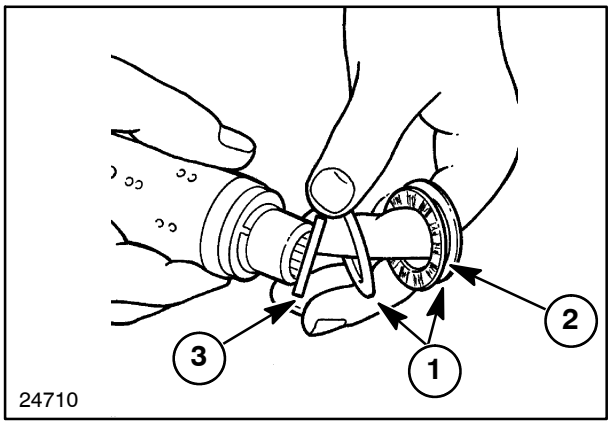
13. Position the control valve body so that the sleeve control shaft trim pin is in a horizontal position.
14. Push the rotating valve inwards, so that the valve, the valve seat sleeve and the thrust bearing can be removed from the control valve body.



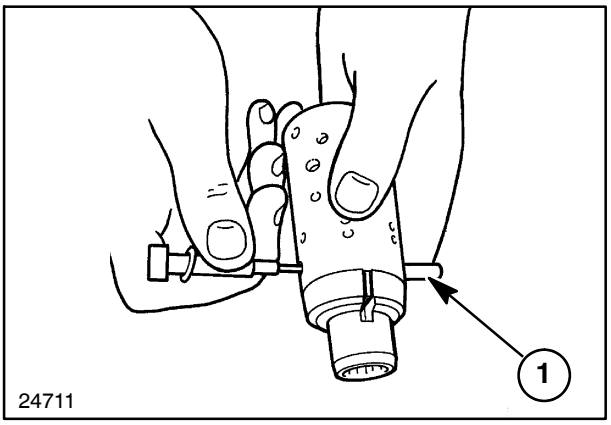
28

15. Remove the two thrust washers, 1, the thrust bearing, 2, and the spring retaining ring, 3, from the valve seat sleeve.



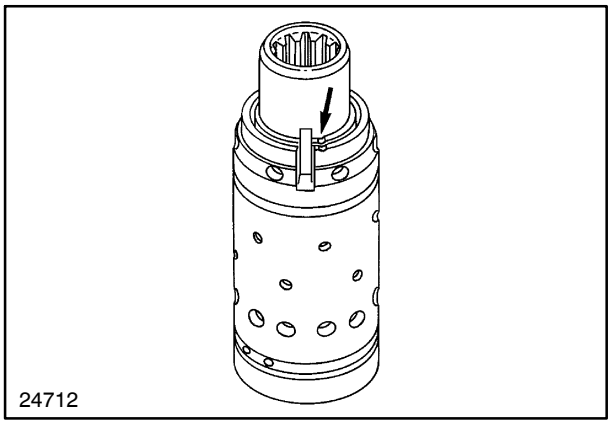
29

16. Remove the valve sleeve trim pin, 1, from the rotating valve assembly.



30

NOTE: *On assembly, two reference marks were made on the rotating valve and the sleeve, corresponding to the neutral position maintained by the springs. Before removing the springs, check that the marks are clearly visible, otherwise renew them.*



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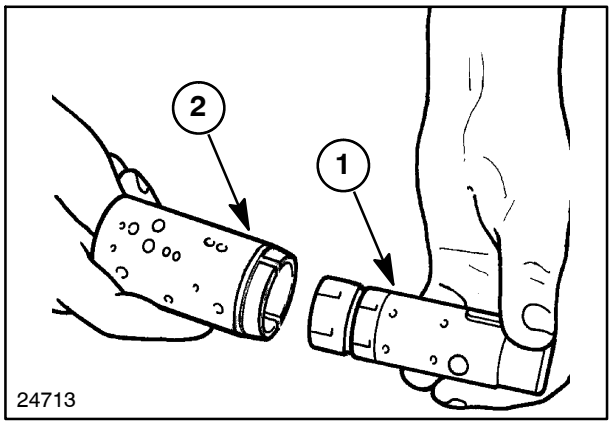
17. Remove the rotating valve spool, 1, from the valve seat sleeve, 2.



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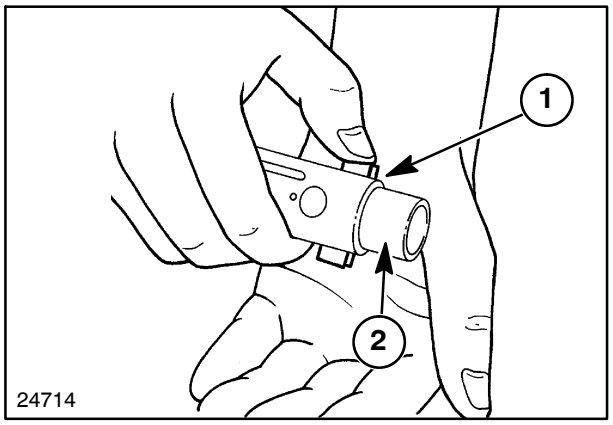
18. Carefully remove the centering springs, 1, from the neutral position in the rotating valve spool, 2.



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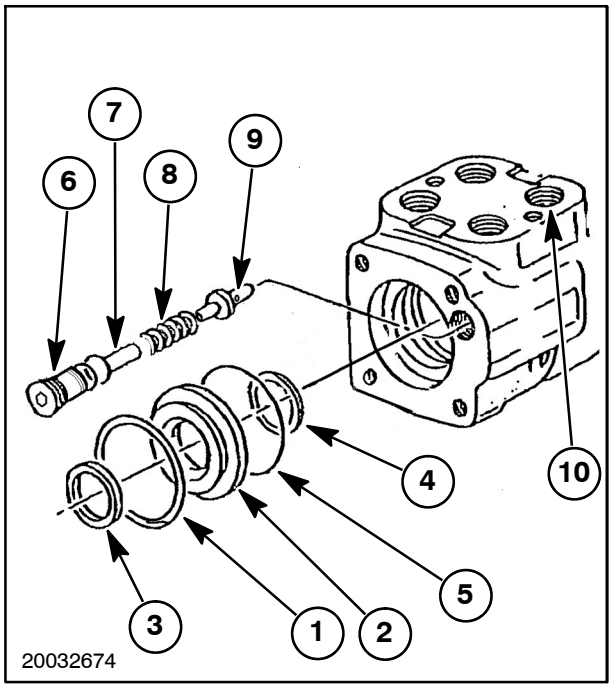
***IMPORTANT**: Be careful not to damage the dust seal seat during seal removal.*

1. Remove the retaining ring, 1, remove the seal gland bushing, 2, remove the dust seal, 3, and oil seal, 4, from the bushing. Remove the O-ring, 5, from the housing.

***NOTE**: The relief valve is staked into place, but can be adjusted by turning the Allen head screw.*

2. Remove the relief valve adjustment screw, 6, plunger, 7, and spring, 8.
3. When removing valve, 9, from housing, use compressed air into the pressure port, 10, of the housing. Use a rag to cover the relief valve hole to prevent the valve from getting dirty.



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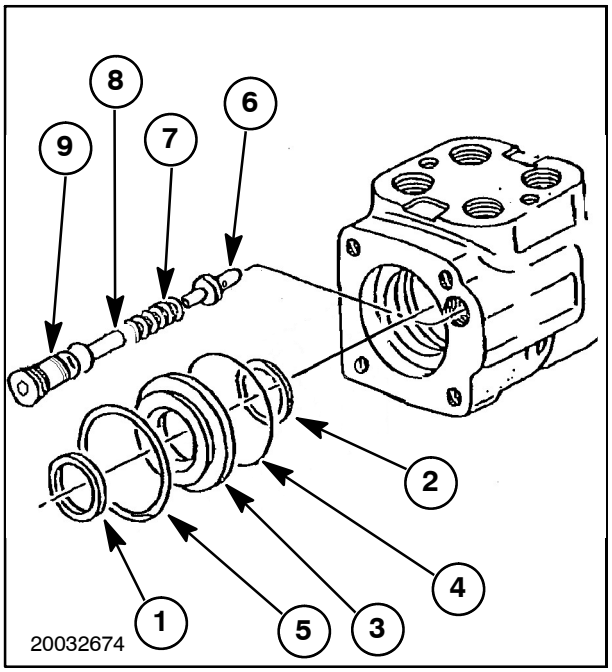
Inspection

1. Thoroughly clean all parts in a suitable solution and allow to air dry. Use compressed air to dry parts. NEVER wipe parts dry with paper towels or cloth as lint in a hydraulic system will cause damage.
2. Discard all old seals and O-rings. Always use new seals and O-rings when reassembling steering control motors.
3. Lubricate all new seals and O-rings with petroleum jelly prior to installation.
4. Lubricate all machined surfaces and bearings with clean hydraulic oil prior to assembly.
5. Inspect the spool and sleeve for evidence of sticking, scuff marks and any other damage. Replace as required.
6. Inspect the pin to make sure it is not bent or cracked.
7. Inspect the internal splines on the spool for wear or damage.
8. Inspect the inside machined surfaces of the housing for wear or damage.
9. Inspect the gerotor parts for wear or damage.
10. Inspect the drive shaft for wear or damage.
11. Inspect the thrust bearing and bearing races for wear or damage.
12. Inspect the centering springs for distortion. Centering springs that are distorted or have lost tension should be replaced.

Assembly

1. Install the new dust seal, 1, and oil seal, 2, into the gland head bushing, 3.
2. Install the O-ring, 4, into the housing, and insert the gland head bushing into the housing.
3. Install the retaining ring, 5, into the housing to hold the bushing in place.
4. Install the relief valve, 6, spring, 7, and plunger, 8, into the housing.
5. Install the retainer screw, 9, and line up the stake marks to ensure proper setting.



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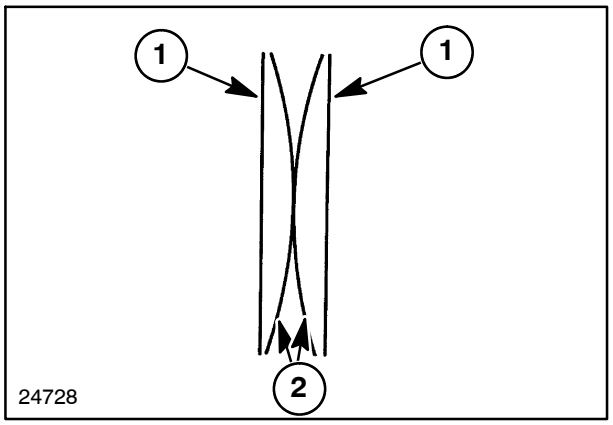
⚠ WARNING ⚠

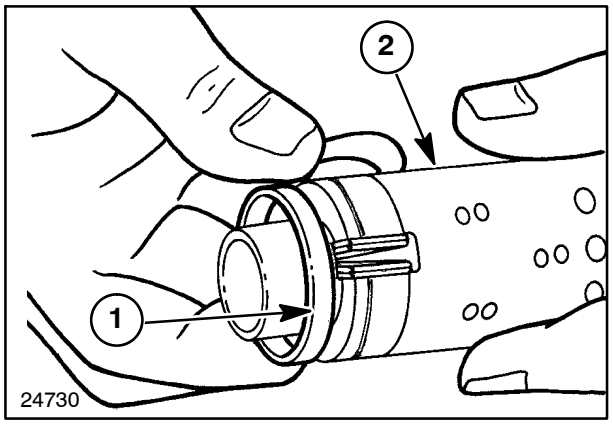
Wear eye protection and use caution when installing centering springs. Springs are under tension and could exit the spool with great force.

6. Install the centering springs into the spool, It's best to install the two flat pieces, 1, first and then install the curved springs, 2, three at a time.



36

7. Center the springs in the spool, 2, and fit the retaining ring, 1, over the centering springs.



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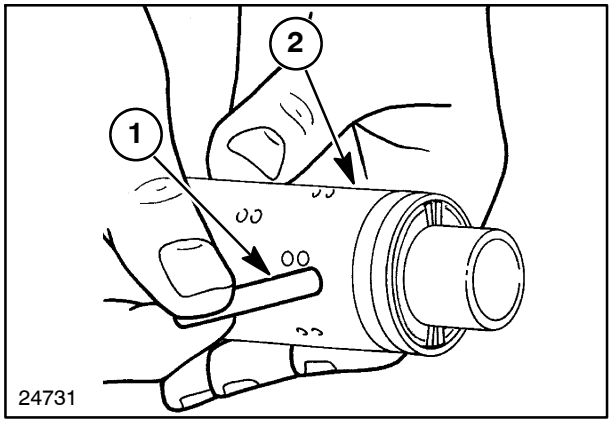
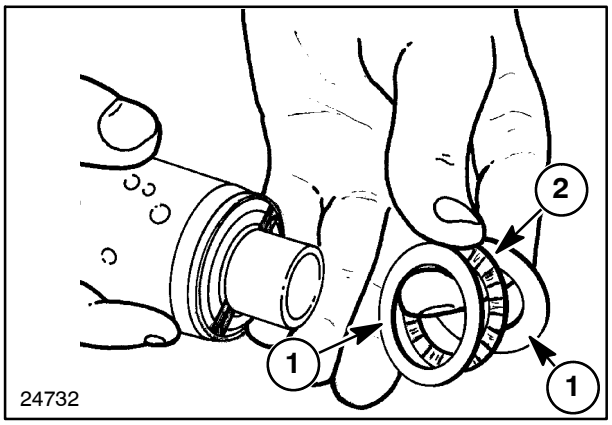
8. Apply a light coating of clean hydraulic fluid to the spool, 2, and slide it into the sleeve, Be sure the centering springs fit into the notches in the sleeve.
9. Install the pin, 1.



38

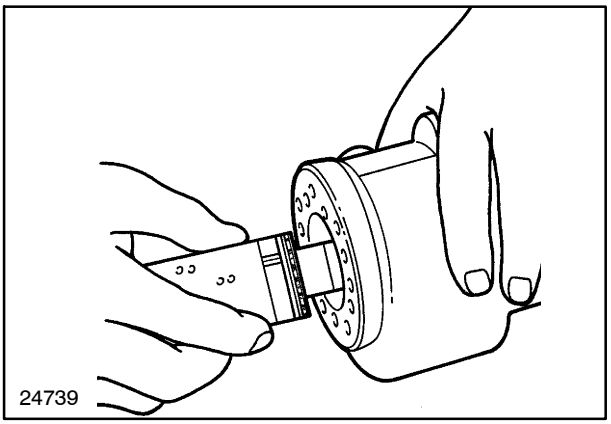
10. Apply a light coating of petroleum jelly to the inner edge of the dust seal and quad seal.
11. Install the bearing races, 1, and thrust bearing, 2, onto the spool. The thrust bearing is placed between the races.



39

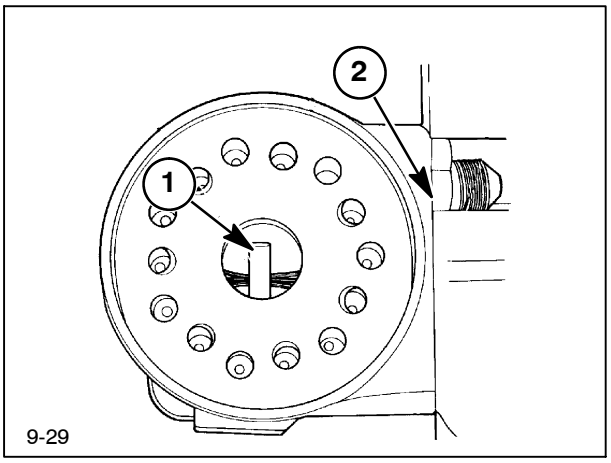
***IMPORTANT**: Use care not to damage the oil seal and dust seal during installation of spool and sleeve assembly.*

12. Apply a light coating of clean hydraulic fluid to the spool and sleeve assembly, and slide it carefully into the housing bore.



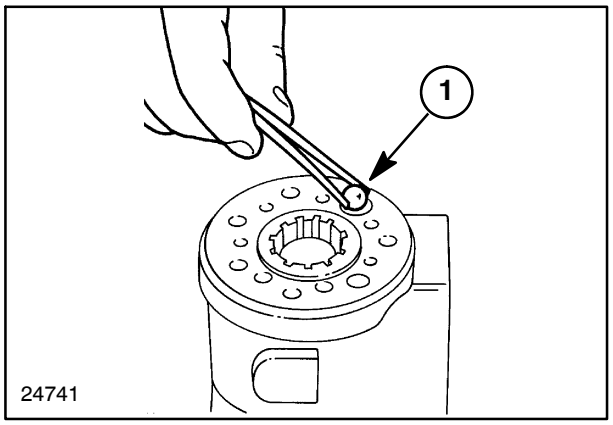
40

13. Position the spool and sleeve assembly so that the pin, 1, is parallel with the port face of the housing, 2.



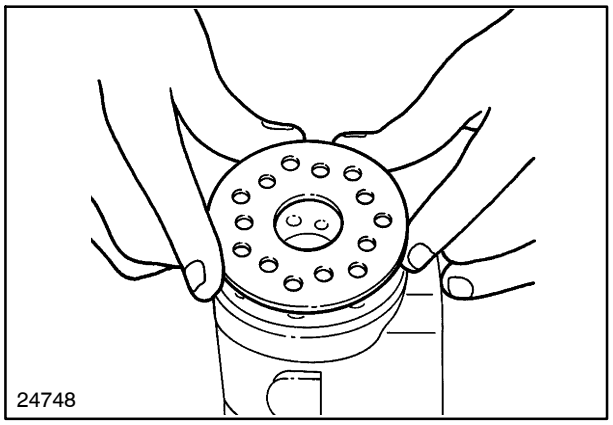
***IMPORTANT**: Do not over tighten the housing in the vise. Housing damage may result.*

14. Clamp the housing in a vise. Use just enough clamping force to hold the housing securely.
15. Install check ball, 1, into the deepest hole of the housing.



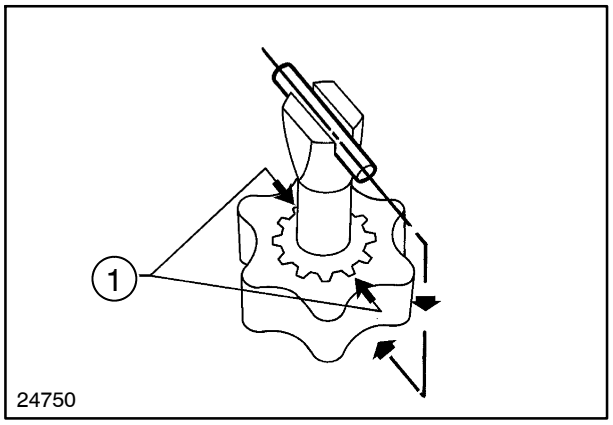
41

16. Lubricate a new O-ring with petroleum jelly and install in the groove of the housing.
17. Install the wear plate onto the housing. Be sure to align the holes as well as the paint marks made during disassembly.



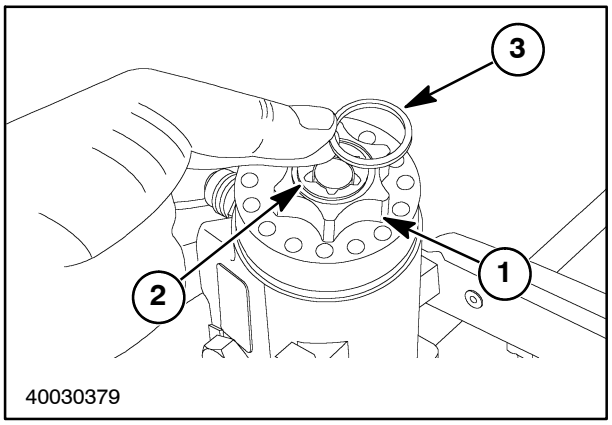
42

18. Install the drive shaft. Be sure to engage the slot in the drive shaft with the pin.
19. Lubricate a new O-ring with petroleum jelly and install in the groove of the wear plate.



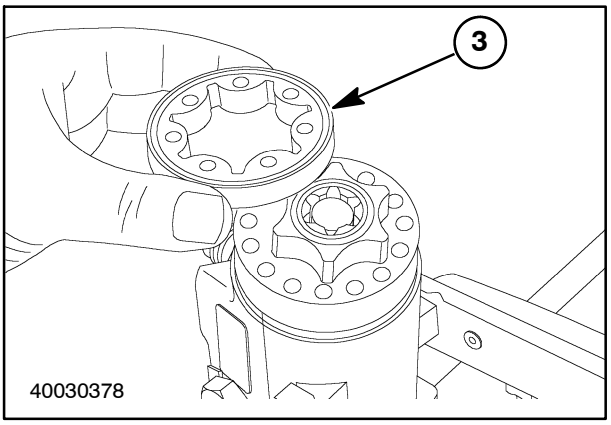
43

20. Install the rotor, 1, on the drive shaft.
21. Lubricate a new O-ring, 2, with petroleum jelly and install in the groove on the rotor.
22. Install the spacer, 3.



44

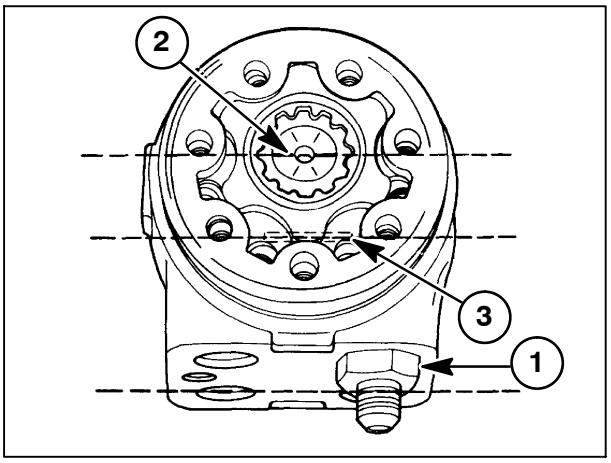
23. Install the gerotor ring, 3, aligning the paint marks made during disassembly.
24. Lubricate a new O-ring with petroleum jelly and install in the groove on the gerotor ring.



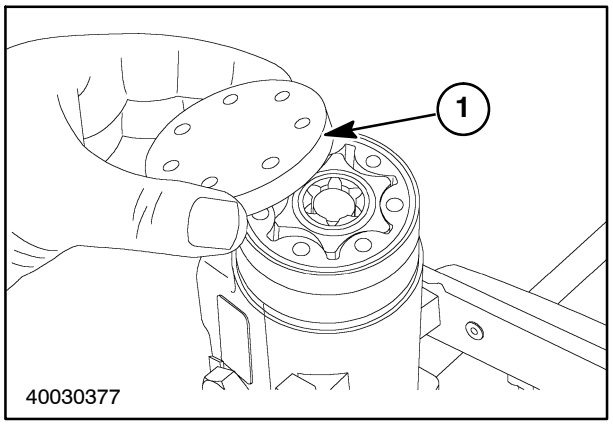
45

25. When the steering control motor is assembled properly, the components are in the correct timing position to allow the motor to function properly. The following areas should be aligned:
    - The port face, 1, of the housing.
    - The pin through the spool and sleeve.
    - The line, 2, drawn on the drive shaft.
    - The middle of the two valleys, 3, in the rotor.

    If any of these areas are not aligned, the steering control motor will not operate properly.



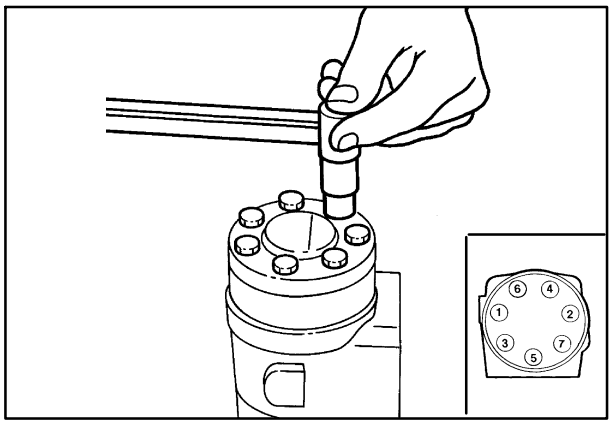
26. Place the end cap, 1, on the housing, being sure to align the paint marks.
27. Install the seven bolts and hand tighten.



46

28. Snug the bolts in a criss-cross pattern evenly.
29. With the seven bolts snugged evenly, use a torque wrench to evenly tighten the bolts in a criss-cross pattern to 20 N·m (15 in-lbs).

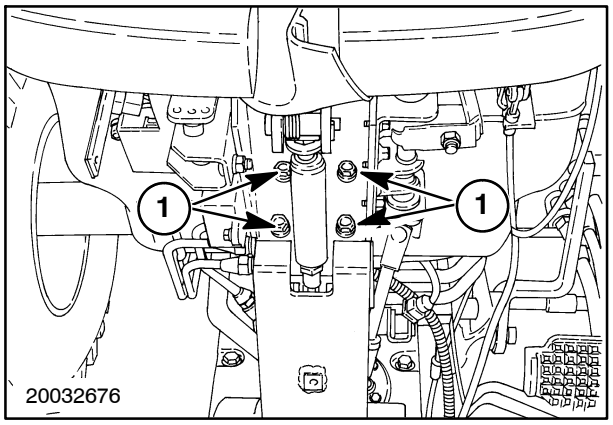
IMPORTANT: *Do not overtighten cap bolts, motor binding may result.*



47

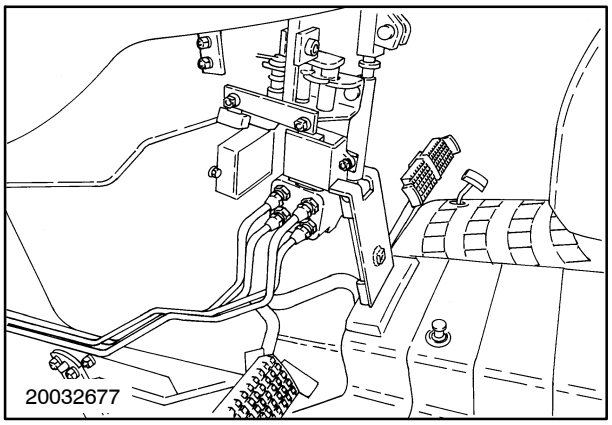
Installation

1. Install the steering control motor onto the steering column. Be sure to align the splines on the control motor input shaft, with the splines on the end of the steering column shaft.
2. Install and tighten the four mounting bolts, 1.
3. Turn the steering wheel left and right to check for freedom of movement. The spool should turn freely in the steering control motor.



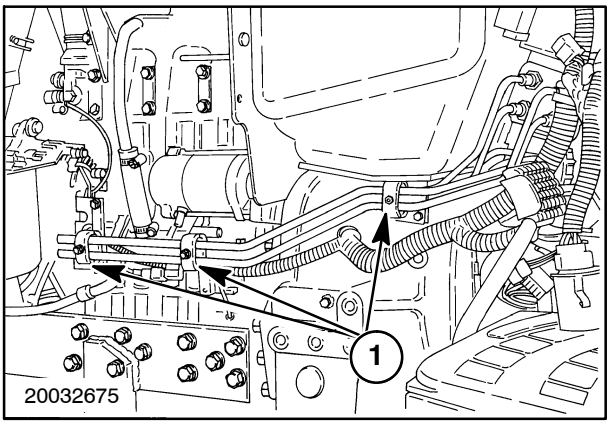
48

4. Remove any caps and plugs on lines and ports.
5. Connect the power steering tubes to the steering control motor. Torque tubes to 29 - 39 N·m (22 - 29 ft-lbs).



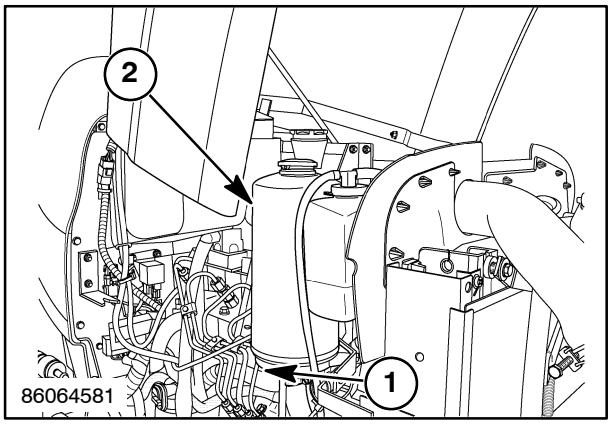
49

6. Install the steering tube fasteners, 1, and mount onto the tractor.



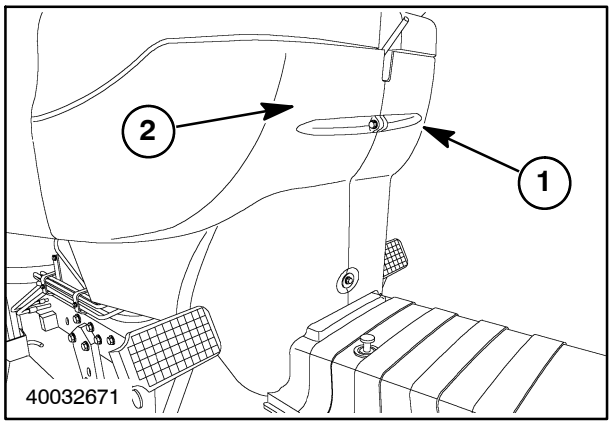
50

7. Tighten the drain plug, 1, and refill the reservoir, 2, with clean hydraulic fluid.
8. Start the engine and turn the steering wheel from stop to stop until the relief valve begins to operate. This will purge any trapped air from the system.



51

9. Install the right, 1, and left, 2, rear hoods on the tractor, (See Platform Section 90).



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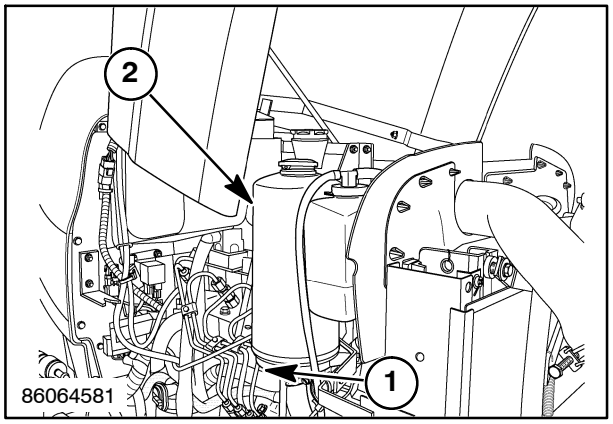
STEERING CYLINDER

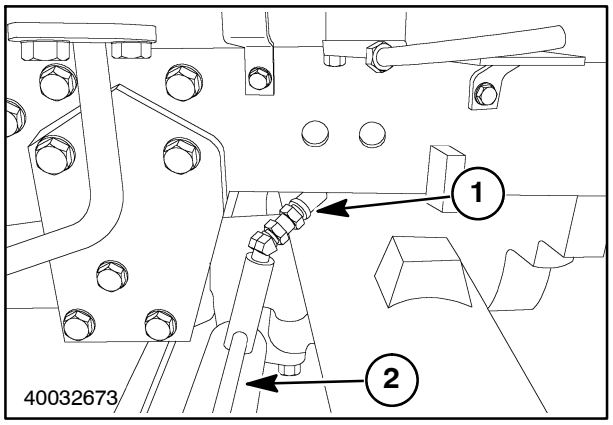
Removal

1. Loosen and remove the drain plug, 1, from the power steering reservoir, 2, and drain into a suitable container.



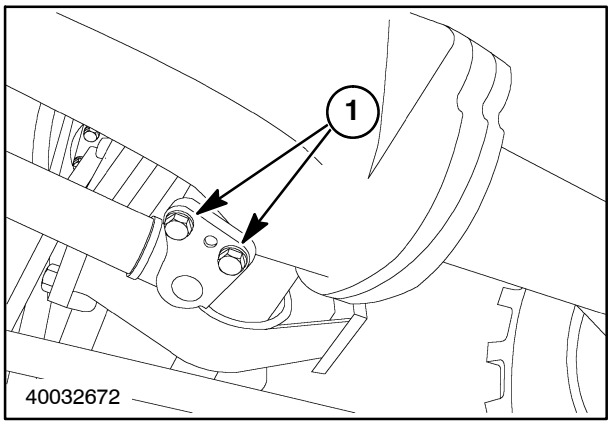
53

2. Disconnect the power steering hoses, 1, from the steering cylinder, 2. Cap and plug all openings to prevent fluid leaks.



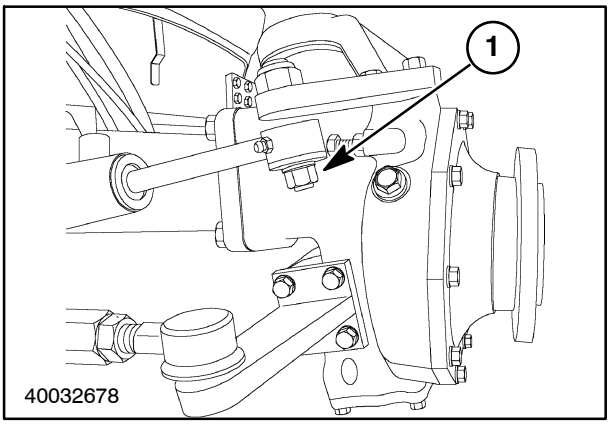
54

3. Loosen and remove the two retaining bolts, 1. Use a pry bar to gently pry the retaining cap and pin out of the axle.



55

4. Loosen and remove the nut, 1, from the steering arm stud. Carefully remove the cylinder from the tractor.



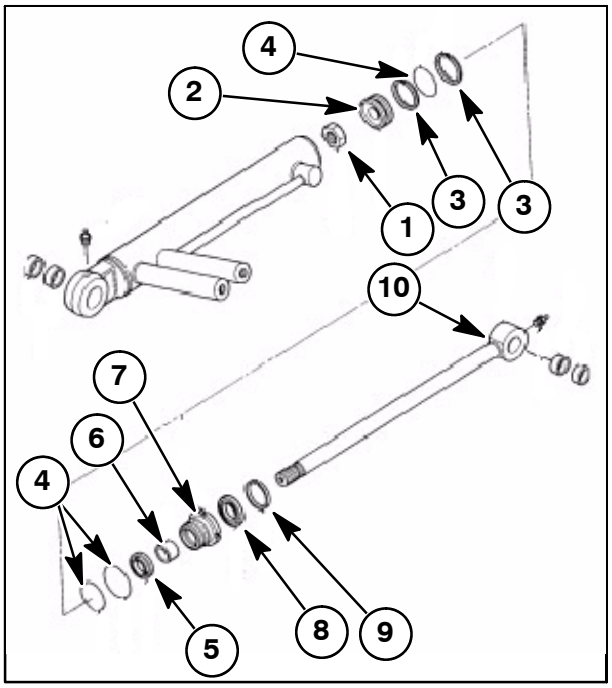
56

Disassembly

1. Use a suitable chisel and hammer to straighten the cylinder barrel crimping from the gland head.
2. Use a spanner wrench to remove the gland head from the cylinder barrel, and remove the piston rod and piston.

***NOTE**: Use care when removing the piston assembly from the cylinder barrel, not to damage the finish on the parts. Remove and discard seals and wipers, use new during assembly.*

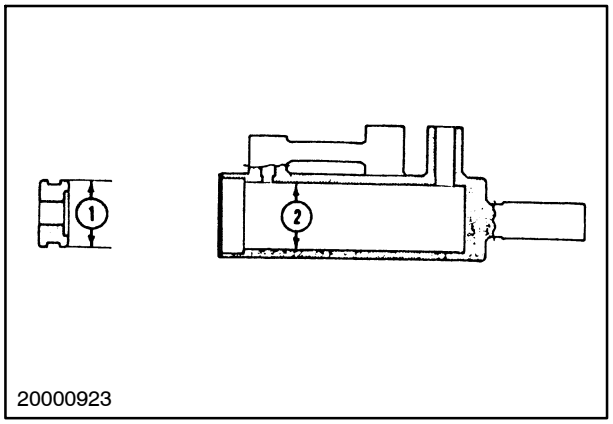
3. Remove the piston nut, 1, the piston, 2, the backup rings, 3, the piston O-rings, 4, the U-ring, 5, the bushing, 6, the gland head, 7, the wiper ring, 8, the back-up ring, 9, and the piston rod, 10.



57

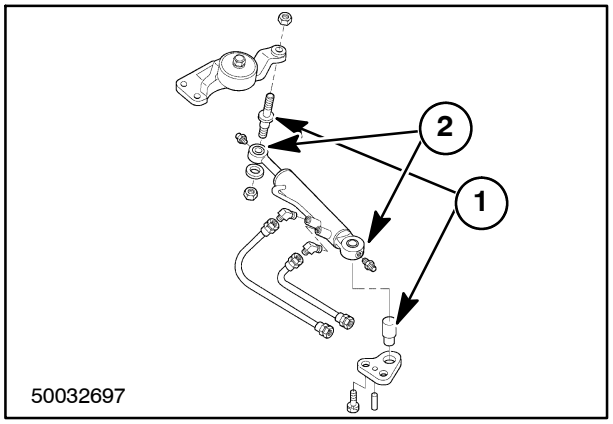
Inspection

1. Clean all parts in a suitable solvent and air dry.
2. Inspect the inside of the cylinder barrel for excess wear, scuffs, and scratches.
3. Inspect the piston for scuffing, score marks, or other damage. Replace with new components if damaged.
4. Use micrometers to measure the inside diameter of the cylinder barrel, and the outside diameter of the piston to determine the clearance. Replace if clearance is in excess of 0.7mm (0.028″).
5. Inspect the cylinder rod for excess wear, straightness, and scoring. Replace, if damaged.



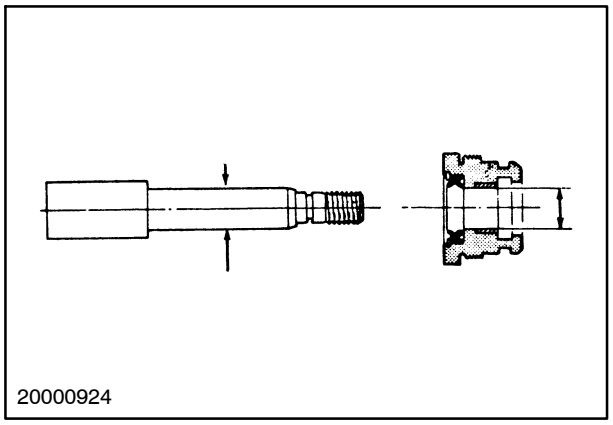
58

6. Inspect the anchor pins, 1, and bushings, 2, for excess wear and excessive clearance. Replace the anchor pins and/or bushings if the clearance is greater than 0.5 mm (0.020″).



59

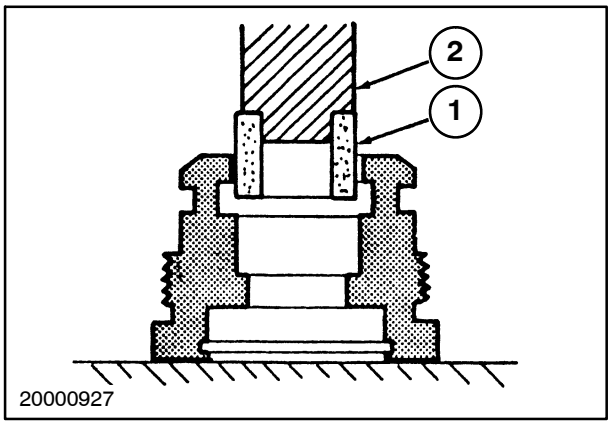
7. Check the rod to gland head clearance. Replace the bushing if the clearance is in excess of 0.3 mm (0.012″).
8. On assembly, replace all O-rings and seals with new ones.



60

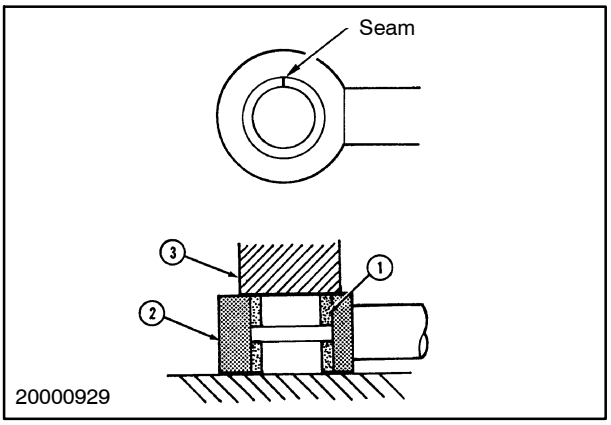
Assembly

1. If the gland head bushing, 1, needs to be replaced, use a suitable driver tool, 2, to install the new bushing.

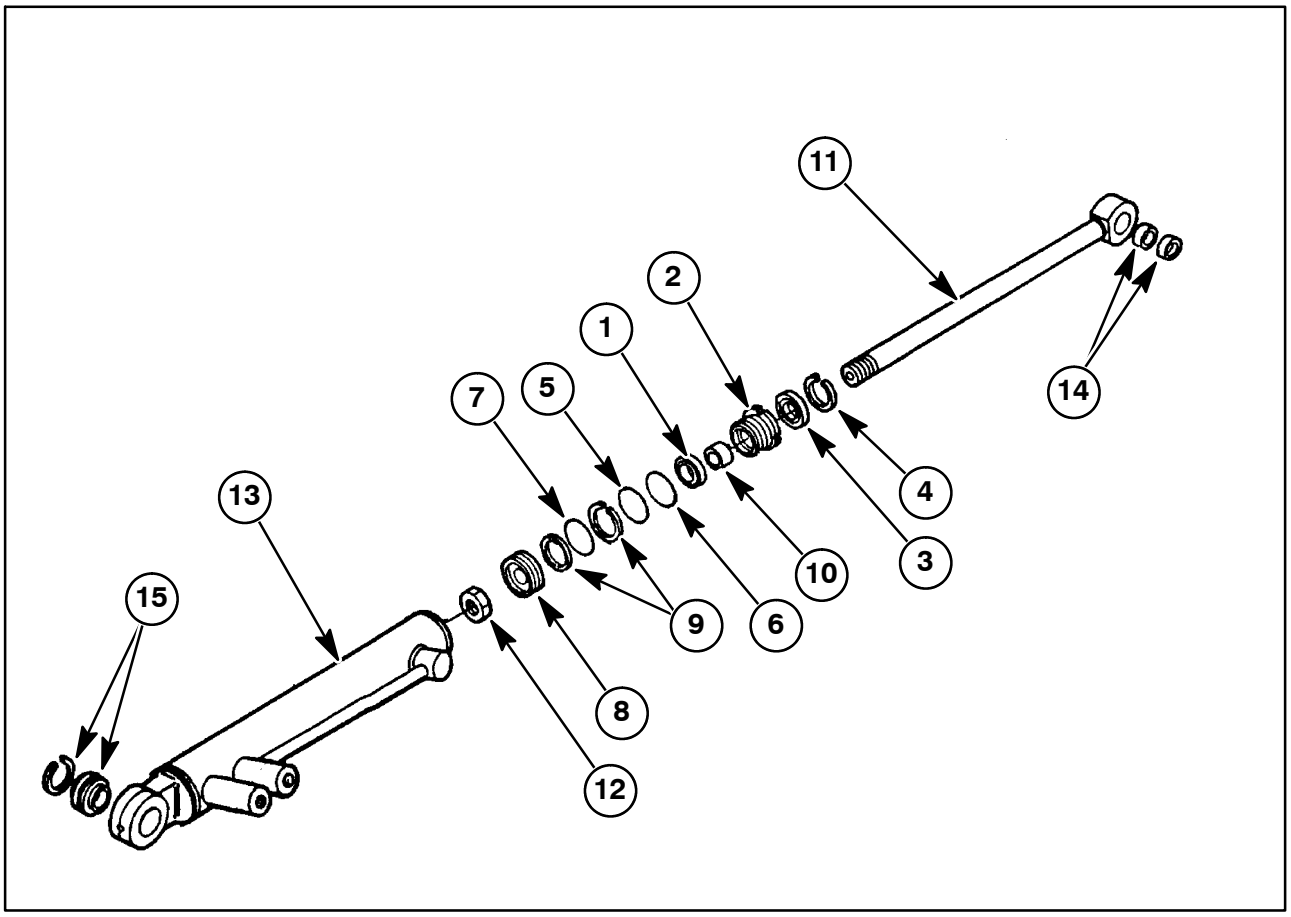


61

2. If the pin bushings need to be replaced, lubricate the bushing bore, 2, and the bushing, 1, with hydraulic oil. With the seam positioned as shown, install the bushing using a suitable driver, 3.



62

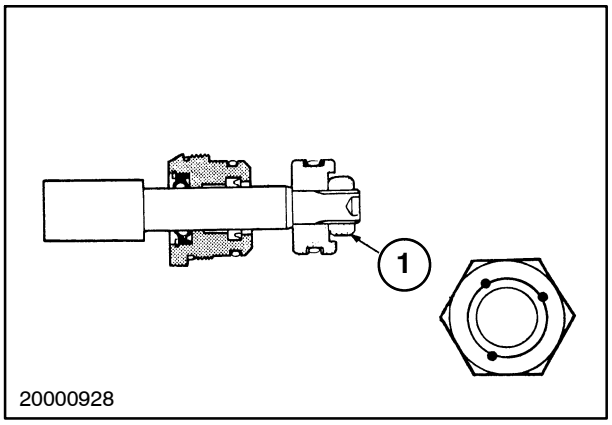


63

1. U-ring
2. Gland head
3. Wiper ring
4. Back-up ring
5. O-ring - Gland head
6. O-ring
7. O-ring-piston
8. Piston
9. Back-up ring
10. Bushing
11. Piston rod
12. Nut
13. Cylinder barrel - RH
14. Bushing
15. Bushing

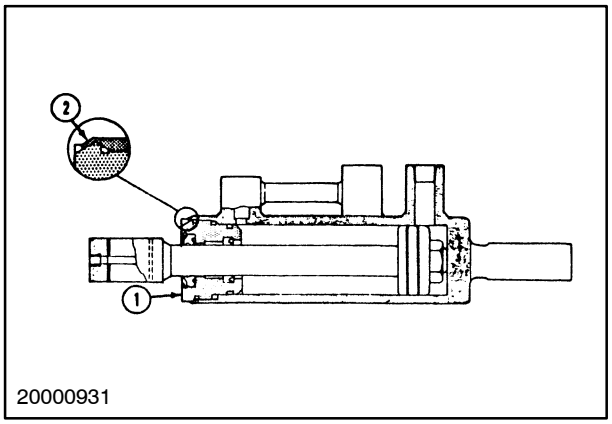
3. Lubricate and install a new U ring seal, 1, in the gland head, 2.
4. Lubricate and install a new wiper ring seal, 3, in the gland head, 2, and secure with a new back-up ring, 4.
5. Lubricate new O-rings, 5 and 6, with petroleum jelly and install in the O-ring grooves on the gland head, 2.
6. Lubricate the new O-ring, 7, with petroleum jelly and install on the piston, 8. Install new back-up rings, 9, on the piston, 8.
7. Install the gland head assembly, the bushing, 10, and the piston assembly, onto the piston rod, 11.
8. Install the piston nut, 12, on the piston rod, 11. Tighten the piston nut, 12, to 56 N·m (42 ft-lbs).
9. Lubricate the cylinder barrel, 13, and the piston assembly with clean hydraulic oil.
10. Carefully install the piston assembly into the cylinder barrel, 13.
11. Tighten and torque the gland head, 2, to 127 N·m (94 ft-lbs).

12. Stake the piston nut, 1, to prevent loosening.



64

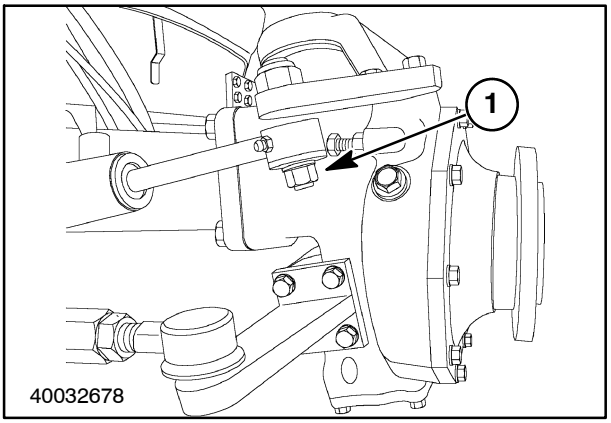
13. Crimp the end of the cylinder barrel, 1, at the gland head, 2, to prevent the gland head from loosening.



65

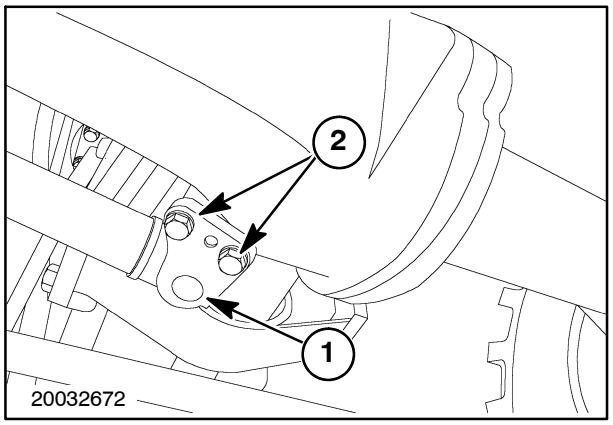
Installation

1. Install the rod end of the steering cylinder onto the steering arm stud. Install the nut, 1. Tighten nut to 190 N·m (140 ft-lbs).



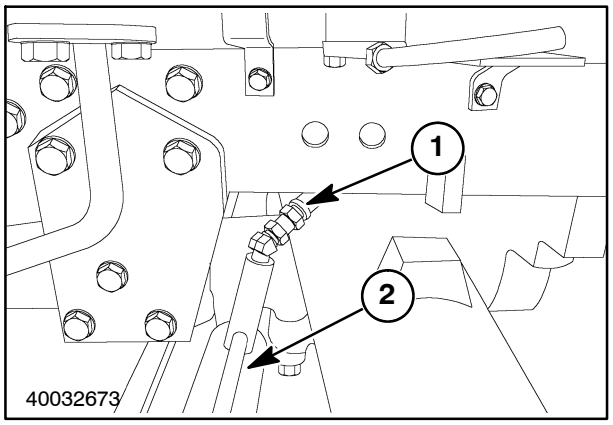
66

2. Install the retaining pin, 1 and secure with the bolts, 2. Torque the bolts to, 95 N·m (70 ft-lbs).



67

3. Connect the steering hoses, 1, to the cylinder, 2.



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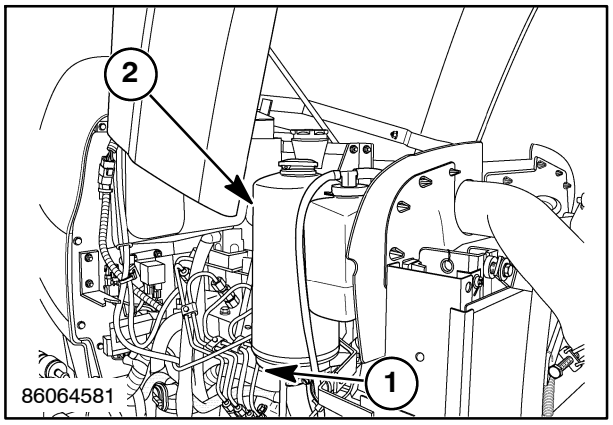
4. Install and tighten the drain bolt, 1. Refill the power steering fluid reservoir, 2.
5. Start the tractor, and operate system, turning the steering wheel left and right, to bleed the air from the system. Check for leaks.
6. Check the fluid level in the power steering fluid reservoir, 2, and refill if necessary, to the proper level.



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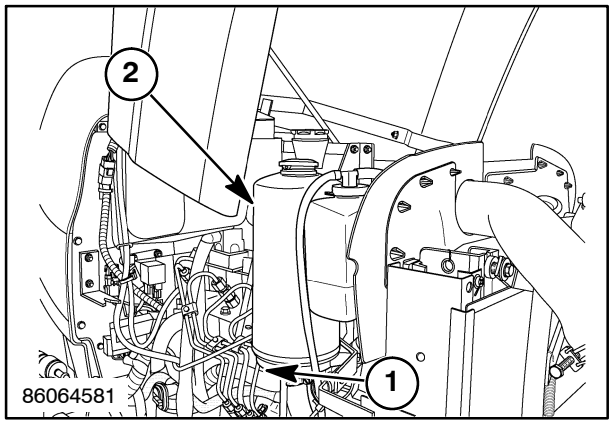
POWER STEERING PUMP AND RESERVOIR TANK

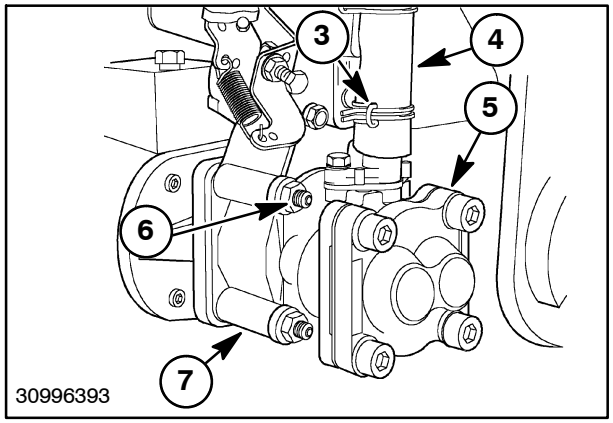
Pump Removal

1. Loosen and remove the drain plug, 1, and drain the fluid from the power steering reservoir, 2.



70

2. Loosen the bottom hose clamp, 3, on the power steering pump suction hose, 4.
3. Remove the suction hose, 4, from the power steering pump, 5.
4. Remove the pressure tube from the bottom of the power steering pump, 5.
5. Loosen and remove the two retaining nuts, 6, and the two retaining bolts (not shown), that secure the power steering pump, 5, to the timing gear cover, 7.
6. Remove the steering pump, 5, from the timing gear cover, 7.



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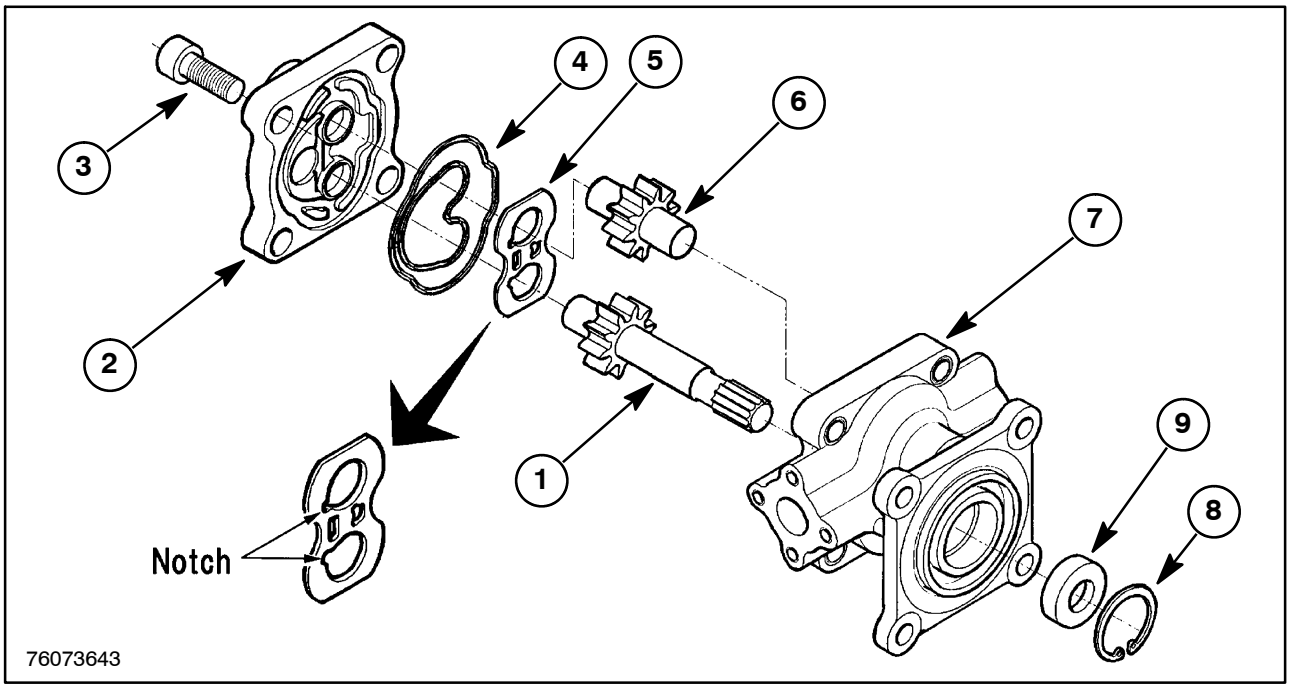
NOTE: *The only service that can be done to the power steering pump is to replace the O-rings and seals. If any other part of the pump is damaged, the entire unit must be replaced.*



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Disassembly

1. Place the pump in a soft jawed vise with the drive shaft, 1, facing downward.
2. Scribe a line on the pump cover, 2, for ease of orientation during assembly
3. Remove the four bolts, 3, securing the cover to the pump, and remove the cover, 2.
4. Remove the seal ring, 4, and the seal plate, 5.
5. Remove the drive gear, 1, and the driven gear, 6, from the pump housing, 7.
6. Remove the snap ring, 8, and the shaft seal, 9, from the pump housing.

Inspection and Repair

1. Wash all parts in a clean solvent and air dry.
2. Discard all used O-rings and seals, and use new during assembly.
3. Inspect all parts for damage or wear. If damaged or worn, replace the entire pump assembly.

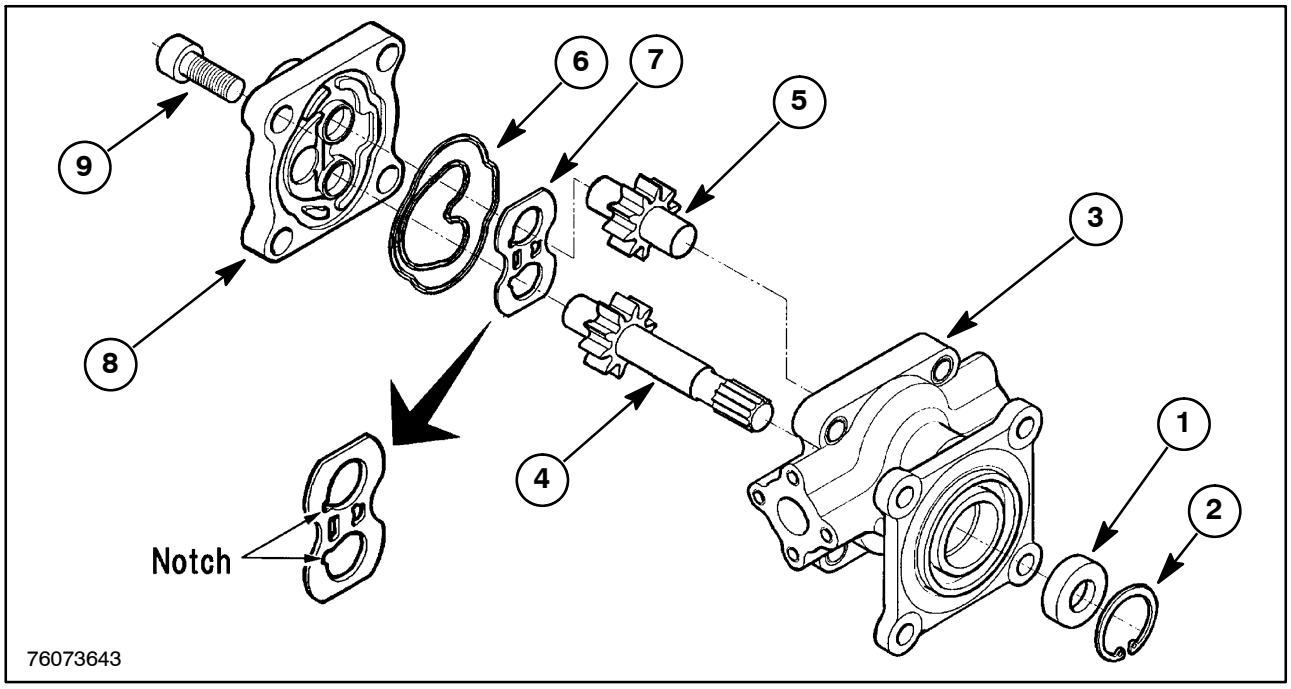
Assembly

NOTE: *Use the scribe marks made during disassembly to assemble the pump in its original orientation.*

1. Lubricate all parts during assembly with clean hydraulic oil.
2. Install a new shaft seal, 1, and a new snap ring, 2, in the pump housing, 3.
3. Install the drive gear, 4, and the driven gear, 5, into the pump housing, 3.
4. Install a new seal ring, 6, and a new seal plate, 7.

IMPORTANT*: Install seal plate, 7, with notches facing in correct direction.*

5. Install the pump cover, 8, and secure with the four bolts, 9. Tighten and torque the bolts to 44 - 49 N·m (33 - 36 ft-lbs).



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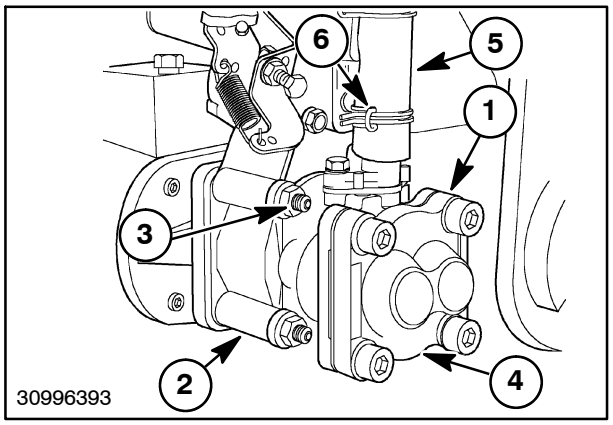
Installation

1. Install the power steering pump, 1, onto the timing gear cover, 2.
2. Install and tighten the two retaining nuts, 3, and the two retaining bolts (not shown), to secure the power steering pump, 1, to the timing gear cover, 2.
3. Install and tighten the pressure tube to the bottom fitting on the power steering pump, 4.
4. Connect the suction hose, 5, to the power steering pump, 1.
5. Install the bottom hose clamp, 6, to the bottom of the suction hose, 5.
6. Install the drain bolt, 7, and fill the power steering reservoir, 8, with clean fluid.



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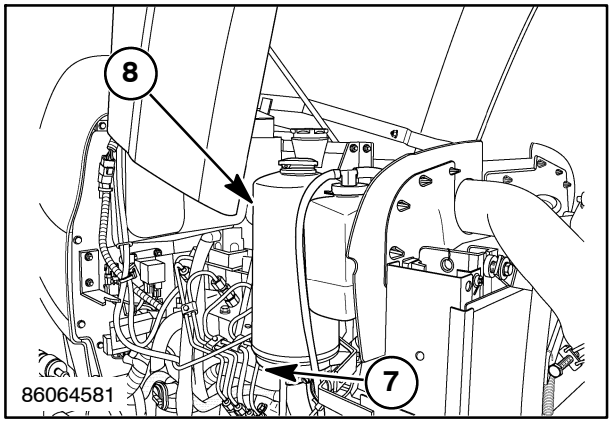

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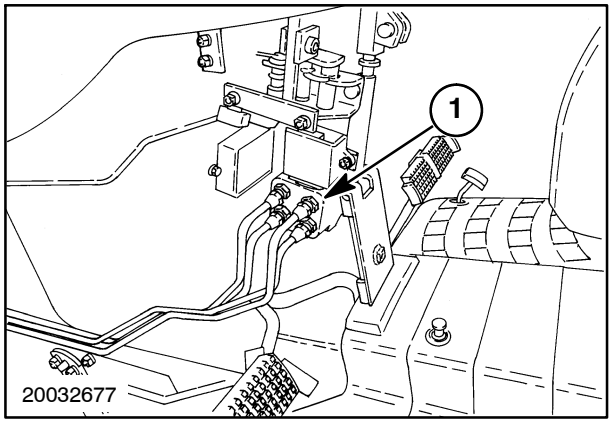
STEERING TUBES

The tube fittings, 1, must be tightened to the specified torque of 29 - 39 N·m (22 - 29 ft-lbs).



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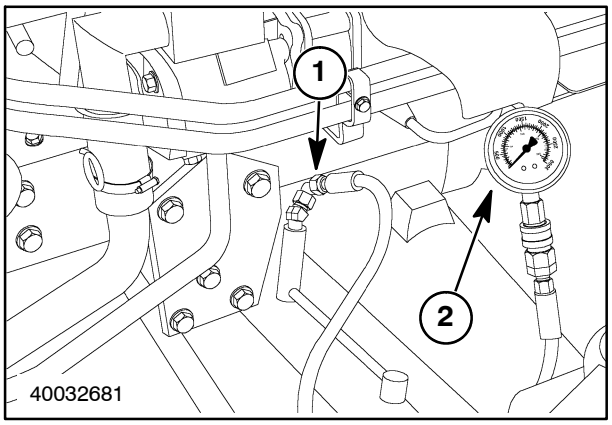
Break-in Procedure

***IMPORTANT**: Check the pump body and oil temperature while during the break-in period. If the temperature is too high or pump is noisy, stop immediately and inspect pump for possible causes.*

After the oil pump has been overhauled, it needs a trial run as follows:

1. Connect a tee fitting, 1, Tool No #NH01412, and 0-3000 psi pressure gauge, 2, between the base end of the steering cylinder tube fitting and steering hose.
2. Start the engine and operate at low idle (1000 RPM) while the steering control valve is in the neutral position, for approximately ten minutes.
3. Increase the engine speed to 2000 RPM and maintain these conditions for another ten minutes.
4. Read the oil pressure gauge and gradually increase the pressure to 150 bar (2175 PSI) by placing steering linkage at full turn position (against steering stops). Allow engine to operate approximately five minutes between increases, as indicated on the chart below.

Step	Pressure	Engine Speed (RPM)	Minutes
1	10 bar (145 PSI) or less	1000	10
2	10 bar (145 PSI) or less	2000	10
3	150 bar (2175 PSI)	1000	5
4	150 bar (2175 PSI)	1500	5
5	150 bar (2175 PSI)	2000	5



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SECTION 44 - WHEELS AND TIRES

Chapter 1 - Wheels and Tires

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DESCRIPTION OF OPERATION

WHEEL TREAD SETTINGS

NOTE: *Tread settings are measured from center of tire to the opposite center of tire.*

IMPORTANT: *Never attempt to widen the tread setting of FWD axle by reversing front wheels, because axle failure will occur.*

FRONT WHEEL SETTINGS

Front Axle: (FWD) (Not Adjustable)

TIRE TYPE	SETTING
(AG) 8 x 16	1338 mm (52.6″)
(AG) 9.5 x 16	1419 mm (55.9″)
(TURF) 27 x 10.55 x 15	1444 mm (56.9″)
(TURF) 27 x 12 LL x 15	1501 mm (59.1″)
(INDUSTRIAL) 12 x 16.5	1432 mm (56.4″)

NOTE: *Torque front wheel bolts to 129 N·m (95 ft-lb.).*

REAR WHEEL SETTINGS

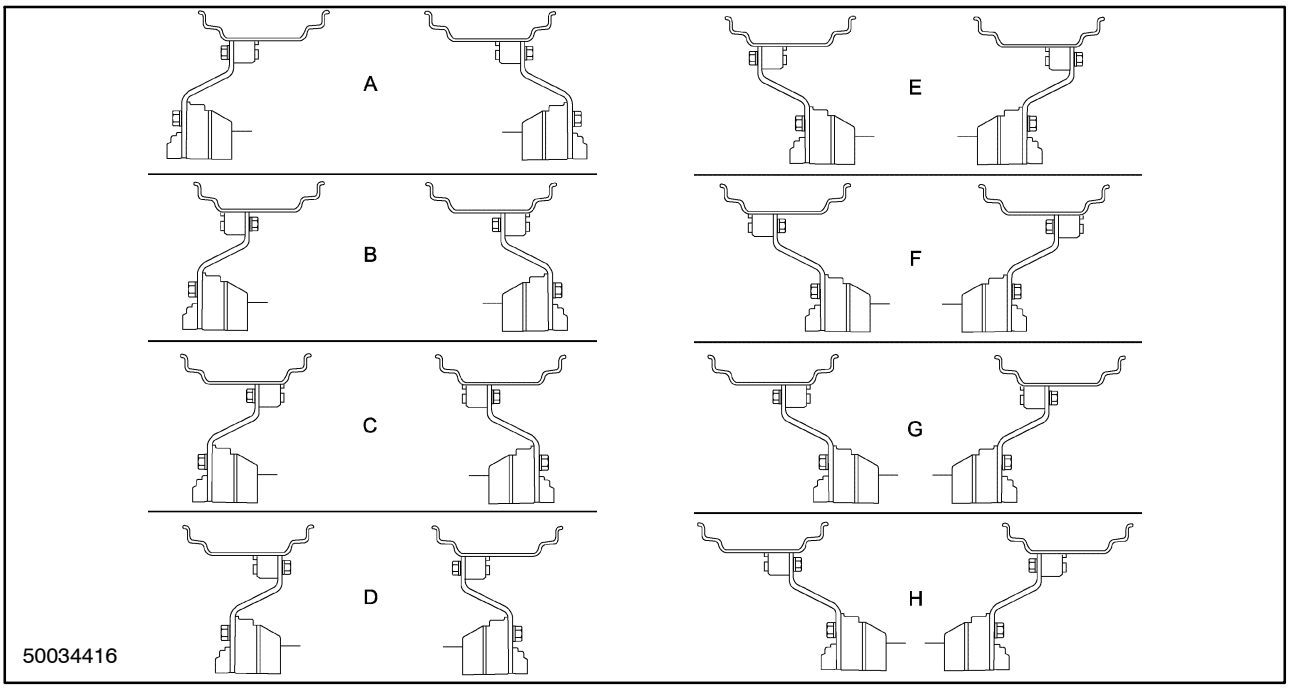
The rear wheel tread width is adjusted by a combination of repositioning the rear wheel rims and discs, and by switching the wheels from side to side.

Rear Axle: (FWD)

TIRE TYPE	MIN (DISH IN)	MAX (DISH OUT)	NO. OF POSITIONS
(AG) 14.9 x 24	1236 mm (48.7″)	1939 mm (76.4″)	8
(AG) 14.9 x 28	1236 mm (48.7″)	1939 mm (76.4″)	8
(TURF) 44 x 18-20	NA	1828 mm (72″)	1
(TURF) 22.5 LL x 16.1	NA	1709 mm (67.3″)	1
(INDUSTRIAL) 18.4 x 24	1341 mm (52.8″)	1939 mm (76.4″)	7

NOTE: *Torque rear wheel bolts to 129 N·m (95 ft-lbs). Torque rim to disc bolts to 244 N·m (180 ft-lbs).*

Position	Rear 4WD Tire Dimensions, Inches (mm)			Tire Type
	Inside To Inside	Tread Setting	Outside To Outside	
A	33.26 (845)	48.66 (1236)	64.06 (1627)	AG-14.9 x 244PR R1
B	37.39 (950)	52.79 (1341)	68.19 (1732)	
C	41.26 (1048)	56.66 (1439)	72.06 (1830)	
D	45.39 (1153)	60.79 (1544)	76.19 (1935)	
E	48.82 (1240)	64.22 (1631)	79.62 (2022)	
F	52.95 (1345)	68.35 (1736)	83.75 (2127)	
G	56.82 (1443)	72.22 (1834)	87.62 (2225)	
H	60.95 (1548)	76.35 (1939)	91.75 (2330)	
A	32.96 (837)	48.66 (1236)	64.36 (1635)	AG-14.9 x 28 6PR R1
B	37.09 (942)	52.79 (1341)	68.49 (1740)	
C	40.96 (1040)	56.66 (1439)	72.36 (1838)	
D	45.09 (1145)	60.79 (1544)	76.49 (1943)	
E	48.52 (1232)	64.22 (1631)	79.92 (2030)	
F	52.65 (1337)	68.35 (1736)	84.05 (2135)	
G	56.52 (1435)	72.22 (1834)	87.92 (2233)	
H	60.65 (1540)	76.35 (1939)	92.05 (2338)	
B	33.99 (863)	52.79 (1341)	71.59 (1819)	18.4-24 8PR R4
C	37.86 (961)	56.66 (1439)	75.46 (1917)	
D	41.99 (1066)	60.79 (1544)	79.59 (2022)	
E	45.42 (1153)	64.22 (1631)	83.02 (2109)	
F	49.55 (1258)	68.35 (1736)	87.15 (2214)	
G	53.42 (1356)	72.22 (1834)	91.02 (2312)	
H	57.55 (1461)	76.35 (1939)	95.15 (2417)	
	36.00 (914)	54.6 (1387)	92.6 (2351)	Turf-44 x 18.00-20,6PR
	34.38 (873)	57.28 (1455)	80.18 (2037)	Galaxy-22.5LL x 16.1, 6PR



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TRACTOR WEIGHTING

For sufficient traction and maximum performance in heavy draft operations, and to counterbalance rear mounted equipment. Weight should be added to the tractor in form of liquid ballast, cast iron weights, or a combination of both. Only enough weight should be added to provide good traction and stability. Adding more weight than is need results in unnecessary soil compaction, increased rolling resistance, and higher fuel consumption.

NOTE: *When adding weight to the tractor, tire pressures may need to be increased. Refer to the tire inflation chart found in this section.*

WEIGHTING FOR STABILITY

Front end ballast may be required for stability and steering control when weight is transferred from the front wheels to the rear wheels as an implement is raised by the tractors three-point hitch.

As a general guide:

Ballast the tractor (less implements) so that approximately one-third of the tractor weight is on the front wheels. For optimal traction, tractors equipped with FWD should be ballast so that 40 - 45% of machine weight is on the front wheels.

When a mounted implement is raised to the transport position, the front wheel reaction should be at least 20% of the tractor weight.

Add additional front wheel ballast as required for stability during operation and transport. Front wheel ballast may not always maintain satisfactory stability if the tractor is operated at high speed on rough terrain. Reduce tractor speed and exercise caution under these conditions.

When using front-mounted attachments, add weight to the rear axle to maintain good traction and stability. Front mounted equipment varies in weight, refer to equipment manual for ballasting.

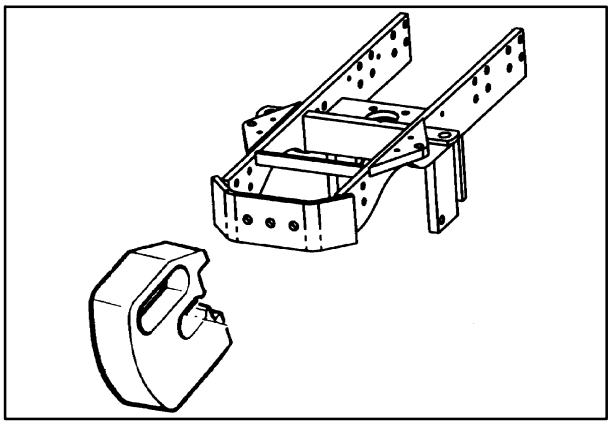
WEIGHT LIMITATIONS

The weighting limitations that follow are limitations only. They do not imply that the tractor should be weighted to attain the weights given. Use only enough weight to obtain good performance.

CAST IRON WEIGHTS (OPTIONAL)

Cast iron weights are available as accessories from your New Holland Dealer. Weights can be mounted on the front end of the tractor and on the rearmost wheels.

27 kg (60 lbs) - #710215016
45 kg (100 lbs) - #718215036



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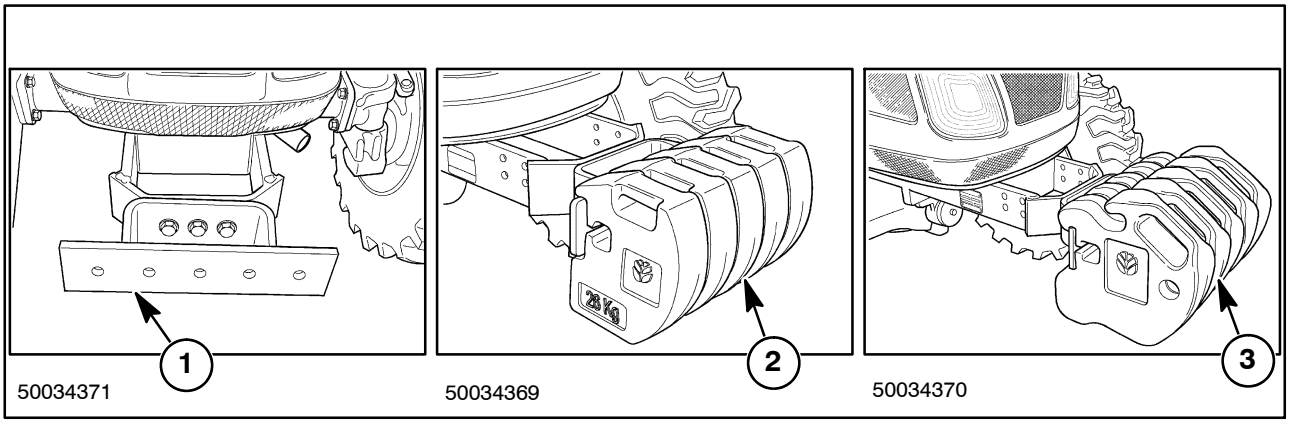
Front Frame Mounted Weights

Tire Type	Weight(s)
Agricultural, Turf, & Industrial	Maximum of (2) weights per tractor @ 27.3 kg (60 lbs) each- 54.6 kg (120 lbs) total Optional: (2) weights @ 45 kg (100 lbs) each - 90 kg (200 lbs) total

Optional Front Weight Extension Bracket

If additional front weights are needed for counterbalancing a rear mounted implement, an optional front weight extension bracket, 1, (#718233006) can be installed to the front of the tractor. With the extension bracket installed, a maximum of (5) 27 kg (60 lbs), 2, or (5) 45 kg (100 lbs), 3, weights can be installed.



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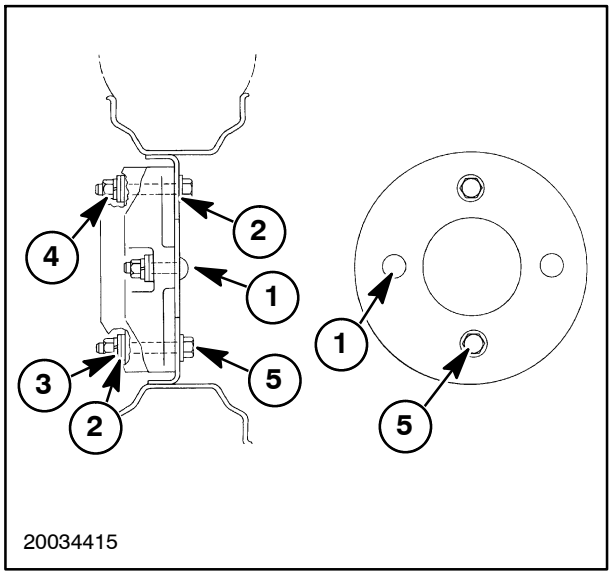
REAR WHEEL WEIGHT INSTALLATION (AG./INDUSTRIAL TIRES)

Hardware needed for one weight per wheel:

Item	Description	Qty.
1	5/8″ x 3-1/2″ carriage bolt	4
2	5/8″ flat washer	8
3	5/8″ lock washer	4
4	5/8″ nut	4

Hardware needed for two weights per wheel:

Item	Description	Qty.
1	5/8″ x 3-1/2″ carriage bolt	2
2	5/8″ flat washer	10
3	5/8″ lock washer	4
4	5/8″ nut	4
5	5/8″ x 7″ cap screw	2



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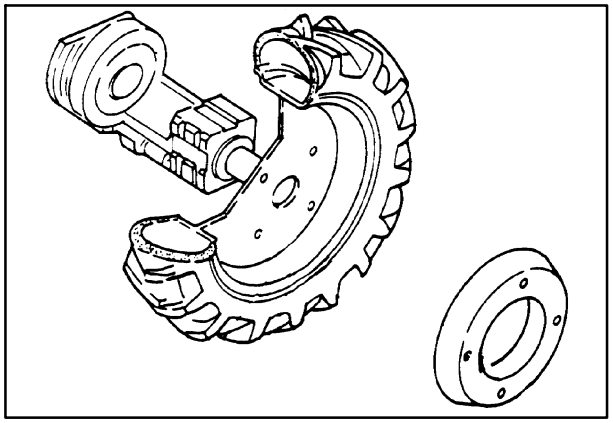
Rear Wheel Weights
#710470026

Tire Type	Weight(s)
Agricultural	Maximum of (2) weights per wheel @ 47.3 kg (105 lbs) each-189 kg (420 lbs) total
Turf	Not Available
Industrial (R4)	Maximum of (2) weights per wheel @ 47.3 kg (105 lbs) each-189 kg (420 lbs) total

NOTE: *Rear wheel weights can be used with liquid ballast.*



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Rear Counterweight Bracket (Optional)
#718740016

Weight bracket, 1, fits any 3 pt. hitch. Maximum of seven suitcase weights.

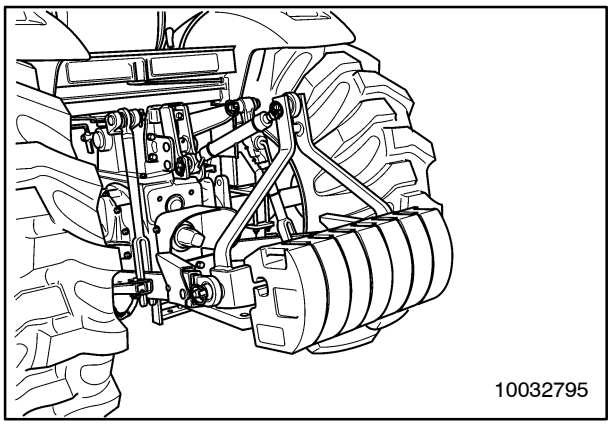
(7) 27 kg (60 lbs) each - 191.0 kg (420 lbs) total

or

(2) 27 kg (60 lbs)

and

(5) 45 kg (100 lbs) - 282 kg (620 lbs) total



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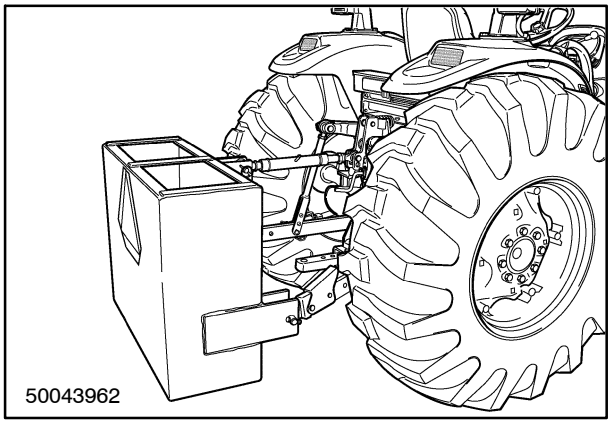
Ballasting Box
#715655026

A Category-2, 3-point hitch, 1825 lbs. capacity ballasting box may be purchased as extra equipment. Load with sand, gravel, or similar loose ballast as needed.

T2410 T2420	Weight (Empty)	Weight (Loaded)
3-Point Hitch Ballasting Box	170kg (374 lbs)	998 kg (2200 lbs)



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LIQUID BALLAST (OPTIONAL)

It is a common practice to add weight to the tractor by filling the rear tires with liquid. A calcium chloride ($CaCl_2$) and water solution is recommended due to it's low freezing point and greater density (weight per gallon) than pure water.

Never exceed the total recommended weight for the tractor. Special equipment is required to fill the tires, consult your local New Holland dealer.

Tires should never be filled beyond 75%. At 75% full, the liquid will come to the valve stem when the valve stem is at it's highest point at the top of the wheel.

TIRE PRESSURE

Tire pressure must be considered when adding weights, implements, or attachment to the tractor, or damage to the tractor may occur.

FRONT TIRE INFLATION PRESSURES		
Tire Type	**Tire Size**	**Inflation Pressure**
Agricultural FWD	8.0 x 16 6PR, R1 9.5 x 16 6PR, R1	1.4 - 2.0 bar (12 - 30 psi)
Turf FWD	27 x 10.5-15 4PR R3 27 x 12LL x 15 6PR R3	1.7 - 2.0 bar (25 - 30 psi) 0.8 bar (12 psi)
Industrial (R4) FWD	12-16.5 8PR, R4	1.1 - 3.5 bar (16 - 50 psi)
REAR TIRE INFLATION PRESSURES		
Agricultural FWD	14.9 x 24 6PR, R1 14.9 x 28 6PR, R1	0.8 - 1.4 bar (12 - 20 psi)
Turf FWD	44 x 18.00-20 6PR, R3 22.5LL x 16.1 6PR, R3	0.8 - 2.0 bar (12 - 30 psi) 0.45 bar (6 psi)
Industrial FWD	18.4 x 24 8PR, R4	0.8 - 1.7 bar (12 - 24 psi)

NOTE: *Do not underinflate or overinflate tires. Do not exceed maximum inflation pressure listed.*

REAR TIRE LIQUID

Ballast Weights (Per Tire)

600 g/5 lbs $CaCL_2$/Gal Solution

Agricultural FWD	14.9 x 24 6PR, R1 14.9 x 28 6PR, R1	507 lbs. (230 kg) 574 lbs. (261 kg)
Turf FWD	44 x 18.00-20 6PR, R3 22.5LL x 16.1 6PR, R3	249 kg (548 lbs) Not Recommended
Industrial FWD	18.4 x 24 8PR, R4	363 kg (800 lbs)

SECTION 50 – CLIMATE CONTROL

Chapter 1 – Climate Control – T2410–T2420 With Cab

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SPECIFICATIONS

COMPRESSOR

Model	SD5H11
Type	Sanden International (U.S.A) Inc.
Bore	35 mm (1.38 in)
Stroke	22.6 mm (0.9 in)
Displacement per revolution	108 cc/rev
Number of Cylinders	5
Rotation	Clockwise
Maximum Allowable Continuous RPM	6000

REFRIGERANT

System Capacity	1.1 Kg (2.40 lb) R134A

REFRIGERANT OIL

System Capacity	135 ml (4.56 fl. oz.) SP-20 PAG Oil

LOW PRESSURE SWITCH

Opening Pressure	4 ± 2 psig
Closing Pressure	20 ± 3 psig

HIGH PRESSURE SWITCH

Opening Pressure	400 ± 10 psig
Closing Pressure	260 ± 20 psig

SPECIAL TOOLS

Listed below are the tools required to service the A/C system. These tools listed are standard equipment. See your authorized service dealer for more information.

Part Number	Description
FNH02343B	Sanden Compressor Tool Kit
FNH00855	Refrigerant Gas Leak Detector
FNH00890	Air Conditioning Spring Lock Coupling Tool
OEM1419	Service Gauge Set (R134A)
OEM1598	R-134A Recovery/Recycle and Recharging Station
OEM1662	Thermometer

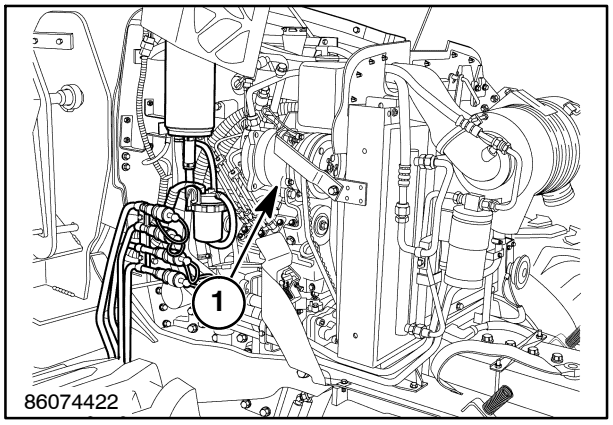
DESCRIPTION AND OPERATION

COMPRESSOR

The compressor, 1, is mounted inside the engine compartment and is driven by the crankshaft pulley. Refrigerant and oil is moved through the air conditioning system by the compressor, which lubricates and cools the unit during operation.

An electromagnetic clutch is used to engage or disengage the compressor as required when operating the air conditioning system. The clutch is of a stationary coil type and forms an integral part of the compressor pulley assembly. When the coil is energized, the clutch plate is pulled against the rotating pulley. De-energizing the coil will allow the plate to return to a standby position.

This system holds 1.1 kg (2.40 lbs) of R-134A refrigerant. When the system is empty it will hold 135 ml (4.56 fl. oz.) of SP-20 PAG Oil.



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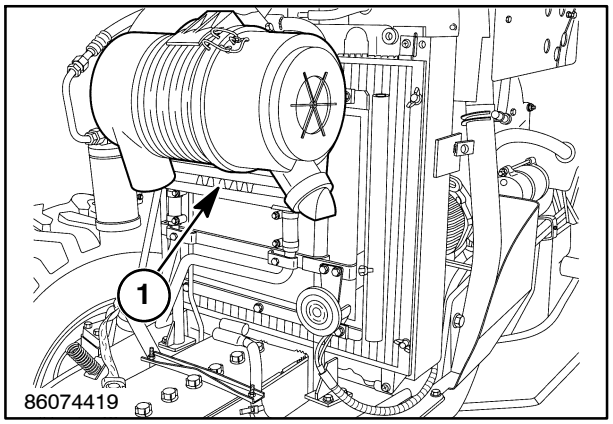
CONDENSER

The condenser, 1, is located at the front of the tractor. The condenser consists of a number of turns of continuous coils mounted in a series of thin cooling fins to provide maximum heat transfer in a minimum amount of space.

The condenser receives the hot, high pressure refrigerant vapor from the compressor. As the hot vapor passes through the coil, outside air is drawn around the coils by the engine fan. Heat is transferred from the hot refrigerant vapor into the cooler outside air flowing across the coils and fins. The refrigerant condenses inside the unit and becomes a high pressure liquid.



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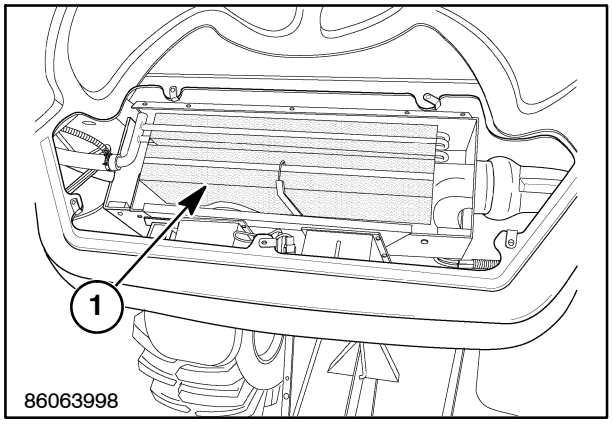
EVAPORATOR

The evaporator core, 1, is located in the ventilation housing located in the cab roof housing. Similar to the condenser, the evaporator core consists of numerous tubes mounted in a series of thin aluminum cooling fins. The fins and tubing are designed to transfer heat from the cab air to the cold refrigerant liquid as it moves through the evaporator tubing.

The low pressure liquid inside the tubes removes heat from air passing around them. As the refrigerant absorbs heat, it boils and flashes to a vapor. The low pressure vapor then flows to the compressor to repeat the refrigerant cycle.



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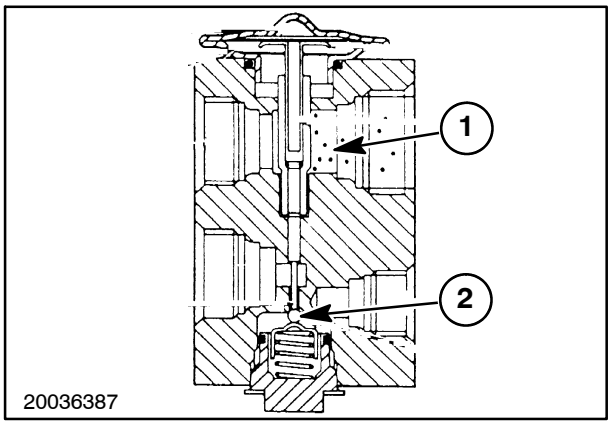
EXPANSION VALVE

The thermal expansion valve is on the pressure line leading from the receiver/drier into the evaporator. The valve changes the liquid refrigerant from high to low pressure without a change from liquid to vapor. A thermostatically controlled valve within the expansion valve body controls the volume of liquid refrigerant passing through the orifice and makes sure the refrigerant is fully vaporized within the evaporator by sensing the amount of superheat of the vapor leaving the evaporator. Liquid refrigerant would damage the compressor.



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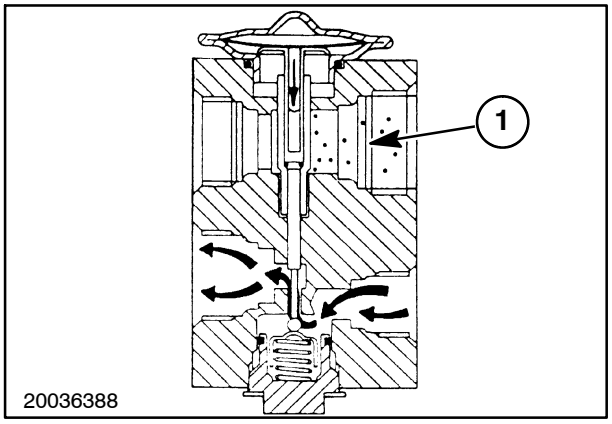
The valve responds to changes in the cooling requirements of the system. When increased cooling is required, the valve opens to increase the refrigerant flow. When less cooling is required, the valve closes and decreases the refrigerant flow. All of the needed temperature and pressure sensing functions are consolidated into this unit. No other external tubes are required for this operation.

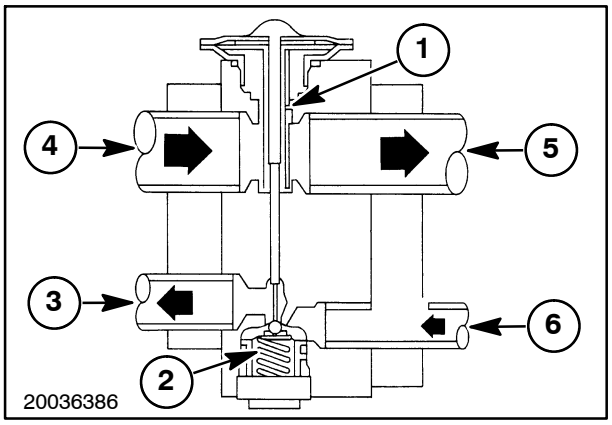
When the compressor is off, pressure, (system plus spring pressure), below the actuating diaphragm, 1, is greater than the pressure above it. The metering ball, 2, is held tightly against the seat by the spring, and no flow is present through the valve.

Upon initial setup of the compressor, the pressure drops rapidly in area 1. The pressure above the diaphragm is now greater than that below. The actuating rod pushes down, unseating the ball and allowing refrigerant to flow to the evaporator. During operation, the pressure below the diaphragm will change and adjust valve position to maintain 8° superheat of the refrigerant flowing from the evaporator.



5

- Temperature Sensor, 1
- Ball and Spring, 2
- To Evaporator, 3
- From Evaporator, 4
- To Compressor, 5
- From Condenser, 6



6

RECEIVER/DRIER

The receiver/drier, 1, is located at the front of the tractor.

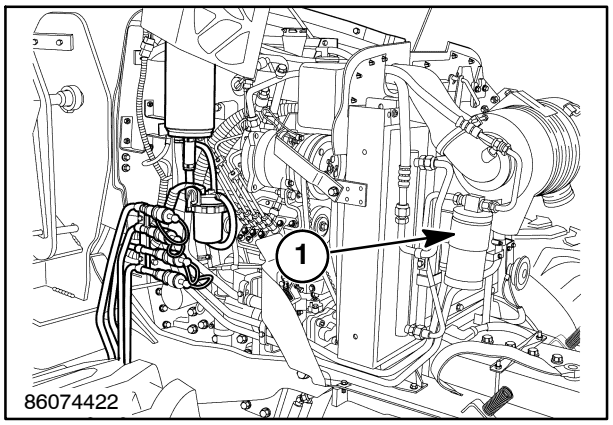
The receiver/drier receives the high pressure liquid refrigerant from the condenser through an inlet line.

The dryer section contains a desiccant to absorb moisture but can only absorb a limited amount of moisture before reaching a saturation point. The ability to retain moisture absorbed is dependent upon temperature. As the outside temperature increases, the ability to retain absorbed moisture decreases. This is why an air conditioning system with a saturated dryer may operate satisfactorily when outside temperatures are low, but stops cooling when the temperature increases.

The refrigerant exits the receiver/drier through an outlet connection and flows to the thermostatic expansion valve.

NOTE: *Any moisture in the air conditioning system is extremely harmful. Moisture not absorbed by the dryer will circulate with the refrigerant. Droplets may collect and freeze in the thermostatic expansion valve restricting refrigerant flow. The moisture circulating in the system may also react with the refrigerant to form hydrochloric acid.*

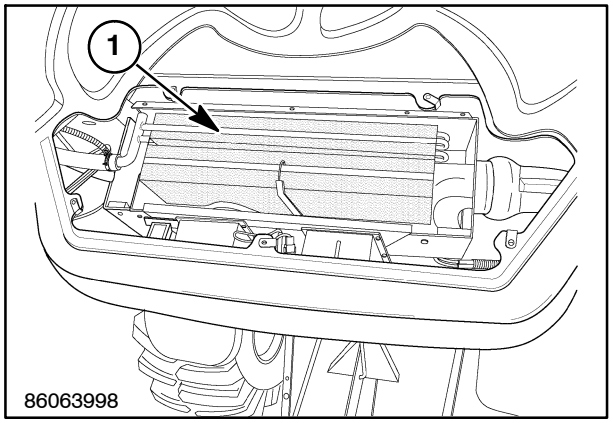
NOTE: *In general, the receiver/drier should be replaced any time the system is opened for service.*



7

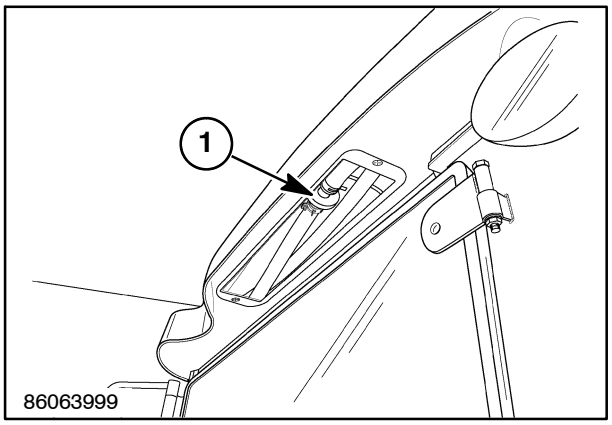
HEATER

The heater core, 1, is located in the ventilation housing located in the cab roof housing. Similar to the evaporator, the heater core consists of numerous tubes in a series of thin aluminum cooling fins. The fins and tubing are designed to transfer heat from the heated engine coolant to the cab air as it moves across the tubing.



8

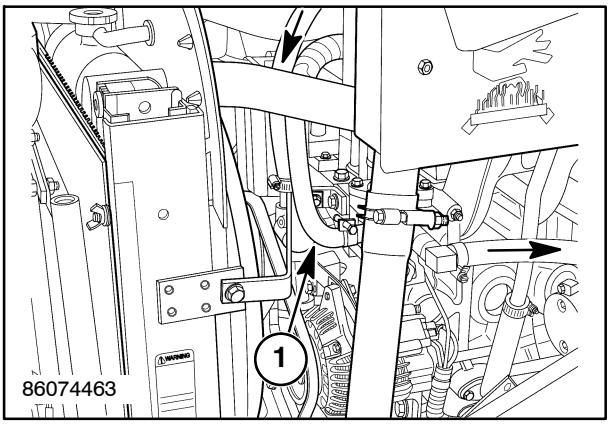
A water valve, 1, is located under an access panel (not shown) on left side of the cab roof. The valve is installed to control the flow of hot engine coolant through the heater core. The valve is controlled with a cable operated switch located inside the cab.



9

HEATER SYSTEM

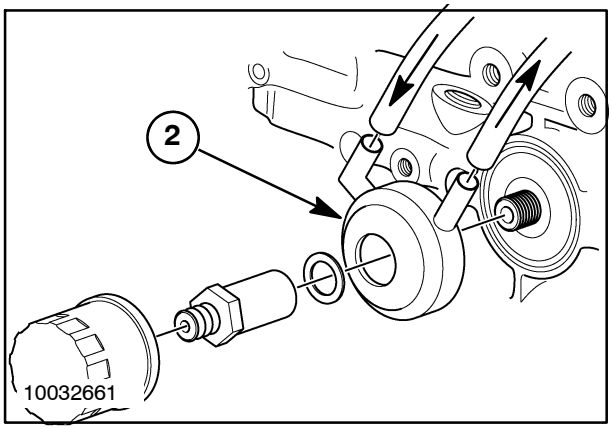
Coolant is sent out the thermostat to the heater core and back, then flows through the water pump, 1, and circulates around the oil cooler, 2, Figure 11. After circulating through the oil cooler, coolant flows back through the water pump, through the engine block, cylinder head and returns to the thermostat.



10

Coolant Flow Chart

- Thermostat (**OUT**) to Heater Valve
- Heater Valve to Heater Core
- Heater Core (**IN**) to Water Pump
- Water Pump to Oil Cooler
- Oil Cooler to Engine Block
- Engine Block to Cylinder Head
- Cylinder Head to Thermostat

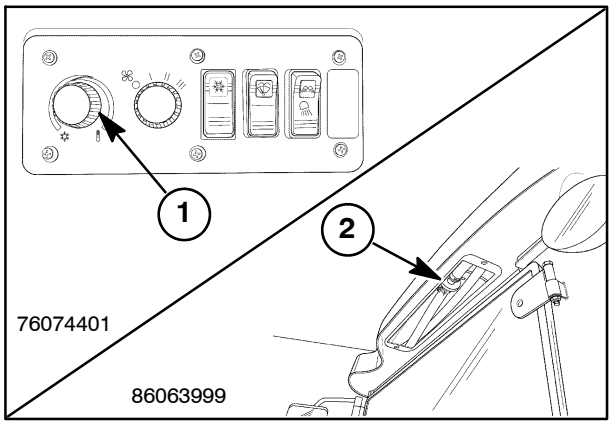


11

As the temperature reaches operating temperatures, turn the temperature knob, 1, clockwise to open the heater valve, 2.

The temperature knob mechanically controls the opening and closing of the heater valve.

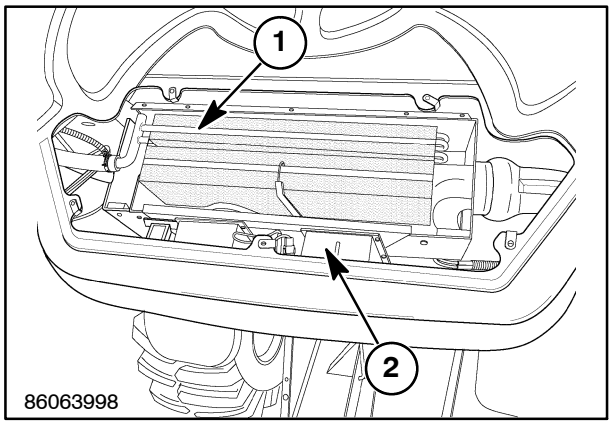
NOTE: *To increase cab temperature, turn knob, 1, clockwise and to decrease cab temperature, turn knob, 1, counterclockwise.*



12

As the hot coolant is flowing through the heater core, 1, the blower motor, 2, is blowing across the heater core coils to produce the hot air coming out of the vents.

NOTE: *The A/C and Heater utilizes the same fans and vents.*



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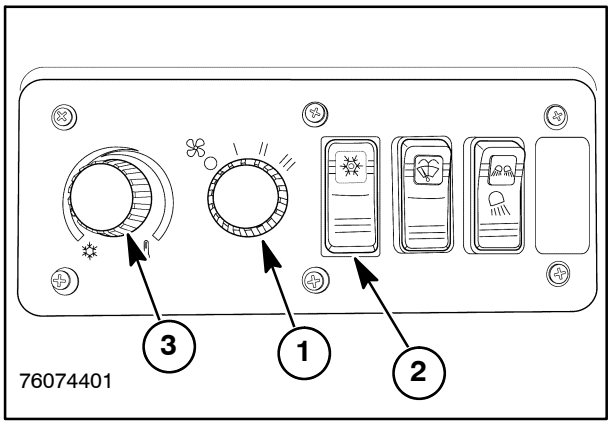
HVAC CONTROL PANEL

A three speed switch, 1, controls the blower motor. The fan speed switch, 1, selects which circuit of the motor to supply with power. The switch uses a speed control resistor to change the fan speed. The motor is wired internally to produce the three different speeds.

The A/C switch, 2, must be depressed to activate the air conditioning system. A light will appear when the switch is activated.

The temperature switch, 3, only controls the water valve. The water valve can be opened and closed with a cable that is positioned between the switch and the water valve.

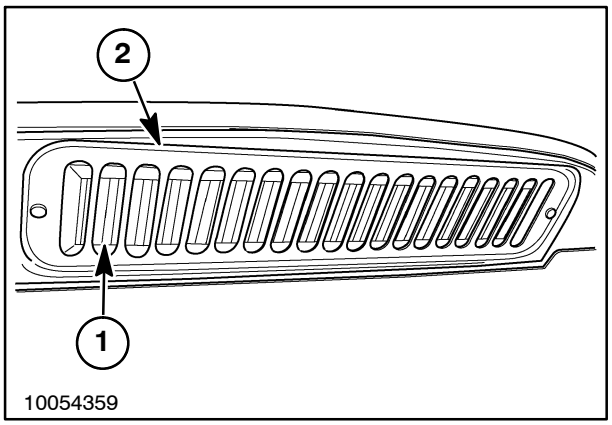


14

CAB AIR FILTER

The cab air filter, 1, is located on the right side of the cab roof behind the access grill, 2.

The filter removes pollen and dust from the incoming air.



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Cleaning Cab Air Filter

Clean the air filter if it shows an accumulation of dirt on the bottom side. Use one the following methods:

Tap the filter gently on a flat surface with the dirty side down.

Compressed air may be used if the pressure does not exceed 2.0 bar (30 psi). Keep the nozzle at least 25 mm (1 in) from the filter surface. Direct the air through the filter, opposite to the air flow through the filter. Do not direct air against the dirty side of the filter because it will force dirt further into the pleats.

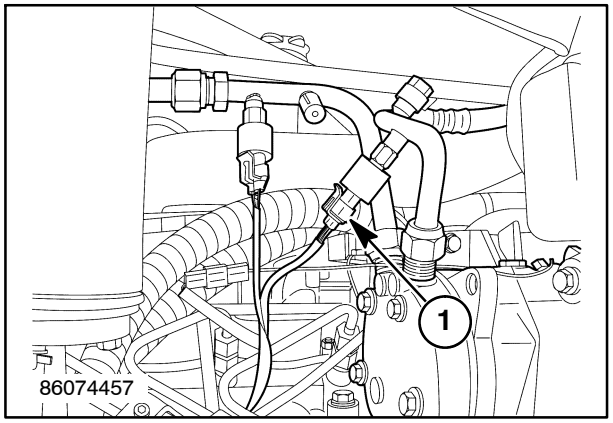
COMPRESSOR PROTECTION SWITCHES

High-Pressure Cutout Switch

The high-pressure switch, 1, is located in the receiver/drier outlet line.

Excessive refrigerant pressure may occur due to a faulty expansion valve or icing up of the expansion valve orifice. Excessive pressure will result in severe damage to the compressor pump. The purpose of the high-pressure switch is to shut off the compressor pump in case of excessive pressure in the refrigerant system.

The high pressure switch is factory set and non-adjustable.



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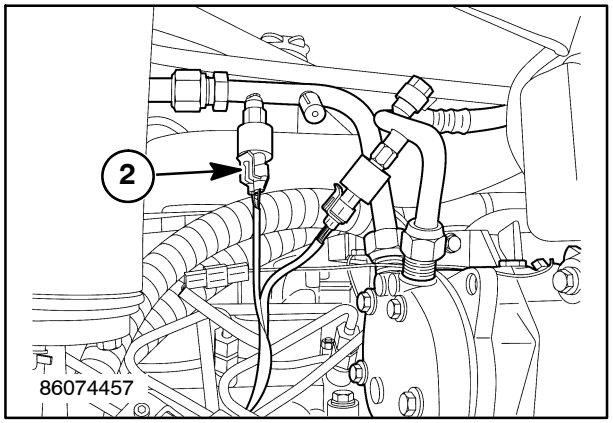
Low-Pressure Cutout Switch

The low-pressure switch, 2, shuts off the compressor pump in the event of excessively low pressure in the refrigerant system.

The low-pressure switch is on the low pressure line near the compressor. Loss of refrigerant in the system will result in insufficient cooling and continuous operation, which in turn could lead to possible damage to the compressor pump.



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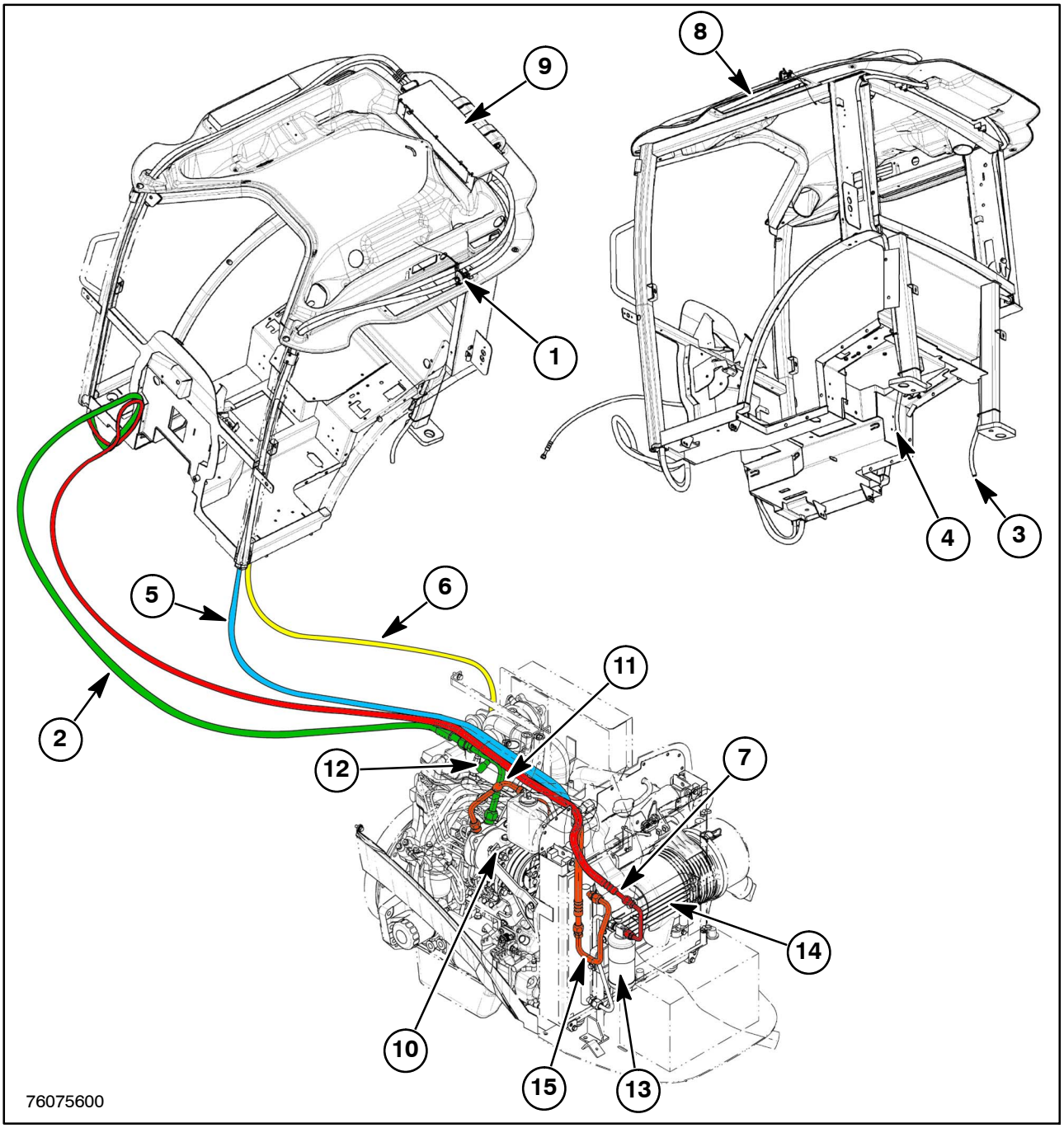
COMPONENT LOCATION

CAB AND ENGINE BAY



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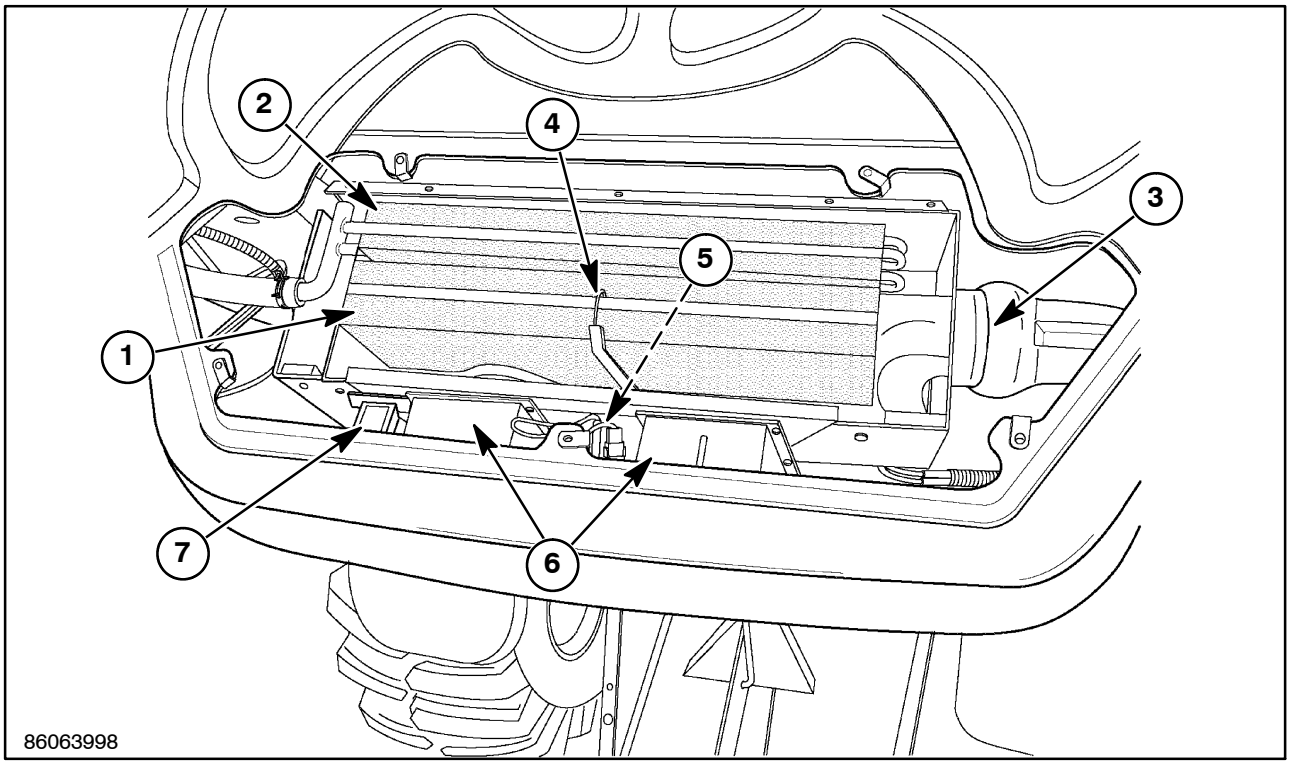
1. Heater Control Valve
2. A/C Suction Hose
3. Condensate Drain Hose (Right)
4. Condensate Drain Hose (Left)
5. Heater Return Hose
6. Heater Supply Hose
7. A/C Liquid Hose
8. Recirculation Filter
9. HVAC Box (Details located in Cab Roof Figure)
10. A/C Compressor
11. High Pressure Switch
12. Low Pressure Switch
13. Receiver/Drier
14. Condenser
15. High Pressure Line (Compressor to Condenser)

CAB ROOF



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1. Evaporator Core
2. Heater Core
3. Expansion Valve
4. Temperature Probe
5. Blower Fan Resistor
6. Blower Motor Assembly
7. Temperature Switch

TROUBLESHOOTING

Problem	Possible Cause	Correction
No Cooling.	A/C Mode Switch not on.	Turn A/C Mode switch on.
	Loss of refrigerant.	Refer to “Pressure Test” in this section.
	Insufficient air flow through evaporator.	Check air filter.
		Check evaporator core and clean as necessary.
		Check blower motor operation. Perform electrical checks. Refer to electrical section 55.
	Loose or broken compressor drive belt.	Check belt and tension. Adjust or replace as necessary.
	Compressor clutch does not engage.	Perform electrical checks. Refer to electrical section 55.
	Faulty expansion valve.	Replace Expansion valve.
	Faulty compressor and/or compressor clutch.	Perform electrical checks. Refer to electrical section 55.
Insufficient Cooling	Dirty Evaporator coil and/or filter.	Visually inspect. Clean as necessary.
	Dirty Condenser core.	Visually inspect. Clean as necessary.
	Compressor drive belt slipping.	Visually inspect. Clean as necessary.
	Faulty expansion valve operation.	Expansion Valve – Testing.
	Evaporator icing up.	Refer to “Pressure Test” in this section.
	Low refrigerant charge.	Refer to “Pressure Test” in this section.
	Heater Valve leak through.	Operate engine at 1500 rpm for 15 minutes to warm engine coolant. Operate the A/C system at maximum cooling. Install stem thermometer in mid-cab louver and record temperature. Close heater core supply valve. Wait a few minutes and check the temperature. If the temperature drops, valve leak through is the problem; replace heater valve. Refer to “Heater Valve – Removal.”
No Heat/Defrost not working.	Heater Core supply and return valves closed. Coolant not hot.	Open Valves. See Engine Cooling section.
	Heater Valve Inoperative.	Operate engine at 1500 rpm for 15 minutes to warm engine coolant. With the heater valve open, verify heater hoses are warm to the touch. Check the operation of the cable between the switch and the valve for proper adjustment. Adjust or replace as necessary.

Problem	Possible Cause	Correction
No air flow/reduced air flow.	Cab temperature approximately equal to temperature set point.	System operating properly.
	Cab air filter dirty.	Clean cab air filter.
	Blower motor inoperable.	Check blower motor operation. Perform electrical checks. Refer to electrical section 55.
Noisy system.	Faulty compressor clutch.	Replace compressor assembly.
A/C system is inoperative.	Blower speed switch defective.	Perform electrical checks. Refer to electrical section 55.
Compressor operates, but blower is inoperative.	No Power and/or ground to blower motor.	Perform electrical checks. Refer to electrical section 55.
	Defective Blower motor.	Replace blower motor.
Blower operates, compressor is inoperative.	High pressure switch activated locking out the clutch.	Check High pressure switch operation. Perform electrical checks. Refer to electrical section 55.
	Low pressure switch activated locking out the clutch.	Check Low pressure switch operation. Perform electrical checks. Refer to electrical section 55.
	Evaporator temperature sensor “freeze” setting reached cycling the clutch OFF.	Check temperature sensor operation. Perform electrical checks. Refer to electrical section 55.
	Open in switched ground to relay from controller. Power and ground to clutch relay. Clutch relay defective.	Perform electrical checks. Refer to electrical section 55.
	Controller defective.	Perform electrical checks. Refer to electrical section 55.

EXPANSION VALVE – TESTING

No	Test Point	Expected Result	Other Result (Possible Cause)
1	Disconnect Low Pressure Switch. Connect the pressure test gauge manifold as described in "Overhaul – Pressure Test." Remove insulation material from top of expansion valve. With engine running and A/C on maximum cooling, cool the top of the expansion valve with ice.	Low pressure gauge shows decrease in pressure. Go to test 2	Expansion Valve defective. Replace as described in "Expansion Valve – Removal" and "Expansion Valve – Installation."
2	Allow the top of the expansion valve to warm.	The valve opens and the pressure rises on the low pressure gauge.	If there is little or no change in pressure, replace the expansion valve as described in "Expansion Valve – Removal" and "Expansion Valve – Installation."

TEMPERATURE/PRESSURE CHART

Ambient Temperature °C (°F)	% Relative Humidity		Louver Temps* °C (°F)		Normal Low Side Pressure kPa (psi)		Normal High Side Pressure kPa (psi)	
	Low RH	High RH	Low RH	High RH	Low RH	High RH	Low RH	High RH
21(70)	19 to 21	81 to 89	4 (40)	11(51)	62 to 62 (9 to 9)	83 to 97 (12 to 14)	779 to 862 (113 to 125)	807 to 889 (117 to 129)
27(80)	18 to 20	69 to 77	8(46)	14 (57)	69 to 83 (10 to 12)	103 to 117 (15 to 17)	917 to 1014 (133 to 147)	993 to 1103 (144 to 160)
32 (90)	16 to 18	58 to 64	12 (53)	18 (64)	90 to 103 (13 to15)	131 to 145 (19 to 21)	1089 to 1200 (158 to 174)	1207 to 1331 (175 to 193)
38(100)	14 to 16	48 to 53	16(60)	21(70)	117 to 131 (17 to 19)	165 to 179 (24 to 26)	1276 to 1413 (185 to 205)	1427 to 1579 (207 to 229)
43(110)	12 to 14	36 to 40	19(66)	25(77)	152 to 165 (22 to 24)	200 to 228 (29 to 33)	1510 to 1669 (219 to 242)	1662 to 1841 (241 to 267)
49(120)	10 to 12	26 to 28	23(73)	28(83)	200 to 221 (29 to 32)	248 to 276 (36 to 40)	1779 to 1972 (258 to 286)	1910 to 2117 (277 to 307)

SERVICE PRECAUTIONARY STATEMENTS

Leak Testing

Recharging an air conditioning system that leaks simply allows more refrigerant to escape into the atmosphere and ultimately leaves the system non-functioning and in need of additional charging.

Therefore, the proper service procedure is to locate and fix any leaks before putting any more refrigerant into the system.

If a large amount of refrigerant has leaked out, the system pressure will be too low to identify all but the largest leaks. In this case, partially recharge the system with no more than one pound of refrigerant to check for leaks.

IMPORTANT:

- *Any refrigerant introduced into the system for the purpose of finding leaks must also be recovered without releasing it into the atmosphere.*
- *Always use the same type of refrigerant for checking leaks as was originally installed into the AC system by the manufacturer.*
- *Never use compressed air to detect system leaks. The introduction of air into the system may create a fire or explosion hazard, may overload the desiccant with moisture, and could contaminate the system with dirt and improper oil.*

All automotive type air conditioning systems leak to some extent. When servicing them it is important that leakage be minimized. Much of the normal leakage comes from the slow seepage of refrigerant through the flexible hoses. Other common sources of leaks are at joints between the flexible hose and metal tubing or at threaded hose connections. These are usually much larger leaks than the natural seepage through the walls of the hose and are almost always repairable.

Research by the EPA has found that leak detection can be difficult, but existing halogen leak detection systems are adequate for the major task of finding and repairing leaks causing complaints. Dye stains are not very satisfactory for finding small leaks.

Newer electronic leak detectors may offer even better leak detection capabilities. However, no single method can find every leak. Electronic leak detectors may not detect leaks of all refrigerants. For example, older units designed to detect R12 may not detect R134a. Be sure that the leak detector you use is state-of-the-art and that it is designed to detect the refrigerant in the system you are servicing.

Service professionals must be extremely diligent in their work to correct all possible leaks. Diligence is essential to ensure that no small, difficult-to-find leaks go undetected.

Before leaving a job, make one last leak check. Catching a leak just after service will save an inconvenient and expensive return visit.

Refilling

Refill the air conditioning system using the weight method. The lubricants used in R134a tend to layer onto the walls of the refrigeration system. This layering obscures the view through the sight glass. Visual methods of refilling R134a systems will result in improper system charging. For this reason, we do not recommend the old practice of topping off a partially discharged air conditioning system using the sight glass. The T2410 and T2420 uses 1.1 kg (2.4 lbs) of R134a refrigerant.

CONTAMINANTS

General

No mobile air conditioning system can operate for long without picking up some contaminants in the refrigerant. The flexible hoses, for example, allow moisture and air to migrate into the refrigerant from the outside atmosphere. Moisture and non-condensable gases (air) are the most common contaminants found in mobile air conditioning systems.

IMPORTANT: *Contaminating R134a with R12 or CFC will lead to copper plating of steel components and major compressor failure.*

Lubricant and refrigerant that remain in service equipment can be contaminants. When you recover a refrigerant, you also will capture a certain amount of lubricant in the extraction or recovery equipment. The equipment will drain the lubricant in a catch bottle or reservoir for measurement and proper final disposal.

Never use a lubricant that has come out of an air conditioning system. Reusing this oil will result in contamination of the air conditioning system with refrigerant, moisture and air from the old oil. Instead, refill the air conditioning system using fresh oil in the same amount as that removed during service. Dispose of the used oils in a manner that complies with federal, state and local disposal requirements.

To avoid contamination between systems using dissimilar refrigerants, the extraction and recycling equipment MUST be dedicated to a single refrigerant.

Preventing Mixing of Service Equipment

To help avoid the mistake of charging a system with an incorrect, incompatible refrigerant, the compressor fittings are different for refrigerants R12 and R134a. Systems using R134a have quick couple service connections, while R12 systems use screw threads. This prevents the use of the same tools for different refrigerants, thereby helping to avoid the mixing of refrigerants in service equipment.

If refrigerants become mixed, the thermodynamic and chemical characteristics will change. This change results in excessive pressure and poor lubrication and leads to failure of the compressor, desiccant (drier) and other system components.

Ultimately, system failure and an expensive repair bill will result if refrigerants become mixed in a single set of service equipment.

REFRIGERANT EXTRACTION AND RECYCLING EQUIPMENT

Both extraction and recycling equipment are in use and available to service technicians. Both types of equipment will remove the refrigerant from an air conditioning system. However, extraction equipment only pulls the refrigerant from the air conditioning system and stores it in an appropriate container. Extraction equipment does not clean the refrigerant. Its only purpose is to recover the refrigerant from an air conditioning system prior to disassembling and servicing it.

Always recycle or reclaim recovered refrigerant before putting it back into an air conditioning system. During service operations involving a partial recharge, or while the air conditioning system is in use, refrigerant can pick up moisture, lubricants, microscopic metal chips, and other potential contaminants. In many cases the contaminants contribute to or are the primary cause of the system failure. Putting used, unclean refrigerant back into an air conditioning system may result in poor system performance.

NOTE: *Reuse of unrecycled, unreclaimed refrigerant will void the warranty.*

Equipment that removes refrigerant from a mobile air conditioning system (recovery equipment) may allow you to put the used refrigerant back in the system without first cleaning it to minimize performance. You may also use such conditioning systems. Non-mobile air conditioning systems use refrigerants and contain contaminants that are different from those in mobile air conditioning systems. Recovery equipment may therefore allow the mixing of different types of refrigerants or introduce contaminants that may not be removable by recycling equipment available in the service shop.

If you want to remove, clean and reuse R134a refrigerant, you must use a machine that both extracts and recycles refrigerant from mobile air conditioning systems. Dedicate that machine to R134a only.

Recycling equipment meeting SAE standards J1990 and J2210 is designed to extract and recycle refrigerants that have been in mobile air conditioning systems only. R134a refrigerant that also is used in non-mobile systems may introduce contaminants to the refrigerant that equipment meeting SAE J1990 and J2210 cannot remove. This equipment is not intended for use on non-mobile systems.

Using Extraction Equipment

Extraction equipment is relatively small and easily portable. It is best used if a shop must service vehicles, such as agricultural or off-highway equipment, that cannot easily be brought into the shop. It is also convenient for shops that must deal with a variety of different refrigerant types and exchange recovered refrigerant at some central location.

Always use extraction equipment on those refrigerants for which it was designed. The lubricants, hoses, and seals in this equipment have been designed to work with only one refrigerant.

To help avoid a mix-up of service equipment and refrigerants, equipment hoses designed for use which each refrigerant are easily identifiable. New service hoses used with R134a must have a black stripe along the hose length and carry the designation “SAE J2196/R134a” (hoses labeled SAE J 2196” and lacking the black stripe were used for R12.)

If you use extraction equipment and send your recovered refrigerant to a reclamation facility, reclaimed refrigerant you purchase must meet the Air Conditioning and Refrigeration Institute standards of purity (ARI Standard 700-88). This will ensure that the refrigerant you are using not only meets the purity requirements of SAE J1991 (for R12) OR J2099 (for R134a), but also that it does not contain incompatible lubricants or other contaminants from non-automotive air conditioning systems.

Using Recycling Equipment

Recycling equipment extracts and removes common contaminants from refrigerants. Recycling equipment designed and certified to meet SAE standards can make refrigerant recovery from mobile air conditioning systems suitable for reuse in automotive air conditioning systems. Like extraction equipment, SAE standards require that each piece of recycling equipment be dedicated to a single refrigerant.

NOTE: *Only equipment capable of recovering and cleaning R134a to meet SAE J2099 purity levels carries a label with the phrase "Design certified by Underwriters' Laboratories, Inc. for compliance with SAE J2099.*

The Underwriters' Laboratories label must be specific that the equipment is "design certified" for the SAE J2099 standard. If not, it certifies only that the machine is free of reasonable shock or other electrical hazards to the user.

Recycling vs. Reclaiming

Recycled refrigerant has been recovered from a mobile air conditioning system and is cleaned by the same shop that recovered it to meet J2099 for R134a. The equipment designed to recycle refrigerant in the shop environment removes only contaminants picked up during the operation of a mobile air conditioning system.

Refrigerant that is either properly recycled or reclaimed is adequate for use in mobile air conditioning systems.

CONTAINMENT OF AIR CONDITIONING REFRIGERANTS

The following procedure is a guide to servicing mobile air conditioning systems in a way that minimizes the potential for losing refrigerant to the atmosphere. Following the procedures in this section will help ensure compliance with SAE J2211 for R134a systems.

⚠ WARNING ⚠

To avoid fire or explosion, do not over-pressurize R134a. Refrigerant 134a poses a fire and explosion risk at air concentrations of greater than 60% by volume. At normal atmospheric pressure and temperature, R134a is nonflammable.

Do not pressure-test or leak-test R134 service equipment or vehicle air conditioning systems with compressed air. Some mixtures of air and R134a are combustible under pressure. These can result in fire or explosion, causing injury or property damage. Refrigerant and lubricant manufacturers can provide additional health and safety information.

Recovery

1. Be sure that all service equipment hose lines have shutoff valves or check valves within 30 cm (12 in) of their ends. This will ensure that only minimal quantities of refrigerant escape to the atmosphere when the equipment is disconnected from the air conditioning system, and only small amounts of moisture and other contaminants can enter the system.
2. Be sure that all equipment, including the connecting hose lines and manifold, are compatible with the refrigerant in the system with which you are going to work, and that your equipment has previously been used only with the refrigerant you are about to service.
3. Be sure that all shutoff valves are tight before connecting them to the air conditioning system.

⚠ CAUTION ⚠

Keep shutoff valves closed at all times unless they are connected to a vehicle's air conditioning system, a refrigerant storage container or another piece of service equipment containing the same refrigerant. This prevents refrigerant from escaping into the atmosphere, damaging the environment, contaminating the equipment, and costing you money.

4. Connect the extraction or recovery equipment to the air conditioning system in accordance with the instructions supplied by the equipment manufacturer.
5. Start the recovery process by turning on the extraction equipment and extracting the refrigerant from the air conditioning system in accordance with the equipment manufacturer's instructions.
6. Continue to extract refrigerant until the air conditioning system is under a vacuum and there is no refrigerant remaining in the vehicle system.
7. Verify that there is no refrigerant remaining in the system by:
   a) Shutting off the extraction unit and observing the system pressure level.
   b) Waiting five minutes and observing the system pressure again. If the system pressure has not risen above atmospheric pressure (0 gauge pressure), all refrigerant has been removed and you may proceed to step 8.

   If after five minutes, the system pressure reading has risen above atmospheric pressure (0 gauge pressure), the extraction/recovery process must be repeated until the pressure reading remains at or below atmospheric for at least two minutes with the extraction equipment shut off before proceeding to step 8.
8. Close the shutoff valve in the service lines.
9. Remove the service lines from the vehicle system. If the recovery equipment has automatic closing shutoff valves, verify that they are operating properly and do not leak.
10. Determine the amount of lubricant removed from the air conditioning system during the refrigerant extraction process. Replenish the air conditioning system with an equal volume of new, correct lubricant.
11. The system is now ready for service or repair.

Flushing

Do not flush this system. In the event of a major compressor failure, replace the compressor output pressure line and receiver/drier to collect most of the debris.

⚠ WARNING ⚠

Do not flush with compressed air. Some mixtures of air and R134a systems could result in fire or explosion. Air from a shop compressor also contains moisture, which would contaminate the system.

IMPORTANT: *Never use CFC11, R11, CFC12, R12, CFC113, R13 or any other substance to flush an R134a system. To do so would break down the lubricant and cause system corrosion.*

Use of other flushing solvents may cause other problems. If a vacuum pump does not remove the solvent, it could affect the chemical stability of the refrigerant and lubricant.

Recharging/Refilling

Recharge the system only with the proper virgin refrigerant or recycled refrigerant purified to meet SAE purity standard (J2099 for R134a). Use the weight method to determine the proper amount of refrigerant. The T2410 and T2420 uses 1.1 kg (2.4 lbs) of R134a refrigerant.

Using a Manifold Gauge Set

When using a manifold gauge set to diagnose, recharge, or service the tractor air conditioning system:

1. Be sure that all equipment hose lines are fitted with shutoff valves or check valves within 30 cm (12″) of their ends and that the valves are closed. This will ensure that only minimal quantities of refrigerants escape to the atmosphere, and that only small amounts of moisture and other contaminants can enter the system.
2. Be sure that all equipment including the connecting hose lines and manifolds are:
   - Compatible with the refrigerant in the air conditioning system;
   - Free of all contaminants;
   - Used only for the same type of refrigerant in the system.
3. Be certain that all shutoff valves are closed tightly before connecting them to the air conditioning system or charging source.
4. Connect the manifold gauge set to the unit according to the instructions supplied by the gauge manufacturer.

5. Perform the desired diagnostic and service operation.
6. Close the shutoff valves on the service hoses.
7. Disconnect the hoses from the system.

NOTE: *Attach the hoses to recovery or recycling equipment whenever disconnecting the manifold gauge set from the air conditioning system, emptying refrigerant from it, or moving the center hose to another device which cannot accept refrigerant pressure. Remove the refrigerant, lubricant, and contaminants from the hoses.*

Checking Refrigerant for Excess Air

At times you may question whether or not a container of refrigerant has been recycled. One check which can be done in the shop is to determine if there is excess air mixed in with the refrigerant. This check is a simple comparison of the container pressure with theoretical pressure at a known temperature. If the pressure is equal to or less than a theoretical value of usable purity established for R134a, the container does not have excess air.

IMPORTANT: *Using R134a with excess air will result in higher system operating pressures and may cause damage to the air conditioning system.*

Do this check in the following manner:

1. Store the container for at least 12 hours at a known temperature of 18.3° C (65° F) or higher. The container must not be in direct sunlight or under the influence of any other direct source of heat.

   Carry out all of the next steps in the same area in which the container is stored, as it is very important that the temperature of the container remain stable.
2. Attach an appropriate pressure gauge to the container. This pressure gauge should read in increments of 6.9 kPa (1 psi).
3. Use a calibrated thermometer to measure the air temperature within 10 cm (4 in) of the container surface.
4. Compare the pressure in the container with the pressure shown for the temperature of the tank for R134a. If the pressure in the container is equal to or less than the pressure in the table, the refrigerant in the container meets the requirements for excess air.

   If the pressure is greater than shown in the table, you may still be able to use the refrigerant by proceeding to step 5.
5. If the pressure exceeds that of the table, connect the tank to recovery or recycling equipment in such a way as to allow you to continue to monitor tank pressure.
6. Bleed a small amount of vapor from the tank into the recovery or recycling equipment until the tank pressure is below that shown in the table for the temperature at which the tank was stored. Close the shutoff valves in the recovery/recycling equipment service hose.

NOTE: *This process may cause the temperature of the tank to drop.*

7. Allow the tank temperature to restabilize at the temperature of the storage room by shaking it and allowing it to sit in the same spot for up to another 12 hours.
8. After making certain that container temperature has again stabilized to room temperature, repeat step 4 above.

If the pressure exceeds that in the table for the storage temperature you measured, the refrigerant in the tank has too much excess air to be used and must be recycled or reclaimed.

If the refrigerant being checked has been contaminated with other refrigerant such as R12, the tank pressure may indicate it contains air. If the tank is vented and the pressures still indicates a high reading and you think there is a possibility of the R134a refrigerant being contaminated with R12, the container must be sent to a reclaim facility.

Containers for Storing Recycled Refrigerant

Recycled refrigerant must be stored in DOT CFR Title 49 or UL containers approved for such use. The container must be specifically marked for the refrigerant type you are storing. The use of unmarked containers can lead to mixing of refrigerants and consequent air conditioning system failure.

Disposable refrigerant containers should not be used for the storage or recovery of used or recycled refrigerant. Disposable container are the type of container in which virgin refrigerant is often sold.

Any container of recycled refrigerant that has been stored or transferred must be checked prior to its use in accordance with the temperature /pressure check described previously in “Checking Refrigerant for Excess Air.”

New storage tanks must be evacuated to at least 635 mm (25 in) of mercury prior to use. Otherwise, excess air may be introduced to the refrigerant.

Disposal of Empty or Near-Empty Disposable Containers

Improper scrapping of a disposable container can release some refrigerant into the atmosphere. This must be avoided by removing any of the remaining contents with a recovery or recycling machine as follows:

1. Attach the service hose of your recovery or recycling machine to the container.
2. Open the container valve and the recovery/recycling equipment shutoff valve and evacuate the container just as you would a mobile air conditioning system.
3. When the maximum stable vacuum has been achieved, close the container valve and the service hoses valve, allowing the vacuum to be in the container.
4. Mark the container “empty” and dispose of it properly.

APPLICABLE SAE STANDARDS

J639 Safety and containment of refrigerant for mechanical vapor compression systems used for mobile air conditioning systems

J1989 Recommended service procedure for the containment of R12

J1991 Standard of purity for use in mobile air conditioning systems

J2099 Standard of purity for recycled R134a for use in a mobile air conditioning system

J2196 Service hose for automotive air conditioning

J2197 R134a service hose fittings for automotive air conditioning service equipment

J2211 Recommended service procedure for the containment of R134a

J2219 Mobile Air Conditioning Industry Criteria and Guidelines

Related SAE Standards:

J1990 Extraction and recycle equipment for mobile air conditioning systems

J2209 R12 extraction equipment for mobile air conditioning systems

J2210 R134a recycling equipment for mobile air conditioning systems

These and other SAE standards may be obtained from

SAE Customer Service

400 Commonwealth Drive

Warrendale, PA 15096-0001

MANIFOLD GAUGES AND INTERPRETATIONS

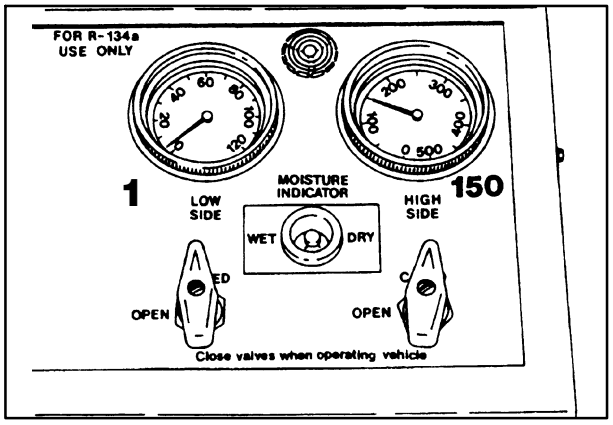
PERFORMANCE TEST EXAMPLES

EXAMPLE 1

Symptoms

1. Evaporator air is lukewarm.
2. Low side pressure is too low. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is too low. See the pressure-temperature chart for correct gauge readings.

DIAGNOSIS: System refrigerant is low. A small leak may cause this.



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Corrective Procedures

1. Leak test the system.
2. Extract the refrigerant from the system.
3. Repair the leaks. Replace any faulty lines or components.
4. Check compressor oil and add oil if necessary.
5. Evacuate the system.
6. Charge the system.
7. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 2

SYMPTOMS

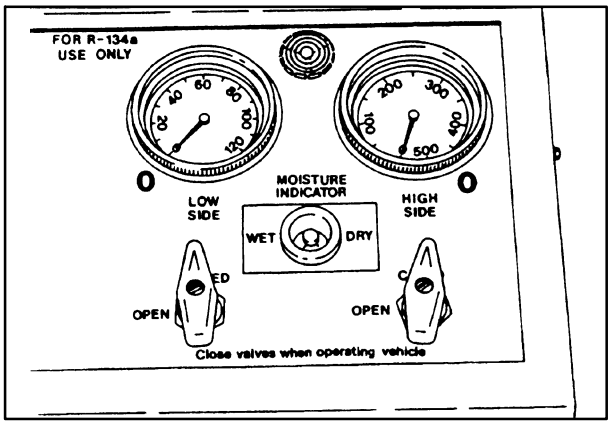
1. Evaporator air is warm.
2. Low side pressure is very low. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is too low. See the pressure-temperature chart for the correct gauge readings.

DIAGNOSIS: System refrigerant is extremely low. A serious leak is indicated.

CORRECTIVE PROCEDURES

1. Leak test the system.
2. Extract the refrigerant from the system.
3. Repair leaks.
4. Check compressor oil to ensure no loss.
5. Evacuate the system.
6. Charge the system.
7. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



21

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 3

SYMPTOMS

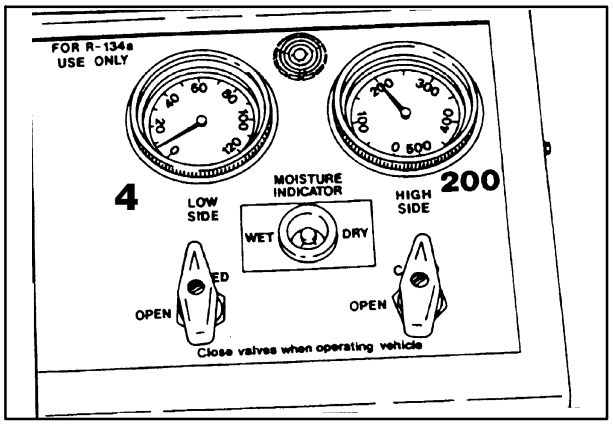
1. Evaporator air is not being cooled.
2. Low side pressure reading does not change when compressor cycles on and off.
3. High side pressure slightly high or slightly low. See charts the pressure-temperature chart for correct gauge readings.

DIAGNOSIS: Non-condensables (air or moisture) are present. System not fully charged.

CORRECTIVE PROCEDURES

1. Leak test the system. Give special attention to the compressor seal area.
2. Extract the refrigerant from the system.
3. Repair any leaks.
4. Replace the receiver/drier.
5. Check the compressor oil to ensure no loss.
6. Evacuate the system.
7. Charge the system.
8. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



22

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 4

SYMPTOMS

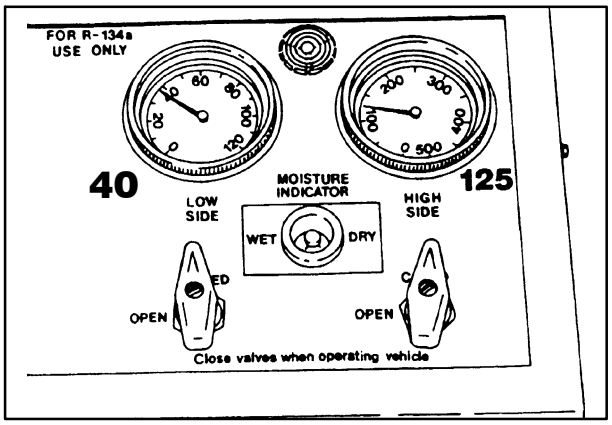
1. Evaporator air is not being cooled.
2. Low side pressure is too high. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is too low. See the pressure-temperature chart for the correct gauge readings.
4. System is fully charged.

DIAGNOSIS: Internal leak in compressor caused by worn or scored pistons, rings, or cylinders.

CORRECTIVE PROCEDURE

Replace the compressor.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



23

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 5

SYMPTOMS

1. Insufficient or no cooling. Engine overheats in some cases.
2. Low side pressure is too high. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is too high. See the pressure-temperature chart for the correct gauge readings.
4. Liquid line is hot.

DIAGNOSIS: The system pressure is too high on the high side due to improper operation of condenser. Refrigerant charge may be normal or excessive.

CORRECTIVE PROCEDURES

1. Check belt tension. Loose or worn drive belts could cause excessive pressures in the compressor head.
2. Look for clogged passages between the condenser fins and coil or other obstructions that could reduce condenser airflow.
3. If engine overheats, inspect the radiator fan and pressure cap for proper operation.

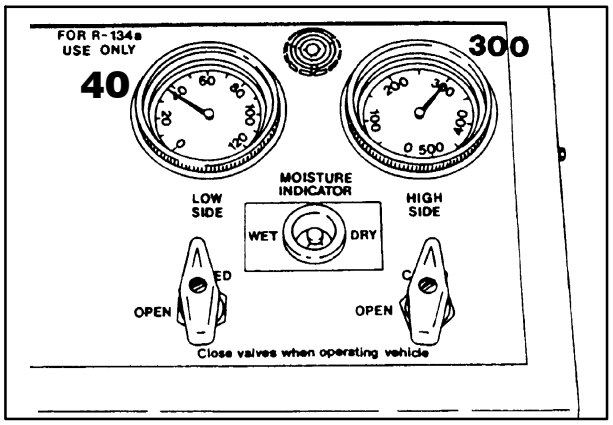
   Run the system and check performance. If it still is unsatisfactory, proceed as follows.
4. Check for refrigerant overcharge and correct as follows:

   a. Extract the refrigerant.

   b. Add new refrigerant.

   Operate the system and recheck the performance. If the gauge readings are still too high, proceed as follows.
5. Extract the refrigerant from the system.
6. Remove the condenser. If it appears to be dirty or plugged, replace it.
7. Replace the receiver/drier.
8. Evacuate the system, and recharge it.
9. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



24

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 6

SYMPTOMS

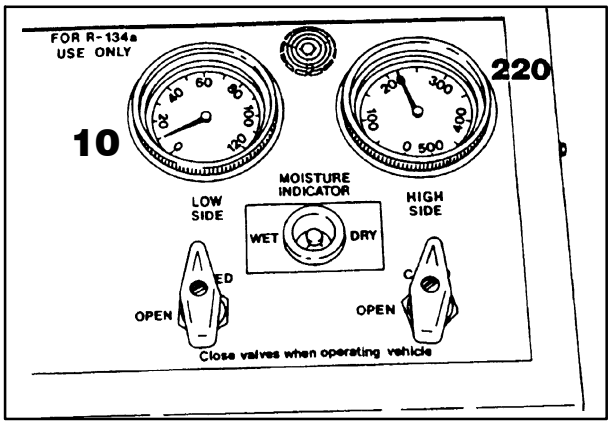
1. Cooling is insufficient during the hottest part of hot days.
2. The low side pressure reading is normal 0.21 – 2.1 bar (3 – 30 psi), but drops to a vacuum during testing.
3. The high side pressure reading is normal but drops when the low side reading shows a vacuum.
4. Evaporator air is sufficiently cold until the low side pressure gauge shows a vacuum; then it becomes warm.

DIAGNOSIS: Excessive moisture is in system. Drying agent in receiver/drier is saturated and releases moisture during high outside air temps. This moisture collects and freezes in the expansion valve, preventing a flow of refrigerant through the evaporator.

CORRECTIVE PROCEDURES

1. Extract the refrigerant from the system.
2. Replace the receiver/drier.
3. Evacuate the system.
4. Charge the system.
5. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



25

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 7

SYMPTOMS

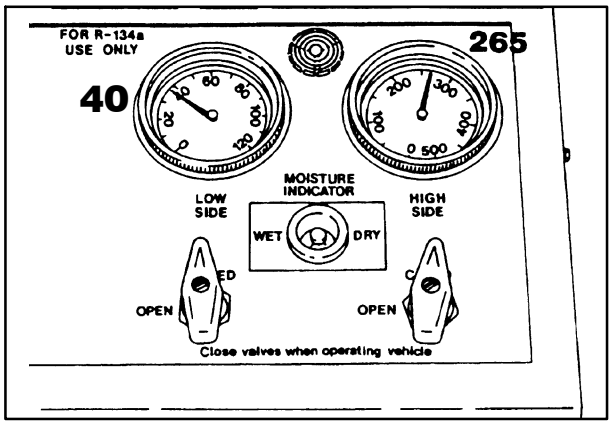
1. Insufficient or no cooling.
2. Low side pressure is too high. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is too high. See the pressure-temperature chart for the correct gauge readings.

DIAGNOSIS: Air in system. This, and the moisture in the air, contaminates the refrigerant, causing the system to malfunction.

CORRECTIVE PROCEDURES

1. Extract the refrigerant from the system.
2. Replace the receiver/drier.
3. Evacuate the system.
4. Charge the system.
5. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



26

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 8

SYMPTOMS

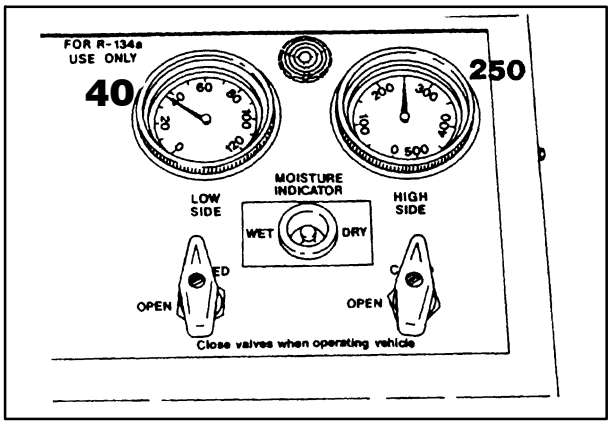
1. Insufficient or no cooling.
2. Low side pressure is too high. The gauge should read 21 – 207 kPa (3 – 30 psi).
3. High side pressure is too high. See the pressure-temperature chart for correct gauge readings.
4. Evaporator and suction hose (to compressor) surfaces show considerable moisture.

DIAGNOSIS: Thermostatic expansion valve is allowing too much refrigerant to flow through the evaporator coils. The valve may be stuck open, or the temperature sensing bulb may be incorrectly mounted.

CORRECTIVE PROCEDURES

1. Check for a sticking expansion valve:
   a. Operate the system at maximum cooling.
   b. Check the low side gauge. The pressure should drop slowly.
2. If the test indicates that the expansion valve is defective, proceed as follows:
   a. Extract the refrigerant from the system.
   b. Replace the expansion valve.
   c. Evacuate the system.
   d. Charge the system.
   e. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



27

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 9

SYMPTOMS

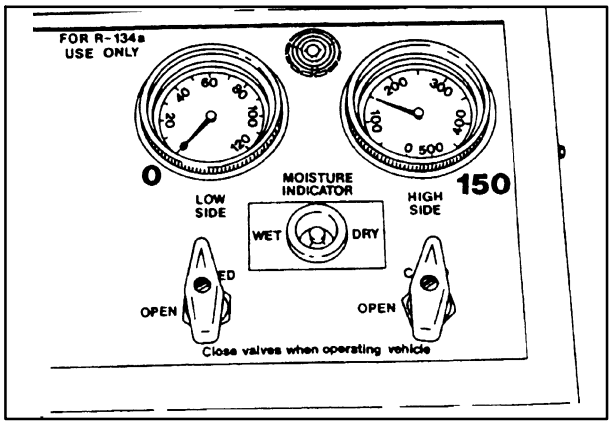
1. Evaporator air is cool, but not sufficiently cold.
2. Low side pressure is too low (0 or vacuum). The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
3. High side pressure is low. See the pressure-temperature chart for the correct gauge readings.
4. The surface of the evaporator valve inlet pipe shows considerable moisture or frost.

DIAGNOSIS: Expansion valve is not permitting a sufficient flow of refrigerant. Possible causes include a valve stuck in restricted or closed position, or too little refrigerant in temperature sensing bulb.

CORRECTIVE PROCEDURES

1. Place a finger on the expansion valve inlet. If the inlet is too cold to keep your finger on it, proceed as follows:
   a. Operate the system at maximum cooling.
   b. Check the low side gauge. The pressure should drop slowly.
2. If the expansion valve inlet surface shows frost or heavy moisture, proceed as follows:
   a. Extract the refrigerant from the system.
   b. Clear blockage at inlet line to expansion valve.
3. If the corrective procedure outlined in Step 1 shows that the expansion valve is defective, proceed as follows:
   a. Evacuate the system.
   b. Charge the system.
   c. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



28

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
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40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

EXAMPLE 10

SYMPTOMS

1. Evaporator is only slightly cool.
2. Liquid line and receiver/drier are cool to touch and show frost or considerable moisture.
3. Low side pressure is too low. The gauge should read 0.21 – 2.1 bar (3 – 30 psi).
4. High side pressure is too low. See the pressure-temperature chart for the correct gauge readings.

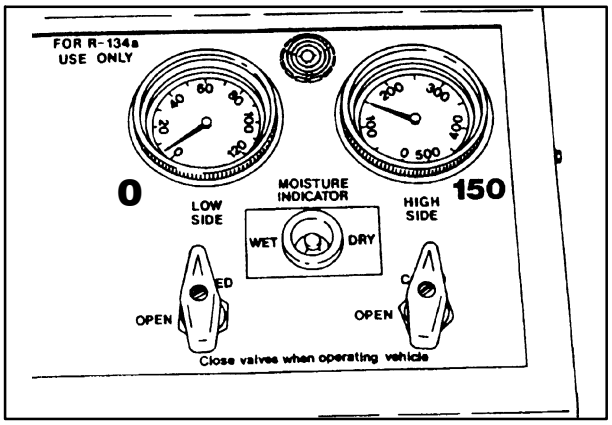
NOTE: *A normal or high reading of the high side pressure gauge under these conditions indicates that the system is overcharged or that the condenser or receiver/drier is too small.*

DIAGNOSIS: Restriction in the liquid line and/or receiver/drier resulting in a "starved" evaporator (compressor moving refrigerant from the evaporator faster than it can enter).

CORRECTIVE PROCEDURES

1. Extract the refrigerant from the system.
2. Replace the liquid lines, receiver/drier, or other obstructed components.
3. Evacuate the system.
4. Charge the system.
5. Performance test the system.

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*



29

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
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43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
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EXAMPLE 11

SYMPTOMS

1. Compressor cycles (cuts in and out) too rapidly.
2. Low side pressure readings are too high, during on and off compressor cycles and between cycles. The readings should be:
   a. 20.7 – 103.4 kPa (3 –15 psi) – cycle on
   b. 248.2 – 268.9 kPa (36 – 39 psi) – cycle off
   c. 165.5 – 193.1 kPa (24 – 28 psi) – between cycles
3. High side pressure is normal. See the pressure-temperature chart for the correct gauge readings.

DIAGNOSIS: Defective thermostatic switch.

CORRECTIVE PROCEDURES

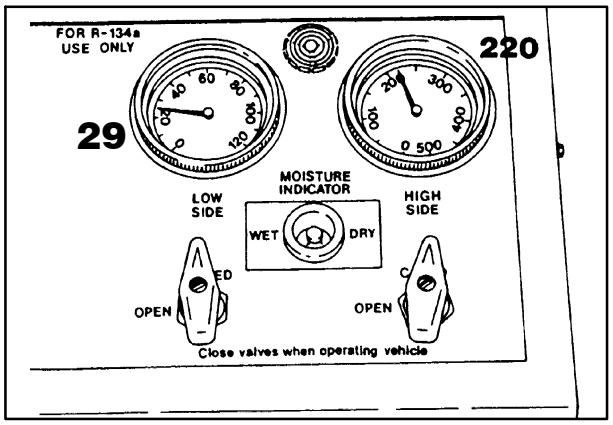
1. Stop the engine and shut off air conditioning system.
2. Replace thermostatic switch.
3. Install the switch's temperature sensing line in the same position and depth (in the evaporator core) as previous bulb.

⚠ CAUTION ⚠

The line is filled with refrigerant under pressure. Do not kink or bend it too sharply.

4. Performance test the system.

***NOTE:** Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure-temperature chart.*

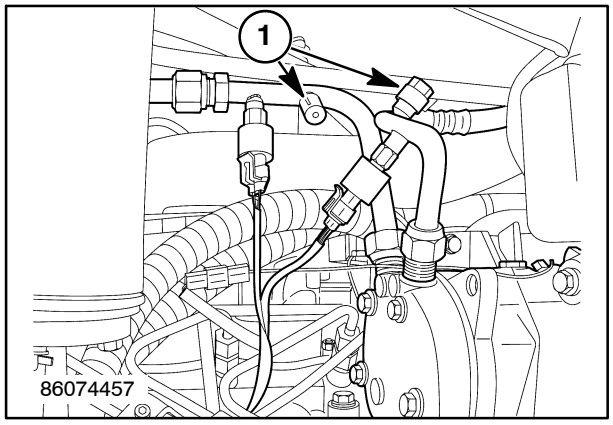


30

Ambient Temperature*		High Pressure Gauge Reading	High-Pressure Gauge Reading
°C	°F	bar	psi
21	70	7.9 – 9.2	114 – 134
24	75	8.7 – 10.1	126 – 146
26	80	9.7 – 11.1	141 – 161
29.5	85	11 – 12.4	159 – 179
32	90	11.6 – 13	168 – 188
35	95	12.5 – 13.9	181 – 201
38	100	13.9 – 15.2	201 – 221
40.5	105	15 – 16.4	218 – 238
43	110	17 – 18.4	246 – 266
46	115	19.1 – 20.5	277 – 297
49	120	21.2 – 22.6	307 – 327

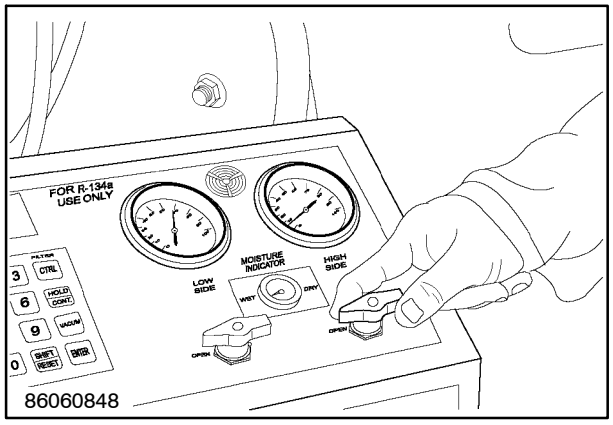
EVACUATING THE REFRIGERANT

1. Recovered refrigerant passes through an oil separator and filter-drier before entering the refrigerant tank. The moisture indicator will turn green when dry refrigerant passes over it.
2. If possible, run the air conditioning system for ten minutes before starting the recovery process. Turn the system off before proceeding.
3. Clean the external surfaces of the compressor and hoses. Remove the caps from the service ports, 1, on the suction and pressure hoses.



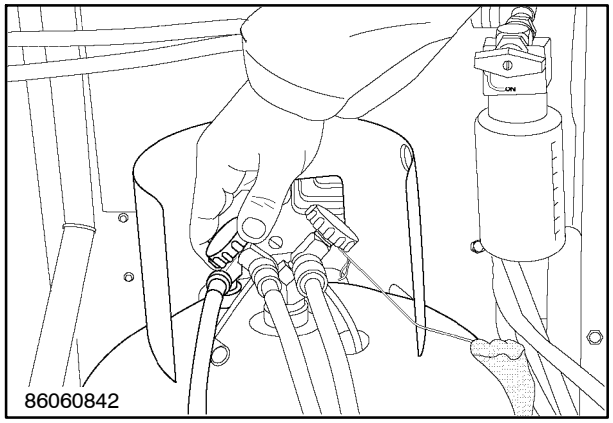
31

4. Make sure the charging station manifold gauge valves are in the closed position. Connect the hose from the low pressure gauge to the port on the suction hose. Connect the hose from the high pressure gauge to the port on the discharge hose. Turn in both thumbscrews to depress the service valves.
5. Open the high and low valves.



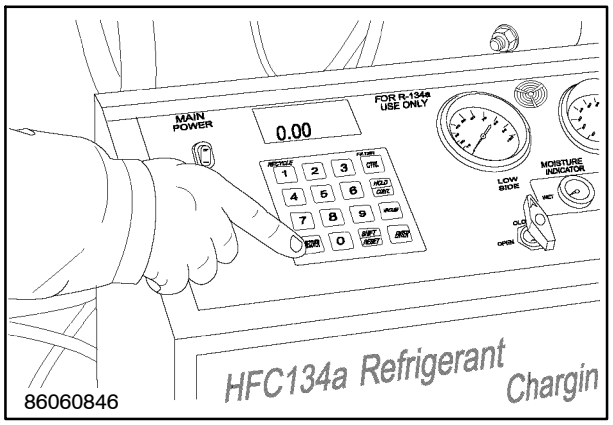
32

6. Make certain the refrigerant tank gas and liquid valves are open.



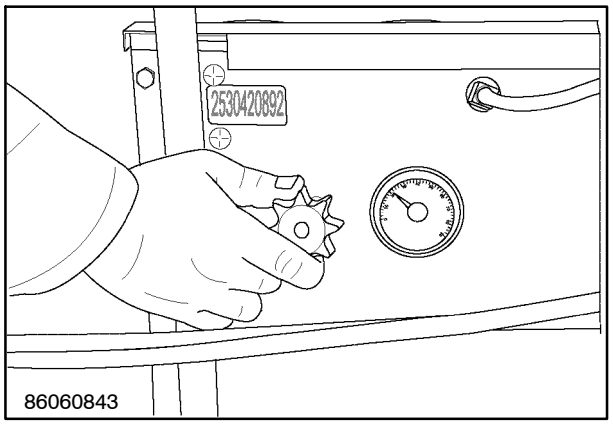
33

7. Connect the main power plug to a 115 volt AC outlet. Move the main power switch to the ON position and depress the recovery start switch. The compressor will shut OFF automatically when recovery is complete.
8. Wait five minutes and observe the manifold pressure gauges for a pressure rise. If pressure rises above zero psi, depress the hold/cont switch. Then wait for the compressor to automatically shut OFF.



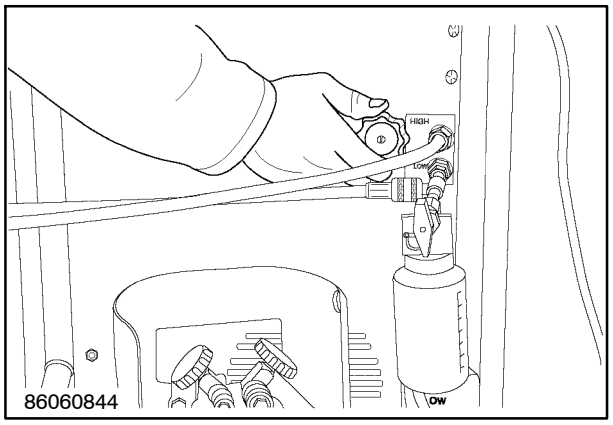
34

9. Drain the oil separator of the A/C system oil. Open the air purge valve long enough to let some of the compressor discharge pressure back into the separator.



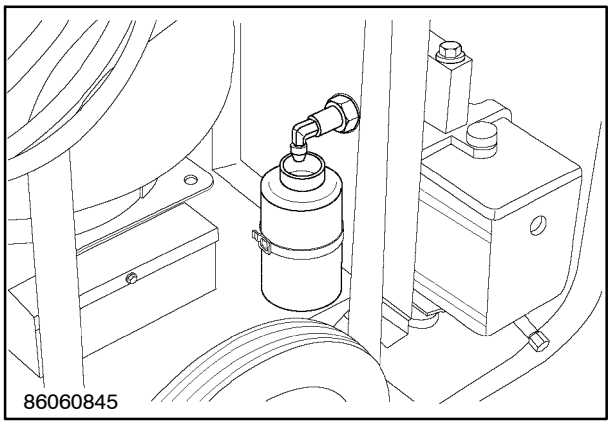
35

10. Slowly open the oil drain valve and drain the oil into the reservoir. When the oil stops draining, close the oil drain valve completely.



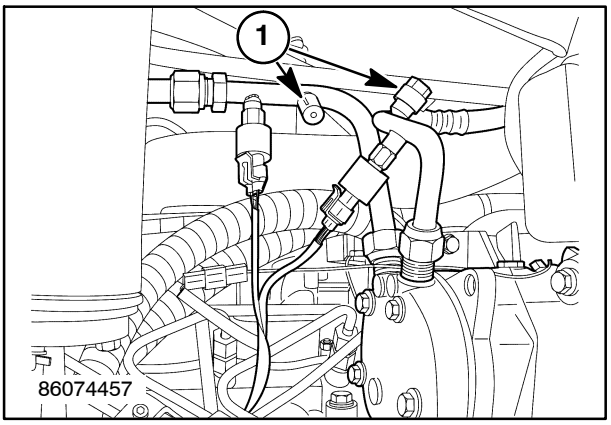
36

11. Fill the A/C compressor with fresh SP-20 PAG oil equal to the amount in the reservoir.



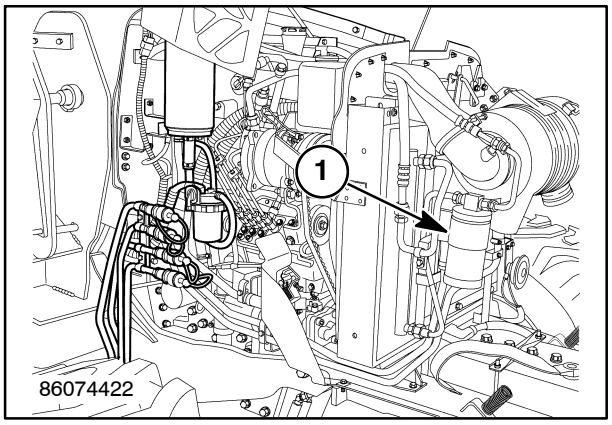
37

12. Disconnect the hoses from the service ports, 1 and install the caps.



38

13. Replace the receiver/drier, 1, if one or more of the following conditions occurs before you remove the air and moisture from the system:
    - The system has been open for service before.
    - Receiver/drier has operated two or more years.
    - Disassembly of compressor shows small particles of moisture removing material (gold or brown particles).
    - Large system leak (broken hose or break in a line).
    - Too much air or moisture in system.
    - Removal of compressor caused the system to be opened (uncapped) longer than 5 minutes.



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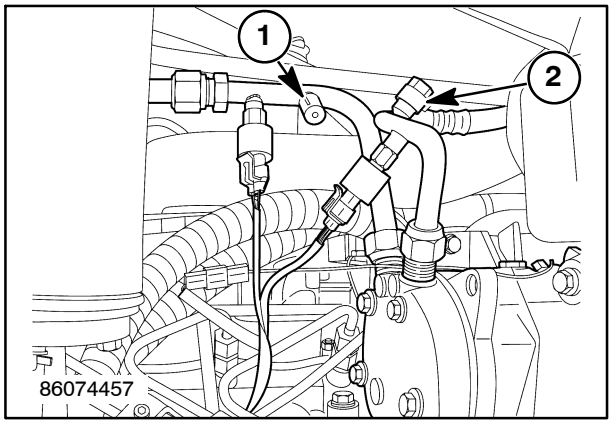
VACUUM TEST

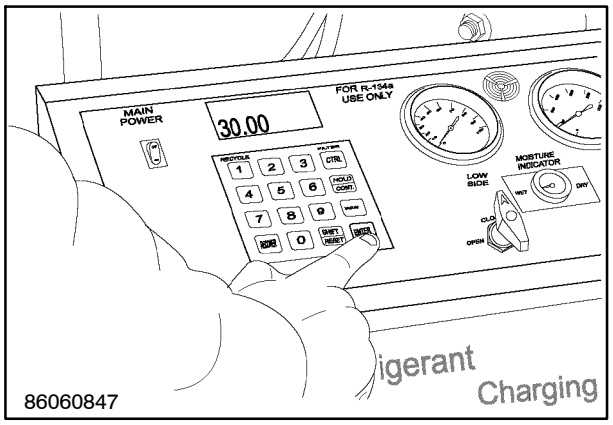
1. Make sure the charging station manifold gauge valves are in the closed position. Connect the hose from the low pressure gauge to the port on the suction hose, 1. Connect the hose from the high pressure gauge to the port on the discharge hose, 2. Turn both thumbscrews to depress the service valves.
2. Removal of air and moisture from the system is necessary after the refrigerant has been removed from the system after the system has been opened for maintenance. Air enters the system when the system is opened air has moisture that must be removed to prevent damage to the system components.
3. Air and moisture are removed from the system by a vacuum pump. A vacuum pump is on the only equipment made that will lower the pressure in a system enough to change the moisture to a vapor so that the moisture can be removed.



40

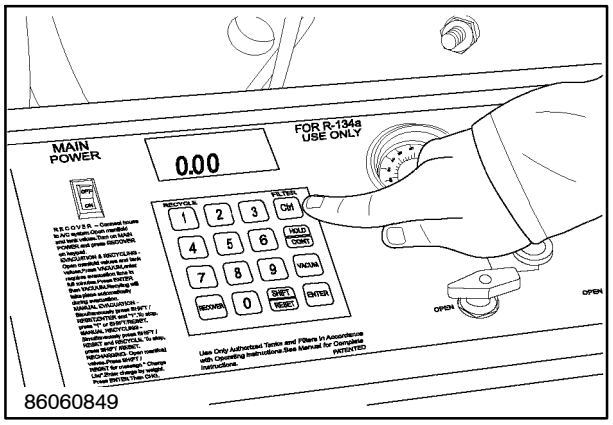
***NOTE*:** Refer to the vacuum pump manufacture's user manual for additional information.

4. Connect the main power plug to a 115 volt AC outlet. Move the main power switch to the ON position. If the program and vacuum do not appear at the top of the display, press the vacuum key. Program a minimum of 45 minutes and press the Enter Key. The display will flash once indicating the programmed data has been accepted.



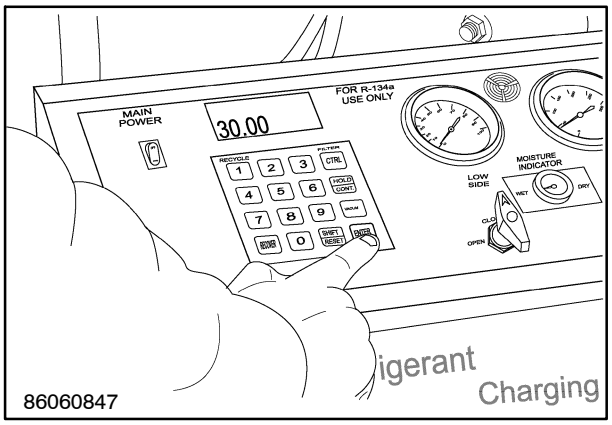
41

5. Press the Charge Key. Program and Charge will appear on the display.



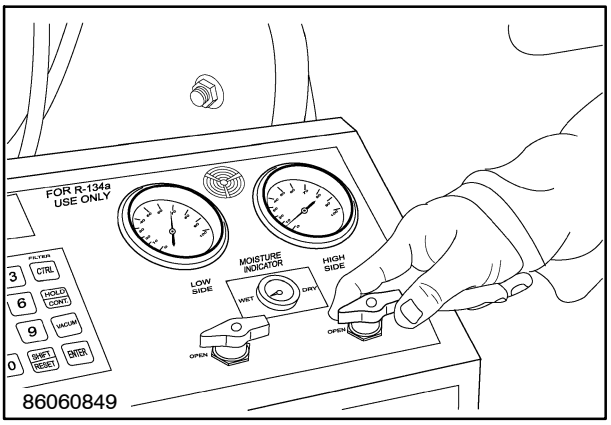
42

6. Program 1.1 kg (2.40 lbs) and press the enter key. The display will flash once indicating the programmed data has been accepted.



43

7. Full open the low and high pressure valves.



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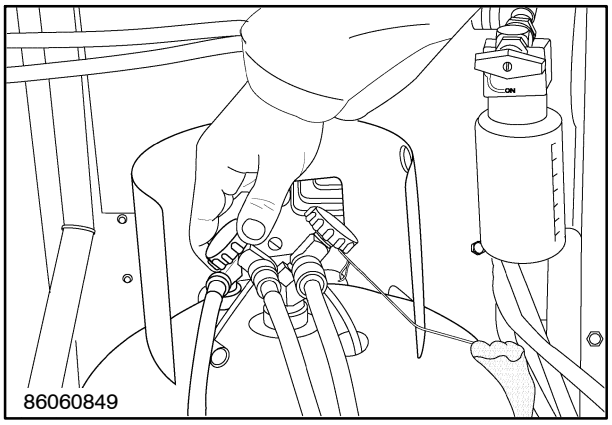
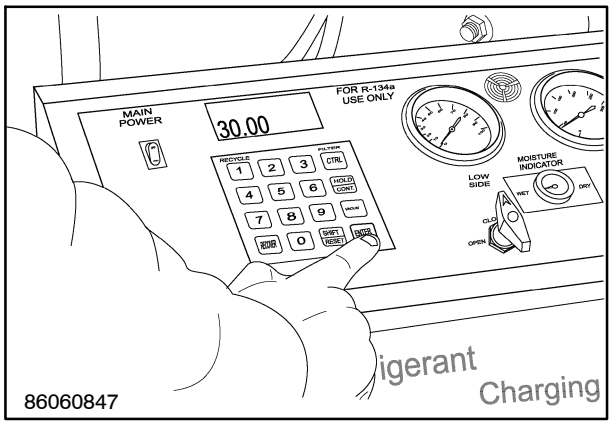
8. Open the red (vapor) and blue (liquid) valves on the tank.
9. Press the Vacuum key. Automatic will show on the display and after a slight delay, the vacuum pump will start. The display will show the amount of time programmed and begin a countdown to zero.



45

10. When the programmed time has elapsed, an automatic hold occurs. Check the low pressure gauge to see that the A/C system maintains a 28 – 29-1/2 in of mercury (Hg). The low pressure gauge must not increase faster than one inch of mercury (Hg) in 15 minutes. If the system will not hold vacuum, a leak exist that must be corrected before recharging can begin. See “Leakage Test” for a leak test.



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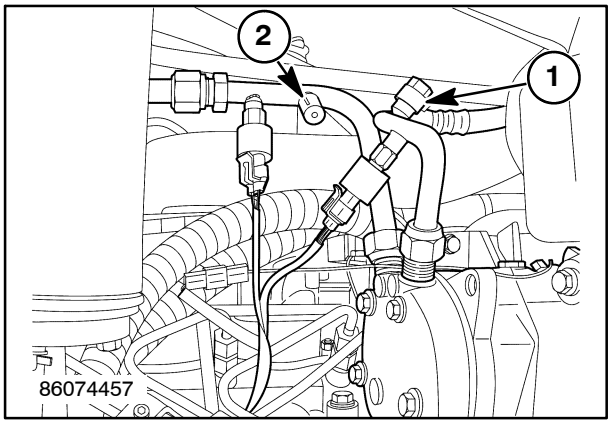
PRESSURE TEST

NOTE: *The compressor casing is stamped with a "D" and "S" to indicate the discharge and suction ports.*

1. Connect the pressure test gauge manifold to the test connections at the compressor. Connect the high side hose to the discharge side, 1, and low side hose to the suction side, 2.



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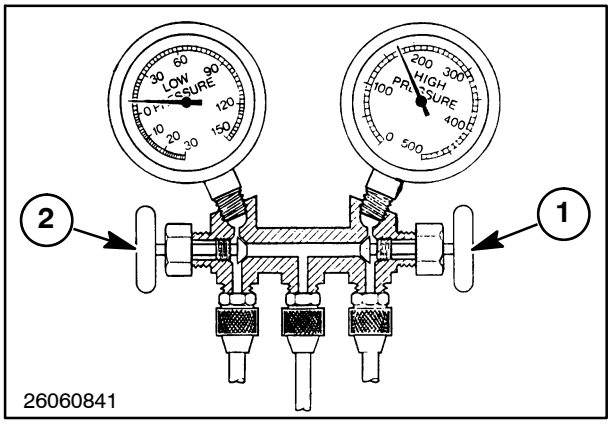
2. On the pressure test gauge manifold, close the high side valve, 1, and the low side valve, 2.
3. Close the cab windows and doors and set the parking brake.
4. Start the engine and run at fast idle speed (approximately 1500 rpm).
5. Set A/C mode switch to "ON".
6. Operate the system at maximum cooling with the blower fan at high speed for 10 minutes to stabilize all components.
7. Check the manifold high and low pressure gauges and compare the reading to the pressure indicated on the air conditioning temperature/ pressure chart. Refer to "Manifold Gauges and interpretations" and "Temperature/Pressure Chart."



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LEAKAGE TEST

1. Shut off the engine.

⚠ WARNING ⚠

When refrigerant comes in contact with an open flame, it forms phosgene gas. Never breathe these fumes.

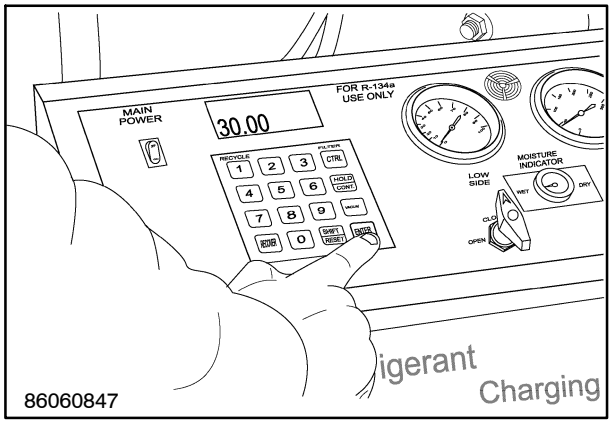
2. Use electronic leak detector OEM1437 to inspect all connections. Use instructions from manufacturer of leak finding tool.

NOTE: *To properly check the expansion valve for leaks, remove the insulation tape.*

3. Check Compressor oil level. Refill as necessary.
4. Repair all leaks and recharge the system.

CHARGING

1. Press the charge key to begin refrigerant charging. Automatic and Charge will appear on the display. The display shows the programmed amount and counts down to zero as charging proceeds. When charging is completed, the display shows CPL.



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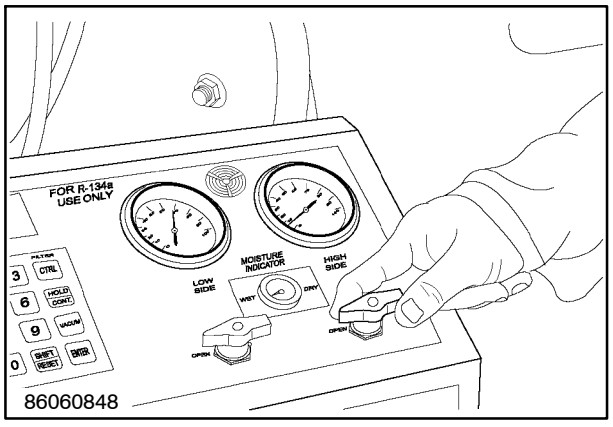
2. Completely close the high and low pressure manifold valves.
3. Start the engine and run at 1500 rpm. Operate the air conditioning system at maximum cooling setting and blower speed with the doors and windows open.

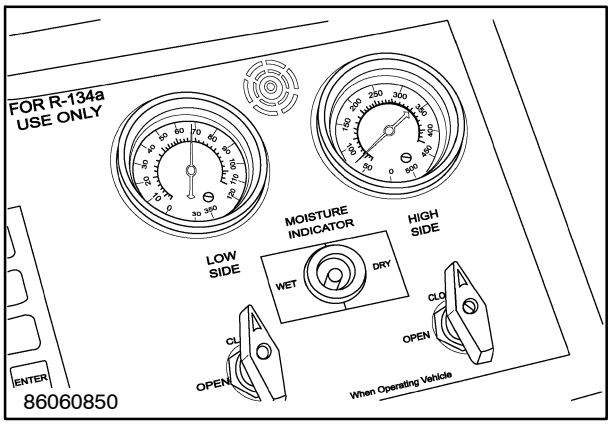
NOTE: *The compressor will not operate if the system pressure is too low or too high. If the compressor fails to operate and the condenser blowers also fail to operate when you actuate the A/C switch, check the system pressure to determine if refrigerant is present. Check for continuity at the pressure switches and the temperature switch located at the evaporator.*



50

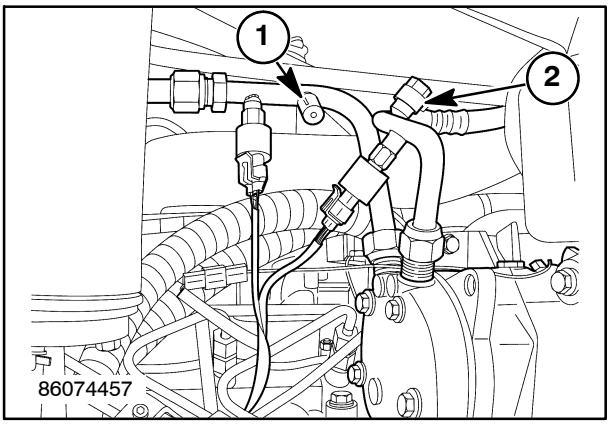
4. Observe the pressure gauge readings to determine that the correct amount of refrigerant has entered the system. See chart on temperature and pressure variations.

IMPORTANT: *Check the OEM equipment manual before performing this step to avoid damaging recovery unit. Pressure reading should be obtainable with valves closed. Damage may occur if machine is started the valves accidentally open or if either or both valves are open while the A/C system operating.*



51

5. Stop the engine, close any open valves and carefully remove the manifold gauge hoses.
6. Install the caps on the suction service port, 1 and the discharge service port, 2.



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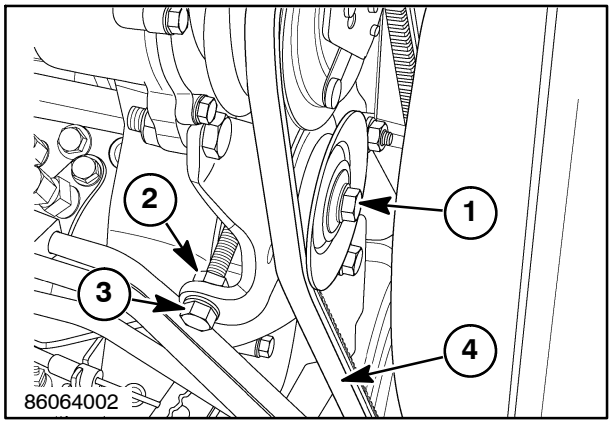
OVERHAUL

BELT REPLACEMENT

1. Loosen pulley bolt, 1, to allow pulley movement.
2. Loosen jam nut, 2 and turn bolt, 3, clockwise to tighten the belt and counterclockwise to loosen the belt.
3. Remove the belt, 4, from the pulleys and replace as needed.
4. Install new belt onto pulleys and secure according to specifications.



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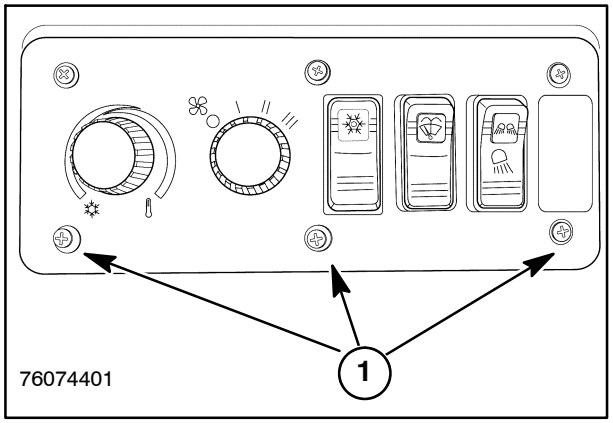
Specification

- Belt Tension – 317± 11 N (71.3± 2.5 lbf)
- Belt Deflection Force – 25± 0.5 N (5.6± 0.11 lbf)
- Belt Deflection – 7 mm (0.28 in)

HVAC CONTROLS

Removal

1. Remove the six screws, 1, securing the HVAC panel to the roof.



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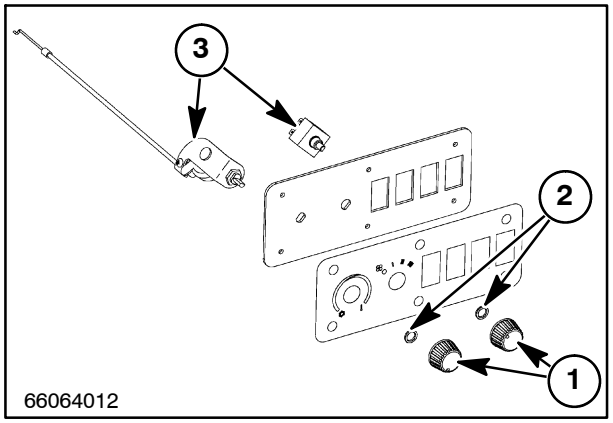
2. Remove the knobs, 1, to switch being replaced by prying/pulling it outward.
3. Remove the nuts, 2, securing the switch, 3, to the cover.



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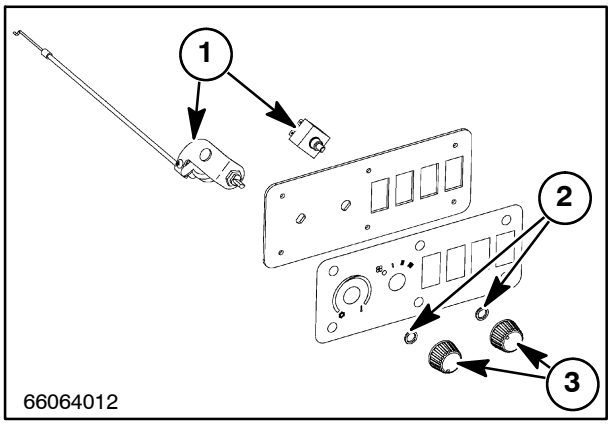
Installation

1. Install new switch, 1 and secure with nuts, 2. Install knobs, 3.



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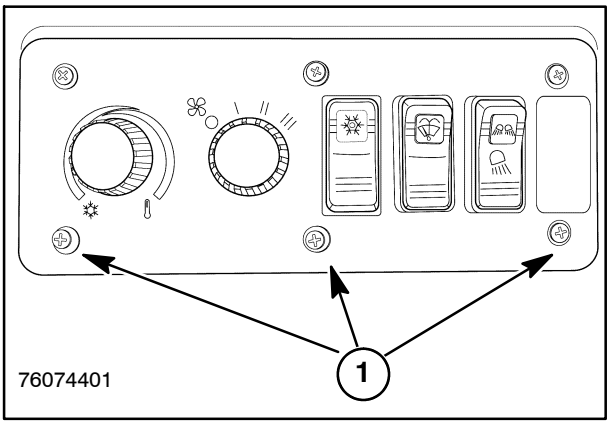
2. Install the six screws, 1, securing the HVAC panel to the roof.



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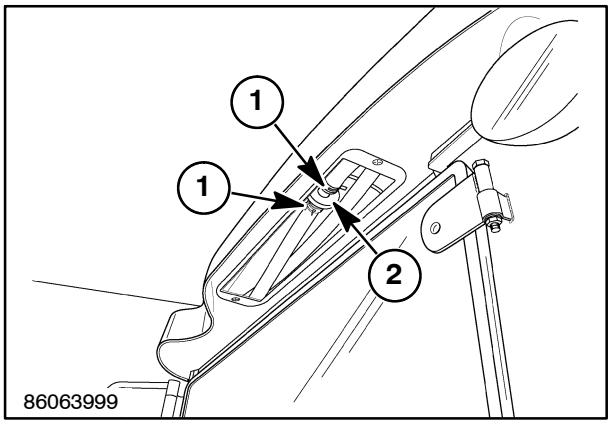
HEATER VALVE

Removal

1. Remove the cover on the left side of the cab, (not shown). Drain the coolant from the system.
2. Remove the hose clamps, 1.
3. Remove the hoses from both sides of the heater valve, 2.
4. Disconnect the cable from the valve, (not shown). Remove valve from the roof.



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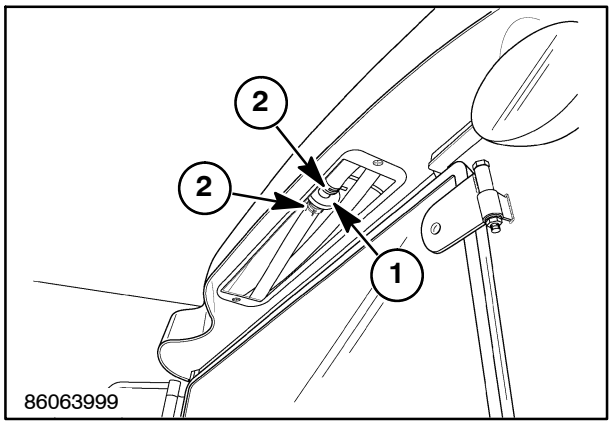
Installation

1. Install the heater valve, 1, into cab roof and attach the heater switch cable to the valve.
2. Attach the heater hoses to both sides of the valve and secure with the hoses clamps, 2, from removal.



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CONDENSER AND RECEIVER/DRYER

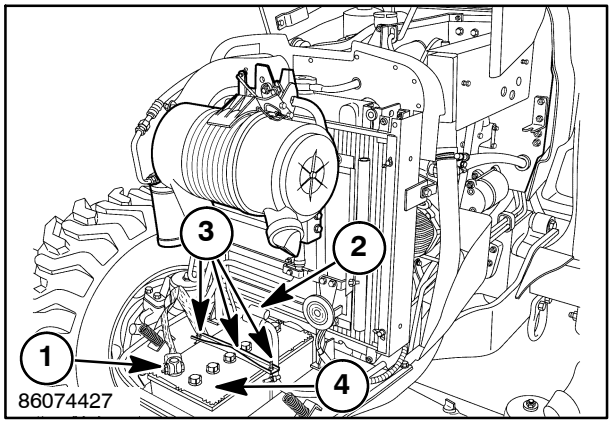
Removal

IMPORTANT: *This component can only be removed after the entire system has been discharged using an appropriate recovery system, as described earlier in this section.*

IMPORTANT: *When the system is open for service, it is required that the receiver/drier be replaced as well to avoid future complications.*

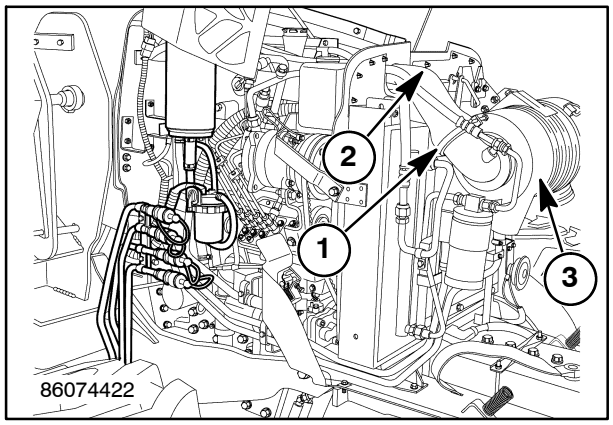
1. Release and lift the tractor hood.
2. Disconnect the negative (–) battery cable, 1.
3. Disconnect the positive (+) battery cable, 2.
4. Remove the hardware, 3, securing the battery.
5. Carefully remove the battery, 4, from the tractor.

IMPORTANT: *Crossing of the battery terminals may cause damage to the electrical system.*



60

6. Loosen hose clamp, 1, and remove the air inlet tube, 2, from the air cleaner assembly, 3.



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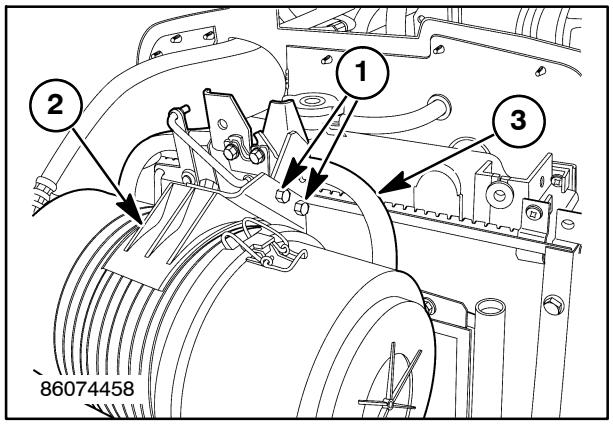
7. Loosen and remove the two M8 bolts, 1, securing the air cleaner assembly, 2, to the A/C condenser support, 3. Remove air cleaner assembly, 2, from tractor.



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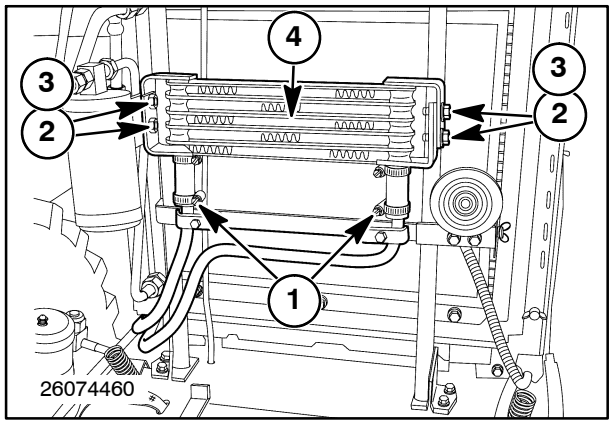
8. **On EHSS Models:** Loosen hose clamps, 1, remove four M8 bolts, 2, four belleville washers, 3, and remove transmission oil cooler, 4, from the tractor.



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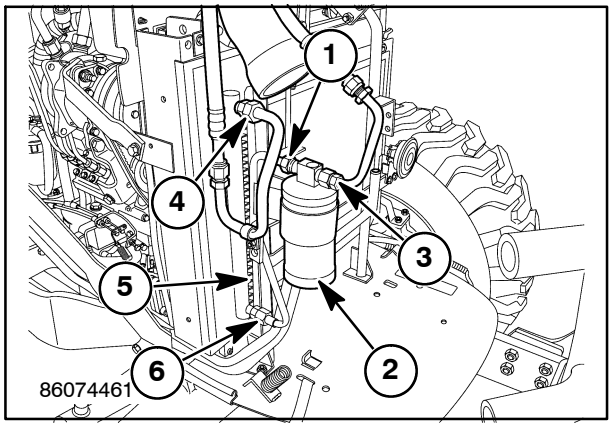
IMPORTANT: *Cap off the lines to keep moisture and debris from entering the system.*

9. Disconnect coupler, 1, from the receiver/dryer, 2.
10. Disconnect the high pressure hose, 3, from the receiver/dryer, 2. Remove receiver/dryer from tractor.
11. Disconnect the high pressure hose, 4, from the top of condenser, 5.
12. Disconnect coupler, 6, from the bottom of condenser, 5.



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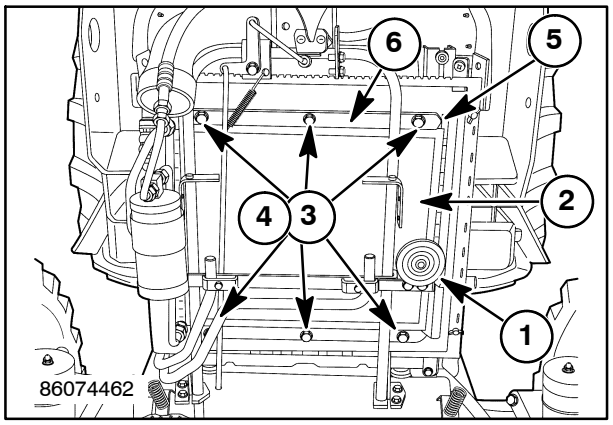
13. Remove wing nut, 1, and pull condenser screen, 2, out the left side of the tractor.
14. Remove six retaining M8 flange bolts, 3, and six M8 flange nuts, 4, securing the condenser, 5, to the support frame, 6. Remove condenser, 5, from the tractor.



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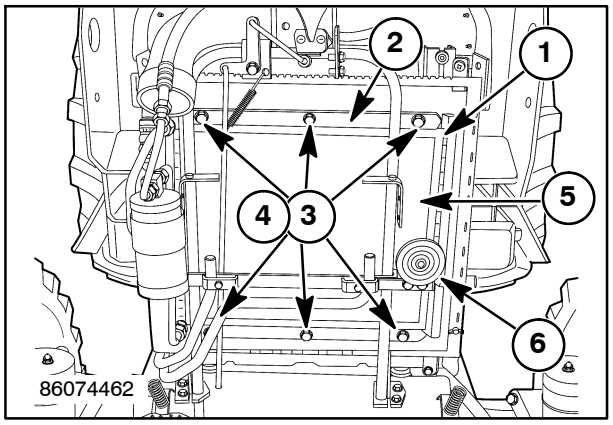
Installation

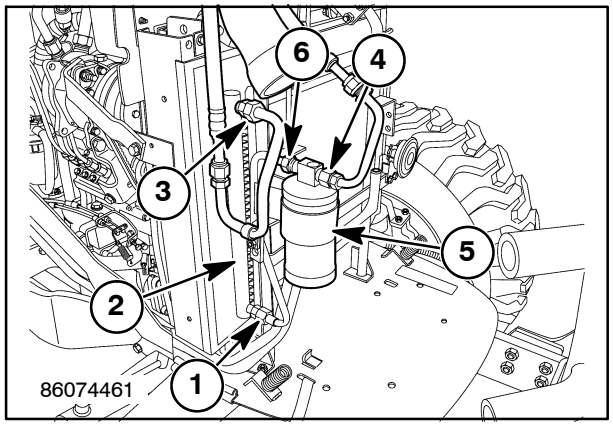
1. Place the condenser, 1, onto the support frame, 2, and secure with six retaining M8 flange bolts, 3, and six M8 flange nuts, 4.
2. Reinstall the condenser screen, 5, and secure with wing nut, 6.



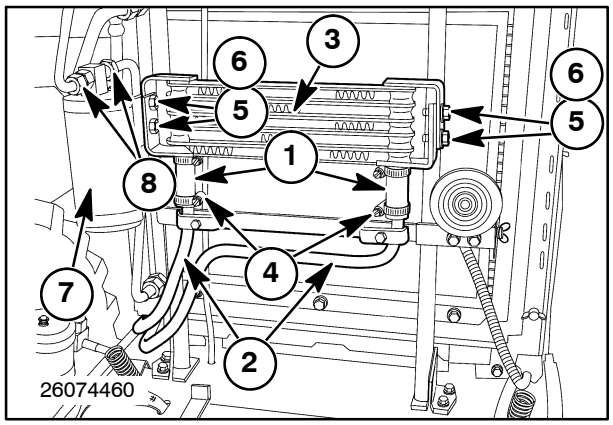
66

IMPORTANT: *Install new O-rings into all lines and hoses prior to reconnecting them to the condenser and receiver/dryer. Lubricate the O-rings with PAG 20 A/C oil before installation.*

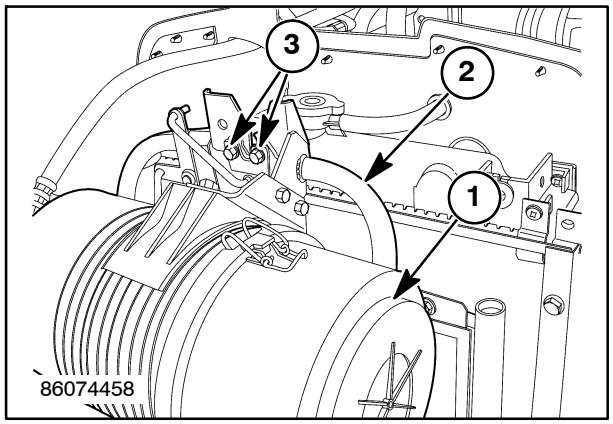
3. Reconnect coupler, 1, to the bottom of condenser, 2.
4. Reconnect the high pressure hose, 3, to top of condenser, 2.
5. Reconnect the high pressure hose, 4, to the receiver/dryer, 5.
6. Reconnect the coupler, 6, to the receiver/dryer, 5.
7. Perform a vacuum test and after all checks are complete, fill system. Refer to the “Vacuum Test” and “Charging” in this section.
8. **On EHSS Models:** Reconnect hoses, 1, onto lines, 2, of the transmission oil cooler, 3. Tighten hose clamps, 4.
9. Using four M8 flange bolts, 5, and four M8 flange nuts, 6, reattach the transmission oil cooler, 3, and the receiver/dryer, 7, to the A/C condenser support.
10. Tighten couplers, 8, on the receiver/dryer, 7, at this time.
11. Reattach the air cleaner assembly, 1, to the A/C condenser support, 2, securing it with two M8 bolts, 3.



67

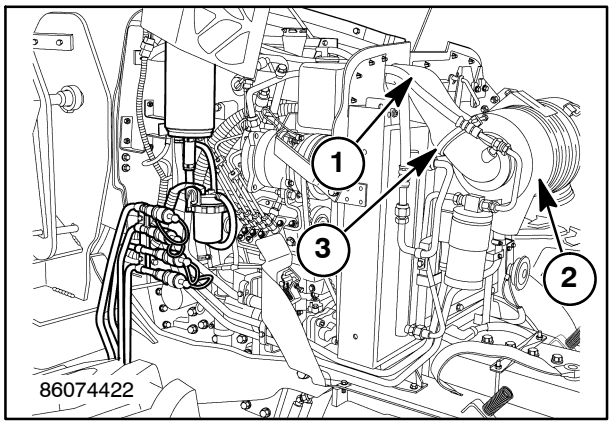


68



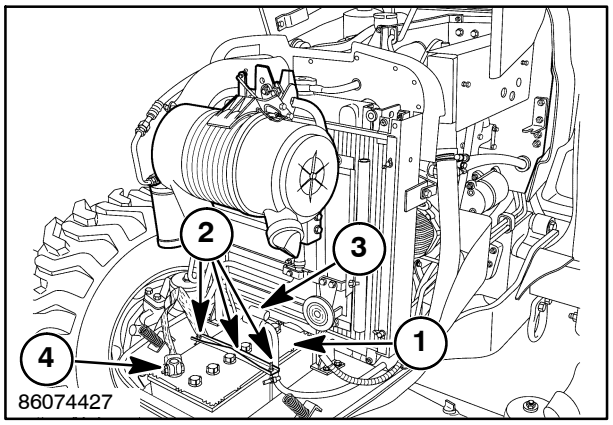
69

12. Reattach the inlet tube, 1, to the air cleaner assembly, 2. Tighten hose clamp, 3.



70

13. Carefully reinstall the battery, 1, into the tractor frame.
14. Reassemble the hardware, 2, securing the battery, 1.
15. Reconnect the positive (+) battery cable, 3.
16. Reconnect the negative (–) battery cable, 4.



71

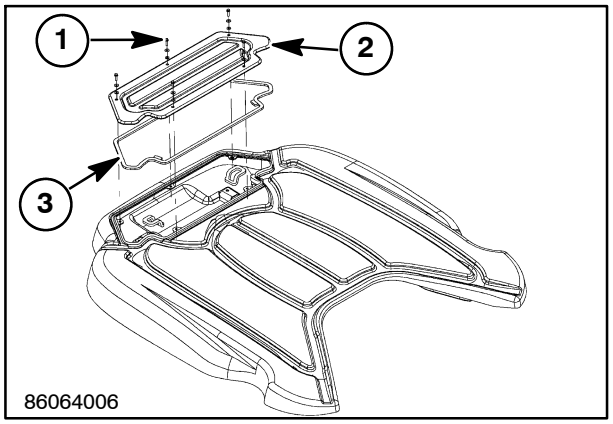
EVAPORATOR/HEATER CORE REPLACEMENT

IMPORTANT: *This component can only be removed after the entire system has been discharged using an appropriate recovery system.*

IMPORTANT: *When the system is open for service, it is required that the receiver/drier be replaced as well to avoid future complication.*

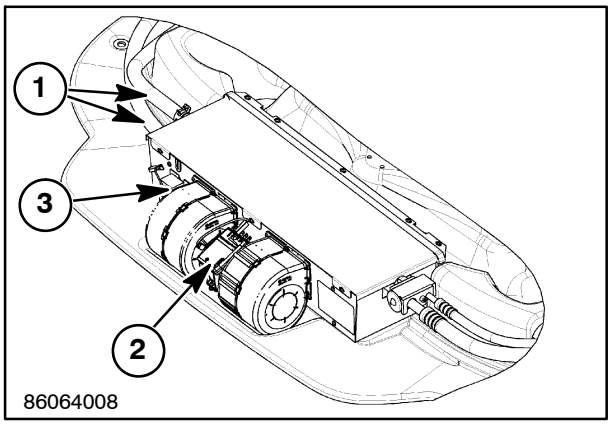
Removal

1. Remove the five M6 bolts, 1. Each bolt will have a flat washer and a rubber washer.
2. Remove the cab roof access panel, 2. When removing the cover make sure not to tear the seal, 3.



72

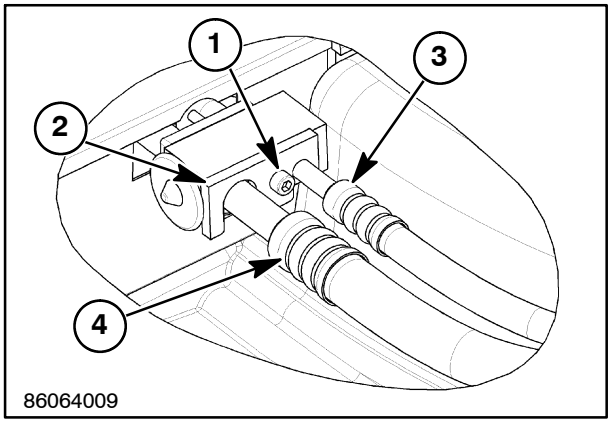
3. Drain the engine coolant and remove the heater hoses, 1.
4. Disconnect the electrical harness to the blower resistor, 2 and the temperature sensor, 3.



73

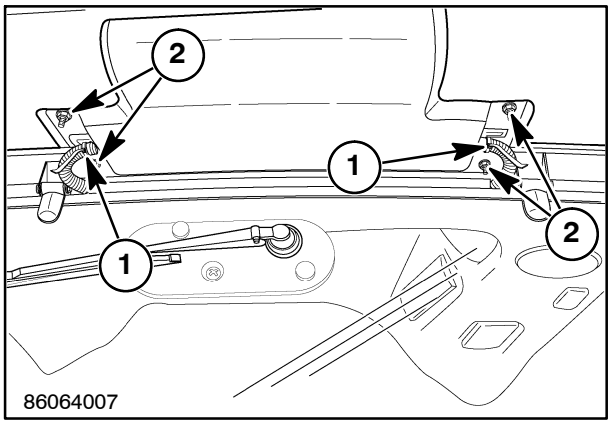
5. Remove the insulation tape (not shown) that is wrapped around the lines going into the thermal expansion valve.
6. Remove the internal hex head bolt, 1, that secures the plate, 2, holding the high pressure hose, 3, and low pressure hose, 4, into the expansion valve.

IMPORTANT: *Cap off the lines to keep moisture and debris from entering the system.*



74

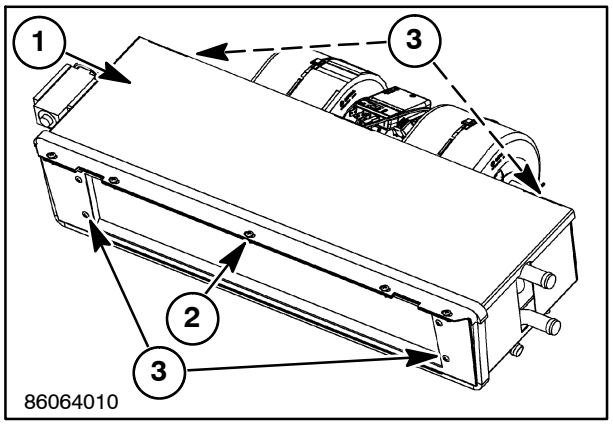
7. Remove the tubing, 1, attached the bottom side of the cab roof by removing the tie straps.
8. Remove the hardware, 2, that secures the HVAC box to the cab roof. Each stud is secured with one (1) M6 nut, one (1) spring lock washer and one (1) flat washer.
9. Remove the HVAC box from the cab roof.



75

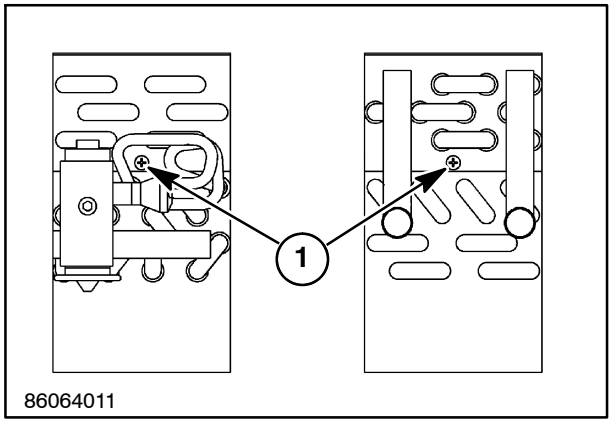
Disassembly

1. Remove the top cover, 1, by removing the seven (7) screws, 2.
2. Remove the four screws, 3, that secure the heater/evaporator in the HVAC box.



76

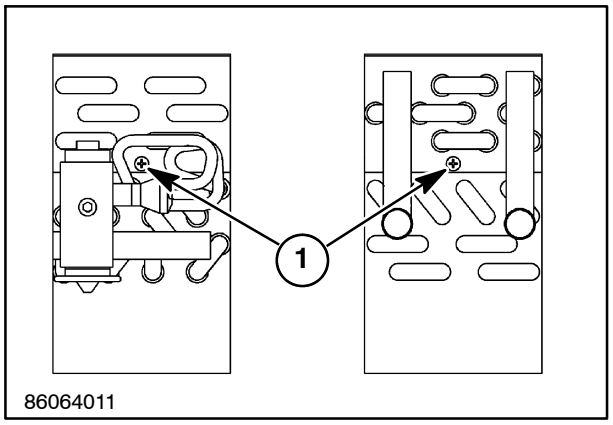
3. To separate the two cores, remove the screws, 1, on each end of the core brackets.



77

Assembly

1. Attach the two cores and install the screws, 1, on each end of the core brackets.



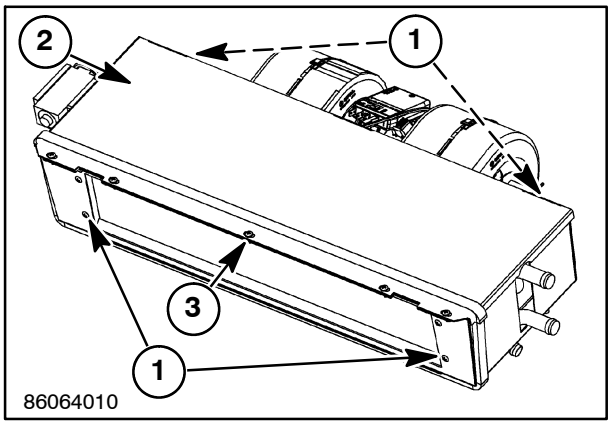
78

2. Install the heater/evaporator cores in the HVAC box and secure with four screws, 1. Torque hardware to 2.2 ± 0.2 N·m (20 ± 2 in-lb).
3. Install the top cover, 2 and secure with seven (7) screws, 3.

IMPORTANT: *Apply silicone sealant to all sheet metal joints and seams.*

IMPORTANT: *Make sure insulation tubing is over the freeze probe.*

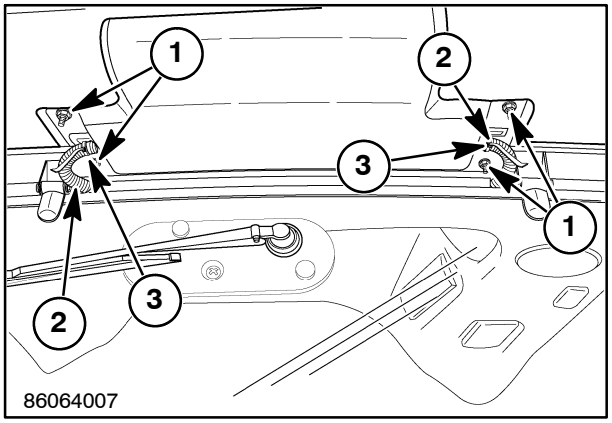
IMPORTANT: *Install insulation tape to the coils of the evaporator.*



79

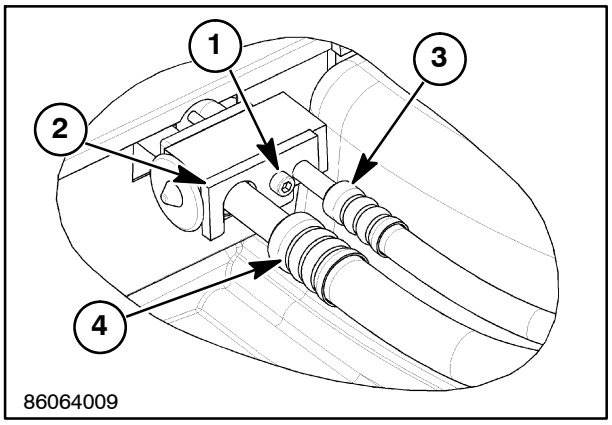
Installation

1. Install the HVAC box into the cab roof.
2. Install the hardware, 1, that secures the HVAC box to the cab roof. Each stud is secured with one (1) M6 nut, one (1) spring lock washer and one (1) flat washer.
3. Install the drain tubes, 2 and secure with tie straps, 3.



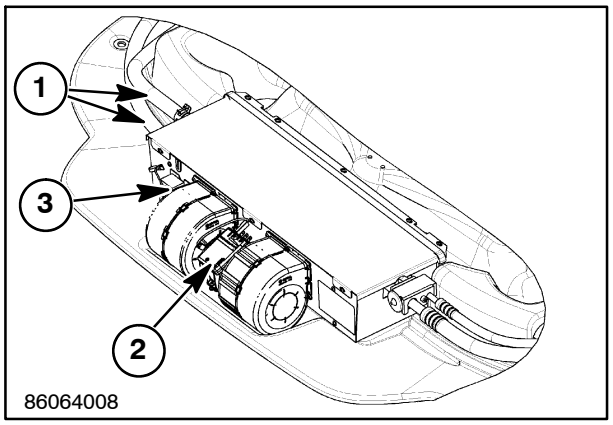
80

4. Install a new O-ring at both connections. Lubricate the O-rings with PAG 20 A/C oil before attaching the high and low pressure hoses.
5. Install the internal hex head bolt, 1, that secures the plate, 2, holding the high pressure hose, 3, and low pressure hose, 4, into the expansion valve. Torque the bolt to 4.5 N·m (40 in-lbs).
6. Install the insulation tape (not shown) around the lines going into the thermal expansion valve.



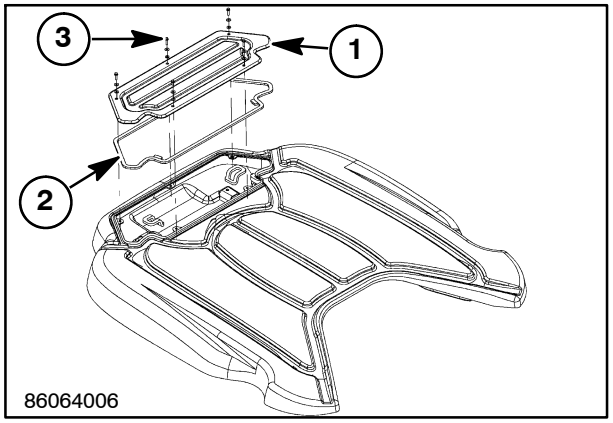
81

7. Install and secure the heater hoses, 1.
8. Connect the electrical harness to the blower resistor, 2 and the temperature sensor, 3.



82

9. Install the cab roof access panel, 1. When installing the cover make sure the seal, 2, is intact.
10. Install the five M6 bolts, 3. Each bolt will have a flat washer and a rubber washer. Torque the hardware to 3.4 N·m (30 in-lbs).
11. Perform a vacuum test and after all checks are complete, fill the system. Refer to the “Vacuum Test” and “Charging” in this section.



83

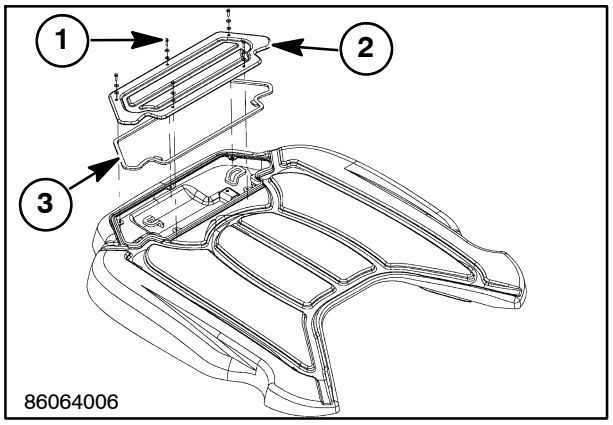
EXPANSION VALVE

IMPORTANT: *This component can only be removed after the entire system has been discharged using an appropriate recovery system.*

IMPORTANT: *When the system is open for service, it is required that the receiver/drier be replaced as well to avoid future complication.*

Removal

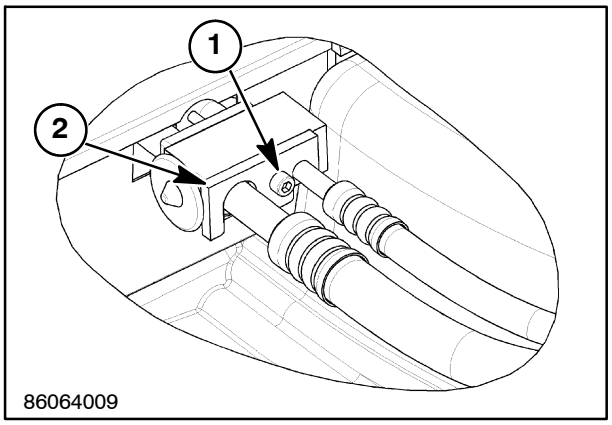
1. Remove the five M6 bolts, 1. Each bolt will have a flat washer and a rubber washer.
2. Remove the cab roof access panel, 2. When removing the cover make sure not to tear the seal, 3.



84

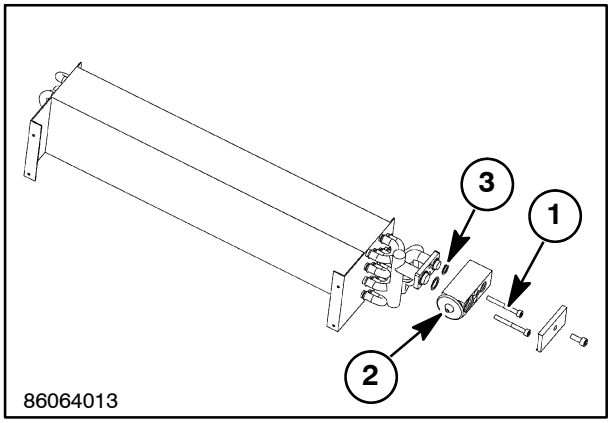
3. Remove the insulation tape (not shown).
4. Remove the internal hex head bolt, 1 and remove the clamping plate, 2.
5. Remove the high and low pressure hoses.

IMPORTANT: *Cap off the lines to keep moisture and debris from entering the system.*



85

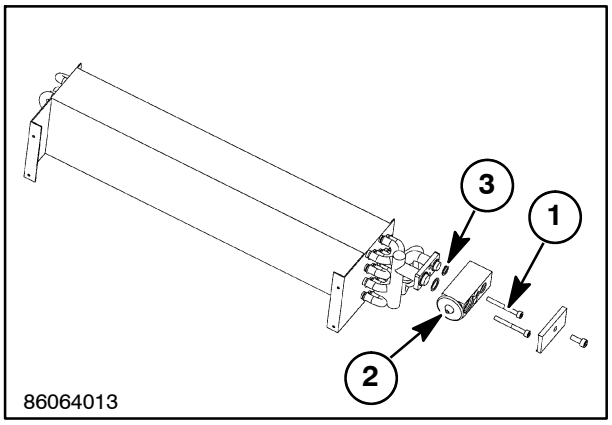
6. Remove the two M5 x 45 mm internal hex bolts, 1.
7. Remove the expansion valve, 2, and the two O-rings, 3.



86

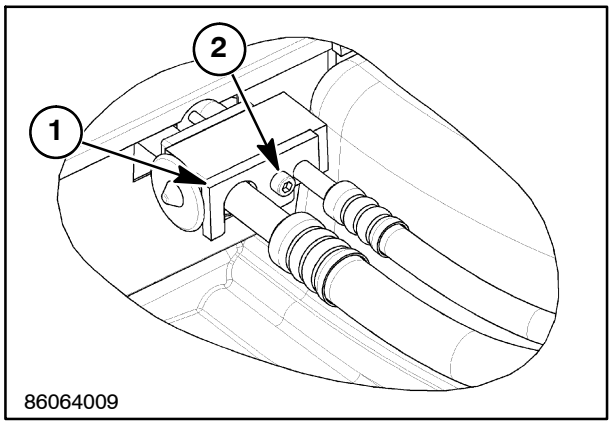
Installation

1. Install a new O-ring, 1, at both connections. Lubricate the O-rings with PAG 20 A/C oil before attaching expansion valve, 2.
2. Install the two M5 x 45 mm internal hex bolts, 3.



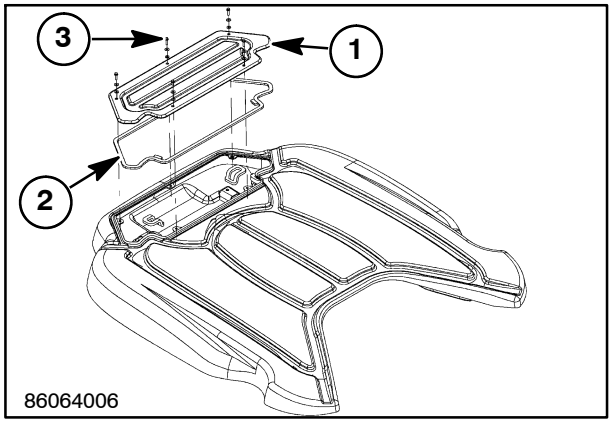
87

3. Install a new O-ring at both connections. Lubricate the O-rings with PAG 20 A/C oil before install the low and high pressure hoses.
4. Install the clamping plate, 1, and secure with the internal hex head bolt, 2. Torque the bolt to 4.5 N·m (40 in-lbs).
5. Install the insulation tape (not shown).



88

6. Install the cab roof access panel, 1. When installing the cover make sure the seal, 2, is intact.
7. Install the five M6 bolts, 3. Each bolt will have a flat washer and a rubber washer. Torque the hardware to 3.4 N·m (30 in-lbs).
8. Perform a vacuum test and after all checks are complete, fill the system. Refer to the “Vacuum Test” and “Charging” in this section.

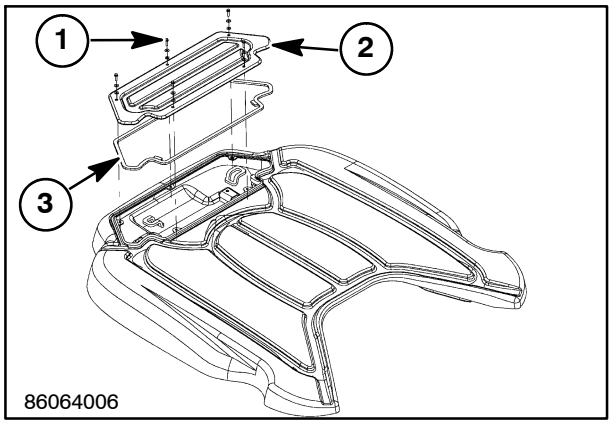


89

TEMPERATURE SENSOR

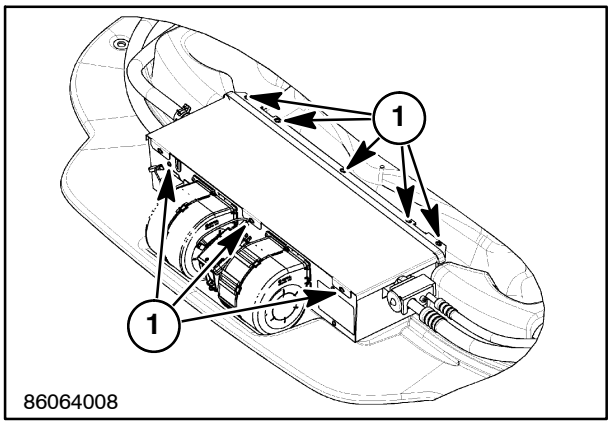
Removal

1. Remove the five M6 bolts, 1. Each bolt will have a flat washer and a rubber washer.
2. Remove the cab roof access panel, 2. When removing the cover make sure not to tear the seal, 3.



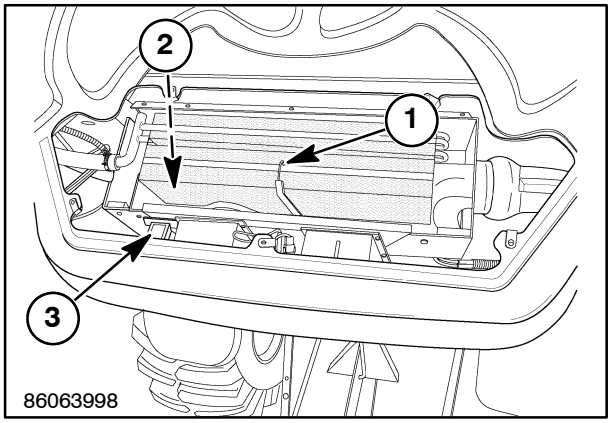
90

3. Remove the screws, 1, that secure the HVAC cover.



91

4. Remove the temperature sensor probe, 1, from the evaporator core.
5. Remove the screws, 2, that secure the switch to the HVAC box.
6. Disconnect the harness at the switch, 3.
7. Remove the switch assembly.

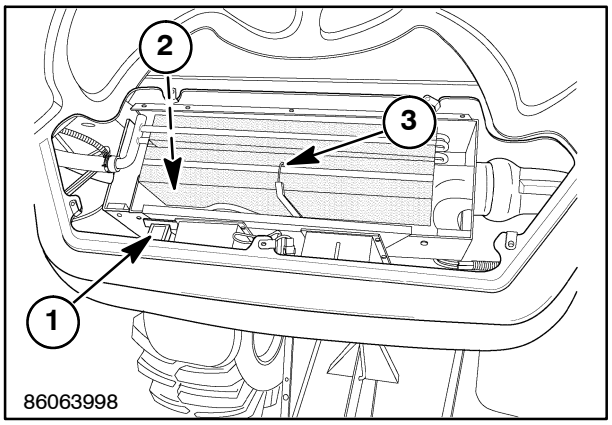


92

Installation

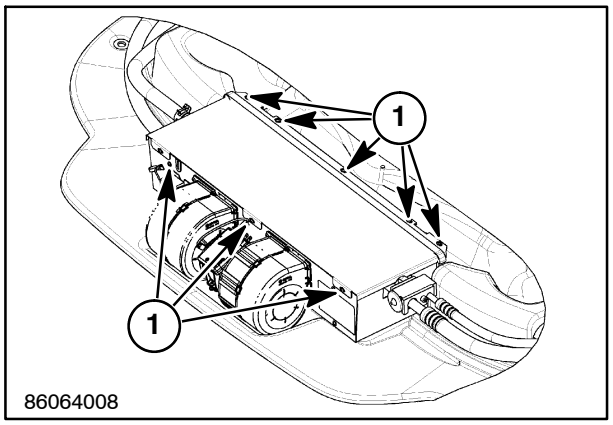
1. Install the switch, 1, into the HVAC box.
2. Secure the switch to the box with screws, 2. Torque hardware to 2.2 ± 0.2 N·m (20 ± 2 in lbs).
3. Connect the harness at the switch.
4. Install the temperature sensor probe, 3, in the evaporator core at a distance of 90 mm (3.54 in).

IMPORTANT: *Make sure the probe is covered with insulation tubing.*



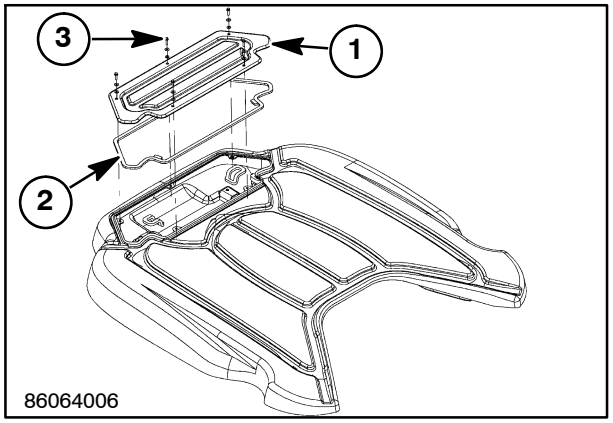
93

5. Install the cover and secure with screws, 1.



94

6. Install the cab roof access panel, 1. When installing the cover make sure the seal, 2, is intact.
7. Install the five M6 bolts, 3. Each bolt will have a flat washer and a rubber washer. Torque the hardware to 3.4 N·m (30 in-lbs).



95

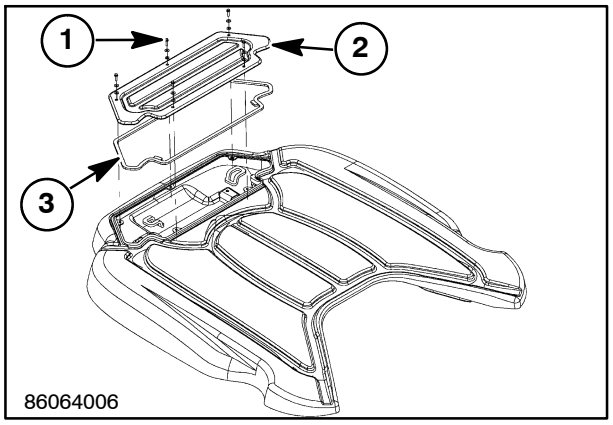
BLOWER MOTOR/BLOWER MOTOR RESISTOR

IMPORTANT: *This component can only be removed after the entire system has been discharged using an appropriate recovery system.*

IMPORTANT: *When the system is open for service, it is required that the receiver/drier be replaced as well to avoid future complication.*

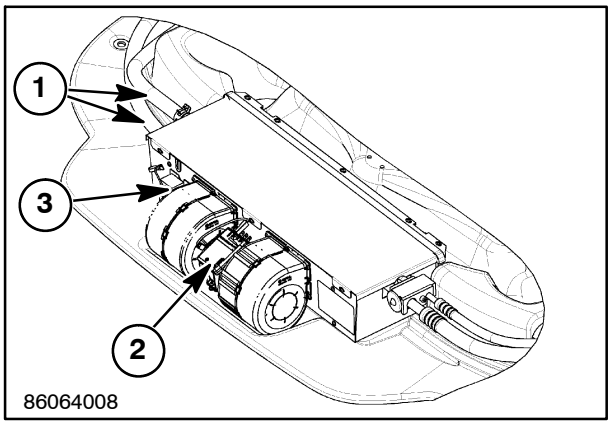
Removal

1. Remove the five M6 bolts, 1. Each bolt will have a flat washer and a rubber washer.
2. Remove the cab roof access panel, 2. When removing the cover make sure not to tear the seal, 3.



96

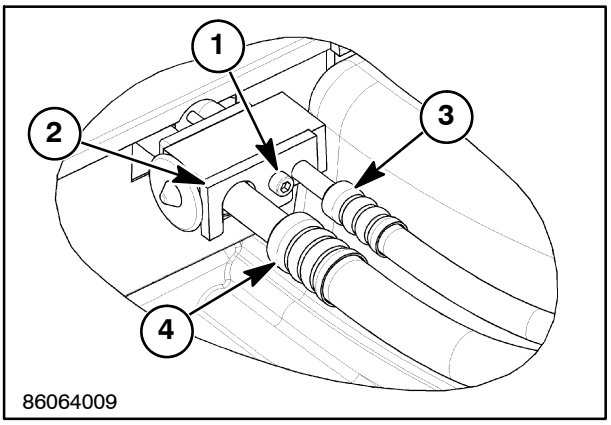
3. Drain the engine coolant and remove the heater hoses, 1.
4. Disconnect the electrical harness to the blower resistor, 2 and the temperature sensor, 3.



97

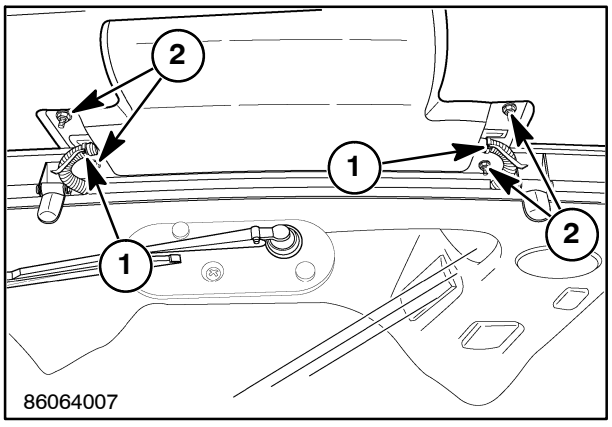
5. Remove the insulation tape (not shown) that is wrapped around the lines going into the thermal expansion valve.
6. Remove the internal hex head bolt, 1, that secures the plate, 2, holding the high pressure hose, 3, and low pressure hose, 4, into the expansion valve.

IMPORTANT: *Cap off the lines to keep moisture and debris from entering the system.*



98

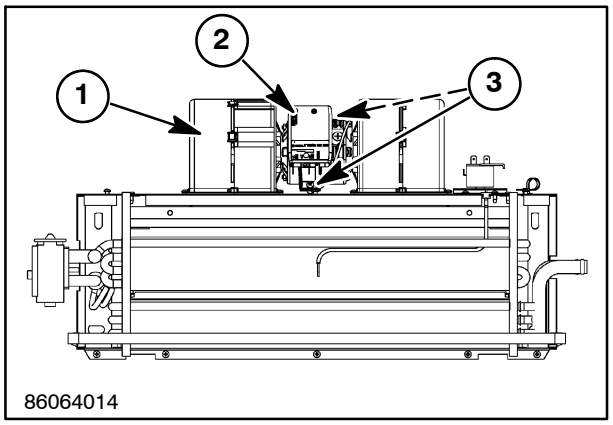
7. Remove the tubing, 1, attached to the bottom side of the cab roof by removing the tie straps.
8. Remove the hardware, 2, that secures the HVAC box to the cab roof. Each stud is secured with one (1) M6 nut, one (1) spring lock washer and one (1) flat washer.
9. Remove the HVAC box from the cab roof.



99

Disassembly

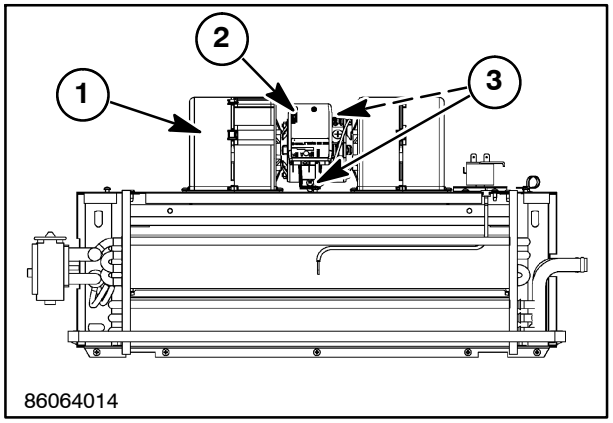
1. Remove the screws that secure the blower motor assembly, 1, to the HVAC box.
2. If only replacing the blower motor resistor, 2, remove the screws, 3, that secure it to the motor.



100

Assembly

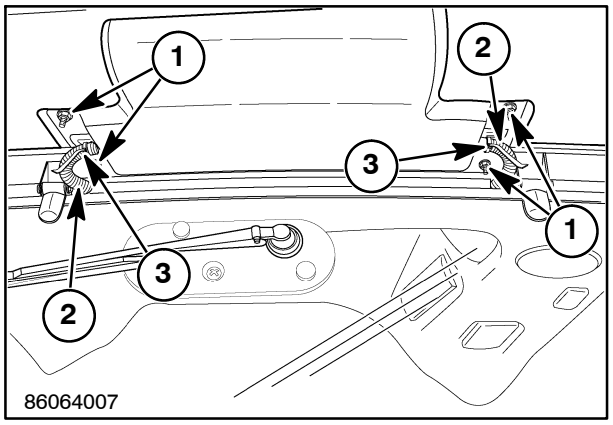
1. Install the screws that secure the blower motor assembly, 1, to the HVAC box.
2. Install the blower motor resistor, 2. Install the screws, 3, that secure the resistor to the motor.



101

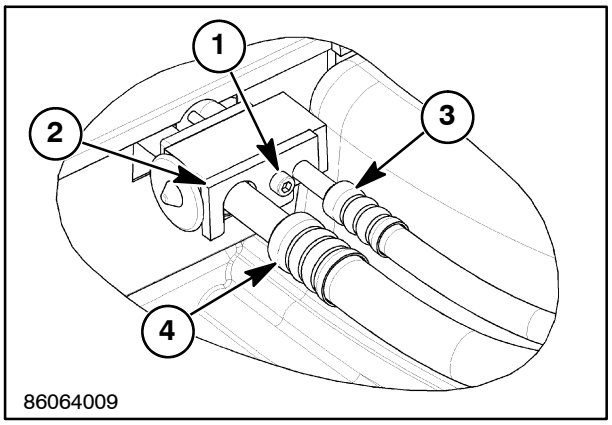
Installation

1. Install the HVAC box into the cab roof.
2. Install the hardware, 1, that secures the HVAC box to the cab roof. Each stud is secured with one (1) M6 nut, one (1) spring lock washer and one (1) flat washer.
3. Install the drain tubes, 2 and secure with tie straps, 3.



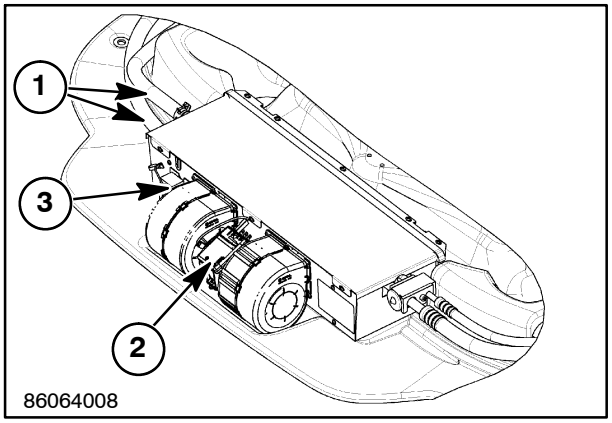
102

4. Install a new O-ring at both connections. Lubricate the O-rings with PAG 20 A/C oil before attaching the high and low pressure hoses.
5. Install the internal hex head bolt, 1, that secures the plate, 2, holding the high pressure hose, 3, and low pressure hose, 4, into the expansion valve. Torque the bolt to 4.5 N·m (40 in-lbs).
6. Install the insulation tape (not shown) around the lines going into the thermal expansion valve.



103

7. Install and secure the heater hoses, 1.
8. Connect the electrical harness to the blower resistor, 2 and the temperature sensor, 3.



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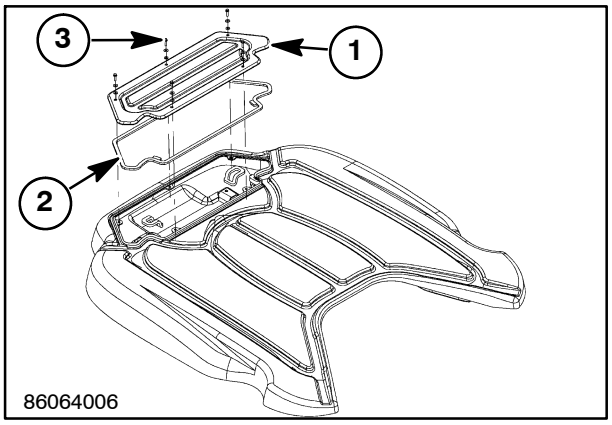
9. Install the cab roof access panel, 1. When installing the cover make sure the seal, 2, is intact.
10. Install the five M6 bolts, 3. Each bolt will have a flat washer and a rubber washer. Torque the hardware to 3.4 N·m (30 in-lbs).
11. Perform a vacuum test and after all checks are complete, fill the system. Refer to the “Vacuum Test” and “Charging” in this section.



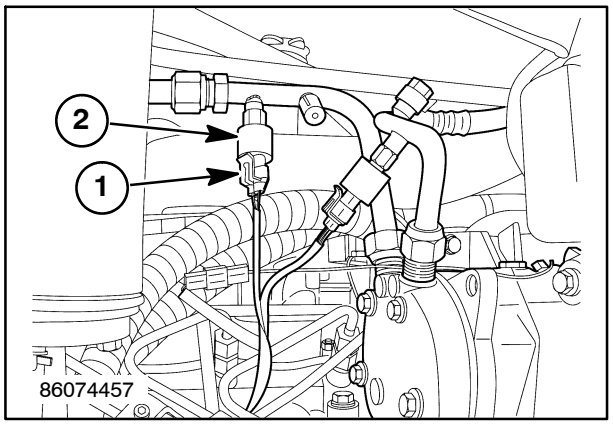
105

LOW PRESSURE SWITCH

IMPORTANT: *The low pressure switch can be replaced without discharging the system.*

Replacement

1. Remove the connector, 1, from low pressure switch.
2. Remove the low pressure switch, 2.
3. Install new switch. Attach the connector to switch.



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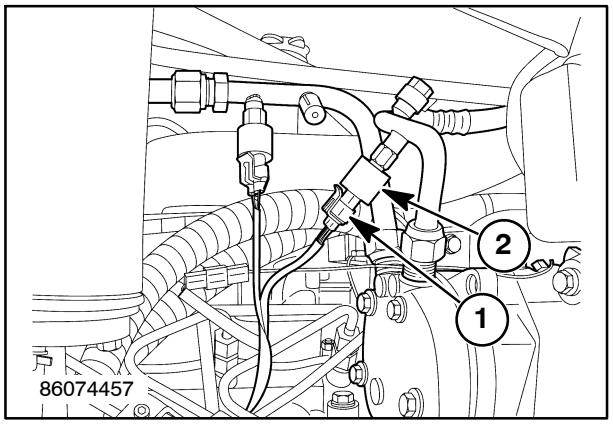
HIGH PRESSURE SWITCH

IMPORTANT: *The high pressure switch can be replaced without discharging the system.*

Replacement

1. Remove the connector, 1, from high pressure switch.
2. Remove the high pressure switch, 2.
3. Install new switch. Attach the connector to switch.



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A/C COMPRESSOR

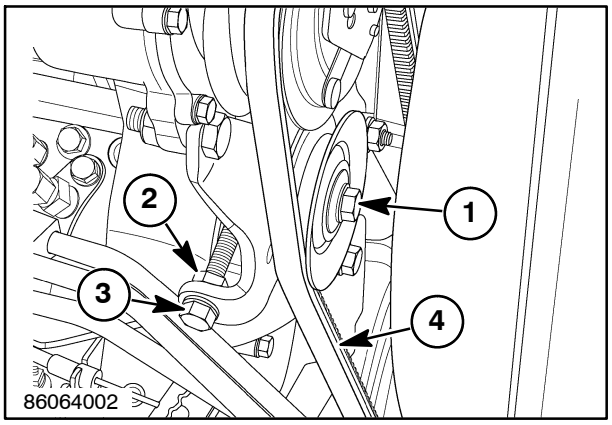
IMPORTANT: *If servicing the A/C compressor is required, contact your authorized Sanden dealer for more information.*

IMPORTANT: *This component can only be removed after the entire system has been discharged using an appropriate recovery system.*

IMPORTANT: *When the system is open for service, it is required that the receiver/drier be replaced as well to avoid future complication.*

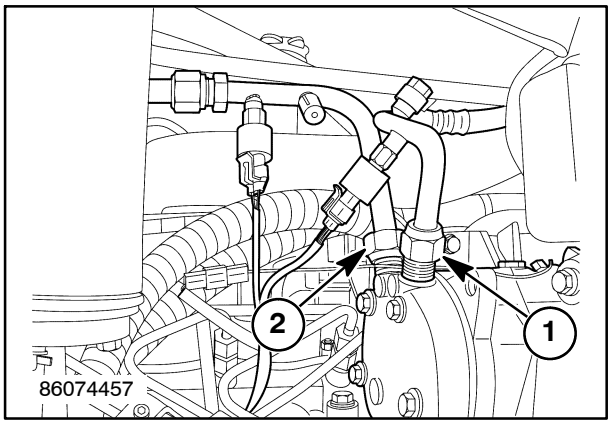
Removal

1. Loosen pulley bolt, 1, to allow pulley movement.
2. Loosen jam nut, 2 and turn bolt, 3, counterclockwise to loosen the belt.
3. Remove the belt, 4, from the pulleys.



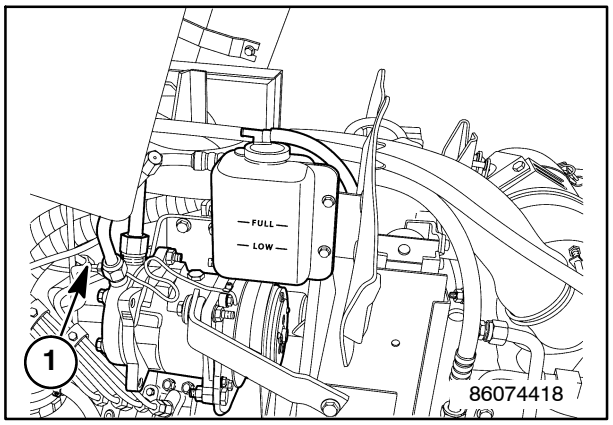
108

4. Remove the high pressure line, 1 and low pressure line, 2 from the compressor.



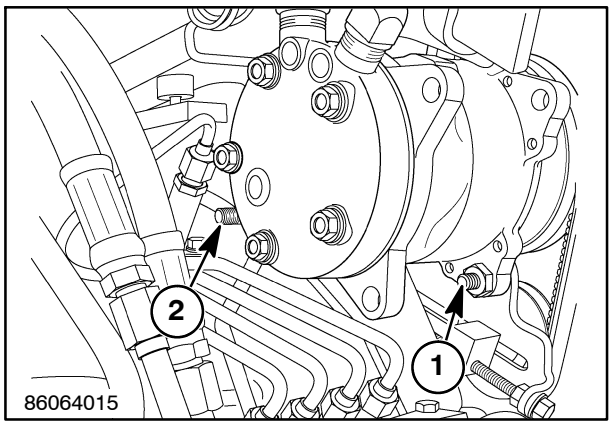
109

5. Disconnect the clutch harness, 1.



110

6. Remove the lower A/C compressor mounting bolt and nut, 1.
7. Remove the rear A/C compressor mounting bolt, 2.
8. Remove the compressor from the tractor.

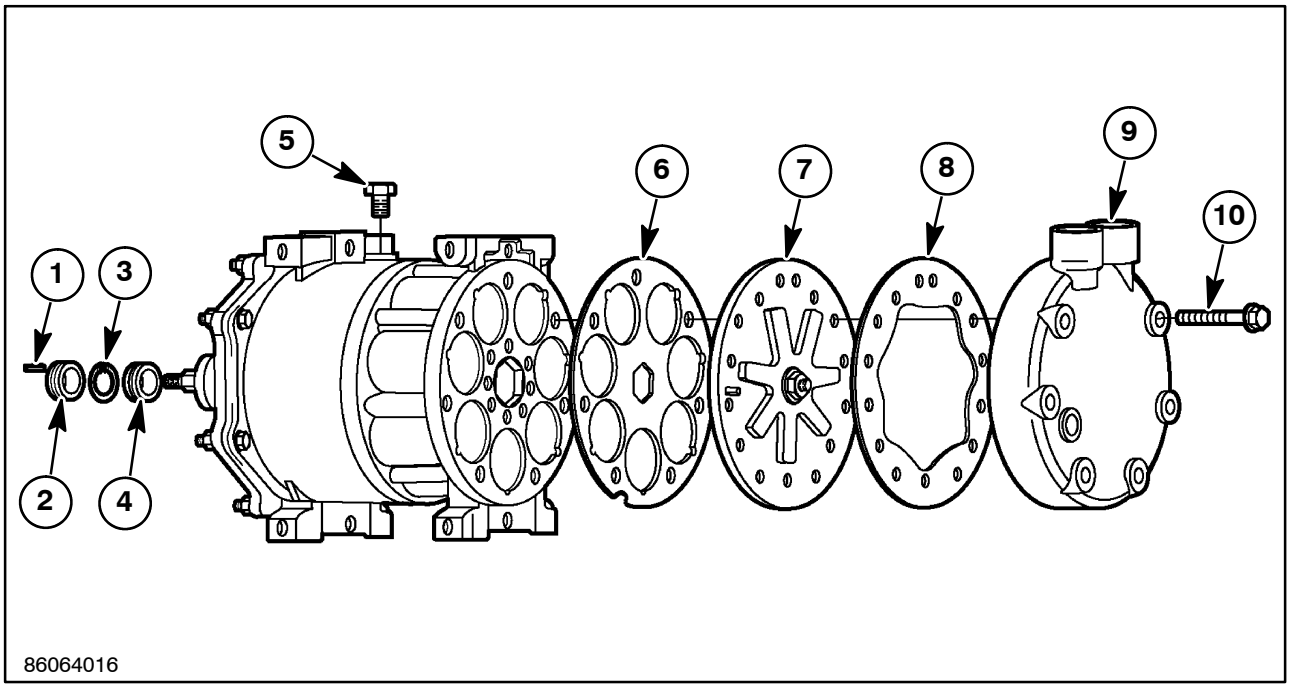


111

COMPRESSOR ASSEMBLY TORQUES

Item	N·m	ft-lb
Armature retaining nut, 1/2″ – 20	30.4 ± 3.9	22.4 ± 2.9
Armature retaining nut, M8	17.7 ± 2.9	13.0 ± 2.2
Cylinder head bolts, M6	13.7 ± 2.9	10 ± 2.2
Cylinder head bolts, M8	34.3 ± 4.9	25.3 ± 3.6
Oil filler plug	19.6 ± 4.9	14.5 ± 13.6
Hose fitting 1″ – 14 rotolock	36.3 ± 3.9	26.7 ± 2.9
7/8″ Tube-O	32.4 ± 3.9	23.9 ± 2.9
3/4″ Tube-O	23.5 ± 3.4	17.3 ± 2.5
Pad fitting bolt, M10	39.2 ± 3.9	28.9 ± 2.9
Pad fitting bolt 3/8″ – 24	39.2 ± 3.9	28.9 ± 2.9
Pad fitting bolt, M8	34.3 ± 3.9	26.3 ± 2.9
Clutch lead wire clamp screw	1.3 ± 0.3	11 ± 3 in-lb
High pressure relief valve	9.8 ± 2.0	7.2 ± 1.4
Thermal protector switch clamp bolt	9.8 ± 2.9 – 2.0	7.2 ± 2.2 – 1.4
Clutch dust cover screws (6 – M5)	9 ± 2	6.5 ± 1.4
Clutch dust cover screws (3 – 1/4″ – 20)	3.6 ± 1.2	2.7 ± 0.9

COMPRESSOR BREAKDOWN



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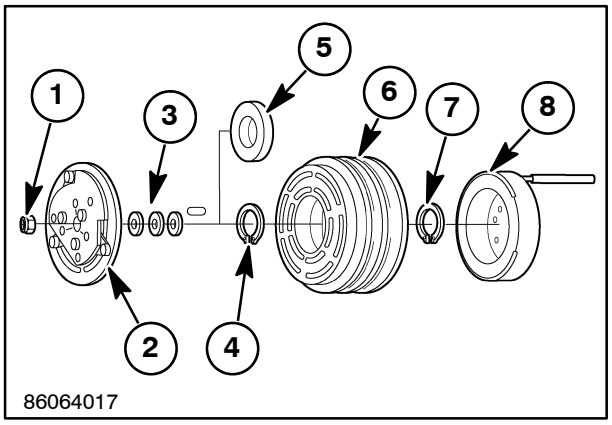
1. Shaft Key*
2. Felt Ring*
3. Shaft Seal Snap Ring*
4. Lip Seal with O-ring*
5. Oil Plug
6. Block Gasket*
7. Valve Plate Assembly*
8. Head Gasket*
9. Cylinder Head*
10. Cylinder Head Bolt
11. Shaft Seal Kit – 2, 3, and 4
12. Valve Plate Kit – 6, 7, and 8
13. Cylinder Head Kit – 8 and 9
14. Gasket Kit – 6 and 8

*Serviced only as a kit.

CLUTCH BREAKDOWN

1. Shaft Nut*
2. Armature Plate*
3. Clutch Shims*
4. Rotor Snap Ring*
5. Rotor Bearing Dust Cover (SD-5)
6. Rotor Assembly*
7. Field Coil Assembly Snap Ring*
8. Field Coil Assembly
9. Accessory Kit – 1, 4, 5 and 7
10. Armature / Rotor Assembly Kit – 2 and 6

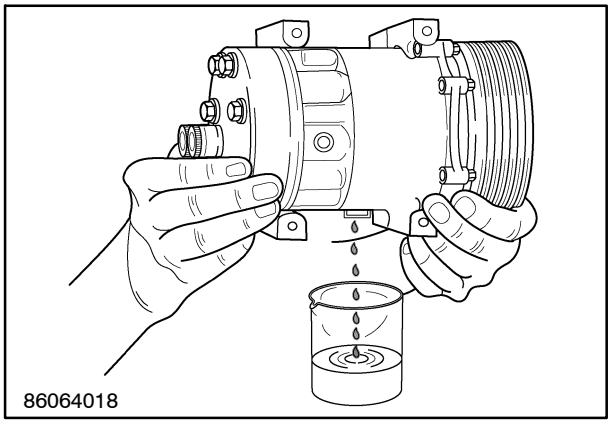
*Serviced only as a kit.



113

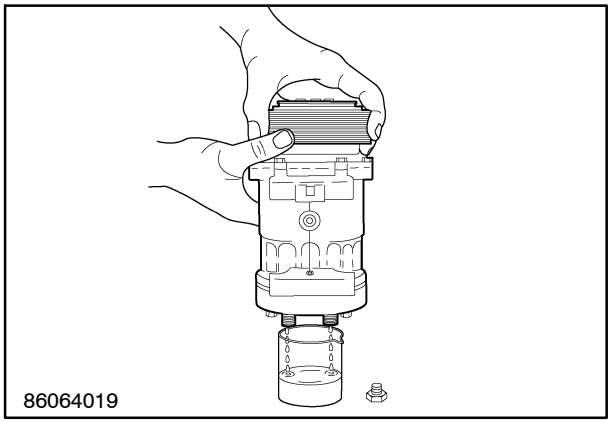
Compressor Repaired Internally and Reinstalled in the System

1. Before making repairs, drain the oil from the compressor.
   - Remove the oil plug and drain as much oil as possible into a suitable container.
   - Drain oil from the suction and discharge ports into a suitable container while turning the armature shaft clockwise.



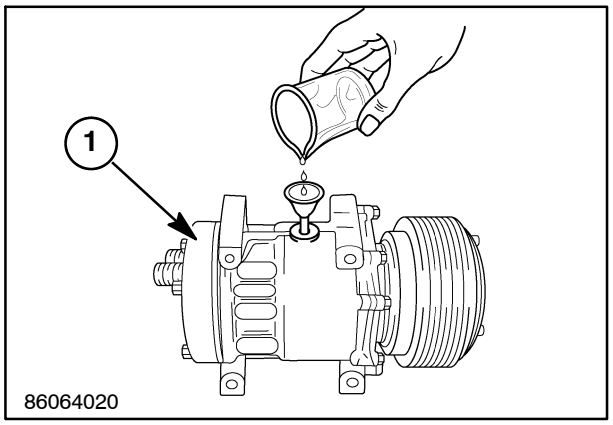
114

2. Measure and record the amount of oil drained from the compressor.
3. Inspect the oil for signs of contamination such as discoloration or foreign material.
4. Repair the compressor as needed.



115

5. Add the same amount of new oil to the compressor, 1, as was measured. Be sure to use the correct oil for the compressor.
6. Reinstall oil plug. Seal and O-ring must be clean and not damaged. Torque to 15 – 20 N·m (11 – 15 ft-lb). Be careful not to cross thread the oil plug.



116

Sanden Compressor Replaced by a New Sanden Compressor of the Same Type

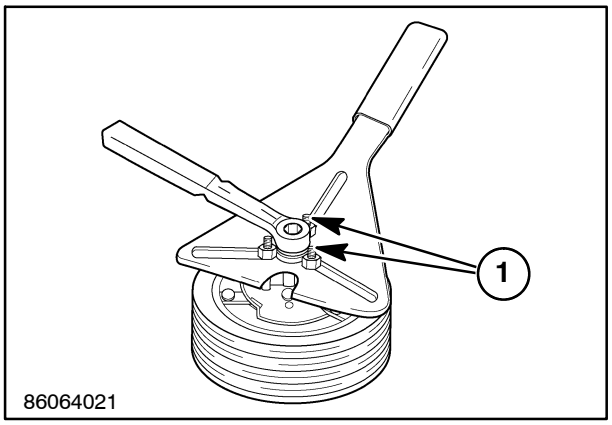
1. Drain oil from the old compressor; measure and record the amount.
2. Drain oil from the new compressor.
3. Add new oil of the correct type to the new compressor. Use the same quantity as was removed from the old compressor.
4. Reinstall oil plug. Seal and O-ring must be clean and not damage. Torque to 15 – 20 N·m (11 – 25 ft-lb).

CLUTCH HEAD REPAIR

Keyed Shaft Armature Removal

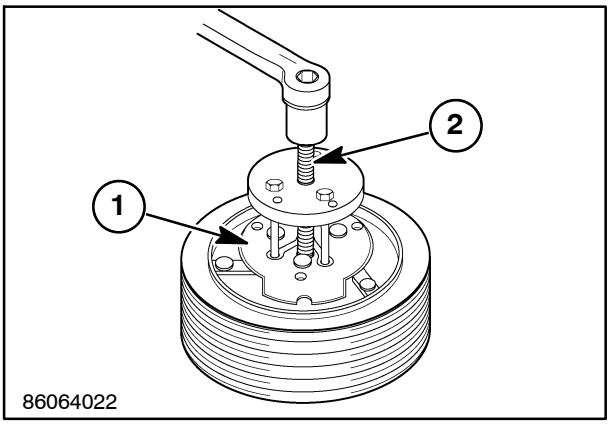
NOTE: *Keyed shaft can be identified in that the holes for the armature plate spanner will have threads in them.*

1. Insert adjustable studs, 1, of armature plate spanner into threaded holes of armature assembly.
2. Hold armature assembly stationary while removing retaining nut.



117

3. Remove armature assembly, 1, using puller. Thread 3 puller bolts into the threaded holes in the armature assembly. Turn center screw, 2, clockwise until armature comes loose.

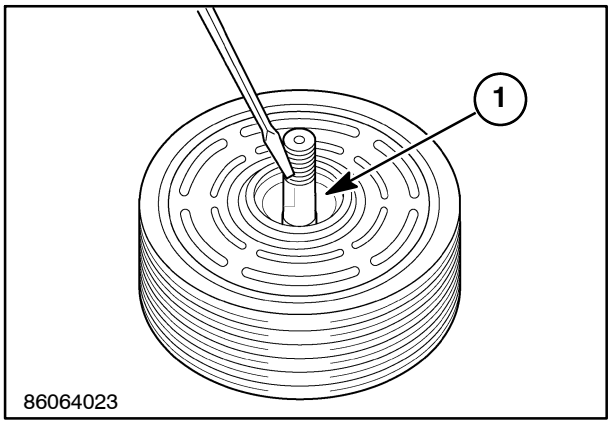


118

4. If shims are above shaft key, remove them now. If shims are below shaft key, and bearing (not shown), dust cover (if applicable) must be removed before shims can be removed.

NOTE: *When removing cover, make sure not to distort.*

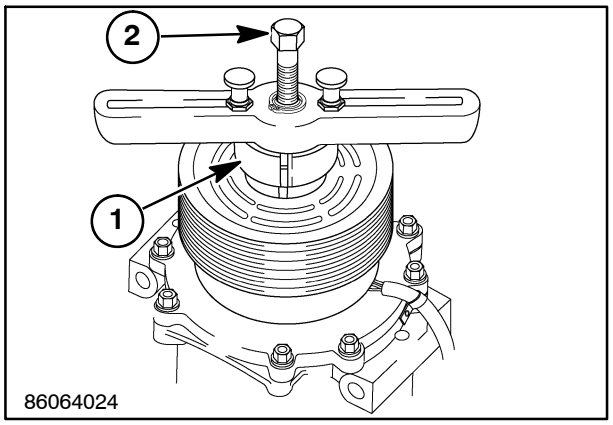
5. Remove shaft key by tapping with a flat blade screwdriver and hammer.
6. Remove shims with a pointed tool and a small screwdriver.



119

Rotor Assembly Removal

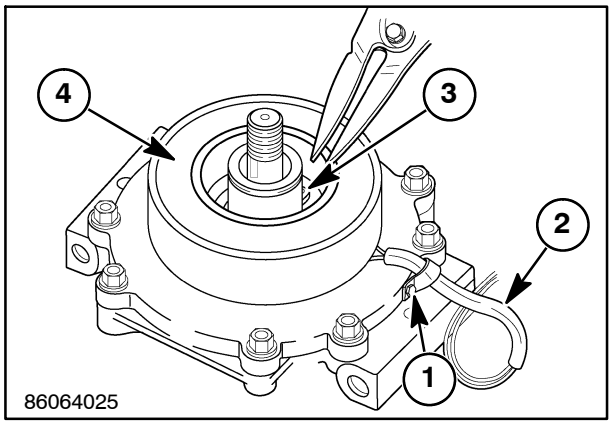
1. If bearing dust cover has not been removed, remove it now. See Keyed Shaft Armature Removal.
2. Remove internal snap ring.
3. Remove rotor snap ring.
4. Remove shaft key.
5. Remove rotor pulley assembly:
   - Insert the lip of the jaws into the snap ring groove.
   - Place rotor pulley shaft protector, 1, (Puller set) over the exposed shaft.
   - Align thumb screws to puller jaws and finger tighten. Turn puller center bolt, 2, clockwise using a socket wrench until rotor pulley is free.



120

Field Coil Assembly Removal

1. Loosen lead wire clamp screw, 1, with screwdriver until wire(s), 2, can be slipped out from under clamp.
2. Undo any wire connections on the compressor which would prevent removal of the field coil assembly.
3. Remove snap ring, 3.
4. Remove the field coil assembly, 4.



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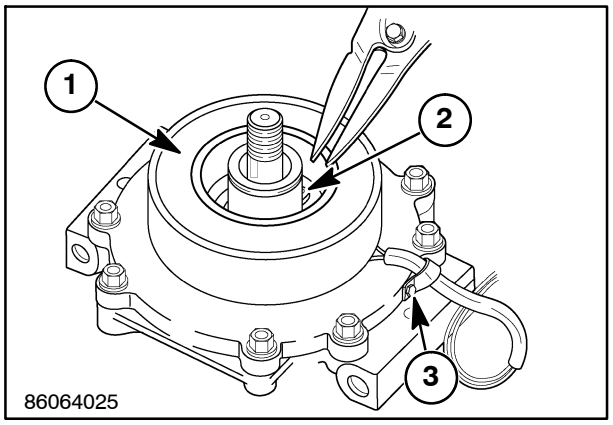
Field Coil Assembly Installation

IMPORTANT: *Protrusion on underside of coil ring must match hole in front housing to prevent movement and correctly locate lead wire(s).*

1. Install field coil assembly, 1.
2. Install snap ring, 2.
3. Install and secure lead clamp screw, 3.



122

Rotor Assembly Installation

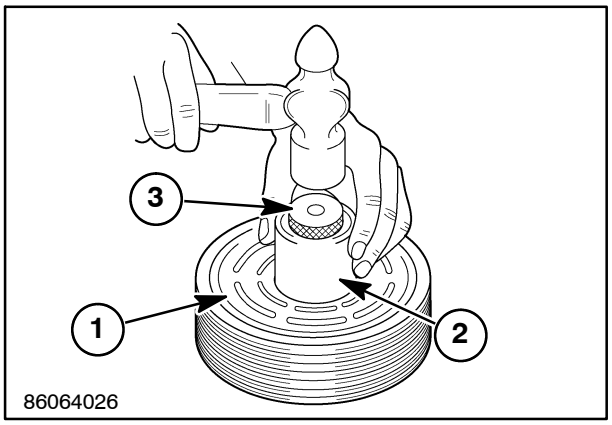
1. Place compressor on support stand, supported at rear end of compressor.

***IMPORTANT**: If the compressor must be clamped in a vise, clamp only on the mounting ears, never on the body of the compressor.*

2. Set rotor, 1, squarely over the front housing boss.
3. Place the rotor installer ring, 2, into the bearing bore. Ensure that the edge rests only on the inner race of the bearing, not on the seal, pulley, or outer race of the bearing.
4. Place the driver, 3, into the ring and drive the rotor down onto the front housing with a hammer or arbor press. Drive the rotor against the front housing step.
5. Install rotor bearing snap ring, if it has been removed.
6. Install rotor retaining snap ring.

***IMPORTANT:** If a bevel is present on the snap ring, it should face up (away from the body of the compressor).*

7. Install rotor bearing dust cover, 1.



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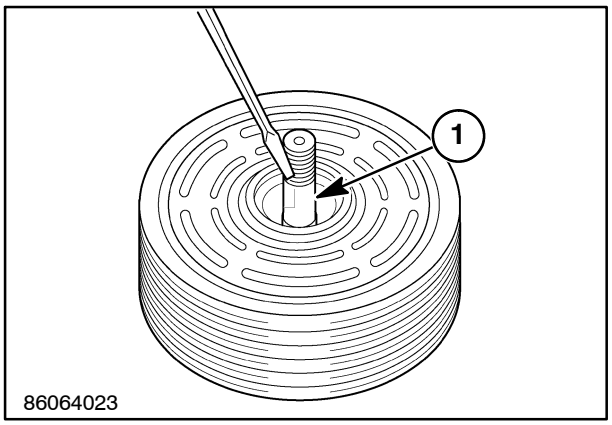

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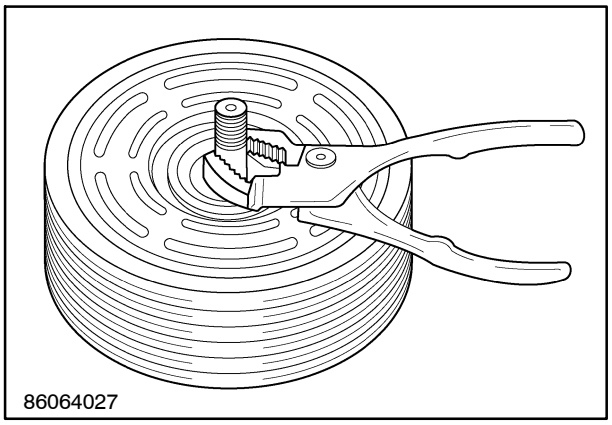
Armature Assembly Installation

1. Install shaft key with pliers.
2. Install clutch shims.

***IMPORTANT**: Clutch air gap is determined by shim thickness. When installing a clutch on a compressor, try the original shims first. When installing a clutch on a compressor that has not had a clutch installed before, first try 1.0, 0.5, 0.1 mm (0.04, 0.02 and 0.004 in) shims.*

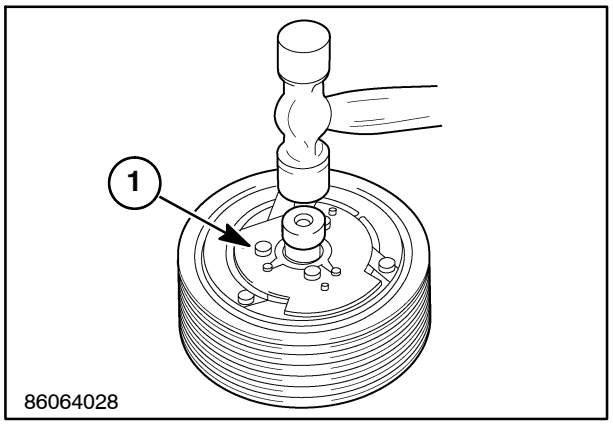


125

3. Align keyway in armature assembly, 1, to shaft key. Using driver and a hammer, drive the armature assembly down over the shaft until it bottoms on the shims. A distinct sound change will be noted if driving with a hammer.
4. Install retaining nut and torque to specification.

   1/2″-20: 27 – 34 N·m (20 – 25 ft-lb)

   M8: 15 – 21 N·m (11 – 15 ft-lb)



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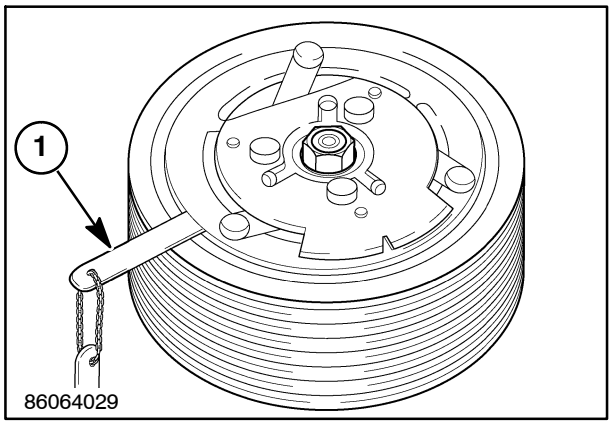
5. Check air gap with feeler gauge, 1. Specification is 0.4 – 0.8 mm (0.016 – 0.031 in). If gap is not even around the clutch, gently tap down at the high spots. If the overall gap is out of spec., remove the armature assembly and change the shims as necessary.



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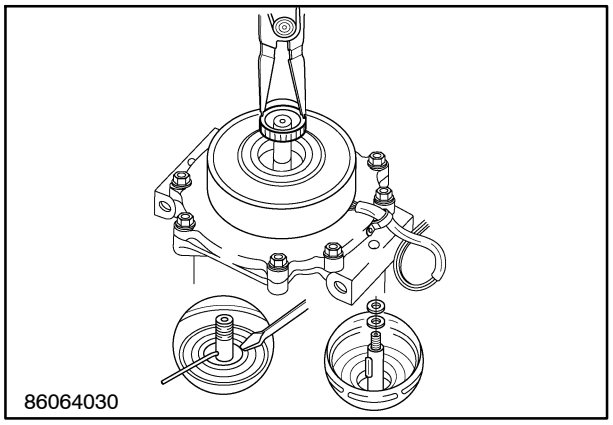
Replacement of Shaft Seal

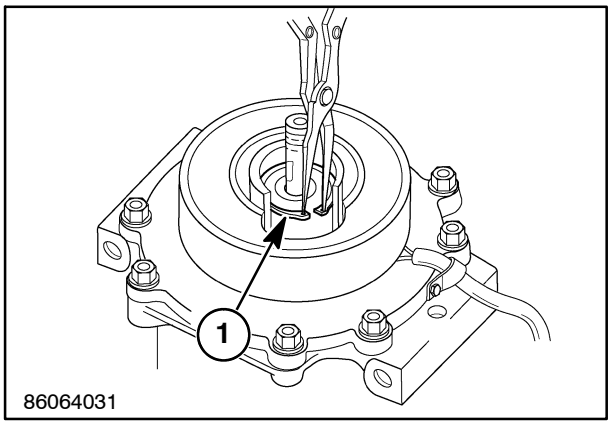
NOTE: *Lip seal assembly and felt ring must never be reused. Always replace these components.*

1. Be sure all gas pressure inside the compressor has been relieved.
2. Remove armature assembly, rotor bearing dust cover(if applicable), shaft key, and clutch shims.
3. Remove the retainer and felt ring.



128

4. Remove seal snap ring, 1.



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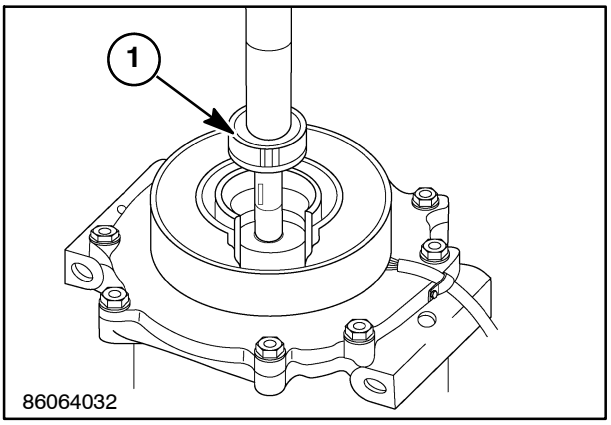
5. Remove lip seal assembly, 1, with removal and installation tool. Twist the tool until the 2 lips on the tool engage the slots in the lip seal housing and pull the seal out with a twisting motion.
6. Clean out shaft seal cavity thoroughly. Debris can be removed using a non-petroleum based solvent and lint free cloth. The area should then be blown out with clean, dry compressed air. Make sure all foreign material is completely removed.



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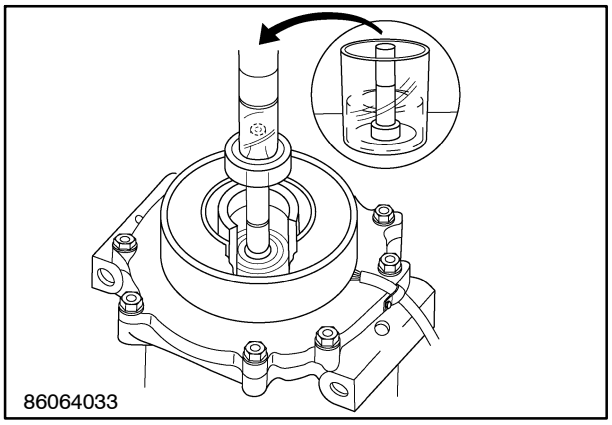
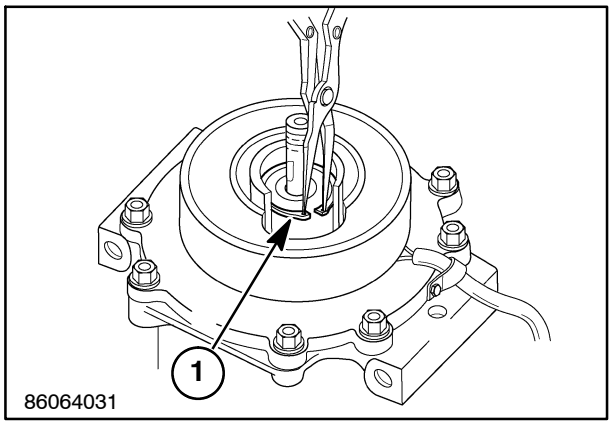
7. Install shaft seal protective sleeve over compressor shaft. Inspect the sleeve to ensure that it has no scratches and is smooth so that the lip seal will not be damaged. Make sure there is no gap between the end of the sleeve and the seal surface on the shaft.
8. Engage the lips of the seal removal and installation tool with the slots in the new lip seal housing. Make sure the lip seal assembly, especially the O-ring, is clean. Dip the entire lip seal assembly, on the tool, into clean refrigerant oil. Make sure the seal assembly is completely covered with oil.
9. Install lip seal over shaft and press firmly to seat. Twist the tool in the opposite direction to disengage it from the seal and withdraw the tool.



131

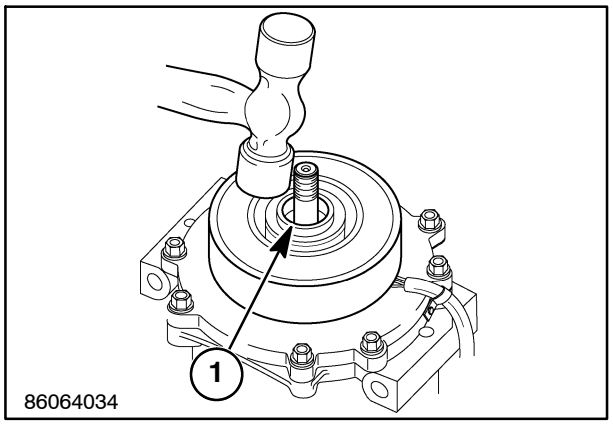
10. Install shaft seal snap ring, 1.

NOTE: *Beveled side should face up (outward/away from compressor body). Ensure that snap ring is completely seated in groove. It may be necessary to tap the snap ring lightly to seat it in the groove.*



132

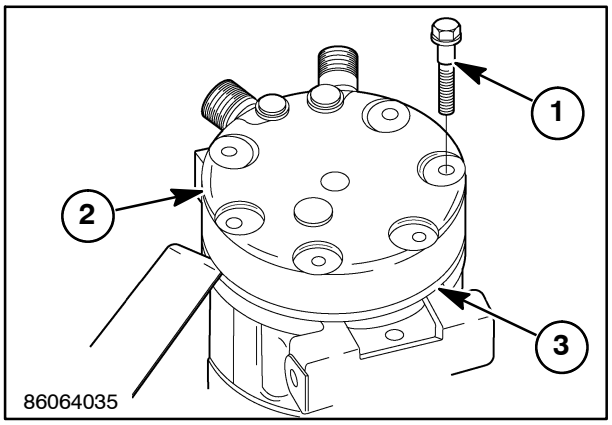
11. Tap new felt ring, 1, assembly into place.
12. Reinstall clutch shims, shaft key, rotor bearing dust cover (if applicable), and armature assembly.
13. Check and adjust air gap as necessary.



133

Cylinder Head Removal

1. Be sure all internal compressor pressure has been relieved.
2. Inspect cylinder head for fitting or thread damage. Replace if damaged.
3. Remove cylinder head bolts, 1.
4. Use a small hammer and gasket scraper to separate the cylinder head, 2, from the valve plate, 3. Be careful not to scratch the gasket surface of the cylinder head.
5. Carefully lift the cylinder head, 2, from the valve plate, 3.



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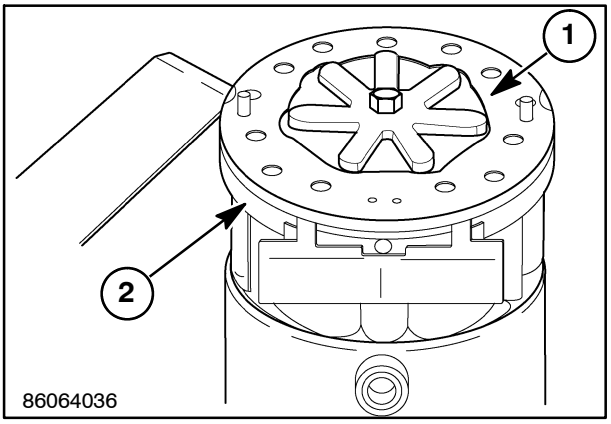
IMPORTANT: *It is recommended that both the head gasket (between the cylinder head and the valve plate) and the block gasket (between the valve plate and the cylinder block) be replaced any time the cylinder head is removed. However, if no service is required to the valve plate, it may be left in place. If the valve plate comes loose from the cylinder block, the block gasket must be replaced.*

6. Carefully remove old head gasket, 1, from top of valve plate, 2, with gasket scraper. Be careful not to disturb valve plate to cylinder block joint if valve plate has been left in place. If valve plate comes loose from cylinder block, proceed to Valve Plate Removal, and replace block gasket.



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Valve Plate Removal

1. Using a small hammer and gasket scraper, carefully separate valve plate, 1, from cylinder block, 2. Be careful not to damage sealing surface of cylinder block.
2. Inspect reed valves and retainer. Replace valve plate assembly if any part is damaged.
3. Carefully remove any gasket material remaining on valve plate, cylinder block or cylinder head, 3. Do not damage sealing surfaces on components.

Valve Plate and Cylinder Head Installation

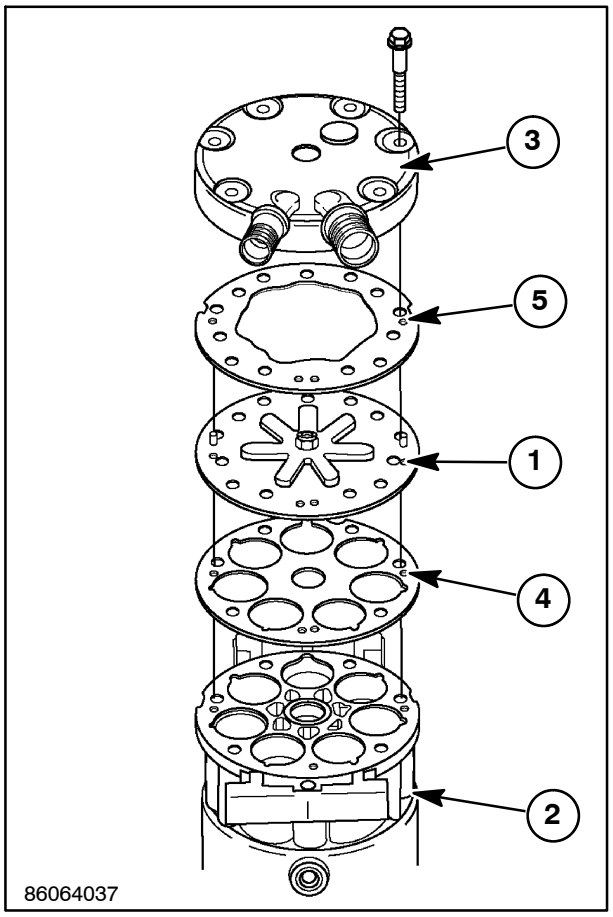
1. Large gasket (4): OD of block gasket is 120 mm (4-3/4 in) and sealing face of block does not have a 114.7 mm (4-1/2 in) diameter step.
2. Small gasket (5): OD of gasket is 114.7 mm (4-1/2 in) and sealing face of the cylinder block has a 114.7 mm (4-1/2 in) diameter step.
3. Coat new block gasket with clean refrigerant oil.
4. Install block gasket, 4. Align new gasket to location pin holes and orifice(s). Notch (if applicable) should face same direction as oil plug or adapter.
5. Place valve plate, 1, on cylinder block, 2, with discharge valve, retainer and nut facing up (away from cylinder block) and location pins properly located in holes.
6. Use vacuum pump and small tube to remove residual oil from each bolt hole.

IMPORTANT: *If this step is not performed, hydraulic pressure can be created when the cylinder head bolts are tightened. This pressure can break the cylinder block.*

7. Coat head gasket, 5, with clean refrigerant oil.
8. Install head gasket cover location pins. Checking for correct orientation.
9. Install cylinder head.
10. Install cylinder head bolts and tighten in a star pattern, as shown.

    Step 1: Torque to approximately 19.6 N·m (14 ft-lb).

    Step 2: Torque to 32.4 – 36.3 N·m (24 – 27 ft-lb).



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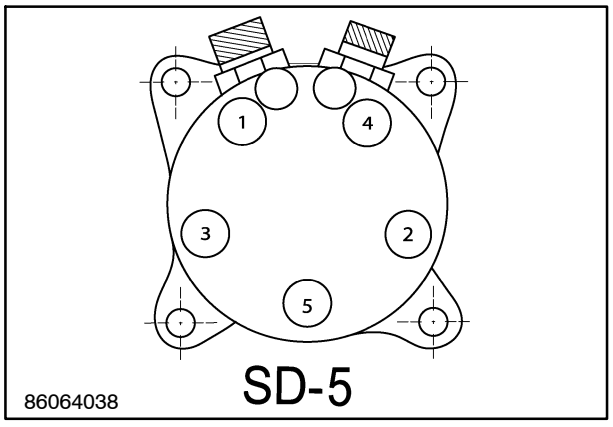

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SECTION 55 - ELECTRICAL SYSTEM

Chapter 1 - Electrical

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INTRODUCTION

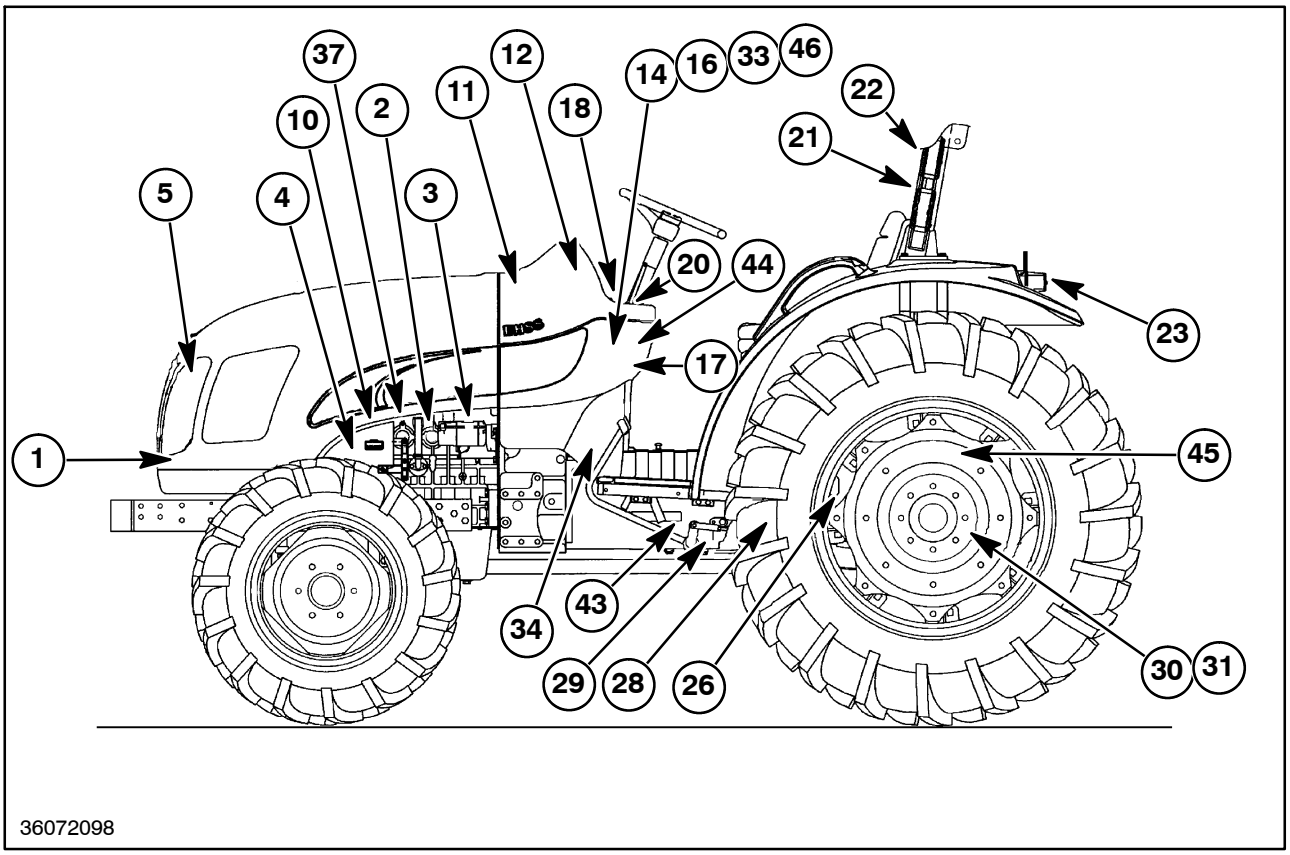
The T2410 and T2420 series tractors, electrical system is a 12 volt negative (-) ground system, consisting of three wiring harnesses (hood, front main, and rear chassis).

NOTE: *References to the directions left, right, front and rear, are made while sitting in the operator seat.*

COMPONENT LOCATION AND FUNCTION

1. **Battery** – Located under the hood, in front of the radiator; electrical power source.
2. **Fusible Link** – Located on the left side of the engine directly above the starter; protects the entire electrical system from damage due to excessive current.
3. **Starter** – Located on the let side of the engine; rotates the engine for starting.
4. **Alternator** – Located on the left side of the engine; generates current to charge the battery.
5. **Headlights** – Located on the front of the tractor; illuminates the area in front of the tractor.
6. **Oil Pressure Switch** – Located on front of the engine cylinder head; illuminates warning light in instrument panel, warning of low engine oil pressure.
7. **Glow Plugs** – Located on the right side of the engine cylinder head; aid in engine startup by warming air in the engine cylinder head combustion chamber.
8. **Fuel Shutoff Solenoid** – Located on the right side of the engine, to the rear of the fuel injection pump; the solenoid shuts off the fuel flow to the injection pump, when the key switch is turned off, to stop the engine.
9. **Main Fuse Block** – Located in the engine compartment, on the right side of the engine firewall; contains fuses that protect individual circuits from damage due to excessive current.
10. **Coolant Temperature Sensor** – Located in the thermostat housing, on the left side of the engine, above the alternator; controls reading of temperature gauge in instrument panel, warns operator of high engine temperatures.
11. **Fuel Level Sender** – Located within the fuel tank; sends a signal indicating the fuel level, to the fuel gauge located in the instrument panel.
12. **Instrument Panel** – Located on the dash panel, in front of the steering wheel; the instrument panel houses the gauges and indicator lights that monitor tractor functions and warn the operator of potential problems.
13. **Glow Plug Relay** – Located in the engine compartment, on the right side of the engine firewall; controls the current flow to the engine glow plugs and indicator light in the instrument panel, when the key switch is in the “HEAT” position.
14. **Safety Start Relay** – Located on the left side of the steering column, underneath the instrument panel; controls the current flow to the starter, during the starting operation.
15. **Key Switch** – Located on the right side of the operator’s console; controls current flow to the start, glow plug, accessory/run and off circuits.
16. **Hazard Flasher/Turn Signal Control Module** – Located on the left side of the steering column, underneath the instrument panel; controls current flow to the hazard flasher/turn signal lights on the rear fenders.
17. **Safety Module** – Located on the left side of the steering column, underneath the instrument panel; controls current during start and run circuits, coordinates operator’s presence in seat, range gear, park brake and PTO functions.
18. **Light Switches (Road and Work)** – Located on the left and right sides of the dash panel; controls current to the headlights and taillights.
19. **Hazard Light Switch** – Located on the right side of the dash panel; controls current to rear hazard lights.
20. **Turn Signal Switch** – Located on left side of dash panel; controls current to flasher /turn signal module and rear hazard lights.
21. **Taillights** – Located on the ROPS of the tractor; provides warning to rearward motorists during transport.
22. **Hazard/Turn Signal Lights** – Located on the ROPS of the tractor; provides warning during transportation and emergency.
23. **Brake Lights** – Located on the rear fenders of the tractor. The brake lights will illuminate when the brake pedals are depressed, with the key switch in any position. The brake lights illuminating, warns anyone following the tractor, the brakes are being applied and the tractor ground speed is being reduced.
24. **Rear Work Light (Optional)** – Located on either the left or right rear fenders of the tractor; illuminates the area behind the tractor.

25. **Seat Safety Switch** – Located beneath the operator seat; controls the circuit for the operator's presence system. If the operator leaves the seat with the tractor running without the forward/ reverse shuttle lever in the "NEUTRAL" position and the parking brake applied, the tractor will shut off in approximately two seconds.
26. **Transmission High and Low Range Modulation Switches** – Located on the left side of the transmission case; controls current to EHSS module to affect shift modulations.
27. **Main Transmission Modulation Switch** – Located underneath the right operator's platform step; controls current to EHSS module to affect shift modulations, depending if the transmission is in either 1st and 2nd or 3rd and 4th gear.
28. **PTO Safety Switch** – Located on the left rear side of the tractor, the PTO switch is part of the safety start and operator presence systems.
29. **Inching Pedal Potentiometer** – Located underneath left operator's platform step; resets the EHSS module for a new modulation when inching pedal is depressed.
30. **7 Pin Connector** - Located on the left rear axle housing of the tractor; provides current and light connection for towed implements.
31. **Fuse block for 7 Pin Connector** – Located beneath 7 pin connector on left rear axle housing off tractor; contains two 15 amp fuses for 7 pin circuits.
32. **Auxiliary Electrical Power Socket** – Located at the right rear of the operator's platform; provides electrical current for any auxiliary 12 volt electrical item, (10 amp maximum).
33. **EHSS Control Module** – Located on the left side of the steering column, underneath the instrument panel; controls current during shift modulations.
34. **EHSS Control Valve** – Located on the rear of the clutch housing; electrically controls the oil flow to the shuttle clutch assembly in the EHSS transmission.
35. **7 Pin Connector Power Relay** – Located on the left side of the steering column, underneath the instrument panel; controls current to the 7 pin connector.
36. **Road Lights Relay** – Located on the right side of the engine firewall, controls current to the front headlights and taillights.
37. **Charging System Diode** – Located on the left side of the engine, near the alternator. The diode is used to prevent current from flowing into the low charge indicator light within the instrument panel.
38. **Brake Lights Relay** – Located on the right side of the engine firewall; controls the current to the brake lights.
39. **Work Lights Relay** – Located on the right side of the engine firewall; the relay controls the current to the front work lights.
40. **Park Brake Switch** – Located underneath the right side operator's platform step; controls current to the park brake indicator light of the instrument panel.
41. **Brake Lights Switch** – Located on the right side of the tractor, underneath the operator's platform. The switch controls current to the brake light relay. When the relay is energized, current flows to the brake lights, when the brake pedals are depressed.
42. **Park Brake** / **Brake Light Interlock Switch** – Located on the right side of the tractor, underneath the operator's platform. This switch interrupts the current flow to the brake light switch, not allowing the brake lights to illuminate, with the park brake applied.
43. **Clutch Safety Switch** – Located on the left side of the tractor, underneath the operator's platform. The switch controls current to the safety start relay, when the clutch pedal is fully depressed.
44. **EHSS Shuttle Lever Switch** – Located on the left side of the instrument panel. The switch controls current to the EHSS control module, when the shuttle change lever changes positions.
45. **Buzzer** – Located on the left side of the HPL housing. The buzzer will alarm when unsafe operation is detected by the safety controller.
46. **Auxiliary Power Relay** – Located on the left side of the steering column, underneath the console covers. This relay provides current to the auxiliary power socket, that is located behind the operator's seat.



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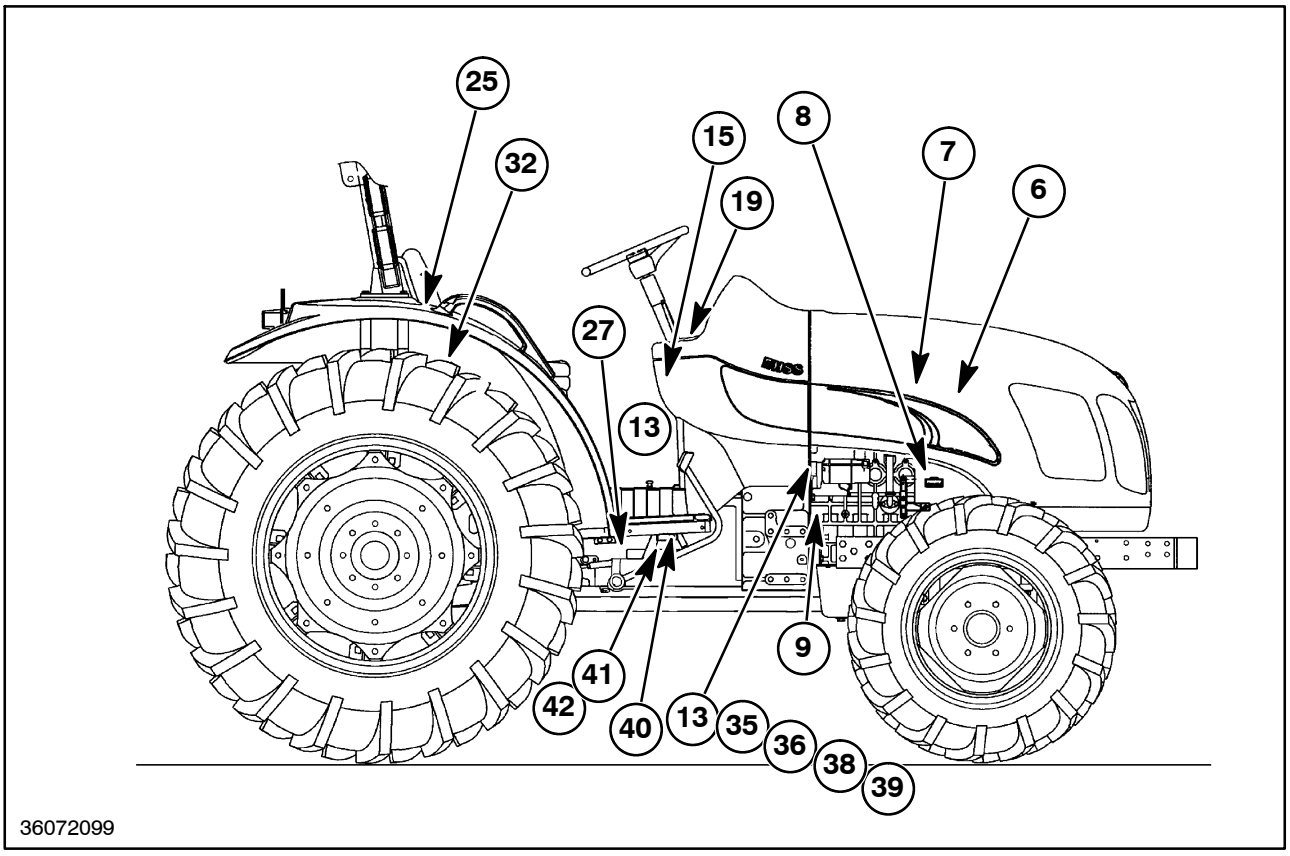

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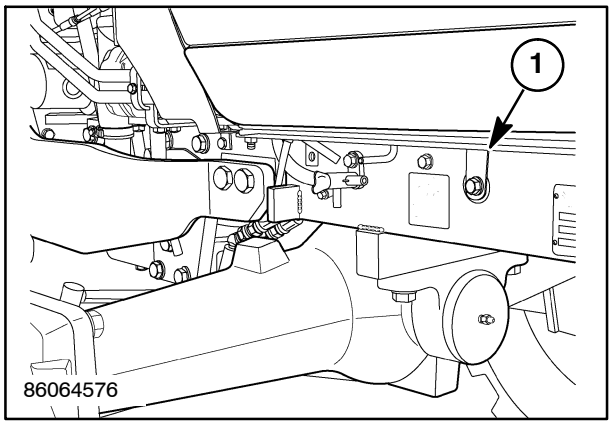
Ground Locations

1. Right side of front frame (battery ground).



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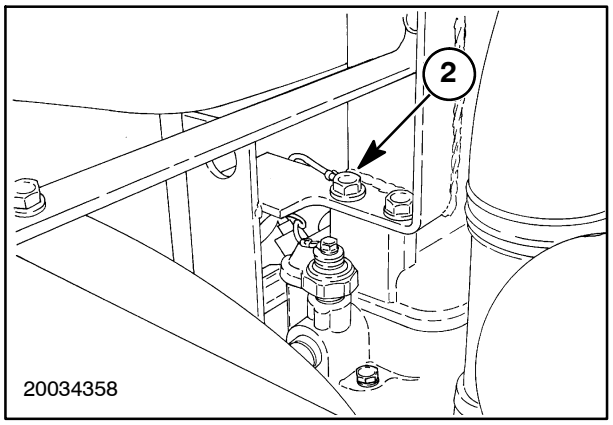
2. Front of engine cylinder head.



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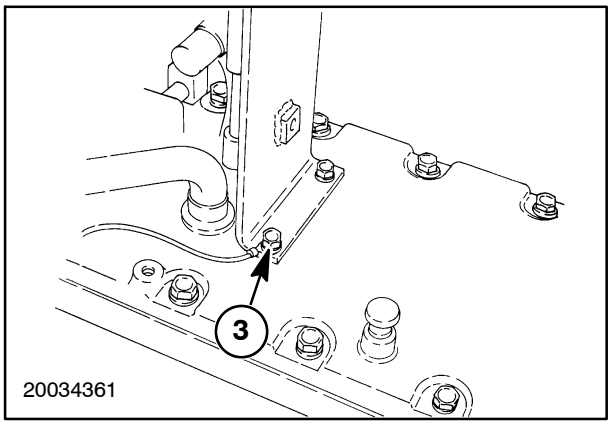
3. Base of steering column bracket.



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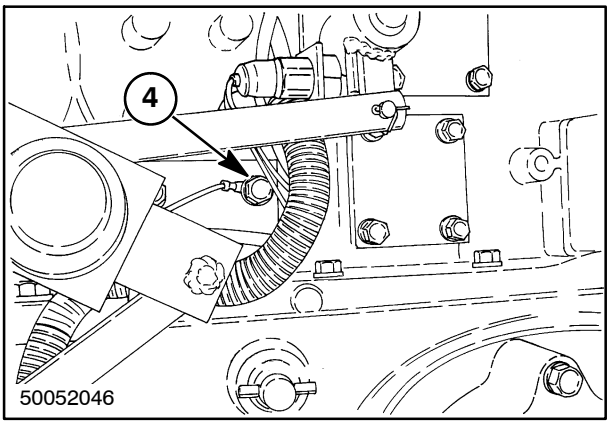
4. Left side of HPL cover.

⚠ WARNING ⚠

Before working on any component of the electrical system, the negative (-) battery cable should be disconnected from the battery, as electrical shock or damage to system components may occur. Some testing requires 12-volt power, however care should be taken in cases were power is needed.



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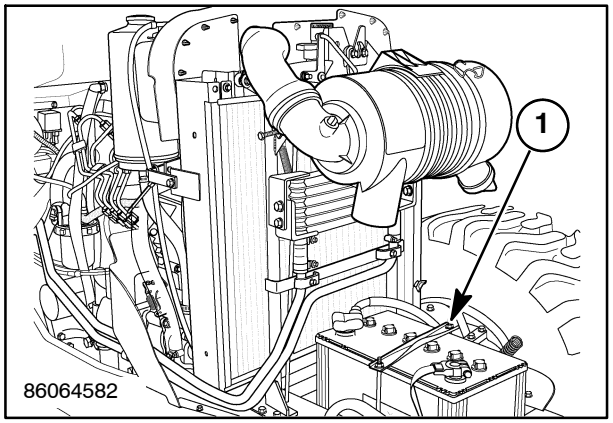
ELECTRICAL SYSTEM COMPONENTS

DESCRIPTION AND TESTING

BATTERY

Description

The T2410, T2420 tractors are equipped with a BCI group 27, 12-volt battery, 1, with a minimum cold cranking ability of 700 amps at 0° F (-18°C). The battery is located underneath the hood in front of the radiator.



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The battery connections must be tight and free of corrosion. If necessary, wash the battery terminals with a solution of baking soda and water, making sure the solution does not get inside the battery. After cleaning, wash the battery with clean water, then apply a small amount of petroleum jelly to the terminals to prevent corrosion.

A good battery charge must be maintained in freezing temperatures. If the battery is allowed to become discharged or run down, the electrolyte level will become weak and possibly freeze. This can result in damage to the battery case. If water must be added, use distilled water. Add the water just before using the tractor. This ensures that the water will mix with the electrolyte during the charging process, preventing the water from freezing.

Check the specific gravity of the electrolyte to determine battery charge.

Checking the Battery Electrolyte Level

NOTE: *Check the battery electrolyte level after every 50 hours of operation.*

⚠ WARNING ⚠

Always check the electrolyte level with the tractor engine off, as an explosive gas is produced inside the battery when the alternator is charging. Do not use an exposed flame and do not smoke when checking the battery electrolyte level.

To check the battery electrolyte level:

1. Clean the top of the battery, then remove the vent plugs.
2. If the electrolyte level is low, add distilled water. The correct level is when the liquid is between the upper and lower line.

NOTE: *Keep distilled water in a nonmetallic container that is clean and well covered.*

3. Install the vent plugs after making sure the vent holes are not blocked. After adding water at below freezing temperatures, run the engine for a period of time. This allows the battery to charge, preventing the water from freezing.

Battery Removal

1. Raise the tractor hood to its fully raised position.
2. Disconnect the negative (-) and positive (+) battery cables from the battery.
3. Remove the grille from the front of the tractor.
4. Remove the battery hold-down hardware and carefully remove the battery from the tractor.

Battery Installation

1. Orient the battery so that the posts are toward the rear of the tractor. Install the battery and the battery hold-down hardware.

IMPORTANT: *Crossing of battery terminals may cause damage to the electrical system.*

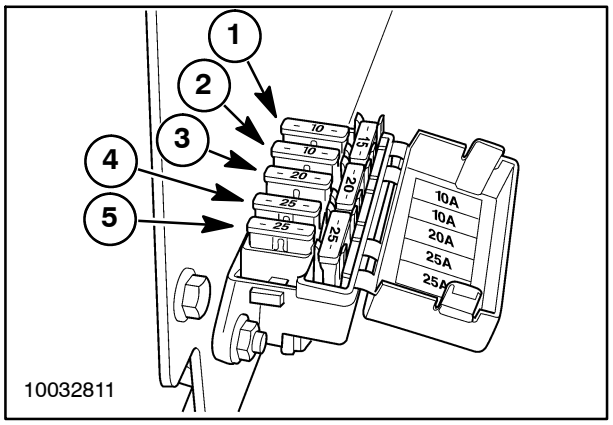
2. Connect the positive (+) battery cable to the positive (+) battery terminal and the negative (-) battery cable to the negative (-) battery terminal.
3. Install the grille onto the front of the tractor.

FUSE BLOCK

The fuse block is located in the engine compartment on the right side of the tractor firewall. Always replace blown fuses with the size specified for that circuit.

From left to right as viewed from above the tractor, the fuse block contains the following fuses:

Fuse #	Fuse Size	Circuit Protected
1	10 amp	Brake lights
2	10 amp	Alternator, safety start, instrument panel, gauges, safety alarm, tail lights, ACC power relay, road lights relay, turn signals
3	20 amp	Hazard lights
4	25 amp	Field lights, option rear work light
5	25 amp	Road lights



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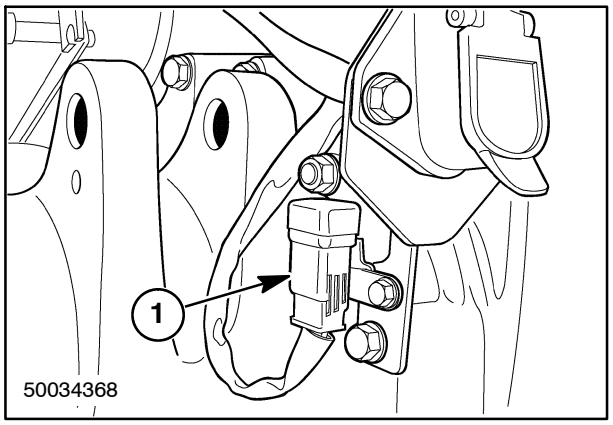
Fuse Block for 7 Pin Connector

There is an auxiliary fuse block for the 7 pin connector that contains two 15 amp fuses, that protect the connector from excessive electrical load. The fuse block, 1, is located below the 7 pin connector on the left rear axle housing.



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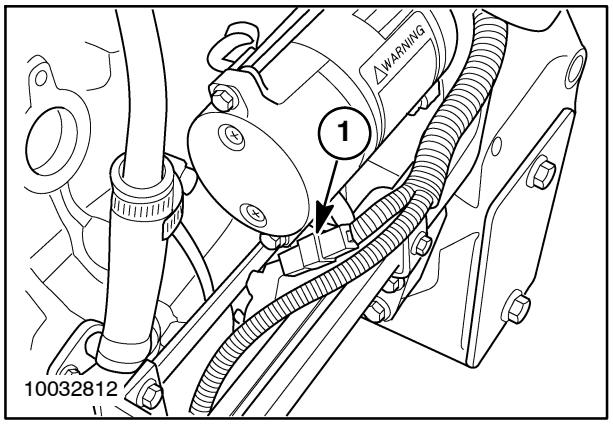
FUSIBLE LINK

A fusible link wire, 1, is used to protect the tractor's entire electrical system. If excessive amperage passes through this wire it will melt down so that it will no longer allow current to pass (similar to the way a fuse works). The fusible link wire, 1, is a red wire that goes from the starter terminal to a connector that links into the main wiring harness.

To replace the fusible link wire:

1. Disconnect the battery.
2. Unplug the connector linking the wire to the main wiring harness.
3. Remove the old fusible link wire from the starter terminal.
4. Replace the old fusible link wire with a new one - first attaching to starter terminal, and then connecting into the main wire harness.

IMPORTANT: *Always replace the fusible link wire with the appropriate fusible link wire for this tractor (part #SBA385608910).*



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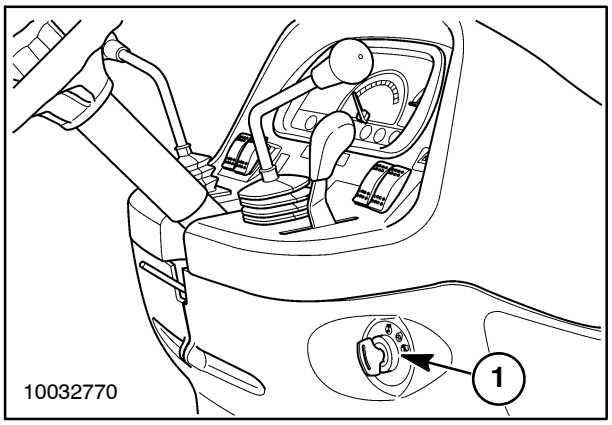
KEY SWITCH

Description

The key start switch, 1, is located on the right side panel. The key switch has four key-operated positions; STOP, AC/RUN, HEAT, and START. Turning the key from the STOP position will align the electrical contacts within the key switch. With the contacts aligned, the circuit is closed and battery current will flow through the circuit.



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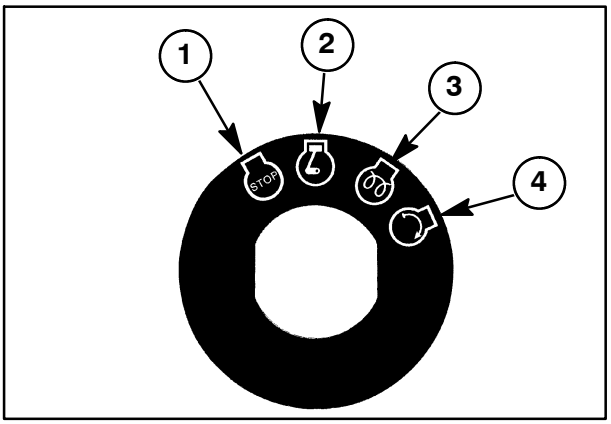
1. STOP POSITION

In the STOP position, 1, there is no battery power supplied to electrical circuits and the key may be removed from the key switch to prevent unauthorized use of the tractor. The STOP position also stops the tractor engine, when running.

2. AC/RUN POSITION

When the key switch is rotated clockwise to the AC/RUN position, 2, battery power is supplied to operate the electrical accessories without the engine running. The switch will also be in this position while the tractor is running.



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3. HEAT POSITION

To pre-heat the engine, turn the key switch to the “HEAT” position, 3. The cold start indicator light goes out after approximately four seconds. The glow plugs heat the precombustion chambers during this time, and the engine will start.

NOTE: *The preheat is auto-timed, when the indicator light goes off, the power to the glow plugs is also removed.*

⚠ WARNING ⚠

Do not use ether with the glow plug starting aid.

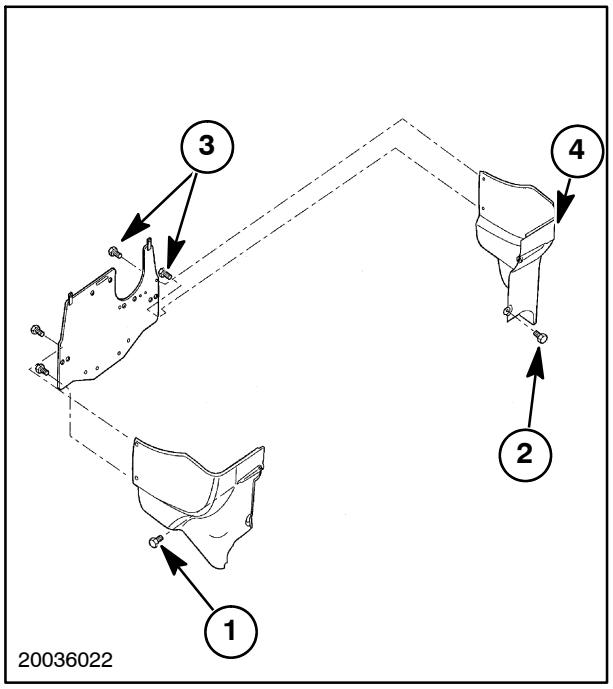
4. START POSITION

NOTE: *The key switch is spring-loaded to return to the AC/RUN position, 2, when released from the START position, 4.*

When the key switch is turned clockwise to the START position, 4, power is supplied to the starter motor to crank and start the engine. This position also provides current to the engine glow plugs to aid in starting the tractor engine.

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two rear bolts, 1, and 2, and front bolts, 3, to allow removal of right steering column shroud, 4.
3. Remove the nut from the key switch.
4. Carefully remove the sealing washer from the key switch and push the switch through the console toward the center access panel opening.
5. Disconnect the key switch from the tractor wire harness to remove the switch from the tractor.



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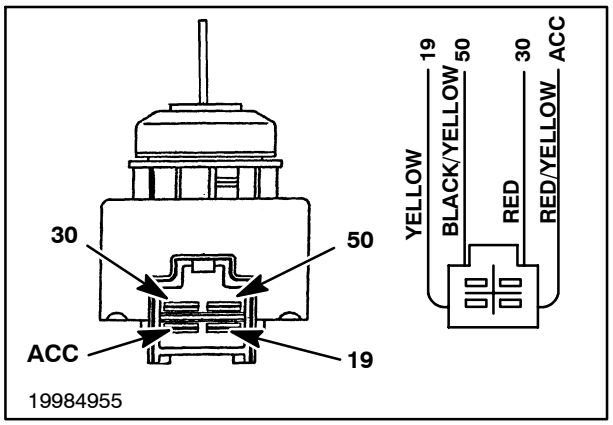
Testing

NOTE: *The key switch is not serviceable and must be replaced if testing determines the switch is defective.*

Key Switch Troubleshooting - Continuity Test

Use an ohmmeter to test each position of the key switch for electrical continuity.



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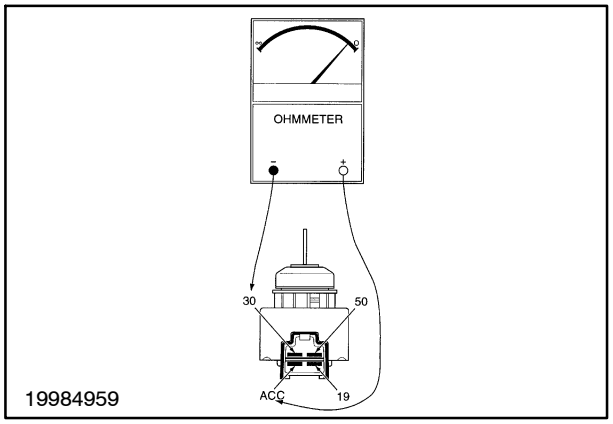
ACCESSORY/RUN Position

1. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
2. Connect the other ohmmeter lead to the connector terminal ACC on the key switch.
3. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
4. Turn the key switch to the ACC/RUN position and observe the ohmmeter.
5. Little or no resistance indicates that there is continuity this key switch position.
6. A high resistance reading indicates that the circuit is open and the key switch needs replaced.



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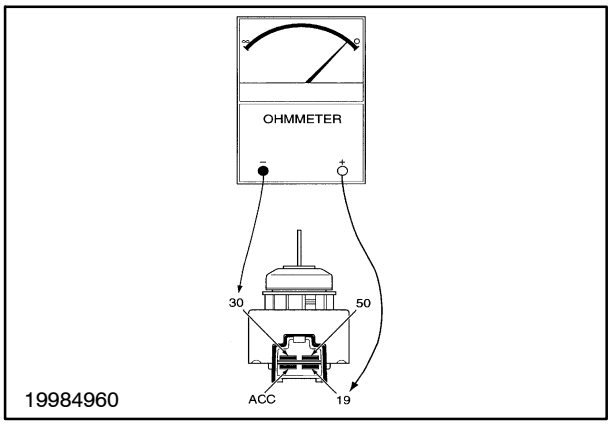
HEAT Position

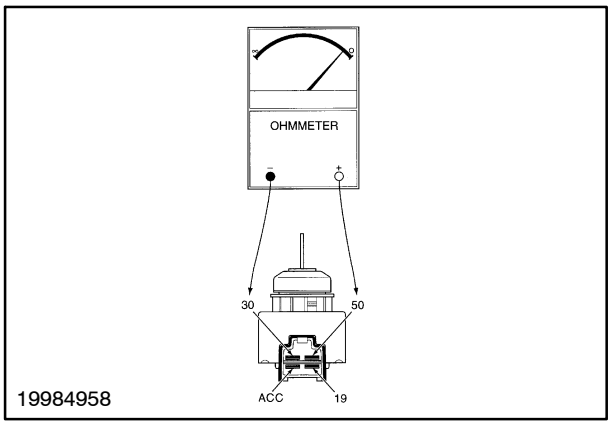
1. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
2. Connect the other ohmmeter lead to the connector terminal 19 on the key switch.
3. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
4. Turn and hold the key switch to the HEAT position and observe the ohmmeter.
5. Little or no resistance indicates that there is continuity in this key switch position and the switch is functioning properly.
6. A high resistance reading indicates that the circuit is open and the key switch needs replaced.



16

START Position

7. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
8. Connect the other ohmmeter lead to the connector terminal 50 on the key switch.
9. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
10. Turn and hold the key switch to the START position and observe the ohmmeter.
11. Little or no resistance indicates that there is continuity this key switch position.
12. A high resistance reading indicates that the circuit is open and the key switch needs replaced.

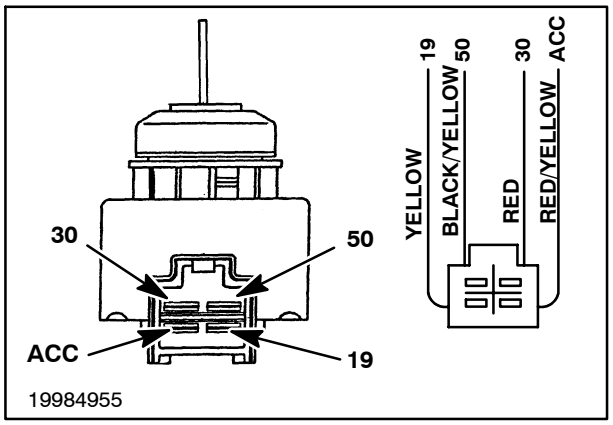


17

Test Lead # 1	Test Lead # 2	Switch Position	Continuity
30	Any	STOP	No (open)
30	50	START	Yes (closed)
30	ACC	ACC/RUN	Yes (closed)
30	19	HEAT	Yes (closed)

Key Switch Troubleshooting - Connector Wiring

Each terminal of the key switch is connected to specific wires of the wiring harness and must be reconnected accordingly.



18

Terminal	Key Switch	Wire Color	Termination
30	Common	Red	Positive (+) terminal on starter motor (battery)
50	Start	Black/Yellow	Safety start relay connector, safety controller
ACC	ACC/RUN	Red/Yellow	Fuse block
19	Heat	Yellow	Safety controller

Installation

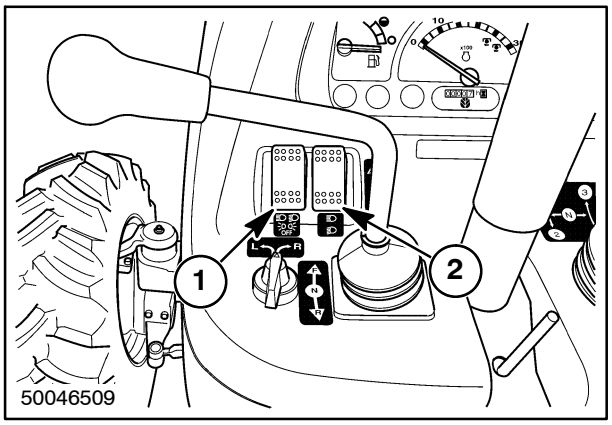
1. Connect the key switch to the tractor wire harness.
2. From inside the operator console, insert the key switch through the key switch hole, slide the sealing washer, and thread the nut onto the key switch. Tighten the nut.
3. Install the center access panel by using the two front and rear bolts.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.

LIGHT SWITCHES

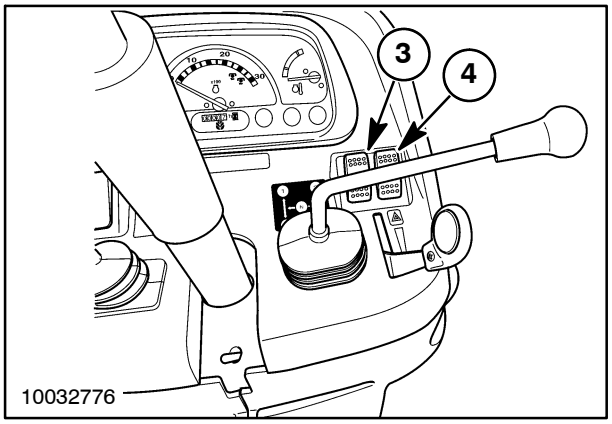
There are several toggle type switches, located in the dash area, that control the front and rear lights of the tractor.

1. Road lights switch
2. High beam road light switch
3. Work lights switch
4. Hazard lights switch

NOTE: *The key switch must be in wither the HEAT, START, or AC/RUN positions for current flow to the road or work light switches. The hazard light switch has current provided when the key is in the "off" or any other position.*



19



20

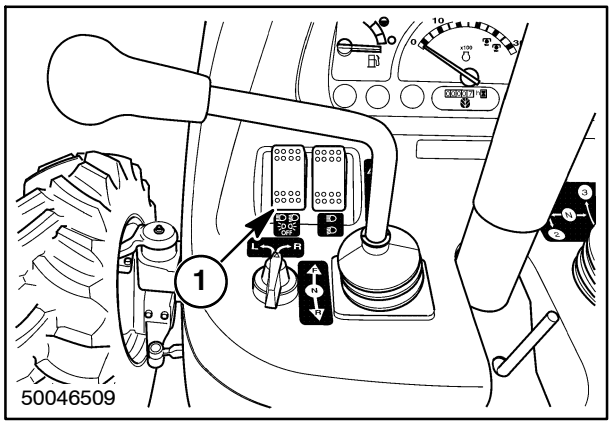
ROAD LIGHTS SWITCH

The road lights switch, 1, has three positions:

REAR - OFF

MID – Instrument panel and taillights illuminated

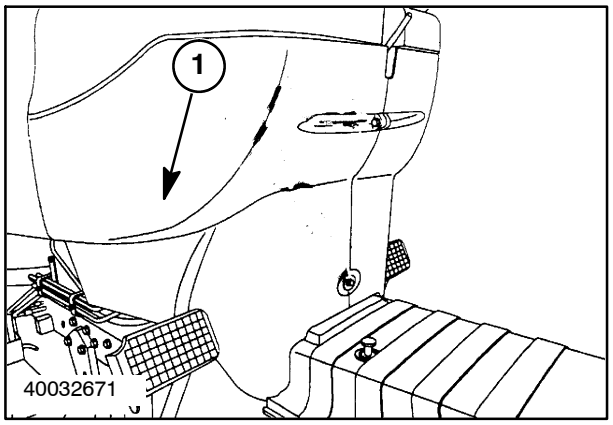
FRONT - Front road lights low beam, taillights and instrument panel lights illuminated.



21

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



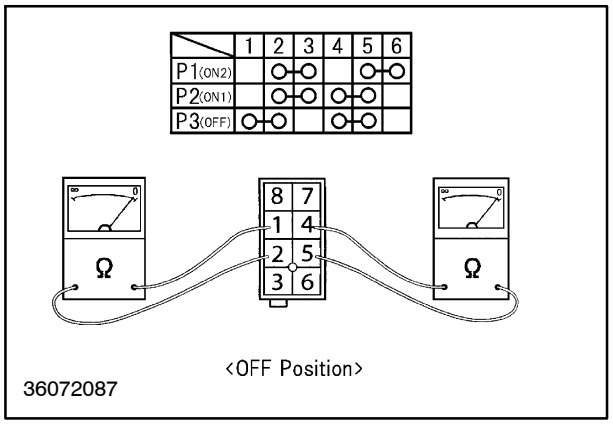
22

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.



23

"REAR" OFF Position

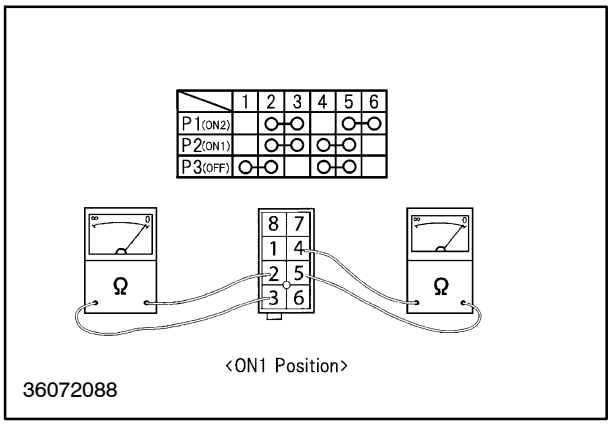
Continuity in terminals: 1 and 2

4 and 5

"MID" Position (Instrument panel and taillights Illuminated): **ON 1**

Continuity in terminals: . . . . . 2 and 3

. . . . . 4 and 5



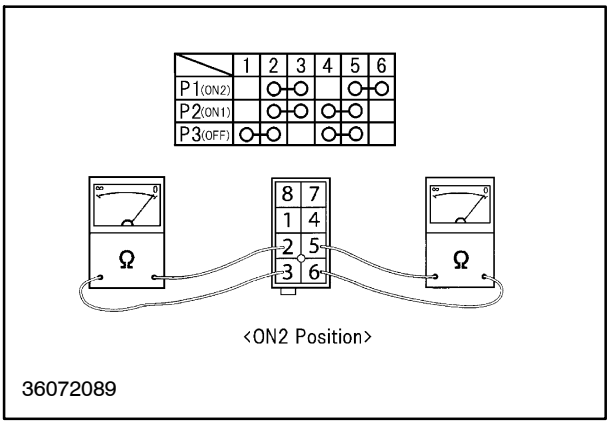
24

"FRONT" Position (Road lights low beam, Instrument panel and taillights Illuminated): **ON 2**

Continuity in terminals: . . . . . 2 and 3

. . . . . 5 and 6

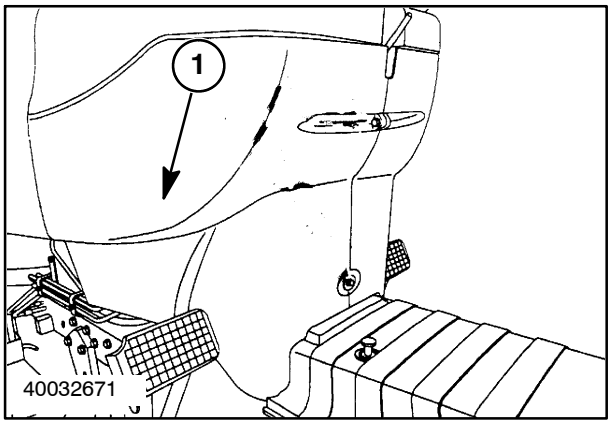
If any other test results are found the switch is defective and should be replaced.



25

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the left side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



26

ROAD LIGHTS HIGH BEAM SWITCH

Description

The road lights high beam switch, 1, has two positions:

REAR – OFF

Front - ON (High beam 65 watt illuminated)

NOTE: *For the high beams to illuminate the road light switch, 2, MUST be in the front "ON" position.*

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

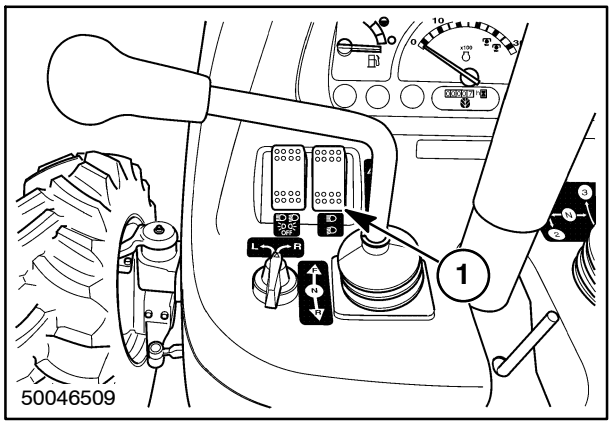
"REAR" OFF Position

No continuity in any terminals

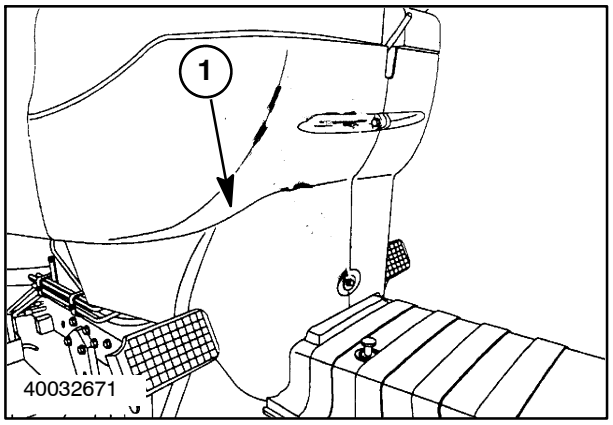
"FRONT" Position (Road lights high beam): **ON**

Continuity in terminals: . . . . . 2 and 3

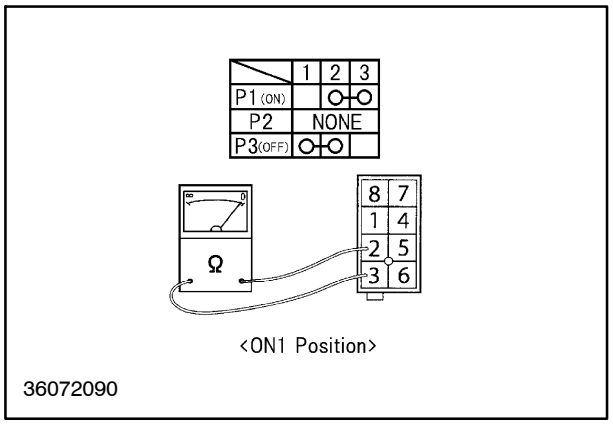
If any other test results are found the switch is defective and should be replaced.



27



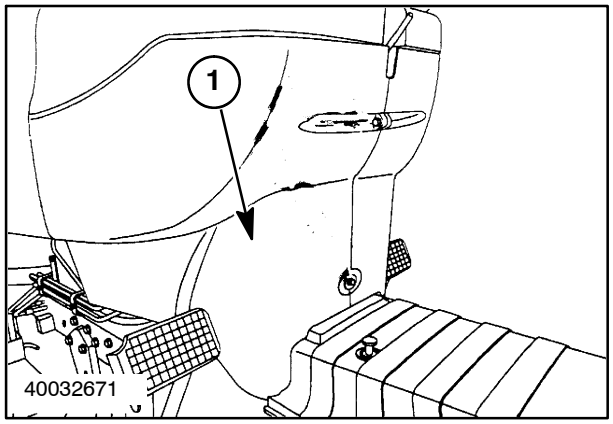
28



29

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the left side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



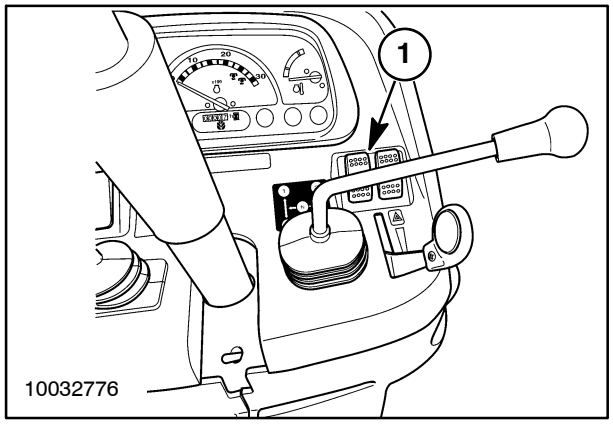
30

WORK LIGHTS SWITCH

The work lights switch, 1, has two positions:

REAR – OFF

Front – ON

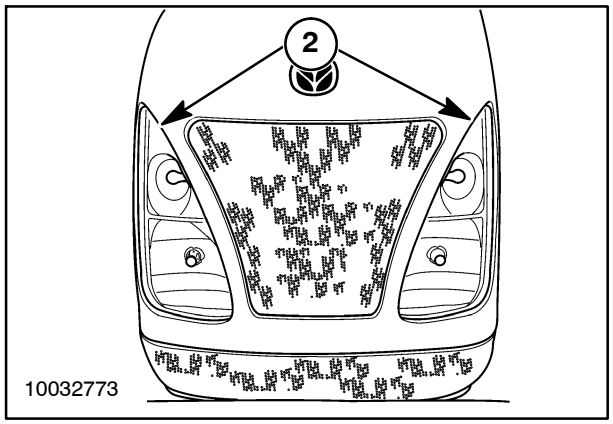


31

The work light switch controls the two front work lights, 2, independent of the road lights.

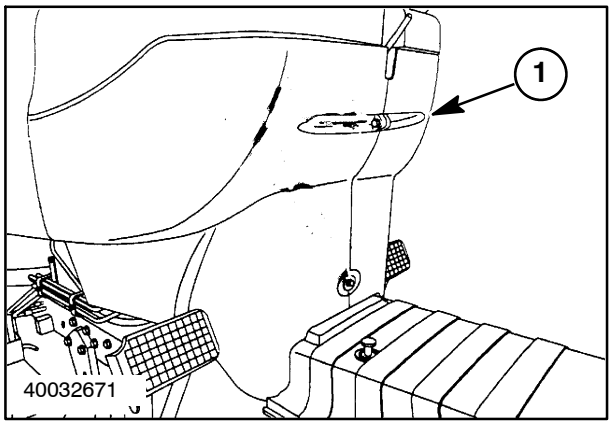
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.



32

2. Remove the right side steering column shroud, 1.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



33

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

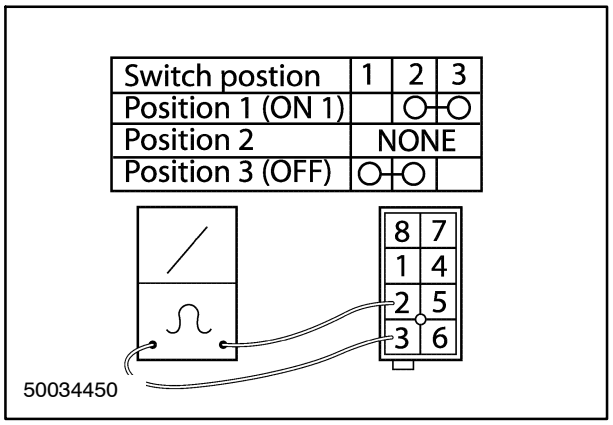
"REAR" OFF Position

No continuity in any terminals:

"FRONT" Position (Work lights illuminate): **ON**

Continuity in terminals: . . . . . 2 and 3

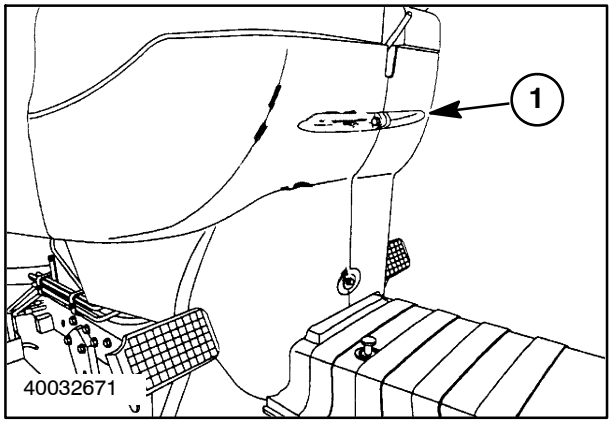
If any other test results are found the switch is defective and should be replaced.



34

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the right side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



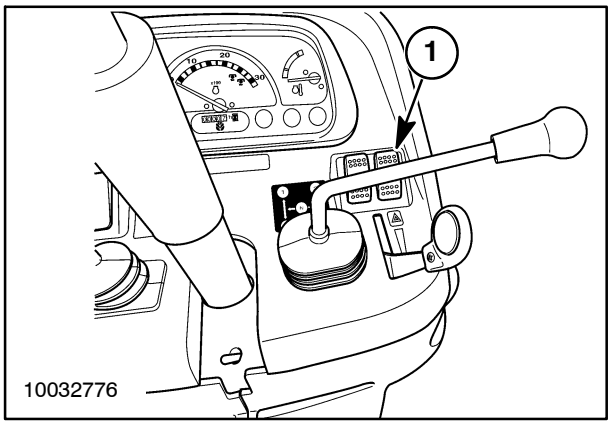
35

HAZARD LIGHTS SWITCH

The hazard lights switch, 1, has two positions:

REAR – OFF

Front – ON

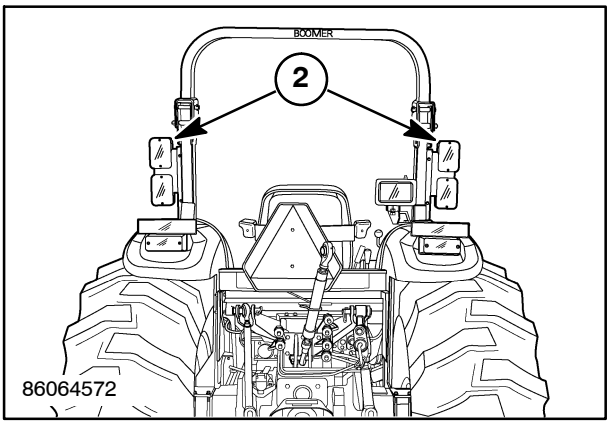


36

This switch controls the rear flasher hazard lights, 2.

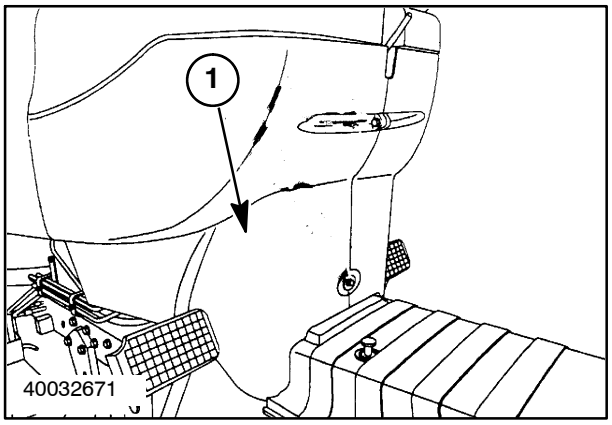
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.



37

2. Remove the right side steering column shroud, 1.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



38

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

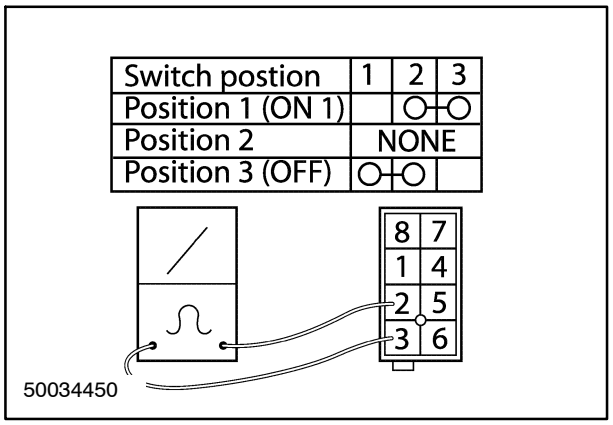
REAR" OFF Position

No continuity in any terminals

FRONT" Position (Hazard lights flashing): **ON**

Continuity in terminals: . . . . . 2 and 3

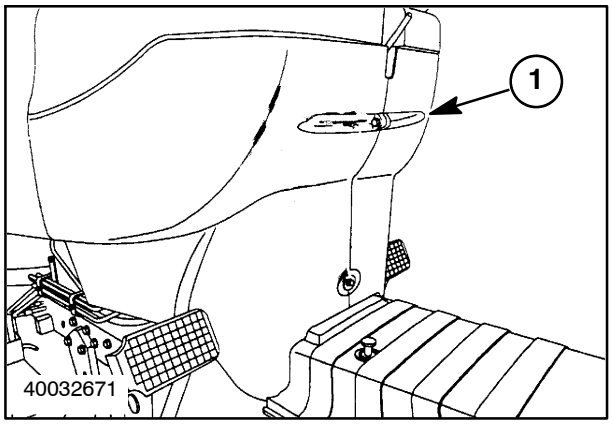
If any other test results are found the switch is defective and should be replaced.



39

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the right side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



40

TURN SIGNAL SWITCH

The turn signal switch, 1, is located on the left side of the dash area.

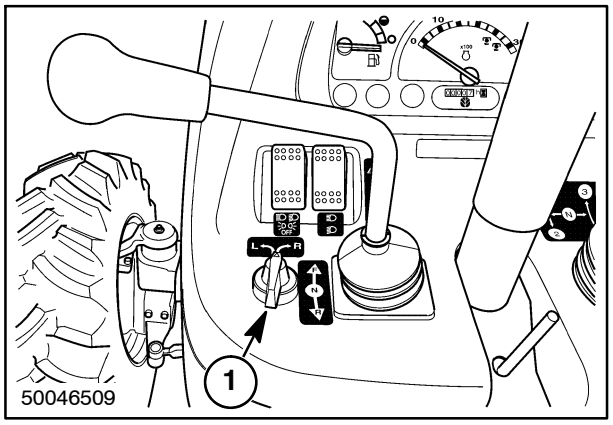
The switch controls the rear flasher lights when designating a right or left turn.

The turn signal switch has three positions:

Right Turn

Left Turn

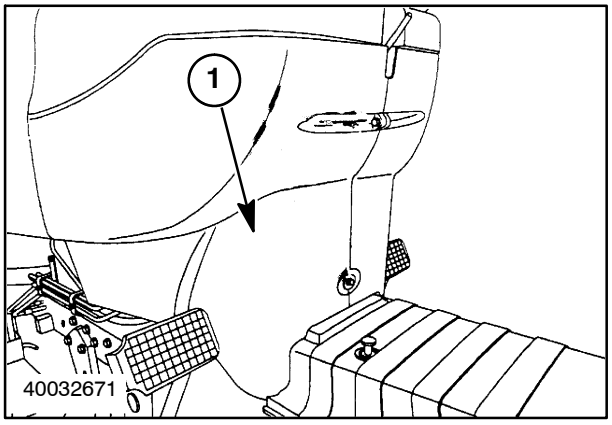
OFF



41

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Pull knob from switch, unscrew retaining nut from switch and remove switch from underneath dash.
4. Disconnect the switch from the tractor wire harness.



42

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

Mid – " OFF " Position

No continuity in any terminals

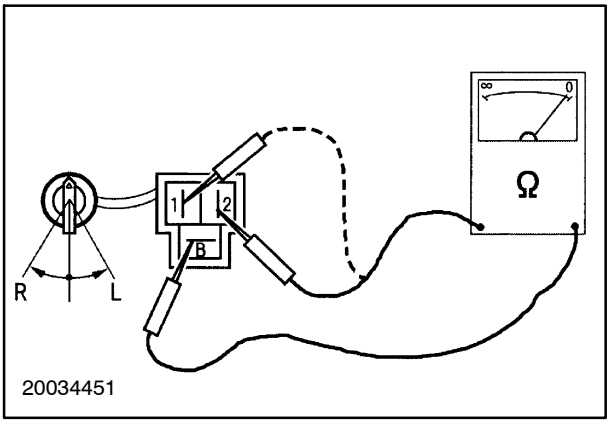
"Right" Turn

Continuity in terminals: . . . . . "B" and 2

"Left" Turn

Continuity in terminals: . . . . . "B" and 1

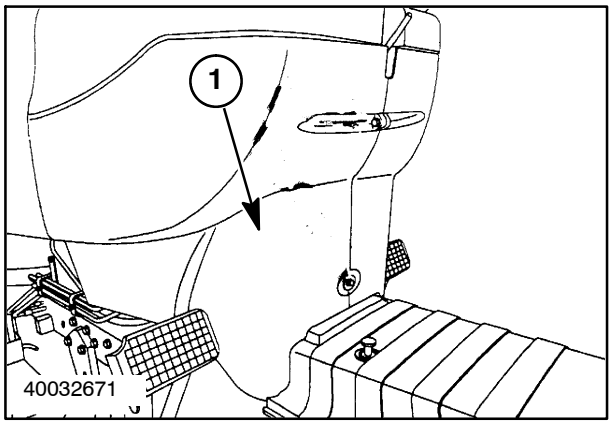
If any other test results are found the switch is defective and should be replaced.



43

Installation

1. Connect the switch to the tractor wire harness.
2. Install switch from underneath dash, align tab on switch with slot in dash. Install retaining nut and knob on switch.
3. Install the left side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



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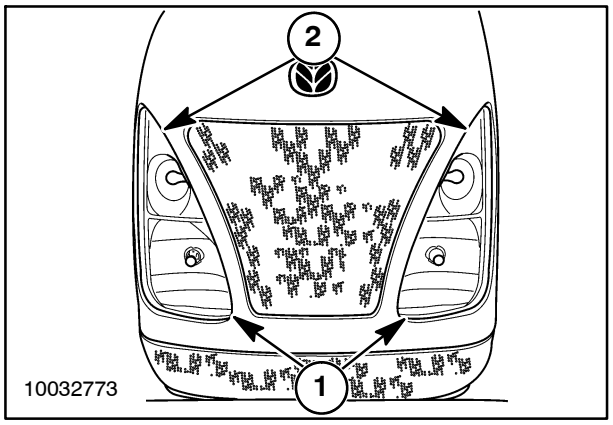
HEADLIGHTS

Description

There are two sets of lights located in the front of the tractor hood, dual element road lights, 1, and single element work lights, 2. The light sets can be activated separately or together. The key switch must be in the “ACC/RUN” position for the lights to operate.



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HEAD LAMP

Removal

1. Open the tractor hood.
2. Bulb Removal:

   Road lights, 1, (Blue Cap/dual element): Release retaining tabs and pull bulb assembly from holder.

   Work lights, 2, (Single element): Turn bulb assembly 1/4 turn and remove bulb from holder.

3. Bulb Replacement:

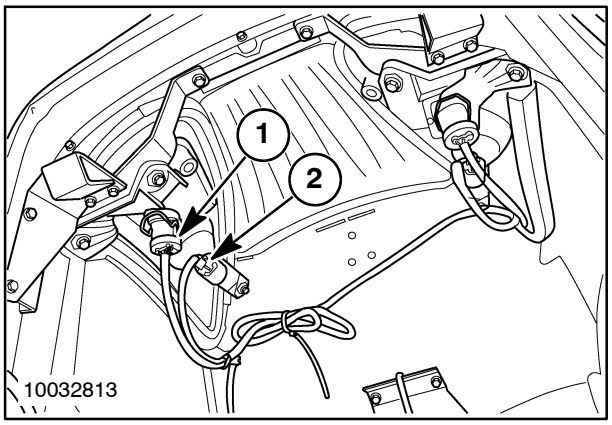
   Road lights: Insert bulb assembly and secure with retaining clips.

   Work lights: Insert bulb assembly into slots and turn 1/4 turn clockwise to secure.

4. Rotate the socket counter-clockwise a quarter turn and remove the socket from the housing.
5. Remove the bulb assembly from the harness.
6. Place a new bulb in the socket, then reinstall the socket in the housing.

IMPORTANT: *Be careful not to touch the bulb with bare fingers. Oil from the fingers can shorten the life of bulb. Use protective cloth or glove when installing bulb.*

NOTE: *Replacement bulbs are:*
Road lights: HB1/9004, dual element 50/65 Watt, Halogen
Work lights: GE886, single element 50 Watt, Halogen.



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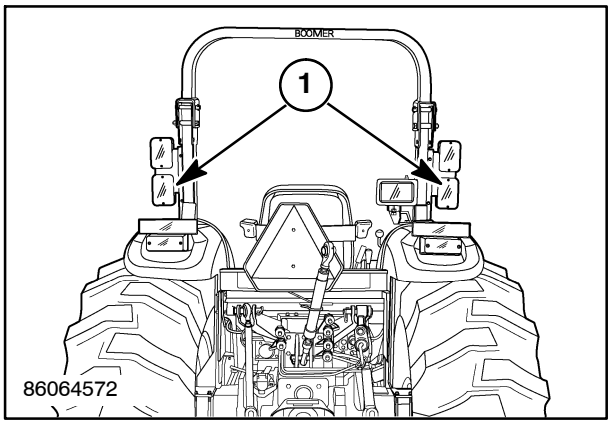
TAILLIGHTS

Description

The taillights, 1, are located on the left and right ROPS uprights. The two taillights illuminate the rear of the tractor to provide warning to approaching vehicles.



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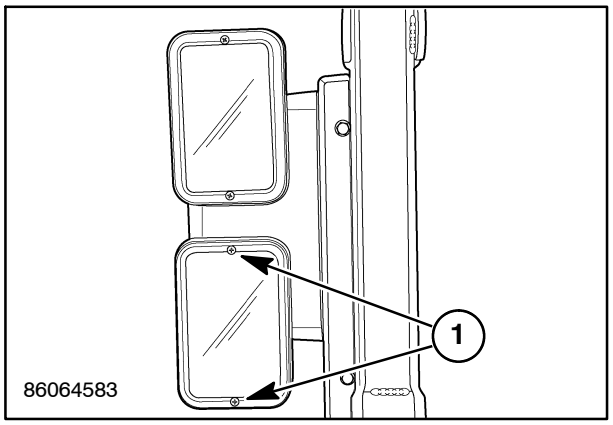
Bulb Replacement

NOTE: *The same procedure is used for both sides.*

To replace a taillight bulb:

1. Remove the two screws, 1, retaining the taillight lens and remove the lens.
2. Rotate the bulb, 2, counter-clockwise to remove.
3. Insert the new bulb into the socket and rotate clockwise.

NOTE: *Replace with an 1157-12-volt bulb.*



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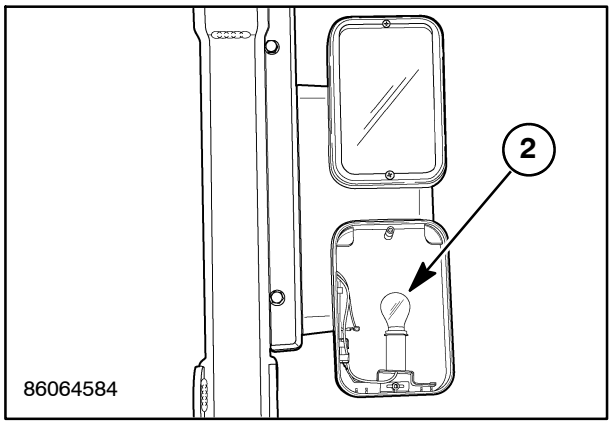

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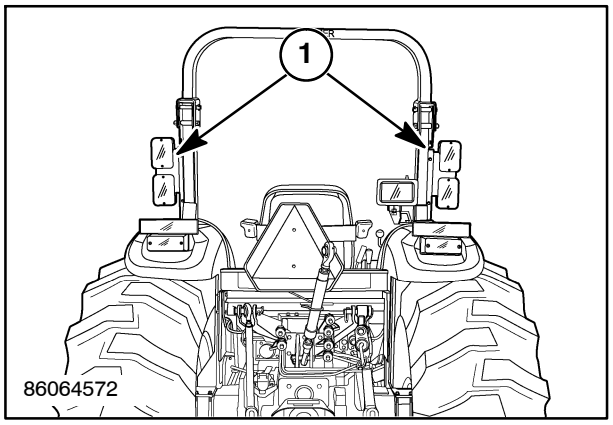
HAZARD/TURN SIGNAL LIGHTS

Description

The hazard/turn signal lights, 1, are located on the left and right rear fenders. The two hazard/turn signal lights provide warning to approaching vehicles of a slow moving or turning vehicle. The hazard/turn signal lights should be used in low visibility situations or at slow speeds on public roads.



50

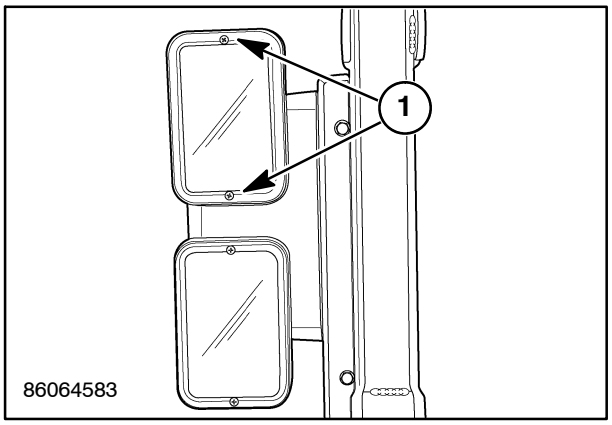
Bulb Replacement

NOTE: *The same procedure is used for both sides.*

To replace a flasher bulb:

1. Remove two screws, 1, from the light assembly.
2. Rotate the bulb, 2, counter clockwise to remove from the socket.
3. Push down on the new bulb and rotate clockwise to insert into the socket.

NOTE: *Replace with a 1156 - 12 volt bulb.*



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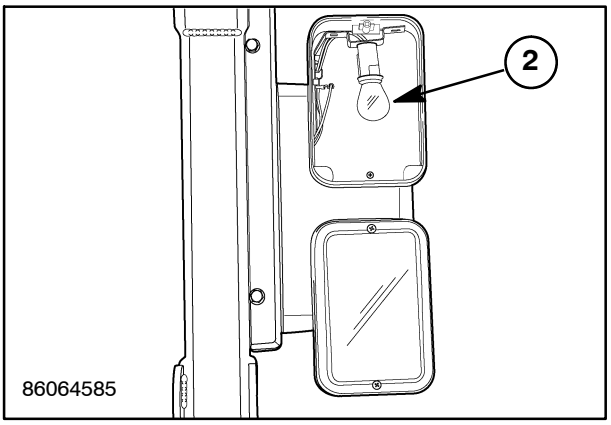
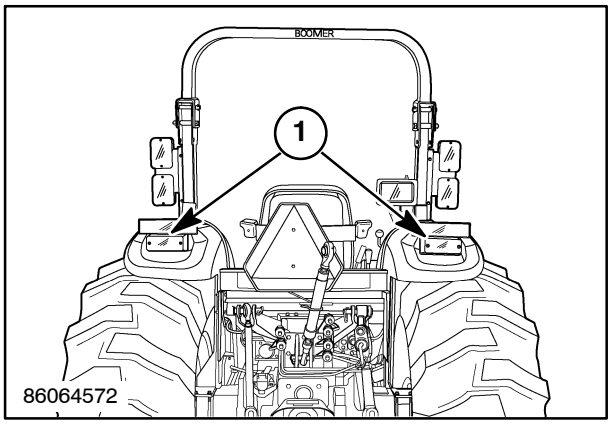


52

Brake Lights

The brake lights, 1, are activated when the brake pedals are depressed, with the key switch in any position. The brake lights illuminating, warns anyone following the tractor, the brakes are being applied and the tractor ground speed is being reduced.

NOTE: *The brake lights will not illuminate if the park brake is applied.*

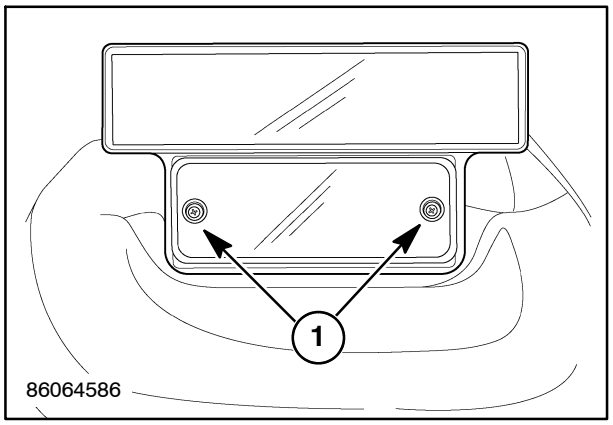


53

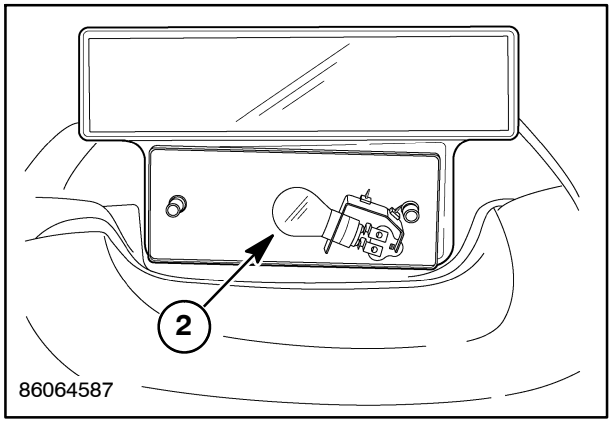
Bulb Replacement

1. Remove the two screws, 1, retaining the brake light lens and remove the lens.
2. Rotate bulb, 2, counter-clockwise to remove.
3. Insert new bulb into socket and rotate clockwise.

NOTE: *Replace with an 1157-12 volt bulb.*



54



55

SHUTTLE SWITCH (FORWARD/REVERSE)

The shuttle switch, 1, located underneath the dash area, on the shuttle lever linkage. This switch is used to engage the EHSS transmission either in the neutral, forward or reverse modes.

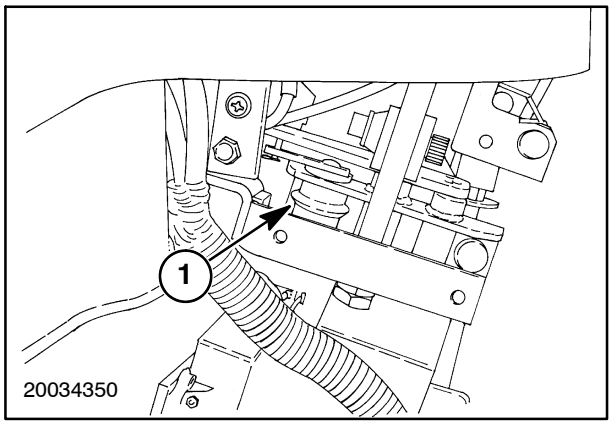
The shuttle switch is also part of the tractor's safety start system. The switch has to be in the "NEUTRAL" position to allow the tractor to start.

The switch has three positions:

NEUTRAL

FORWARD

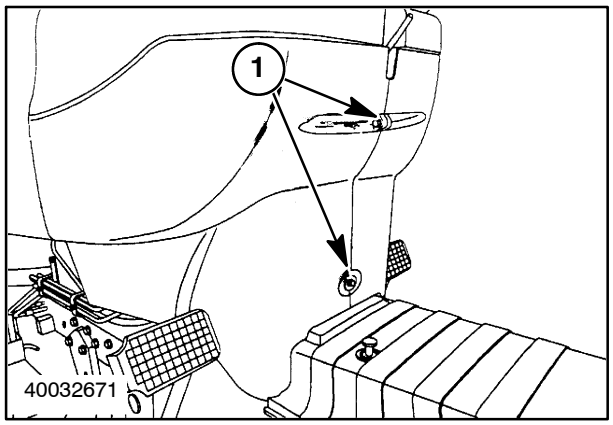
REVERSE



56

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Disconnect the switch from the tractor wire harness.



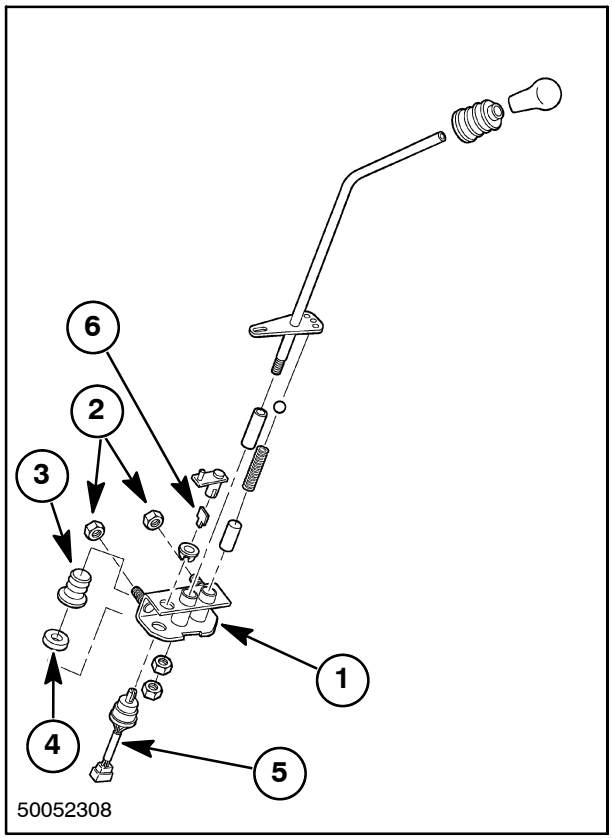
57

4. Remove the switch mounting bracket, 1, by removing the two retaining nuts, 2.

NOTE: *Removing the switch, mounting bracket and shift lever as an assembly. This will make removing and installing the switch easier.*

5. Remove rubber boot, 3, from top of switch, unscrew switch retaining nut, 4, and remove switch, 5, from bracket.

NOTE: *Pay attention not to lose spade, 6, that connects switch to shift linkage.*



58

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

Terminal wire leads identification:

1. Blue/White
2. Blue
3. Red
4. Black/White

“NEUTRAL” Position

Continuity in terminals: B and 3

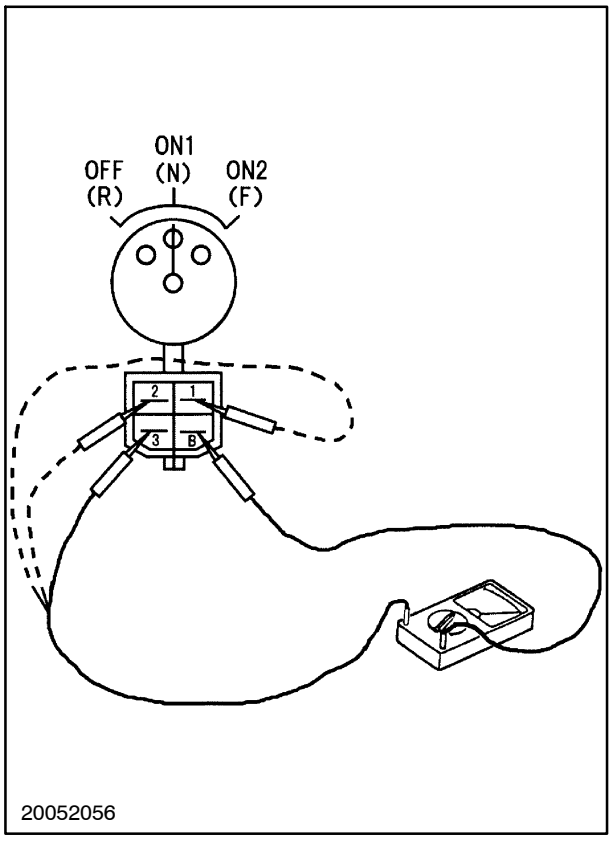
“FORWARD” Position

Continuity in terminals: B and 2

“REVERSE” Position

Continuity in terminals: B and 1

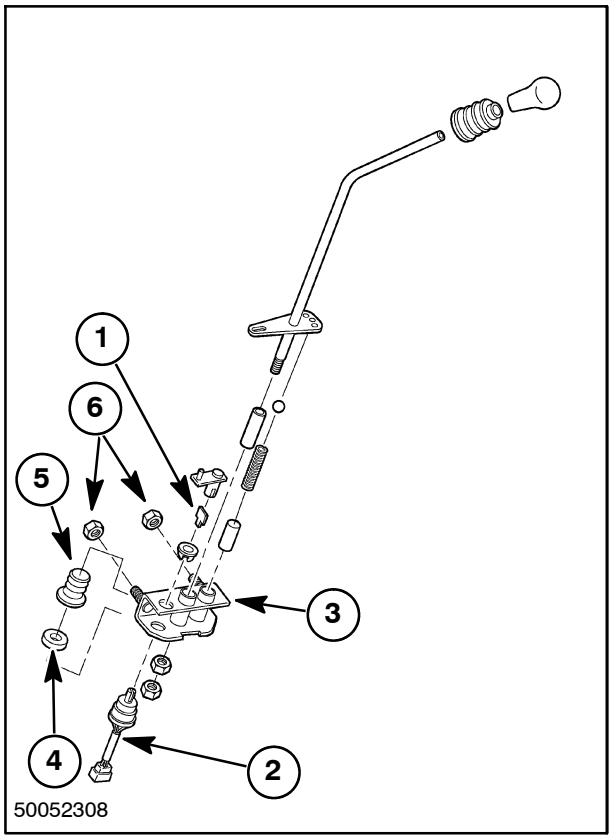
If any other test results are found the switch is defective and should be replaced.



59

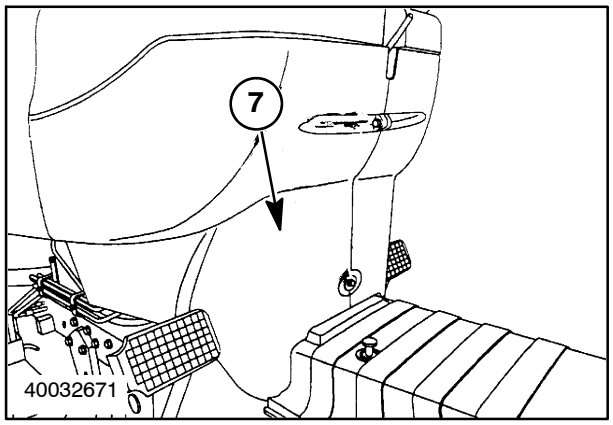
Installation

1. Install spade, 1, into the slot of the switch post.
2. Install switch, 2, (aligning spade that is in post of switch into slot of shift linkage) into mounting bracket, 3, insert tab of switch into slot in mounting bracket, secure with switch retaining nut, 4, and place rubber boot, 5, on top of switch.
3. Install switch and mounting bracket assembly onto steering column and secure with the two nuts, 6.
4. Connect the switch to the tractor wire harness.



60

5. Install the left side steering column shroud, 7.
6. Connect the negative (-) battery cable from the negative (-) battery terminal.

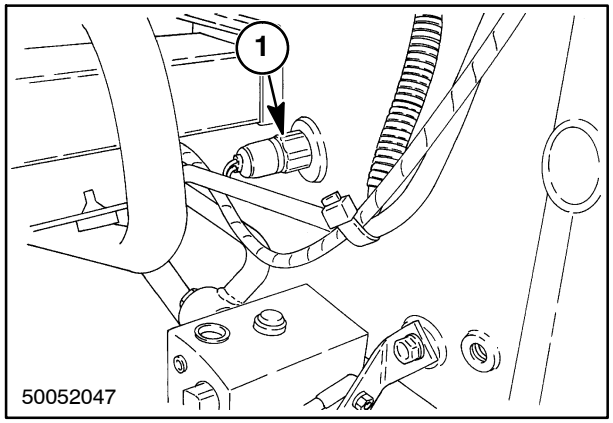


61

TRANSMISSION MODULATION SWITCHES

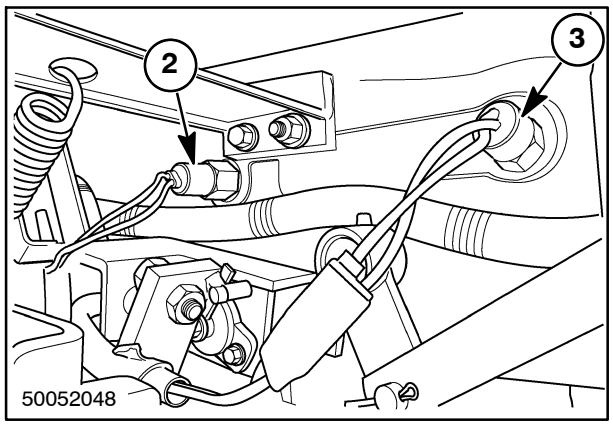
There are three transmission modulations switches on the EHSS transmission. Single-pole push button type switch that is externally mounted on transmission case, but internally actuated.

1. Main transmission 1-2 (right front of transmission).



62

2. High Range (left rear of transmission).
3. Low Range (left rear of transmission).



63

The purpose of these switches, is to supply current to the EHSS control module when the transmission is in 1st or 2nd gear and when either in “HIGH” or “LOW” range gears, so that the controller can supply different modulations during a shuttle shift.

Removal (All Switches)

NOTE: *Place shift lever in either in 1st or 2nd gear to aid in switch removal and installation.*

Main 1-2 Switch (ball located behind switch)

1. Unplug wire leads from the switch to the wire harness.
2. Unscrew switch from transmission housing.

Testing

Use an ohmmeter between the leads of switch to test both positions of the switch.

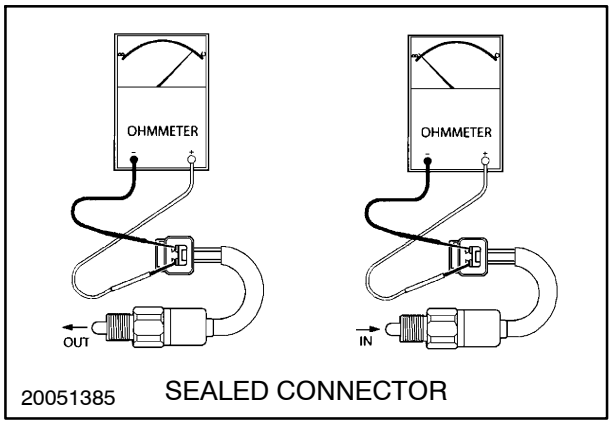
MAIN 1-2 Switch

1st or 2nd gear – switch closed – continuity

3rd or 4th gear - switch open – no continuity

EXTENDED POSITION – Continuity

RETRACTED POSITION – No Continuity



20051385 SEALED CONNECTOR

64

“HIGH” and “LOW” Range Switches

High or Low in engaged position – switch closed - continuity

EXTENDED POSITION – No continuity

RETRACTED POSITION – Continuity

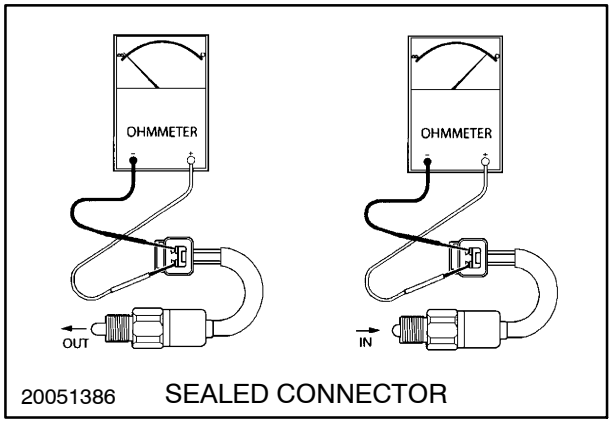
If any other test results are found the switch is defective and should be replaced.

Installation (All Switches)

1. Thread switch into transmission housing, make sure there is a sealing washer installed on end of switch.

NOTE: *On Main 1-2 switch, install ball into housing before installing switch.*

2. Connect wire leads from switch to wire harness.
3. Connect the negative (-) battery cable from the negative (-) battery terminal.

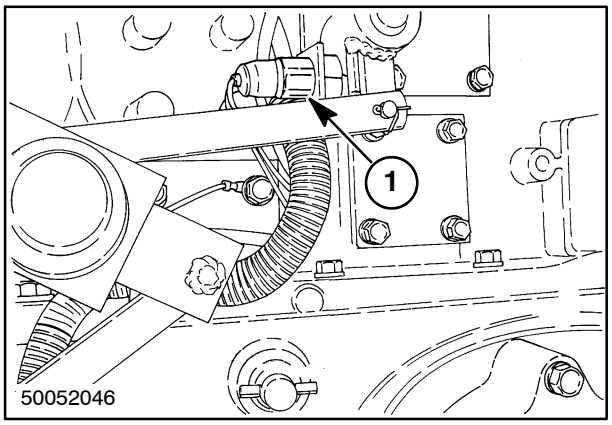


20051386 SEALED CONNECTOR

65

PTO Safety Switch

The rear PTO safety switch, 1, is a single-pole, push button type switch, located on the rear left side of the tractor on the PTO shift lever support bracket. When the PTO is in the “ON” position (lever in the forward position) the switch contacts are open. The tractor will not start when the PTO is engaged. When the PTO is in the “OFF” position, (lever in the rear position) the switch plunger retracts to close the contacts, completing the circuit and allowing the tractor to start.



66

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Unplug wire leads from the switch to the wire harness.
3. Unscrew switch from shift lever support bracket.

Testing

Use an ohmmeter between the leads of switch to test both positions of the switch.

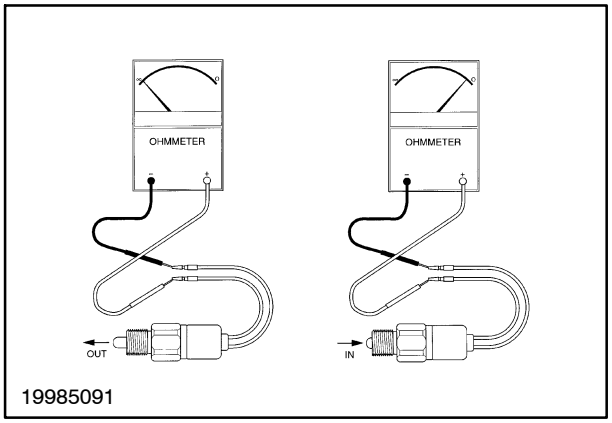
PTO “ON” Position – No Continuity

PTO “OFF” Position – Continuity

EXTENDED POSITION – No continuity

RETRACTED POSITION – Continuity

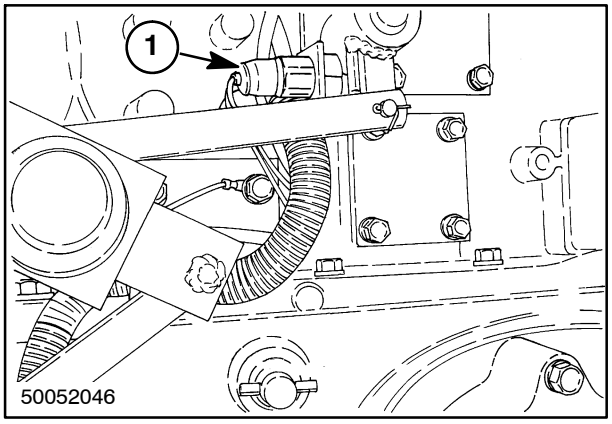
If any other test results are found the switch is defective and should be replaced.



67

Installation

1. Thread switch, 1, into shift lever support bracket.
2. Plug wire leads, 2, from the switch into the wire harness.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.



68

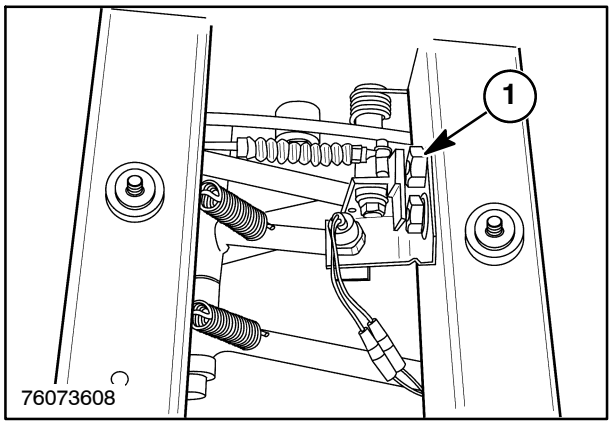
PARK BRAKE SAFETY SWITCH

Description

NOTE: *The right-side operator platform was removed to provide a view of the location of the park brake switch.*

The park brake safety switch, 1, is a single-pole push button type switch, located underneath the right-side operator platform. When the park brake is engaged, the switch contacts are closed.

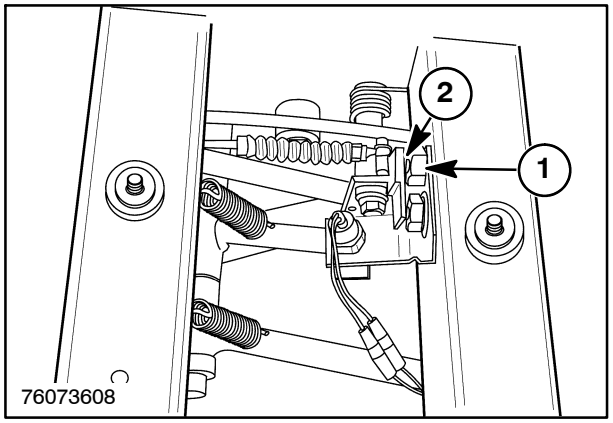
This allows the tractor to start or run with operator out of the operator's seat, providing the shuttle switch is in the "NEUTRAL" position.



69

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the right-side operator platform.
3. Unplug wire leads from the switch to the wire harness.
4. Remove jam nut, 1, from end of switch and unscrew switch, 2, from platform support bracket.



70

Testing

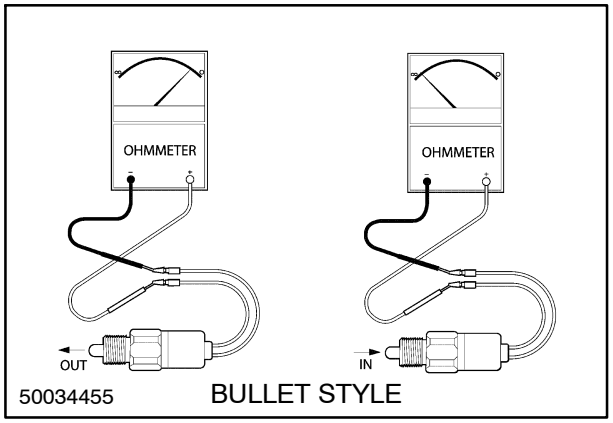
Use an ohmmeter between the leads of switch to test both positions of the switch.

Park brakes applied, switch is extended and contacts are closed. (Continuity)

EXTENDED POSITION – Continuity

RETRACTED POSITION – No Continuity

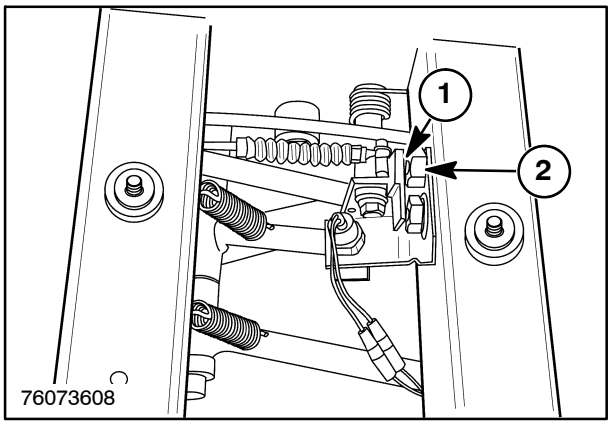
If any other test results are found the switch is defective and should be replaced.



71

Installation

1. Thread switch, 1, into the operator platform support and install and tighten jam nut, 2, on end of switch.
2. Plug wire leads from the switch into the wire harness.
3. Install operator platform.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.



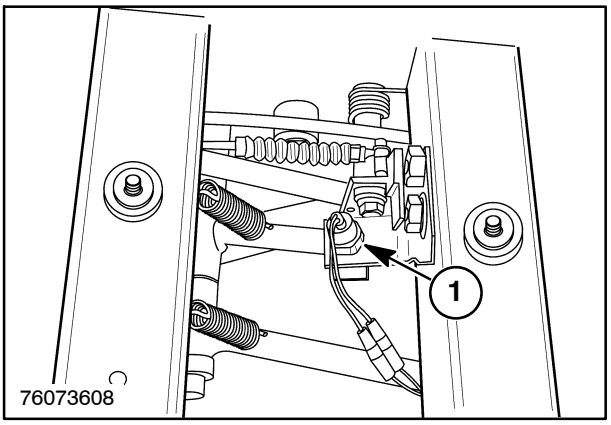
72

BRAKE LIGHT SWITCH

Description

NOTE: *The right-side operator platform was removed to provide a view of the location of the brake light switch.*

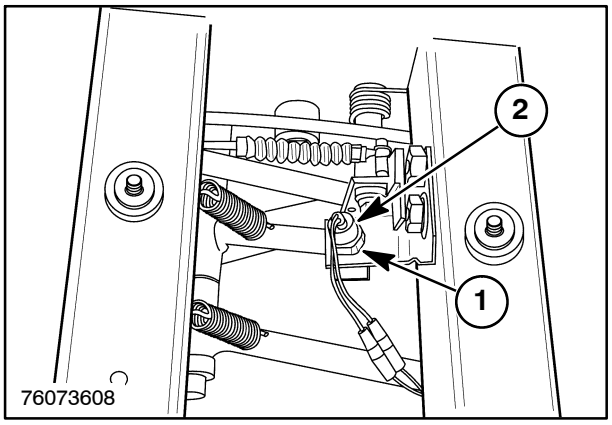
The brake light switch, 1, is a single-pole push button type switch, located underneath the right-side operator platform. When the brake pedals are depressed, the switch contacts are closed.



73

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the right-side operator platform.
3. Unplug the wire leads from the switch to the wire harness.
4. Remove the jam nut, 1, from the end of the switch and unscrew the switch, 2, from the switch support bracket.



74

Testing

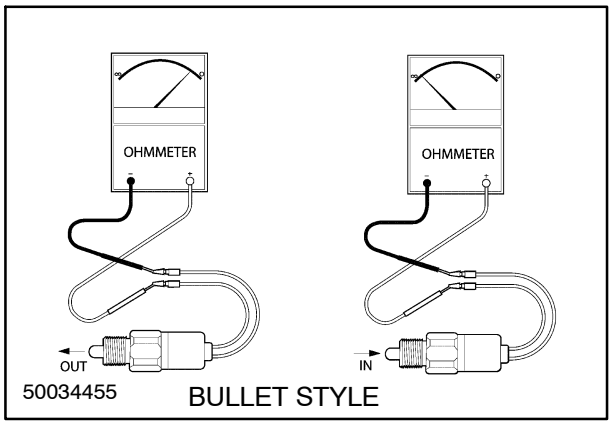
Use an ohmmeter between the leads of the switch to test both positions of the the switch.

When the brake pedals are depressed, the switch plunger is extended and the contacts are closed. (Continuity)

EXTENDED POSITION – Continuity

RETRACTED POSITION – No Continuity

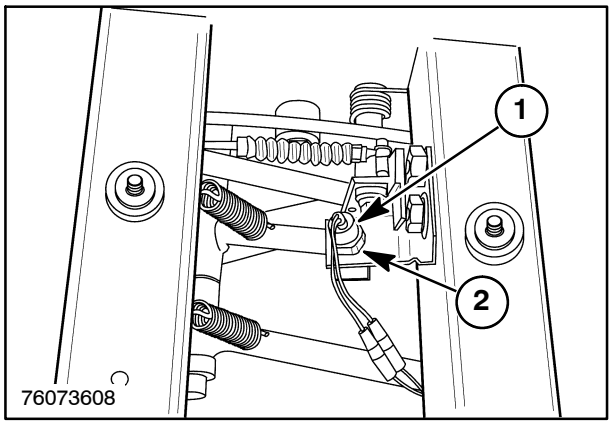
If any other test results are found the switch is defective and should be replaced.



75

Installation

1. Thread switch, 1, into the switch support bracket. Install and tighten jam nut, 2, on the end of the switch.
2. Plug wire leads from the switch into the wire harness.
3. Install the operator platform.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.



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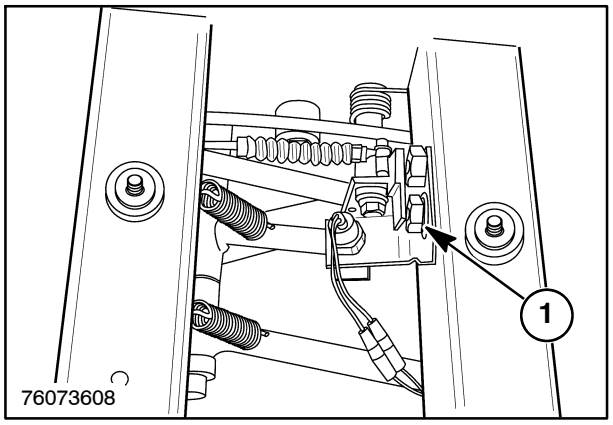
PARK BRAKE / BRAKE LIGHT INTERLOCK SWITCH

Description

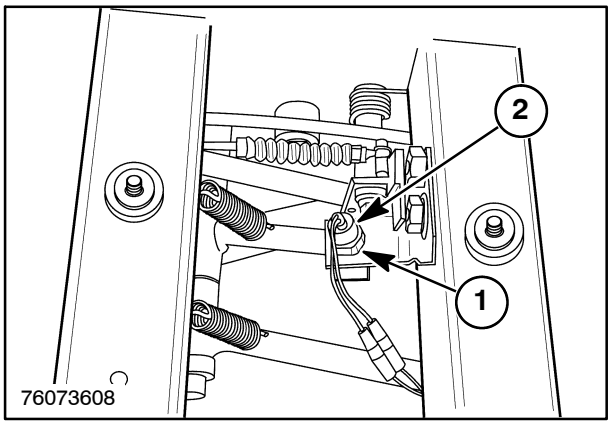
The park brake / brake light interlock switch, 1, is a single-pole push button type switch, located underneath the right-side operator platform. When the park brake is engaged, the interlock switch is open, interrupting the current flow to the brake light switch not allowing the brake lights to illuminate.



77

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the right-side operator platform.
3. Uplug the wire leads from the switch to the wire harness.
4. Remove the jam nut, 1, from the end of the switch and unscrew switch, 2, from the platform support bracket.



78

Testing

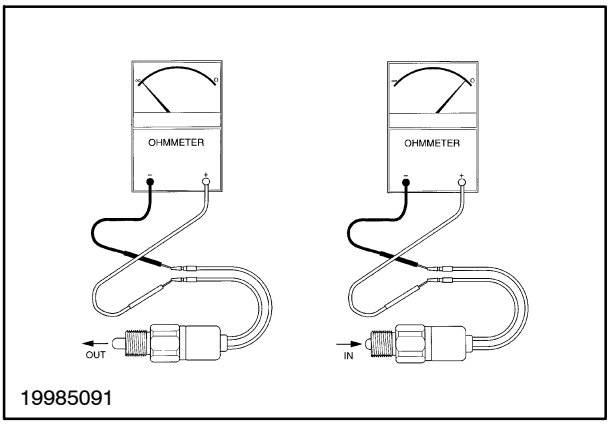
Use an ohmmeter between the leads of the switch to test both positions of the switch.

Park brakes applied, the switch is extended and contacts are open. (No Continuity)

EXTENDED POSITION - No Continuity.

RETRACTED POSITION - Continuity.

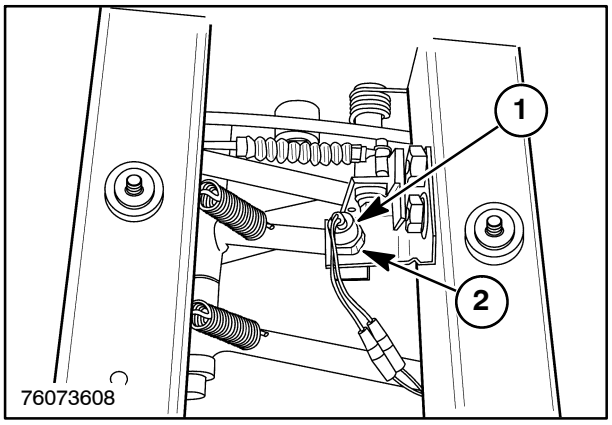
If any other test results are found, the switch is defective and should be replaced.



79

Installation

1. Thread switch, 1, into the operator platform support and install and tighten the jam nut, 2, on the end of the switch.
2. Plug wire leads from the switch into the wire harness.
3. Install the operator platform.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.

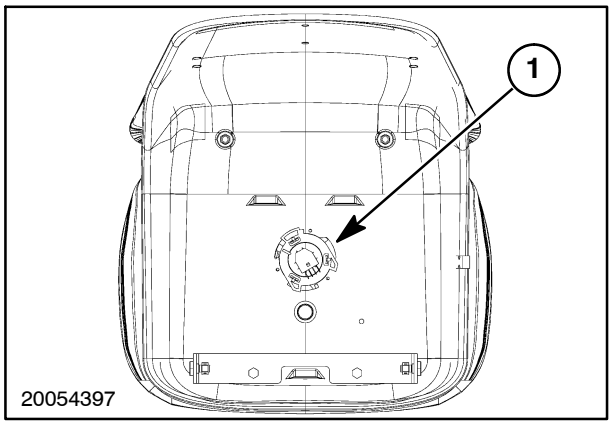


80

SEAT SAFETY SWITCH

Description

The seat safety start switch, 1, is a double pole, button type switch mounted to the bottom side of the seat pan. When the operator is not seated, the switch contacts are open and will not allow the tractor to start. When the operator is seated, the switch contacts are closed, allowing the tractor to start.



81

Removal

NOTE: *The seat safety switch may be tested by removing the switch harness from the switch and placing ohmmeter test leads on the switch terminals. Push down on the middle of the seat to check for switch continuity. However, it is recommended to remove the seat switch from the seat for testing.*

1. Tilt the seat forward to reveal the seat safety switch.
2. Disconnect the seat switch harness from the switch.
3. Rotate the switch counter-clockwise to release the locking tabs and remove the switch from the seat.

Testing

Use an ohmmeter to test both of the positions of the seat switch for electrical continuity.

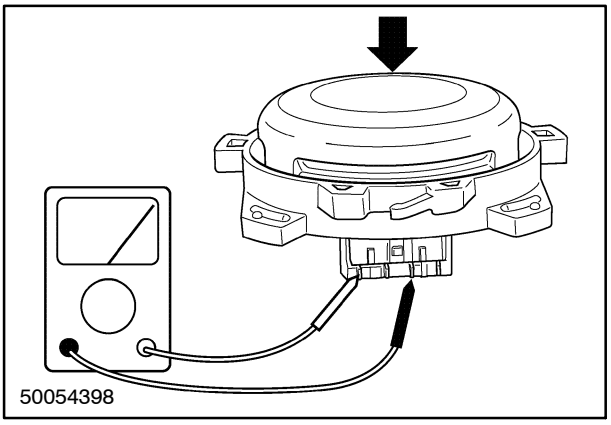
Extended Position

With the switch in the “extended” (OUT) position continuity should not exist between any of the four terminals. If continuity exists between any of the switch terminals while the switch is in the “extended” position, the switch is defective and needs to be replaced.

Retracted Position

With the switch in the “retracted” (IN) position, continuity should exist across the following terminals:

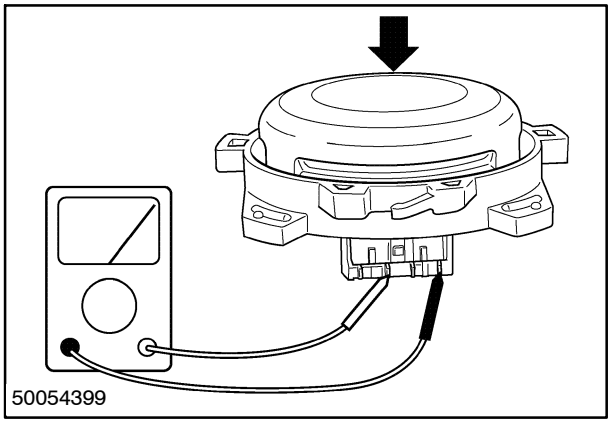
Check continuity between terminals #1 and #3.



82

Check continuity between terminals #2 and #4.

If continuity does not exist between the two sets of terminals while the switch is in the “retracted” position the switch is defective and needs to be replaced.



83

Installation

1. Tilt the seat forward to reveal the bottom of the seat.
2. Rotate the switch clockwise to retain the locking tabs.
3. Connect the seat switch harness to the switch.

RELAYS

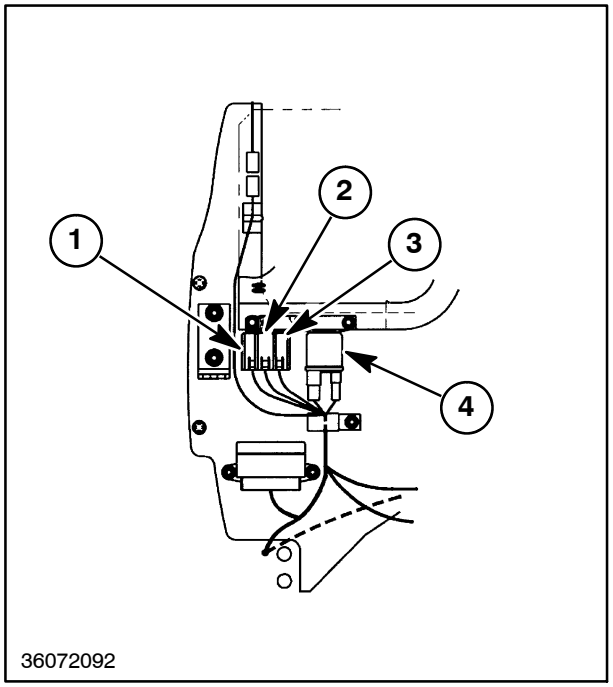
Description

Relays are used on the tractors to automatically complete (close) a circuit. A relay contains two parts of a circuit. One part, the control circuit, uses current to energize a coil. The other part, the function circuit is a switch. When energized, the coil of the relay becomes an electromagnet opening or closing the function circuit.

There are six relays used on T2410 or T2420 tractors.

Relay Locations:

1. Road lights - Right side of engine firewall.
2. Brake lights - Right side of engine firewall.
3. Work lights - Right side of engine firewall.
4. Engine glow plugs – Right side of engine fire wall.



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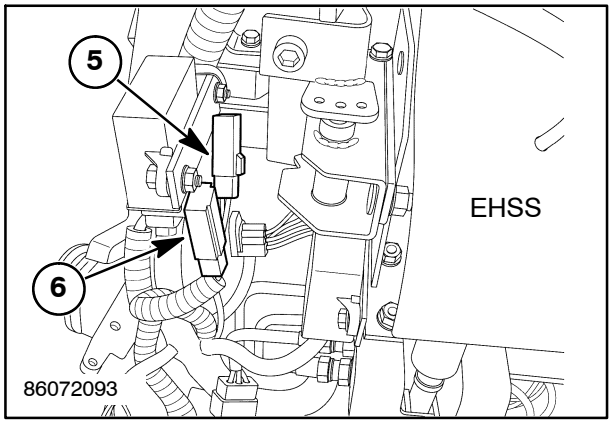
5. Safety start – Left side of steering column.
6. ACC power – Left side of steering column.



85

ROAD LIGHTS RELAY

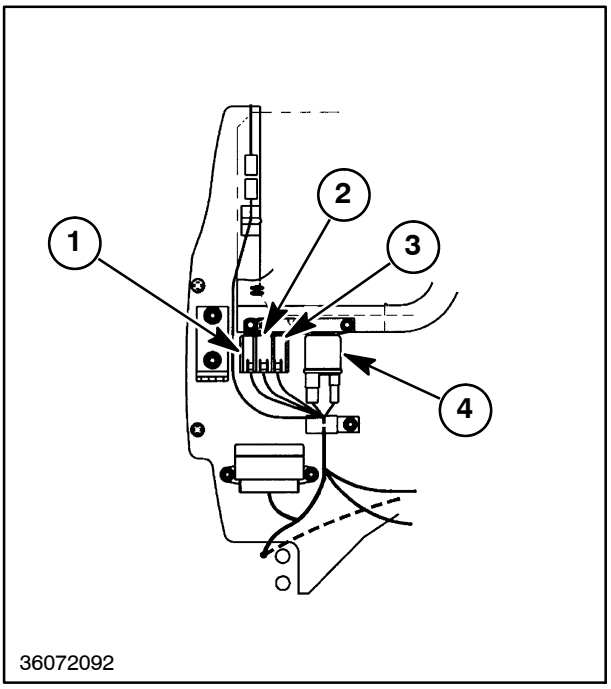
The road lights relay, 1, provides the current to the front dual element head lights. The road light switch controls the road lights relay. When the relay latches it sends current to the road lights high / low switch. When the high / low switch is in the back position the low beams illuminate and when in the front position the high beams illuminate.

BRAKE LIGHTS RELAY

The brake lights relay, 2, provides current to the two rear brake lights. The brake lights switch controls the brake lights relay. When the relay latches it sends current to the brake lights.

WORK LIGHTS RELAY

The work lights relay, 3, provides the current to the front single element work lights. The work lights switch controls the work lights relay. When the relay latches it sends current to the front work lights.



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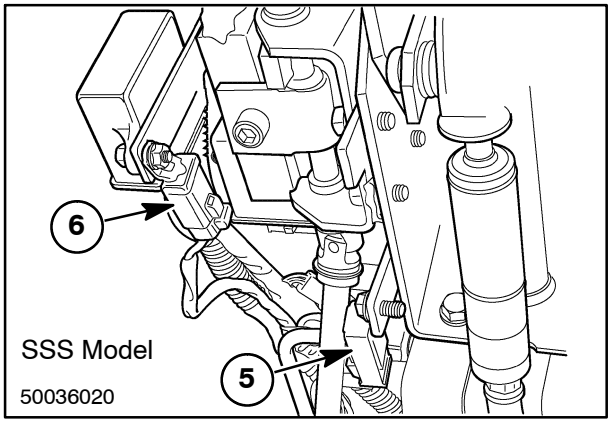
ENGINE GLOW PLUG RELAY

The glow plug relay, 4, provides current to the engine glow plugs for preheating the engine. The key switch sends current to the safety controller and the controller transfers current to the relay. The safety controller limits the amount of time (5 seconds) that current is provided to the relay and glow plugs.

SAFETY START RELAY

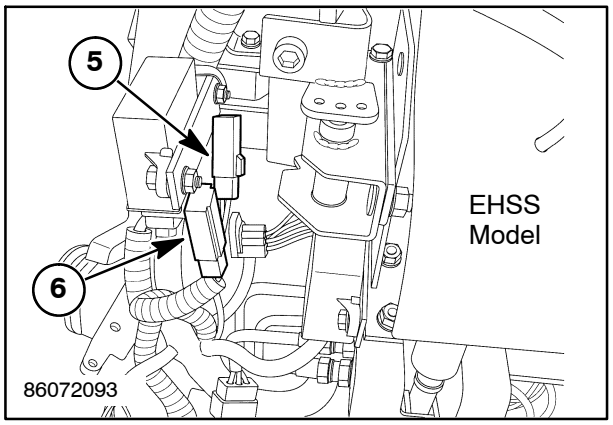
The safety start relay, 5, provides current to the engine starter, for starting the engine. The safety controller sends current to the relay, so that the relay can activate and latch. The forward /reverse shuttle, rear PTO, seat and parking brake safety switches act in series to provide current to the controller.



87

AUXILIARY POWER RELAY

The auxiliary power relay, 6, provides current to the auxiliary electrical power socket, located behind the operator's seat. The relay is activated when the key switch is in the "ACC/RUN position.



88

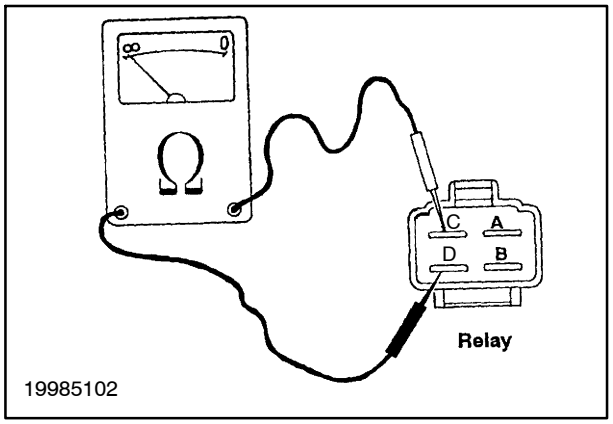
Relay Removal (All Relays)

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Unplug the wire harness connector from the relay.
3. Remove the retaining screw and remove the relay from the tractor.

Relay Testing
(Road Lights, Work Lights, Safety Start, Brake Light, Auxiliary Power)

NON-ENERGIZED

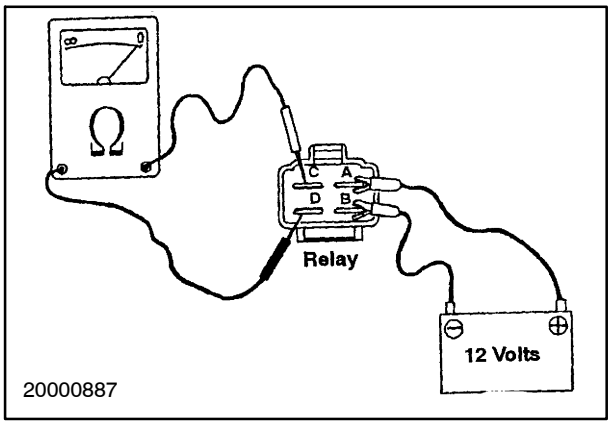
1. Connect the ohmmeter test probes to terminals "C" and "D" of the relay. Observe the ohmmeter reading.
2. There should be no continuity between the terminals "C" and "D" when the relay is not energized. If continuity exists between terminals "C" and "D" when the relay is not energized, the relay is defective and requires replacement.



89

ENERGIZED

1. Connect a jumper wire from the positive (+) terminal of the 12-volt power source to the “A” terminal of the relay.
2. Connect the negative (-) terminal of the 12-volt power source to the “B” terminal of the relay.
3. Connect the ohmmeter test probes to terminals “C” and “D” on the relay. Observe the ohmmeter reading.
4. There should be little or no resistance between the “C” and “D” terminals of the relay when energized, indicating that continuity exists between terminals “C” and “D”. If continuity does not exist between terminals “C” and “D” when the relay is energized, the relay is defective and requires replacement.

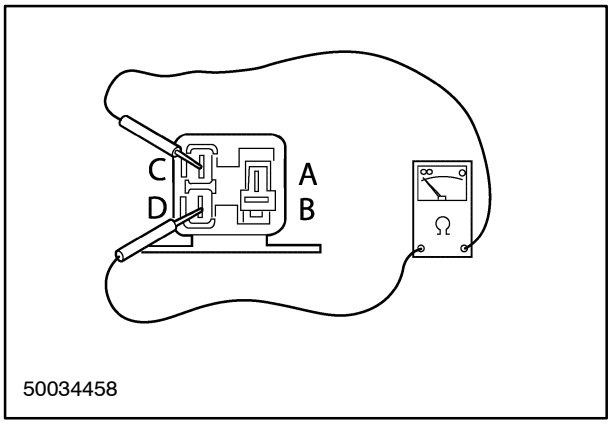


90

GLOW PLUG RELAY TESTING

NON-ENERGIZED

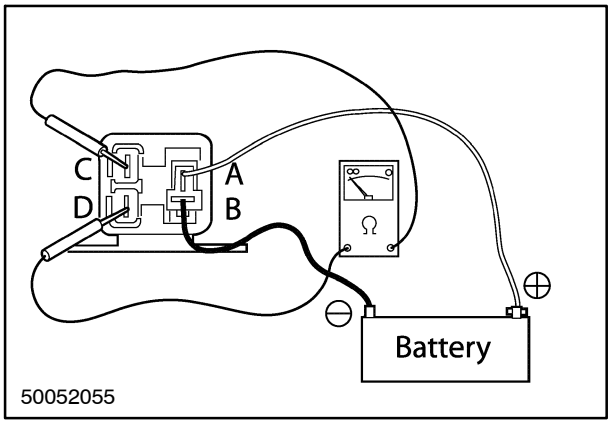
1. Using an ohmmeter. Connect test probes to terminals “C” and “D” on the relay. Observe the ohmmeter reading.
2. There should be high resistance between terminals “C” and “D”. Indicating no continuity and that the relay is functioning properly when non- energized. If there is continuity, the relay is defective and needs to be replaced.



91

ENERGIZED

1. To test the relay when energized, connect jumper wires to a 12-volt power source and to terminals “A” and “B” (brass terminals) on the relay.
2. Connect ohmmeter test probes to the “C” and “D” terminals on the relay and observe the ohmmeter. Little or no resistance between the terminals indicates that there is continuity and that the relay is functioning properly. If there is no continuity between the terminals, the relay is defective and needs to be replaced.



92

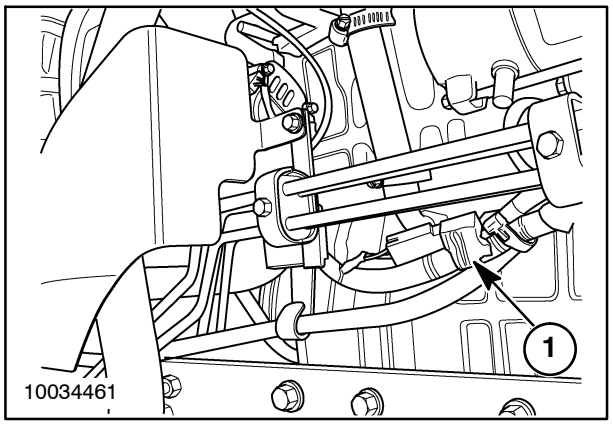
Relay Installation (All Relays)

1. Install the retaining screw and relay onto the tractor.
2. Plug the wire harness connector into the relay.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.

DIODES

Charging System Diode

The charging system diode, 1, is located along the left side of the engine near the alternator. The charging system diode is used to prevent current from back feeding into the low charge indicator light within the instrument panel.



93

Removal

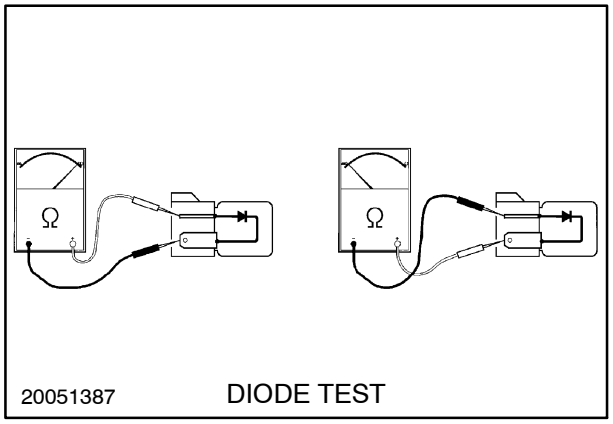
1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Unplug the connector from the diode.
3. Remove the diode from the tractor.

Testing

NOTE: *For this test, an electrical multimeter with diode test capabilities may be used in place of an ohmmeter. If a multimeter with diode testing capabilities is unavailable, use an ohmmeter to test as described below.*

Use an ohmmeter to verify that the diode is functioning properly.

The diode should allow current to flow in one direction but not the other. Touch the ohmmeter test probes to the diode terminals and observe the ohmmeter. Switch the ohmmeter test probes and observe the ohmmeter. The ohmmeter should show little or no resistance the one way and a high resistance the other way indicating that the diode is only allowing current to flow in one direction. If the test results are not as described, the diode is defective and requires replacement.



94

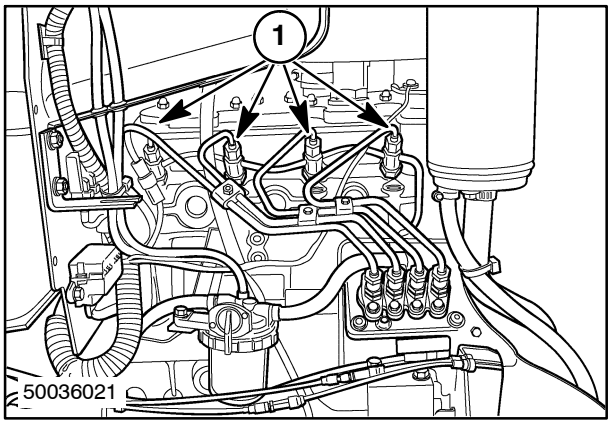
Installation

1. Plug the diode into the connector on the tractor wire harness.
2. Connect the negative (-) battery cable to the negative (-) battery terminal.

ENGINE GLOW PLUGS

Description

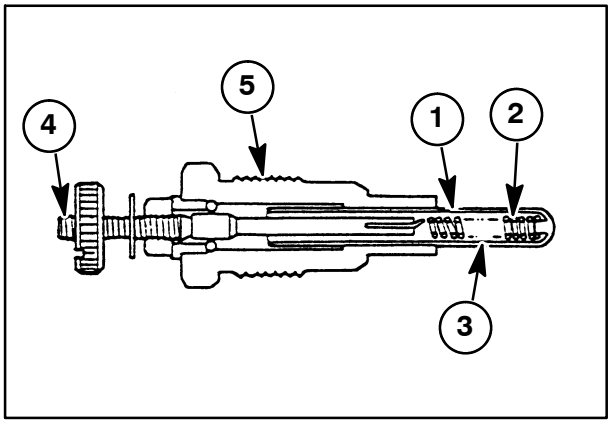
The engine glow plugs, 1, are located on the right side of the cylinder head, above the fuel injectors. The glow plugs are used to preheat the air in the pre-combustion chamber. This aids in the starting of the engine when cold.



95

The glow plugs use a heating element that is contained in a stainless steel sheath, 1. The coiled heating wire, 2, is sintered into magnesium oxide powder, 3. The magnesium oxide powder is used to evenly transfer heat to the stainless steel sheath, which heats the air in the combustion chamber. The magnesium oxide powder is also used to insulate the heating wire from the outer sheath and glow plug body.

The glow plug heats when electrical current is passed from the glow plug electrode, 4, to one end of the heating wire, 2. Electrical resistance warms the heating wire when electrical current is flowing through the wire. The opposite end of the wire is connected to the sheath. The sheath and the glow plug body, 5, are grounded by the engine block.



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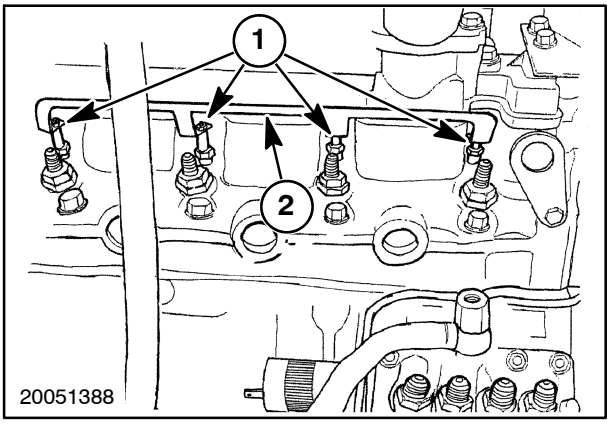
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the three nuts, 1, and the washers securing the electrode bar, 2, to the glow plugs.
3. Remove the glow plugs from the cylinder engine head.



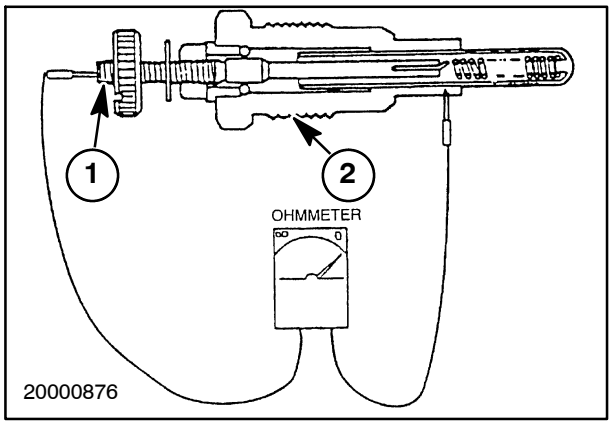
97

Testing

1. Clean the carbon from the glow plug sheath.

NOTE: *Do not test resistance using the glow plug sheath.*

2. Using an ohmmeter, touch one of the test probes to the glow plug electrode, 1. Touch the other test probe to the glow plug body, 2.
3. Observe the ohmmeter. A resistance reading of 1.6 ohms maximum is normal for the engine glow plugs. If the resistance reading is too high, the glow plug is defective and requires replacement.



98

Installation

1. Thread the glow plugs into the engine cylinder head. Torque each glow plug to 10 - 15 N·m (11.0 - 14.5 ft-lbs).
2. Install the electrode bar and the washers onto the glow plugs. Secure by using the three nuts.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.

FUEL LEVEL SENDER

Description

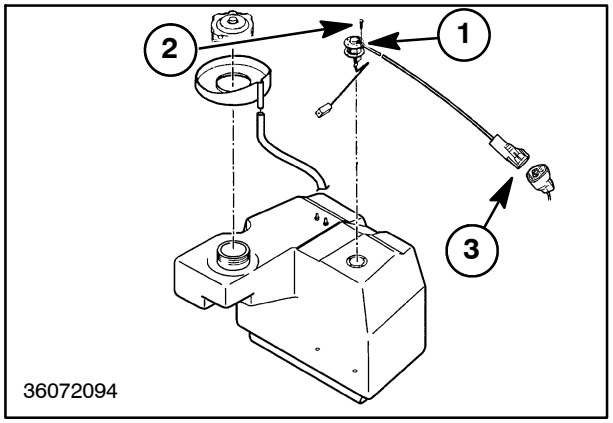
The fuel level sending unit, 1, is mounted on top of the inside of the fuel tank. The sender float moves up and down with the fuel level in the tank, while changing the resistance to the ground circuit of the fuel gauge.

Removal

⚠ WARNING ⚠

Do not expose diesel fuel to open flame or spark. Clean up spills immediately. Do not smoke while near diesel fuel. Serious injury could result.

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the panels from the center console of the tractor to gain access to the fuel tank.
3. Remove the five screws, 2, and disconnect the wire harness, 3, to remove from the fuel level sending unit from the fuel tank.



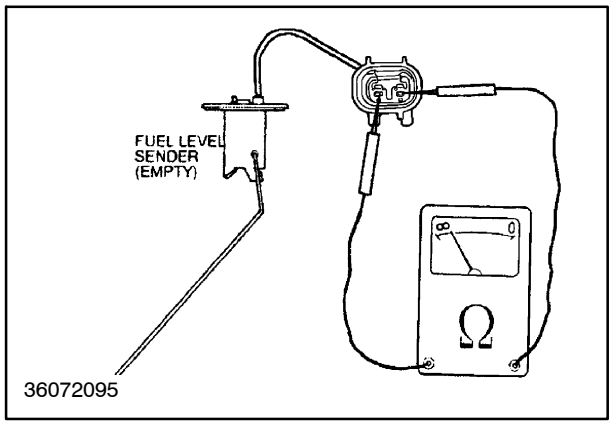
99

Testing

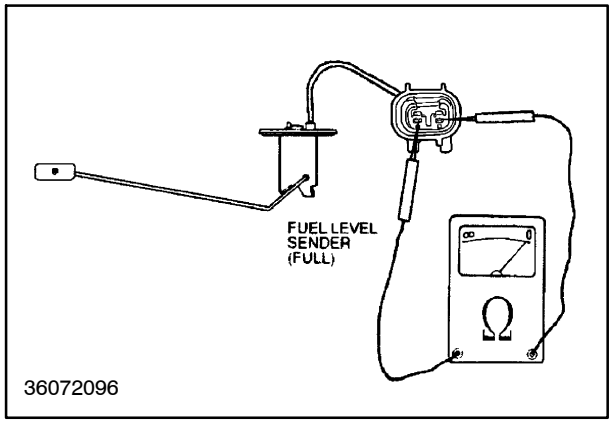
Use an ohmmeter to test the fuel level sender.

1. Remove the sender from the fuel tank.
2. Attach the meter leads, to the two leads of the sender wire harness.
   - With the sender in the EMPTY (DOWN) position, the meter reading will be 103 - 117 ohms.
   - With the sender in the FULL (UP) position, the meter reading will be 0.8 - 5 ohms.

If test results do not match the above, replace the fuel level sender.



100



101

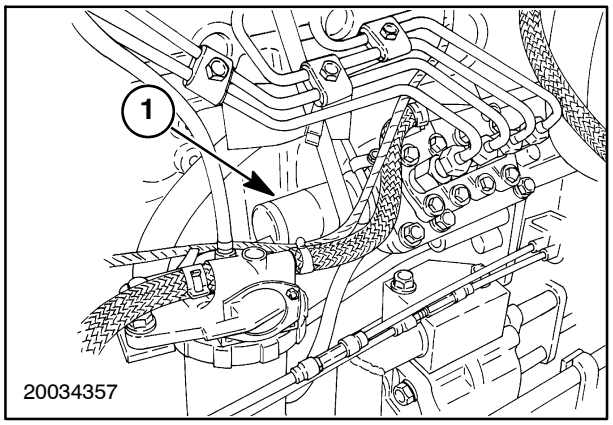
Installation

1. Install the fuel level sending unit by using the five screws.
2. Connect the tractor wire harness to the fuel level sending unit.
3. Install the panels onto the center console of the tractor.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.

FUEL SHUTOFF SOLENOID

Description

The injection pump is equipped with a fuel shutoff solenoid, 1, threaded into the rear of the injection pump casting. The solenoid plunger is spring-loaded; when the solenoid is not energized the plunger pushes the injection pump control rack forward into the closed (shut-off) position. When the solenoid is energized, as when the key switch is turned to the “On” and “Start” Positions, the solenoid plunger is retracted and the governor linkage moves the pump control rack rearward into operating position.



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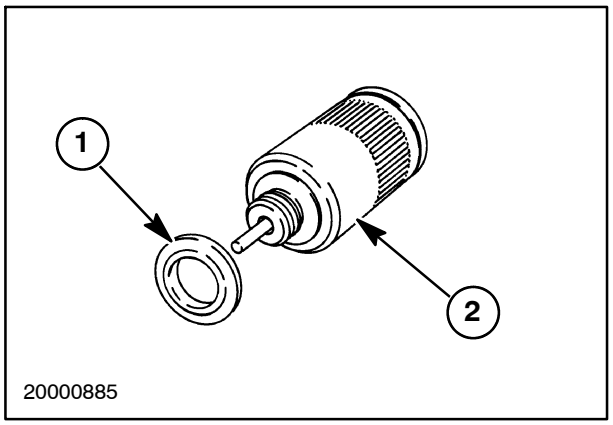
Removal

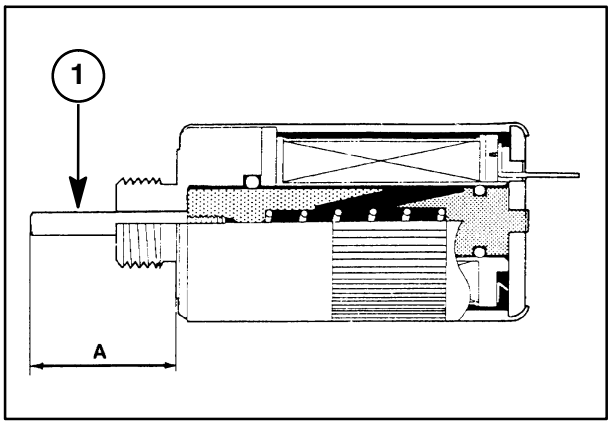
1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect the fuel shutoff wire from the fuel shutoff solenoid.
3. Using pliers, remove the solenoid from the rear of the injection pump casting.
4. Remove the sealing washer, 1, from the fuel shutoff solenoid, 2.



103

Testing

1. With the solenoid de-energized, measure the protrusion distance “A” of the plunger, 1, as shown at right.
   - In the shut-off position, the plunger protrusion distance, A, should measure 25.5 - 26.4 mm (1.004 - 1.04 in).



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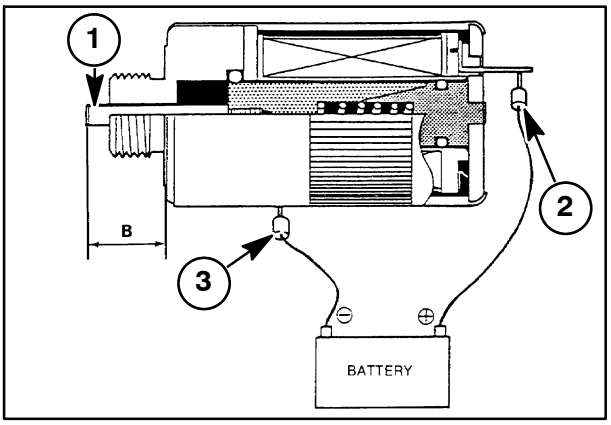
2. Connect a jumper wire from the solenoid terminal, 2, to the battery positive (+) terminal. Connect a second jumper from the battery negative (-) terminal to the solenoid body, 3. The solenoid plunger will retract. Measure the protrusion distance “B” of the plunger, 1, as shown at right.
   - In the retracted position, the plunger protrusion distance, B, should measure 11.5 - 14.5 mm (0.453 - 0.571 in).

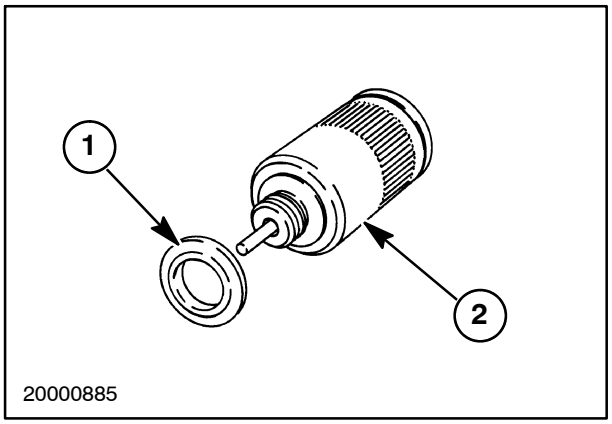
If the measurements are not within the limits specified above, replace the solenoid.



105

Installation

1. Install a new sealing washer, 1, onto the fuel shutoff solenoid, 2.
2. Thread the fuel shutoff solenoid, 2, into the back of the injection pump casting and tighten.
3. Connect the fuel shutoff solenoid wire to the fuel shutoff solenoid.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.



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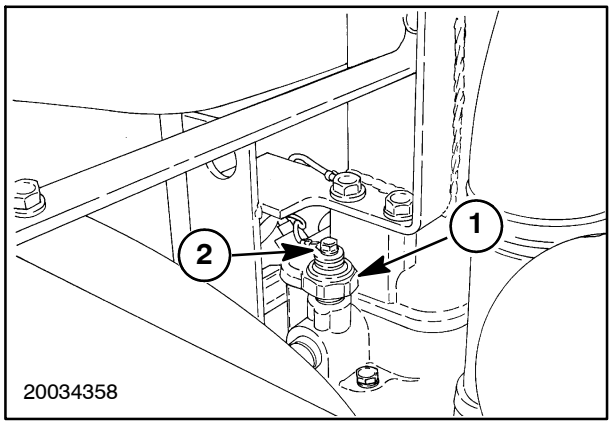
OIL PRESSURE SWITCH

Description

The oil pressure switch, 1, is located on the front of the engine cylinder head. The switch opens under normal oil pressure (above 6 PSI) and closes when the oil pressure is low (below 6 PSI) to complete the ground circuit of the oil pressure warning light.

When the ground circuit is completed, the oil pressure warning light within the instrument panel illuminates. The engine oil pressure switch is closed before the tractor engine is started, and is opened after the engine is started. If the warning light fails to stop illuminating after the engine is started, the oil level inside the engine may be low or there may be a problem with the tractor engine.



107

Removal

1. Remove the retaining screw, 2, that secures the electrical ring terminal to the oil pressure switch, 1.
2. Unthread the oil pressure switch from the engine cylinder head.

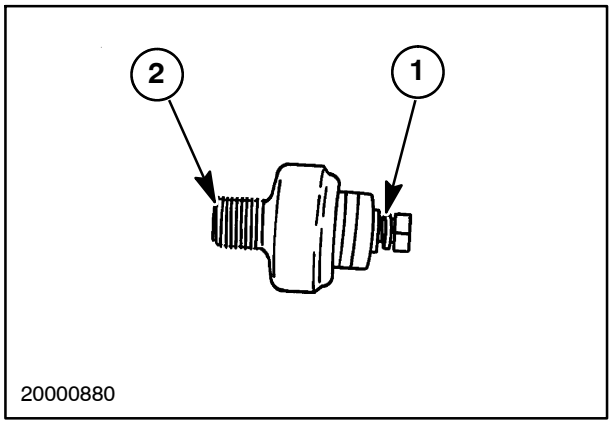
Testing

1. Using an ohmmeter, touch one test lead to the pressure switch terminal, 1, and the other test lead to the threads of the switch body, 2.
2. Observe the ohmmeter. There should be little or no resistance, indicating continuity in the switch. If there is no continuity, the switch is defective and needs replaced.

⚠ CAUTION ⚠

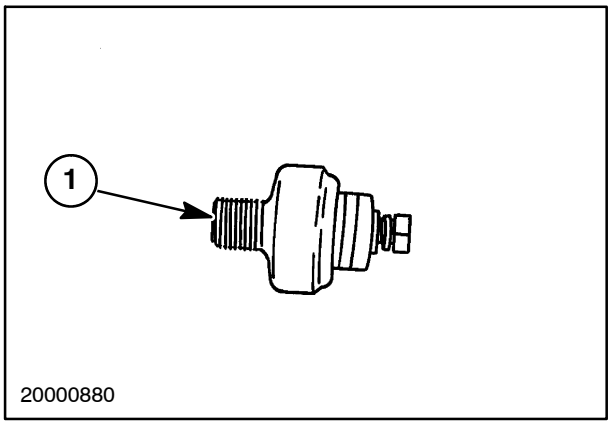
Do not use high pressure compressed air for the following test, otherwise damage may occur to the oil pressure switch.

NOTE: *The following test is not a calibrated test. The purpose of the test is to see if the switch contacts open at pressure.*



108

3. While the test leads are connected to the switch, pressurize the switch oil pressure port, 1, with low pressure (10 - 20 psi) compressed air.
4. Observe the ohmmeter. While air pressure is being supplied to the oil pressure port, the ohmmeter should indicate high resistance, or no continuity. If there is continuity, the switch is defective and needs replaced.



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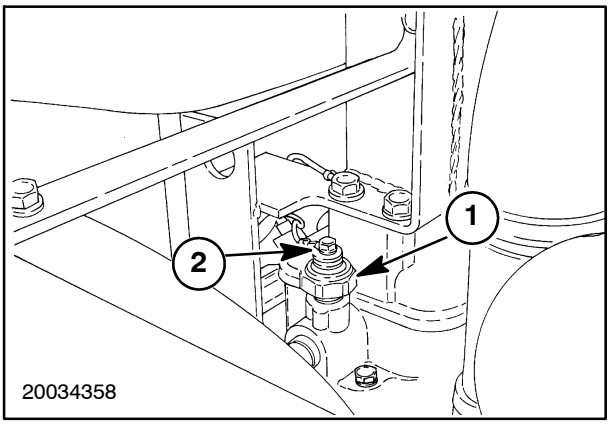
Installation

1. Apply Loctite® - 567 thread sealant onto the switch threads and install the oil pressure switch, 1, into the engine cylinder head.
2. Install the ring terminal onto the oil pressure switch by using the retaining screw, 2.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.



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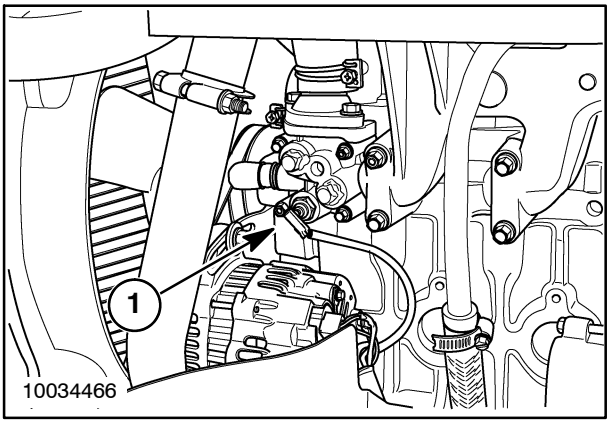
COOLANT TEMPERATURE SENDING UNIT

Description

The engine coolant temperature sending unit, 1, is located on the left side of the thermostat housing. The sending unit regulates a variable resistance to ground, which translates to movement of the engine temperature gauge within the instrument panel. The sending unit decreases ground resistance as the coolant temperature rises, causing the temperature gauge to rise.



111

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Drain the engine coolant from the radiator into a clean pan.
3. Disconnect the wire lead from the sending unit.
4. Unthread the engine coolant-sending unit from the thermostat housing for removal.

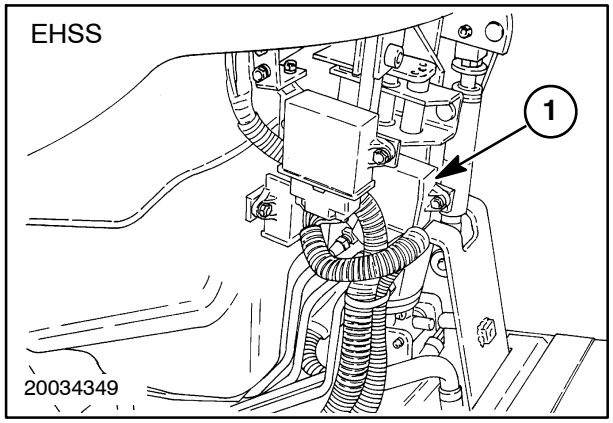
Installation

1. Apply Loctite - 567 to the threaded portion of the engine coolant temperature sending unit.
2. Install the engine coolant temperature sending unit into the thermostat housing.
3. Connect the wire lead to the engine coolant temperature sending unit.
4. Fill the radiator with the recommended coolant mixture.
5. Connect the negative (-) battery cable to the negative (-) battery terminal.

SAFETY AND FLASHER CONTROLLERS

SAFETY CONTROLLER

The safety controller, 1, located on the left side of the steering column, coordinates the safety start, safe operation and shutdown functions of the tractor electrical system.



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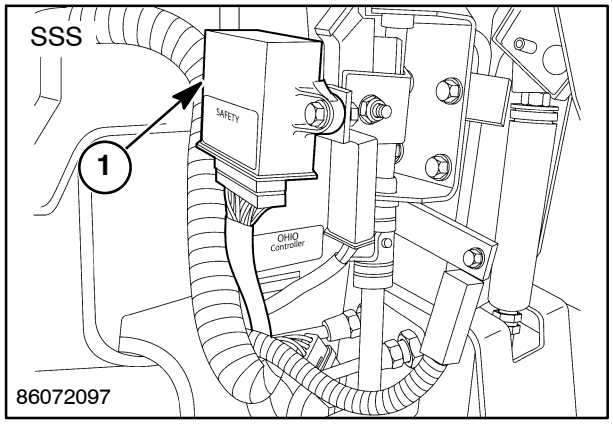
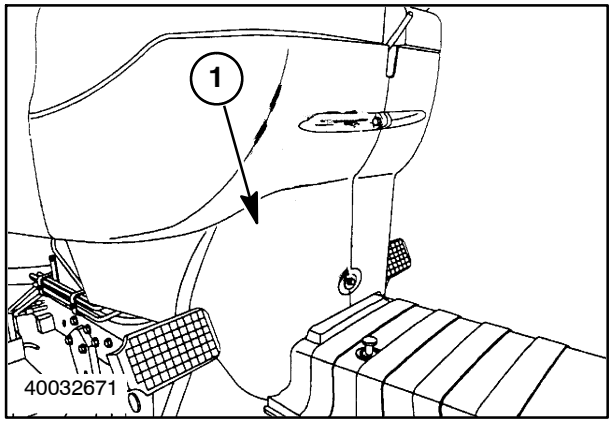


113

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the left side steering column shroud, 1.
3. Disconnect the safety controller from the tractor wire harness.
4. Remove the two mounting screws and remove controller from the tractor.



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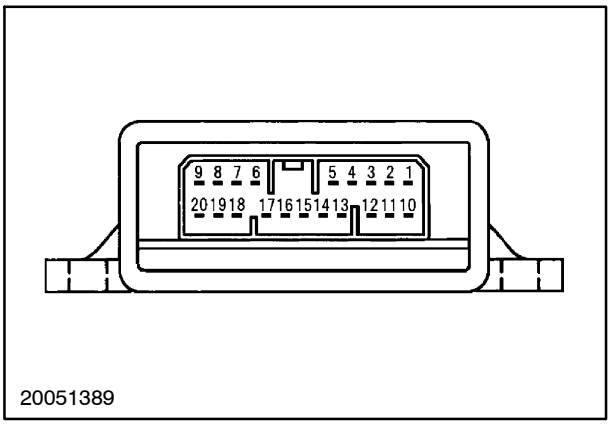
Testing

Terminal identification (as viewed from bottom of switch).



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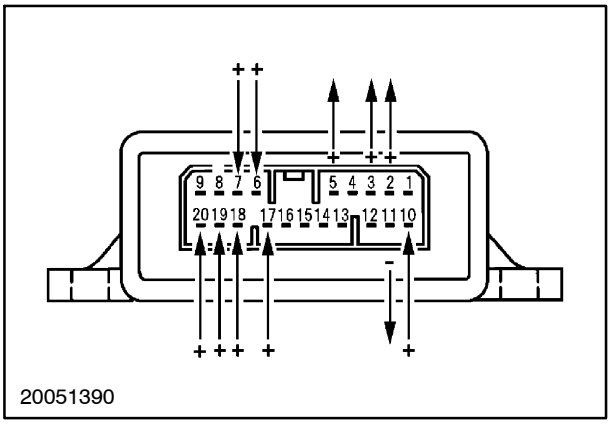
Terminal #	Function	Terminal #	Function
1	Not used.	11	Ground (-).
2	To safety start relay via clutch safety switch.	12	Not used.
3	To glow plug relay.	13	Not used.
4	To alarm buzzer.	14	From parking brake lamp.
5	To fuel shutoff solenoid.	15	From glow plug lamp.
6	From terminal #19 of key switch.	16	From PTO indicator lamp.
7	10-amp #2 fuse (input).	17	From terminal #50 of key switch.
8	From seat switch.	18	From “AC” terminal of key switch via 10-amp fuse.
9	From parking brake switch.	19	From shuttle switch.
10	20-amp #3 fuse (input).	20	From rear PTO switch.

Testing Safety Start Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 6, 7, 10, 17, 18, 19, 20
Ground (-)	Terminal #11
Output (+)	Terminal #s 2, 3, 5



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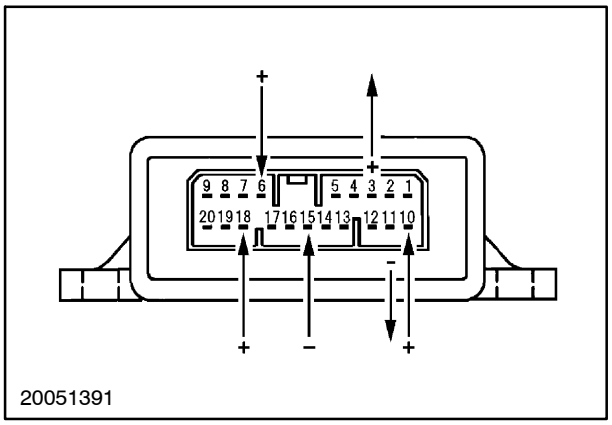
Testing Engine Preheat Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 6, 10, 18
Ground (-)	Terminal #11
Output (+)	Terminals #3
Input (-)	Terminal #15



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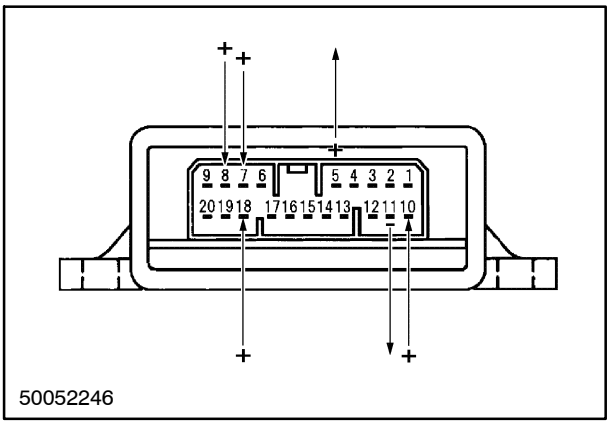
Testing Safe Operation Circuit (operator present)

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 7, 8, 10, 18
Ground (-)	Terminal # 11
Output (+)	Terminal # 5



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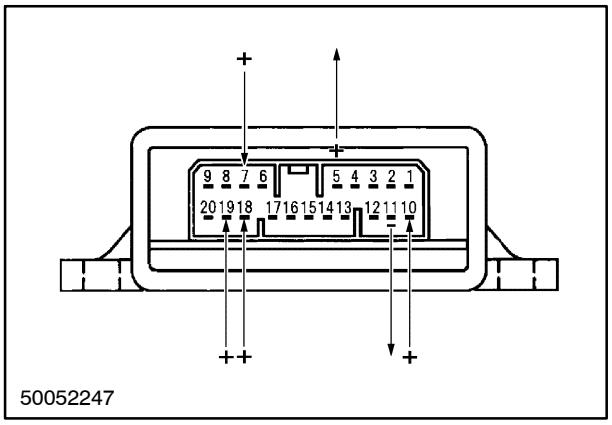
Testing Safe Operation Circuit (operator not present)

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 7, 10, 18 , 19
Ground (-)	Terminal # 11
Output (+)	Terminal # 5

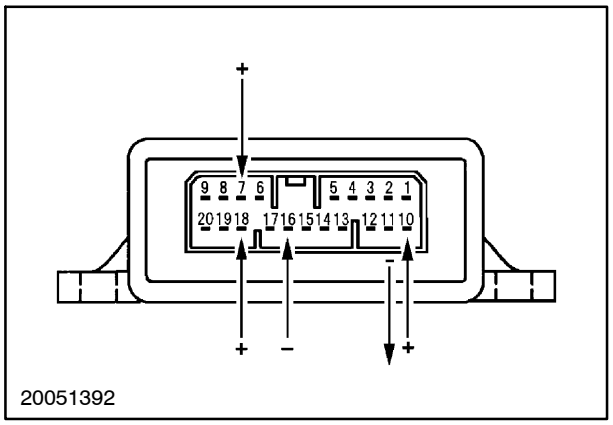


119

Testing PTO Indicator Light Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 7, 10, 18
Ground (-)	Terminal #11
Input (-)	Terminal #16

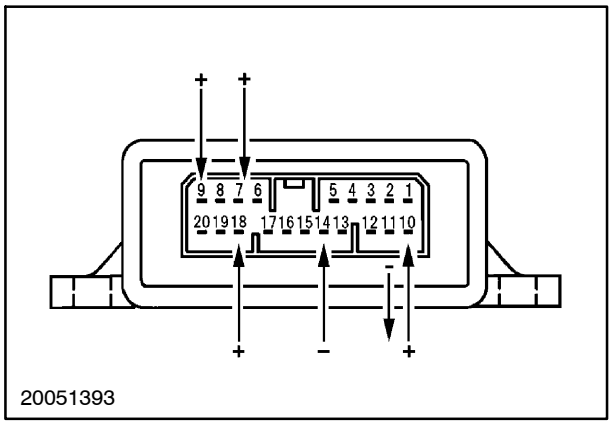


120

Testing Parking Brake Indicator Light Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals.

Input (+)	Terminal #s 7, 9, 10, 18
Ground (-)	Terminal #11
Input (-)	Terminal #14



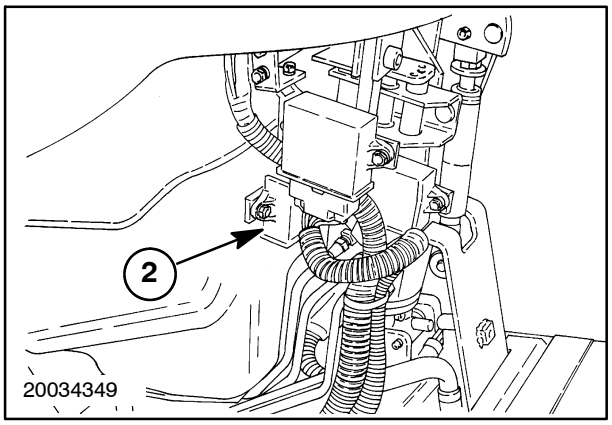
121

FLASHER CONTROLLER

The flasher controller, 2, located on the left side of the steering column, coordinates the hazard flashing and turn signal lights functions of the tractor electrical system.

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.



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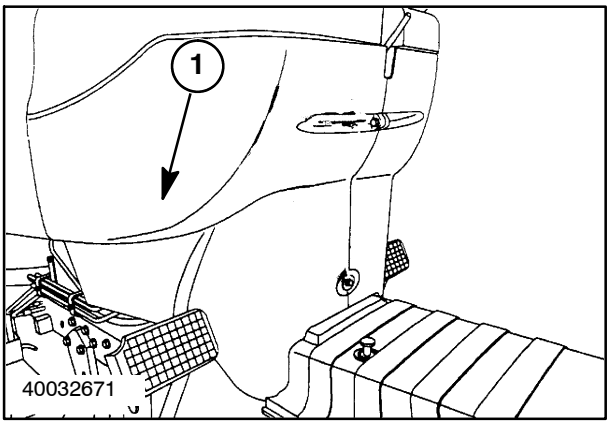
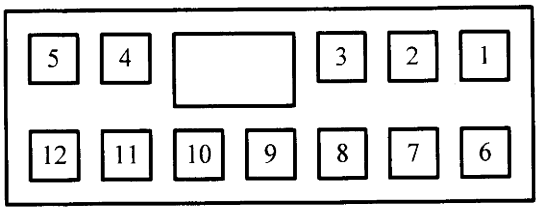
2. Remove the left side steering column shroud, 1.
3. Disconnect the flasher controller from the tractor wire harness.
4. Remove the two mounting screws and remove controller from the tractor.



123

Testing

Terminal identification (as viewed from bottom of controller).



Flasher Control Module Terminals

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Terminal #	Function	Terminal #	Function
1	Left turn flasher (red) (output).	7	#3 fuse 20 amp (input).
2	Right turn flasher (red) (output).	8	#3 fuse 20 amp (input).
3	Left flasher (yellow) (output).	9	Trailer hazard lights (output).
4	Hazard switch (input).	10	Turn signal switch left turn (input).
5	Ground (-).	11	Turn signal switch right turn (input).
6	Right flasher (yellow) (output).	12	#3 fuse 20 amp (input).

Flasher Controller Test

This test is designed to verify that the flasher controller is functioning properly.

Needed Parts

(1) Flasher controller

(4) 12V # 1156 bulbs

(1) 12 volt battery

14 or 16 gauge wire (different colors if available) determine length

(9) Female pin connectors

(2) Battery test connectors

Test Procedures

Connections For All Tests

1. Connect the four #1156 bulbs to the flasher controller at terminals #1, 2, 3, and 6 and the negative battery terminal as indicated in the test diagram.
2. Connect the #5 terminal of the controller to the negative terminal of the battery.

Hazard Lights Test

This test will simulate the hazard lights circuit being activated.

- Connect terminal #4 to the positive terminal of the battery.
- Connect terminal #7, 8, 12 to the positive terminal of the battery.

Results: Bulbs connected to terminals #3 and #6 will flash on and off.

Bulbs connected to terminals #1 and #2 will not illuminate.

Left Turn Signal Test

This test will simulate a left turn signal circuit.

- Connect terminal #10 to the positive terminal of the battery.
- Connect terminal #7, 8, 12 to the positive terminal of the battery.

Results: Bulbs connected to terminals #1 and #3 will flash on and off .

Bulbs connected to terminals #2 and #6 will illuminate (solid).

Right Turn Signal Test

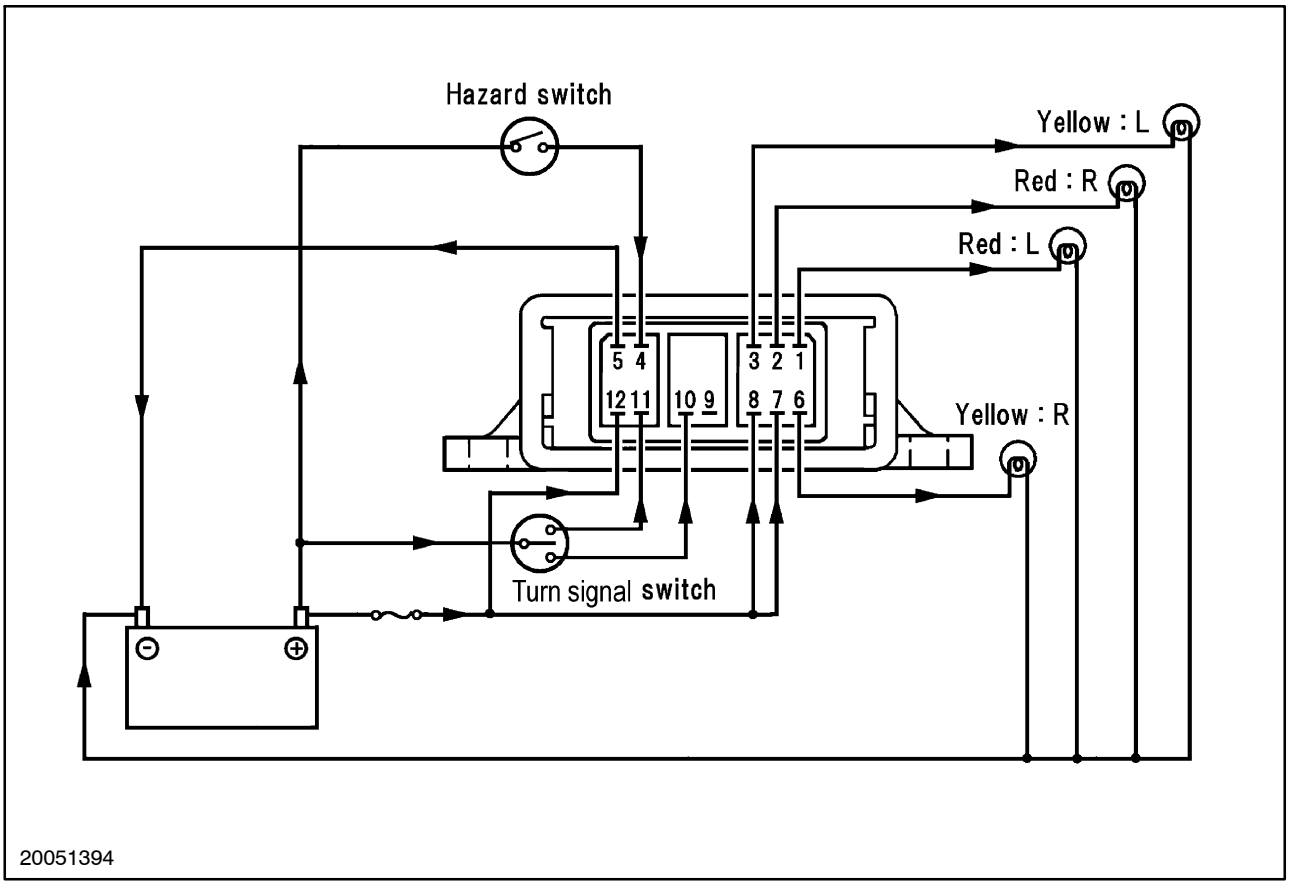
This test will simulate a right turn signal circuit.

- Connect terminal #11 to the positive terminal of the battery.
- Connect terminal #7, 8, 12 to the positive terminal of the battery.

Results: Bulbs connected to terminals #2 and #6 will flash on and off.

Bulbs connected to terminals #1 and #3 will illuminate (solid).

NOTE: *If all the results were as indicated as above, then the controller is good.*



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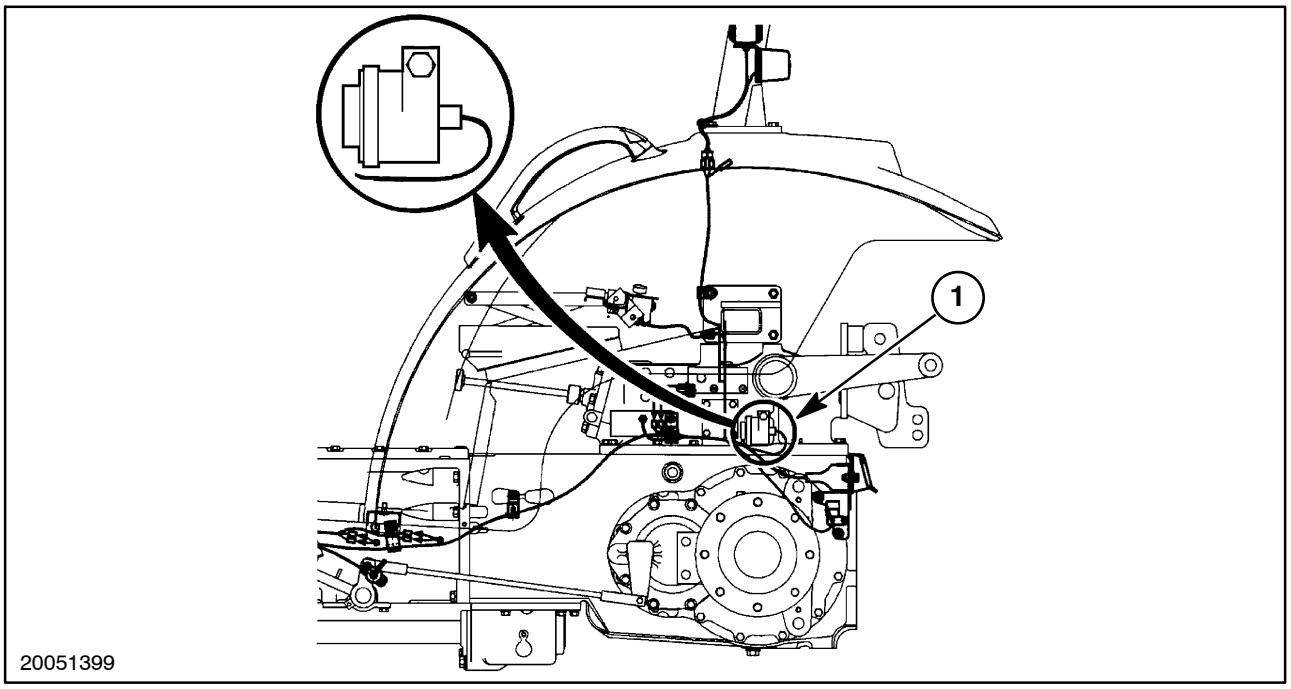

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SAFETY ALARM BUZZER

Description

The safety alarm buzzer, 1, is located on the left side of the HPL housing.

The buzzer will alarm for approximately eight seconds, when safety controller detects an unsafe operation by the tractor operator.

Examples Of Alarm Situation

A. Buzzer will activate when:

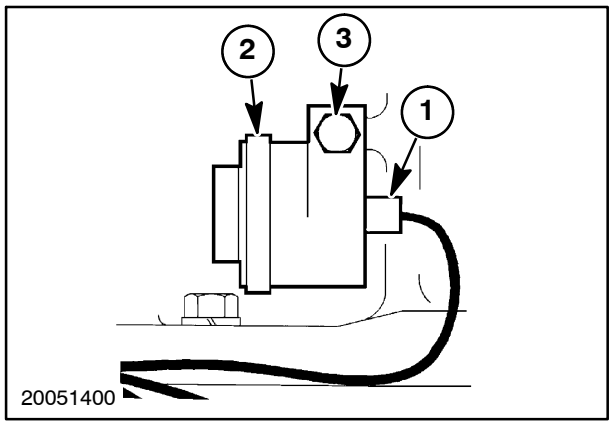
- Key switch in “OFF” position
- PTO in “OFF” position
- Range gear selector in “NEUTRAL” position
- Parking brake is in the “DISENGAGED” position

B. Buzzer will activate when:

- Engine is “RUNNING /Key “ON”
- PTO in “OFF” position
- Range selector in “GEAR” position
- Parking brake is in the “ENGAGED” position

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect the connector,1, from the buzzer, 2. Remove the mounting bolt, 3, and buzzer from the HPL housing.



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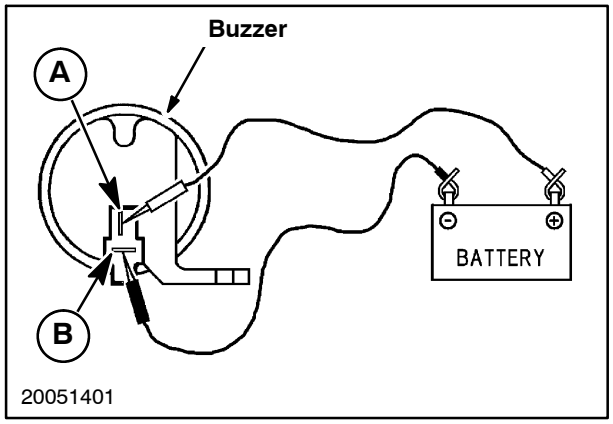
Inspection

NOTE: *The Buzzer cannot be inspected with an ohmmeter.*

1. Connect terminal “A” to the positive terminal of a battery, using a jumper wire.
2. Connect terminal “B” to the negative terminal of a battery, using a jumper wire.
3. The buzzer should alarm when connected to the battery. If the buzzer does not alarm, replace the buzzer.



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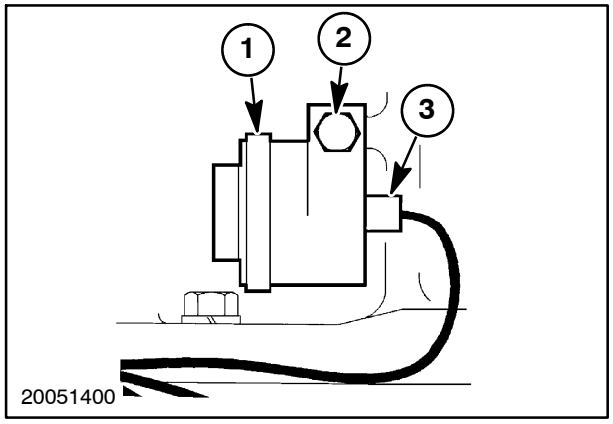
Installation

1. Install the buzzer, 1, on the HPL housing using bolt, 2.
2. Connect the connector, 3, to the buzzer.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.



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SECTION 55 - ELECTRICAL SYSTEM

Chapter 2 - Electrical Circuits

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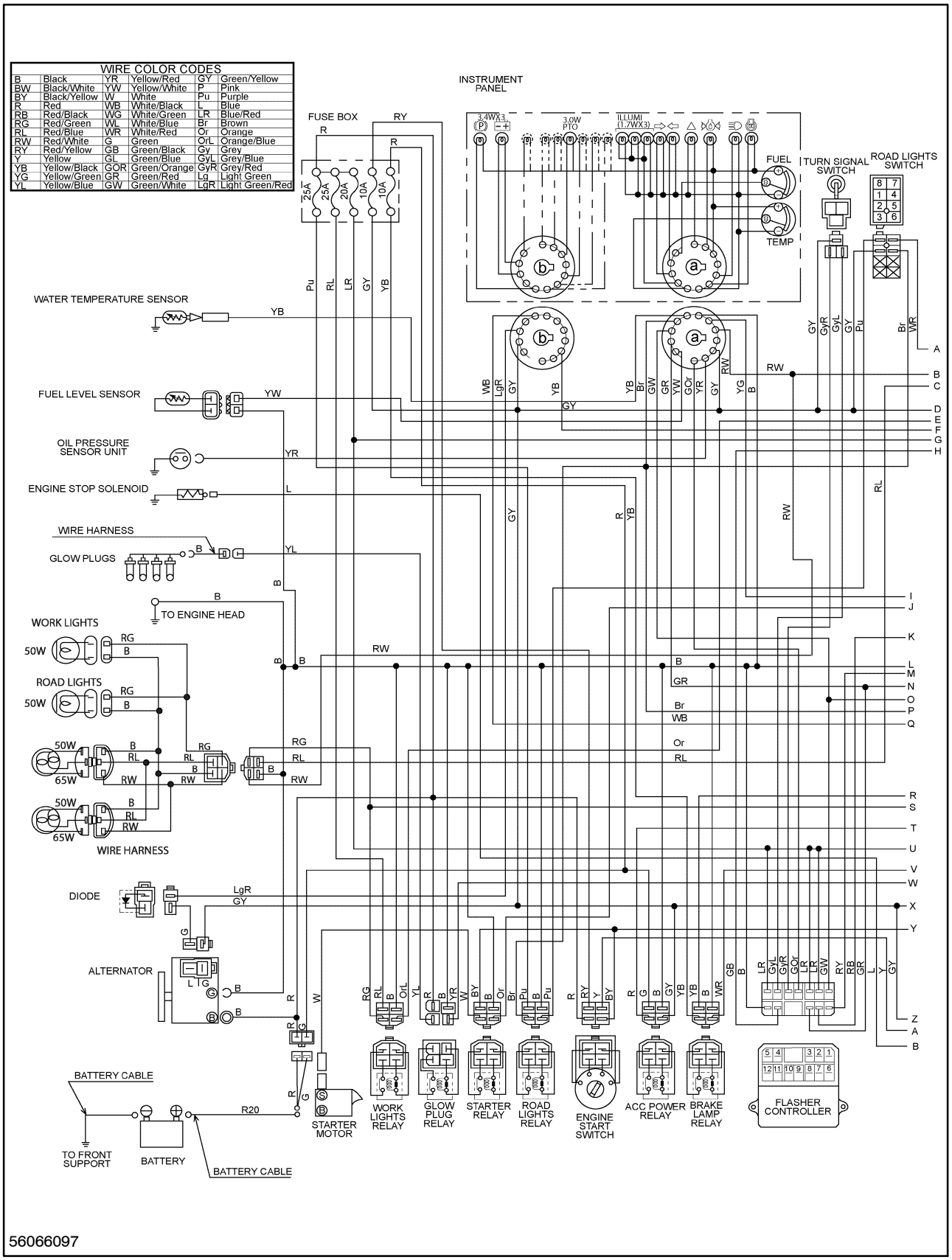
COMPLETE SCHEMATICS
T2410 - T2420



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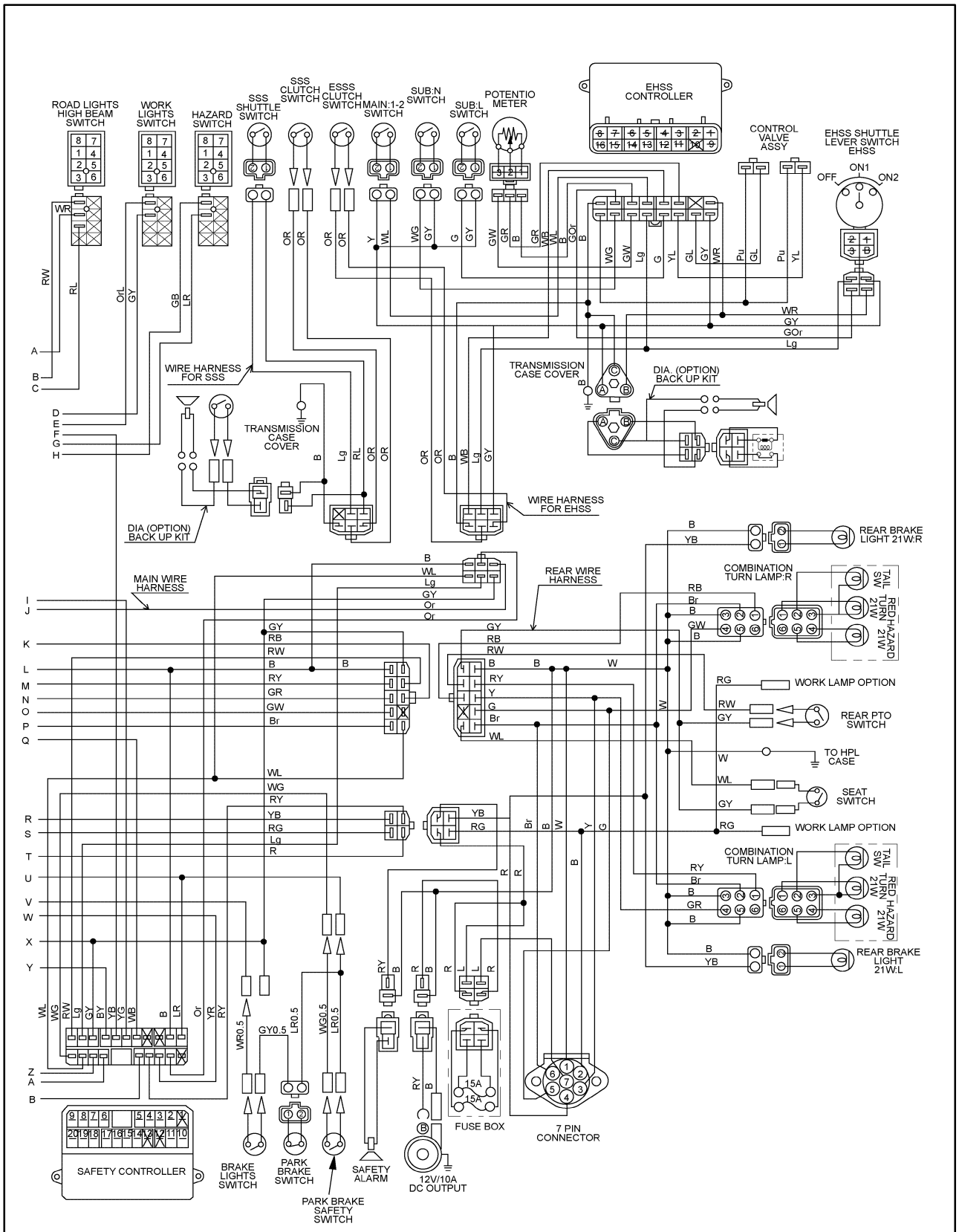
COMPLETE SCHEMATICS (CONT.)
T2410 - T2420



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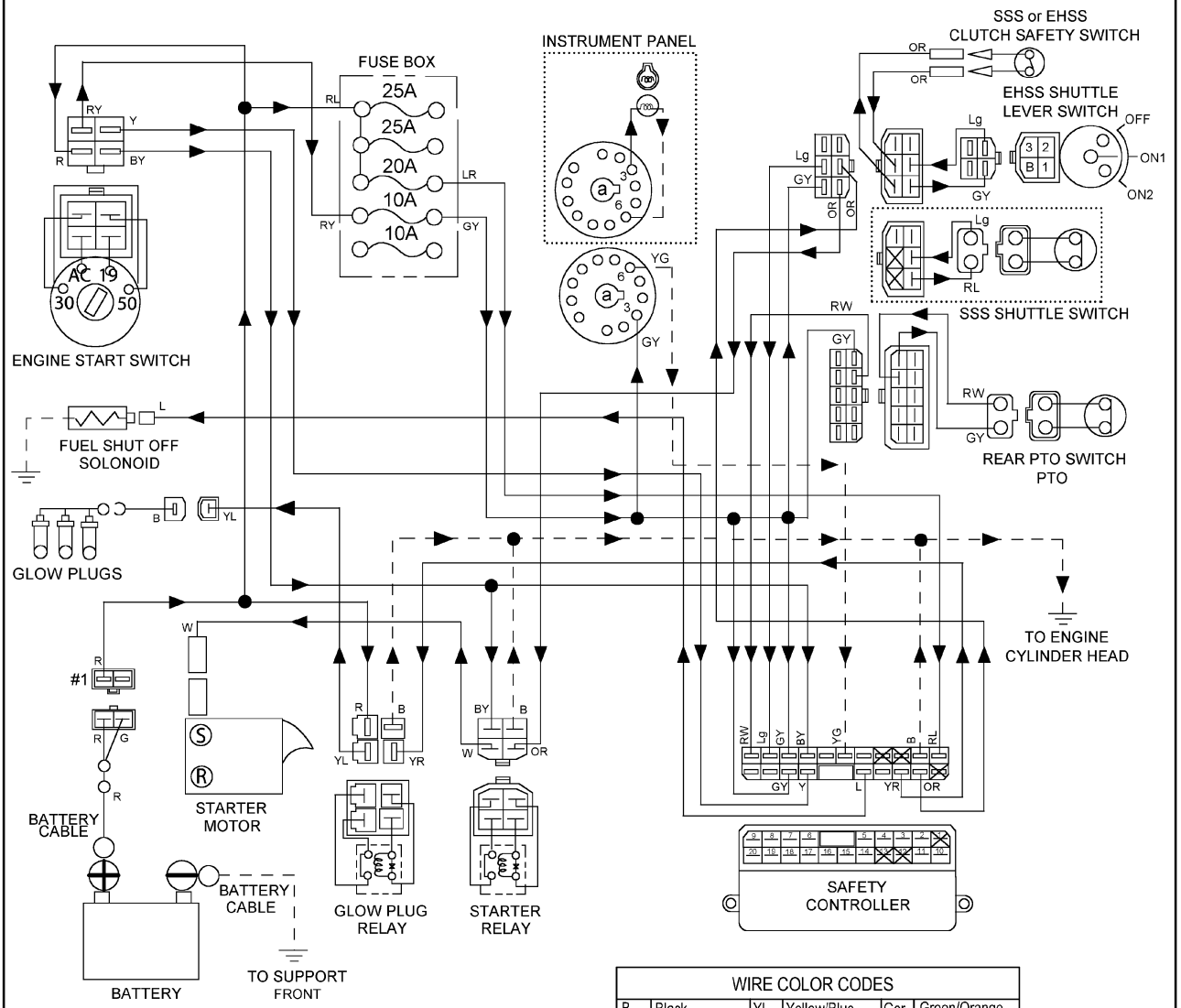
STARTING CIRCUIT - (WITH OR WITHOUT OPERATOR PRESENT)



WIRE COLOR CODES					
B	Black	YL	Yellow/Blue	Gor	Green/Orange
BY	Black/Yellow	YW	Yellow/White	Pu	Purple
BW	Black/White	W	White	P	Pink
R	Red	WR	White/Red	L	Blue
RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
RY	Red/Yellow	WG	White/Green	Or	Orange
RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

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STARTING CIRCUIT - (WITH OR WITHOUT OPERATOR PRESENT)

NOTE: *The starting circuit is shown with:*

- Operator present or not present.
- EHSS or SSS shuttle lever in “NEUTRAL” position.
- Rear PTO in “OFF” position.
- Clutch pedal fully depressed position.

NOTE: *The seat switch and the park brake switch are unrelated to the safety start system of the tractor.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- Glow plug relay, switch side terminal.
- #3 fuse (20 amp).
- Terminal “30” of the key switch.

3. The #3 fuse (20 amp) supplies current to terminal #10 of the safety controller.
4. When the key switch is in the “START” position current crosses from terminal “30” to the “AC”, “50” and “19” terminals.

Terminal “AC” of Key Switch

1. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) of the fuse panel.
2. #2 fuse (10 amp) supplies current to:
   - Rear PTO switch.
   - “B” terminal of the “EHSS” or input side of “SSS” shuttle switch.
   - Terminals #7 and #18 of the safety controller.
   - Terminal #3 of the instrument panel “A” connecter.

Terminal “50” of Key Switch
Current flows from the “50” terminal of the key switch to the switch side of the starter relay and terminal #17 of the safety controller.

Terminal “19” of Key Switch
Current flows from the “19” terminal of the key switch to terminal #6 of the safety controller.

Shuttle Switch Function
When the shuttle switch is in the “NEUTRAL” position current transfers from terminal “B” to terminal #3. From terminal #3, current travels to terminal #19 of the safety controller.

Rear PTO Safety Switch Function
When the rear PTO is in the “OFF” position the PTO safety switch closes, sending current to terminal #20 of the safety controller.

Ground Circuits
Ground source for the starting circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following components:

- Glow plug relay (coil side).
- Starter relay (coil side).
- Terminal #11 of the safety controller.
- Terminal #6 of the instrument panel.

Safety Controller Functions
When the proper current inputs and ground path circuits are provided the following safety controller output currents and ground paths occur:

Controller Inputs:

- Terminal #6, from key switch terminal “19”.
- Terminal #7, from #2 fuse, (10 amp).
- Terminal #10, from #3 fuse, (20 amp).
- Terminal #17, from key switch terminal “50”.
- Terminal #18, from #2 fuse, (10 amp).
- Terminal #19, from shuttle switch.
- Terminal #20, from Rear PTO safety switch.

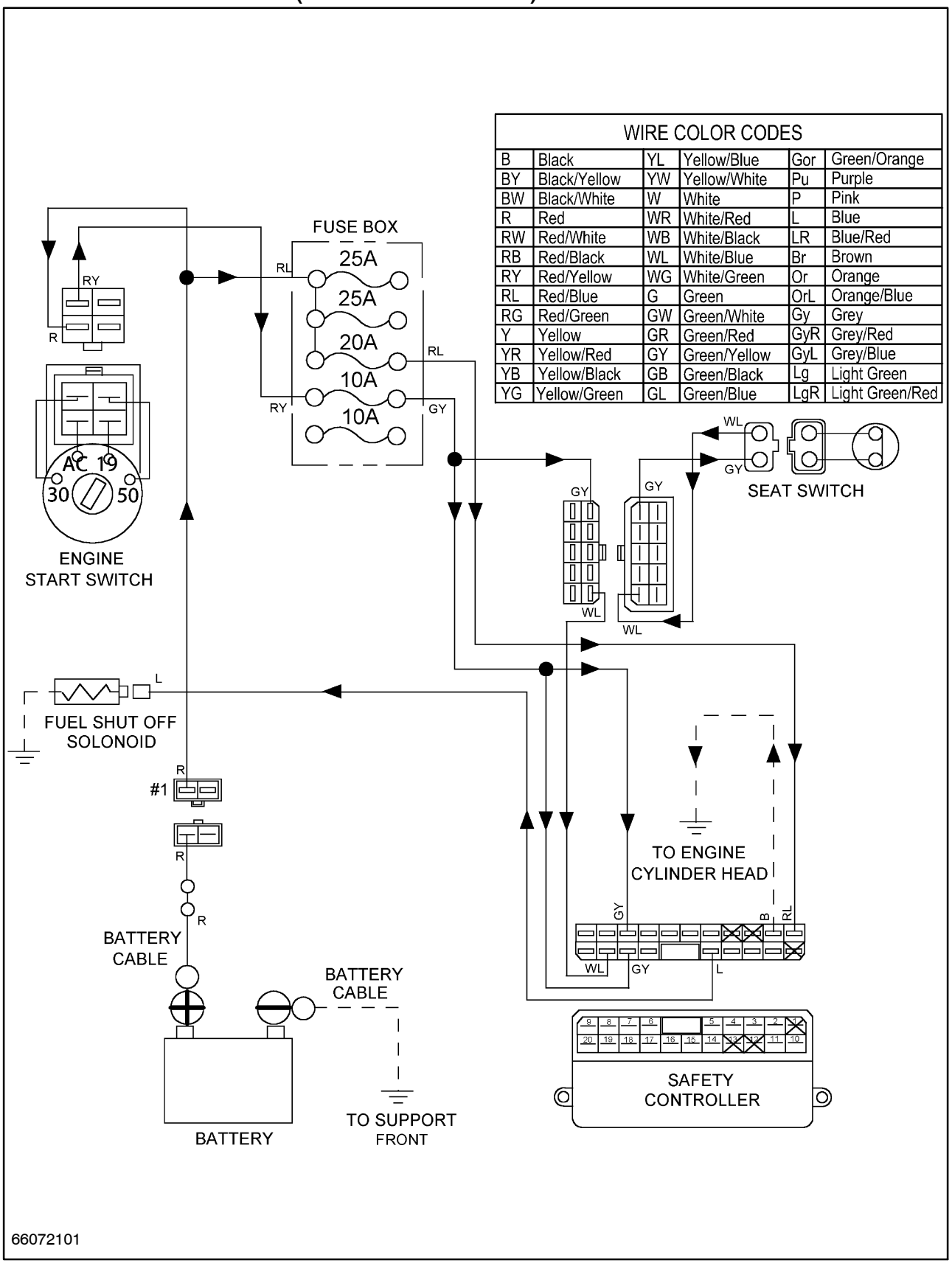
Controller Outputs:

- Terminal #2, provides current to the starter relay (coil side), via the clutch pedal safety switch. This current energizes and latches the starter relay, allowing current to be sent to the starter motor to rotate the engine.
- Terminal #3, provides current to the glow plug relay (coil side). This current energizes and latches the glow plug relay, allowing current to be sent to the engine glow plugs, to preheat the engine.
- Terminal #5, provides current to fuel shutoff solenoid. This current energizes the fuel shutoff solenoid, allowing fuel to be delivered from the injection pump.

Glow Plug Indicator Light
When current is provided to terminal #3 of the instrument panel from the #2 (10 amp) fuse and terminal #6 is provided a ground source by terminal #15 of the safety controller, the glow plug indicator light will illuminate during the starting cycle.

TROUBLESHOOTING STARTING CIRCUIT (OPERATOR PRESENT)		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Starter motor will not energize.	Insufficient battery charge.	Test battery. Charge, add water, or replace as necessary.
	Blown 10 or 20 amp fuse.	Inspect and replace 10 amp or 20 amp fuse as necessary.
	Blown fusible link.	Inspect and replace fusible link as necessary.
	Defective key switch.	Test key switch and replace as necessary.
	Defective shuttle, clutch or PTO safety switches.	Test switches and replace as necessary.
	Defective starter relay.	Test relay and replace if necessary.
	Malfunctioning starter motor.	Test starter motor and repair or replace as necessary.
	Defective safety controller.	Test controller replace as necessary.
Starter motor energizes, but fails to start engine (lacks exhaust smoke).	Defective safety controller.	Test controller replace as necessary.
	Malfunctioning fuel shutoff solenoid.	Test fuel shutoff solenoid and replace as necessary.

SAFE OPERATION CIRCUIT (OPERATOR PRESENT)



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SAFE OPERATION CIRCUIT (OPERATOR PRESENT)

NOTE: *The safe operation circuit is shown with:*

- Operator present.

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- #3 fuse (20 amp).
- Terminal “30” of the key switch.

3. The #3 fuse (20 amp) supplies current to terminal 10 of the safety controller.
4. When the key switch is in the “RUN” position current crosses from terminal “30” to the “AC terminal.

Terminal “AC” of Key Switch

1. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) of the fuse panel.
2. #2 fuse (10 amp) supplies current to:
   - Seat switch.
   - Terminals #7 and #18 of the safety controller.

Seat Safety Switch Function
When the operator is in the seat, the seat safety switch closes, sending current to terminal #8 of the safety controller.

Ground Circuits
Ground source for the safe operation circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following components:

- Terminal #11 of the safety controller.

Safety Controller Functions
When the proper current inputs and ground path circuits are provided the following safety controller output currents and ground paths occur:

Controller Inputs:

- Terminal #7, from #2 fuse, (10 amp).
- Terminal #8, from seat safety switch.
- Terminal #10, from #3 fuse, (20 amp).
- Terminal #18, from #2 fuse, (10 amp).

Controller Outputs:

- Terminal #5, provides current to fuel shutoff solenoid. This current energizes the fuel shutoff solenoid, allowing fuel to be delivered from the injection pump and allowing the engine to remain operating.

TROUBLESHOOTING SAFE OPERATION CIRCUIT (Operator Present)		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Engine does not continue to run while operator is seated.	Malfunctioning fuel shutoff solenoid.	Test fuel shutoff solenoid and replace as necessary.
	Malfunctioning safety seat switch.	Test seat switch and replace as necessary.
	Defective safety controller.	Test controller replace as necessary.
	Loose connection in safe operation circuit.	Check for loose connectors, grounds or wire damage.
	Blown 10 or 20 amp fuse.	Check fuse(s) and replace as necessary.

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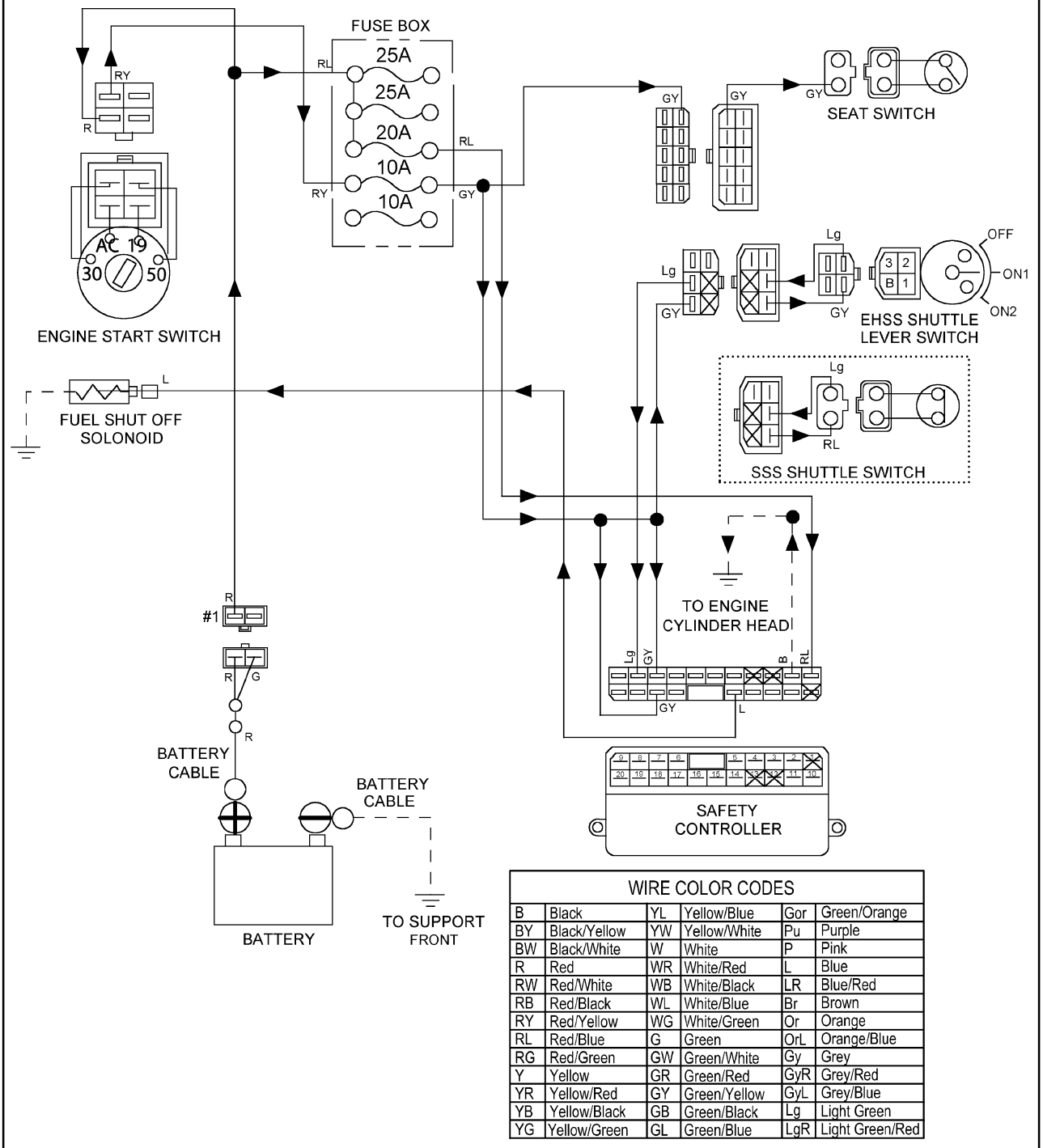
SAFE OPERATION CIRCUIT (OPERATOR NOT PRESENT)



WIRE COLOR CODES					
B	Black	YL	Yellow/Blue	Gor	Green/Orange
BY	Black/Yellow	YW	Yellow/White	Pu	Purple
BW	Black/White	W	White	P	Pink
R	Red	WR	White/Red	L	Blue
RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
RY	Red/Yellow	WG	White/Green	Or	Orange
RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

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SAFE OPERATION CIRCUIT (OPERATOR NOT PRESENT)

NOTE: *The safe operation circuit is shown with:*

- Operator not present.
- Shuttle switch in neutral position.
- Rear PTO “engaged or not engaged”.

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- #3 fuse (20 amp).
- Terminal “30” of the key switch.

3. The #3 fuse (20 amp) supplies current to terminal #10 of the safety controller.
4. When the key switch is in the “RUN” position current crosses from terminal “30” to the “AC” terminal.

Terminal “AC” of Key Switch

1. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) of the fuse panel.
2. #2 fuse (10 amp) supplies current to:
   - Terminals #7 and #18 of the safety controller.
   - Input side of EHSS or SSS shuttle switch.

Seat Safety Switch Function
When the operator is NOT in the seat, the seat safety switch opens, terminating current at the switch.

Shuttle Switch Function
When the EHSS or SSS shuttle switch is in the “NEUTRAL” position, the shuttle switch. Transfers current to terminal #19 of the safety controller.

Ground Circuits
Ground source for the safe operation circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following components:

- Terminal #11 of the safety controller.

Safety Controller Functions
When the proper current inputs and ground path circuits are provided the following safety controller output currents and ground paths occur:

Controller Inputs:

- Terminal #7, from #2 fuse, (10 amp).
- Terminal #10, from #3 fuse, (20 amp).
- Terminal #18, from #2 fuse, (10 amp).
- Terminal #19, from shuttle switch.

Controller Outputs:

- Terminal #5, provides current to fuel shutoff solenoid. This current energizes the fuel shutoff solenoid, allowing fuel to be delivered from the injection pump and allowing the engine to remain operating.

TROUBLESHOOTING SAFE OPERATION CIRCUIT (Operator Not Present)		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Engine does not continue to run while operator is not seated with the shuttle switch in neutral.	Defective shuttle switch.	Test shuttle switch and replace as necessary.
	Malfunctioning fuel shutoff solenoid.	Test fuel shutoff solenoid and replace as necessary.
	Defective safety controller.	Test controller replace as necessary.
	Loosen connection in safe operation circuit.	Check for loose connectors, grounds or wire damage.
	Blown 10 or 20 amp fuse.	Check fuse(s) and replace as necessary.

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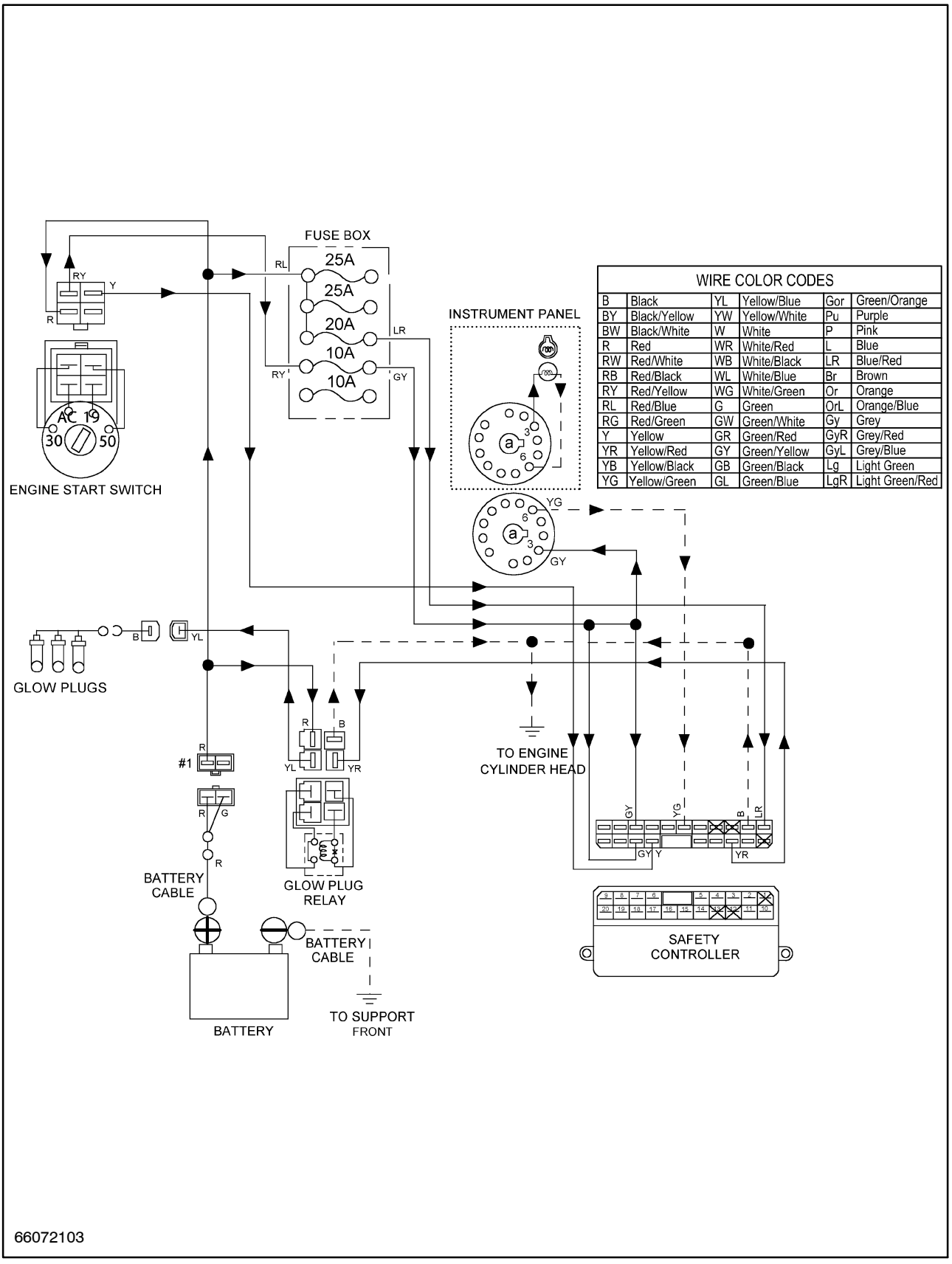
ENGINE GLOW PLUG CIRCUIT



ENGINE GLOW PLUG CIRCUIT

When the key switch is in the “HEAT” position, electrical current is being supplied to the safety controller, which transfers current to the glow plug relay for approximately four seconds. The relay sends current to the glow plugs to preheat the engine to aid in starting.

NOTE: *When the safety controller shuts off the current to the relay, the current is also cutoff to the glow plugs.*

Operation

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- Terminal “30” of the key switch.
- Switch side of the glow plug relay.
- #3 fuse (20 amp).

3. When the key switch is place in the “HEAT” or “START” position, current transfers from terminal “30” to “ 19” and “AC” terminals.
4. Terminal “19” of the key switch sends current to terminal #6 of the safety controller.
5. Terminal “AC” of the key switch provides current to the #2, (10 amp) fuse.
6. The #2, (10 amp) fuse supplies current to:
   - #3 terminal of the instrument panel.
   - Terminals #7 and #18 of the safety controller.

Ground Circuits
The ground source for the glow plug circuit is located on the front of the engine cylinder head. Ground source is provided to the following components.

- Safety controller, terminal #11.
- Glow plug relay, coil side.

Safety Controller Functions:

Inputs:

- Terminal #6, from key switch terminal “19”.
- Terminals #7, from the #2 (10 amp) fuse.
- Terminal #10, from the #3 (20 amp) fuse.
- Terminals #18, from the #2 (10 amp) fuse.

Ground Circuit:

- Terminal #11, provided by engine cylinder head ground source.
- Terminal #15 provides the ground source for the glow plug indicator light.

Outputs:

- Terminal #3 provides current to coil side of glow plug relay.

Relay Functions

1. When the coil side of the relay receives current from the #3 terminal of the safety controller and a ground source, the relay energizes and latches. The relay latches sending current to the glow plugs for approximately four seconds, after four seconds, the current from the controller to the relay is cutoff by a timer in the controller and the glow plugs stop heating.

Glow Plug Indicator Light

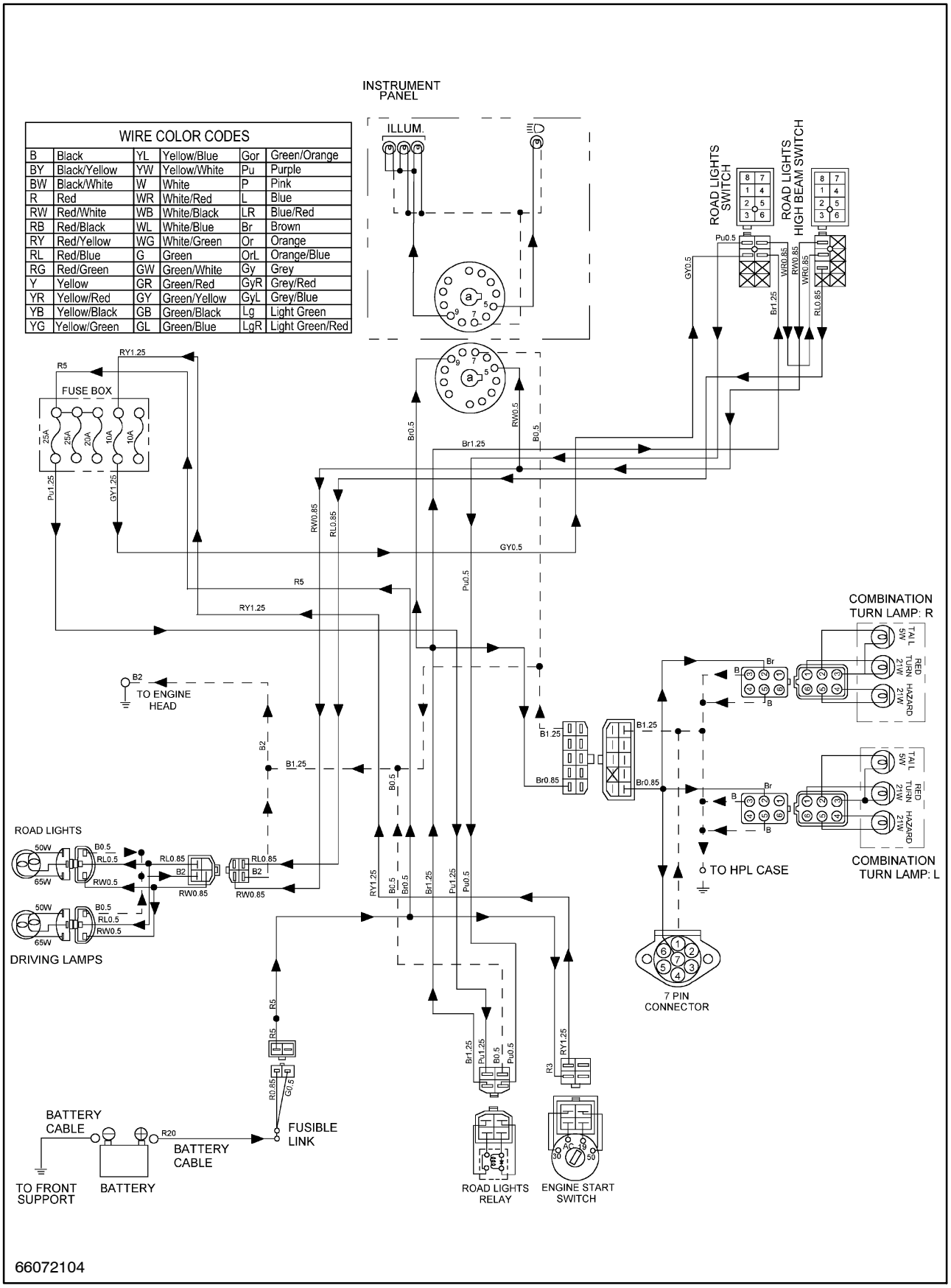
1. Current to the glow plug indicator light is provided by terminal #3 of the instrument panel, this current is controlled by the #2 (10 amp fuse).

2. The ground source for the indicator light is provided by terminal #6 of the instrument panel, this ground source is controller by terminal #15 of the safety controller.

3. The glow plug indicator light will illuminate for approximately four seconds to correspond to the glow plug heating cycle.

TROUBLESHOOTING GLOW PLUG CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative glow plugs.	Blown fusible link.	Check fusible link wire and replace as necessary.
	Defective key switch.	Test key switch, replace as necessary.
	Defective safety controller.	Test controller replace as necessary.
	Defective glow plug relay.	Test relay, replace as necessary.
	Glow plug buss bar disconnected or corroded.	Check buss bar connection for loose wire or corrosion.
	Malfunctioning glow plugs.	Check glow plugs and replace as necessary.
	Blown #3 20 amp fuse.	Check fuse, replace as necessary.
	Blown #2 10 amp fuse.	Check fuse, replace as necessary.
Inoperative glow plug indicator light.	Blown #2 10 amp fuse.	Check fuse, replace as necessary.
	Faulty indicator bulb.	Check bulb, replace as necessary.
	Ground circuit, not provided in terminal #15 of the safety controller.	Check controller for proper function.

ROAD LIGHTS CIRCUIT (LOW AND HIGH BEAM) (ALL TRACTORS)



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ROAD LIGHTS CIRCUIT (LOW AND HIGH BEAM) (ALL TRACTORS)

NOTE: *The road and work lights can be activated separately or together. The key switch has to be in the "ACC/RUN position for the lights to illuminate.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.

2. From the starter motor, current flows through the fusible link wire to terminal #30 of the key switch and the #5 (25 amp) fuse.

3. When the key switch is in the "ACC"/RUN position, current is transferred from terminal "30" to the "AC" terminal.

4. Current flows from the "AC" terminal of the key switch to the #2 (10 amp) fuse.

5. From the #2 (10 amp) fuse current travels to the road lights switch.

6. The #5 (25 amp) fuse sends current to the switch side of the road lights relay.

Ground Circuit
The engine cylinder head ground terminal provides a ground source for:

- Road lights bulbs.
- Road lights relay.
- Taillights.
- Terminal #7 of the instrument panel.

Roads Lights (Low Beam)

1. Current enters the road lights switch at terminal #2, when the switch is placed in the mid position, current is transferred from terminal #2 to terminal #3. Terminal #3 sends current to the coil side of the road lights relay.

2. When the road lights relay has current from terminal #3 of the road lights switch and a ground source provide by the engine cylinder head ground terminal.

The relay latches sending current to:

- Instrument panel illumination lights.
- Taillights.
- Road lights switch terminal #5. When the switch is placed in the mid position, current is also transferred from terminal #5 to terminal #4. Terminal #4 is open and does not send current anywhere.

3. When the switch is placed in the front position, current is transferred from terminal #5 to terminal #6. Current from terminal #6 exists the road lights switch and is transferred to terminal #2 of the road lights high beam switch.

4. Current exists terminal #1 of the high beam switch and travels to the front low beam (50W) road lights.

Road Lights (High Beam)

NOTE: *For the high beams to illuminate, the road lights switch has to be in the "ON" position.*

1. Place the road lights high beam switch in the front position. This will allow current to be transferred from terminal #2 to terminal #3 of the high beam switch.

2. Current exists terminal #3 of the switch and travels to the (65W) high beam road lights and terminal #5 of the instrument panel, for the high beam indicator light.

TROUBLESHOOTING ROAD LIGHTS CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative Road lights, taillights.	Blown #2 (10 amp) or #5 (25 amp) fuse.	Inspect and replace10 or 25 amp fuse as necessary.
	Defective road lights switch.	Test switch, replace as necessary.
	Defective road lights relay.	Test relay and replace if necessary.
	Loose tractor lights connectors.	Check connectors fro proper connections.
	Improper ground circuit.	Check ground circuit connector for corrosion.
	Defective road light bulb.	Check bulb, replace as necessary.
Inoperative Road lights, (High Beam).	Defective road lights high beam switch.	Test switch, replace as necessary.
	Improper connection between road lights switch and road lights high beam switch.	Check connection between switches, check for current at terminal #2 of the high beam switch.
	Defective road light bulb.	Check bulb, replace as necessary.

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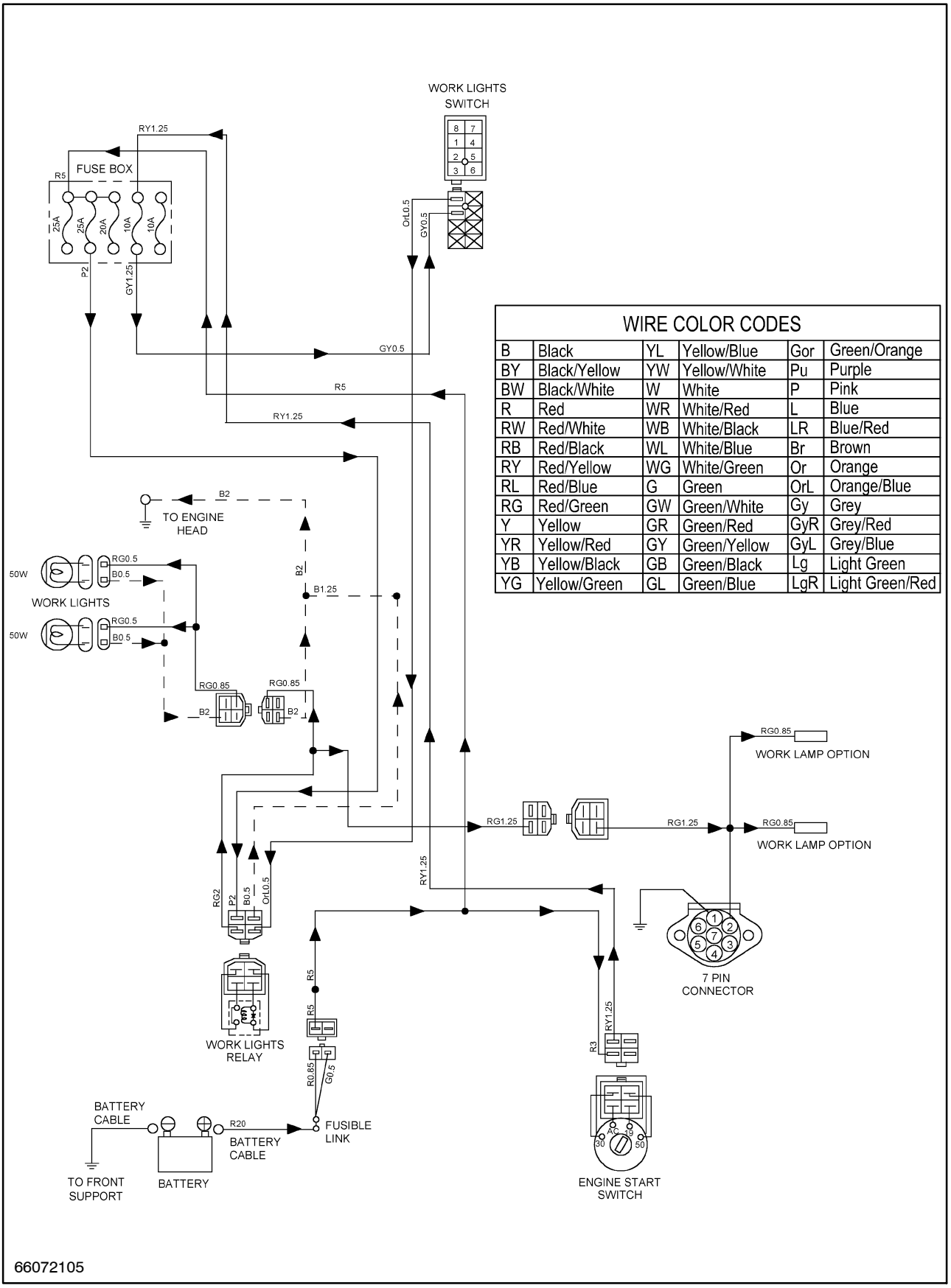
WORK LIGHTS CIRCUIT (ALL TRACTORS)



WIRE COLOR CODES					
B	Black	YL	Yellow/Blue	Gor	Green/Orange
BY	Black/Yellow	YW	Yellow/White	Pu	Purple
BW	Black/White	W	White	P	Pink
R	Red	WR	White/Red	L	Blue
RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
RY	Red/Yellow	WG	White/Green	Or	Orange
RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

66072105

WORK LIGHTS CIRCUIT (ALL TRACTORS)

NOTE: *The road and work lights can be activated separately or together. The key switch has to be in the "ACC/RUN position for the lights to illuminate.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.

2. From the starter motor, current flows through the fusible link wire to terminal #30 of the key switch and the #4 (25 amp) fuse.

3. When the key switch is in the "ACC"/RUN position, current is transferred from terminal "30" to the "AC" terminal.

4. Current flows from the "AC" terminal of the key switch to the #2 (10 amp) fuse.

5. From the #2 (10 amp) fuse current travels to the work lights switch.

Work Lights "ON"

1. When the works lights are placed in the "ON" position, current flows from the #2 to the #3 terminal of the switch.

2. From the #3 terminal of the work lights switch, current is sent to the coil side of the work lights relay.

3. When current from the work lights switch and ground source from the engine cylinder head ground terminal are present, the relay energizes and latches.

4. When the relay latches, current from the #4 (25 amp) fuse is sent to the two (50W) work lights, the ground source from the engine cylinder head ground terminal, completes the circuit and the work lights illuminate.

5. Current flows to the rear work light connectors and the 7 pin connector.

TROUBLESHOOTING WORK LIGHTS CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative work lights.	Blown #2 (10 amp) or #4 (25 amp) fuse.	Inspect and replace10 or 25 amp fuse as necessary.
	Defective work lights switch.	Test switch, replace as necessary.
	Defective work lights relay.	Test relay and replace if necessary.
	Loose tractor lights connectors.	Check connectors for proper connections.
	Improper ground circuit.	Check ground circuit connector for corrosion.
	Defective work light bulb.	Check bulb, replace as necessary.

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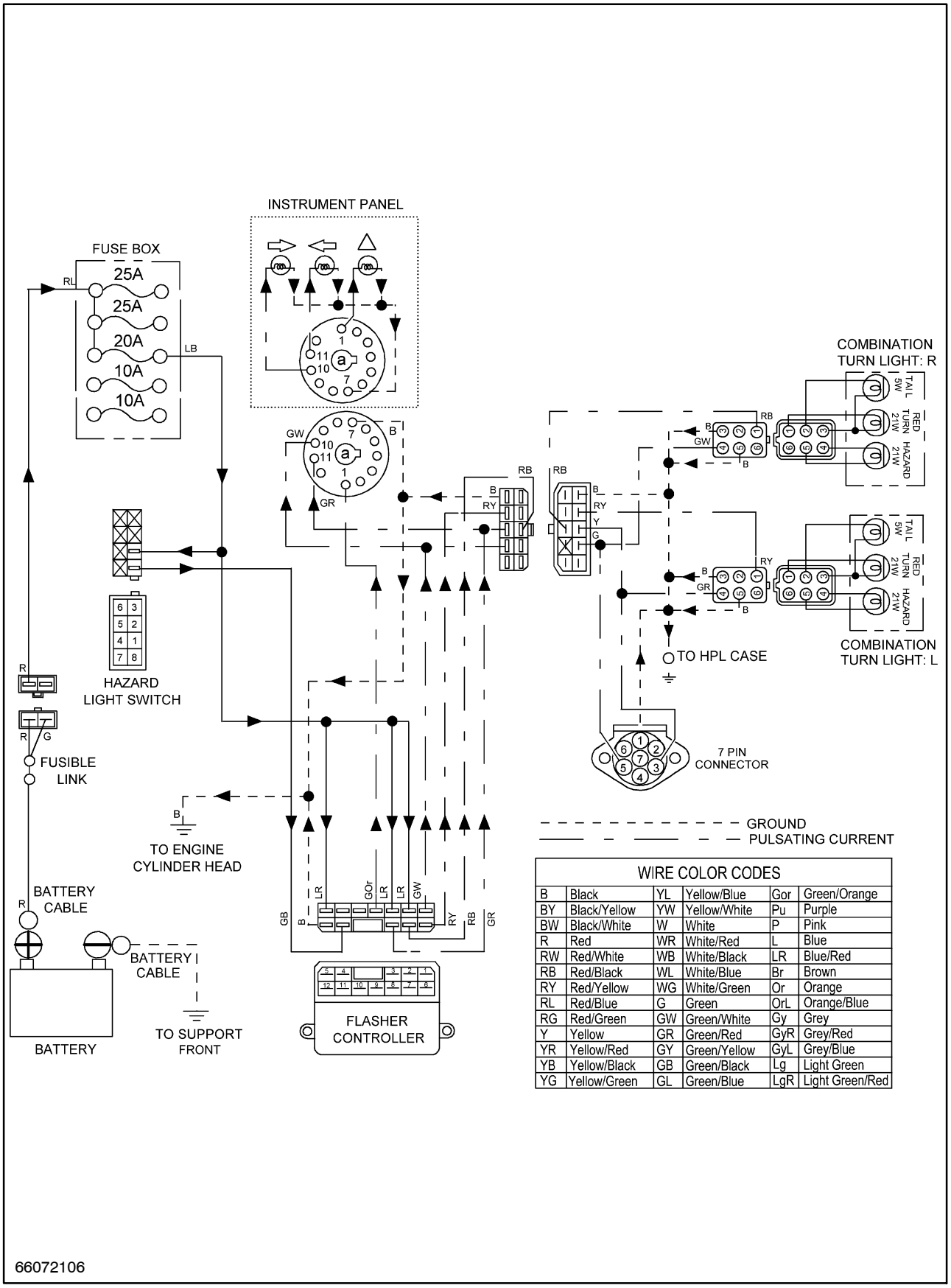
HAZARD FLASHER CIRCUIT



WIRE COLOR CODES					
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BY	Black/Yellow	YW	Yellow/White	Pu	Purple
BW	Black/White	W	White	P	Pink
R	Red	WR	White/Red	L	Blue
RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
RY	Red/Yellow	WG	White/Green	Or	Orange
RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

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HAZARD FLASHER CIRCUIT

NOTE: *There are no terminal markings on the flasher controller, refer to the wiring diagram for flasher terminal identification.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link to reach the #3 (20 amp) fuse. The 20 amp fuse sends current to a wire splice.
3. One path of the wire splice supplies current to terminals #7, #8, #12 of the flasher controller.
4. The other path of the wire splice sends current to terminal #2 of the hazard switch.
5. When the hazard switch is placed in the “ON” position, current is transferred from terminal #2 to terminal #3 of the switch.
6. Terminal #3 of the hazard switch sends current to terminal #4 of the flasher controller.
7. When current is supplied to terminal #4 and the ground circuit is completed to terminal #5 of the controller. The flasher controller is energized.
8. When the flasher controller is energized, pulsating current flows from terminals #1, #2, #3, #6 and #9 of the controller.

Flasher Controller Functions

Terminal #1
Terminal #1 sends pulsating current to the left red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light flashes on and off.

Terminal #2
Terminal #2 sends pulsating current to the right red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light flashes on and off.

Terminal #3
Terminal #3 sends pulsating current to a wire splice, one path of the splice sends current to terminal #11 of the instrument panel for the left turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the left turn indicator will flash on and off. The other path of the wire splice sends current to the left hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will flash on and off.

Terminal #6
Terminal #6 sends pulsating current to a wire splice, one path of the splice sends current to terminal #10 of the instrument panel for the right turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the right turn indicator will flash on and off. The other path of the wire splice sends current to the right hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will flash on and off.

Terminal #9
Terminal #9 sends pulsating current to terminal #1 of the instrument panel for the SMV indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the SMV indicator will flash on and off.

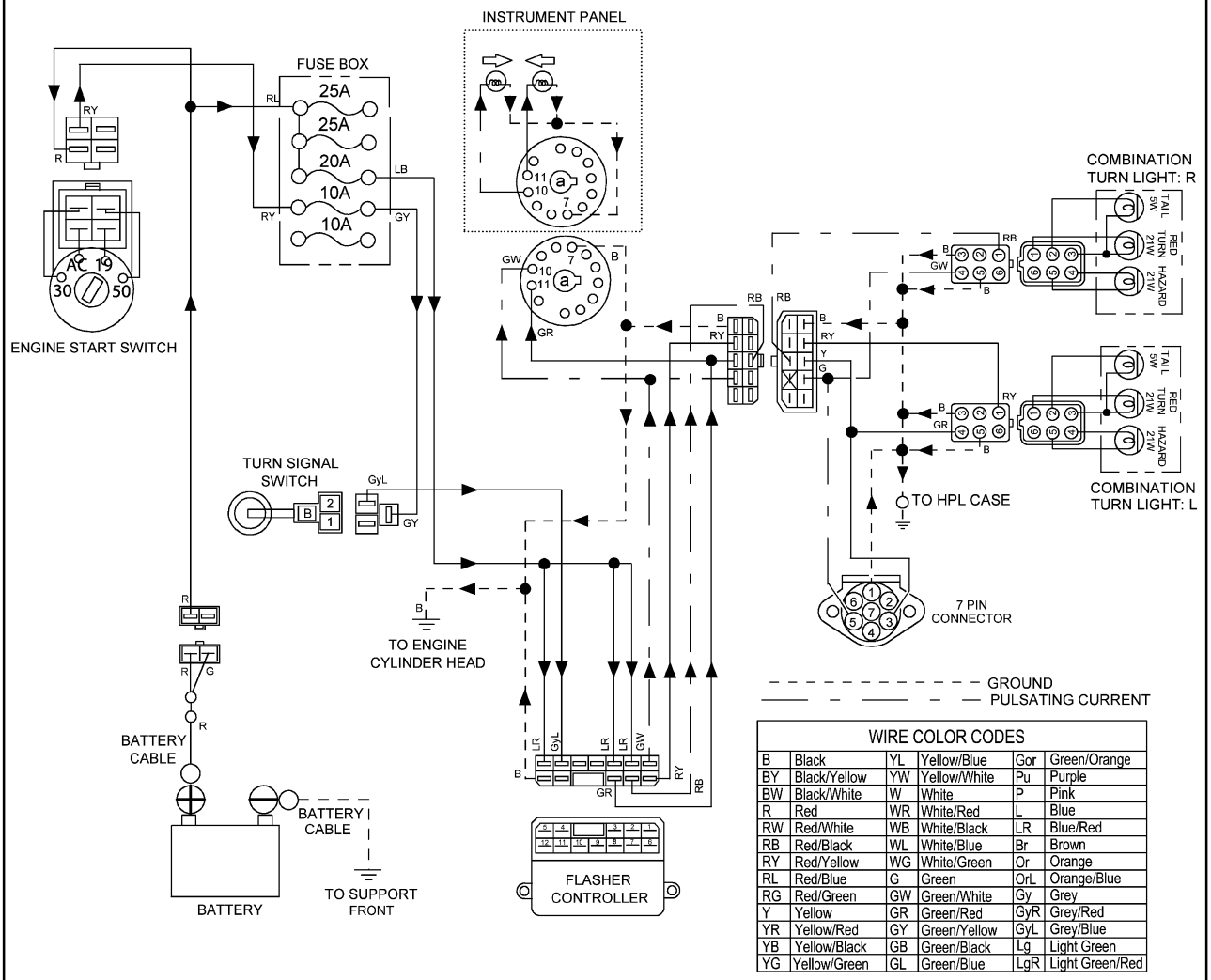
7 pin Connecter Functions
Terminal #1 is the ground source for the connecter.

Terminal #3 receives pulsating current for left side light.

Terminal #5 receives pulsating current for a right turn.

TROUBLESHOOTING HAZARD FLASHER CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative flasher signals.	Blown 20 amp fuse.	Inspect and replace fuse as necessary.
	Defective hazard switch.	Test switch, replace as necessary.
	Malfunctioning flasher controller.	Test controller, replace as necessary.
	Loose tractor lights connectors.	Check connectors fro proper connections.
	Improper ground circuit.	Check ground circuit connector for corrosion.

RIGHT TURN SIGNAL CIRCUIT



WIRE COLOR CODES					
B	Black	YL	Yellow/Blue	Gor	Green/Orange
BY	Black/Yellow	YW	Yellow/White	Pu	Purple
BW	Black/White	W	White	P	Pink
R	Red	WR	White/Red	L	Blue
RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
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RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

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RIGHT TURN SIGNAL CIRCUIT

NOTE: *The right turn signal circuit is shown with the turn signal switch in the "Right" position. There are no terminal markings on the flasher controller, refer to the wiring diagram for flasher terminal identification. The key switch has to be in the "AC"/Run position for the turn signals to function.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link to reach a wire splice. One path of the splice sends current to the #3 (20 amp) fuse. The other path sends current to terminal "30" of the key switch.
3. The #3 (20 amp) fuse supplies current to terminals #7, #8, #12 of the flasher controller.
4. When the key switch is placed in the "RUN" position current is transferred from terminal "30" to terminal "AC".
5. Current travels from the "AC" terminal of the key switch to the #2 (10 amp) fuse.
6. The #2 (10 amp) fuse supplies current to terminal "B" of the turn signal switch.
7. When the turn signal switch is placed in the "Right" position current is transferred from the "B" to the #2 terminal.
8. The #2 terminal of the turn signal switch supplies current to terminal #11 of the flasher controller.
9. When terminal #11 is supplied with current and terminal #5 has a completed ground source, the flasher controller is energized.
10. When the flasher controller is energized, the following flasher controller terminals have outputs:
    - #2 and #6 have pulsating current flow.
    - #1 and #3 have continuous current flow.

Flasher Controller Terminal Functions

Terminal #2
Terminal #2 sends pulsating current to the right red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light flashes on and off.

Terminal #6
Terminal #6 sends pulsating current to a wire splice, one path of the splice sends current to terminal #10 of the instrument panel for the right turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the right turn indicator will flash on and off. The other path of the wire splice sends current to the right hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will flash on and off.

Terminal #1
Terminal #1 sends current to the left red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light will illuminate continuously.

Terminal #3
Terminal #3 sends current to a wire splice, one path of the splice sends current to terminal #11 of the instrument panel for the left turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the left turn indicator will illuminate continuously. The other path of the wire splice sends current to the left hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will illuminate continuously.

Terminals 7, 8 and 12
These terminals have current supplied by the #3 (20 amp) fuse.

Terminal #5
Terminal #5 is the ground source for the flasher controller.

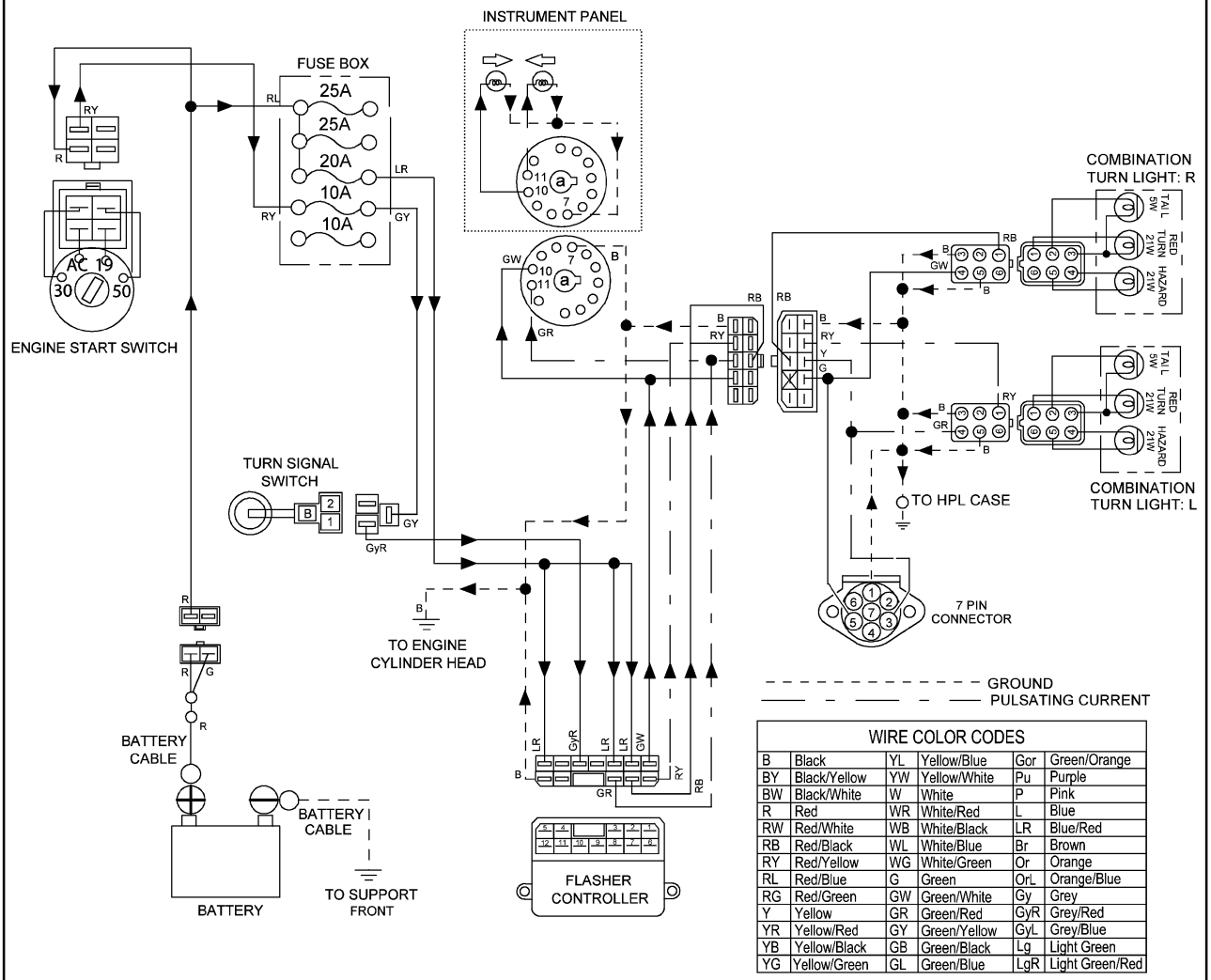
7 pin Connecter Functions
Terminal #1 is the ground source for the connecter.

Terminal #3 receives continuously current for left side light.

Terminal #5 receives pulsating current for a right turn.

TROUBLESHOOTING RIGHT TURN SIGNAL CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative turn signals.	Blown 10 or 20 amp fuse.	Inspect and replace fuse as necessary.
	Defective turn signal switch.	Test switch, replace as necessary.
	Malfunctioning flasher controller.	Test controller, replace as necessary.
	Loose rear tractor lights connector.	Check connector for proper connection.
	Improper ground circuit.	Check ground circuit connector for corrosion.

LEFT TURN SIGNAL CIRCUIT



WIRE COLOR CODES					
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RW	Red/White	WB	White/Black	LR	Blue/Red
RB	Red/Black	WL	White/Blue	Br	Brown
RY	Red/Yellow	WG	White/Green	Or	Orange
RL	Red/Blue	G	Green	OrL	Orange/Blue
RG	Red/Green	GW	Green/White	Gy	Grey
Y	Yellow	GR	Green/Red	GyR	Grey/Red
YR	Yellow/Red	GY	Green/Yellow	GyL	Grey/Blue
YB	Yellow/Black	GB	Green/Black	Lg	Light Green
YG	Yellow/Green	GL	Green/Blue	LgR	Light Green/Red

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LEFT TURN SIGNAL CIRCUIT

NOTE: *The left turn signal circuit is shown with the turn signal switch in the "Left" position. There are no terminal markings on the flasher controller, refer to the wiring diagram for flasher terminal identification. The key switch has to be in the "AC"/Run position for the turn signals to function.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link to reach a wire splice. One path of the splice sends current to the #3 (20 amp) fuse. The other path sends current to terminal "30" of the key switch.
3. The #3 (20 amp) fuse supplies current to terminals #7, #8, #12 of the flasher controller.
4. When the key switch is placed in the "RUN" position current is transferred from terminal "30" to terminal "AC".
5. Current travels from the "AC" terminal of the key switch to the #2 (10 amp) fuse.
6. The #2 (10 amp) fuse supplies current to terminal "B" of the turn signal switch.
7. When the turn signal switch is placed in the "Left" position current is transferred from the "B" to the #1 terminal.
8. The #1 terminal of the turn signal switch supplies current to terminal #10 of the flasher controller.
9. When terminal #10 is supplied with current and terminal #5 has a completed ground source, the flasher controller is energized.
10. When the flasher controller is energized, the following flasher controller terminals have outputs:
    - #1 and #3 have pulsating current flow.
    - #2 and #6 have continuous current flow.

Flasher Controller Terminal Functions

Terminal #1
Terminal #1 sends pulsating current to the left red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light flashes on and off.

Terminal #3
Terminal #3 sends pulsating current to a wire splice, one path of the splice sends current to terminal #11 of the instrument panel for the left turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the left turn indicator will flash on and off. The other path of the wire splice sends current to the left hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will flash on and off.

Terminal #2
Terminal #2 sends current to the right red turn light, the ground source is completed by the ground terminal located on the left rear side of the HPL housing. When current and ground are present, the red turn light will illuminate continuously.

Terminal #6
Terminal #6 sends current to a wire splice, one path of the splice sends current to terminal #10 of the instrument panel for the right turn indicator. The ground source for the indicator light is provided by terminal #7 of the instrument panel. When current and ground circuits are completed, the right turn indicator will illuminate continuously. The other path of the wire splice sends current to the right hazard light. The ground source for the hazard light is completed by the hazard light mounting bolt and the ground terminal located at the left side of the HPL housing. When the current and ground circuits are completed, the hazard light will illuminate continuously.

Terminals 7, 8 and 12
These terminals have current supplied by the #3 (20 amp) fuse.

Terminal #5
Terminal #5 is the ground source for the flasher controller.

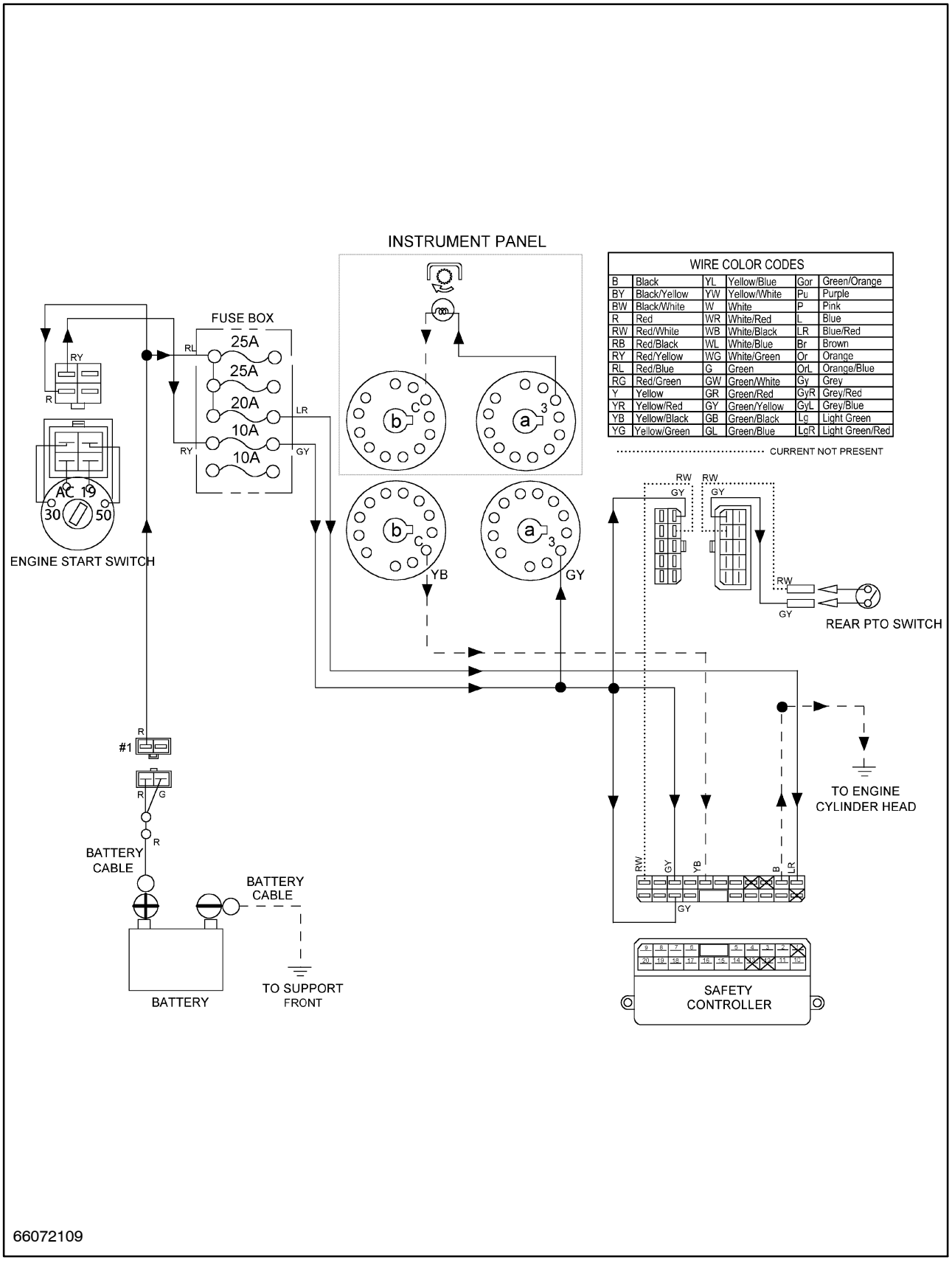
7 pin Connecter Functions
Terminal #1 is the ground source for the connecter.

Terminal #3 receives pulsating current for left side light.

Terminal #5 receives continuously current for a right turn.

TROUBLESHOOTING LEFT TURN SIGNAL CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative turn signals.	Blown 10 or 20 amp fuse.	Inspect and replace fuse as necessary.
	Defective turn signal switch.	Test switch, replace as necessary.
	Malfunctioning flasher controller.	Test controller, replace as necessary.
	Loose rear tractor lights connector.	Check connector for proper connection.
	Improper ground circuit.	Check ground circuit connector for corrosion.

PTO INDICATOR LIGHT CIRCUIT



PTO INDICATOR LIGHT CIRCUIT

NOTE: *The PTO indicator light, located in the instrument panel, illuminates when the PTO is engaged, warning the operator that the PTO is operational.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- Terminal “30” of the key switch.
- #3 (20 amp fuse).

3. When the key switch is placed in the “RUN” position current is transferred from terminal “30” to terminal “AC”.
4. Current travels from the “AC” terminal of the key switch to the #2 (10 amp) fuse.
5. The #2 (10 amp) fuse supplies current to:
   - Terminal #3 of the instrument panel.
   - PTO safety switch.
   - Terminals #7 and #18 of the safety controller.
6. The #3 (20 amp) fuse supplies current to:
   - Terminal #10 of the safety controller.

PTO Safety Switch

1. When the PTO is placed in the “ON” position the PTO safety switch opens, terminating current at the switch. No current is sent to terminal #20 of safety controller.

Safety Controller Functions
(Inputs):

Terminal #7 current from #2 (10 amp) fuse.

Terminal #10 current from #3 (20 amp) fuse.

Terminal #18 current from #2 (10 amp) fuse.

(Ground source): Terminal #11, provided by engine cylinder head ground terminal.

(Output):
Terminal #16 provides a ground source to the PTO indicator light in instrument panel.

PTO Indicator Light Function
When current is provided by terminal #3 of the instrument panel, from #2 (10 amp) fuse and a ground source provide by terminal “C” of the instrument panel, from terminal #16 of the safety controller. The indicator light illuminates, warning the operator that the PTO is engaged.

TROUBLESHOOTING PTO INDICATOR LIGHT CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative Indicator Light.	Defective indicator bulb.	Replace bulb if necessary.
	Blown 10 or 20 amp fuse.	Inspect and replace fuses as necessary.
	Defective PTO safety switch.	Test switch, replace as necessary.
	Malfunctioning safety controller.	Test controller, replace as necessary.
	Improper ground circuit.	Check ground circuit connector for corrosion.
Indicator light remains illuminated.	Wire coming from terminal “C” of instrument panel shorted to ground.	Check wire routing and wire for damage, repair as necessary.
	Malfunction safety controller.	Test controller, replace as necessary.
	PTO safety switch stuck in closed position.	Test switch, replace as necessary.

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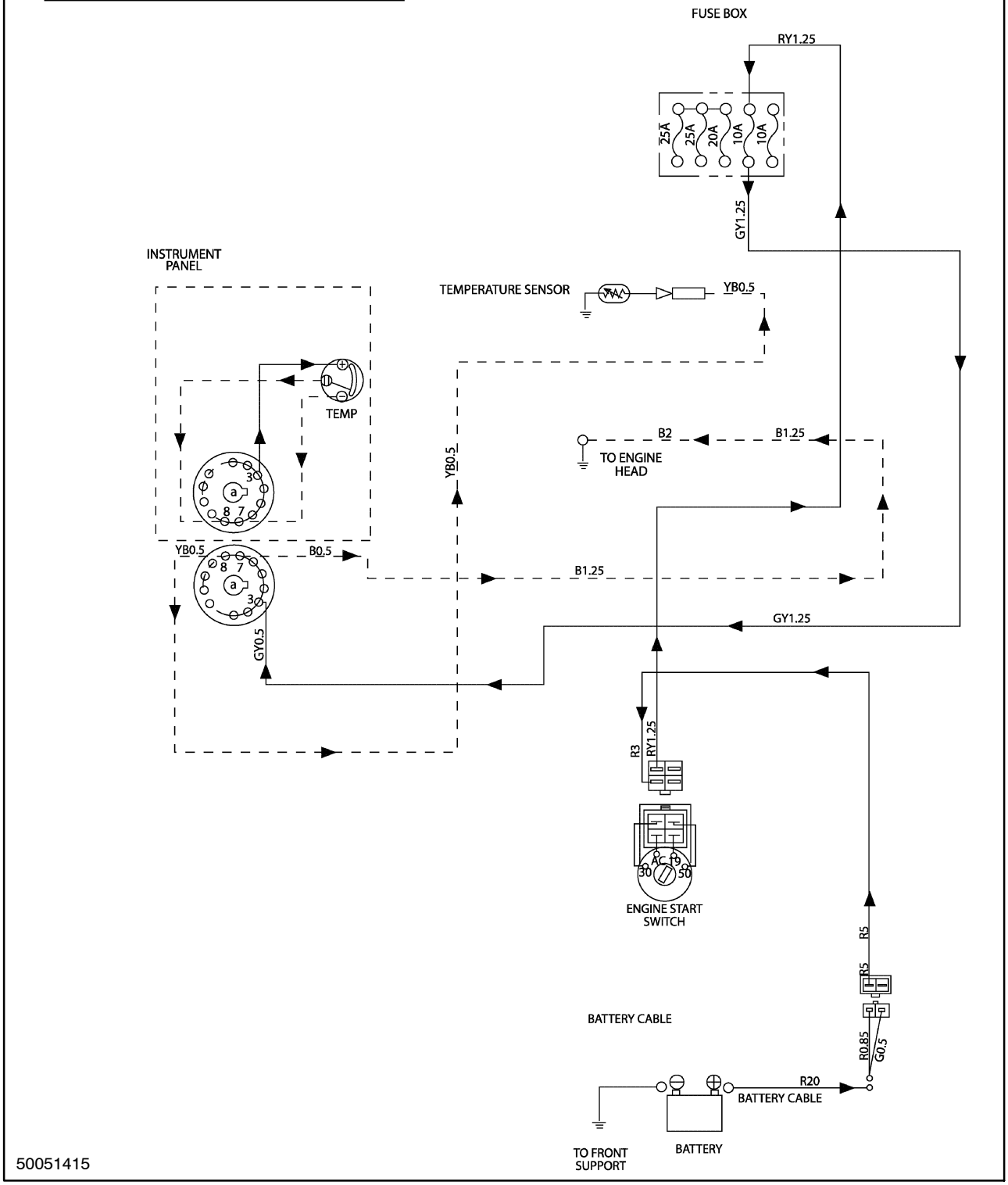
ENGINE COOLANT TEMPERATURE GAUGE CIRCUIT

WIRE COLOR CODES					
B	Black	YR	Yellow/Red	GY	Green/Yellow
BW	Black/White	YW	Yellow/White	P	Pink
BY	Black/Yellow	W	White	Pu	Purple
R	Red	WB	White/Black	L	Blue
RB	Red/Black	WG	White/Green	LR	Blue/Red
RG	Red/Green	WL	White/Blue	Br	Brown
RL	Red/Blue	WR	White/Red	Or	Orange
RW	Red/White	G	Green	OrL	Orange/Blue
RY	Red/Yellow	GB	Green/Black	Gy	Grey
Y	Yellow	GL	Green/Blue	GyL	Grey/Blue
YB	Yellow/Black	GOR	Green/Orange	GyR	Grey/Red
YG	Yellow/Green	GR	Green/Red	Lg	Light Green
YL	Yellow/Blue	GW	Green/White	LgR	Light Green/Red



ENGINE COOLANT TEMPERATURE GAUGE CIRCUIT

1. Current starts at the battery, and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire to terminal “30” of the key switch.
3. When the key switch is in the “RUN” position current crosses from terminal “30” to the “AC” terminal.
4. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) fuse of the fuse panel.
5. Current flows from the #2 fuse to the #3 terminal of the instrument panel.
6. The #3 terminal of the instrument panel provides current to the (+) terminal of the temperature gauge.
7. The #7 terminal of the instrument panel provides constant ground source for the (-) terminal of the temperature gauge.
8. The #8 terminal of the instrument panel provides the variable resistance to ground by the means of the temperature sensor located in the engine cylinder head. As the resistance decreases the temperature reading of the gauge increases.

TROUBLESHOOTING ENGINE COOLANT TEMPERATURE GAUGE CIRCUIT		
TROUBLE	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative Engine Temperature Gauge.	Blown 10 amp fuse.	Check fuse and replace as necessary.
	Improper ground circuit.	Check ground connections and repair as necessary.
	Malfunctioning temperature gauge.	Test temperature gauge and replace instrument panel if necessary.
	Malfunctioning engine temperature sender.	Test engine temperature sender and replace as necessary.

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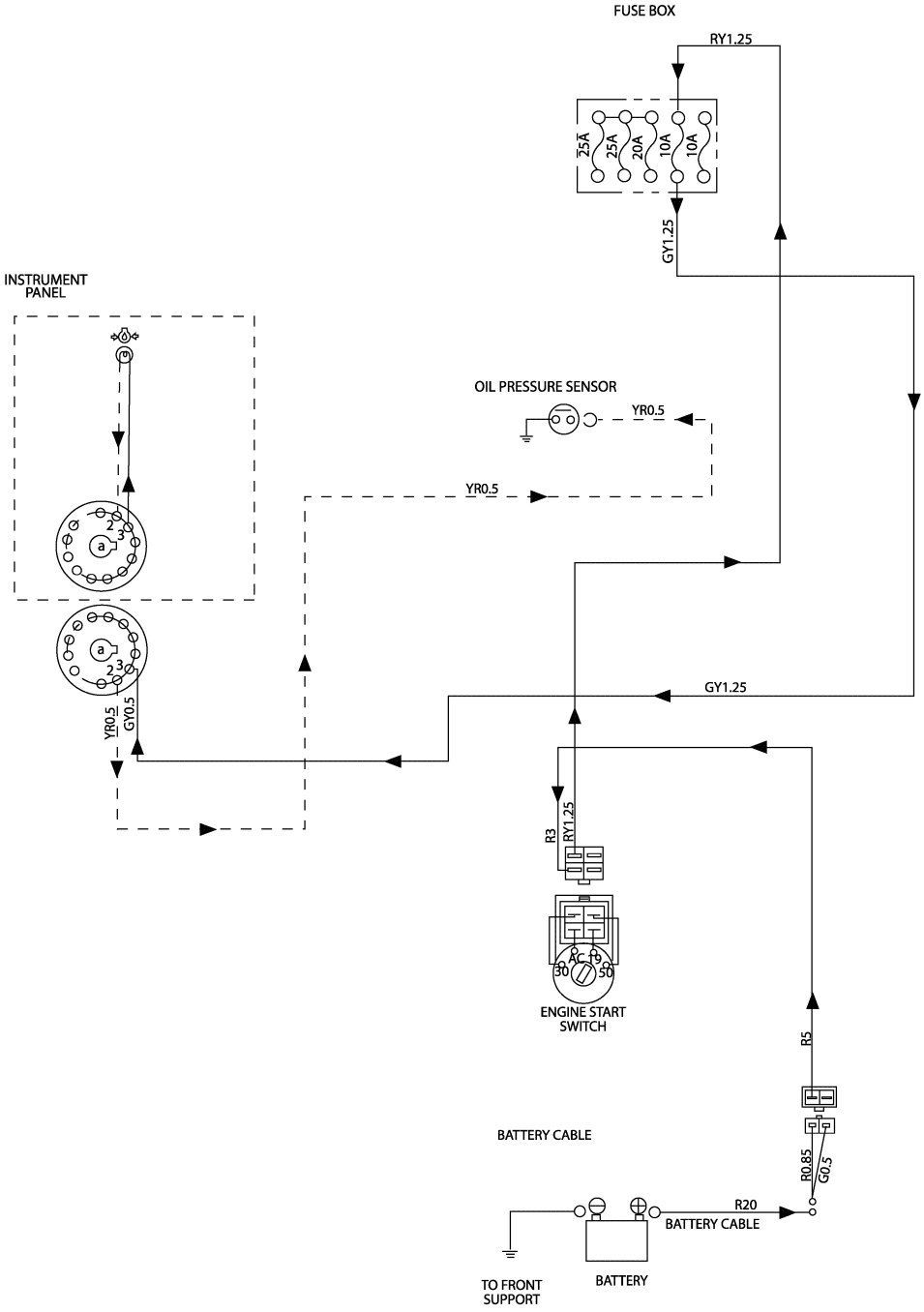
ENGINE OIL PRESSURE INDICATOR LIGHT CIRCUIT

WIRE COLOR CODES					
B	Black	YR	Yellow/Red	GY	Green/Yellow
BW	Black/White	YW	Yellow/White	P	Pink
BY	Black/Yellow	W	White	Pu	Purple
R	Red	WB	White/Black	L	Blue
RB	Red/Black	WG	White/Green	LR	Blue/Red
RG	Red/Green	WL	White/Blue	Br	Brown
RL	Red/Blue	WR	White/Red	Or	Orange
RW	Red/White	G	Green	OrL	Orange/Blue
RY	Red/Yellow	GB	Green/Black	Gy	Grey
Y	Yellow	GL	Green/Blue	GyL	Grey/Blue
YB	Yellow/Black	GOR	Green/Orange	GyR	Grey/Red
YG	Yellow/Green	GR	Green/Red	Lg	Light Green
YL	Yellow/Blue	GW	Green/White	LgR	Light Green/Red



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ENGINE OIL PRESSURE INDICATOR LIGHT CIRCUIT

1. Current starts at the battery, and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire to terminal “30” of the key switch.
3. When the key switch is in the “RUN” position current crosses from terminal “30” to the “AC” terminal.
4. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) fuse of the fuse panel.
5. Current flows from the #2 fuse to the #3 terminal of the instrument panel.
6. The #3 terminal of the instrument panel provides current to the indicator light.
7. When the oil pressure falls below .41 bar (6 PSI) the oil pressure switch closes and completes the ground circuit to terminal #2 of instrument panel, for the indicator light. This causes the light to illuminate warning the operator of engine problems.

TROUBLESHOOTING ENGINE OIL PRESSURE INDICATOR LIGHT CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative low oil pressure indicator light.	Blown 10 amp fuse.	Check fuse and replace as necessary.
	Defective indicator bulb.	Check indicator bulb and replace as necessary.
	Malfunctioning low oil pressure switch.	Test low oil pressure switch and replace as necessary.
Low oil pressure indicator light remains illuminated.	Low engine oil pressure.	Check fuse and replace as necessary.
	Malfunctioning low oil pressure switch.	Check engine oil pressure switch closes at .41 bar (6 PSI).
	Wire from low oil pressure switch to indicator bulb is short circuited to ground.	Test low oil pressure switch and replace as necessary. Check wire harness for damage repair as necessary.
	Lack of engine oil.	STOP engine, immediately check, engine oil level. Add oil until engine dipstick registers full.

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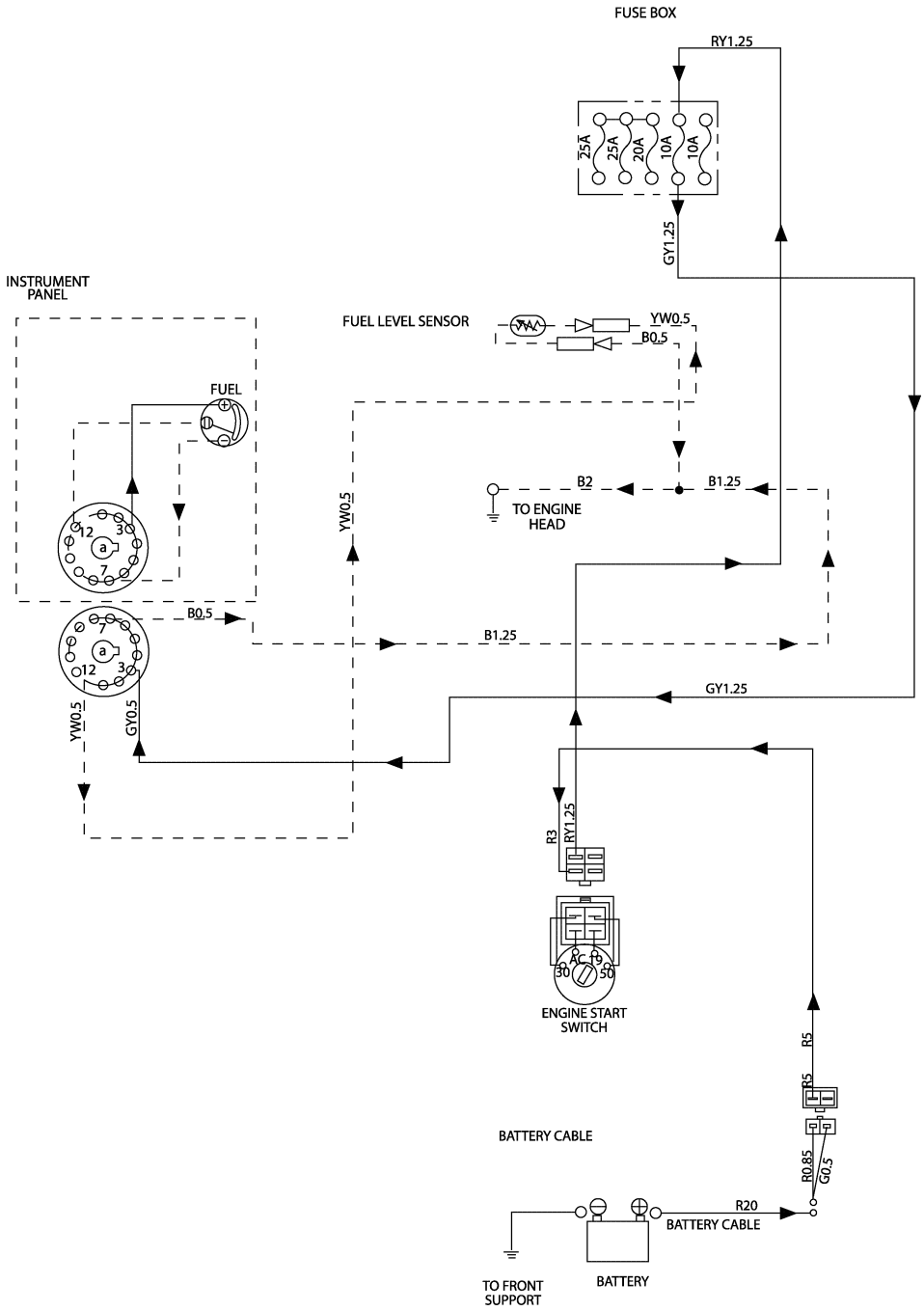
FUEL GAUGE CIRCUIT

WIRE COLOR CODES					
B	Black	YR	Yellow/Red	GY	Green/Yellow
BW	Black/White	YW	Yellow/White	P	Pink
BY	Black/Yellow	W	White	Pu	Purple
R	Red	WB	White/Black	L	Blue
RB	Red/Black	WG	White/Green	LR	Blue/Red
RG	Red/Green	WL	White/Blue	Br	Brown
RL	Red/Blue	WR	White/Red	Or	Orange
RW	Red/White	G	Green	OrL	Orange/Blue
RY	Red/Yellow	GB	Green/Black	Gy	Grey
Y	Yellow	GL	Green/Blue	GyL	Grey/Blue
YB	Yellow/Black	GOR	Green/Orange	GyR	Grey/Red
YG	Yellow/Green	GR	Green/Red	Lg	Light Green
YL	Yellow/Blue	GW	Green/White	LgR	Light Green/Red



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FUEL GAUGE CIRCUIT

1. Current starts at the battery, and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire to terminal “30” of the key switch.
3. When the key switch is in the “RUN” position current crosses from terminal “30” to the “AC” terminal.
4. Current flows from the “AC” terminal of the key switch to the #2 fuse (10 amp) fuse of the fuse panel.
5. Current flows from the #2 fuse to the #3 terminal of the instrument panel.
6. The #3 terminal of the instrument panel provides current to the (+) terminal of the fuel gauge.
7. The #7 terminal of the instrument panel provides constant ground source provided by the engine cylinder head ground terminal, for the (-) terminal of the fuel gauge.
8. The #12 terminal of the instrument panel provides the variable resistance to ground by the means of the fuel sensor located in the fuel tank. As the resistance decreases the fuel reading of the gauge increases.

TROUBLESHOOTING FUEL GAUGE CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative fuel level gauge.	Blown 10 amp fuse.	Check fuse and replace as necessary.
	Malfunctioning fuel level sending unit.	Test fuel level sending unit and replace as necessary.
	Improper ground circuit.	Check ground connection at engine cylinder head.
	Malfunctioning fuel gauge.	Test fuel gauge and replace instrument panel if necessary.

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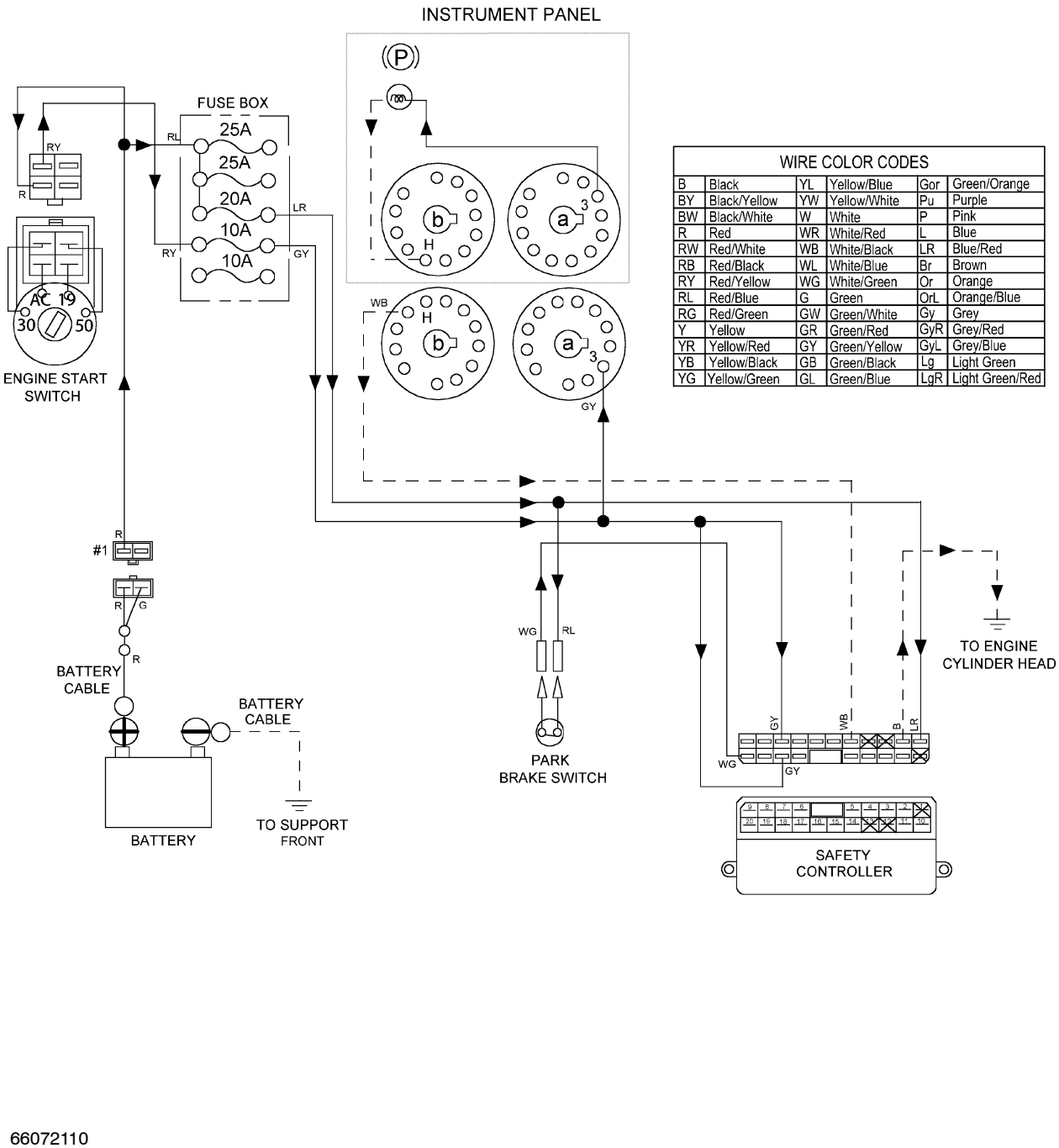
PARK BRAKE INDICATOR LIGHT CIRCUIT



PARK BRAKE INDICATOR LIGHT CIRCUIT

NOTE: *The park brake indicator light, located in the instrument panel, illuminates when the park brake is engaged, warning the operator that the park brake is applied.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current splits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- Terminal “30” of the key switch.
- #3 (20 amp fuse).

3. When the key switch is placed in the “RUN” position current is transferred from terminal “30” to terminal “AC”.
4. Current travels from the “AC” terminal of the key switch to the #2 (10 amp) fuse.
5. The #2 (10 amp) fuse supplies current to:
    - Terminal #3 of the instrument panel.
    - Terminals #7 and #18 of the safety controller.
6. The #3 (20 amp) fuse supplies current to:
    - Terminal #10 of the safety controller.
    - Park Brake switch (input).

Park Brake Safety Switch

1. When the park brake is applied the park brake safety switch closes, sending current to terminal #9 of the safety controller.

Safety Controller Functions
(Inputs):

Terminal #7 current from #2 (10 amp) fuse.

Terminal #9 current from park brake safety switch.

Terminal #10 current from #3 (20 amp) fuse.

Terminal #18 current from #2 (10 amp) fuse.

(**Ground source**): Terminal #11, provided by engine cylinder head ground terminal.

(Output):

Terminal #14 provides a ground source to the park brake indicator light in instrument panel.

Park Brake Indicator Light Function
When current is provided by terminal #3 of the instrument panel, from #2 (10 amp) fuse and a ground source provide by terminal “H” of the instrument panel, from terminal #14 of the safety controller. The indicator light illuminates, warning the operator that the park brake is engaged.

TROUBLESHOOTING PARK BRAKE INDICATOR LIGHT CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative indicator light.	Defective indicator bulb.	Replace bulb if necessary.
	Blown 10 or 20 amp fuse.	Inspect and replace fuses as necessary.
	Defective park brake safety switch.	Test switch, replace as necessary.
	Malfunctioning safety controller.	Test controller, replace as necessary.
	Improper ground circuit.	Check ground circuit connector for corrosion.
Indicator light remains illuminated.	Wire coming from terminal “H” of instrument panel shorted to ground.	Check wire routing and wire for damage, repair as necessary.
	Malfunction safety controller.	Test controller, replace as necessary.
	Park brake safety switch stuck in closed position.	Test switch, replace as necessary.

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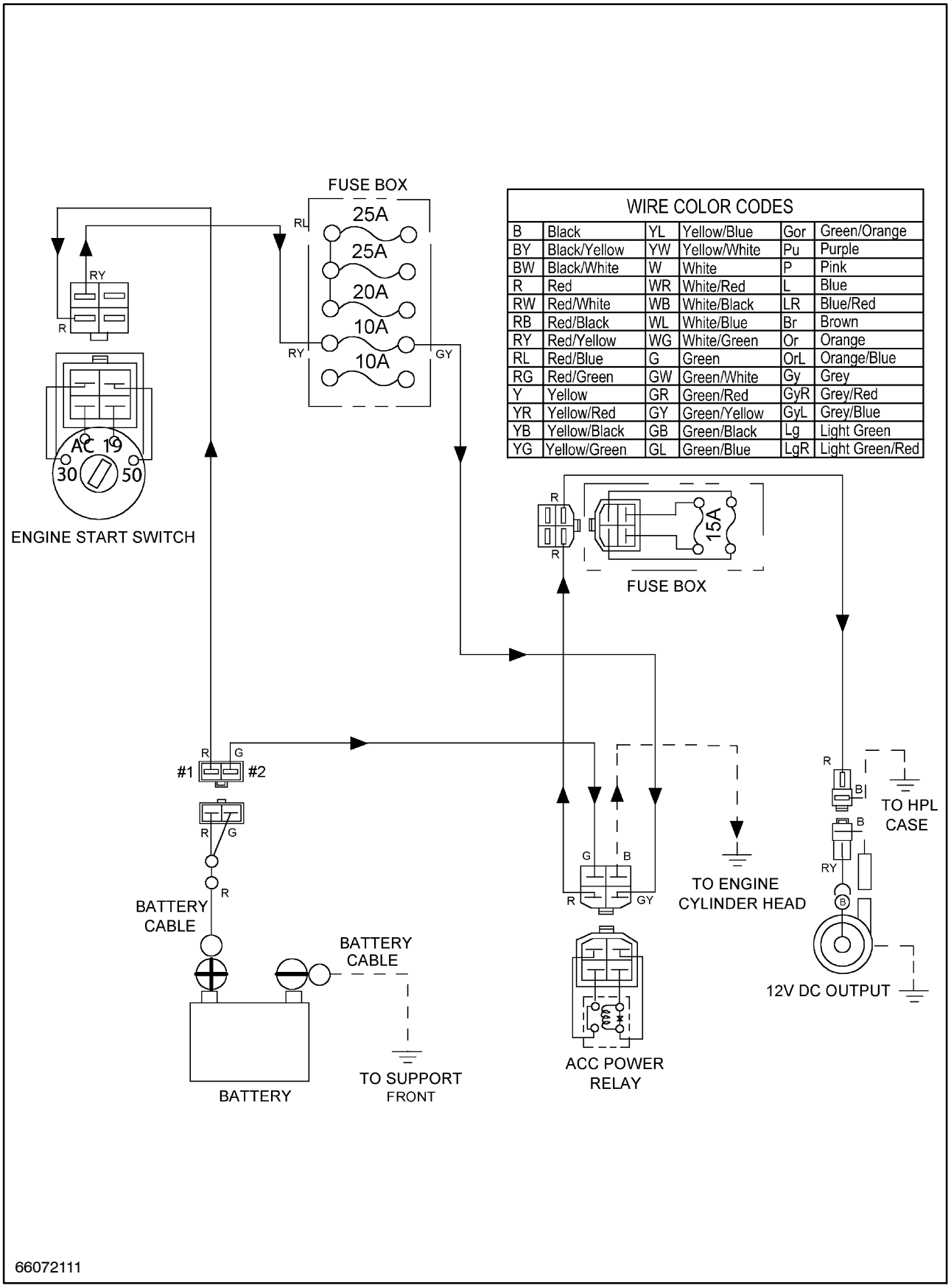
AUXILIARY POWER SOCKET CIRCUIT



AUXILIARY POWER SOCKET CIRCUIT

NOTE: *The auxiliary power socket is located on the right rear of the operator's platform. The socket can be used to power any 12 volt electrical item.*

(15 amps maximum current) The key switch must be in the "ACC/RUN" position for socket to have current available.

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

#1 terminal of connector – Sends current to:

- Terminal "30" of the key switch.

#2 terminal of connector – Sends current to:

- "ACC" Power Relay, switch side terminal.

3. When the key switch is in the "RUN" position current crosses from terminal "30" to the "AC terminal.

Terminal "AC" of key switch

1. Current flows from the "AC" terminal of the key switch to the #2 fuse (10 amp) of the fuse panel.
2. #2 fuse (10 amp) supplies current to:

- "ACC" power relay, coil side terminal.

"ACC" Power relay

When the relay coil side is provide current by the (10 amp) fuse and ground source provided by the ground location at the engine cylinder head, the relay energizes and latches. When the relay latches current is sent to input side of the #6 (15 amp) fuse.

#6 (15 amp fuse)

The #6 (15 amp) fuse sends current to the auxiliary power socket.

Ground Circuits

1. The engine cylinder head ground terminal provides the ground source for the ACC power relay.
2. The HPL cylinder case ground terminal provides the ground circuit for the auxiliary power socket.

Power Socket Functions

When the power socket is provided with current from the #6 (15 amp) fuse and a ground source from the HPL case ground terminal, a 12 volt power supply (15 amp maximum) is available.

TROUBLESHOOTING AUXILIARY POWER SOCKET CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
12 volt power supply not available at power socket.	Blown #1 (10 amp) or #6 (15 amp) fuse.	Inspect and replace fuses as necessary.
	Faulty ACC power relay.	Check relay and replace if necessary.
	Improper ground circuit.	Check ground circuit connector for corrosion.
	Key switch is not in the “ACC/RUN position.	Place key switch in “ACC/RUN position.

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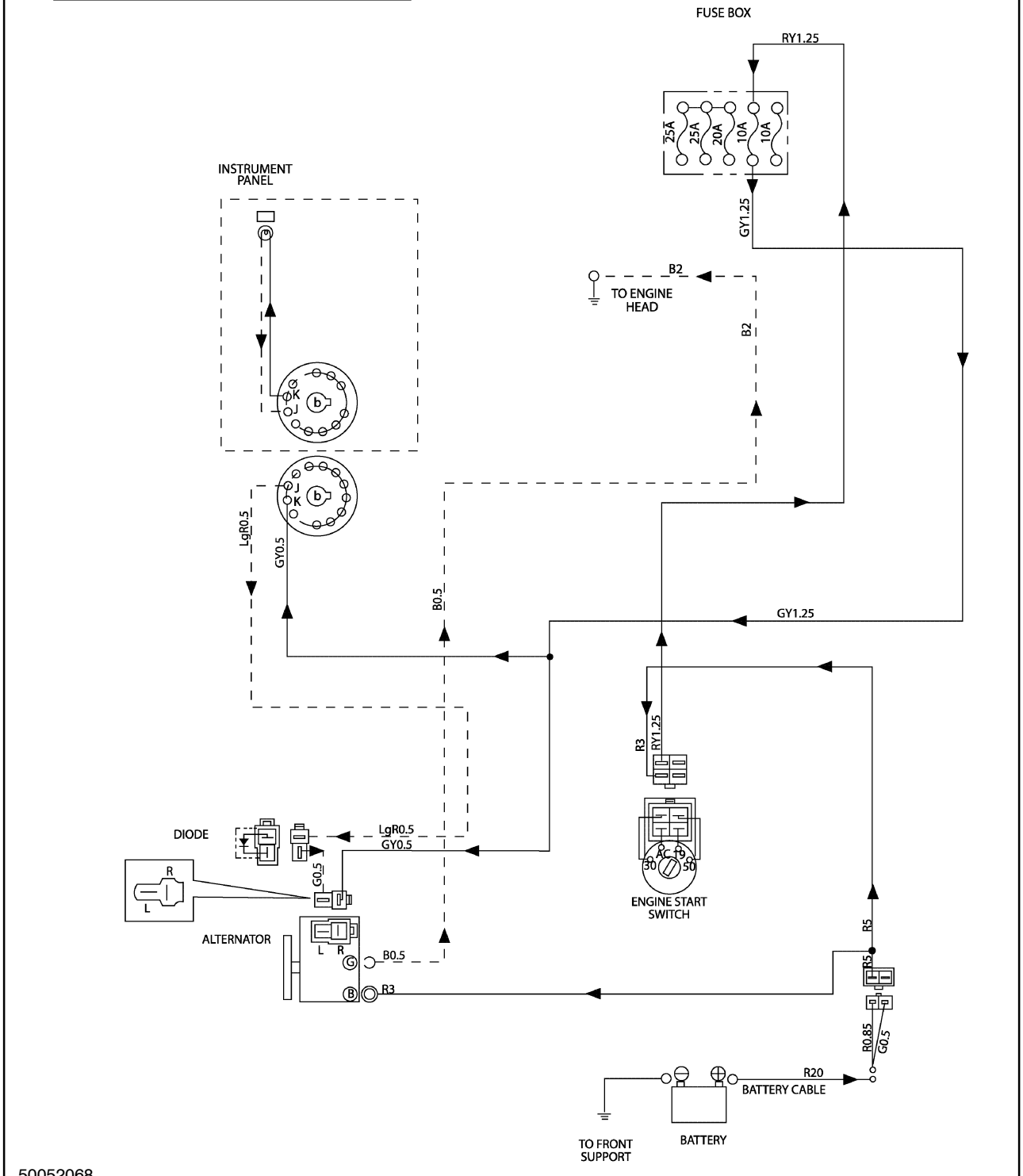
CHARGING SYSTEM CIRCUIT

WIRE COLOR CODES					
B	Black	YR	Yellow/Red	GY	Green/Yellow
BW	Black/White	YW	Yellow/White	P	Pink
BY	Black/Yellow	W	White	Pu	Purple
R	Red	WB	White/Black	L	Blue
RB	Red/Black	WG	White/Green	LR	Blue/Red
RG	Red/Green	WL	White/Blue	Br	Brown
RL	Red/Blue	WR	White/Red	Or	Orange
RW	Red/White	G	Green	OrL	Orange/Blue
RY	Red/Yellow	GB	Green/Black	Gy	Grey
Y	Yellow	GL	Green/Blue	GyL	Grey/Blue
YB	Yellow/Black	GOR	Green/Orange	GyR	Grey/Red
YG	Yellow/Green	GR	Green/Red	Lg	Light Green
YL	Yellow/Blue	GW	Green/White	LgR	Light Green/Red



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CHARGING SYSTEM CIRCUIT

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.

2. From the engine starter motor, current flows through the fusible link wire to a wire splice. The wire splice splits current into two different paths.

   - One path goes to the “B” terminal of the alternator.
   - The other path travels to terminal “30” of the key switch.

3. When the key switch is in the “ACC/RUN” position, current flows from the “ACC” terminal to the 10 amp fuse within the fuse panel. Current passes through the fuse to a wire splice. The wire splice splits the current into two different paths.

   - One path sends current to terminal “K” of the instrument panel connector. Terminal “K” provides current to the charge indicator light.
   - The other path sends current to the “R” “Regulator” terminal of the alternator.

4. The alternator is grounded by the “GND” terminal on the alternator through the wiring harness to the engine block.

5. If the tractor engine is not running or the alternator is not producing a sufficient amount of charge, (with the key switch in the “ACC/RUN” position) The charge indicator light will illuminate.

   - The current for the indicator light is provided by terminal “K” of the instrument panel connector.
   - The ground circuit for the indicator light is provided by terminal “J” of the instrument panel connector. From terminal “J” the ground path passes through a diode that is located at alternator R/L connector, then to the “L” terminal of the alternator. The ground source for the “L” terminal is provided by the field coil.
   - When the ground circuit is complete to terminal “J” and current is provided to terminal “K” by the key switch, the charge indicator light will illuminate.

6. When the tractor is running with the alternator rotating and the key switch in the “ACC/RUN” position, the alternator produces an increased regulated voltage to the battery.

   - When the alternator is producing current, the ground circuit, through the “L” terminal, for the charge indicator light is disrupted causing the indicator light to not illuminate.
   - The “R” regulator terminal controls the voltage output from the alternator. If current is not present at the “R” terminal the alternator will not produce current.
   - The “B” terminal of the alternator is the output connection between the alternator and the battery.

TROUBLESHOOTING CHARGING SYSTEM CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Charge light remains illuminated.	Faulty alternator component.	Test alternator and repair as necessary.
	Short circuit to ground between alternator and warning lamp.	Check wiring and repair as necessary.
Charge light does not illuminate.	Blown 10 amp fuse.	Inspect 10 amp fuse and replace as necessary.
	Faulty charge indicator bulb.	Inspect indicator bulb and replace as necessary.
	Open charge light circuit.	Inspect connections, grounds, and wiring for charge circuit repair as necessary.
	Alternator diode open.	Check diode for proper continuity.
Insufficient or no battery charge, hard starting of dim indicator light.	Battery charge less than 75%.	Test battery. Charge, add water or replace as necessary.
	Fan belt slipping.	Check fan belt tension, adjust as necessary.
	Loose wiring connections.	Check wiring harness connectors for good pin connections.
	Open alternator excitation circuit terminal “R” of alternator.	Inspect Green/Yellow Wire from 10 amp fuse to “R” terminal of alternator.
	Blown 10 amp fuse.	Inspect 10 amp fuse and replace as necessary.
Battery failure, frequent burnout of bulbs and fuses.	Overcharge condition.	Check alternator voltage output and repair as needed.
	Improper ground circuit for alternator.	Check ground circuit and connections.

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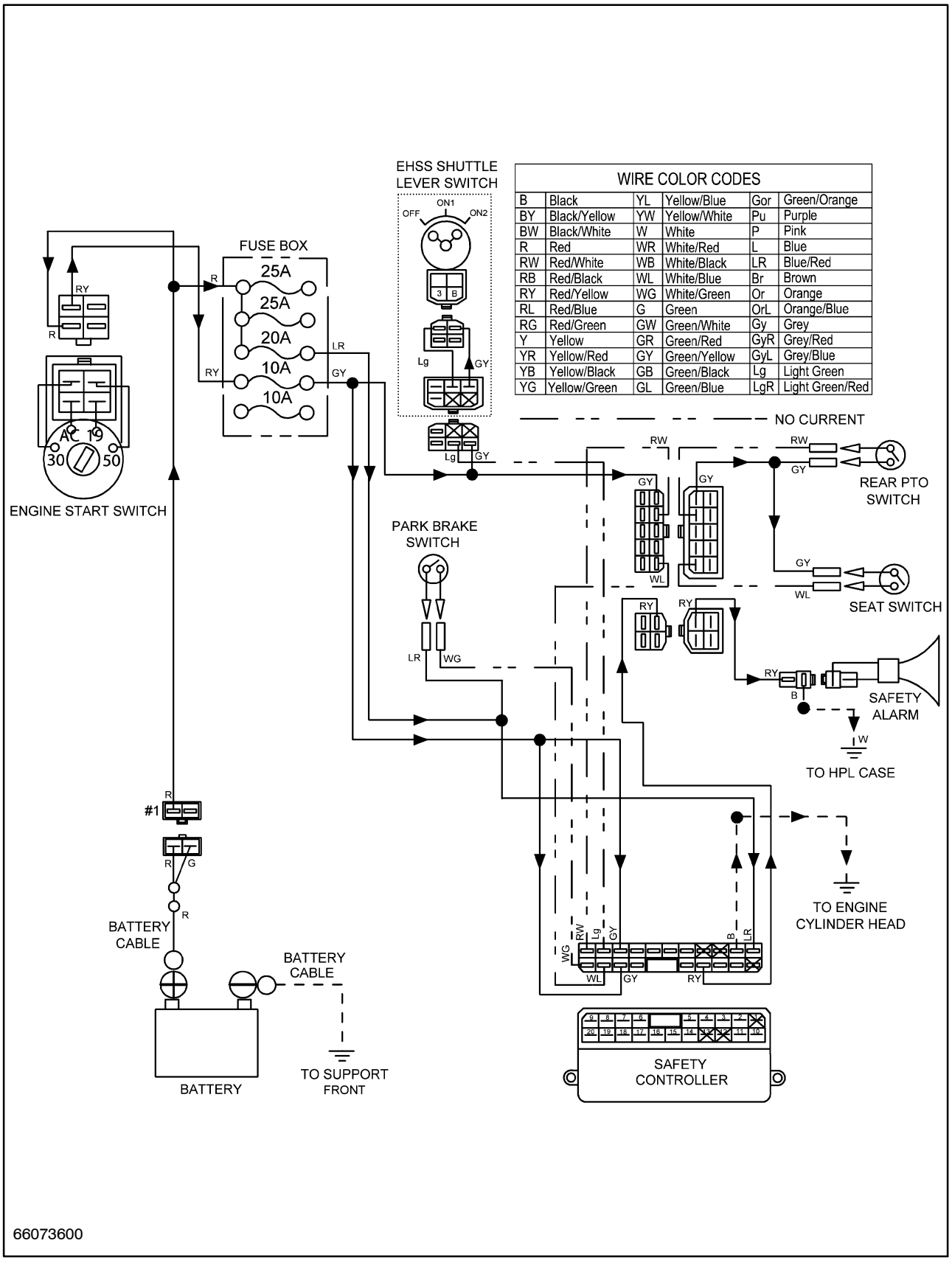
SAFETY ALARM CIRCUIT



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SAFETY ALARM CIRCUIT

NOTE: *The safety alarm, located at the left side of the HPL housing ,alarms when the park brake is not engaged, warning the operator that the park brake is not applied and an unsafe condition may exist.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

   #1 terminal of connector – Sends current to:

   - Terminal “30” of the key switch.
   - #3 (20 amp fuse).
3. When the key switch is placed in the “RUN” position current is transferred from terminal “30” to terminal “AC”.
4. Current travels from the “AC” terminal of the key switch to the #2 (10 amp) fuse.
5. The #2 (10 amp) fuse supplies current to:
   - Terminals #7 and #18 of the safety controller.
6. The #3 (20 amp) fuse supplies current to:
   - Terminal # 10 of the safety controller.
   - Park brake switch (input).

Park Brake Safety Switch

1. When the park brake is not applied the park brake safety switch is open, not allowing current to be sent to terminal #9 of the safety controller. This will allow the safety buzzer to alarm.

Seat Safety Switch

1. When the operator is not in the seat, the seat safety switch is open, not allowing current to be sent to terminal #8 of the safety controller.

Rear PTO Safety Switch

1. When the rear PTO is engaged without an operator in the seat, the rear PTO safety switch is open, not allowing current to be sent to terminal #20 of the safety controller. This will allow the safety buzzer to alarm.

EHSS Shuttle Switch

1. When the shuttle switch is placed in either forward or reverse with the park brake applied, the shuttle switch does not allow current to be sent to terminal #19 of the safety controller. This will allow the safety buzzer to alarm.

Safety Controller Functions

Inputs

Terminal #7 current from #2 (10 amp) fuse.

Terminal #10 current from #3 (20 amp) fuse.

Terminal #18 current from #2 (10 amp) fuse.

Ground Source

Terminal #11, provided by engine cylinder head ground terminal.

Output

Terminal #4 provides current to the safety alarm, allowing the alarm to sound.

Alarm Control Terminals

Terminal #8, no current provided by seat safety switch.

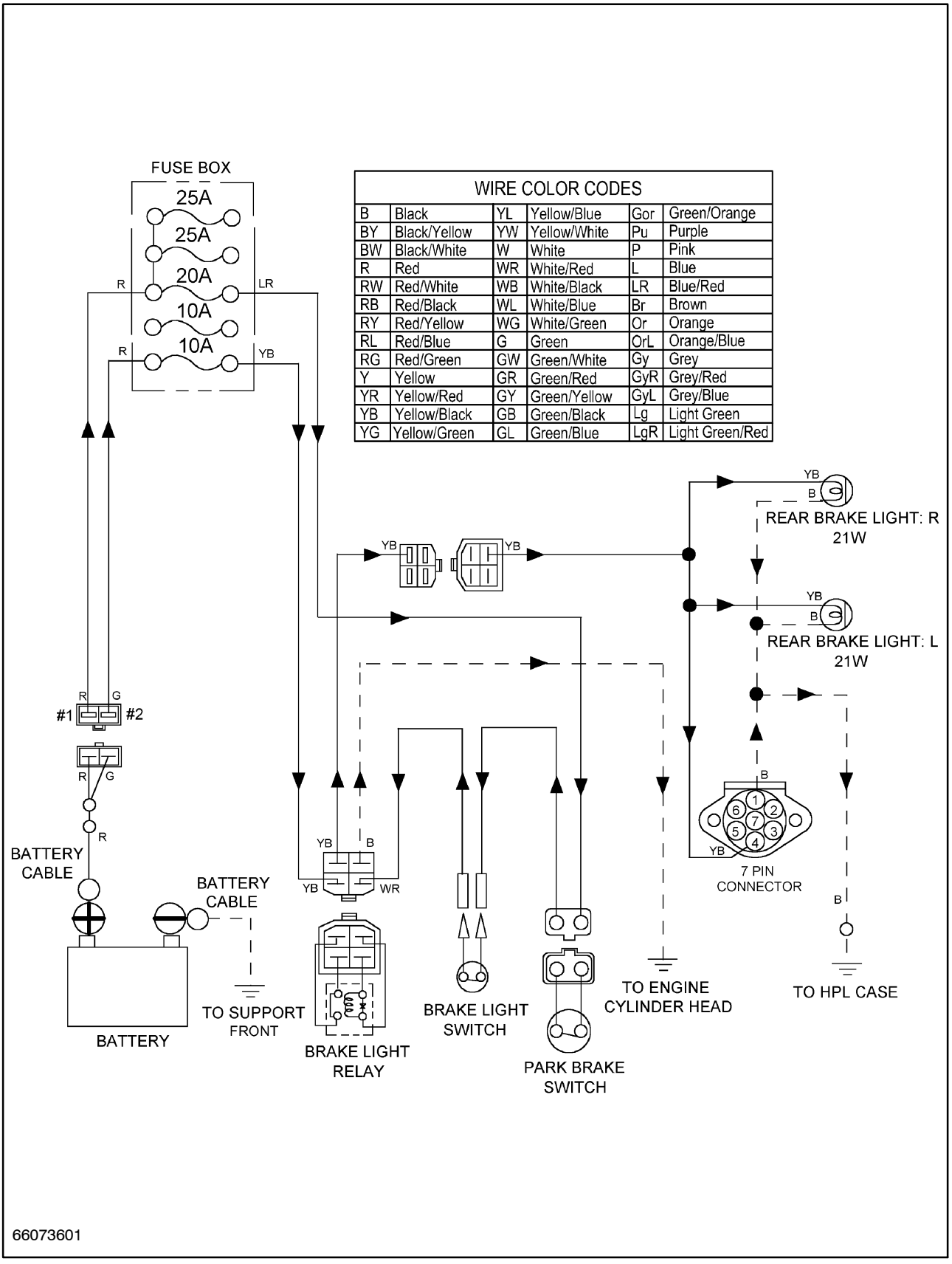
Terminal #9, no current provided by park brake safety switch.

Terminal #19, no current provided by the EHSS shuttle safety switch.

Terminal #20, no current provided by the rear PTO safety switch.

TROUBLESHOOTING SAFETY ALARM CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Safety alarm will not sound.	Blown #2 (10 amp) or #3 (20 amp) fuse.	Inspect and replace fuses as necessary.
	Faulty safety controller.	Test controller and replace as necessary.
	Improper ground circuit.	Check ground circuit connector for corrosion.
	Park brake switch stuck in closed position.	Test switch, replace if necessary.
	Faulty safety alarm.	Test alarm, replace as necessary.
Safety alarm will not shut off.	Defective safety controller.	Test controller and replace as necessary.
	Park brake switch stuck in open position.	Test switch, replace if necessary.

BRAKE LIGHTS CIRCUIT



BRAKE LIGHTS CIRCUIT

NOTE: *The brake lights are located on both rear fenders. The lights will illuminate with the key switch in any position, when both brake pedals are depressed, warning anyone following the tractor, the brakes are being applied and the tractor ground speed is being reduced.*

1. Current starts at the battery and flows through the positive (+) battery cable to the engine starter motor.
2. From the starter motor, current flows through the fusible link wire. From the fusible link, the current spits into two different directions due to a wire connector.

   #1 terminal of connector – Sends current to:

   - #3 (20 amp fuse).
   - #1 (10 amp fuse).
3. The #3 (20 amp) fuse supplies current to the park brake switch.
4. When the park brake is not applied, the park brake switch is closed, allowing current to flow to the brake lights switch.
5. When the brake pedals are depressed, the brake lights switch is closed and current flows to the coil side of brake lights relay.
6. The #1 (10 amp) fuse supplies current to the switch side of the brake lights relay.
7. When a ground source is supplied to the brake lights relay, the relay is energized, allowing the relay to latch and sends current to the rear brake lights and terminal #4 of the 7 pin connector. When a ground source is provided to the brake lights, the rear brake lights will illuminate.

NOTE: *The brake lights will not illuminate if the park brake is engaged.*

TROUBLESHOOTING BRAKE LIGHTS CIRCUIT		
PROBLEM	**POSSIBLE CAUSE**	**CORRECTION**
Inoperative brake lights.	Blown #1 (10 amp) or #3 (20 amp) fuse.	Inspect and replace fuses as necessary.
	Defective brake lights switch.	Test switch, replace if necessary.
	Defective park brake switch.	Test switch, replace if necessary.
	Defective brake lights relay.	Test relay, replace if necessary.
	Loose brake lights connections.	Check wire harness for proper connections.
	Improper ground circuit.	Check ground connections for corrosion.
	Defective brake light bulb.	Check bulb, replace as necessary.

SECTION 55 - ELECTRICAL SYSTEM

Chapter 3 - Instrument Panel

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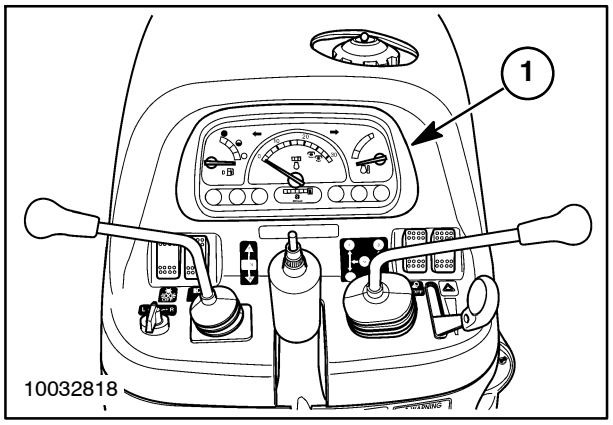
INSTRUMENT PANEL

DESCRIPTION

The instrument panel, 1, is located at the top of the dash panel. The instrument panel houses the gauges, indicator lights, hour meter and tachometer that monitor the tractor functions.



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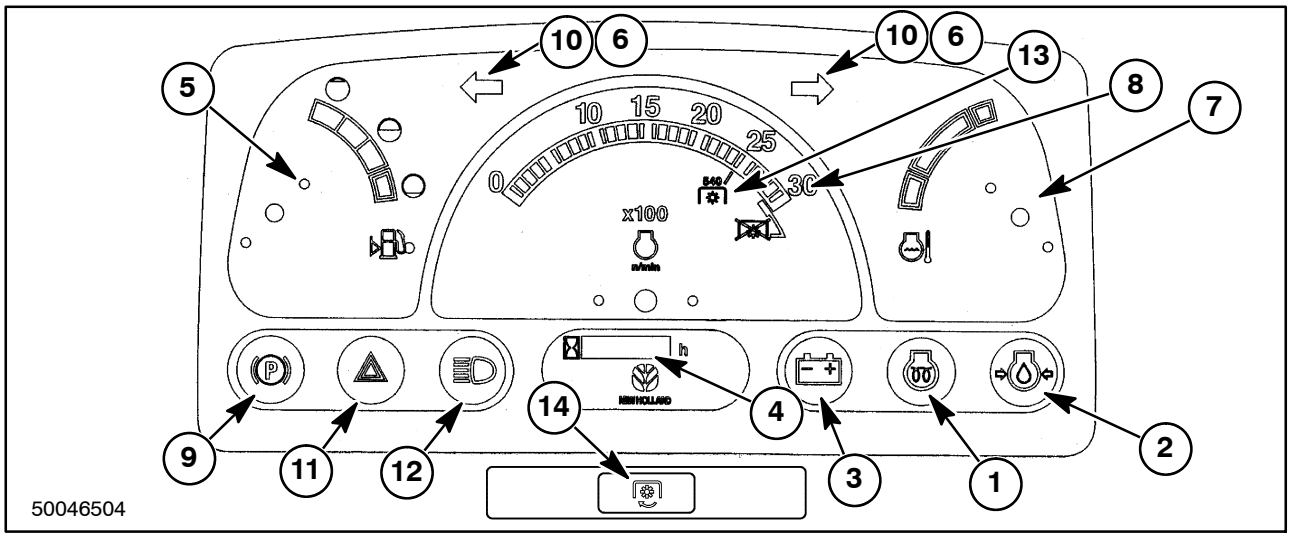

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INSTRUMENT PANEL COMPONENTS

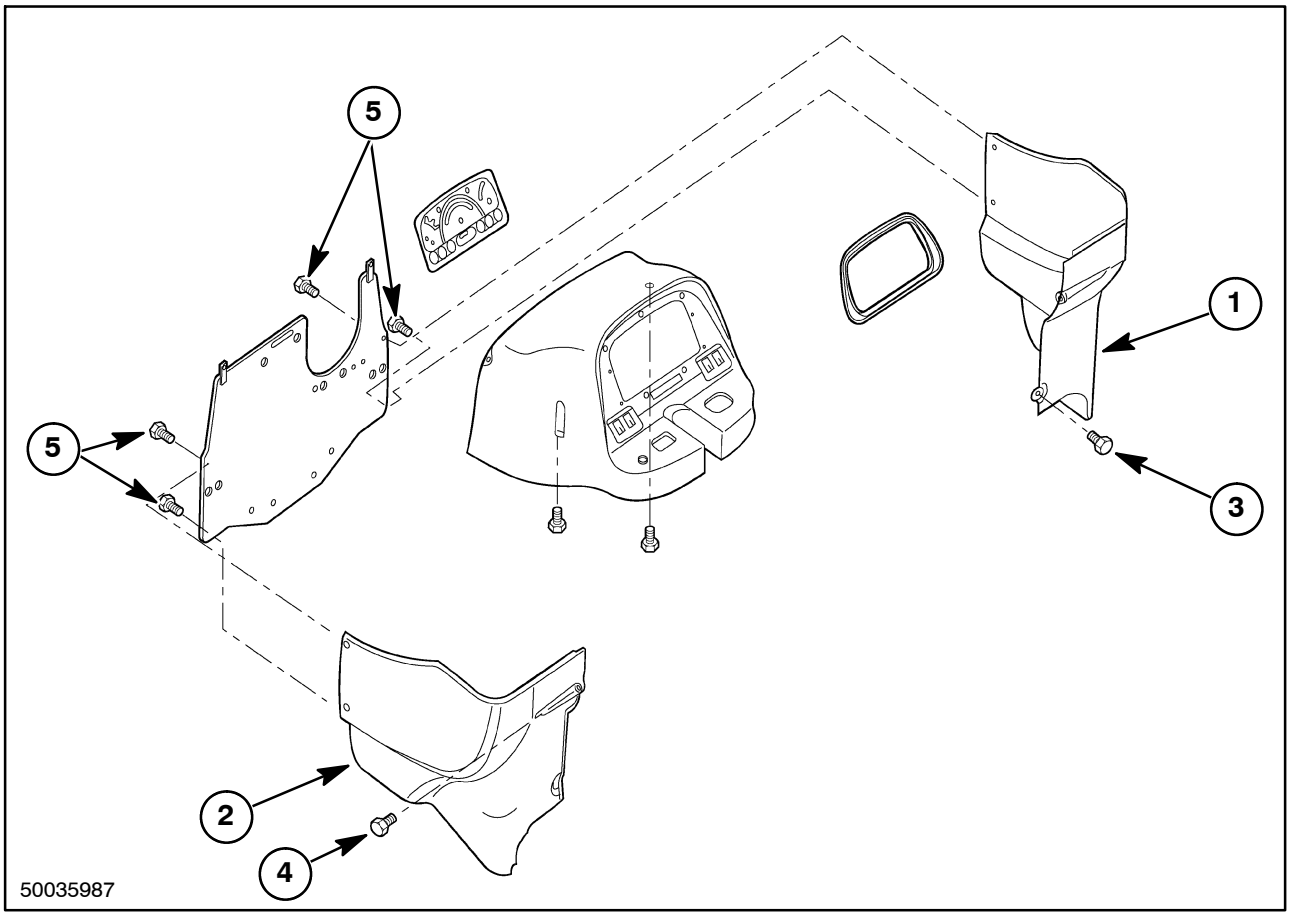
1. **Cold Starting Indicator Light** - Illuminates when the key switch is turned to the "HEAT" position. It remains lit for approximately four seconds when the key is in position, during which time the glow plugs are heating the precombustion chambers of cylinder head.
2. **Engine Oil Pressure Warning Light** - Illuminates with the key switch in the "ACC/RUN" position and remains lit for a short period of time after the engine is started. The light indicates oil pressure only and goes out when sufficient oil pressure is present at the oil sender. If the bulb becomes lit during operation, stop the tractor engine immediately and investigate the cause.
3. **Battery Charge Warning Light** - Illuminates when the key switch is in the "ACC/RUN" position and goes out when the engine is started. If this bulb becomes lit during operation, it indicates that the charging system is not operating normally. As the battery can become fully discharged under these conditions, the problem should be investigated as soon as possible.
4. **Proof Meter** - Records the hours and portions of hours that your tractor has been operated based on an average engine speed of 1833 RPM. Engine speeds below 1833 RPM accumulate engine hours at a slower rate than clock hours. Engine speeds above 1833 RPM accumulate engine hours faster than clock hours. Use the proof meter as a guide to determine hourly service and maintenance intervals.
5. **Fuel Gauge** - Indicates the amount of diesel fuel remaining in the tank. The gauge is activated when the key switch is in the "ACC/RUN" position. It will register empty with the key switch in the "STOP" position.
6. **Flasher Warning Hazard Lights** - Operate when the flasher switch is turned on, regardless of the key switch position. Use the flasher warning lights and the SMV emblem when traveling on public roads, day or night.
7. **Temperature Gauge** - Indicates coolant temperature. It is activated when the key switch is turned to the "ACC/RUN" position. The gauge will register cold with the key switch in the "STOP" position. If the needle registers in the green range of the gauge, this indicates a normal operating temperature. If the needle moves to the red portion of the gauge, this indicates an overheated condition. Stop the tractor engine immediately and investigate the cause.
8. **Tachometer** - Registers engine RPM (Revolutions Per Minute). The gauge is marked in increments of 100 and will return to zero when the engine is not running.
9. **Parking Brake Light** - Illuminates if the parking brake is engaged when the key switch is turned from the "OFF" position.
10. **Flasher Turn Lights** - When the turn signal switch is moved to the right for right turns, the right arrow will flash. When moved to the left for left turns, the left arrow will flash. The key switch has to be in the "ACC/RUN" or "START" positions.

NOTE: *The arrow opposite the direction will illuminate constant, not flashing.*

11. **Flasher Warning Hazard Lights Indicator** - SMV symbol flashes in unison with directional arrows, 6, when the flasher switch is turned on, regardless of key position.
12. **High Beam Road Light Indicator** - The light symbol will illuminate "Blue" when the road light switch is placed in the forward (High Beam) position.
13. **PTO Speed Indicator** - Determined by the position of the needle on the tachometer. The tachometer is marked to indicate 540 PTO RPM. If the needle registers above the 540 RPM mark, this indicates a dangerous over speed condition, and the engine RPM should be reduced immediately.
14. **PTO Indicator Light*** - Illuminates with the key switch in the "ON" position and the PTO clutch lever engaged. This light indicates that the PTO clutch is engaged.

Instrument Panel Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the right, 1, and left, 2, rear hood panels by removing retaining bolts, 3, 4, 5.
3. Tilt steering wheel rearward to ease tilting of dash panel.



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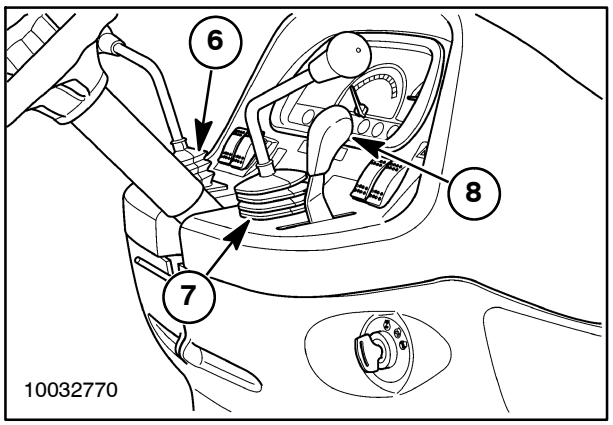
4. Remove rubber boots, 6, and 7, from dash panel.
5. Remove throttle control knob, 8, from lever.



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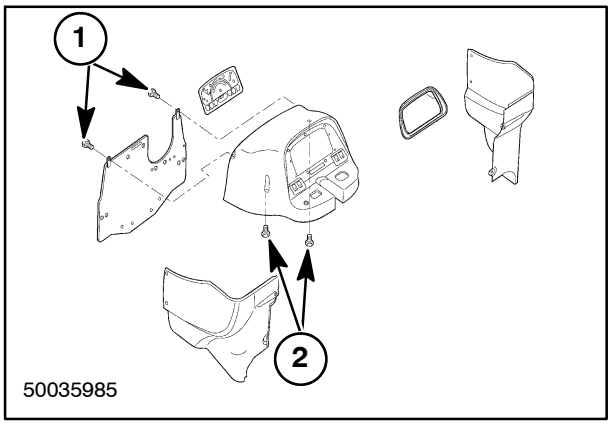
6. Remove the two front retaining bolts, 1.
7. Remove the left and right underside retaining screws, 2, from dash panel.
8. Tilt dash panel rearward to gain access to underside of instrument panel.



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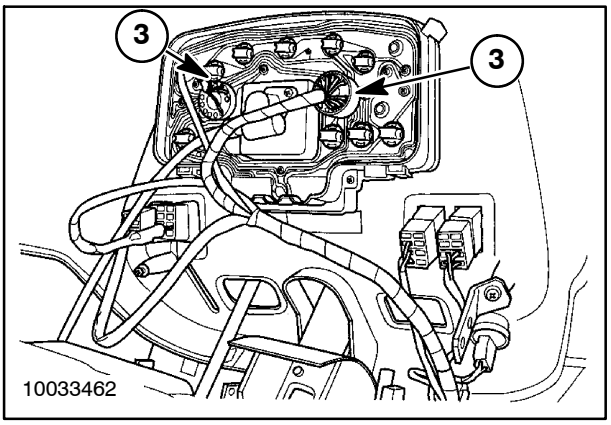
9. Remove the two wire harness connectors, 3, and tachometer cable, 4, from the instrument panel.



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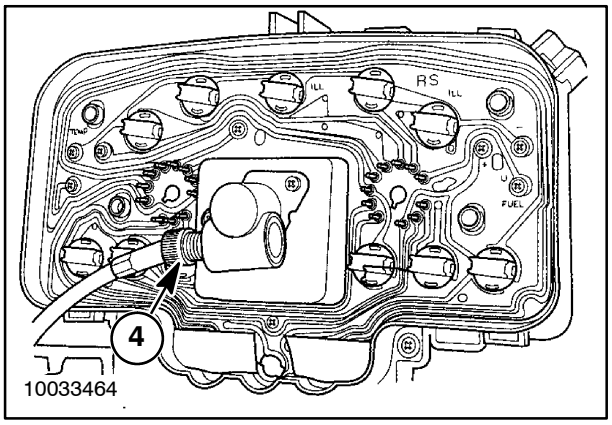
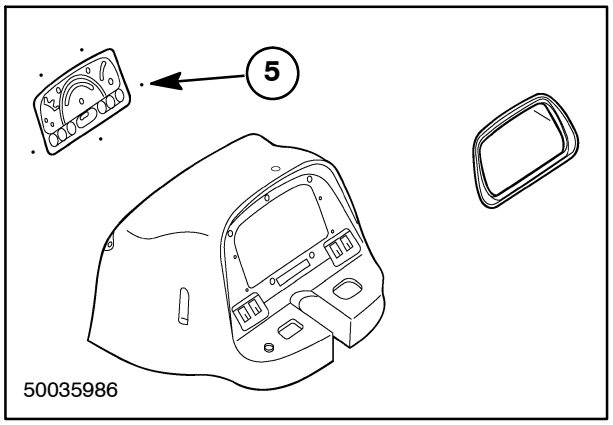


7

10. Remove the five retaining screws, 5, from the backside of the instrument panel and lift instrument panel out of rear of dash.

NOTE: *The instrument panel is serviced as an assembly, only components serviced, are the tachometer drive elbow and indicator and illumination light bulbs.*



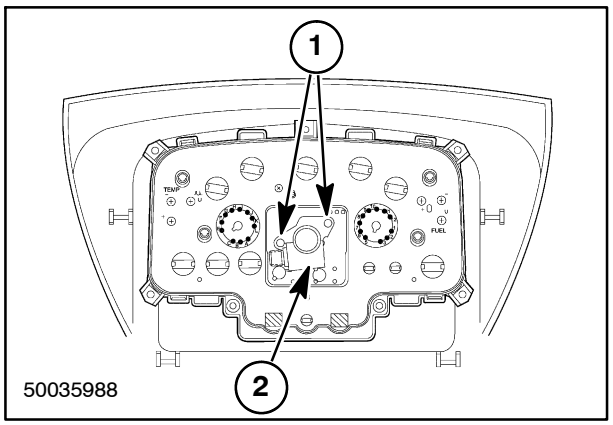
8

TACHOMETER

Tachometer Drive Elbow Removal

NOTE: *Check the tachometer cable for damage before removing the tachometer drive elbow from the instrument panel.*

1. Remove the instrument panel, SEE INSTRUMENT PANEL REMOVAL.
2. Remove the two retaining screws, 1, and remove the tachometer drive elbow, 2, from the instrument panel.



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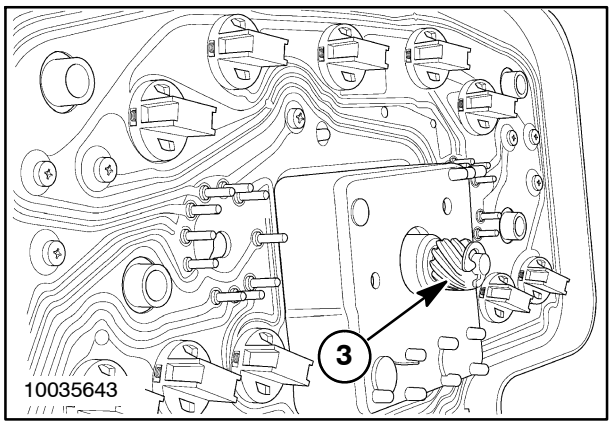
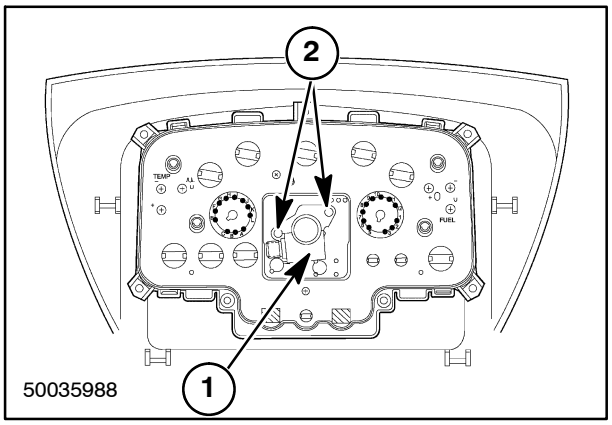
3. Inspect gear, 3, on input shaft for excessive wear or damage. If gear is damaged, instrument panel assembly has to be replaced.



10

Tachometer Drive Elbow Installation

1. Lube both gears with petroleum jelly.
2. Place tachometer drive elbow, 1, onto input gear, install and tighten retaining screws, 2.
3. Install the instrument panel, *SEE INSTRUMENT PANEL INSTALLATION.*

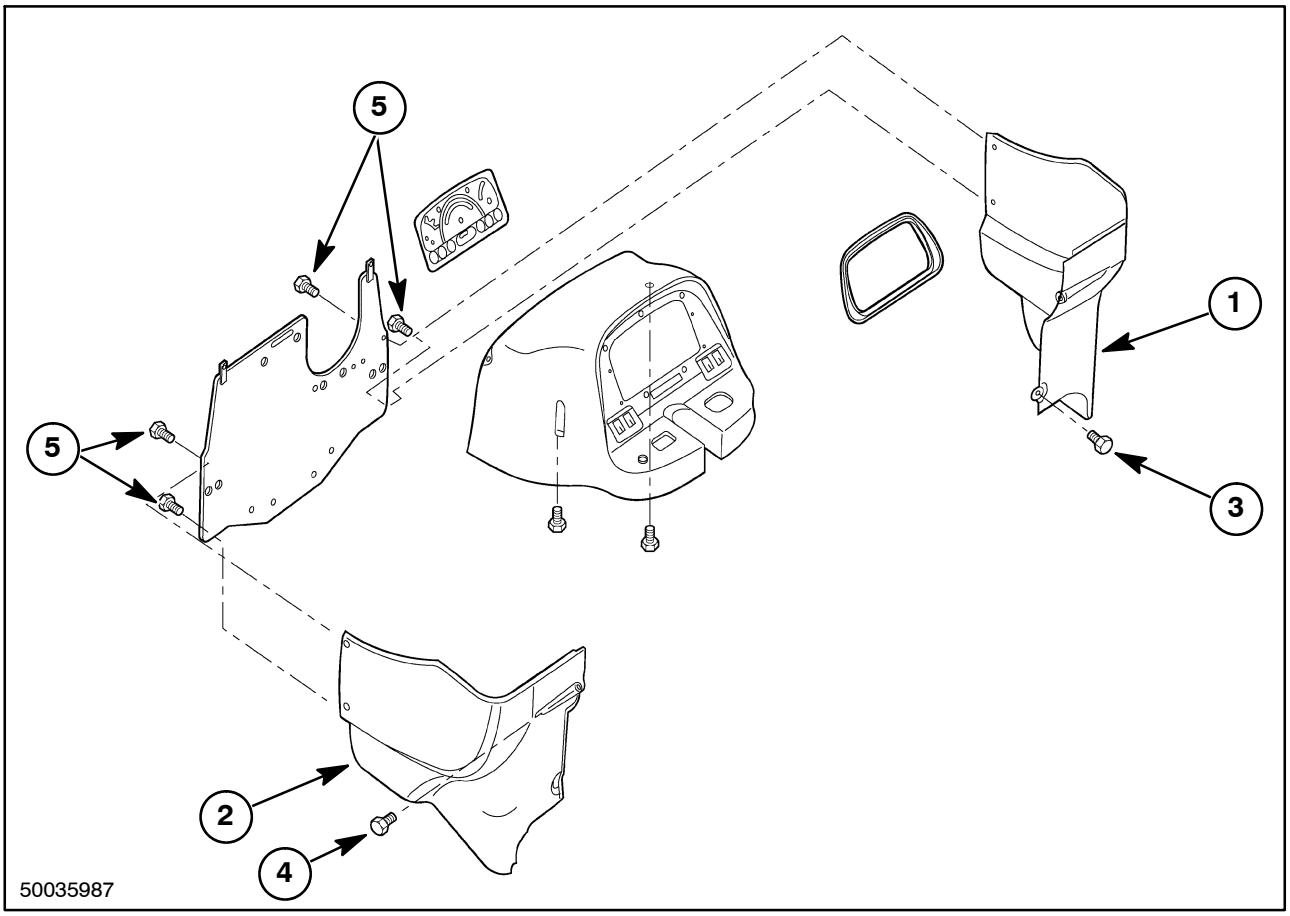


11

INSTRUMENT PANEL BULBS

Replacement

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the right, 1, and left, 2, rear hood panels by removing retaining bolts, 3, 4, 5.
3. Tilt steering wheel rearward to ease tilting of dash panel.



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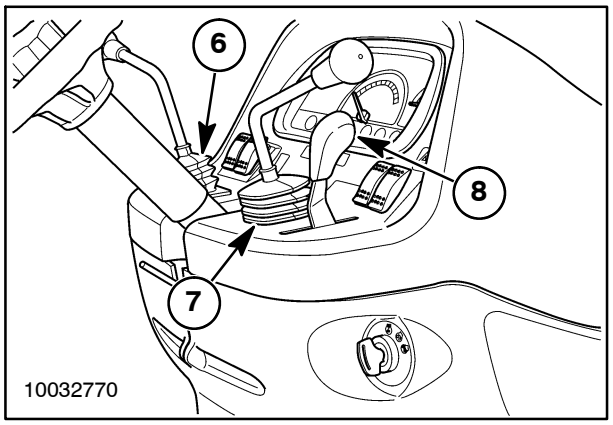
4. Remove rubber boots, 6, and 7 from dash panel.
5. Remove throttle control knob, 8, from lever.



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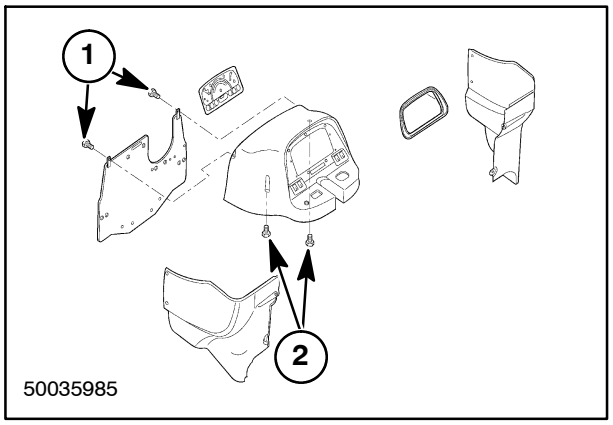
6. Remove the two front retaining bolts, 1.
7. Remove the left and right underside retaining screws, 2, from dash panel.
8. Tilt dash panel rearward to gain access to underside of instrument panel.



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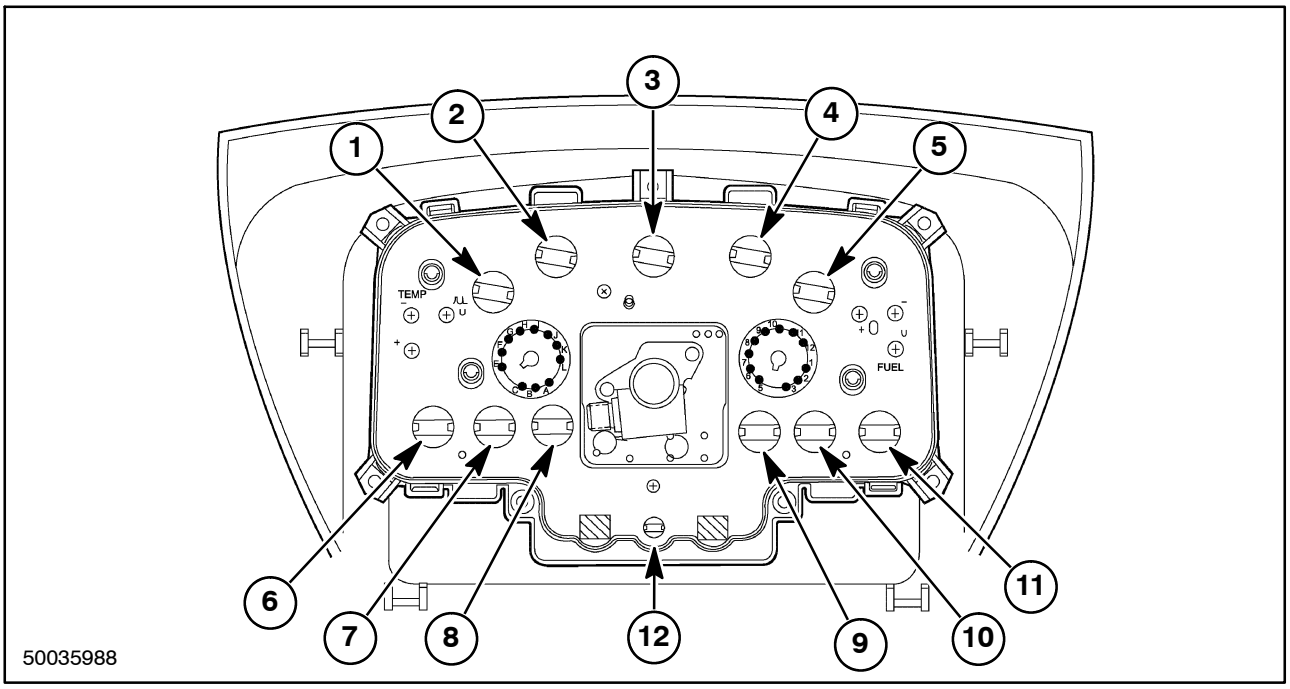

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9. Rotate bulb 1/4 turn and remove from rear of instrument panel.
10. Inspect bulb mating surface of instrument panel for corrosion and clean if necessary. Install correct size bulb according to chart.

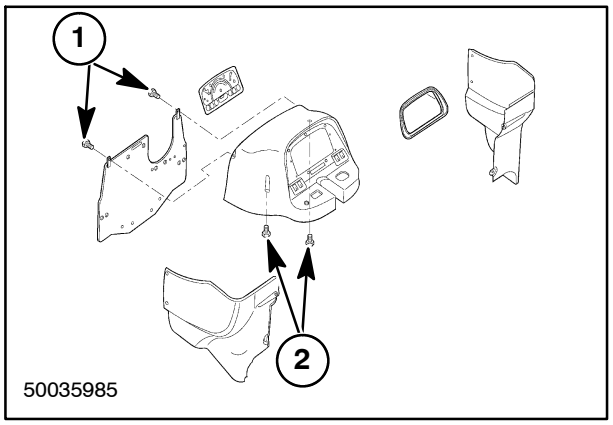
BULB IDENTIFICATION

Number	Designation	Industry Number	Candle Power (W)
1	Illumination – Temperature Gauge	758	1.7
2	Warning – Right turn Signal	158	3.4
3	Illumination – Tachometer	758	1.7
4	Warning – left Turn Signal	158	3.4
5	Illumination - Fuel Gauge	758	1.7
6	Warning – Parking Brake	158	3.4
7	Warning – Hazard lights (SMV Emblem)	158	3.4
8	Warning - Road lights (High beam)	158	3.4
9	Warning - Battery	158	3.4
10	Warning – Preheat	158	3.4
11	Warning – Engine Oil Pressure	158	3.4
12	Warning – Hazard lights (Double Arrows)	2473 MFX6	3.0
	Warning – PTO Light	2473 MFX6	3.0

INSTRUMENT PANEL

Installation

1. Install the left and right underside retaining screws, 1, from dash panel.
2. Install the two front retaining bolts, 2.



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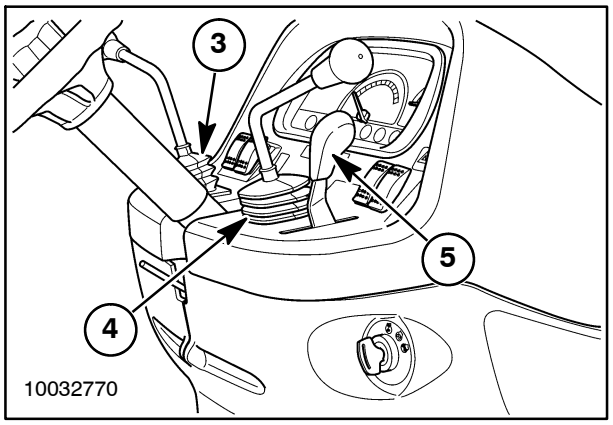
3. Place rubber boots, 3 and 4, into dash panel.
4. Install throttle control knob, 5, onto lever.



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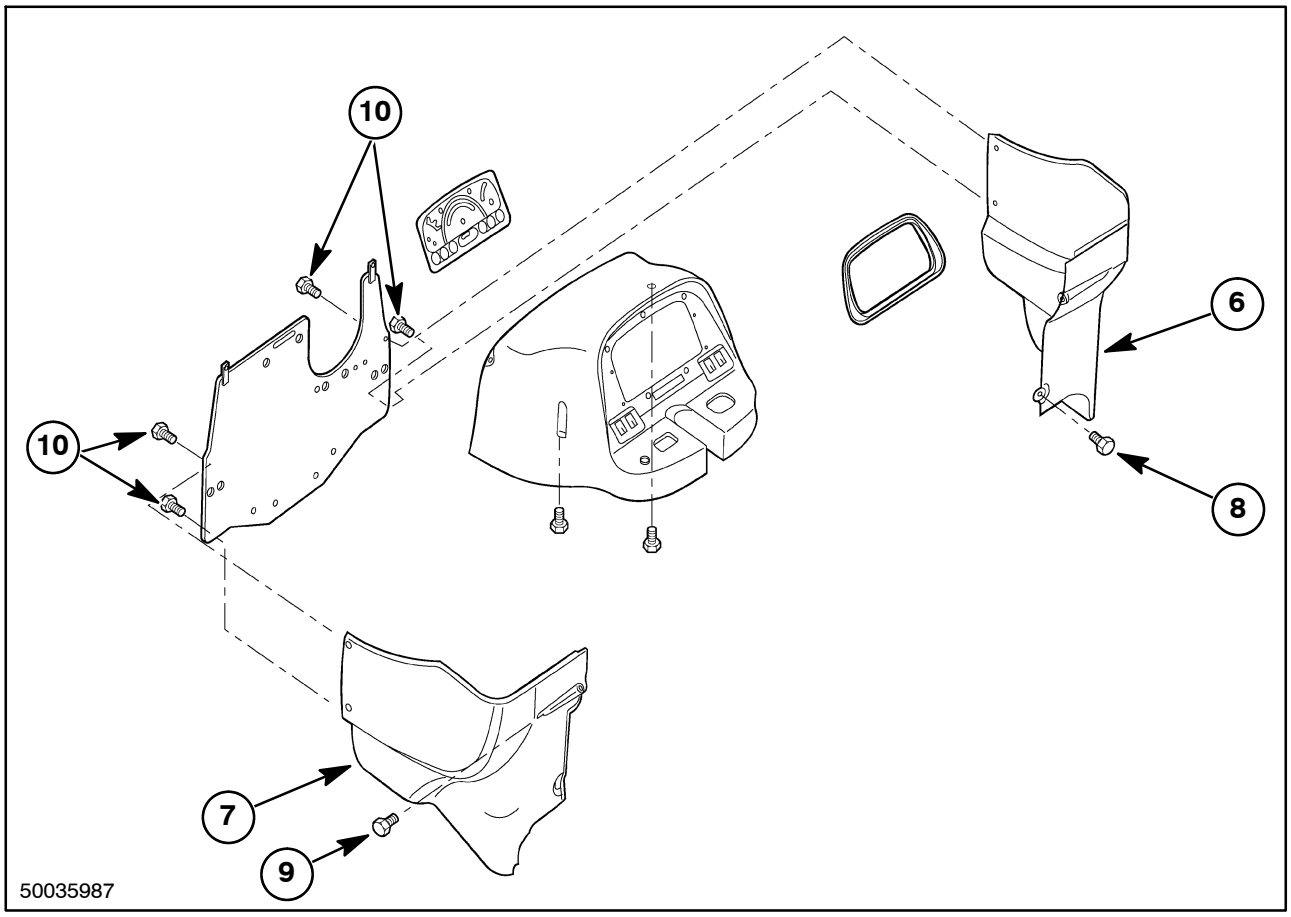

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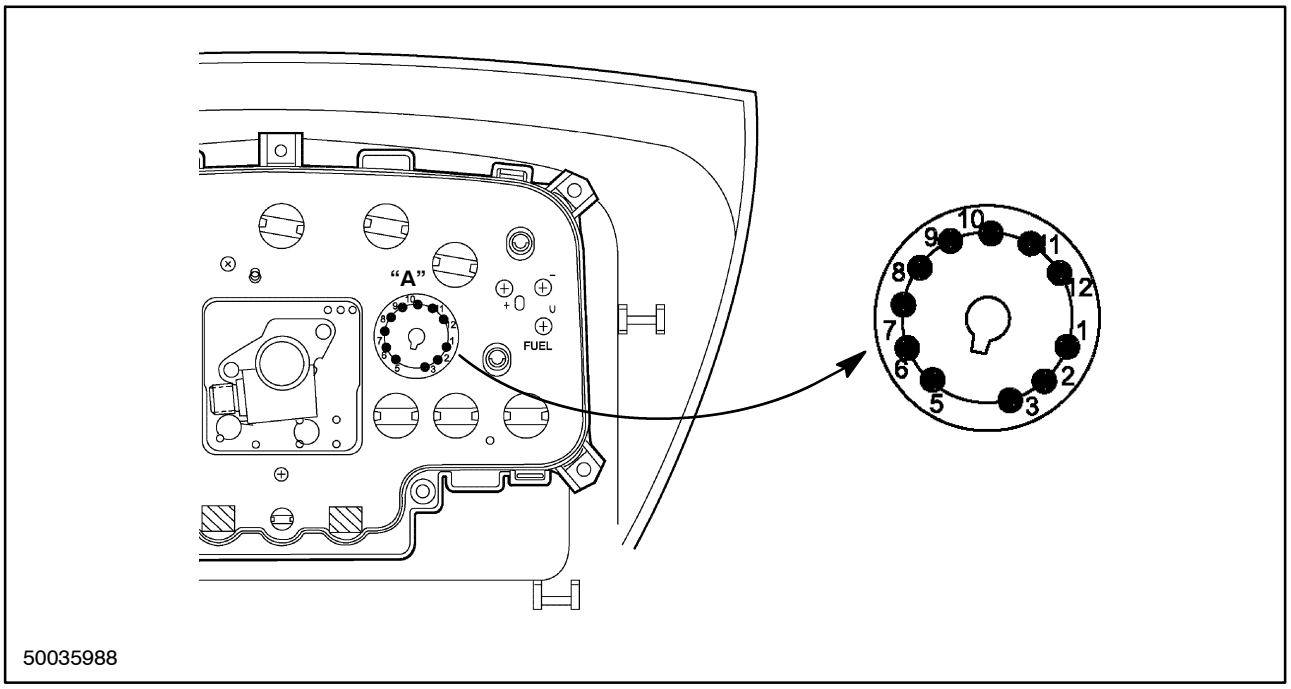
5. Install the right, 6, and left, 7, rear hood panels with retaining bolts, 8, 9, 10.
6. Connect the negative (-) battery cable to the negative (-) battery terminal.



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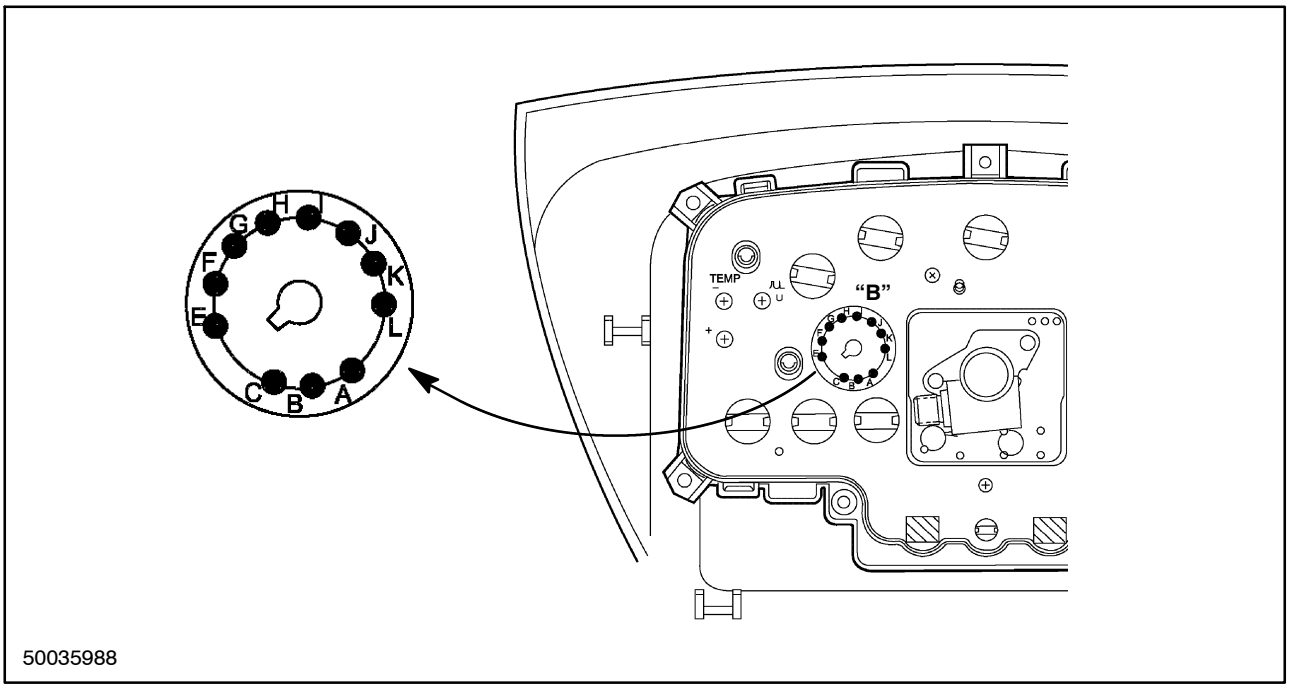
INSTRUMENT PANEL CONNECTOR IDENTIFICATION

CONNECTOR "A"

Terminal	Function
1	Hazard Indicator Light
2	Engine Oil Pressure Indicator Light
3	(+) current to IP
5	High Beam Indicator Light
6	Glow Plug Indicator Light
7	Ground (-)
8	Temperature Gauge Sender
9	(+) Illumination
10	Right turn Signal
11	Left Turn Signal
12	Fuel Gauge Sender



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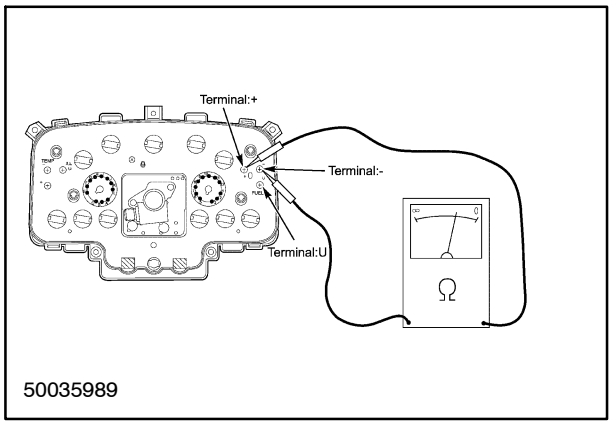
CONNECTOR "B"

Terminal	Function
A	Trailer Hazard Indicator Light
B	NA
C	Rear PTO Indicator Light
E	NA
F	NA
G	NA
H	Parking Brake Indicator Light
I	Not used
J	Charge Indicator Light
K	Charge Indicator Light
L	NA

FUEL AND TEMPERATURE GAUGE TESTING

Fuel Gauge Testing

1. Disconnect (-) battery cable from the (-) negative battery terminal.
2. Disconnect both “a” and “b” instrument panel wire harness connectors from rear of the instrument panel.
3. Using an ohmmeter, touch one test lead to the (+) terminal and the other test lead to the (-) terminal of the fuel gauge.
4. Observe the ohmmeter, the measured resistance should be about 88 ohms ± 3 ohms. If resistance is not between 85 to 91 ohms, the gauge is defective and the instrument panel needs to be replaced.
5. Using an ohmmeter, touch one test lead to the “U” terminal and the other test lead to the (+) terminal of the fuel gauge.
6. Observe the ohmmeter, the measured resistance should be about 73 ohms ± 3 ohms. If resistance is not between 70 to 76 ohms, the gauge is defective and the instrument panel needs to be replaced.
7. Using an ohmmeter, touch one test lead to the “U” terminal and the other test lead to the (-) terminal of the fuel gauge.
8. Observe the ohmmeter, the measured resistance should be about 57 ohms ± 3 ohms. If resistance is not between 54 to 60 ohms, the gauge is defective and the instrument panel needs to be replaced.



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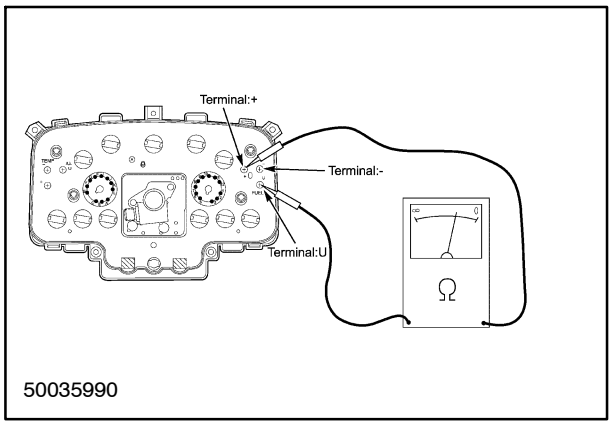

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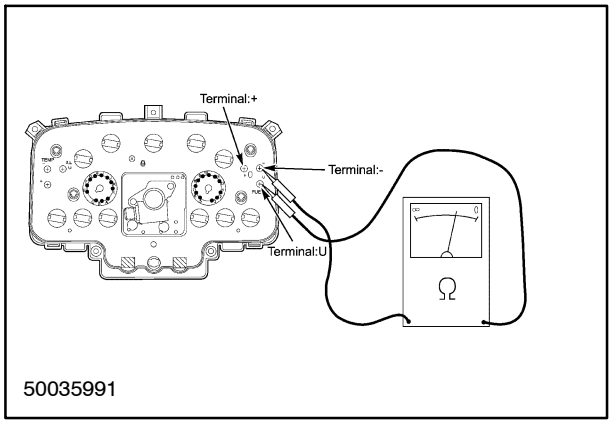

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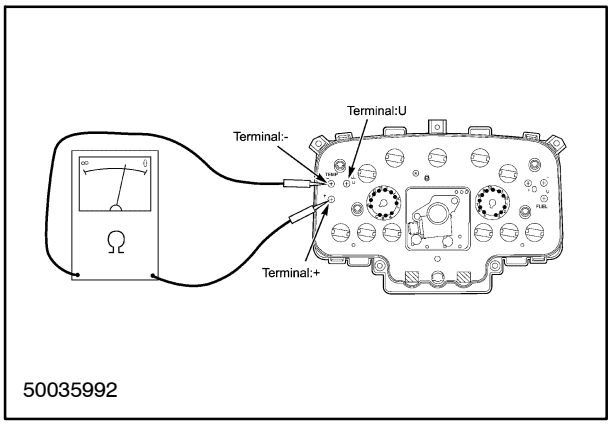
TEMPERATURE GAUGE TESTING

1. Disconnect (-) battery cable from the (-) negative battery terminal.
2. Disconnect both “a” and “b” instrument panel wire harness connectors from rear of the instrument panel.
3. Using an ohmmeter, touch one test lead to the (+) terminal and the other test lead to the (-) terminal of the fuel gauge.
4. Observe the ohmmeter, the measured resistance should be about 88 ohms ± 3 ohms. If resistance is not between 85 to 91 ohms, the gauge is defective and the instrument panel needs to be replaced.
5. Using an ohmmeter, touch one test lead to the “U” terminal and the other test lead to the (+) terminal of the fuel gauge.
6. Observe the ohmmeter, the measured resistance should be about 78 ohms ± 3 ohms. If resistance is not between 75 to 81 ohms, the gauge is defective and the instrument panel needs to be replaced.
7. Using an ohmmeter, touch one test lead to the “U” terminal and the other test lead to the (-) terminal of the fuel gauge.
8. Observe the ohmmeter, the measured resistance should be about 52 ohms ± 3 ohms. If resistance is not between 49 to 55 ohms, the gauge is defective and the instrument panel needs to be replaced.



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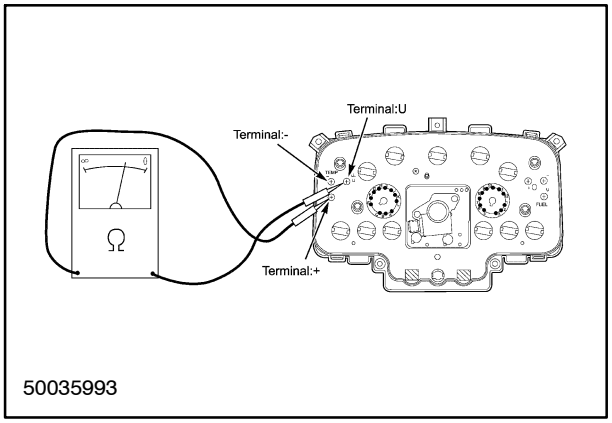

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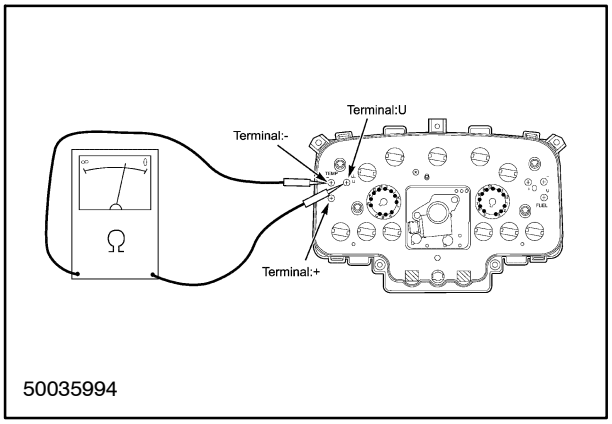

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SECTION 55 - ELECTRICAL SYSTEM

Chapter 4 - Alternator and Starter

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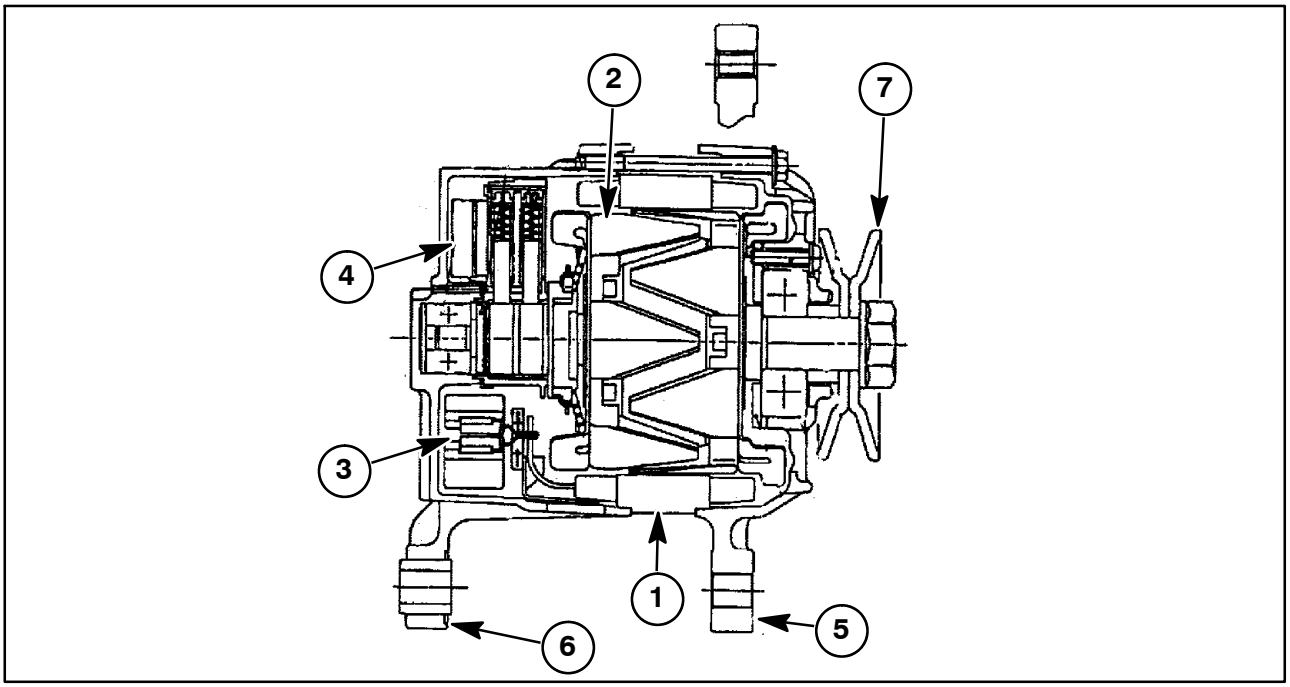
CHARGING SYSTEM



1

DESCRIPTION OF OPERATION

Alternator

The T2410 and T2420 model tractors are equipped with a 40-amp output alternator. The alternator is equipped with an integrated circuit (IC) regulator, meaning voltage is regulated internally and electronically within the alternator.

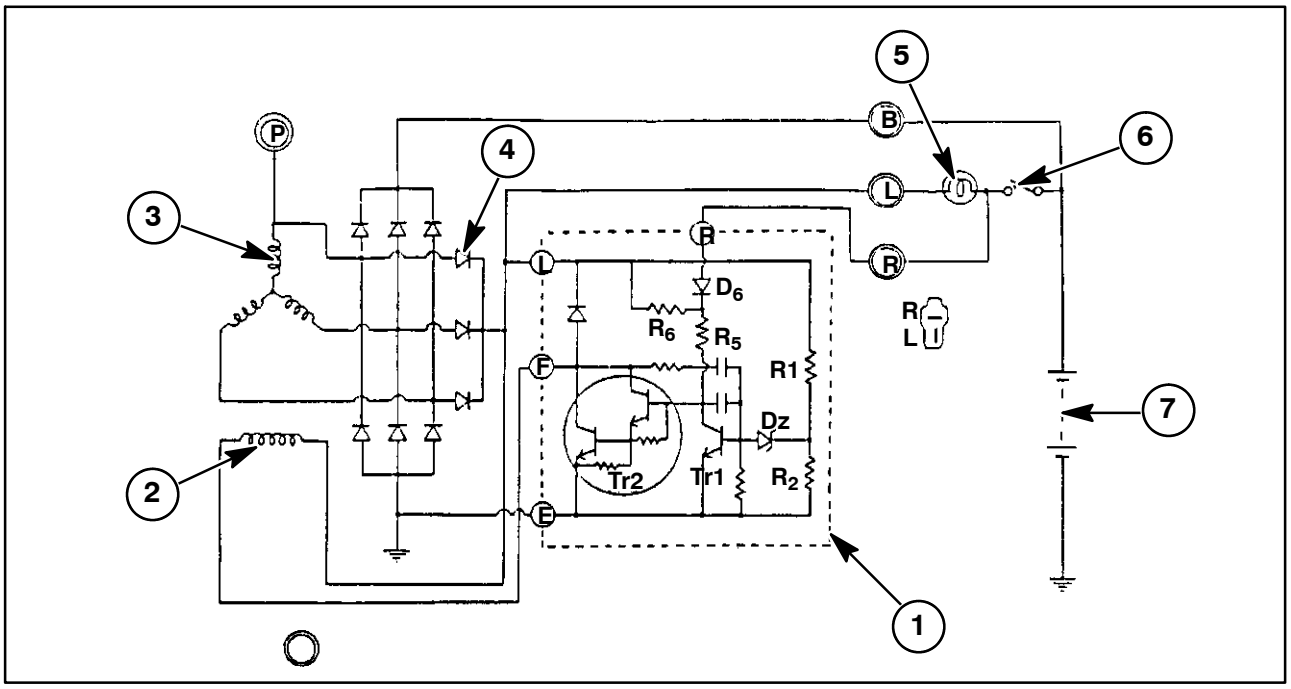
The principle components of the alternator are the stator, 1, the rotor, 2, the rectifier assembly, 3, and the IC regulator, 4.

The rectifier assembly, 3, consist of two heat sinks, one positive (+) and one negative (-), and a diode trio. The diode trio is use as a field supply diode and is connected to terminal “L” on the alternator.

The IC regulator, 4, is a solid state unit and can only be serviced as an assembly.

The internal components of the alternator are housed in a two-piece frame, which is divided into a drive end (front) frame, 5, and a rear frame, 6. The frame contains open slots to allow for cooling of the alternator.

The alternator is rotated in the frame by using a belt-driven pulley, 7, which is powered off of the engine crankshaft pulley by a belt.



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Charging Circuit

The charging circuit and internal connections are shown. The charging system consists of an IC voltage regulator, 1, (enclosed with dotted lines), a battery, 7, and connecting wires. Because of the use of IC, the voltage regulator is very compact and is built into the alternator.

The IC voltage regulator, 1, permits the field current to flow directly from the diode trio, 4, to the field coil, 2, without passing through the external circuit. Consequently, there are no voltage drops caused by the key switch or the external wiring as with conventional vibrating-contact regulators mounted separately from the alternator. To aid in initial voltage buildup when the engine is started, the field current is supplied through the indicator lamp, 5, from the battery, 7.

Since the frequency pulse output of 1/10 the alternator speed develops on the “P” terminal, this terminal is used for speed detection.

Principle of IC Regulator

The basic function of the IC voltage regulator is to make the terminal voltage constant by detecting the generated voltage and increasing/decreasing the field current.

As indicated, the regulator consists of two basic sections: a voltage control device and an output device to handle the field current. The voltage control device includes the voltage divider network, R1 and R2, a zener diode, DZ, for voltage reference, and a single amplifying transistor, Tr1. The output device is a darlington-type amplifier which is called power transistor, Tr2. The power transistor, Tr2, is placed in series with the alternator field coil and ground.

The signal amplifying transistor, Tr1, senses the generated voltage and turns the power transistor, Tr2, on and off many times per second most of the time the engine is in operation.

The basic operating principles are explained as follows, see Figure 2:

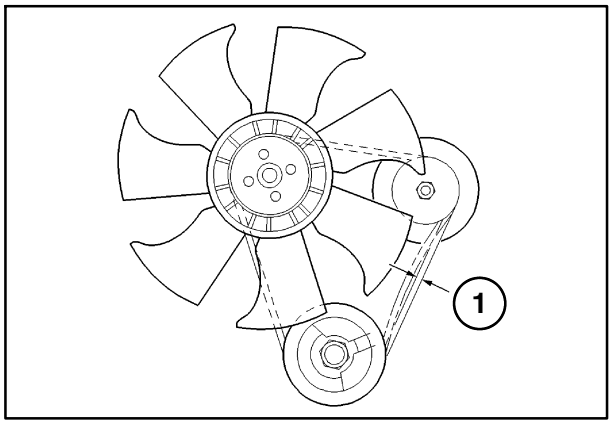
1. When the key switch, 6, is closed, current from the battery, 7, flows through the indicator lamp, 5, and resistor R6, which are in parallel to the field coil, 2. From here it continues to flow on through the field coil, 2, to the ground, completing the circuit back to the battery, 7.
2. When the alternator begins to rotate, AC voltages are generated by the stator coil, 3. The diodes in the rectifier assembly change the stator AC voltages to DC voltage which appears between ground and the “B” terminal.
3. The stator also supplies DC field current through the diode trio, 4, the field coil, 2, the power transistor, Tr2, and then through the diodes in the rectifier assembly back to the stator.
4. When the generated voltage is low, no current flows in the zener diode, DZ, since the voltage at point “A” is lower than the zener voltage.
5. As the speed and voltage increase, the voltage at point “A” also increases until it reaches the limiting value set at the factory. As the zener diode, DZ, breaks down, current flows through R1, DZ, and the base-emitter circuit of Tr1 to ground. This renders Tr1 conductive, so that much of the current flows through the collector-emitter circuit of Tr1. This reduces the base current of Tr2 thereby reducing the field current. This means that Tr1 turns on and Tr2 turns off.
6. When the generated voltage decreases, the zener diode, DZ, again turns off and Tr1 also turns off. This cycle repeats many times per second, and the alternator output voltage is, therefore, regulated within a narrow limit.

   In other words, the action is similar to the conventional vibrating-contact regulator, in that current to the field coil, 2, is varied to limit the output voltage, but in place of the voltage coil and spring system, there is a voltage divider network, R1 and R2, and a zener diode, DZ.

PRELIMINARY ALTERNATOR TESTS

Drive Belt

1. Check the alternator drive belt deflection by applying 5 kg (12 lbs) of force between the crank pulley and the alternator pulley, 1. Belt deflection should be 5 - 10 mm (0.2 - 0.39 in).



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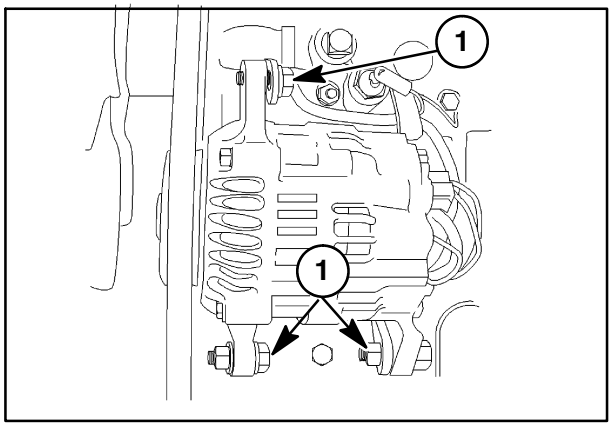
2. If the drive-belt deflection needs adjusted, loosen the adjusting/mounting bolts, 1, and adjust the alternator as needed to obtain proper belt deflection.



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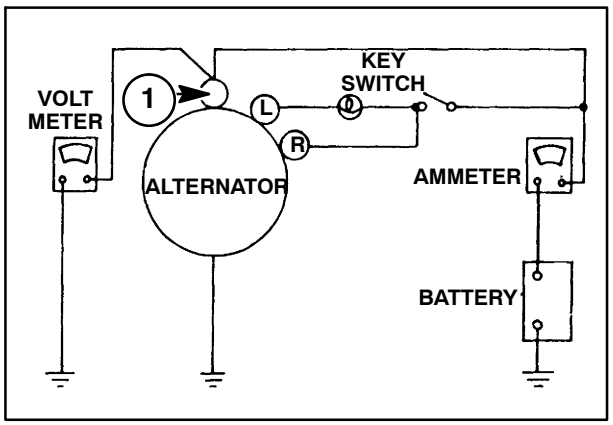
Alternator Output

NOTE: *Use the following methods if an alternator/ charging system analyzer is unavailable.*

1. Connect a 50-amp capacity test ammeter between the positive (+) battery cable and the key switch.
2. Connect a voltmeter to the battery terminal, 1, of the alternator and to a ground source.
3. Observe the voltmeter. The meter should indicate battery voltage. If the voltmeter does not read battery voltage, the wiring between the alternator and the battery may be faulty and should be repaired or replaced.



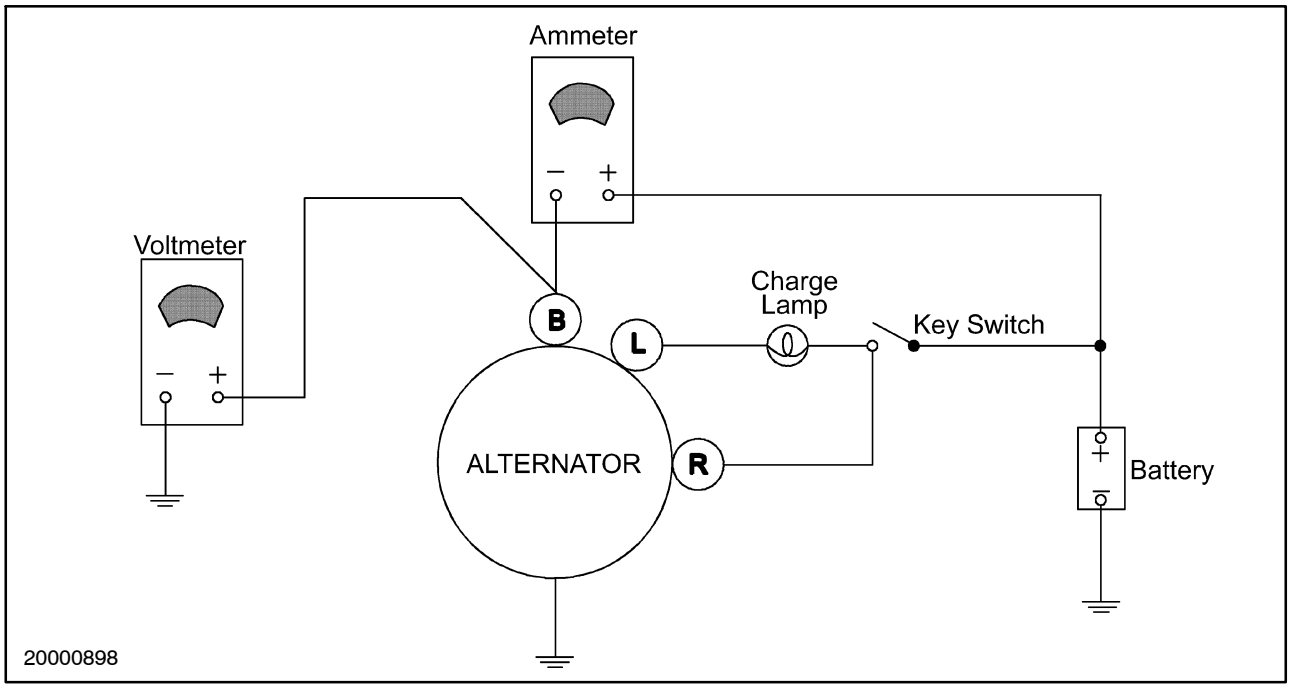
5

⚠ WARNING ⚠

Do not attempt to start the engine without first shorting the wires between the ammeter leads. Otherwise, injury or damage to the charging and testing components may occur.

4. Use a jumper wire to short the test ammeter leads and start the tractor engine.

5. After the tractor engine is started, remove the jumper wire between the test leads of the ammeter.
6. Increase the engine speed to approximately 2000 RPMs and observe the ammeter reading.
7. If the ammeter indicates 5 amps or less, observe the voltmeter reading. The voltmeter is indicating adjusting voltage, which is the amount of increased voltage the alternator supplies to the battery. The reading should indicate a higher voltage that what is indicated when voltage is taken at the battery. If the reading is not higher, the alternator is not generating enough voltage and a component may be malfunctioning.
8. If the ammeter indicated more than 5 amps, continue to charge the battery until the ammeter reading falls below 5 amps. If the reading does not fall below 5 amps, test the battery or replace the battery with one that is fully charged.



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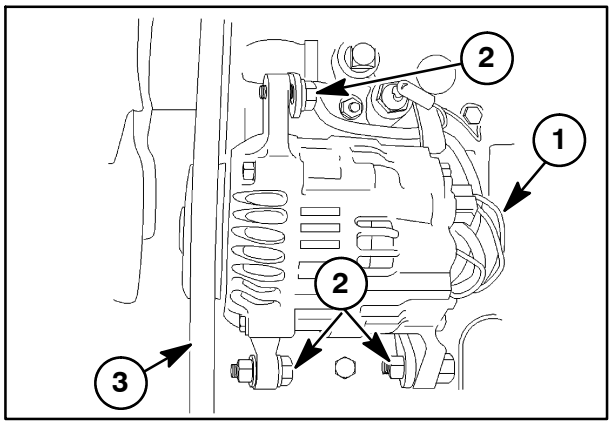
NOTE: *Bench testing the alternator will achieve the best results for the following tests (see alternator bench testing).*

1. If the previous test was satisfactory, open the key switch (OFF) and connect an ammeter between the battery terminal “B”, of the alternator and the battery wire, as shown.
2. Connect the positive (+) lead of a voltmeter to the “B” terminal on the alternator. Connect the negative (-) lead to a suitable ground. Confirm that the voltmeter indicated battery voltage.
3. Apply the parking brake and start the tractor engine. Turn on all 12-volt powered accessories such as headlight and indicator lights. Immediately raise engine RPMs to 2000 or more to record the maximum value indicated on the ammeter.
4. If the amperage value is more than 70% of the nominal alternator output, as described in alternator specifications, the alternator is considered to be working satisfactorily.

Alternator Removal

5. Disconnect the negative (-) battery cable from the negative battery terminal.
6. Disconnect all wiring, 1, from the rear of the alternator.
7. Loosen the alternator mounting bolts, 2, and remove the V-belt, 3, from the alternator drive pulley.
8. Remove the alternator mounting bolts, 2, and remove the alternator from the tractor engine.



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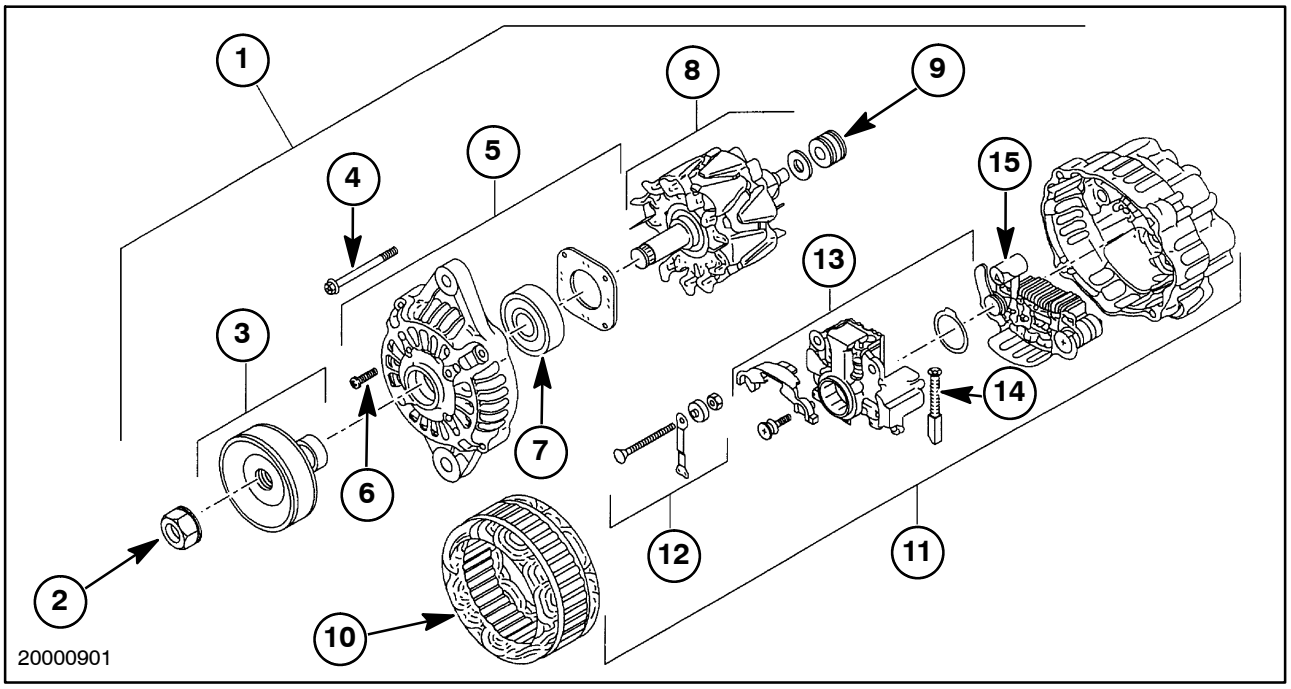
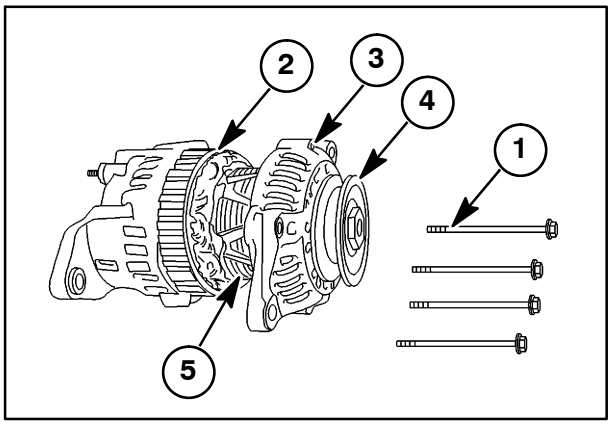


8

1. Alternator Assembly
2. Pulley Nut
3. Pulley Assembly
4. Bolt
5. Front Alternator Frame Assembly
6. Bolt
7. Front Rotor Bearing
8. Rotor Assembly
9. Rear Rotor Bearing
10. Stator
11. Rear Alternator Frame Assembly
12. Terminal Assembly
13. IC Regulator Assembly
14. Rotor Brush and Spring
15. Rectifier

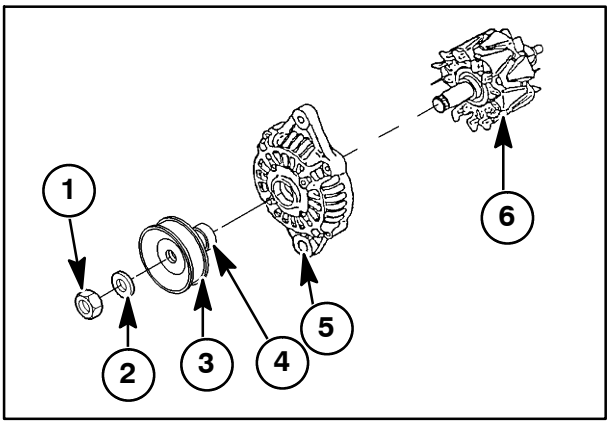
Alternator Disassembly

1. Mark the front alternator frame, 5, the rear alternator frame, 11, and the stator, 10, with scribe marks to insure that the alternator is assembled as taken apart. (Figure 8).
2. Remove the four (4) alternator frame retaining bolts, 1.
3. Carefully separate the front frame, 3, and the rear frame and stator, 2. The rotor assembly, 5, and the pulley, 4, will be removed with the front frame, 3.



9

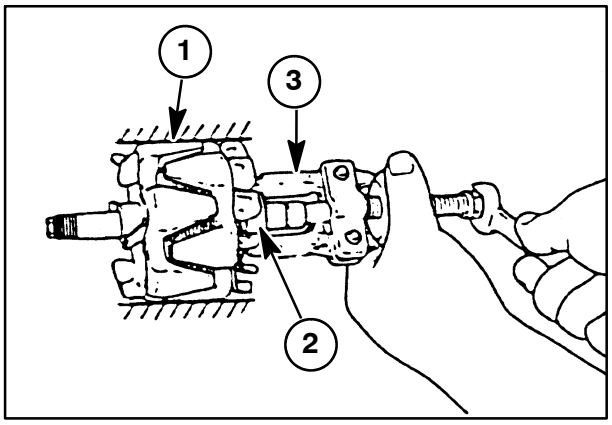
4. To remove the pulley nut, 1, use an impact wrench or place the rotor, 6, into a soft jaw vice and use a wrench. Remove the washer, 2, the pulley, 3, spacer, 4, and the front frame, 5, from the rotor, 6.



10

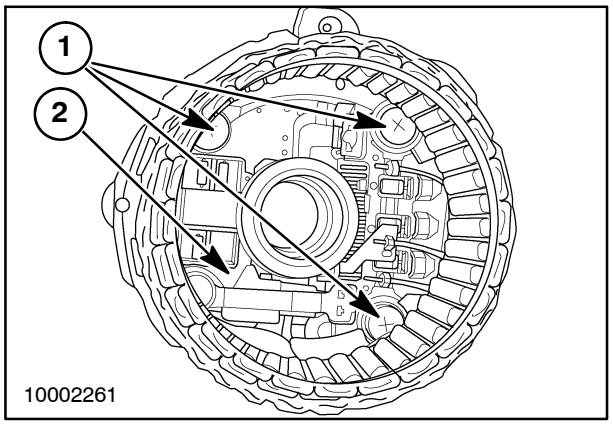
NOTE: *When removing the rear rotor bearing from the rotor, be sure to apply even pressure to the rear rotor bearing.*

5. The rear rotor bearing, 2, may be removed from the rotor, 1, by using a bearing puller, 3.



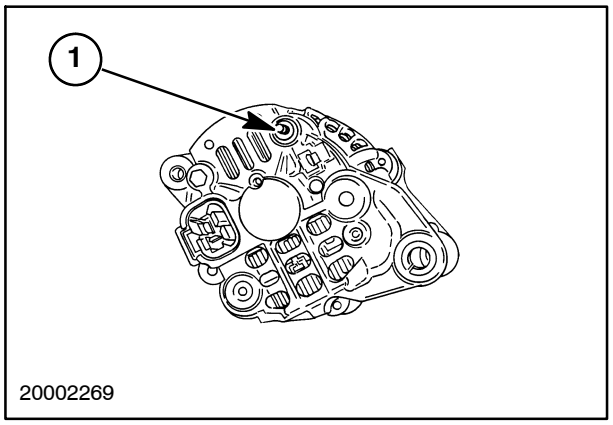
11

6. Remove the three (3) screws, 1, which secure the regulator/rectifier assembly, 2, to the rear alternator frame.



12

7. Remove the battery terminal nut, 1, from the rear of the alternator frame.
8. Carefully remove the stator and the regulator/rectifier assembly from the rear alternator frame.

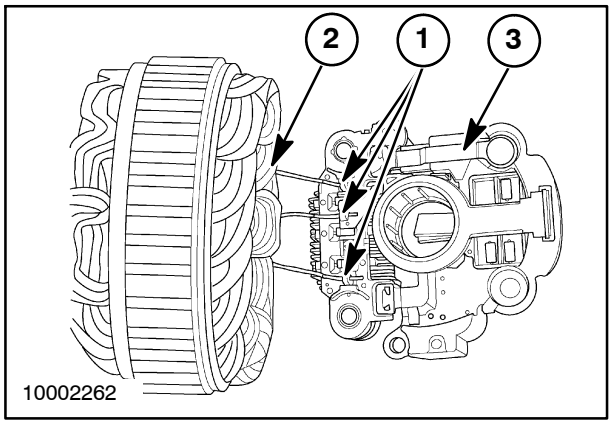


13

⚠ CAUTION ⚠

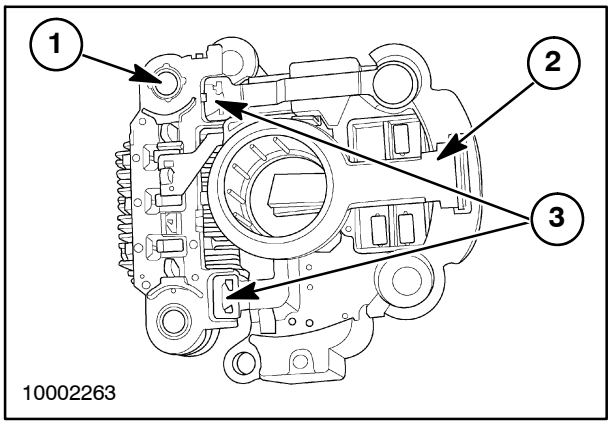
Preheat the soldering iron before attempting to unsolder the stator leads or the regulator/rectifier assembly. To avoid any damage to the rectifier diodes, use a pair of needle-nose pliers to remove the excess heat from the area being soldered. Hold the pliers just below the solder joint on the rectifier to remove excess heat. Use a damp cloth to cool the components once they have been separated.

9. Unsolder the three stator leads, 1, and remove the stator, 2, from the rectifier/regulator assembly, 3.



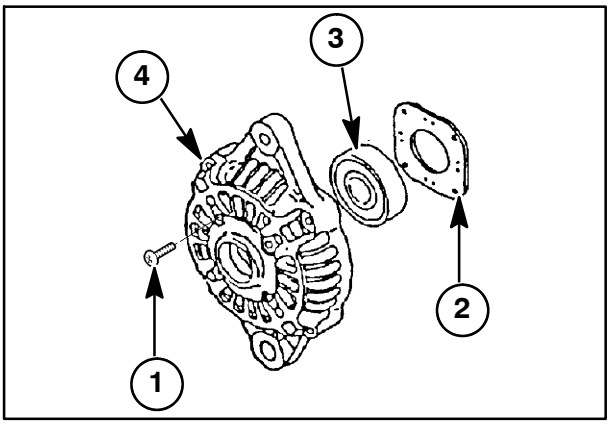
14

10. Unsolder the IC regulator assembly, 1, from the rectifier assembly, 2, at the solder joints, 3.



15

11. Remove the four (4) screws, 1, from the front alternator frame, 4. Remove the retaining plate, 2, and the front rotor bearing, 3.



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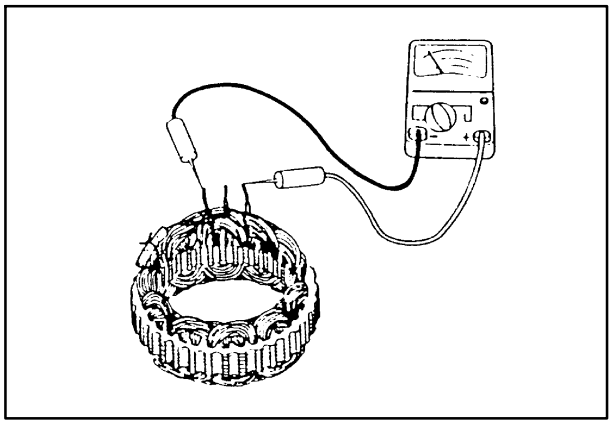
ALTERNATOR COMPONENT TESTING AND INSPECTION

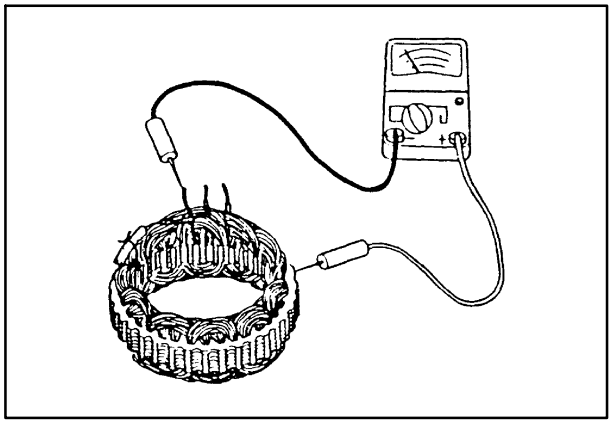
Stator

1. Using an ohmmeter, touch the ohmmeter test probes to different leads of the stator coil.
2. Observe the ohmmeter. The ohmmeter should read a resistance of less than 1 ohm, for each of the phase wires, indicating continuity.
3. If there is no continuity, inspect the lead wire connection for breaks. The lead wire may be repaired with solder if damage is not excessive. If the lead wire is good, the stator coil is faulty and needs replaced.



17

4. Using an ohmmeter, touch one of the ohmmeter test probes to the stator coil and the other test probe to the stator core.
5. Observe the ohmmeter. Resistance should be high, indicating no continuity between the coil and the core. If there is continuity, the stator is defective and needs replaced.



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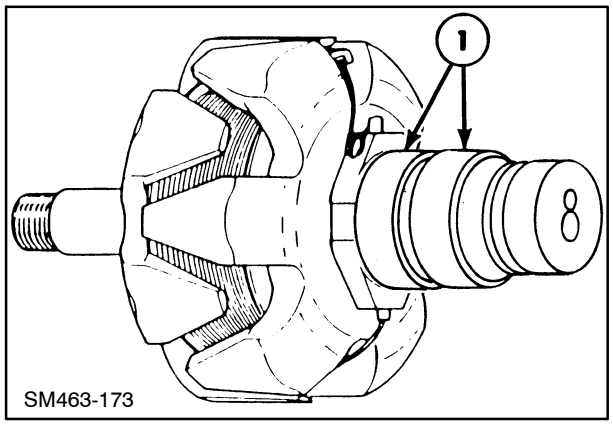
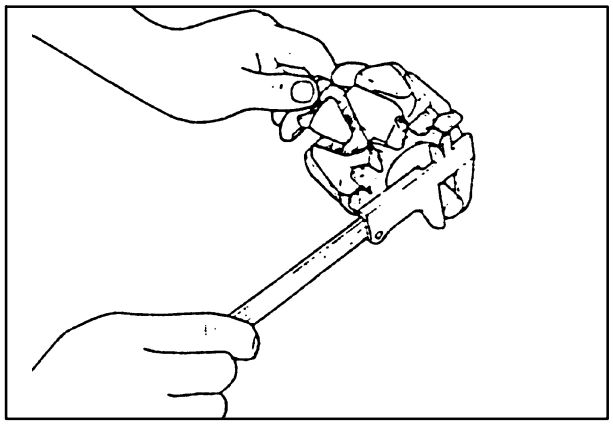
Rotor

1. Inspect the rotor brush contacts, 1, for pitting, roughness, and dirt. If necessary, use # 600 grit fine sandpaper to clean dirt off of the contacts. If the contacts are pitted or damaged excessively, replace the rotor.



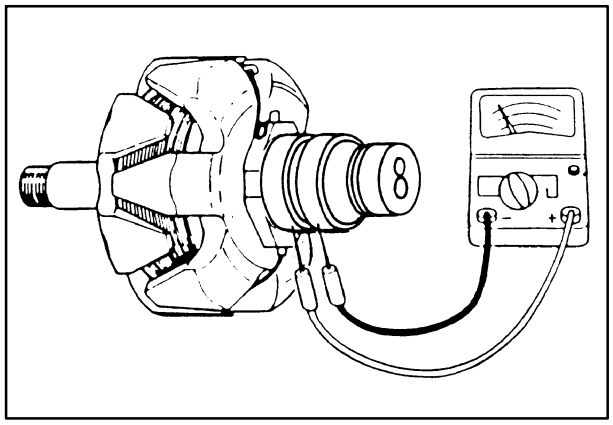
19

2. Use a suitable measuring device to determine the outer diameter of each brush contact. The minimum outer diameter of the brush contacts is 22.1 mm (0.871 in).



20

3. Using an ohmmeter, touch one ohmmeter test probe to a brush contact. Touch the other test probe to the remaining brush contact.
4. Observe the ohmmeter. The ohmmeter resistance reading should be approximately 3 ohms. If the reading is not as specified, the rotor is defective and needs replaced.



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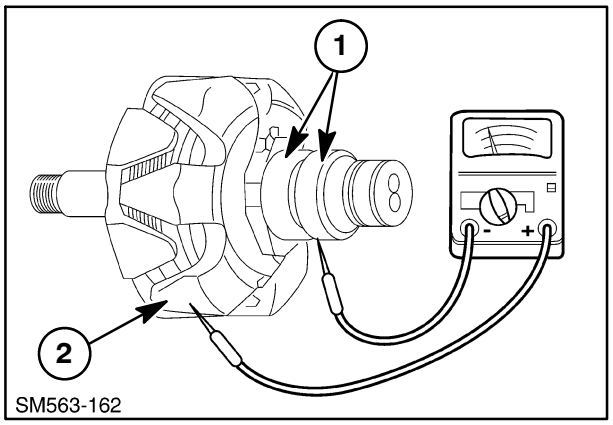
NOTE: *When testing the resistance between the brush contacts and rotor poles, be sure that the ohmmeter test probe touching the rotor pole is not insulated by paint.*

1. Using an ohmmeter, touch one ohmmeter test probe to one of the rotor brush contacts, 1, and the other test probe to one of the rotor poles, 2.
2. Observe the ohmmeter. Resistance should be high, indicating no continuity between the rotor poles and brush contacts. If there is continuity, the rotor is defective and needs replaced.



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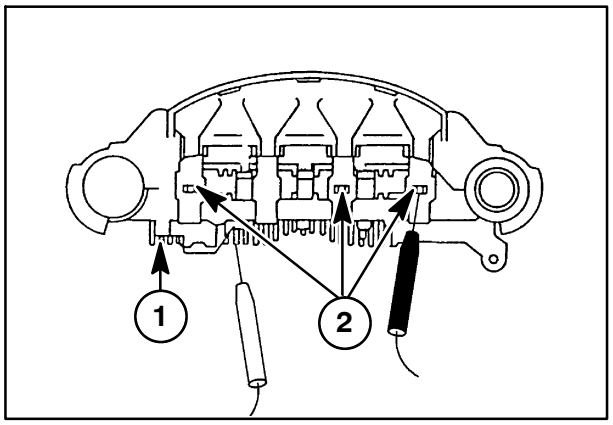
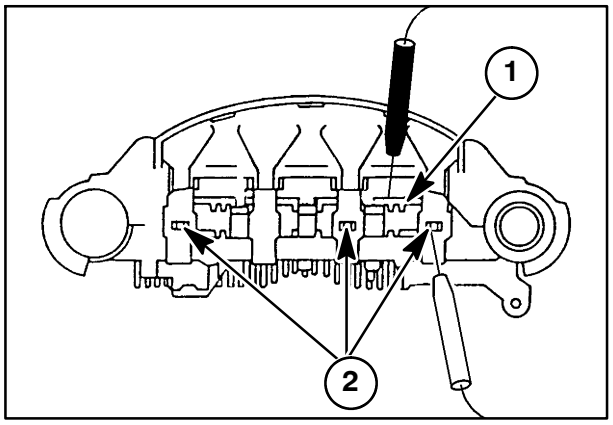
Rectifier Inspection

1. Using an ohmmeter, touch the positive (+) test probe to the positive (+) portion of the diode plate, 1, and the negative (•) test probe to the other test probe to a stator coil lead connection terminals, 2.
2. Observe the ohmmeter for continuity.
3. Now switch the positions of the test probes and observe the ohmmeter for continuity. The ohmmeter should indicate continuity in one direction only. If there is continuity in both directions or no continuity at all, the rectifier assembly is defective and needs replaced.
4. Using the same procedure described in the three previous steps, test the diodes between the negative (-) portion of the diode plate, 1, and the stator lead connections, 2. Again, replace the rectifier assembly if the diodes test defective.

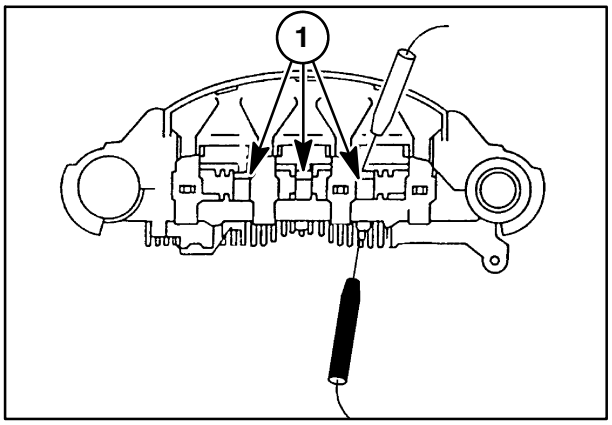


23



24

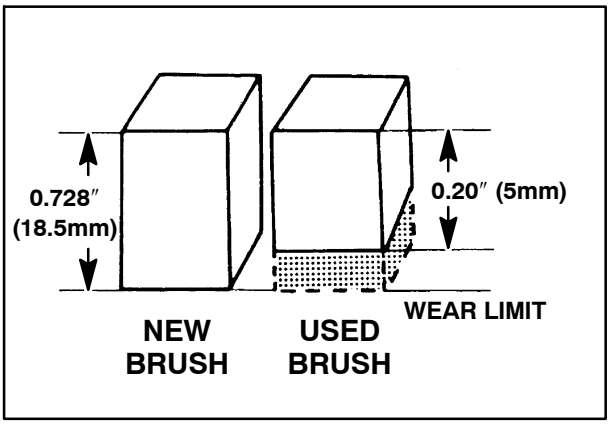
5. Test each of the three small diodes, 1, by touching the positive (+) ohmmeter test probe to one end of a diode and the negative (•) test probe to the opposite end of the diode.
6. Observe the ohmmeter for continuity.
7. Now switch the positions of the test probes and observe the ohmmeter for continuity. The ohmmeter should indicate continuity in one direction only. If there is continuity in both directions, or no continuity at all, the rectifier assembly is defective and needs replaced.



25

Brushes

1. Carefully clean the alternator brushes with a soft, dry cloth and electrical component cleaner, if available.
2. Inspect the brushes and brush springs for corrosion, damage, stretched springs, or a damaged brush holder. If damaged, replace the brush assembly.
3. Use a suitable measuring device to measure brush wear. The minimum brush length is 5 mm (0.020 in). If either brush is worn beyond specifications, replace the brush assemblies.



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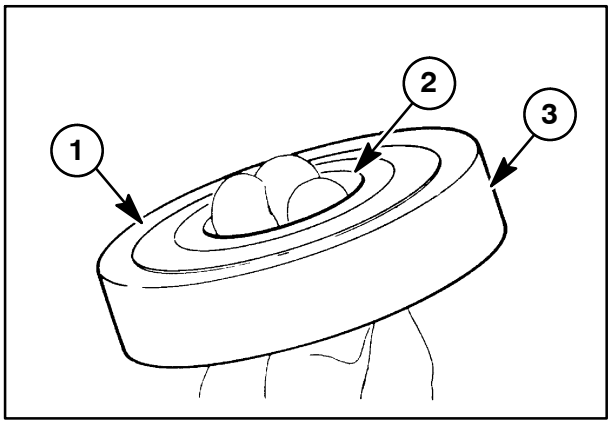
Bearings

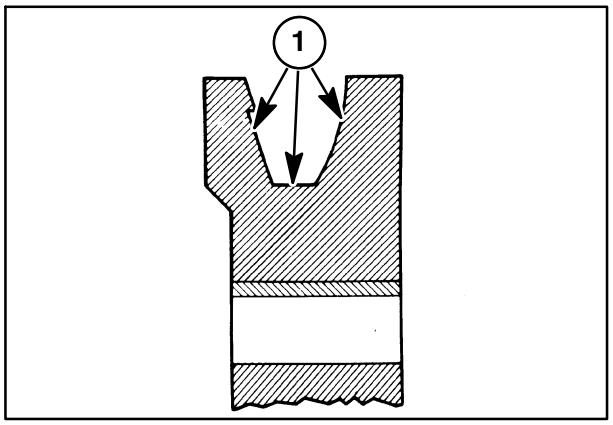
1. Inspect the alternator bearings for smooth operation by spinning the bearing. Replace bearings that are rough and do not rotate smoothly.
2. Inspect the bearings for grease leakage between the bearing seal, 3, and races, 1 and 2.
3. Inspect the inner race, 1, and the outer race, 2, for signs of spinning in the alternator frame or on the rotor shaft.
4. Replace bearings that are damaged in any way.



27

Drive Pulley

1. Inspect the drive pulley for a worn, bent, cracked, or otherwise damaged belt groove, 1.
2. A polished surface in the bottom of the belt groove indicates a worn pulley.



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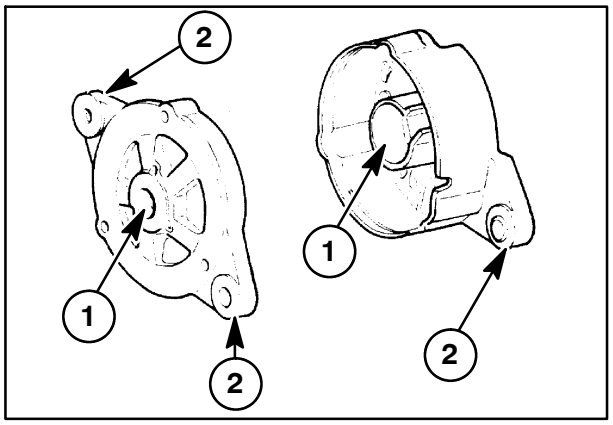
Alternator Housing

1. Inspect the bearing housing bores, 1, for scoring, cracks or evidence that the bearing was spinning inside the bore.
2. Inspect the frames for cracked or broken mounting bosses, 2, or any other distortion or damage.

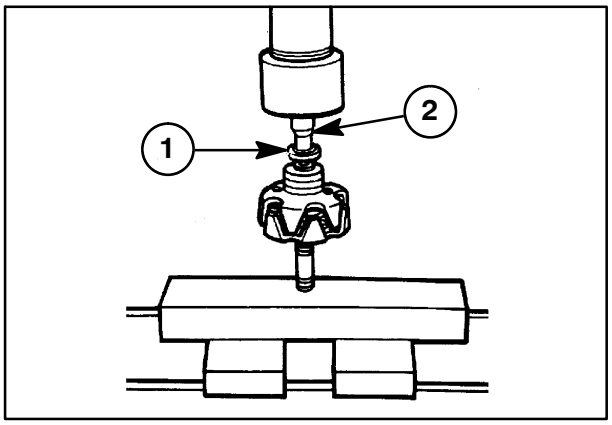


29

Assembly

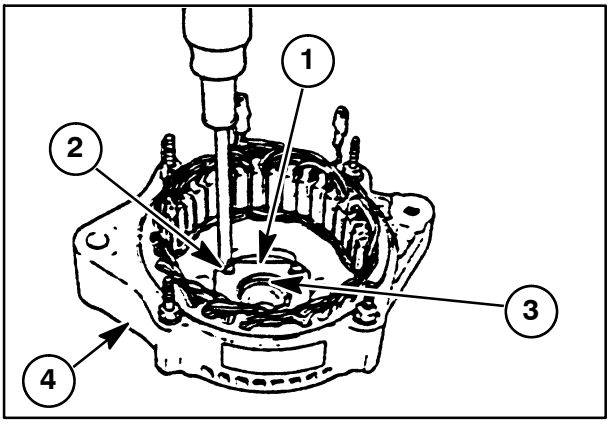
NOTE: *When installing the rear rotor bearing, be sure that top sleeve used to press the bearing onto the rotor contacts the inner race of the bearing only.*

1. Install the rear rotor bearing, 1, and spacer onto the rotor by using a press, 2, and two sleeves, such as tubing or 15 mm deep sockets, 3. The bottom sleeve will support the rotor as the top sleeve presses the rear bearing spacer onto the rotor.



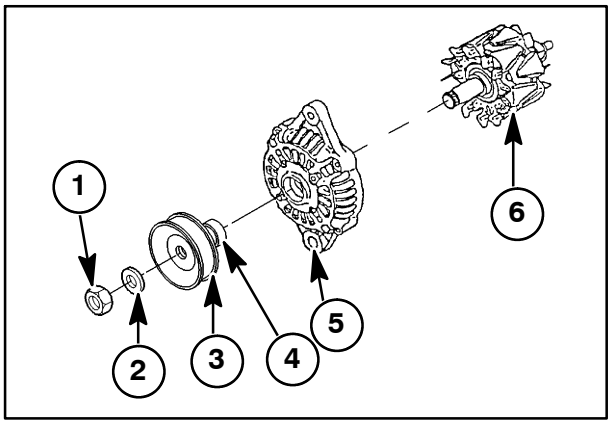
30

2. Install the front rotor bearing, 3, and front bearing retaining plate, 1, into the front alternator frame, 4, and secure using the four (4) retaining screws, 2.



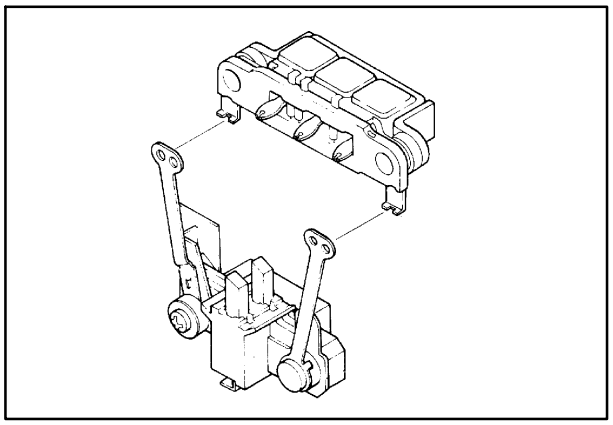
31

3. Install the washer, 2, pulley, 3, spacer, 4, and front frame, 5, onto the rotor, 6.
4. To install the pulley nut, 1, use an impact wrench or place the rotor, 6, into a soft jaw vice and use a wrench to tighten the pulley assembly to the rotor.



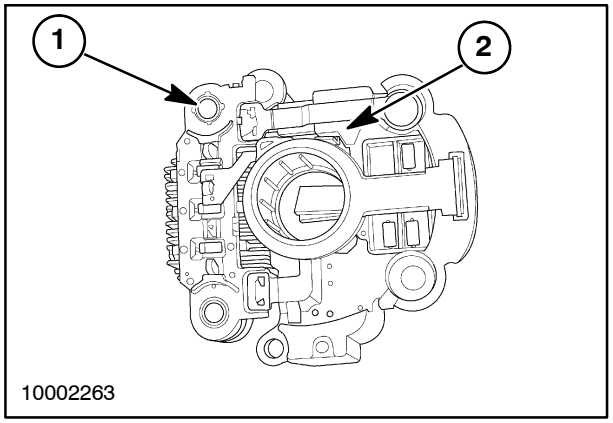
32

5. Use the following guidelines when soldering alternator components.
   - Clean all terminals to be soldered and remove excess solder.
   - Preheat the soldering iron and use rosin-core solder to solder terminals and/or wires. To avoid damage to the rectifier diodes, use a pair of needle nose pliers to remove excess heat from the area being soldered. Hold the pliers just below the solder joint on the rectifier to remove excess heat.
   - Make good, solid, solder joints for best alternator performance.
   - After soldering, quickly cool the solder joint with a damp cloth.



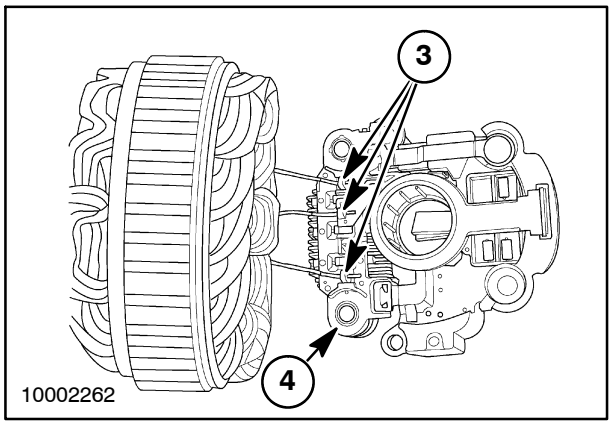
33

6. Solder the IC regulator, 1, and rectifier, 2, together.



34

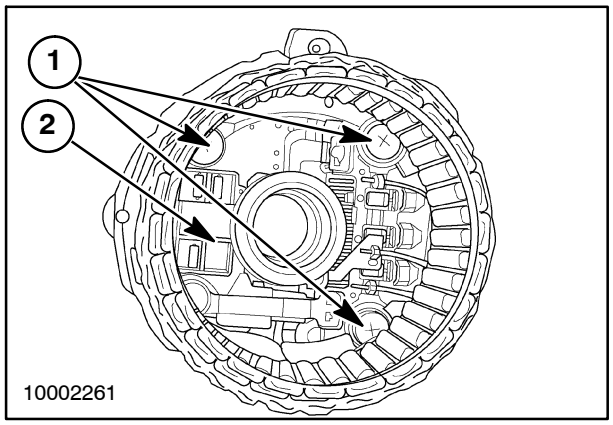
7. Solder the stator leads, 3, to the terminals on the rectifier/regulator assembly, 4.



35

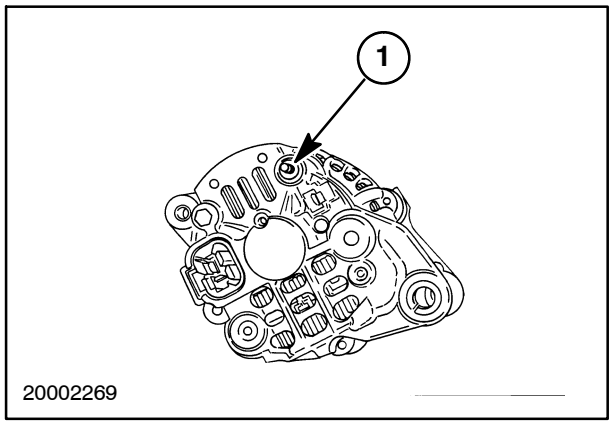
NOTE: *Secure the regulator/rectifier assembly to the rear alternator frame before pressing the stator into the rear frame.*

8. Secure the regulator/rectifier assembly, 2, to the rear alternator frame using the three (3) retaining screws, 1. Manually press the stator assembly into the rear alternator frame.



36

9. Install the battery terminal nut, 1, to the rear of the alternator frame.



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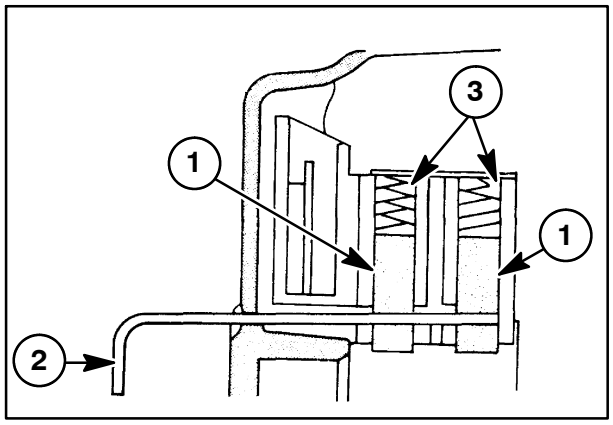
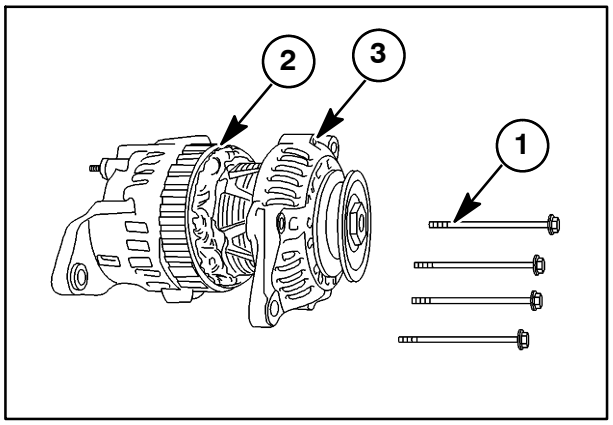
10. Push the brushes, 1, and springs, 3, into the brush holder and insert a piece of wire, 2, through the rear of the alternator frame and into the brush holder to hold the brushes out of the way while the alternator halves are being assembled.



38

11. Assemble the front alternator frame, 3, and rear alternator frame, 2, together. Be sure to align the scribe marks made when the alternator was disassembled to insure proper reassembly. Use the four (4) bolts, 1, to secure the front and rear frames together.



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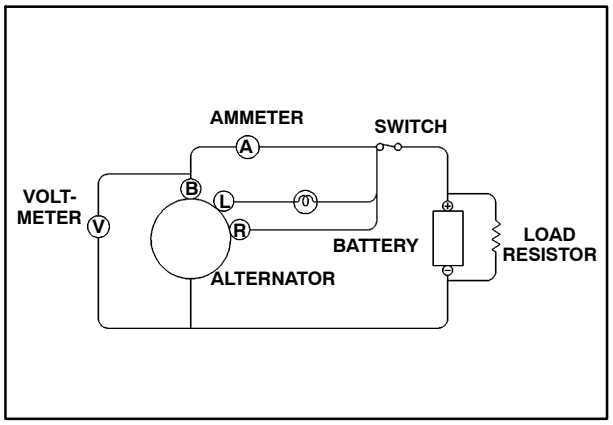
Alternator Bench Check

1. Connect the alternator to a testing circuit, as shown. Set the load resistance to zero (0).

NOTE: *Alternator rotation direction is clockwise, as viewed looking at the pulley.*

2. Slowly increase the alternator rotational speed and observe the voltage reading indicated on the voltmeter.
3. If the voltage is uncontrolled when increasing alternator speed and increases above 15.5 volts, disassemble and check the alternator for malfunctioning components.
4. If the voltage reading is below 15.5 volts, set alternator's rotational speed to 5000 RPM and set the load resistance to achieve maximum output from the alternator.
5. If the amperage value is more than 70% of the nominal alternator output as described in alternator specifications, the alternator is considered to be working satisfactorily.



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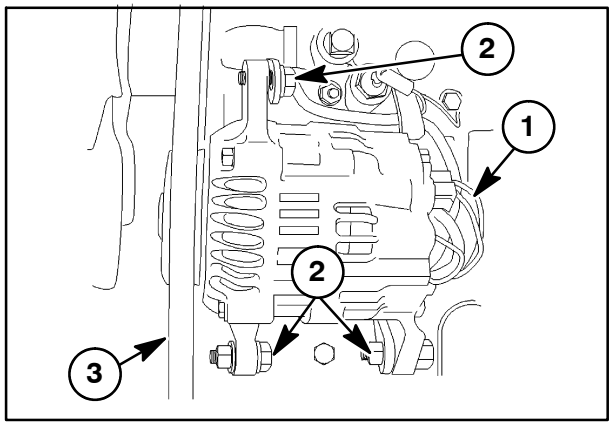
Installation

1. Align the alternator with the alternator mounting holes located on the engine block and brackets. Use the adjusting/mounting bolts, 2, to secure the alternator to the mounting brackets. Be sure to install the V-belt, 3, into the drive pulley.
2. Connect all wire terminals, 1, to rear of the alternator.



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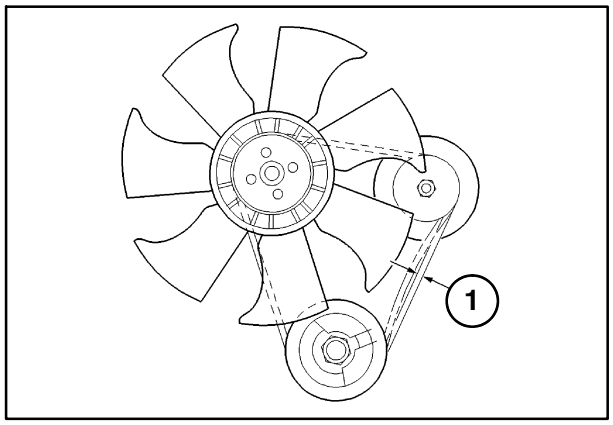
3. Adjust the alternator drive belt deflection by loosening the mounting bolts and moving the alternator into or away from the engine block. Belt deflection should be 5 – 10 mm (0.2 – 0.39 in) when applying 5 kg (12 lbs) of force between the crank pulley and the alternator pulley, 1.



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ALTERNATOR SPECIFICATIONS

Manufacturer	Mitsubishi
Model	A007TA1777
Polarity	Negative Ground
Rotational Direction (viewed from pulley)	Clockwise
Drive Belt Tension	5 – 10 mm (0.2 – 0.39 in) deflection @ 5 kg (12 lbs) of force
Adjusting Voltage	14.4 – 15.0 volts
Load Characteristics	
Terminal voltage	13.5 volts
Current	40 amp minimum
Rpm	2500 (Engine RPM 4285 (Alternator RPM)
Brush Length	
Wear Limit (min. length)	5 mm (0.20 in)
Original	18.5 mm (0.728 in)
Brush Contact Rings	
Wear Limit (min. diameter)	22.1 mm (0.871 in)
Original Diameter	22.7 mm (0.894 in)
Bearing	
Front	ECSC8
Rear	6303DDG
Stator Coil Resistance	less than 1.0 ohm
Rotor Coil Resistance	3.0 ohms

ALTERNATOR TROUBLESHOOTING

NO CHARGING

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection, short circuit.	Repair
Alternator	Loose connection, no ground, short circuit.	Repair or replace
	Defective rectifier.	Replace
	Loose connection on RF resistor.	Replace
Regulator	Defective regulator.	Replace
	Loose connection of alternator or regulator.	Repair or replace

INSUFFICIENT CHARGING

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection or short circuit.	Repair
Alternator	Loose drive belt.	Repair
	Short in rotor coil.	Replace
	Short in stator coil.	Replace
	Defective rectifier.	Replace
	Insufficient brush contact.	Repair or replace
Regulator	Defective regulator.	Replace
	Loose connection of alternator and regulator.	Repair
Battery	Defective battery.	Replace

OVERCHARGE

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Battery	Internal short.	Replace
Regulator	Defective regulator.	Replace

UNSTABLE CHARGING CIRCUIT

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection or open wire.	Repair or replace
Alternator	Loose drive belt.	Repair
	Short in rotor coil.	Replace
	Short in stator coil.	Replace
	Broken brush or spring.	Replace
	Loose connection.	Repair
Regulator	Defective regulator.	Replace
	Loose connection at alternator and regulator.	Repair or replace

ABNORMAL NOISE OF ALTERNATOR

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Alternator	Loose mounting hardware.	Repair
	Defective bearings.	Repair or replace
	Rotor core and stator in contact.	Replace
	Defective diode.	Replace
	Short in stator coil.	Replace

STARTER MOTOR SPECIFICATIONS

Manufacturer	Denso Corporation
Model	228000-5122
Current Draw	
Under Load	500A @ 7.5V
No Load	less than 110 amps
No Load RPM	4000 RPM
No Load Voltage	11.5 volts
Clutch System	Overrunning Pinion Clutch
Brush Length	
New	15 mm
Wear Limit	12 mm
Brush Spring Tension	2.7 - 3.6 kg (5.9 - 7.8 lbs)
Commutator Diameter	
New	35 mm
Wear Limit	34 mm
Commutator Insulation Depth	0.2 – 0.85 mm
Armature Runout	
Commutator	0.02 - 0.05 mm
Armature Shaft	.0.02 mm

STARTER MOTOR TROUBLESHOOTING

PINION SHAFT FAILS TO ADVANCE:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Open circuit, battery, and switch terminal connections.	Repair or replace
	Open circuit, fuse.	Replace fuse
Key switch	No contact.	Repair or replace
Starter motor	Sleeve bearing burnt out.	Repair or replace
	Lever broken.	Replace
Solenoid	Plunger movement defective or coil open or shorted.	Repair or replace

PINION MOTOR ROTATES BUT NO ROTATION TRANSMITTED TO ENGINE:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Starting motor	Clutch defective.	Replace
	Orbital gear or planetary gears damaged.	Replace

MOTOR ROTATES BEFORE PINION MESHES WITH RING GEAR:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Starter motor	Shift lever damaged.	Replace
	Slip ring defective.	Replace
	Pinion teeth worn.	Replace
	Pinion push out position defective.	Adjust
Engine	Ring gear worn.	Replace
Solenoid	Solenoid defective.	Replace

PINION MESHES WITH RING GEAR BUT STARTING MOTOR FAILS TO TURN:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Line connecting solenoid to battery broken or defective ground.	Repair or replace
	Lead wire connecting solenoid to motor tightened improperly.	Repair or replace
Starting motor	Ball bearing locked.	Replace
	Brush worn.	Replace
	Improper installation.	Reinstall
	Brush spring defective.	Replace
	Commutator dirty.	Clean
	Armature of field coil defective.	Repair or replace
	Field coil-to-brush connection defective.	Replace
Solenoid	Contact not touching properly.	Replace
	Contact contacting surface roughened.	Replace
Battery	In discharge state.	Recharge or replace

MOTOR FAILS TO STOP AFTER ENGINE STARTS AND KEY SWITCH IS TURNED OFF:

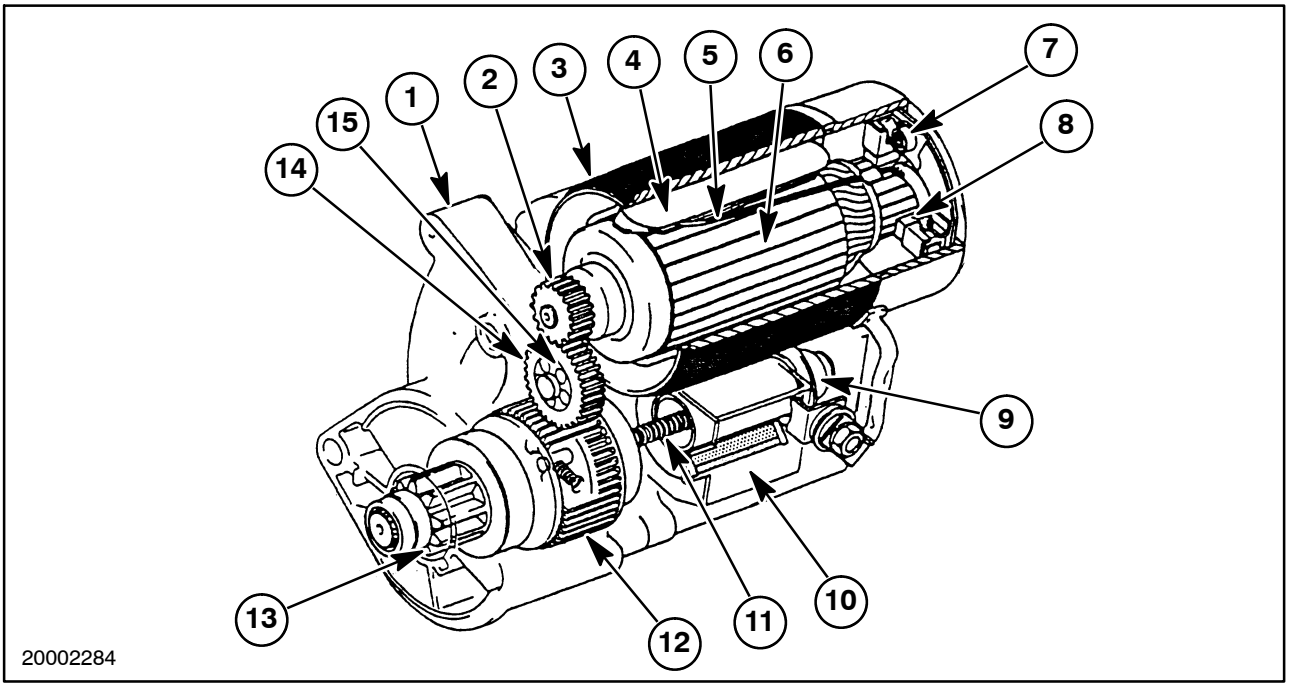
FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Key switch	Switch defective.	Replace
Solenoid	Solenoid defective.	Replace

STARTING SYSTEM

DESCRIPTION OF OPERATION

The starting system consists of a starter motor equipped with an electromagnetic starter solenoid, a key switch, a start relay, several safety switches, and heavy-duty wiring.

COMPONENTS



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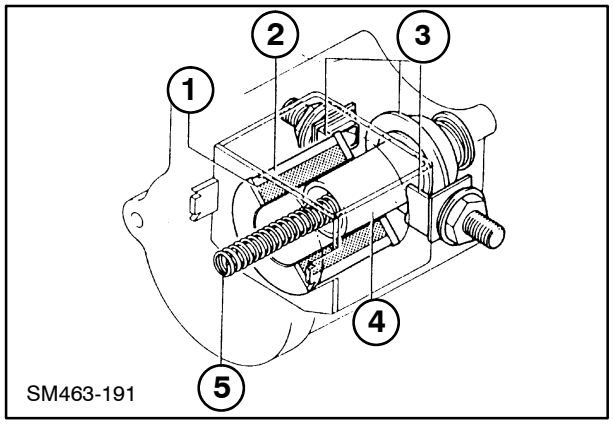
1. Reduction Uni Cover
2. Armature Drive Gear
3. Motor/Field Coil Housing (Yoke)
4. Permanent Magnet
5. Field Coil
6. Armature
7. Brush Spring
8. Brush
9. Plunger
10. Solenoid
11. Return Spring
12. Pinion Clutch
13. Pinion
14. Idler Gear
15. Idler Gear Roller Bearing

Starter Motor Assembly

The starter motor features a high-speed motor that utilizes a gear reduction unit, an overrunning pinion clutch, 12, and permanent magnets, 4, in a field coil, 5, for magnetic field induction. The reduction unit consists of a small drive gear, 2, on the motor armature, 6, which drives an idler gear, 14, in the reduction unit. The idler gear is splined to the gear on the pinion clutch housing, 12. When the starter solenoid, 10, is energized, the solenoid plunger, 9, pushes the pinion gear, 13, out, engaging with the engine flywheel. The starter motor then is turning the flywheel, which rotates the engine. The use of the gear reduction unit allows use of the compact, high-speed motor and provides more torque and power to turn the engine flywheel. The sliding pinion mechanism is enclosed, resulting in a more durable mechanism.

Starter Solenoid

The starter solenoid is an electromagnetic type solenoid that is located on the bottom of the starter motor assembly. The solenoid contains two coils, a pull-in coil, 1, and a hold-in coil, 2. When the key switch is turned to the “START” position and the safety start relay is closed (safety switches closed), current from the battery will energize the solenoid’s two coils. With the coils energized, the solenoid plunger, 4, pushes a spring, 5, which will then push the pinion gear out to engage the flywheel. At the same time, a set of contacts, 3, on the solenoid become closed, allowing current to flow to the starter motor. Closing the contacts also supplies current to both ends of the solenoid pull in coil, which makes the coil become non-energized. The hold-in coil continues to engage the pinion gear with the flywheel.



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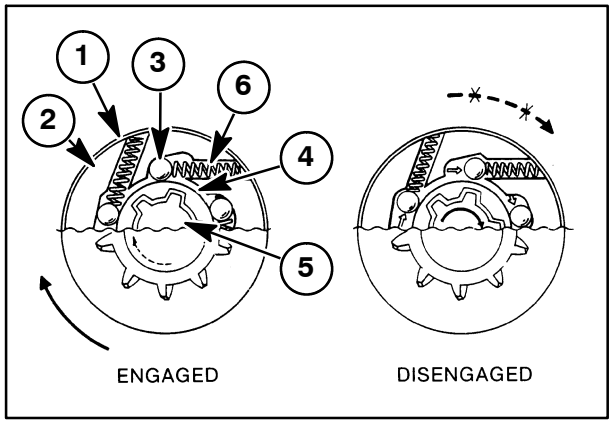
Pinion Clutch

To prevent the engine from driving the starter motor once the engine is running, the pinion gear is equipped with an overrunning clutch. The clutch will disengage the pinion gear from the rest of the starter components once the engine has been started and the key switch is in the “START” position. The clutch consists of an outer gear/shell, 1, a cam with tapered notches, 2, rollers, 3, roller springs, 6, a splined pinion collar/tube that acts as a clutch hub, 4, and the pinion shaft, 5. As the starter motor engages and rotates, the rollers are locked against the pinion collar with the tension provided by the roller springs. While the rollers are locked, the clutch assembly is locked, allowing the pinion gear to rotate the flywheel. When the engine starts, the flywheel moves faster than the starter motor and this causes the rollers to become unlocked. With the rollers unlocked, the clutch assembly is unlocked, allowing the pinion gear and shaft to turn independently of the starter motor.



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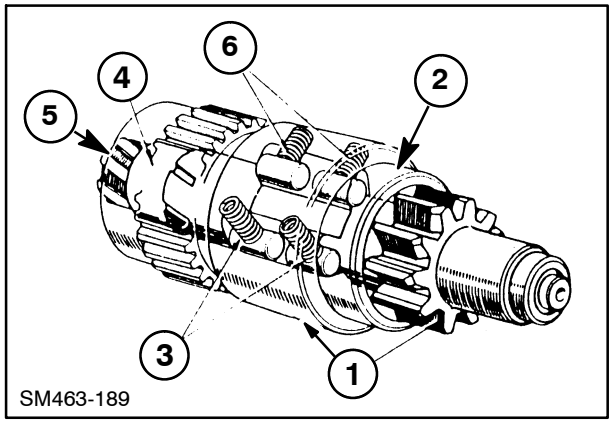
1. Clutch Gear - Outer Shell
2. Cam
3. Roller
4. Spline Tube - Inner (Pinion Collar)
5. Pinion Shaft
6. Roller Spring

The clutch is not serviceable and is replaced as a complete assembly.

Once the engine is started and the key switch is released from the “START” position, the solenoid’s pull in coil becomes energized, pulling the solenoid plunger in, which disengages the pinion from the flywheel.



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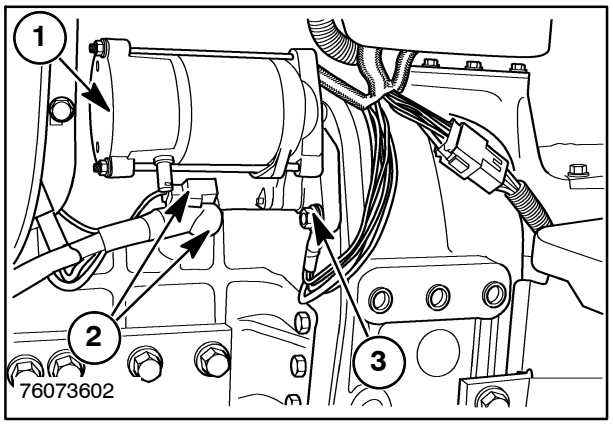
Removal

1. Disconnect the negative (-) battery cable from the battery.
2. Disconnect the wiring harness connections, 2, from the starter motor, 1.
3. Remove the two (2) bolts, 3, which secure the starter assembly, 1, to the tractor engine.



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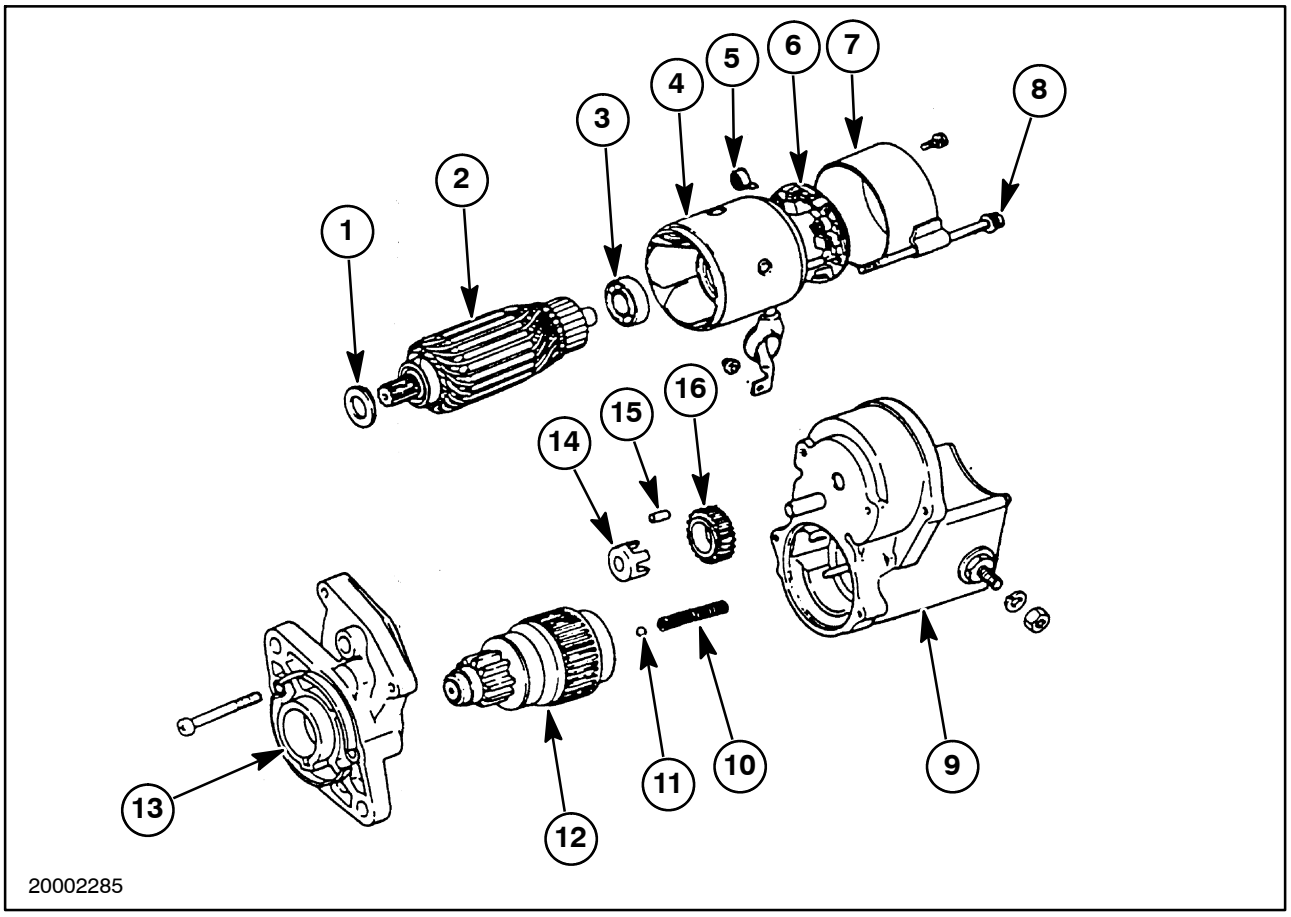

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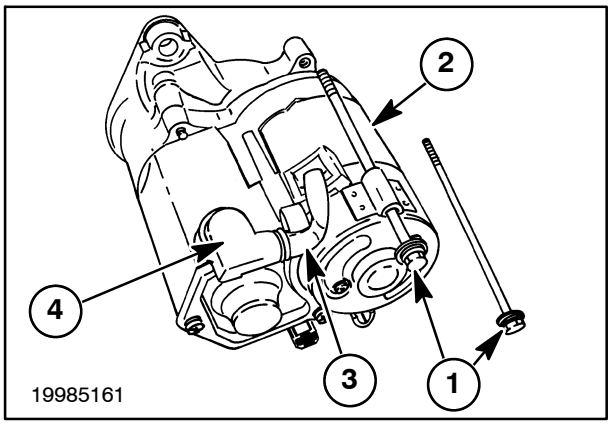
1. Felt Washer
2. Armature (with Front Bearing)
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush Holder
7. Brush Cover
8. Through Bolt
9. Solenoid Housing
10. Return Spring
11. Steel Ball
12. Pinion Clutch
13. Reduction Unit Housing
14. Idler Gear Roller Bearing
15. Roller
16. Idler Gear

Disassembly

1. Remove the field coil wire, 3, the solenoid terminal, 4.
2. Remove the long through bolts, 1, securing the motor assembly, 2, to the gear reduction unit housing.



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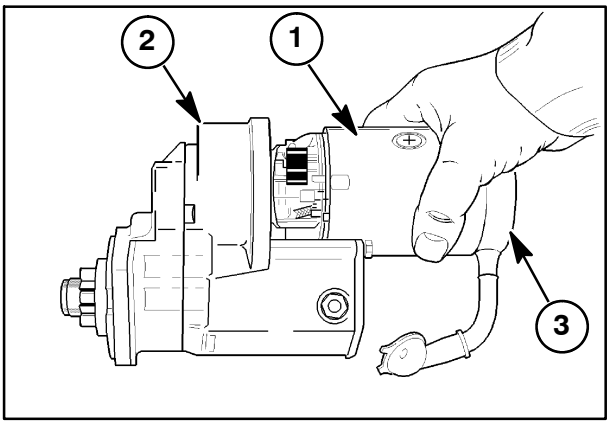
3. Slide the motor assembly, 1, from the gear reduction unit housing, 2.
4. Remove the two screws which secure the brush cover, 3, to the motor/field coil housing, 1.



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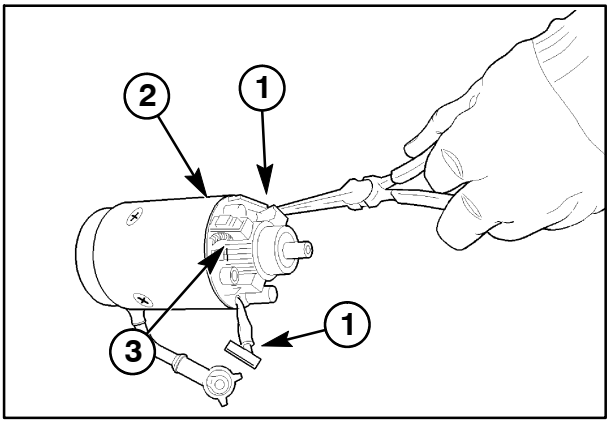
NOTE: *Before removing the brush holder, scribe aligning marks on the brush holder and the motor/field coil housing.*

5. Use a suitable pair of pliers to remove the insulated armature commutator brushes, 1, from the brush holder, 2.
6. Slide the brush holder, 2, from the armature commutator, 3.



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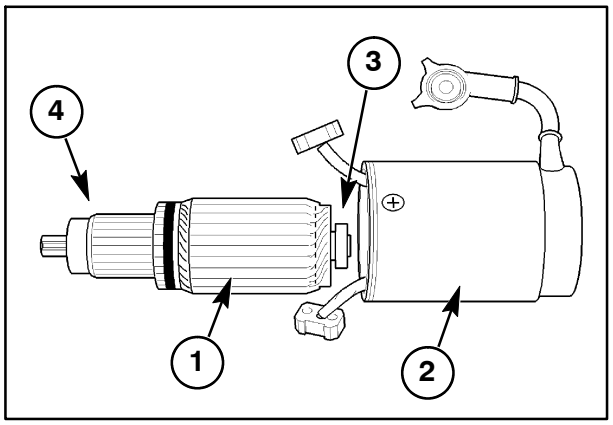
7. Remove the armature, 1, from the motor/field coil housing, 2. The rear armature bearing, 3, is a light press fit and it may be necessary to pull the armature from the housing, gripping on the front bearing, 4.



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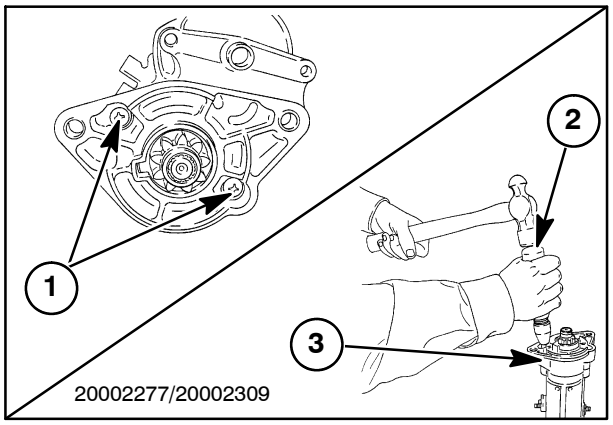
8. Use an impact tool, 2, to remove the two (2) screws, 1, securing the gear reduction cover, 3, to the starter housing.



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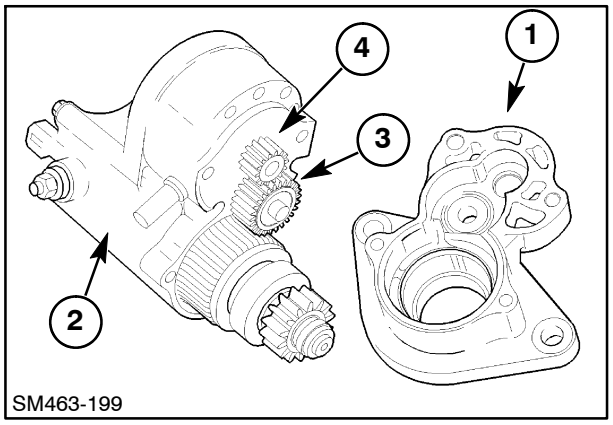
NOTE: *The pinion gear, 4, and idler gear with roller bearings, 3, will be free to fall out when the gear reduction unit cover, 1, is removed from the starter assembly, 2. Use care not to lose any of these pieces.*

9. Carefully remove the reduction unit cover, 1, from the starter assembly, 2.



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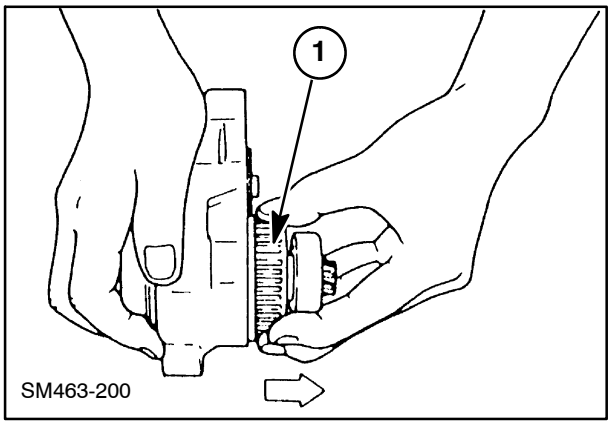
10. Pull the pinion clutch assembly, 1, from the reduction unit cover or the starter motor assembly.



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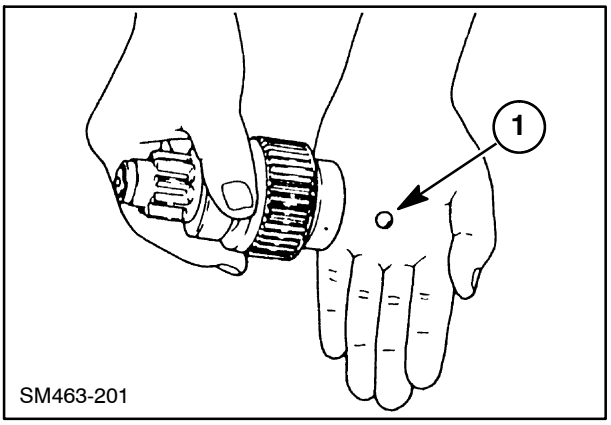
11. Remove the steel ball, 1, from the center of the pinion clutch.



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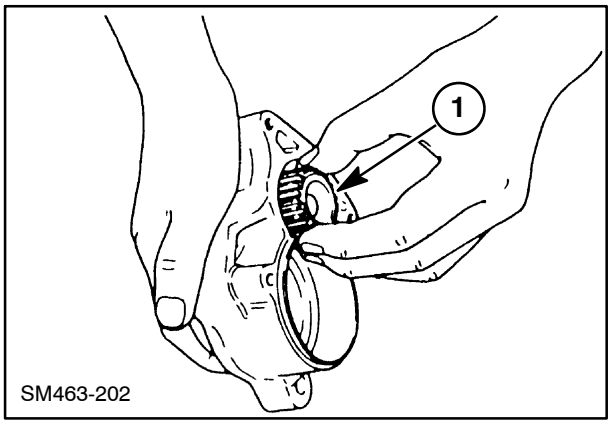
NOTE: *When removing the idler gear and bearing, be careful not to lose the bearing rollers contained in the bearing.*

12. Remove the idler gear and bearing, 1, and pinion gear from the reduction unit cover, if they were not removed when the reduction unit cover and the starter motor housing was separated.



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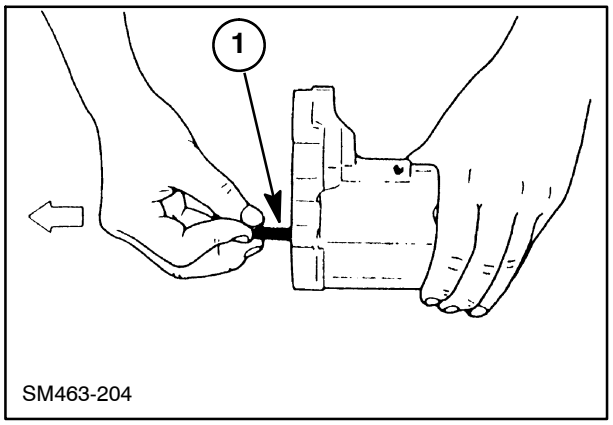
13. Remove the return spring, 1, from the electromagnetic solenoid.



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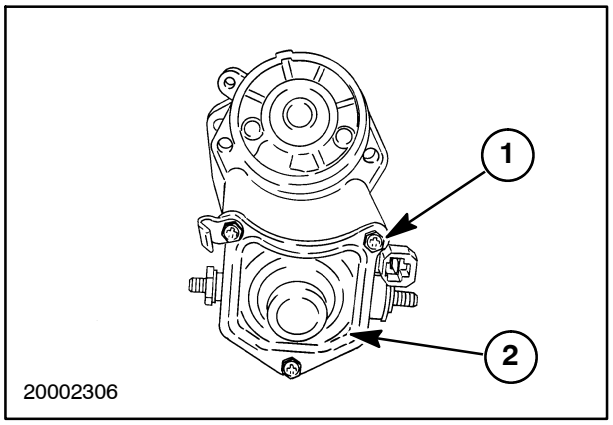
14. Remove the three (3) screws, 1, securing the solenoid cover, 2, to the starter housing. Pry the cover from the housing.



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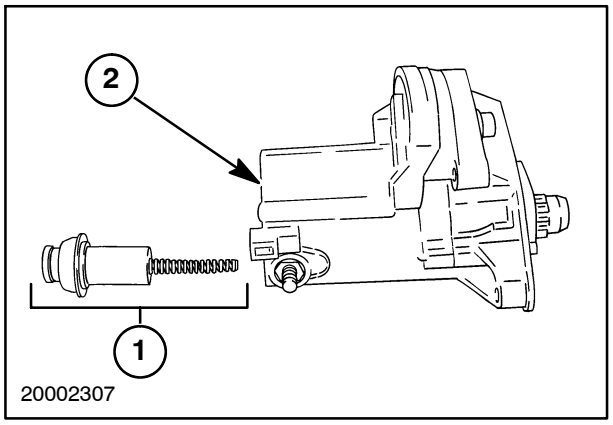
15. Remove the solenoid plunger and spring assembly, 1, from the starter housing, 2.



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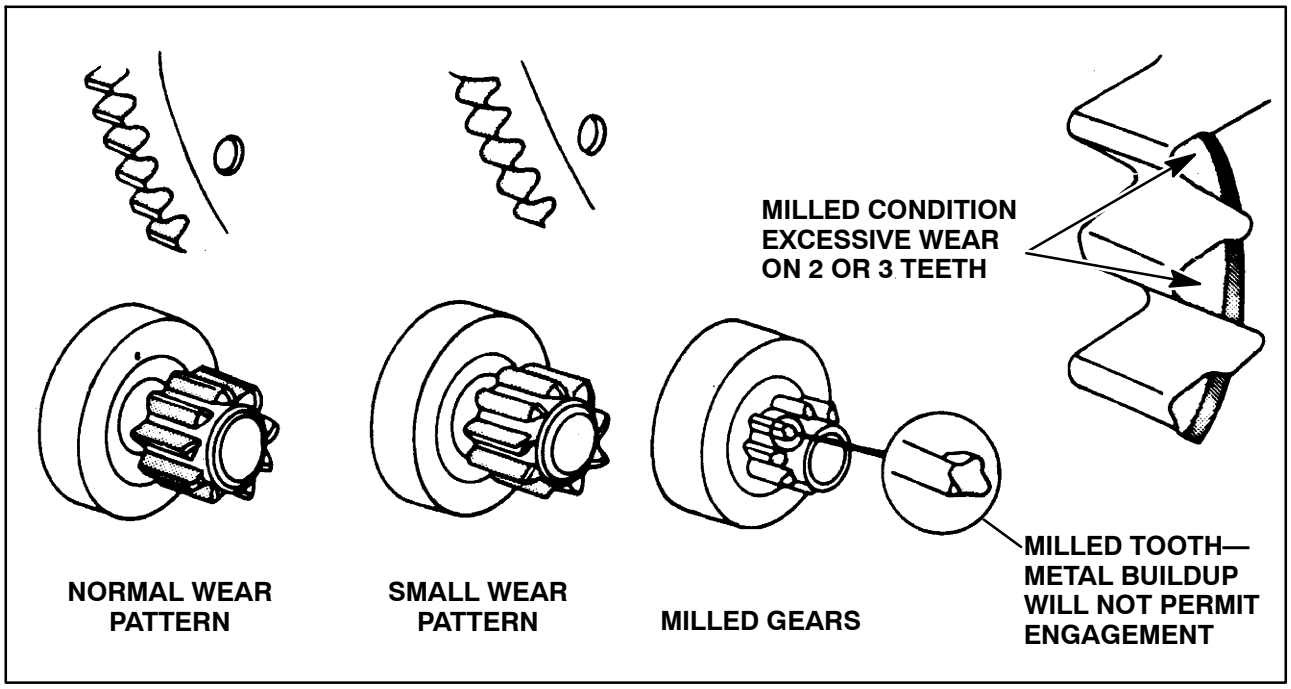

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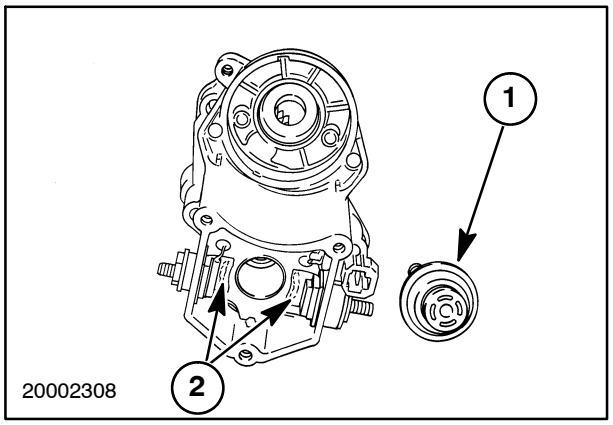
Inspection

1. Inspect the gear splines on the pinion clutch, the pinion, the armature, and the intermediate gear for damaged or missing splines. Replace any damaged parts.
2. Hold the pinion clutch housing and rotate the pinion. The pinion should rotate smoothly, although not necessarily easily, in one direction only. If the pinion can spin in both directions, the clutch is defective and needs replaced.
3. Inspect the motor housing, brush cover, gear reduction unit, and starter housing for damage such as cracks, fatigue, wear, etc. Replace any damaged parts.
4. Inspect the brush terminals, battery terminals, and motor terminals for corrosion, loose connections or damage. Repair or replace any damaged parts.

5. Clean and inspect the solenoid plunger contact ring, 1, and solenoid contacts, 2. Dirty contacts or pitting may be cleaned with fine grit sandpaper or a fine abrasive pad.
6. Inspect that all bearings rotate freely when rotated manually by hand and are not damaged or have excessive play. Replace any damaged bearings.



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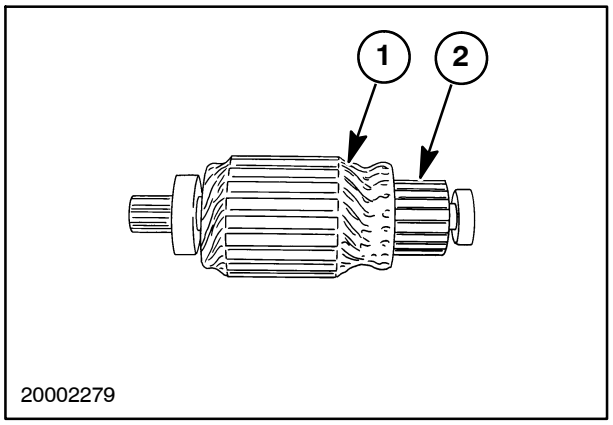
7. Inspect the armature windings, 1, for burnt, broken, or loose connections.
8. Inspect the commutator contacts, 2, for burnt segments, indicating an open winding.



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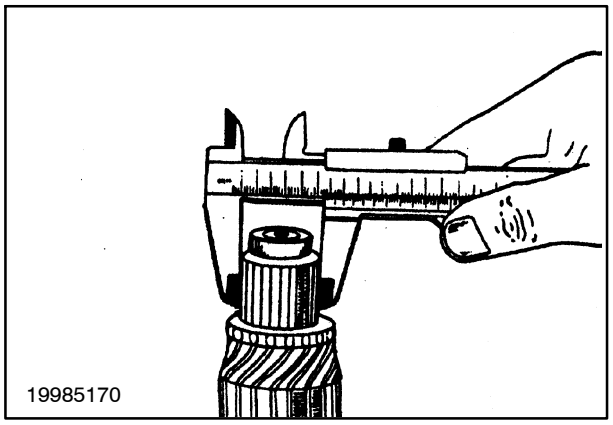
9. Use a suitable measuring device to measure the commutator diameter. The minimum commutator diameter is 34.0 mm (1.339 in). If the commutator is worn beyond these specifications, replace the armature.



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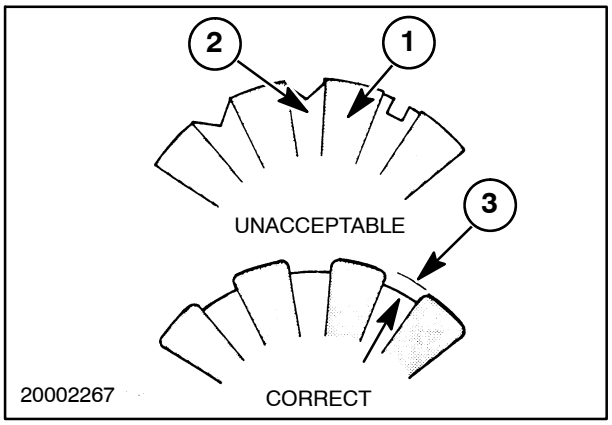
10. Inspect the mica insulating valleys, 2, between the commutator contacts, 1, for uneven wear. Use a suitable measuring device to check the distance, 3, between the top of the contact to the bottom of the insulating valley. The distance should be 0.5 - 0.8 mm (0.020 - 0.031 in). If the distance is not within these specifications or there is uneven wear, the insulating valleys may be undercut with a suitable file.



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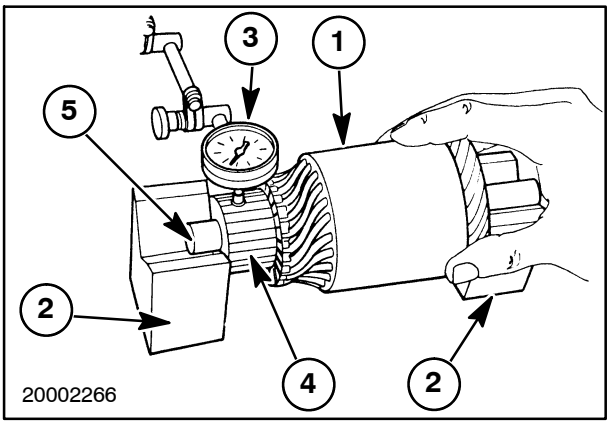
NOTE: *If not previously removed, the armature bearings will need to be removed for this test.*

11. Place the armature, 1, in a set of precision V-blocks, 2, and use a dial indicator, 3, to measure commutator, 4, runout and shaft, 5, runout. Commutator runout should not be more than 0.2 mm (0.008 in). Shaft runout should not be more than 0.05 mm (0.002 in).



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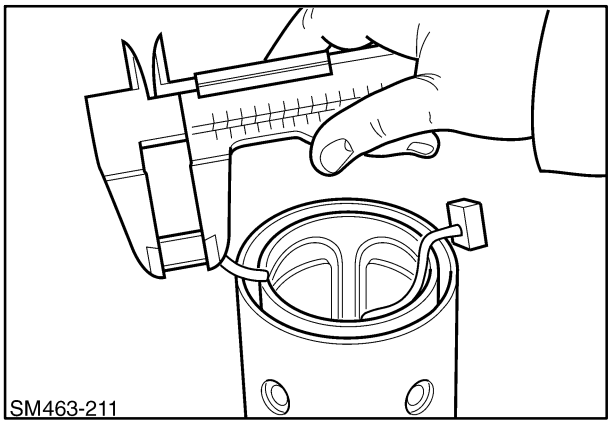
NOTE: *When measuring the brush length, remove the brush from the brush support and measure the middle portion of the brush.*

12. Use a suitable measuring device to measure the length of the four armature brushes. Compare the measurement of each brush with brush length specifications. If the brush is not within specifications or is damaged in any way, replace the brushes.



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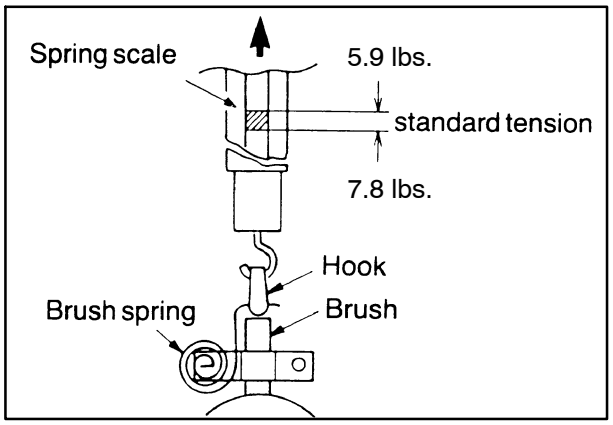
13. Test the brush spring tension by connecting a spring balance to the brush spring and pulling until the spring moves. Observe the reading indicated on the spring balance. If the reading is between 2.7 - 3.6 kg (5.9 - 7.8 lb), the spring tension is within specifications. Otherwise, replace the brush springs.



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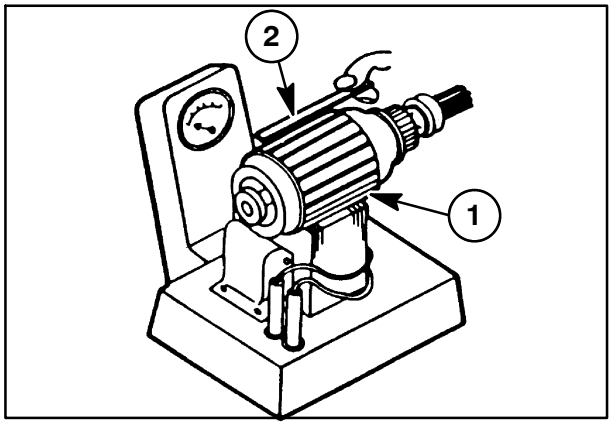
ELECTRICAL TESTING

Armature

1. Use a growler, 2, to inspect the armature coil, 1, for short circuits. Replace if the armature is shorted.



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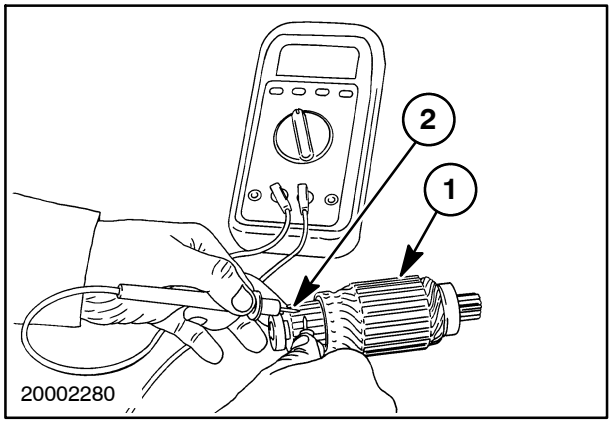
2. Use an ohmmeter to test for continuity in the armature coil, 1.
3. Touch one ohmmeter test probe to a commutator contact, 2. Touch the ohmmeter test probe to an adjacent commutator contact.
4. Observe the ohmmeter. Repeat the test on each adjacent commutator contact. Little or no resistance indicates that there is continuity and the armature coil is good. High resistance indicates that the armature is defective and needs replaced.



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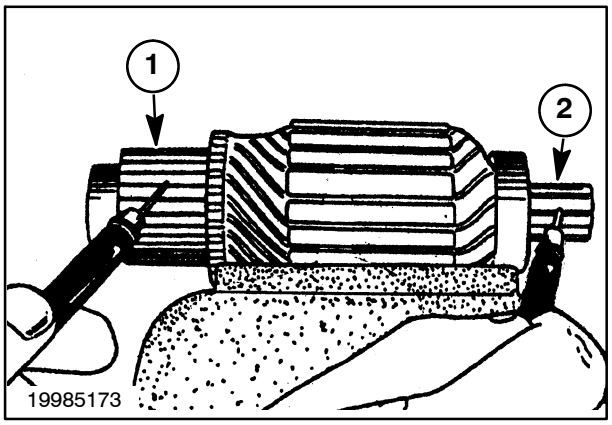
5. If the armature is tested OK, touch one ohmmeter test probe to a commutator contact, 1. Touch the other test probe to the armature shaft, 2.
6. Observe the ohmmeter. A high resistance reading indicates the armature is good. Little or no resistance indicates that the armature is defective and needs replaced.



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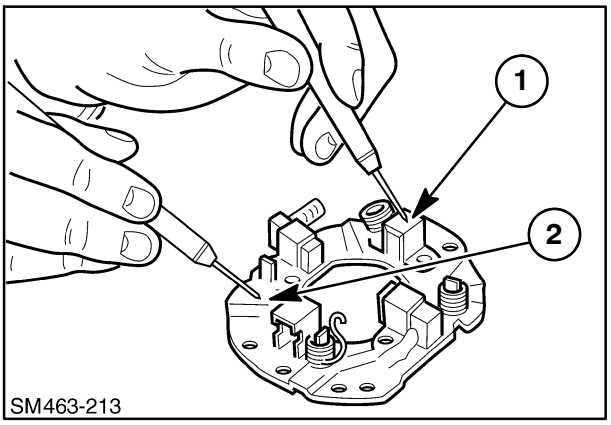
Brush Holder

1. Using an ohmmeter, touch one test probe to the insulated brush holder, 1, and the other test probe to the brush holder plate, 2.
2. Observe the ohmmeter. Repeat the test for the opposite insulated brush holder.
3. A reading high resistance indicates no continuity and the brush holder is good. Little or no resistance indicates that there is continuity and the brush holder is defective and needs replaced.



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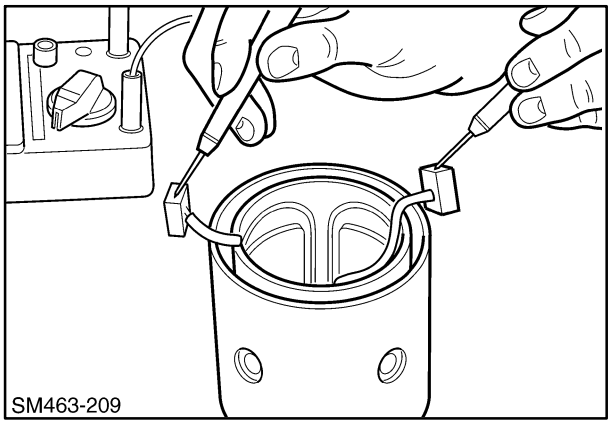
Field Coil

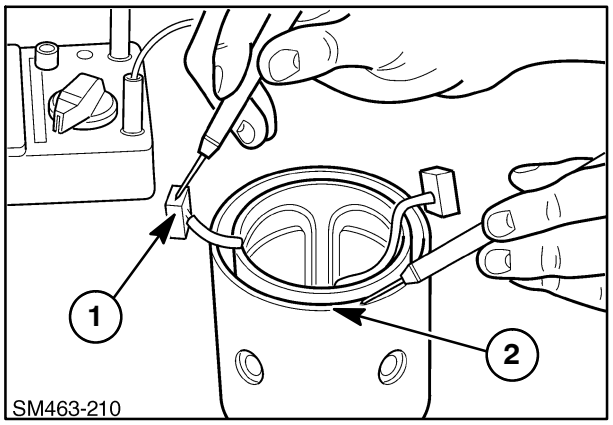
1. Use an ohmmeter to test the field coil.
2. Touch one ohmmeter test probe to one of the field coil brushes. Touch the other test probe to the remaining field coil brush.
3. Observe the ohmmeter. Little or no resistance indicates continuity and that the field coil is functioning properly. High resistance indicates the field coil is defective and needs replaced.



73

NOTE: *Paint on the field coil/motor housing will give a false reading when testing to see if the field coil is grounded. Be sure to remove paint from the field coil/motor housing.*

4. If the previous test indicated the field coil was not defective, touch one ohmmeter test probe to one of the field coil brushes, 1. Touch the other test probe to the field coil housing, 2.
5. Observe the ohmmeter. If the reading shows high resistance, indicating no continuity, the field coil is not grounded and is functioning properly. If there is little or no resistance indicating continuity, the field coil is defective and needs replaced.



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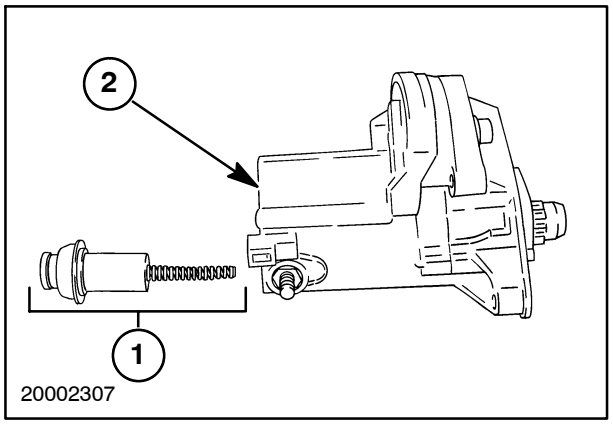
Starter Solenoid

NOTE: *The following test should be performed with the starter assembly partially assembled.*

NOTE: *If solenoid will not be disassembled after this test, apply white lithium grease to the armature drive gear, pinion clutch, idler gear and roller bearings, and the pinion clutch steel ball and return spring.*

1. Install the solenoid plunger and spring assembly, 1, into the starter housing, 2.



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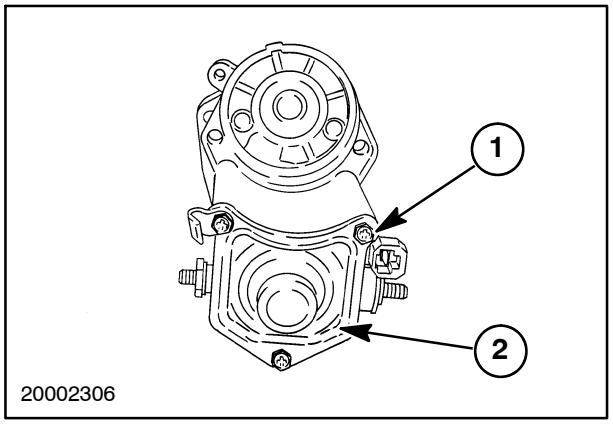
2. Install the solenoid cover and gasket to the starter housing. Install the three (3) screws, 1, securing the solenoid cover, 2, and gasket to the starter housing.



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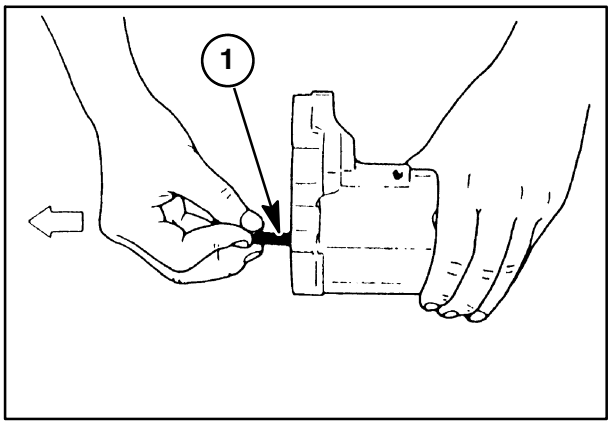
3. Install the return spring, 1, into the solenoid.



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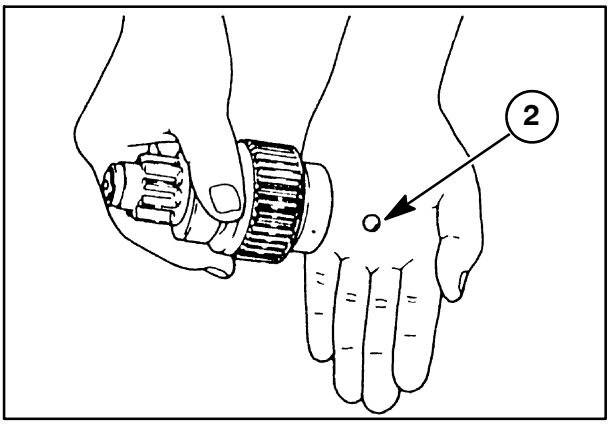
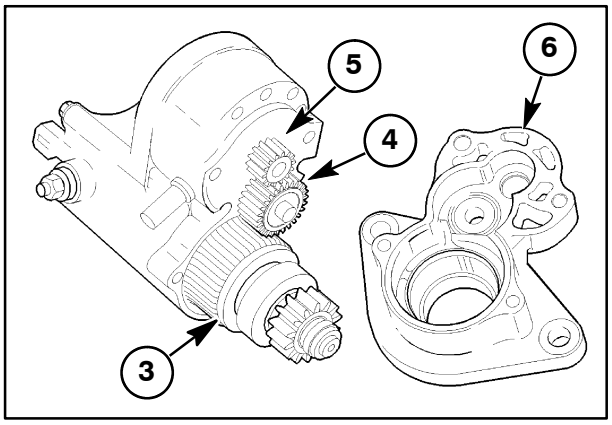
4. Install the steel ball, 2, into the center of the pinion clutch.



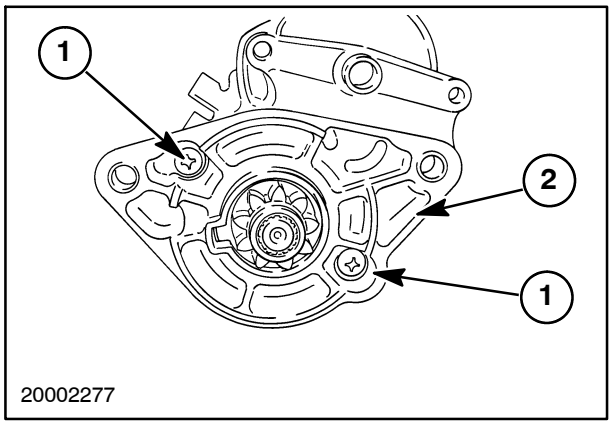
78

5. Install the pinion clutch, 3, in the starter housing. Make sure the rear clutch bearing is completely seated in the housing.
6. Grease the idler gear bearing with petroleum jelly and install the gear, 4, and bearing onto the starter housing. Align the bearing and gear so that it meshes with the pinion clutch and is aligned with the hole in the housing for the pin which the bearing rides on.
7. Install the pinion gear, 5, in the proper recess in the reduction unit cover, 6, as the cover is being installed onto starter motor housing.



79

8. Secure the gear reduction cover, 2, with the two (2) retaining screws, 1.



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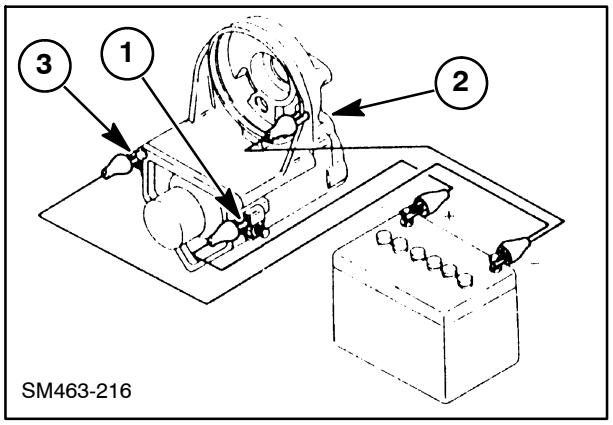
⚠ CAUTION ⚠

Do not perform this test for more than 3 - 5 seconds at a time, as damage may occur to the solenoid or other components.

NOTE: *Be sure to use test leads that have 14 awg wire or thicker for this test.*

9. Connect a test lead from the positive (+) terminal of a 12-volt power source to the starter switch terminal, 1, (spade terminal) of the starter.
10. Use another test lead to connect the negative (•) terminal of the 12-volt power source to the starter housing, 2.
11. Connect a second negative (-) test lead from the 12-volt power source to the field coil terminal, 3. This completes the circuit to send current to the hold-in and pull-in coils of the solenoid.
12. Observe the starter pinion. The solenoid should have caused the pinion to jump forward when the third test lead was connected to the field coil terminal. This indicates the pull-in coil is working properly.
13. Remove the test lead to the field coil terminal, 3, and observe the starter pinion. The solenoid should keep the pinion extended when the third test lead is removed. This indicates the hold-in coil is working properly.
14. If the solenoid fails to perform as described, replace the solenoid assembly.



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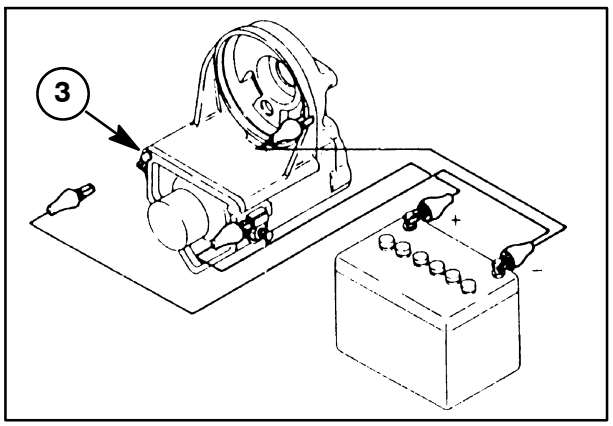

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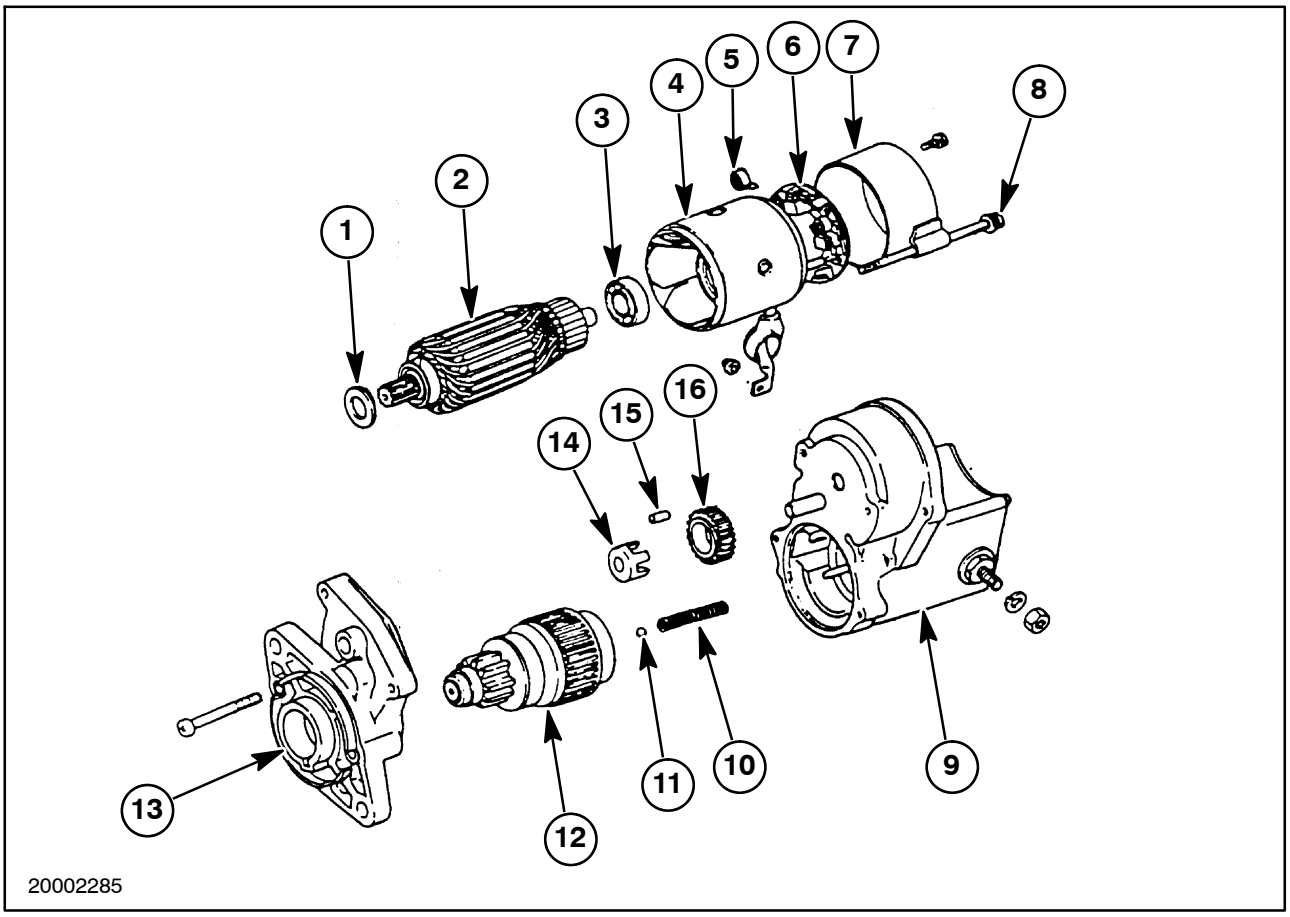

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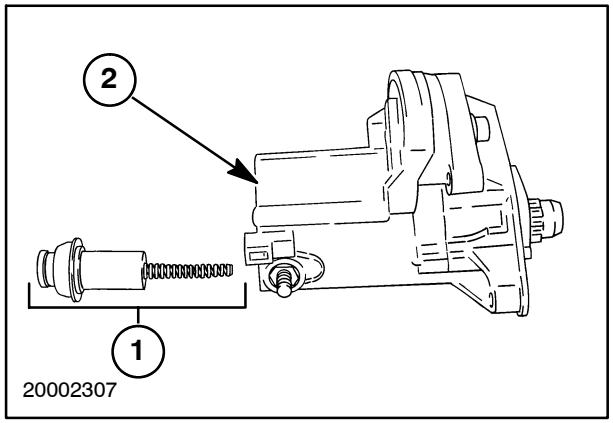
1. Felt Washer
2. Armature (with Front Bearing)
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush Holder
7. Brush Cover
8. Through Bolt
9. Solenoid Housing
10. Return Spring
11. Steel Ball
12. Pinion Clutch
13. Reduction Unit Housing
14. Idler Gear Roller Bearing
15. Roller
16. Idler Gear

Assembly

NOTE: *Use white lithium grease to lubricate parts indicated.*

1. Install the solenoid plunger, 1, into the starter housing, 2.



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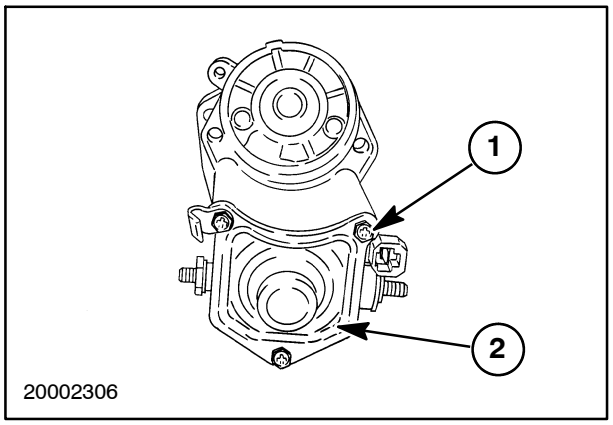
2. Install the solenoid cover and gasket to the starter housing. Install the three (3) screws, 1, securing the solenoid cover, 2, and gasket to the starter housing.



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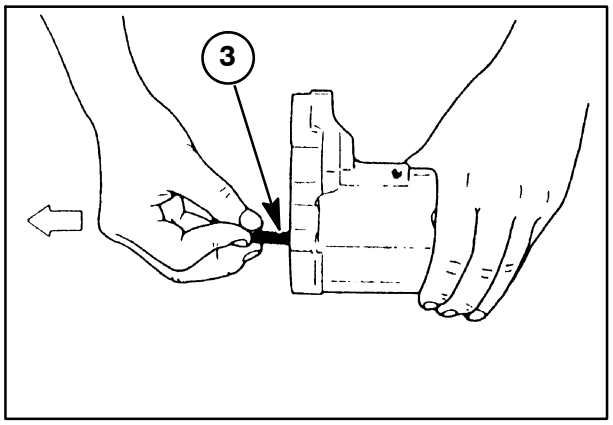
3. Grease and install the return spring, 3, into the solenoid.



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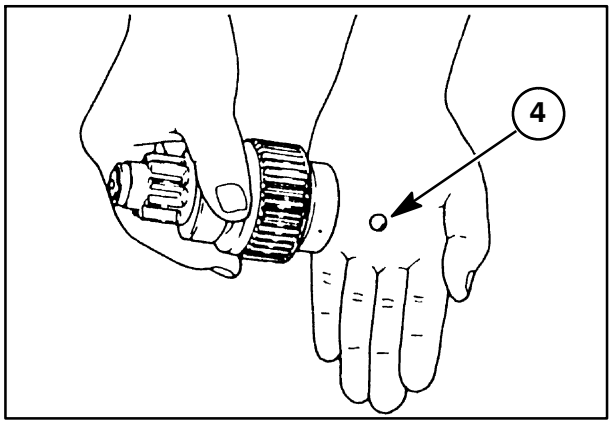
4. Grease and install the steel ball, 4, into the center of the pinion clutch.



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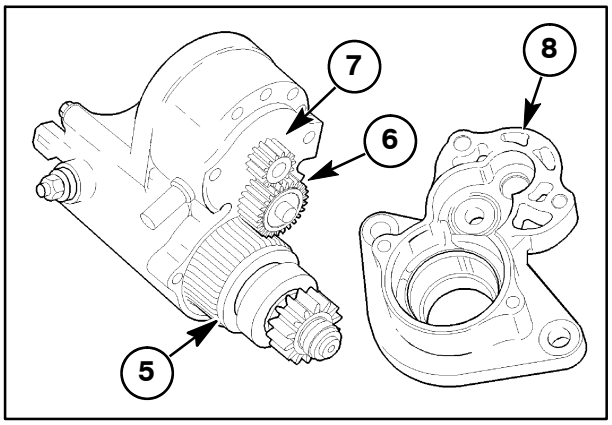
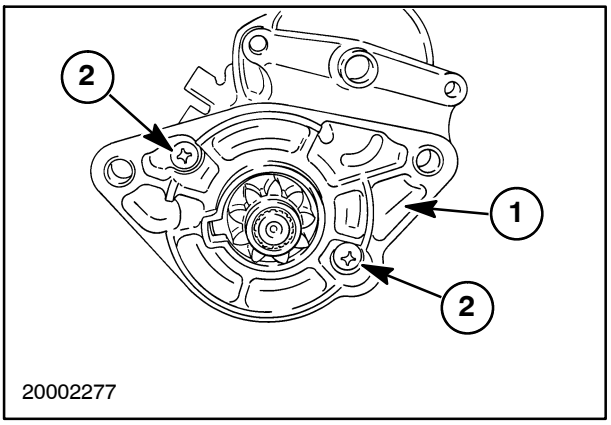
5. Grease and install the pinion clutch, 5, in the starter housing. Make sure the rear clutch bearing is completely seated in the housing.
6. Grease the idler gear bearing and gear and install the gear, 6, and bearing onto the starter housing. Align the bearing and gear so that it meshes with the pinion clutch and is aligned with the hole in the housing for the pin which the bearing rides on.
7. Install the drive gear, 7, in the proper recess in the reduction unit cover, 8, as the cover is being installed onto starter motor housing.



88

8. Secure the gear reduction cover, 1, with the two (2) retaining screws, 2.



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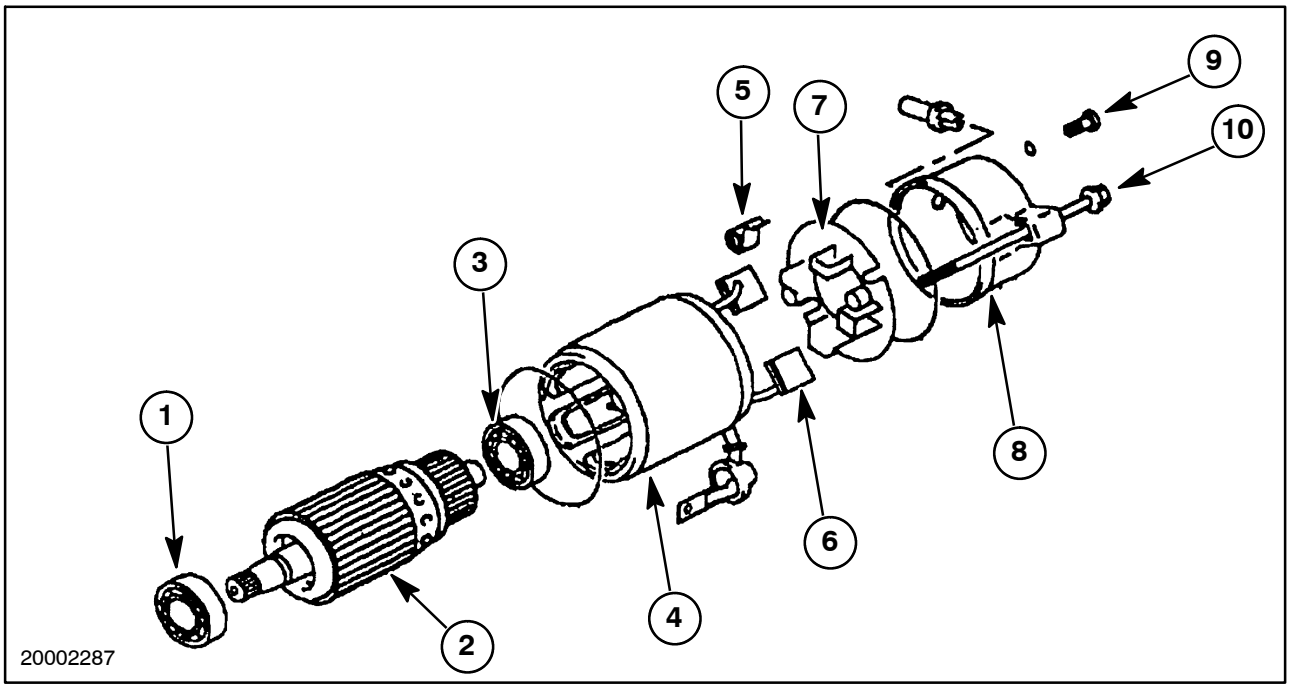

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1. Front Armature Bearing
2. Armature
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush
7. Brush Holder
8. Brush Cover
9. Bolt
10. Through Bolt

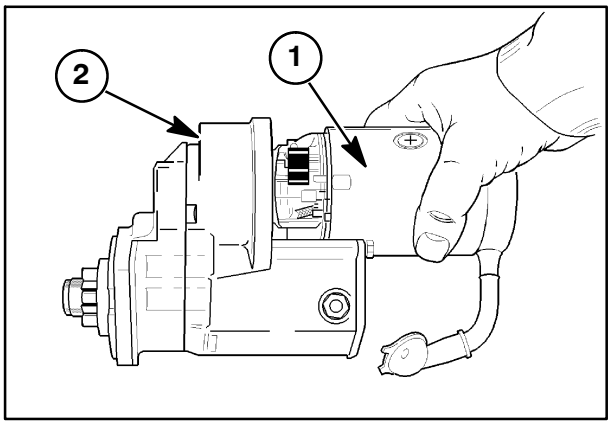
9. If removed, install the front and rear bearings, 1, 3, onto the armature, 2.
10. Install the armature, 2, into the motor/field coil housing, 4. Be sure that the rear bearing, 3, is properly seated in the motor housing.

NOTE: *When installing the field coil brushes, be sure that the aligning marks made on the brush holder and motor/field coil housing will line up when the brush holder is installed onto the armature commutator.*

11. Install the field coil brushes, 6, into the brush holder, 7, by holding the brush springs, 5, away as the brush is being inserted into the insulated brush holder.
12. Install the brush holder, 7, onto the armature commutator.
13. Secure the brush cover, 8, to the brush holder, 7, using the two (2) retaining bolts, 9.

NOTE: *Be sure the aligning marks made on the starter housing and motor/field coil housing line up when installing the motor assembly to the starter assembly.*

14. Install the motor assembly, 1, into the starter assembly, 2.



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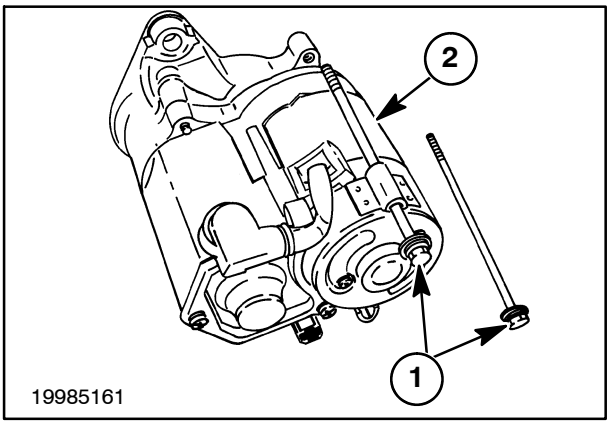
15. Secure the motor assembly, 2, to the starter assembly using the two (2) long through bolts, 1.



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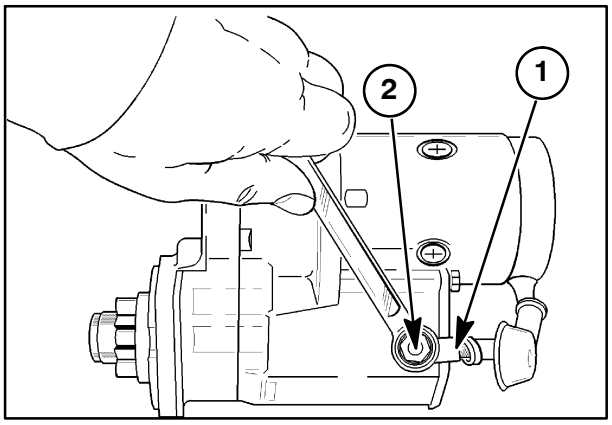
16. Install the field coil wire, 1, the solenoid terminal, 2.



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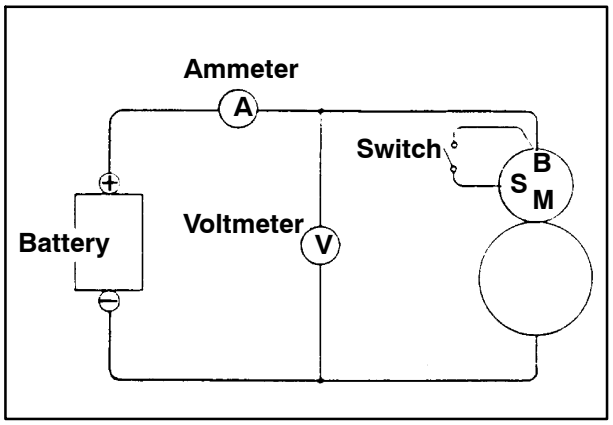
No Load Test

NOTE: *Before installing the starter motor to the tractor engine, it is recommended that a no load test be performed on the starter motor.*

⚠ CAUTION ⚠

Do not operate the starter for than 30 seconds at a time.

1. Connect a battery and switch to the battery terminal of the starter and the “S” terminal of the solenoid.
2. Connect an ammeter between the positive (+) battery terminal of the battery and the battery terminal of the starter solenoid.
3. Connect a voltmeter, after the ammeter, between the positive (+) lead from the battery and the negative (-) lead from the battery.
4. Close the switch and record the readings indicated on the ammeter and voltmeter.
5. Test starter components if any abnormal operation is noted.
6. Service limits are 11.5 volts, 110 amps maximum at 4000 RPM.



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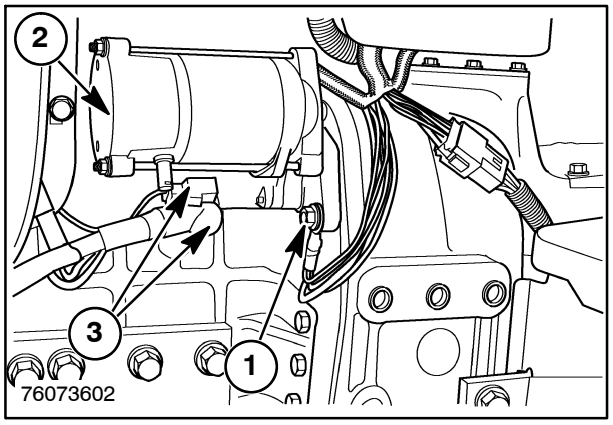
Installation

1. Install the starter motor, 2, to the engine and secure using the two (2) retaining bolts, 1. Be sure all ground terminals are connected to the bottom starter bolt.
2. Connect the tractor wiring harness connections, 3, to the starter.
3. Connect the negative (-) battery cable to the battery.



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SECTION 55 – ELECTRICAL SYSTEM

Chapter 5 – Electrical – T2410 – T2420 With Cab

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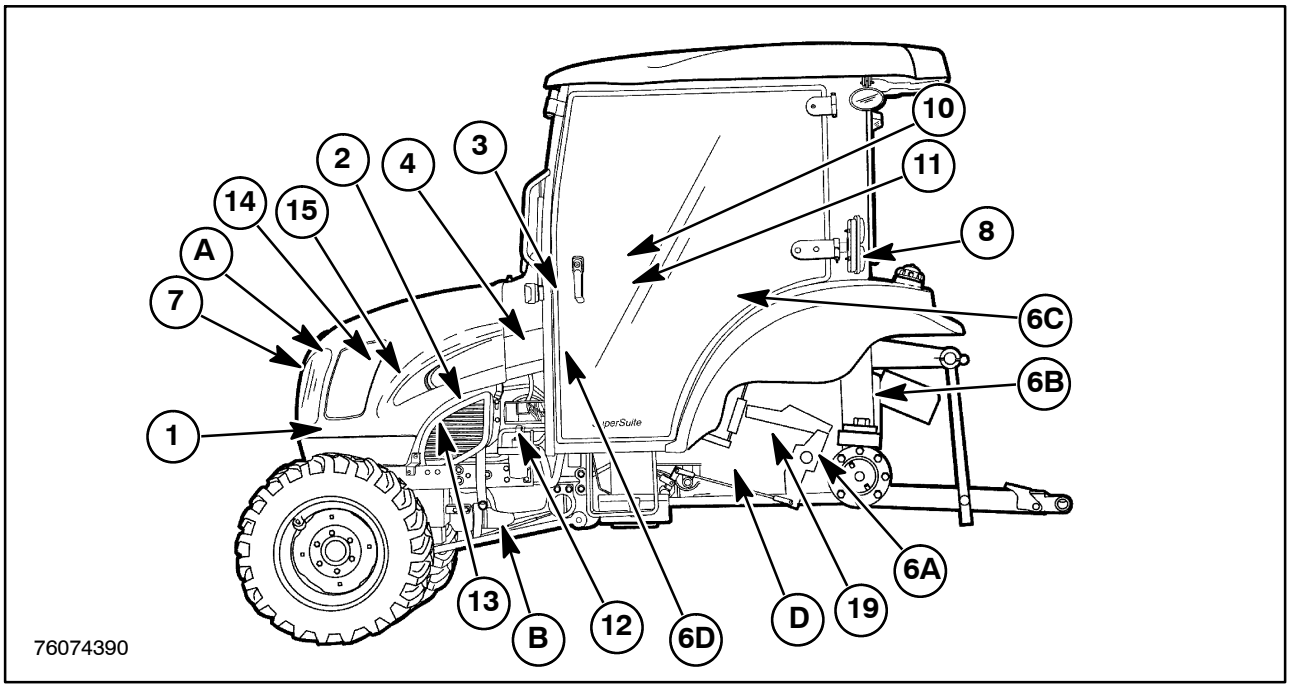
BOLT TORQUE SPECIFICATIONS

Bolt Size	Grade No.	Coarse Thread			Fine Thread		
		Pitch (mm)	Foot-Pounds	Newton Meters	Pitch (mm)	Foot-Pounds	Newton-Meters
M6	4T, 4	1.0	3.6-5.8	4.9-7.9	------	------	------
	7T, 7		5.9-9.4	7.9-12.7			
	8T, 8, 11		7.2-10	9.8-13.6			
M8	4T	1.25	7.2-14	9.8-19	1.0	12-17	16.3-23
	7T		17-22	23-29.8		19-27	25.7-36.6
	8T		20-26	27.1-35.2		22-31	29.8-42
M10	4T	1.5	20-25	27.1-33.9	1.25	20-29	27.1-39.3
	7T		34-40	46.1-54.2		35-47	47.4-63.7
	8T		38-46	51.5-62.3		40-52	54.2-70.5
M12	4T	1.75	28-34	37.9-46.1	1.25	31-41	42-55.6
	7T		51-59	69.1-79.9		56-68	75.9-92.1
	8t		57-66	77.2-89.4		62-75	84-101.6
M14	4T	2.0	49-56	66.475.9	1.5	52-64	70.5-86.7
	7T		81-93	109.8-126		90-106	122-143.6
	8T		96-109	130.1-147.7		107-124	145-168
M16	4T	2.0	67-77	90.8-104.3	1.5	69-83	93.5-112.5
	7T		116-130	157.2-176.2		120-138	162.6-187
	8T		129-145	174.8-196.5		140-158	189.7-214.1
M18	4T	2.0	88-100	119.2-136	1.5	100-117	136-158.5
	7T		150-168	203.3-227.6		177-199	239.8-269.6
	8T		175-194	237.1-262.9		202-231	273.7-313
M20	4T	2.5	108-130	146.3-176.2	1.5	132-150	178.9-203.3
	7T		186-205	252-277.8		206-242	279.1-327.9
	8T		213-249	288.6-337.4		246-289	333.3-391.6

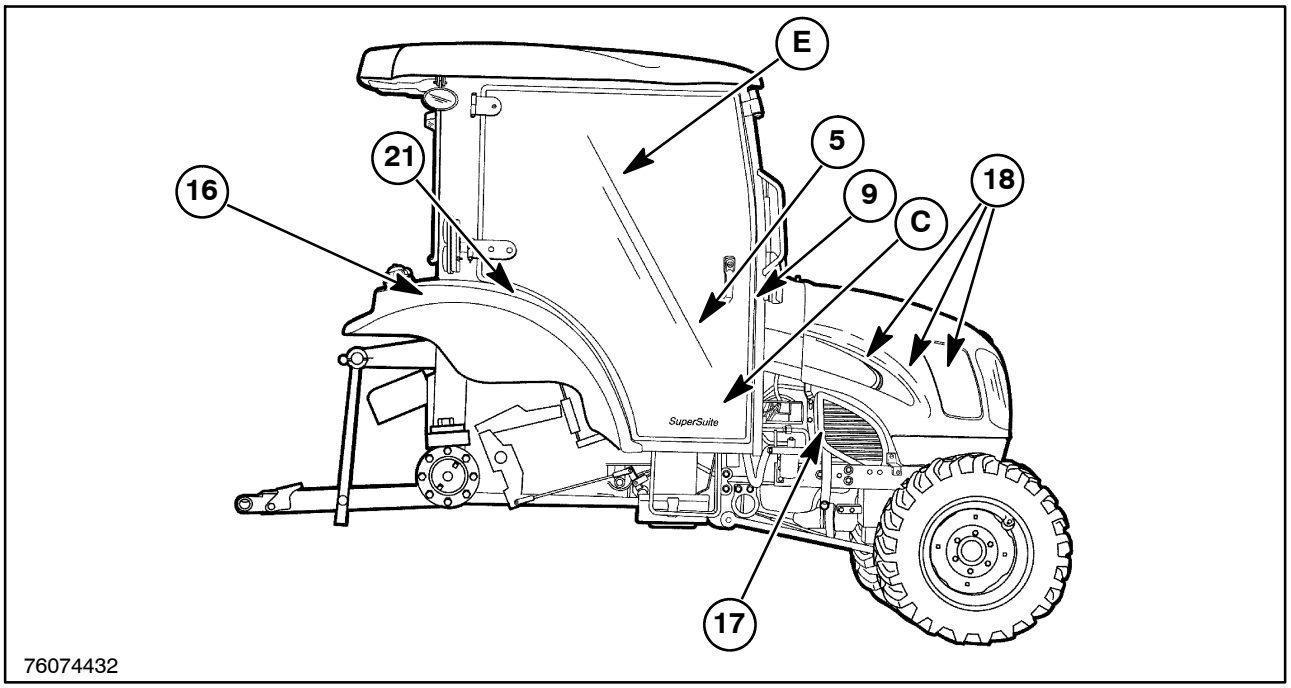
DESCRIPTION OF OPERATION

The T2410 and T2420, cab, electrical system is a 12-volt negative (–) ground system consisting of 5 main wiring harnesses.

COMPONENT LOCATION AND FUNCTION



1



2

1. **Battery** - Located under the hood, in front of the radiator; electrical power source. Group 27
2. **Fusible Link (40 Amp.)** - Located on the left side of the engine underneath the starter; protects the entire electrical system from damage due to excessive current.
3. **Fuse Block** – Located in the lower steering wheel console panel; contains fuses that protect individual circuits from damage due to excessive current.
4. **Relay/Diode Panels** – Located on both sides of the steering wheel column; houses relays utilized by individual circuits and diodes which direct current within a circuit to allow the use of one wire within multiple circuits to control a relay.
5. **Key Switch** – Located on the right side of the operator's console; used to switch battery power on or off to the tractor's electronic circuits, supply power to the engine glow plugs, or to start the tractor.
6. **Safety Start Switches (4)** – Range gear (A), rear PTO (B), operator's seat switch (C), and the clutch/inching pedal switch (D); will not allow the tractor to start with the transmission or the PTO engaged, or without an operator in the operator's seat.

NOTE: *The park brake switch also lights the parking brake indicator light on the instrument panel when the parking brake is engaged.*

NOTE: *The tractor may be started without the operator being seated when the parking brake lever is engaged.*

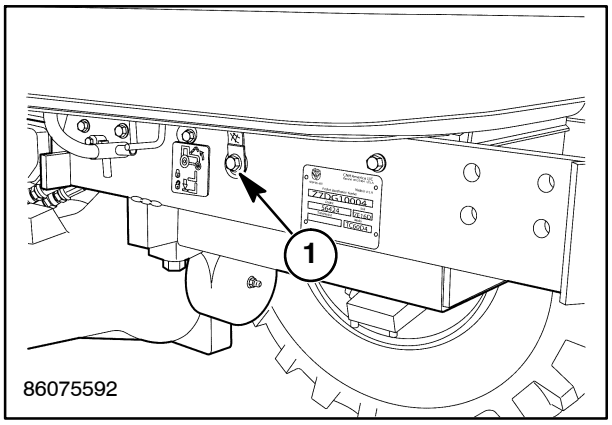
7. **Headlights** – Four lights, located in the front grill of the tractor, used to illuminate the area in front of the tractor.
8. **Taillights/Directional Signals/ Flasher Warning (Hazard) Lights** – Located on both sides of the cab; provide warning during transportation and emergency.
9. **Instrument Panel** – Located in the center of the dash panel; houses gauges and indicator lights that monitor tractor functions.
10. **Light Switch** – Located on the left side of the dash panel; switches the headlight, taillight and the instrument panel lights on or off.
11. **Hazard (Flashing Warning Lights) Switch** – Located on the left side of the dash panel; switches the flashing warning (hazard) lights on and off.
12. **Starter** – Located on the left side of the engine; rotates the engine for starting.
13. **Alternator (55 Amp.)** – Located on the left side of the engine; generates power to charge the battery.
14. **Engine Oil Pressure Switch** – Located in front of the cylinder head; provides warning of low engine oil pressure.
15. **Engine Coolant Temperature Sending Unit** – Located in the thermostat housing on the front left side of the engine; warns the operator of high operating temperatures.
16. **Fuel Level Sending Unit** – Located inside the fuel tank; sends a signal indicating fuel level to the instrument panel.
17. **Fuel Shutoff Solenoid** – Located on the right side of the engine; shuts off the fuel flow to the injection pump to stop the engine.
18. **Engine Glow Plugs** – Located on the right side of the cylinder head, adjacent to the fuel injectors; aid in engine startup by warming the air in the combustion chamber.
19. **Park Brake Switch** – Located under the left platform; actuates with the parking brake mechanism; indicates when the parking brake is engaged by illuminating a light on the instrument panel.
20. **Auxiliary Electrical Power Socket** – Located at the right rear of the cab; provides electrical current for any auxiliary 12 volt electrical item (15 amp maximum).

WIRING HARNESSES, Figures 1 and 2

A. Hood (Front lights)
B. Front Main (Includes engine area, starter, alternator, glow plugs, fuel solenoid)
C. Panel (Includes relay and fuse areas)
D. Rear Chassis
E. Cab

Grounds

1. Negative battery post to the right side of the frame
2. Middle front of cab on clutch housing
3. Left rear cab frame
4. Left side behind rear tire on HPL housing



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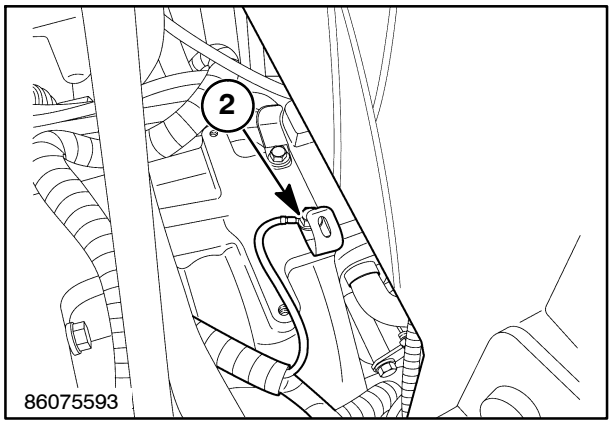

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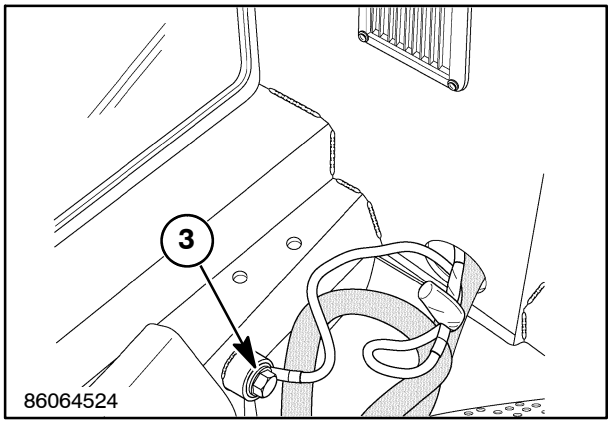

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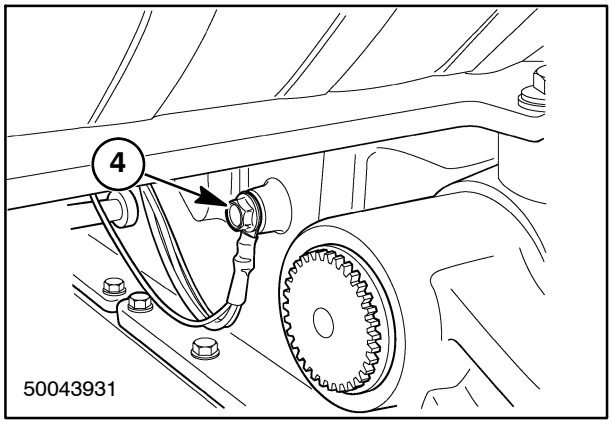


6

ELECTRICAL SYSTEM COMPONENTS

WARNING

Before working on any component of the electrical system, the negative (-) battery cable should be disconnected from the battery, as electrical shock or damage to the system components may occur. Some testing requires 12-volt power; use caution whenever power is used.

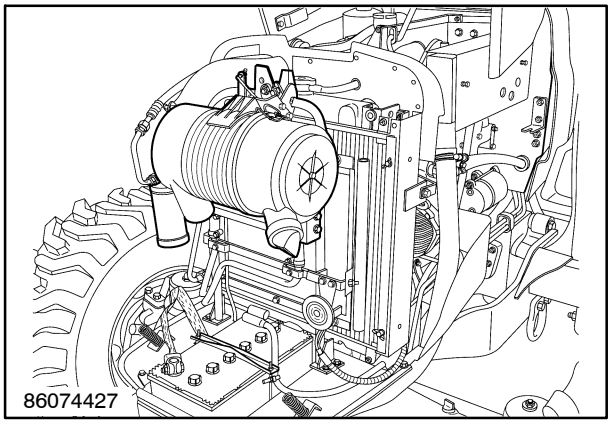
BATTERY

The tractor is equipped with a BCI group 27, 12-volt battery with a minimum cold cranking ability of 700 amps at 0°F (-18°C).

Make sure the battery connections are tight and free of corrosion. A solution of baking soda and water may be used to wash the outside surface and terminals of the battery when necessary. However, make sure the solution does not get inside the battery. After cleaning, wash the battery with clean water, then apply a small amount of petroleum jelly to the terminals to prevent corrosion.

In freezing temperatures, a good battery charge must be maintained. If the battery becomes discharged or run down, the electrolyte becomes weak and may freeze, causing damage to the case. If you must add water, use distilled water. Add the water just before using the tractor so that the water will mix with the electrolyte during the charging process, thus preventing the water from freezing.

To determine the battery charge, check the specific gravity of the electrolyte.



7

Checking the Electrolyte Level

NOTE: *Check the battery electrolyte level after every 50 hours of operation.*

⚠ WARNING ⚠

Always check the electrolyte level with the tractor engine off, as an explosive gas is produced inside the battery when the alternator is charging. Do not use an exposed flame and do not smoke when checking the battery electrolyte level.

To check the battery electrolyte level:

1. Clean the top of the battery, then remove the vent plugs.
2. Add distilled water if the electrolyte level is low. The level is correct when the liquid is 6.35 mm (1/4 in) above the plates.

NOTE: *Keep distilled water in a non-metallic container that is clean and well-covered.*

3. Install the vent plug after making sure the vent holes are not blocked. At below freezing temperatures, run the engine for a period of time after adding water, allowing the battery to charge, which prevents the water from freezing.

Removal

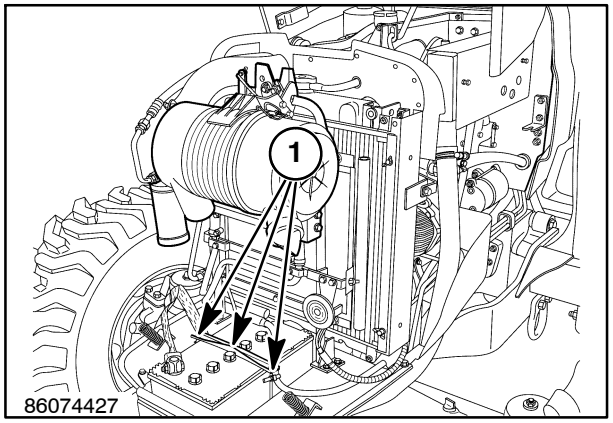
1. Release and lift the tractor engine cover.
2. Disconnect the negative (–) battery cable.
3. Disconnect the positive (+) battery cable.
4. Remove the hardware, 1, securing the battery.
5. Carefully remove the battery from the tractor.

IMPORTANT: *Crossing the battery terminals may cause damage to the electrical system.*

Installation

NOTE: *When replacing the battery, use only a BCI group 47, 12 volt battery. Make sure the battery fits the battery tray correctly and is properly secured with the mounting hardware. Never use a battery that does not fit properly in the battery tray. Do not overtighten the battery securing hardware. Do not overtighten the battery cables.*

1. Place the battery in the battery tray with the battery posts towards the front of the tractor.
2. Use the battery hold down hardware, 1, to secure the battery in the battery tray.
3. Connect the positive (+) cable to the positive terminal.
4. Connect the negative (–) cable to the negative terminal.
5. Lower and secure the tractor engine cover.



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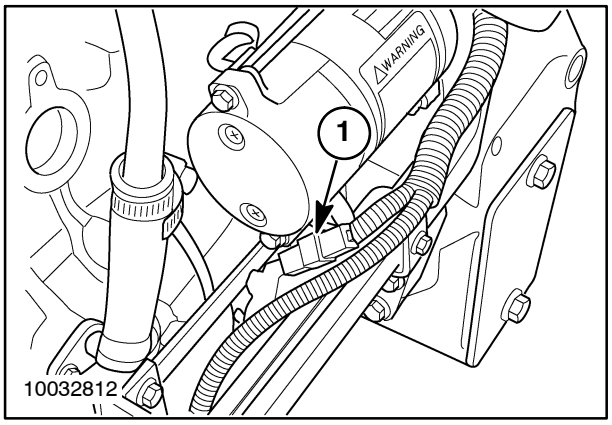
FUSIBLE LINK

A fusible link wire, 1, is used to protect the tractor's entire electrical system. If excessive amperage passes through this wire it will melt down so that it will no longer allow current to pass (similar to the way a fuse works). The fusible link wire, 1, is a red wire that goes from the starter terminal to a connector that links into the main wiring harness.

To replace the fusible link wire:

1. Disconnect the battery.
2. Unplug the connector linking the wire to the main wiring harness.
3. Remove the old fusible link wire from the starter terminal.
4. Replace the old fusible link wire with a new one – first attaching to starter terminal, and then connecting into the main wire harness.

IMPORTANT: *Always replace the fusible link wire with the appropriate fusible link wire for this tractor (part #SBA385608910).*



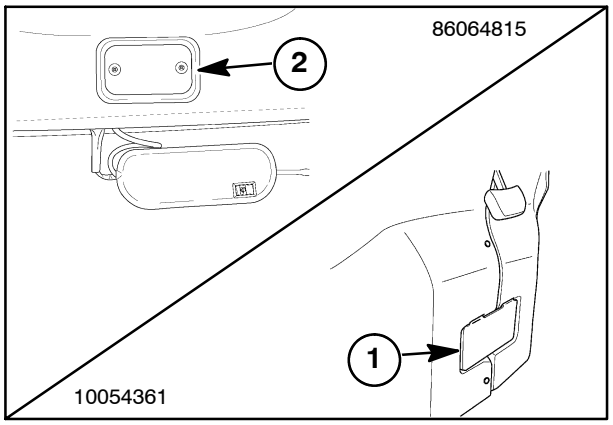
9

FUSE BLOCKS

The tractor main fuse block, 1, is located in the lower steering wheel console panel.

The cab fuse block, 2, is located in the upper rear of the cab, centered above the rear window.

To gain access to either fuse panel, remove the two screws that retain the panel cover.



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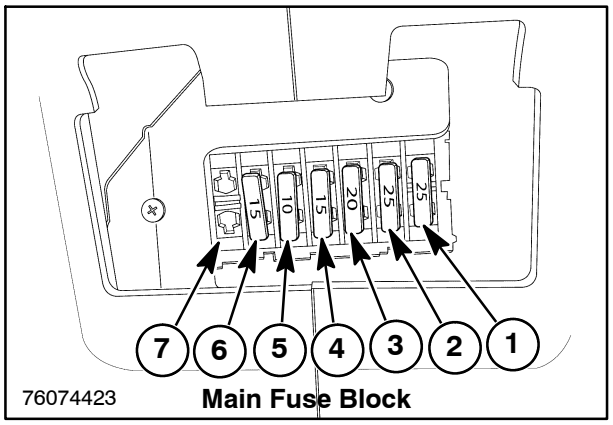

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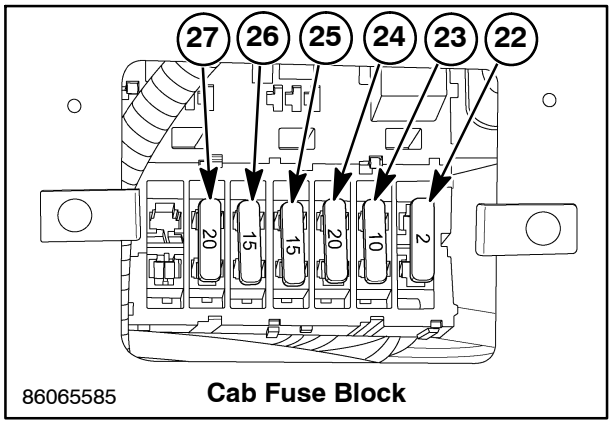

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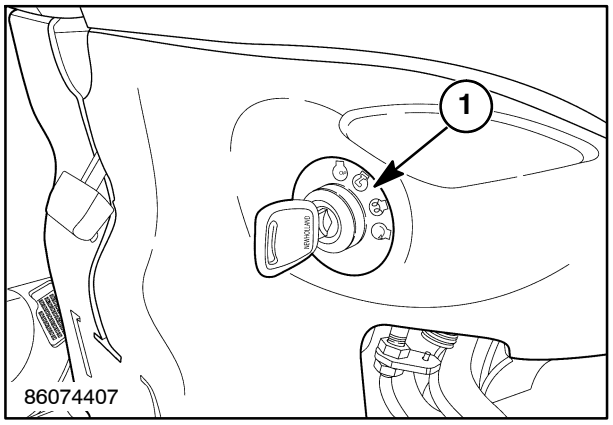
From left to right the fuse block contains the following fuses:

FUSE # and SIZE	FUNCTION
TRACTOR Main Fuse Block	
Fuse #1 – 25 Amp	Head Lights (low and high), Hazard Lights
Fuse #2 – 25 Amp	Front Work lights (Radio Memory, Cab Dome Light - Input to 2 amp fuse)
Fuse #3 – 20 Amp	Safety Start, Park Brake Alarm, Glow Plugs, Fuel Shutoff
Fuse #4 – 15 Amp	Work lights, Relay, Head Light Relay, Turn Signals, Backup Alarm, Instrument Panel, Alternator
Fuse #5 – 10 Amp	Brake Lights, Horn
Fuse #6 – 15 Amp	Trailer Socket
Fuse #7 – Open	
CAB Fuse Block	
Fuse #22 – 2 Amp	Radio(Memory), Cab Dome light
Fuse #23 – 10 Amp	Radio (Functions)
Fuse #24 – 20 Amp	HVAC
Fuse #25 – 15 Amp	Beacon, Auxiliary Power Socket
Fuse #26 – 15 Amp	Front Wiper, Rear Wiper,
Fuse #27 – 20 Amp	Cab Work lights

KEY SWITCH

The key switch, 1, is located on the right-hand side of the console just below the hand throttle. Turning the key right to the “ACC/RUN” position activates the warning lights, and instruments. The second position to the right is the “HEAT” position. This activates the engine glow plugs to preheat the engine for start up. The engine starts when the key is turned to the extreme right. The key spring returns to the “ACC/RUN” position when released.

The key switch is not serviceable and must be replaced if troubleshooting determines the switch is defective.



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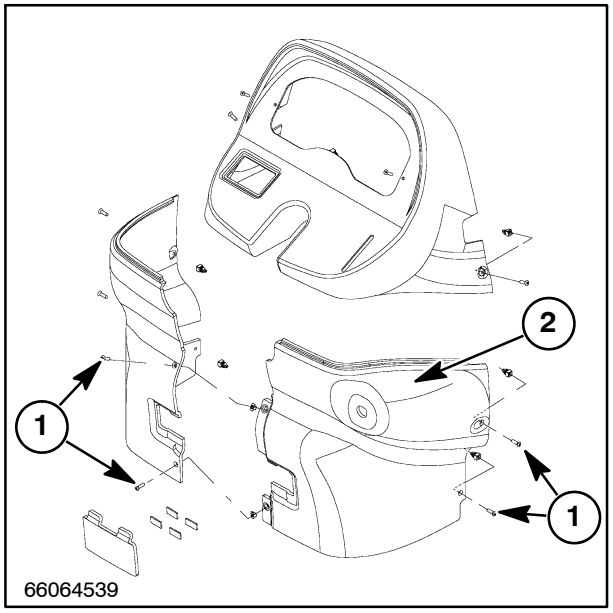
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the two side and middle retaining screws, 1, from the side panel, 2, and remove the right side panel from the tractor.
3. Unplug the connector from the key switch.
4. Remove the retaining nut from the switch and remove switch from the panel.



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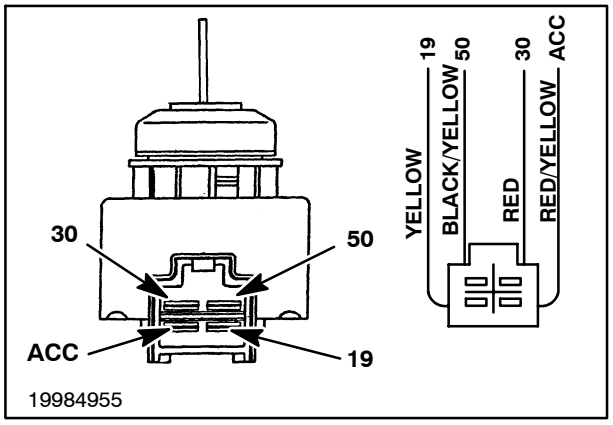
Testing

NOTE: *The key switch is not serviceable and must be replaced if testing determines the switch is defective.*

Key Switch Troubleshooting – Continuity Test

Use an ohmmeter to test each position of the key switch for electrical continuity.



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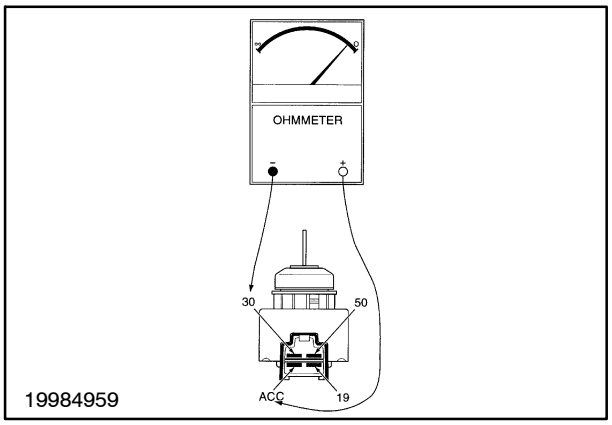
ACCESSORY/RUN Position

1. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
2. Connect the other ohmmeter lead to the connector terminal ACC on the key switch.
3. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
4. Turn the key switch to the ACC/RUN position and observe the ohmmeter.
5. Little or no resistance indicates that there is continuity this key switch position.
6. A high resistance reading indicates that the circuit is open and the key switch needs replaced.



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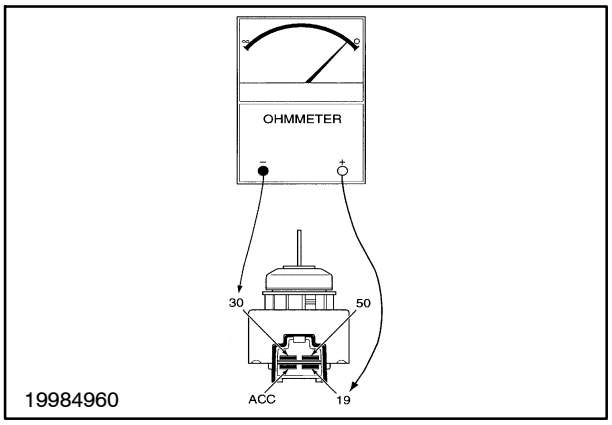
HEAT Position

1. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
2. Connect the other ohmmeter lead to the connector terminal 19 on the key switch.
3. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
4. Turn and hold the key switch to the HEAT position and observe the ohmmeter.
5. Little or no resistance indicates that there is continuity in this key switch position and the switch is functioning properly.
6. A high resistance reading indicates that the circuit is open and the key switch needs replaced.



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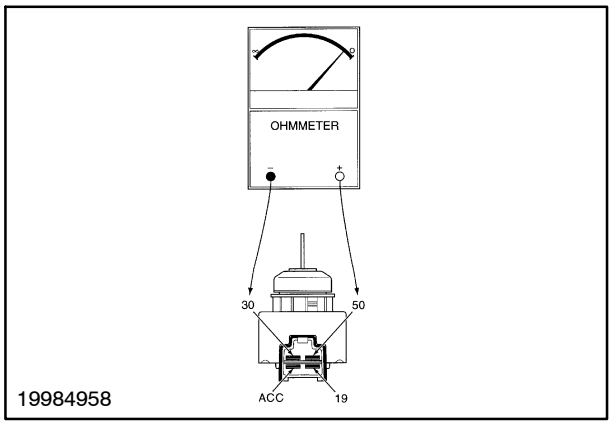
START Position

7. Connect one ohmmeter lead to the connector terminal 30 on the key switch.
8. Connect the other ohmmeter lead to the connector terminal 50 on the key switch.
9. With the key in the STOP position, continuity should not exist between any of the terminals. If there is continuity, replace the key switch.
10. Turn and hold the key switch to the START position and observe the ohmmeter.
11. Little or no resistance indicates that there is continuity this key switch position.
12. A high resistance reading indicates that the circuit is open and the key switch needs replaced.



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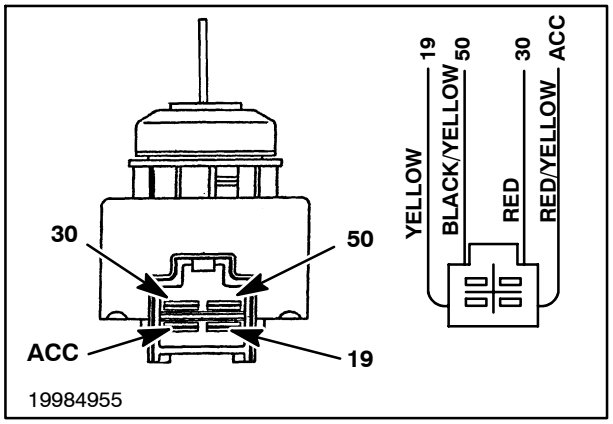
Test Lead # 1	Test Lead # 2	Switch Position	Continuity
30	Any	STOP	No (open)
30	50	START	Yes (closed)
30	ACC	ACC/RUN	Yes (closed)
30	19	HEAT	Yes (closed)

Key Switch Troubleshooting – Connector Wiring

Each terminal of the key switch is connected to specific wires of the wiring harness and must be reconnected accordingly.



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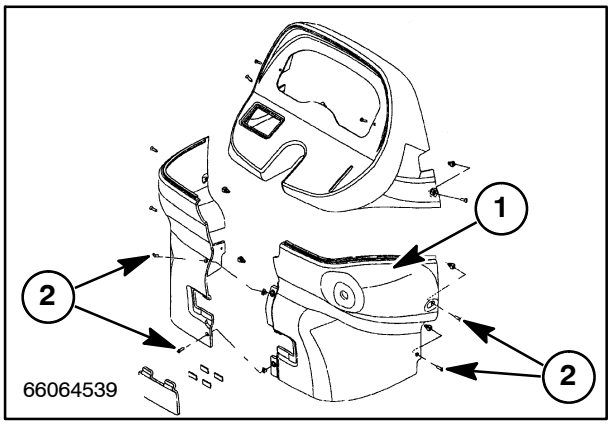
Terminal	Key Switch	Wire Color	Termination
30	Common	Red	Positive (+) terminal on starter motor (battery)
50	Start	Black/Yellow	Safety start relay connector, safety controller
ACC	ACC/RUN	Red/Yellow	Fuse block
19	Heat	Yellow	Glow controller, safety controller, glow plugs, glow indicator lamp

Installation

1. Connect the key switch to the tractor wire harness.
2. From inside the operator console, insert the key switch through the key switch hole, and thread the nut onto the key switch. Tighten the nut.
3. Install the right side panel, 1, and secure with two side and two middle retaining screws, 2.
4. Connect the negative (–) battery cable to the negative (–) battery terminal.



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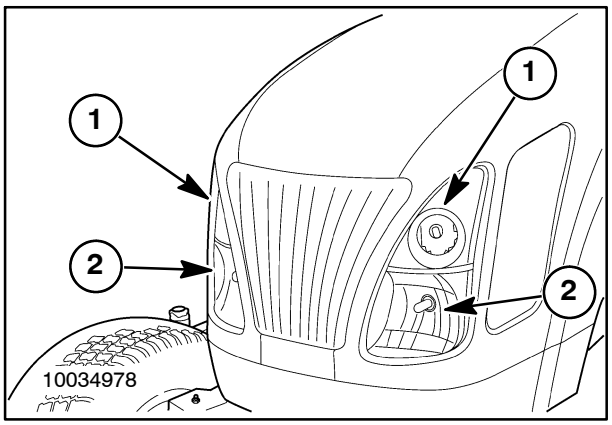
HEADLIGHTS

There are for halogen front head lights on the (DA) series cab tractors.

- Two work headlights, 1.
- Two road headlights, 2.

NOTE: *The road headlights are dual element (50/654 watt).*



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Replacement

If head lamps, 1, fail to operate, the bulb must be replaced. To change the bulb:

1. Open the tractor hood.
2. Bulb Removal:

   Road lights, 1, (Blue Cap/dual element): Release retaining tabs and pull bulb assembly from holder.

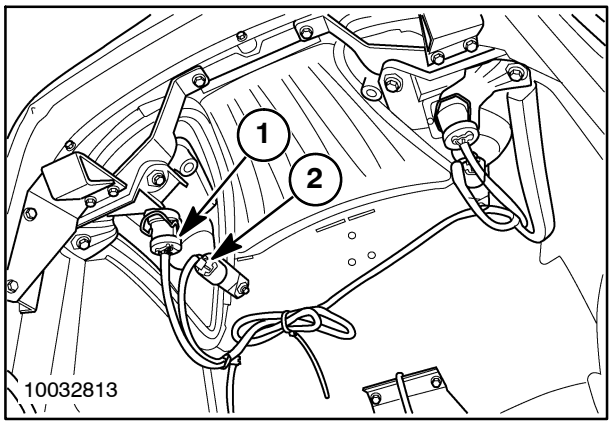
   Work lights, 2, (Single element): Turn bulb assembly 1/4 turn and remove bulb from holder.
3. Bulb Replacement:

   Road lights: Insert bulb assembly and secure with retaining clips.

   Work lights: Insert bulb assembly into slots and turn 1/4 turn clockwise to secure.
4. Rotate the socket counterclockwise a quarter turn and remove the socket from the housing.
5. Remove the bulb assembly from the harness.
6. Place a new bulb in the socket, then reinstall the socket in the housing.

IMPORTANT: *Be careful not to touch the bulb with bare fingers. Oil from the fingers can shorten the life of bulb. Use protective cloth or glove when installing bulb.*

NOTE: *Replacement bulbs are:*
Road lights: HB1/9004, dual element 50/65 Watt, Halogen
Work lights: GE886, single element 50 Watt, Halogen.



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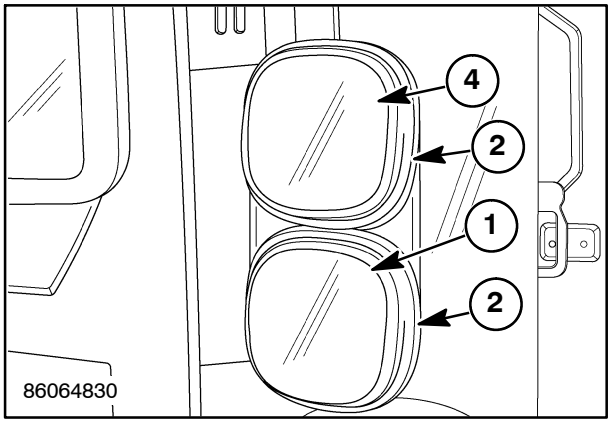
TAILLIGHT/REAR FLASHER LIGHTS

The taillights are located on the left and right rear of cab uprights. The taillights illuminate the rear of the tractor to provide warning to approaching vehicles.

NOTE: *The same procedure is used for both sides.*

To replace a taillight bulb:

1. Pull taillight lens, 1, out of the rubber lamp housing, 2.



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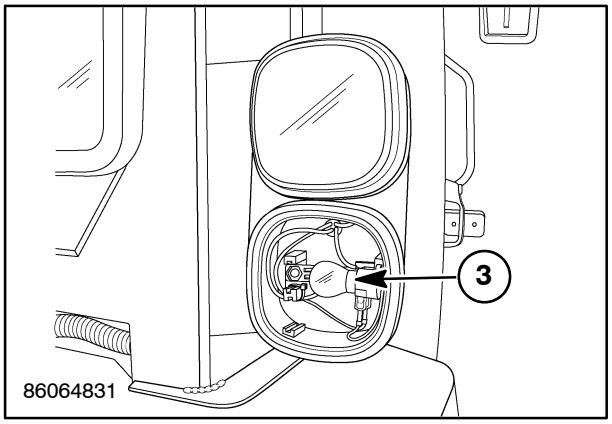
2. Remove the defective bulb, 3, by turning it counterclockwise and pulling it out of the socket.
3. Install the new bulb by pushing it into the socket and rotating it clockwise until it locks into place.

NOTE: *Replace the defective bulb with a new #1156 bulb.*



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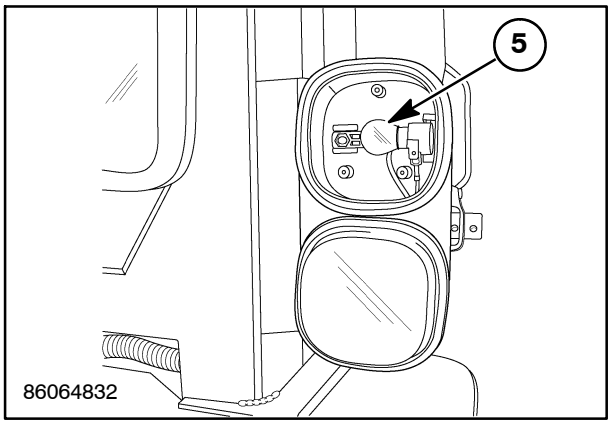
NOTE: *The same procedure is used on both sides.*

To replace a flasher bulb:

1. Pull flasher/turn lens, 4, out of rubber housing, 2.
2. Remove the defective bulb, 5, by turning it counterclockwise and pulling it out of the socket.
3. Install the new bulb by pushing it into the socket and rotating it clockwise until it locks into place.

NOTE: *Replace the defective bulb with a new #1157 bulb.*



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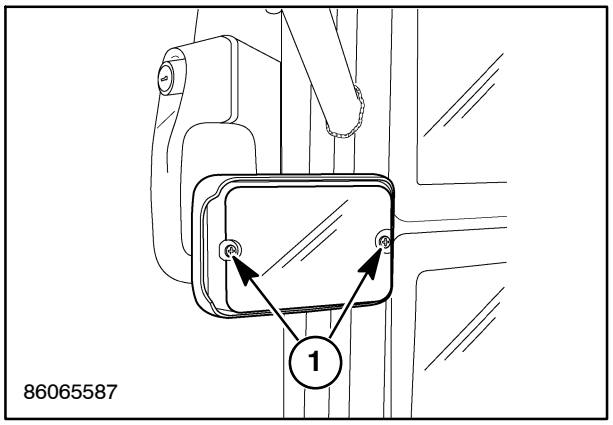
FRONT FLASHER WARNING LIGHT/TURN SIGNALS

NOTE: *The same procedure is used on both sides.*

To replace a flasher bulb:

1. Remove the two screws, 1, retaining the signal lens and remove the lens.



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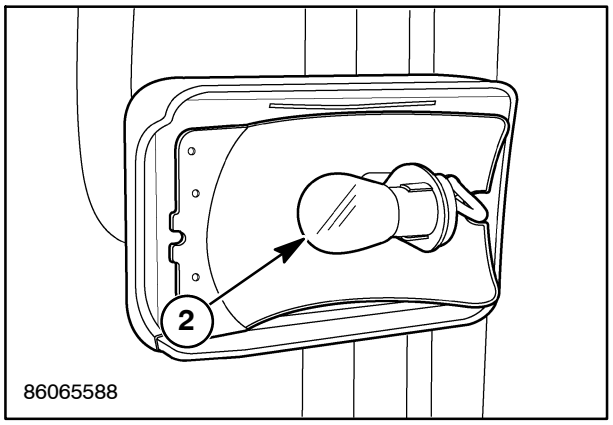
2. Remove the defective bulb, 2, by turning it counterclockwise and pulling it out of the socket.
3. Install the new bulb by pushing it in to the socket and rotating it clockwise until it locks into place.

NOTE: *Replace the defective bulb with a new #7506 bulb.*



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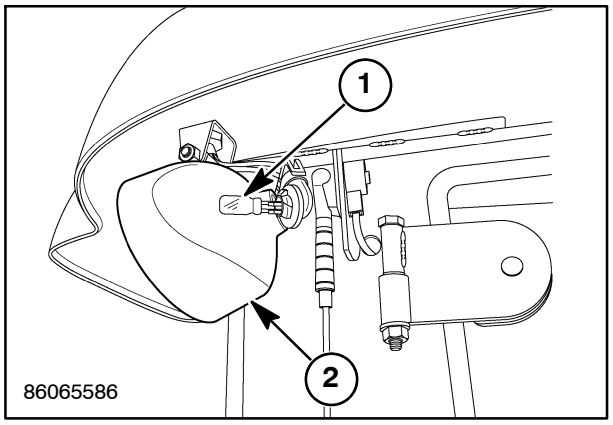
CAB WORK LIGHTS

NOTE: *The same procedure is used on all sides.*

1. Remove the defective bulb assembly, 1, by rotating it counterclockwise and pulling it out of the rear of the light housing, 2.
2. Release the retaining tabs and remove bulb assembly.
3. Reconnect new bulb assembly onto the harness, making sure the retaining clips are securely locked into position.
4. Place new bulb assembly into the rear of the light housing, 2, rotating it clockwise until it locks into place.

IMPORTANT*: Be careful not to touch the bulb with bare fingers. Oil from the fingers can shorten the life of the bulb. Use protective cloth or gloves when installing bulb.*

NOTE: *Replace the defective bulb with a new GE886 single element 50 Watt, Halogen.*



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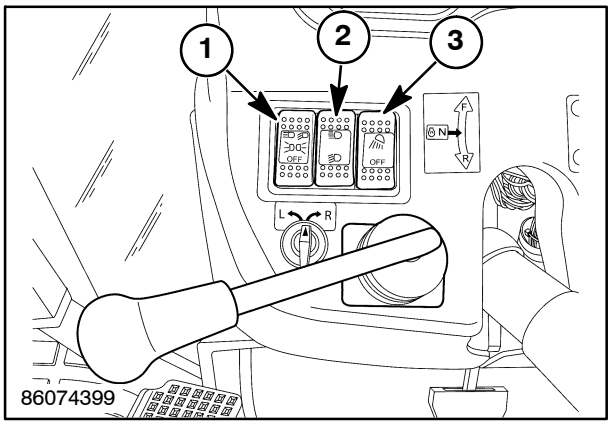
DASH SWITCHES

There are several toggle type switches, located in the dash area, that control the front and rear lights of the tractor.

1. Road lights switch
2. High beam road light switch
3. Work lights switch
4. Hazard lights switch
5. Horn switch

NOTE: *The key switch must be in either the HEAT, START, or AC/RUN positions for current flow to the road or work light switches. The hazard light switch has current provided when the key is in the "off" or any other position.*



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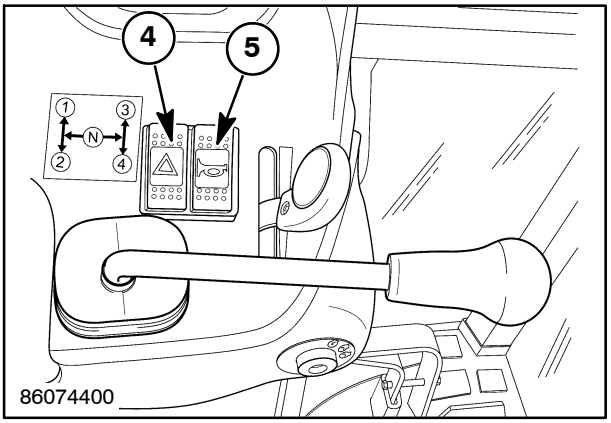

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ROAD LIGHTS SWITCH

The road lights switch, 1, has three positions:

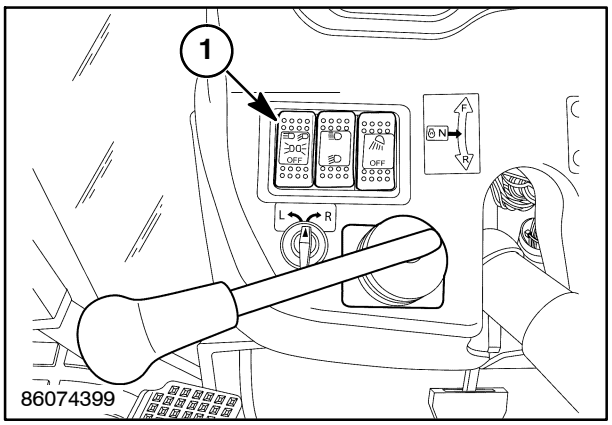
REAR – OFF

MID – Instrument panel and taillights illuminated

FRONT – Front road lights low beam, taillights and instrument panel lights illuminated.

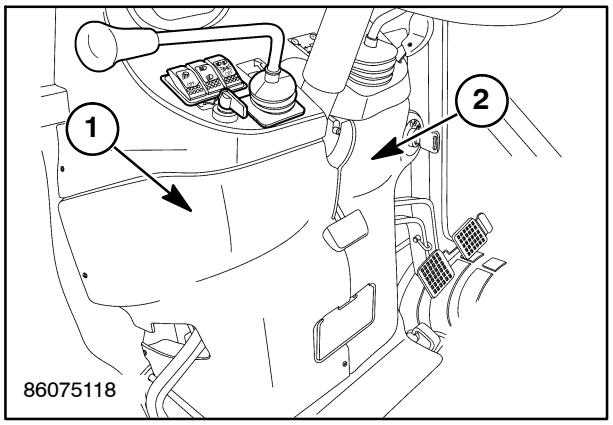
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.



31

2. Remove the two side panels, 1 and 2.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



32

Testing

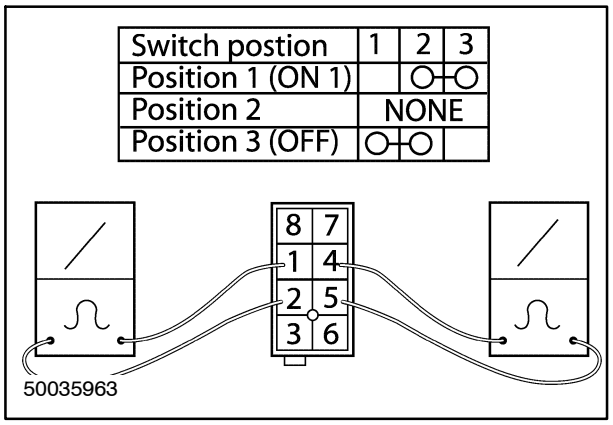
Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

"REAR" OFF Position

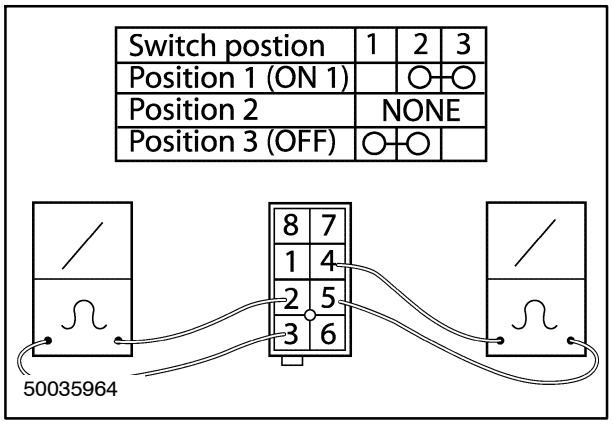
Continuity in terminals: 1 and 2
4 and 5



33

"MID" Position (Instrument panel and taillights Illuminated)

Continuity in terminals: 2 and 3
4 and 5

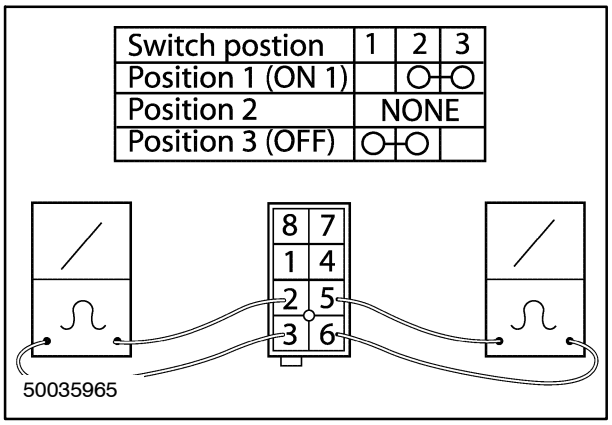


34

"FRONT" Position (Road lights low beam, Instrument panel and taillights Illuminated)

Continuity in terminals: 2 and 3
5 and 6

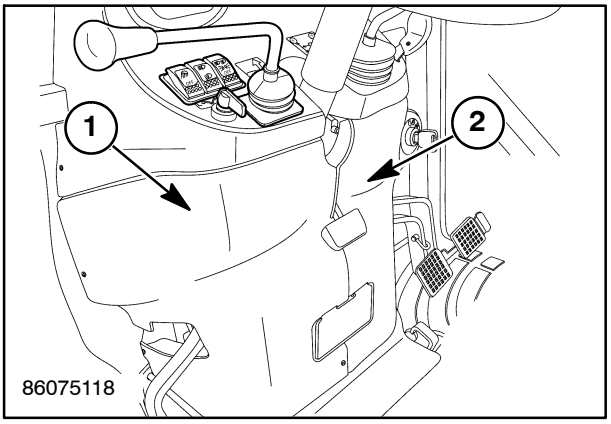
If any other test results are found the switch is defective and should be replaced.



35

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the two side panels, 1 and 2.
4. Connect the negative (–) battery cable from the negative (–) battery terminal.



36

ROAD LIGHTS HIGH BEAM SWITCH

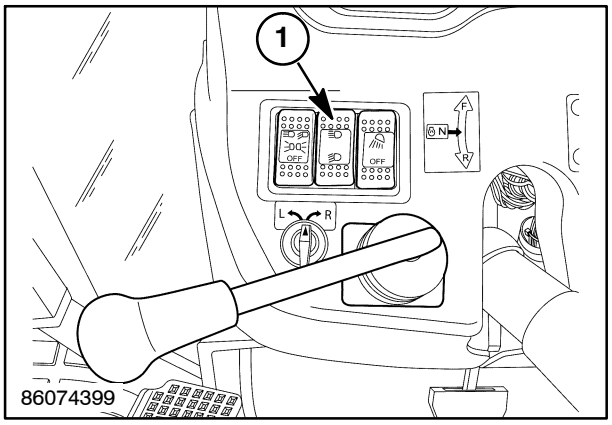
The road lights high beam switch, 1, has two positions:

REAR – OFF
Front – ON (High beam 65 watt illuminated)

NOTE: *For the high beams to illuminate the road light switch, 2, MUST be in the front "ON" position.*

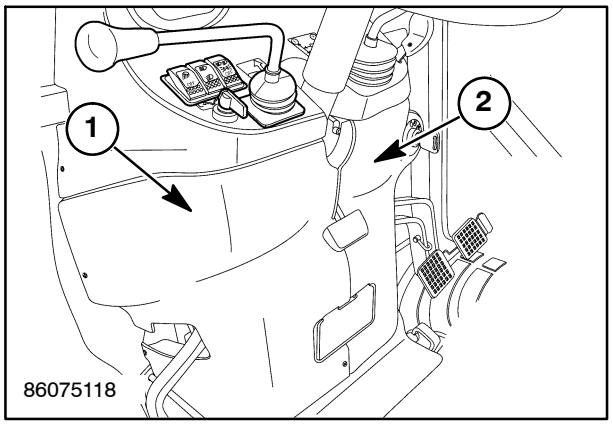
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.



37

2. Remove the two side panels, 1 and 2.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



38

Testing

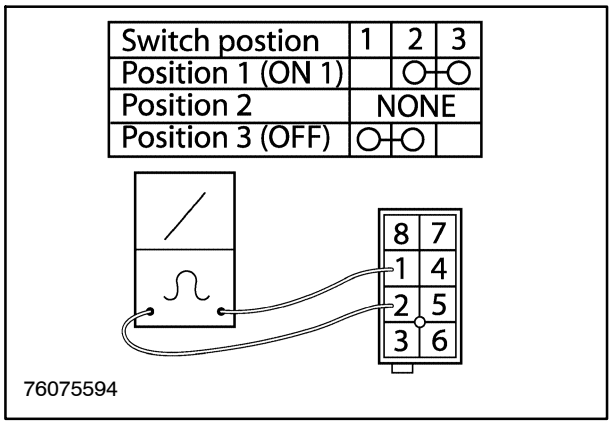
Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

"REAR" OFF Position

Continuity in terminals: 1 and 2.



39

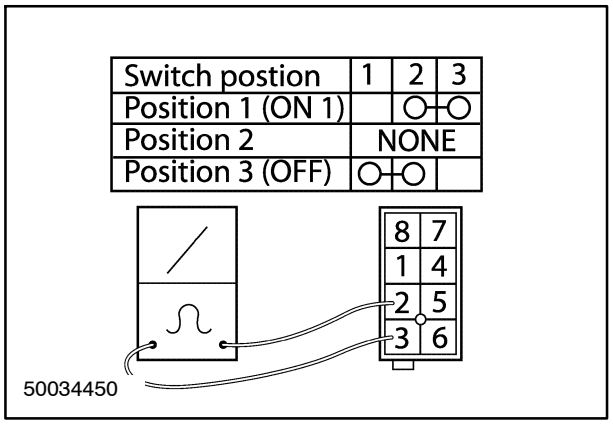
"FRONT" Position (Road lights high beam)

Continuity in terminals: 2 and 3

If any other test results are found the switch is defective and should be replaced.

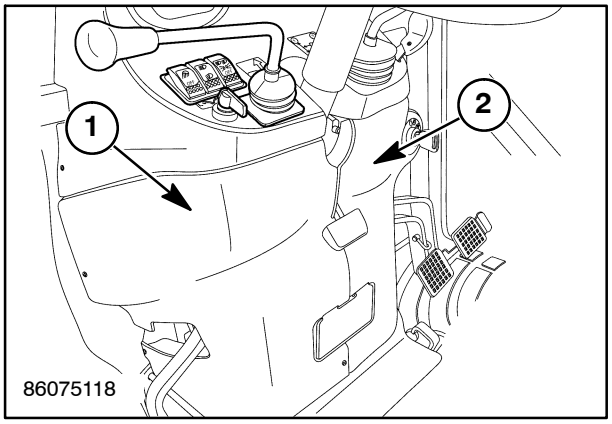
Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.



40

3. Install the two side panels, 1 and 2.
4. Connect the negative (–) battery cable from the negative (–) battery terminal.



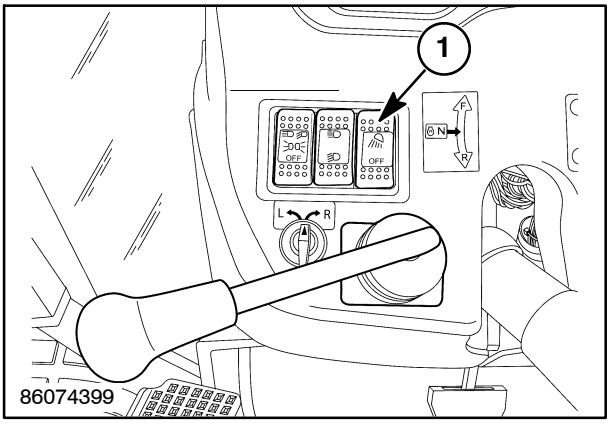
41

WORK LIGHTS SWITCH

The work lights switch, 1, has two positions:

REAR – OFF

Front – ON

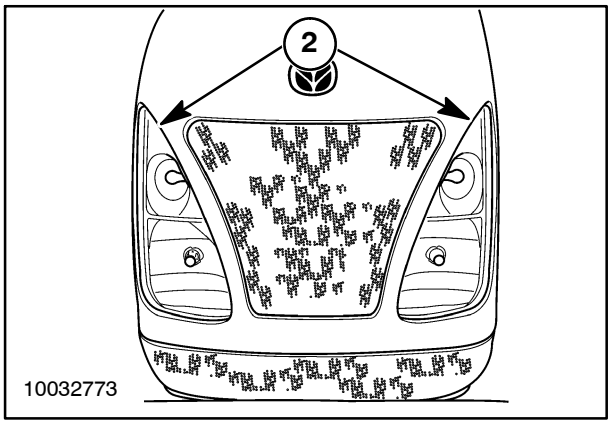


42

The work light switch controls the two front work lights, 2, independent of the road lights.

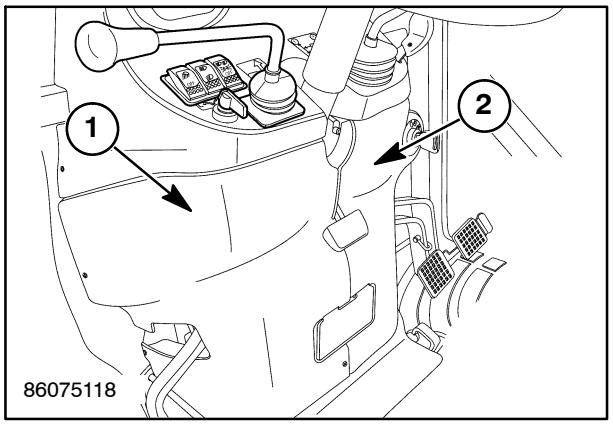
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.



43

2. Remove the two side panels, 1 and 2.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



44

Testing

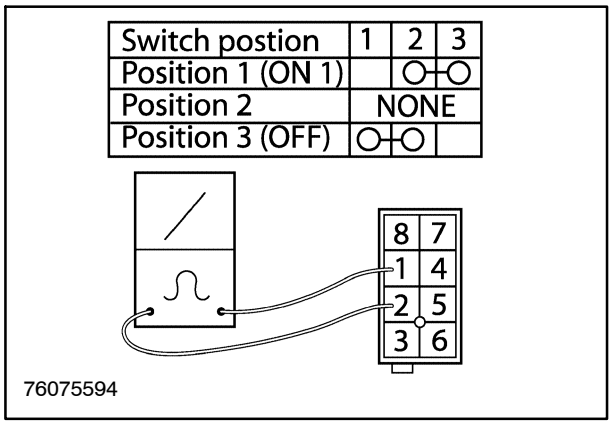
Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

"REAR" OFF Position

Continuity in terminals: 1 and 2



45

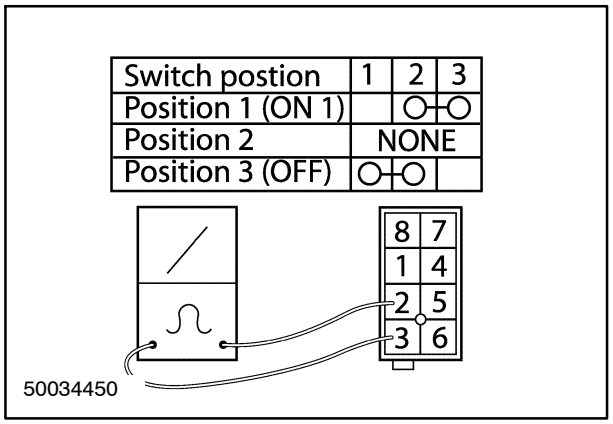
"FRONT" Position (Work lights illuminate)

Continuity in terminals: 2 and 3

If any other test results are found the switch is defective and should be replaced.

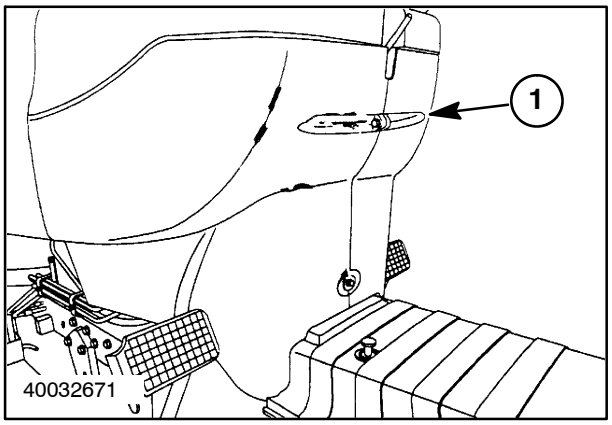
Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.



46

3. Install the right side steering column shroud, 1.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.

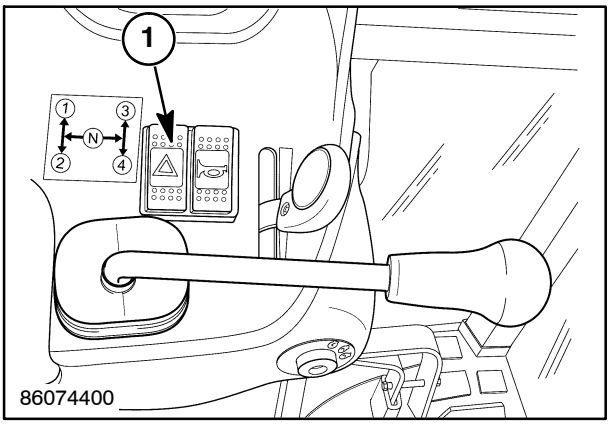


47

HAZARD LIGHTS SWITCH

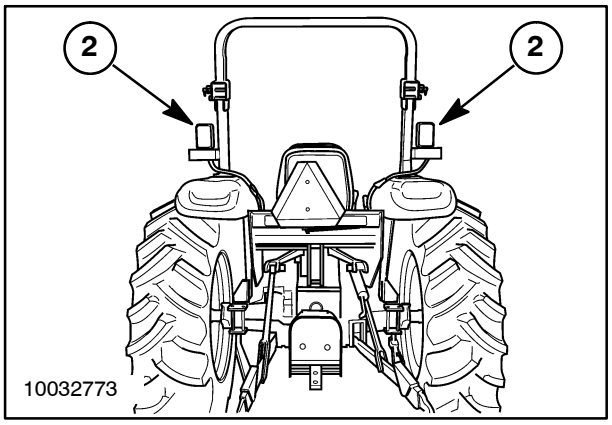
The hazard lights switch, 1, has two positions:

REAR – OFF
Front - ON



48

This switch controls the rear flasher hazard lights, 2.

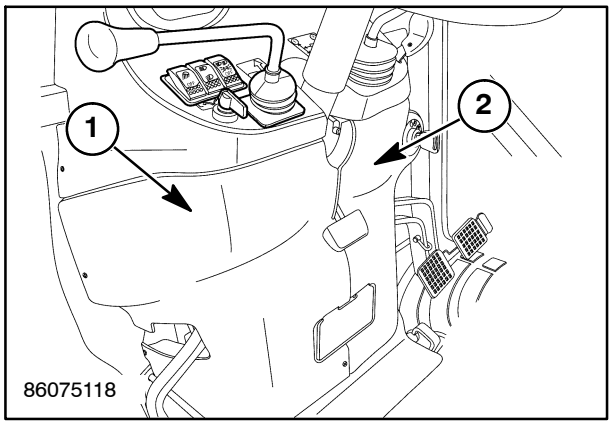


49

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.

2. Remove the two side panels, 1 and 2.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wire harness.



50

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

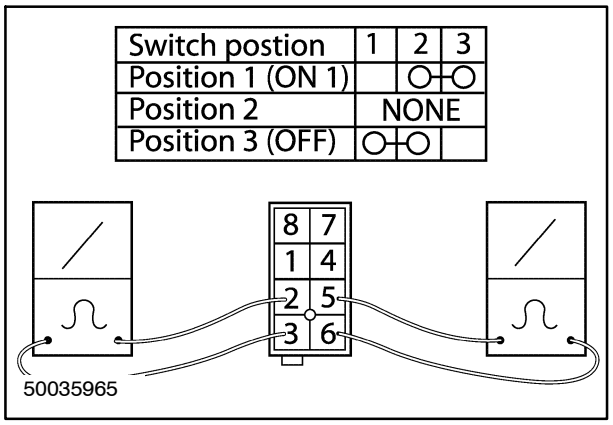
Terminals viewed from rear of switch.

REAR" OFF Position

No continuity in any terminals

FRONT" Position (Hazard lights flashing)

Continuity in terminals: 2 and 3
5 and 6

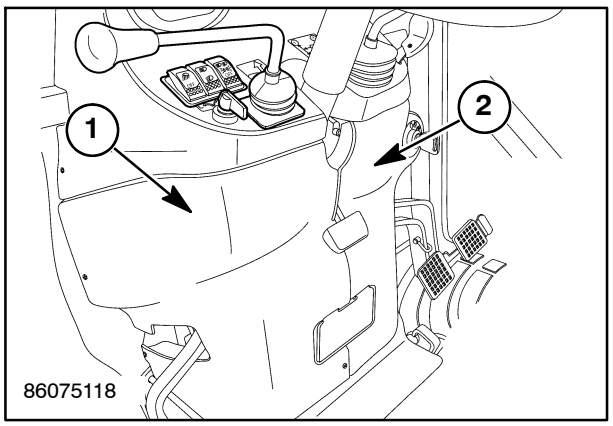


51

If any other test results are found the switch is defective and should be replaced.

Installation

1. Connect the switch to the tractor wire harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the two side panels, 1 and 2.
4. Connect the negative (–) battery cable from the negative (–) battery terminal.



52

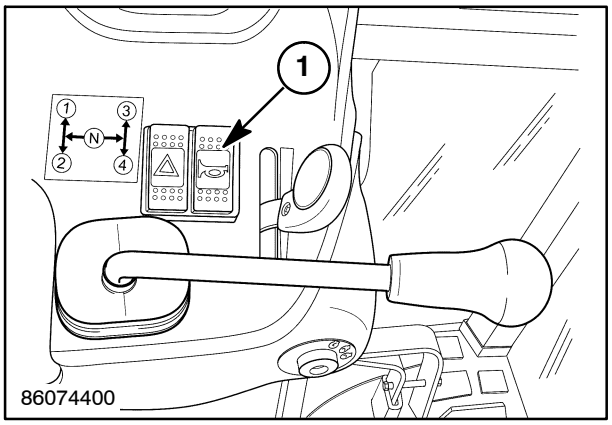
HORN SWITCH

The horn switch, 1, has two positions:

Rear – OFF

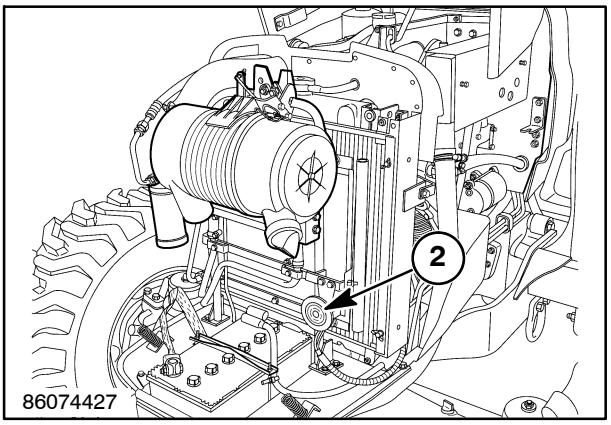
Front – ON

NOTE: *The horn switch is a momentary toggle switch. The horn, 2, will sound as long as the switch is held in the front "ON" position.*



53

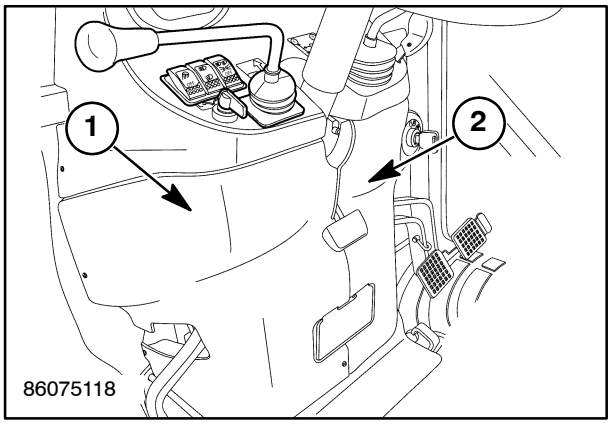
NOTE: *The horn, 2, will operate with key switch in any position.*



54

Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the two side panels, 1 and 2.
3. Working from underneath dash, push inwards on the switch retaining tabs and pull switch out from dash area.
4. Disconnect the switch from the tractor wiring harness.



55

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

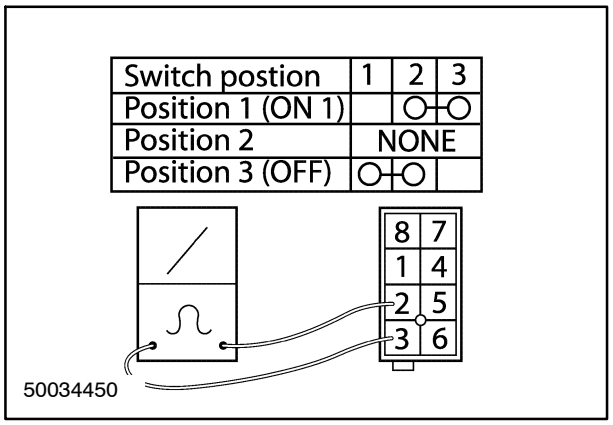
Terminals viewed from the rear of switch.

"REAR" OFF Position

No continuity in any terminal

"FRONT" ON Position

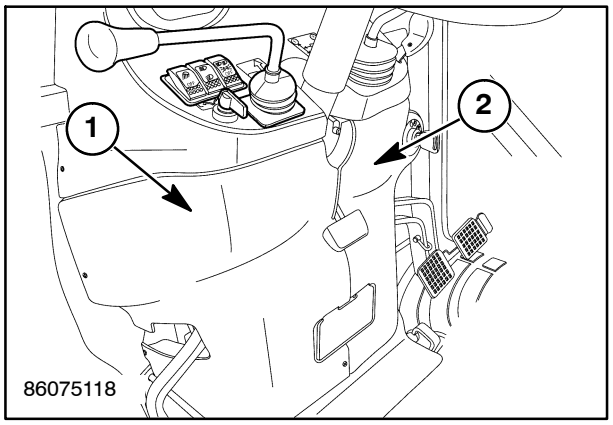
Continuity in terminals: 2 and 3



56

Installation

1. Connect the switch to the tractor wiring harness.
2. Push inwards on the switch until retaining tabs latch on backside of dash.
3. Install the two side panels, 1 and 2.
4. Connect the negative (–) battery cable to the negative (–) battery terminal.



57

TURN SIGNAL SWITCH

The turn signal switch, 1, is located on the left side of the dash area.

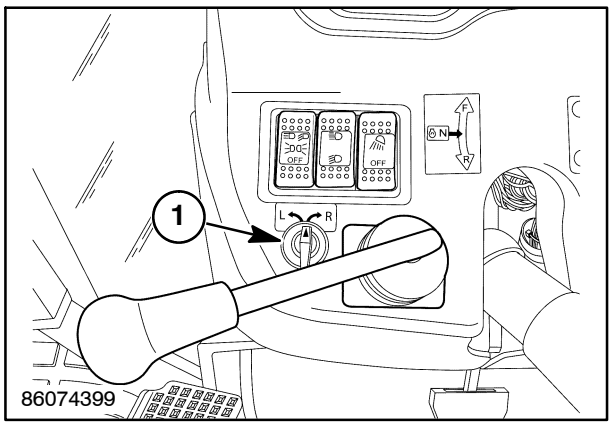
The switch controls the rear flasher lights when designating a right or left turn.

The turn signal switch has three positions:

Right Turn

Left Turn

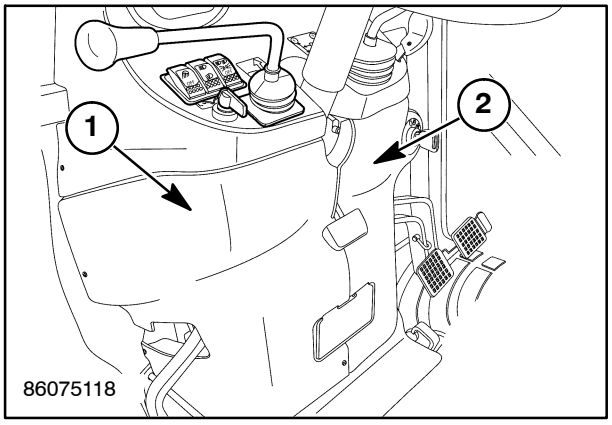
OFF



58

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two side panels, 1 and 2.
3. Pull knob from switch, unscrew retaining nut from switch and remove switch from underneath dash.
4. Disconnect the switch from the tractor wire harness.



59

Testing

Use an ohmmeter to test the switch for electrical continuity.

All positions are referenced as switch is mounted on tractor.

Terminals viewed from rear of switch.

Mid – " OFF " Position

No continuity in any terminals

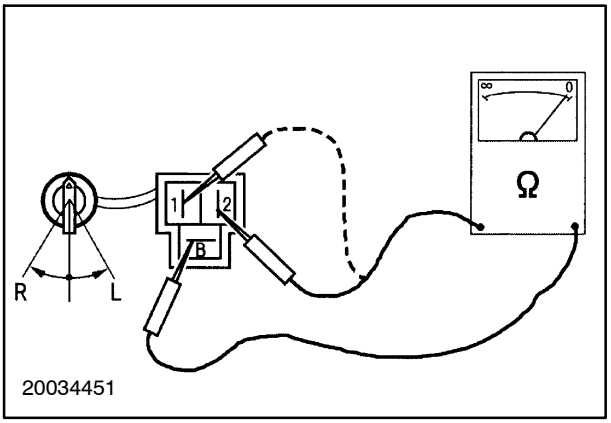
"Right" Turn

Continuity in terminals: "B" and 2

"Left" Turn

Continuity in terminals: "B" and 1

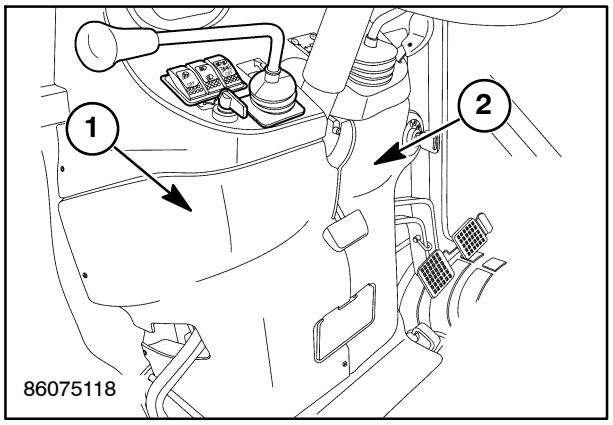
If any other test results are found the switch is defective and should be replaced.



60

Installation

1. Connect the switch to the tractor wire harness.
2. Install switch from underneath dash, align tab on switch with slot in dash. Install retaining nut and knob on switch.
3. Install the two side panels, 1 and 2.
4. Connect the negative (-) battery cable from the negative (-) battery terminal.



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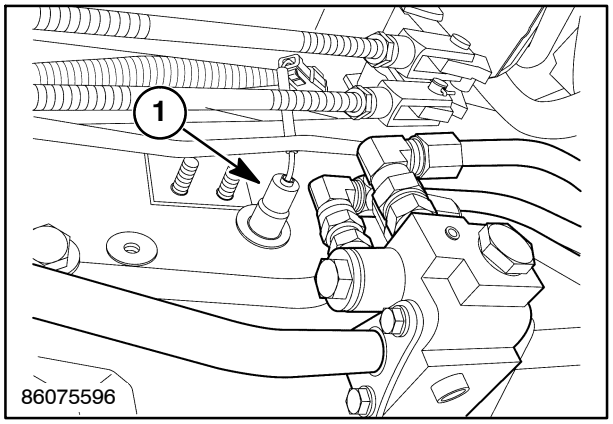
TRANSMISSION RANGE SAFETY SWITCH

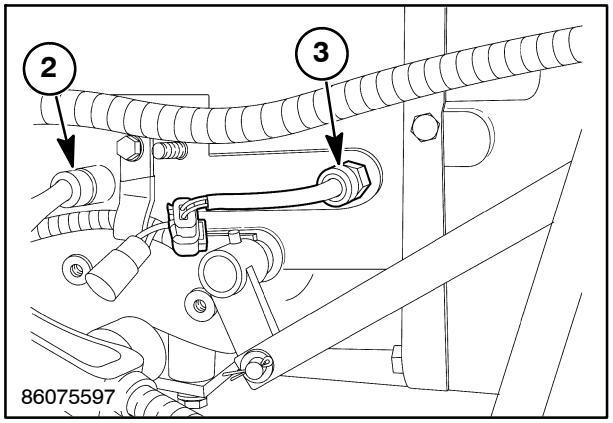
There are three transmission modulations switches on the EHSS transmission. Single-pole push button type switch that is externally mounted on transmission case, but internally actuated.

1. Main transmission (right front of transmission)



62

2. High Range (left rear of transmission)
3. Low Range (left rear of transmission)



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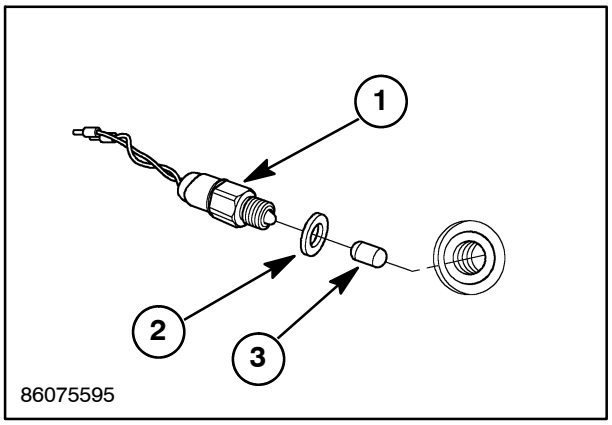
The purpose of these switches, is to supply current to the EHSS control module when the transmission is in 1st or 2nd gear and when either in “HIGH” or “LOW” range gears, so that the controller can supply different modulations during a shuttle shift.

Removal (all switches)

NOTE: *Place shift lever in either in 1st or 2nd gear to aid in switch removal and installation.*

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect the transmission range safety switch leads from the wiring harness.
3. Remove the transmission range safety switch, 1, with the rubber washer, 2, from the transmission case.



64

NOTE: *The range shift rail, operates the transmission range safety switch. Grooves in the shift rails accept the balk pin, extending the plunger in the safety switch, when the range control lever is in neutral. This completes the circuit, allowing the tractor to start.*

4. Use a pencil magnet to remove the balk pin, 3, from the transmission range safety switch hole in the transmission case. Inspect the balk pin, 3, for damage.

Testing

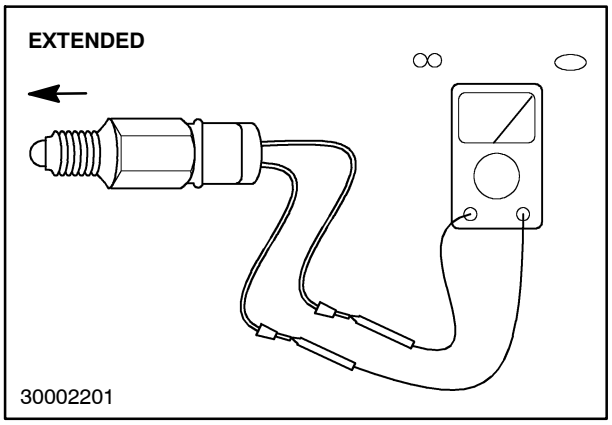
Use an ohmmeter to test both of the positions of the transmission range safety switch for electrical continuity.

Extended Position

1. With the transmission range safety switch in the "extended" position, touch one of the test probes to the one switch lead. Touch the other test probe to the other switch lead.
2. Observe the ohmmeter. The ohmmeter should show little or no resistance indicating that continuity exists between the two leads. If continuity does not exist, the switch is defective and needs replaced.

Retracted Position (Not Shown)

3. Using an ohmmeter, continuity should not exist between the two leads. If continuity exists between the two leads while the switch is in the "retracted" position, the switch is defective and needs replaced.



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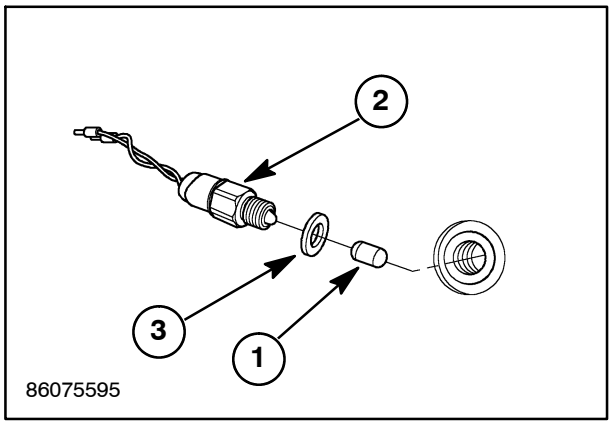
Installation

1. Insert the balk pin, 1, into the transmission range safety switch hole in the transmission case.
2. Install the transmission range safety switch, 2, with the rubber washer, 3, into the transmission case.
3. Connect the wiring harness to the transmission range safety switch leads.
4. Connect the negative (-) batter cable to the negative (-) battery terminal.



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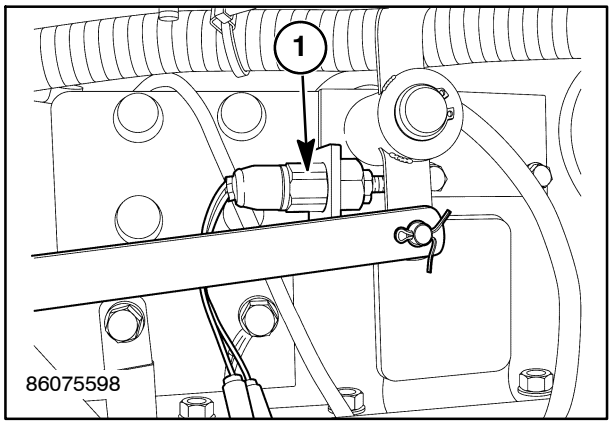
REAR (MAIN) PTO SAFETY SWITCH

The rear (Main) PTO safety switch, 1, is a single pole, push button type switch. This switch is located underneath the left side of the cab platform, on the PTO linkage.

When the PTO is engaged, the contacts in the switch are open, not allowing the tractor to start.

When the PTO is disengaged, the contacts in the switch are closed, completing the circuit. This allows the tractor to start.



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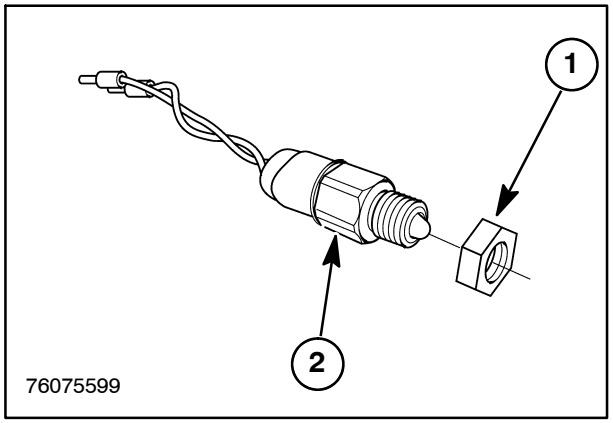
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect the rear PTO safety switch leads from the wiring harness.
3. Remove nut, 1, and remove PTO safety switch, 2, from bracket.



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Testing

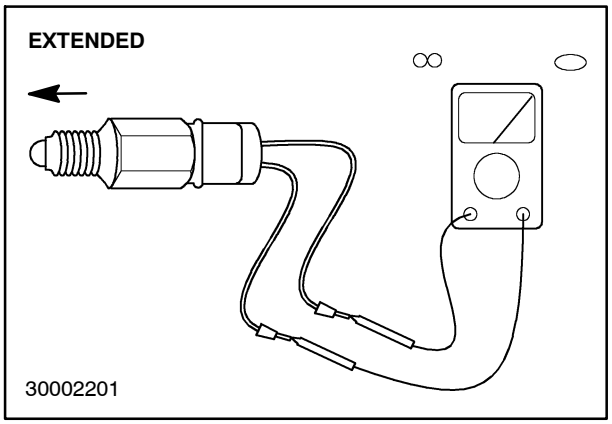
Use an ohmmeter to test both of the positions of the transmission range safety switch for electrical continuity.

Extended Position

1. With the transmission range safety switch in the "extended" position, touch one of the test probes to the one switch lead. Touch the other test probe to the other switch lead.
2. Observe the ohmmeter. The ohmmeter should show little or no resistance indicating that continuity exists between the two leads. If continuity does not exist, the switch is defective and needs replaced.

Retracted Position (Not Shown)

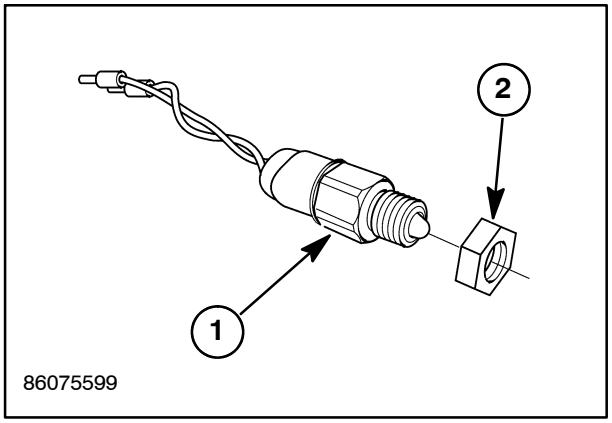
3. Using an ohmmeter, continuity should not exist between the two leads. If continuity exists between the two leads while the switch is in the "retracted" position, the switch is defective and needs replaced.



69

Installation

1. Place PTO switch, 1, into mounting bracket and secure with nut, 2.
2. Connect the wiring harness to the transmission range safety switch leads.
3. Connect the negative (-) batter cable to the negative (-) battery terminal.

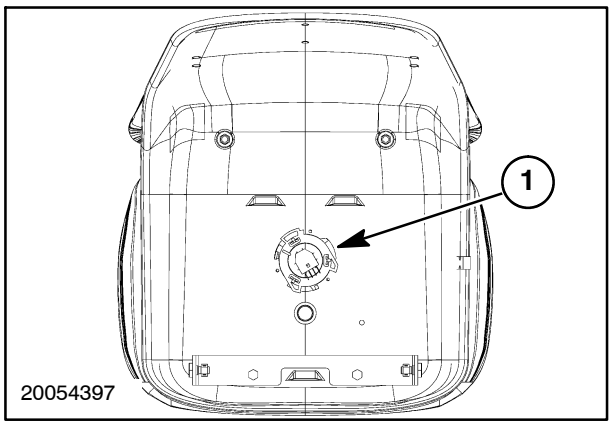


70

SEAT SAFETY SWITCH

Description

The seat safety switch, 1, is a double pole, button type switch mounted to the bottom side of the seat pan. When the operator is not seated, the switch contacts are open and when the operator is seated, the switch contacts are closed.



71

Removal

NOTE: *The seat safety switch may be tested by removing the switch harness from the switch and placing ohmmeter test leads on the switch terminals. Push down on the middle of the seat to check for switch continuity However, it is recommended to remove the seat switch from the seat for testing.*

1. Tilt the seat forward to reveal the seat safety switch.
2. Disconnect the seat switch harness from the switch.
3. Rotate the switch counterclockwise to release the locking tabs and remove the switch from the seat.

Testing

Use an ohmmeter to test both of the positions of the seat switch for electrical continuity.

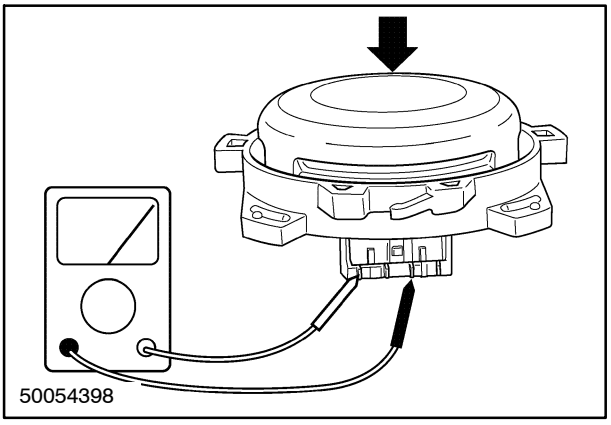
Extended Position

With the switch in the “extended” (OUT) position continuity should not exist between any of the four terminals. If continuity exists between any of the switch terminals while the switch is in the “extended” position, the switch is defective and needs to be replaced.

Retracted Position

With the switch in the “retracted” (IN) position, continuity should exist across the following terminals:

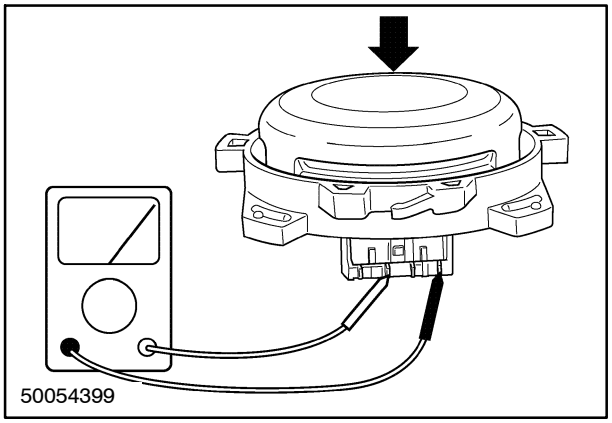
Check continuity between Terminals #1 and #3.



72

Check continuity between Terminals #2 and #4.

If continuity does not exist between the two sets of terminals while the switch is in the “retracted” position the switch is defective and needs to be replaced.



73

Installation

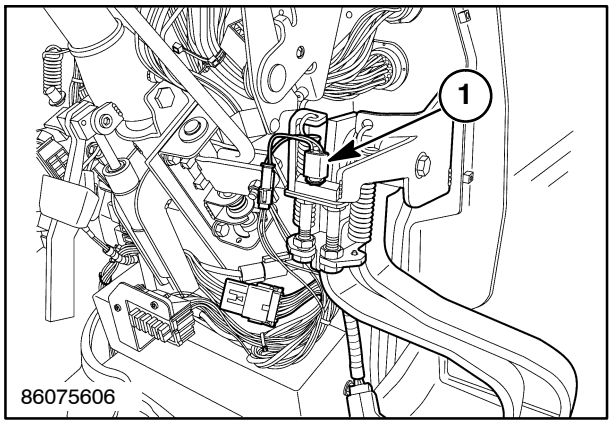
1. Tilt the seat forward to reveal the bottom of the seat.
2. Rotate the switch clockwise to retain the locking tabs.
3. Connect the seat switch harness to the switch.

BRAKE LIGHT SWITCH

Description

NOTE: *The two side panels have been removed to provide a view of the location of the brake light switch.*

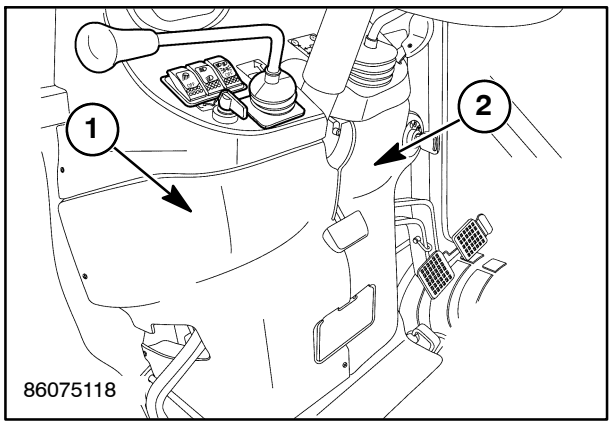
The brake light switch, 1, is a single-pole pushbutton type switch, located underneath the steering wheel on the right hand side. When the brake pedals are depressed, the switch contacts are closed.



74

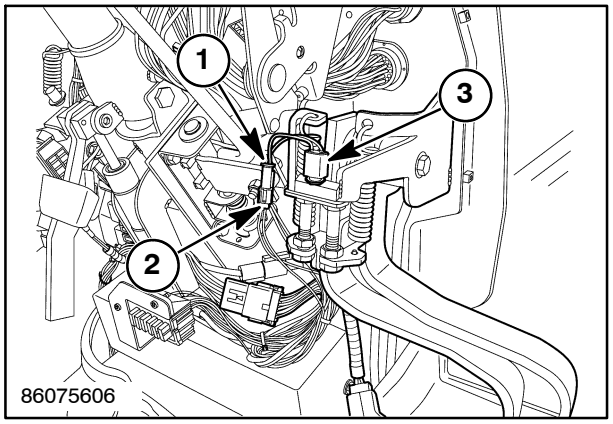
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the two side panels, 1, and 2.



75

3. Unplug the wire leads, 1, from the switch to the wire harness, 2.
4. Unscrew the switch, 3, from the switch support bracket.



76

Testing

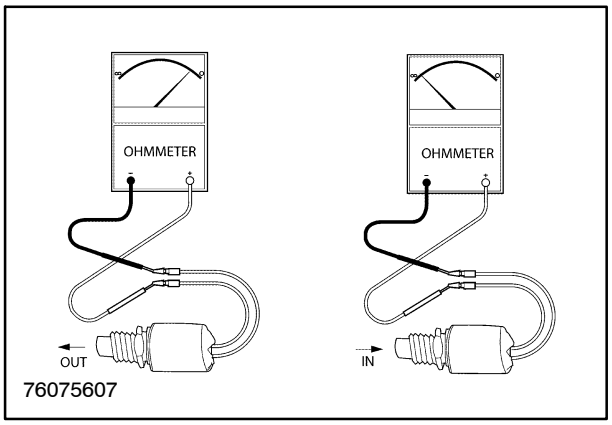
Use an ohmmeter between the leads of the switch to test both positions of the switch.

When the brake pedals are depressed, the switch plunger is extended and the contacts are closed (Continuity).

EXTENDED POSITION – Continuity

RETRACTED POSITION – No Continuity

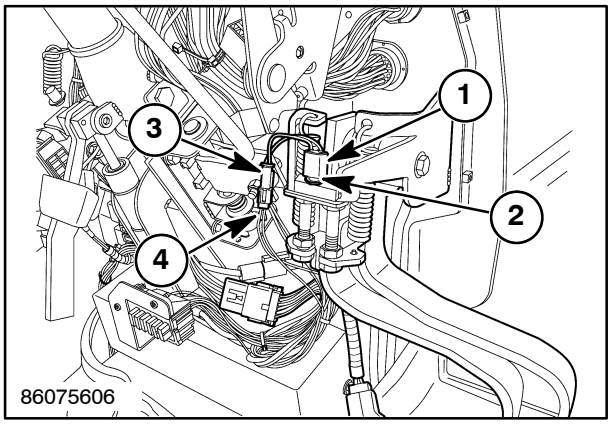
If any other test results are found the switch is defective and should be replaced.



77

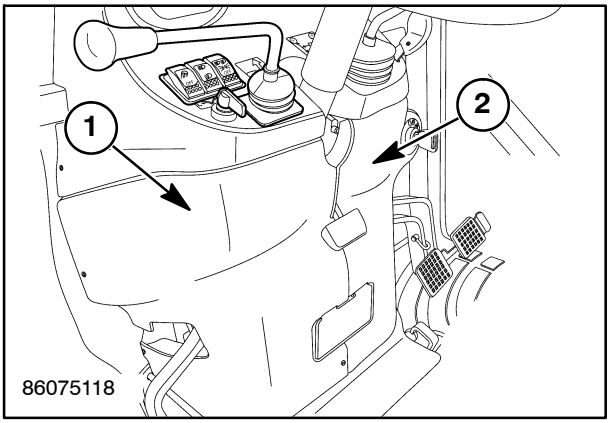
Installation

1. Thread switch, 1, into the switch support bracket. Install and tighten nut, 2, on the end of the switch.
2. Plug wire leads, 3, from the switch into the wire harness, 4.



78

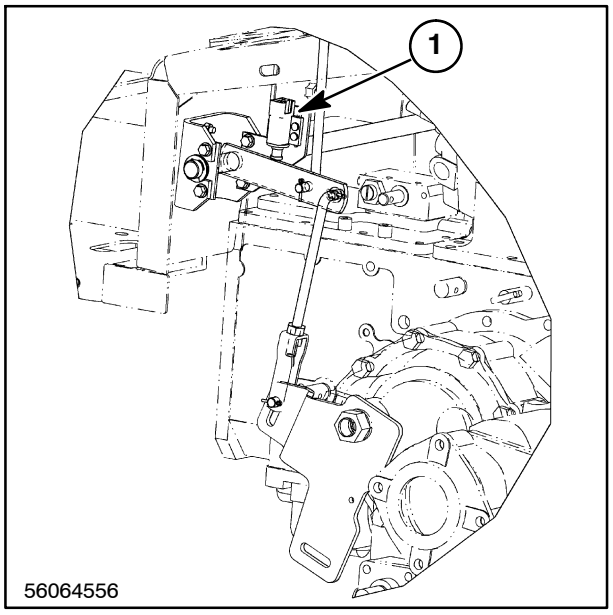
3. Install the two side cover, 1, and 2.
4. Connect the negative (–) battery cable to the negative (–) battery terminal.



79

PARK BRAKE SAFETY SWITCH

The parking safety switch, 1, is a double-pole, single throw-style switch located on the brake control lever pivot bracket. The park brake switch is located beneath the left cab platform.



80

Testing

Use an ohmmeter to test both of the positions of the parking brake safety switch for electrical continuity.

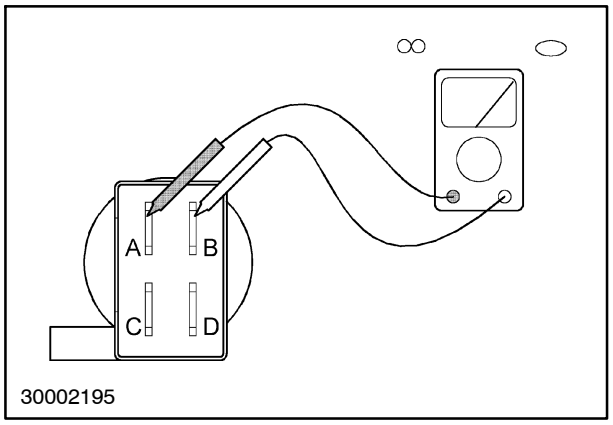
Extended Position (Not Shown)

1. With the park brake safety switch in the “extended” (“off”) position, continuity should not exist between any of the four terminals. If continuity exists between any of the four terminals while the switch is in the “extended” position, the switch is defective and needs replaced.

Retracted Position

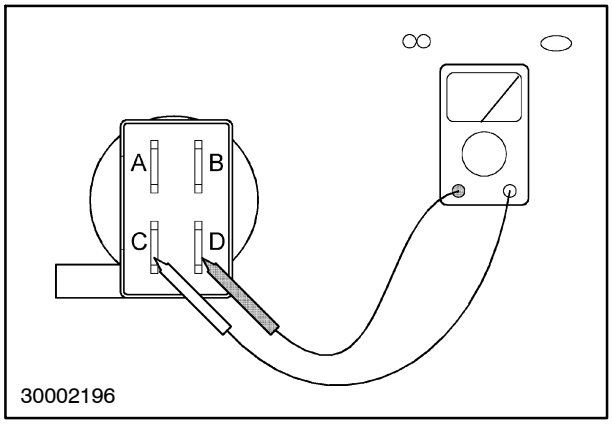
Using an ohmmeter, touch one of the test probes to terminal, A. Touch the other test probe to terminal, B.

1. Push the park brake safety switch into the “retracted” position.
2. Observe the ohmmeter. The ohmmeter should show little or no resistance indicating that continuity exists between terminal, A, and terminal, B. If continuity does not exist between terminal A, and terminal, B, the switch is defective and needs replaced.



81

3. Using an ohmmeter, touch one of the test probes to terminal, C. Touch the other test probe to terminal, D.
4. Observe the ohmmeter. The ohmmeter should show little or no resistance indicating that continuity exists between terminal, C, and terminal, D. If continuity does not exist between terminal, C, and terminal, D, the switch is defective and needs replaced.



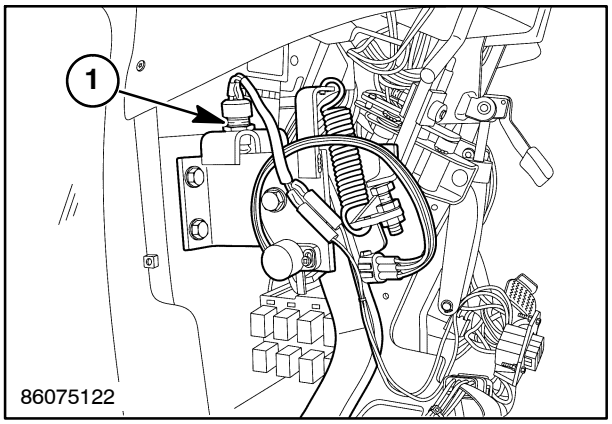
82

EHSS CLUTCH/INCHING PEDAL SWITCH

Description

NOTE: *The two side panels have been removed to provide a view of the location of the clutch/inching pedal switch.*

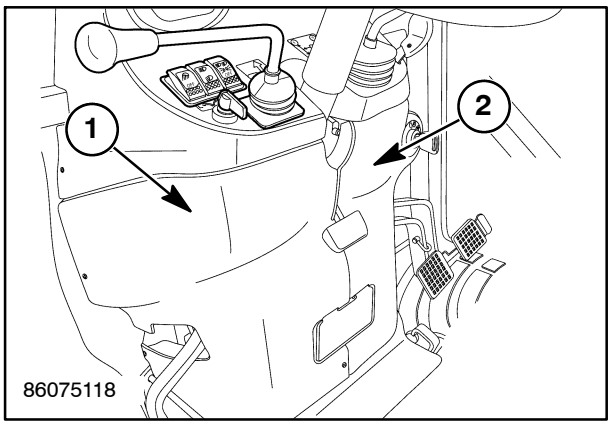
The clutch/inching pedal switch, 1, is a single-pole pushbutton type switch, located underneath the steering wheel on the left hand side. When the pedal is depressed, the switch contacts are closed.



83

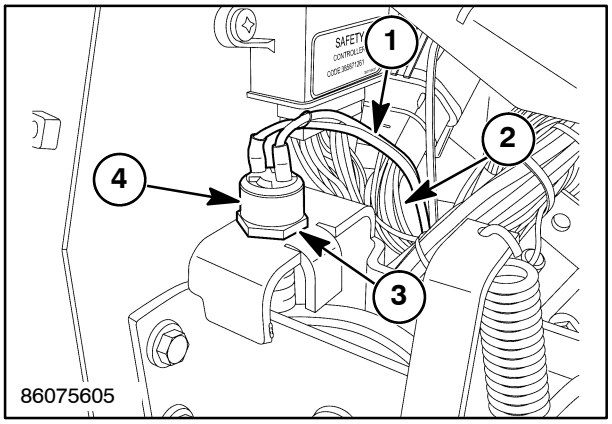
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two side panels, 1, and 2.



84

3. Unplug the wire leads, 1, from the switch to the wire harness, 2.
4. Remove the jam nut, 3, from the end of the switch and unscrew the switch, 4, from the switch support bracket.



85

Testing

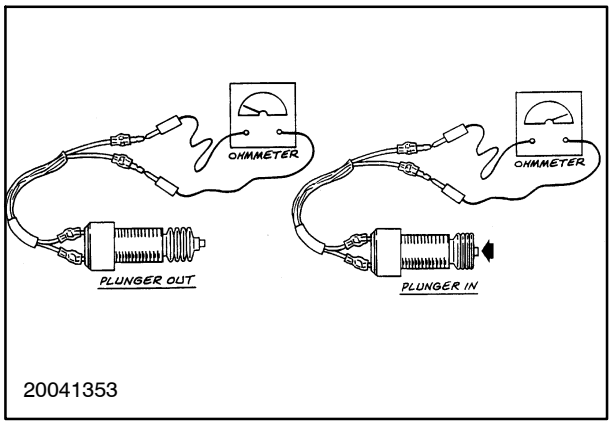
Use an ohmmeter between the leads of the switch to test both positions of the switch.

When the clutch/inching pedals are depressed, the switch plunger is retracted and the contacts are closed (Continuity).

RETRACTED POSITION – Continuity

EXTENDED POSITION – No Continuity

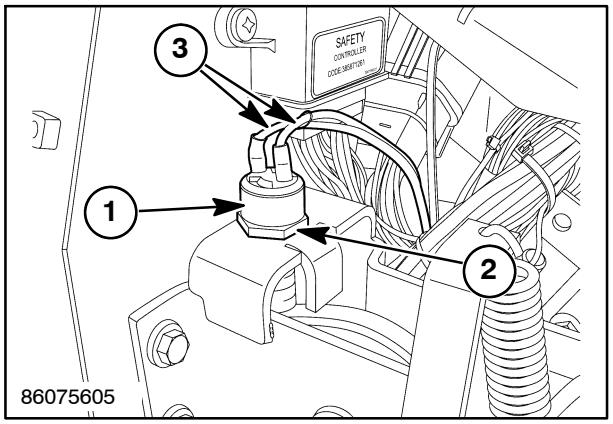
If any other test results are found the switch is defective and should be replaced.



86

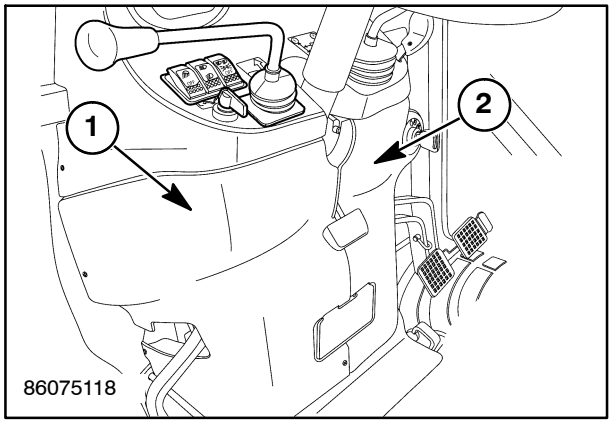
Installation

1. Thread switch, 1, into the switch support bracket. Install and tighten nut, 2, on the end of the switch.
2. Plug wire leads, 3, from the switch into the wire harness, 4.



87

3. Install the two side cover, 1, and 2.
4. Connect the negative (–) battery cable to the negative (–) battery terminal.



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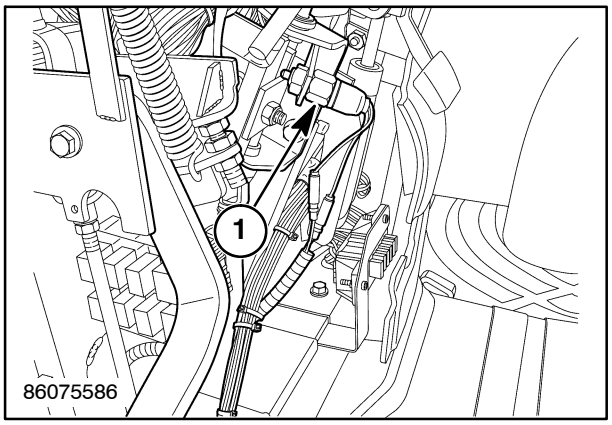
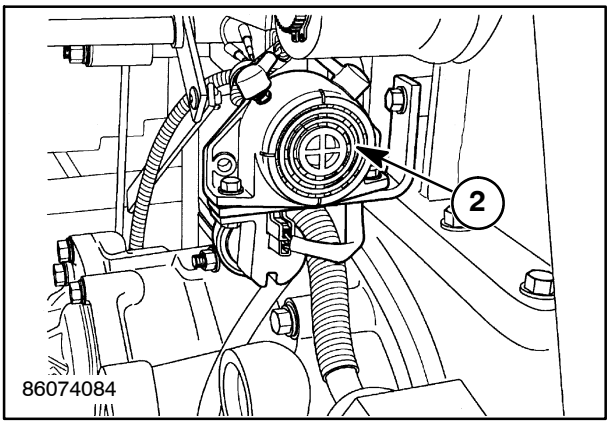
BACKUP ALARM SWITCH (OPTIONAL) – SSS TRANSMISSION MODELS

On SSS Transmission Models: The backup alarm switch, 1, is a single pole push button type switch, mounted underneath the steering column console, on the left hand side. When the operator shifts the tractor into reverse, the switch contacts become closed, causing the alarm, 2, (figure 90) to sound, alerting the surrounding areas that the tractor is backing up.

NOTE: *The left side panel has been removed to provide a view of the location of the backup alarm switch.*



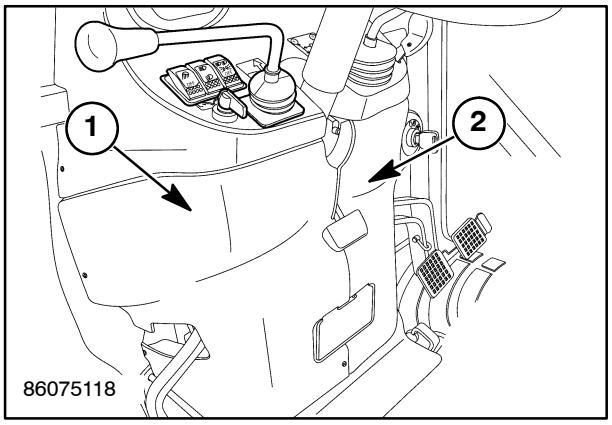
89



90

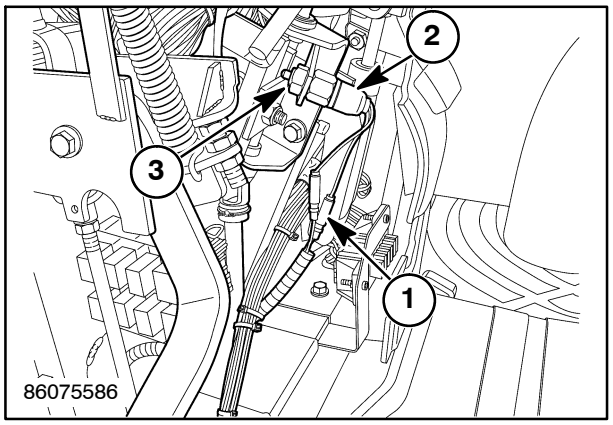
Removal

1. Disconnect the negative (–) battery cable from the negative (–) battery terminal.
2. Remove the two side panels, 1, and 2.



91

3. Unplug the harness wire leads, 1, from the switch, 2.
4. Remove the jam nut, 3, and pull switch, 2, from support bracket.



92

Testing

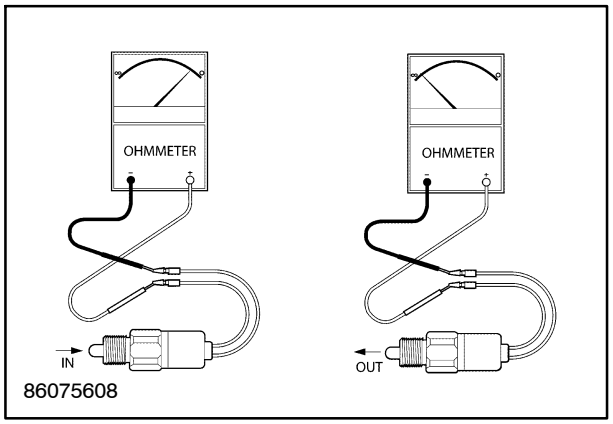
Use an ohmmeter between the leads of the switch to test both positions of the switch.

When the tractor is placed in reverse the switch plunger is retracted, and the contacts are closed. (Continuity)

EXTENDED POSITION – No Continuity

RETRACTED POSITION – Continuity

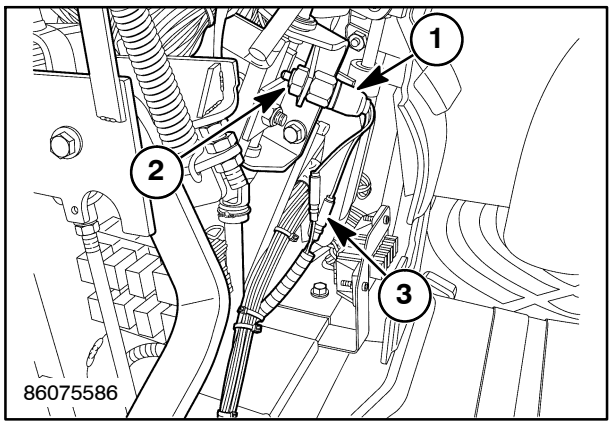
If any other results are found, the switch is defective and needs replaced.



93

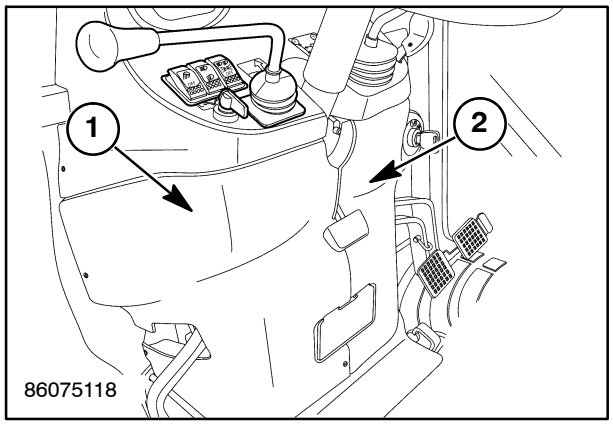
Installation

1. Insert switch, 1, into support bracket and secure with jam nut, 2.
2. Plug the wire leads, 3, from the switch into the wiring harness



94

3. Install the two side panels, 1, and 2.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.

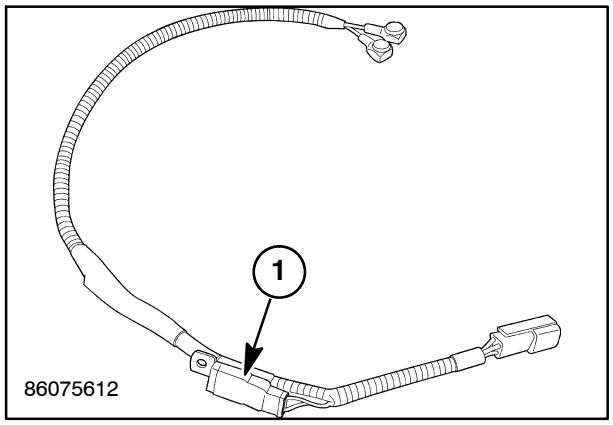


95

BACKUP ALARM SWITCH (OPTIONAL) - EHSS TRANSMISSION MODELS

On EHSS Transmission Models: When the operator shifts the transmission shuttle into reverse, a relay, 1, becomes energized and latches. When the relay latches, it sends current to the alarm, causing it to sound, alerting the surrounding areas that the tractor is backing up.

NOTE: *The backup alarm relay, 1, is located underneath the operator's cab on the left hand side, in the middle of the alarm harness.*



96

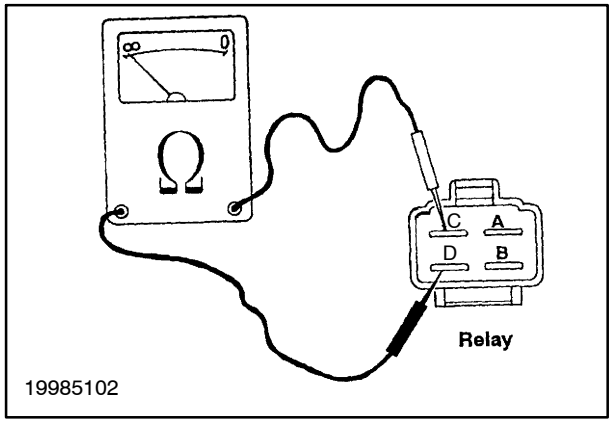
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Unplug the wiring harness connector from the relay.

Testing

NON-ENERGIZED

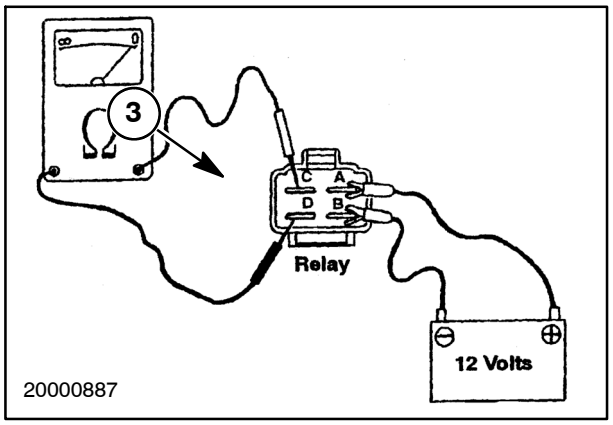
1. Connect the ohmmeter test probes to terminals "C" and "D" of the relay. Observe the ohmmeter reading.
2. There should be no continuity between the terminals "C" and "D" when the relay is not energized. If continuity exists between terminals "C" and "D" when the relay in not energized, the relay is defective and requires replacement.



97

ENERGIZED

1. Connect a jumper wire from the positive (+) terminal of the 12-volt power source to the “A” terminal of the relay.
2. Connect the negative (-) terminal of the 12 – volt power source to the “B” terminal of the relay.
3. Connect the ohmmeter test probes to terminals “C” and “D” on the relay. Observe the ohmmeter reading.
4. There should be little or no resistance between the “C” and “D” terminals of the relay when energized, indicating that continuity exists. If continuity does not exist between terminals “C” and “D” when the relay energized, the relay is defective and requires replacement.



98

Installation

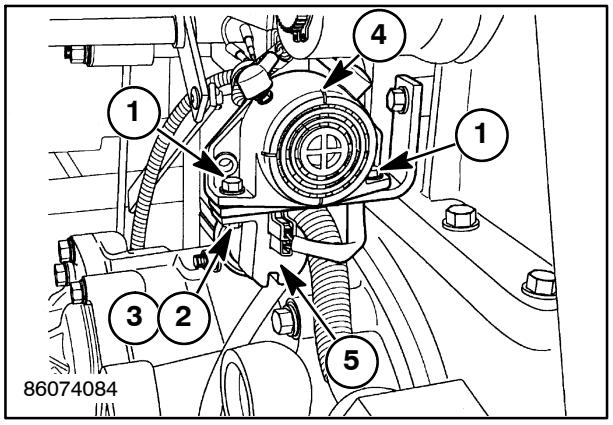
1. Plug wiring harness connector into relay.
2. Connect the negative (-) battery cable to the negative (-) battery terminal.

BACKUP ALARM

Removal

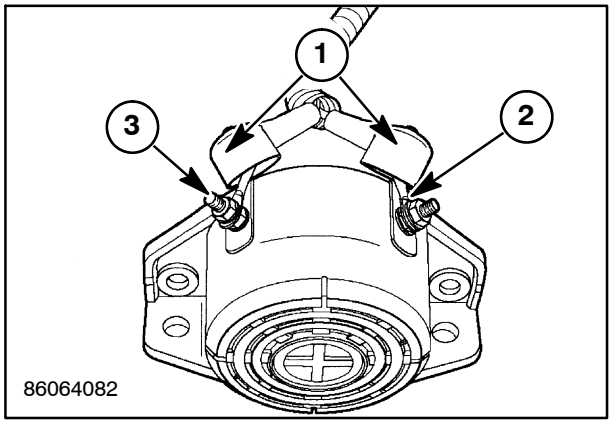
1. Remove two M6 bolts, 1, M6 locknut, 2, and M6 washer, 3, securing the backup alarm, 4, and safety alarms, 5.

NOTE: *The backup and safety alarms are located on the left side of the HPL cover.*



99

2. Pull protective plastic covers, 1, exposing the positive and negative terminals.
3. Disconnect the black wire, 2, from the negative terminal.
4. On EHSS Models: Remove the green and yellow wire, 3, from the positive terminal.
5. On SSS Models: Remove the red and blue wire, 3, from the positive terminal.

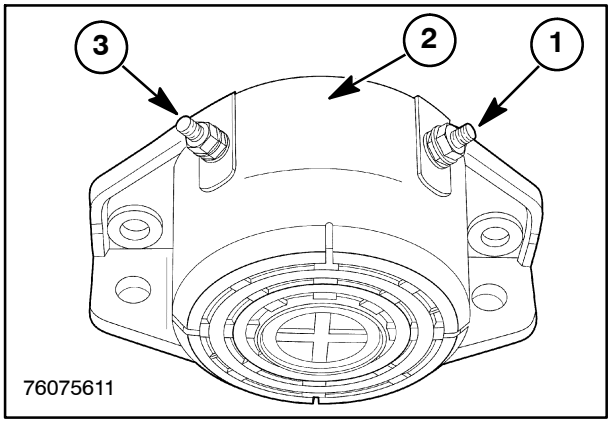


100

Testing

The following test is designed to verify that the backup alarm is functioning properly.

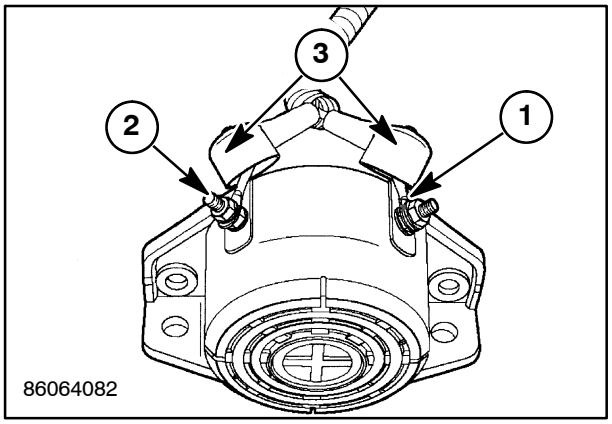
1. Attach a ground wire to the negative terminal, 1, of the alarm, 2.
2. Attach a 12V power supply to the positive terminal, 3, of the alarm, 2. If the alarm does not sound, the alarm is defective and needs replaced.



101

Installation

1. Reconnect the alarm and the harness by securing the black wire, 1, to the negative terminal.
2. On EHSS Models: Secure the green and yellow wire, 2, to the positive terminal. Replace protective cover, 3.
3. On SSS Models: Secure the red and blue wire, 3, to the positive terminal. Replace protective cover, 3.



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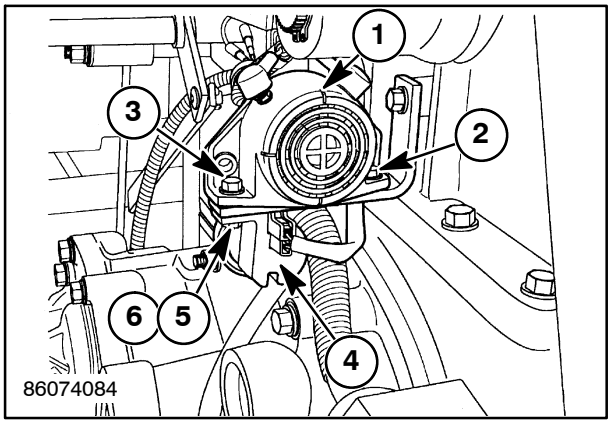
4. Attach the backup alarm, 1, and secure with one M6 x 12mm bolt, 2, and one M6 x 20mm bolt, 3.
5. Attach the safety alarm, 4, to the bottom of the bracket with M6 washer, 5, and M6 locknut, 6.



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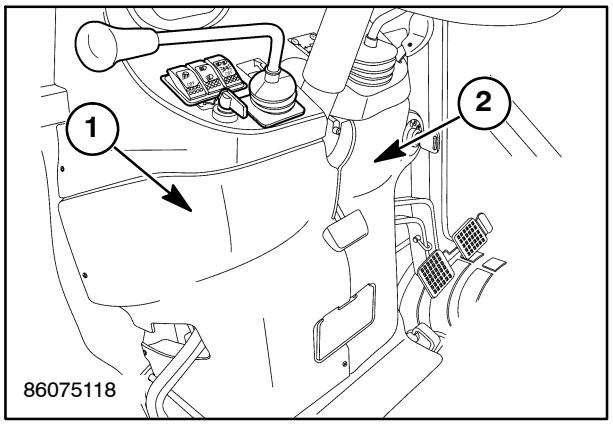
EHSS INCHING PEDAL POTENTIOMETER

IMPORTANT: *Before adjusting the potentiometer, the pedal stop bolt and oil flow stop cable must be adjusted.*

1. Remove the two side panels, 1, and 2.



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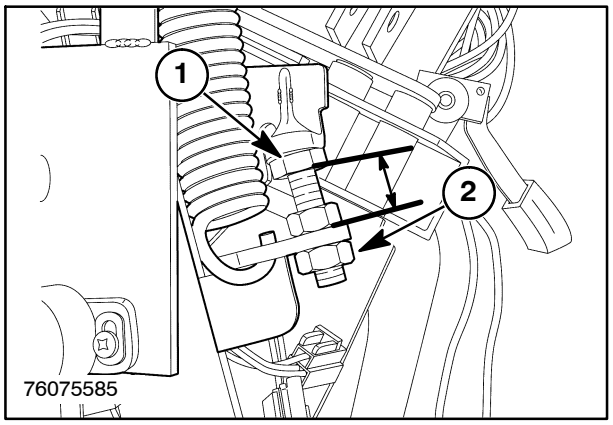
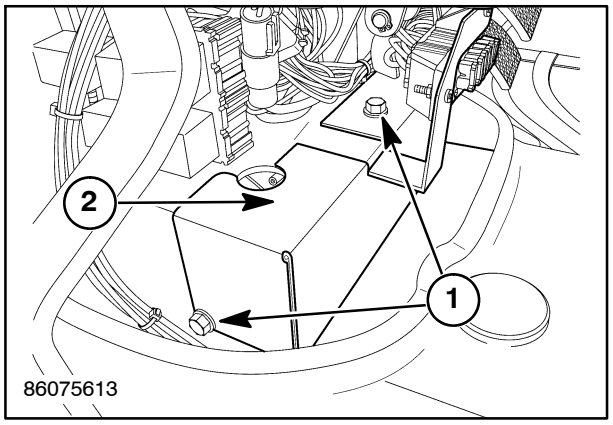
2. Loosen the lock nut, 1, and adjust the inching pedal stop bolt, 2, to 18.6mm (0.732”) from the underside of the bolt head to the surface of the pedal tab.



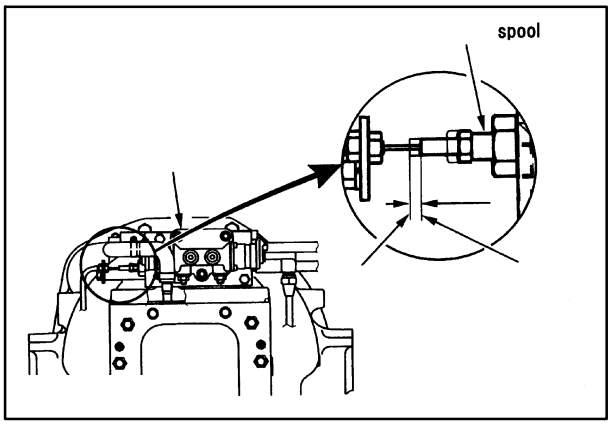
105

3. Remove three M8 screws, 1, securing cover plate, 2, to gain access to the control valve.



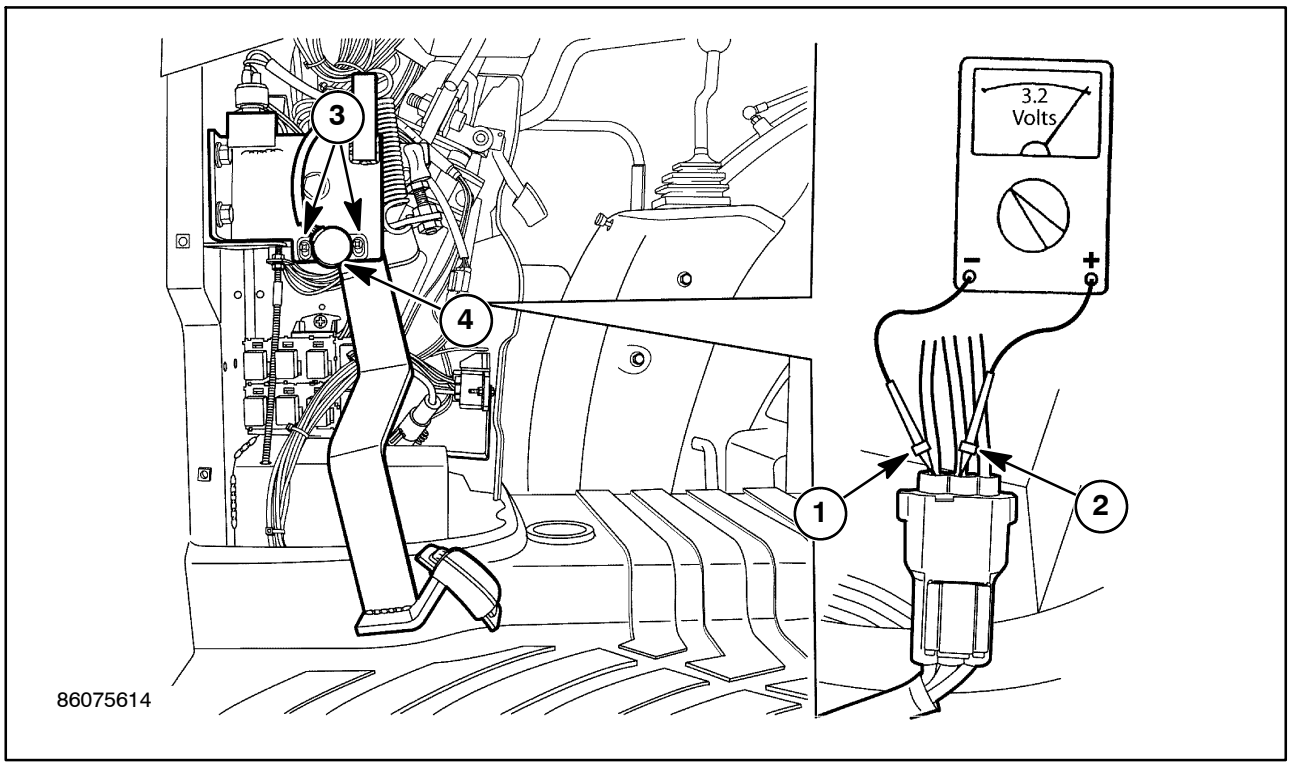
106

4. Depress the inching pedal fully and hold.
5. Turn the cable adjuster on the oil flow stop cable until 2mm (0.078”) of free travel exists. Release pedal.



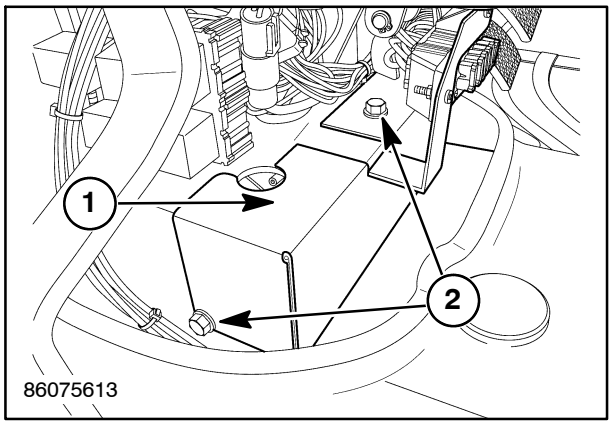
107

6. Insert the black voltmeter lead into the EHSS potentiometer connector, wire number HP102, 1.
7. Insert the red voltmeter lead into the EHSS potentiometer connector, wire number HP105, 2.
8. Turn the key switch to the “ON” position.
9. The volt meter should read 3.2 volts, **with the inching pedal fully depressed.** If a reading other than 3.2 volts is found, proceed to Step 9.
10. Loosen the screws, 3, for the potentiometer, 4. Turn the potentiometer until the voltmeter reading is 3.2 volts with the inching pedal fully depressed.
11. Tighten the screws, 1, to hold the potentiometer, 4, position.
12. Turn the key switch to the “OFF” position.



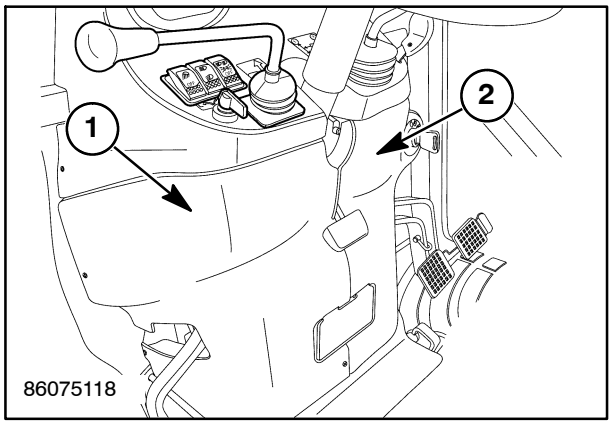
108

13. Install cover plate, 1, and secure with three M8 screws, 2.



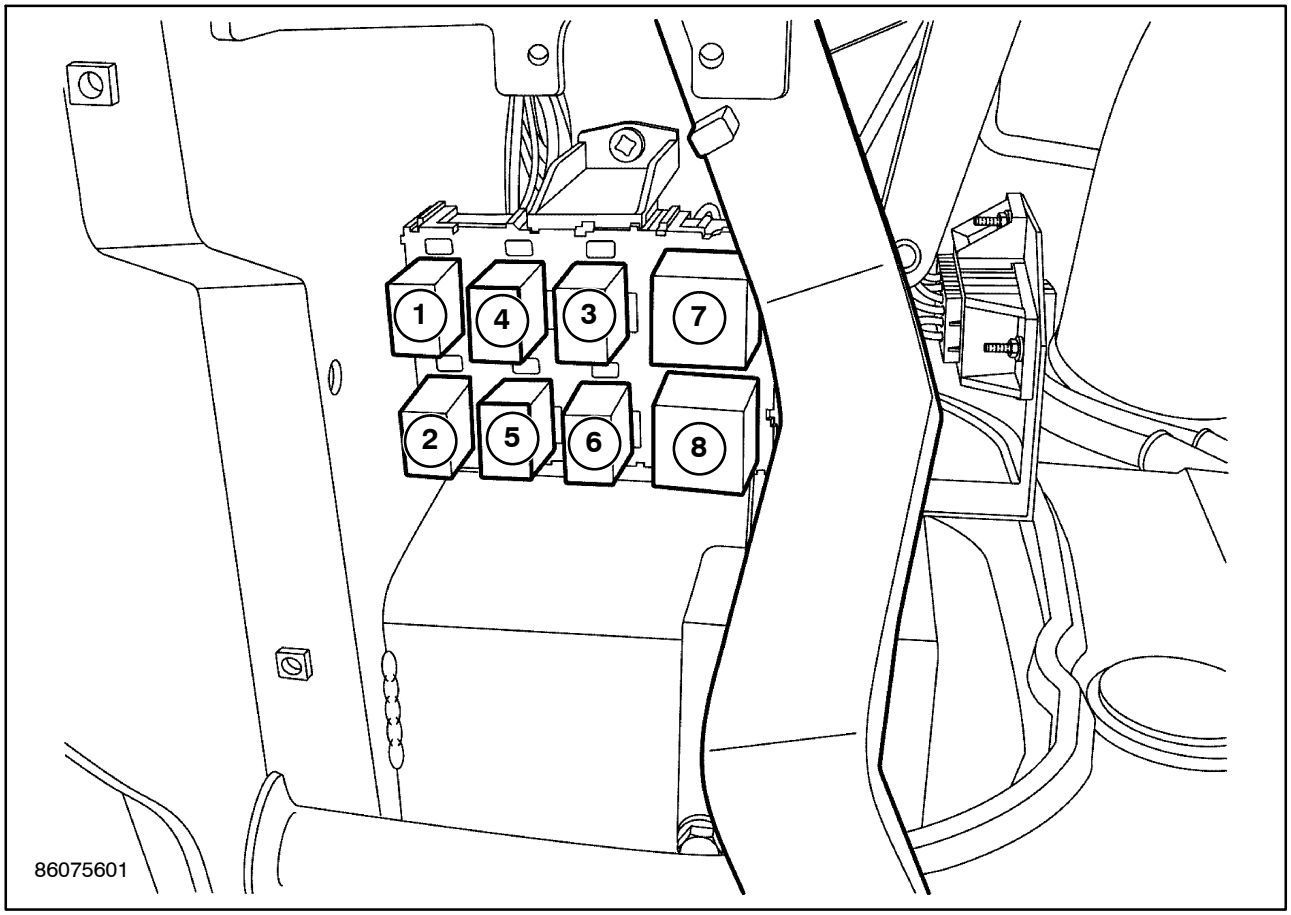
109

14. Install the two side panels, 1, and 2.



110

RELAYS

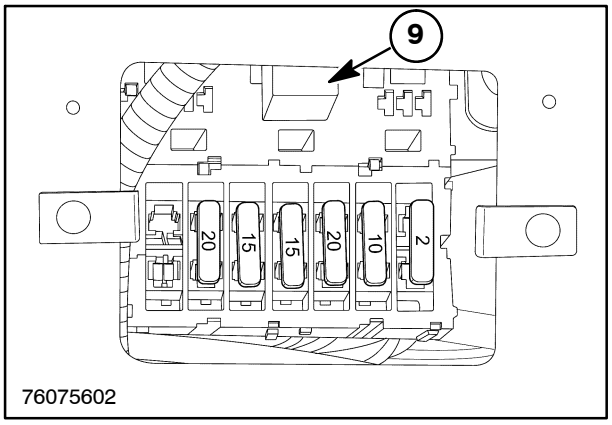


111

Relay Panel Identification

1. Work Relay (R-1)
2. Glow Plug Relay (R-2)
3. Starter Relay (R-3)
4. Position Lights Relay (R-4)
5. Acc. Power Relay (R-5)
6. Brake Light Relay (R-6)
7. Flasher Cut-Off Relay (R-10)
8. Cab Power Relay (R-12)
9. HVAC (R15) (located near cab fuse block, top rear of cab)

(R#) Wiring Schematic Identification

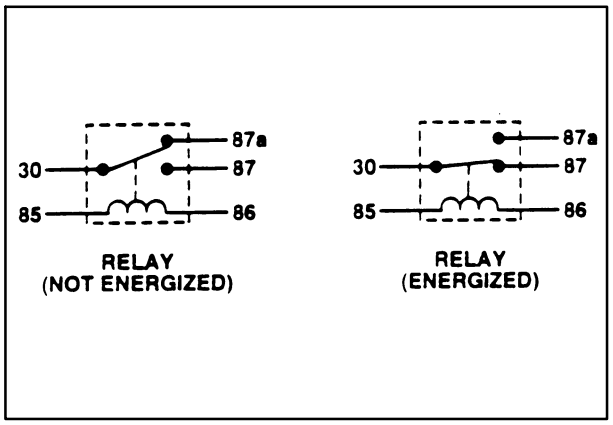


112

RELAYS

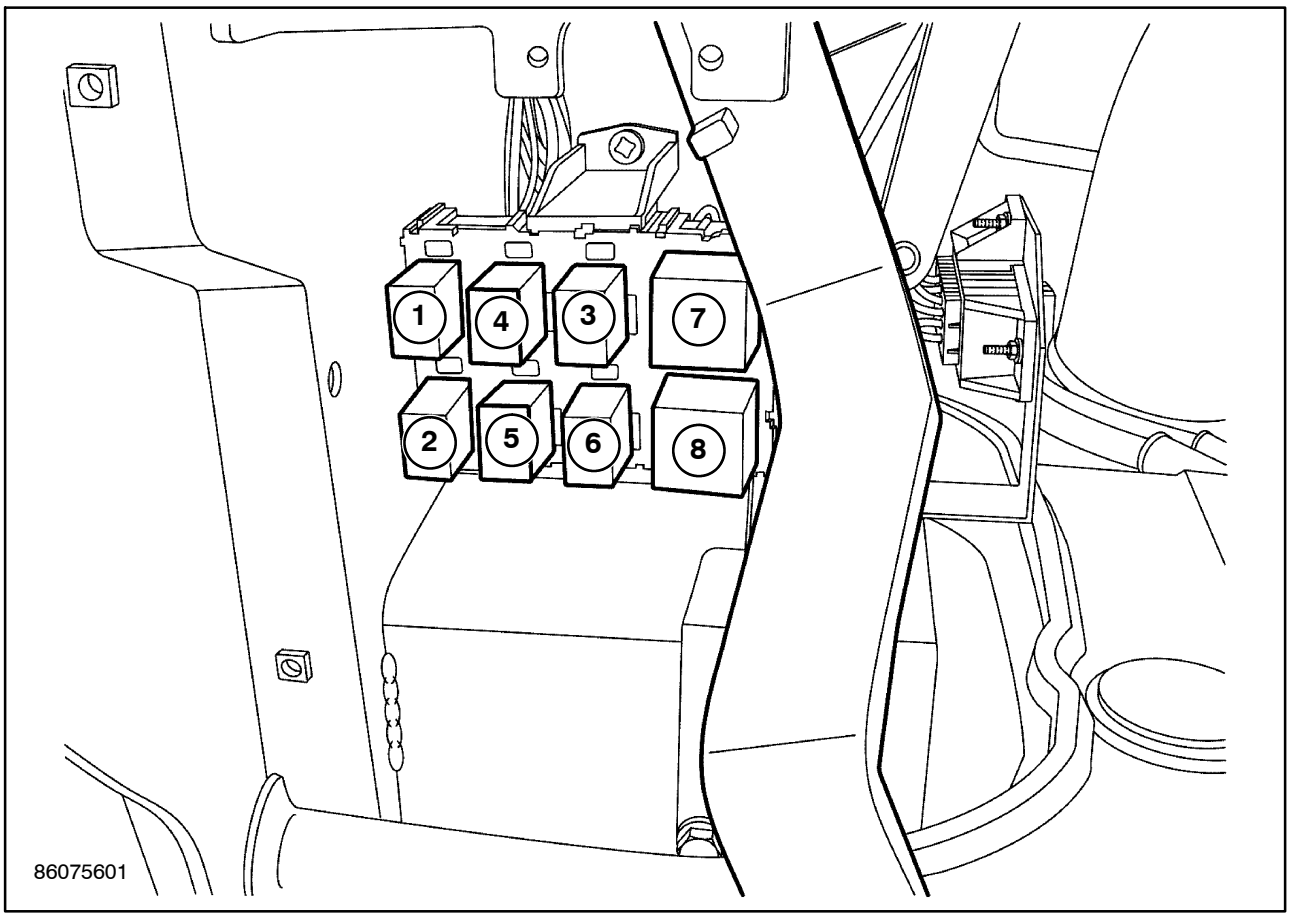
Description

Relays are used to automatically complete (close) a circuit. The relays are located underneath the steering column console, on the left hand side. A relay contains two parts of a circuit. One part, the control circuit, uses current to energize a coil. The other part, the function circuit, is a switch. When energizes, the coil of a relay becomes a electromagnet opening or closing a single circuit or directing current from one circuit to another, depending on the type of relay.



113

There are a total of nine relays used on the T2410 and T2420 tractors.



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1. Work Relay (R1)
2. Glow Plug Relay (R2)
3. Starter Relay (R3)
4. Position Lights Relay (R4)
5. ACC Power Relay (R5)
6. Brake Light Relay (R6)
7. Flasher Cutoff Relay (R10)
8. Cab Power (R12)
9. HVAC Relay (Figure 112)

WORK LIGHTS RELAY

The work relay, 1, provides the current to the front single element work lights. The work lights switch controls the work relay. When the relay latches, it sends current to the front work lights.

GLOW PLUG RELAY

The glow plug relay, 2, provides current to the engine glow plugs for preheating the engine. The key switch sends current to the safety controller and the controller transfers current to the relay. The safety controller limits the amount of time (5 seconds) that current is provided to the relay and glow plugs.

STARTER RELAY

The starter relay, 3, provides current to the engine starter, for starting the engine. The safety controller sends current to the relay, so that the relay can activate and latch. The forward/reverse shuttle, rear PTO, seat and parking brake switched act in series, to provide current to the controller.

POSITION LIGHTS RELAY

The position lights relay, 4, provides current to the two rear tail lights, interior opera light, and license plate light (optional). The road lights switch controls the position lights relay. When the road lights switch is placed in the MID of FRONT positions, the relay latches it sends current to the tail lights, opera light, and license plate lights.

ACC POWER RELAY

The ACC power relay, 5, sends current to the number six fuse in the main fuse block and then transfers current to the 7-pin trailer socket.

BRAKE LIGHTS RELAY

The brake lights relay, 6, provides current to the two rear brake lights. The brake lights switch controls the brake light relay. When the relay latches it sends current to the brake lights.

FLASHER CUTOFF RELAY

The flasher cutoff relay, 7, provides current to the rear turn signal and hazard lamps. The turn signal and hazard switches control the flasher cutoff relay. When the relay latches it sends current to the corresponding lights.

CAB POWER RELAY

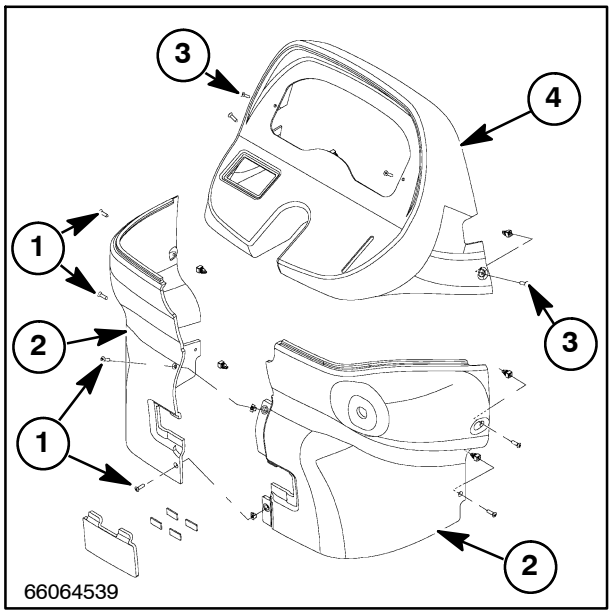
The cab power relay, 8, sends current to the cab fuse block in the upper rear of the cab, centered above the rear window.

HVAC RELAY

The HVAC relay, 9, (Figure 112) provides current to the A/C system. Cab fuse #24, 20-amp, provides current to the HVAC relay.

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two side and middle retaining screws, 1, from the two side panels, 2, and remove the panels from the tractor.
3. Tilt steering column fully rear rearward, before trying to remove top panel.
4. Remove instrumental panel from top consol panel.
5. Remove the handle throttle knob also disconnect, horn, hazard and work light switches.
6. Remove the two side retaining screws, 3, and lift the top panel, 4, from the tractor.
7. All relays are now accessible.



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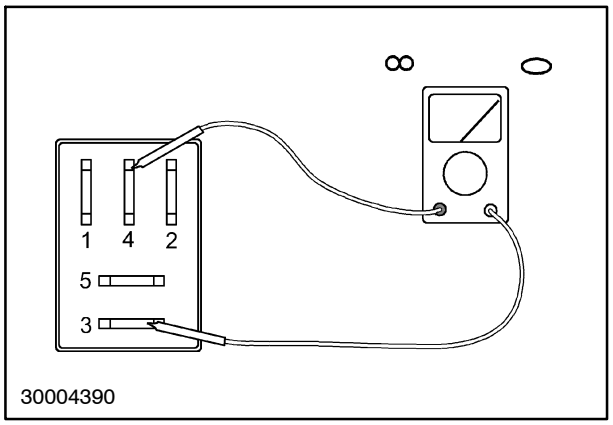
TESTING-MICRO RELAYS

WORK LIGHTS, GLOW PLUG, STARTER POSITION LIGHTS, ACCESSORY POWER, BRAKE LIGHT RELAYS AND HVAC RELAYS

Replacement

1. Remove the relay suspected of being faulty from the tractor to test.
2. Using an ohmmeter, touch one test probe to terminal 3 and the other test probe to terminal 4.
3. Observe the ohmmeter. There should be little or no resistance, indicating continuity. If there is no continuity, the relay is defective and needs replaced.
4. If the previous test showed continuity, touch one ohmmeter probe to terminal 1 and the remaining probe to terminal 2.
5. Observe the ohmmeter. The ohmmeter should read approximately 79.5 ohms. If the reading is not as specified, the relay is defective and needs replaced.



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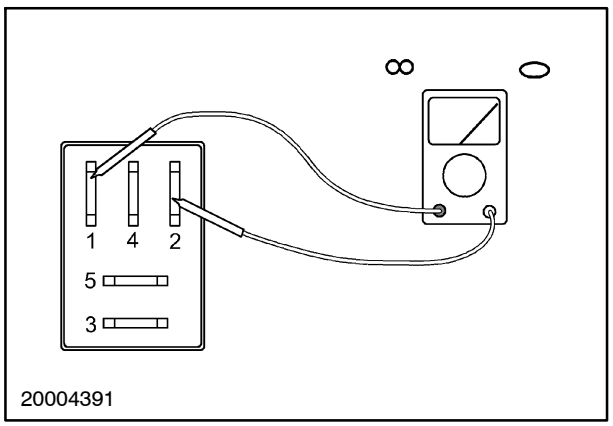

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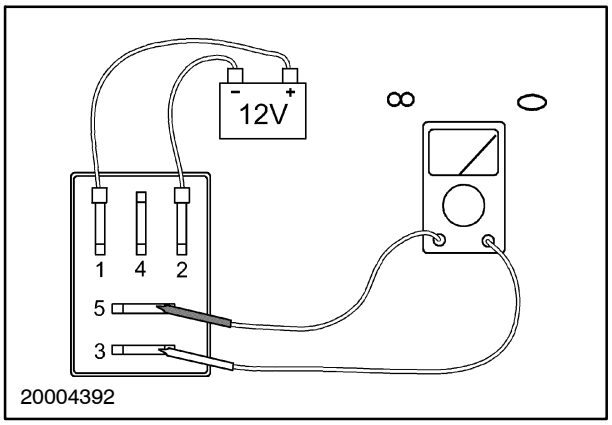
6. If the results from the previous test were good, use a jumper lead to connect the positive (+) terminal of a 12-volt power source to terminal 1 of the relay. Use a jumper lead to connect the negative (-) terminal of a 12-volt power source to terminal 2 of the relay. The relay should now energize.
7. Using an ohmmeter touch a test probe to terminal 3 of the relay. Touch the other ohmmeter test probe to terminal 5.
8. Observe the ohmmeter. There should be little or no resistance, indicating continuity. If there is no continuity, the relay is defective and needs replaced.



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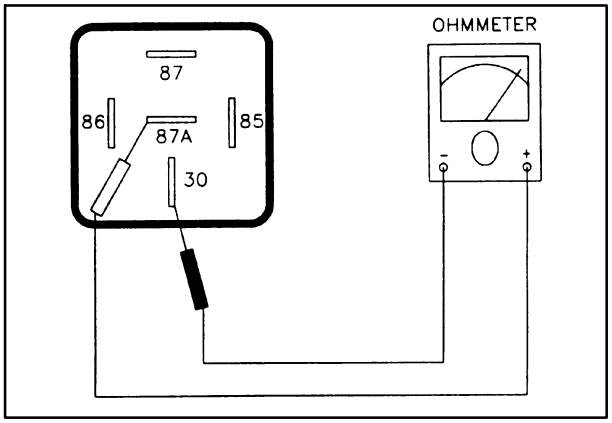
TESTING - STANDARD RELAYS

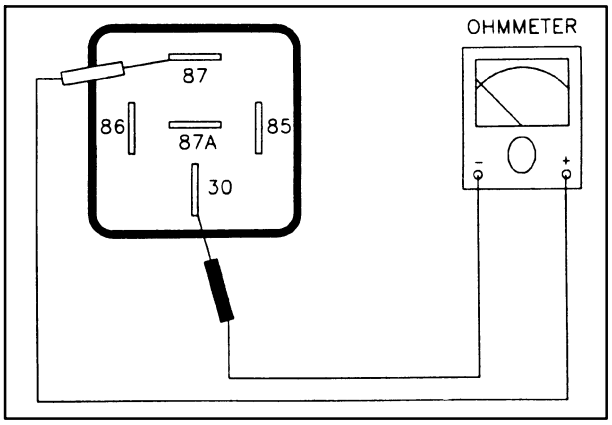
FLASHER CUT-OFF AND CAB POWER

Replacement

1. Remove the relay suspected of being faulty from the tractor to test.
2. Using an ohmmeter, touch one test probe to terminal 87A and the other test probe to terminal 30.
3. Observe the ohmmeter. There should be little or no resistance, indicating continuity. If there is no continuity, the relay is defective and needs replaced.
4. Repeat the previous test for terminal 30 and 87. There should be no continuity between these terminals. If tests indicate continuity, the relay is defective and needs replaced.

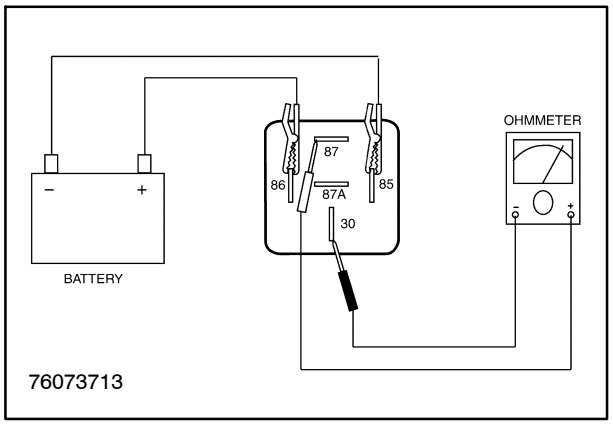


119

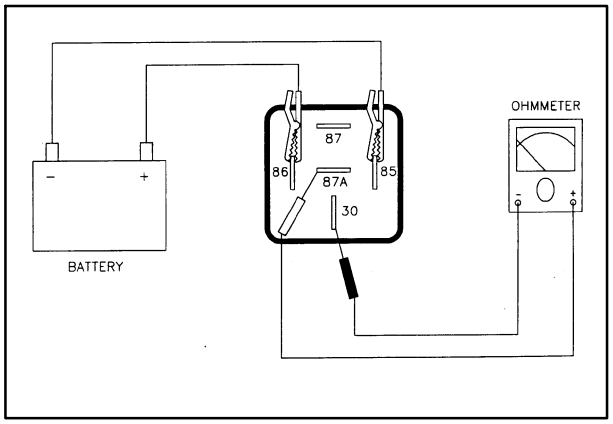


120

5. If the results from the previous test were good, use a jumper lead to connect the positive (+) terminal of a 12-volt power source to terminal 86 of the relay. Use a jumper lead to connect the negative (–) terminal of a 12-volt power source to terminal 85 of the relay. The relay should now energize.
6. Using an ohmmeter touch a test probe to terminal 30 of the relay. Touch the other ohmmeter test probe to terminal 87.
7. Observe the ohmmeter. There should be little or no resistance, indicating continuity. If there is no continuity, the relay is defective and needs replaced.
8. While the 12-volt power source is still connected, touch an ohmmeter test probe to terminal 30 and terminal 87A. There should be high resistance indicating no continuity between the terminals. If there is continuity, the relay is defective and needs replaced.



121



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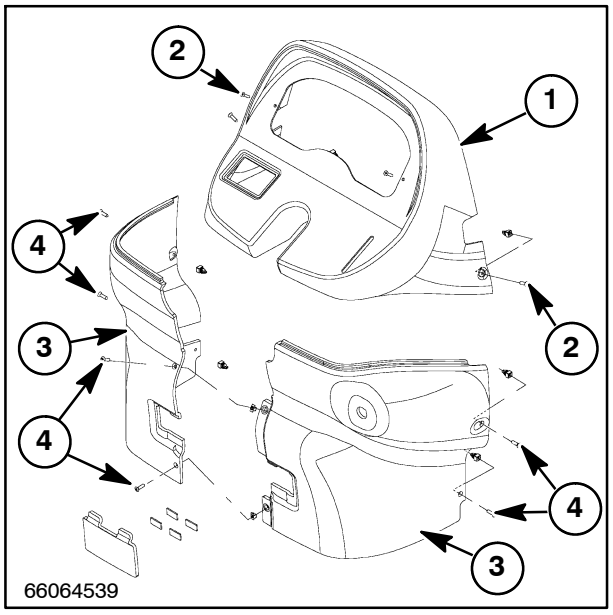
Installation (All Relays)

1. Tilt steering column fully rear rearward, before trying to install top panel.
2. Place the top panel, 1, into position and install the two side retaining screws, 2.
3. Install hand throttle knob while connecting horn, hazard and work light switches.
4. Install instrument panel into top console panel.
5. Install the two side panels, 3, and secure with the two side and middle retaining screws, 4.



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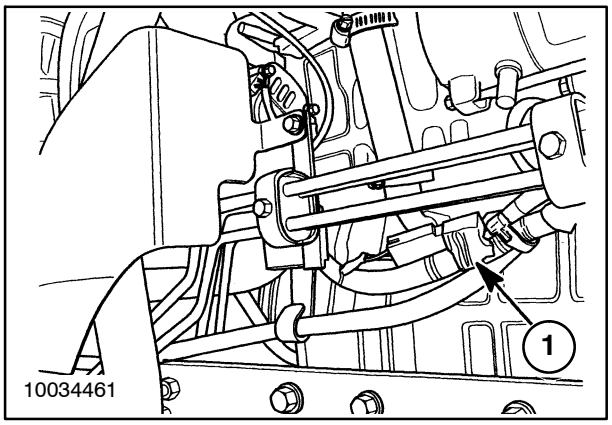
DIODES

Charging System Diode

The charging system diode, 1, is located along the left side of the engine near the alternator. The charging system diode is used to prevent current from back feeding into the low charge indicator light within the instrument panel.



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Removal

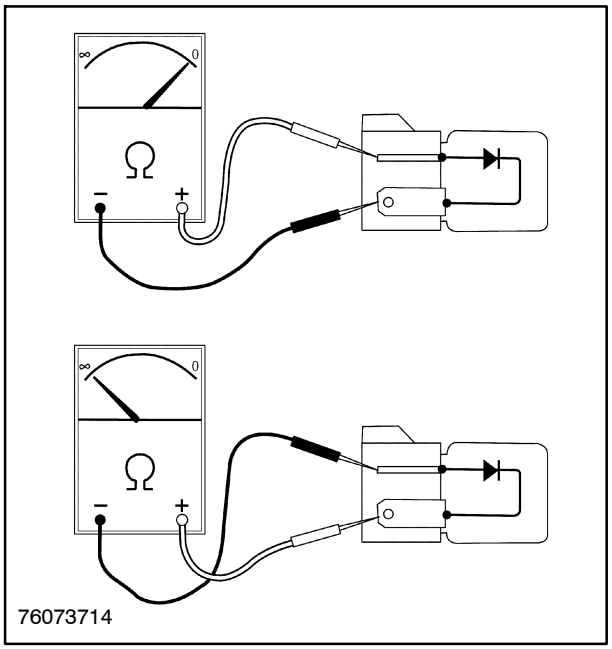
1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Unplug the connector from the diode.
3. Remove the diode from the tractor.

Testing

NOTE: *For this test, an electrical multimeter with diode test capabilities may be used in place of an ohmmeter. If a multimeter with diode testing capabilities is Unavailable, use an ohmmeter to test as described below.*

Use an ohmmeter to verify that the diode is functioning properly.

The diode should allow current to flow in one direction but not the other. Touch the ohmmeter test probes to the diode terminals and observe the ohmmeter. Switch the ohmmeter test probes and observe the ohmmeter. The ohmmeter should show little or no resistance the one way and a high resistance the other way indicating that the diode is only allowing current to flow in one direction. If the test results are not as described, the diode is defective and requires replacement.



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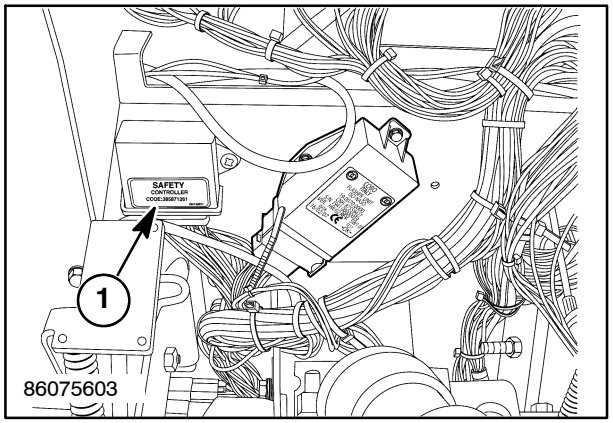
Installation

1. Plug the diode into the connector on the tractor wire harness.
2. Connect the negative (-) battery cable to the negative (-) battery terminal.

SAFETY CONTROLLER

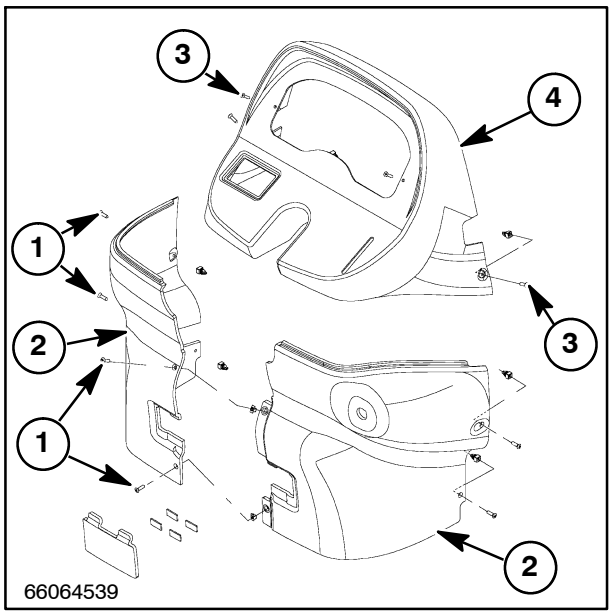
The safety controller, 1, located on the firewall underneath the instrument panel, coordinates the safety start, safe operation and shutdown functions of the tractor electrical system.



126

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two side and middle retaining screws, 1, from the two side panels, 2, and remove the panels from the tractor.
3. Tilt steering column fully rear rearward, before trying to remove top panel.
4. Remove instrumental panel from top consol panel.
5. Remove the handle throttle knob also disconnect horn, hazard and work light switches.
6. Remove the two side retaining screws, 3, and lift the top panel, 4, from the tractor.



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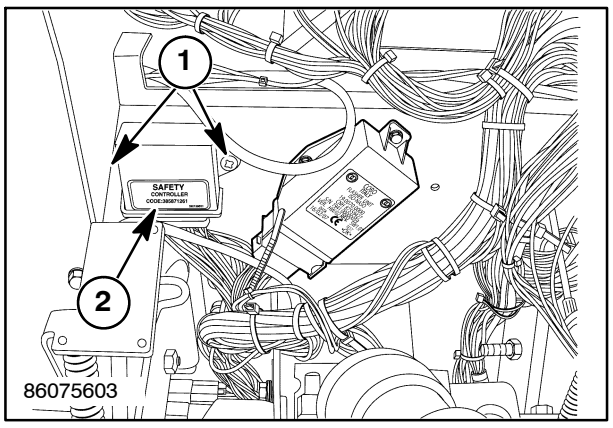
7. Disconnect the safety controller from the tractor wire harness.
8. Remove the two mounting screws, 1, and remove controller, 2, from the tractor.



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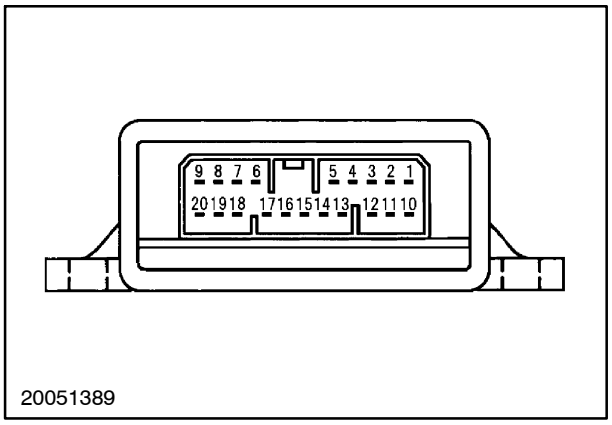
Testing

Terminal identification (as viewed from bottom of switch)



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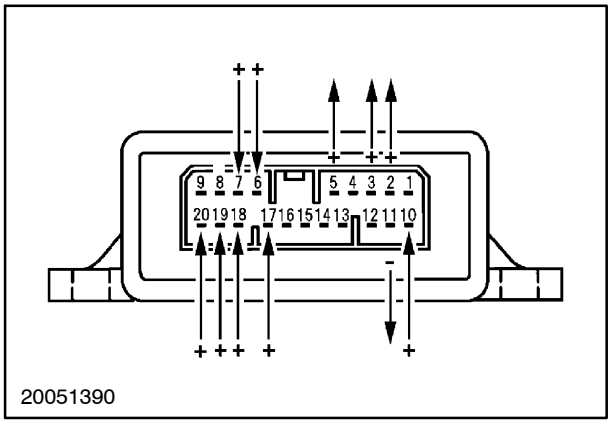
Terminal #	Function	Terminal #	Function
1	Not used	11	Ground (–)
2	To safety start relay	12	Not used
3	To glow plug relay	13	Not used
4	To alarm buzzer	14	From parking brake lamp
5	To fuel shutoff solenoid	15	From glow plug lamp
6	From terminal #19 of key switch	16	From PTO indicator lamp
7	10-amp #2 fuse (input)	17	From terminal #50 of key switch
8	From seat switch	18	From “AC” terminal of key switch via 15-amp fuse
9	From parking brake switch	19	From shuttle switch
10	25-amp #4 fuse (input)	20	From rear PTO switch

Testing Safety Start Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals

Input (+)	Terminal #s 6, 7, 10, 17, 18, 19, 20
Ground (–)	Terminal #11
Output (+)	Terminal #s 2, 3, 5

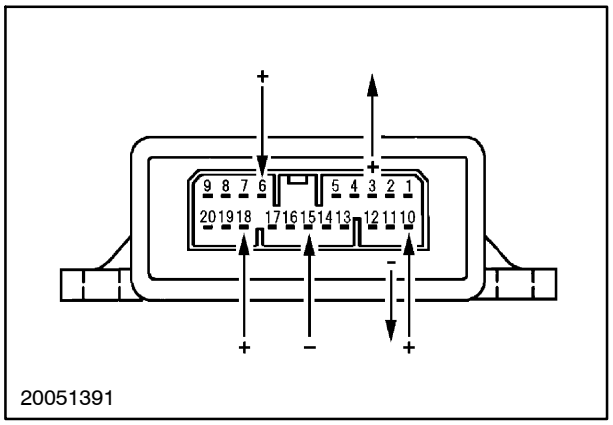


130

Testing Engine Preheat Circuit

Using a 12 volt supply and ohm meter test output current at indicated terminals

Input (+)	Terminal #s 6, 10, 18
Ground (-)	Terminal #11
Output (+)	Terminals #3
Input (-)	Terminal #15



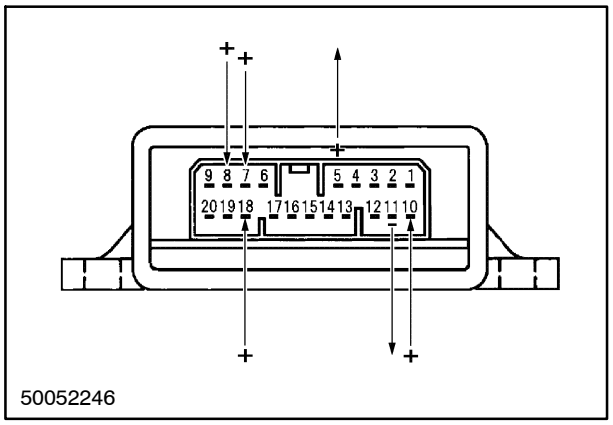
131

Testing Safe Operation Circuit

(Operator Present)

Using a 12 volt supply and ohm meter test output current at indicated terminals

Input (+)	Terminal #s 7, 8, 10, 18
Ground (-)	Terminal # 11
Output (+)	Terminal # 5



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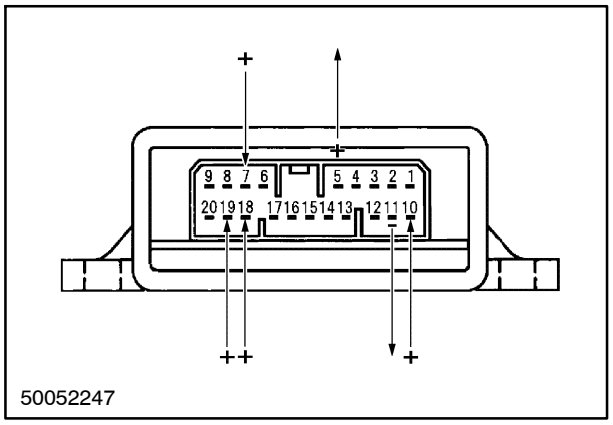
Testing Safe Operation Circuit

(Operator Not Present)

Using a 12 volt supply and ohm meter test output current at indicated terminals

Input (+)	Terminal #s 7, 10, 18 , 19
Ground (-)	Terminal # 11
Output (+)	Terminal # 5



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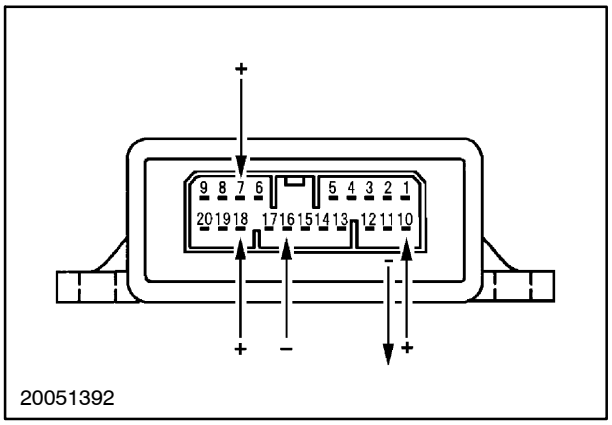
Testing PTO Indicator Light Circuit
Using a 12 volt supply and ohm meter test output current at indicated terminals

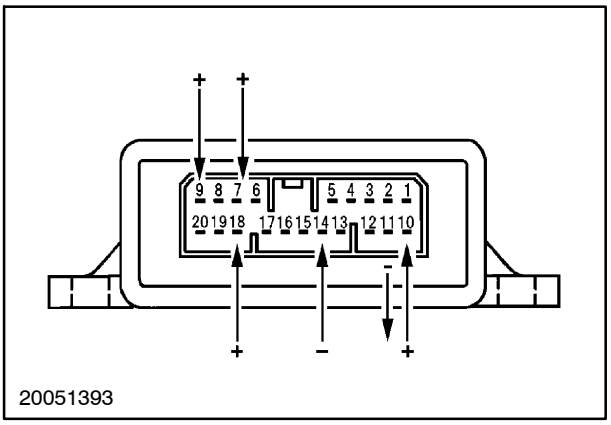
Input (+)	Terminal #s 7, 10, 18
Ground (-)	Terminal #11
Input (-)	Terminal #16



134

Testing Parking Brake Indicator Light Circuit
Using a 12 volt supply and ohm meter test output current at indicated terminals

Input (+)	Terminal #s 7, 9, 10, 18
Ground (-)	Terminal #11
Input (-)	Terminal #14



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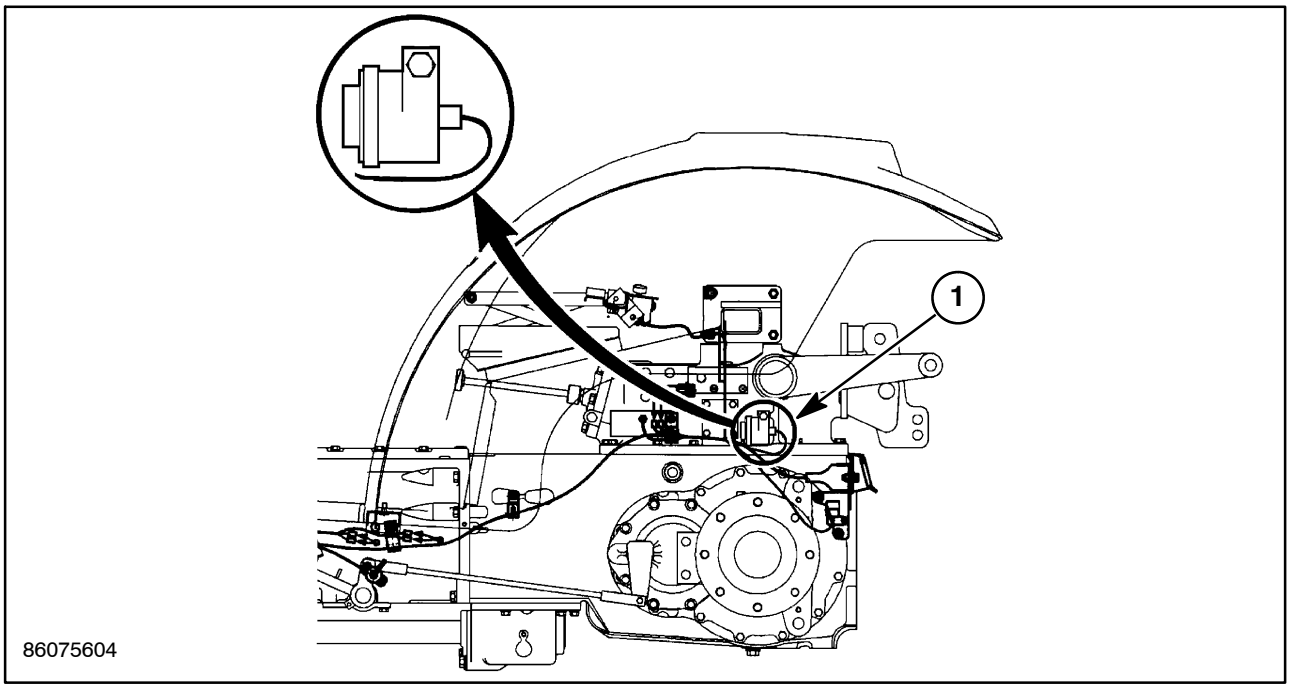

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SAFETY ALARM BUZZER

Description

The safety alarm buzzer, 1, is located on the left side of the HPL housing.

The buzzer will alarm for approximately eight seconds, when safety controller detects an unsafe operation by the tractor operator.

Examples of alarm situation

A. Buzzer will activate when:

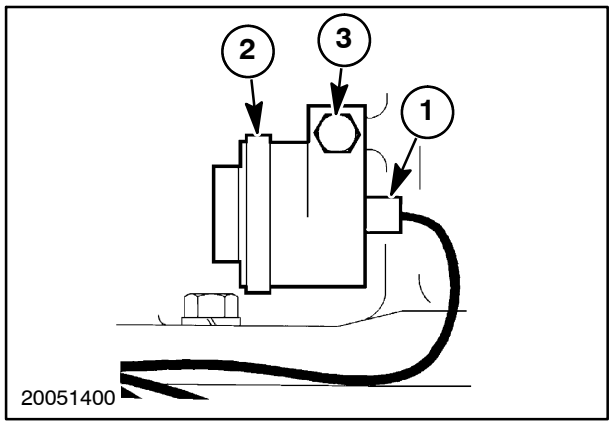
- Key switch in “OFF” position
- PTO in “OFF” position
- Range gear selector in “NEUTRAL” position
- Parking brake is in the “DISENGAGED” position

B. Buzzer will activate when:

- Engine is “RUNNING /Key “ON”
- PTO in “OFF” position
- Range selector in “GEAR” position
- Parking brake is in the “ENGAGED” position

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect the connector,1, from the buzzer, 2. Remove the mounting bolt, 3, and buzzer from the HPL housing.



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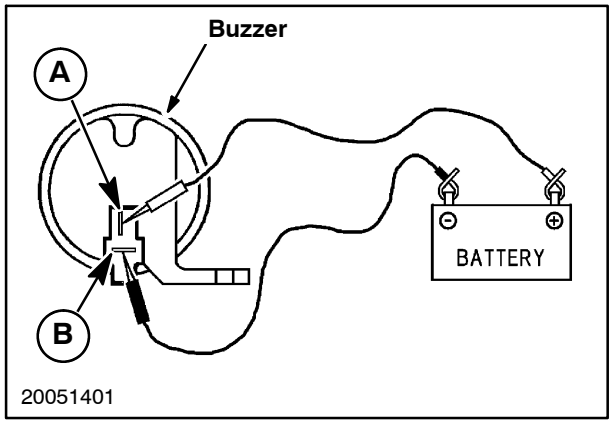
Inspection

NOTE: *The Buzzer cannot be inspected with an ohmmeter.*

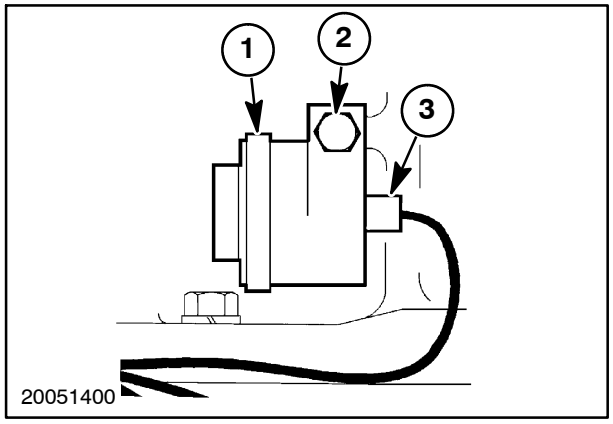
1. Connect terminal “A” to the positive terminal of a battery, using a jumper wire.
2. Connect terminal “B” to the negative terminal of a battery, using a jumper wire.
3. The buzzer should alarm when connected to the battery. If the buzzer does not alarm, replace the buzzer.



138

Installation

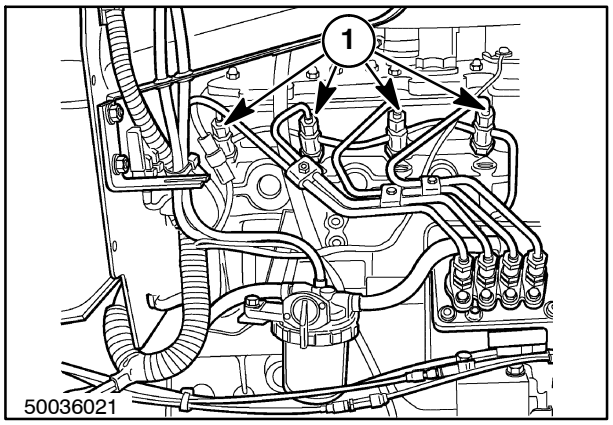
1. Install the buzzer, 1, on the HPL housing using bolt, 2.
2. Connect the connector, 3, to the buzzer.
3. Connect the negative (-) battery cable to the negative (-) battery terminal.



139

ENGINE GLOW PLUGS

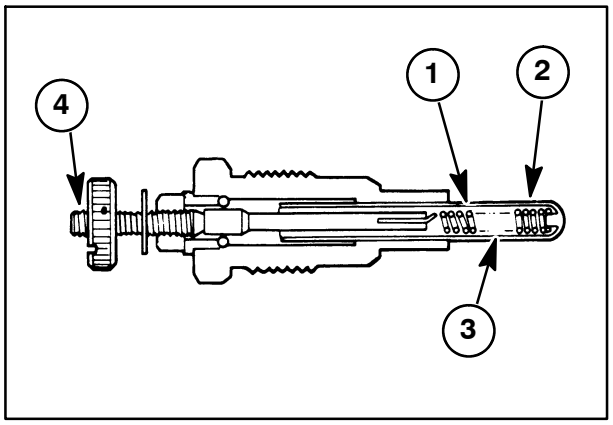
The engine glow plugs, 1, are located on the right side of the engine cylinder head, above the fuel injectors. The glow plugs are used to preheat the air in the pre-combustion chamber. This aids in the starting of the engine when cold.



140

The glow plugs utilize a heating element that is contained in a stainless steel sheath, 1. The coiled heating wire, 2, is sintered into magnesium oxide powder, 3. The magnesium oxide powder is used to evenly transfer heat to the stainless steel sheath, which heats the air in the combustion chamber. The magnesium oxide powder is also used to insulate the heating wire from the outer sheath and glow plug body.

The glow plug heats when electrical current is passed from the glow plug electrode, 4, to one end of the heating wire, 2. Electrical resistance warms the heating wire when electrical current is flowing through the wire. The opposite end of the wire is connected to the sheath. The sheath and glow plug body, 5, are grounded by the engine block.

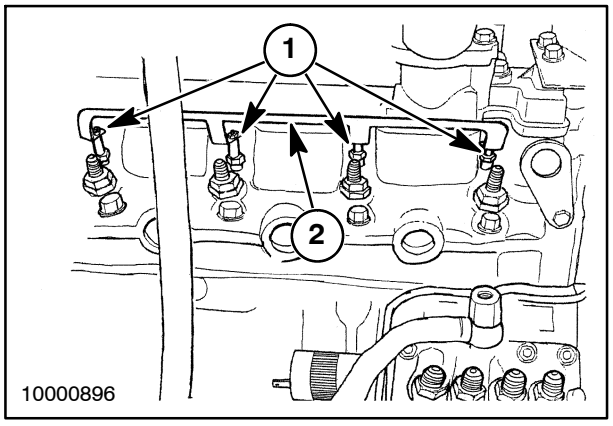


141

NOTE: *All deluxe TC tractors utilize a fast heating type glow plug (marked Y-701RS).*

Removal

1. Disconnect the negative (–) battery cable from the battery.
2. Remove the electrode nuts, 1, the electrical connector, 2, and washers securing the electrode bus bar, 3, to the glow plugs.
3. Remove the glow plug(s) from the engine cylinder head.



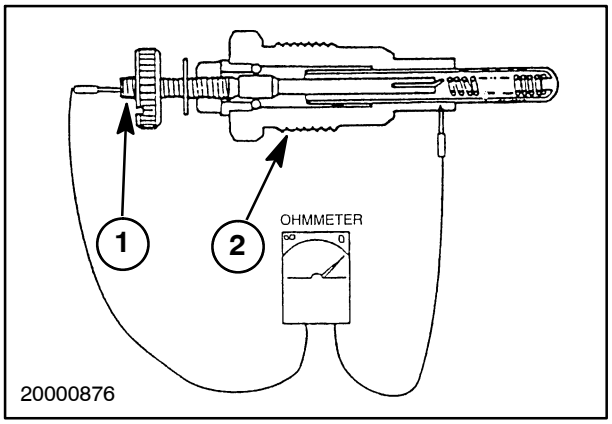
142

Testing

1. Remove carbon from the sheath end of the glow plug

NOTE: *Do not test resistance using the glow plug sheath.*

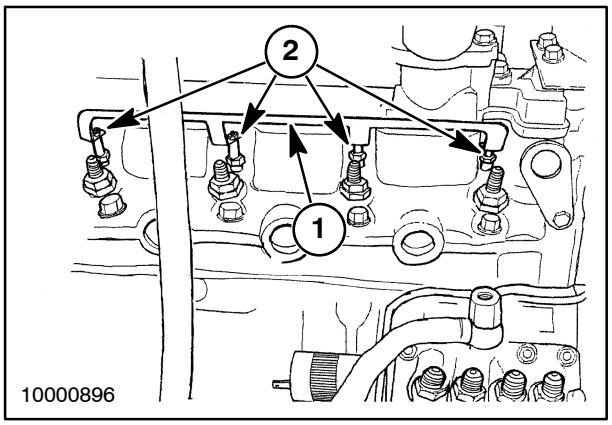
2. Using an ohmmeter, touch one test probe to the glow plug electrode, 1. Touch the other test probe to the glow plug body, 2.
3. Observe the ohmmeter reading, a resistance reading of 0.8 ohms maximum is normal for the TC deluxe model tractor glow plugs. A resistance reading of 1.0 ohms maximum is normal for TC economy model tractor glow plugs. If the resistance is too high, the glow plug is defective and needs replaced.



143

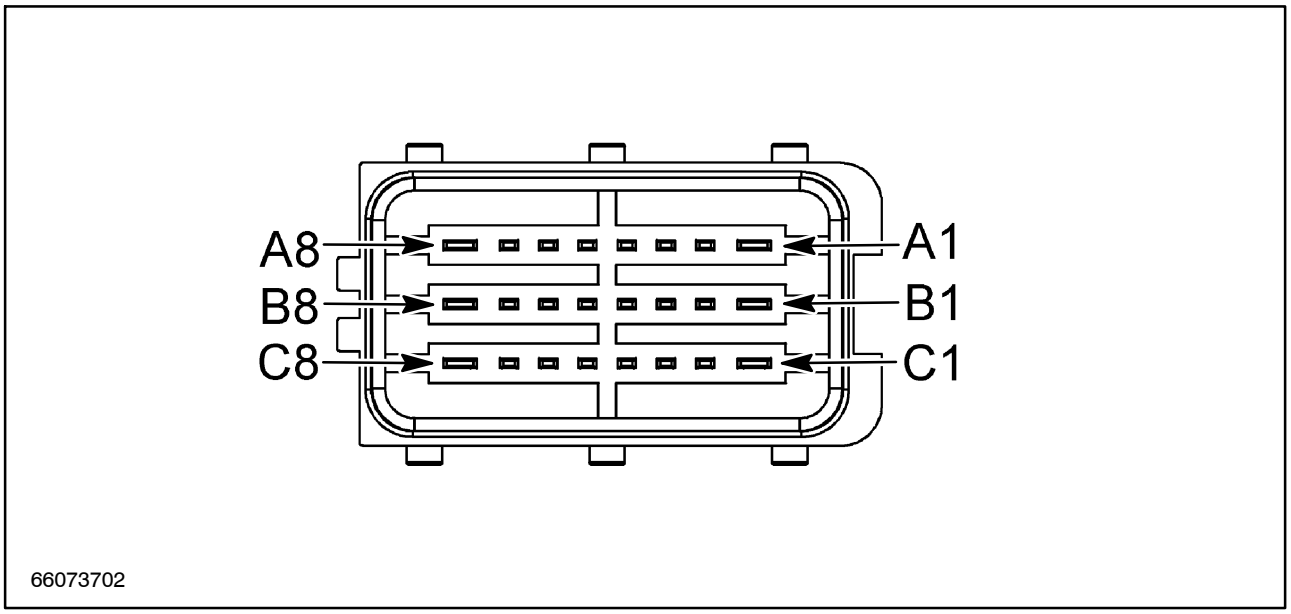
Installation

1. Thread the glow plugs into the engine cylinder head. Torque each glow plug to 10 - 15 N·m (11.0 - 14.5 ft-lb).
2. Install the electrode bus, 1, and the washers onto the glow plugs. Secure with the three (3) nuts, 2.
3. Connect the electrical connector, 3, to the wire harness.
4. Connect the negative (-) battery cable to the battery.



144

HAZARD FLASHER/TURN SIGNAL CONTROL MODULE



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Terminal Identification

A1 – Flasher Cutoff Relay Input (+)
A2 – Right Flasher Lights (Front /Rear)
A3 – Right Trailer Light
A4 – Left Flasher Lights (Front /Rear)
A5 – Left Trailer Light
A6 – NA
A7 – Brake Light Input (+)
A8 – Ground (–)

B1 – Flasher Cutoff Relay Input (+)
B2 – Right Turn
B3 – Left Turn
B4 – Hazard Switch Input (+)
B5 – Trailer Pilot
B6 – Right Tail
B7 – Left Tail
B8 – Ground (–)

Testing

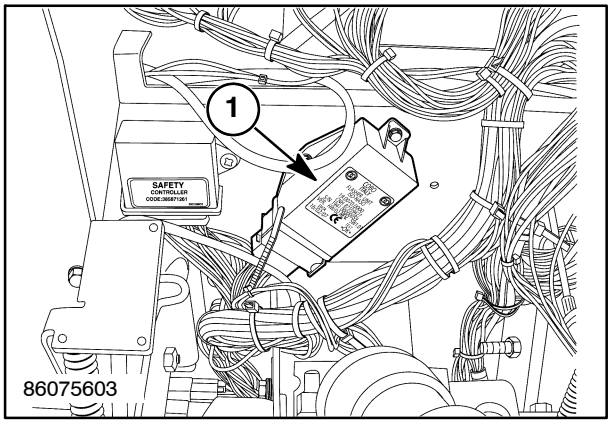
The following tests are designed to verify that the flasher module is functioning properly.

Needed Parts:

(1) Flasher Module
(4 or 6) 12V #1156 Light Bulbs
(1) 12V Battery
(11) Female Pin Connectors
(2) Battery Test Connectors
(1) Switch
14 or 16 Gauge Wire (different colors if available)
Wire Length – (to be determined)

HAZARD FLASHER/TURN SIGNAL CONTROL MODULE

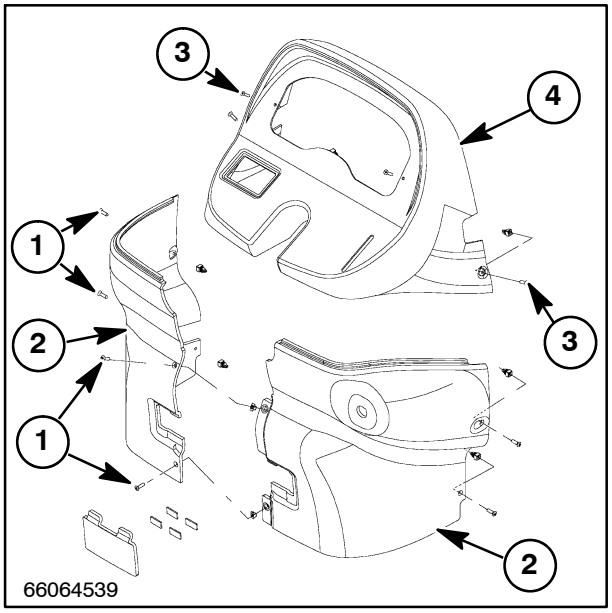
The flasher/turn signal control module, 1, located on the firewall underneath the instrument panel, controls the hazard, right, left, and brake light functions.



146

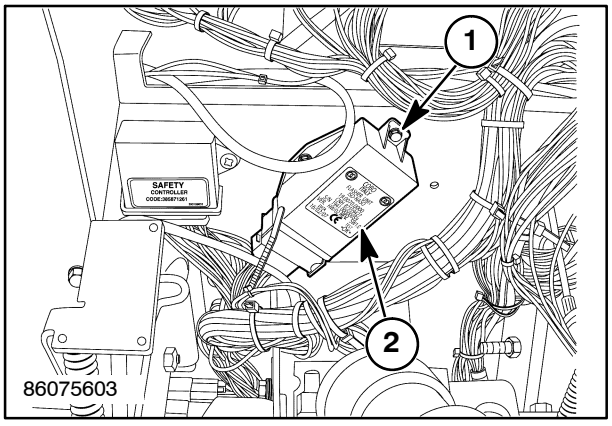
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the two side and middle retaining screws, 1, from the two side panels, 2, and remove the panels from the tractor.
3. Tilt steering column fully rear rearward, before trying to remove top panel.
4. Remove instrumental panel from top consol panel.
5. Remove the handle throttle knob also disconnect horn, hazard and work light switches.
6. Remove the two side retaining screws, 3, and lift the top panel, 4, from the tractor.



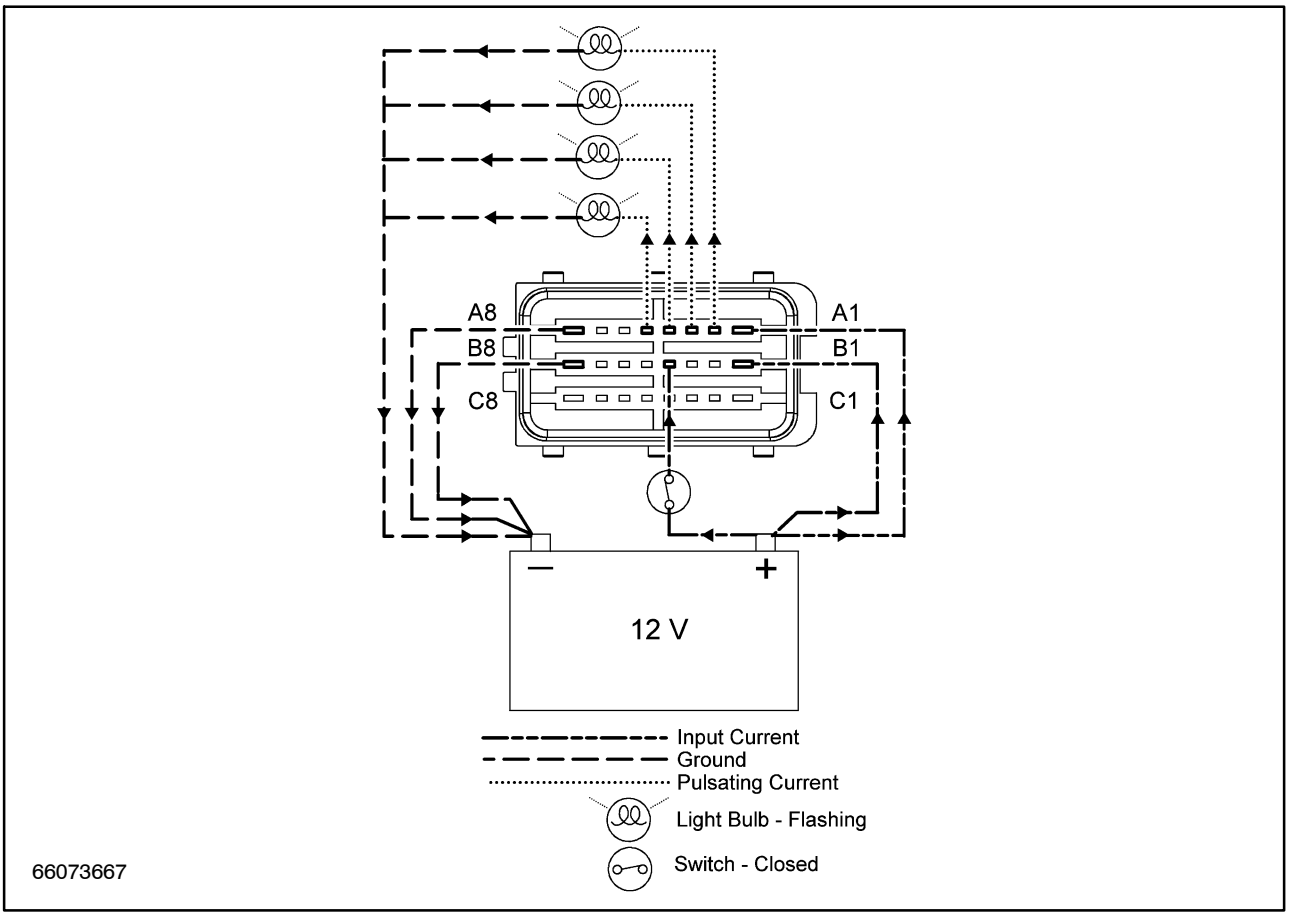
147

7. Disconnect the module from the tractor wire harness.
8. Remove the mounting screw, 1, and remove module, 2, from the tractor.



148

HAZARD LIGHTS CIRCUIT



149

This test will simulate the hazard lights circuit being activated.

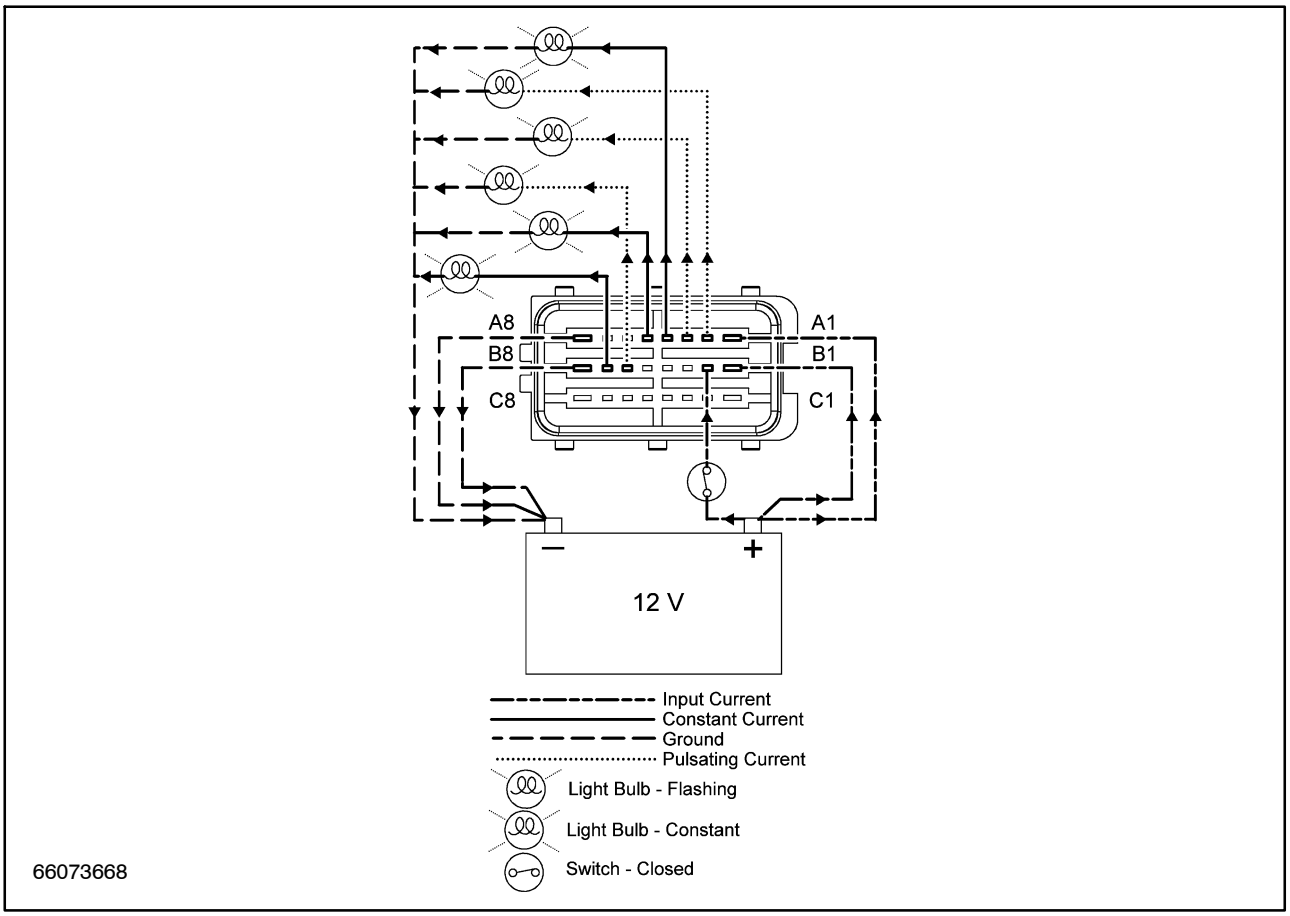
Connect the flasher module terminals as listed on the chart below:

A1, B1	Positive Battery Terminal
A8, B8	Negative Battery Terminal
B4 (Hazard Switch Input)	Positive Battery Terminal through Switch
A2, A3, A4, and A5	# 1156 Light Bulbs Connect other terminals of bulb to ground

Test Results

When the switch is closed and current is provided to terminal B4, the lights connected to terminals A2, A3, A4, and A5 should flash on and off.

RIGHT TURN SIGNAL



150

This test will simulate the right turn signal circuit being activated.

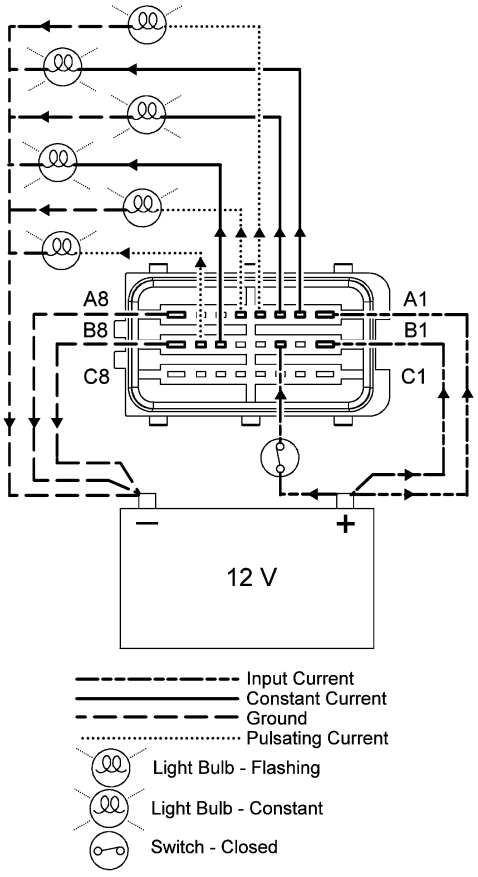
Connect the flasher module terminals as listed on the chart below:

A1, B1	Positive Battery Terminal
A8, B8	Negative Battery Terminal
B2 (Right Turn Input)	Positive Battery Terminal through Switch
A2, A3, A4, A5, B6, B7	# 1156 Light Bulbs Connect other terminals of bulb to ground

Test Results

When the switch is closed current is provided to terminal B2, the lights connected to terminals A2, A3, and B6 should flash on and off. Lights connected to terminals A4, A5, and B7 should continuously illuminate.

LEFT TURN SIGNAL



151

This test will simulate the left turn signal circuit being activated.

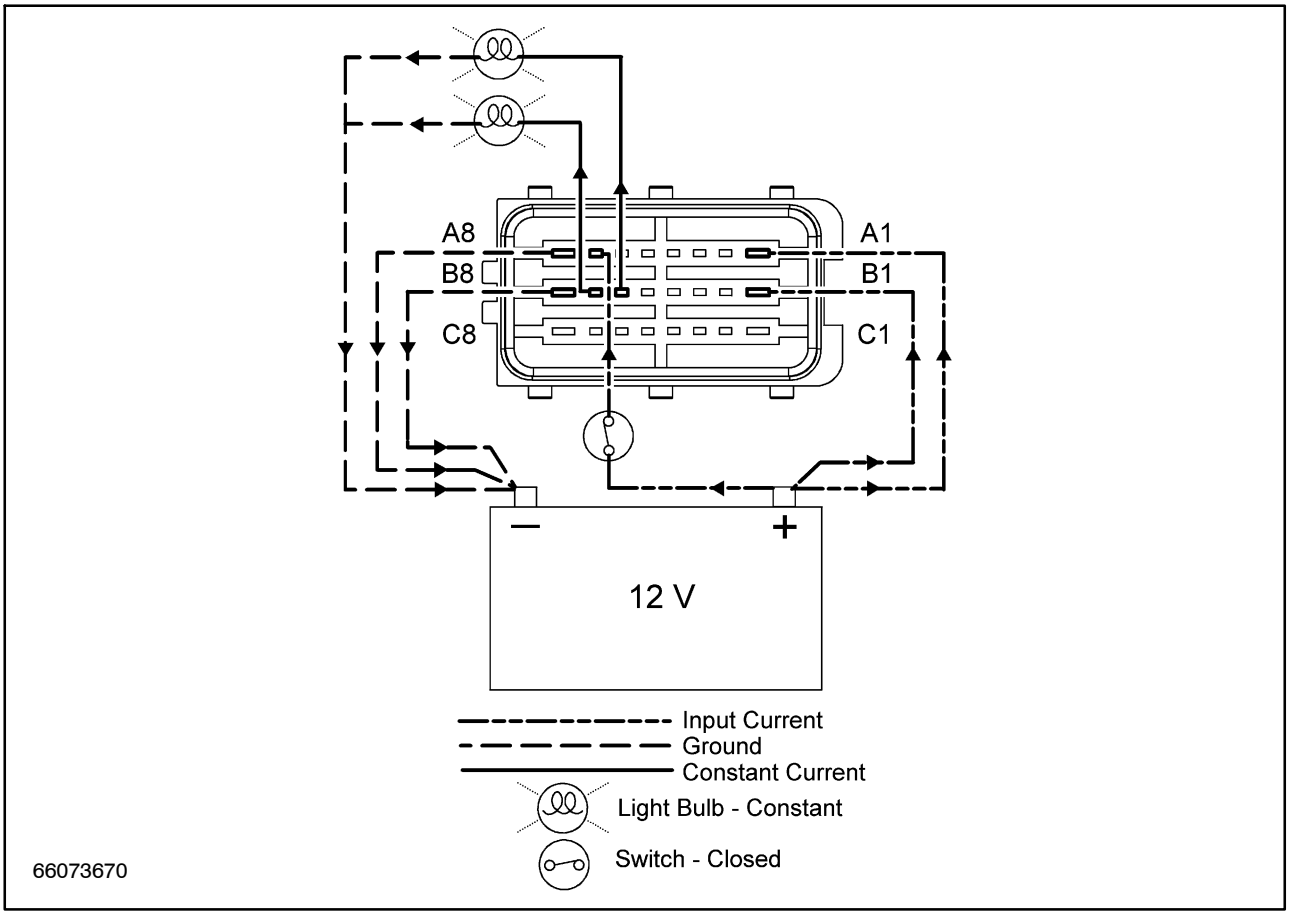
Connect the flasher module terminals as listed on the chart below:

A1, B1	Positive Battery Terminal
A8, B8	Negative Battery Terminal
B3 (Left Turn Input)	Positive Battery Terminal through Switch
A2, A3, A4, A5, B6, B7	# 1156 Light Bulbs Connect other terminals of bulb to ground

Test Results

When the switch is closed current is provided to terminal B3, the lights connected to terminals A4, A5, and B7 should flash on and off. Lights connected to terminals A2, A3, and B6 should continuously illuminate.

BRAKE LIGHTS



152

This test will simulate the brake lights circuit being activated.

Connect the flasher module terminals as listed on the chart below:

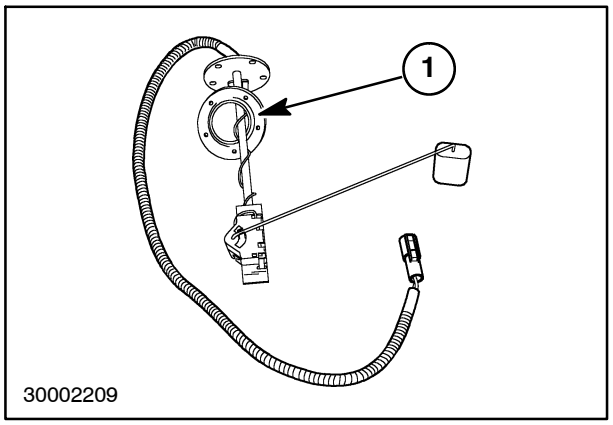
A1, B1	Positive Battery Terminal
A8, B8	Negative Battery Terminal
A7 (Brake Light Input)	Positive Battery Terminal through Switch
B6, B7	# 1156 Light Bulbs Connect other terminals of bulb to ground

Test Results

When the switch is closed current is provided to terminal A7, the lights connected to terminals B6 and B7 should continuously illuminate.

FUEL LEVEL SENDING UNIT

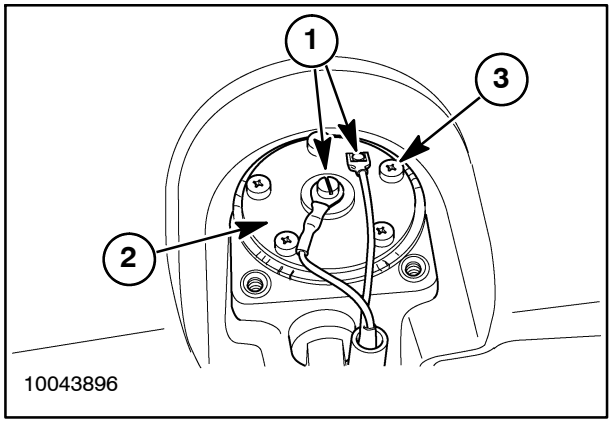
The fuel level sending unit, 1, is mounted on top of the fuel tank and extends into the tank. The sending unit utilizes a float the raise and lowers with the fuel level inside the tank. The float regulates a variable resistance to ground, which translates into movement of the fuel gauge on the instrument panel. As the float lowers (fuel being consumed) inside the tank, the ground resistance increases, indicating less fuel on the fuel gauge.



153

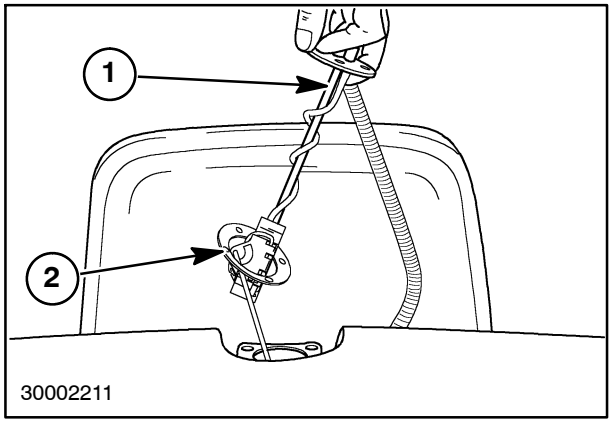
Removal

1. Disconnect the negative (–) battery cable from the battery.
2. Remove the fuel tank from rear of the tractor, as described in Section 90.
3. Disconnect the two wiring leads, 1, from the fuel level sending unit, 2.
4. Remove the five retaining screws, 3, that secure the sending unit, 2, to the fuel tank.



154

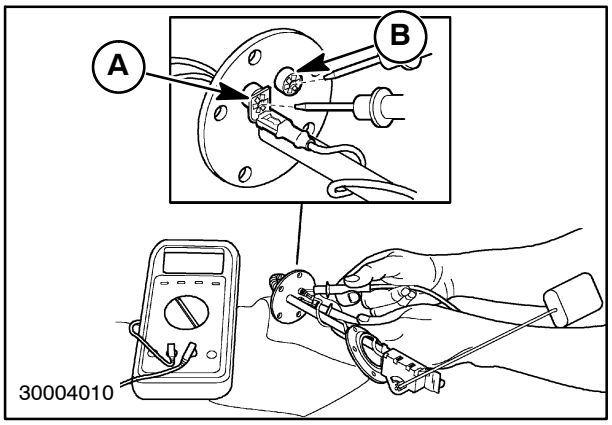
5. Carefully remove the sending unit, 1, from the fuel tank.
6. Remove and discard the sealing gasket, 2, from the sending unit, 1.



155

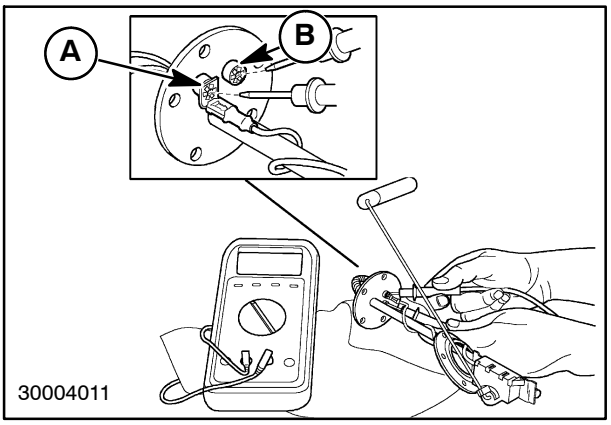
Testing

1. Using an ohmmeter, touch one test probe to terminal “A” of the sending unit, touch the other test probe to terminal “B” of the sending unit. Observe the reading on the ohmmeter.
2. With the sending unit float in the down position (tank empty), the ohmmeter should indicate between 248-252 ohms. If the ohmmeter reading is not within these specifications, the sending unit is defective and needs replaced.



156

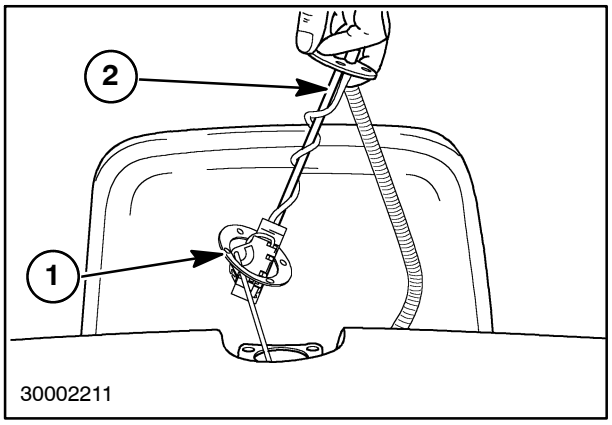
3. With the sender in the up position (tank full), the ohmmeter should indicate between 28-32 ohms. If the ohmmeter reading is not within these specifications, the sending unit is defective and needs replaced.



157

Installation

1. Install a new sealing gasket, 1, between the sending unit, 2, and the fuel tank.
2. Carefully place the sending unit, 2, into the fuel tank.



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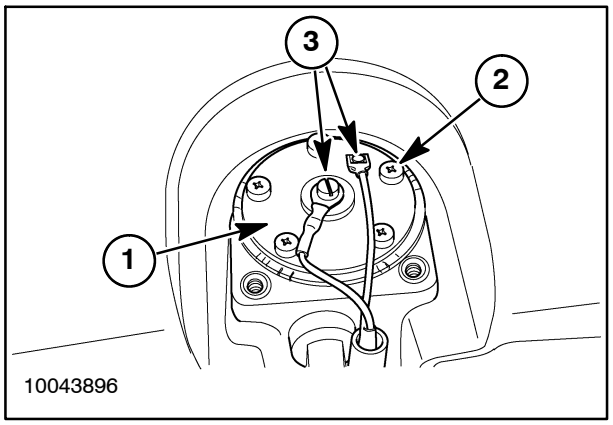
3. Secure the sending unit, 1, to the fuel tank using the five retaining screws, 2.
4. Reconnect electrical harness leads, 3, to the sending unit.
5. Reinstall fuel tank onto tractor, as described in Section 90.
6. Connect the negative (-) battery cable to the battery.



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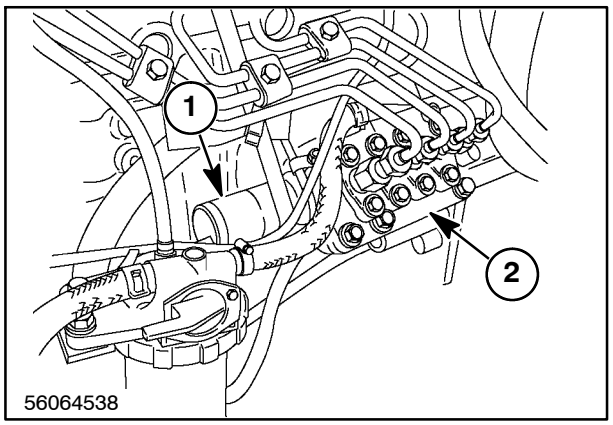
FUEL SHUTOFF SOLENOID

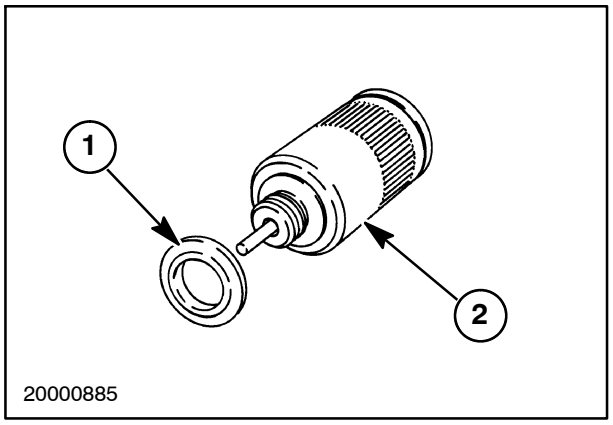
The fuel shutoff solenoid, 1, is located on the right side of the engine, threaded into the rear of the fuel injection pump, 2. The fuel shutoff solenoid contains a spring-loaded plunger that pushes the injection pump control rack to the closed (shut-off) position when the solenoid is not energized. When the key switch is turned to the "ACC/RUN" or "START" position, the safety stop relay closes completing the circuit that energizes the solenoid. This retracts the plunger from the injection pump, and the injection pump control rack moves into the position that allows the engine to start.

Removal

1. Disconnect the negative (–) battery cable from the battery.
2. Disconnect the wiring harness lead from the fuel shutoff solenoid, 1.
3. Using a pair of pliers, carefully remove the fuel shutoff solenoid, 1, from the fuel injection pump, 2.
4. Remove and discard the sealing washer, 1, which seals the solenoid, 2, to the fuel injection pump.



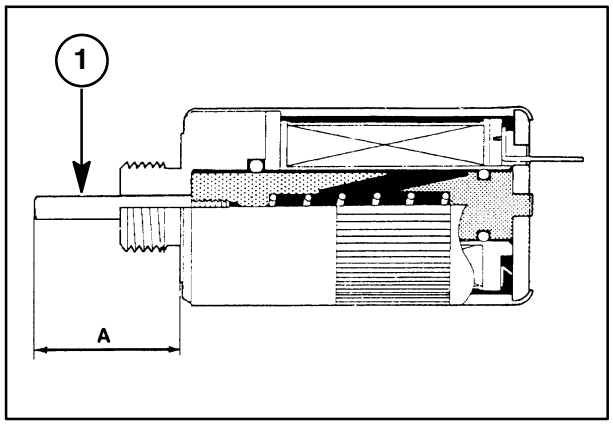
160



161

Testing

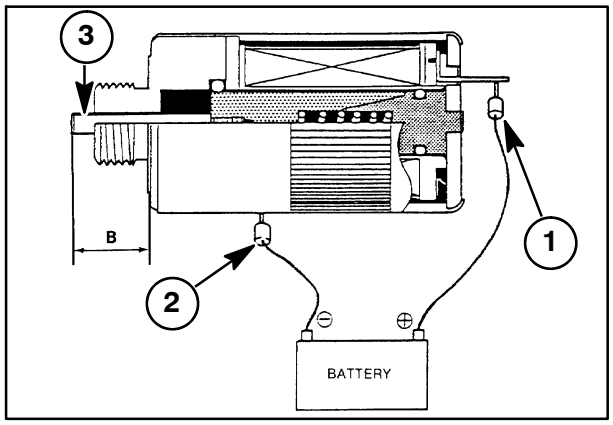
1. Using a suitable measuring device, measure the actuating pin, 1, protrusion distance, “A”, on the solenoid. The distance should measure between 25.5 – 26.4 mm (1.004 – 1.040 in.). If the distance is not within these specifications, the solenoid is defective and needs replaced.



162

NOTE: *When connecting the 12-volt power supply to the solenoid body, be sure paint is the removed from the body. Otherwise, the power will not be transferred to the solenoid.*

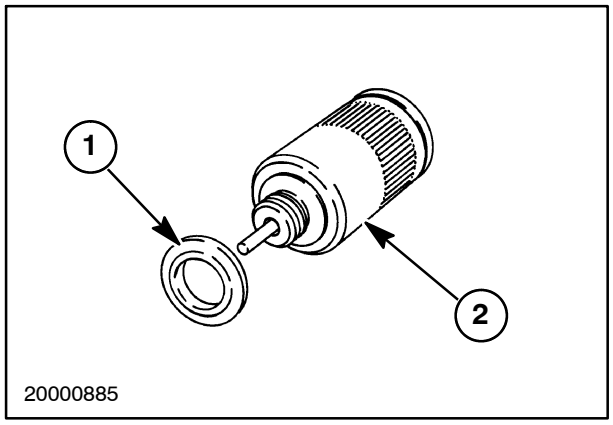
2. Use jumper wires to connect the positive (+) terminal of a 12-volt power supply to the solenoid lead, 1. Connect the negative terminal of the 12-volt power supply to the solenoid body, 2. The plunger should retract into the solenoid body.
3. Using a suitable measuring device, measure the actuating pin, 1, protrusion distance, “B” on the solenoid. The distance should measure between 11.5 –14.5 mm (0.453 – 0.571 in.). If the distance is not within these specifications or the plunger does not retract, the solenoid is defective and needs replaced.



163

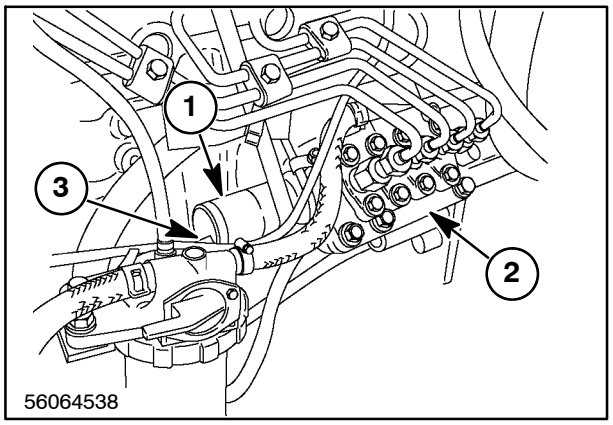
Installation

1. Install a new sealing washer, 1, on the solenoid, 2.



164

2. Thread the fuel shutoff solenoid, 1, into the fuel injection pump, 2. Use pliers to tighten the solenoid into the injection pump.
3. Connect the wiring harness lead, 3, into the fuel shutoff solenoid, 1.
4. Connect the negative (-) battery cable to the battery.



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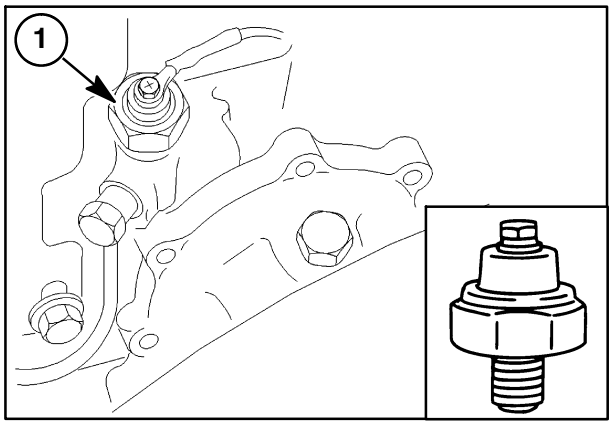
ENGINE OIL PRESSURE SWITCH

The oil pressure sender, 1, is located on the top front side of the engine. The switch opens under normal oil pressure (above 6 PSI) and closes when oil pressure is low (below 6 PSI) to complete the ground circuit of the oil pressure warning light.

When the ground circuit is completed, the oil pressure warning light illuminates on the instrument panel when the key switch is turned to the "ON" position and goes out when the engine is started. If the light does not go out after the engine has started, first check the engine oil level. If oil level is correct, check for a malfunctioning sender or engine oil pump.



166

Testing

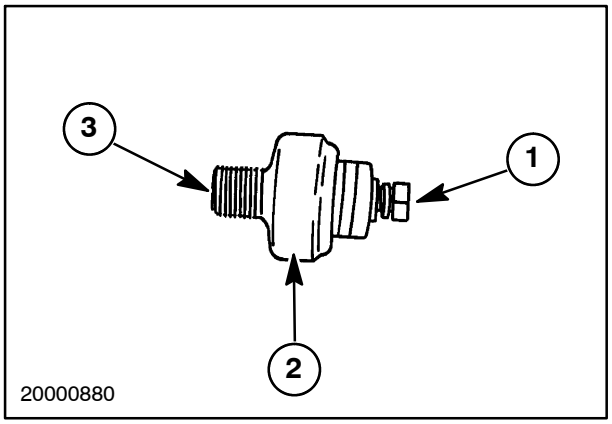
1. Using an ohmmeter, touch one test lead to the pressure switch terminal, 1, and the other test lead to the switch body, 2.
2. Observe the ohmmeter. There should be little or no resistance, indicating continuity in the switch. If there is no continuity, the switch is defective and needs replaced.

NOTE: *The following test is not a calibrated test. The purpose of the test is to see if the switch opens at pressure.*

1. While the test leads are connected to the switch, pressurize the switch oil pressure port, 3, with low pressure (10-30 psi) compressed air.
2. Observe the ohmmeter. While air pressure is being supplied to the oil pressure port, the ohmmeter should indicate high resistance, or no continuity. If there is continuity, the switch is defective and needs replaced.

⚠ CAUTION ⚠

Do not use high pressure compressed air for the following test, otherwise damage may occur to the oil pressure switch.



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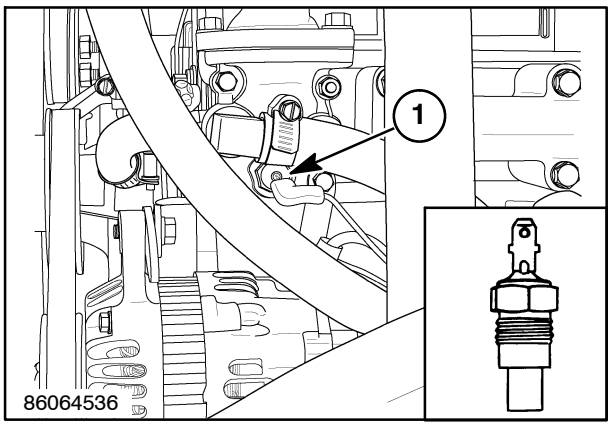
ENGINE COOLANT TEMPERATURE SENDING UNIT

The coolant temperature sender, 1, is located at the left front side of the engine inside the thermostat housing. This sender regulates a variable resistance to ground, which translates into the movement of the temperature gauge.



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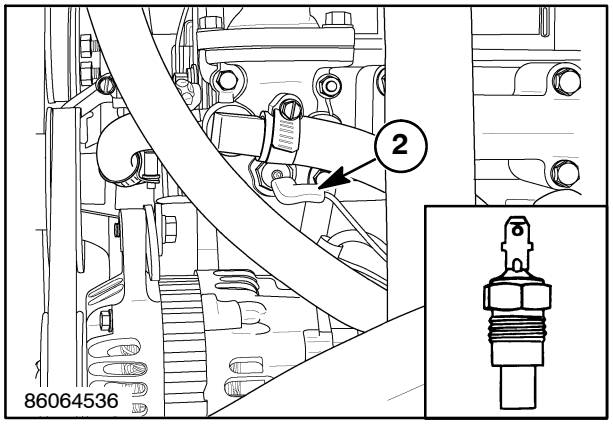
Testing

⚠ WARNING ⚠

Do not perform sending unit test with tractor engine running. Contact with moving parts will cause bodily injury.

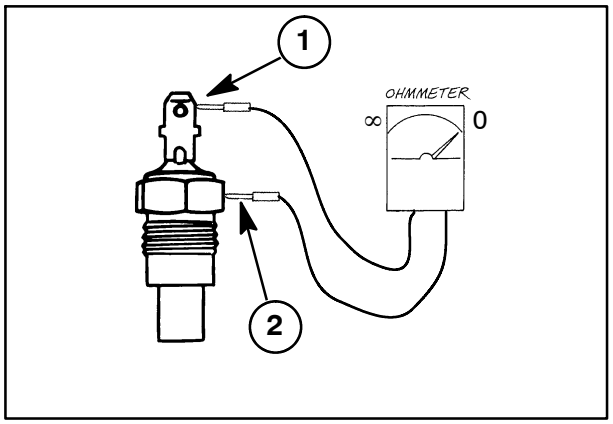
NOTE: *Engine paint must be removed from sending unit body or the ohmmeter will indicate a false reading when the ohmmeter test lead is touched to sending unit body.*

1. Disconnect the main wiring harness terminal, 2, from the coolant temperature sending unit.



169

2. Using an ohmmeter, touch one test lead to the sending unit terminal, 1. Touch the other test lead to the sending unit body, 2.



170

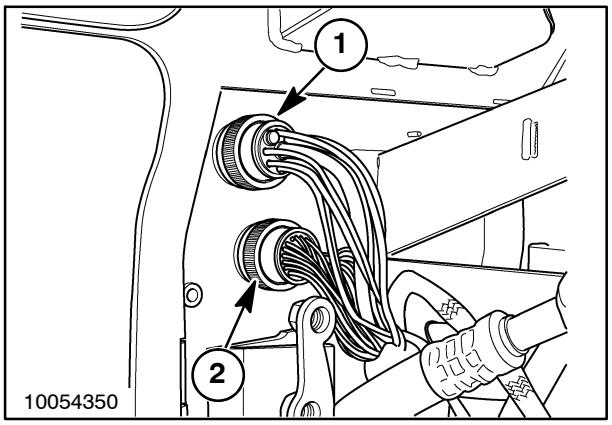
3. Observe the ohmmeter for resistance readings at different engine operating temperatures. If resistance is too high, the sending unit us defective and needs replaced.

Coolant Temperature	Sending Unit Temperature
35° C (95° F)	670.0 ± 80 ohms
80° C (176° F)	118.0 ± 6 ohms
105° C (221° F)	54.5 ± 2.7 ohms
115° C (239° F)	42.0 ± 2.5 ohms

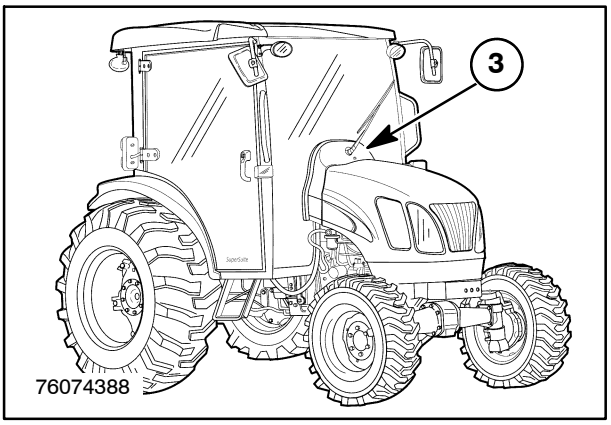
CAB TO TRACTOR HARNESS MAIN CONNECTORS

The power connector, 1, and signal connector, 2, are located on the cab right front frame wall.

NOTE: *To access the cab connectors the rear hood panel, 3, has to be removed. (Refer to Section 90 for panel removal).*



171



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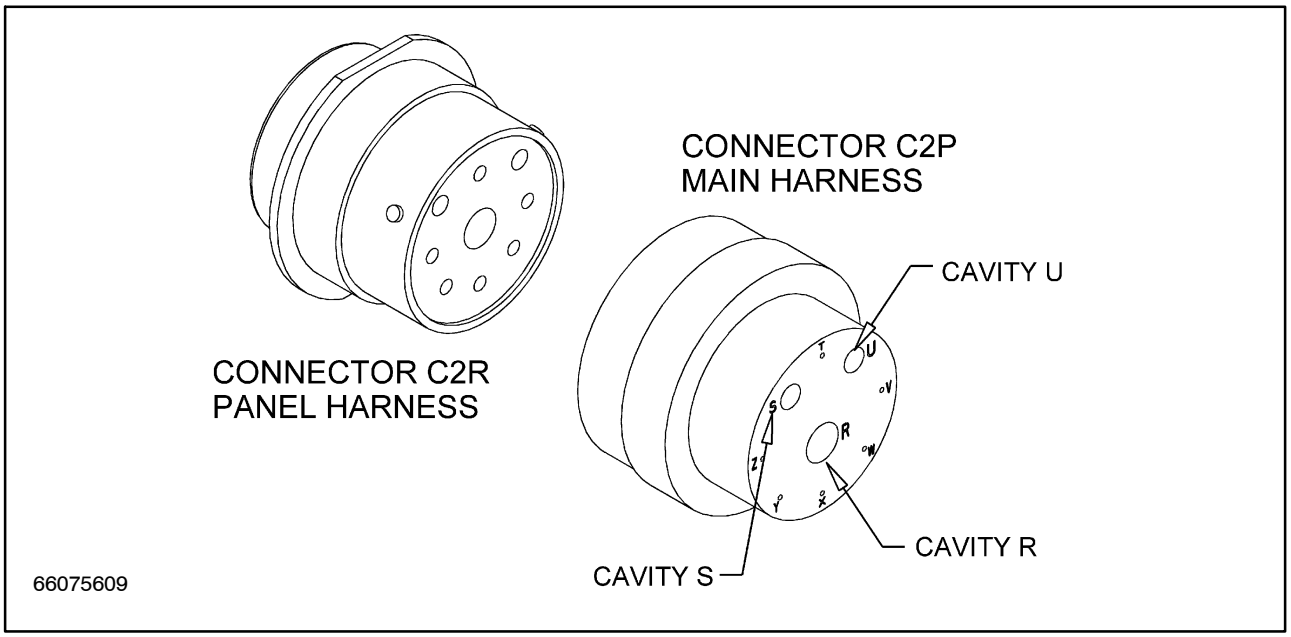
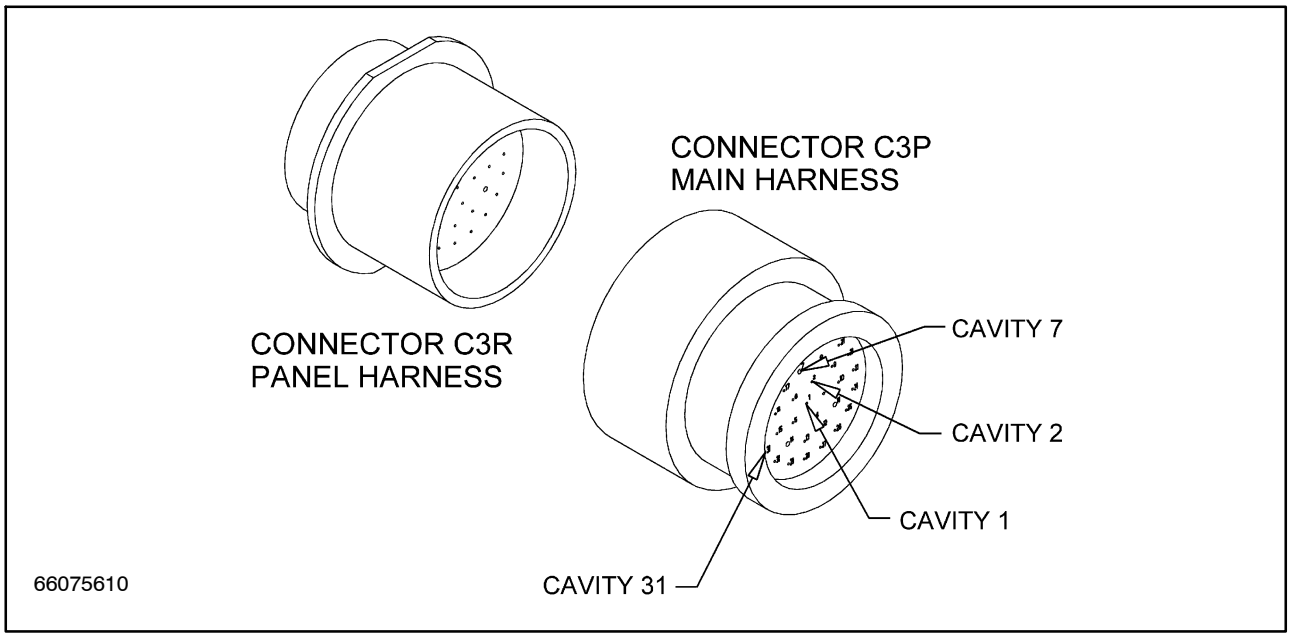


173

1. Power Connector (C2R – C2P)

(Circuits in Connector)

R. Open
S. Alternator
T. Work Lamp
U. Cab Power
V. Glow Plug
W. Starter
X. Auxiliary Power
Y. Ground
Z. ACC Power



174

2. Signal Connector (C3R – C3P)

(Circuits in Connector)

1. Fuel Level Sensor
2. Engine Oil Pressure Sensor
3. Tail Lamp
4. Flasher Lamp (RH)
5. Flasher Lamp (LH)
6. Battery Charging
7. ACC Power
8. Water Temperature Sensor
9. Parking Brake Switch (Power)
10. Trailer Brake Lamp
12. Backup Alarm Kit (Dia)
13. Engine Stop Solenoid
14. Open
15. Input from Seat Safety Switch
16. Input from Park Brake Switch

SECTION 55 – ELECTRICAL SYSTEM

Chapter 6 – Schematics – T2410 – T2420 With Cab

CONTENTS

Section	Description	Page
	Electrical Schematic Diagrams	2
	Starting Circuit (Operator Present or Not Present)	28
	Safe Operation (Operator Present)	32
	Safe Operation (Operator Not Present)	36
	Safety Alarm	40
	Glow Plugs	44
	Road Lights (Position, Low and High Beam)	48
	Work Lights	52
	Cab Work Lights	56
	Interior Cab Lights	60
	Hazard Flashers	62
	Right Turn Signal	66
	Left Turn Signal	70
	HVAC	74
	Auxiliary Power Socket	78
	Front And Rear Wipers	80
	Horn	84
	Radio	86
	Beacon	90
	PTO Indicator Light	94
	Park Brake Indicator Light	98
	Engine Low Oil Pressure Indicator Light	102
	Engine Coolant Temperature Gauge	104
	Fuel Level Gauge Circuit	106
	Tachometer	108
	Charging	112
	Brake Lights	116
	Backup Alarm (SSS)	120
	Backup Alarm (EHSS)	122

ELECTRICAL SCHEMATIC DIAGRAMS

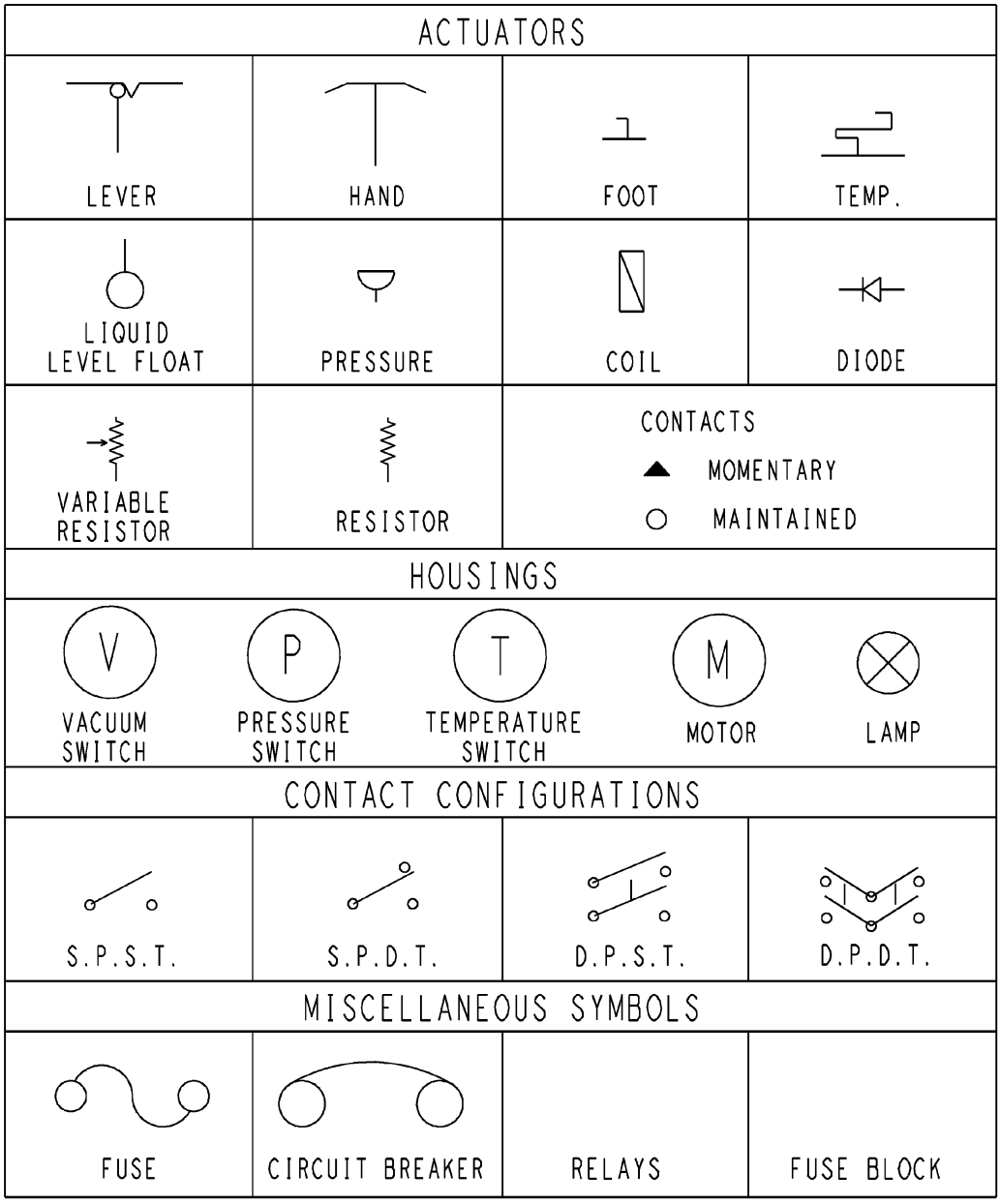
ELECTRICAL SCHEMATIC DIAGRAM 87609811 NEW HOLLAND CLASS 4 NAR COMPACT TRACTOR WITH CAB

CIRCUIT DESCRIPTION	PAGE
CHARGING SYSTEM	7
SAFETY SYSTEM	8
SAFETY SYSTEM	9
STARTING SYSTEM	10
INSTRUMENT CLUSTER	11
AIR CONDITIONING	12
LIGHT SWITCHES	13
HEADLIGHT/HAZARD	14
FRONT WARNING LIGHTS	15
WARNING LIGHTS	16
CAB POWER	17
HVAC	18
RADIO	19
WIPER	20
WORK LIGHTS	21
CAB GROUND	22
EHSS	23
GROUNDS	24
TRAILER SOCKET	25

NEW HOLLAND

PAGE 1

1


ACTUATORS
LEVER
HAND
FOOT
TEMP.
LIQUID LEVEL FLOAT
PRESSURE
COIL
DIODE
VARIABLE RESISTOR
RESISTOR
CONTACTS
MOMENTARY
MAINTAINED
HOUSINGS
V
VACUUM SWITCH
P
PRESSURE SWITCH
T
TEMPERATURE SWITCH
M
MOTOR
LAMP
CONTACT CONFIGURATIONS
S.P.S.T.
S.P.D.T.
D.P.S.T.
D.P.D.T.
MISCELLANEOUS SYMBOLS
FUSE
CIRCUIT BREAKER
RELAYS
FUSE BLOCK

PAGE 2

2

COLOR ABBREVIATIONS

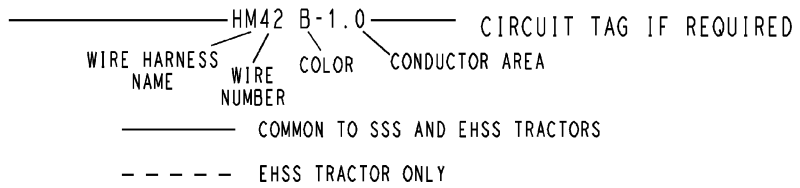
ABBREVIATION	COLOR
R	RED
T	TAN
W	WHITE
Y	YELLOW
B	BLACK
BR	BROWN
G	GREY

ABBREVIATION	COLOR
O	ORANGE
P	PINK
V	VIOLET (PURPLE)
DB	DARK BLUE
LB	LIGHT BLUE
DG	DARK GREEN
LG	LIGHT GREEN

NOTES:
1. FOR ELECTRICAL SYSTEM INSTRUCTIONS SEE ES-A7384

2. DIAGRAM SHOWN WITH VEHICLE PARKED, POWER OFF, ALL CONTROLS IN NEUTRAL AND PARK BRAKE SET.

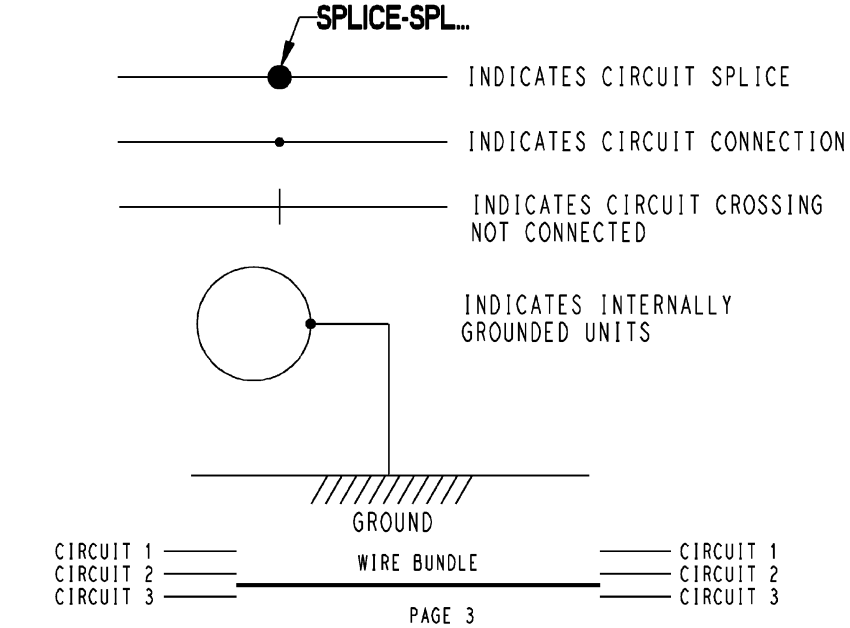
CIRCUIT DIAGRAM LEGENDS



WIRE HARNESS NAME

ABBREVIATION	HARNESS
HM	MAIN
HC	CHASSIS
HP	PANEL
HT	TRANSMISSION

ABBREVIATION	HARNESS
HH	HOOD
BC	BATTERY CABLE
HR	ROOF



PAGE 3

3

TABLE OF RELAYS

RELAY NUMBER	PAGE LOCATION	REF. DES.	FUNCTION
1	13	C58_R1	WORK RELAY
2	10	C58_R2	GLOW PLUG RELAY
3	10	C58_R3	STARTER RELAY
4	15	C58_R4	DRIVE LAMP RELAY
5	15	C58_R5	ACC POWER RELAY
6	12	C58_R6	BRAKE LAMP RELAY
10	17	C58_R10	FLASHER CUTOFF RELAY
12	15	C58_R12	CAB POWER REALY
15	18	C91	HVAC RELAY
16	23	C502_R16	EHSS BACKUP ALARM RELAY

TABLE OF SPLICES

SPLICE NAME	PAGE LOCATION	HARNESS USED ON	CIRCUIT
1	13	PANEL	ACC POWER
2	9	PANEL	ACC POWER
3	15	PANEL	LIGHTING POWER
6	24	PANEL	GROUND
7	24	PANEL	GROUND
8	16	PANEL	UNSW B+
9	23	PANEL	SEAT SW
10	23	PANEL	EHSS LEVER REV
11	13	PANEL	HIGH BEAM
12	23	PANEL	EHSS LEVER BACK
15	24	MAIN	UNSW B+
20	24	MAIN	UNSW B+
21	8	MAIN	UNSW B+
25	14	HOOD	LOW BEAM
26	14	HOOD	GROUND
27	14	HOOD	HIGH BEAM
28	14	HOOD	WORKLIGHT B+
29	16	ROOF	POSITION LIGHTS
30	17	ROOF	CAB SW B+
31	13	MAIN	WORK LIGHTS
32	7	TRANS	ALARM KIT
33	8	MAIN	ALTERNATOR
34	24	MAIN	UNSW B+
36	15	PANEL	LH TURN
37	15	PANEL	RH TURN
38	12	PANEL	BRAKE LIGHTS
39	22	ROOF	GROUND
40	22	ROOF	GROUND
41	23	JUMPER	EHSS BACKUP ALARM
A	12	PANEL	ACC POWER
B	10	PANEL	GLOW PLUGS
C	15	PANEL	CAB POWER
D	15	PANEL	CAB POWER

TABLE OF CONNECTOR LOCATIONS

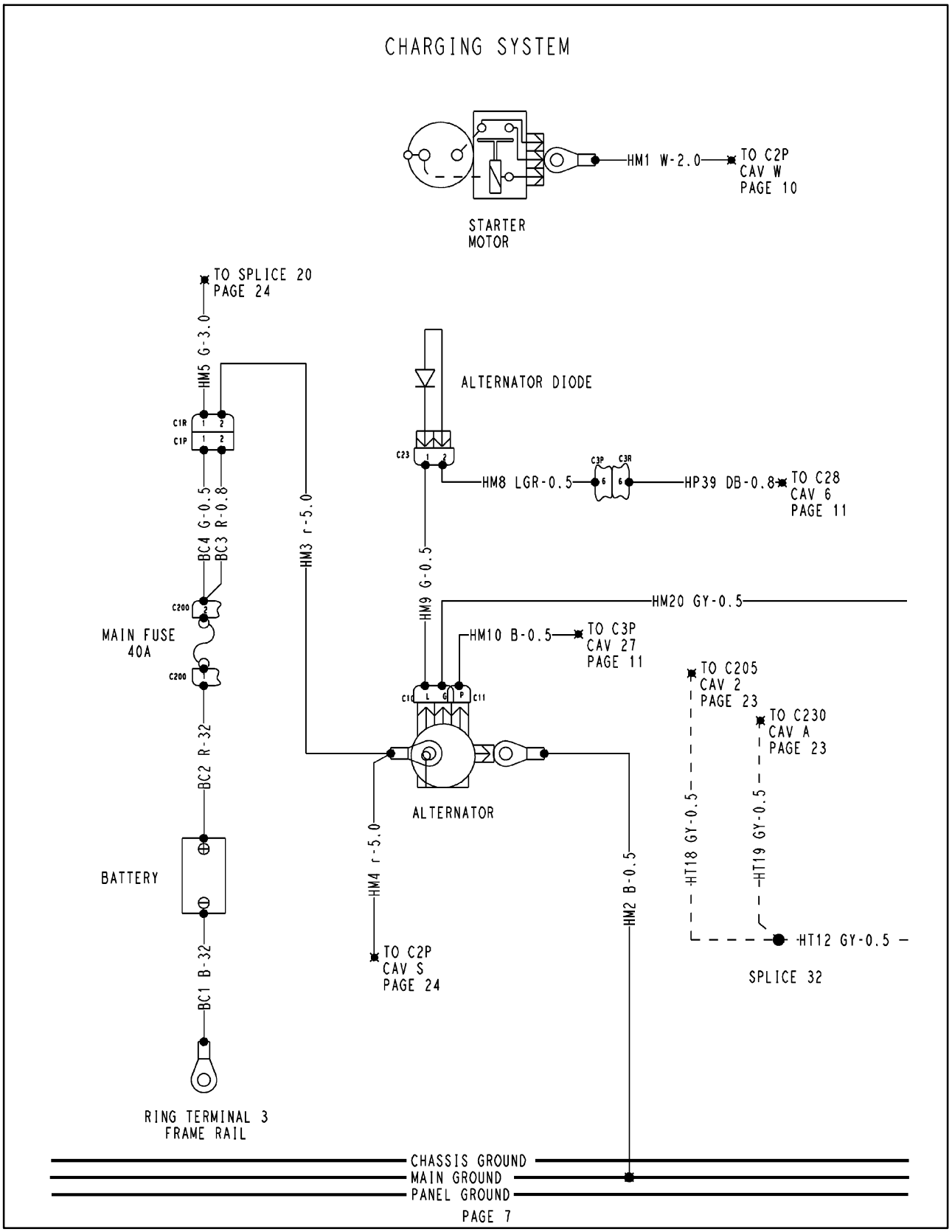
REF. DES.	PAGE LOCATION	HARNESS USED ON	REF. DES.	PAGE LOCATION	HARNESS USED ON
C1P	7	BATTERY	63_64	15	PANEL
C1R	7	MAIN	65	14	PANEL
C2P	10,13,15,24	MAIN	66	8	PANEL
C2R	10,13,15,24	PANEL	67	23	PANEL
C3P	7,8,9,11,13,15,23	MAIN	68	23	PANEL
C3R	7,8,9,11,13,15,23	PANEL	70	9	PANEL
C4P	8,9,11	MAIN	71	8	PANEL
C4R	8,9,11	CHASSIS	81	19	ROOF
C5P	25	MAIN	82	21	ROOF
C5R	25	CHASSIS	83	21	ROOF
C6P	16,20	PANEL	85	16	CHASSIS
C6R	16,20	ROOF	86	16	CHASSIS
C7P	17	PANEL	91	17	ROOF
C7R	17	ROOF	92	18	ROOF
C8P	14	MAIN	96	20	ROOF
C8R	14	HOOD	97	20	ROOF
C9	20	PANEL	98	19	ROOF
C10P	8,9,23	MAIN	99	19	ROOF
C10R	8,9,23	TRANS	100	19	ROOF
C10	7	MAIN	101	19	ROOF
C11	7	MAIN	102	19	ROOF
C13	10	PANEL	107	19	ROOF
C14	13	PANEL	108	19	ROOF
C22	13	PANEL	109	19	ROOF
C23	7	MAIN	110	19	ROOF
C25	8	MAIN	111	16	ROOF
C26	9	MAIN	112	16	ROOF
C28	11	PANEL	113	16	ROOF
C32	11	MAIN	114	16	ROOF
C33	11	CHASSIS	115	18	ROOF
C35	14	PANEL	116	18	ROOF
C38	14	PANEL	117	18	ROOF
C39	23	PANEL	118	18	ROOF
C40	12	PANEL	119	18	ROOF
C41	14	HOOD	120	16	ROOF
C42	14	HOOD	121	21	ROOF
C43	13	PANEL	123	21	ROOF
C44	13	PANEL	124	21	ROOF
C47	12	MAIN	125	18	ROOF
C53	14	HOOD	126	20	ROOF
C54	12	MAIN	127	20	ROOF
C55	14	HOOD	130	19	ROOF
C56	12	MAIN	131	19	ROOF
C57	10,12,15	PANEL	140	16	ROOF
C58	10,12,13,15,17	PANEL	141	16	ROOF
C59	13	PANEL	142	16	ROOF
C60_61	15	PANEL	143	16	ROOF

TABLE OF CONNECTOR LOCATIONS

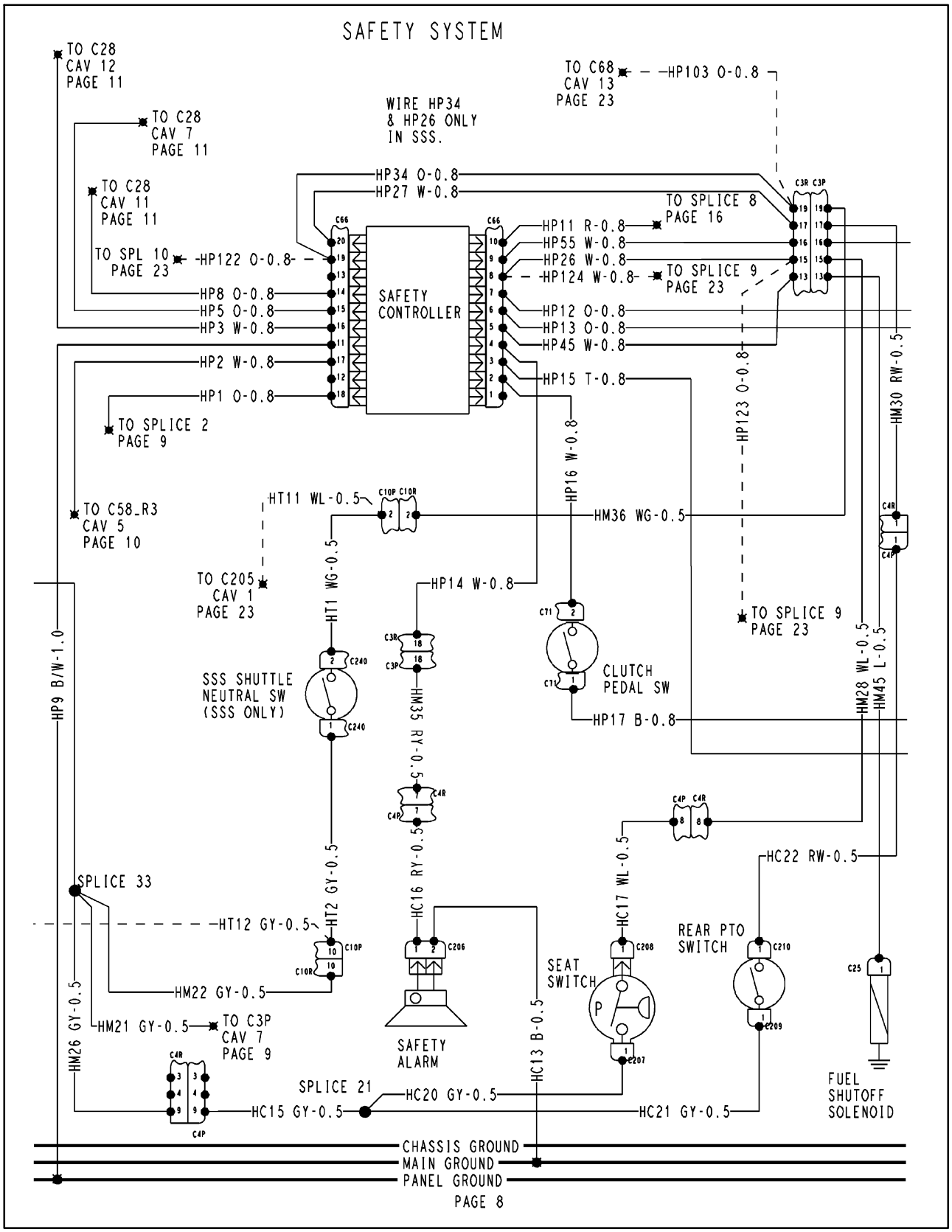
REF. DES.	PAGE LOCATION	HARNESS USED ON		REF. DES.	PAGE LOCATION	HARNESS USED ON
C144	19	ROOF		C209	8	MAIN
C145	19	ROOF		C210	8	MAIN
C200	7	CHASSIS		C220	11	MAIN
C201	23	MAIN		C225	25	CHASSIS
C202	23	MAIN		C230P	23	TRANS
				C230R	23	TRANS
C203	23	MAIN		C240	8	MAIN
C204	23	MAIN		C500	10	MAIN
C205	23	MAIN		C501	10	MAIN
C206	8	MAIN		C502	23	JUMPER
C207	8	MAIN				
C208	8	MAIN				

TABLE OF FUSES

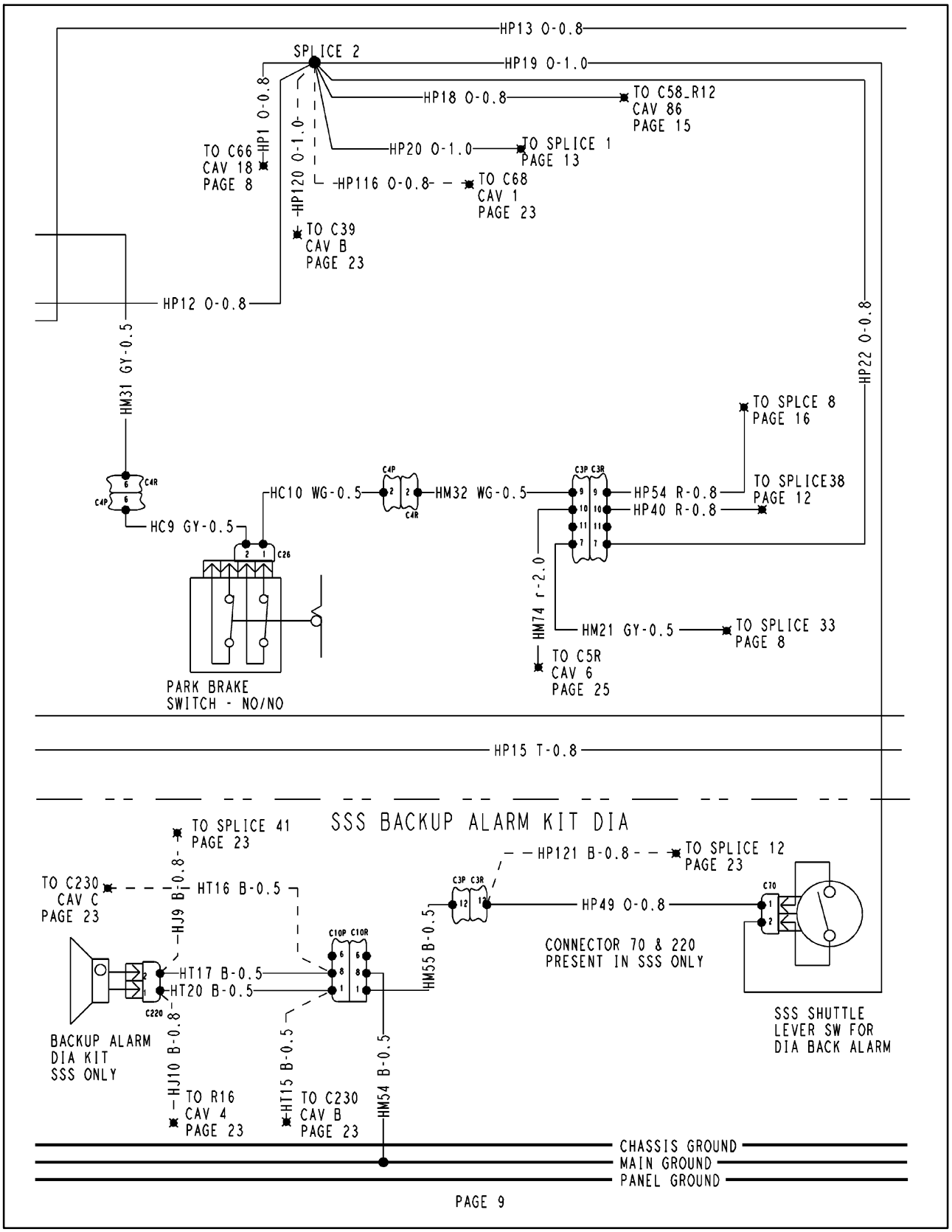
FUSE ID	PAGE LOCATION	CIRCUIT IDENTIFICATION
1	12	SW B+
2	12	SW B+
3	10	SW B+
4	10	IGNITION
5	12	UNSW B+
6	15	TRAILER SOCKET
22	17	RADIO/DOME LIGHT
23	17	RADIO
24	17	HVAC
25	17	BEACON/AUX POWER
26	17	WIPER SYSTEM
27	17	WORK LIGHTS
28	17	CAB POWER
BATTERY	7	BATTERY


CHARGING SYSTEM
HM1 W-2.0
TO C2P
CAV W
PAGE 10
STARTER
MOTOR
TO SPLICE 20
PAGE 24
HM5 G-3.0
C1R
C1P
ALTERNATOR DIODE
C23
HM8 LGR-0.5
C3P
C3R
HP39 DB-0.8
TO C28
CAV 6
PAGE 11
BC4 G-0.5
BC3 R-0.8
HM3 r-5.0
HM9 G-0.5
HM20 GY-0.5
C200
MAIN FUSE
40A
HM10 B-0.5
TO C3P
CAV 27
PAGE 11
TO C205
CAV 2
PAGE 23
TO C230
CAV A
PAGE 23
C10
C11
L
G
P
BC2 R-32
ALTERNATOR
HT18 GY-0.5
HT19 GY-0.5
HM4 r-5.0
HM2 B-0.5
BATTERY
TO C2P
CAV S
PAGE 24
HT12 GY-0.5
SPLICE 32
BC1 B-32
RING TERMINAL 3
FRAME RAIL
CHASSIS GROUND
MAIN GROUND
PANEL GROUND
PAGE 7

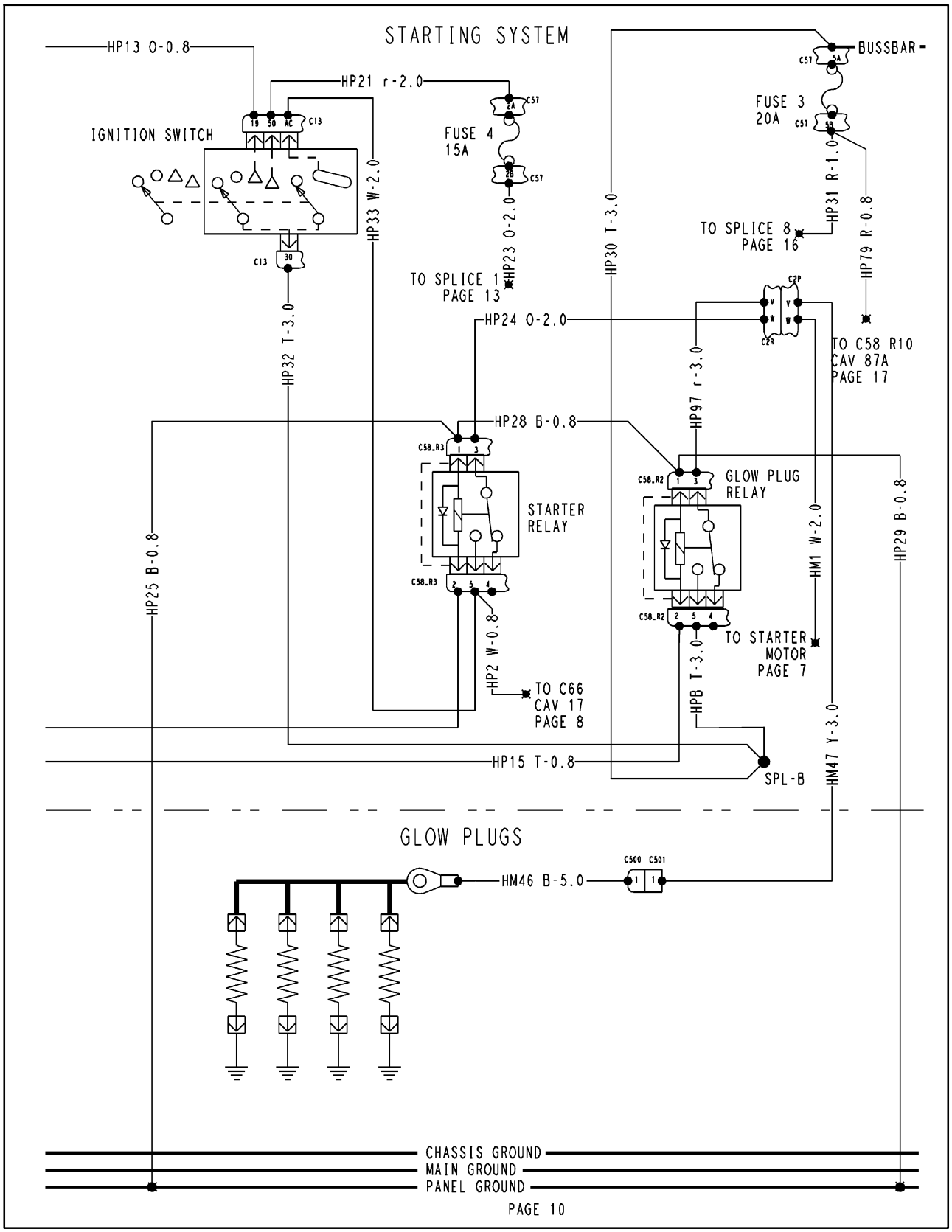
7


SAFETY SYSTEM
TO C28 CAV 12 PAGE 11
TO C28 CAV 7 PAGE 11
TO C28 CAV 11 PAGE 11
TO SPL 10 PAGE 23
WIRE HP34 & HP26 ONLY IN SSS.
TO C68 CAV 13 PAGE 23
HP103 O-0.8
HP34 O-0.8
HP27 W-0.8
HP122 O-0.8
HP8 O-0.8
HP5 O-0.8
HP3 W-0.8
HP2 W-0.8
HP1 O-0.8
SAFETY CONTROLLER
HP11 R-0.8
HP55 W-0.8
HP26 W-0.8
HP124 W-0.8
HP12 O-0.8
HP13 O-0.8
HP45 W-0.8
HP15 T-0.8
TO SPLICE 8 PAGE 16
TO SPLICE 9 PAGE 23
HP123 O-0.8
HM30 RW-0.5
TO SPLICE 2 PAGE 9
HP16 W-0.8
HT11 WL-0.5
HM36 WG-0.5
TO C58_R3 CAV 5 PAGE 10
TO C205 CAV 1 PAGE 23
HT1 WG-0.5
HP14 W-0.8
HM35 RY-0.5
HC16 RY-0.5
SSS SHUTTLE NEUTRAL SW (SSS ONLY)
CLUTCH PEDAL SW
HP17 B-0.8
HM28 WL-0.5
HM45 L-0.5
HP9 B/W-1.0
HT2 GY-0.5
HC17 WL-0.5
HC22 RW-0.5
SPLICE 33
HT12 GY-0.5
HM22 GY-0.5
HM21 GY-0.5
TO C3P CAV 7 PAGE 9
HM26 GY-0.5
SAFETY ALARM
SEAT SWITCH
REAR PTO SWITCH
HC13 B-0.5
SPLICE 21
HC20 GY-0.5
HC15 GY-0.5
HC21 GY-0.5
FUEL SHUTOFF SOLENOID
CHASSIS GROUND
MAIN GROUND
PANEL GROUND
PAGE 8

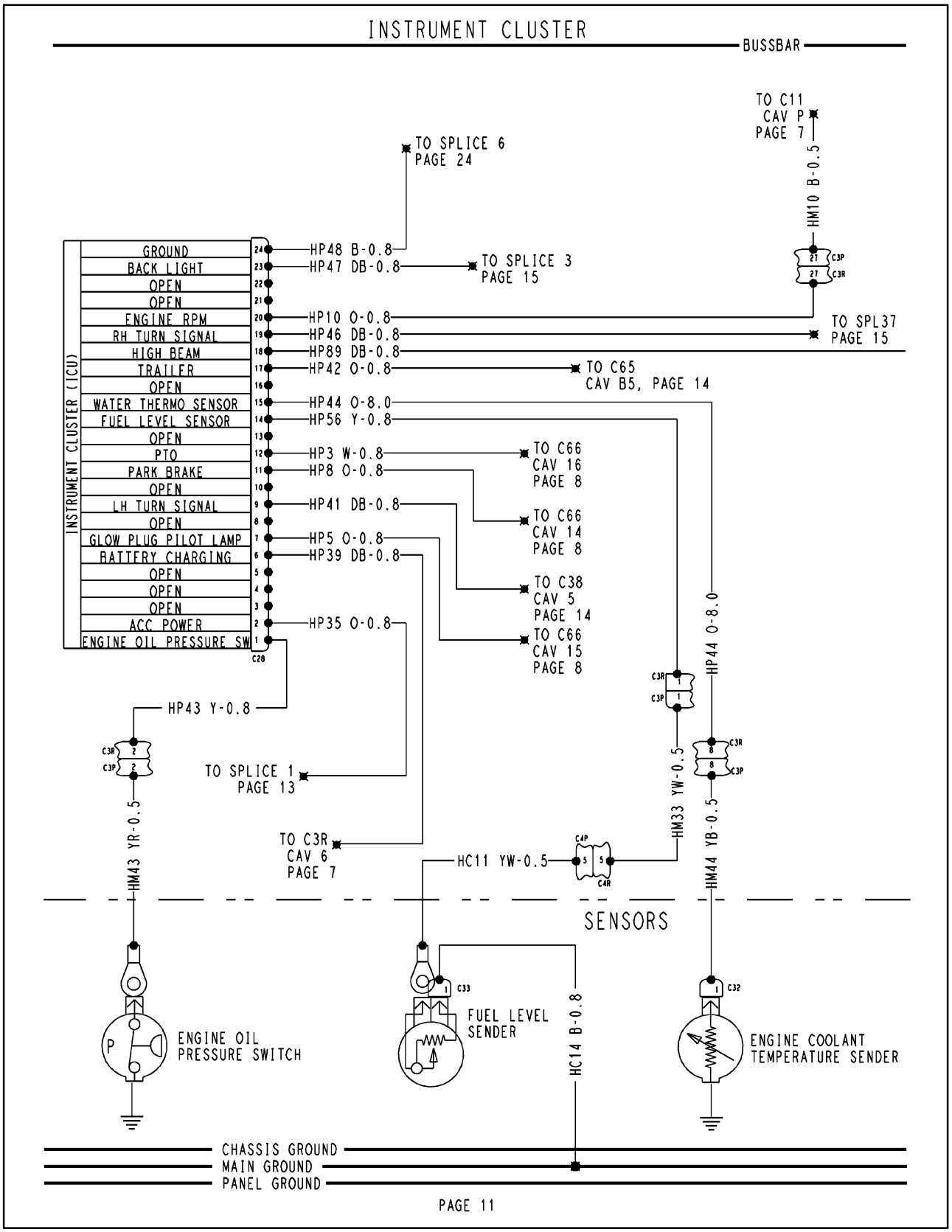
8


HP13 O-0.8
SPLICE 2
HP19 O-1.0
HP18 O-0.8
TO C58_R12
CAV 86
PAGE 15
HP1 O-0.8
TO C66
CAV 18
PAGE 8
HP120 O-1.0
HP20 O-1.0
TO SPLICE 1
PAGE 13
HP116 O-0.8
TO C68
CAV 1
PAGE 23
TO C39
CAV B
PAGE 23
HP12 O-0.8
HP22 O-0.8
HM31 GY-0.5
TO SPLCE 8
PAGE 16
C4R
C4P
HC10 WG-0.5
C4P
HM32 WG-0.5
C3P C3R
HP54 R-0.8
HP40 R-0.8
TO SPLICE38
PAGE 12
HC9 GY-0.5
C26
HM74 r-2.0
HM21 GY-0.5
TO SPLICE 33
PAGE 8
TO C5R
CAV 6
PAGE 25
PARK BRAKE
SWITCH - NO/NO
HP15 T-0.8
SSS BACKUP ALARM KIT DIA
TO SPLICE 41
PAGE 23
HP121 B-0.8
TO SPLICE 12
PAGE 23
TO C230
CAV C
PAGE 23
HT16 B-0.5
HJ9 B-0.8
C3P C3R
C10P C10R
HP49 O-0.8
C70
HM55 B-0.5
HT17 B-0.5
HT20 B-0.5
C220
CONNECTOR 70 & 220
PRESENT IN SSS ONLY
BACKUP ALARM
DIA KIT
SSS ONLY
SSS SHUTTLE
LEVER SW FOR
DIA BACK ALARM
HJ10 B-0.8
TO R16
CAV 4
PAGE 23
HT15 B-0.5
TO C230
CAV B
PAGE 23
HM54 B-0.5
CHASSIS GROUND
MAIN GROUND
PANEL GROUND
PAGE 9

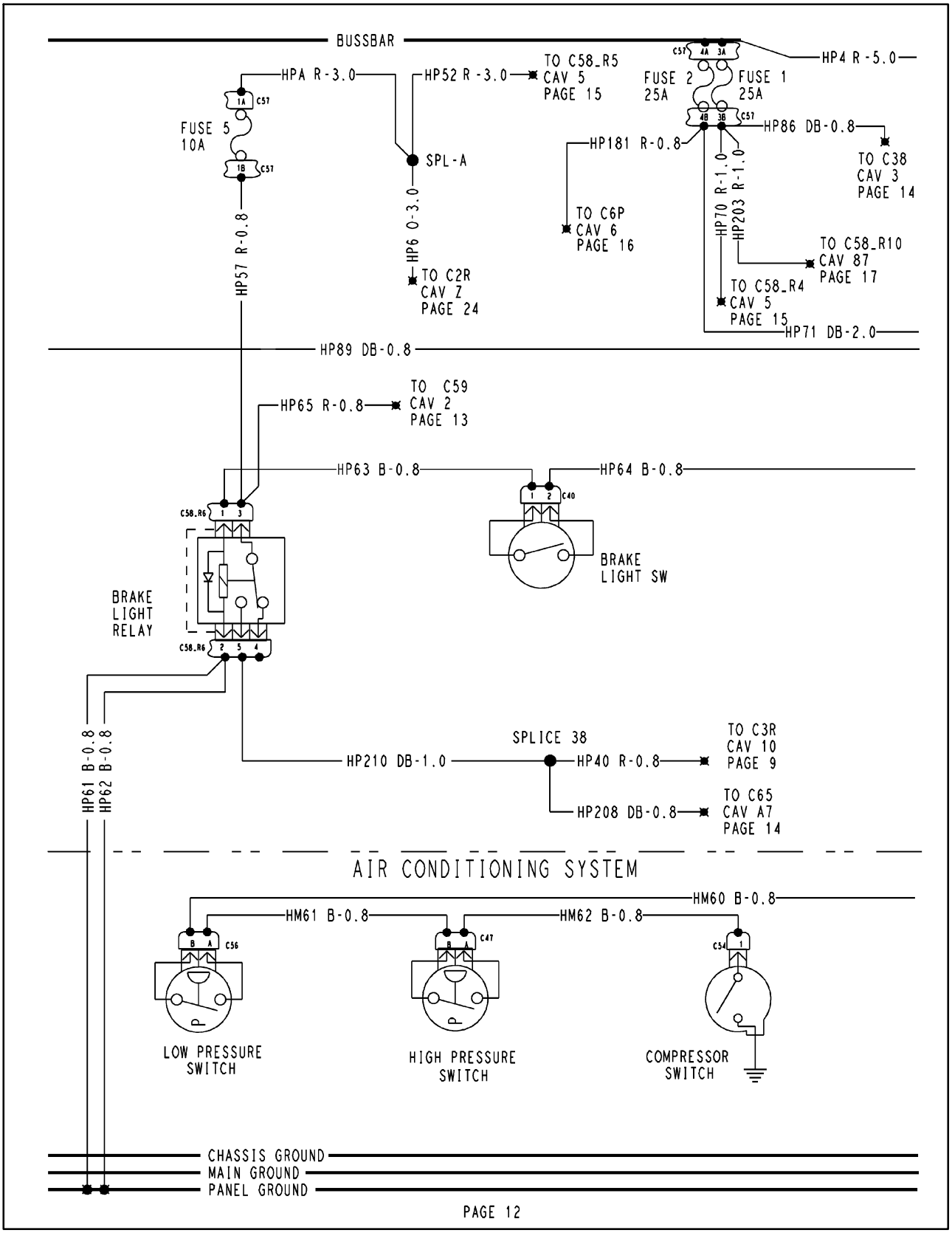
9


STARTING SYSTEM
HP13 O-0.8
HP21 r-2.0
IGNITION SWITCH
19 50 AC
C13
30
HP33 W-2.0
HP32 T-3.0
FUSE 4
15A
2A
2B
C57
HP23 O-2.0
TO SPLICE 1
PAGE 13
BUSSBAR
5A
FUSE 3
20A
5B
HP31 R-1.0
TO SPLICE 8
PAGE 16
HP30 T-3.0
HP79 R-0.8
C2P
C2R
HP24 O-2.0
TO C58 R10
CAV 87A
PAGE 17
HP97 r-3.0
HP28 B-0.8
C58.R3
STARTER
RELAY
C58.R2
GLOW PLUG
RELAY
HP25 B-0.8
HM1 W-2.0
HP29 B-0.8
HP2 W-0.8
TO C66
CAV 17
PAGE 8
TO STARTER
MOTOR
PAGE 7
HPB T-3.0
HP15 T-0.8
SPL-B
HM47 Y-3.0
GLOW PLUGS
HM46 B-5.0
C500 C501
CHASSIS GROUND
MAIN GROUND
PANEL GROUND
PAGE 10

10


INSTRUMENT CLUSTER
BUSSBAR
TO C11
CAV P
PAGE 7
HM10 B-0.5
TO SPLICE 6
PAGE 24
INSTRUMENT CLUSTER (ICU)
GROUND
BACK LIGHT
OPEN
OPEN
ENGINE RPM
RH TURN SIGNAL
HIGH BEAM
TRAILER
OPEN
WATER THERMO SENSOR
FUEL LEVEL SENSOR
OPEN
PTO
PARK BRAKE
OPEN
LH TURN SIGNAL
OPEN
GLOW PLUG PILOT LAMP
BATTERY CHARGING
OPEN
OPEN
OPEN
ACC POWER
ENGINE OIL PRESSURE SW
C28
HP48 B-0.8
HP47 DB-0.8
HP10 O-0.8
HP46 DB-0.8
HP89 DB-0.8
HP42 O-0.8
HP44 O-8.0
HP56 Y-0.8
HP3 W-0.8
HP8 O-0.8
HP41 DB-0.8
HP5 O-0.8
HP39 DB-0.8
HP35 O-0.8
HP43 Y-0.8
TO SPLICE 3
PAGE 15
TO SPL37
PAGE 15
TO C65
CAV B5, PAGE 14
TO C66
CAV 16
PAGE 8
TO C66
CAV 14
PAGE 8
TO C38
CAV 5
PAGE 14
TO C66
CAV 15
PAGE 8
C3R
C3P
C27
HM33 YW-0.5
HM44 YB-0.5
HM43 YR-0.5
TO SPLICE 1
PAGE 13
TO C3R
CAV 6
PAGE 7
HC11 YW-0.5
C4P
C4R
SENSORS
ENGINE OIL
PRESSURE SWITCH
C33
FUEL LEVEL
SENDER
HC14 B-0.8
C32
ENGINE COOLANT
TEMPERATURE SENDER
CHASSIS GROUND
MAIN GROUND
PANEL GROUND
PAGE 11

11


BUSSBAR
HPA R-3.0
HP52 R-3.0
TO C58_R5
CAV 5
PAGE 15
HP4 R-5.0
FUSE 2
25A
FUSE 1
25A
FUSE 5
10A
SPL-A
HP181 R-0.8
HP86 DB-0.8
TO C38
CAV 3
PAGE 14
HP70 R-1.0
HP203 R-1.0
TO C6P
CAV 6
PAGE 16
TO C58_R10
CAV 87
PAGE 17
HP57 R-0.8
HP6 O-3.0
TO C2R
CAV Z
PAGE 24
TO C58_R4
CAV 5
PAGE 15
HP71 DB-2.0
HP89 DB-0.8
TO C59
CAV 2
PAGE 13
HP65 R-0.8
HP63 B-0.8
HP64 B-0.8
BRAKE
LIGHT SW
BRAKE
LIGHT
RELAY
HP61 B-0.8
HP62 B-0.8
SPLICE 38
HP210 DB-1.0
HP40 R-0.8
TO C3R
CAV 10
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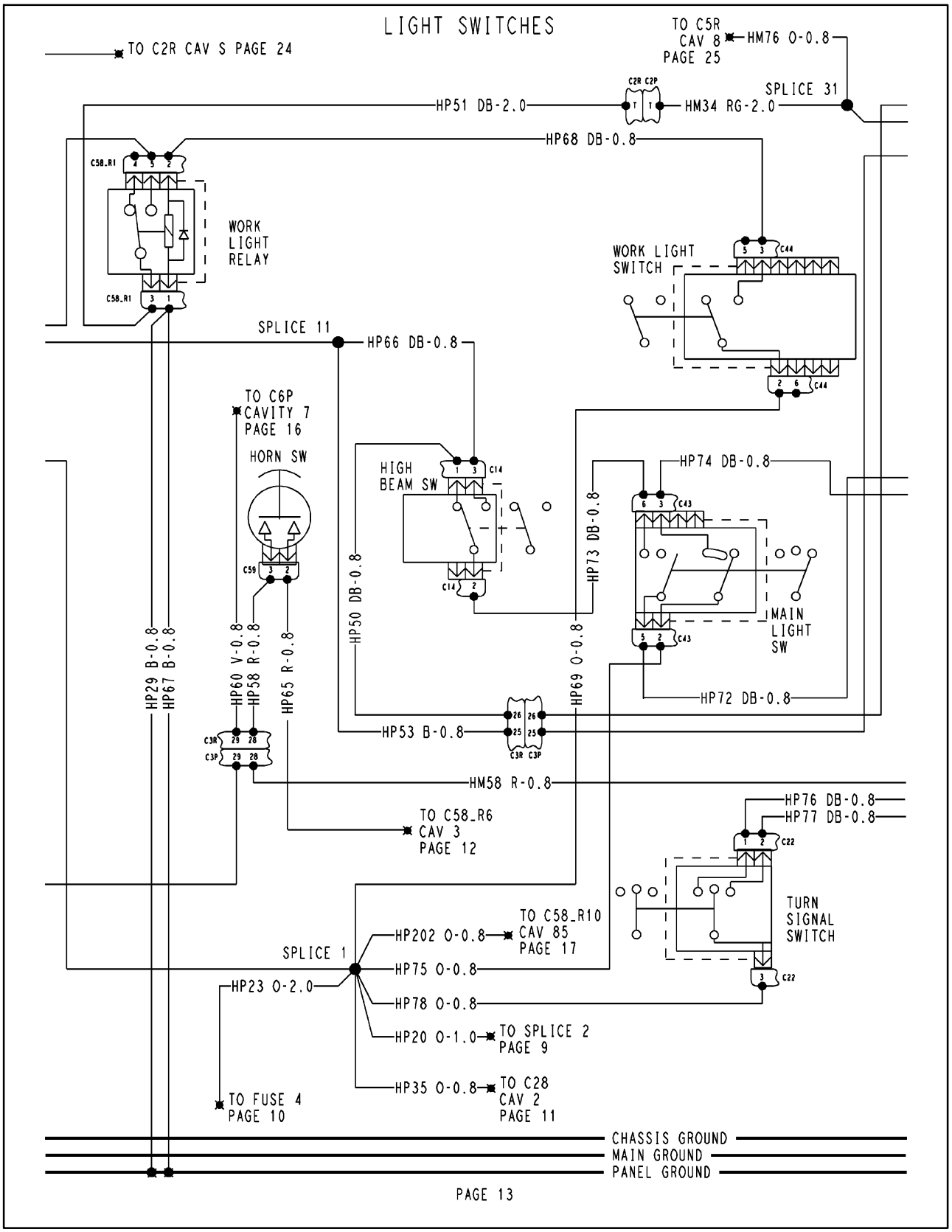
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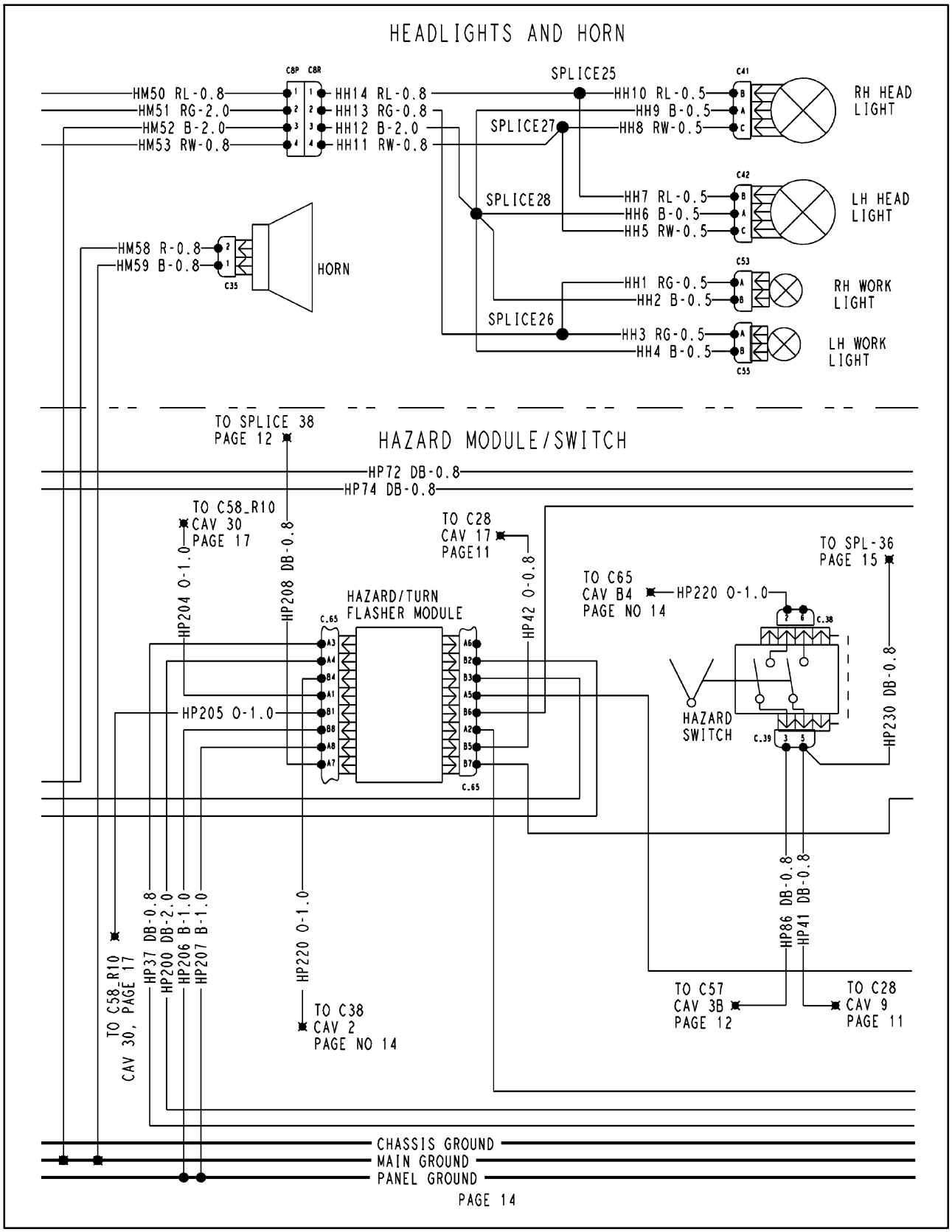
HEADLIGHTS AND HORN
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HH13 RG-0.8
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HH11 RW-0.8
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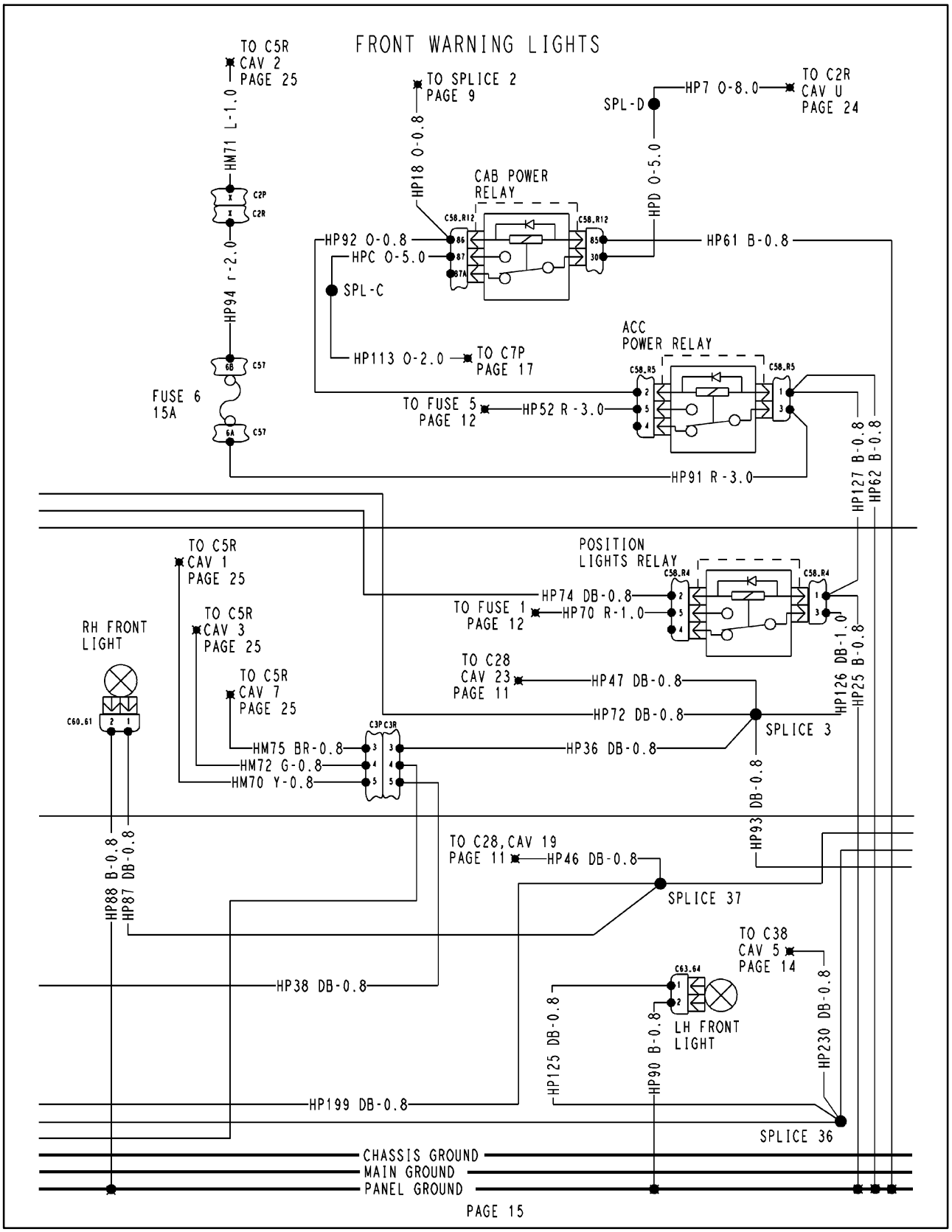
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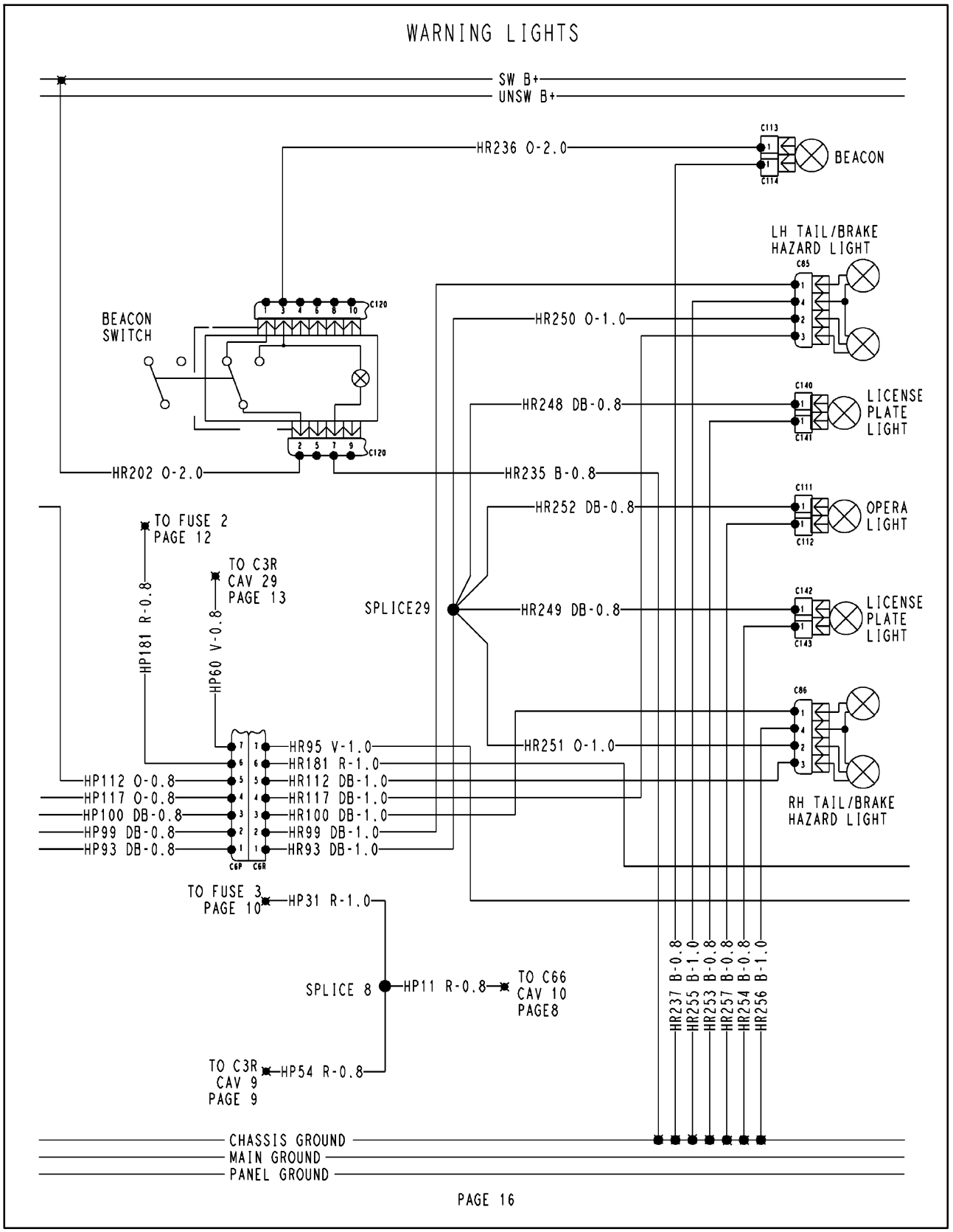
WARNING LIGHTS
SW B+
UNSW B+
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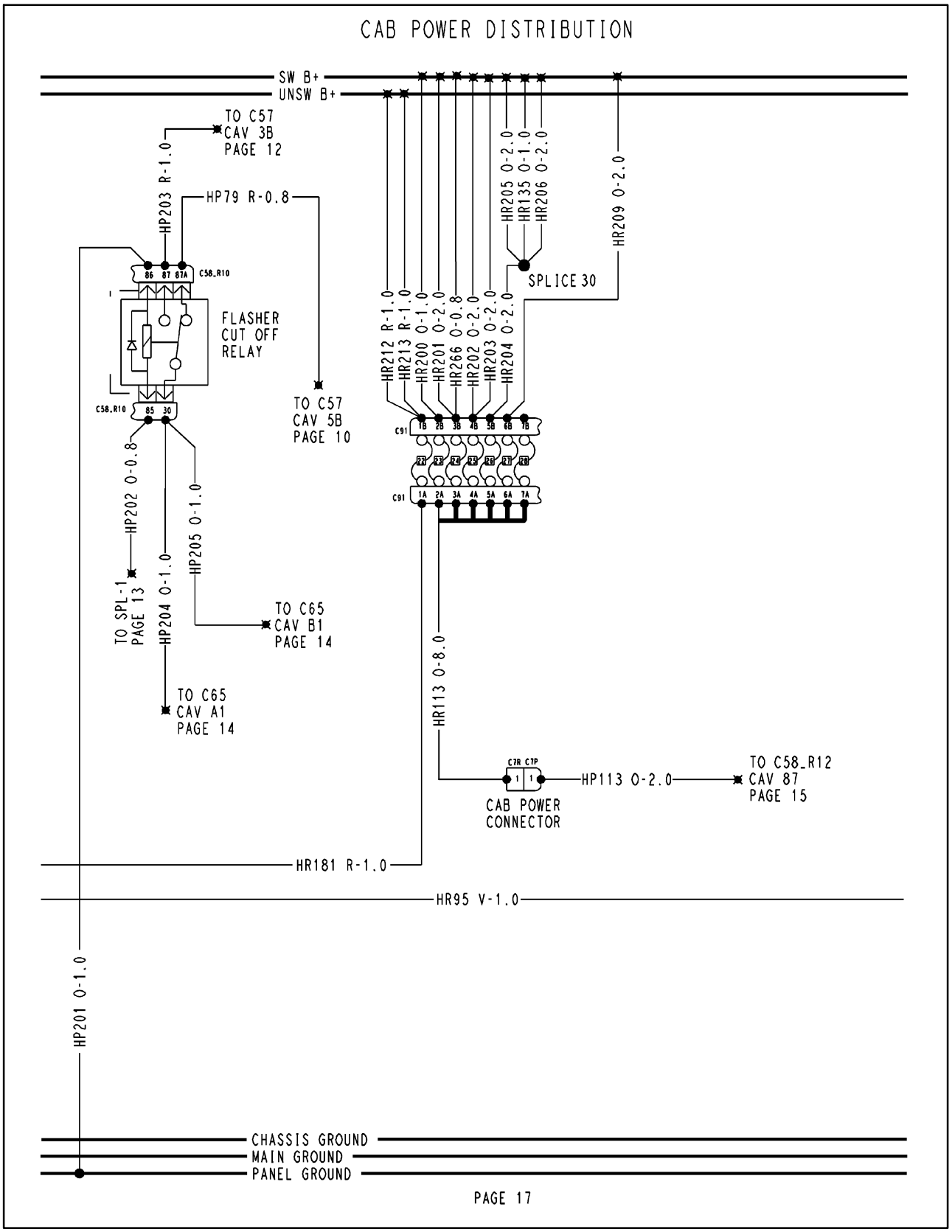
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HR95 V-1.0
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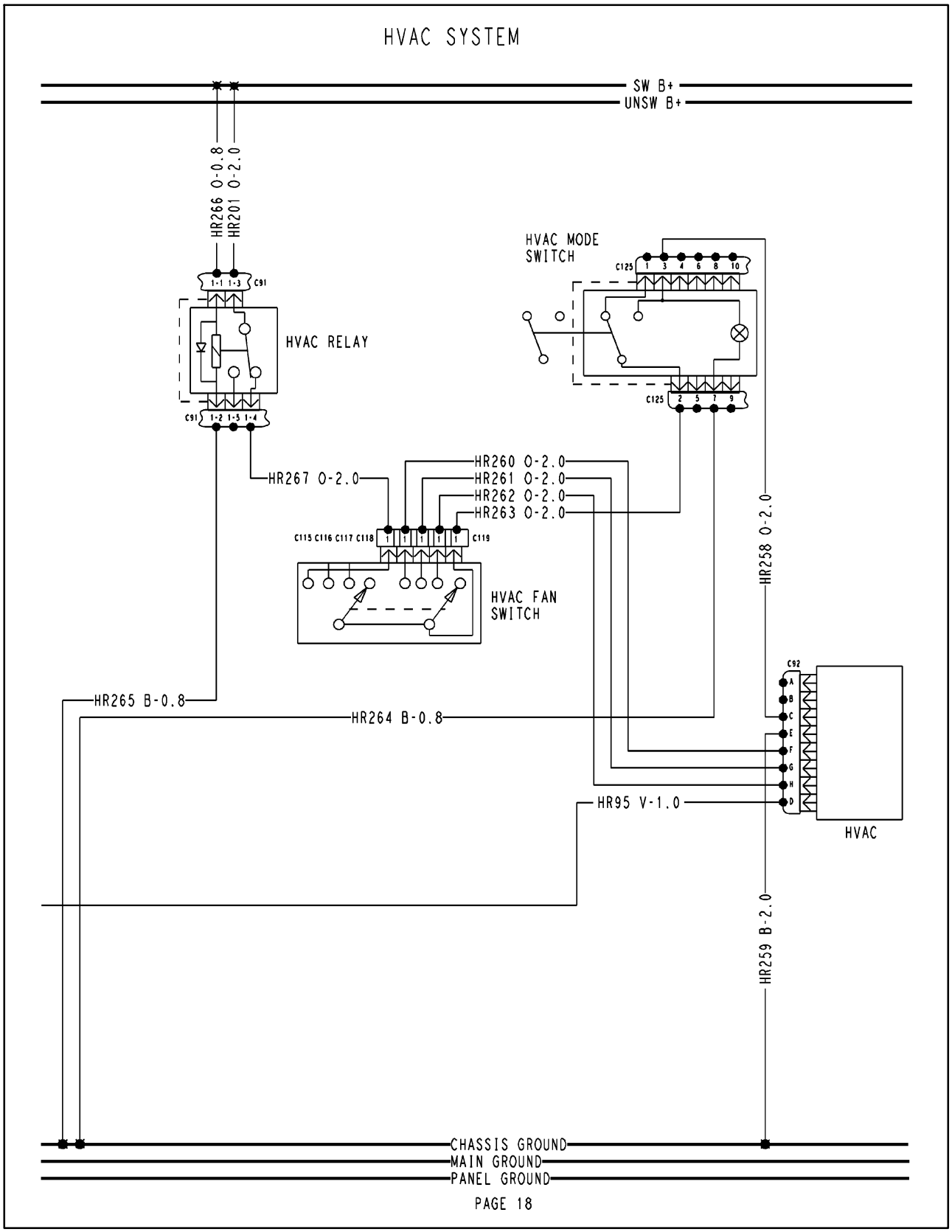
HVAC SYSTEM
SW B+
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HR266 O-0.8
HR201 O-2.0
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HVAC RELAY
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HR267 O-2.0
HR260 O-2.0
HR261 O-2.0
HR262 O-2.0
HR263 O-2.0
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HR264 B-0.8
HR95 V-1.0
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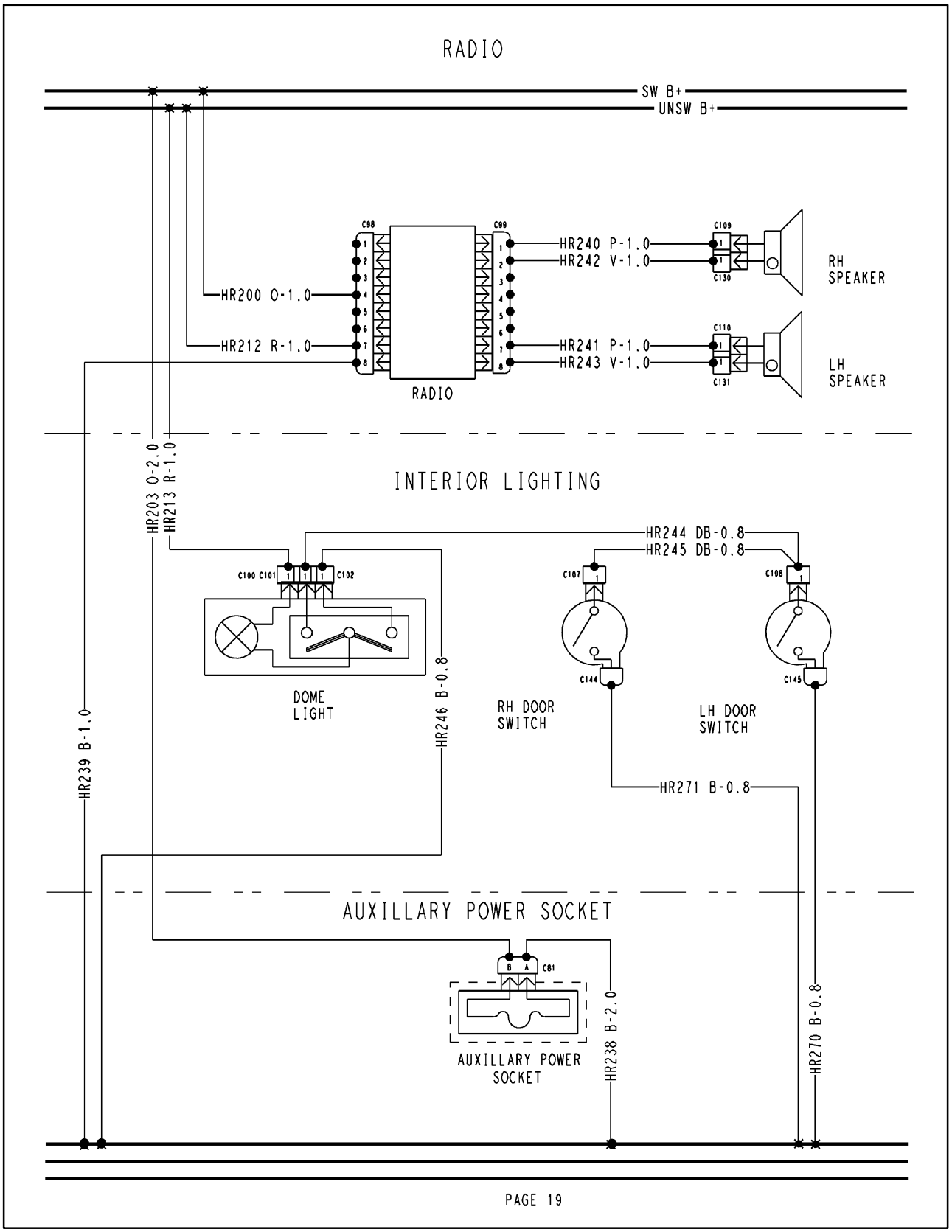
RADIO
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HR242 V-1.0
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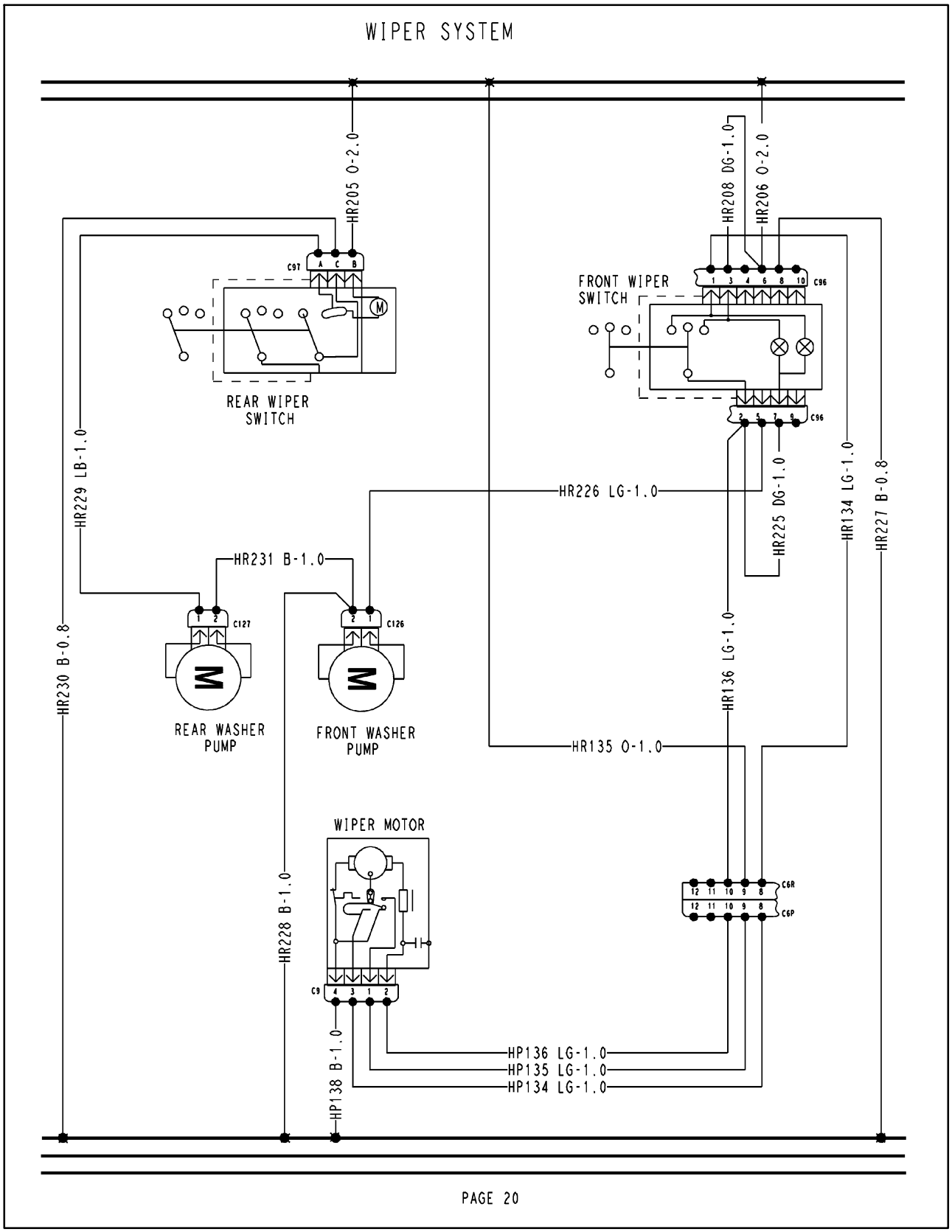
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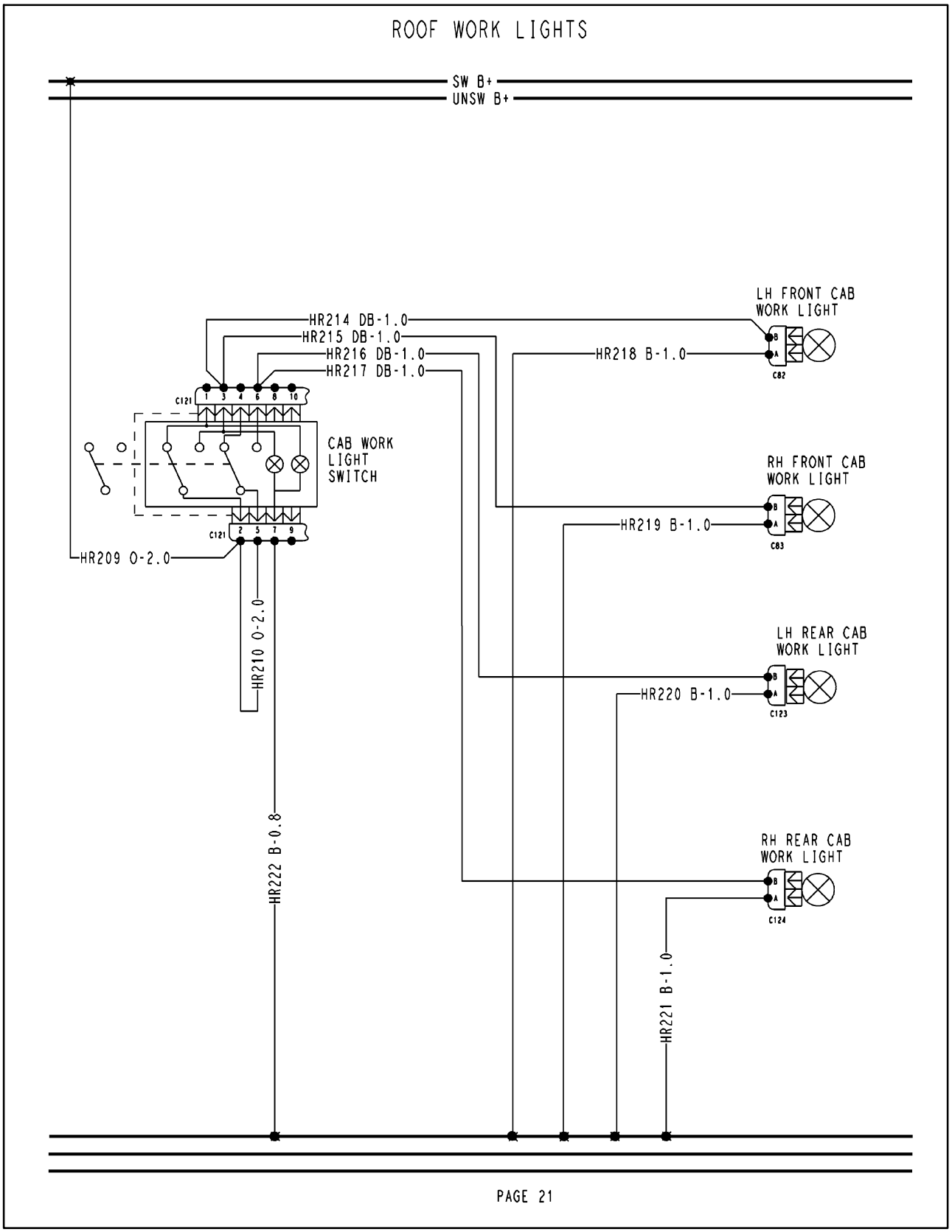
ROOF WORK LIGHTS
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UNSW B+
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HR215 DB-1.0
HR216 DB-1.0
HR217 DB-1.0
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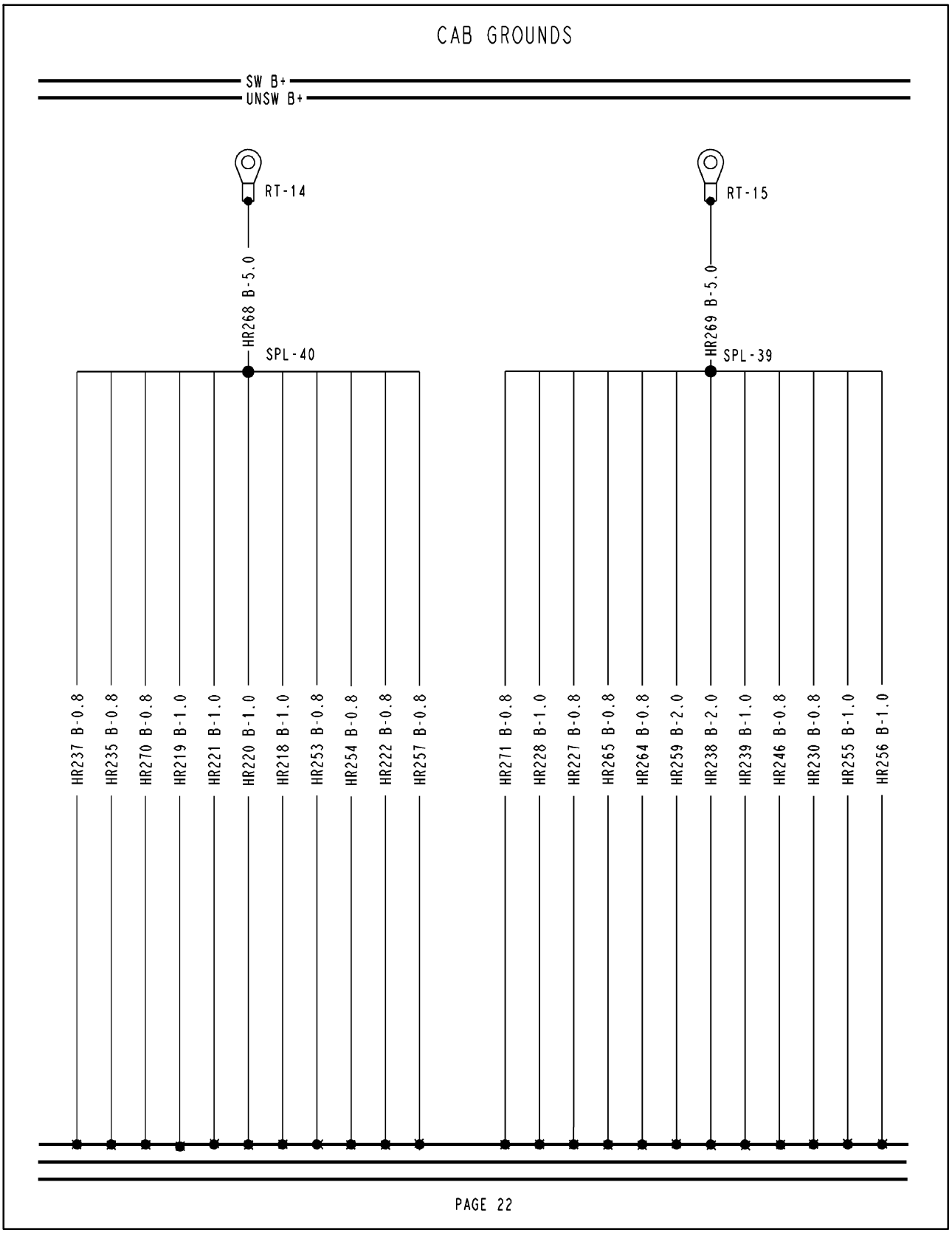
CAB GROUNDS
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SPL-40
RT-15
HR269 B-5.0
SPL-39
HR237 B-0.8
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HR270 B-0.8
HR219 B-1.0
HR221 B-1.0
HR220 B-1.0
HR218 B-1.0
HR253 B-0.8
HR254 B-0.8
HR222 B-0.8
HR257 B-0.8
HR271 B-0.8
HR228 B-1.0
HR227 B-0.8
HR265 B-0.8
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HR238 B-2.0
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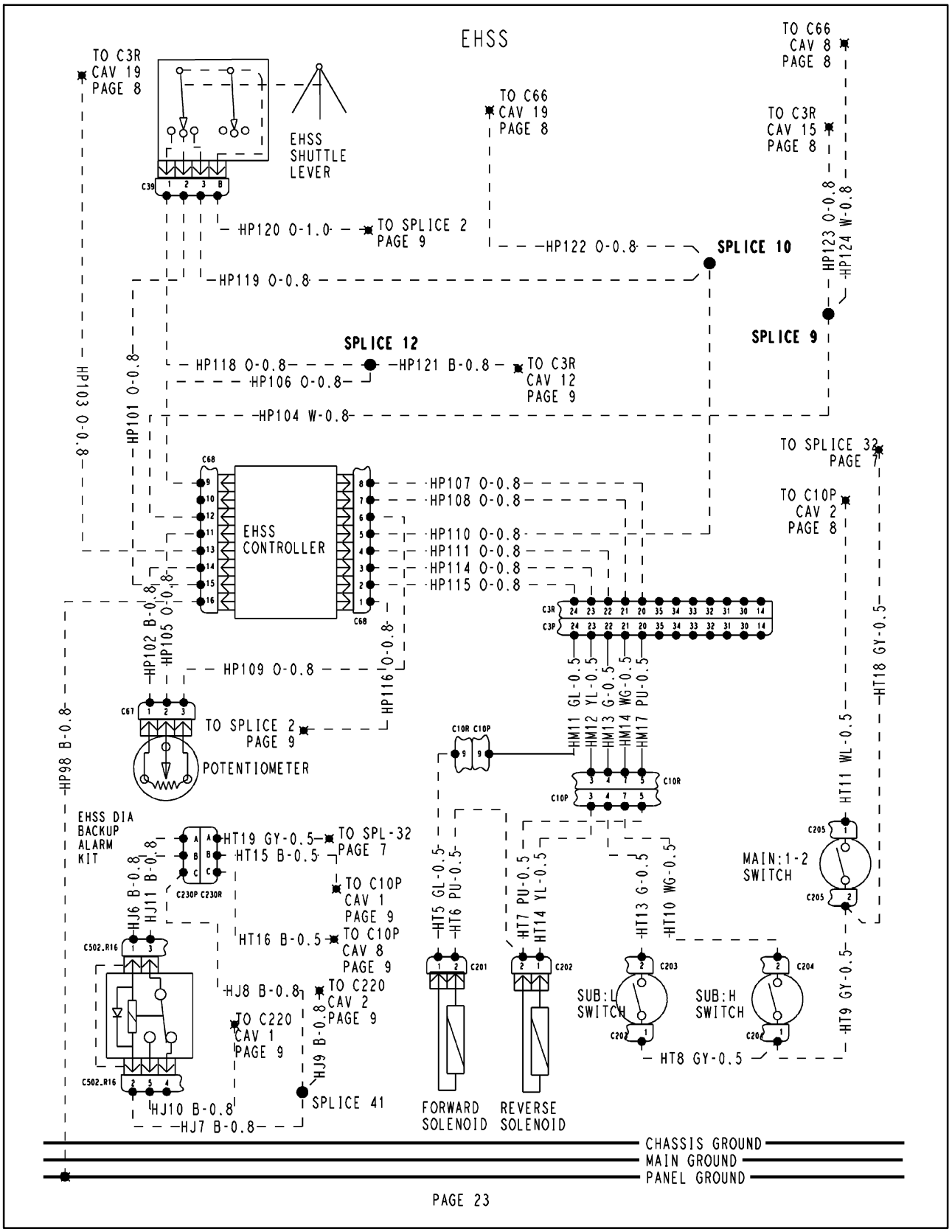
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HP105 O-0.8
HP109 O-0.8
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HM13 G-0.5
HM14 WG-0.5
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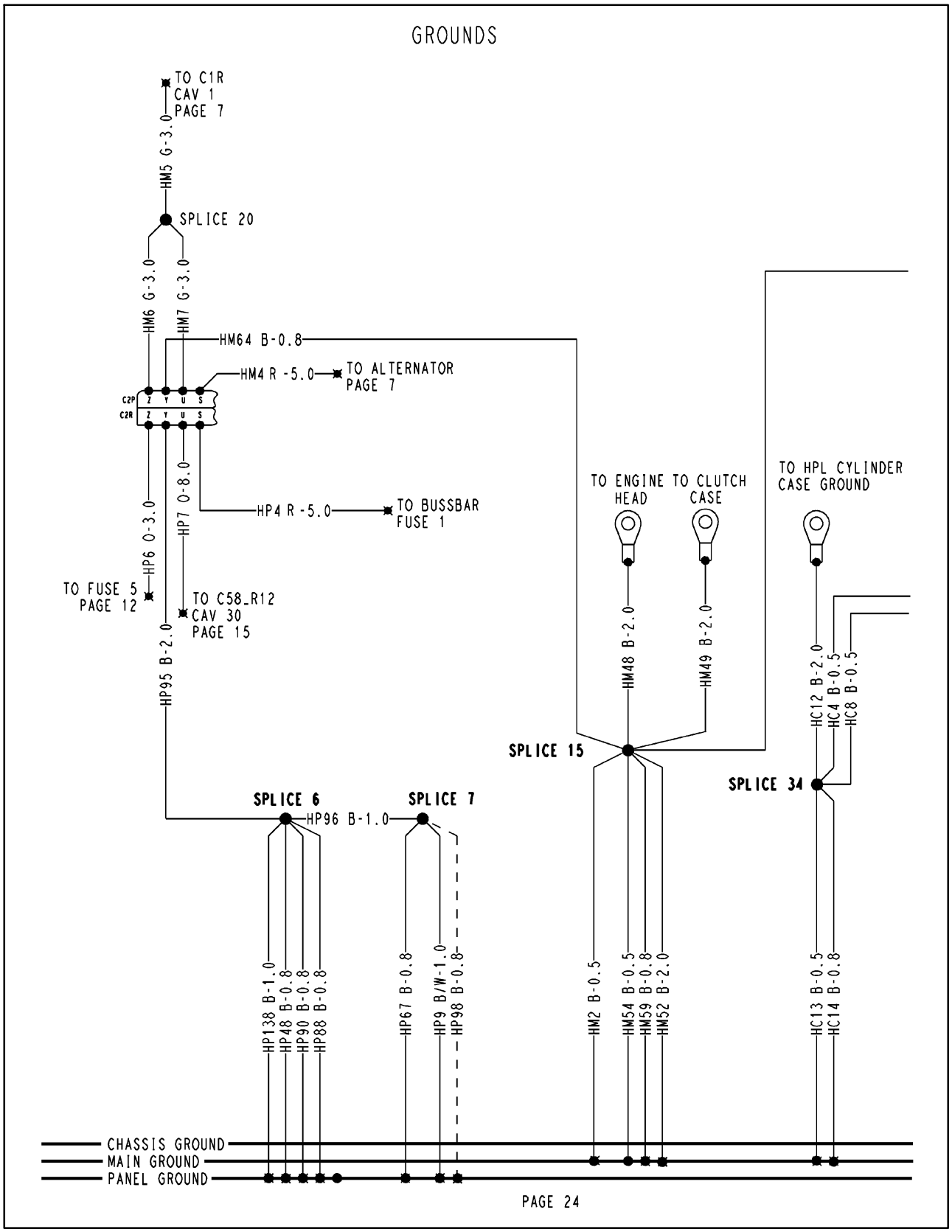
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HM7 G-3.0
HM64 B-0.8
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HP7 O-8.0
HP4 R -5.0
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HP96 B-1.0
HP138 B-1.0
HP48 B-0.8
HP90 B-0.8
HP88 B-0.8
HP67 B-0.8
HP9 B/W-1.0
HP98 B-0.8
HM2 B-0.5
HM54 B-0.5
HM59 B-0.8
HM52 B-2.0
HC13 B-0.5
HC14 B-0.8
CHASSIS GROUND
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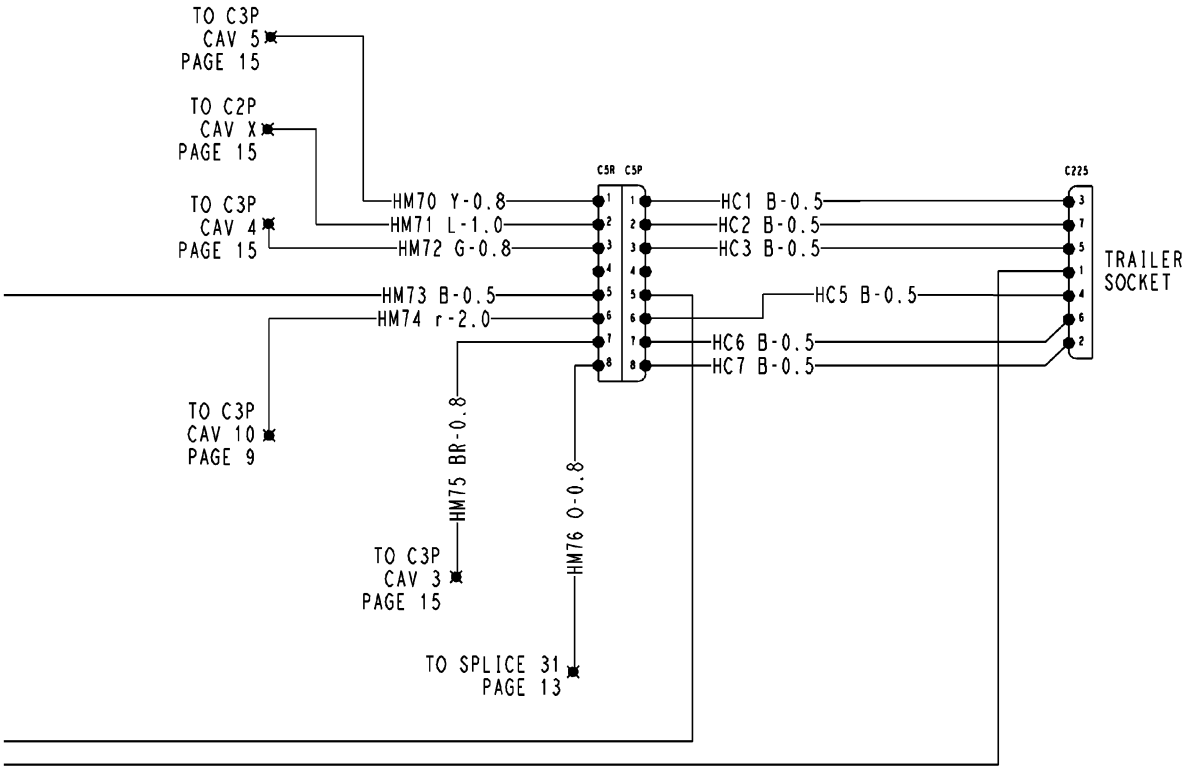
TRAILER SOCKET



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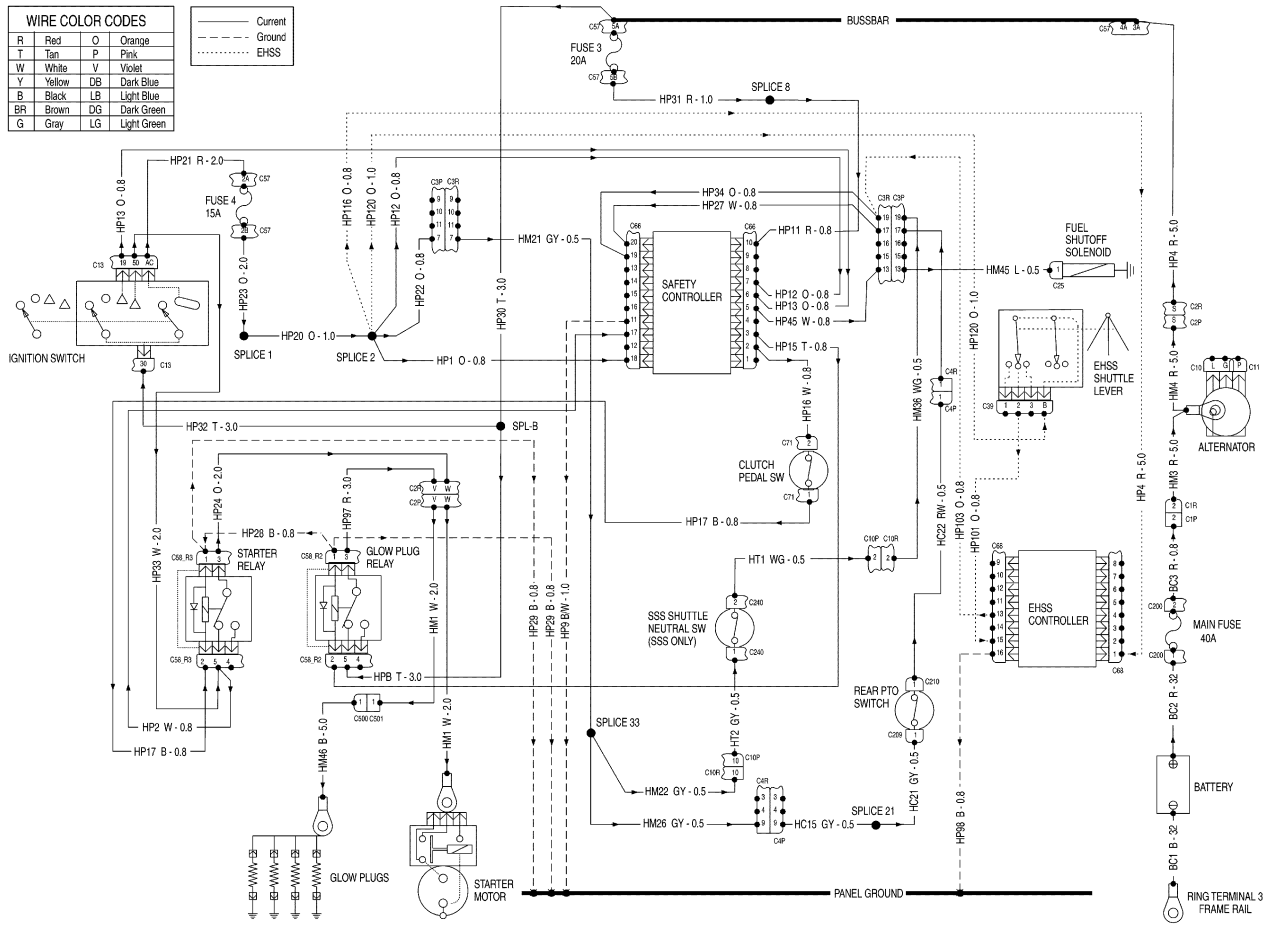
STARTING CIRCUIT (OPERATOR PRESENT or NOT PRESENT)



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STARTING CIRCUIT (OPERATOR PRESENT or NOT PRESENT)

NOTE: *The starting circuit is shown with:*

- *Clutch / Inching pedal* ***fully depressed***
- *EHSS / SSS shuttle lever in "****Neutral****" position*
- *Rear PTO* ***"Off"***

NOTE: *The seat switch and park brake are unrelated to the safety start system of the tractor*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.

2. From the fusible link wire current flows to terminal "30" of the key switch .

3. When the key switch is in the "Start" position current crosses from terminal "30" to the "AC", "50" and "19" terminals.

Key Switch Terminals

Terminal "AC"

1. Current flows from the "AC" terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

2. Current passes through the #4 fuse to:
   - Terminal "B" of the "EHSS" or input side of "SSS" shuttle switch
   - Terminal # 1 of the EHSS Controller
   - Terminals # 7 and # 18 of the Safety controller
   - Rear PTO safety switch

Terminal # 50

1. Current flows from the #50 terminal of the key switch to terminal #5 of the starter relay and terminal #17 of the safety controller.

Terminal #19

1. Current flows from the #19 terminal of the key switch and travels to the # 6 of the safety controller.

Safety Switches

- When the **"EHSS" shuttle switch** is in the "Neutral" position current crosses over from the "B" terminal to the # 2 terminal. From the # 2 terminal of the shuttle switch, current travels to the # 15 terminal of the EHSS controller.
- When the **"SSS" shuttle switch** is in the "Neutral" position the switch closes sending current to terminal # 19 of the safety controller.
- When the rear PTO is in the "OFF" position, the **PTO switch** closes allowing current to travel to terminal #20 of the safety controller.
- When the clutch pedal is depressed, the **clutch switch** closes, sending current to terminal # 2 (coil side) of the starter relay.

Ground Circuits

Ground source for the starting circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following terminals:

- Glow plug relay
- Starter relay
- Terminal # 11 of the safety controller
- Terminal # 16 of the EHSS controller

Safety Controller Functions

Controller Inputs (+)

- Terminal # 6 – From terminal # 19 of the key switch
- Terminal # 7 – From Fuse # 4
- Terminal # 10 – From Fuse # 3
- Terminal # 17 – From Terminal # 50 of the key switch
- Terminal # 18 – From Fuse # 4
- Terminal #19 – From shuttle switches
- Terminal # 20 – From rear PTO switch

Controller Outputs (+)

- Terminal # 2 – To the clutch pedal switch
- Terminal # 3 – To glow plug relay, coil side
- Terminal # 5 – To fuel shutoff solenoid

EHSS Controller Functions

Controller Inputs (+)

- Terminal # 1 – From Fuse # 4
- Terminal # 15 – From the EHSS shuttle switch

Controller Outputs (+)

- Terminal # 13 – To terminal # 19 of the safety controller

Relay Functions

Starter Relay

The starter relay is energized by current provided when the clutch switch is closed. When the relay is energized, the contacts close, sending current to the starter motor, causing the engine to rotate.

Glow Plug Relay

The glow plug relay is energized by current provided by terminal # 3 of the safety controller. When the relay is energized, the contacts close, sending current to the glow plugs, causing the glow plugs to heat when the engine is in the start mode.

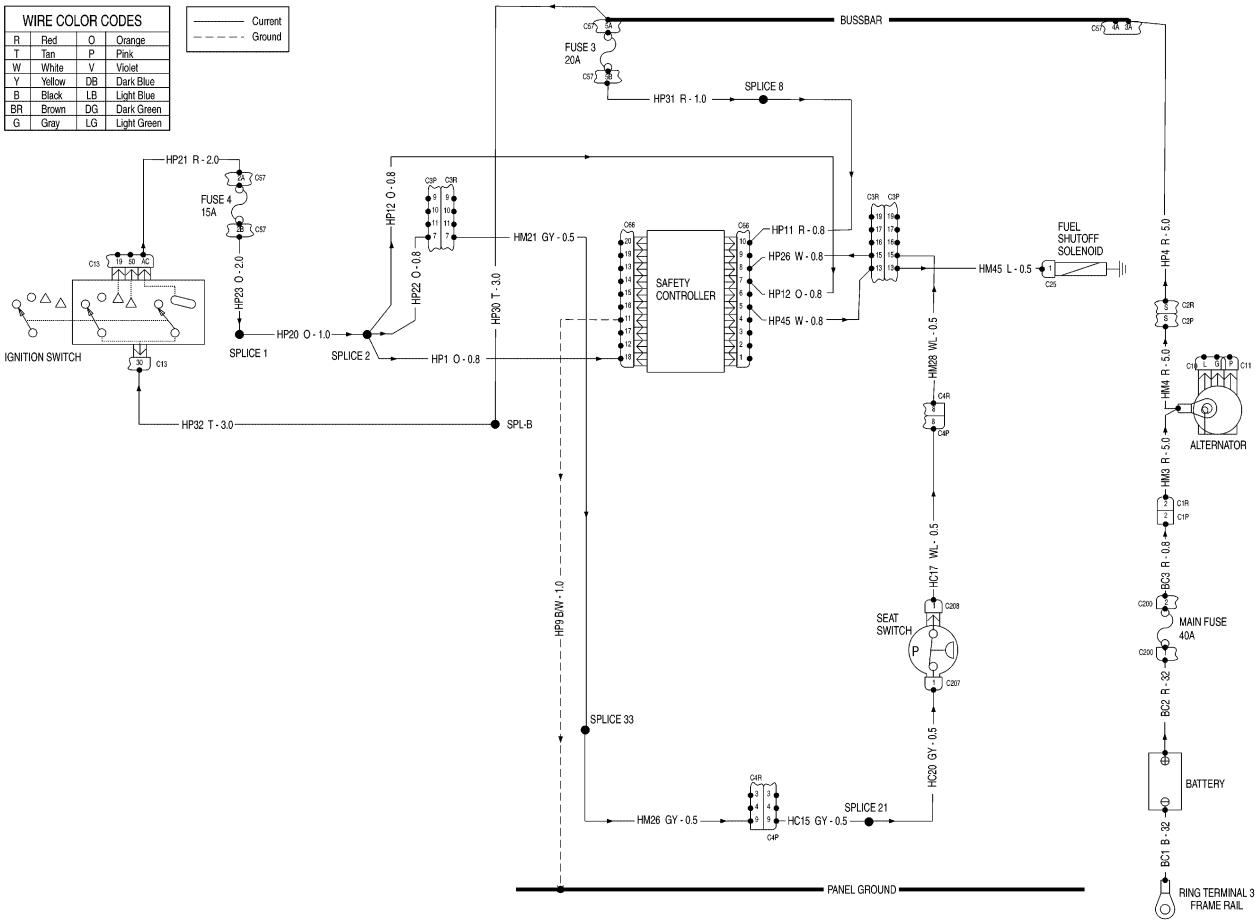
Fuel Shutoff Solenoid

The fuel shutoff solenoid is provided with current from terminal # 5 from the safety controller. This current causes the solenoid to open, which allows fuel to flow to the injection pump. When the engine is rotating and injection pump delivering fuel the engine should start.

STARTING CIRCUIT (OPERATOR PRESENT or NOT PRESENT) TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Starter will not energize.	Insufficient battery charge	Recharge or replace battery
	Blown 40-amp fusible link	Replace 40-amp fusible link
	Faulty ignition switch	Check switch, replace if necessary
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Blown #3, 20-amp fuse	Replace 20-amp fuse
	Faulty shuttle safety switch	Check switch, replace if necessary
	Faulty operator safety controller	Check controller, replace if necessary
	Faulty EHSS controller	Check controller, replace if necessary
	Faulty Rear PTO safety switch	Check switch, replace if necessary
	Faulty clutch pedal safety switch	Check switch, replace if necessary
	Faulty PTO safety start relay	Check relay, replace if necessary
	Faulty starter relay	Check relay, replace if necessary
	Faulty Starter motor	Check starter, replace if necessary
Starter will energize but engine will not start	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Blown #3, 20-amp fuse	Replace 20-amp fuse
	Faulty operator safety controller	Check controller, replace if necessary
	Faulty fuel shutoff solenoid	Check solenoid, replace if necessary

SAFE OPERATION (OPERATOR PRESENT)



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SAFE OPERATION (OPERATOR PRESENT)

NOTE: *The safe operation circuit is shown with:*

- *Operator Present*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.
2. Current passes through the #4 fuse to:
   - Terminals # 7 and # 18 of the Safety controller
   - Seat Switch

Ground Circuits

Ground source for the starting circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following terminals:

- Terminal # 11 of the safety controller

Seat Switch Function

When the operator is in the seat, the seat switch closes, sending current to terminal # 8 of the safety controller.

Safety Controller Functions

Controller Inputs (+)

- Terminal # 7 – From Fuse # 4
- Terminal # 8 – From seat switch
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4

Controller Outputs (+)

- Terminal # 5 – To fuel shutoff solenoid

Fuel Shutoff Solenoid

Terminal #5 of the safety controller provides current to fuel shutoff solenoid.

This current energizes the solenoid, allowing fuel to be delivered to the injection pump and allowing the engine to remain operating.

**SAFE OPERATION (OPERATOR PRESENT)
TROUBLESHOOTING**

CONDITION	POSSIBLE CAUSE	REMEDY
Tractor will not operate with operator present.	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Blown #3, 20-amp fuse	Replace 20-amp fuse
	Faulty operator seat safety switch	Check switch, replace if necessary
	Faulty fuel shutoff relay	Check relay, replace if necessary
	Faulty operator safety controller	Check controller, replace if necessary
	Faulty fuel shutoff solenoid	Check solenoid, replace if necessary

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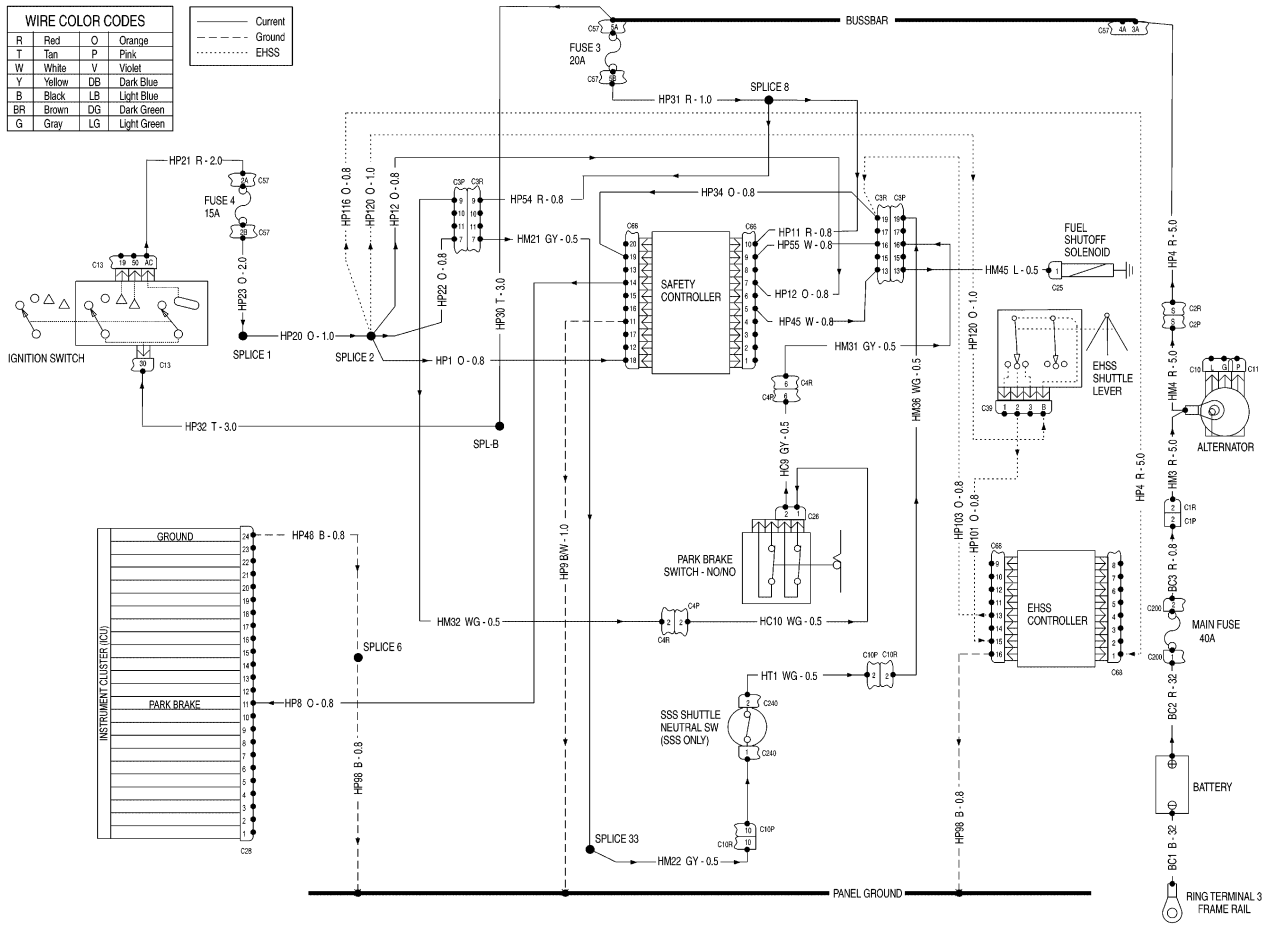
SAFE OPERATION (OPERATOR NOT PRESENT)



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SAFE OPERATION (OPERATOR NOT PRESENT)

NOTE: *The safe operation circuit is shown with:*

- *Operator **NOT** present*
- *Shuttle switch in "**NEUTRAL**" position*
- *Rear PTO **(engaged or not engaged)***
- *Park Brake "**ON**"*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal "30"of the key switch.
3. When the key switch is in the "ACC/RUN " position current crosses from terminal "30" to the "AC" terminal.

Key Switch Terminals

Terminal "AC"

1. Current flows from the "AC" terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.
2. Current passes through the #4 fuse to:
   - Terminals # 7 and # 18 of the Safety controller
   - Terminal "B" of the "EHSS" or input side of "SSS" shuttle switch

Ground Circuits

Ground source for the starting circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following terminals:

- Terminal # 11 of the safety controller

Seat Switch Function

When the operator is NOT in the seat, the seat switch is opens, terminating current at the seat switch.

Shuttle Switch Function

When the "EHSS" or "SSS" shuttle switch is in the "NEUTRAL" position, the shuttle switch, transfers current to terminal # 19 of the safety controller.

Safety Controller Functions

Controller Inputs (+)

- Terminal # 7 – From Fuse # 4
- Terminal # 9 – From park brake switch
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4
- Terminal #19 – From shuttle switches

Controller Outputs (+)

- Terminal # 5 – To fuel shutoff solenoid
- Terminal # 14 – To park brake indicator light

EHSS Controller Functions

Controller Inputs (+)

- Terminal # 1 – From Fuse # 4
- Terminal # 15 – From the EHSS shuttle switch

Controller Outputs (+)

- Terminal # 13 – To terminal # 19 of the safety controller

Fuel Shutoff Solenoid

Terminal #5 of the safety controller provides current to fuel shutoff solenoid. This current energizes the solenoid, allowing fuel to be delivered to the injection pump and allowing the engine to remain operating.

Safety Alarm

When terminal # 9 of the safety controller is provided current by the park brake switch, the safety alarm will not sound. The park brake does not control the operation of the tractor, only the safety alarm.

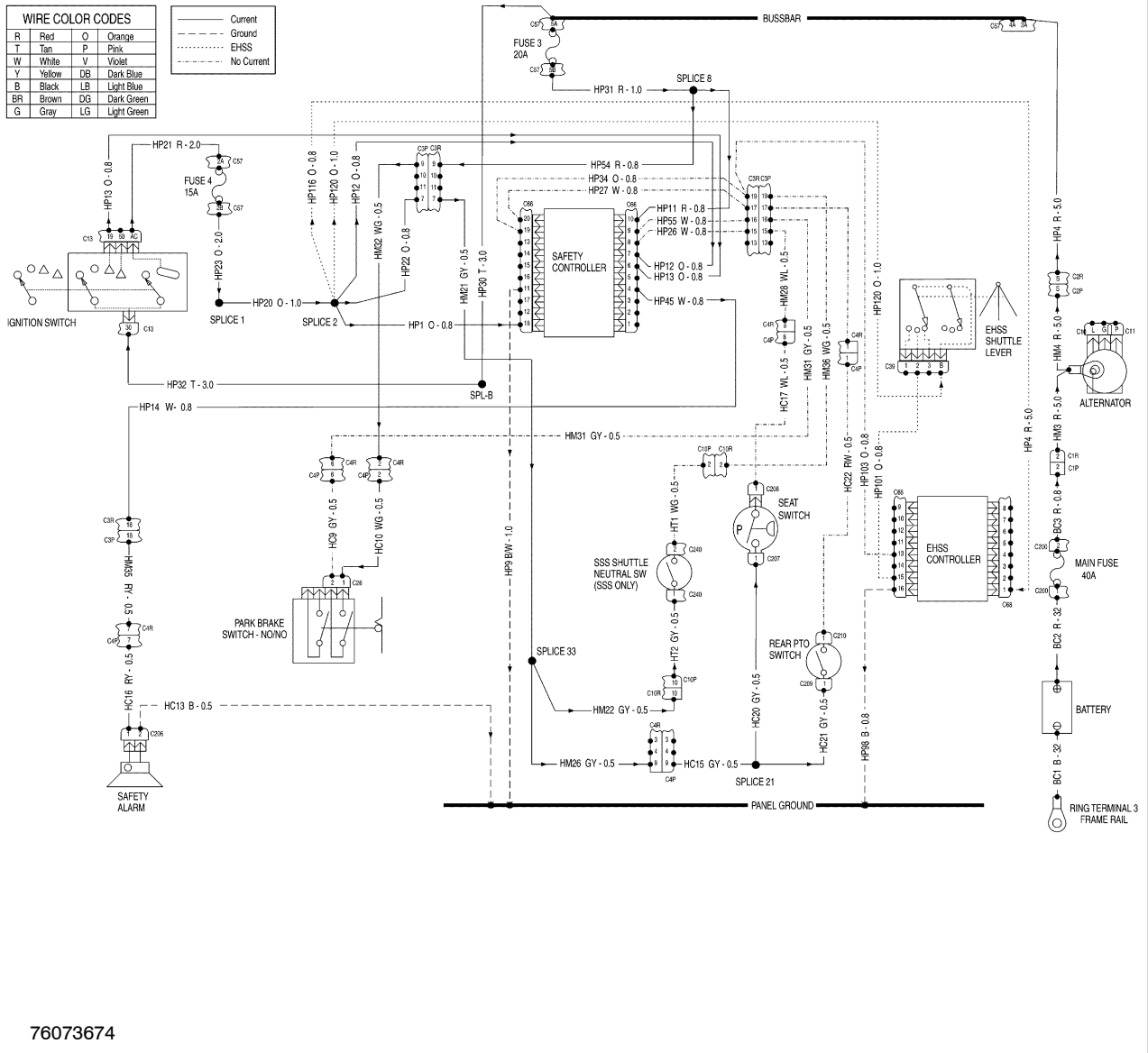
Park Brake Indicator Light

The park brake indicator light is provided current from terminal # 14 of the safety controller and a ground source by terminal # 24 of the instrument panel.

SAFE OPERATION (OPERATOR NOT PRESENT) TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Tractor will not operate without operator present.	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Blown #3, 20-amp fuse	Replace 20-amp fuse
	Faulty Shuttle safety switch	Check switch, replace if necessary
	Faulty operator safety controller	Check controller, replace if necessary
	Faulty fuel shutoff solenoid	Check solenoid, replace if necessary

SAFETY ALARM



SAFETY ALARM

NOTE: *The safety alarm, located at the left side of the HPL housing, alarms when the Park brake is not engaged, warning the operator that the park brake is not applied and an unsafe condition may exist.*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.
2. Current passes through the # 4 fuse to:
   - Terminals # 7 and # 18 of the safety controller
3. Current passes through the # 3 fuse to :
   - Terminal #10 of the safety controller
   - Park brake switch , input

Ground Circuits

Ground source for the starting circuit is located on the front of the engine cylinder head.

Ground circuit is provided to the following terminals:

- Terminal # 11 of the safety controller
- Terminal # 2 of the safety alarm

Park Brake Switch

When the park brake is not applied, the park brake switch is open, not allowing current to be sent to terminal # 9 of the safety controller. This will allow the safety alarm to sound.

Seat Switch

When the operator is not in the seat, the seat switch is open, not allowing current to be sent to terminal # 8 of the safety controller. This will allow the safety alarm to sound.

Rear PTO Switch

When the rear PTO is applied, the PTO switch is open, not allowing current to be sent to terminal # 20 of the safety controller. This will allow the safety alarm to sound.

“EHSS” / “SSS” Shuttle Switch

When the shuttle switch is placed in either forward or reverse with the park brake applied, the shuttle switch does not allow current to be sent to terminal # 19 of the safety controller. This will allow the safety alarm to sound.

Safety Controller Functions

Controller Inputs (+)

- Terminal # 7 – From Fuse # 4
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4

Controller Outputs (+)

- Terminal # 4 – To safety alarm

Alarm Control Terminals

- Terminal # 8, no current from the seat switch
- Terminal # 9, no current from the park brake switch
- Terminal # 19, no current from the shuttle switch
- Terminal # 20, no current from the rear PTO switch

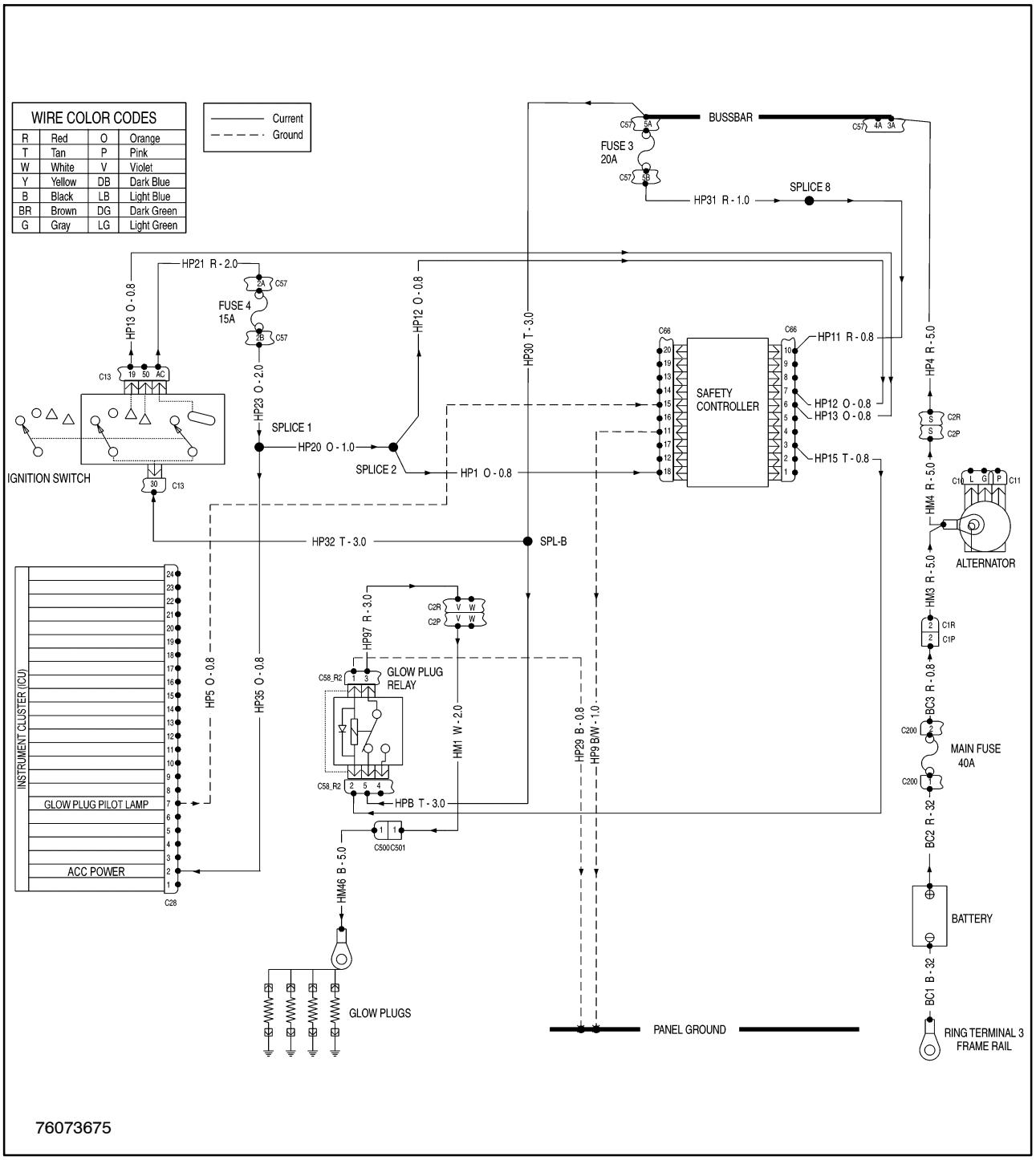
Ground Terminals

- Terminal # 11, provided by the cylinder head ground source

SAFETY ALARM - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Alarm will not sound	Blown 40-amp fusible link	Replace 40-amp fusible link
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Park brake switch failed in open mode	Replace park brake switch
	Open circuit in harness to park brake alarm	Inspect wiring harness and repair as necessary
	Defective park brake alarm	Replace park brake switch
	Operator seat safety switch failed in closed mode	Replace seat switch
	Faulty safety controller	Test controller, replace if necessary
Alarm will not shut off	Park brake failed in open mode	Replace park brake switch
	Blown #3 20-amp fuse	Replace 20-amp fuse
	Defective park brake alarm	Replace park brake alarm
	Short circuit in harness to park brake alarm	Inspect wiring harness and repair as necessary

GLOW PLUGS



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GLOW PLUGS

When the key switch is placed in the “HEAT” position, electrical current is being supplied to the safety controller, which transfers current to the glow plug relay for approximately four seconds. The relay sends current to the glow plugs to preheat the engine to aid in starting.

NOTE: *When the safety controller shuts off the current to the relay, the current is also cutoff to the glow plugs.*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “HEAT” position current crosses from terminal “30” to the “19” and “AC” terminals.

Key Switch Terminals

Terminal “19”

- Terminal “19’ provides current to terminal # 6 of the safety controller.

Terminal “AC”

- Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse # 3 – Provides current to terminal# 10 of the safety controller

Fuse #4 – Provides current to terminal # 7 and # 18 of the safety controller

Ground Circuits

The ground source for the glow plug circuit is located on the front of the engine cylinder head. Ground source is provided to the following components.

- Terminal # 11 of the safety controller
- Glow plug relay , coil side

Safety Controller Functions

Controller Inputs (+)

- Terminal # 6 – From terminal “19” of key switch
- Terminal # 7 – From Fuse # 4
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4

Controller Outputs (+)

- Terminal # 3 – To glow plug relay, coil side

Ground Terminals

- Terminal # 11, provided by the cylinder head ground source
- Terminal # 15, provides ground source for glow plug indictor light

Relay Functions

Glow Plug Relay

When the coil side of the relay receives current from the # 3 terminal of the safety controller and a ground source is provided to other side of the coil, the relay energizes and latches. The relay latches, sending current to the glow plugs for approximately four seconds. After four seconds, the current from the controller is cutoff to the relay, by a timer in the controller and the glow plugs stop heating.

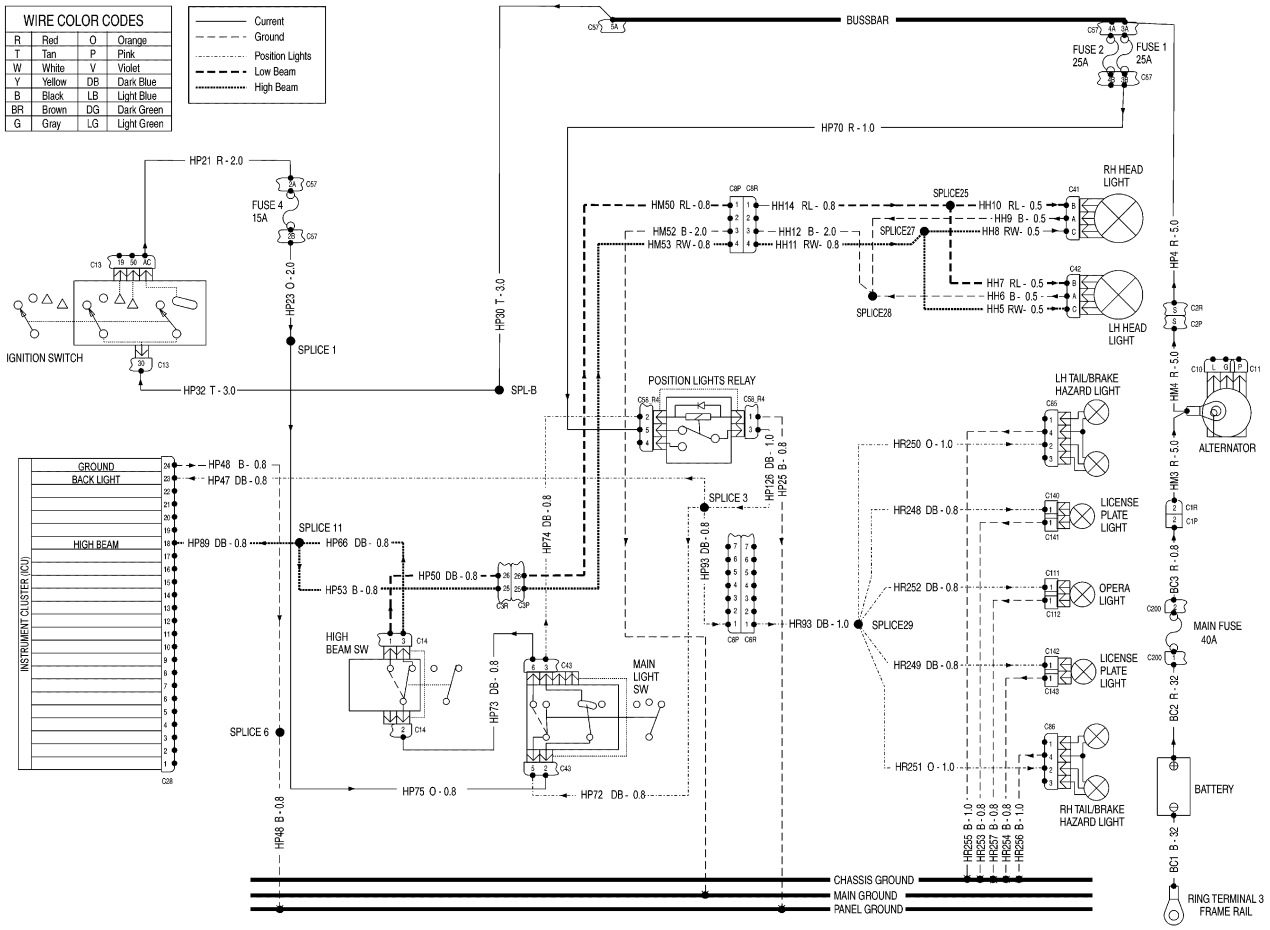
Glow Plug Indicator Light

1. Current to the glow plug indicator light is provided by terminal # 2 of the instrument panel, this current is controlled by fuse # 4.
2. The ground source for the indicator light terminal # 7 of the instrument panel is provided by terminal # 15 of the safety controller.
3. The glow plug indicator light will illuminate for approximately four seconds to correspond to the glow plug heating cycle.

GLOW PLUGS – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Engine glow plug will not heat	Insufficient battery charge	Test battery. Charge, add water, or replace as necessary
	Blown main 40-amp fusible link	Inspect fusible link and replace as necessary
	Blow #4, 15-amp fuse	Inspect fuse and replace as necessary
	Blow #3 20-amp fuse	Inspect fuse and replace as necessary
	Defective key switch	Test key switch and replace as necessary
	Corroded electrode buss bar connection	Remove buss bar, clean bar and glow plug electrodes
	Defective glow plug(s)	Test glow plug(s) and replace as necessary
	Defective glow plug power relay	Test relay and replace as necessary
Glow plug indicator light will not illuminate while key switch is in “ACC/RUN/HEAT” or “START” position	Insufficient battery charge	Test battery. Charge, add water, or replace as necessary
	Blow 40-amp fusible link	Inspect fusible link and replace as necessary
	Defective key switch	Test key switch and replace as necessary
	Faulty glow plug indicator bulb	Check glow plug indicator light and replace as necessary
	Glow plug indicator light circuit open	Check circuit connections, grounds, and wires
	Faulty safety controller	Test controller, replace if necessary
	Blown #4, 15-amp glow plug circuit or instrument panel fuse	Inspect and replace fuses as necessary

ROAD LIGHTS (POSITION, LOW and HIGH BEAM)



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ROAD LIGHTS (POSITION, LOW and HIGH BEAM)

NOTE: *The road and work lights can be activated separately or together. The key switch has to be in the "ACC/RUN" position for the lights to illuminate.*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal "30"of the key switch.
3. When the key switch is in the "ACC/RUN " position current crosses from terminal "30" to the "AC" terminal.

Key Switch Terminals

Terminal "AC"

1. Current flows from the "AC" terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 1 (25 amp) provides current to:
   - Position lights relay, terminal # 5
   - Position lights
   - Instrument panel backlighting
   - High Beam switch
   - Low and High Beam road lights
2. Fuse # 4 (15 amp) provides current to:
   - Main light switch control circuit

Ground Circuits

A ground source is provide to the following components

- Road Light bulbs
- Taillights
- Instrument Panel, terminal # 24
- Position lights relay

Position Lights (Tail, IP, License, and Cab Opera)

1. Current enters the main light switch at terminal # 2, when the switch is placed in the mid position, current exists the switch through terminal # 3.
2. Terminal #3 of the main light switch provides current to terminal # 2 (coil side) of the position lights relay.
3. When terminal # 2 has current and terminal # 1 is supplied with a ground source, the position lights relay energizes, latching terminals # 3 and # 5.
4. Terminal # 3 of the position lights relay provides current to:
   - Taillights
   - License plate lights (optional)
   - Cab opera light
   - Terminal # 5 of the main light switch
   - Terminal # 23 of the instrument panel

Road Lights (Low Beam)

1. When the main light switch is placed in the front (2nd) position , current is transferred from terminal # 5 to terminal # 6.
2. Terminal #6 of the main light switch provides current to terminal # 2 of the high beam switch.
3. When the high beam switch is in the “OFF” position current is transferred from terminal # 2 to terminal # 1.
4. Terminal # 1 of the high beam switch provides current to the low beam (50W) road lights.

Road Lights (High Beam)

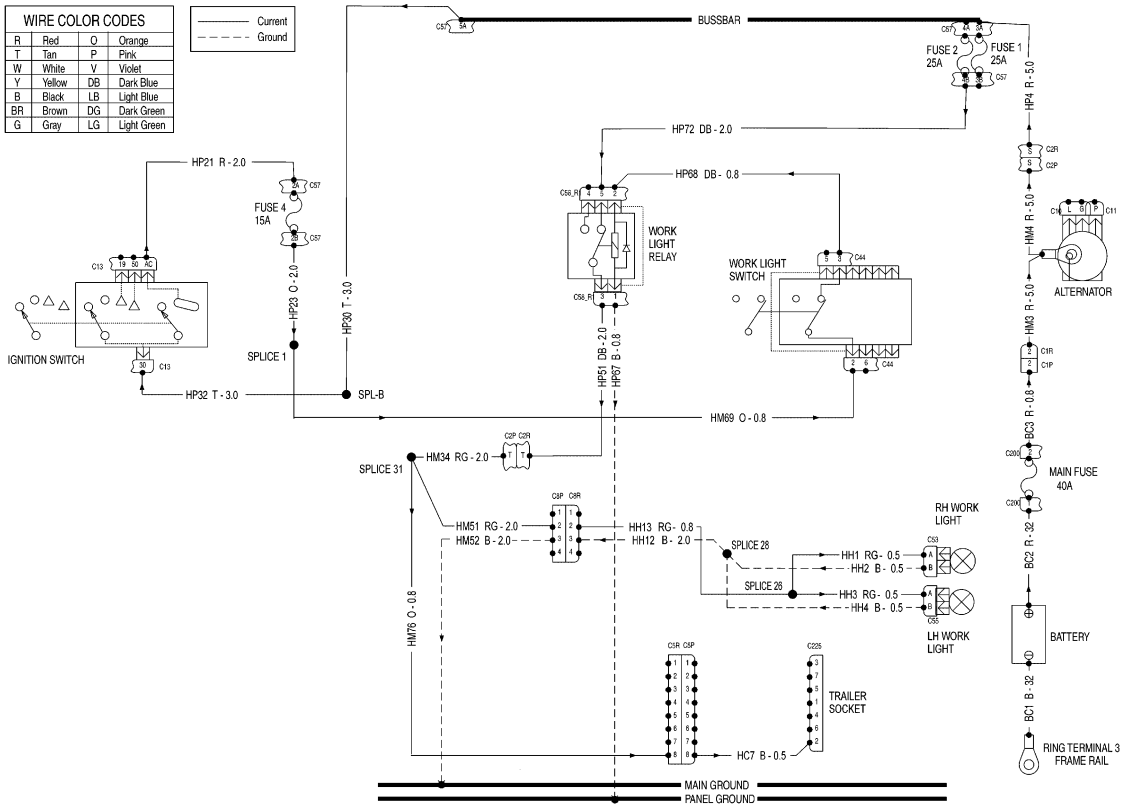
NOTE: *The main light switch has to be placed in the front (2nd) position, low beams “ON”, to allow the high beams to be activated.*

1. When the main light switch is placed in the front (2nd) position, current is transferred from terminal # 5 to terminal # 6.
2. Terminal #6 of the main light switch provides current to terminal # 2 of the high beam switch.
3. When the high beam switch is in the “ON” position current is transferred from terminal # 2 to terminal # 3.
4. Terminal # 3 of the high beam switch provides current to the high beam (65W) road lights and terminal # 18 of the instrument panel, for the high beam indicator light.

ROAD LIGHTS (POSITION, LOW and HIGH BEAM) TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Position lights will not illuminate	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blow #1, 25-amp fuse	Replace 25-amp fuse
	Blow #4, 15-amp fuse	Replace 15-amp fuse
	Faulty main light switch	Check switch, replace if necessary
	Faulty position lights relay	Check relay, replace if necessary
	Faulty ground connection	Check ground circuit, correct if necessary
	Faulty taillight bulb	Replace bulb
Road lights (low beam) will not illuminate	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blow #1, 25-amp fuse	Replace 25-amp fuse
	Blow #4, 15-amp fuse	Replace 15-amp fuse
	Faulty position lights relay	Check relay, replace if necessary
	Faulty main light switch	Check switch, replace if necessary
	Faulty ground connection	Check ground circuit, correct if necessary
	Faulty headlight bulb	Replace bulb
Road lights (high beam) will not illuminate	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blow #1, 25-amp fuse	Replace 25-amp fuse
	Blow #4, 15-amp fuse	Replace 15-amp fuse
	Faulty position lights relay	Check relay, replace if necessary
	Faulty high beam switch	Check switch, replace if necessary
	Faulty ground connection	Check ground circuit, correct if necessary
	Faulty headlight bulb	Replace bulb

WORK LIGHTS



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WORK LIGHTS

NOTE: *The road and work lights can be activated separately or together. The key switch has to be in the "ACC/RUN" position for the lights to illuminate.*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal "30"of the key switch.
3. When the key switch is in the "ACC/RUN " position current crosses from terminal "30" to the "AC" terminal.

Key Switch Terminals

Terminal "AC"

1. Current flows from the "AC" terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 2 (25 amp) provides current to:
   - Work lights relay, terminal # 5
   - Work lights
2. Fuse # 4 (15 amp) provides current to:
   - Work light switch control circuit

Ground Circuits

A ground source is provide to the following components

- Work light bulbs
- Work lights relay

Work Lights "ON"

1. Terminal # 2 of the work light switch is supplied current by fuse # 4.
2. When the work light switch is place in the "ON" position terminals #2 and # 3 are connected.
3. Terminal # 3 of the switch supplies current to terminal # 2 (coil side) of the work light relay.
4. When current from the work light switch and a ground source is supplied to coil side of the relay, the relay energizes and latches.
5. When the relay latches, terminals # 3 and # 5 are connected, sending current to the two (50W) work lights and with a ground source provided to the bulbs, the work lights will illuminate.
6. Current is also provided to terminal # 2 of the 7 pin connector.

WORK LIGHTS - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Inoperative work lights	Blow #2 (25-amp) or #4 (15-amp) fuse.	Inspect and replace 15- or 25-amp fuse as necessary.
	Defective work lights switch.	Test switch, replace as necessary.
	Defective work lights relay.	Test relay, replace as necessary.
	Loose tractor lights connectors	Check connectors for proper connections.
	Improper ground circuit.	Check ground circuit connector for corrosion.
	Defective work light bulb.	Check bulb, replace as necessary.

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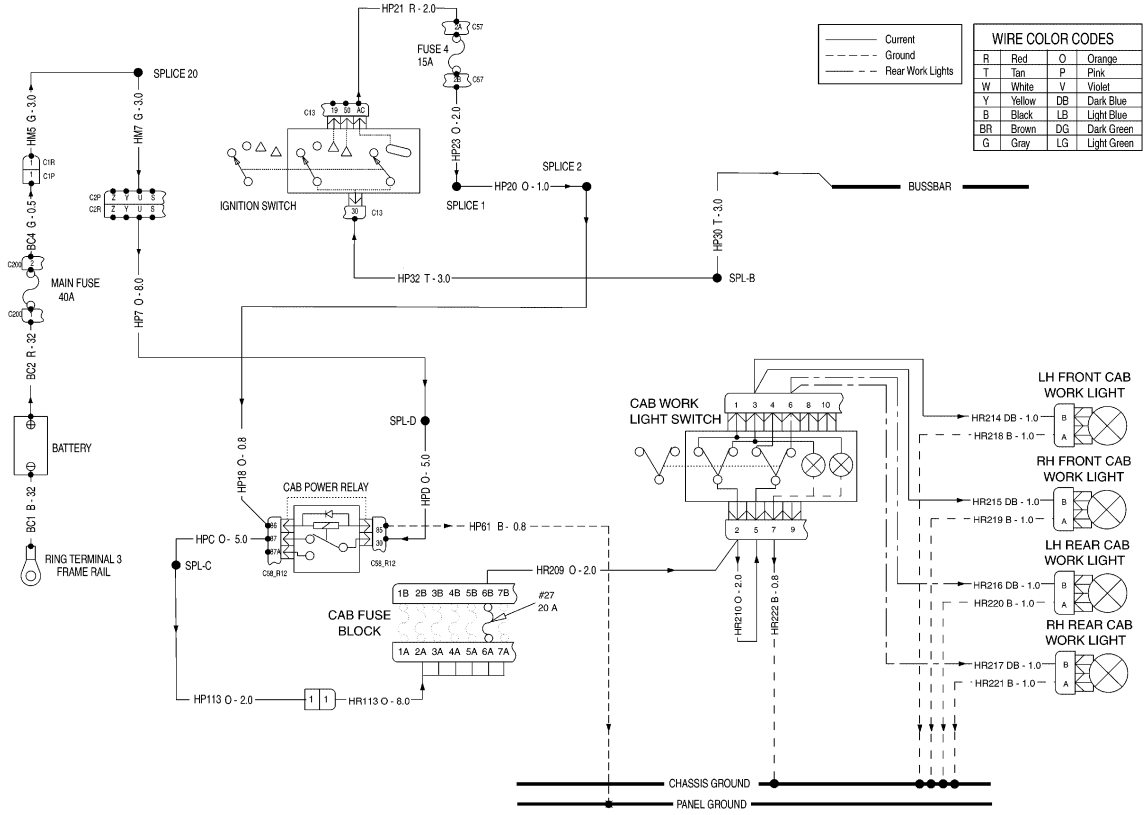
CAB WORK LIGHTS



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CAB WORK LIGHTS

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
2. Fuse # 27 Cab fuse block (20 amp) provides current to:
   - Cab work lights switch
   - Cab work lights

Ground Circuits

A ground source is provide to the following components

- Cab work light bulbs
- Cab power relay

Cab Power Relay

1. When current from fuse # 4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse 27 (20 amp)

Cab Work Lights Switch

(Front Lights)

1. When the switch is placed in the first (middle) position, current is transferred from terminal # 2 to # 3.
2. Terminal # 3 provides current to the two front cab work lights
3. Ground source for these lights is provided by the chassis ground.

(Front and Rear Lights)

1. When the switch is placed in the second (upper)position, current is transferred from terminals # 2 to # 3 and # 5 to # 6.
2. Terminal # 3 provides current to the two front cab work lights and terminal # 6 provides current to the rear cab work lights.
3. Ground source for these lights is provided by the chassis ground.

CAB WORK LIGHTS - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Cab work lights will not illuminate	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #27, 20-amp fuse	Replace 20-amp fuse
	Faulty cab work light switch	Check switch, replace if necessary.
	Faulty ground connection	Check ground circuit, correct if necessary
	Faulty light bulb	Replace bulb

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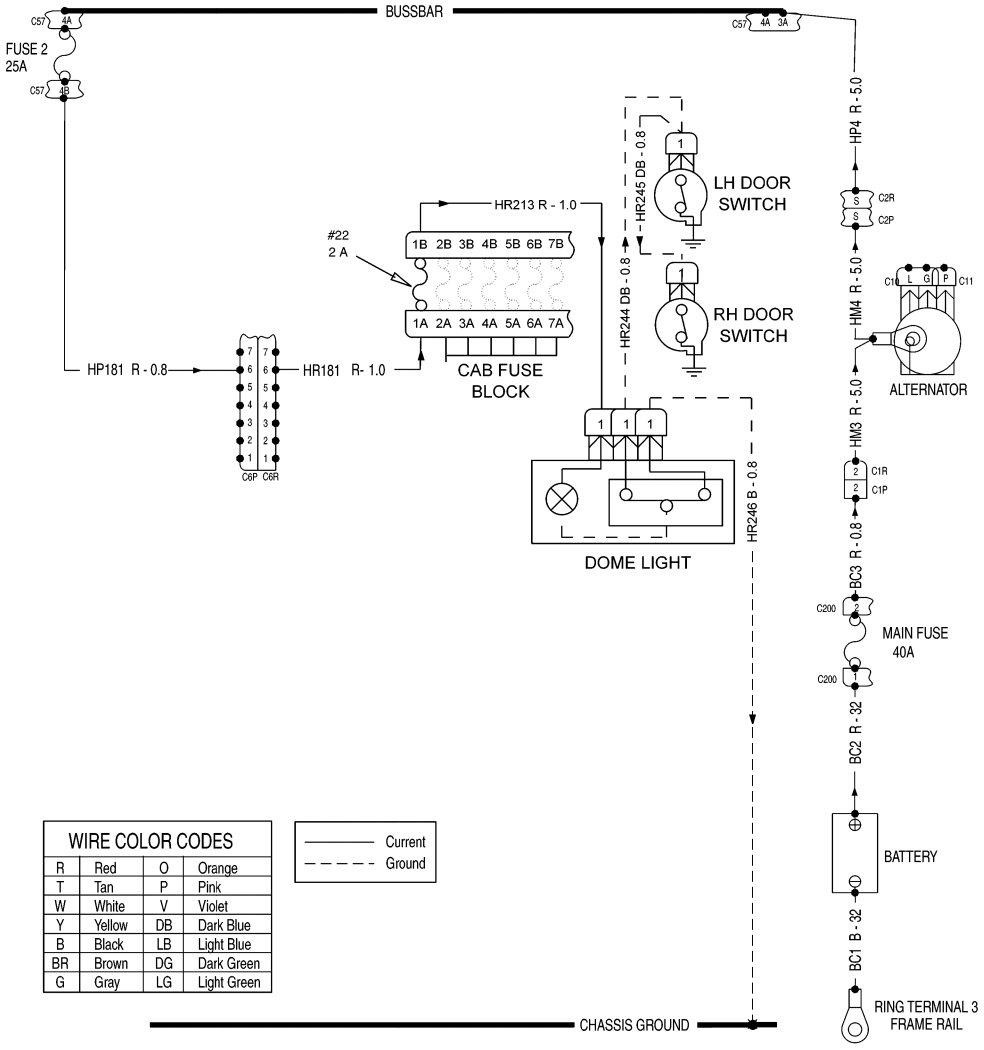
INTERIOR CAB LIGHTS



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INTERIOR CAB LIGHTS

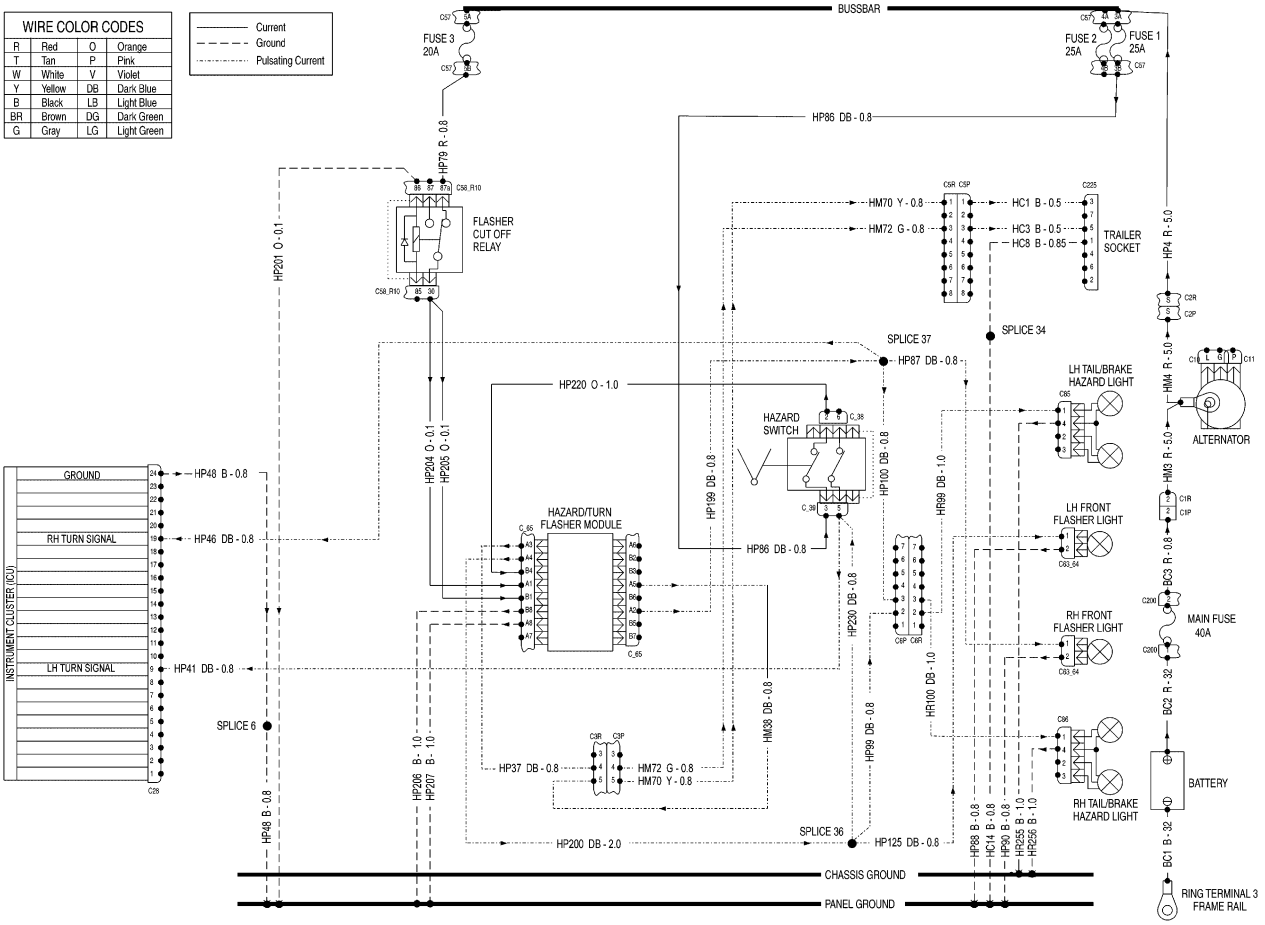
1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to fuse # 2 (25 amp).
3. Fuse # 2 provides current to fuse # 22, Cab fuse block (2 amp).
4. The 2–amp fuse provides current to the dome light.
5. The dome light will illuminate if the following occur:
   - Right door opened
   - Left door opened
   - Dome light switch placed in the “ON” position.

These three actions provide a ground source for the dome light.

INTERIOR CAB LIGHTS – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Dome light will not illuminate	Blown #2, 25-amp fuse	Replace 25-amp fuse
	Blown #22, 2-amp fuse	Replace 2-amp fuse
	Faulty dome light switch	Check dome light switch, replace dome light assembly, if necessary.
	Faulty dome light bulb	Replace bulb
Dome light will not go out when doors are closed	Faulty door switch or misadjusted striker plate.	Test switches or adjust striker plates to actuate switch when doors are closed.

HAZARD FLASHERS



HAZARD FLASHERS

NOTE: *The hazard lights can be activated with the key switch either in the "OFF" or "ON" position.*

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to fuse # 1 (25 amp) and fuse # 3 (20 amp).
3. Fuse # 1 provides current to terminal # 3 of the hazard switch.
4. Fuse # 3 provides current to flasher cutoff relay, terminal 87a

Hazard Switch Function

1. When the hazard switch is place in the "ON" position current is transferred from terminal # 3 to # 2.
2. Terminal # 2 provides current to Terminal B4 of the hazard / turn flasher module.

Flasher Cutoff Relay Function

The function of the flasher cutoff relay is to provide current to the hazard / turn module either when the key switch is in the "ON" or "OFF" mode.

1. When the flasher cutoff relay is not energized, key switch in "OFF" position terminals 87a and 30 are connected.
2. When the flasher cutoff relay is energized, key switch in "ON" position terminals 87 and 30 are connected.

Hazard / Turn Flasher Module Functions

Module Inputs (+)

- Terminal A1 – Current from flasher cutoff relay
- Terminal B1 – Current from flasher cutoff relay
- Terminal B4 – Current from hazard switch

Module Outputs (+)

- Terminal A2 – Pulsating current to right front and rear hazard lights and right turn/hazard indicator light of instrument panel, terminal # 19
- Terminal A3 – Pulsating current to right trailer light, 7–pin connector
- Terminal A4 – Pulsating current to left front and rear hazard lights and left turn/hazard indicator light of instrument panel, terminal # 9
- Terminal A5 – Pulsating current to left trailer light, 7–pin connector

Ground Circuits (–)

- Terminal A8 – provided by the cylinder head ground source
- Terminal B8 – provided by the cylinder head ground source

HAZARD FLASHER - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Hazard Signal Lights will not illuminate or flash	Blown #1, 25-amp fuse	Inspect fuse and replace as necessary
	Blown #3, 20-amp fuse	Inspect fuse and replace as necessary
	Hazard signal bulb(s) burnt out	Inspect bulb(s) and replace as necessary
	Defective hazard switch	Test switch and replace as necessary
	Defective flasher cutoff relay	Test flasher relay by using a known functioning flasher relay and replace as necessary
	Defective hazard/turn flasher controller	Test controller and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed
Instrument panel hazard indicator(s) does not illuminate	Indicator bulb(s) burnt out	Inspect bulb and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed

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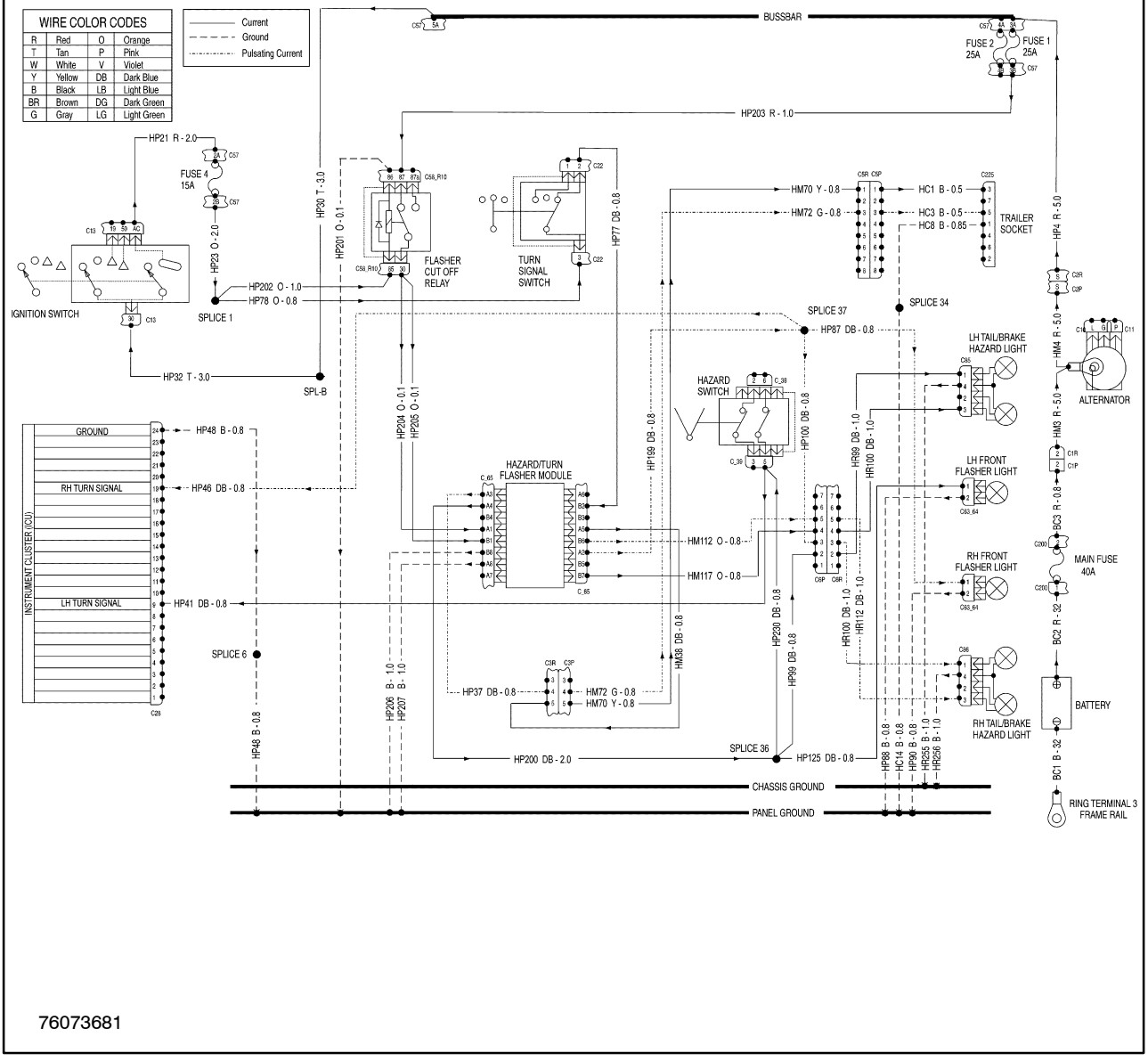
RIGHT TURN SIGNAL



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RIGHT TURN SIGNAL

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 1 (25 amp) provides current to:
   - Flasher cutoff relay, terminal # 87

1. Fuse # 4 (15 amp) provides current to:
   - Turn signal switch , terminal # 3
   - Flasher cutoff relay, terminal # 85

Turn Signal Switch Function

1. When the turn signal switch is placed in the “Right Turn” position current is transferred from terminal # 3 to # 2
2. Terminal # 2 supplies current to terminal B2 of the hazard / turn flasher module.

Flasher Cutoff Relay Function

The function of the flasher cutoff relay is to provide current to the hazard / turn module either when the key switch is in the “ON” or “OFF” mode.

1. When the flasher cutoff relay is not energized, key switch in “OFF” position terminals 87a and 30 are connected.
2. When the flasher cutoff relay is energized, key switch in “ON” position terminals 87 and 30 are connected.

Hazard / Turn Flasher Module Functions

Module Inputs (+)

- Terminal A1 – Current from flasher cutoff relay
- Terminal B1 – Current from flasher cutoff relay
- Terminal B2 – Current from turn signal switch

Module Outputs (+)

- Terminal A2 – Pulsating current to right front and rear hazard lights and right turn/hazard indicator light of instrument panel, terminal # 19
- Terminal A3 – Pulsating current to right trailer light, 7–pin connector
- Terminal A4 – Constant current to left front and rear hazard lights and left turn/hazard indicator light of instrument panel, terminal # 9
- Terminal A5 – Constant current to left trailer light, 7–pin connector
- Terminal B6 – Pulsating current to right taillight
- Terminal B7 – Constant current to left taillight

Ground Circuits (-)

- Terminal A8 – provided by the cylinder head ground source
- Terminal B8 – provided by the cylinder head ground source

Light functions:

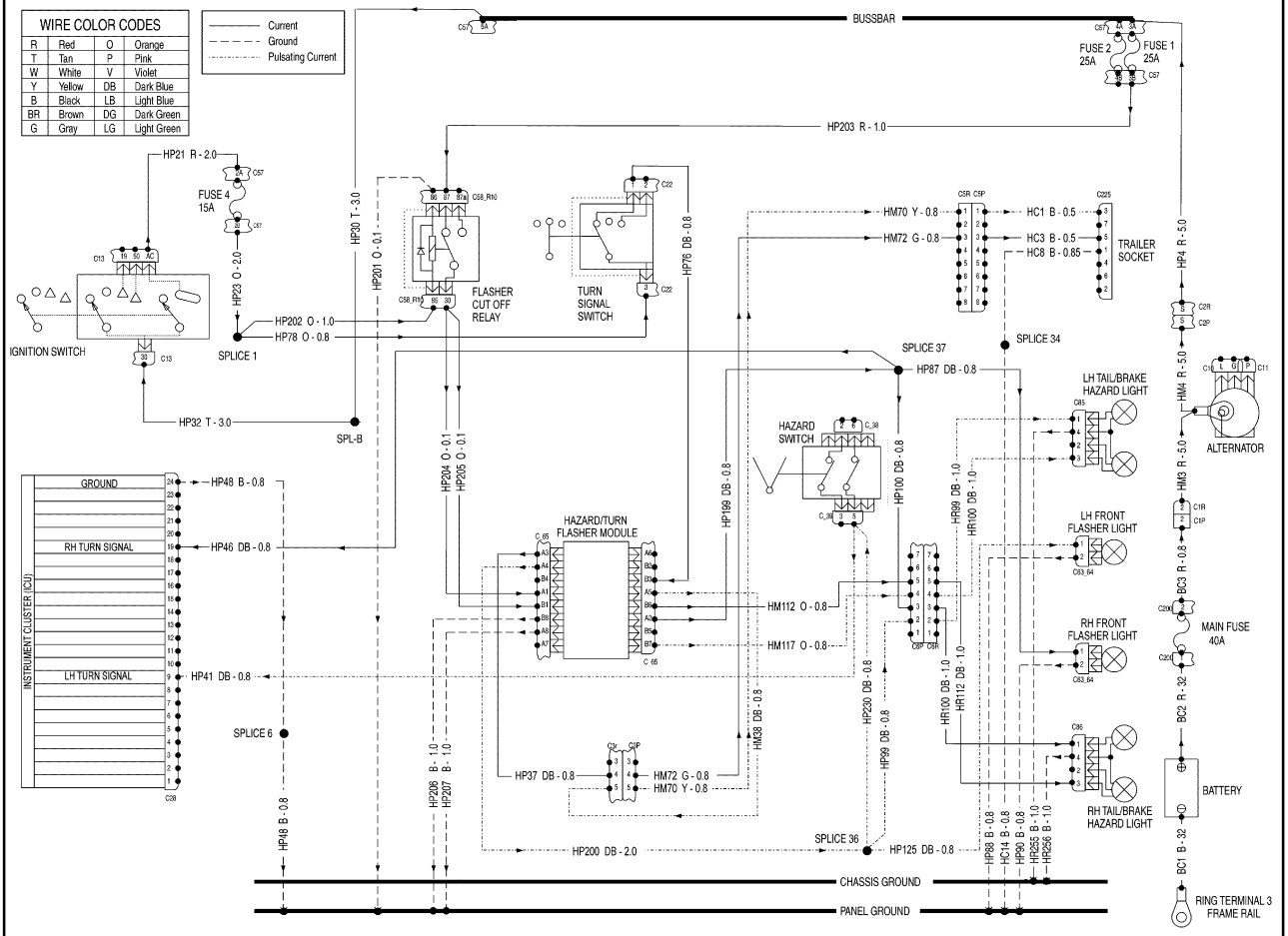
With the right turn signal activated the following lights will illuminate as follows:

- Right side front and rear hazard lights will flash on and off
- Right side taillight will flash on and off
- Right turn indicator light in instrument panel will flash on and off
- Right trailer light will flash on and off
- Left side front and rear hazard light will illuminate constant
- Left side taillight will illuminate constant
- Left turn indicator light in instrument panel will illuminate constant
- Left trailer light will illuminate constant

RIGHT TURN SIGNAL – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Directional signal will not illuminate or flash	Blown #1, 25-amp hazard or directional signal fuse	Inspect fuse and replace as necessary
	Blown #4, 15-amp fuse	Inspect fuse and replace as necessary
	Directional signal bulb burnt out	Inspect bulb and replace as necessary
	Defective directional signal switch	Test switch and replace as necessary
	Defective hazard/turn flasher module	Test module and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed
Instrument panel turn indicator does not illuminate	Indicator bulb burnt out	Inspect bulb and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed

LEFT TURN SIGNAL



LEFT TURN SIGNAL

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 1 (25 amp) provides current to:
   - Flasher cutoff relay, terminal # 87
2. Fuse # 4 (15 amp) provides current to:
   - Turn signal switch , terminal # 3
   - Flasher cutoff relay, terminal # 85

Turn Signal Switch Function

1. When the turn signal switch is placed in the “Left Turn” position current is transferred from terminal # 3 to # 1.
2. Terminal # 1 supplies current to terminal B3 of the hazard / turn flasher module.

Flasher Cutoff Relay Function

The function of the flasher cutoff relay is to provide current to the hazard / turn module either when the key switch is in the “ON” or “OFF” mode.

1. When the flasher cutoff relay is not energized, key switch in “OFF” position terminals 87a and 30 are connected.
2. When the flasher cutoff relay is energized, key switch in “ON” position terminals 87 and 30 are connected.

Hazard / Turn Flasher Module Functions

Module Inputs (+)

- Terminal A1 – Current from flasher cutoff relay
- Terminal B1 – Current from flasher cutoff relay
- Terminal B3 – Current from turn signal switch

Module Outputs (+)

- Terminal A2 – Constant current to right front and rear hazard lights and right turn/hazard indicator light of instrument panel, terminal # 19
- Terminal A3 – Constant current to right trailer light, 7–pin connector
- Terminal A4 – Pulsating current to left front and rear hazard lights and left turn/hazard indicator light of instrument panel, terminal # 9
- Terminal A5 – Pulsating current to left trailer light, 7–pin connector
- Terminal B6 – Constant current to right taillight
- Terminal B7 – Pulsating current to left taillight

Ground Circuits (-)

- Terminal A8 – provided by the cylinder head ground source
- Terminal B8 – provided by the cylinder head ground source

Light functions:

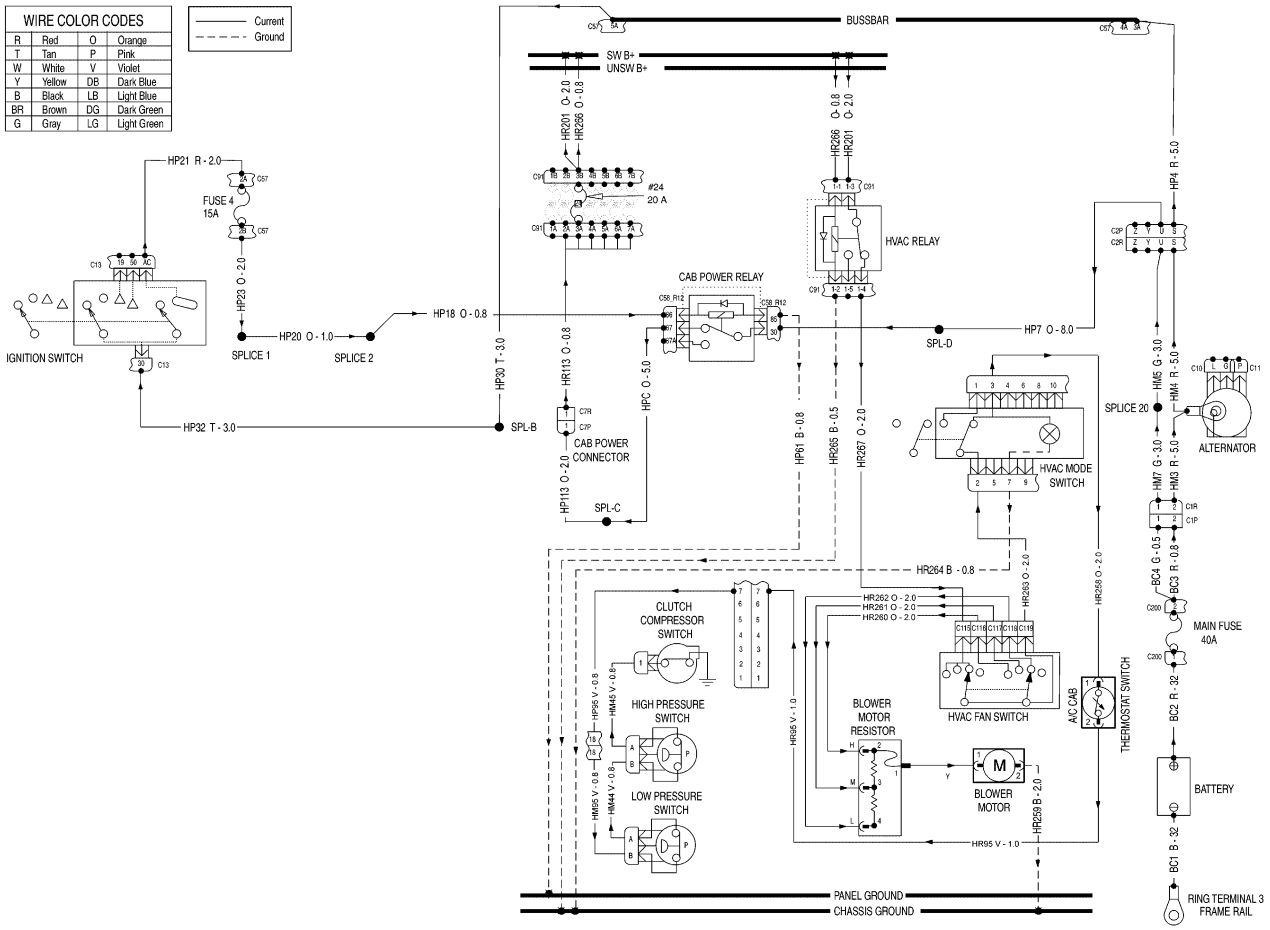
With the left turn signal activated the following lights will illuminate as follows:

- Right side front and rear hazard lights will illuminate constant
- Right side taillight will illuminate constant
- Right turn indicator light in instrument panel will illuminate constant
- Right trailer light will illuminate constant
- Left side front and rear hazard light will flash on and off
- Left side taillight will flash on and off
- Left turn indicator light in instrument panel will flash on and off
- Left trailer light will flash on and off

LEFT TURN SIGNAL – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Directional signal will not illuminate or flash	Blown #1, 25-amp hazard or directional signal fuse	Inspect fuse and replace as necessary
	Blown #4, 15-amp fuse	Inspect fuse and replace as necessary
	Directional signal bulb burnt out	Inspect bulb and replace as necessary
	Defective or directional signal switch	Test switch and replace as necessary
	Defective hazard/turn flasher module	Test module and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed
Instrument panel turn indicator does not illuminate	Indicator bulb burnt out	Inspect bulb and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed

HVAC



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HVAC

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
2. Fuse # 24 Cab fuse block (20 amp) provides current to:
   - HVAC Relay

Ground Circuits

A ground source is provide to the following components

- Cab power relay
- HVAC Relay

Cab Power Relay

1. When current from the fuse #4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse #24 (20 amp)
3. The #24, 20-amp fuse provides current to terminals 1-1 and 1-3 of the HVAC relay.

HVAC Relay

1. When current is provided to the HVAC relay by fuse #24 and the ground circuit is completed by the chassis ground, the HVAC relay is energized.
2. When the relay is energized, terminals 1-3 and 1-4 are latched, providing current to HVAC fan circuit.

HVAC Fan Switch

1. When the HVAC switch is placed in the “LOW”, “MED” or “HIGH” speed positions, current is transferred from terminal C-115 to C-116, C-117 and C-118 of the switch.
2. Terminal C-119 provides current to terminal #2 of the HVAC mode switch.

HVAC Mode Switch

1. When the HVAC mode switch is placed in the “ON” position, current is transferred from terminal #2 to terminal #3.
2. Terminal #3 provides current to the thermostat switch.

HVAC Thermostat Switch

1. When the thermostat switch reads the correct temperature from the evaporator coils, the switch closes.
2. When the thermostat switch closes, current is sent to the AC low pressure switch.

High and Low A/C Pressure Switches

1. When correct low side pressure is present at the A/C low pressure switch, the switch closes sending current to the A/C high pressure switch.

(Pressure Range of 4 to 20 psig)

1. When the correct high pressure is present at the A/C high pressure switch, the switch closes, sending current to the A/C compressor clutch.

(Pressure Range 260 to400 psig)

A/C Compressor Clutch

1. When current and proper ground is present a the A/C compressor clutch, the clutch locks and allows the fan belt to drive the A/C compressor.

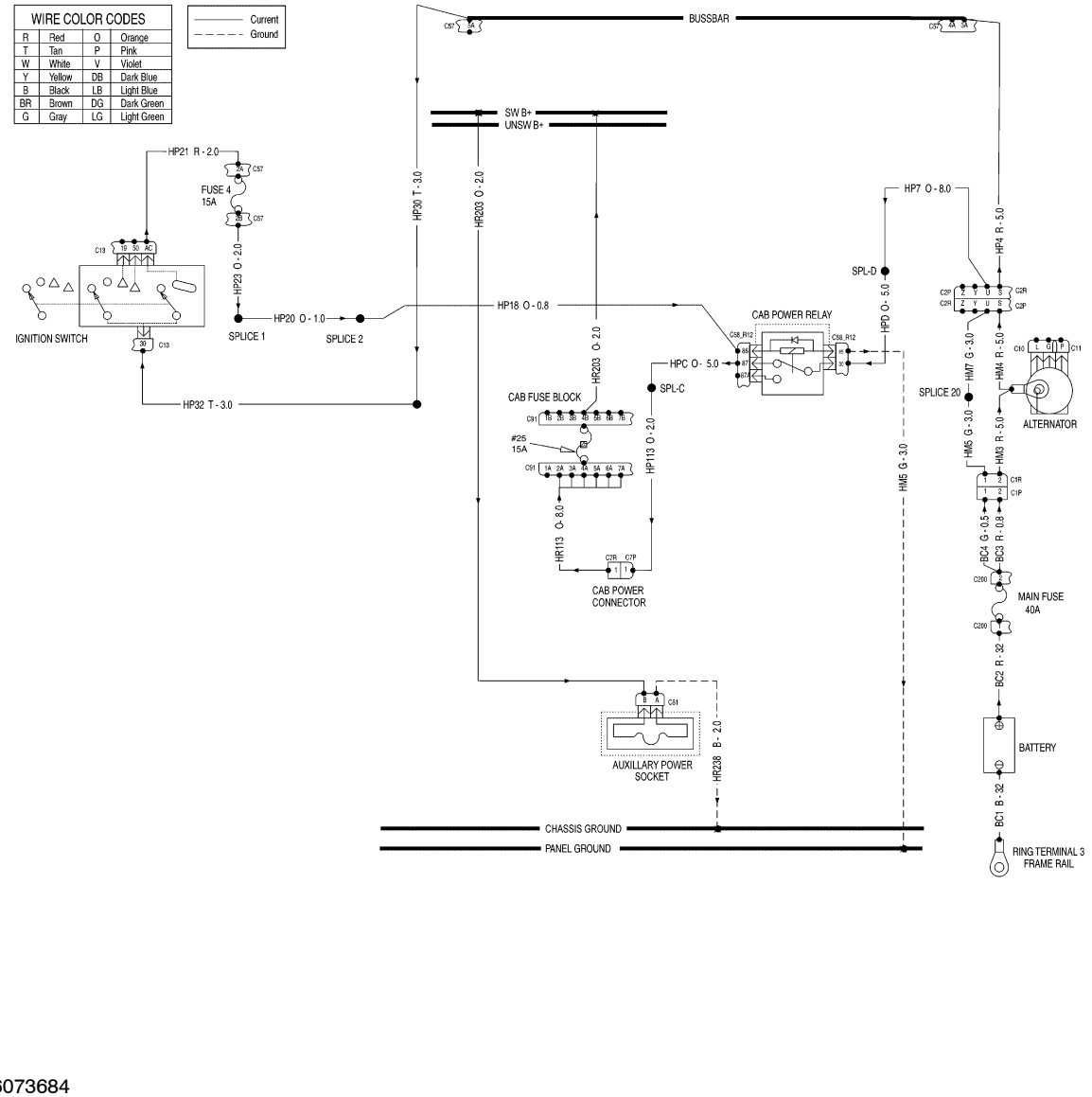
HVAC Fan

1. Terminal C–118 provides current to the fan resister for low speed of the fan.
2. Terminal C–117 provides current to the fan resister for medium speed of the fan.
3. Terminal C–116 provides current to the fan resister for high speed of the fan.
4. The fan is provided a ground source by terminal “E” of the fan.

HVAC – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
HVAC will not work	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #24, 20-amp fuse	Replace 20-amp fuse
	Faulty HVAC relay	Check relay, replace if necessary
	Faulty HVAC mode switch	Check switch, replace if necessary
	Faulty HVAC fan switch.	Check switch, replace if necessary
	Faulty low pressure switch or A/C system press low side pressures too low.	Check switch, replace if necessary or test pressures of A/C system
	Faulty high pressure switch or A/C system press high side pressures excessive .	Check switch, replace if necessary or test pressures of A/C system
	Compressor clutch faulty	Check clutch, replace if necessary.
Fan speed incorrect or fan not working	Faulty HVAC fan switch.	Check switch, replace if necessary
	Faulty blower motor resistor	Check resistor replace blower assembly if necessary.
	Faulty blower motor	Check motor, replace if necessary

AUXILIARY POWER SOCKET



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AUXILIARY POWER SOCKET

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
2. Fuse # 25 Cab fuse block (15 amp) provides current to:
   - Auxiliary power socket

Ground Circuits

A ground source is provide to the following components

- Cab power relay
- Auxiliary power socket, terminal “A”

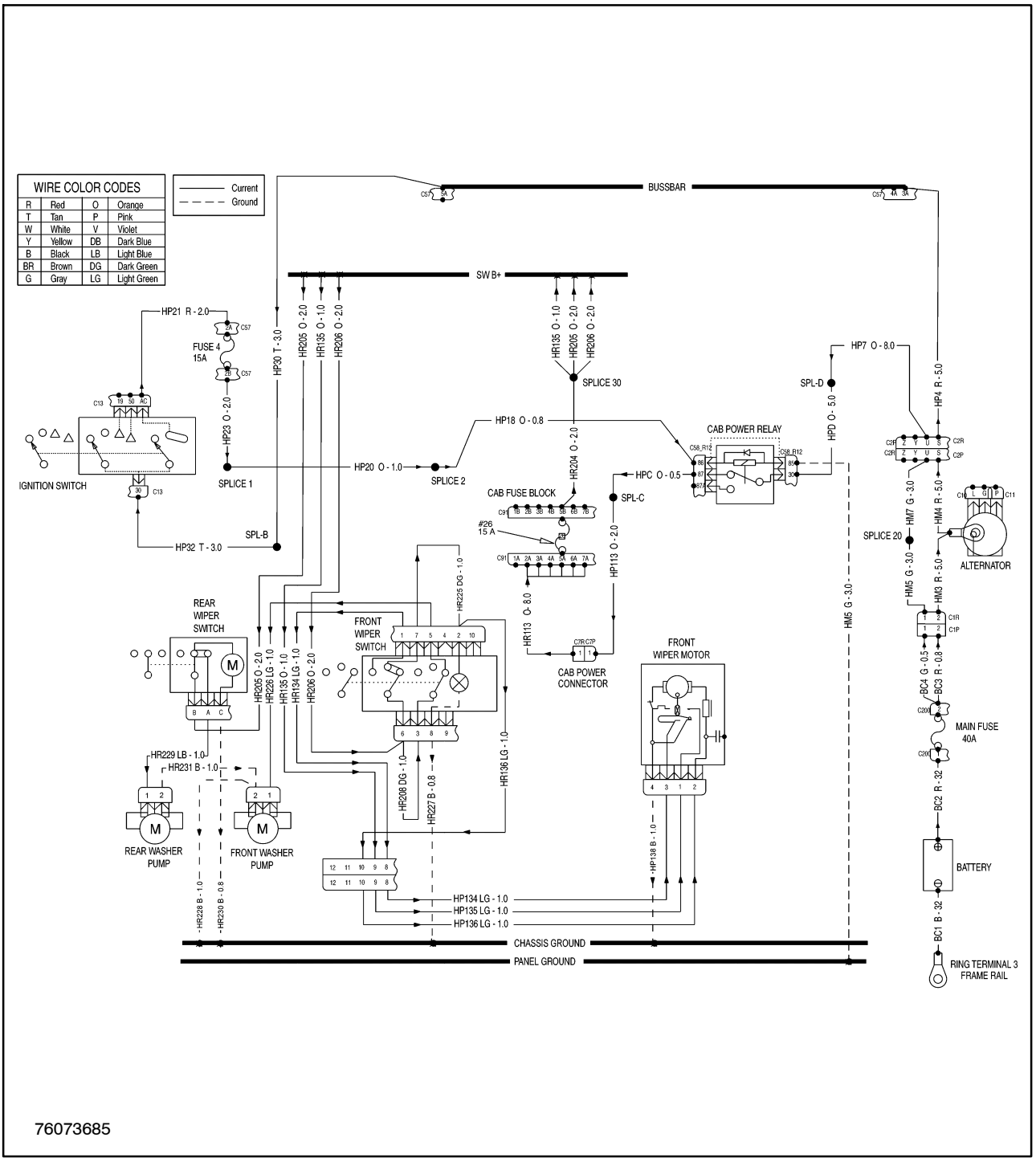
Cab Power Relay

1. When current from fuse #4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse #25 (15 amp)
3. The #25, 15–amp fuse provides current to auxiliary power socket, terminal “ B”.

AUXILIARY POWER SOCKET – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Power socket does not have Current present.	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #25, 15-amp fuse	Replace 15-amp fuse
	Power socket connection not making contact.	Check connector for proper contact.
	Faulty power socket	Check socket , replace if necessary

FRONT AND REAR WIPERS



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FRONT AND REAR WIPERS

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
2. Fuse # 26 Cab fuse block (15 amp) provides current to:
   - Terminal#6 and #3 of the front wiper switch
   - Terminal “B” of the rear wiper switch
   - Terminal #1 of the front wiper motor

Ground Circuits

A ground source is provide to the following components

- Cab power relay
- Front wiper switch
- Front and Rear washer pumps
- Front and Rear wiper motors

Cab Power Relay

1. When current from fuse #4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse #26 (15 amp)
3. Fuse # 26 Cab fuse block (15 amp) provides current to:
   - Terminal#6 and #3 of the front wiper switch
   - Terminal “B” of the rear wiper switch
   - Terminal #1 of the front wiper motor

Front Wiper and Washer

1. Current is supplied to terminal #6 of the front wiper switch.
2. When the switch is placed in the “ON” position the current is transferred from terminal #6 to terminal #7 of the switch.
3. Terminal #7 supplies current to terminal #2 of the switch (switch indicator light) and terminal #2 of the front wiper motor.
4. With current supplied to terminal #2 and ground source supplied to terminal #4 of the motor, the motor will now rotate.
5. When switch terminal #2 has current and #8 has a ground source, the switch indicator light will illuminate.
6. When the switch is placed in the upper position, terminal #3 and terminal #5 are connected.
7. Terminal #5 of the switch provides current to terminal #1 of the front washer pump.
8. When pump terminal #1 has current and terminal #2 has a ground source, the pump will deliver fluid to the front washer.
9. When the front wiper switch is placed in the “OFF” position, terminals #6 and #1 are connected.
10. Terminal #1 of the switch provides current to terminal #3 of the motor.
11. Terminal #1 of the motor (Park) and terminal #3 (Park Feed) have current present when, the front wiper switch is placed in the “OFF” position. The (Park) function allows the motor to return to the “Home Position” no matter what position the motor shaft was in when the switch is placed in the “OFF” position.

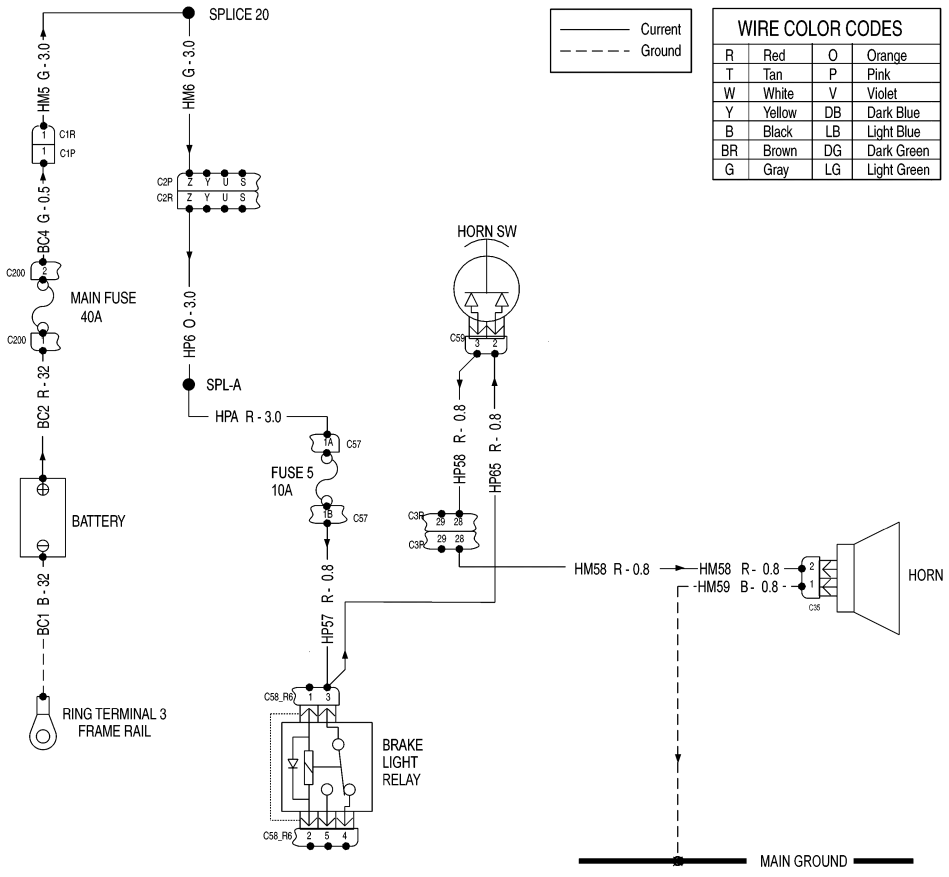
Rear Wiper and Washer

1. Rear wiper switch terminal “B” is supplied current from the #26, 15-amp fuse.
2. When the switch is placed in the first position the rear wiper motor rotates.
3. When the switch is placed in the second position, the rear wiper motor rotates and the rear pump is provided current to terminal #1 and delivers fluid.

FRONT AND REAR WIPERS – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Front wiper will not work	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #26, 15-amp fuse	Replace 15-amp fuse
	Faulty wiper switch	Check switch, replace if necessary
	Faulty wiper motor	Check wiper motor , replace if necessary
Rear wiper will not work	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #26, 15-amp fuse	Replace 15-amp fuse
	Faulty wiper switch	Check switch, replace motor assembly if necessary
	Faulty wiper motor	Check wiper motor, replace assembly if necessary.

HORN



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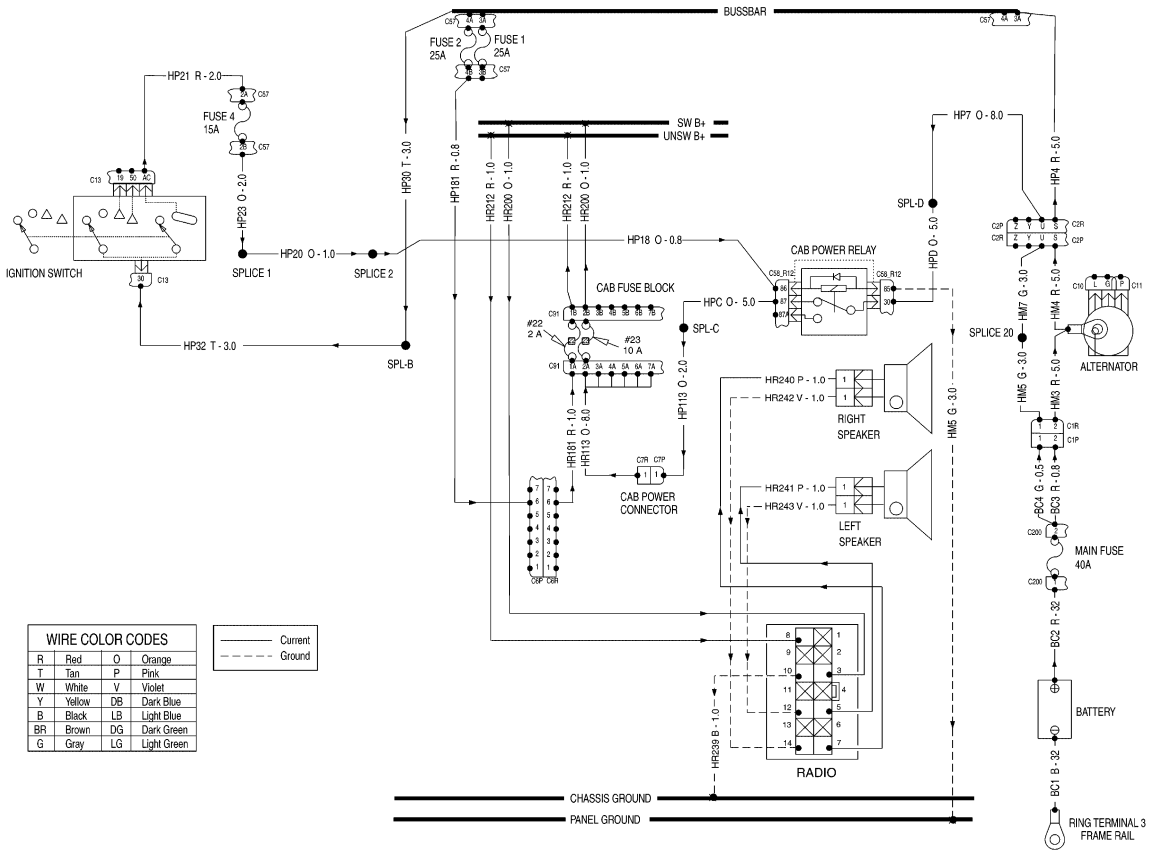
HORN

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to fuse # 5 (10 amp) fuse .
3. Fuse # 5 provides current to terminal # 2 of the horn switch.
4. When the horn switch is placed in the “ON” position, terminals #2 and #3 are connected, and the horn sounds.
5. Ground source for horn terminal #1 is the main ground location.

HORN CIRCUIT - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Horn will not work	Blown #5, 10-amp fuse	Replace 10-amp fuse
	Faulty horn switch	Check switch, replace if necessary
	Faulty ground circuit	Check ground circuit, repair if necessary
	Faulty horn	Check horn , replace if necessary

RADIO



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RADIO

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch and fuse #2 (25 amp)
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 2 (25 amp) provides current to:
   - Fuse #22 (2 amp)

   The 2-amp fuse provides current to the radio for memory functions, when the key switch is in the “OFF” position.
2. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
3. Fuse # 23 Cab fuse block (10 amp) provides current to:
   - Terminal # 3 of the radio

Ground Circuits

A ground source is provide to the following components

- Cab power relay
- Radio
- Left and Right speakers

Cab Power Relay

1. When current from fuse #4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse #23 (10 amp)
3. Fuse # 23 Cab fuse block (10 amp) provides current to:
   - Terminal # 3 of the radio

Radio Functions

1. The radio terminals have the following functions:
   - Terminal #3, current input (functional)
   - Terminal #5, current output, left speaker
   - Terminal #7, current output, right speaker
   - Terminal #8, current input (memory)
   - Terminal #10, ground
   - Terminal #12, ground, left speaker
   - Terminal #14, ground, right speaker

RADIO – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Radio will not play	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #23, 10-amp fuse	Replace 10-amp fuse
	Radio Harness connector not making contact	Check connector for proper contact.
	Faulty radio	Replace radio
Memory on radio will not function	Blown #2, 25-amp fuse	Replace 25-amp fuse
	Blown #22, 2-amp fuse	Replace 2-amp fuse
	Faulty radio	Replace radio

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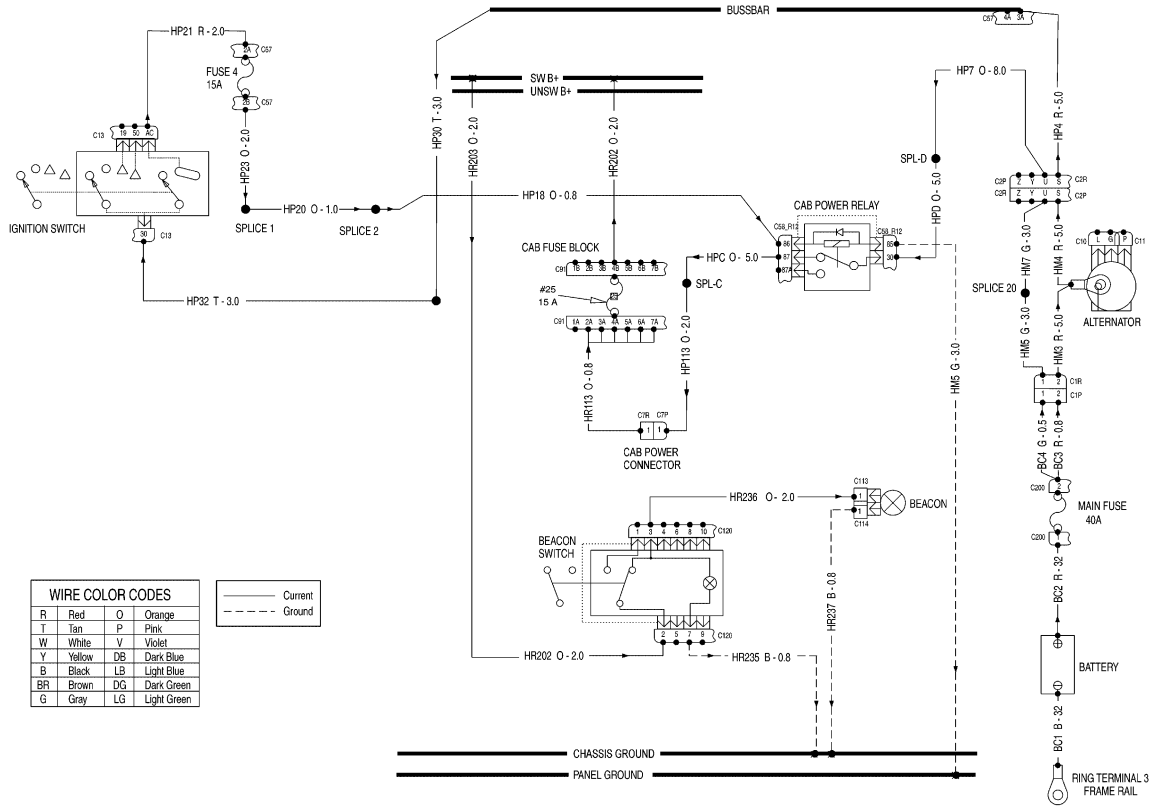
BEACON



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BEACON

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch and fuse #2 (25 amp)
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Cab power relay (coil side)
2. Fuse # 25 Cab fuse block (15 amp) provides current to:
   - Beacon Switch, terminal #2

Ground Circuits

A ground source is provide to the following components

- Cab power relay
- Beacon
- Beacon switch

Cab Power Relay

1. When current from fuse #4 and a ground source is supplied to coil side of the relay, the relay energizes and latches.
2. When the relay latches, terminals # 30 and # 87 are connected, sending current to the cab fuse block, fuse #25 (15 amp)
3. Fuse # 25 Cab fuse block (15 amp) provides current to:
   - Beacon Switch, terminal #2

Beacon Switch

1. When the beacon switch is placed in the “ON” position, current is transferred from terminal #2 to terminal #3 of the switch.
2. Terminal #3 of the switch provides current to the beacon and internal switch indicator light..

BEACON - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Beacon will not work	Ignition switch not in the “ON” position	Place ignition switch in the “ON” position
	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty cab power relay	Test relay, replace if necessary
	Blown #25, 15-amp fuse	Replace 15-amp fuse
	Faulty beacon switch	Check switch, replace if necessary
	External power socket connection not making contact.	Check connector for proper contact.
	Faulty Beacon	Check Beacon , replace if necessary

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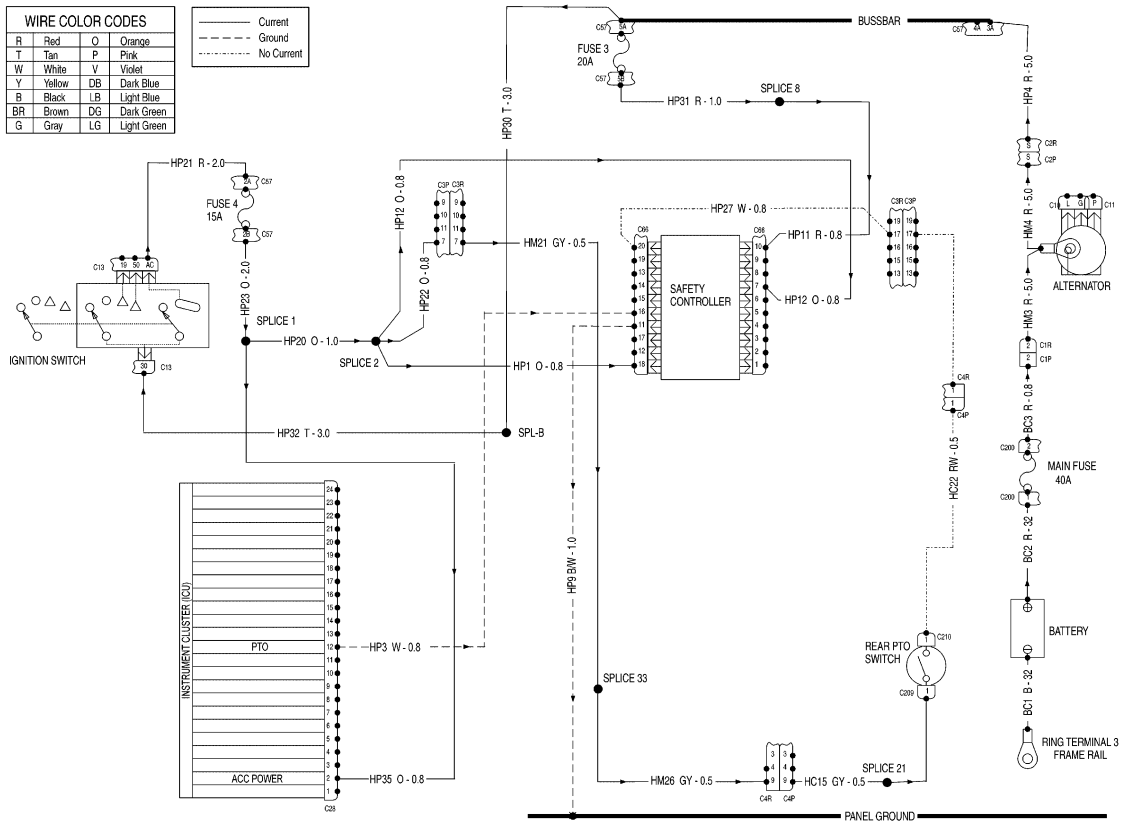
PTO INDICATOR LIGHT



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PTO INDICATOR LIGHT

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

- Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse # 3 – Provides current to terminal# 10 of the safety controller

Fuse #4 – Provides current to: Terminal # 7 and # 18 of the safety controller
Terminal # 2 of instrument panel
Input to rear PTO switch

Ground Circuits

The ground source for the glow plug circuit is located on the front of the engine cylinder head. Ground source is provided to the following components.

- Terminal # 11 of the safety controller

Rear PTO Switch

1. When the PTO is place in the “ON” position the PTO switch opens, terminating current at the switch. No current is sent to terminal #20 of the safety controller.

Safety Controller Functions

When current is not present at terminal #20 of the safety controller, terminal #16 provides a ground source.

Controller Inputs (+)

- Terminal # 7 – From Fuse # 4
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4

Ground Terminals (-)

- Terminal # 11, provided by the cylinder head ground source
- Terminal # 16, provides ground source for PTO indictor light

PTO Indicator Light

1. Current to the PTO indicator light is provided by terminal # 2 of the instrument panel, this current is controlled by fuse # 4.
2. The ground source for the indicator light terminal # 12 of the instrument panel is provided by terminal # 16 of the safety controller.
3. The PTO indicator light will illuminate when the PTO is in the engaged position, warning the operator that the PTO is engaged.

PTO INDICATOR LIGHT - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
PTO light will not illuminate	Blown, #4, 15-amp instrument panel fuse	Inspect and replace fuse as needed
	Blown #3, 20-amp fuse	Inspect and replace fuse as needed
	PTO indicator bulb faulty	Inspect bulb and replace as necessary
	Faulty wiring or ground terminal	Inspect tractor wiring harness and ground terminals for damage, corrosion, loose connectors, or short circuits. Repair or replace as necessary.
	Faulty rear PTO switch	Test switch and replace as necessary
	Faulty safety controller	Test controller and replace as necessary
	Malfunctioning Instrument Panel	Test instrument panel and replace as necessary
PTO indicator light remains illuminated	Rear PTO switch improperly adjusted	Check switch adjustment
	Defective safety controller	Test controller and replace as necessary
	Faulty wiring or ground terminal	Inspect tractor wiring harness and ground terminals for damage, corrosion, loose connectors, or short circuits. Repair or replace as necessary.

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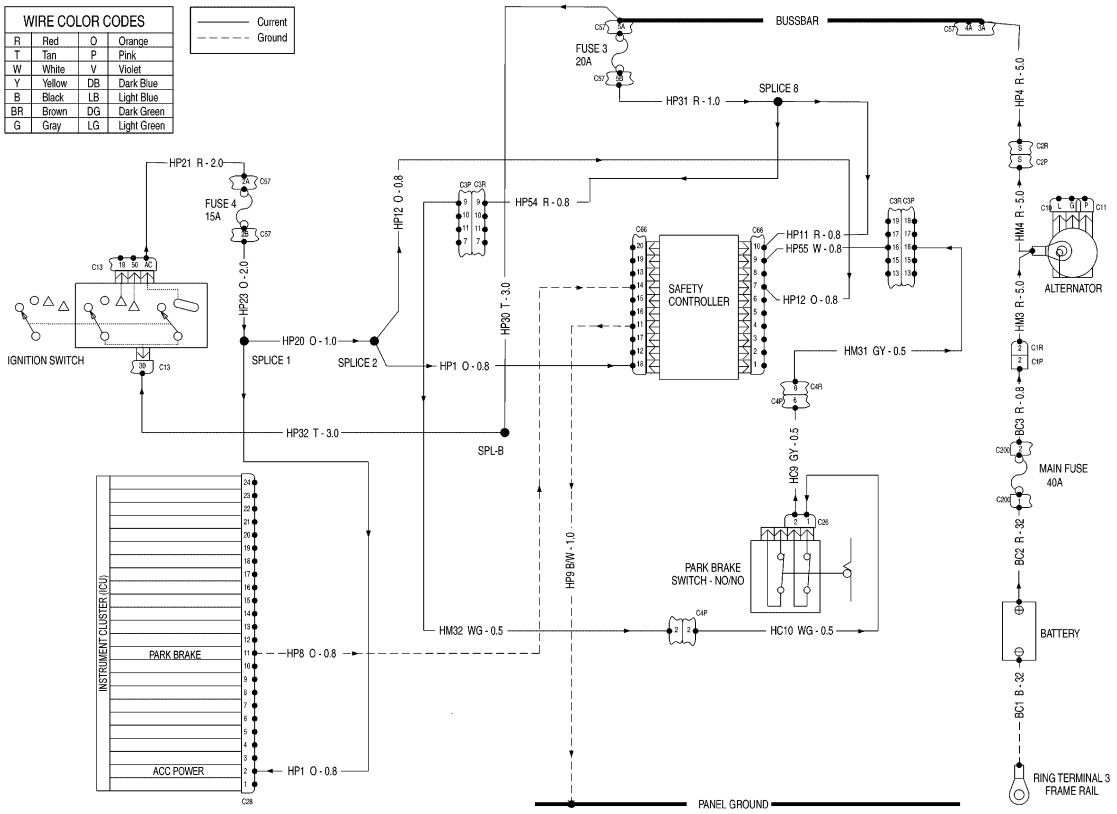
PARK BRAKE INDICATOR LIGHT



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PARK BRAKE INDICATOR LIGHT

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

- Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse # 3 – Provides current to: Terminal# 10 of the safety controller
Input to park brake switch

Fuse #4 – Provides current to: Terminal # 7 and # 18 of the safety controller
Terminal # 2 of instrument panel

Ground Circuits

The ground source for the glow plug circuit is located on the front of the engine cylinder head. Ground source is provided to the following components.

- Terminal # 11 of the safety controller

Park Brake Switch

1. When the park brake is place in the “ON” position the park brake switch closes, sending current to terminal #9 of the safety controller.

Safety Controller Functions

When current is present at terminal #9 of the safety controller, terminal #14 provides a ground source.

Controller Inputs (+)

- Terminal # 7 – From Fuse # 4
- Terminal # 10 – From Fuse # 3
- Terminal # 18 – From Fuse # 4

Ground Terminals (-)

- Terminal # 11, provided by the cylinder head ground source
- Terminal # 14, provides ground source for park brake indictor light

Park Brake Indicator Light

1. Current to the park brake indicator light is provided by terminal # 2 of the instrument panel, this current is controlled by fuse # 4.
2. The ground source for the indicator light terminal # 11 of the instrument panel is provided by terminal # 14 of the safety controller.
3. The park brake indicator light will illuminate when the park brake is in the engaged position, warning the operator that the park brake is engaged.

PARK BRAKE INDICATOR LIGHT – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Park brake indicator light will not illuminate	Blown #4, 15-amp fuse	Inspect and replace fuse as needed.
	Blown #3, 20-amp fuse	Inspect and replace fuse as needed.
	Indicator bulb faulty	Inspect bulb and replace as necessary
	Faulty safety controller	Check controller, replace as necessary
	Faulty wiring or ground terminal	Inspect tractor wiring harness and ground terminals for damage, corrosion, loose connectors or short circuits. Repair or replace as necessary
	Faulty Park Brake switch	Test switch replace as necessary
Park brake indicator light remains illuminated	Faulty Park Brake switch	Test switch replace as necessary
	Faulty wiring or ground terminal	Inspect tractor wiring harness and ground terminals for damage, corrosion, loose connectors or short circuits. Repair or replace as necessary

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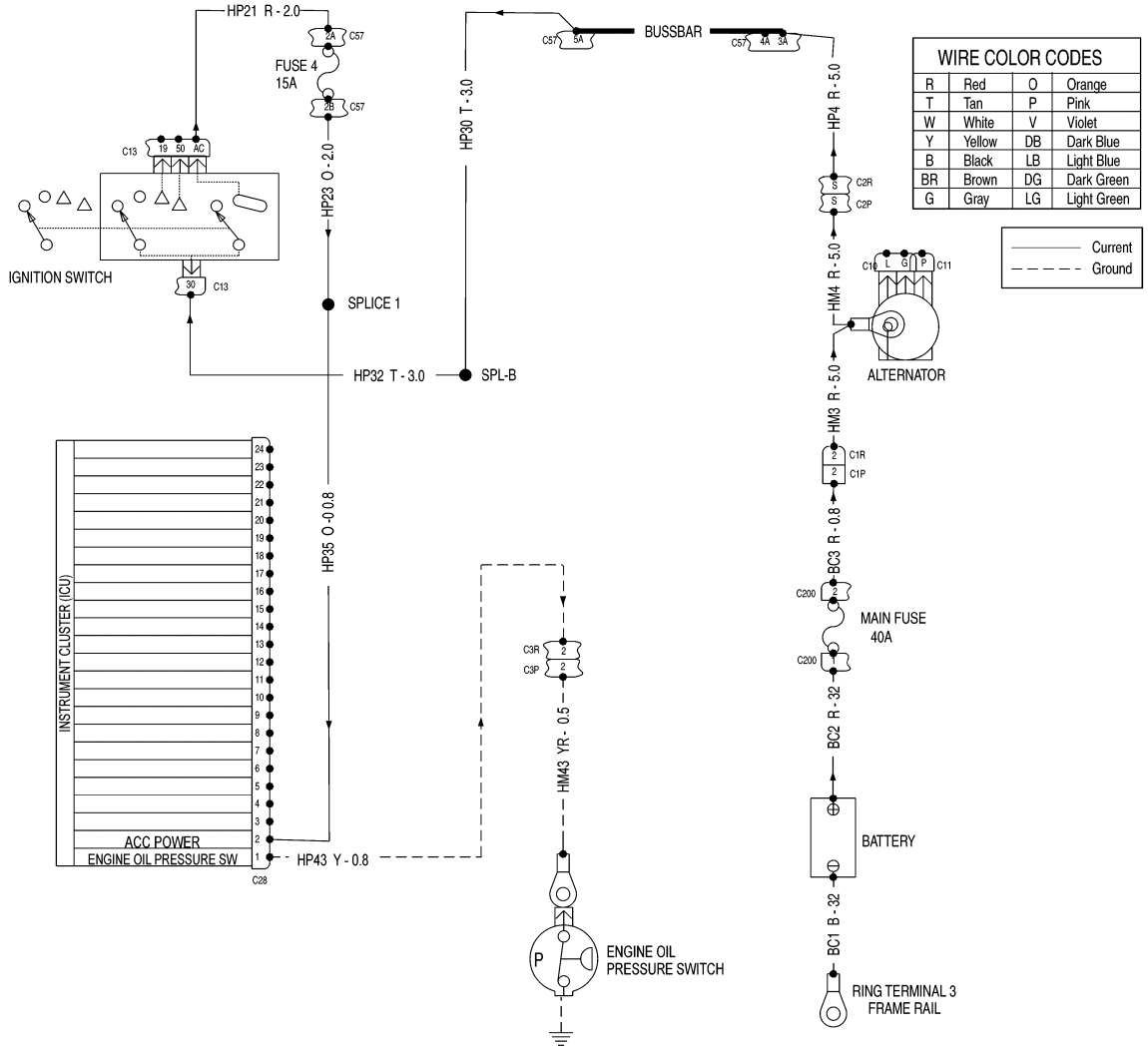
ENGINE LOW OIL PRESSURE INDICATOR LIGHT



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ENGINE LOW OIL PRESSURE INDICATOR LIGHT

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

1. Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse #4 – Provides current to terminal # 2 of the instrument panel.

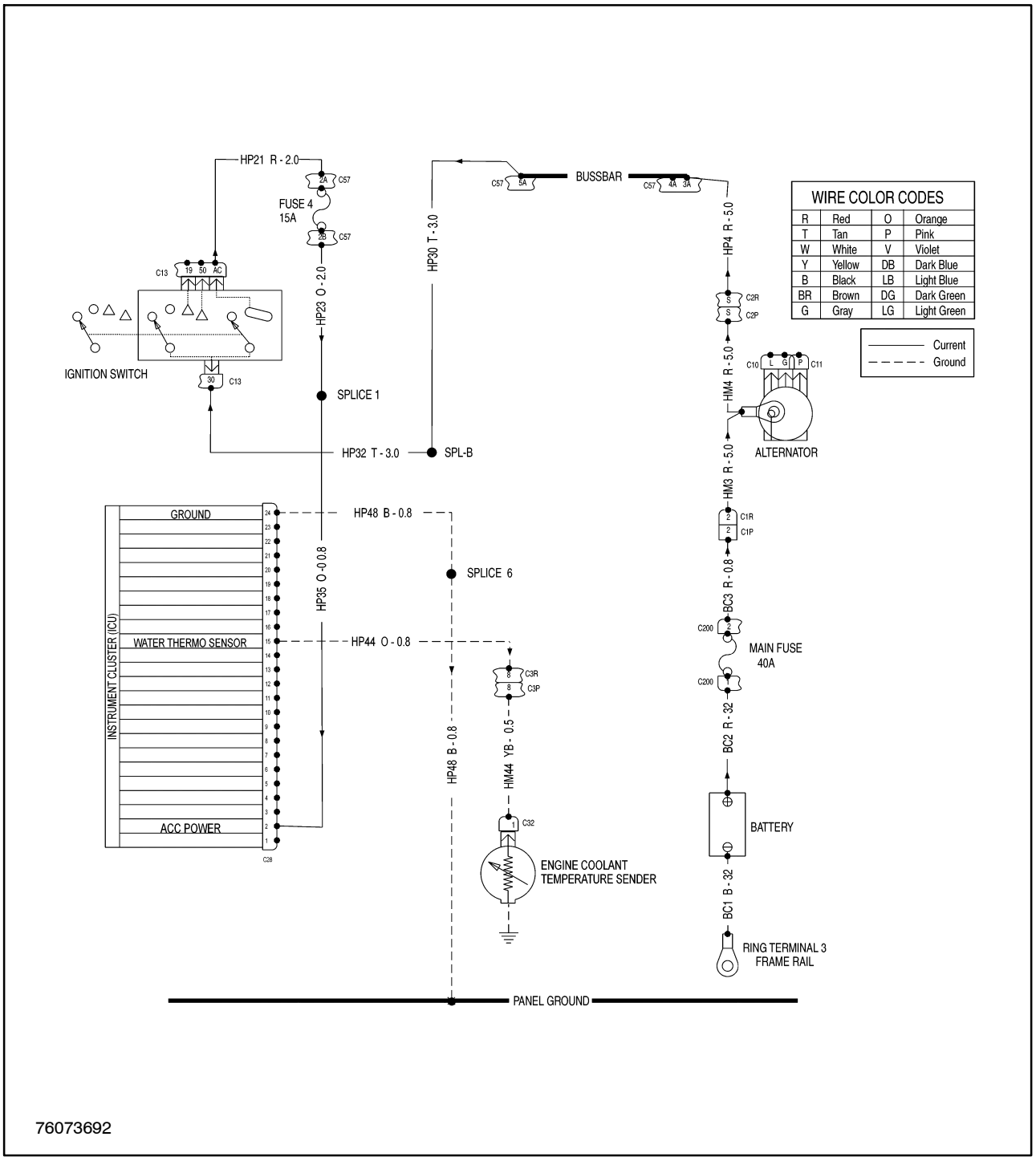
Engine Oil Pressure Switch

When the engine oil pressure falls below .41 bar (6 psi), the engine oil pressure switch closes and completes the ground circuit to terminal # 1 of the instrument panel, for the indicator light. The is cause the light to illuminate, warning the operator to an engine problem.

ENGINE LOW OIL PRESSURE INDICATOR LIGHT – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Oil pressure warning light remains illuminated	Low engine oil pressure	Test engine lubrication system and repair as necessary
	Defective oil pressure switch	Test oil pressure switch and replace as necessary
	Oil pressure circuit is short-circuited	Check oil pressure switch, ground and wires for short circuit
	Defective instrument panel	Test instrument panel and replace as necessary
Oil pressure warning light will not illuminate	Blown #4, 15-amp fuse	Replace fuse as necessary
	Faulty oil pressure warning bulb	Inspect warning bulb and replace as necessary
	Oil pressure circuit open	Check oil pressure switch connections and wires

ENGINE COOLANT TEMPERATURE GAUGE



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ENGINE COOLANT TEMPERATURE GAUGE

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

1. Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse #4 – Provides current to terminal # 2 of the instrument panel.

Ground Circuits

A ground source is provided to the following:

- Terminal #24 of the instrument panel.

Engine Coolant Temperature Sender

The temperature sender works as a variable resister to ground. As the temperature of the engine increases the resistance of the sender decreases, allowing the temperature gauge to read a higher temperature. The sender provides a ground circuit to terminal #15 of the instrument panel.

Temperature Gauge

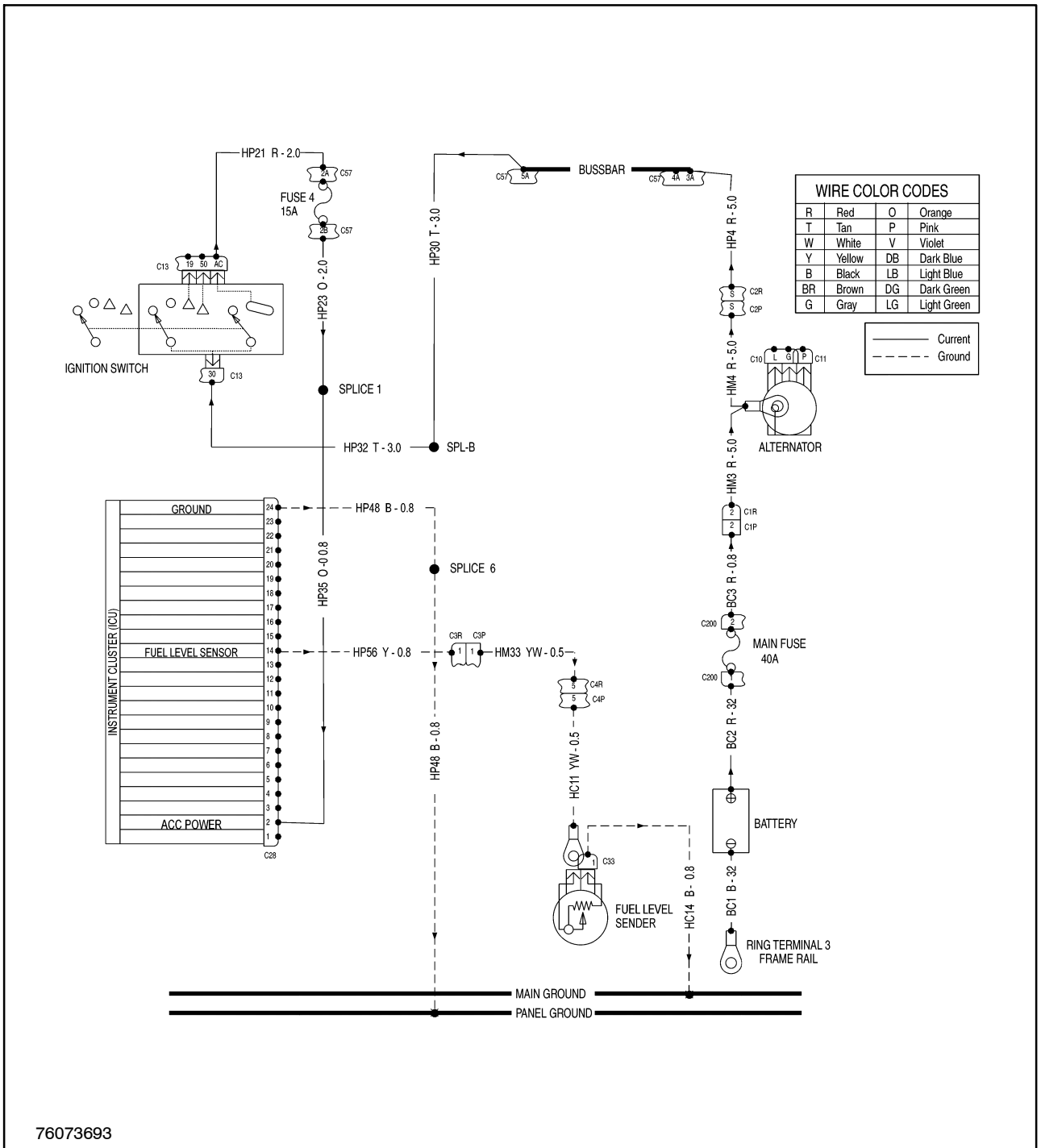
For the temperature gauge to work properly the following must exist:

- Current provided to terminal #2 of the instrument panel
- Constant ground provide to terminal #24 of the instrument panel
- Variable resistance to ground provided to terminal #15 of the instrument panel

ENGINE COOLANT TEMPERATURE GAUGE – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Inoperative temperature gauge	Blown #4, 15-amp instrument panel fuse	Check 15-amp fuse and replace as necessary
	Defective coolant temperature sending unit	Test coolant temperature sending unit and replace as necessary
	Defective temperature gauge	Test temperature gauge, replace instrument panel as necessary
	Faulty ground for temperature gauge	Check ground terminal at starter bolt. Repair as necessary

FUEL LEVEL GAUGE CIRCUIT



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FUEL LEVEL GAUGE CIRCUIT

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

1. Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse #4 – Provides current to terminal # 2 of the instrument panel.

Ground Circuits

A ground source is provided to the following:

- Terminal #24 of the instrument panel.
- Fuel Level sender

Fuel Level Sender

The fuel level sender works as a variable resister to ground. As the fuel level in the fuel tank increases the resistance of the sender decreases, allowing the fuel level gauge to read a higher level reading. The sender provides a ground circuit to terminal #14 of the instrument panel.

Fuel Level Gauge

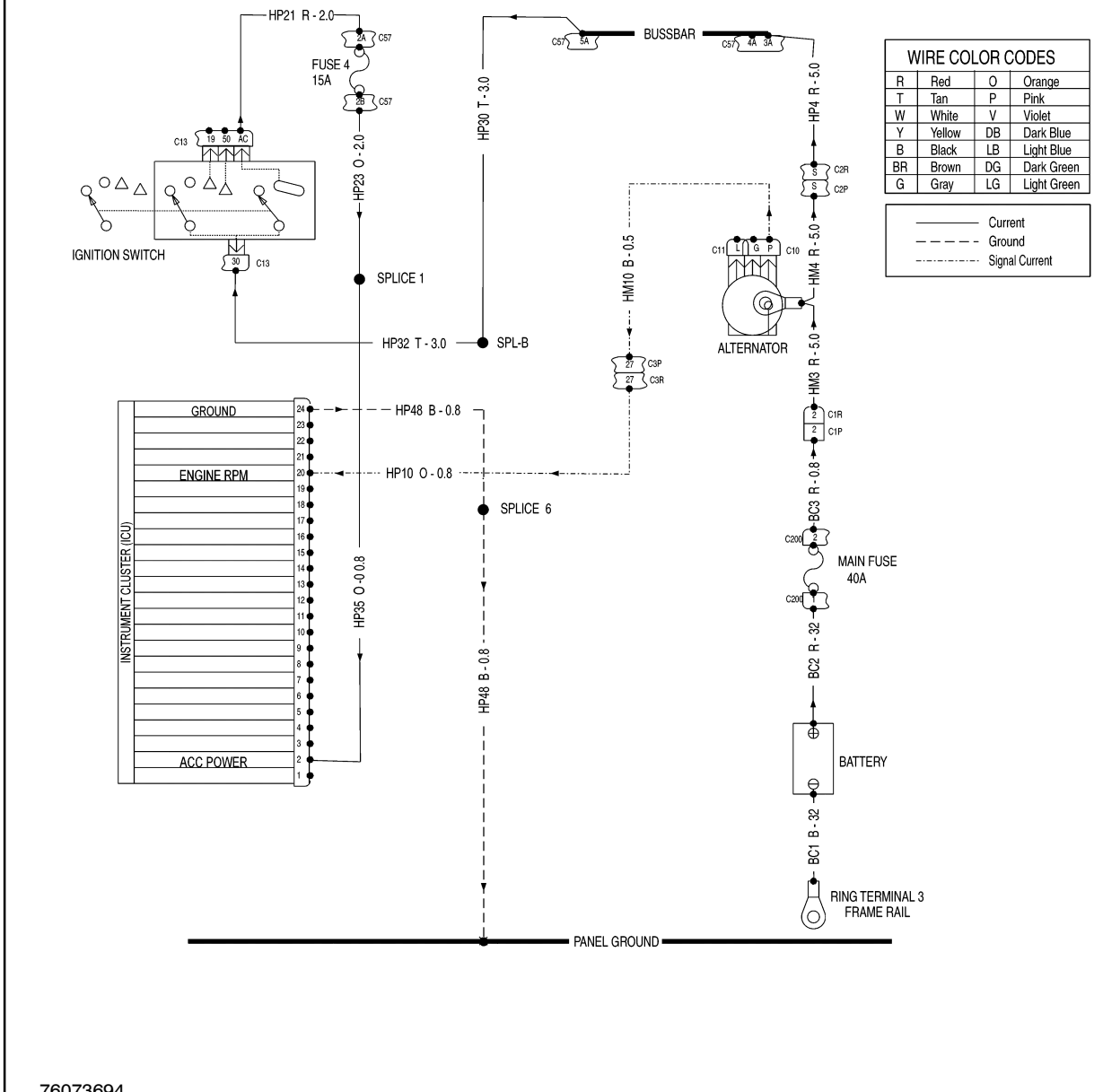
For the fuel level gauge to work properly the following must exist:

- Current provided to terminal #2 of the instrument panel
- Constant ground provide to terminal #24 of the instrument panel
- Variable resistance to ground provided to terminal #14 of the instrument panel

FUEL LEVEL GAUGE CIRCUIT – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Inoperative fuel level gauge	Blown #4, 15-amp instrument panel fuse	Check fuse and replace as necessary
	Malfunctioning fuel level sending unit	Test fuel level sending unit and replace as necessary
	Improper ground circuit	Check fuel level sending unit connections and circuit grounds and repair as necessary
	Malfunctioning fuel gauge	Test fuel gauge and replace instrument panel as necessary

TACHOMETER



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TACHOMETER

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

1. Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse #4 – Provides current to terminal # 2 of the instrument panel.

Ground Circuits

A ground source is provided to the following:

- Terminal #24 of the instrument panel.

Alternator

Terminal “P” of the alternator (HM10 B-0.5 coded wire) provides a signal current to terminal #20 of the instrument panel. This current controls the tachometer’s engine RPM reading.

Tachometer

For the tachometer to work properly the following must exist:

- Current provided to terminal #2 of the instrument panel
- Constant ground provide to terminal #24 of the instrument panel
- Signal current provided to terminal #20 of the instrument panel

TACHOMETER - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Tachometer does not operate when tractor engine is running	Blown #4, 15-amp instrument panel fuse	Inspect and replace fuse as necessary
	Defective tachometer	Test tachometer and replace instrument panel as necessary
	Tachometer pick-up wire damaged, corroded, disconnected or short-circuited	Inspect tachometer pick-up, repair or replace as necessary
	Faulty tachometer gauge ground	Inspect and repair ground wire as necessary
	Defective alternator component	Test alternator and components, repair or replace as necessary
Inaccurate tachometer reading	Malfunctioning tachometer	Test tachometer and replace instrument panel as necessary
	Loose alternator belt	Adjust belt tension

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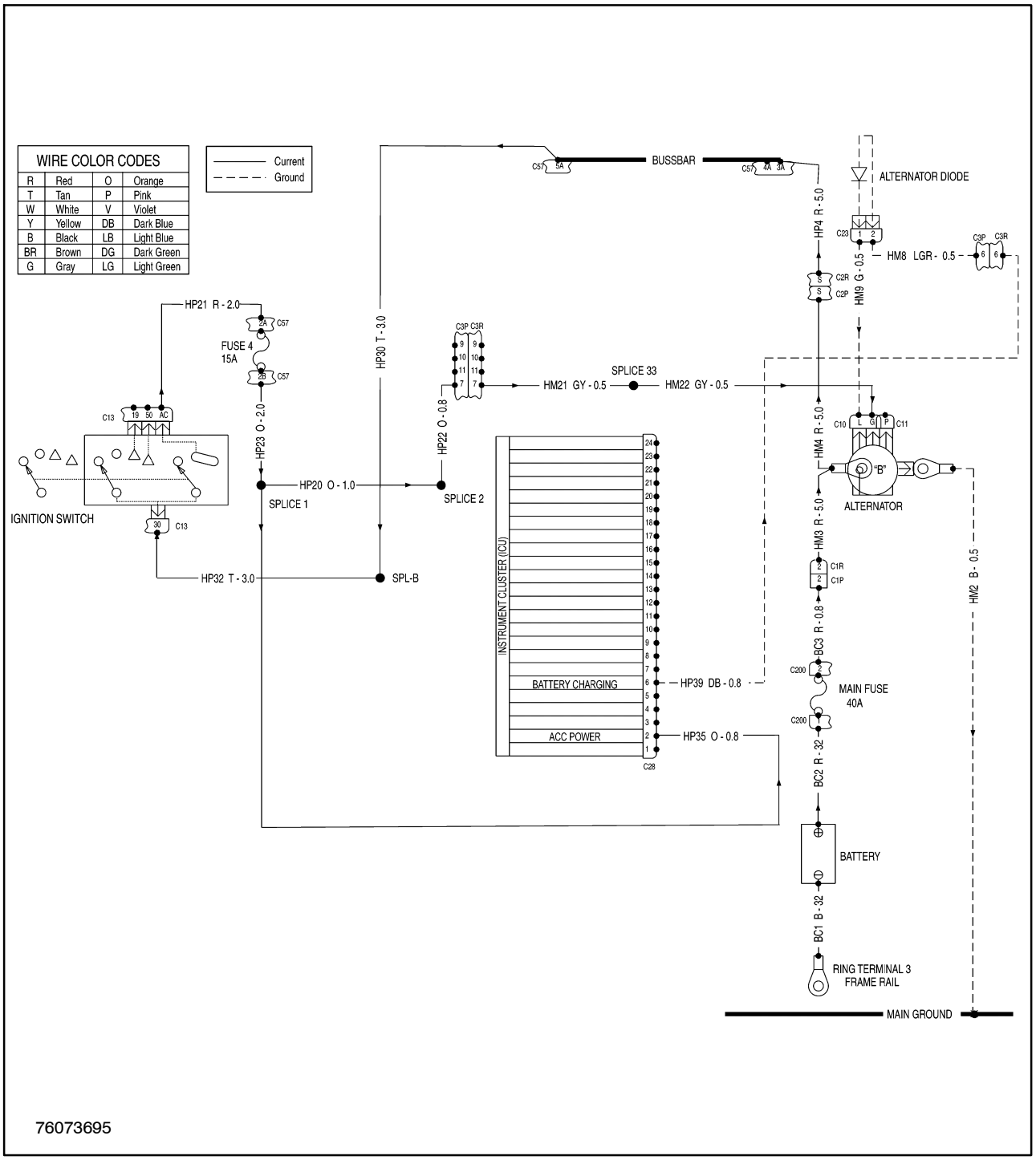
CHARGING


WIRE COLOR CODES
R Red
T Tan
W White
Y Yellow
B Black
BR Brown
G Gray
O Orange
P Pink
V Violet
DB Dark Blue
LB Light Blue
DG Dark Green
LG Light Green
Current
Ground
BUSSBAR
ALTERNATOR DIODE
HP4 R - 5.0
HM8 LGR - 0.5
HM9 G - 0.5
HP21 R - 2.0
FUSE 4
15A
HP23 O - 2.0
HP30 T - 3.0
HP22 O - 0.8
HM21 GY - 0.5
SPLICE 33
HM22 GY - 0.5
HM4 R - 5.0
ALTERNATOR
HM3 R - 5.0
HM2 B - 0.5
IGNITION SWITCH
HP20 O - 1.0
SPLICE 1
SPLICE 2
HP32 T - 3.0
SPL-B
INSTRUMENT CLUSTER (ICU)
BATTERY CHARGING
ACC POWER
HP39 DB - 0.8
HP35 O - 0.8
BC3 R - 0.8
MAIN FUSE
40A
BC2 R - 32
BATTERY
BC1 B - 32
RING TERMINAL 3
FRAME RAIL
MAIN GROUND
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CHARGING

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30” of the key switch.
3. When the key switch is in the “ACC/RUN” position current crosses from terminal “30” to the “AC” terminals.

Key Switch Terminals

Terminal “AC”

1. Terminal “AC” provides current to Fuse # 4.

Fuse Functions

Fuse #4 – Provides current to:

- Terminal # 2 of the instrument panel.
- Terminal “G” of the alternator

Alternator/Indicator Light

1. If the tractor engine is not running or the alternator is not producing a sufficient amount of charge, (with key switch in the “ACC/RUN” position) the charge light will illuminate.
   - The current for the indicator light is provided by terminal #2 of the instrument panel.
   - The ground source for the indicator light is provided by terminal #6 of the instrument panel from terminal #6, the ground path passes through an external diode, then to the “L” terminal of the alternator. The ground source for the “L” terminal is provided by the alternator field coil.
   - When the ground circuit is complete to terminal #6 and current is provided to terminal #2 by fuse #4, the charge light will illuminate.
2. When the tractor engine is running with the alternator rotating and the ignition key in the “ACC/RUN” position, the alternator produces and increased regulated voltage to the battery.
   - When the alternator is producing current, the ground circuit, through the “L” terminal for the charge indicator light is disrupted, causing the indicator light to not illuminate.
   - The “G” (regulator) terminal controls the voltage output from the alternator. If current is not present at the “G” terminal the alternator will not produce current.
   - The “B” terminal of the alternator is the output connection between the alternator and the battery.

CHARGING - TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Charge light remains illuminated	Faulty alternator component	Test alternator and repair a necessary
	Short circuit to ground between alternator and warning lamp	Check wiring and repair as necessary
Charge light does not illuminate	Blown #4, 15-amp instrument panel fuse	Inspect 15-amp fuse and replace as necessary
	Faulty charge indicator bulb	Inspect indicator bulb and replace as necessary
	Open charge light circuit	Inspect connections, grounds, and wiring for charge circuit and repair as necessary
Insufficient or no battery charge, hard starting, or dim indicator light	Battery charge less than 75%	Test battery. Charge, add water, or replace as necessary
	Fan belt slipping	Check fan belt tension, adjust as necessary
	Loose wiring connections	Check wiring connections for charge circuit, repair as necessary
	Continuity fault in external wiring	Check wiring harness and repair as necessary
	Blown #4, 15-amp alternator excitation fuse	Inspect 15-amp fuse and replace as necessary
Battery failure, frequent burnout of lamps and fuses	Overcharge condition	Check alternator voltage output and repair as necessary
	Ground circuit for alternator short-circuited	Check alternator wiring and connections and repair as necessary

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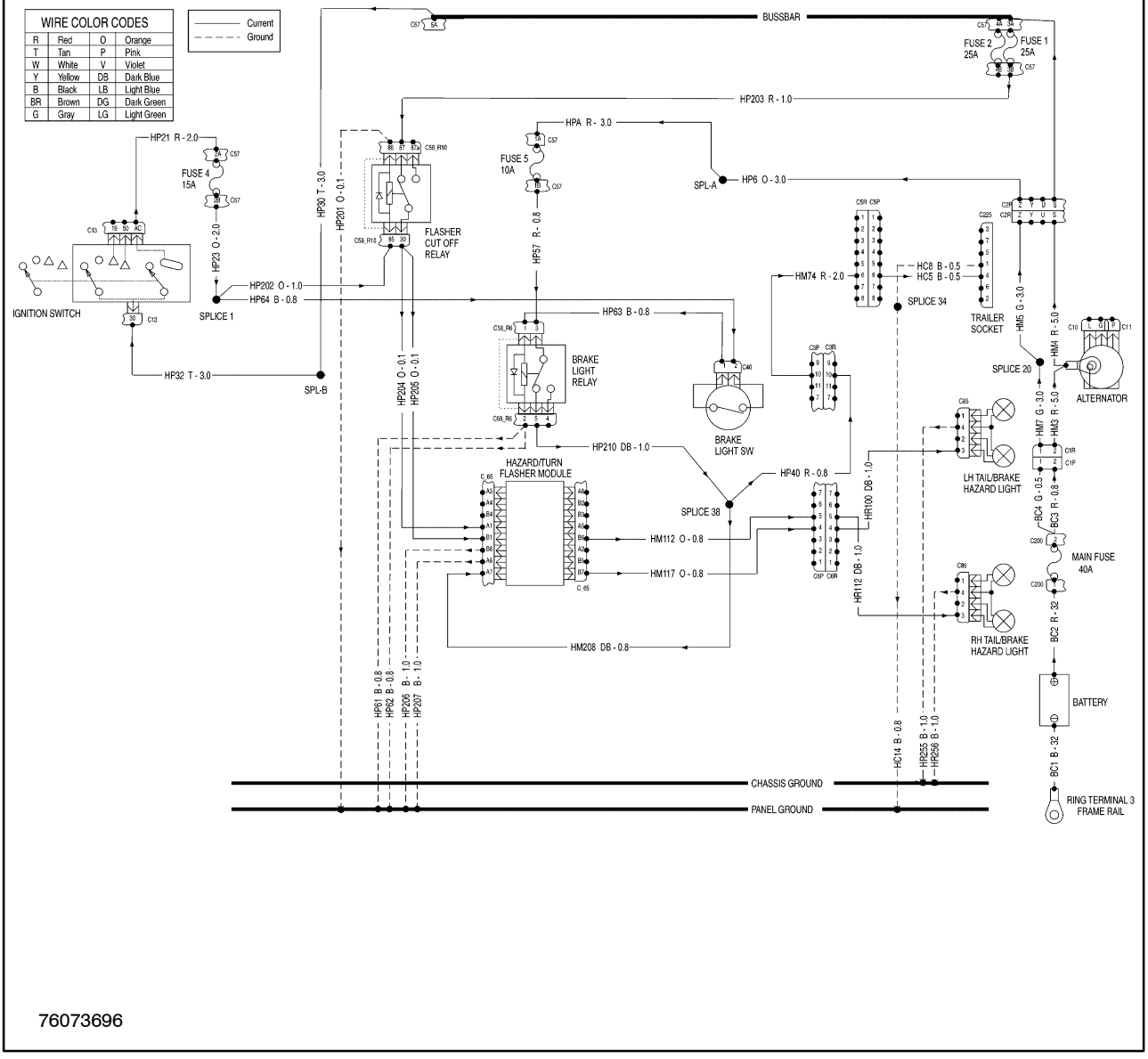
BRAKE LIGHTS



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BRAKE LIGHTS

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 1 (25 amp) provides current to:
   - Flasher cutoff relay, terminal # 87
2. Fuse # 4 (15 amp) provides current to:
   - Flasher cutoff relay, terminal # 85
   - Brake light switch
3. Fuse #5 (10 amp) provides current to:
   - Brake light relay

Ground Circuits

Ground source is provided to the following:

- Terminal #2 of the brake light relay
- Terminals A8 and B8 of the hazard/turn flasher module
- Right and left taillights
- Flasher cutoff relay
- 7–pin connector, terminal #1

Brake Light Switch Function

1. When the brakes are applied the switch contacts close sending current to terminal # 1 (coil side) of the brake light relay.

Brake Light Relay Function

1. When current is provided to terminal #1 and a ground source provided to terminal #2, the relay energizes, latching terminals #3 and #5.
2. Terminal #5 sends current to:
   - Terminal A7 of the hazard/turn flasher module
   - Terminal #4 of the 7–pin connector

Flasher Cutoff Relay Function

The function of the flasher cutoff relay is to provide current to the hazard / turn module either when the key switch is in the “ON” or “OFF” mode.

1. When the flasher cutoff relay is not energized, key switch in “OFF” position terminals 87a and 30 are connected.
2. When the flasher cutoff relay is energized, key switch in “ON” position terminals 87 and 30 are connected.

Hazard / Turn Flasher Module Functions

Module Inputs (+)

- Terminal A1 – Current from flasher cutoff relay
- Terminal B1 – Current from flasher cutoff relay
- Terminal A7 – Current from brake light relay

Module Outputs (+)

- Terminal B6 – Current to right taillight
- Terminal B7 – Current to left taillight

Ground Circuits (-)

- Terminal A8 – provided by the cylinder head ground source
- Terminal B8 – provided by the cylinder head ground source

Brake Lights Functions

The hazard/turn flasher module sends current to the right and left taillights to illuminate taillights to indicate brakes being applied.

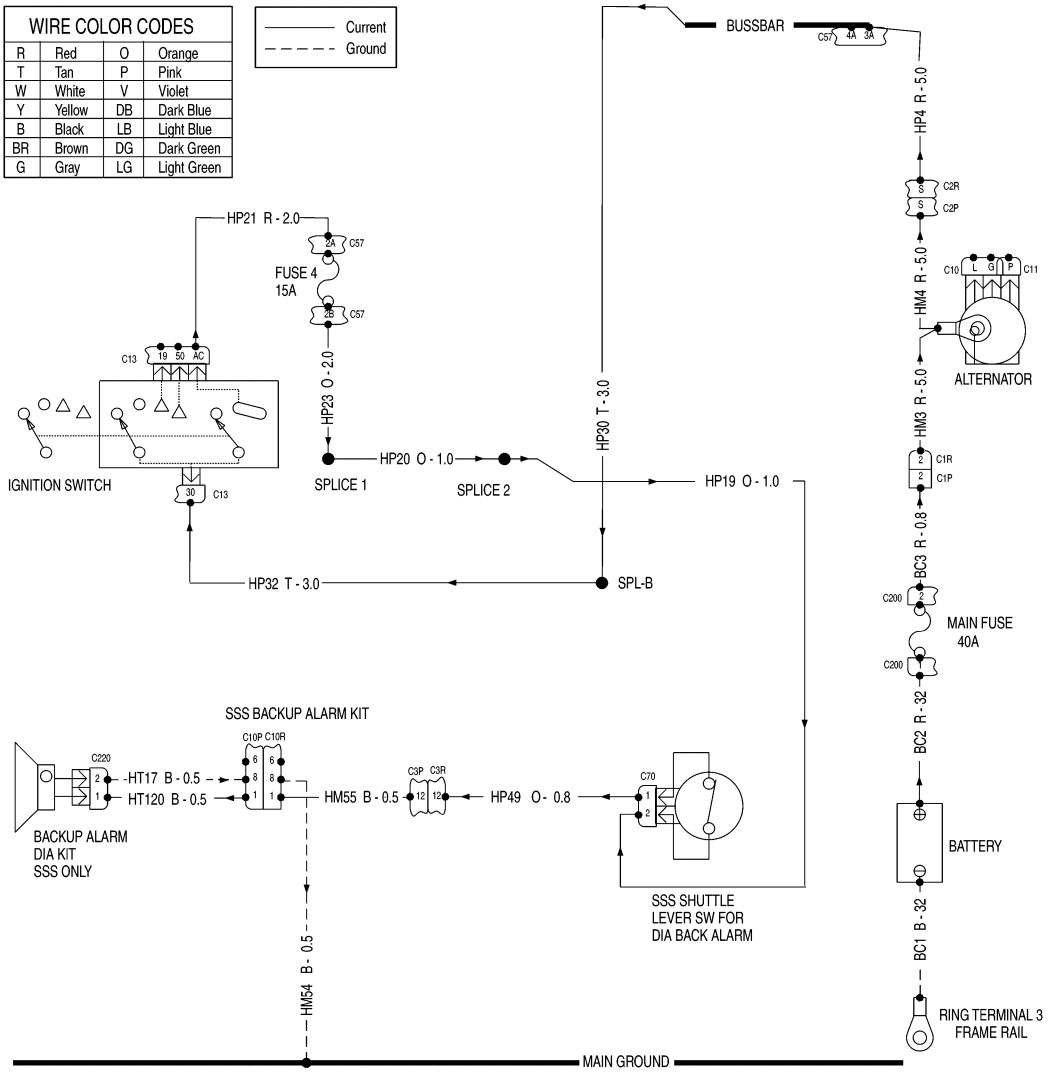
The brake light relay sends current to the 7–pin connecter for trailer brake lights operation.

NOTE: *If either right or left turn signals are activated and the brakes are applied, taillight illumination (with brake lights) will not be detected, because taillight bulb is already illuminated by the turn signal circuit.*

BRAKE LIGHTS – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Brake lights will not illuminate , when brake pedals are de-pressed.	Blown #5, 10–amp fuse	Replace 10 amp fuse
	Blown #1, 25–amp or #4, 15–amp fuse	Replace 25 or 15 amp fuse.
	Faulty ground circuit	Check ground locations for proper contact
	Faulty brake light switch	Test switch , replace if necessary
	Faulty brake light relay	Test relay, replace if necessary
	Faulty hazard/turn flasher module	Test module, replace if necessary
	Faulty flasher cutoff relay	Test relay, replace if necessary
	Faulty brake light bulb	Check bulb, replace if necessary.
Brake lights will not go out When brake pedals are not depressed.	Faulty brake light switch	Test switch , replace if necessary
	Faulty brake light relay	Test relay, replace if necessary
	Faulty hazard/turn flasher module	Test module, replace if necessary

BACKUP ALARM (SSS)



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BACKUP ALARM (SSS)

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - Backup alarm switch

Ground Circuit

Ground source is provided to the following:

- Backup alarm

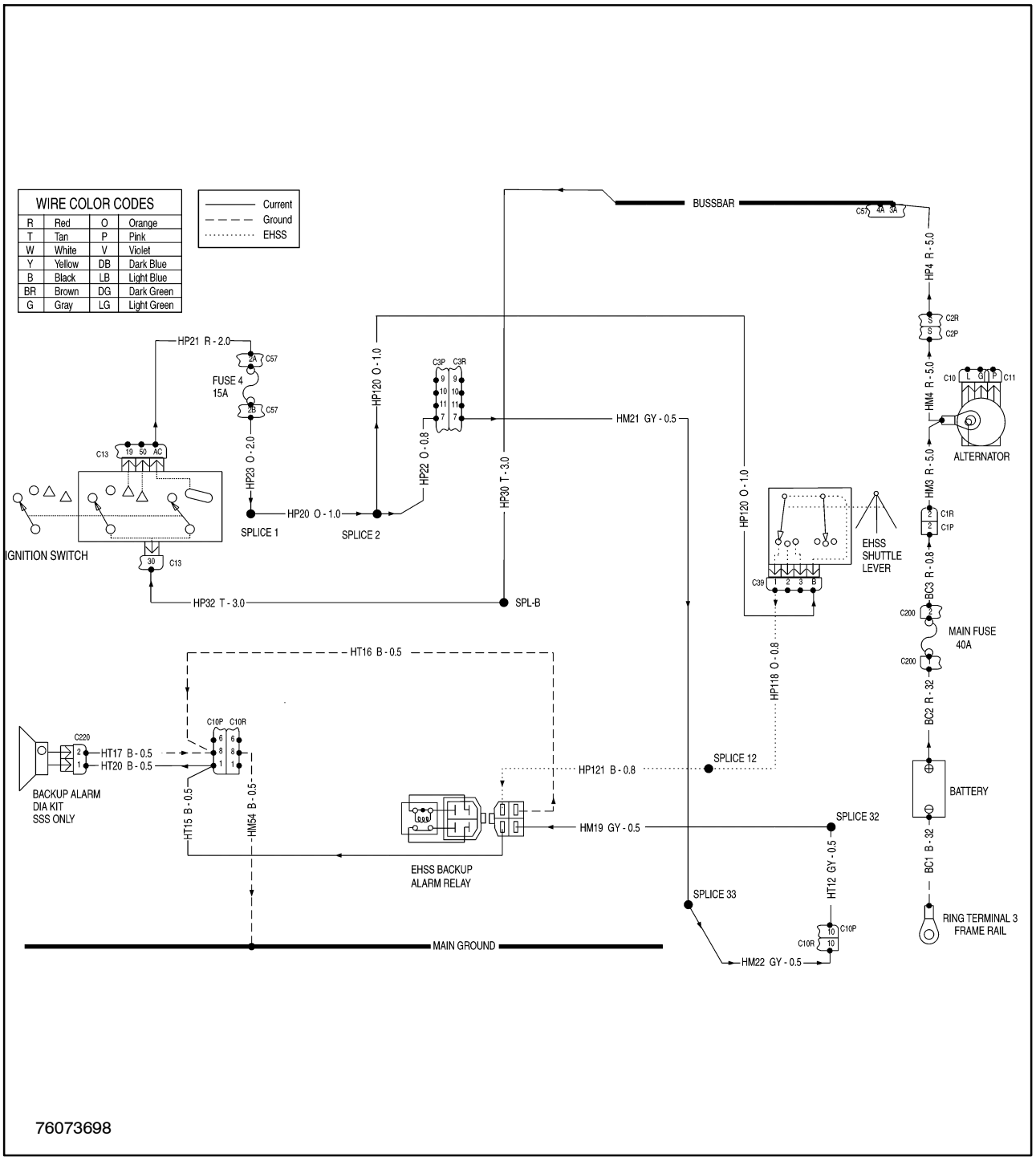
Switch and alarm functions:

When the shuttle lever is placed in the reverse position, the backup alarm switch closes, sending current to the backup alarm.

BACKUP ALARM (SSS) – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Backup alarm will not sound , when shuttle lever is in reverse position.	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty ground circuit	Check ground locations for proper contact
	Faulty backup alarm switch	Test switch, replace if necessary
	Faulty backup alarm	Test alarm, replace if necessary
Backup alarm will not go off, when shuttle lever is not in reverse position.	Faulty backup alarm switch	Test switch, replace if necessary

BACKUP ALARM (EHSS)



BACKUP ALARM (EHSS)

1. Current starts at the battery, and flows through the positive (+) battery cable to the main 40 amp fusible link.
2. From the fusible link wire current flows to terminal “30”of the key switch.
3. When the key switch is in the “ACC/RUN ” position current crosses from terminal “30” to the “AC” terminal.

Key Switch Terminals

Terminal “AC”

1. Current flows from the “AC” terminal of the key switch to the # 4 fuse (15 amp) fuse of the fuse panel.

Fuse Functions

1. Fuse # 4 (15 amp) provides current to:
   - EHSS shuttle switch
   - Backup alarm relay (switch side)

Ground Circuit

Ground source is provided to the following:

- Backup alarm
- EHSS backup alarm relay (coil side)

Switch and Alarm functions:

When the EHSS shuttle lever is placed in the reverse position, the shuttle switch transfers current from terminal “B” to terminal #1. Terminal #1 sends current to the backup alarm relay (coil side).

Backup Alarm Relay

When current is provided by the shuttle switch and a ground source is provided, the relay energizes, latching the relay contacts and sending current to the backup alarm.

BACKUP ALARM (EHSS) – TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY
Backup alarm will not sound, when shuttle lever is in reverse position.	Blown #4, 15-amp fuse	Replace 15-amp fuse
	Faulty ground circuit	Check ground locations for proper contact
	Faulty EHSS shuttle switch	Test switch , replace if necessary
	Faulty backup alarm relay	Test relay, replace if necessary
	Faulty backup alarm	Test alarm, replace if necessary
Backup alarm will not go off, when shuttle lever is not in reverse position.	Faulty EHSS shuttle switch	Test switch , replace if necessary
	Faulty backup alarm relay	Test relay. replace if necessary

SECTION 55 - ELECTRICAL SYSTEM

Chapter 7 - Instrument Panel – T2410 – T2420 With Cab

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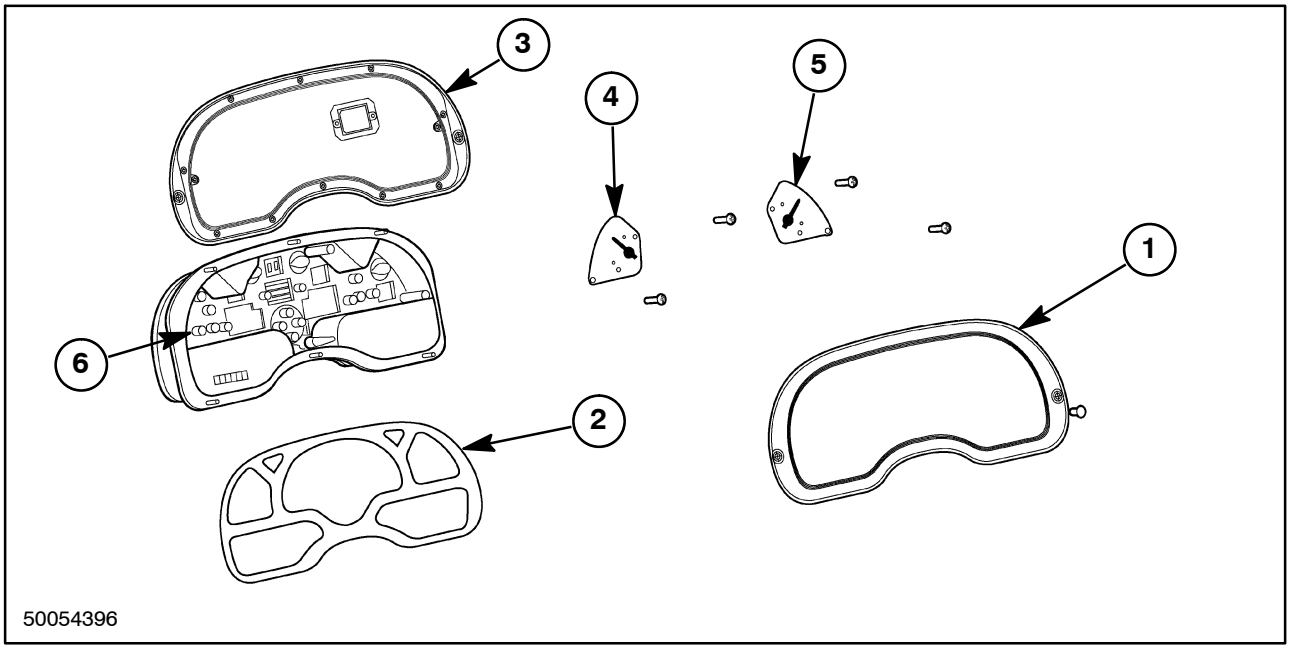
COMPONENT OPERATION AND SERVICING

INSTRUMENT PANEL

The following components of the instrument panel are serviced separately:

1. Lens
2. Bezel
3. Rear Cover
4. Fuel Gauge
5. Temperature Gauge
6. Indicator/Illumination Bulbs

NOTE: *The proof meter and tachometer are not serviced as a separate component. Replace the Instrument Panel assembly if there is a performance problem with the hour meter.*



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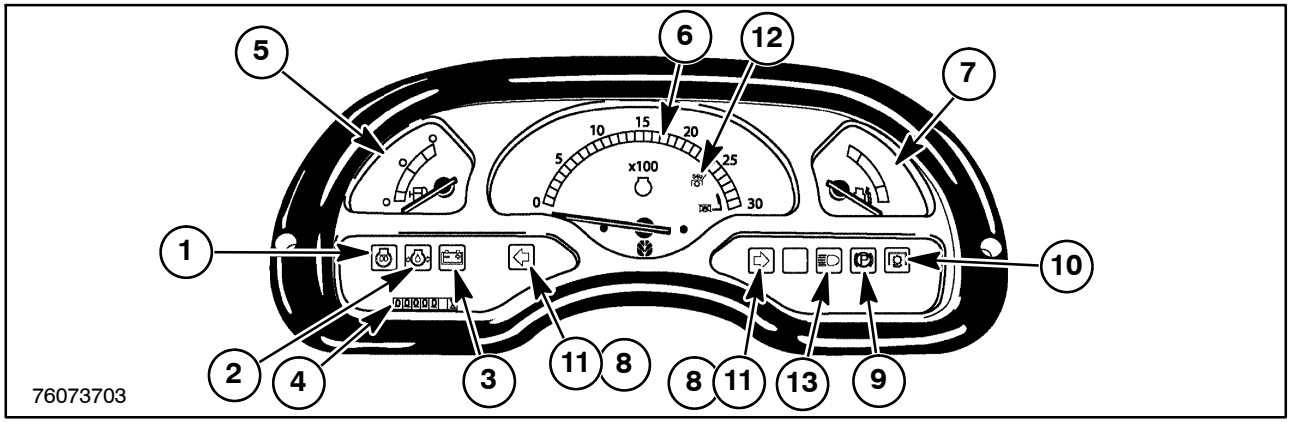

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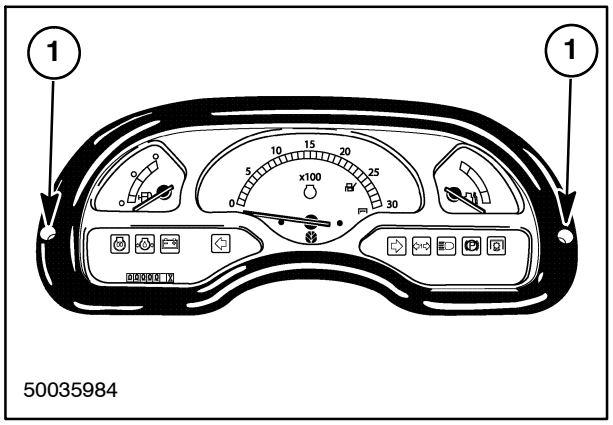
1. **Cold Starting Indicator Light** – Illuminates when the key switch is turned to the "ACC/RUN" position. It remains lit for approximately four seconds when the key is in position, during which time the glow plugs are heating the precombustion chambers of the cylinder head.
2. **Engine Oil Pressure Warning Light** – Illuminates with the key switch in the "ACC/RUN" position and remains lit for a short period of time after the engine is started. The light indicates oil pressure only, and goes out when sufficient oil pressure is present at the oil sender. If the bulb lights during operation, stop the tractor engine immediately and investigate the cause.
3. **Battery Charge Warning Light** – Illuminates when the key switch is in the "ACC/RUN" position and goes out when the engine is started. If this bulb lights during operation, it indicates that the charging system is not operating normally. As the battery can become fully discharged under these conditions, the problem should be investigated as soon as possible.
4. **Proof Meter** – Records the hours and portions of hours that your tractor has been operated, regardless of engine RPM. Use the proof meter as a guide to determine hourly service and maintenance intervals.
5. **Fuel Gauge** – Indicates the amount of diesel fuel remaining in the tank. The gauge is activated when the key switch is in the "ACC/RUN" position. It will resister "empty" with the key switch in the "STOP" position.
6. **Tachometer** – Registers engine RPM (Revolutions Per Minute) The gauge is marked in increments of 100 and will return to zero when the engine is not running.
7. **Temperature Gauge** – Indicates coolant temperature. It is activated when the key switch is turned to the "ACC/RUN" position. The gauge will register "cold" with the key switch in the "STOP" position. If the needle registers in the green range of the gauge, this indicates a normal operating temperature. If the needle moves to the red portion of the gauge, indicating an overheated condition, stop the tractor engine IMMEDIATELY and investigate the cause.
8. **Flasher Warning Hazard Lights** – Operate when the flasher switch is turned on, regardless of the key switch position. Use the flasher warning lights and the SMV placard when traveling on public roads, day or night.
9. **Parking Brake Light** – Illuminates if the parking brake is engaged when the key switch is turned from the "OFF" position.
10. **PTO "On" Indicator** – When the rear PTO position is engaged, and the key switch is in the "ACC/RUN" or "START" position, this indicator will be illuminated amber.
11. **Flasher Turn Lights** – Operate when the turn signal switch is moved forward for right turns (the RH arrow will flash) or rearward for left turns (the LH arrow will flash.) The key switch must be in the "ACC/RUN" or "START" position for the turn signals to operate.
12. **PTO Speed Indicator** – Determined by the position of the needle on the tachometer. The tachometer is marked to indicate 540 PTO RPM. If the needle registers above the 540 RPM mark, this indicates a dangerous over speed condition, and the engine RPM should be reduced immediately. (only on HST tractor)
13. **High Beam Road Light Indicator** – The light symbol will illuminate "Blue" when the light switch is place in the (High Beam) position.

Removal

Remove the two screws, 1, from each side of the instrument panel and pull the panel assembly out of the dash.

NOTE: *Additional wire harness length is provided so that the instrument panel can be removed from the mounting without unplugging the harness.*



3

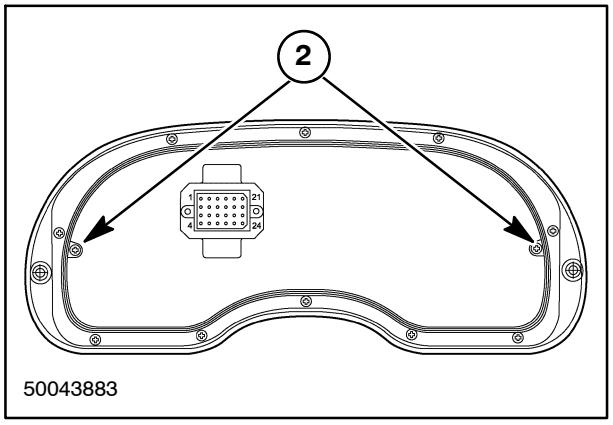
COMPONENT TESTING AND REPLACEMENT

FUEL GAUGE

Testing

Instrument panel viewed from rear, pin #s are not marked on panel

1. Remove the two retaining screws, 2, from panel and remove rear cover to expose circuit board.



4

2. Using an ohmmeter, measure the resistance between pins:

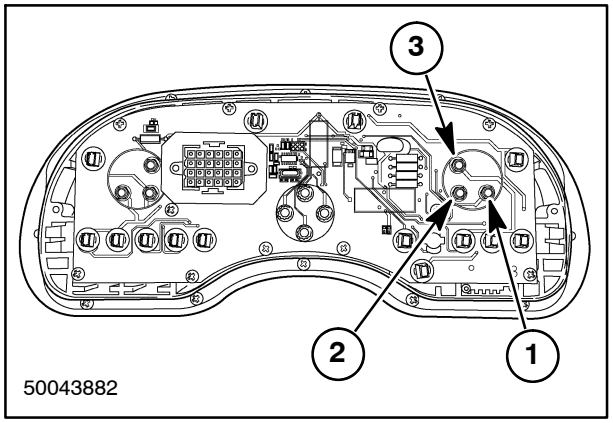
   #1 and #2 = The measured resistance should be between 223 and 301 ohms.

   #1 and #3 = The measured resistance should be between 78 and 106 ohms

   #2 and #3 = The measured resistance should be between 232 and 312 ohms

   Fuel Level/Gauge Reading Relationship

Gauge Reading	Ohms from Sender
Empty	240 ohms
1/8	190 ohms
3/4	67 ohms
Full	33 ohms



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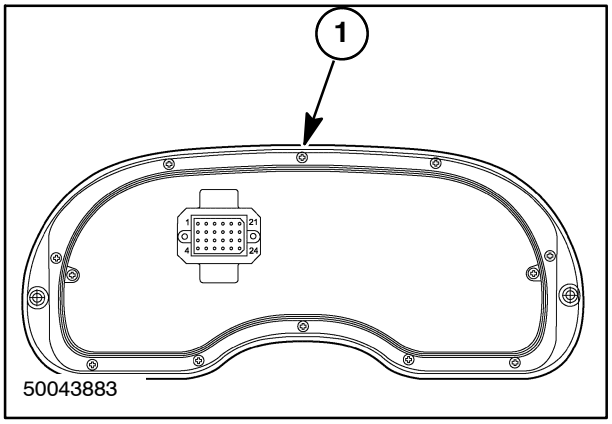
If the resistance measure is outside the ranges or a open circuit is measured, the fuel gauge should be replaced.

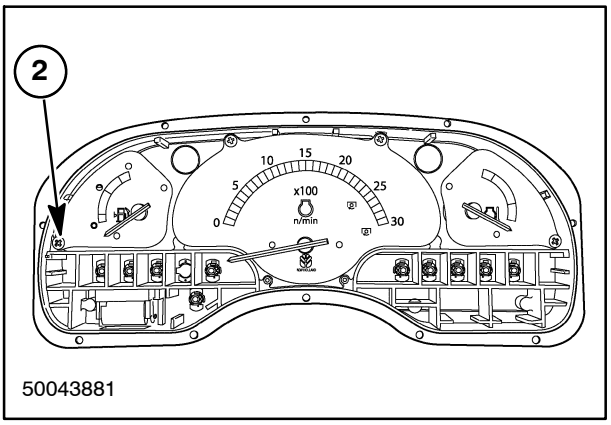
Replacement

1. Remove the ten retaining screws, 1, from the rear of the panel, then remove the lens and bezel from the panel body.



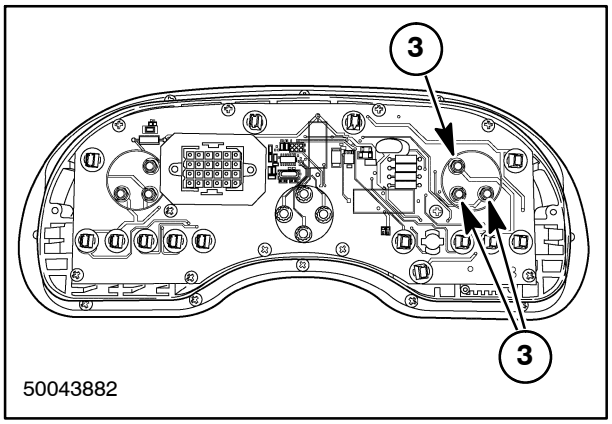
6

2. Remove the gauge face plate retaining screw, 2 from the panel.



7

3. Remove the three retaining nuts, 3, from the circuit board and remove the fuel gauge from the front on the instrument panel.
4. Insert new fuel gauge into panel, secure with face plate retaining screw and nuts. Reassembly lens and rear cover.



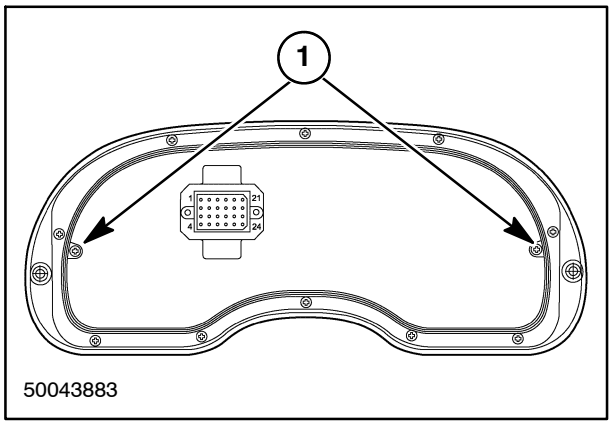
8

TEMPERATURE GAUGE

Testing

Instrument panel viewed from the rear, pin #s are not marked on panel

1. Remove the two retaining screws from panel, 1, and remove rear cover to expose circuit board.



9

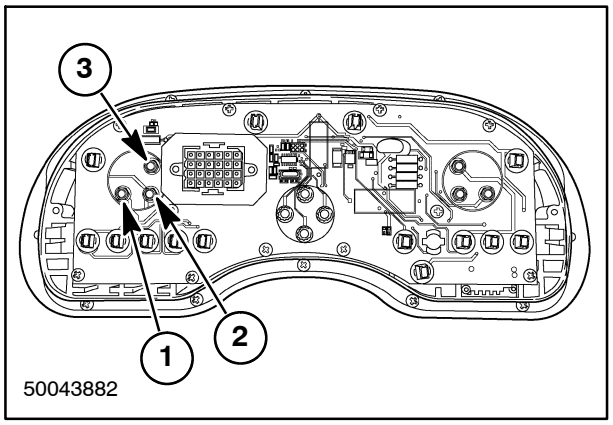
2. Using an ohmmeter, measure the resistance between pins:

   #1 and #2 = The measured resistance should be between 232 and 312 ohms.

   #1 and #3 = The measured resistance should be between 78 and 106 ohms

   #2 and #3 = The measured resistance should be between 223 and 301 ohms

If the resistance measure is outside the ranges or a open circuit is measured, the temperature gauge should be replaced.



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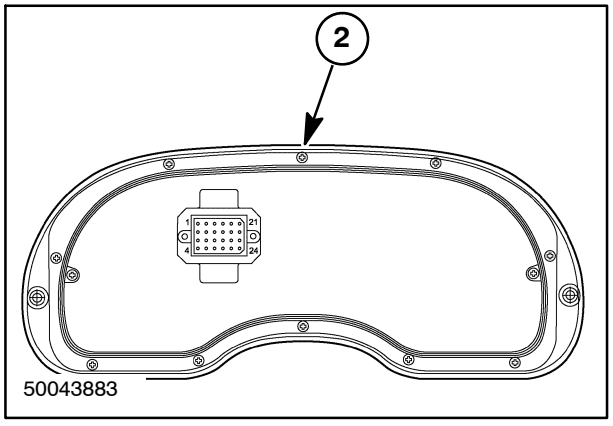
Engine Temperature/Gauge Reading Relationship

Gauge Reading	Temperature	Ohms from Sender
Blue/Green Border	Approximately 60°C (140°F)	84 ohms
Middle of Green	80°C (176°F) ± 5°C (41°F)	41 ohms
Green/Red Border	105°C (221°F) ± 3°C (37°F)	15 ohms

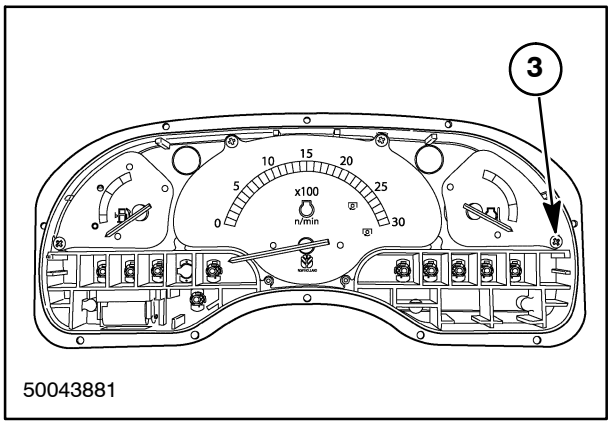
Replacement

1. Remove the ten retaining screws, 2, from the rear of the panel, then remove the lens and bezel from the panel body.



11

2. Remove the gauge face plate retaining screw, 3 from the panel.



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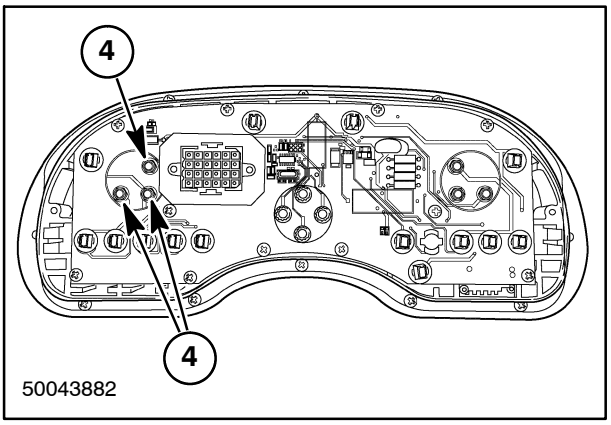
3. Remove the three retaining nuts, 4, from the circuit board and remove the temperature gauge from the front on the instrument panel.
4. Insert new temperature gauge into panel, secure with face plate retaining screw and nuts. Reassembly lens and rear cover.



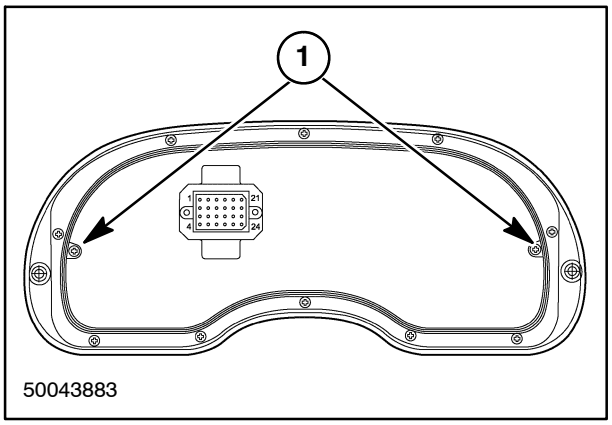
13

TACHOMETER

Testing

Instrument panel viewed from the rear, pin #s are not marked on panel

1. Remove the two retaining screws, 1, from panel and remove rear cover to expose circuit board.



14

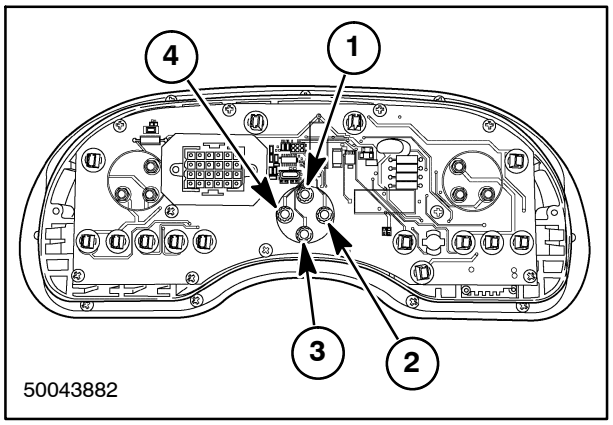
2. Using an ohmmeter, measure the resistance between pins:

   #1 and #2 = The measured resistance should be between 191 and 257 ohms.

   #3 and #4 = The measured resistance should be between 207 and 279 ohms

If the resistance measure is outside the ranges or a open circuit is measured, the instrument panel should be replaced as an assembly.

The tachometer is not serviced as a separate component.



15

PROOF METER (hour meter)

The proof meter shares the same common current input terminal #20 and ground terminal #2 as the tachometer, on the instrument panel connector.

There is not a test procedure to check the proof meter alone.

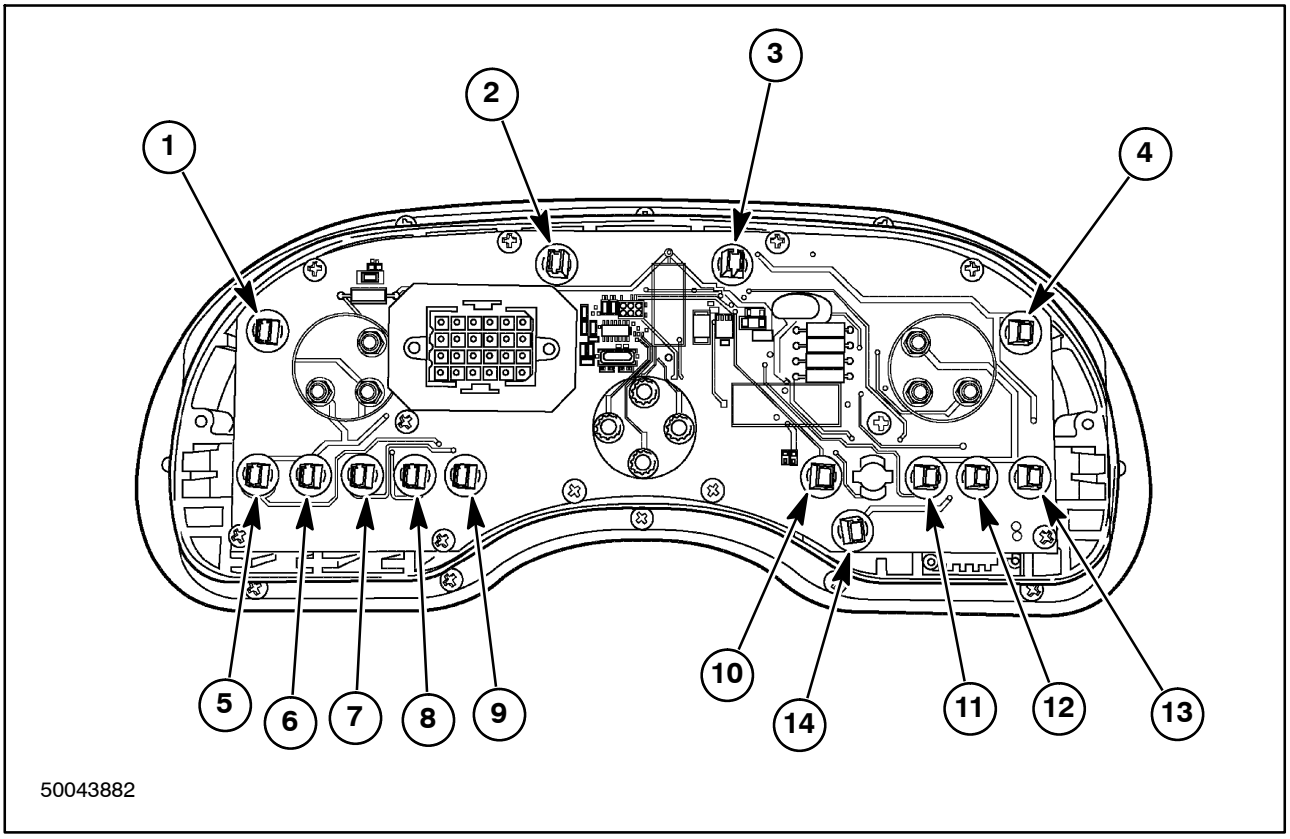
If the tachometer is working correctly and the proof meter does not register hours, the problem exists either in the instrument panel printed circuit board or the proof meter itself.

The proof meter is not serviced separately and if the proof meter does not work correctly, the instrument panel has to be replaced.

INSTRUMENT PANEL INDICATOR AND ILLUMINATION LIGHTS

Bulb Identification Chart

BULB #	DESIGNATION	CANDLE POWER
1	ILLUM - TEMP GAUGE	0.7
2	ILLUM – TACHOMETER	0.7
3	ILLUM – TACHOMETER	0.7
4	ILLUM – FUEL GAUGE	0.7
5	WARN – PTO	0.7
6	WARN – PARK BRAKE	0.7
7	WARN – HEAD LIGHT	0.7
8	HAZARD LIGHT	0.7
9	RIGHT TURN SIGNAL	0.7
10	LEFT TURN SIGNAL	0.7
11	WARN – BATT. CHARGE	0.7
12	WARN – OIL PRESSURE	0.7
13	WARN – PREHEAT	0.7
14	ILLUM – HOUR METER	0.7



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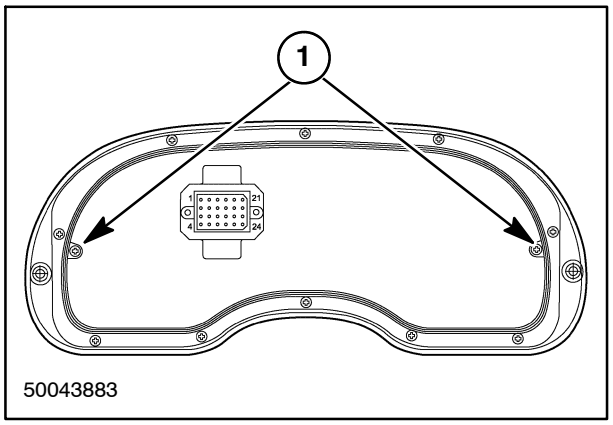
Bulb Replacement

1. Remove the two retaining screws, 1,from panel and remove rear cover to expose circuit board.
2. Rotate bulb assembly counterclockwise a quarter turn and remove bulb assembly from the instrument panel.
3. Insert bulb assembly into appropriate hole in circuit board, turn bulb assembly a quarter turn clockwise
4. Reassemble rear cover to instrument panel.

NOTE: *All bulbs are the same candle power (0.7) and are interchangeable in positions. Part #87300474*



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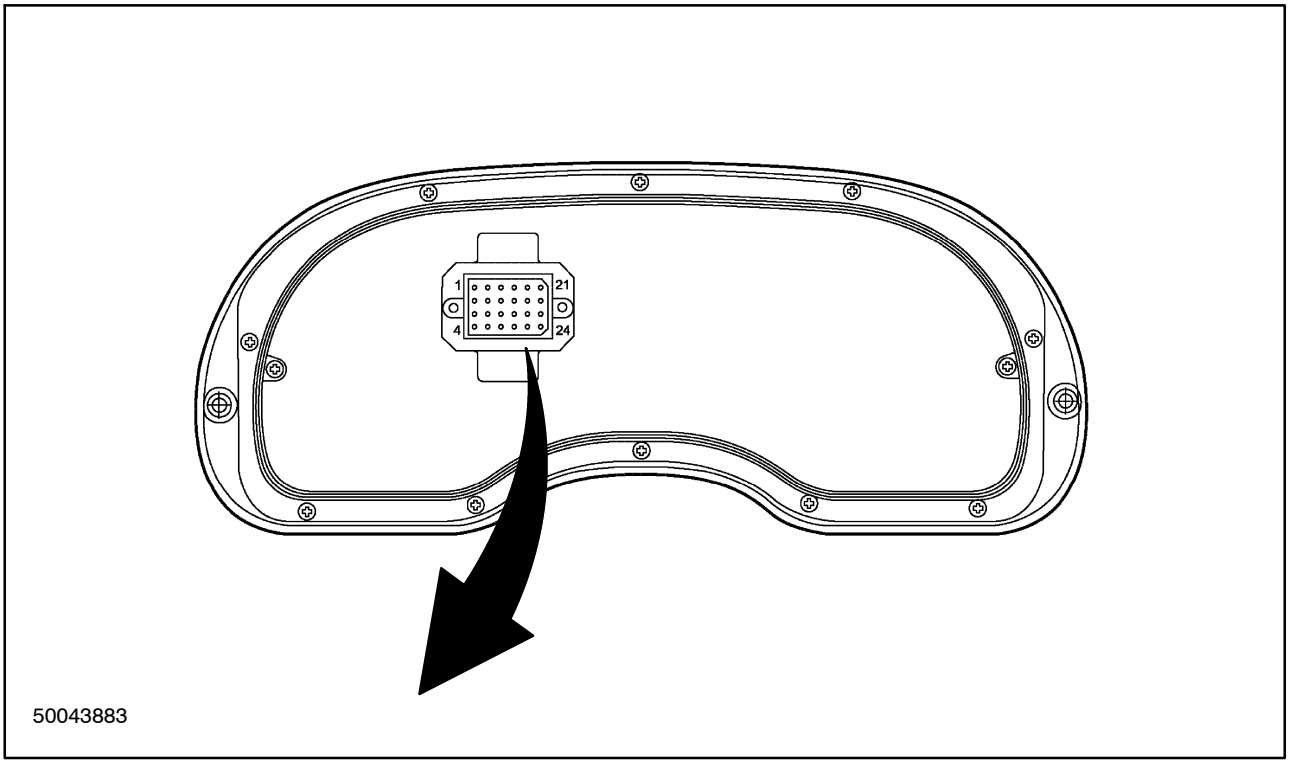
Instrument Panel Master Plug Identification - As viewed from rear of instrument panel



18

1	**5**	**9**	**13**	**17**	**21**
2	**6**	**10**	**14**	**18**	**22**
3	**7**	**11**	**15**	**19**	**23**
4	**8**	**12**	**16**	**20**	**24**

Pin # Function

1. Engine Oil Pressure Indicator Light
2. Switched Power (+)
3. Open
4. Open
5. Open
6. Alternator Charging (-)
7. Glow Plug Indicator Light
8. Open
9. Left Turn Signal Indicator Light
10. Open
11. Parking Brake Indicator Light
12. PTO Indicator Light

Pin # Function

13. Open
14. Fuel Level Gauge
15. Engine Temperature Gauge
16. Open
17. Trailer
18. (High Beam)
19. Right Turn Signal Indicator Light
20. Engine RPM
21. Open
22. Open
23. Panel Illumination
24. Constant Ground (-)

SECTION 55 – ELECTRICAL SYSTEM

Chapter 8 – Alternator and Starter – T2410 – T2420 With Cab

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ALTERNATOR SPECIFICATIONS

Manufacturer	Mitsubishi
Model	A007TA1777
Output Rating	55 amp
Polarity	Negative Ground
Rotational Direction (viewed from pulley)	Clockwise
Drive Belt Tension	10 – 15 mm (0.39 – 0.59 in) deflection @ 9 – 11 kg (20 – 25 lb) of force
Adjusting Voltage	14.5 – 15.0 volts
Load Characteristics	
Terminal voltage	13.5 volts
Current	30 amp minimum
Rpm	2500
Brush Length	
Wear Limit (min. length)	5 mm (0.20 in)
Original	18.5 mm (0.728 in)
Brush Contact Rings	
Wear Limit (min. diameter)	22.1 mm (0.871 in)
Original Diameter	22.7mm (0.894 in)
Bearing	
Front	ECSC8
Rear	6303DDG
Stator Coil Resistance	less than 1.0 ohm
Rotor Coil Resistance	3.0 ohms

ALTERNATOR TROUBLESHOOTING

NO CHARGING

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection, short circuit	Repair
Alternator	Loose connection, no ground, short circuit	Repair or replace
	Defective rectifier	Replace
	Loose connection on RF resistor	Replace
Regulator	Defective regulator	Replace
	Loose connection of alternator or regulator	Repair or replace

INSUFFICIENT CHARGING

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection or short circuit	Repair
Alternator	Loose drive belt	Repair
	Short in rotor coil	Replace
	Short in stator coil	Replace
	Defective rectifier	Replace
	Insufficient brush contact	Repair or replace
Regulator	Defective regulator	Replace
	Loose connection of alternator and regulator	Repair
Battery	Defective battery	Replace

OVERCHARGE

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Battery	Internal short	Replace
Regulator	Defective regulator	Replace

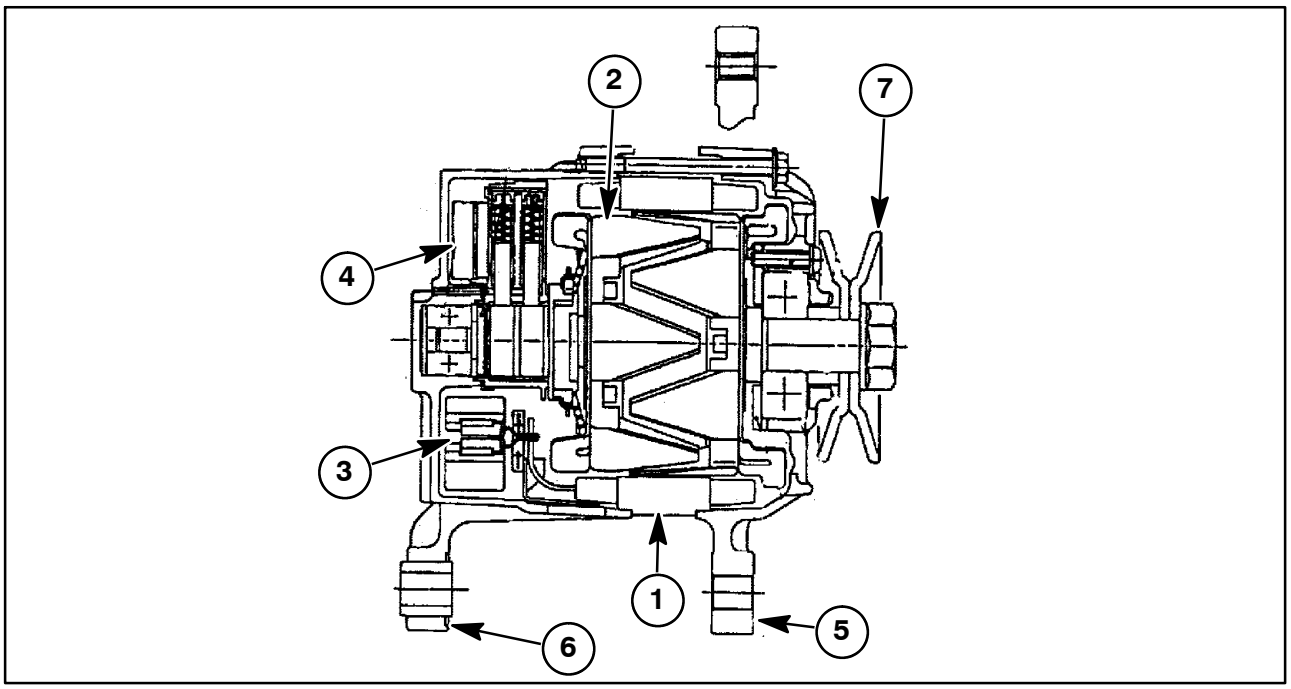
UNSTABLE CHARGING CIRCUIT

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Loose connection or open wire	Repair or replace
Alternator	Loose drive belt	Repair
	Short in rotor coil	Replace
	Short in stator coil	Replace
	Broken brush or spring	Replace
	Loose connection	Repair
Regulator	Defective regulator	Replace
	Loose connection at alternator and regulator	Repair or replace

ABNORMAL NOISE OF ALTERNATOR

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Alternator	Loose mounting hardware	Repair
	Defective bearings	Repair or replace
	Rotor core and stator in contact	Replace
	Defective diode	Replace
	Short in stator coil	Replace

CHARGING SYSTEM



1

ALTERNATOR

Description of Operation

T2410 and T2420 cab tractors are equipped with a 55-amp output alternator. The alternator is equipped with an integrated circuit (IC) regulator, meaning voltage is regulated internally and electronically within the alternator.

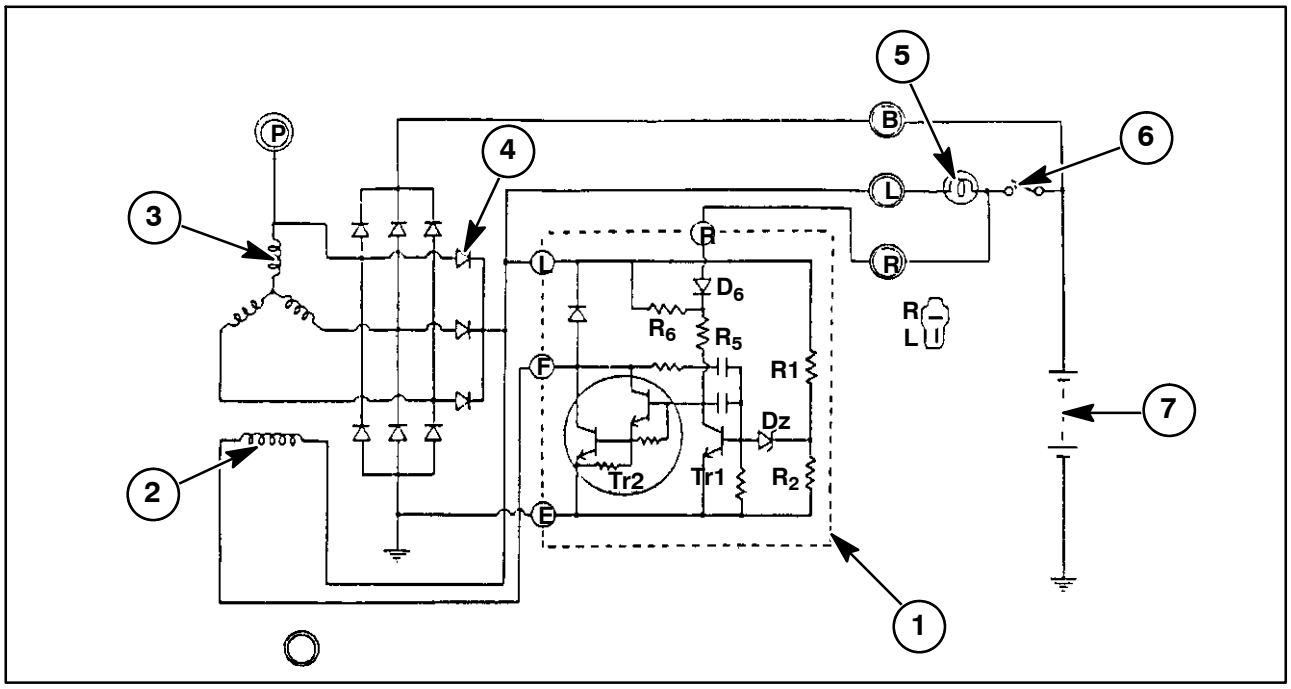
The principle components of the alternator are the stator, 1, the rotor, 2, the rectifier assembly, 3, and the IC regulator, 4.

The rectifier assembly, 3, consist of two heat sinks, one positive (+) and one negative (–), and a diode trio. The diode trio is use as a field supply diode and is connected to terminal “L” on the alternator.

The IC regulator, 4, is a solid state unit and can only be serviced as an assembly.

The internal components of the alternator are housed in a two-piece frame, which is divided into a drive end (front) frame, 5, and a rear frame, 6. The frame contains open slots to allow for cooling of the alternator.

The alternator is rotated in the frame by using a belt-driven pulley, 7, which is powered off of the engine crankshaft pulley by a belt



2

Charging Circuit

The charging circuit and internal connections are shown. The charging system consists of an IC voltage regulator, 1, (enclosed with dotted lines), a battery, 7, and connecting wires. Because of the use of IC, the voltage regulator is very compact and is built into the alternator.

The IC voltage regulator, 1, permits the field current to flow directly from the diode trio, 4, to the field coil, 2, without passing through the external circuit. Consequently, there are no voltage drops caused by the key switch or the external wiring as with conventional vibrating-contact regulators mounted separately from the alternator. To aid in initial voltage buildup when the engine is started, the field current is supplied through the indicator lamp, 5, from the battery, 7.

Since the frequency pulse output of 1/10 the alternator speed develops on the “P” terminal, this terminal is used for speed detection.

Principle of IC Regulator

The basic function of the IC voltage regulator is to make the terminal voltage constant by detecting the generated voltage and increasing/decreasing the field current.

As indicated, the regulator consists of two basic sections: a voltage control device and an output device to handle the field current. The voltage control device includes the voltage divider network, R1 and R2, a zener diode, DZ, for voltage reference, and a single amplifying transistor, Tr1. The output device is a darlington-type amplifier which is called power transistor, Tr2. The power transistor, Tr2, is placed in series with the alternator field coil and ground.

The signal amplifying transistor, Tr1, senses the generated voltage and turns the power transistor, Tr2, on and off many times per second most of the time the engine is in operation.

The basic operating principles are explained as follows, see Figure 2:

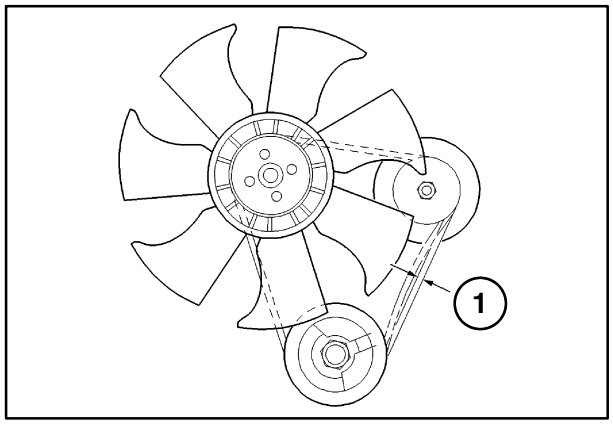
1. When the key switch, 6, is closed, current from the battery, 7, flows through the indicator lamp, 5, and resistor R6, which are in parallel to the field coil, 2. From here it continues to flow on through the field coil, 2, to the ground, completing the circuit back to the battery, 7.
2. When the alternator begins to rotate, AC voltages are generated by the stator coil, 3. The diodes in the rectifier assembly change the stator AC voltages to DC voltage which appears between ground and the “B” terminal.
3. The stator also supplies DC field current through the diode trio, 4, the field coil, 2, the power transistor, Tr2, and then through the diodes in the rectifier assembly back to the stator.
4. When the generated voltage is low, no current flows in the zener diode, DZ, since the voltage at point “A” is lower than the zener voltage.
5. As the speed and voltage increase, the voltage at point “A” also increases until it reaches the limiting value set at the factory. As the zener diode, DZ, breaks down, current flows through R1, DZ, and the base-emitter circuit of Tr1 to ground. This renders Tr1 conductive, so that much of the current flows through the collector-emitter circuit of Tr1. This reduces the base current of Tr2 thereby reducing the field current. This means that Tr1 turns on and Tr2 turns off.
6. When the generated voltage decreases, the zener diode, DZ, again turns off and Tr1 also turns off. This cycle repeats many times per second, and the alternator output voltage is, therefore, regulated within a narrow limit.

   In other words, the action is similar to the conventional vibrating-contact regulator, in that current to the field coil, 2, is varied to limit the output voltage, but in place of the voltage coil and spring system, there is a voltage divider network, R1 and R2, and a zener diode, DZ.

PRELIMINARY ALTERNATOR TESTS

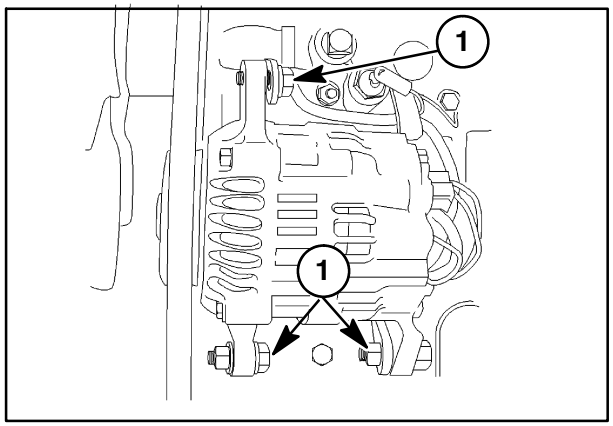
Alternator Drive Belt

1. Check the alternator drive belt deflection by applying 5 kg (11 lb) of force between the crank pulley and the alternator pulley, 1. Belt deflection should be 5–10 mm (0.2–0.4 in).



3

1. If the drive-belt deflection needs adjusted, loosen the adjusting/mounting bolts, 1, and adjust the alternator as needed to obtain proper belt deflection.

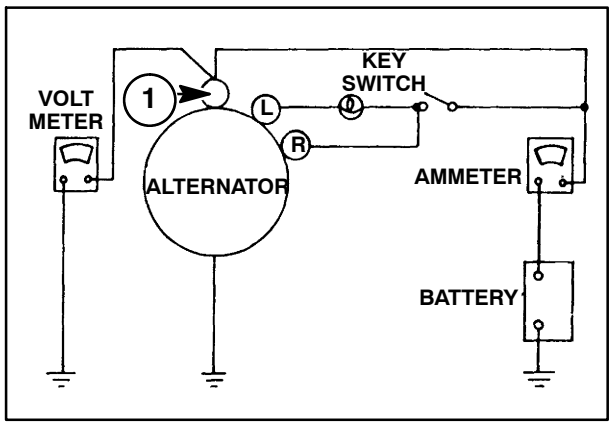


4

Alternator Output

NOTE: *Use the following methods if an alternator/ charging system analyzer is unavailable.*

1. Connect a 50-amp capacity test ammeter between the positive (+) battery cable and the key switch.
2. Connect a voltmeter to the battery terminal, 1, of the alternator and to a ground source.
3. Observe the voltmeter. The meter should indicate battery voltage. If the voltmeter does not read battery voltage, the wiring between the alternator and the battery may be faulty and should be repaired or replaced.



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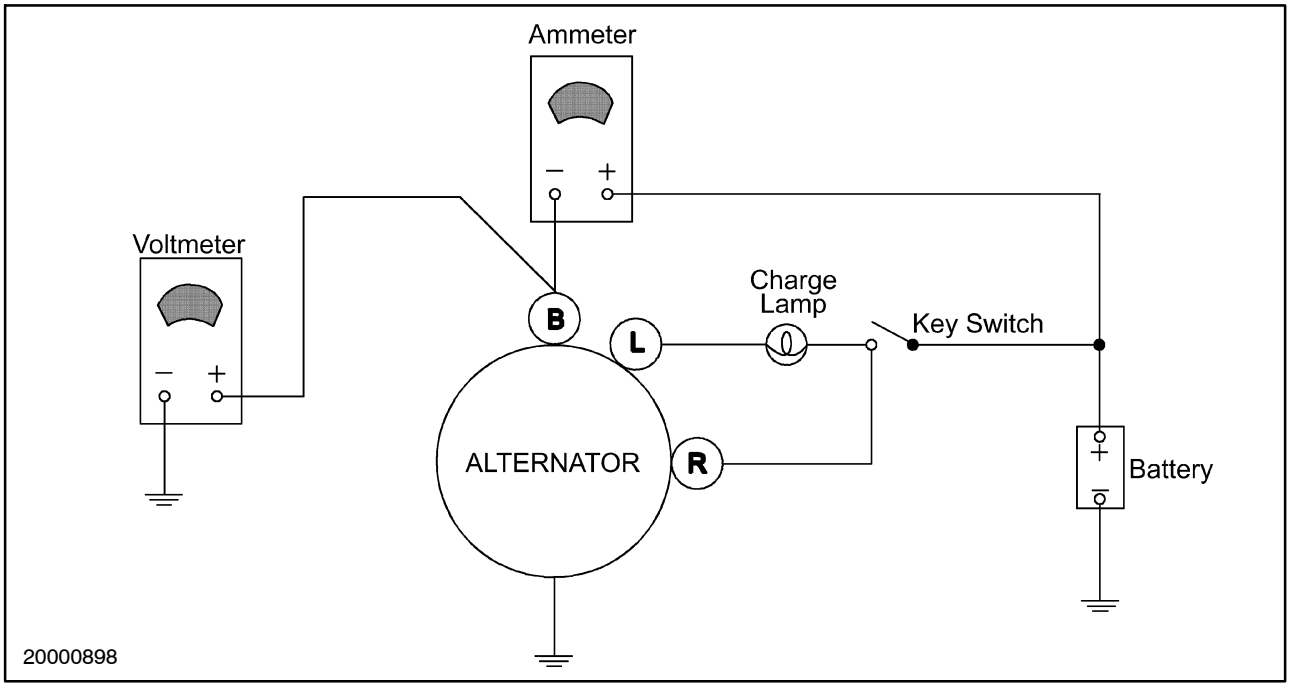
⚠ WARNING ⚠

Do not attempt to start the engine without first shorting the wires between the ammeter leads. Otherwise, injury or damage to the charging and testing components may occur.

4. Use a jumper wire to short the test ammeter leads and start the tractor engine.

5. After the tractor engine is started, remove the jumper wire between the test leads of the ammeter.
6. Increase the engine speed to approximately 2000RPMs and observe the ammeter reading.
7. If the ammeter indicates 5 amps or less, observe the voltmeter reading. The voltmeter is indicating adjusting voltage, which is the amount of increased voltage the alternator supplies to the battery. The reading should indicate a higher voltage that what is indicated when voltage is taken at the battery. If the reading is not higher, the alternator is not generating enough voltage and a component may be malfunctioning.
8. If the ammeter indicated more than 5 amps, continue to charge the battery until the ammeter reading falls below 5 amps. If the reading does not fall below 5 amps, test the battery or replace the battery with one that is fully charged.



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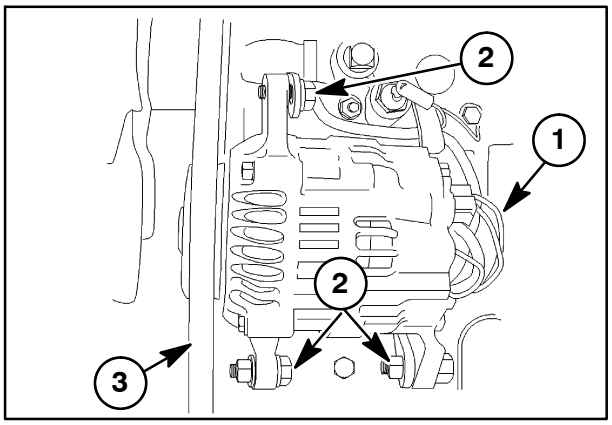
NOTE: *bench testing the alternator will achieve the best results for the following tests. (see alternator bench testing).*

1. If the previous test was satisfactory, open the key switch (OFF) and connect an ammeter between the battery terminal "B", of the alternator and the battery wire, as shown.
2. Connect the positive (+) lead of a voltmeter to the "B" terminal on the alternator. Connect the negative (-) lead to a suitable ground. Confirm that the voltmeter indicated battery voltage.
3. Apply the parking brake and start the tractor engine. Turn on all 12-volt powered accessories such as headlight and indicator lights. Immediately raise engine RPMs to 2000 or more to record the maximum value indicated on the ammeter.
4. If the amperage value is more than 70% of the nominal alternator output, as described in alternator specifications, the alternator is considered to be working satisfactorily.

Alternator Removal

5. Disconnect the negative (–) battery cable from the negative battery terminal.
6. Disconnect all wiring, 1, from the rear of the alternator.
7. Loosen the alternator mounting bolts, 2, and remove the V-belt, 3, from the alternator drive pulley.
8. Remove the alternator mounting bolts, 2, and remove the alternator from the tractor engine.



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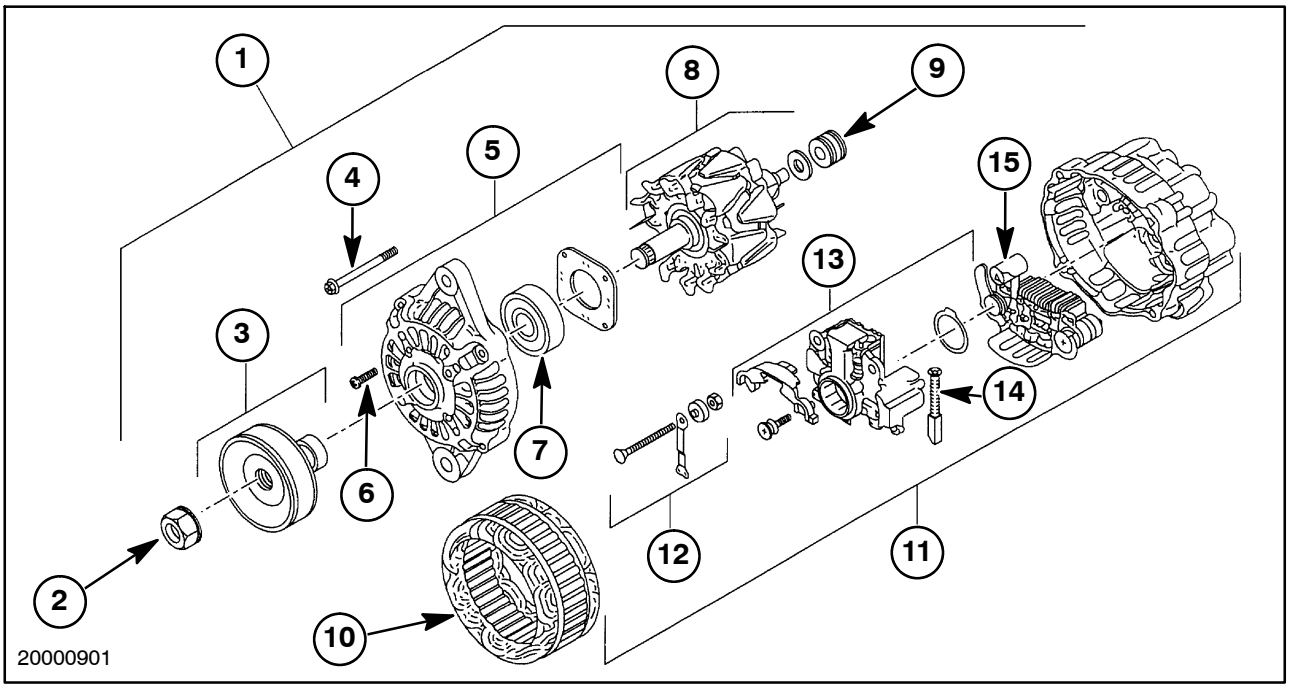


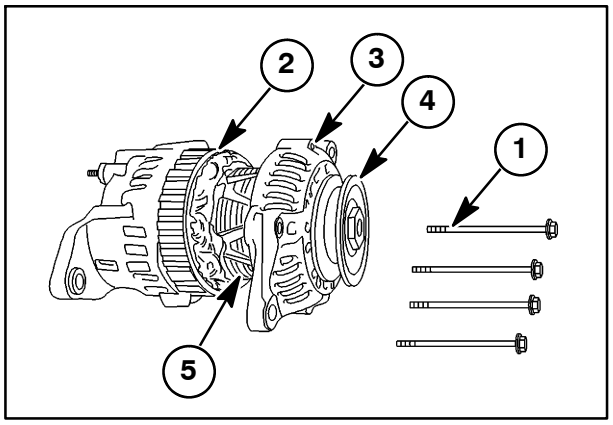
8

1. Alternator Assembly
2. Pulley Nut
3. Pulley Assembly
4. Bolt
5. Front Alternator Frame Assembly
6. Bolt
7. Front Rotor Bearing
8. Rotor Assembly
9. Rear Rotor Bearing
10. Stator
11. Rear Alternator Frame Assembly
12. Terminal Assembly
13. IC Regulator Assembly
14. Rotor Brush and Spring
15. Rectifier

Alternator Disassembly

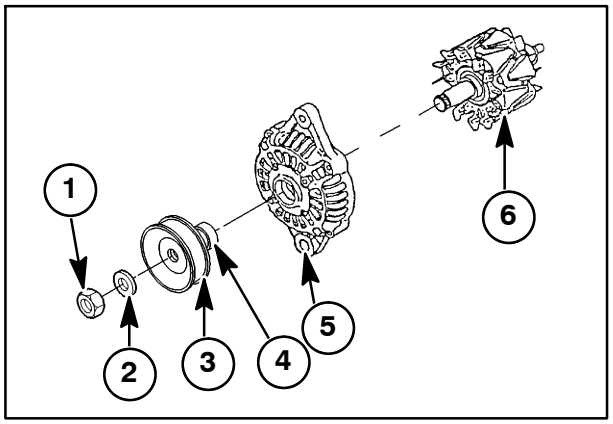
1. Mark the front alternator frame, 5, the rear alternator frame, 11, and the stator, 10, with scribe marks to insure that the alternator is assembled as taken apart.

2. Remove the four (4) alternator frame retaining bolts, 1.
3. Carefully separate the front frame, 3, and the rear frame and stator, 2. The rotor assembly, 5, and the pulley, 4, will be removed with the front frame, 3.



9

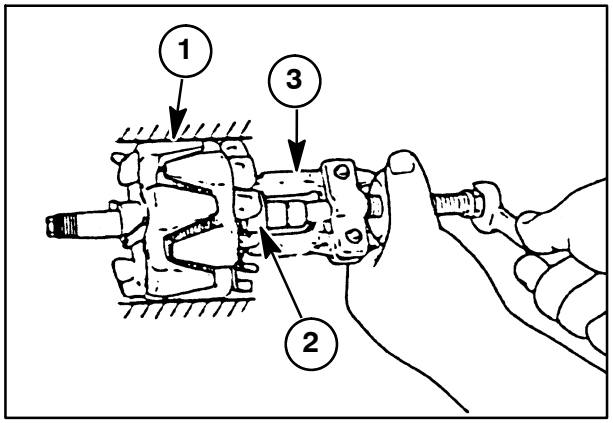
4. To remove the pulley nut, 1, use an impact wrench or place the rotor, 6, into a soft jaw vice and use a wrench. Remove the washer, 2, the pulley, 3, spacer, 4, and the front frame, 5, from the rotor, 6.



10

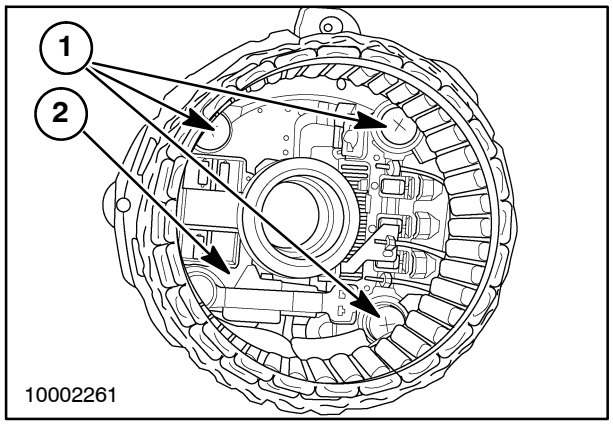
NOTE: *When removing the rear rotor bearing from the rotor, be sure to apply even pressure to the rear rotor bearing.*

5. The rear rotor bearing, 2, may be removed from the rotor, 1, by using a bearing puller, 3.



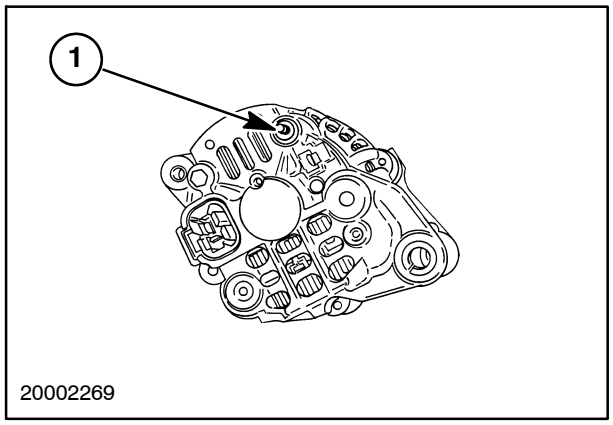
11

6. Remove the three (3) screws, 1, which secure the regulator/ rectifier assembly, 2, to the rear alternator frame.



12

7. Remove the battery terminal nut, 1, from the rear of the alternator frame.
8. Carefully remove the stator and the regulator/ rectifier assembly from the rear alternator frame.

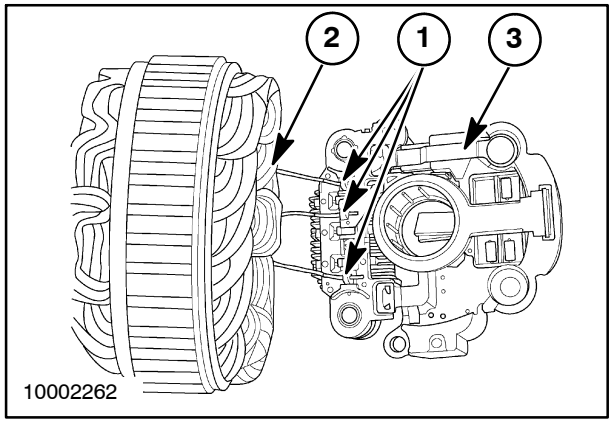


13

⚠ CAUTION ⚠

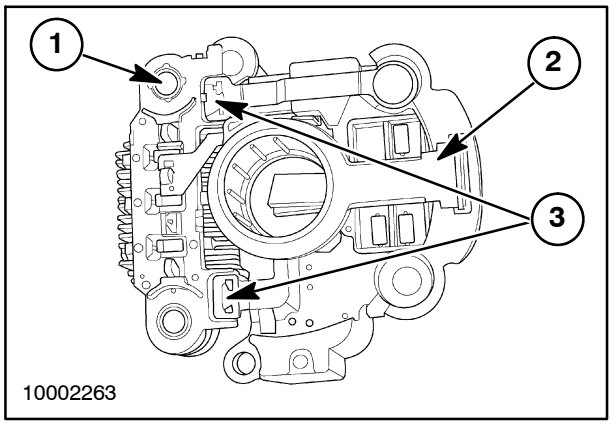
Preheat the soldering iron before attempting to unsolder the stator leads or the regulator/rectifier assembly. To avoid any damage to the rectifier diodes, use a pair of needle-nose pliers to remove the excess heat from the area being soldered. Hold the pliers just below the solder joint on the rectifier to remove excess heat. Use a damp cloth to cool the components once they have been separated.

9. Unsolder the three stator leads, 1, and remove the stator, 2, from the rectifier/regulator assembly, 3.



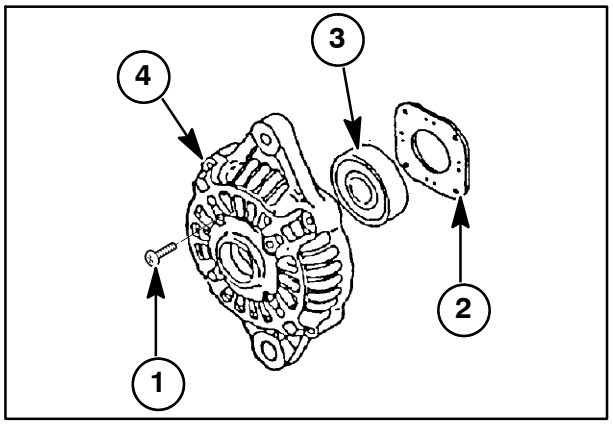
14

10. Unsolder the IC regulator assembly, 1, from the rectifier assembly, 2, at the solder joints, 3.



15

11. Remove the four (4) screws, 1, from the front alternator frame, 4. Remove the retaining plate, 2, and the front rotor bearing, 3.



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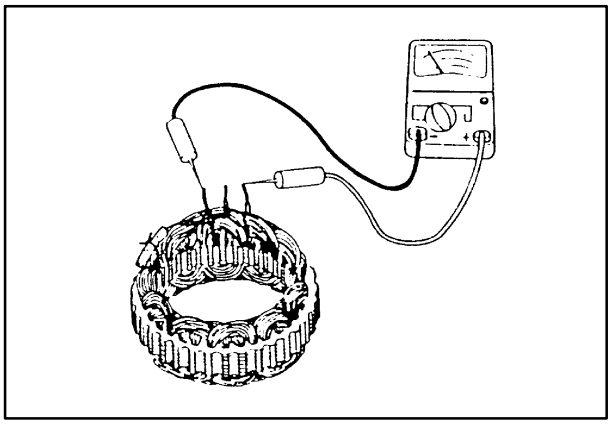
ALTERNATOR COMPONENT TESTING AND INSPECTION

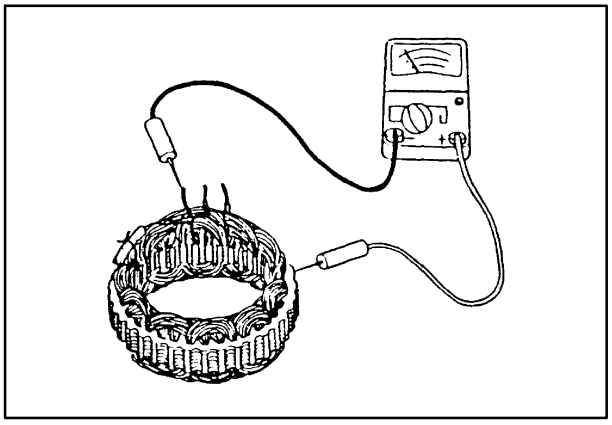
Stator

1. Using an ohmmeter, touch the ohmmeter test probes to different leads of the stator coil.
2. Observe the ohmmeter. The ohmmeter should read a resistance of less than 1 ohm, for each of the phase wires, indicating continuity.
3. If there is no continuity, inspect the lead wire connection for breaks. The lead wire may be repaired with solder if damage is not excessive. If the lead wire is good, the stator coil is faulty and needs replaced.



17

4. Using an ohmmeter, touch one of the ohmmeter test probes to the stator coil and the other test probe to the stator core.
5. Observe the ohmmeter. Resistance should be high, indicating no continuity between the coil and the core. If there is continuity, the stator is defective and needs replaced.



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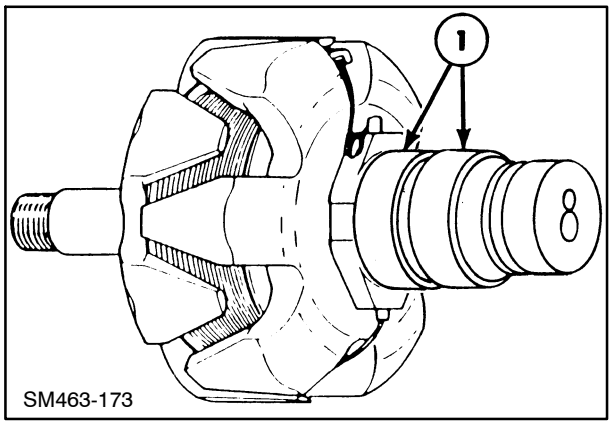
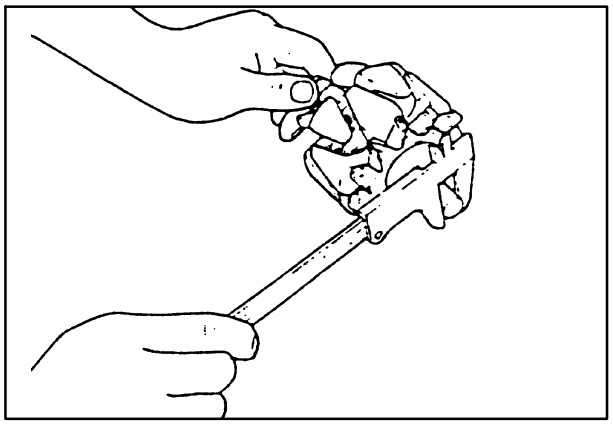
Rotor

1. Inspect the rotor brush contacts, 1, for pitting, roughness, and dirt. If necessary, use # 600 grit fine sandpaper to clean dirt off of the contacts. If the contacts are pitted or damaged excessively, replace the rotor.



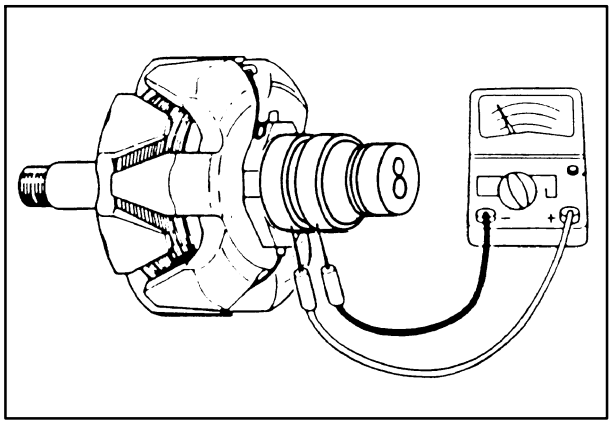
19

2. Use a suitable measuring device to determine the outer diameter of each brush contact. The minimum outer diameter of the brush contacts is 22.1 mm (0.871 in).



20

3. Using an ohmmeter, touch one ohmmeter test probe to a brush contact. Touch the other test probe to the remaining brush contact.
4. Observe the ohmmeter. The ohmmeter resistance reading should be approximately 3 ohms. If the reading is not as specified, the rotor is defective and needs replaced.



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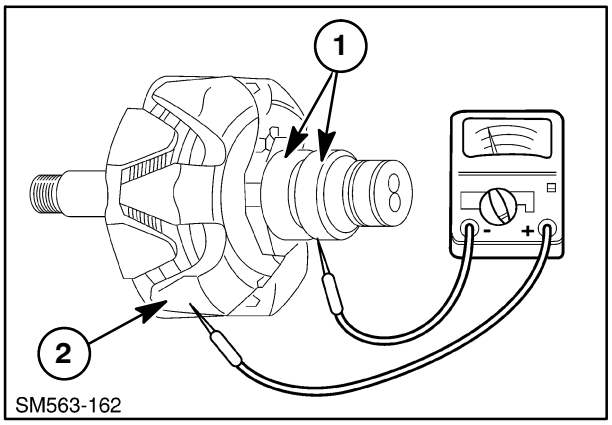
NOTE: *When testing the resistance between the brush contacts and rotor poles, be sure that the ohmmeter test probe touching the rotor pole is not insulated by paint.*

1. Using an ohmmeter, touch one ohmmeter test probe to one of the rotor brush contacts, 1, and the other test probe to one of the rotor poles, 2.
2. Observe the ohmmeter. Resistance should be high, indicating no continuity between the rotor poles and brush contacts. If there is continuity, the rotor is defective and needs replaced.



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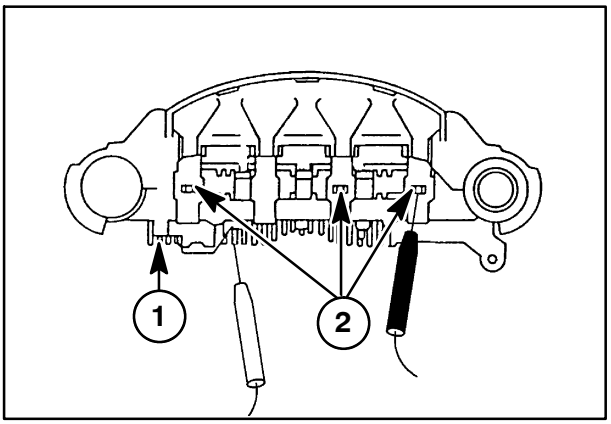
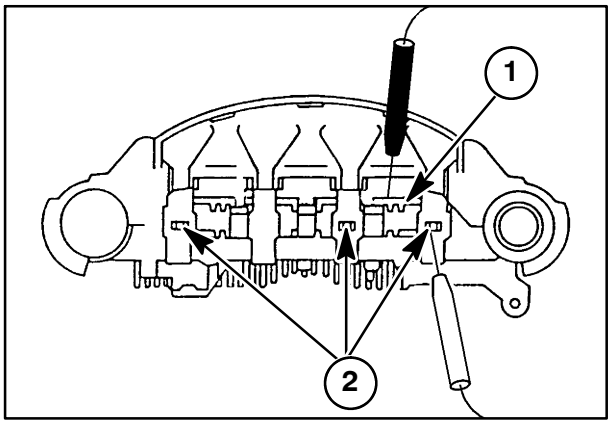
Rectifier Assembly

1. Using an ohmmeter, touch the positive (+) test probe to the positive (+) portion of the diode plate, 1, and the negative (–) test probe to the other test probe to a stator coil lead connection terminals, 2.
2. Observe the ohmmeter for continuity.
3. Now switch the positions of the test probes and observe the ohmmeter for continuity. The ohmmeter should indicate continuity in one direction only. If there is continuity in both directions or no continuity at all, the rectifier assembly is defective and needs replaced.
4. Using the same procedure described in the three previous steps, test the diodes between the negative (–) portion of the diode plate, 1, and the stator lead connections, 2. Again, replace the rectifier assembly if the diodes test defective.

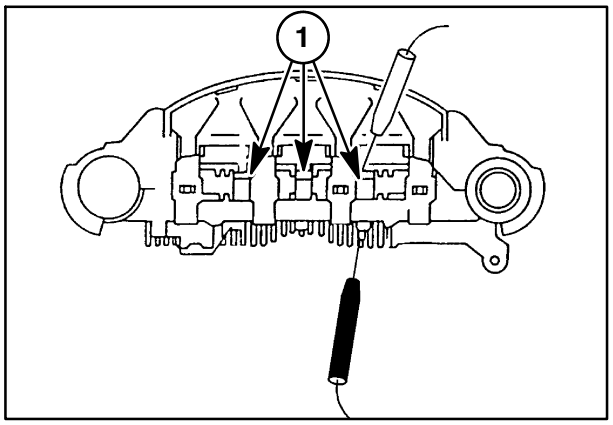


23



24

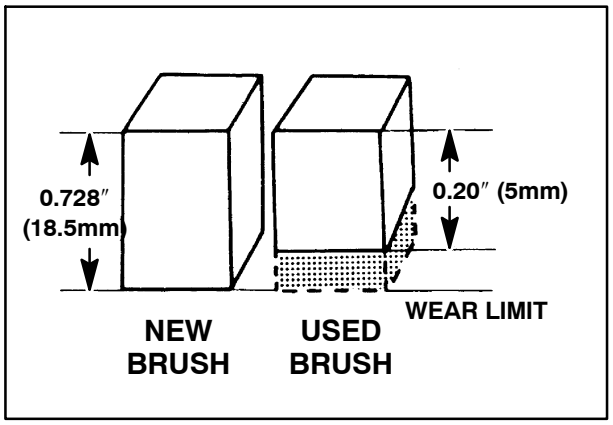
5. Test each of the three small diodes, 1, by touching the positive (+) ohmmeter test probe to one end of a diode and the negative (–) test probe to the opposite end of the diode.
6. Observe the ohmmeter for continuity.
7. Now switch the positions of the test probes and observe the ohmmeter for continuity. The ohmmeter should indicate continuity in one direction only. If there is continuity in both directions, or no continuity at all, the rectifier assembly is defective and needs replaced.



25

Alternator Brushes

1. Carefully clean the alternator brushes with a soft, dry cloth and electrical component cleaner, if available.
2. Inspect the brushes and brush springs for corrosion, damage, stretched springs, or a damaged brush holder. If damaged, replace the brush assembly.
3. Use a suitable measuring device to measure brush wear. The minimum brush length is 5 mm (.020 in). If either brush is worn beyond specifications, replace the brush assemblies.



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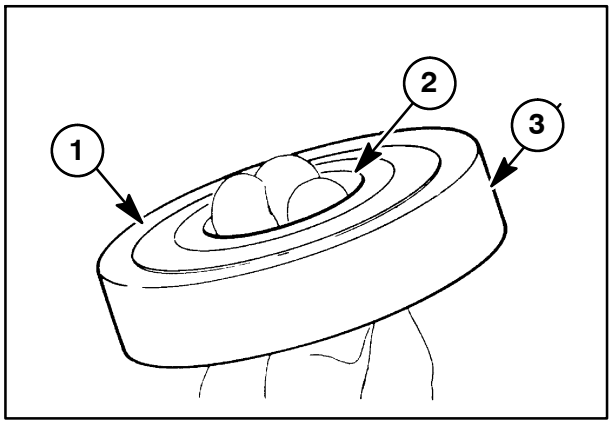
Alternator Bearings

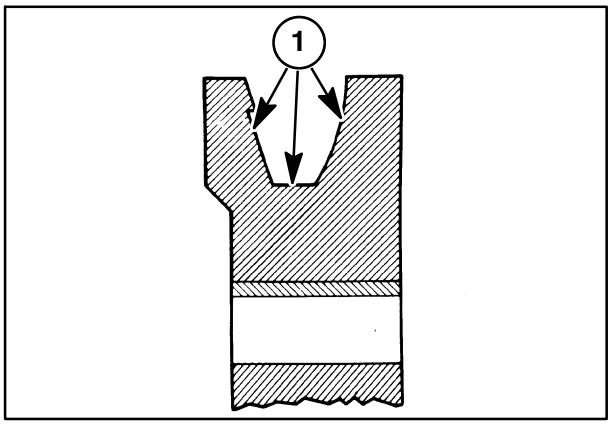
1. Inspect the alternator bearings for smooth operation by spinning the bearing. Replace bearings that are rough and do not rotate smoothly.
2. Inspect the bearings for grease leakage between the bearing seal, 3, and races, 1, and 2.
3. Inspect the inner race, 1, and the outer race, 2, for signs of spinning in the alternator frame or on the rotor shaft.
4. Replace bearings that are damaged in any way.



27

Drive Pulley

1. Inspect the drive pulley for a worn, bent, cracked, or otherwise damaged belt groove, 1.
2. A polished surface in the bottom of the belt groove indicates a worn pulley.



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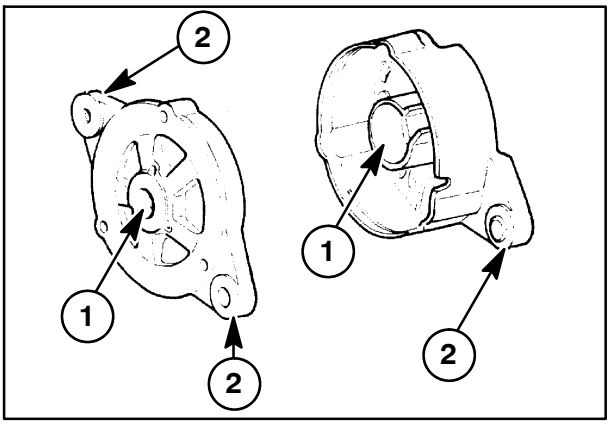
Alternator Frames

1. Inspect the bearing housing bores, 1, for scoring, cracks or evidence that the bearing was spinning inside the bore.
2. Inspect the frames for cracked or broken mounting bosses, 2, or any other distortion or damage.

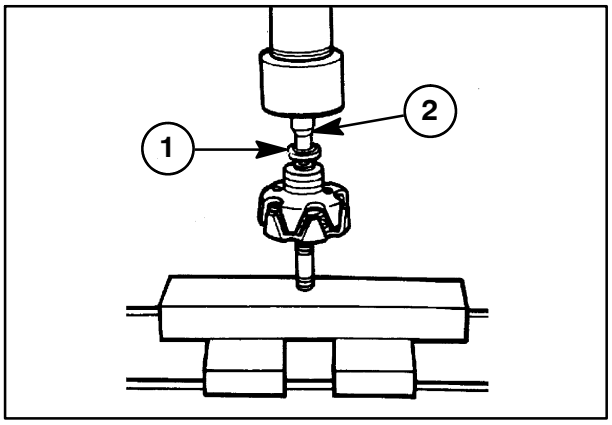


29

Assembly

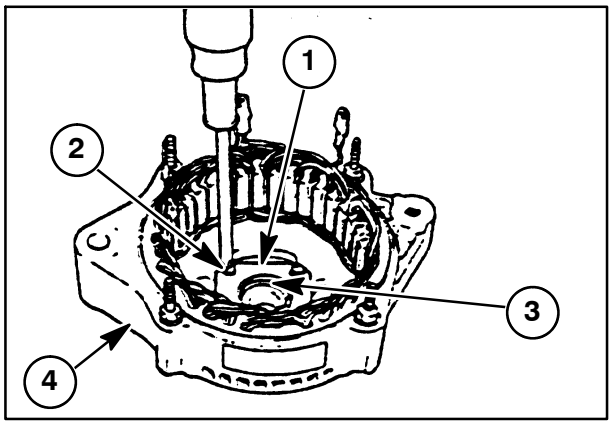
NOTE: *When installing the rear rotor bearing, be sure that top sleeve used to press the bearing onto the rotor contacts the inner race of the bearing only.*

1. Install the rear rotor bearing, 1, and spacer onto the rotor by using a press, 2, and two sleeves, such as tubing or 15-mm deep sockets, 3. The bottom sleeve will support the rotor as the top sleeve presses the rear bearing spacer onto the rotor.



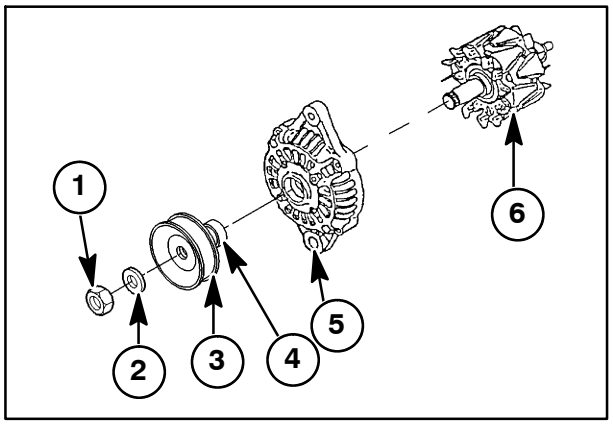
30

2. Install the front rotor bearing, 3, and front bearing retaining plate, 1, into the front alternator frame, 4, and secure using the four (4) retaining screws, 2.



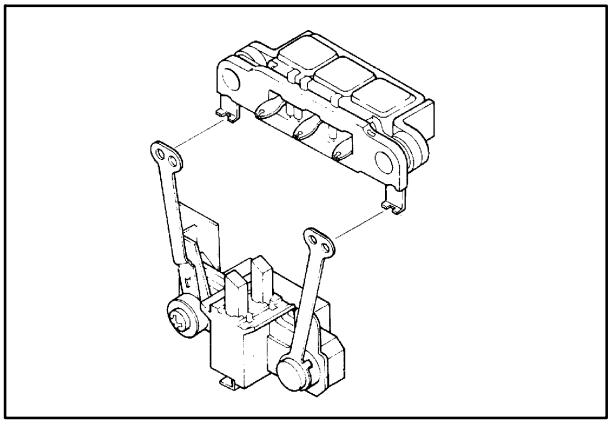
31

3. Install the washer, 2, pulley, 3, spacer, 4, and front frame, 5, onto the rotor, 6.
4. To install the pulley nut, 1, use an impact wrench or place the rotor, 6, into a soft jaw vice and use a wrench to tighten the pulley assembly to the rotor.



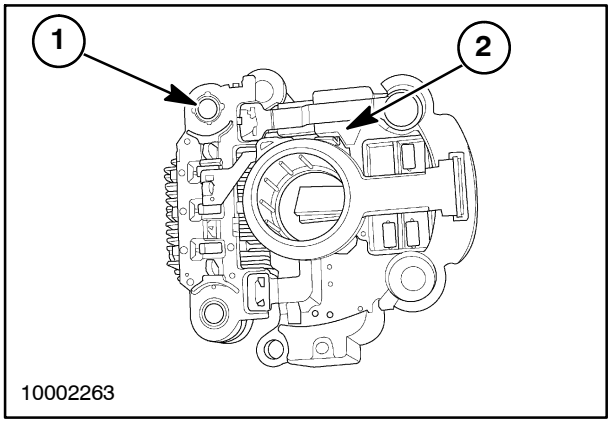
32

5. Use the following guidelines when soldering alternator components.
   - Clean all terminals to be soldered and remove excess solder.
   - Preheat the soldering iron and use rosin-core solder to solder terminals and/or wires. To avoid damage to the rectifier diodes, use a pair of needle nose pliers to remove excess heat from the area being soldered. Hold the pliers just below the solder joint on the rectifier to remove excess heat.
   - Make good, solid, solder joints for best alternator performance.
   - After soldering, quickly cool the solder joint with a damp cloth.



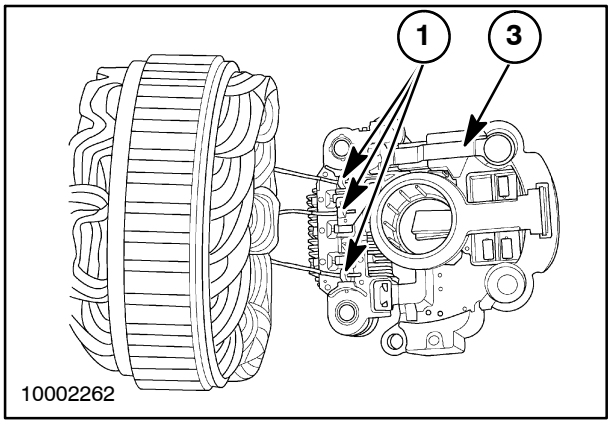
33

6. Solder the IC regulator, 1, and rectifier, 2, together.



34

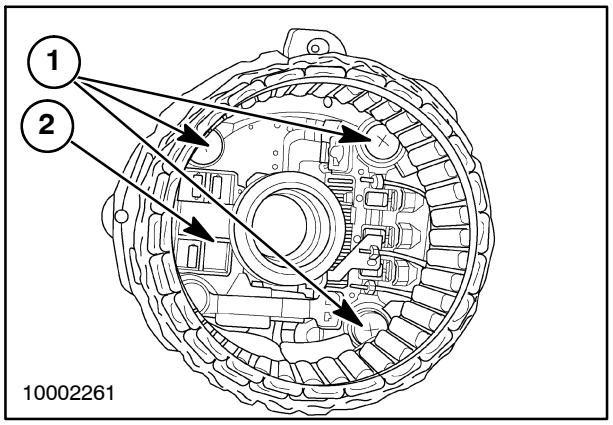
7. Solder the stator leads, 1, to the terminals on the rectifier/regulator assembly, 2.



35

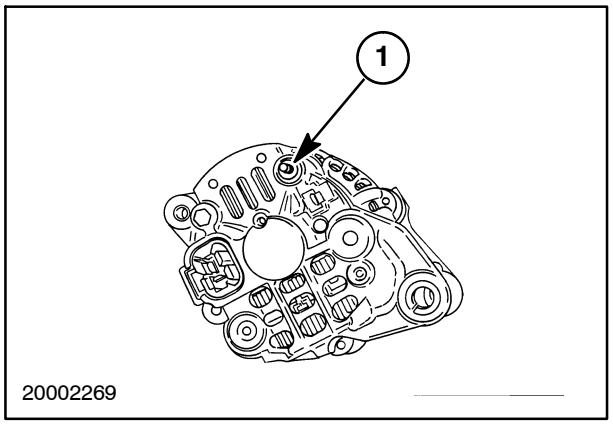
NOTE: *Secure the regulator/rectifier assembly to the rear alternator frame before pressing the stator into the rear frame.*

8. Secure the regulator/rectifier assembly, 2, to the rear alternator frame using the three (3) retaining screws, 1. Manually press the stator assembly into the rear alternator frame.



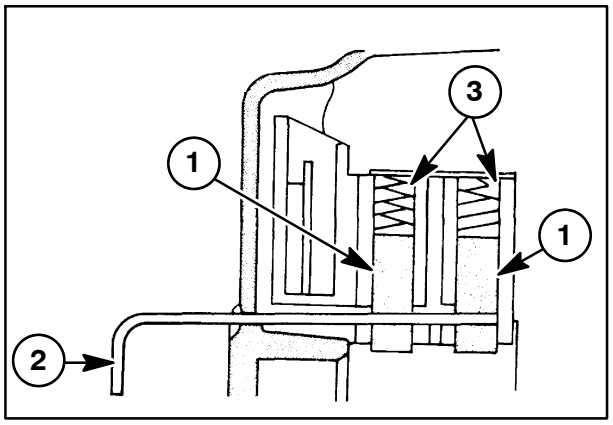
36

9. Install the battery terminal nut, 1, to the rear of the alternator frame.



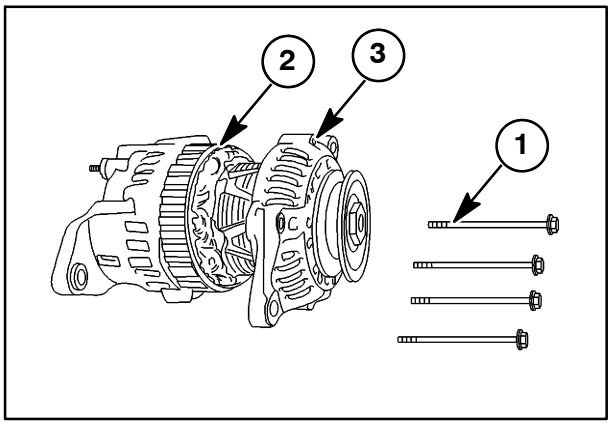
37

10. Push the brushes, 1, and springs, 3, into the brush holder and insert a piece of wire, 2, through the rear of the alternator frame and into the brush holder to hold the brushes out of the way while the alternator halves are being assembled.



38

11. Assemble the front alternator frame, 3, and rear alternator frame, 2, together. Be sure to align the scribe marks made when the alternator was disassembled to insure proper reassembly. Use the four (4) bolts, 1, to secure the front and rear frames together.



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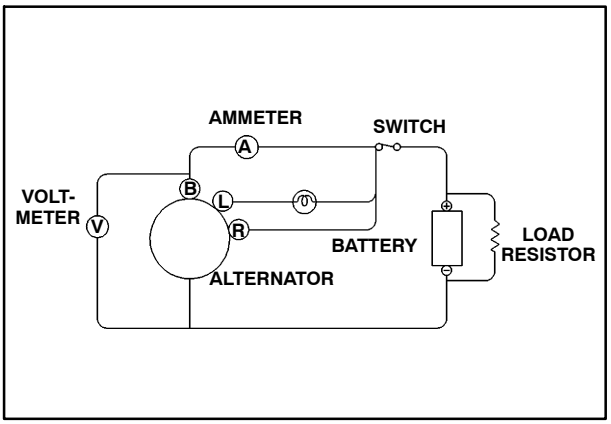
Alternator Bench Check

1. Connect the alternator to a testing circuit, as shown. Set the load resistance to zero (0).

NOTE: *Alternator rotation direction is clockwise, as viewed looking at the pulley.*

2. Slowly increase the alternator rotational speed and observe the voltage reading indicated on the voltmeter.
3. If the voltage is uncontrolled when increasing alternator speed and increases above 15.5 volts, disassemble and check the alternator for malfunctioning components.

1. If the voltage reading is below 15.5 volts, set alternator's rotational speed to 5000 rpm and set the load resistance to achieve maximum output from the alternator.
2. If the amperage value is more than 70% of the nominal alternator output as described in alternator specifications, the alternator is considered to be working satisfactorily.



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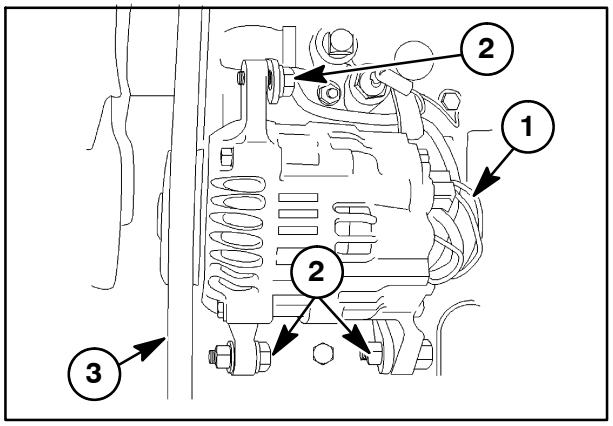
Installation

1. Align the alternator with the alternator mounting holes located on the engine block and brackets. Use the adjusting/mounting bolts, 2, to secure the alternator to the mounting brackets. Be sure to install the v-belt, 3, into the drive pulley.
2. Connect all wire terminals, 1, to rear of the alternator.



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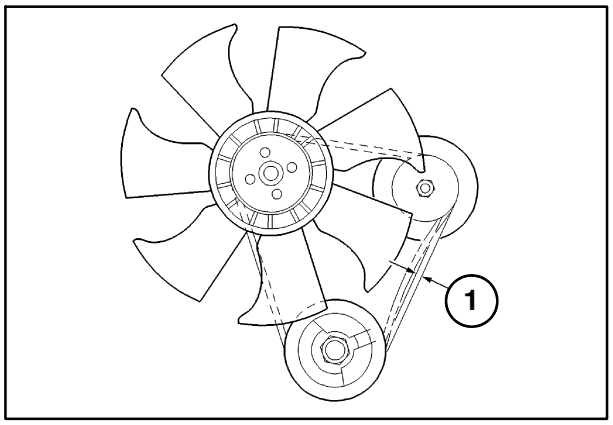
3. Adjust the alternator drive belt deflection by loosening the mounting bolts and moving the alternator into or away from the engine block. Belt deflection should be 5 – 10 mm (0.2 – 0.4 in) when applying 5 kg (11 lb) of force between the crank pulley and the alternator pulley, 1.



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STARTER MOTOR SPECIFICATIONS

Manufacturer	Denso Corporation
Model	2288000-5120
Current Draw	
Under Load	500A @ 7.5V
No Load	less than 110 amps
No Load RPM	4000 rpm
No Load Voltage	11.5 volts
Clutch System	Overrunning Pinion Clutch
Brush Length	
New	15 mm
Wear Limit	12 mm
Brush Spring Tension	2.7 – 3.6 kg (5.9 – 7.8 lb)
Commutator Diameter	
New	35 mm
Wear Limit	34 mm
Commutator Insulation Depth	0.2 – 0.85 mm
Armature Runout	
Commutator	0.02 – 0.05 mm
Armature Shaft	.0.02 mm

STARTER MOTOR TROUBLESHOOTING

PINION SHAFT FAILS TO ADVANCE:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Open circuit, battery, and switch terminal connections	Repair or replace
	Open circuit, fuse	Replace fuse
Key switch	No contact	Repair or replace
Starter motor	Sleeve bearing burnt out	Repair or replace
	Lever broken	Replace
Solenoid	Plunger movement defective or coil open or shorted	Repair or replace

PINION MOTOR ROTATES BUT NO ROTATION TRANSMITTED TO ENGINE:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Starting motor	Clutch defective	Replace
	Orbital gear or planetary gears damaged	Replace

MOTOR ROTATES BEFORE PINION MESHES WITH RING GEAR:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Starter motor	Shift lever damaged	Replace
	Slip ring defective	Replace
	Pinion teeth worn	Replace
	Pinion push out position defective	Adjust
Engine	Ring gear worn	Replace
Solenoid	Solenoid defective	Replace

PINION MESHES WITH RING GEAR BUT STARTING MOTOR FAILS TO TURN:

FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Wiring	Line connecting solenoid to battery broken or defective ground	Repair or replace
	Lead wire connecting solenoid to motor tightened improperly	Repair or replace
Starting motor	Ball bearing locked	Replace
	Brush worn	Replace
	Improper installation	Reinstall
	Brush spring defective	Replace
	Commutator dirty	Clean
	Armature of field coil defective	Repair or replace
	Field coil-to-brush connection defective	Replace
Solenoid	Contact not touching properly	Replace
	Contact contacting surface roughened	Replace
Battery	In discharge state	Recharge or replace

MOTOR FAILS TO STOP AFTER ENGINE STARTS AND KEY SWITCH IS TURNED OFF:

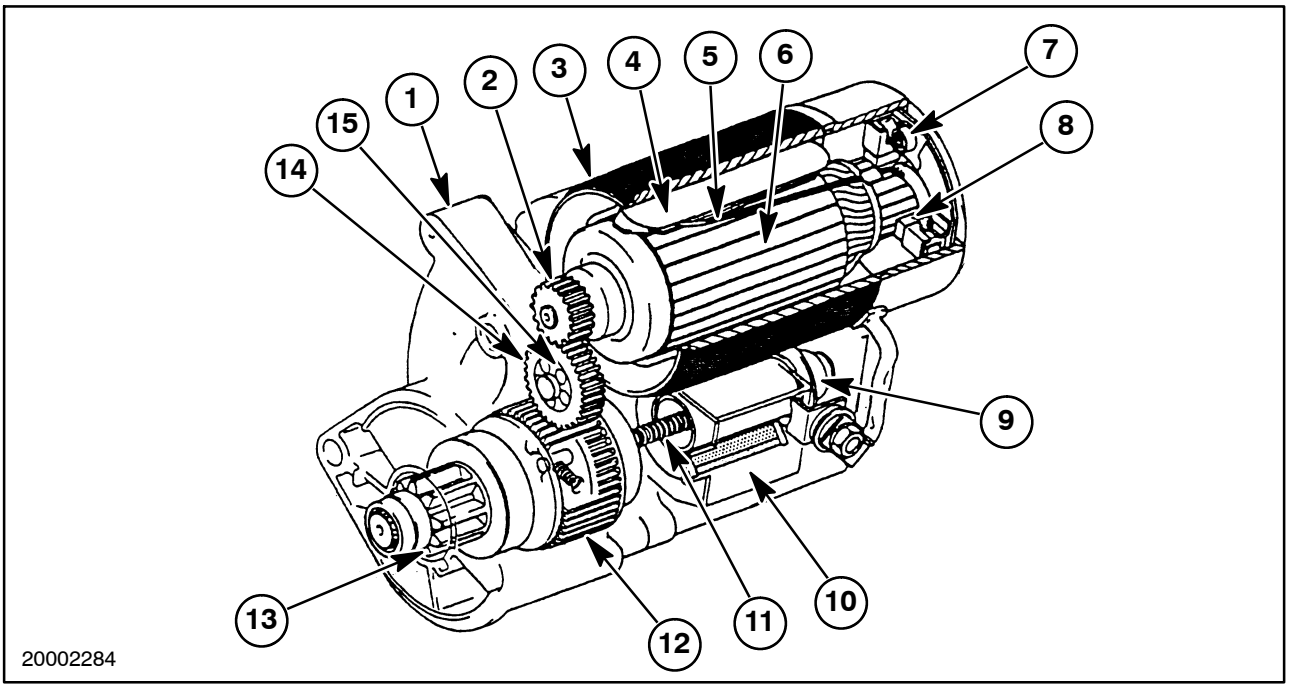
FAULT LOCATION	POSSIBLE CAUSE	CORRECTION
Key switch	Switch defective	Replace
Solenoid	Solenoid defective	Replace

STARTING SYSTEM

DESCRIPTION OF OPERATION

The starting system consists of a starter motor equipped with an electromagnetic starter solenoid, a key switch, a start relay, several safety switches, and heavy-duty wiring.

STARTER COMPONENTS



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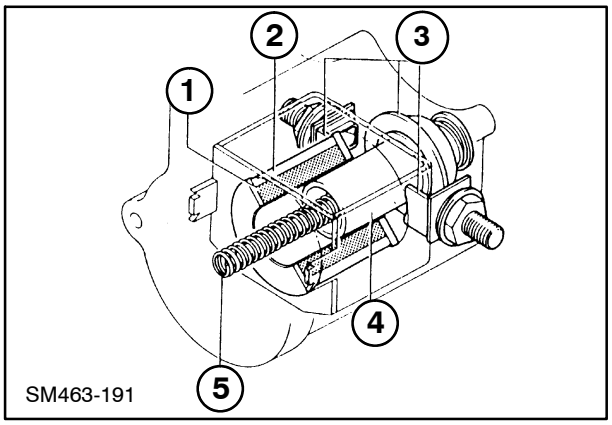
1. Reduction Uni Cover
2. Armature Drive Gear
3. Motor/Field Coil Housing (Yoke)
4. Permanent Magnet
5. Field Coil
6. Armature
7. Brush Spring
8. Brush
9. Plunger
10. Solenoid
11. Return Spring
12. Pinion Clutch
13. Pinion
14. Idler Gear
15. Idler Gear Roller Bearing

Starter Motor Assembly

The starter motor features a high-speed motor that utilizes a gear reduction unit, an overrunning pinion clutch, 12, and permanent magnets, 4, in a field coil, 5, for magnetic field induction. The reduction unit consists of a small drive gear, 2, on the motor armature, 6, which drives an idler gear, 14, in the reduction unit. The idler gear is splined to the gear on the pinion clutch housing, 12. When the starter solenoid, 10, is energized, the solenoid plunger, 9, pushes the pinion gear, 13, out, engaging with the engine flywheel. The starter motor then is turning the flywheel, which rotates the engine. The use of the gear reduction unit allows use of the compact, high-speed motor and provides more torque and power to turn the engine flywheel. The sliding pinion mechanism is enclosed, resulting in a more durable mechanism.

Starter Solenoid

The starter solenoid is an electromagnetic type solenoid that is located on the bottom of the starter motor assembly. The solenoid contains two coils, a pull-in coil, 1, and a hold-in coil, 2. When the key switch is turned to the “START” position and the safety start relay is closed (safety switches closed), current from the battery will energize the solenoid’s two coils. With the coils energized, the solenoid plunger, 4, pushes a spring, 5, which will then push the pinion gear out to engage the flywheel. At the same time, a set of contacts, 3, on the solenoid become closed, allowing current to flow to the starter motor. Closing the contacts also supplies current to both ends of the solenoid pull in coil, which makes the coil become non-energized. The hold-in coil continues to engage the pinion gear with the flywheel.



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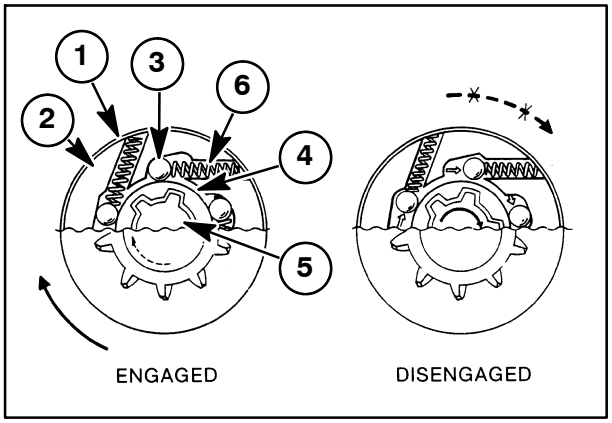
Pinion Clutch

To prevent the engine from driving the starter motor once the engine is running, the pinion gear is equipped with an overrunning clutch. The clutch will disengage the pinion gear from the rest of the starter components once the engine has been started and the key switch is in the “START” position. The clutch consists of an outer gear/shell, 1, a cam with tapered notches, 2, rollers, 3, roller springs, 6, a splined pinion collar/tube that acts as a clutch hub, 4, and the pinion shaft, 5. As the starter motor engages and rotates, the rollers are locked against the pinion collar with the tension provided by the roller springs. While the rollers are locked, the clutch assembly is locked, allowing the pinion gear to rotate the flywheel. When the engine starts, the flywheel moves faster than the starter motor and this causes the rollers to become unlocked. With the rollers unlocked, the clutch assembly is unlocked, allowing the pinion gear and shaft to turn independently of the starter motor.

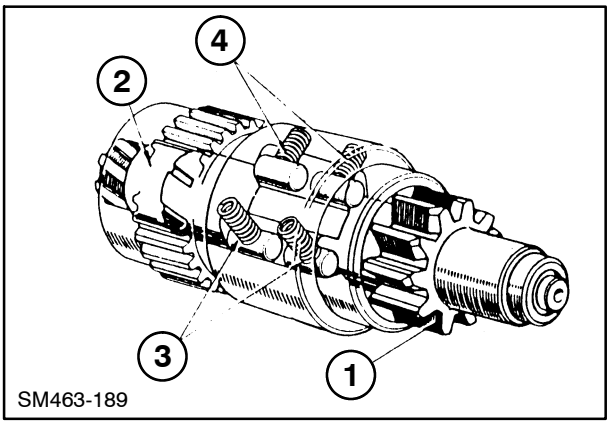
The clutch is not serviceable and is replaced as a complete assembly.

Once the engine is started and the key switch is released from the “START” position, the solenoid’s pull in coil becomes energized, pulling the solenoid plunger in, which disengages the pinion from the flywheel.



45

1. Clutch Gear – Outer Shell
2. Cam
3. Roller
4. Spline Tube – Inner (Pinion Collar)
5. Pinion Shaft
6. Roller Spring



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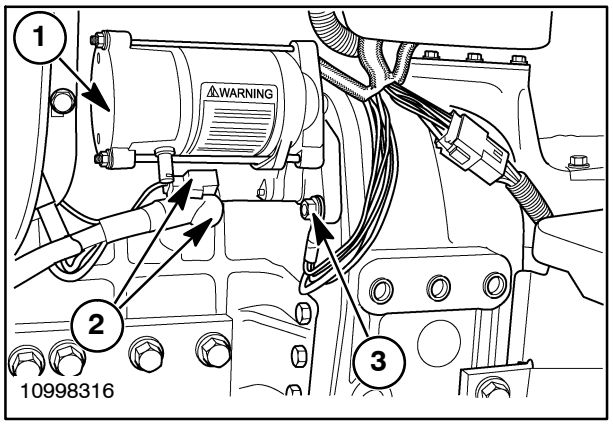
Removal

1. Disconnect the negative (-) battery cable from the battery.
2. Disconnect the wiring harness connections, 2, from the starter motor, 1.
3. Remove the two (2) bolts, 3, which secure the starter assembly, 1, to the tractor engine.



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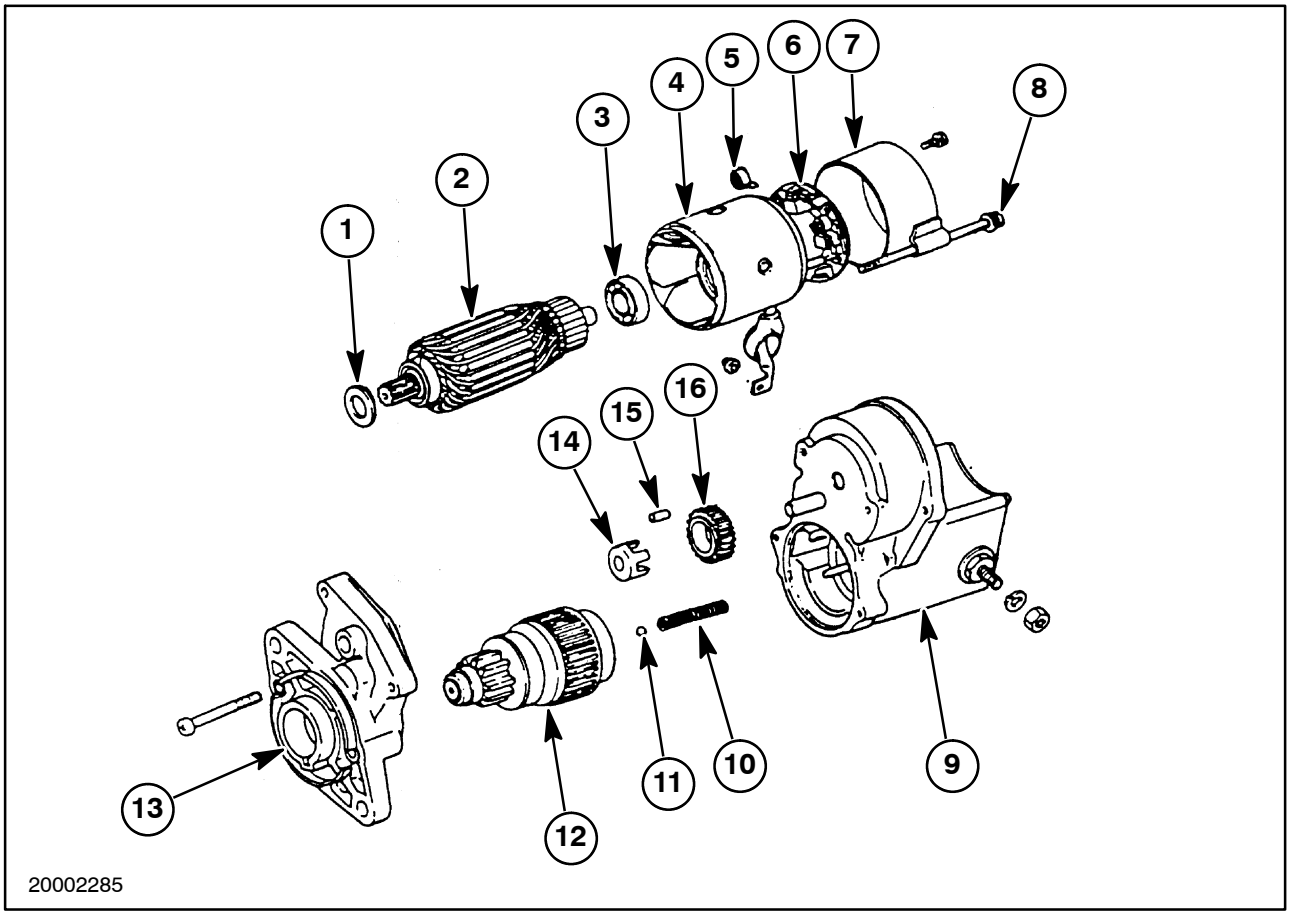

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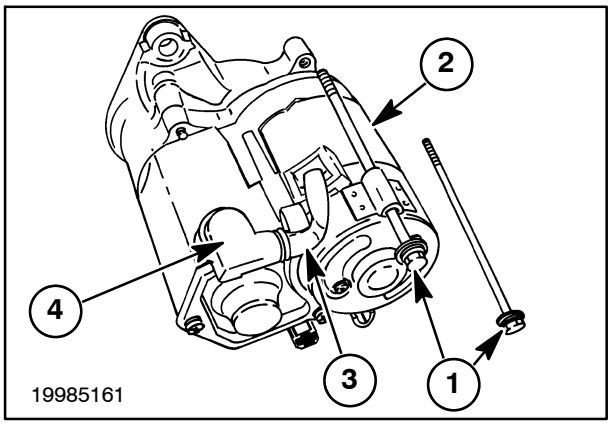
1. Felt Washer
2. Armature (with Front Bearing)
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush Holder
7. Brush Cover
8. Through Bolt
9. Solenoid Housing
10. Return Spring
11. Steel Ball
12. Pinion Clutch
13. Reduction Unit Housing
14. Idler Gear Roller Bearing
15. Roller
16. Idler Gear

Disassembly

1. Remove the field coil wire, 3, the solenoid terminal, 4.
2. Remove the long through bolts, 1, securing the motor assembly, 2 to the gear reduction unit housing.



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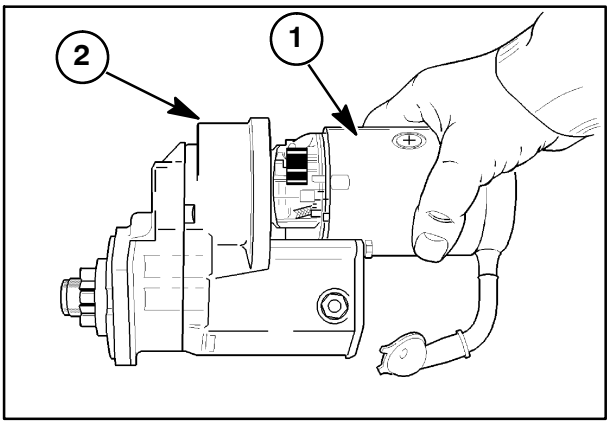
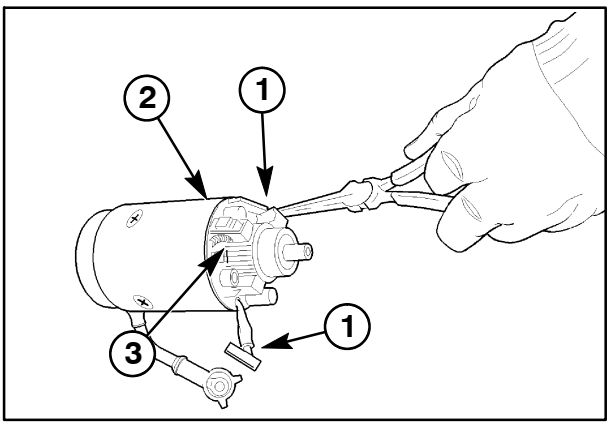
3. Slide the motor assembly, 1, from the gear reduction unit housing, 2.
4. Remove the two (2) screws, 1, which secure the brush cover, 2, to the motor/field coil housing, 3.



50

NOTE: *Before removing the brush holder, scribe aligning marks on the brush holder and the motor/field coil housing.*

5. Use a suitable pair of pliers to remove the insulated armature commutator brushes, 1, from the brush holder, 2.
6. Slide the brush holder, 2, from the armature commutator, 3.



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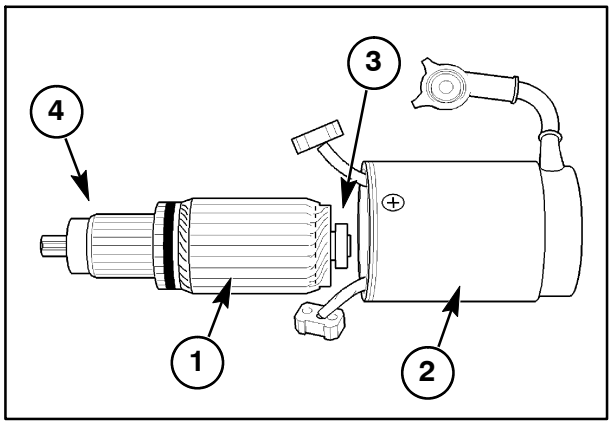
7. Remove the armature, 1, from the motor/field coil housing, 2. The rear armature bearing, 3, is a light press fit and it may be necessary to pull the armature from the housing, gripping on the front bearing, 4.



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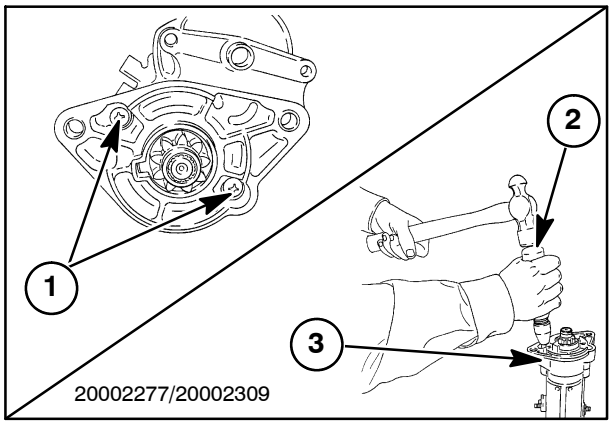
8. Use an impact tool, 2, to remove the two (2) screws, 1, securing the gear reduction cover, 3, to the starter housing.



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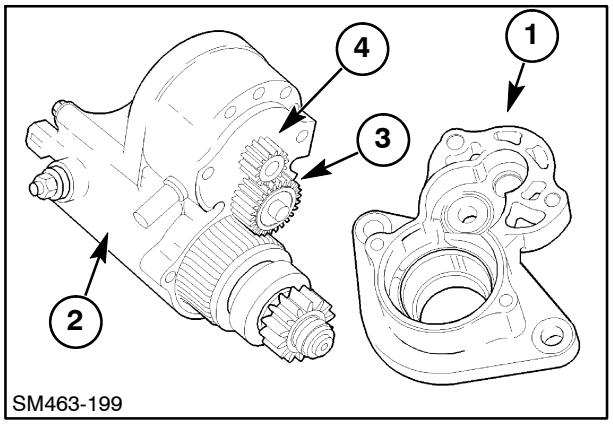
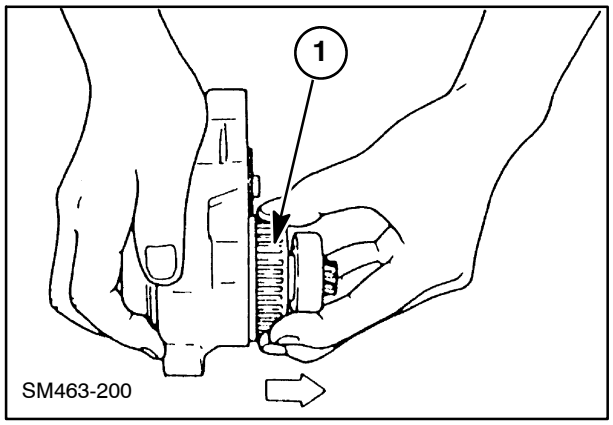
NOTE: *The pinion gear, 4, and idler gear with roller bearings, 3, will be free to fall out when the gear reduction unit cover, 1, is removed from the starter assembly, 2. Use care not to lose any of these pieces.*

9. Carefully remove the reduction unit cover, 1, from the starter assembly, 2



54

10. Pull the pinion clutch assembly, 1, from the reduction unit cover or the starter motor assembly.



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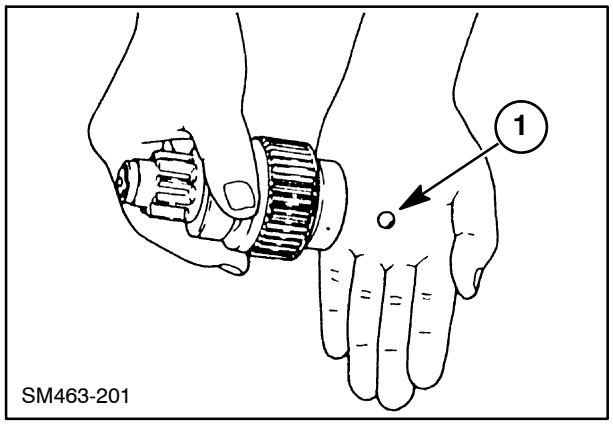
11. Remove the steel ball, 1, from the center of the pinion clutch.



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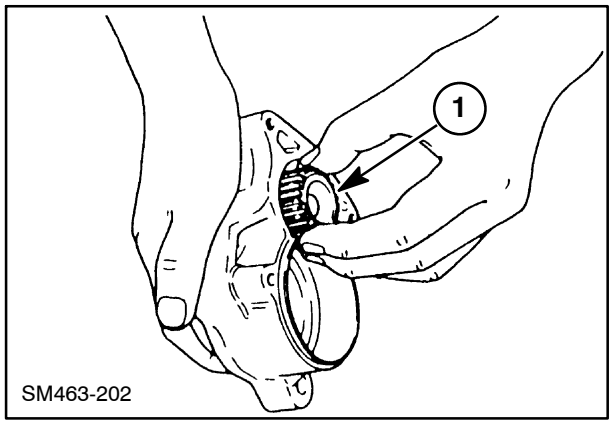
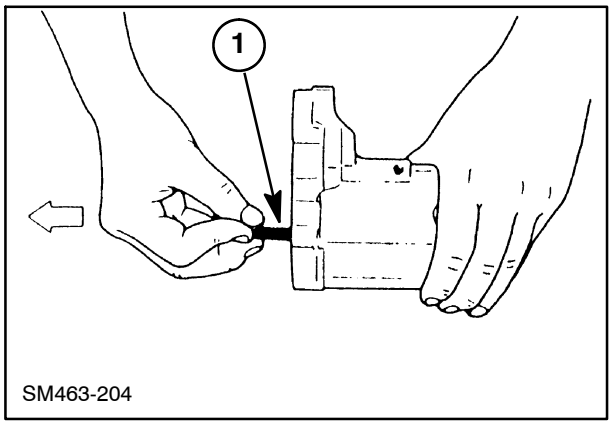
NOTE: *When removing the idler gear and bearing, be careful not to lose the bearing rollers contained in the bearing.*

12. Remove the idler gear and bearing, 1, and pinion gear from the reduction unit cover, if they were not removed when the reduction unit cover and the starter motor housing was separated.



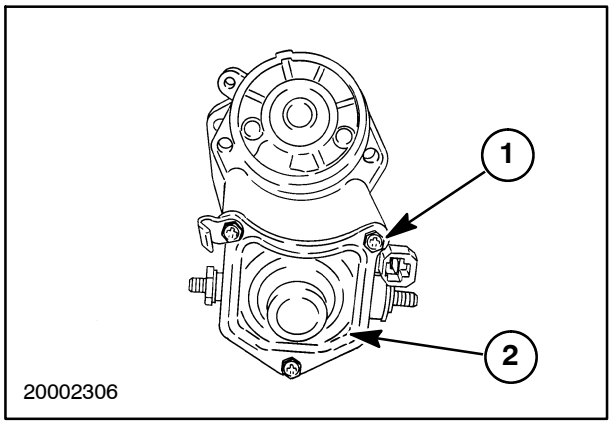
57

13. Remove the return spring, 1, from the electromagnetic solenoid.



58

14. Remove the three (3) screws, 1, securing the solenoid cover, 2, to the starter housing. Pry the cover from the housing.



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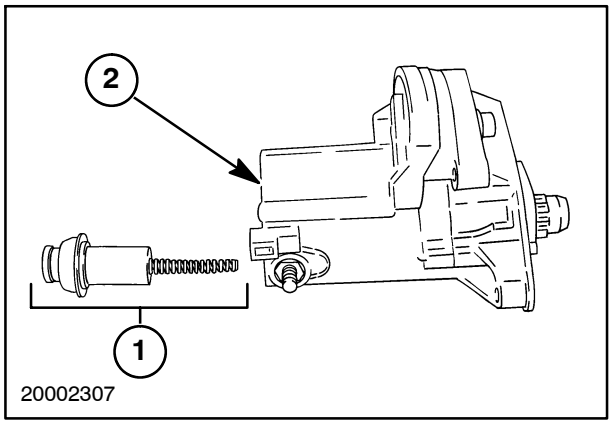
15. Remove the solenoid plunger and spring assembly, 1, from the starter housing, 2.



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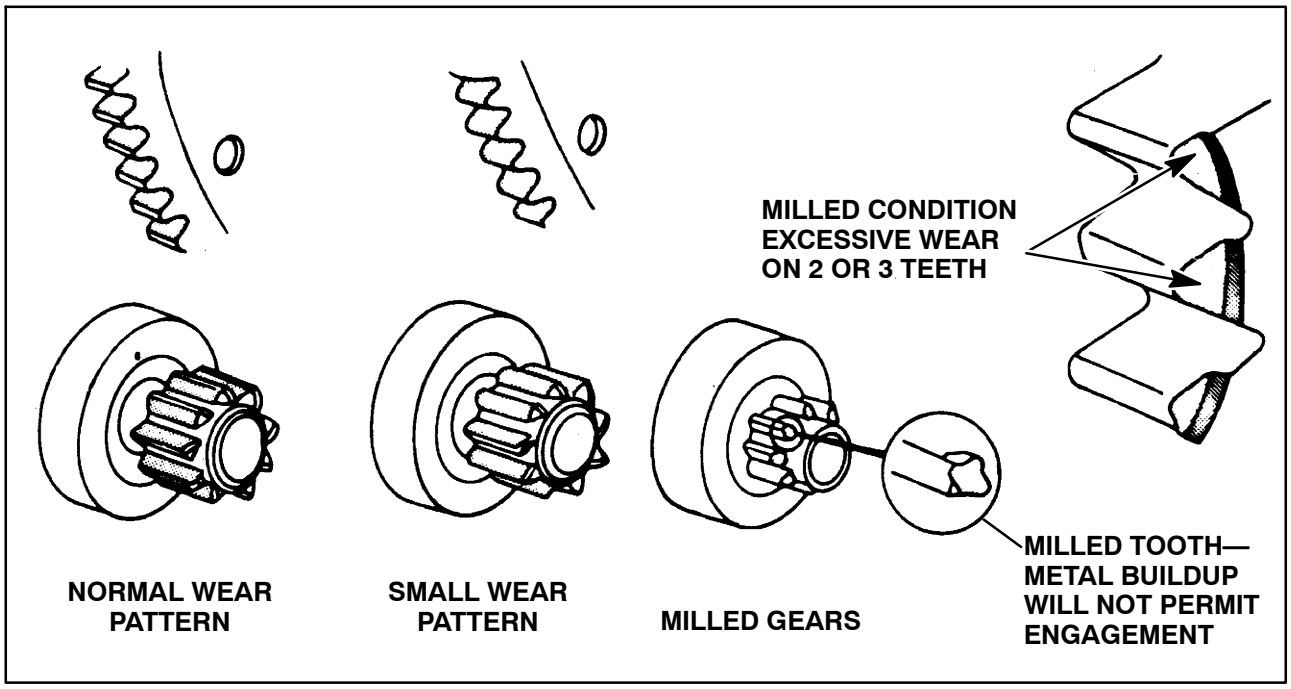

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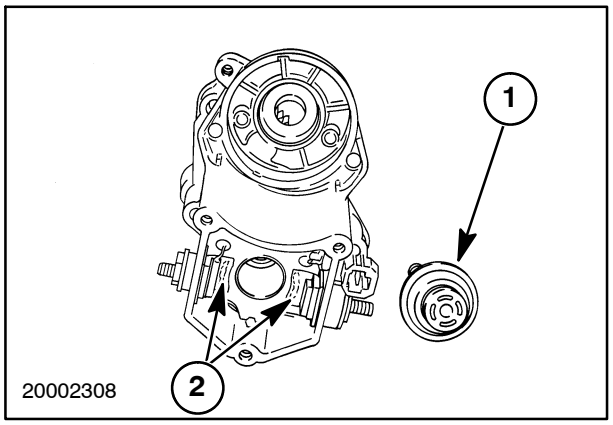
Inspection

1. Inspect the gear splines on the pinion clutch, the pinion, the armature, and the intermediate gear for damaged or missing splines. Replace any damaged parts.
2. Hold the pinion clutch housing and rotate the pinion. The pinion should rotate smoothly, although not necessarily easily, in one direction only. If the pinion can spin in both directions, the clutch is defective and needs replaced.
3. Inspect the motor housing, brush cover, gear reduction unit, and starter housing for damage such as cracks, fatigue, wear, etc. Replace any damaged parts.
4. Inspect the brush terminals, battery terminals, and motor terminals for corrosion, loose connections or damage. Repair or replace any damaged parts.

5. Clean and inspect the solenoid plunger contact ring, 1, and solenoid contacts, 2. Dirty contacts or pitting may be cleaned with fine grit sandpaper or a fine abrasive pad.
6. Inspect that all bearings rotate freely when rotated manually by hand and are not damaged or have excessive play. Replace any damaged bearings.



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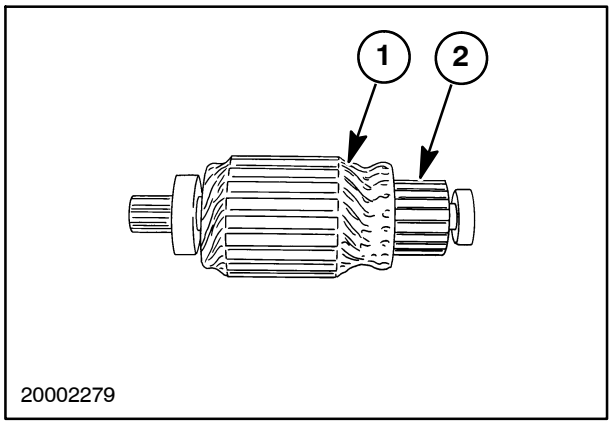
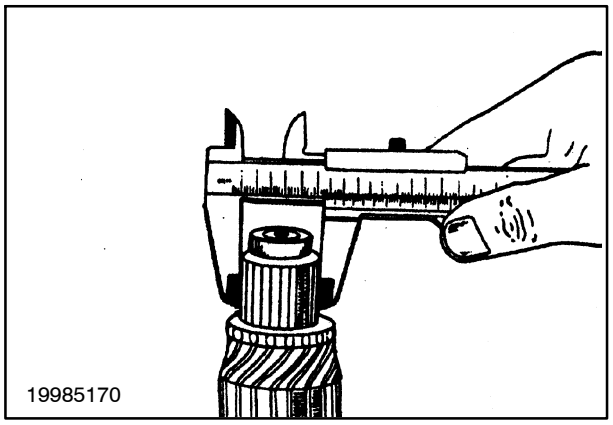
7. Inspect the armature windings, 1, for burnt, broken, or loose connections.
8. Inspect the commutator contacts, 2, for burnt segments, indicating an open winding.



63

9. Use a suitable measuring device to measure the commutator diameter. The minimum commutator diameter is 34.0 mm (1.339 in). If the commutator is worn beyond these specifications, replace the armature.



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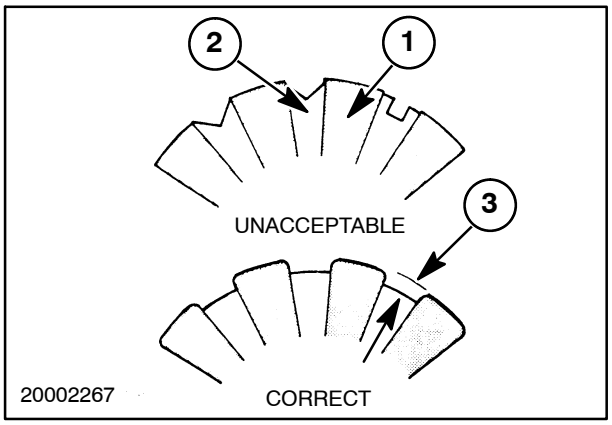
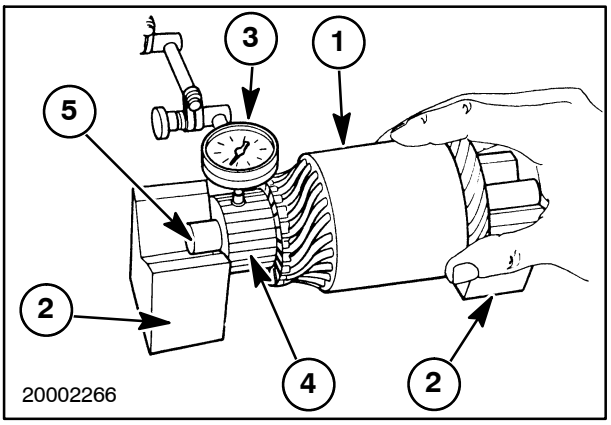
10. Inspect the mica insulating valleys, 2, between the commutator contacts, 1, for uneven wear. Use a suitable measuring device to check the distance, 3, between the top of the contact to the bottom of the insulating valley. The distance should be 0.5 – 0.8 mm (0.020 – 0.031 in). If the distance is not within these specifications or there is uneven wear, the insulating valleys may be undercut with a suitable file.



65

NOTE: *If not previously removed, the armature bearings will need to be removed for this test.*

11. Place the armature, 1, in a set of precision V-blocks, 2, and use a dial indicator, 3, to measure commutator, 4, runout and shaft, 5, runout. Commutator runout should not be more than 0.2 mm (0.008 in). Shaft runout should not be more than 0.05 mm (0.002 in).



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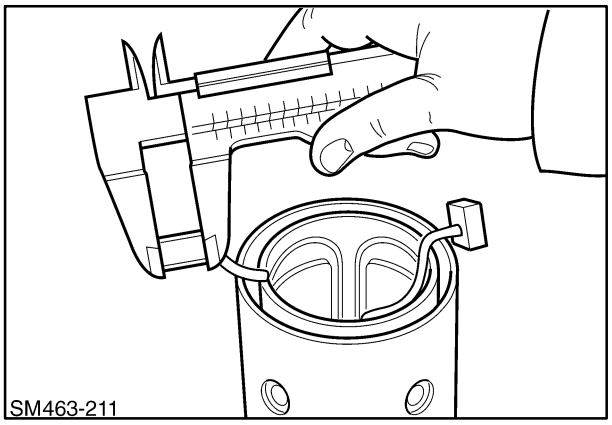
NOTE: *When measuring the brush length, remove the brush from the brush support and measure the middle portion of the brush.*

12. Use a suitable measuring device to measure the length of the four armature brushes. Compare the measurement of each brush with brush length specifications. If the brush is not within specifications or is damaged in any way, replace the brushes.



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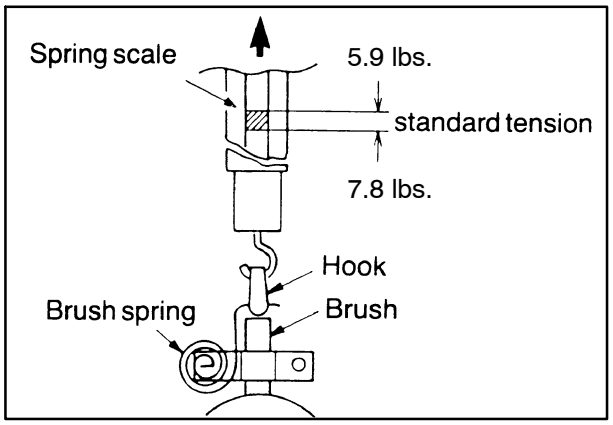
13. Test the brush spring tension by connecting a spring balance to the brush spring and pulling until the spring moves. Observe the reading indicated on the spring balance. If the reading is between 2.7 – 3.6 kg (5.9 – 7.8 lb), the spring tension is within specifications. Otherwise, replace the brush springs.



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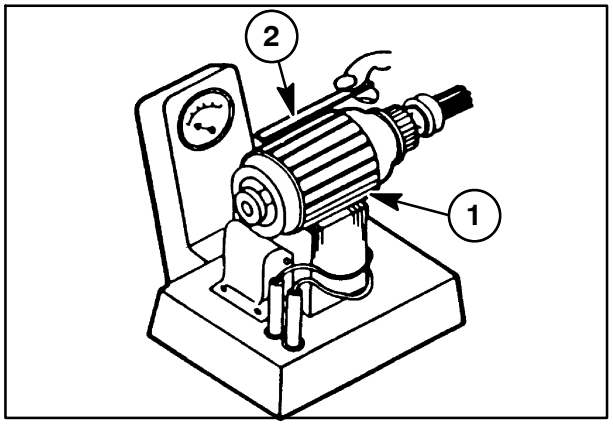
ELECTRICAL TESTING

Armature

1. Use a growler, 2, to inspect the armature coil, 1, for short circuits. Replace if the armature is shorted.



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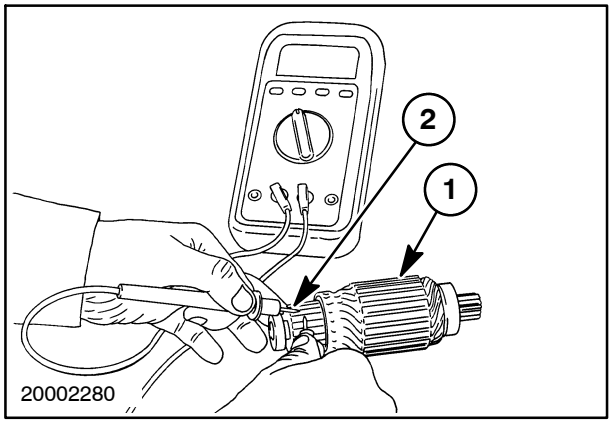
2. Use an ohmmeter to test for continuity in the armature coil, 1.
3. Touch one ohmmeter test probe to a commutator contact, 2. Touch the ohmmeter test probe to an adjacent commutator contact.
4. Observe the ohmmeter. Repeat the test on each adjacent commutator contact. Little or no resistance indicates that there is continuity and the armature coil is good. High resistance indicates that the armature is defective and needs replaced.



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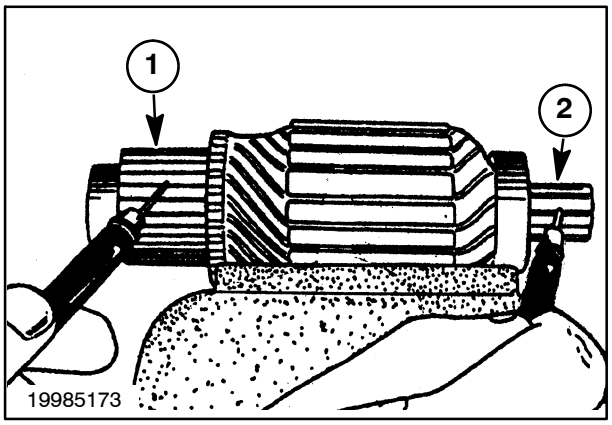
5. If the armature is tested OK, touch one ohmmeter test probe to a commutator contact, 1. Touch the other test probe to the armature shaft, 2.
6. Observe the ohmmeter. A high resistance reading indicates the armature is good. Little or no resistance indicates that the armature is defective and needs replaced.



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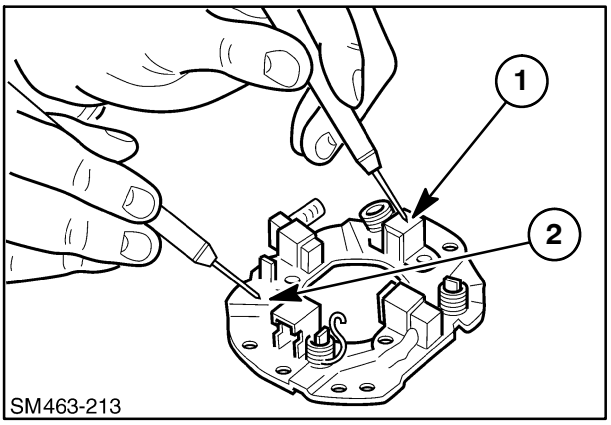
Brush Holder

1. Using an ohmmeter, touch one test probe to the insulated brush holder, 1, and the other test probe to the brush holder plate, 2.
2. Observe the ohmmeter. Repeat the test for the opposite insulated brush holder.
3. A reading high resistance indicates no continuity and the brush holder is good. Little or no resistance indicates that there is continuity and the brush holder is defective and needs replaced.



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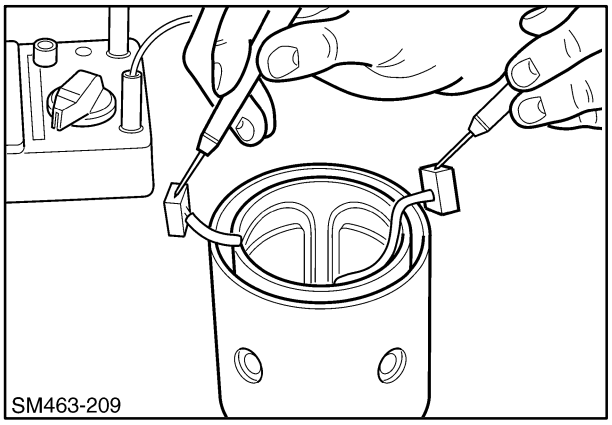
Field Coil

1. Use an ohmmeter to test the field coil.
2. Touch one ohmmeter test probe to one of the field coil brushes. Touch the other test probe to the remaining field coil brush.
3. Observe the ohmmeter. Little or no resistance indicates continuity and that the field coil is functioning properly. High resistance indicates the field coil is defective and needs replaced.



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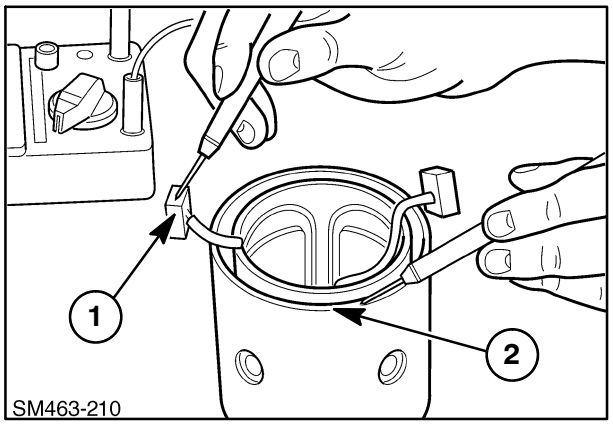
NOTE: *Paint on the field coil/motor housing will give a false reading when testing to see if the field coil is grounded. Be sure to remove paint from the field coil/motor housing.*

4. If the previous test indicated the field coil was not defective, touch one ohmmeter test probe to one of the field coil brushes, 1. Touch the other test probe to the field coil housing, 2.
5. Observe the ohmmeter. If the reading shows high resistance, indicating no continuity, the field coil is not grounded and is functioning properly. If there is little or no resistance indicating continuity, the field coil is defective and needs replaced.



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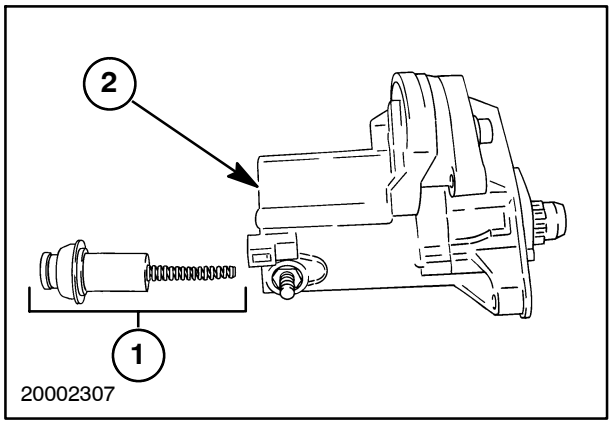
Starter Solenoid

NOTE: *The following test should be performed with the starter assembly partially assembled.*

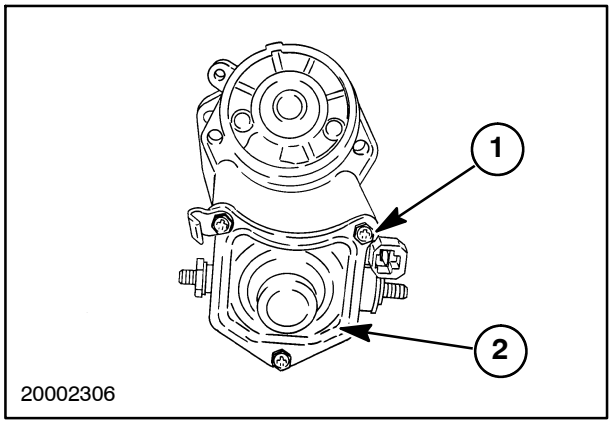
NOTE: *If solenoid will not be disassembled after this test, apply white lithium grease to the armature drive gear, pinion clutch, idler gear and roller bearings, and the pinion clutch steel ball and return spring.*

1. Install the solenoid plunger and spring assembly, 1, into the starter housing, 2.



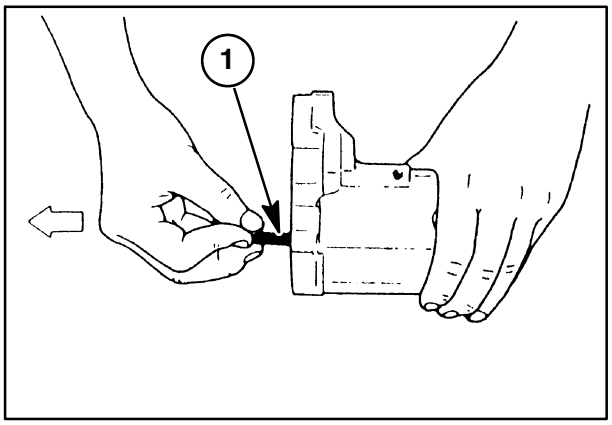
75

2. Install the solenoid cover and gasket to the starter housing. Install the three (3) screws, 1, securing the solenoid cover, 2, and gasket to the starter housing.



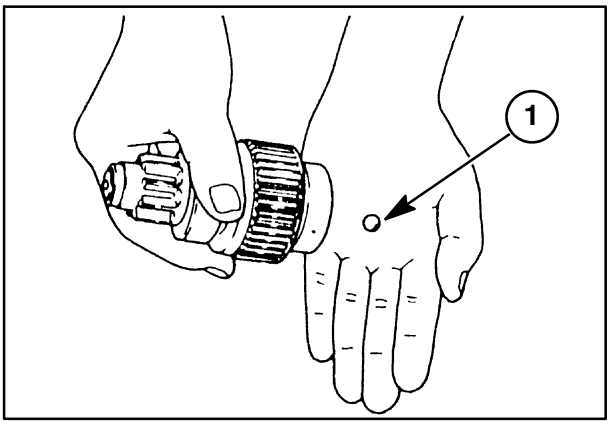
76

3. Install the return spring, 1, into the solenoid.



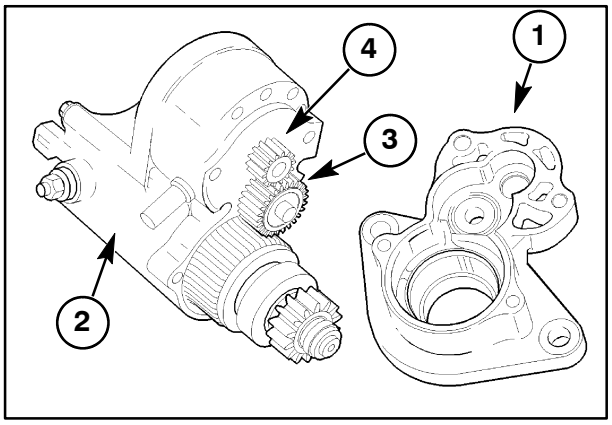
77

4. Install the steel ball, 1, into the center of the pinion clutch.



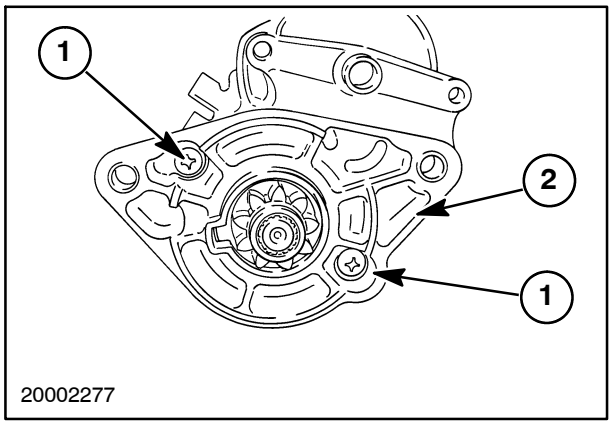
78

5. Install the pinion clutch, 5, in the starter housing. Make sure the rear clutch bearing is completely seated in the housing.
6. Grease the idler gear bearing with petroleum jelly and install the gear, 3, and bearing onto the starter housing. Align the bearing and gear so that it meshes with the pinion clutch and is aligned with the hole in the housing for the pin which the bearing rides on.
7. Install the pinion gear, 4, in the proper recess in the reduction unit cover, 1, as the cover is being installed onto starter motor housing.



79

8. Secure the gear reduction cover, 2, with the two (2) retaining screws, 1.



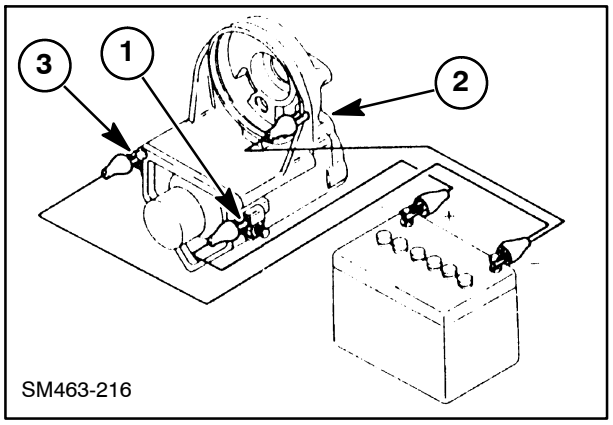
80

⚠ CAUTION ⚠

Do not perform this test for more than 3 – 5 seconds at a time, as damage may occur to the solenoid or other components.

NOTE: *Be sure to use test leads that have 14 awg wire or thicker for this test.*

9. Connect a test lead from the positive (+) terminal of a 12-volt power source to the starter switch terminal, 1, (spade terminal) of the starter.
10. Use another test lead to connect the negative (–) terminal of the 12-volt power source to the starter housing, 2.
11. Connect a second negative (–) test lead from the 12-volt power source to the field coil terminal, 3. This completes the circuit to send current to the hold-in and pull-in coils of the solenoid.
12. Observe the starter pinion. The solenoid should have caused the pinion to jump forward when the third test lead was connected to the field coil terminal. This indicates the pull-in coil is working properly.
13. Remove the test lead to the field coil terminal, 3, and observe the starter pinion. The solenoid should keep the pinion extended when the third test lead is removed. This indicates the hold-in coil is working properly.
14. If the solenoid fails to perform as described, replace the solenoid assembly.



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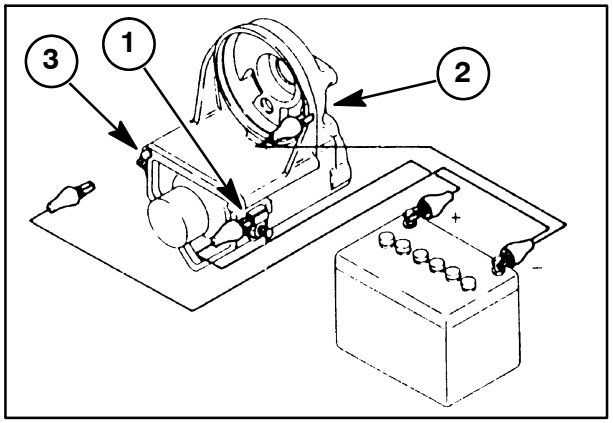
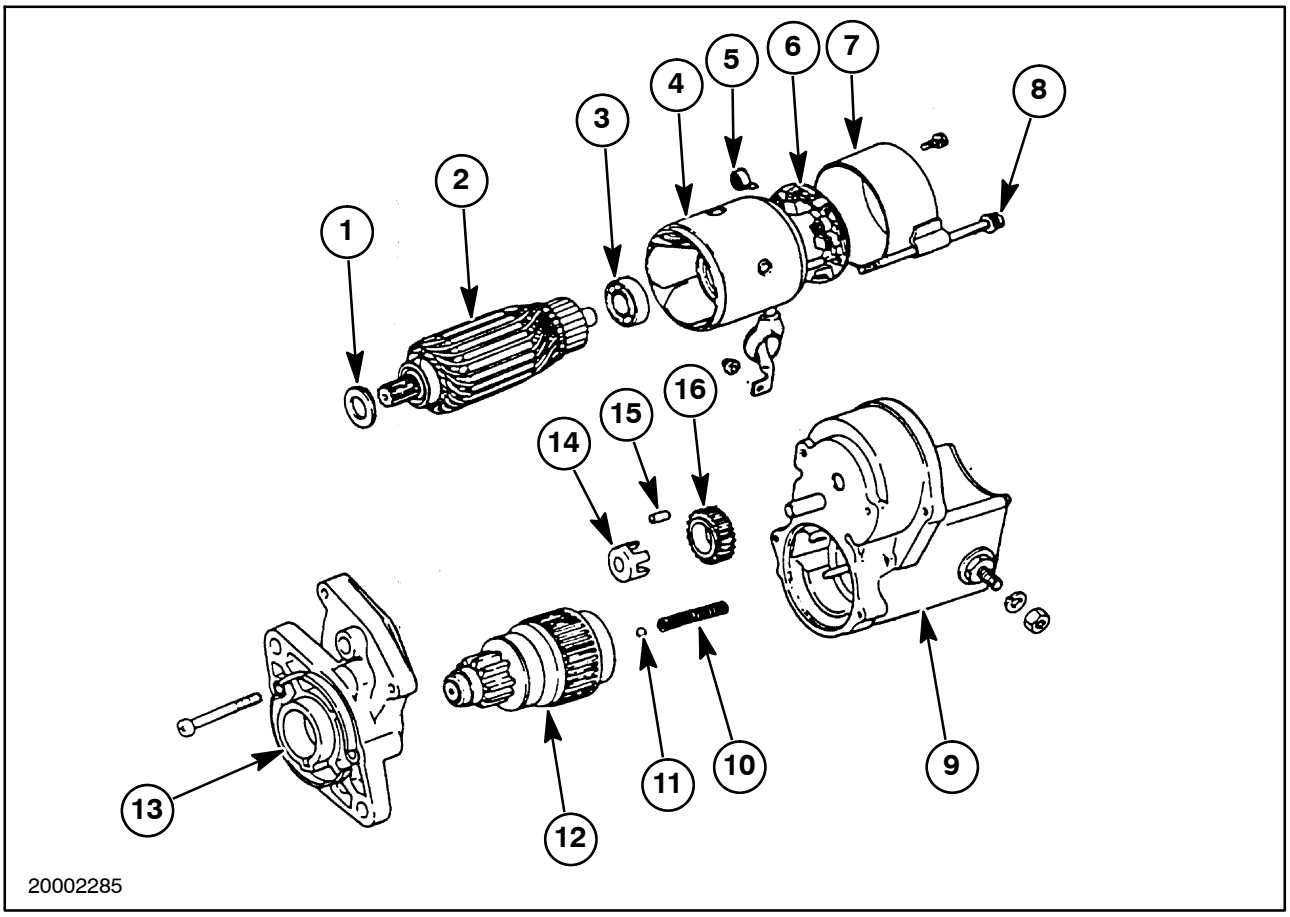


82



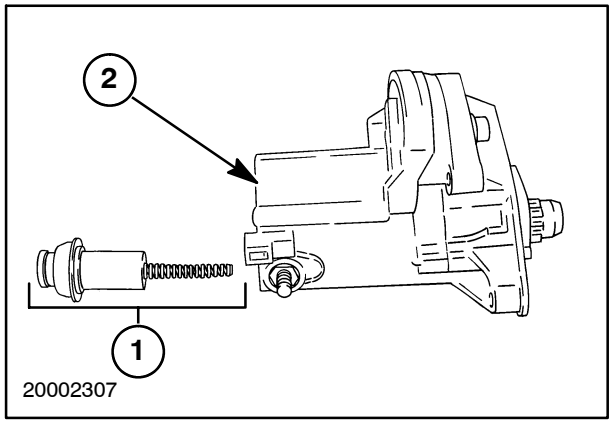
83

1. Felt Washer
2. Armature (with Front Bearing)
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush Holder
7. Brush Cover
8. Through Bolt
9. Solenoid Housing
10. Return Spring
11. Steel Ball
12. Pinion Clutch
13. Reduction Unit Housing
14. Idler Gear Roller Bearing
15. Roller
16. Idler Gear

Assembly

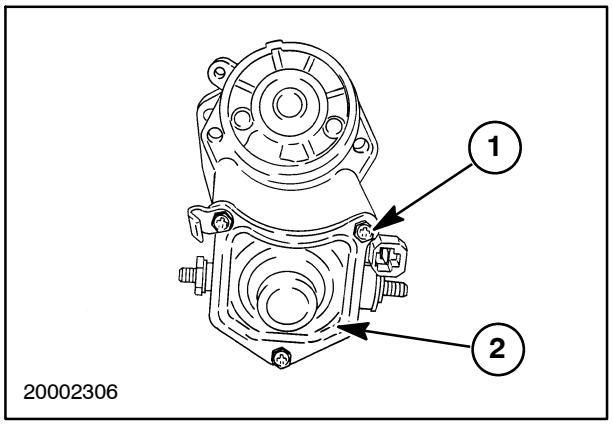
NOTE: *Use white lithium grease to lubricate parts indicated.*

1. Install the solenoid plunger, 1, into the starter housing, 2.



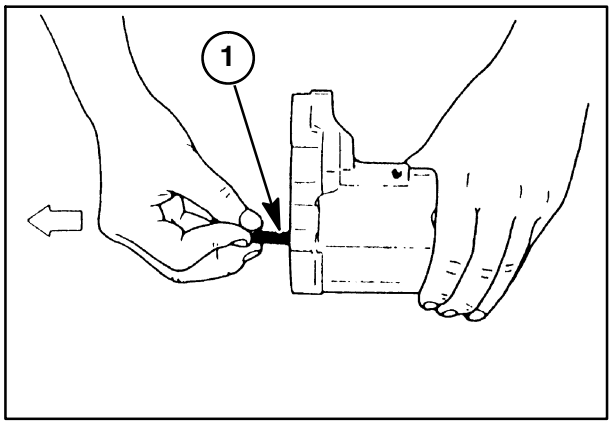
84

2. Install the solenoid cover and gasket to the starter housing. Install the three (3) screws, 1, securing the solenoid cover, 2, and gasket to the starter housing.



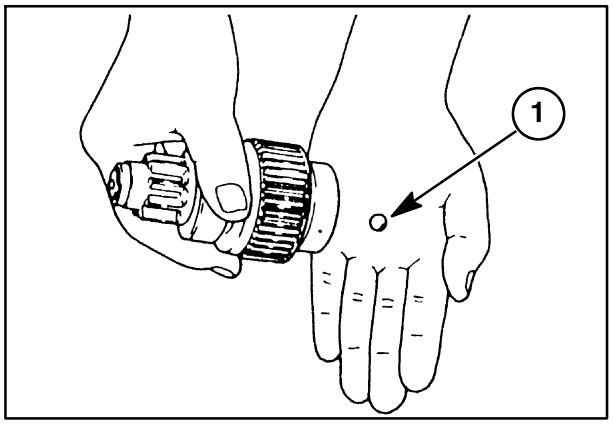
85

3. Grease and install the return spring, 1, into the solenoid.



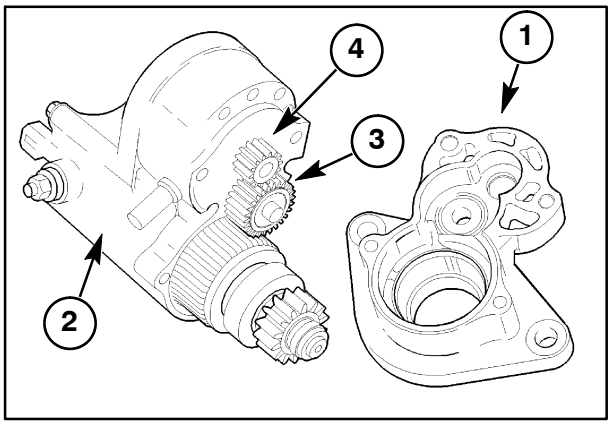
86

4. Grease and install the steel ball, 1, into the center of the pinion clutch.



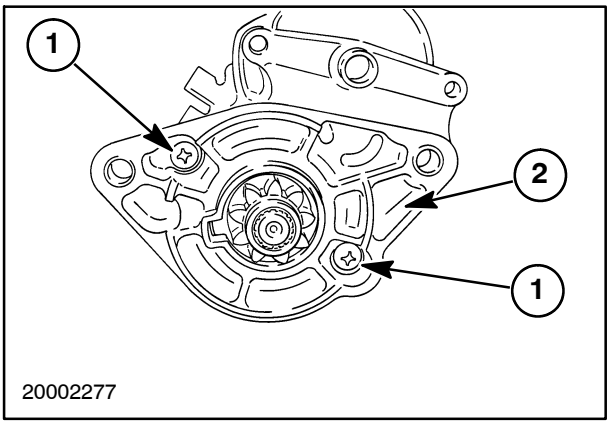
87

5. Grease and install the pinion clutch, 5, in the starter housing. Make sure the rear clutch bearing is completely seated in the housing.
6. Grease the idler gear bearing and gear and install the gear, 3, and bearing onto the starter housing. Align the bearing and gear so that it meshes with the pinion clutch and is aligned with the hole in the housing for the pin which the bearing rides on.
7. Install the drive gear, 4, in the proper recess in the reduction unit cover, 1, as the cover is being installed onto starter motor housing.

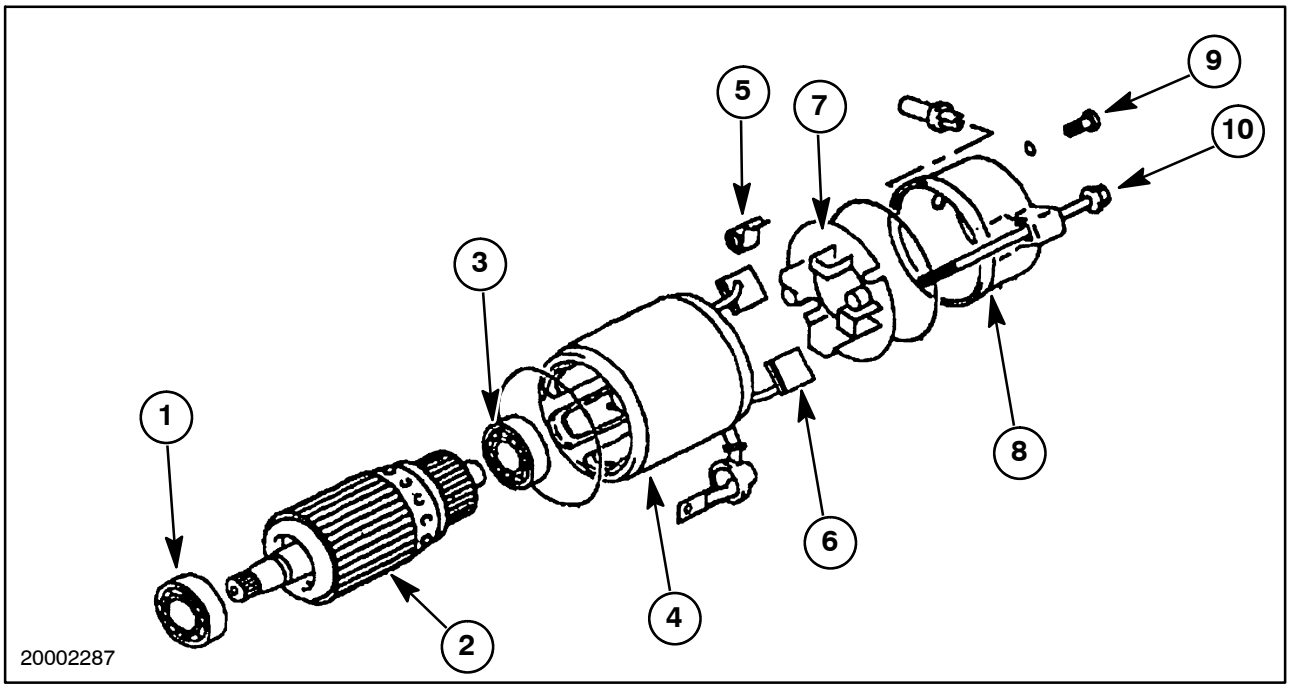


88

8. Secure the gear reduction cover, 2, with the two (2) retaining screws, 1.



89



90

1. Front Armature Bearing
2. Armature
3. Rear Armature Bearing
4. Motor/Field Coil Housing
5. Brush Spring
6. Brush
7. Brush Holder
8. Brush Cover
9. Bolt
10. Through Bolt

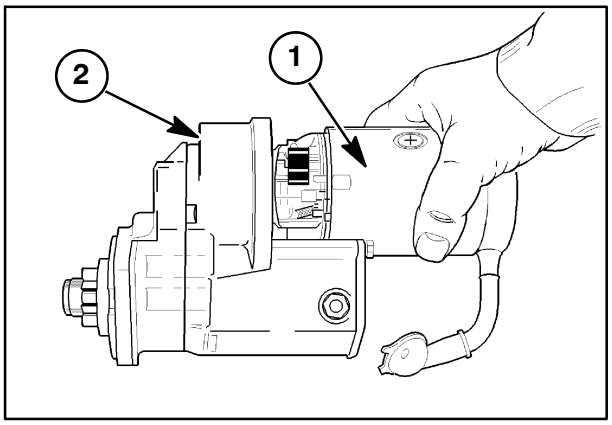
9. If removed, install the front and rear bearings, 1, 3, onto the armature, 2.
10. Install the armature, 2, into the motor/field coil housing, 4. Be sure that the rear bearing, 3, is properly seated in the motor housing.

NOTE: *When installing the field coil brushes, be sure that the aligning marks made on the brush holder and motor/field coil housing will line up when the brush holder is installed onto the armature commutator.*

11. Install the field coil brushes, 6, into the brush holder, 7, by holding the brush springs, 5, away as the brush is being inserted into the insulated brush holder.
12. Install the brush holder, 7, onto the armature commutator.
13. Secure the brush cover, 8, to the brush holder, 7, using the two (2) retaining bolts, 9.

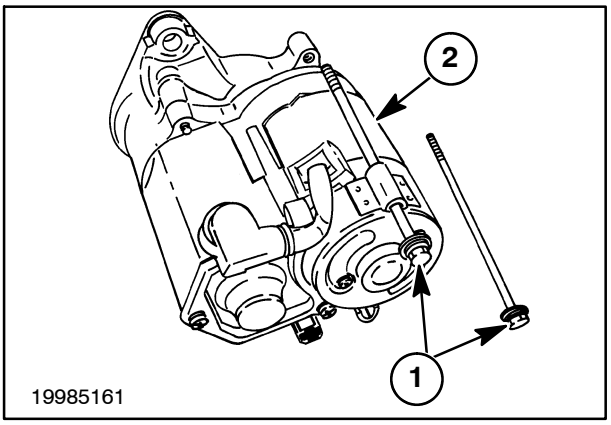
NOTE: *Be sure the aligning marks made on the starter housing and motor/field coil housing line up when installing the motor assembly to the starter assembly.*

14. Install the motor assembly, 1, into the starter assembly, 2.



91

15. Secure the motor assembly, 2, to the starter assembly using the two (2) long through bolts, 1.



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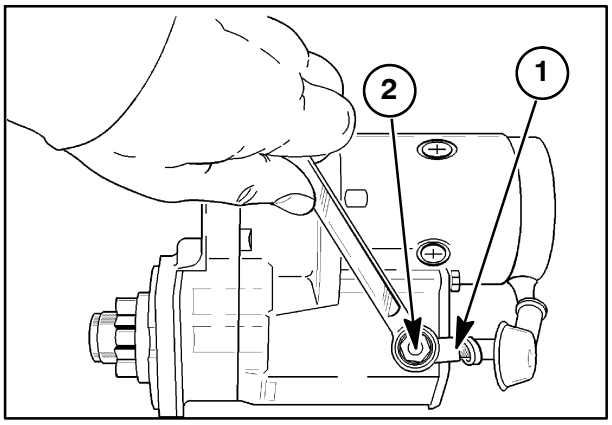
16. Install the field coil wire, 1, the solenoid terminal, 2.



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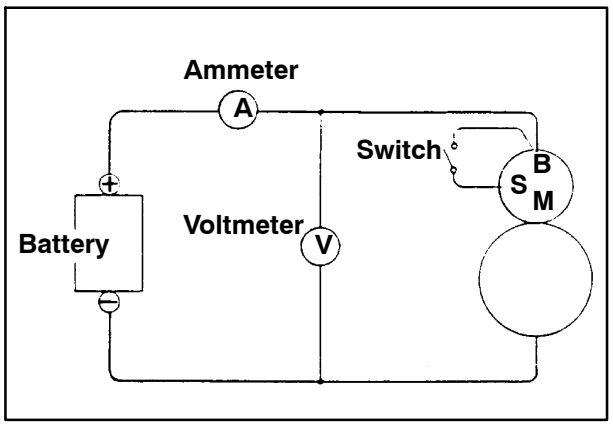
No Load Test

NOTE: *Before installing the starter motor to the tractor engine, it is recommended that a no load test be performed on the starter motor.*

⚠ CAUTION ⚠

Do not operate the starter for than 30 seconds at a time.

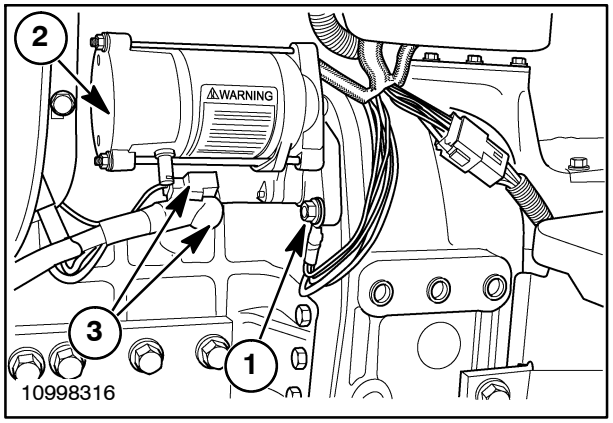
1. Connect a battery and switch to the battery terminal of the starter and the “S” terminal of the solenoid.
2. Connect an ammeter between the positive (+) battery terminal of the battery and the battery terminal of the starter solenoid.
3. Connect a voltmeter, after the ammeter, between the positive (+) lead from the battery and the negative (–) lead from the battery.
4. Close the switch and record the readings indicated on the ammeter and voltmeter.
5. Test starter components if any abnormal operation is noted.
6. Service limits are 11.5 volts, 110 amps maximum at 4000 rpm.



94

Installation

1. Install the starter motor, 2, to the engine and secure using the two (2) retaining bolts, 1. Be sure all ground terminals are connected to the bottom starter bolt.
2. Connect the tractor wiring harness connections, to the starter.
3. Connect the negative (–) battery cable to the battery.



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SECTION 90 - PLATFORM

Chapter 1 - Platform

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DESCRIPTION OF OPERATION AND OVERHAUL

This section describes the removal and installation of components such as, dash panels, fenders, hood, and the side steps.

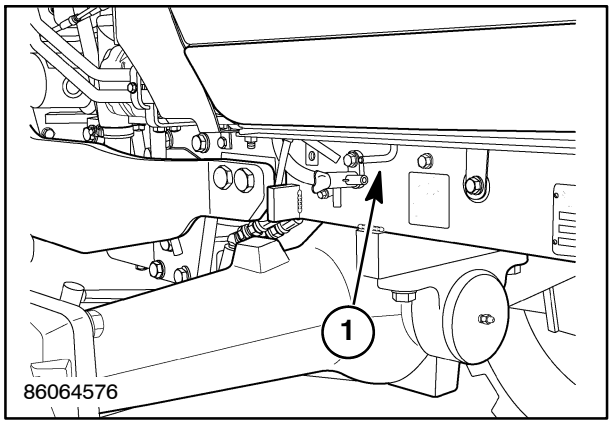
DANGER

Lift and handle all heavy parts using suitable lifting equipment. Support parts or an assembly by means of suitable slings, hooks, or jack stands. Make sure that no person is near a raised load.

HOOD

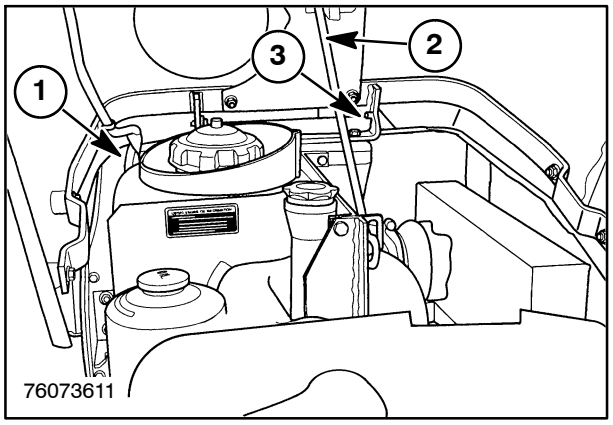
Removal

1. Release the hood latch under the right hand side of the hood, 1, and open the hood.



1

2. Disconnect the headlight wiring, 1, from the main wire harness.
3. Remove the clip, and washer from the hood prop rod, 2.
4. Remove the clip, 3, from the hood mounting bracket.
5. Support the hood and remove the prop rod from the hood. Carefully remove the hood from the tractor.



2

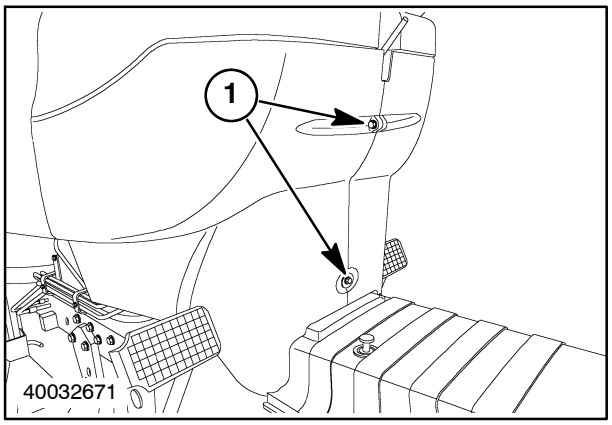
Installation

1. Carefully lift the hood into position over the tractor.
2. Slide the hood onto the hood hinges and secure to the tractor by using the clip, 3.
3. Install the hood prop rod, 2, using the flat washer, and clip.
4. Connect the headlight wiring to the main wire harness.

REAR SIDE HOODS

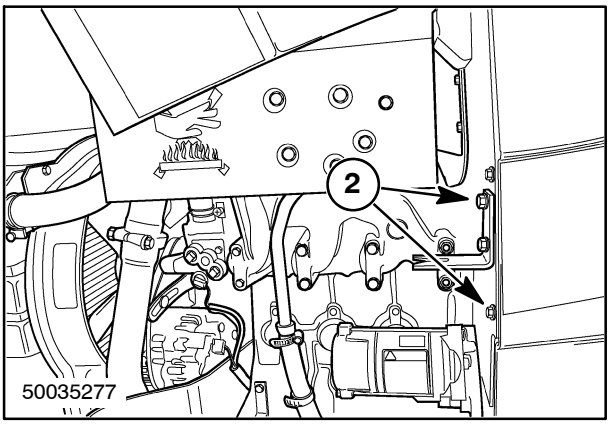
Removal

1. Remove the two bolts, 1, that attach the rear hood panels together.
2. Lift the hood to access the bolts that attach the rear hood panels to the firewall.



3

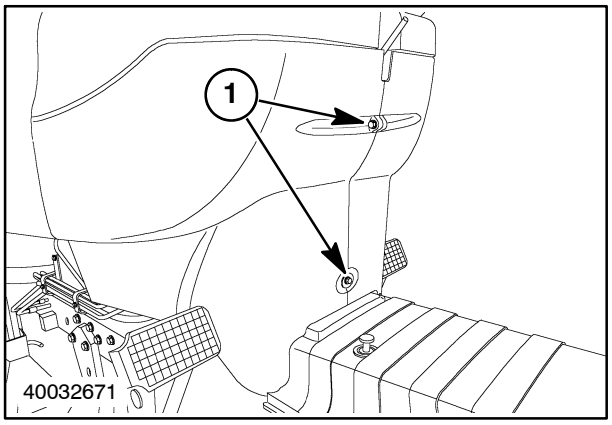
3. Loosen and remove the two bolts, 2, that attach the rear hood panel to the firewall. Repeat for opposite side.
4. Disconnect the ignition switch from the wire harness to allow the panel to be removed.



4

Installation

1. Connect the ignition switch to the wire harness, and install the panels.
2. Install the two bolts, 2, Figure 4, that attach the rear hood panel to the firewall. Repeat for opposite side.
3. Install the two bolts, 1, that attach the rear hood panels together.
4. Close the hood.



5

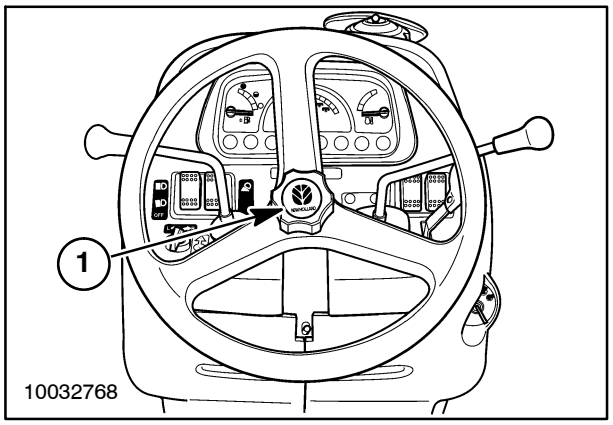
STEERING WHEEL

Removal

1. Carefully pry the plastic cap, 1, from the center of the steering wheel to gain access to the steering wheel mounting nut.

NOTE: *The steering wheel fastening nut and stud is a left hand thread.*

2. Unthread the nut with washer, and use a puller to remove the steering wheel from the steering column.



6

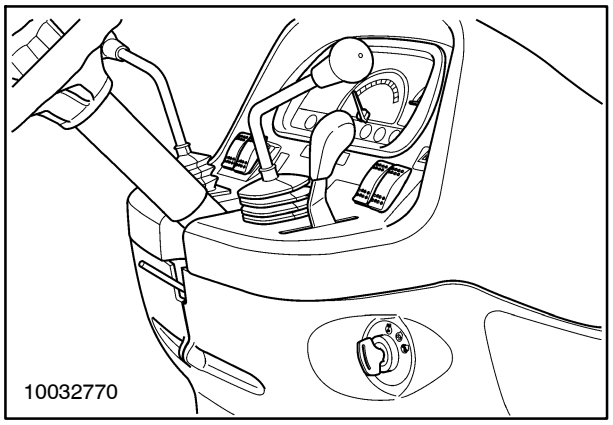
Installation

1. Apply anti-seize compound onto the steering column spline.
2. Install the steering wheel onto the steering column by using the nut with the washer. Apply standard torque to the mounting hardware.
3. Press the plastic cap into the center of the steering wheel.

DASH PANEL

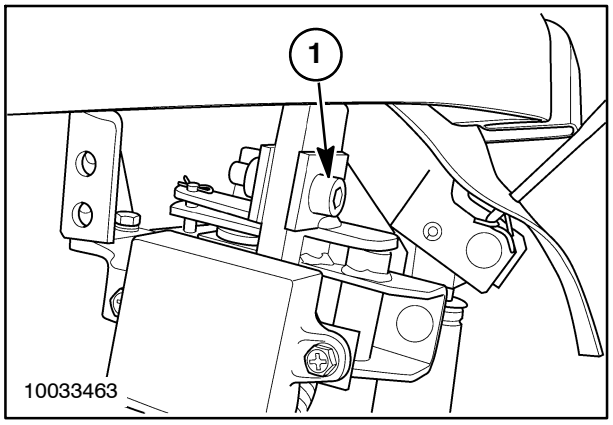
Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the rear hood panels. (See Rear Hood Panels in this section).
3. Tilt the steering wheel back to gain better access to controls.
4. Remove the rubber boots, and knobs.(on the control levers) from the dash panel.



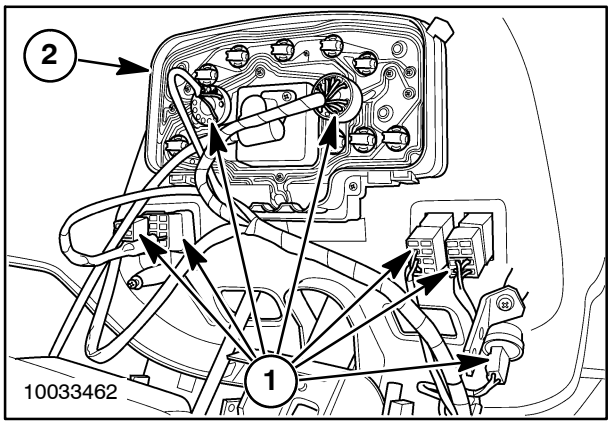
7

5. Remove the two bolts that fasten the dash panel to the firewall.
6. Remove the Allen head bolt, 1, that attaches the shuttle control lever, and remove the lever from the dash panel.



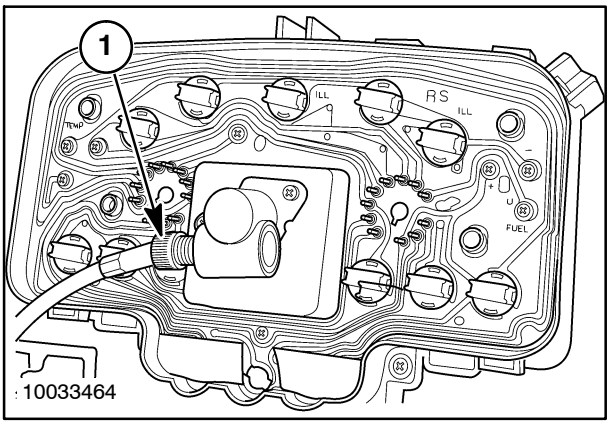
8

7. Remove the bolts securing the dash panel to the tractor.
8. Disconnect the wire harness plugs, 1, from the rear of the instrument panel, 2.



9

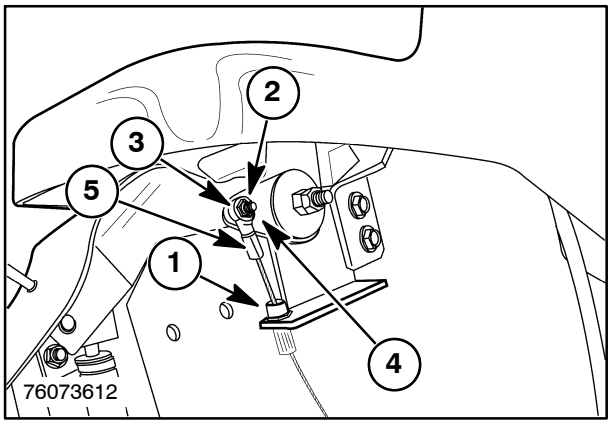
9. Disconnect the tachometer cable, 1, from the instrument panel.



10

NOTE: *Remove the dash panel with the hand throttle assembly attached.*

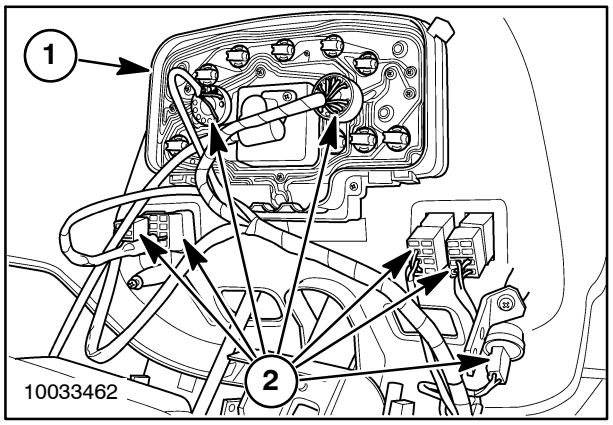
10. Remove the clip, 1, from the throttle cable.
11. Remove the cotter pin, 2, and washer, 3, from the throttle lever, 4. Remove the throttle cable, 5, from the lever.
12. Making sure all components are free, remove the dash panel by lifting over the gearshift lever.



11

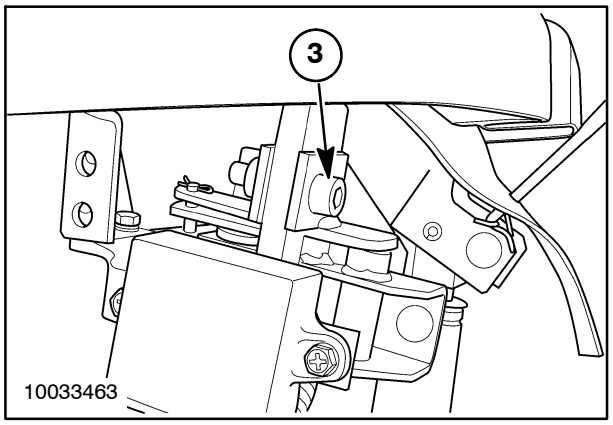
Installation

1. Install the dash panel by lowering over the gearshift lever.
2. Tilt the dash panel to access the rear of the cluster, 1. Connect the wire harness to the switches and cluster, 2. Connect the tachometer.
3. Install the two firewall mount bolts and tighten.
4. Align the dash panel with the mounting brackets, and install the mounting bolts.



12

5. Install the shuttle shift control lever through the dash panel, and fasten it with the Allen head bolt, 3.
6. Install the rubber boots and knobs onto the levers.
7. Install the hand throttle cable to the throttle lever.
8. Install the rear hood panels (See Rear Hood Panels Installation).
9. Install the hood (See Hood Installation).

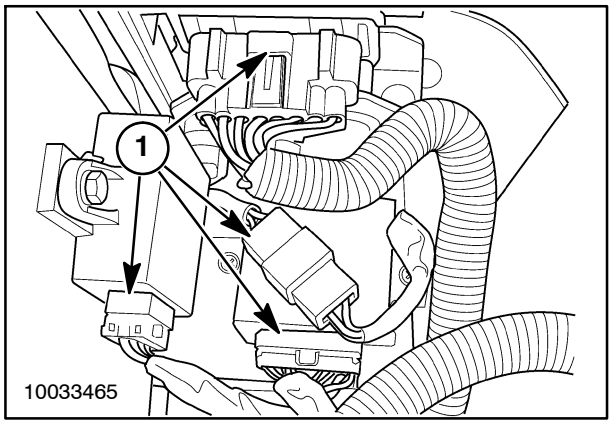


13

STEERING COLUMN

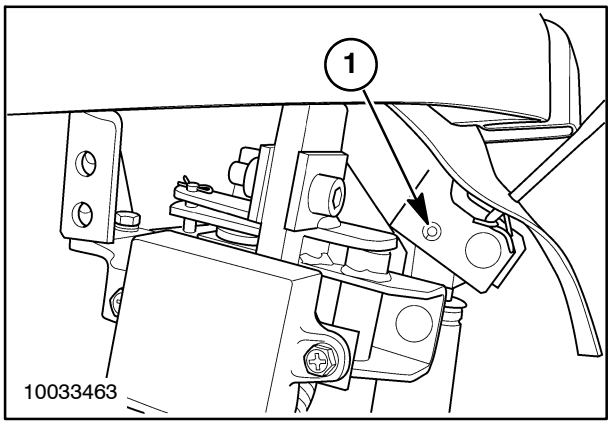
Removal

1. Remove dash panel (See Dash Panel Removal).
2. Remove the fuel tank hold down bracket.
3. Disconnect the wire harness from the module boxes and shuttle shift switch, 1.



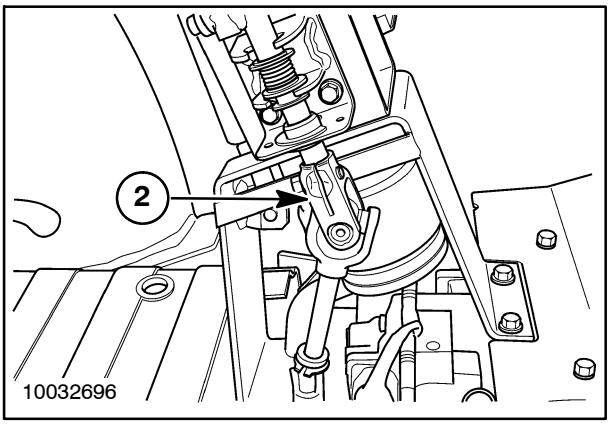
14

4. Remove the roll pin, 1, from the top of the tilt steering cylinder.



15

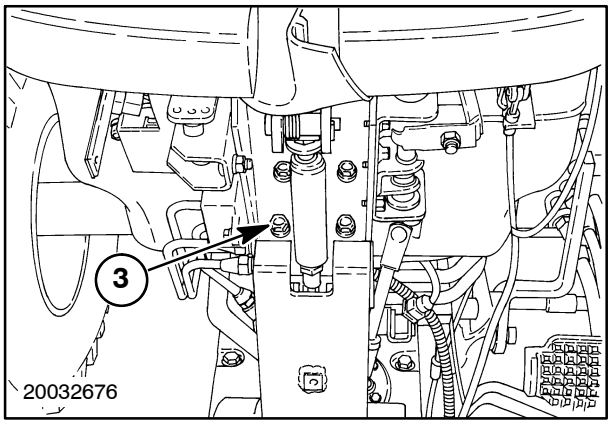
5. Mark the position of the shift control shaft at the universal joint, 2, loosen and remove the bolt.



16

6. Carefully, remove the four bolts, 3, that attach the steering motor to the column.
7. Lift the column from the tractor.

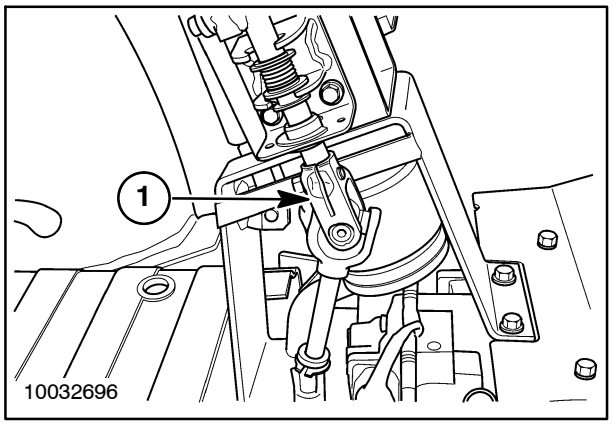
NOTE: *The fuel tank has to be removed from the tractor to remove the lower mount bracket.*



17

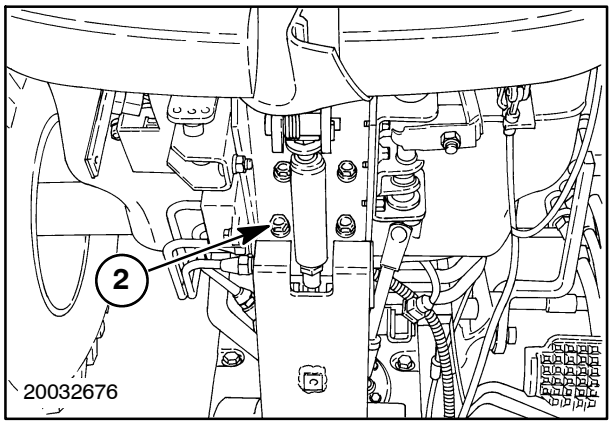
Installation

1. Align the steering motor up with the holes in the lower bracket.
2. Carefully lower the steering column down onto the lower bracket, align the steering shaft with the steering motor splines.
3. Align the shift control shaft at the universal joint, 1, and install the bolt.



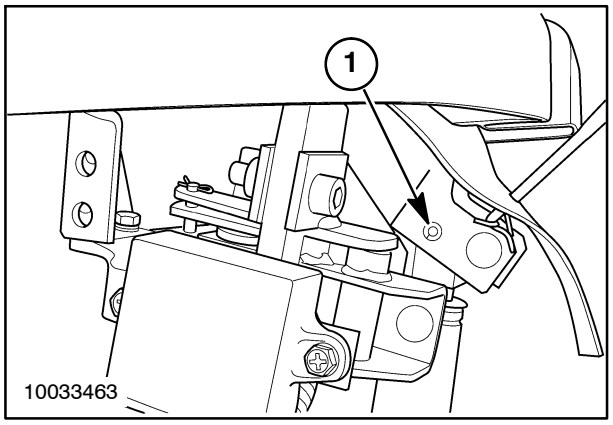
18

4. Install the four mount bolts, 2, through the bracket into the steering motor and tighten.



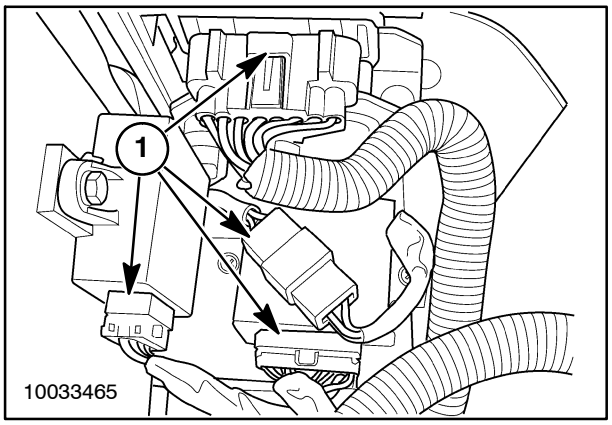
19

5. Install the roll pin, 1, into the top of the tilt steering cylinder.



20

6. Connect the wire harness to the module boxes and shuttle shift switch, 1.
7. Install the fuel tank hold down bracket.
8. Install dash panel (See Dash Panel Installation).

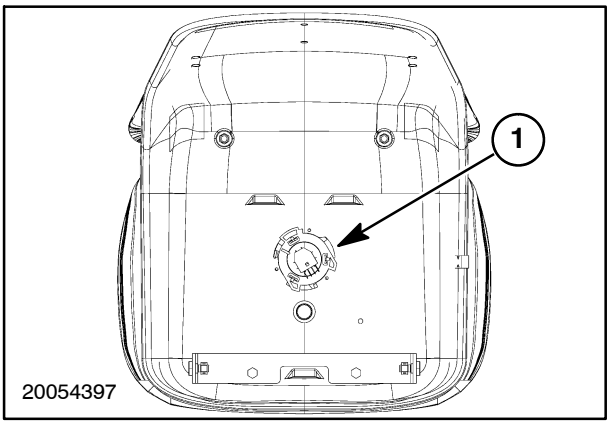


21

SEAT

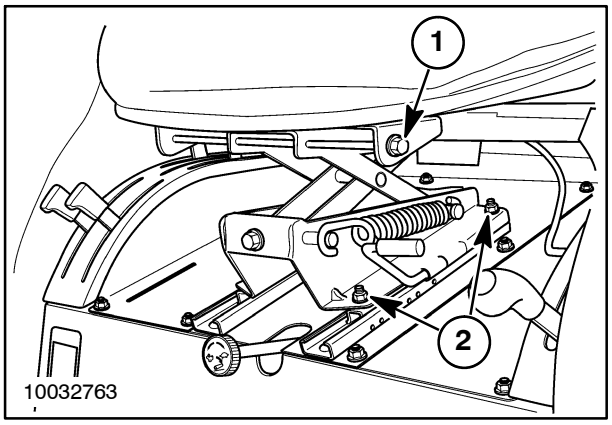
Removal and Disassembly

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Tilt seat forward.
3. Disconnect the seat safety switch, 1, from the wiring harness.



22

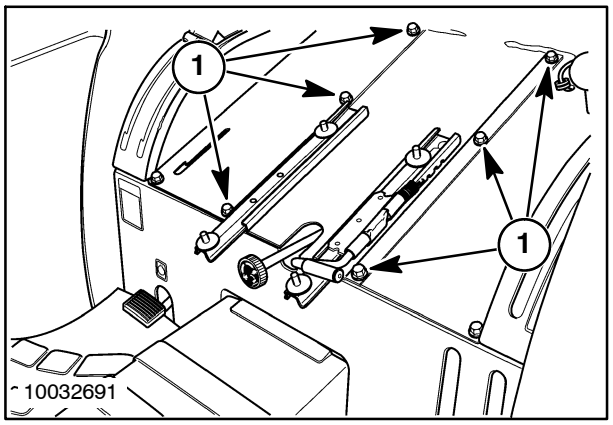
4. Remove the two bolts, 1, that attach the seat to the pedestal. Remove the seat from the pedestal.
5. Remove the four mounting bolts, 2, from the slide rails.
6. Lift the seat from the tractor.



23

NOTE: *The slide rail components are not serviced separately. If the slide rail does not function properly, replace the slide rails as an assembly.*

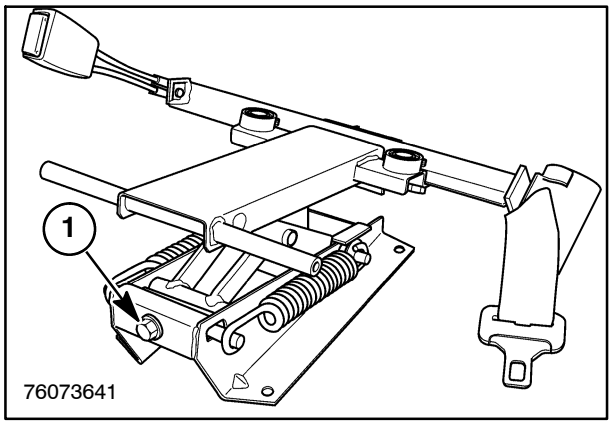
7. Remove the six bolts, 1, from the center deck plate.
8. Remove the deck plate. (Slide rail hardware can be removed from the back of the plate).



24

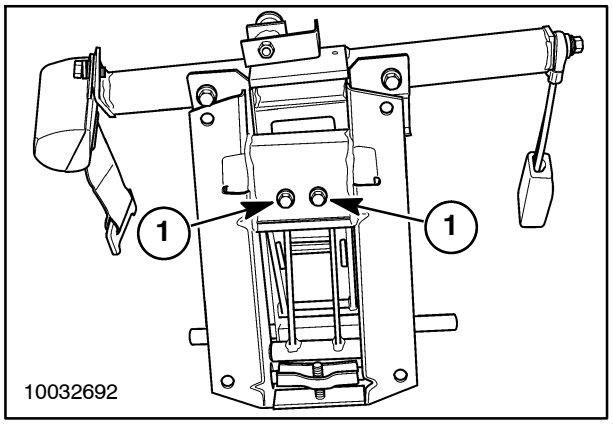
Bushing Replacement

1. Loosen and remove the spring tension adjustment bolt, 1.
2. Remove the springs from the pedestal.



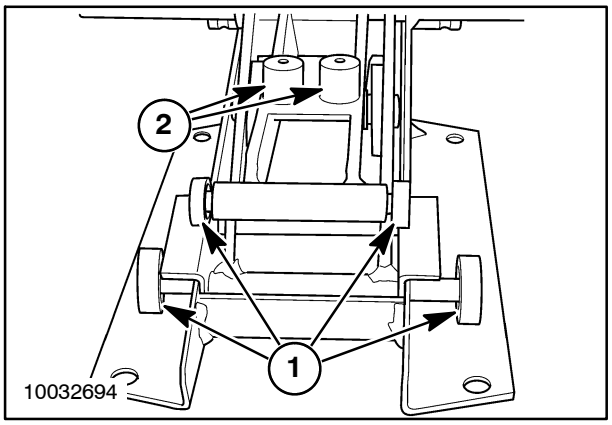
25

3. Turn over the pedestal to gain access to the bottom side. Remove the two bolts, 1, from the stop mount.



26

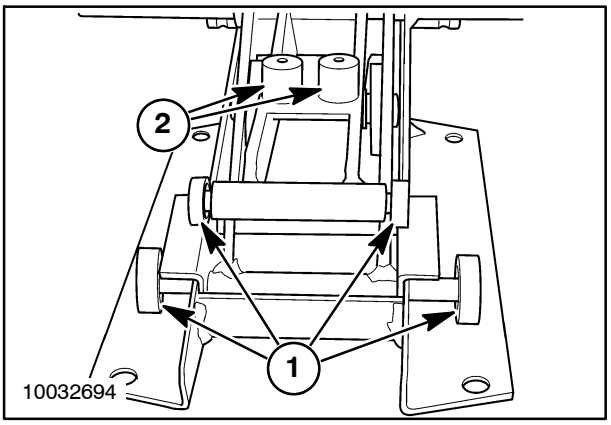
4. Expand the pedestal so the top half separates from the scissors.
5. Remove the four metal bushings, 1, and two rubber stops, 2, from the pedestal.



27

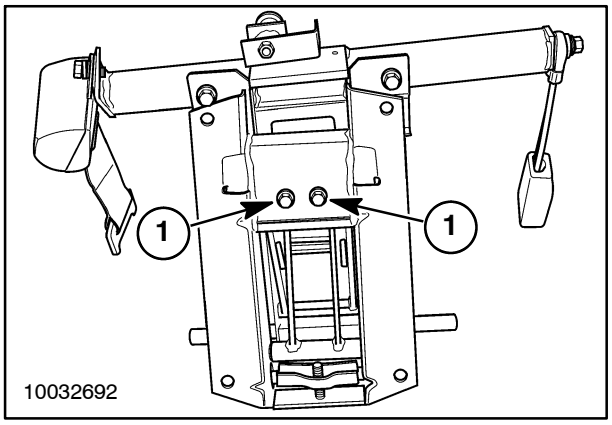
Assembly and Installation

1. Install the four metal bushings, 1, and two rubber stops, 2, onto the pedestal.
2. Collapse the pedestal so the top bushings go back into place.



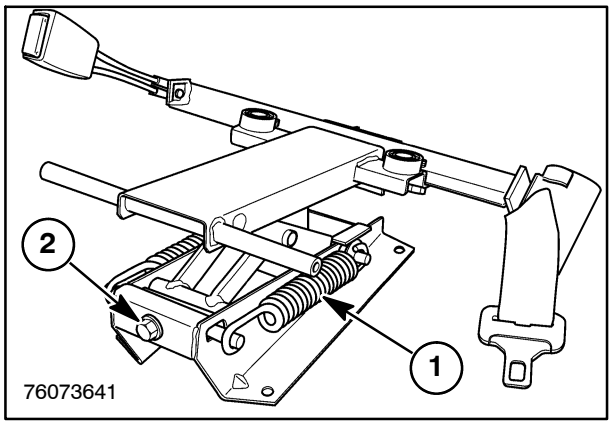
28

3. Turn over the pedestal to gain access to the bottom side. Install the stop mount into place and fasten it with the two bolts, 1.



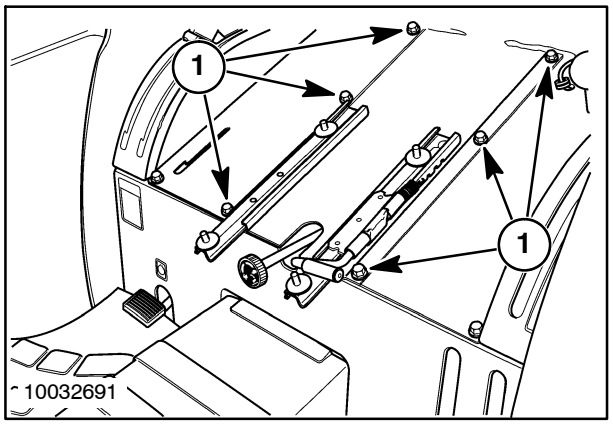
29

4. Install the springs, 1, onto the pedestal.
5. Install and adjust the spring tension adjustment bolt, 2.



30

6. Install the slide rails onto the mount plate.
7. Install the mount plate onto the tractor.
8. Install and tighten the six nuts, 1, that attach the plate to the tractor.



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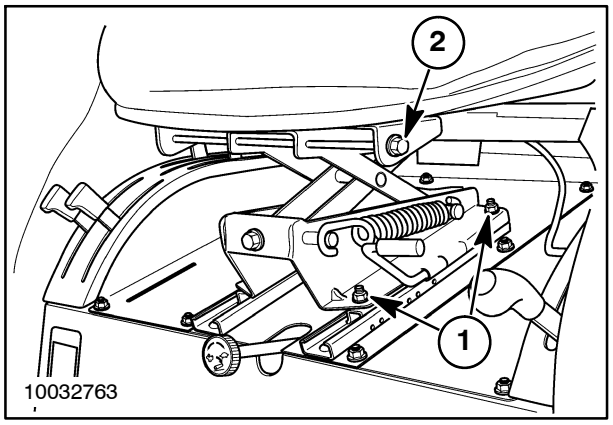
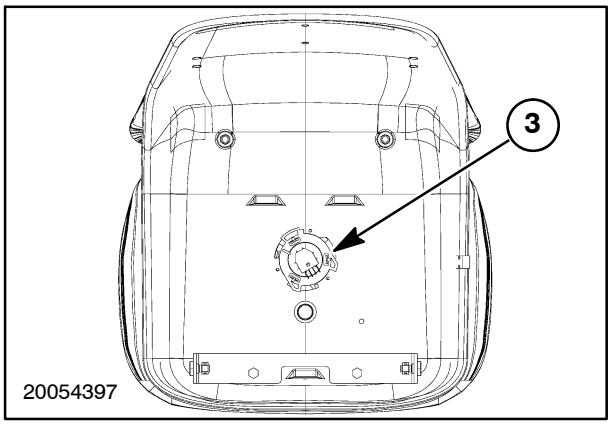
9. Install the seat pedestal onto the slide rails.
10. Install the four mounting nuts, 1, onto the slide rails.
11. Place the seat onto the pedestal, Install the two bolts, 2, that attach the seat to the pedestal.



32

12. Tilt the seat forward.
13. Connect the seat safety switch, 3, to the wire harness.
14. Connect the negative (-) battery cable from the negative (-) battery terminal.



33

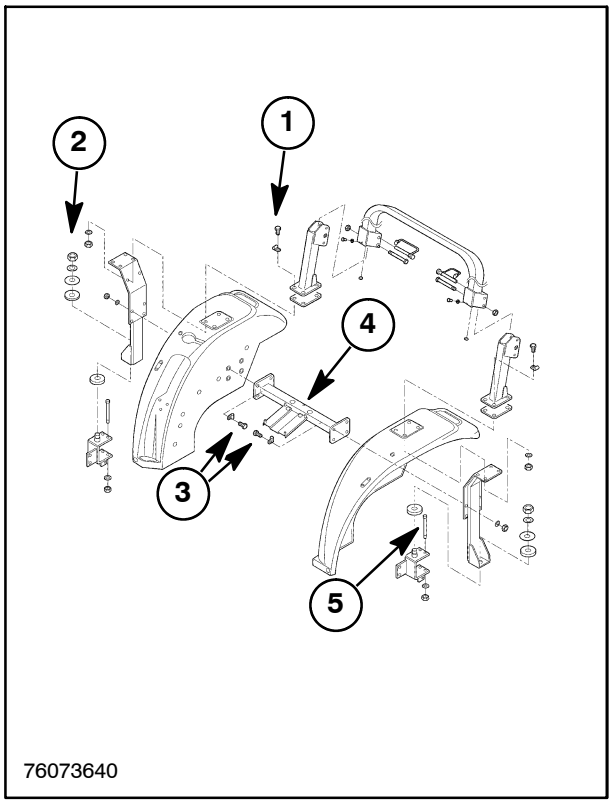
ROLL OVER PROTECTION SYSTEM (ROPS)

Removal

DANGER

Lift and handle all heavy parts using suitable lifting equipment. Support parts or an assembly by means of suitable slings, hooks, or jack stands. Make sure that no person is near a raised load.

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Disconnect all attaching wires from the ROPS.
3. Remove the eight retaining bolts, 1, and two nuts, 2, from the top of the fenders.
4. Use a suitable lifting device to remove the upper ROPS assembly from the tractor.
5. Remove the four bolts, 3, from each side of the lower ROPS that connects it to the center support bracket, 4.
6. Remove the four bolts, 5, that connect the ROPS to the axle. Remove the three-point hitch adjustment bar from the lower ROPS. Remove the lower ROPS unit. (repeat for opposite side).



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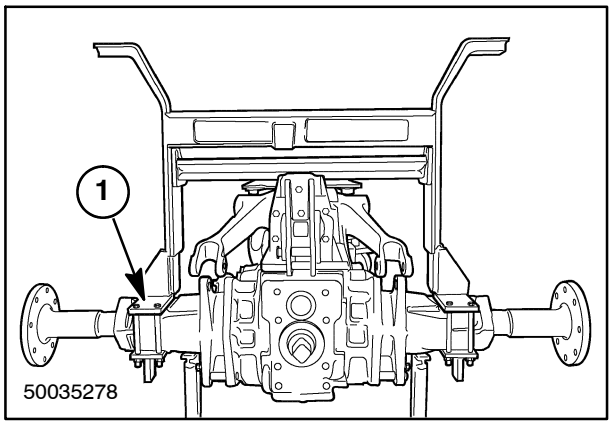
Installation

DANGER

Lift and handle all heavy parts using suitable lifting equipment. Support parts or an assembly by means of suitable slings, hooks, or jack stands. Make sure that no person is near a raised load.

1. Install lower ROPS unit onto the axle, install the four bolts, 1, and torque to 75 N·m (55 ft-lbs).
2. Install the three-point hitch adjustment bar to the lower ROPS.
3. Install fenders onto lower ROPS.
4. Attach the ROPS to the center support bracket by installing the four bolts, 3, (Figure 34), and torque to 75 N·m (55 ft-lbs).
5. Install the two gaskets on the top of the fender surface, lift the ROPS upper unit onto the top of the fenders.
6. Install the eight bolts, 1, (Figure 34), with nuts. Torque the bolts and nuts to 108 N·m (80 ft-lbs).
7. Connect the wires and plugs removed during disassembly.
8. Connect the negative (-) battery cable to the negative (-) battery terminal.



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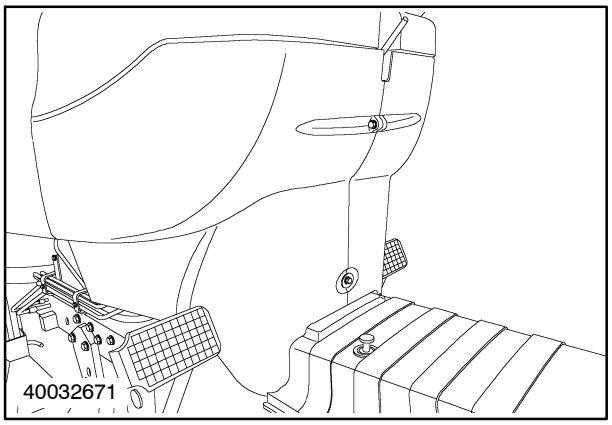
FUEL TANK

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove rear hood panels (See Rear Hood Panel Removal).
3. Remove the dash panel (See Dash Panel Removal).
4. Remove the hood (See Hood Removal).



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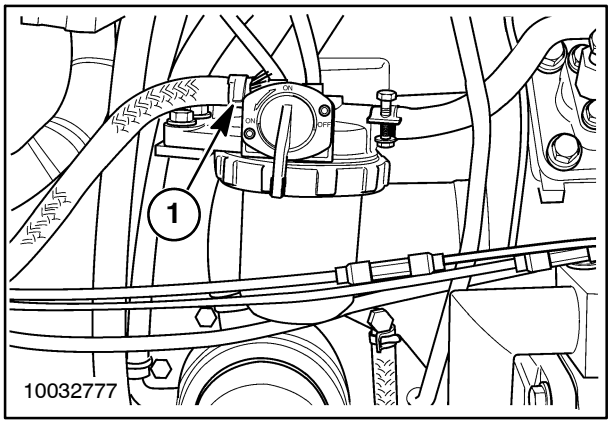
⚠ WARNING ⚠

Allow the engine to cool before draining fuel. Do not expose diesel fuel to open flame. Do not smoke while near diesel fuel. Injury or death may result. Clean up fuel spills immediately.

NOTE: *The fuel tank can store up to 13.5 gallons (51 liters) of fuel.*

5. Remove the fuel hose, 1, from the fuel shutoff valve and drain the fuel into a clean container.



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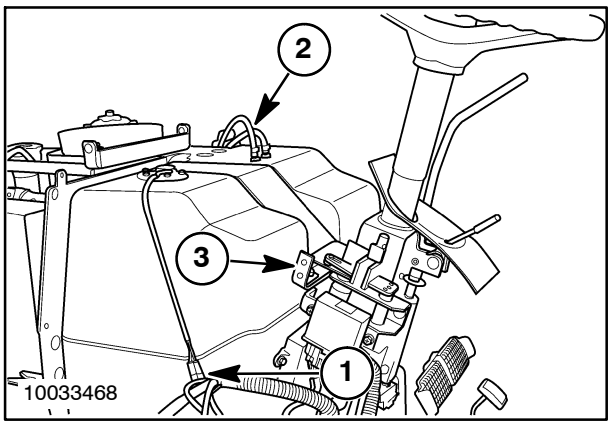
6. Disconnect the wire leads, 1, from the fuel level-sending unit.
7. Disconnect the fuel return lines, 2, from the top of the fuel tank.
8. Remove the fuel tank-retaining bracket, 3.
9. Remove the fuel tank from the tractor.



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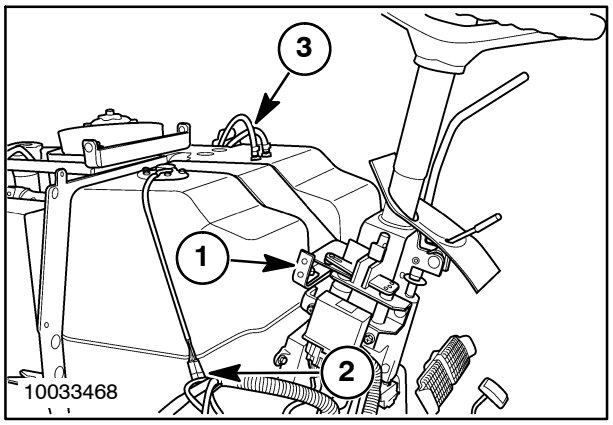
Installation

1. Install the fuel tank onto tractor, and install the fuel tank retaining bracket, 1.
2. Connect the fuel level-sending unit to the tractor wire harness, 2.
3. Connect the fuel return lines, 3, to the top of the tank.



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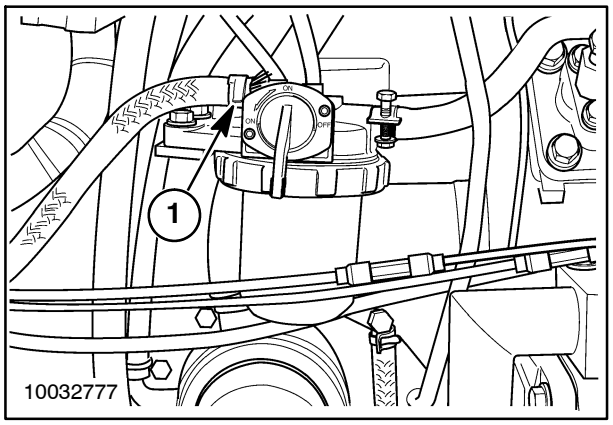
4. Connect the fuel hose, 1, to the shut off valve.
5. Install the dash panel (See Dash Panel Installation).
6. Install the rear hood panels onto the tractor.
7. Install hood onto tractor.
8. Connect the negative (-) battery cable to the negative (-) battery terminal.



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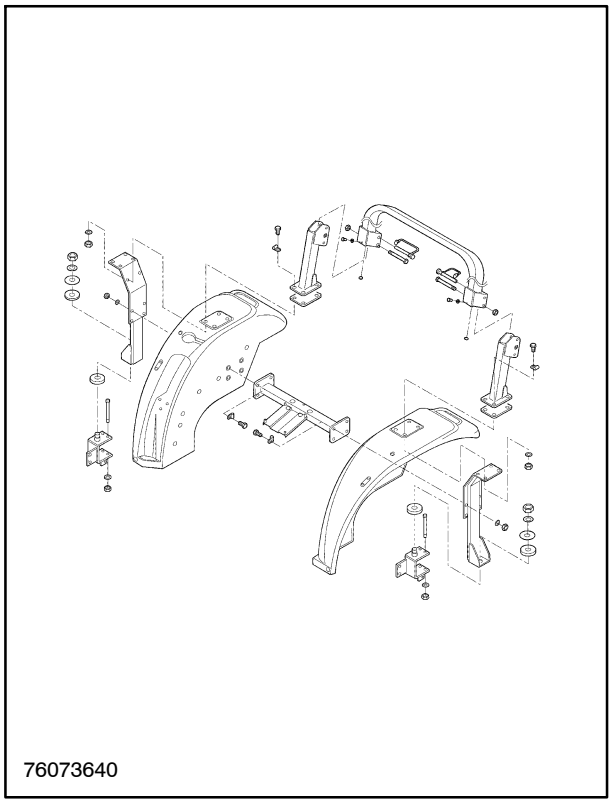
REAR FENDERS

Removal

1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Remove the upper ROPS (See ROPS Removal).
3. Remove the seat assembly (See Seat Removal).
4. Support the rear axles and remove the rear wheels.
5. Remove the bolts attaching the fenders to the inner deck assembly.
6. Remove the fenders from the tractor.

Installation

1. Install the left and right fenders onto the tractor.
2. Install the upper ROPS (See ROPS Installation).
3. Install the seat assembly (See Seat Installation).
4. Apply standard torque to all hardware.
5. Install the rear wheels. Torque the wheel mounting bolts to 129 N·m (95 ft-lbs).
6. Connect the negative (-) battery cable to the negative (-) battery terminal.



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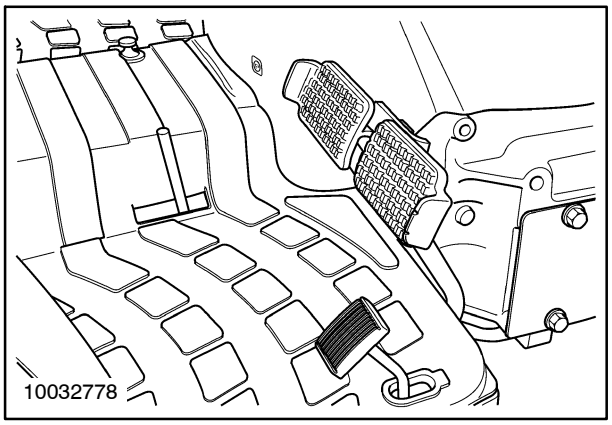
OPERATOR PLATFORM

Removal

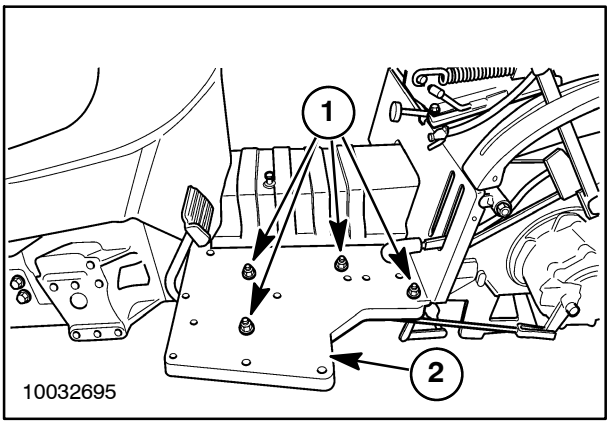
1. Disconnect the negative (-) battery cable from the negative (-) battery terminal.
2. Lift the rubber traction mats from the operator platform. Remove rubber pedal covers.
3. Disconnect the foot pedal throttle cable.

NOTE: *Make sure that no wire harnesses are attached to the operator platforms before removing from the tractor.*



42

4. Remove the mounting bolts, 1, to remove the operator platform, 2, from the tractor.



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Installation

1. Install the operator platform, 2, by using the retaining bolts, 1.
2. Install the throttle control cable.
3. Fasten the rubber traction mats to the operator platform, use a light coat of Vaseline on the rubber studs and push them down into the mounting holes.
4. Connect the negative (-) battery cable to the negative (-) battery terminal.

SECTION 90 - PLATFORM

Chapter 2 - Platform – T2410–T2420 With Cab

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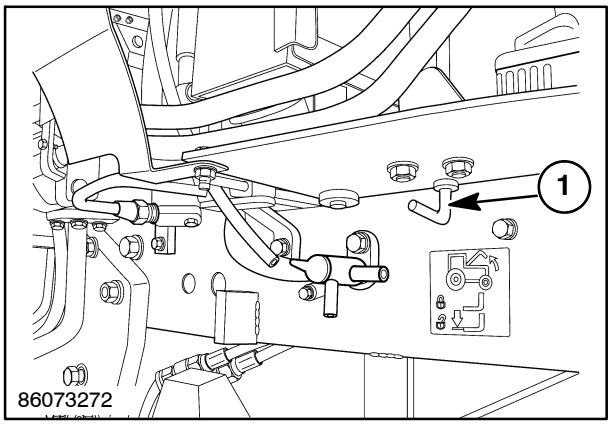
HOOD

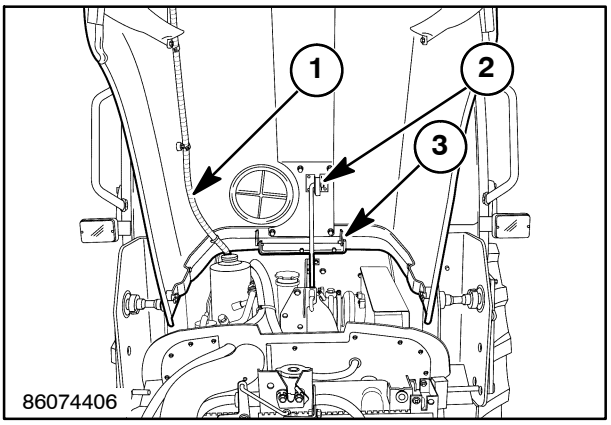
Removal

1. Release the hood latch, 1, and open the hood.



1

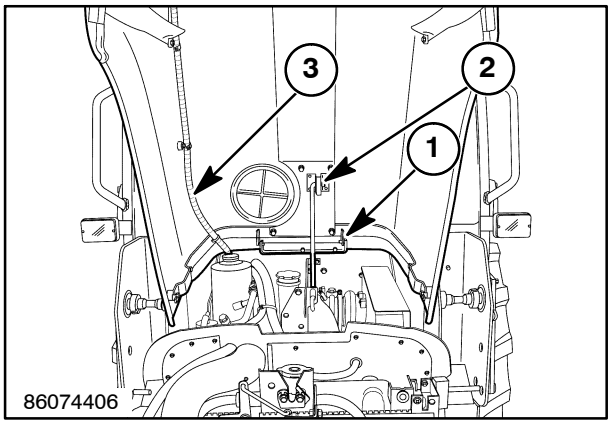
2. Disconnect the headlight wire harness connector, 1.
3. Remove the cotter key from the hood support, 2.
4. Remove the hair pin clip, 3, from the hood mounting bracket.
5. Remove the hood from the tractor.



2

Installation

1. Position the hood so that the mounting holes in the hood align with the holes in the hood mounting bracket at, 1. Attach hair pin clip
2. Attach hood support with cotter pin at, 2.
3. Connect the headlight wire harness connector, 3.
4. Close and latch the hood.

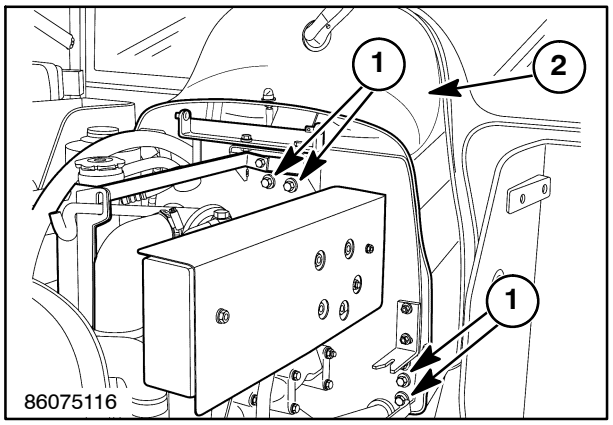


3

REAR HOOD PANELS

Removal

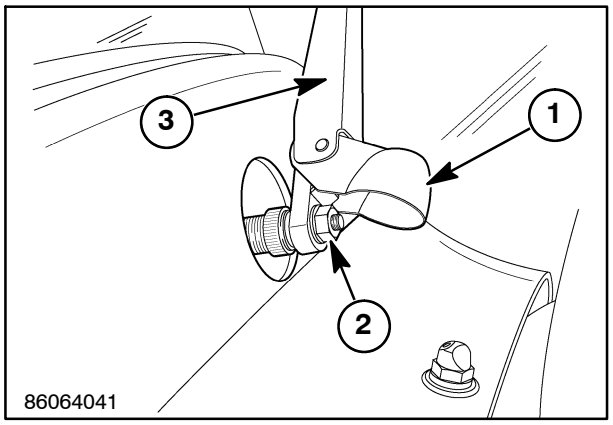
1. Open and remove the hood.
2. Remove the six bolts, 1, that secure the rear hood panel, 2.



4

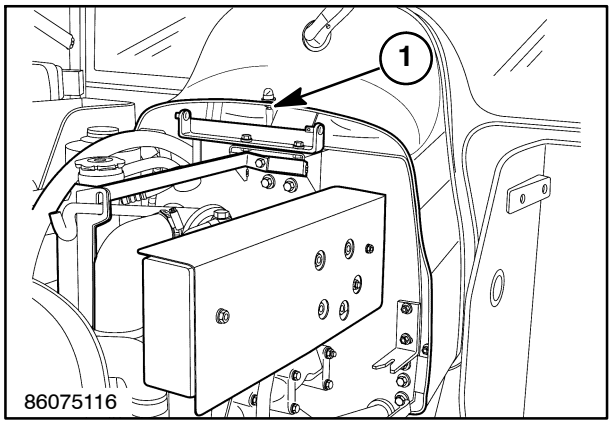
3. Lift the wiper arm cover, 1.

   Remove the wiper arm retaining nut, 2. Remove the wiper arm assembly, 3.



5

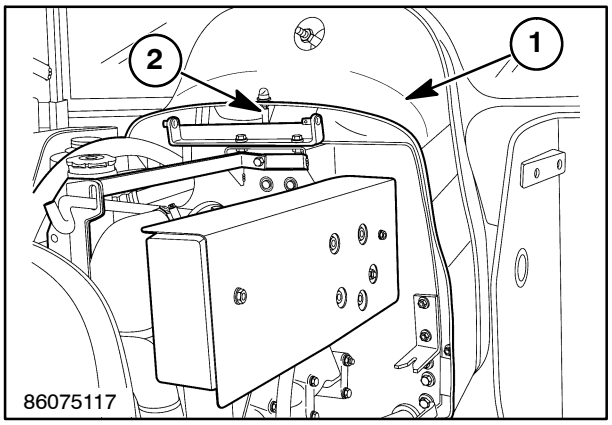
4. Remove the washer hose, 1, going to the washer nozzle.
5. Remove the rear hood panel.



6

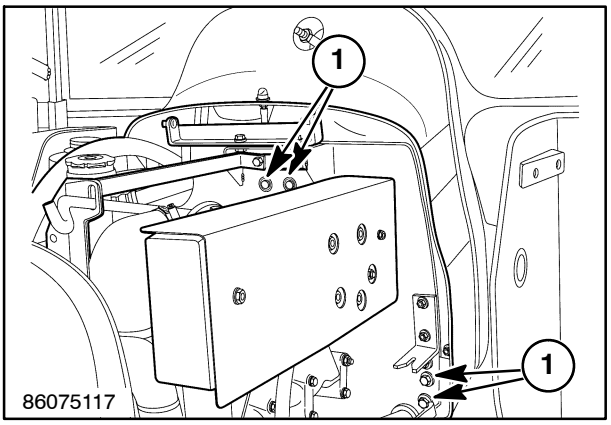
Installation

1. Position rear hood panel, 1, in place and connect washer hose, 2.



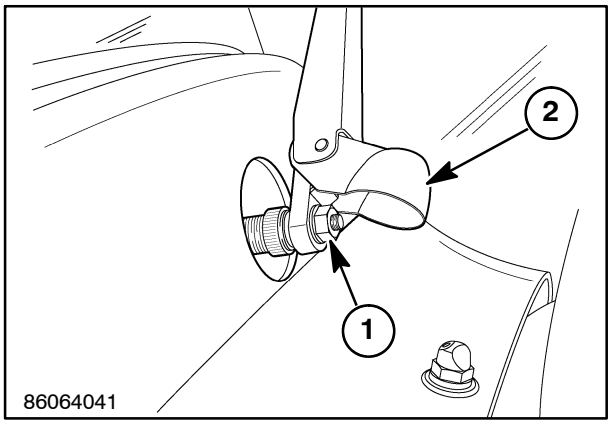
7

2. Install the six bolts securing the rear hood panel at, 1.



8

3. Install the wiper arm assembly. Secure the wiper arm with retaining nut, 1.
4. Lower the wiper arm cover, 2.
5. Close the hood.



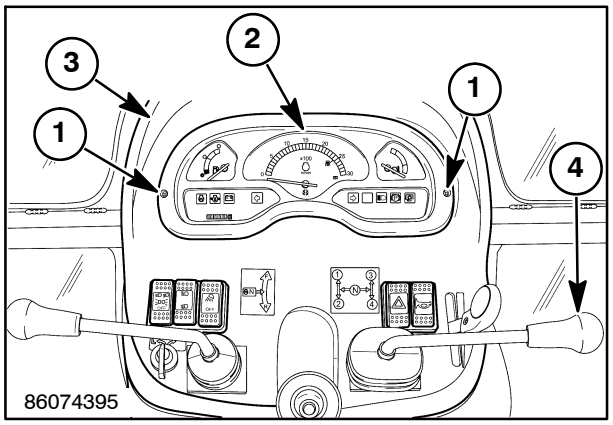
9

DASH CONSOLE

Removal

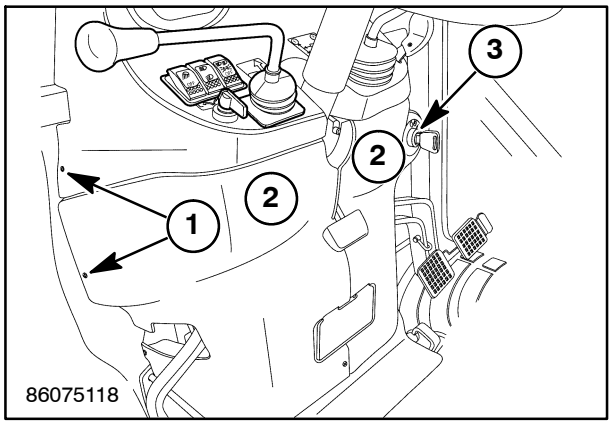
1. Loosen and remove the two instrument panel retaining screws, 1.
2. Remove the instrument panel, 2, from the dash console, 3.

   Remove shifter lever handle, 4.
3. Disconnect the instrument panel wire harness connector from the instrument panel.



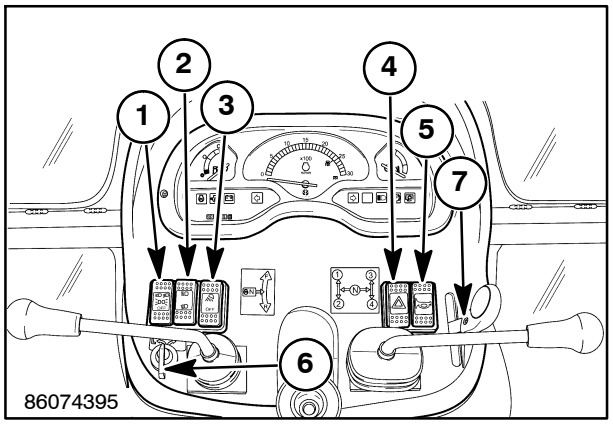
10

4. Remove screws, 1, and remove both lower side panels, 2.
5. Disconnect the harness to the keyswitch, 3.



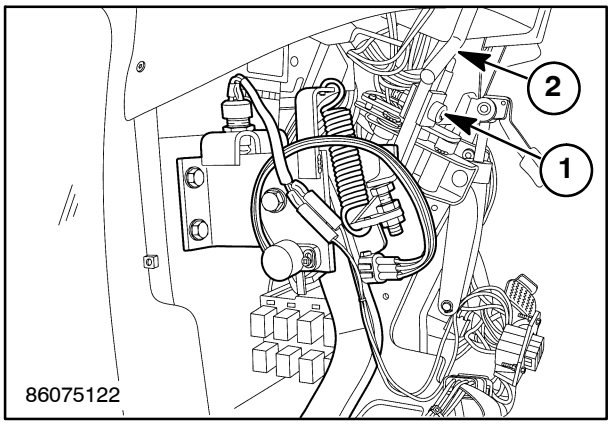
11

6. Disconnect the wire connector plugs from the road light switch, 1, high beam switch, 2, exterior work lamp switch, 3, hazard switch, 4, horn switch, 5, and turn signal switch, 6.
7. Remove throttle handle by removing screw, 7.



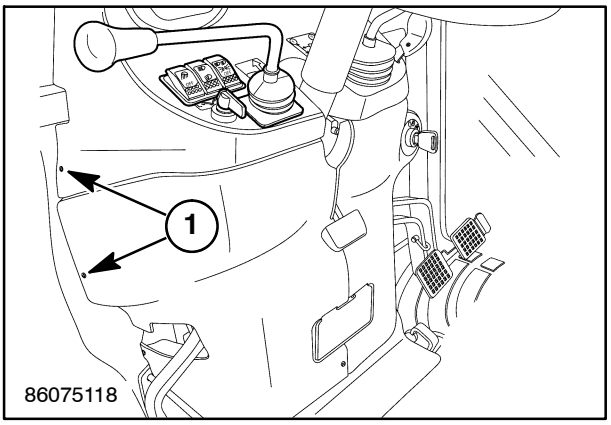
12

8. Remove allen bolt, 1, from forward/reverse lever, 2. Remove lever.



13

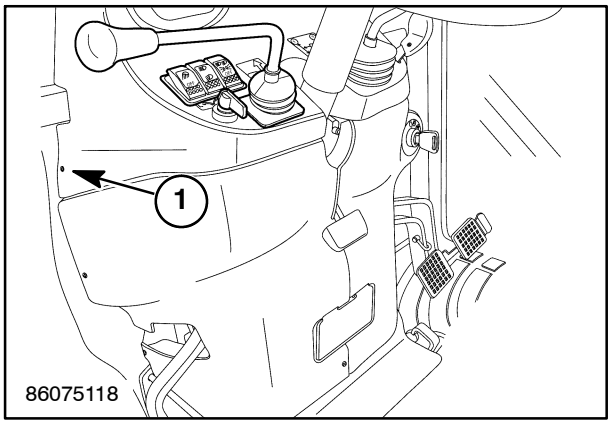
9. Loosen and remove the screws, 1, securing the dash console to the firewall.
10. Remove the dash console.



14

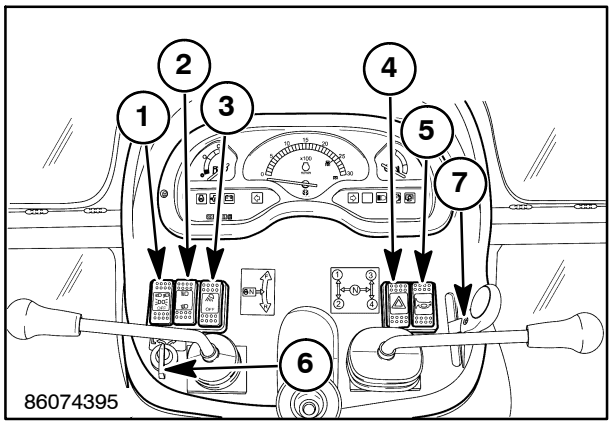
Installation

1. Position the dash console on the firewall, aligning the mounting holes.
2. Install the retaining bolts through the dash console and into the firewall.
3. Tighten the retaining bolts.



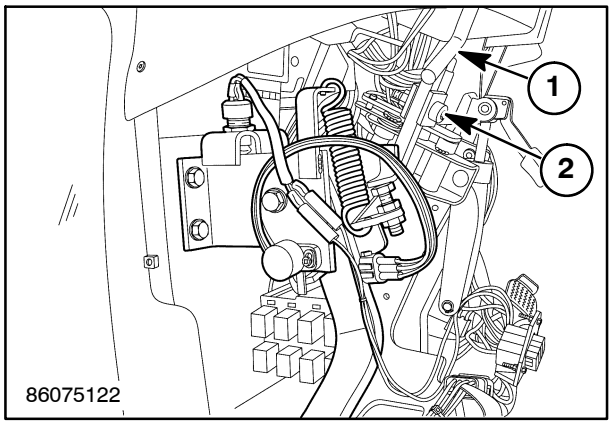
15

4. Connect the wire connector plugs to the road light switch, 1, high beam switch, 2, exterior work lamp switch, 3, hazard switch, 4, horn switch, 5, and turn signal switch, 6.
5. Attach throttle handle with screw, 7.



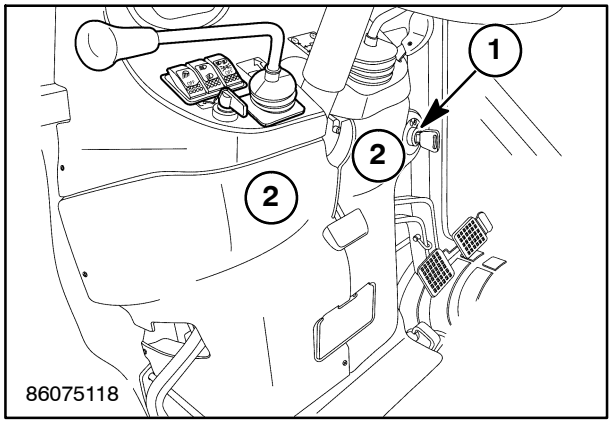
16

6. Install foward/reverse lever, 1. Secure with allen bolt, 2.



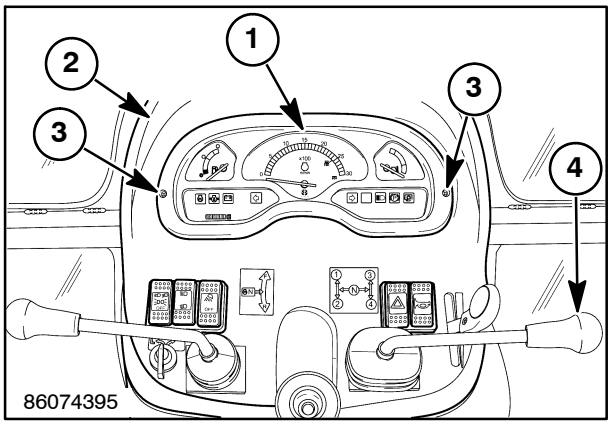
17

7. Connect the instrument panel wire harness connector to the key switch, 1.
8. Install the side panels, 2.



18

9. Install the instrument panel, 1, into the dash console, 2, and secure with the two retaining screws, 3.
10. Replace shifter lever handle, 4.

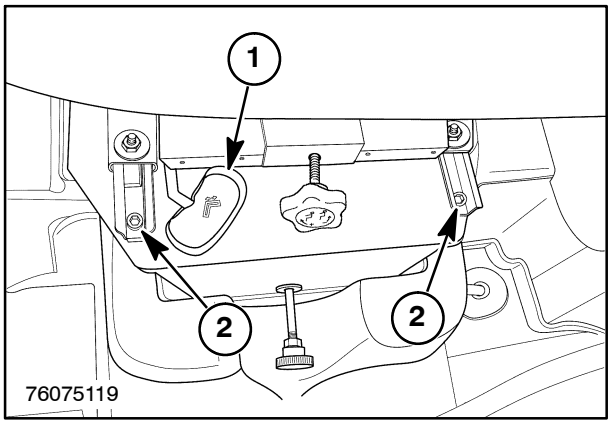


19

OPERATOR'S SEAT

Removal

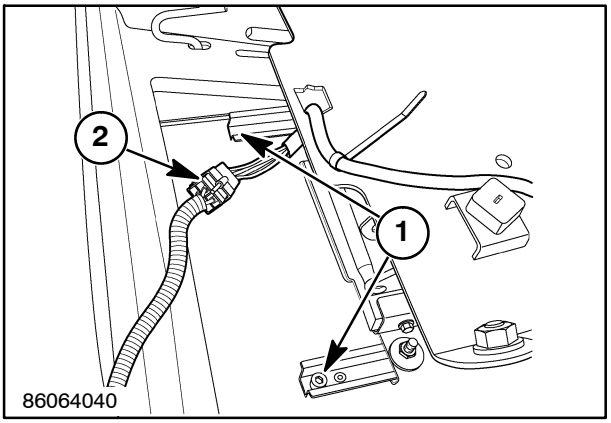
1. Pull lever, 1, and push seat rearward. Remove both M8 x 30 mm internal hex head screws and washers, 2.



20

2. Pull lever again and move the seat forward. Remove both M8 x 30 mm internal hex head screws and washers, 1.
3. Disconnect the seat switch, 2.
4. Remove the seat assembly from the cab.

IMPORTANT: *Seat is very heavy. Use caution when removing from the cab. Serious injury can occur to self and/or seat assembly if dropped.*

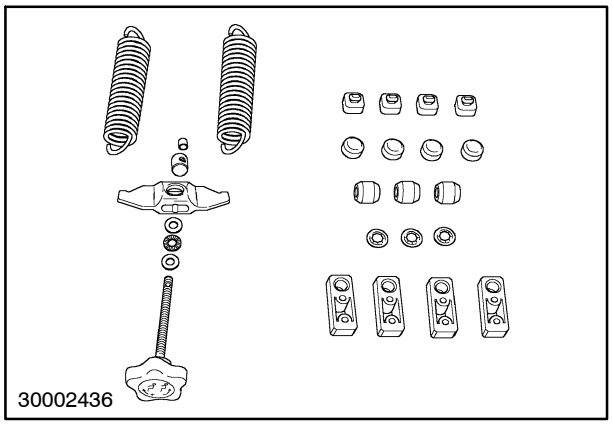


21

Disassembly

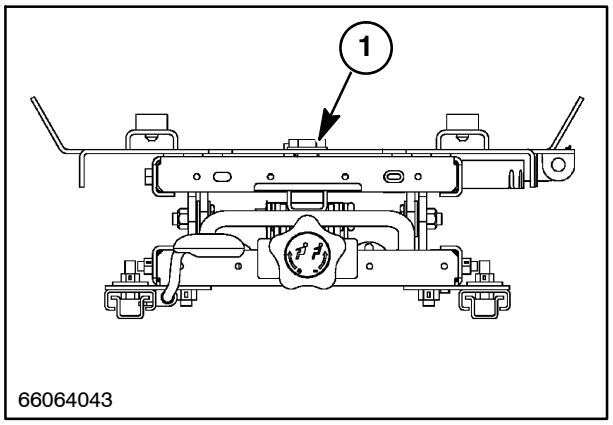
NOTE: *Use rebuild kit #87385287 to rebuild the seat on the T2410 and T2420.*

1. Remove the seat from the tractor.



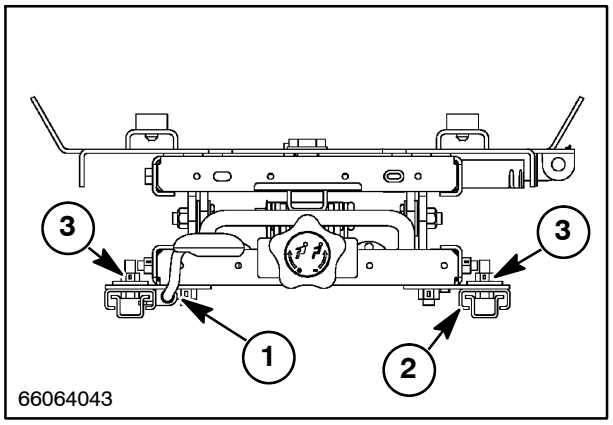
22

2. Place the seat assembly on a bench. Fold the seat front, and loosen the bolt, 1, in the center.
3. Remove the seat from the seat pedestal.



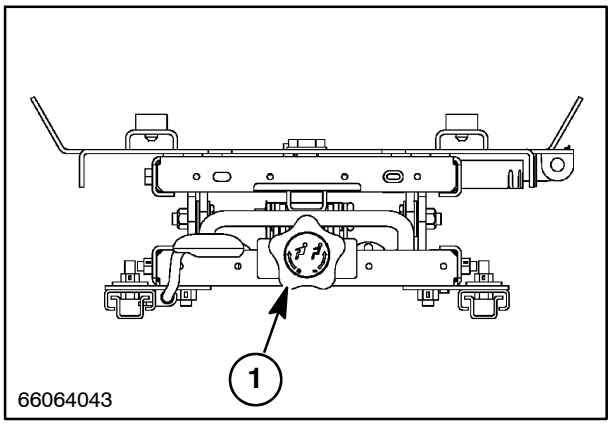
23

4. Remove the fore and aft slide lever, 1, and slide, 2, by removing the two nuts and washers, 3, on each slide.



24

5. Turn the weight adjustment knob, 1, clockwise, until it is all the way in, to reduce the spring tension on the extension springs.

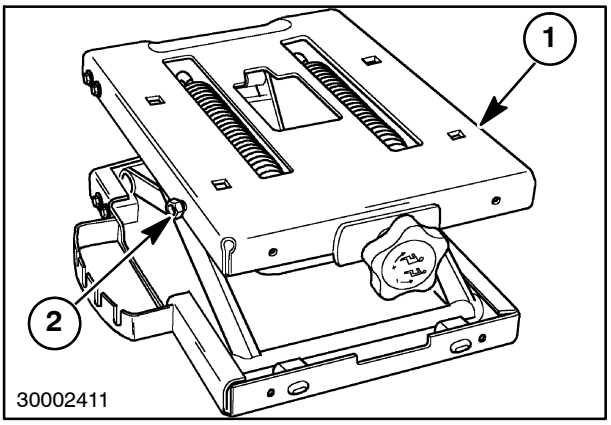


25

⚠ WARNING ⚠

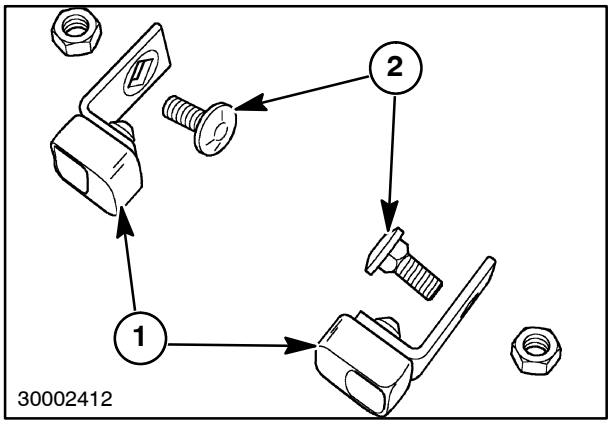
The seat pedestal is under spring tension. The pedestal must be compressed while removing the nuts and carriage bolts in step 6.

6. Place the seat pedestal, 1, on the bench with the bottom side facing up. Remove the nut, 2, from the carriage bolt, on both sides of the seat base.



26

7. Remove the slider stop brackets, 1, and the carriage bolts, 2, from the seat pedestal assembly.

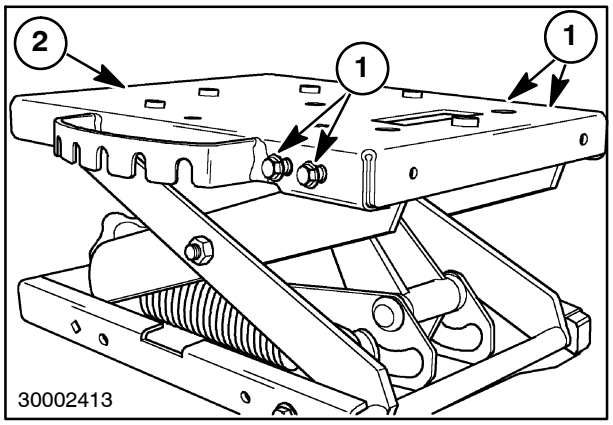


27

⚠ WARNING ⚠

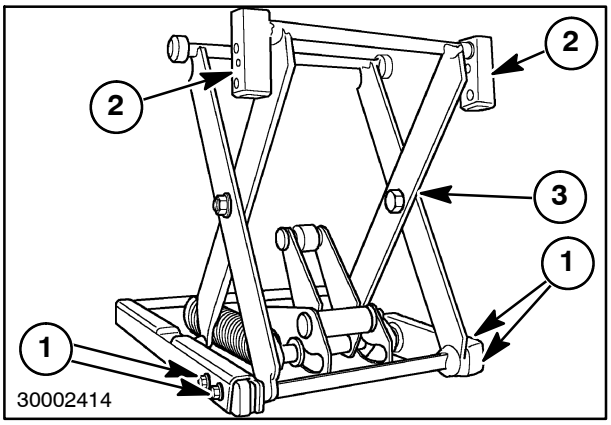
Keep hands and fingers away from the scissors linkage when removing from the slide base. Serious personal injury could result if extremities are caught in the scissors linkage.

8. Remove the four bolts, 1, securing the top slide base, 2. Remove the slide base, 2.



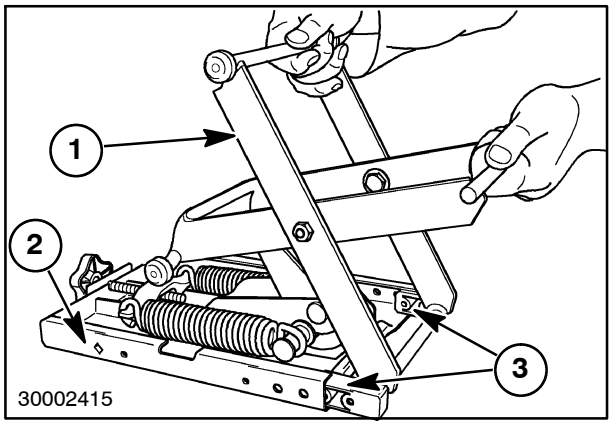
28

9. Remove the four bolts, 1, from the shaft blocks.
10. Remove the shaft blocks, 2, from the scissors linkage, 3.



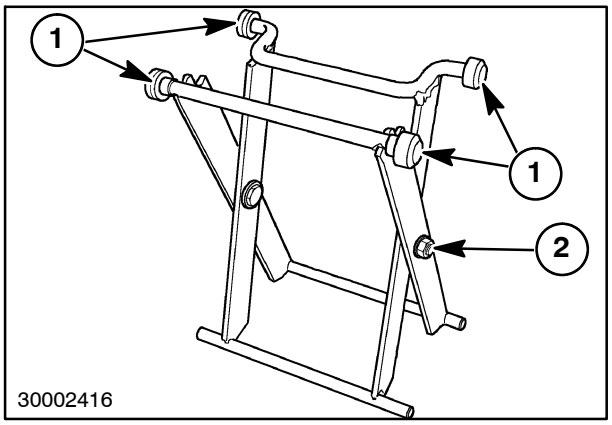
29

11. Remove the scissors linkage, 1, from the slide base, 2. Remove the shaft blocks, 3.



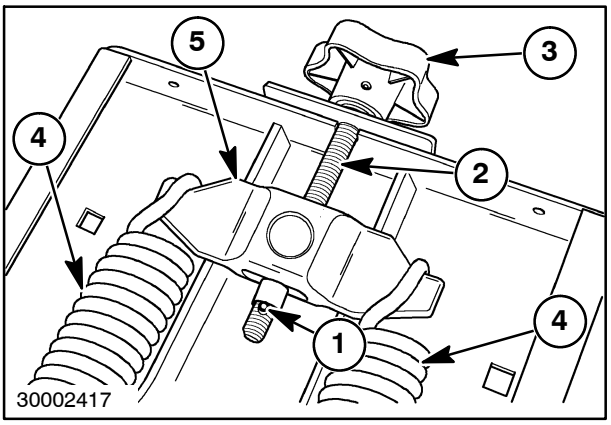
30

12. Remove the four rollers, 1, from the scissors linkage, 2.



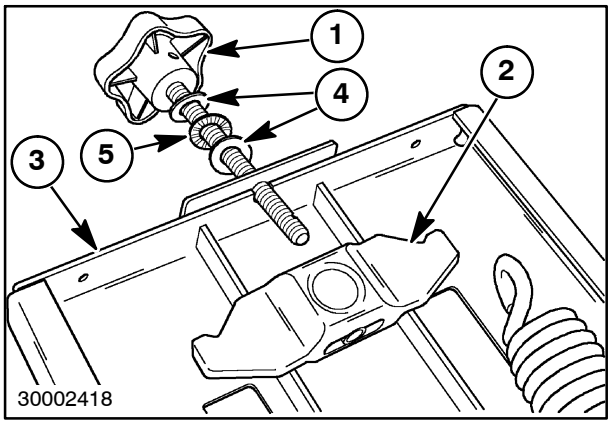
31

13. Drive the roll pin, 1, out of the weight adjustment knob and shaft assembly, 2.
14. Turn the adjustment knob, 3, counter clockwise to relieve any tension on the extension springs, 4.
15. Disconnect the extension springs, 4, from the weight adjust bar, 5.



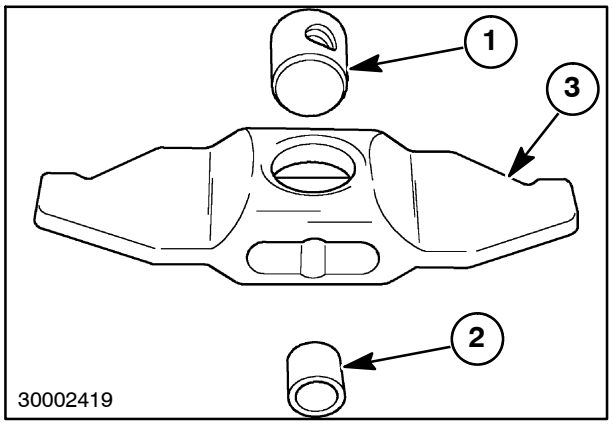
32

16. Turn the weight adjustment knob and shaft assembly, 1, counter clockwise and remove from the weight adjust bar, 2, and the slide base, 3.
17. Remove the two thrust races, 4, and the thrust bearing, 5, from the weight adjust shaft.



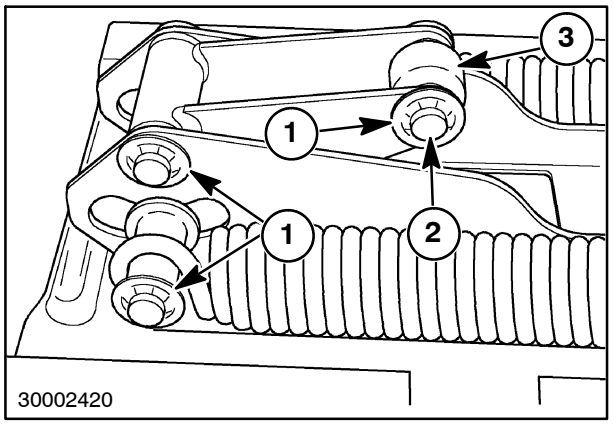
33

18. Remove the weight adjust nut, 1, and the weight adjust spacer, 2, from the weight adjust bar, 3.



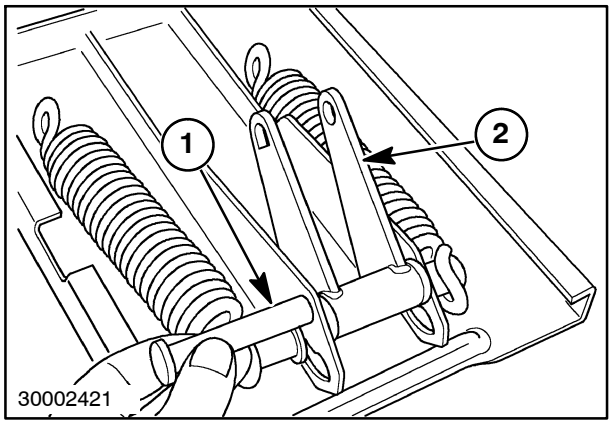
34

19. Remove the three pushnuts, 1, from the linkage pins.
20. Remove the top linkage pin, 2, and roller, 3.



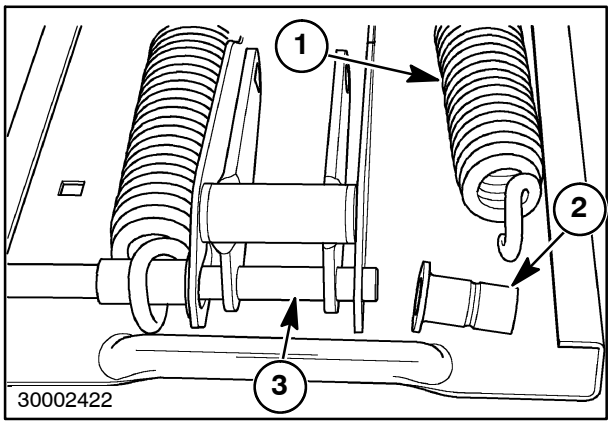
35

21. Remove the linkage pivot pin, 1, from the pivot linkage, 2.



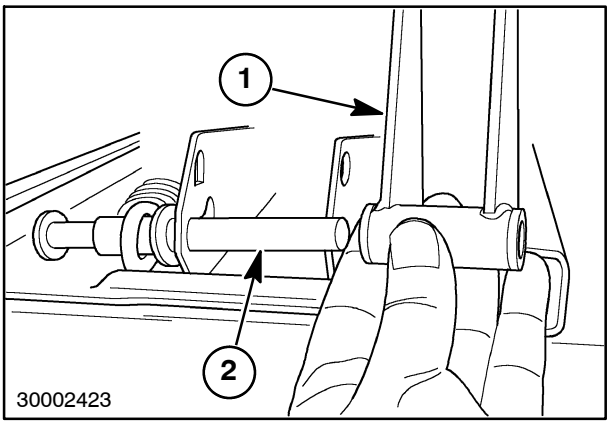
36

22. Remove the extension spring, 1, and the collar, 2, from the spring pin, 3.



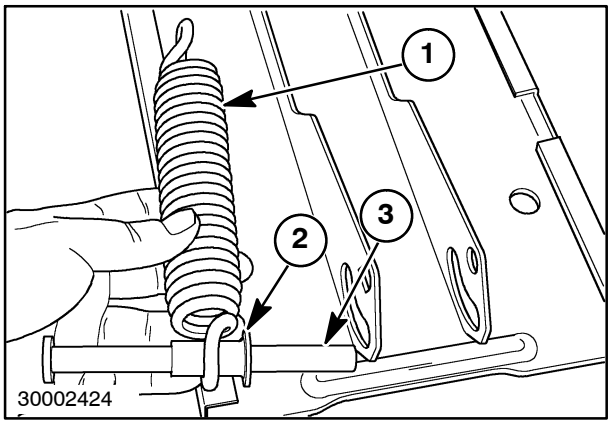
37

23. Remove the pivot linkage, 1, from the spring pin, 2.



38

24. Remove the remaining extension spring, 1, collar, 2, and spring pin, 3.



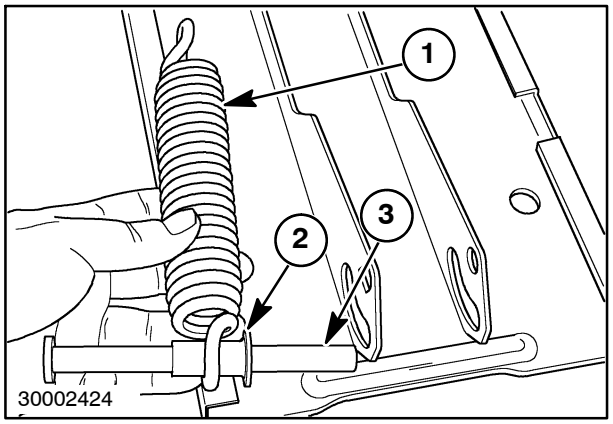
39

Inspection

1. Clean all parts in a suitable solvent and allow to air dry.
2. Check all parts for damage or excess wear. Repair or replace as necessary.

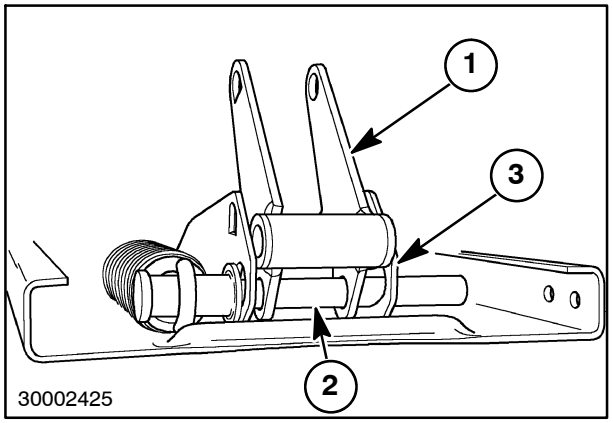
Assembly

1. Lightly lubricate the spring pin, 3, and the collar, 2, with Loctite Anti Seize 767, and install a new extension spring, 1.



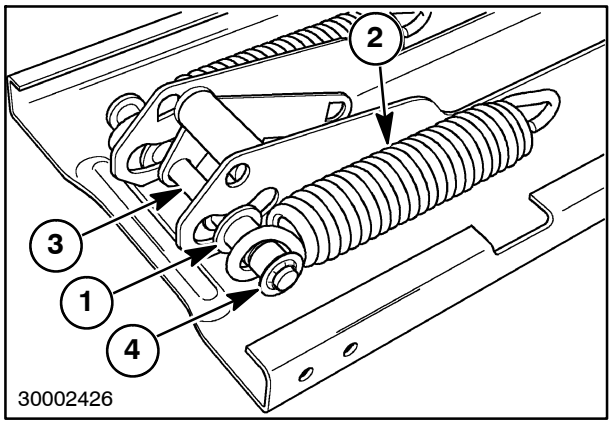
40

2. Install the pivot linkage, 1, onto the spring pin, 2, and slide the spring pin, 2, through the holes in the slide base, 3.



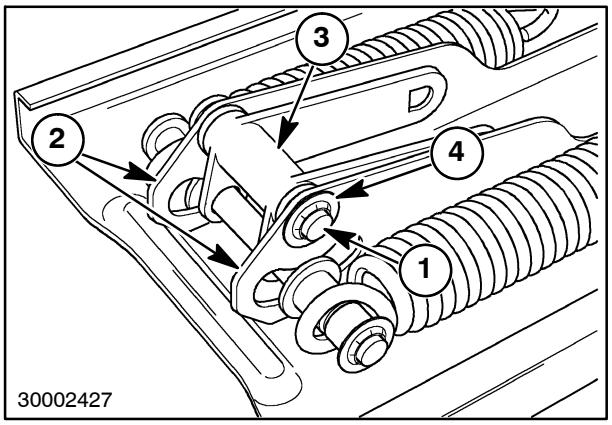
41

3. Install the remaining collar, 1, and a new extension spring, 2, onto the spring pin, 3. Install a new pushnut, 4, onto the spring pin, 3.



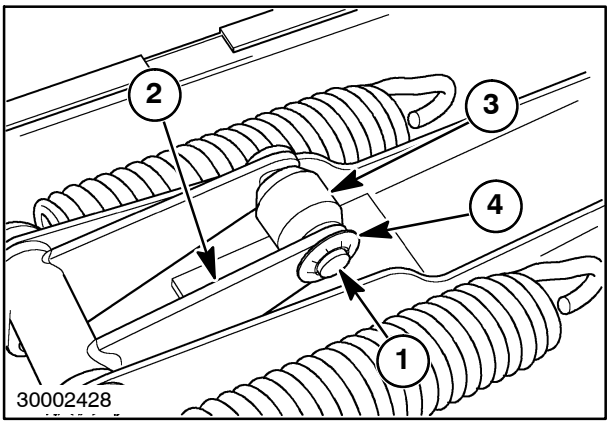
42

4. Lightly lubricate the linkage pivot pin, 1, with Anti Seize 767, and install through the slide base, 2, and the linkage pivot, 3. Secure with a new pushnut, 4.



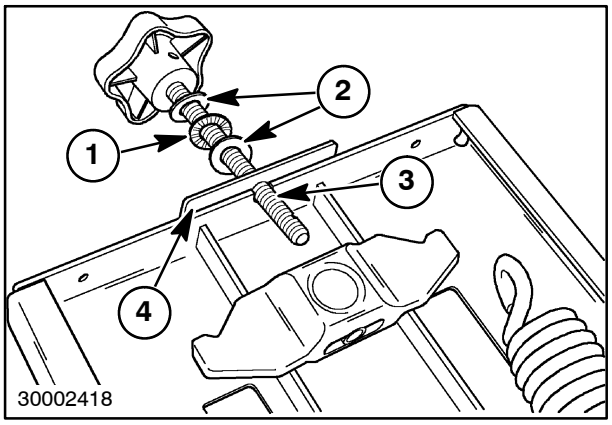
43

5. Lightly lubricate the top linkage pin, 1, with Anti Seize 767, and install through the top of the pivot linkage, 2, while installing a new roller, 3, on the linkage pin, 1. Secure with a new pushnut, 4.



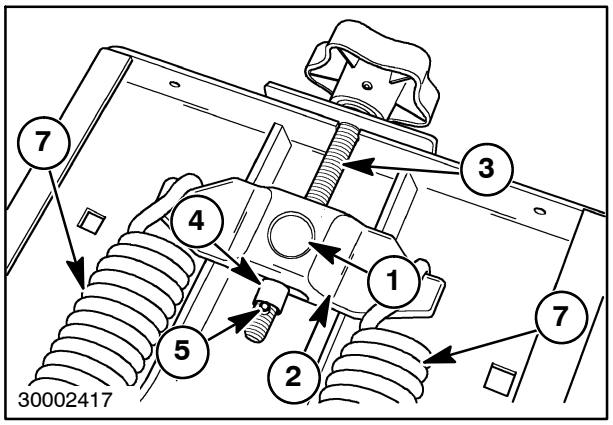
44

6. Lightly lubricate the new thrust bearing, 1, with Anti Seize 767, and install along with the two new thrust races, 2, onto the new adjustment knob and shaft assembly, 3. Insert the assembly through the hole in the slide base, 4.



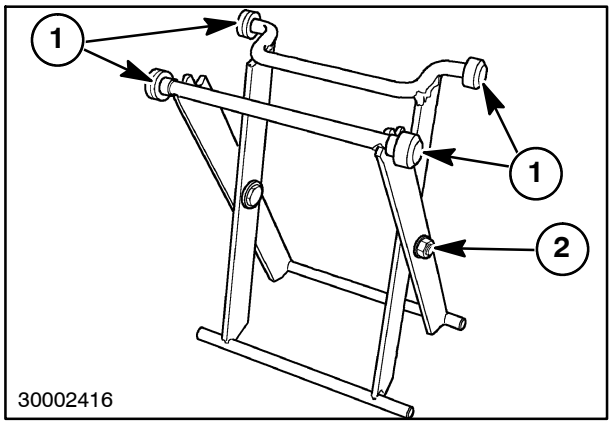
45

7. Install a new weight adjust nut, 1, into the new weight adjust bar, 2, and thread the adjustment knob and shaft assembly, 3, into the weight adjust nut, 1.
8. Install a new weight adjust spacer, 4,and drive a new roll pin, 5, through the weight adjust shaft. Connect the extension springs, 7, to the weight adjust bar, 2.



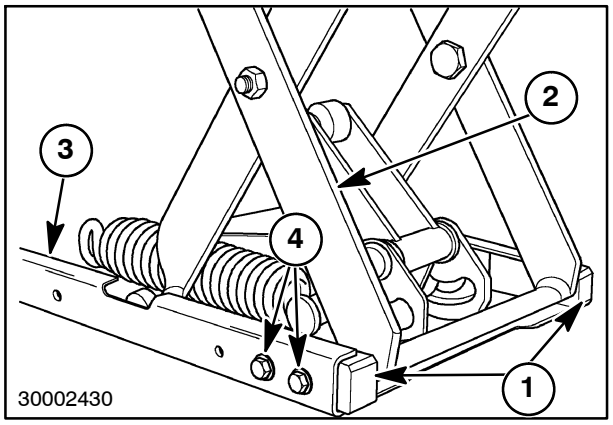
46

9. Lightly lubricate the four new rollers, 1, and install onto the scissors linkage, 2.



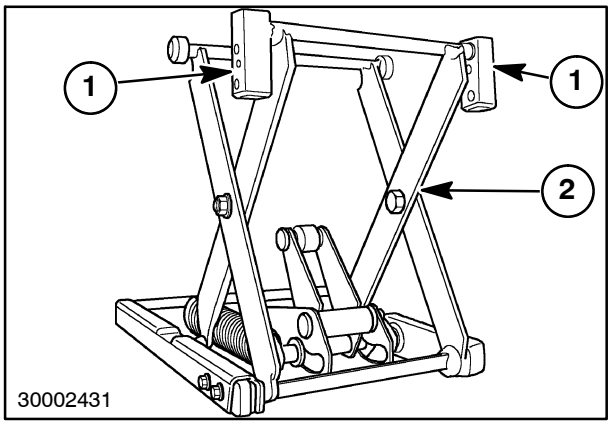
47

10. Lightly lubricate two new shaft blocks, 1,and install on the scissors linkage, 2.
11. Install the scissors linkage, 2, onto the slide base, 3.
12. Secure the shaft blocks to the slide base, 3, with two screws, 4, in each side.



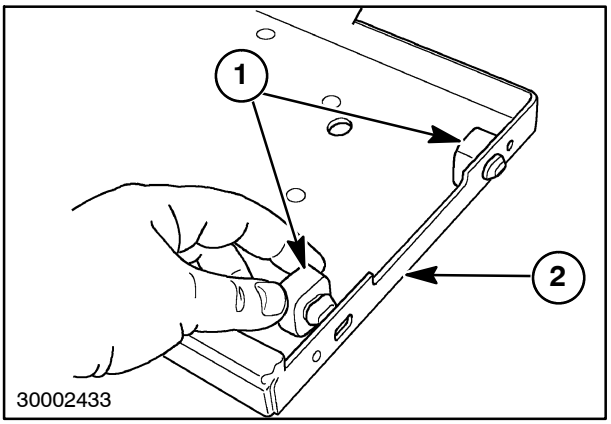
48

13. Lightly lubricate two new shaft blocks, 1, and install onto the scissors linkage, 2.



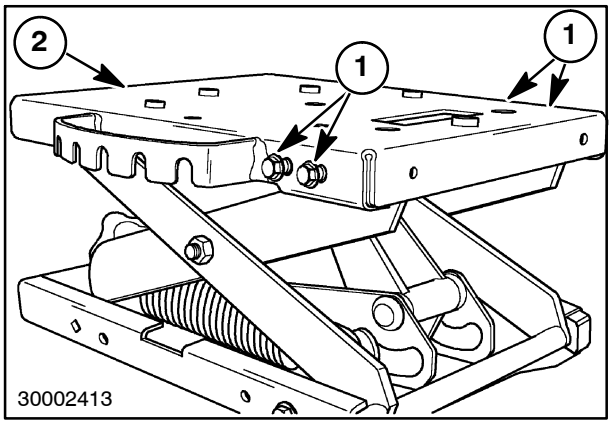
49

14. Install new bumpers, 1, in the top slide base, 2.



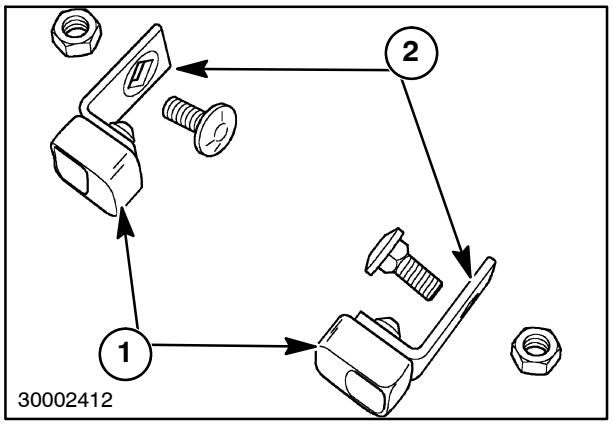
50

15. Install the top slide base, 2, onto the scissors linkage, and secure with two bolts, 1, on each side.



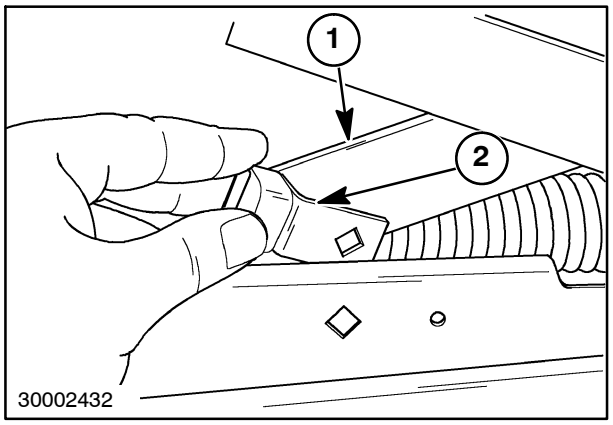
51

16. Install new bumpers, 1, in the slide stop brackets, 2.



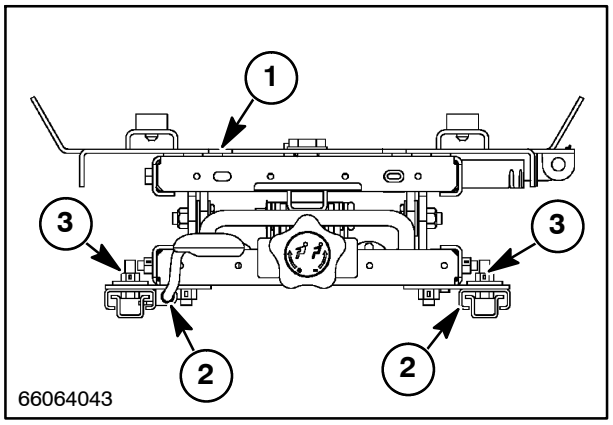
52

17. Compress the seat pedestal assembly, 1, and install the slide stop brackets, 2. Secure with the carriage bolts, and nuts.



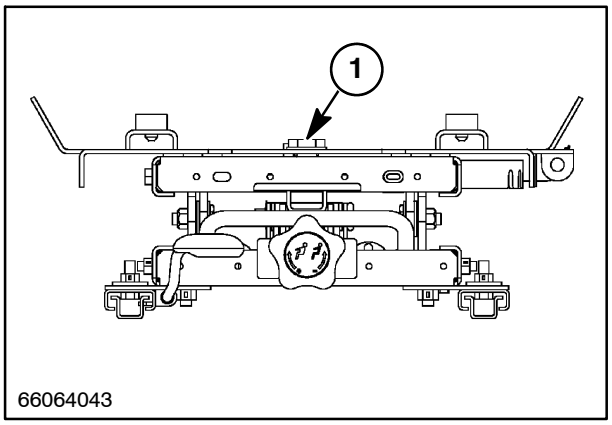
53

18. Position the seat pedestal assembly, 1, on the bench with the bottom side facing up.
19. Install the slide plate, 2, onto the seat pedestal assembly, 1. Secure with four nuts and washers, 3.



54

20. Install the seat base, onto the seat pedestal assembly. Install and tighten the retaining bolt, 1.
21. Install the seat assembly onto the tractor.

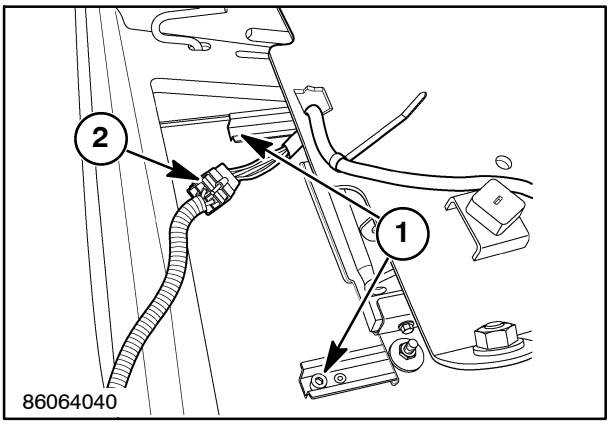


55

Installation

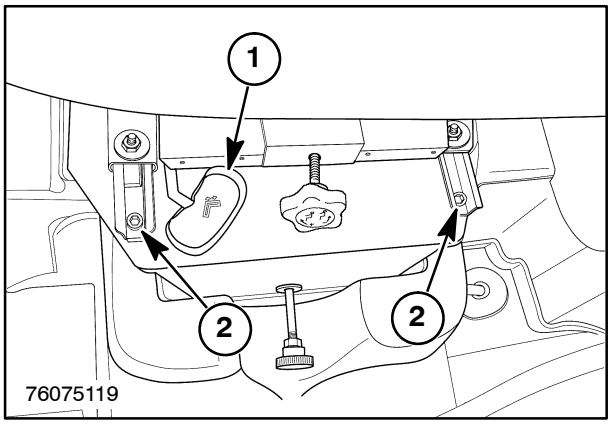
1. Install the seat assembly in the cab.
2. Install both M8 x 30 internal hex head screws and washers, 1.
3. Connect the seat switch, 2.

***IMPORTANT**: Seat is very heavy. Use caution when installing into the cab. Serious injury can occur to self and/or seat assembly if dropped.*



56

4. Pull lever, 1, and push seat rearward. Install both M8 x 30 mm internal hex head screws and washers, 2.

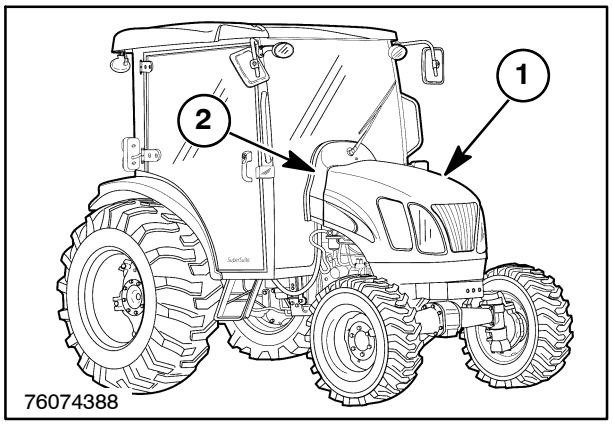


57

FRONT WIPER MOTOR

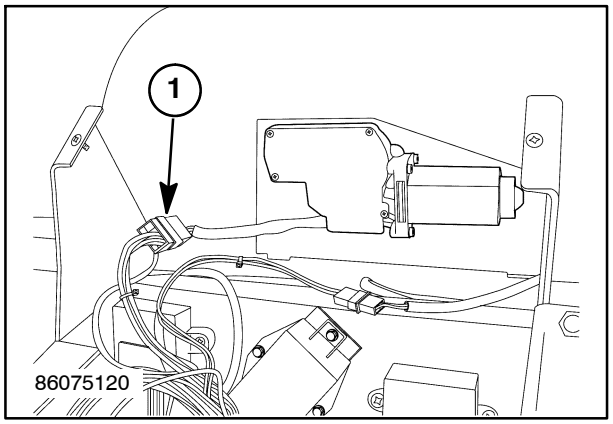
Removal

1. Remove the hood, 1, and rear hood panel, 2, as described in Section 90, Chapter 2, of repair manual.



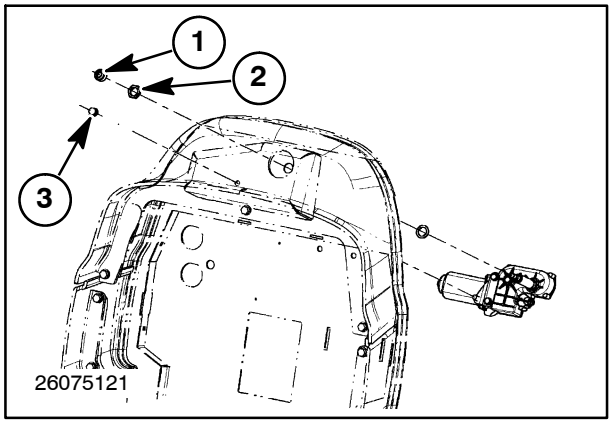
58

2. Disconnect wiper motor harness, 1.



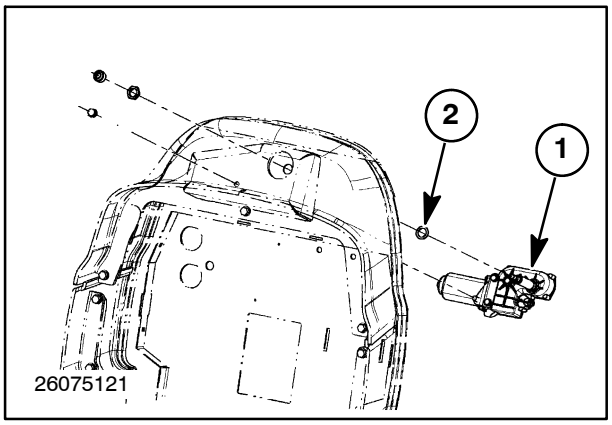
59

3. Remove the black plastic dust cap, 1.
4. Remove the nut, 2, retaining the motor to the firewall.
5. Remove the nut, 3.



60

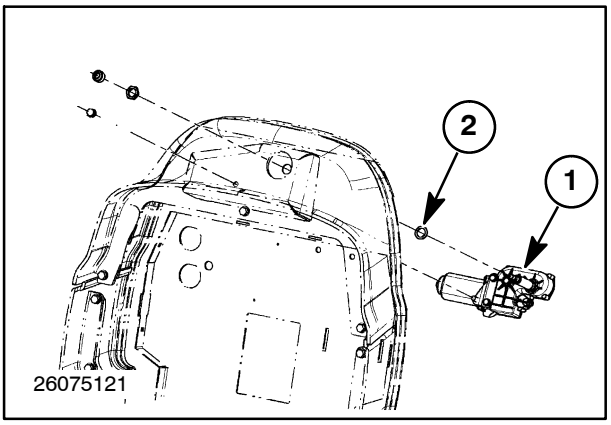
6. Remove the wiper motor, 1 and washer, 2, from inside the cab.



61

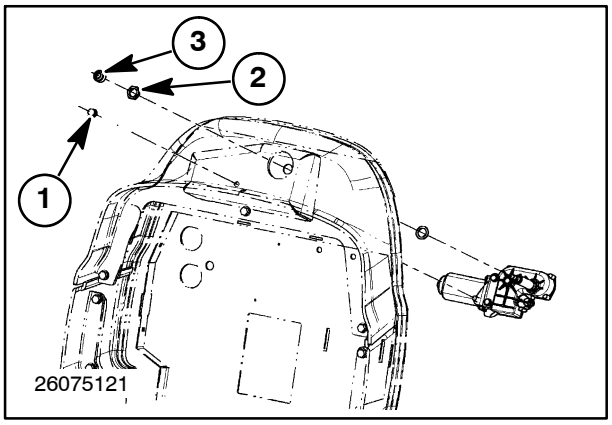
Installation

1. Install the wiper motor, 1 and washer, 2, from inside the cab.



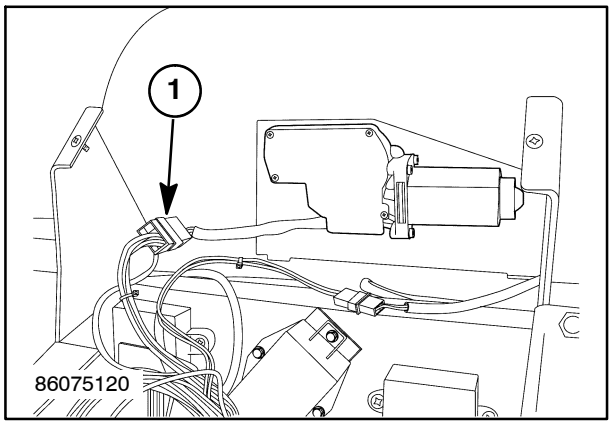
62

2. Install the nut, 1.
3. Install the nut, 2, to secure the motor to the firewall.
4. Install the black plastic dust cap, 3.



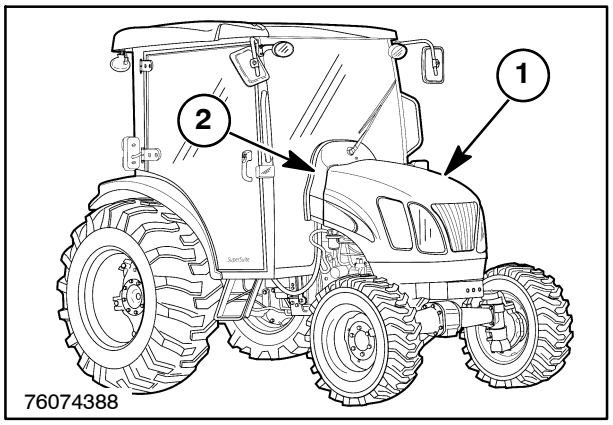
63

5. Connect wiper motor harness, 1.



64

6. Install hood, 1, and rear hood panel, 2, as described in Section 90, Chapter 2, of repair manual.



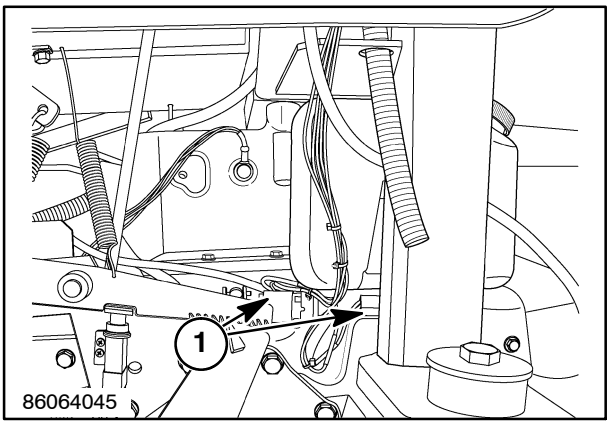
65

WASHER TANK

Removal

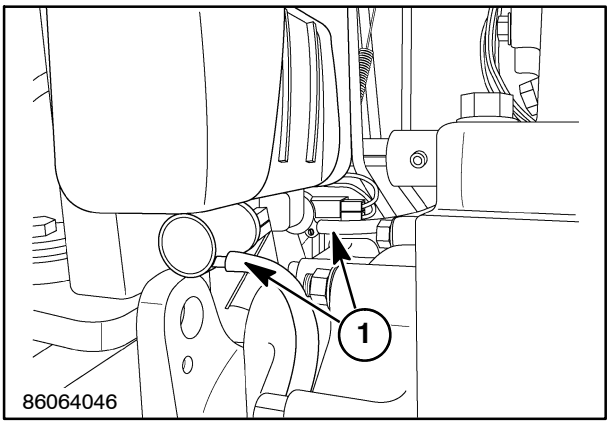
1. Disconnect the electrical connectors, 1, at each washer motor.

NOTE: *The left tire is removed for clarity.*



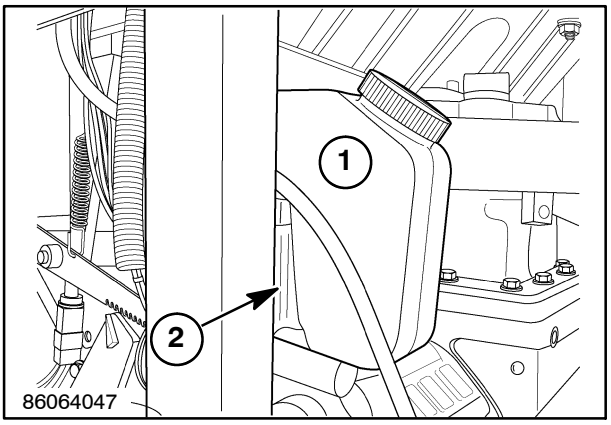
66

2. Disconnect each washer hose, 1, from each motor.



67

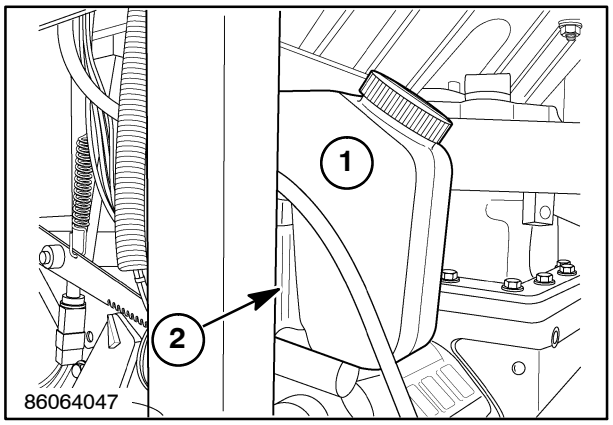
3. Remove the washer bottle, 1, from the left pillar bracket, 2, by pushing upward.



68

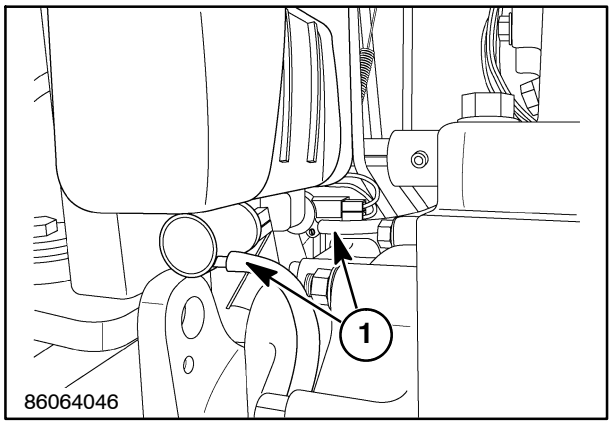
Installation

1. Install the washer bottle, 1, in the left pillar bracket, 2, by pushing downward.



69

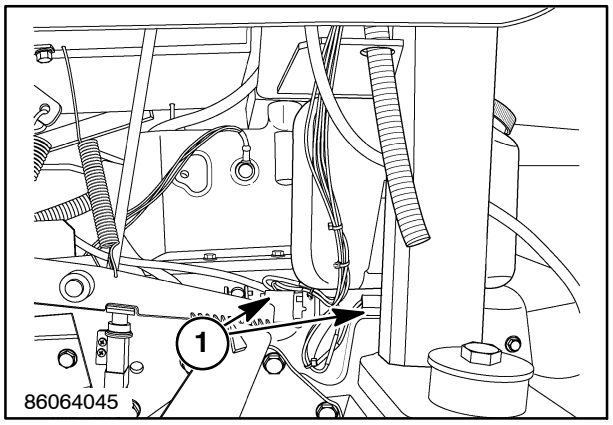
2. Attach each washer hose, 1, to each motor.



70

3. Connect the electrical connectors, 1, at each washer motor.

NOTE: *The left tire is removed for clarity.*

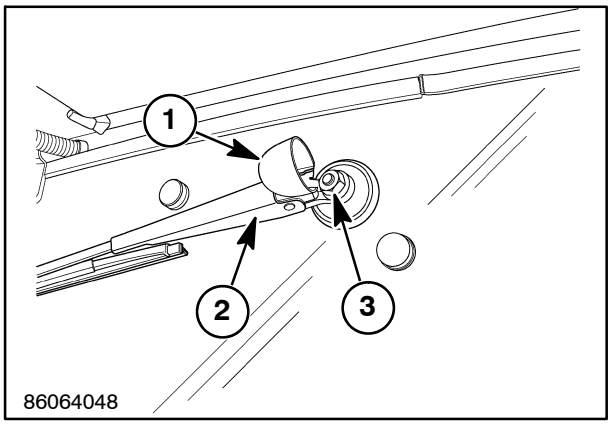


71

REAR WIPER MOTOR

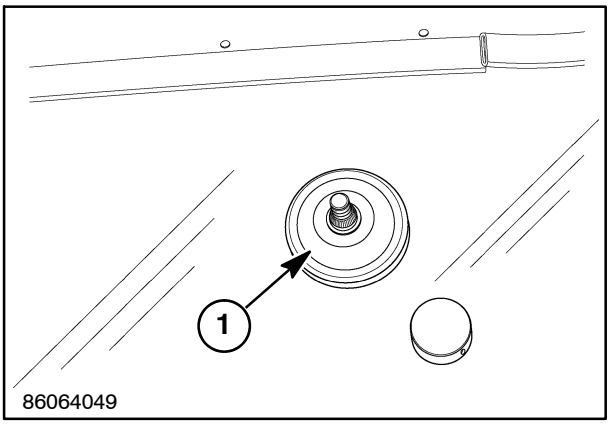
Removal

1. Lift the cover, 1, on wiper arm, 2 and remove the retaining nut, 3. Remove the wiper arm.



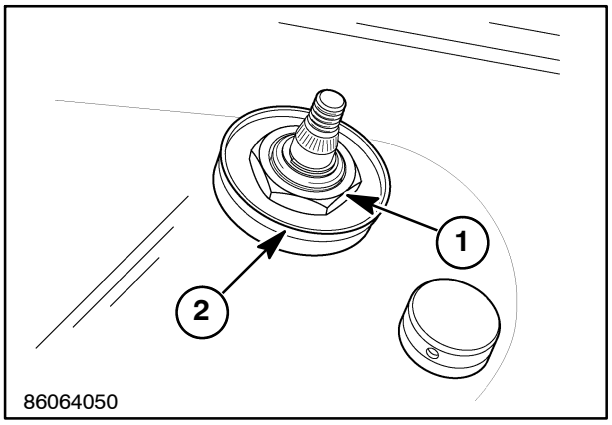
72

2. Remove the plastic cover, 1, protecting the components.



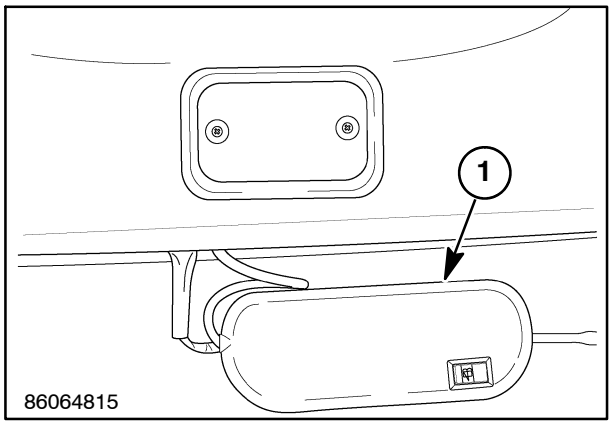
73

3. Remove the nut, 1, securing the wiper motor.
4. Remove the metal washer, 2.



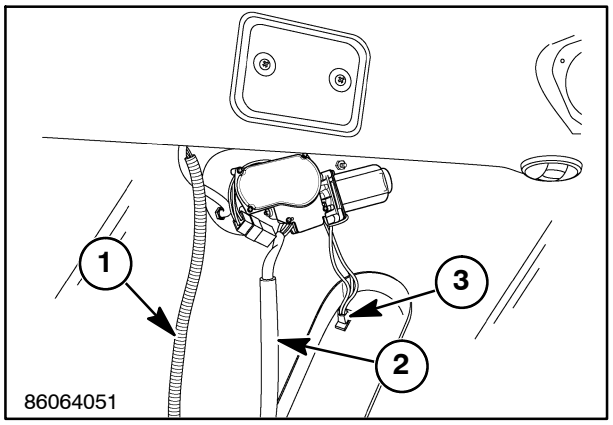
74

5. On the inside of the glass, remove the cover, 1, to the wiper motor assembly.



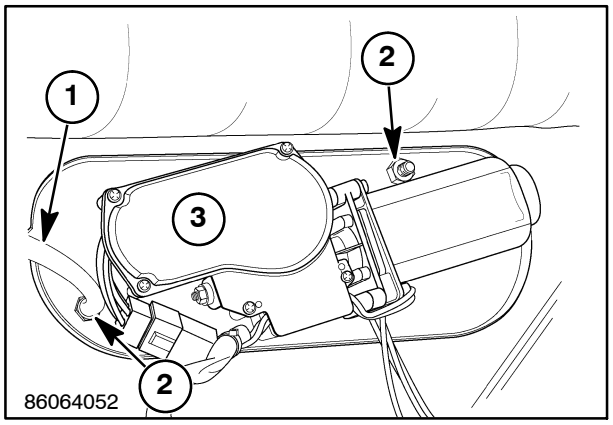
75

6. Disconnect the harness, 1, (connector not shown) at the wiper motor harness, 2, (connector not shown).
7. Remove switch, 3, from cover.



76

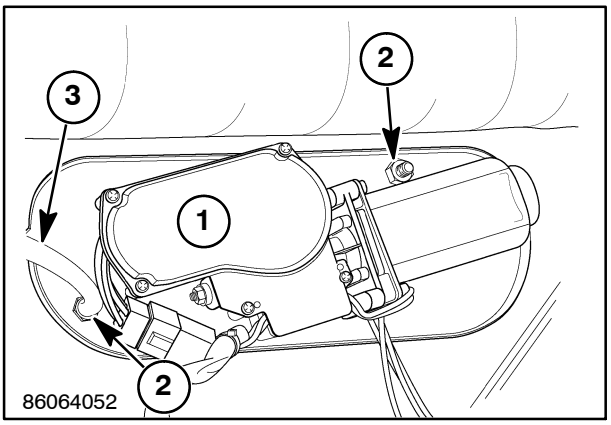
8. Remove the washer hose, 1.
9. Remove the two nuts and serrated lockwashers, 2, that secure the wiper motor assembly, 3, to the glass.



77

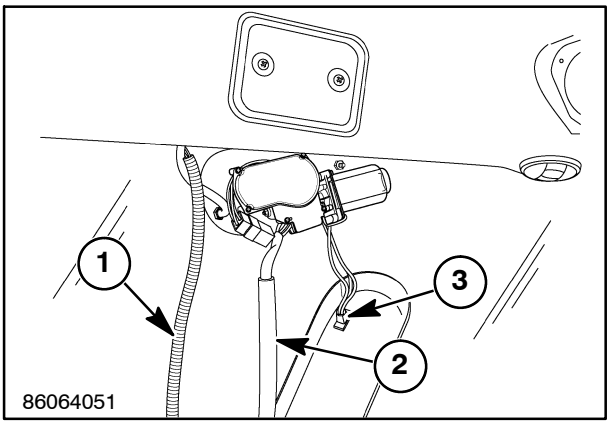
Installation

1. Install the wiper motor assembly, 1 on studs coming through the glass. Secure with two nuts and serrated lockwashers, 2.
2. Install the washer hose, 3.



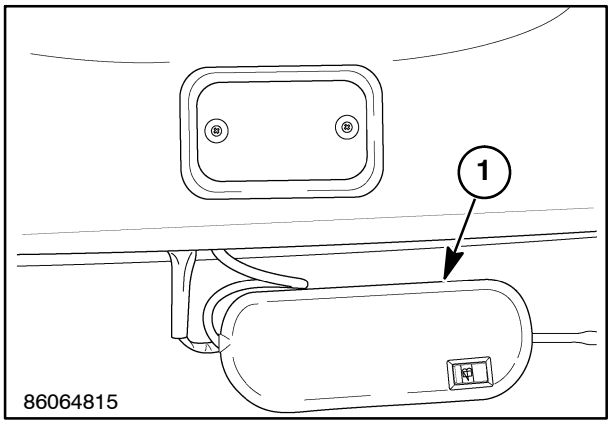
78

3. Connect the harness, 1, (connector not shown) to the wiper motor harness, 2, (connector not shown).
4. Install switch, 3, in cover.



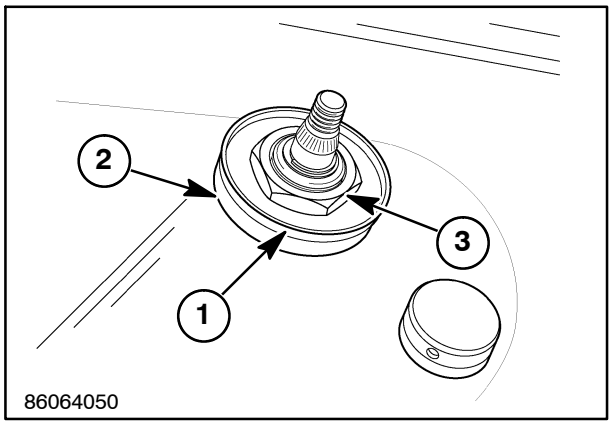
79

5. Insert the wire harness in cover and install the cover, 1, to the wiper motor assembly.



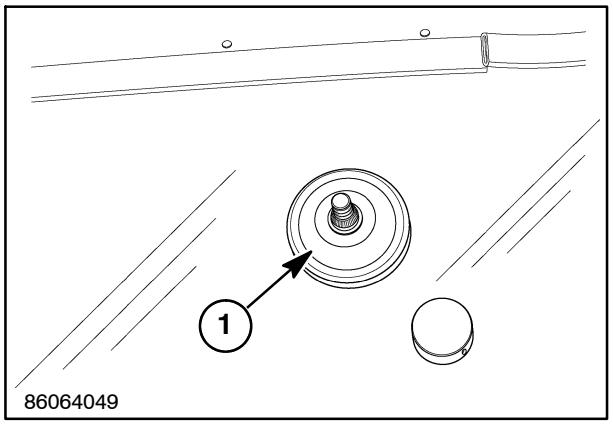
80

6. Install the metal washer, 1, against the rubber, 2, in the glass. Install the washer with the lip facing the rear of the tractor.
7. Install the nut, 3, securing the wiper motor.



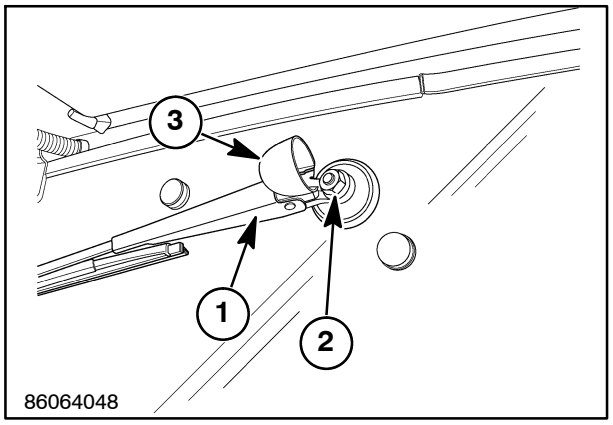
81

8. Install the plastic cover, 1, protecting the components.



82

9. Install the wiper arm, 1.
10. Install and secure the retaining nut, 2.
11. Install the cover, 3, on wiper arm.

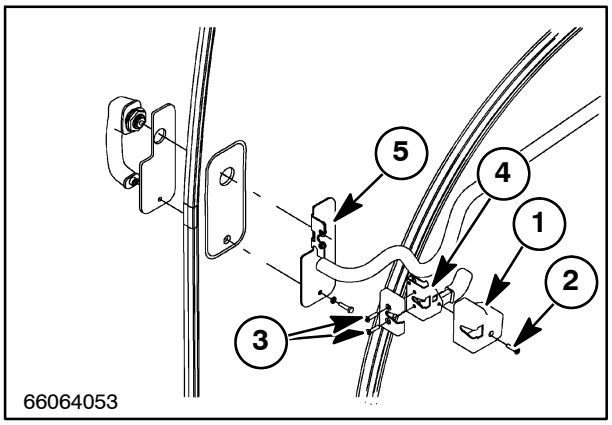


83

DOOR HANDLE AND LATCH

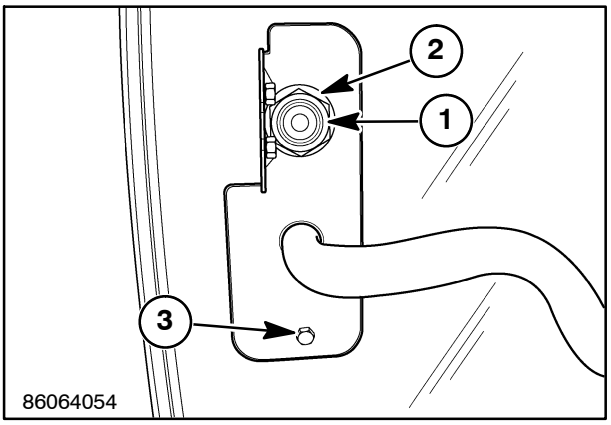
Removal

1. Remove the cover, 1, by removing screw, 2.
2. Remove the two screws, 3, that secure the latch assembly, 4, to the mounting bracket, 5.



84

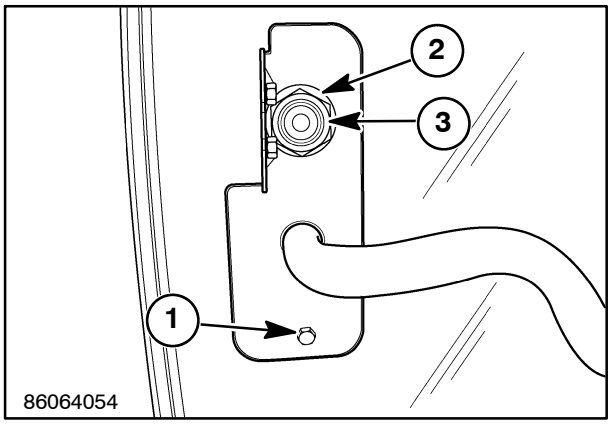
3. Remove the jam nut, 1 and washer, 2.
4. Remove the lower bolt and washer, 3. Remove the door handle.



85

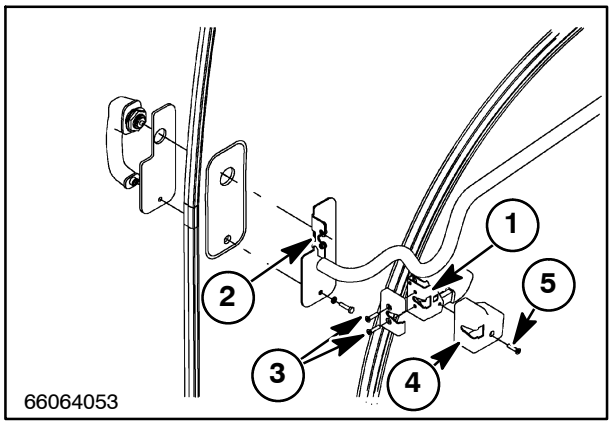
Installation

1. Install the door handle and secure with the lower bolt and washer, 1.
2. Install the washer, 2 and jam nut, 3.



86

3. Install the latch assembly, 1, to the mounting bracket, 2 and secure with two screws, 3.
4. Install the cover, 4 and secure with screw, 5.

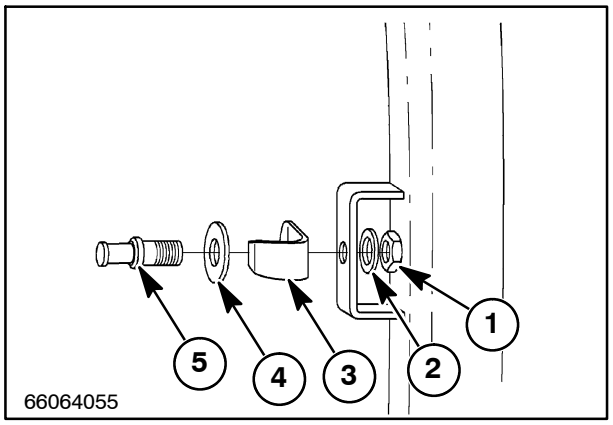


87

DOOR STRIKER

Replacement

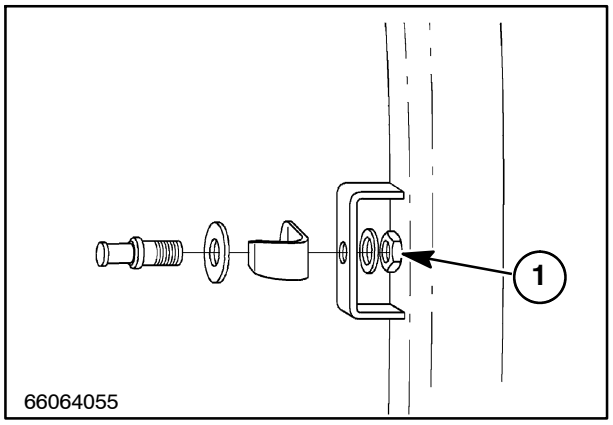
1. Remove the nut, 1 and washer, 2, which secures the striker protector, 3, washer, 4 and striker, 5.
2. Install the striker assembly as shown and secure with the washer, 2 and nut, 1.



88

Adjustment

1. Loosen nut, 1 and move the striker assembly to the desired position in order to make the door shut and seal properly.



89

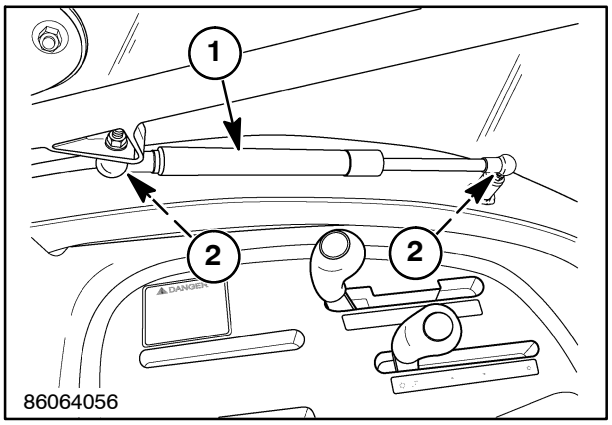
CAB DOOR

⚠ CAUTION ⚠

When replacing a door, have an assistant help in removing the door from the cab. Serious injury and/or damage to the door can occur.

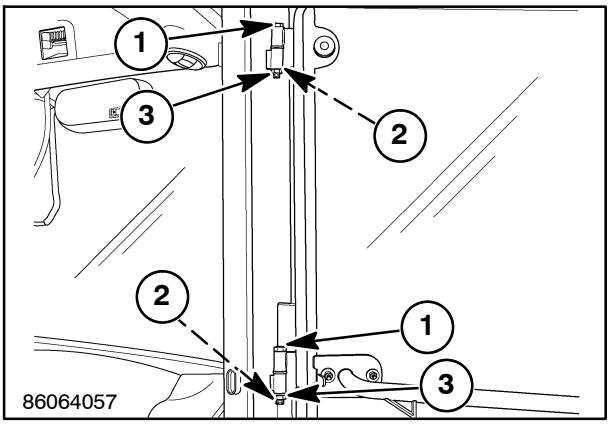
Removal

1. Remove the door shock, 1, by removing the spring clip, 2, on each end of the shock.
2. Pry the shock away from each mounting flange.



90

3. Remove the bolts, 1, washer, 2 and nut, 3, which secures each door hinge.
4. Remove the door from the cab.

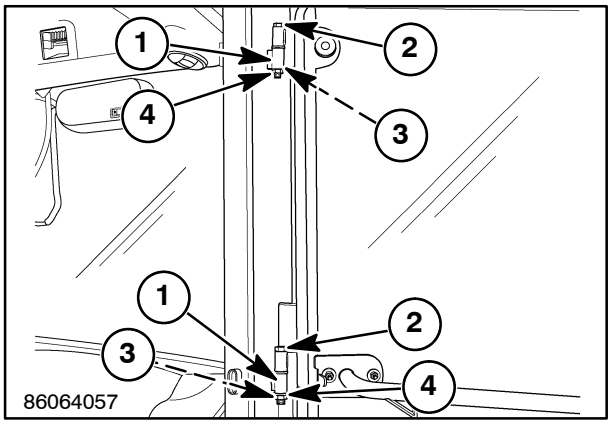


91

Installation

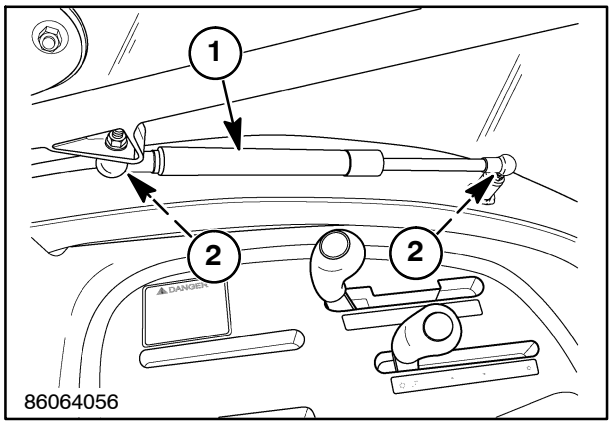
1. Install the door on the cab hinge brackets, 1.
2. Install the bolts, 2, washer, 3 and secure with nut, 4.

IMPORTANT: *The door must be installed with the hinges sitting on top of the cab hinge supports.*



92

3. Push the shock onto each mounting flange.
4. Secure the door shock, 1, with the spring clip, 2.
5. Adjust the door as necessary.



93

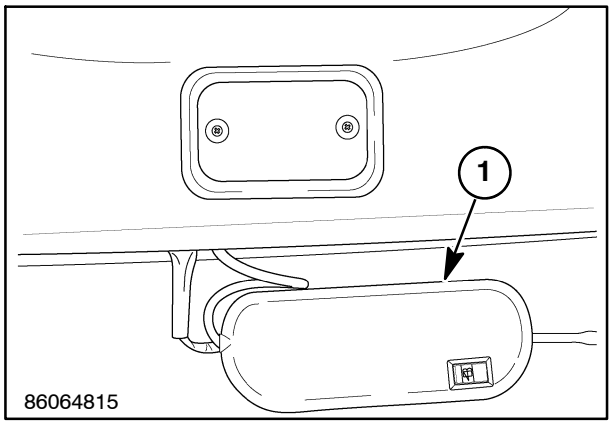
CAB REAR WINDOW

⚠ CAUTION ⚠

When replacing the rear window, have an assistant help in removing the window assembly from the cab. Serious injury and/or damage to the window can occur.

Removal

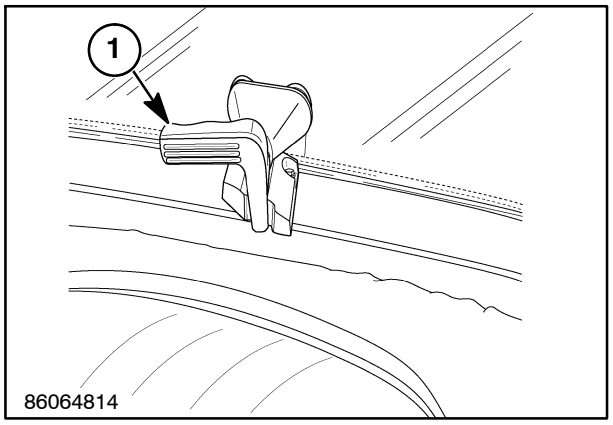
1. On the inside of the glass, remove the cover, 1, to the wiper motor assembly and disconnect the electrical connector and washer hose, (not shown).



94

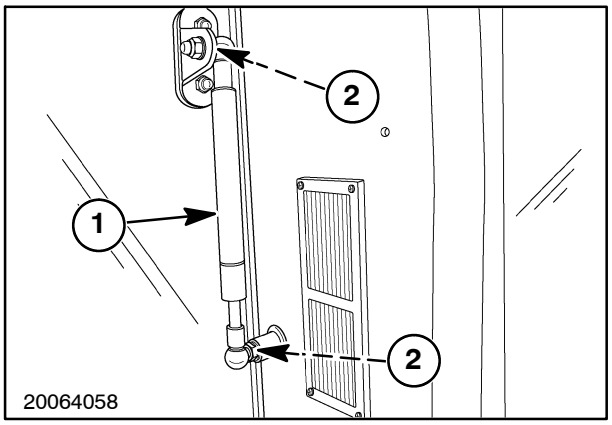
2. Unlock the window by turning the handle, 1, clockwise.

NOTE: *The handle is shown in the locked position.*



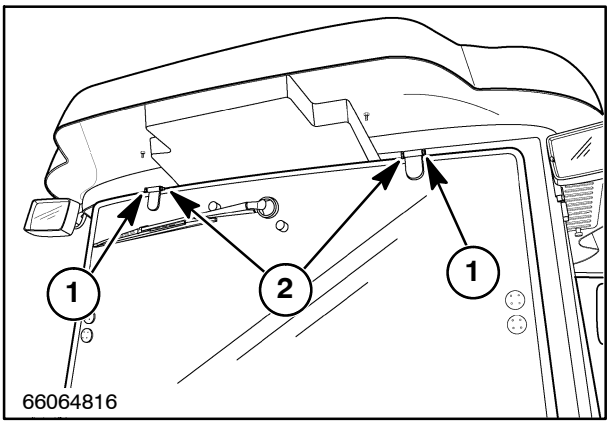
95

3. Remove the window shock, 1, by removing the spring clip, 2, on each end of the shock.
4. Carefully pry the shock away from each mounting flange.



96

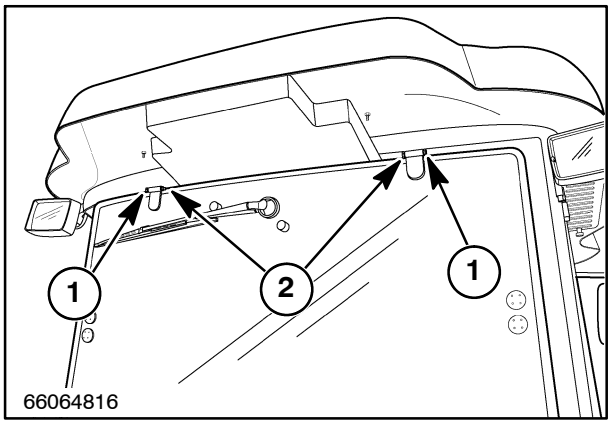
5. Remove the hinge pins, 1, by removing the retaining ring, 2.
6. Remove the window assembly.



97

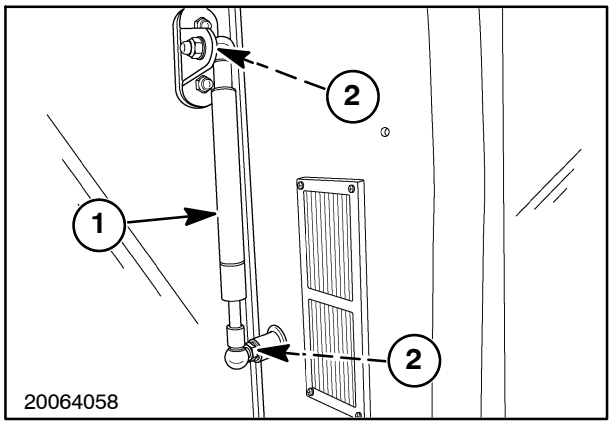
Installation

1. Install the window assembly so that the window hinges are inside the mounting flanges on the cab.
2. Insert a pin, 1, through each hinge and flange and secure with a retaining clip, 2.



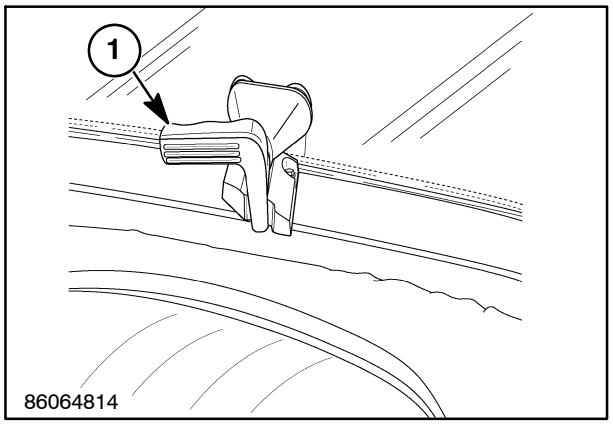
98

3. Push the shock onto each mounting flange.
4. Secure the window shock, 1, with the spring clip, 2.



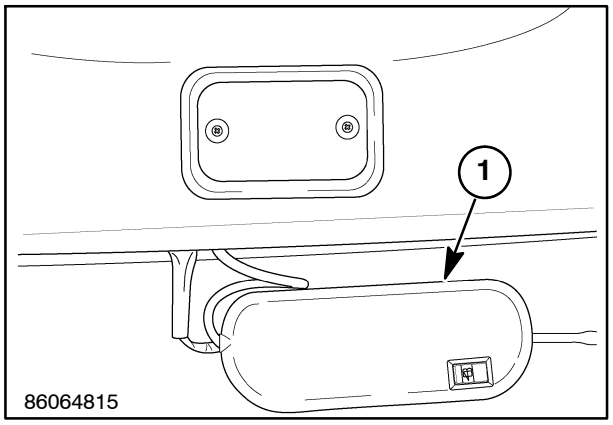
99

5. Lock the window by turning the handle, 1, counterclockwise, as shown.



100

6. Attach the washer hose, reconnect the harness connectors and insert the wire harness in cover.
7. Install the cover, 1, to the wiper motor assembly.

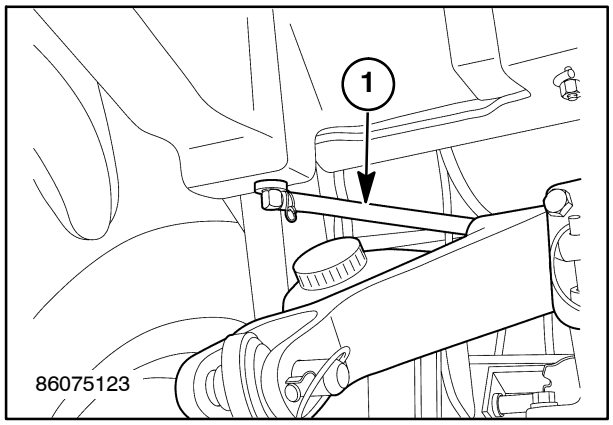


101

FUEL TANK

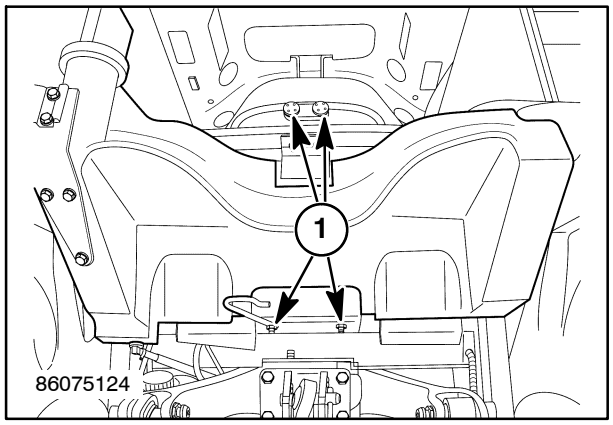
Removal

1. Drain the fuel into a clean suitable container.
2. Pinch off the feed tube, 1, on the bottom side of the fuel tank and remove the hose from the tank.



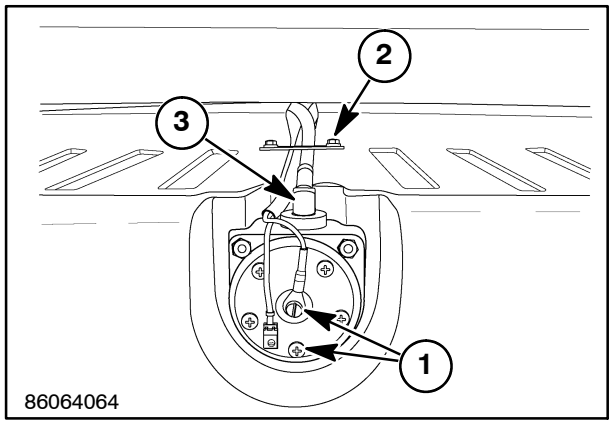
102

3. Remove the four mounting bolts, 1.



103

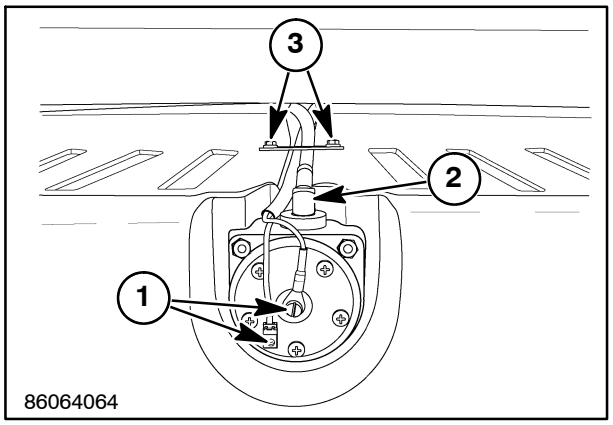
4. Carefully slide the fuel tank back to disconnect the electrical connections, 1, retaining bracket, 2, and fuel return line, 3.
5. Remove fuel tank.



104

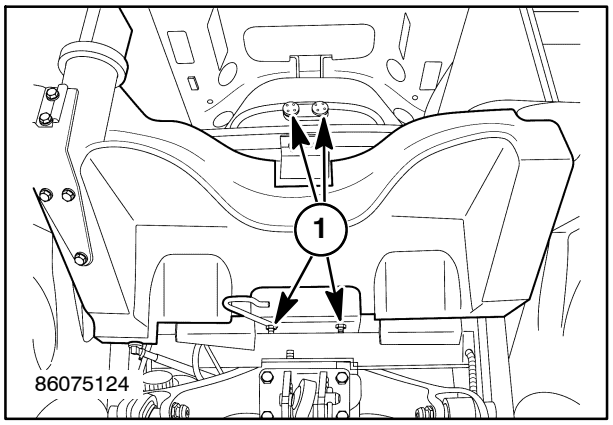
Installation

1. Install the tank into the tractor leaving enough room to hook up electrical connections.
2. Connect the electrical connections, 1 and the fuel return line, 2.
3. Install the retaining bracket by securing the bolt and washer, 3.



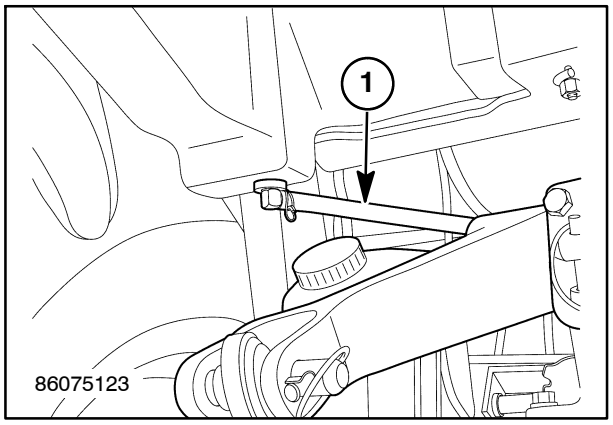
105

4. Slide the fuel tank into place. Using the four bolts shown, 1, mount the fuel tank.



106

5. Connect the feed line, 1, to the port on the underside of the tank.
6. Refill the fuel tank and check for leaks.

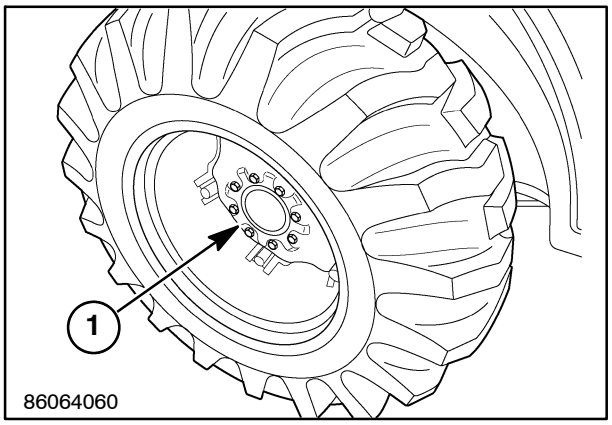


107

FENDERS

Removal

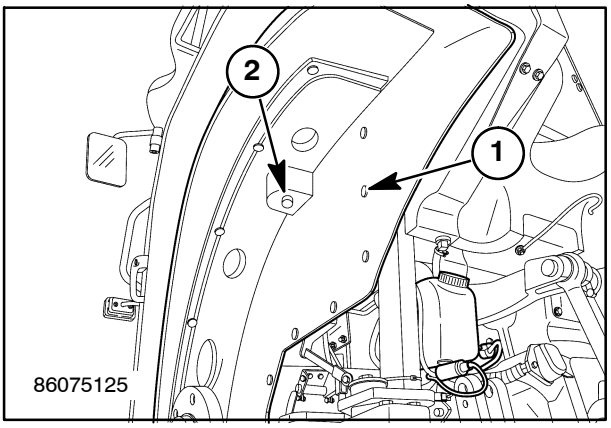
1. Place jack stands under the rear axle, not shown.
2. Remove the wheel, 1, from the tractor.



108

3. Remove the fastener buttons and nylon washers, 1, and nut, 2, which secures the fender to the cab.

NOTE: *Left fender has 14 fastener buttons and nylon washers. Right fender has 13.*

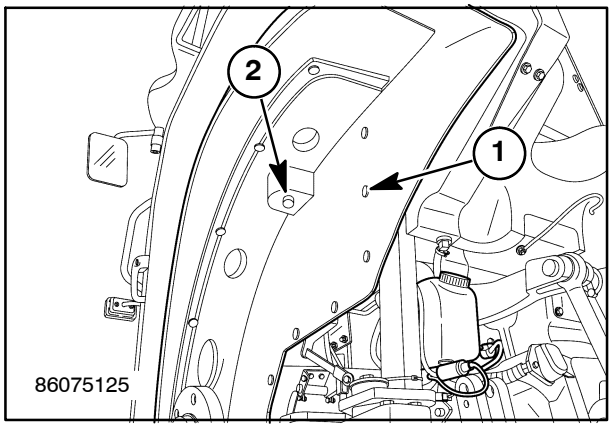


109

Installation

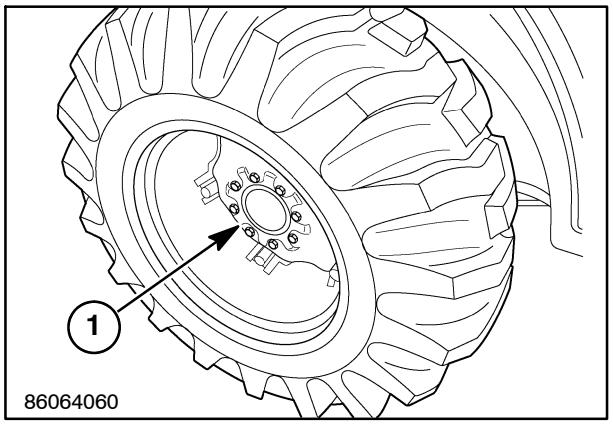
1. Install the fender to the cab and secure the fender with fastener buttons and nylon washers, 1, and nut, 2.

NOTE: *Left fender has 14 fastener buttons and nylon washers. Right fender has 13.*



110

2. Install the wheel, 1, onto the tractor. Torque the lug bolts to 129 N·m (95 ft-lb).
3. Remove the jack stands from under the rear axle, not shown.

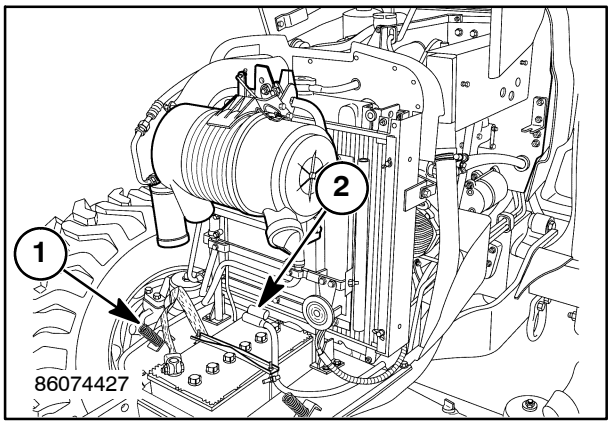


111

CAB

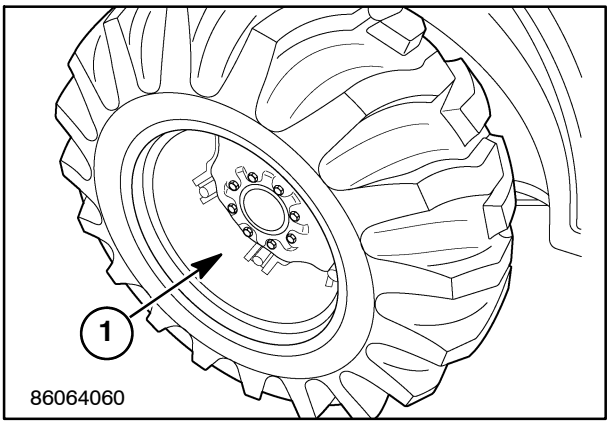
Removal

1. Remove the negative (–) battery cable, 1, and the (+) battery cable, 2, from the battery.



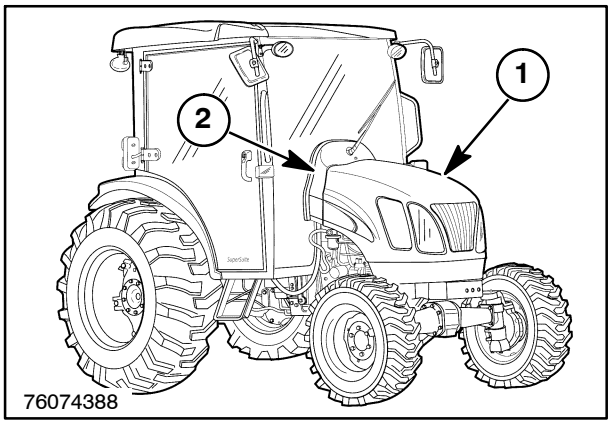
112

2. Place jack stands under the rear axle, not shown.
3. Remove the rear wheels, 1, from the tractor.



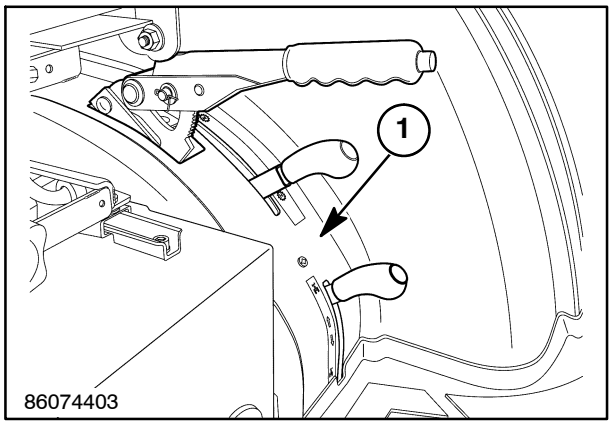
113

4. Remove the hood, 1, and the rear hood panel, 2, as described earlier in this section.



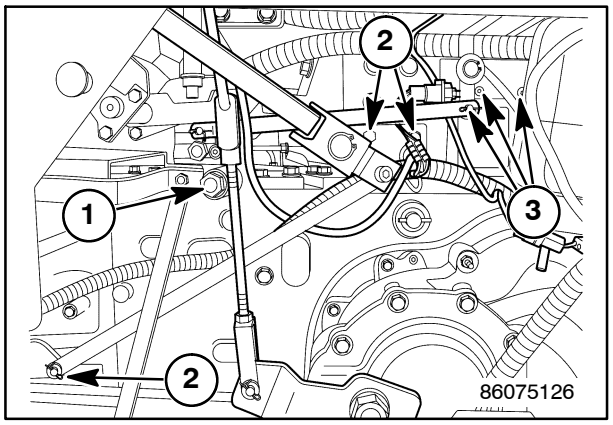
114

5. From inside the cab, remove the handles from the FWD, Range, and PTO levers. Remove the left side control pod, 1.



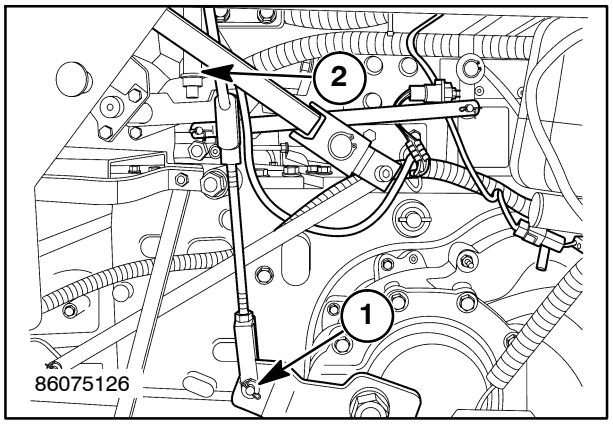
115

6. Disconnect the FWD linkage at, 1, the Range linkage at, 2, and the PTO linkage at, 3. Remove all levers from the cab.



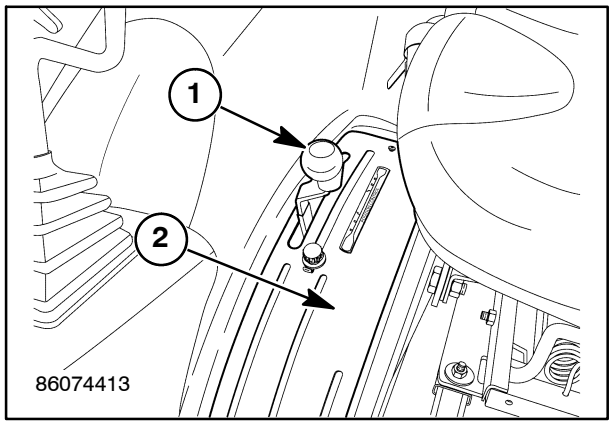
116

7. Disconnect the parking brake at, 1, and the safety switch, 2.



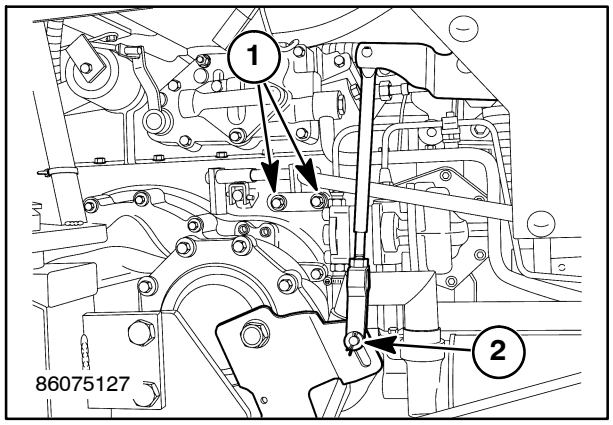
117

8. Remove the handle, 1, from the three point hitch lever.
9. Remove the right side control pod, 2.



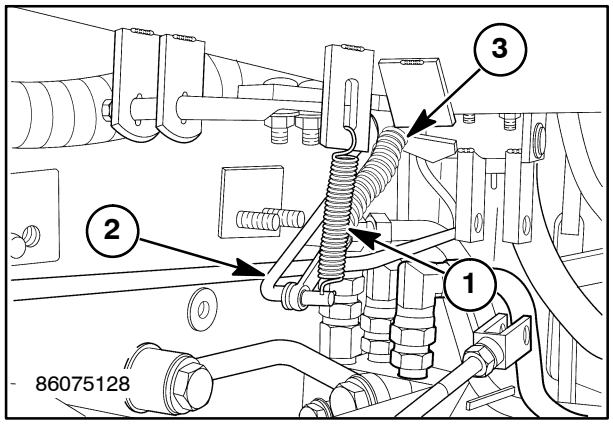
118

10. Remove differential lock lever at, 1.
11. Disconnect parking brake at, 2.



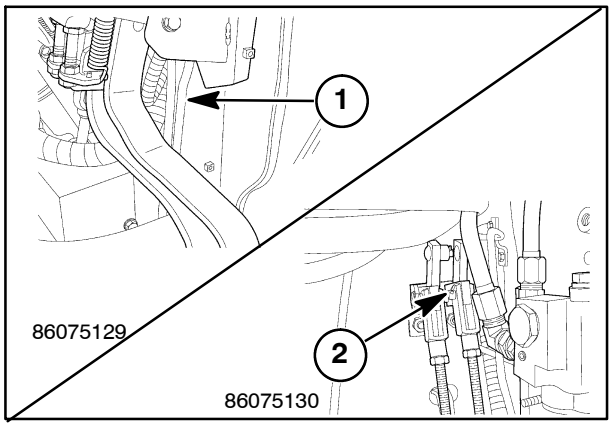
119

12. Disconnect the spring, 1, from the foot throttle linkage, 2. Remove foot throttle cable from cable clamp from under the cab at, 3.



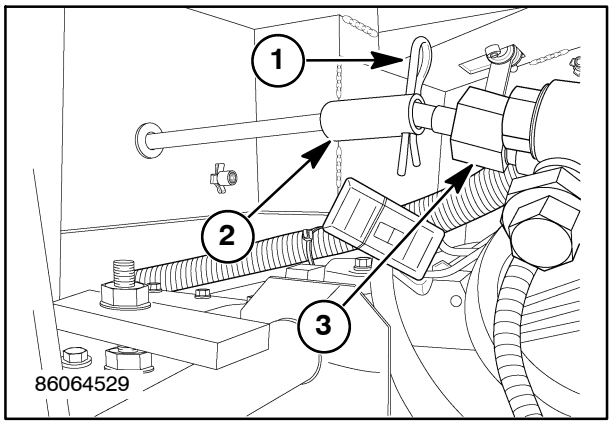
120

13. Disconnect the brake pedal linkage, 1, from under the cab at, 2.



121

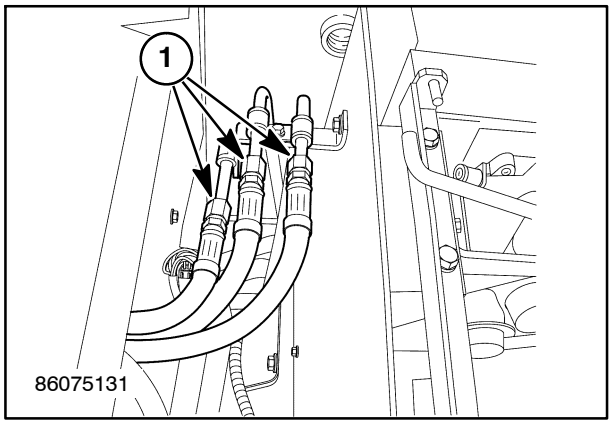
14. Remove the hair pin, 1, and disconnect the rod, 2, which connects to the HPL Drop Rate Control Valve, 3.
15. Disconnect the harness that goes into the cab behind the seat on the right hand side. Harness feeds the following:
    - Seat Switch
    - Hi/Low Speed Control switch
    - HST Cruise Control



122

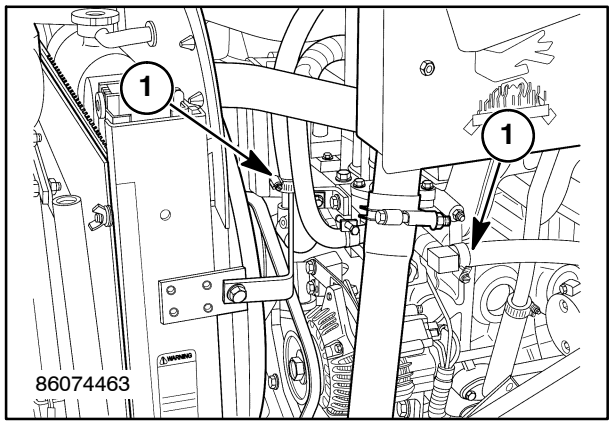
16. Disconnect the power steering hoses, 1, that are located under the rear hood panel.

NOTE: *Mark the hoses to assure proper installation during reassembly.*



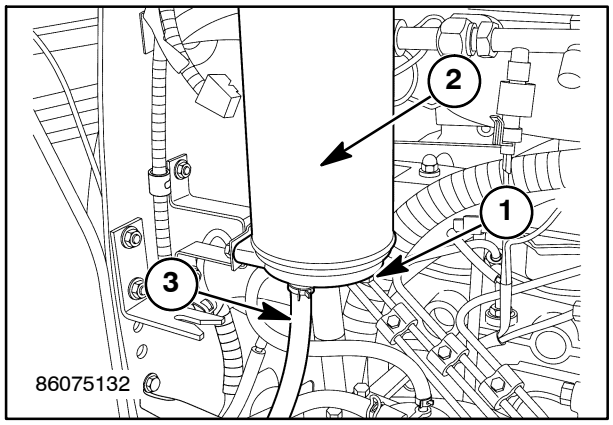
123

17. Disconnect the water pump hoses, 1. Drain the engine coolant into a suitable container.



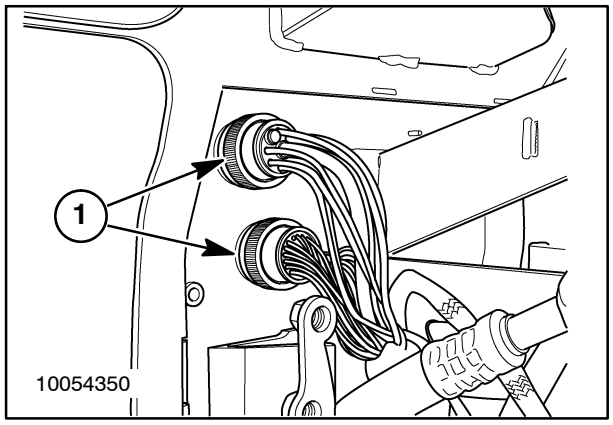
124

18. Remove the drain plug, 1, from the power steering fluid reservoir, 2, and drain fluid into a suitable container.
19. Disconnect reservoir hose, 3.



125

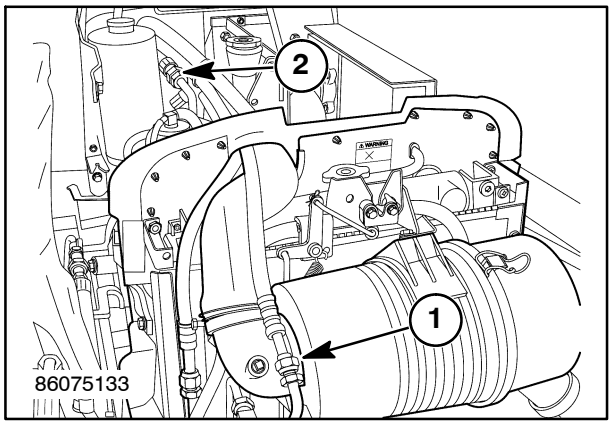
20. Disconnect the electrical harness connectors, 1, at the cab.



126

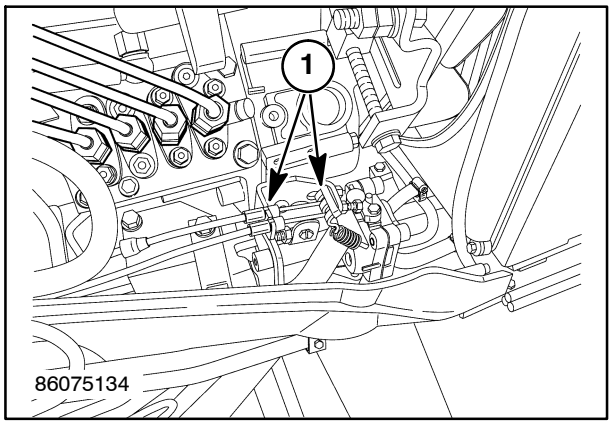
21. Evacuate the A/C system as described in Section 50 of the repair manual.
22. Disconnect the high pressure line going to the receiver/dryer, 1.
23. Disconnect the low pressure hose going into the A/C compressor, 2.

NOTE: *Cap off all connections to keep moisture and debris from entering the system.*



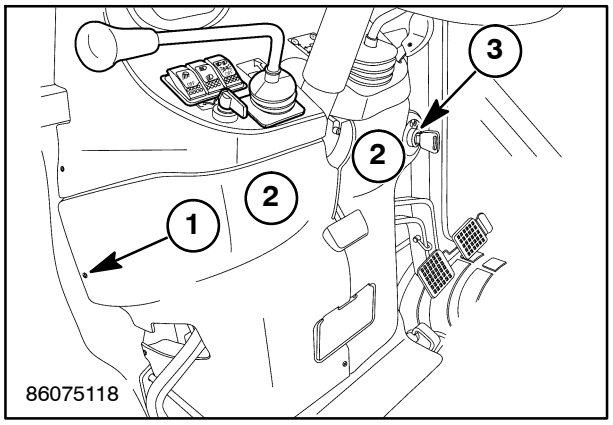
127

24. Disconnect the throttle cable at, 1.



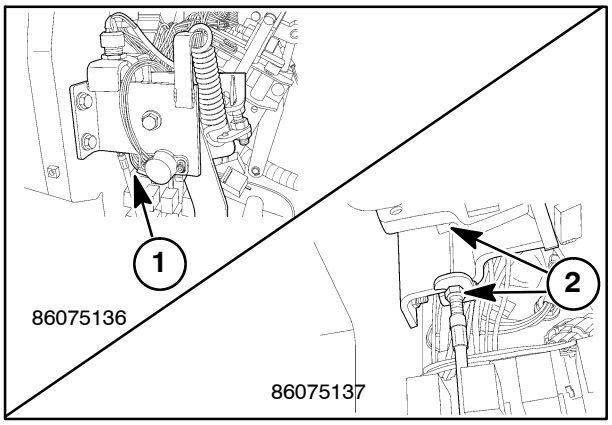
128

25. Remove screws, 1, and remove lower panels, 2. Disconnect the key switch, 3.



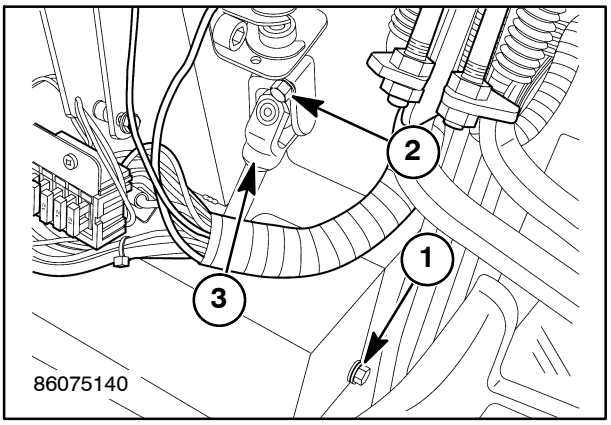
129

26. Disconnect the clutch/inching pedal cable, 1, or clutch rod (not shown). Disconnect the cable at, 2.



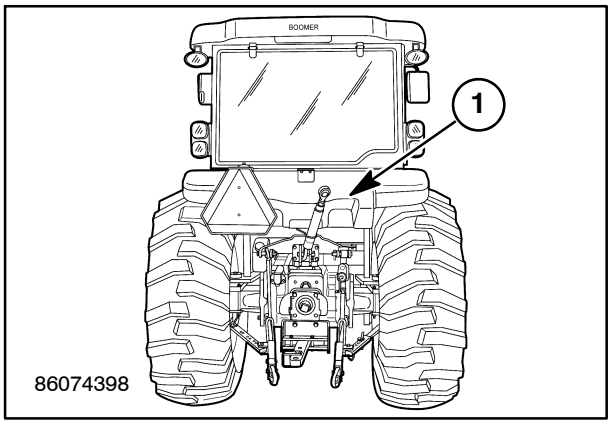
130

27. Remove bolts from access cover, 1, for the EHSS solenoid valve.
28. Remove bolt, 2, from shifter linkage, 3. Disconnect linkage from shifter lever.



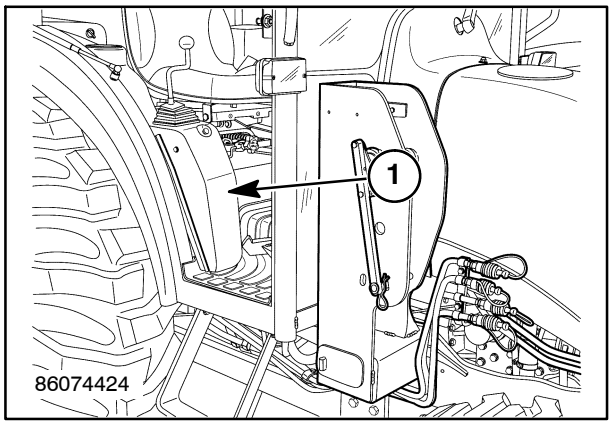
131

29. Remove the fuel tank, 1, as described earlier in this section.



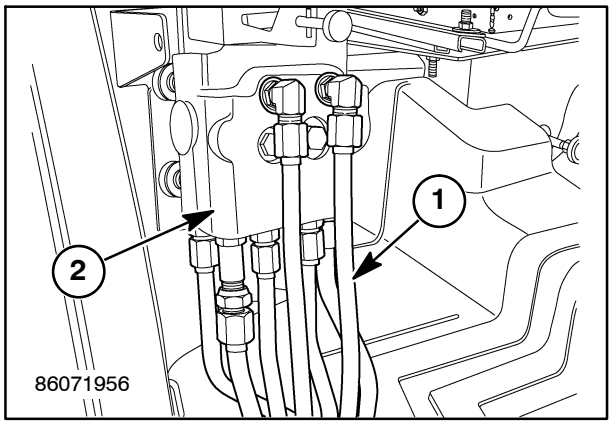
132

30. If equipped, remove the remote loader control valve cover, 1.



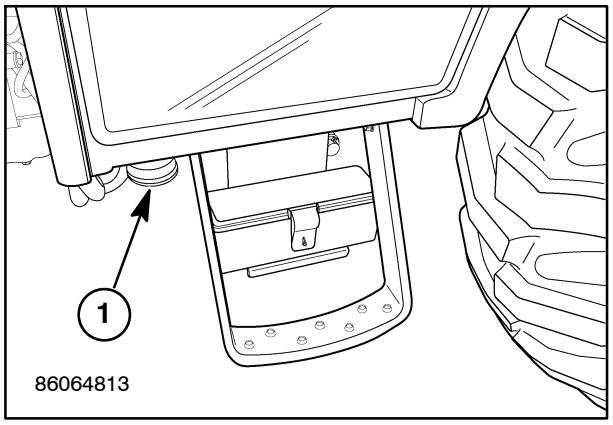
133

31. Disconnect all hydraulic tubing, 1, from the remote valve, 2.



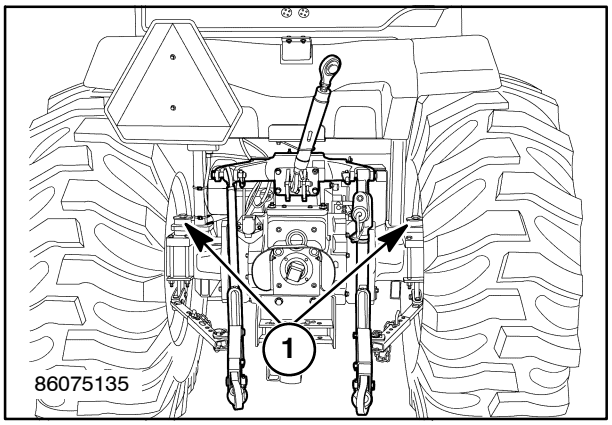
134

32. Remove the right and left front cab mounting bolts and washers, 1.



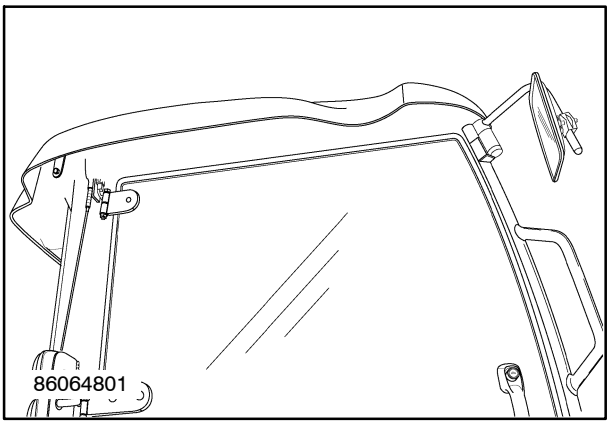
135

33. Remove the right and left rear mounting bolts and washers, 1.



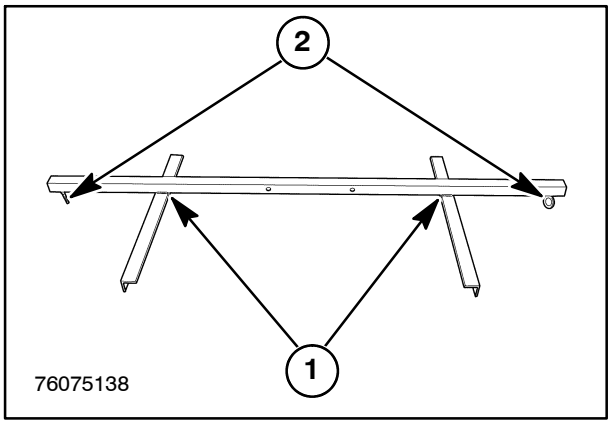
136

34. Prior to lifting the cab off the tractor, remove both cab access doors as described earlier in this section.



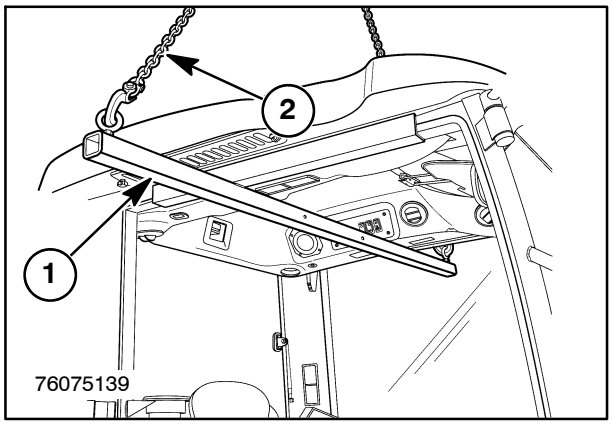
137

35. Special tool #380002802 as shown is for safely removing the cab from the tractor, without causing any damage to the machine.
36. The tool is equipped with two locating pins at, 1, and two lifting eyelets, 2.



138

37. Insert special tool #380002802, 1, in through the cab and attach to a suitable lifting device with a chain, 2. Raise the tool upward aligning the locating pins into the holes in the upper door rails.
38. Slowly raise the cab from atop of the tractor, making sure all linkages, hoses, tubes, and electrical components have been disconnected.
39. Remove the cab completely from the tractor and sit on a firm level surface.



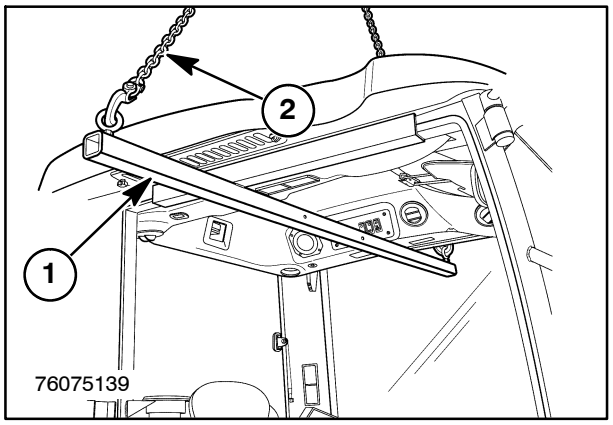
139

Installation

1. Insert special tool #380002802, 1, in through the cab and attach to a suitable lifting device with a chain, 2. Raise the tool upward aligning the locating pins into the holes in the upper door rails.

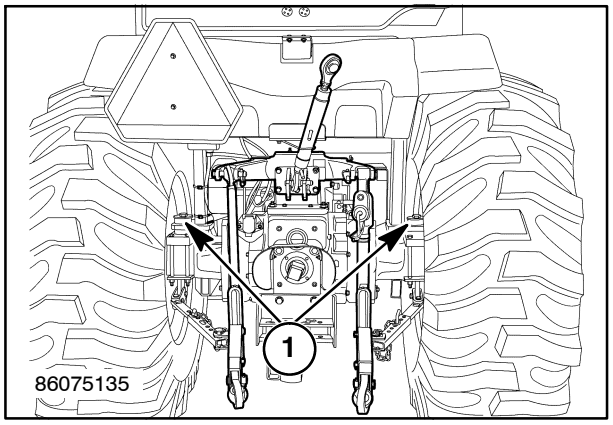
IMPORTANT: *Use caution when sitting the cab on the tractor. Make sure all linkages, cables, and hoses are clear of getting trapped under the cab.*

2. Slowly lower the cab onto the tractor.



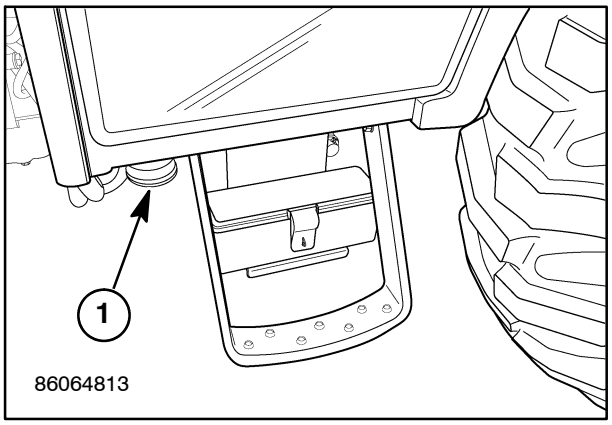
140

3. Install the right and left rear mounting bolts and washers, 1.



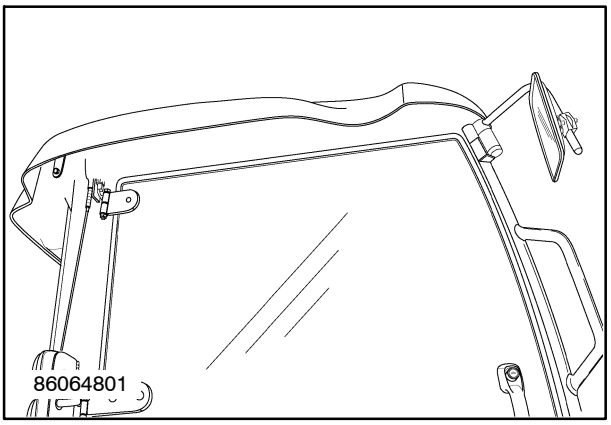
141

4. Install the right and left front cab mounting bolts and washers, 1.



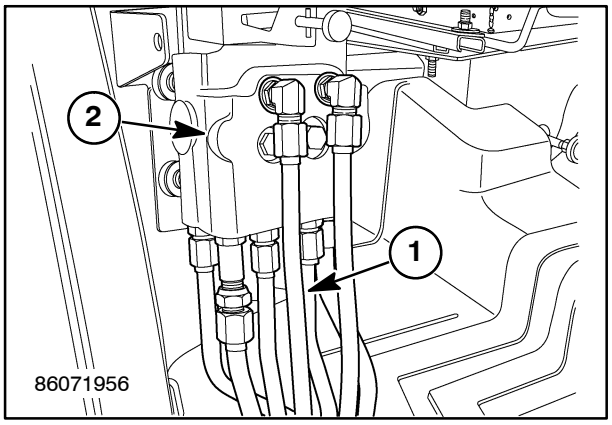
142

5. Install both cab access doors as described earlier in this section.



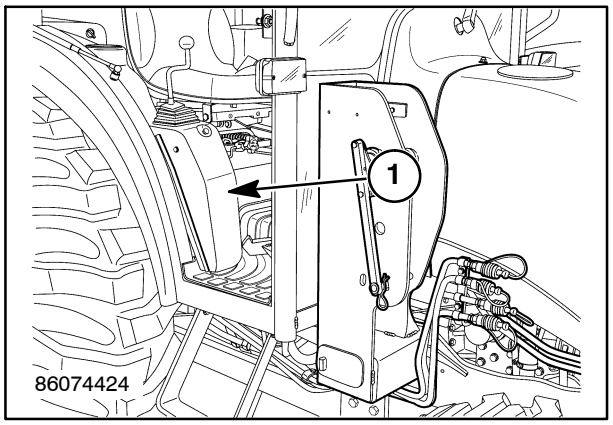
143

6. If equipped connect all hydraulic tubing, 1, to the remote valve, 2.



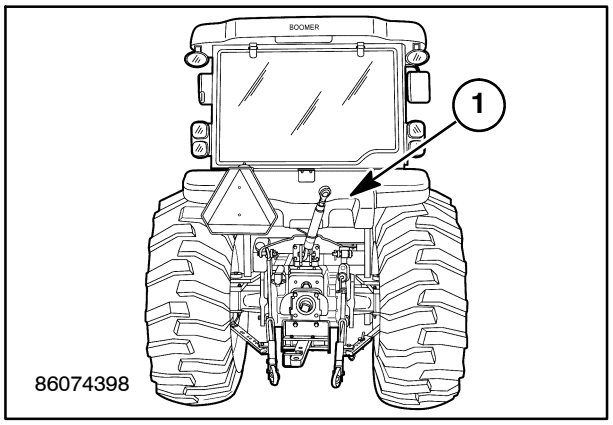
144

7. Install the remote loader control valve cover, 1.



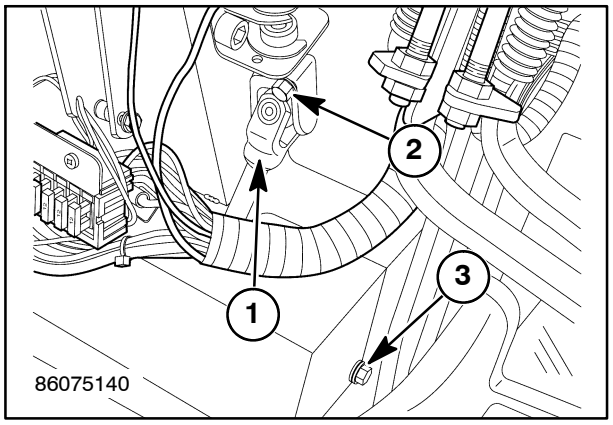
145

8. Install the fuel tank, 1, as described earlier in this section.



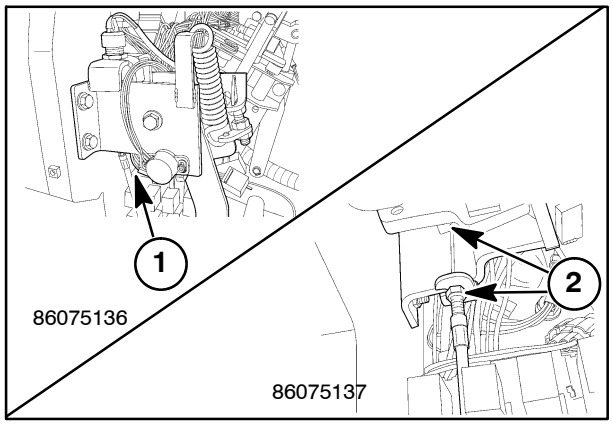
146

9. Connect shifter linkage, 1, to the shifter lever using bolt, 2.
10. Install the access cover, 3, for the EHSS solenoid valve.



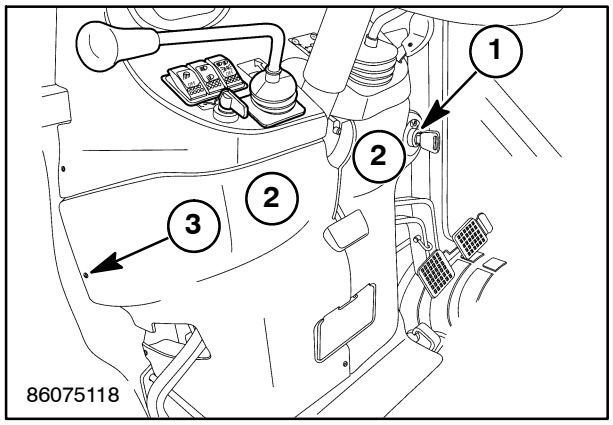
147

11. Connect the clutch/inching pedal cable, 1, or clutch rod (not shown). Connect the cable at, 2.



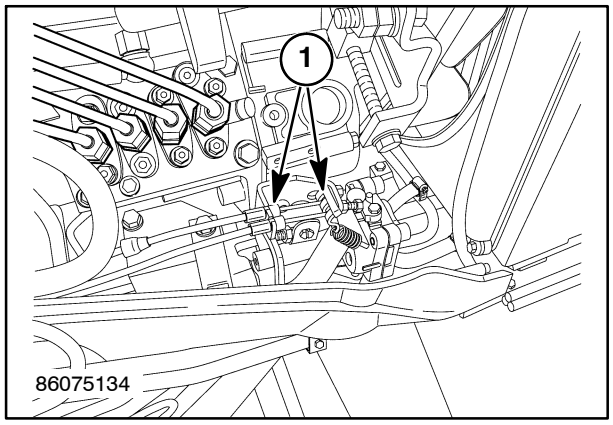
148

12. Connect the key switch, 1. Install the lower panels, 2, using screws, 3.



149

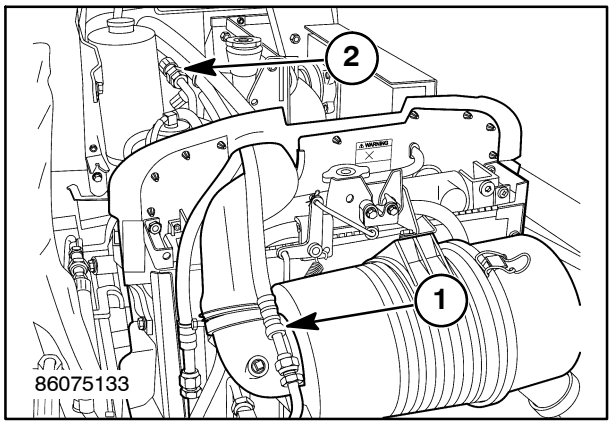
13. Connect the throttle cable at, 1.



150

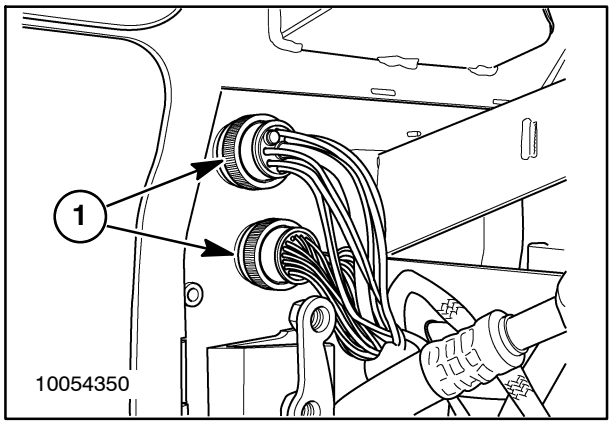
IMPORTANT: *Whenever the A/C system is opened for service, the receiver/dryer must be replaced.*

14. Replace O-rings and connect the high pressure line going to the receiver/dryer, 1.
15. Replace O-rings and connect the low pressure hose going into the A/C compressor, 2.
16. See “charging” the A/C system as described in Section 50 of the repair manual.



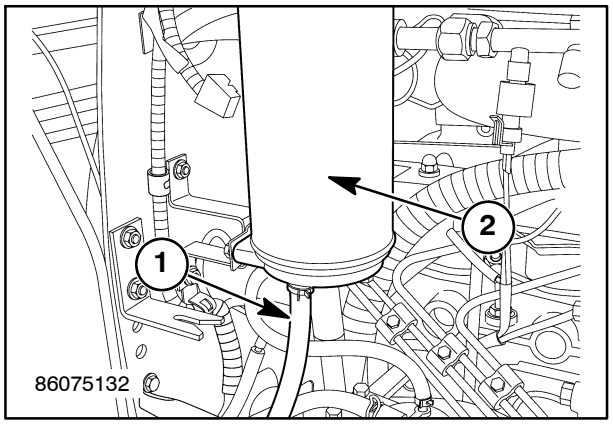
151

17. Connect the electrical harness connectors, 1, at the cab.



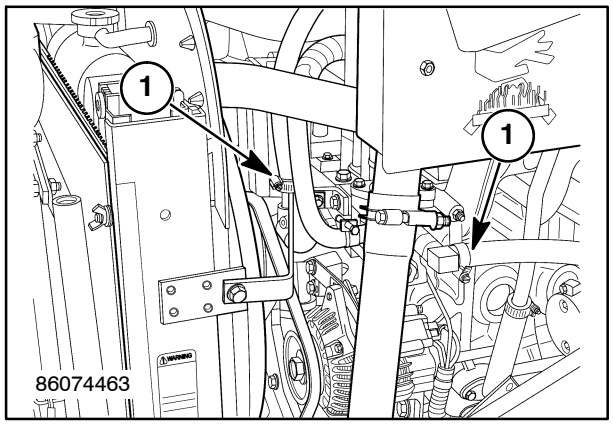
152

18. Connect the power steering hose, 1, to reservoir, 2.
19. Fill the power steering fluid reservoir.



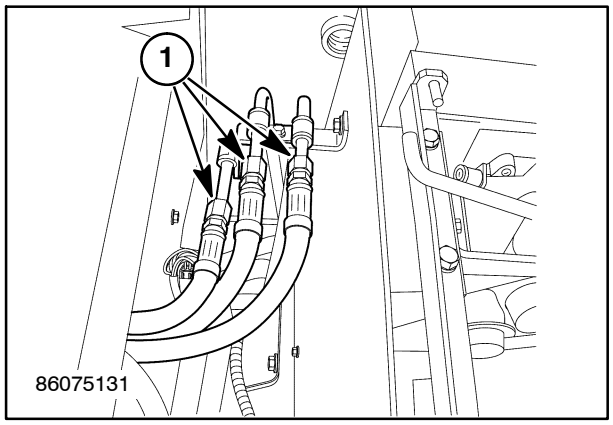
153

20. Connect the water pump hoses, 1, to the engine.
21. Fill the engine with coolant and bleed the air from the system.



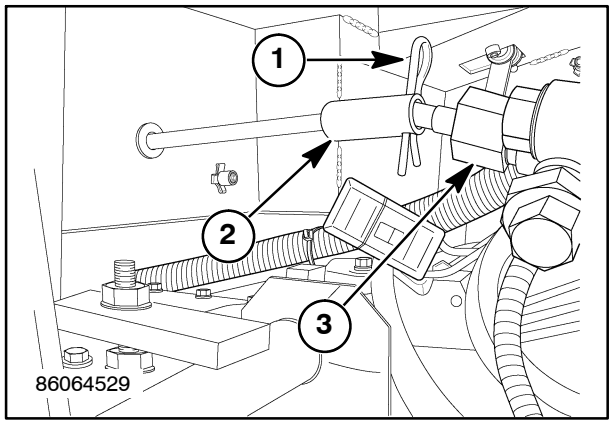
154

22. Connect the power steering hoses, 1, that are located under the rear hood panel.



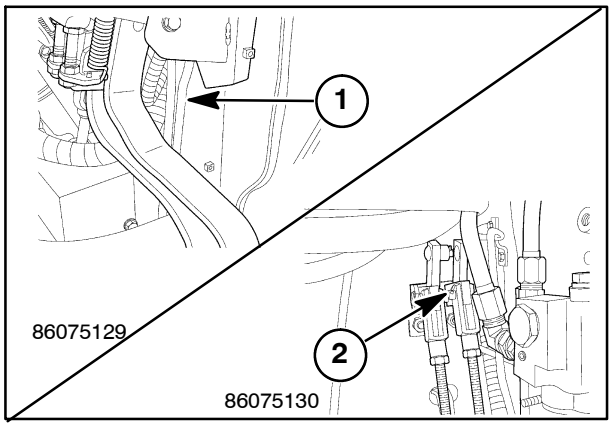
155

23. Install the hair pin, 1, to connect the rod, 2, to the HPL Drop Rate Control Valve, 3.
24. Connect the harness that goes into the cab behind the seat on the right hand side. Harness feeds the following:
    - Seat Switch
    - Hi/Low Speed Control switch
    - HST Cruise Control



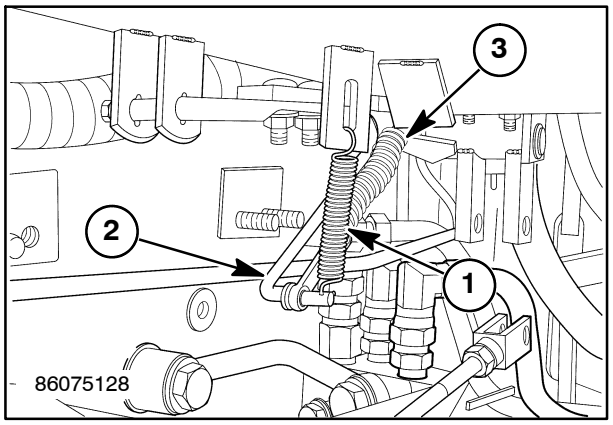
156

25. Connect the brake pedal linkage, 1, from under the cab at, 2.



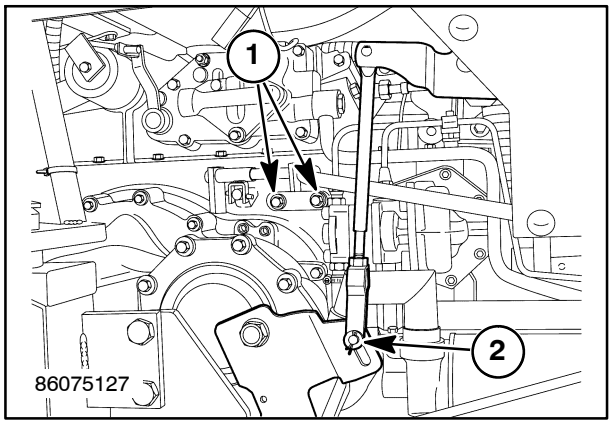
157

26. Connect the spring, 1, to the foot throttle linkage, 2. Install foot throttle cable to the cable clamp from under the cab at, 3.



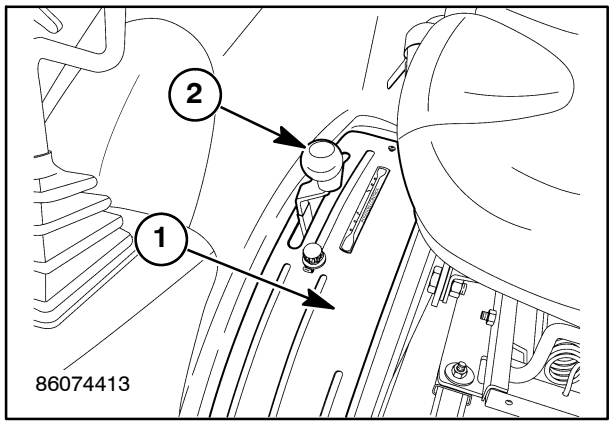
158

27. Install the differential lock lever at, 1.
28. Connect the parking brake at, 2.



159

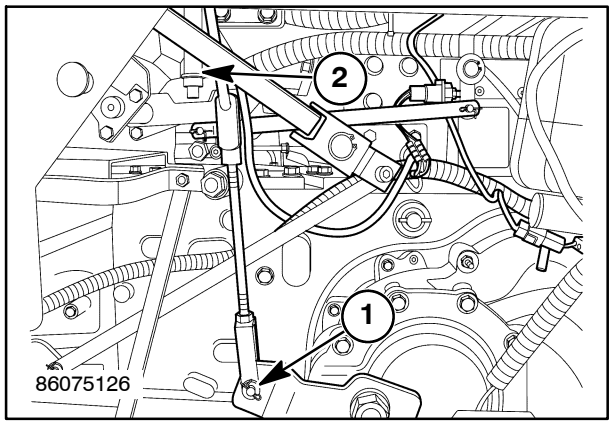
29. Install the right side control pod, 1
30. Attach the handle, 2, to the three point hitch lever.



160

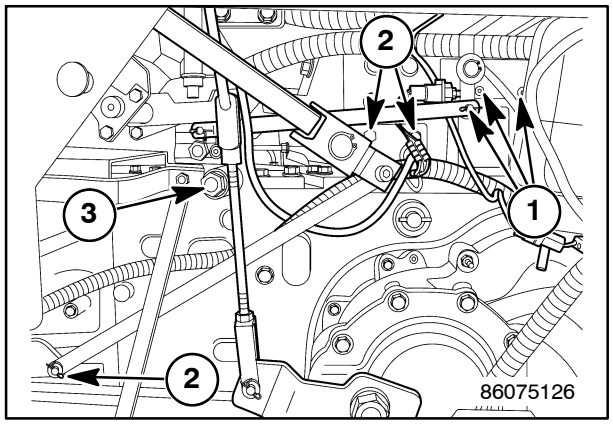
31. Connect the parking brake at, 1. Mount the parking brake safety switch, 2.

NOTE: *Refer to section 55 in the repair manual for parking brake safety switch adjustment.*



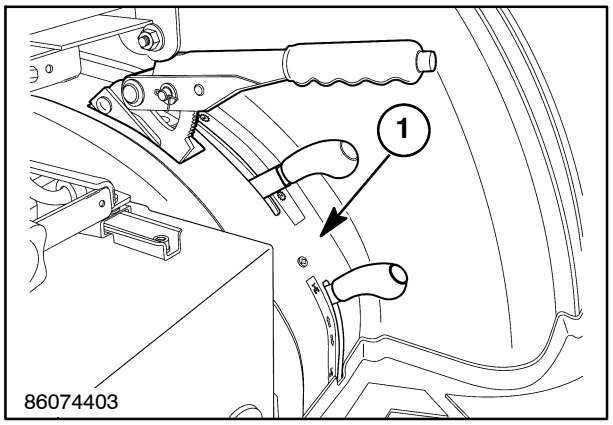
161

32. Connect the following linkages in this order.
    - PTO linkage at, 1.
    - Range linkage at, 2.
    - FWD linkage at, 3.



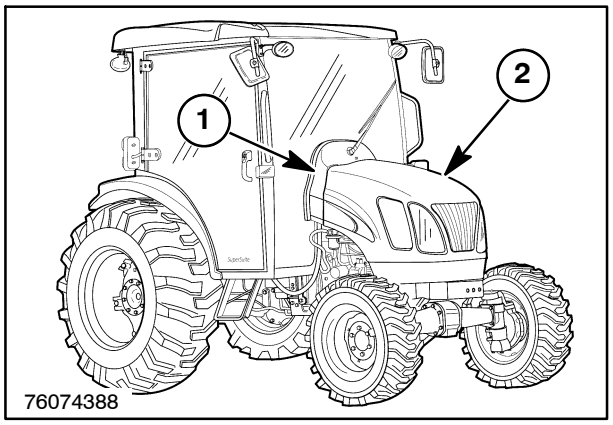
162

33. Install the left side control pod, 1. Attach the handles to the FWD, Range, and PTO levers.



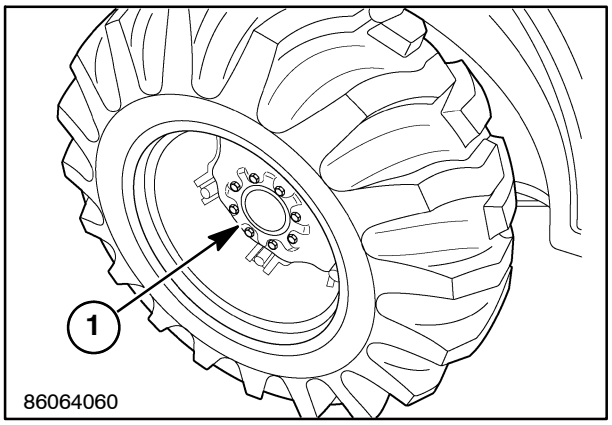
163

34. Install the rear hood panel, 1, and the hood, 2, as described earlier in this section.



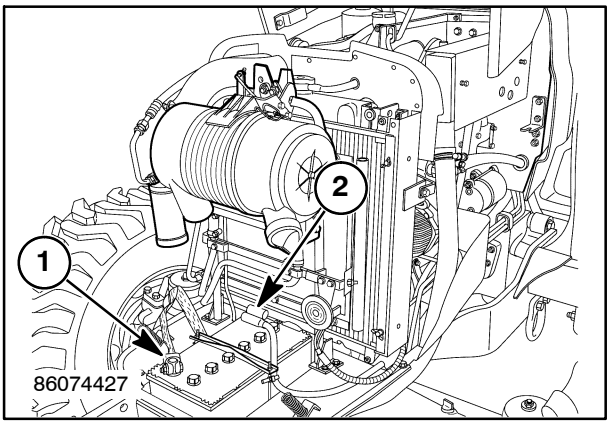
164

35. Install the rear wheels, 1, to the tractor. Torque the lug bolts to 129 Nm (95 ft lbs.)
36. Remove the jack stands from under the rear axle, not shown.



165

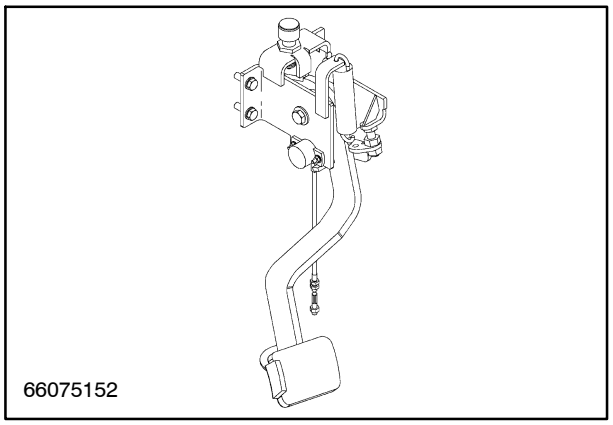
37. Connect the negative (–) battery cable, 1, and the (+) battery cable, 2, to the battery.



166

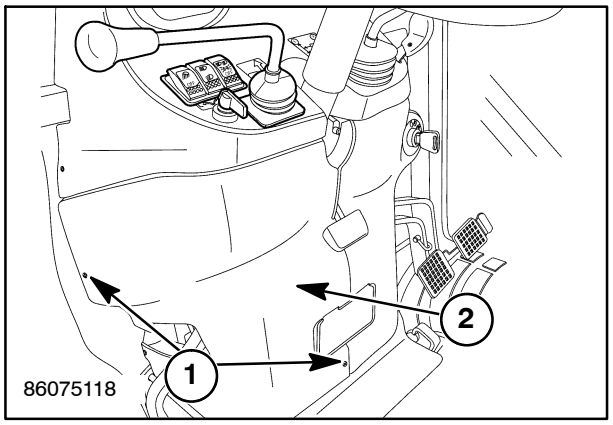
CLUTCH/INCHING PEDAL (EHSS)

Removal



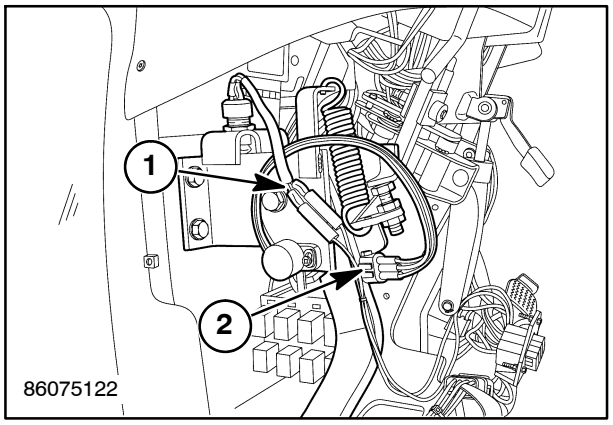
167

1. Remove screws, 1, from the lower dash panel, 2. Remove panel.



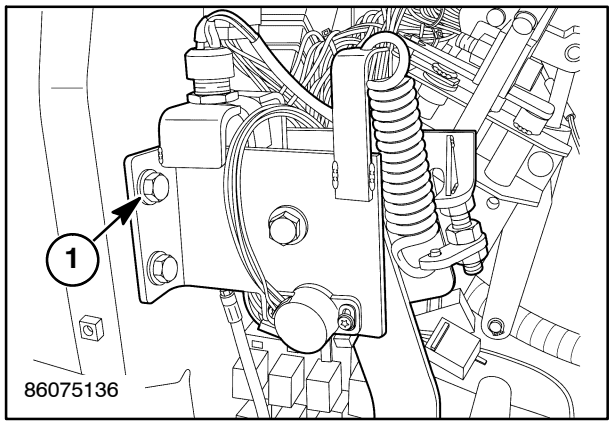
168

2. Disconnect the clutch safety switch, 1, and the potentiometer cable, 2.



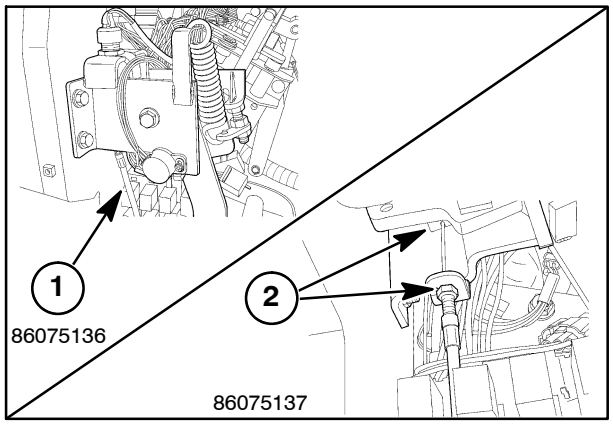
169

3. Remove the four bolts, 1, that hold the pedal assembly to the fire wall.



170

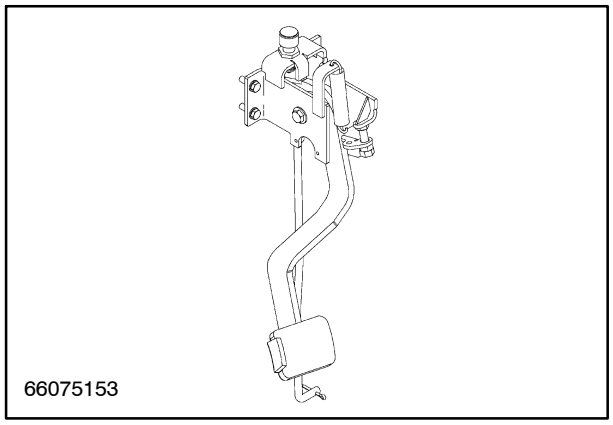
4. Disconnect the dump cable, 1, from the pedal assembly at, 2.
5. Remove the pedal assembly.
6. Inspect all pivot points for excessive wear.



171

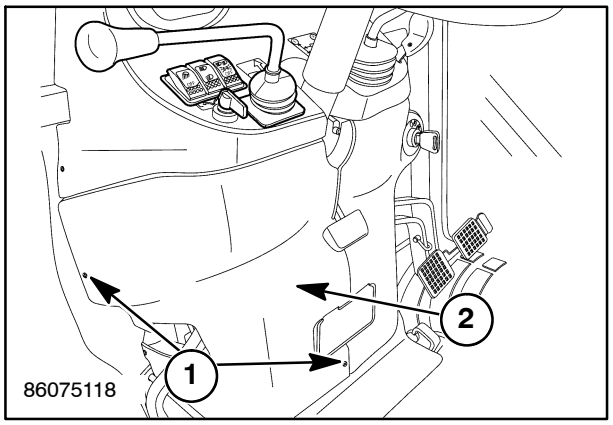
CLUTCH/INCHING PEDAL (SSS)

Removal



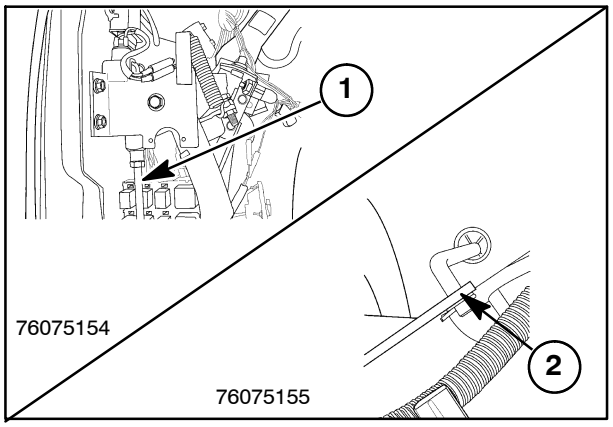
172

1. Remove screws, 1, from the lower dash panel, 2. Remove panel.



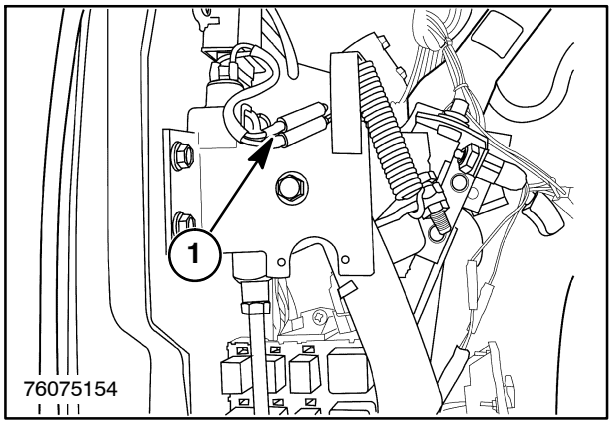
173

2. Disconnect the clutch pedal linkage, 1, from under the cab at, 2.



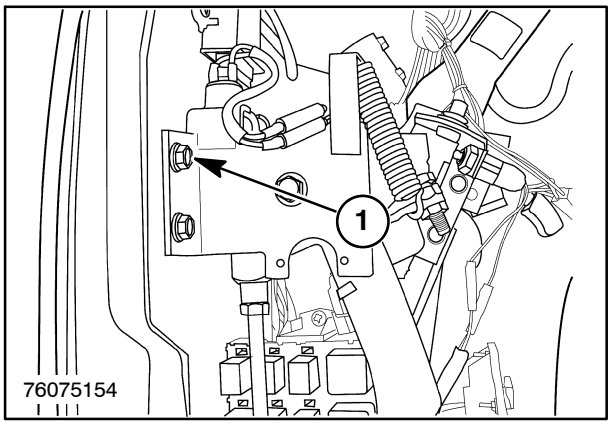
174

3. Disconnect the clutch safety switch, 1.



175

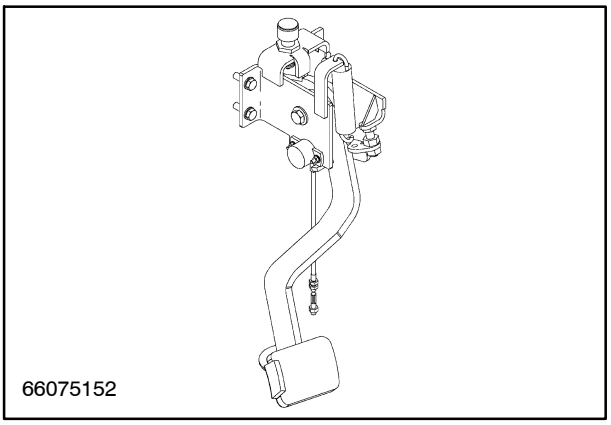
4. Remove the four bolts, 1, that hold the pedal assembly to the fire wall
5. Remove the pedal assembly.
6. Inspect all pivot points for excessive wear.



176

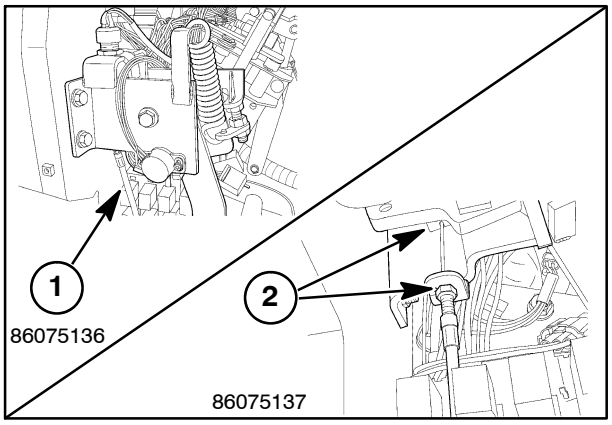
CLUTCH/INCHING PEDAL (EHSS)

Installation



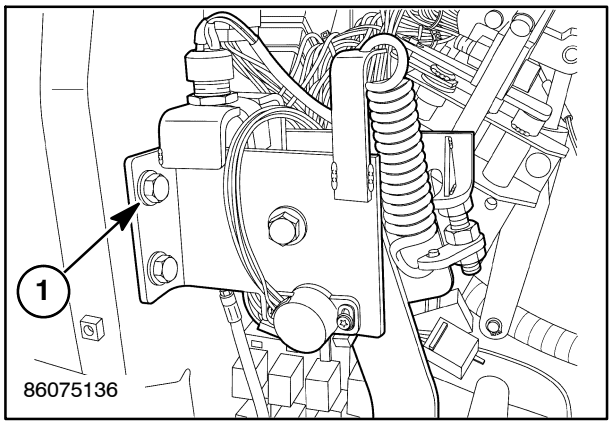
177

1. Connect the dump cable, 1, to the pedal assembly at, 2.



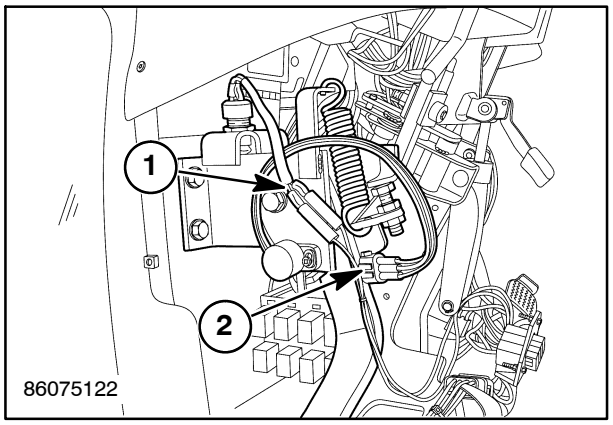
178

2. Install the four bolts, 1, that hold the pedal assembly to the fire wall.



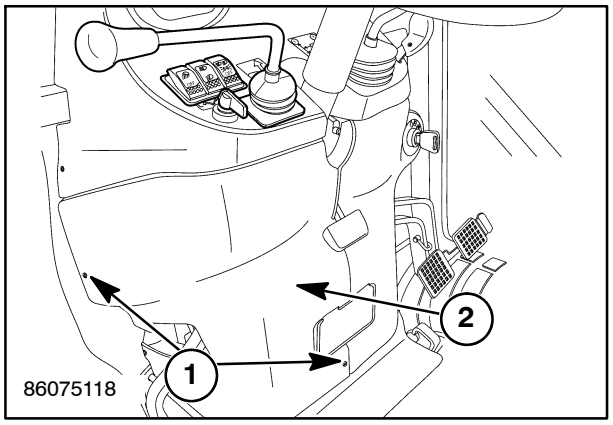
179

3. Connect the clutch safety switch, 1, and the potentiometer cable, 2.
4. Check clutch cable adjustment. Refer to Clutch/ Inching Pedal And Cable Adjustments in this Section 90.



180

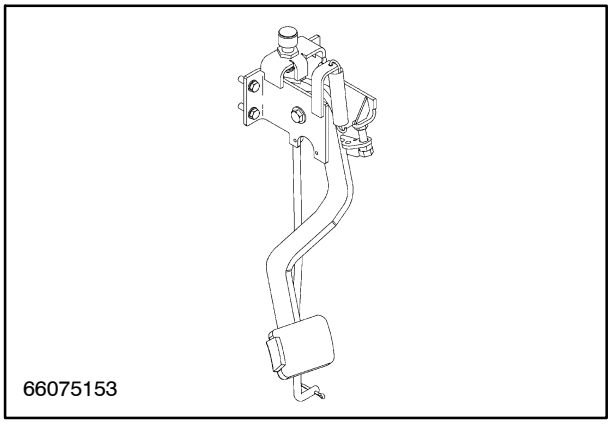
5. Install the lower dash panel, 1. Secure with screws, 2.



181

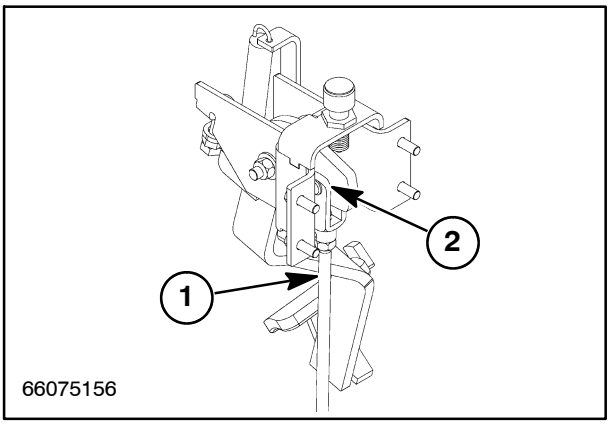
CLUTCH/INCHING PEDAL (SSS)

Installation



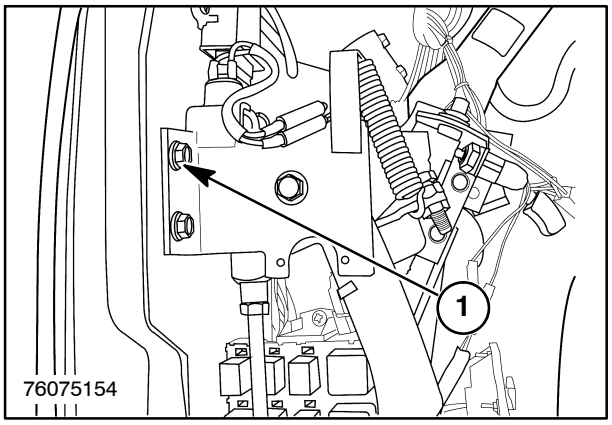
182

1. Connect clutch linkage rod, 1, to pedal assembly at, 2.



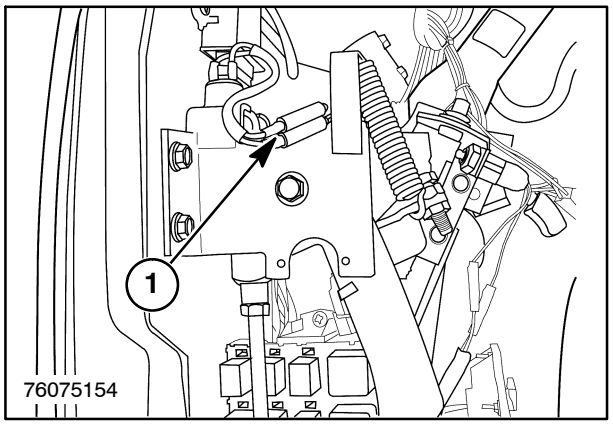
183

2. Install the four bolts, 1, that hold the pedal assembly to the fire wall



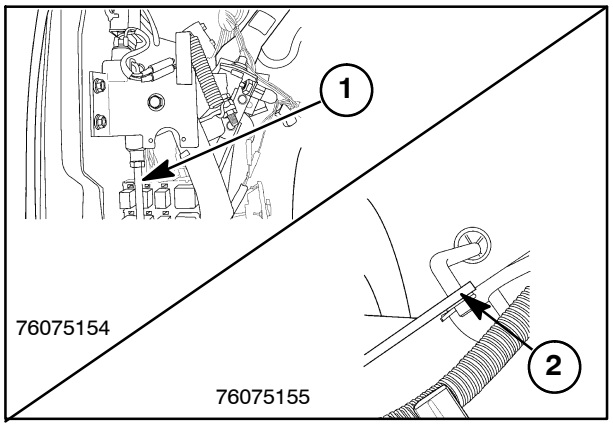
184

3. Connect the clutch safety switch, 1.



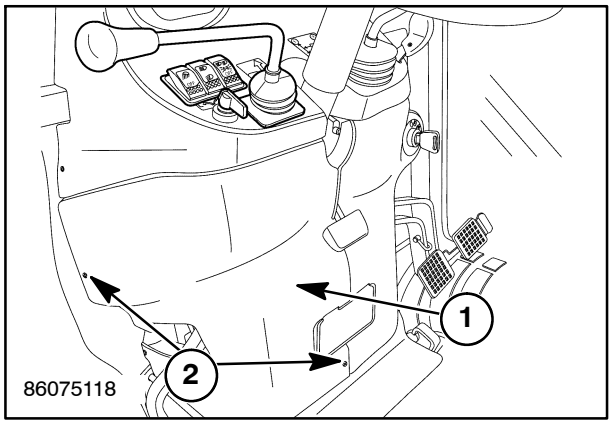
185

4. Connect the clutch pedal linkage, 1, from under the cab at, 2.
5. Adjust the clutch pedal. Refer to Clutch Pedal (SSS) Adjustment in this Section 90.



186

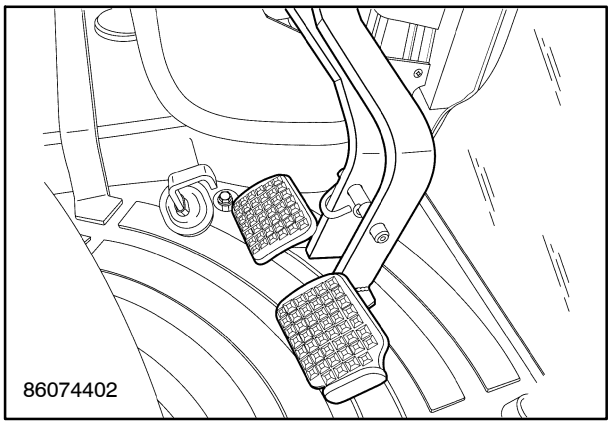
6. Install the lower dash panel, 1. Secure with screws, 2.



187

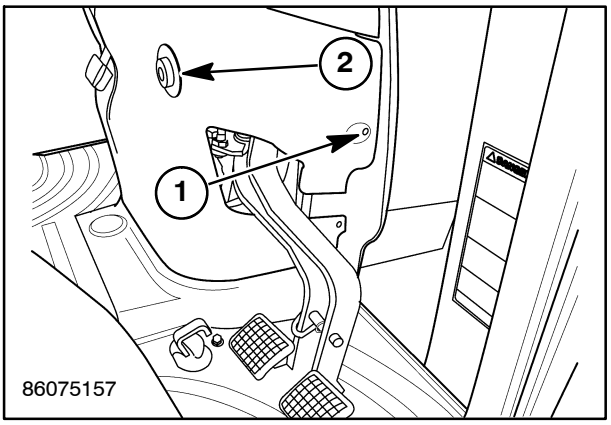
BRAKE PEDAL

Removal



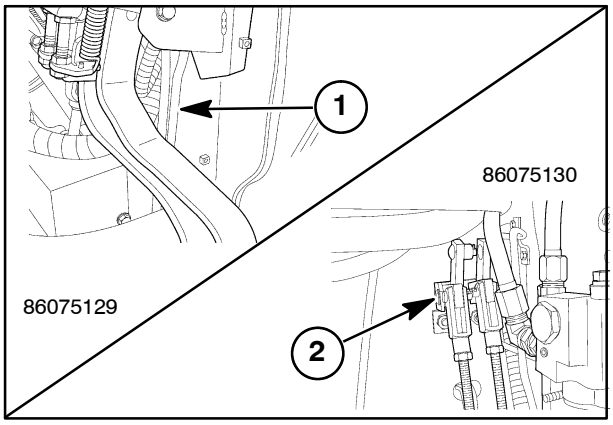
188

1. Remove screws, 1, from the lower dash panel. Disconnect the key switch, 2. Remove panel



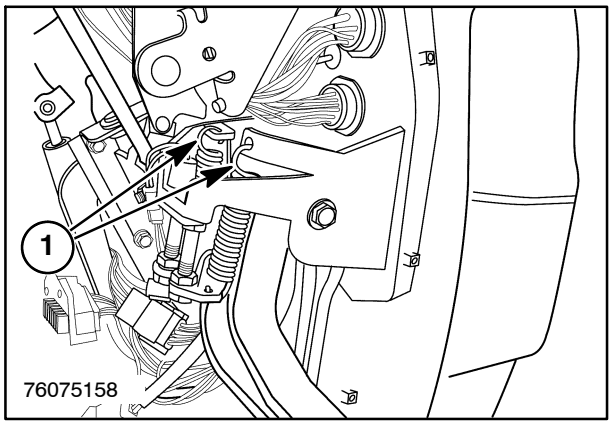
189

2. Disconnect the brake pedal linkages, 1, from under the cab at, 2.



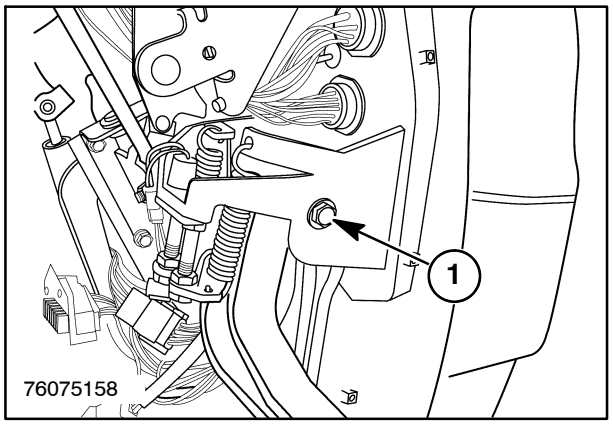
190

3. Remove both brake pedal springs, 1.



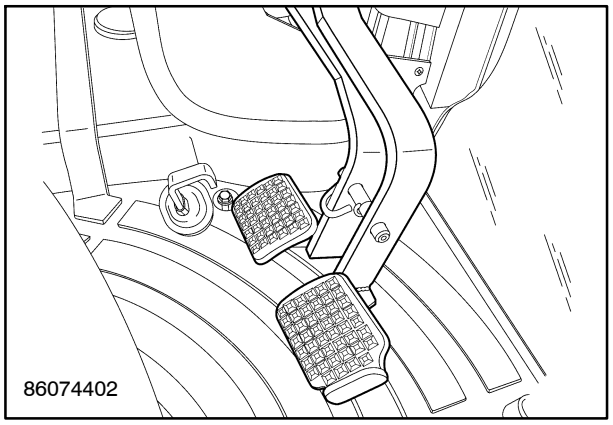
191

4. Remove the brake pedal mounting bolt, 1.
5. Remove the pedals.
6. Inspect all pivot points for excessive wear.



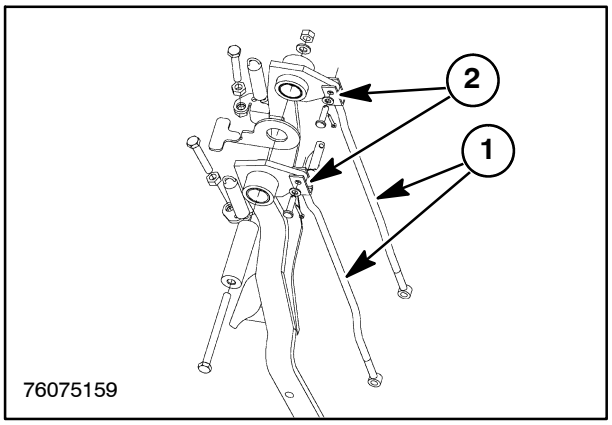
192

Installation



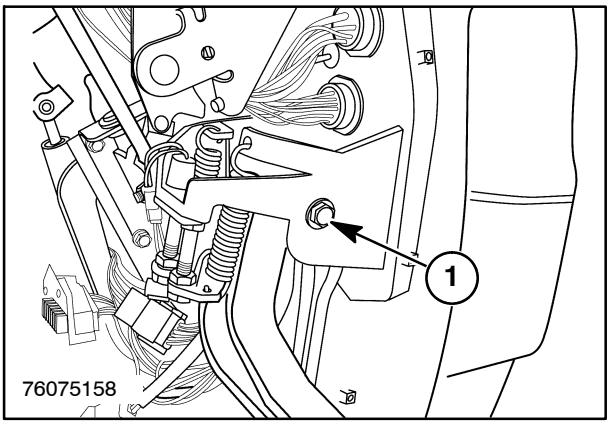
193

1. Connect the brake pedal linkage, 1, to the pedal assembly at, 2.



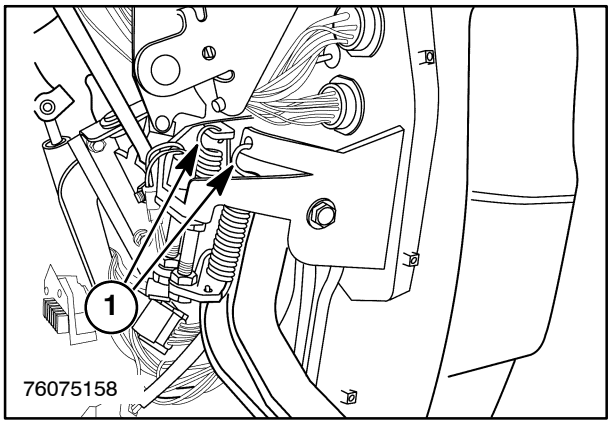
194

2. Install the brake pedal mounting bolt, 1.



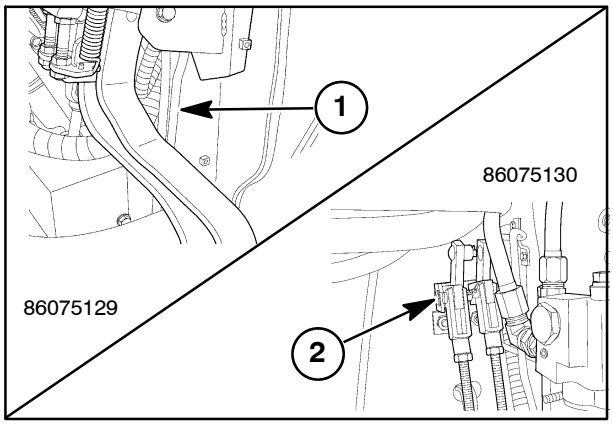
195

3. Connect both brake pedal springs, 1.



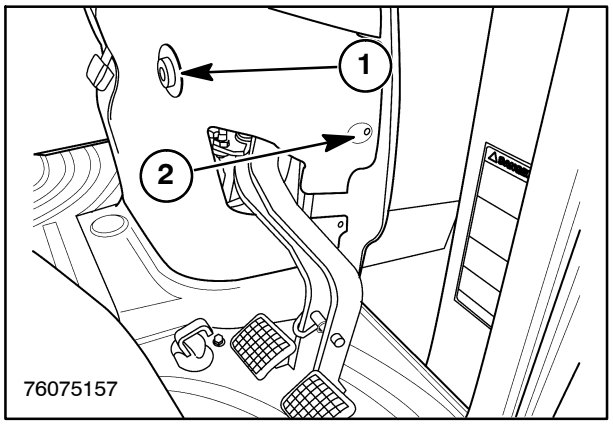
196

4. Connect the brake pedal linkages, 1, from under the cab at, 2.



197

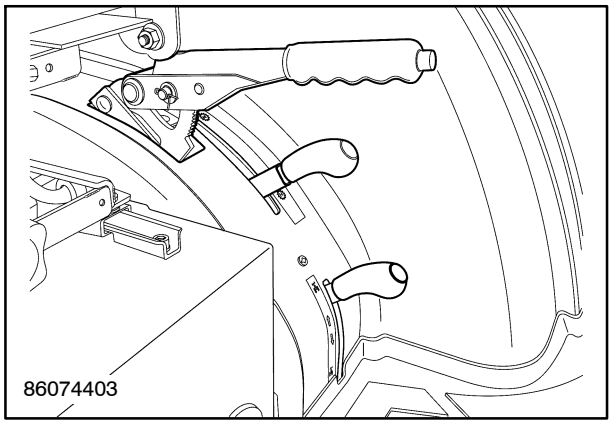
5. Connect the key switch, 1 to the lower dash panel. Install the panel in place and secure with screws, 2.
6. Check pedal adjustment. Refer to Brake Adjustment in this Section 90.



198

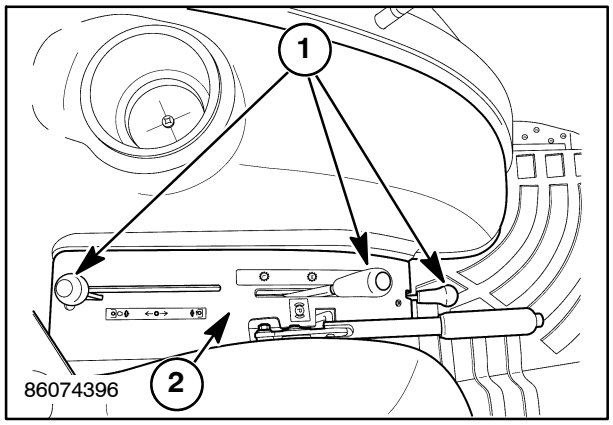
PARK BRAKE

Removal



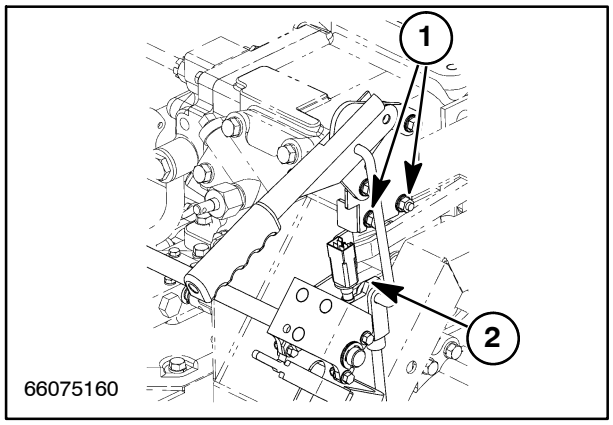
199

1. Remove the PTO, Range, and FWD handles, 1. Remove the two bolts, or screws securing the LH pod, 2.



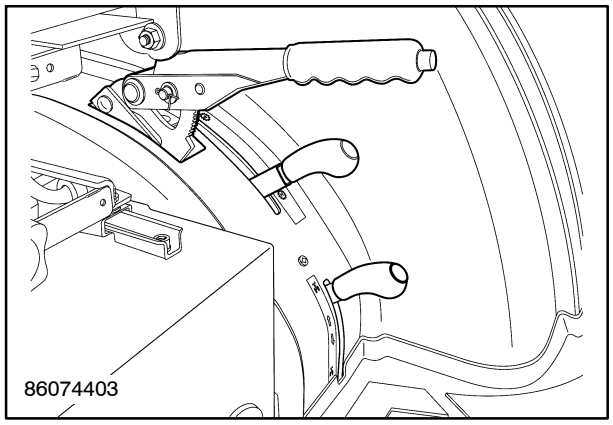
200

2. From under the cab, loosen the two flange nuts, 1, that secure the parking brake mounting bracket. Remove the cotter pin connecting the linkages at, 2. Disconnect the linkages.
3. Remove the park brake and the pod simultaneously.



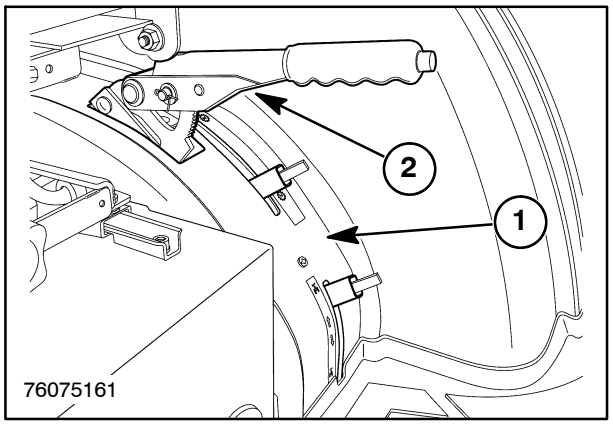
201

Installation



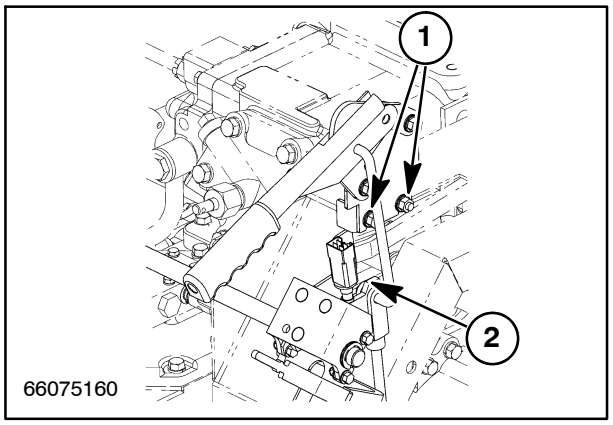
202

1. Position the pod, 1, and the park brake assembly, 2, together in their mounting and feed them through the cab.



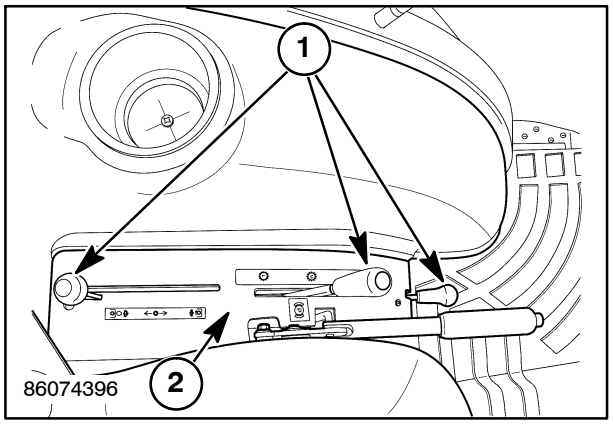
203

2. From under the cab, tighten the two flange nuts, 1, that secure the park brake mounting bracket. Connect the linkages at, 2. Install the cotter pin.



204

3. Attach the PTO, Range, and FWD handles, 1. Tighten the two bolts, or screws securing the LH pod, 2.
4. Check Park Brake Adjustment in this Section 90.

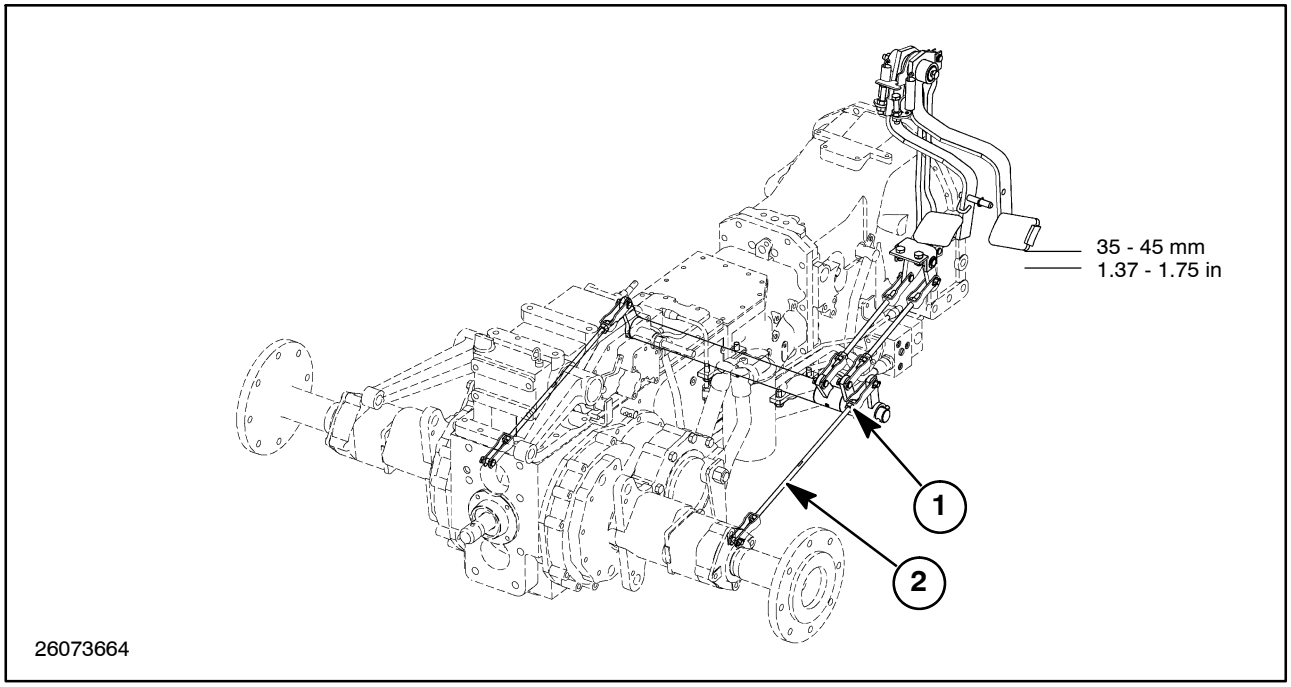


205

BRAKE PEDAL ADJUSTMENT

Whenever brake pedal travel becomes excessive, or if the travel of one pedal is unequal to that of the other, each pedal should be adjusted.

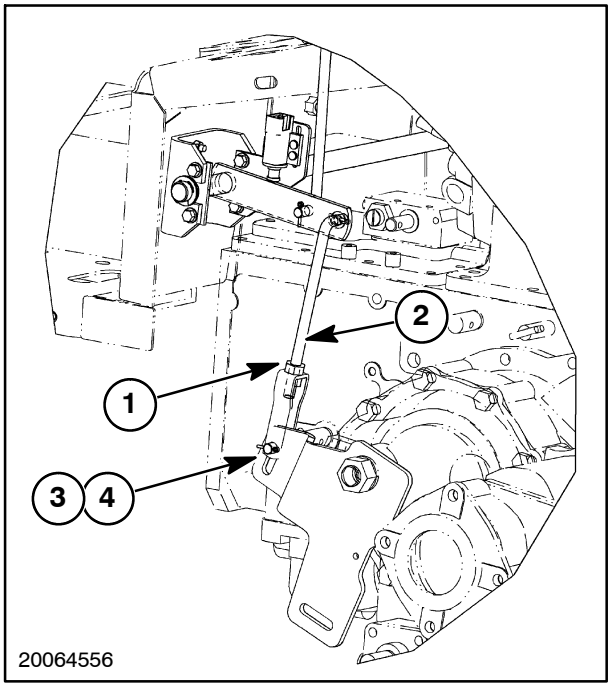
1. Loosen the locknut, 1, and rotate the brake rod, 2, until there is 35 - 45 mm (1.37 - 1.75 in) of pedal free play. Lengthening the rod increases free play. Shortening the rod decreases free play.
2. Test drive the tractor to make sure the braking action of both rear wheels is equal. Readjust as necessary.



206

Park Brake Adjustment

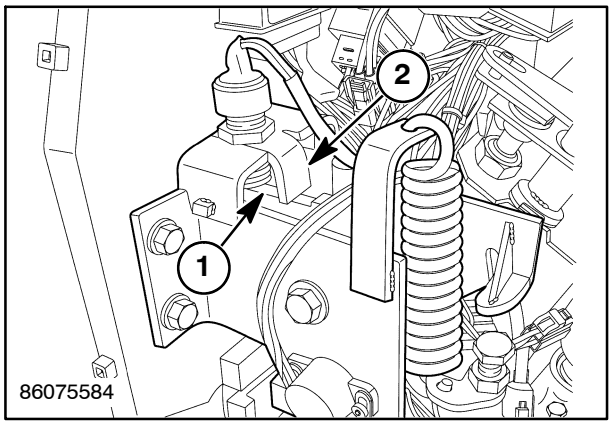
1. Adjust left and right brake pedal linkages evenly.
2. Loosen jam nut, 1, and adjust the left and right park brake link assemblies, 2, so that the clevis pin, 3, is at the top of the slot in the brake lever bracket, 4. This adjustment is done with the park brake not applied.
3. As soon as the park brake hand handle is pulled upwards, the brake lever brackets should start to rotate.
4. Make sure both park brake linkages are equally adjusted.
5. Tighten jam nut, 1, on linkage.



207

CLUTCH/INCHING PEDAL TRAVEL STOP

The clutch pedal, 1, has a fixed stop, 2, to prevent damage to the clutch components due to over travel.

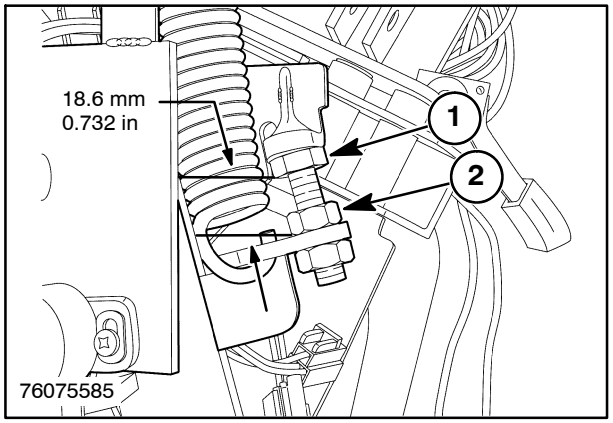


208

CLUTCH/INCHING PEDAL AND CABLE (EHSS)

Adjustments

1. Adjust the clutch pedal stop bolt, 1, to a height of 18.6 mm (0.732 in) from the underside of the bolt head to the surface of pedal tab.
2. Loosen jam nut, 2, and increase bolt length to decrease pedal travel, shorten bolt length to increase pedal travel. Tighten jam nut, 2, after adjustment is complete.



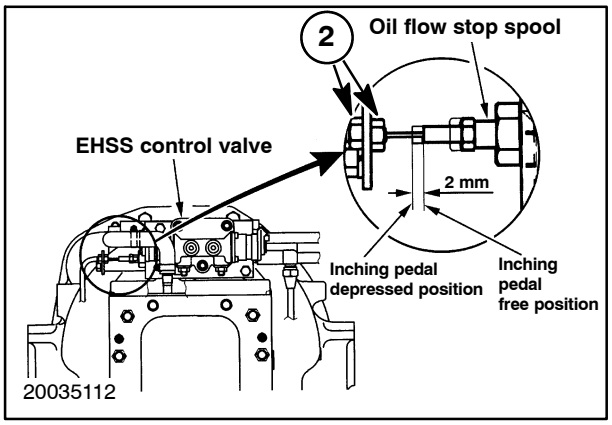
209

The inching pedal controls the dump valve, via a control cable, for the hydraulic shuttle shift transmission. When the inching pedal is depressed the dump valve releases all the hydraulic pressure to the transmission hydraulic clutch packs. When the hydraulic pressure is released the forward or reverse drive of the tractor is interrupted.

Adjustment Procedure

NOTE: *Check and adjust maximum inching pedal travel before adjusting dump valve spool travel.*

1. Slowly depress the inching pedal to full travel.
2. Remove left steering column side panel and EHSS solenoid valve cover to gain access to measure dump valve spool travel.
3. Depress the inching pedal fully and hold
4. Full inching pedal travel equates to a dump valve total spool travel of 2 mm + 0.25 (0.080 in + 0.010).

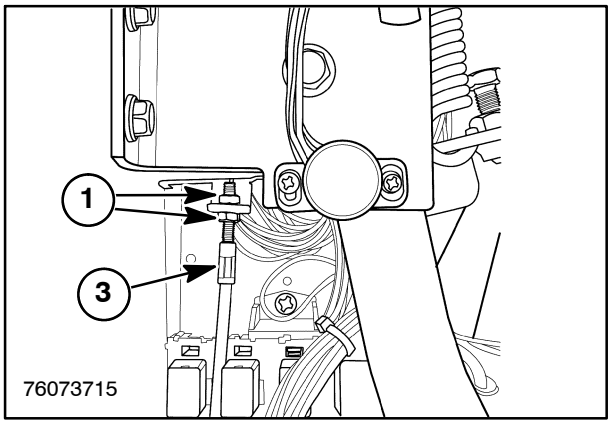


210

5. If required, adjust the cable by loosening lock nuts, 1, on the upper end and nuts, 2, (Figure 210) on the valve end of the cable. Rotate cable at adjuster flat, 3, to lengthen or shorten the cable as required until the specified amount of cable travel is achieved.

NOTE: *If the cable travel is **less** than the specified amount, the dump valve will not be pulled outward enough to stop the oil flow to the shuttle clutch with the inching pedal fully depressed, causing hard shifting of the synchronized (1-4) gears.*

*If the cable travel is **more** than the specified amount, damage to the cable assembly may occur.*

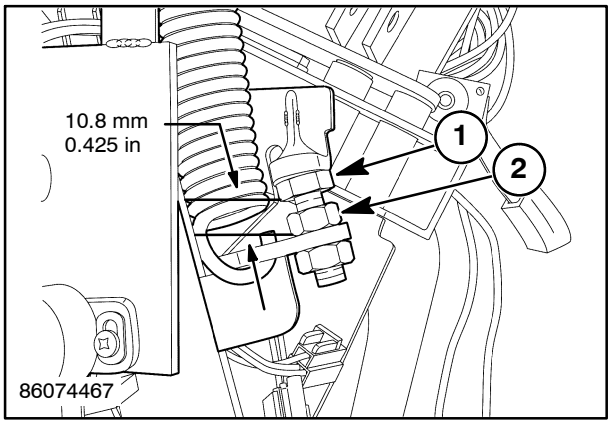


211

CLUTCH PEDAL (SSS)

Adjustments

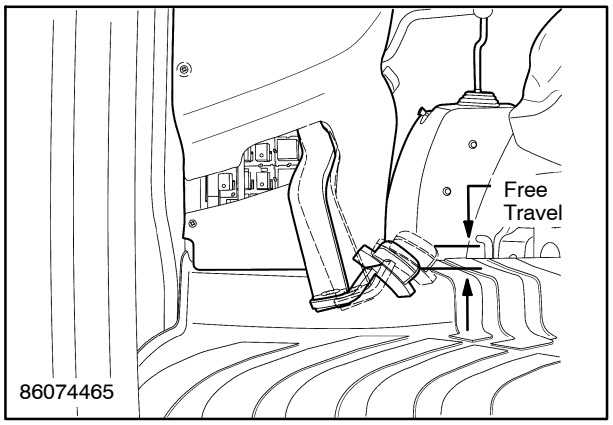
1. Adjust the clutch pedal stop bolt, 1, to a height of 10.8 mm (0.425 in) from the underside of the bolt head to the surface of pedal tab.
2. Loosen jam nut, 2, and increase bolt length to decrease pedal travel, shorten bolt length to increase pedal travel. Tighten jam nut, 2, after adjustment is complete.



212

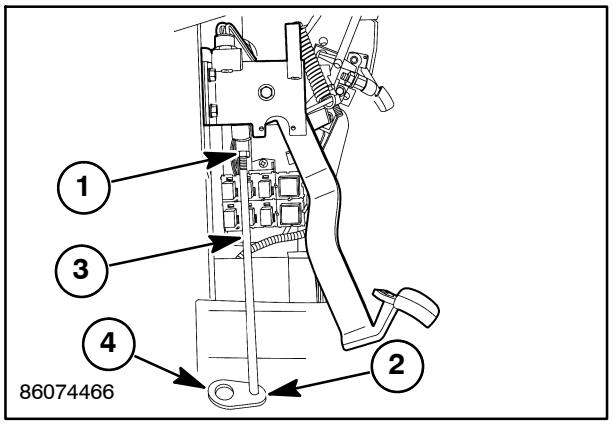
NOTE: *Check clutch pedal free travel after every 50 hours of operation.*

3. Check and adjust the clutch pedal free travel, if necessary. Free travel should be maintained at 19 ± 5 mm (3/4 ± 3/16 in).



213

4. To adjust the clutch pedal loosen jam nut, 1.
5. Remove cotter pin, 2, and disconnect rod, 3, from the clutch shaft end plate, 4. Lengthen rod, 3, to decrease pedal free travel, shorten rod to increase pedal free travel.



214