SECTION 1
GENERAL INFORMATION

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INTRODUCTION

This service manual provides the technical information needed to properly service and maintain the Models L565, LX565, and LX665 skid-steer loaders. Use it in conjunction with the operator's manual which is supplied with the loader. Keep both manuals available for ready reference.

The L_ _ _ designates a factory standard built unit.

The LX_ _ _ designates a factory deluxe built unit. Options factory installed include work lights, taillights, and auxiliary boom hydraulics.

The L565, LX565, and LX665 have many similarities with the major differences being engine horsepower and lifting capacity.

Whenever working on New Holland equipment, left and right sides of the machine are determined by standing behind the unit, looking in the direction of travel.

The easiest and least time-consuming removal, disassembly, and reassembly procedures are detailed in the manual. Modifying these procedures is not recommended.

New Holland skid-steer loaders are designed with emphasis on safety for operator protection. However, careless and negligent operation can still result in serious injury to persons or damage to property. Be sure to read and follow all safety instructions in this manual.

Your New Holland dealer is interested in your obtaining the most from your investment and will be glad to answer any questions you may have about your loader. When major service is required, your dealer's staff of trained service technicians is ready to serve you.

When in need of parts, always order genuine New Holland service parts from your New Holland dealer. Be prepared to give your dealer the model and serial number of the engine and loader (the location of these numbers is described later in this section). Record the serial numbers here.

Loader Model _____

Loader Serial Number _____

Engine Model _____

Engine Serial Number _____

CAUTION: THIS SYMBOL IS USED THROUGHOUT THIS BOOK WHENEVER YOUR OWN PERSONAL SAFETY IS INVOLVED. TAKE TIME TO BE CAREFUL!

ABOUT IMPROVEMENTS

New Holland is continually striving to improve its products. We must, therefore, reserve the right to make improvements or changes when it becomes practical and possible to do so, without incurring any obligation to make changes or additions to the equipment sold previously.

ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

PRECAUTIONARY STATEMENTS

PERSONAL SAFETY

Throughout this manual and on machine decals, you will find precautionary statements (“CAUTION”, “WARNING”, and “DANGER”) 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.

CAUTION: THE WORD “CAUTION” IS USED WHERE A SAFE BEHAVIORAL PRACTICE ACCORDING TO OPERATING AND MAINTENANCE INSTRUCTIONS AND COMMON SAFETY PRACTICES WILL PROTECT THE OPERATOR AND OTHERS FROM ACCIDENT INVOLVEMENT.

WARNING: THE WORD “WARNING” DENOTES A POTENTIAL OR HIDDEN HAZARD WHICH HAS A POTENTIAL FOR SERIOUS INJURY. IT IS USED TO WARN OPERATORS AND OTHERS TO EXERCISE EVERY APPROPRIATE MEANS TO AVOID A SURPRISE INVOLVEMENT WITH MACHINERY.

DANGER: THE WORD “DANGER” DENOTES A FORBIDDEN PRACTICE IN CONNECTION WITH A SERIOUS HAZARD.

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

MACHINE SAFETY

Additional precautionary statements (“ATTENTION” and “IMPORTANT”) are followed by specific instructions. These statements are intended for machine safety.

ATTENTION: The word “ATTENTION” is used to warn the operator of potential machine damage if a certain procedure is not followed.

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.

SAFETY PRECAUTION INFORMATION

UNSAFE OPERATING PRACTICES AND IMPROPER USE OF THE SKID-STEER LOADER AND ITS ATTACHMENTS ON THE PART OF THE OPERATOR CAN RESULT IN INJURIES. OBSERVE THE FOLLOWING SAFETY PRECAUTIONS AT ALL TIMES:

1. **FOR SERVICING, THE LOADER SHOULD BE ON LEVEL TERRAIN, ENGINE STOPPED WITH THE WHEELS BLOCKED OR THE ENTIRE LOADER SOLIDLY SUPPORTED WITH THE WHEELS OFF THE GROUND BEFORE SERVICING ANY COMPONENT OF THE DRIVETRAIN.**
2. **FOR SERVICING UNDER THE OPERATOR'S SEAT, RAISE THE SEAT AND PAN ASSEMBLY TO THE RAISED LATCHED POSITION AND SECURELY LATCH.**
3. **DO NOT OPERATE THE LOADER UNLESS THE SEAT IS LATCHED IN THE OPERATE POSITION.**
4. **DO NOT SERVICE THE LOADER WITH A RAISED BOOM UNLESS THE BOOM IS RESTING ON THE BOOM LOCK PINS.**
5. **DO NOT SERVICE THE LOADER WITH THE ENGINE RUNNING UNLESS THE LOADER IS PROPERLY AND SECURELY SUPPORTED WITH ALL FOUR WHEELS OFF THE GROUND.**
6. **USE CAUTION WHEN SERVICING THE UNIT AROUND MOVING PARTS.**
7. **DO NOT TILT THE BOOM AND CAB WITHOUT PROPER INSTRUCTION.**
8. **DO NOT TILT THE BOOM AND CAB WITHOUT USING THE PROPER CAB TILTING TOOL.**
9. **REINSTALL ALL SHIELDS REMOVED FOR SERVICE.**
10. **NEVER LOOSEN ANY HYDRAULIC CONNECTIONS BEFORE RELIEVING THE PRESSURE IN THE HYDRAULIC SYSTEM.**
11. **WEAR EYE PROTECTION SUCH AS GOGGLES, ETC.**
12. **WEAR EAR PROTECTION SUCH AS EARPLUGS, ETC. WHEN YOU FEEL THE NOISE LEVEL IS UNCOMFORTABLE.**
13. **IF ANY SERVICING OR ADJUSTMENTS REQUIRE THE BATTERY TO BE DISCONNECTED, DISCONNECT THE (-) NEGATIVE GROUND CABLE.**
14. **WHEN SERVICING ELECTRICAL COMPONENTS, DISCONNECT THE (-) NEGATIVE GROUND CABLE.**
15. **IF THE ELECTRONIC INSTRUMENT CLUSTER (EIC) REQUIRES REMOVAL FROM THE DASH AREA OR THE SKID-STEER LOADER, DISCONNECT THE (-) NEGATIVE GROUND BATTERY CABLE. THIS WILL SHUT OFF POWER TO THE EIC AND PREVENT DAMAGE TO THE EIC BOARD OR BLOWING THE 5-AMP FUSES IF THE BOARD IS ACCIDENTALLY GROUNDED.**
16. **IF WELDING IS REQUIRED ON THE SKID-STEER LOADER, DISCONNECT THE (-) NEGATIVE GROUND CABLE. FAILURE TO DISCONNECT THE BATTERY MAY RESULT IN DAMAGE TO THE EIC (ELECTRONIC INSTRUMENT CLUSTER) MONITORING SYSTEM AND OTHER ELECTRICAL COMPONENTS.**
17. **IF WELDING IS REQUIRED ON AN ATTACHMENT, REMOVE THE ATTACHMENT FROM THE SKID-STEER LOADER.**

18. **GIVE COMPLETE AND UNDIVIDED ATTENTION TO THE JOB AT HAND SO THAT COMPLETE CONTROL OF THE LOADER IS MAINTAINED AT ALL TIMES.**

19. **DRIVE SLOWLY OVER ROUGH GROUND AND ON SLOPES; KEEP ALERT FOR HOLES, DITCHES AND OTHER IRREGULARITIES THAT MAY CAUSE THE LOADER TO OVERTURN.**

20. **AVOID STEEP HILLSIDE OPERATION WHICH COULD CAUSE THE LOADER TO OVERTURN.**

21. **NEVER TRANSPORT A LOADED BUCKET AT FULL HEIGHT. OPERATE THE LOADER WITH THE LOAD AS LOW AS POSSIBLE UNTIL IT BECOMES NECESSARY TO RAISE THE BOOM TO DISCHARGE THE LOAD INTO A TRUCK, CONTAINER, ETC.**

22. **REDUCE SPEED WHEN TURNING SO THERE IS NO DANGER OF THE LOADER OVERTURNING.**

23. **NEVER DRIVE UP OR BACK UP A HILL OR INCLINE WITH A RAISED BOOM OR THE LOADER COULD OVERTURN.**

24. **ALWAYS LOOK BEHIND YOU BEFORE BACKING UP THE LOADER.**

25. **MAINTAIN PROPER TRANSMISSION OIL LEVEL TO PREVENT LOSS OF HYDROSTATIC BRAKING.**

26. **DO NOT ALLOW PASSENGERS TO RIDE ON THE LOADER AT ANY TIME.**

27. **DO NOT ALLOW CHILDREN TO OPERATE THE LOADER OR RIDE ON THE LOADER AT ANY TIME.**

28. **DO NOT ALLOW ANYONE TO OPERATE THE LOADER WITHOUT PROPER INSTRUCTION.**

    OSHA REQUIRES THAT ALL OPERATORS BE INSTRUCTED ON THE PROPER OPERATION OF THE MACHINE BEFORE THEY OPERATE THE UNIT.

29. **DO NOT OPERATE THE LOADER IN ANY POSITION OTHER THAN WHILE IN THE OPERATOR'S SEAT WITH THE SEAT BELT SECURELY FASTENED.**

30. **BEFORE STARTING THE ENGINE, BE SURE THAT ALL OPERATING CONTROLS ARE IN NEUTRAL AND THE PARKING BRAKE IS ENGAGED.**

31. **NEVER OPERATE THE LOADER ENGINE IN A CLOSED BUILDING WITHOUT ADEQUATE VENTILATION.**

32. **REFUEL THE LOADER OUTDOORS WITH THE ENGINE SHUT OFF. REPLACE THE FUEL CAP SECURELY. USE AN APPROVED FUEL CONTAINER. DO NOT SMOKE WHEN HANDLING FUEL. AVOID SPILLING FUEL.**

33. **AFTER OPERATING THE ENGINE, NEVER TOUCH THE MUFFLER, EXHAUST PIPE, ENGINE OR RADIATOR UNTIL THEY HAVE HAD TIME TO COOL.**

34. **DRESS APPROPRIATELY - WEAR RELATIVELY TIGHT-FITTING CLOTHING WHEN OPERATING THE LOADER. LOOSE OR TORN CLOTHING CAN CATCH IN MOVING PARTS OR CONTROLS.**

35. **BEFORE SERVICING THE LOADER, OR ANY OF ITS ATTACHED EQUIPMENT, BE SURE THAT THE ATTACHMENTS ARE LOWERED TO THE GROUND OR THAT THE BOOM ARMS ARE SUPPORTED BY THE BOOM LOCK PINS.**

36. **DO NOT WORK UNDER OVERHANGS, ELECTRIC WIRES, OR WHERE THERE IS DANGER OF A SLIDE.**

37. **WEAR AN APPROVED SAFETY HAT WHEN OPERATING THE MACHINE AND WHILE IN ANY WORK AREA.**

38. **WHEN DRIVING THE LOADER ON A ROAD OR HIGHWAY, USE WARNING LIGHTS OR WARNING DEVICES AS MAY BE REQUIRED BY LOCAL OR STATE GOVERNMENT REGULATIONS. HEADLIGHTS, WARNING LIGHTS AND SMV SIGNS ARE AVAILABLE THROUGH YOUR NEW HOLLAND DEALER.**

39. **KEEP THE LOADER CLEAN. DO NOT ALLOW TRASH, DEBRIS OR OTHER ARTICLES TO ACCUMULATE IN THE CAB, FLOOR OR FOOT CONTROL PEDAL AREA THAT MAY HINDER SAFE MACHINE OPERATION.**

40. **NEVER OPERATE THE LOADER WITH ANY OF THE SHIELDING REMOVED.**

41. **NEVER OPERATE THE LOADER WITHOUT WINDOWS AND/OR SCREENS IN PLACE.**

42. **NEVER EXTEND ANY PART OF THE BODY OUTSIDE OF THE OPERATOR'S AREA.**

43. **ALWAYS PROPERLY TIE DOWN THE SKID-STEER LOADER TO A TRUCK OR TRAILER BEFORE TRANSPORT.**

44. **MAKE SURE ALL BYSTANDERS ARE AT A SAFE DISTANCE AWAY FROM THE LOADER BEFORE STARTING THE ENGINE.**

45. **DO NOT ALLOW ANYONE NEAR THE LOADER WHILE THE ENGINE IS RUNNING AND THE LOADER IS OPERATIONAL.**

46. **WHEN USING THE SKID-STEER LOADER TO CRANE OBJECTS, DO NOT ALLOW ANYONE TO RIDE ON OBJECTS BEING CRANED.**

47. **DO NOT USE THE SKID-STEER LOADER AS A WORK PLATFORM FOR SUPPORTING MATERIALS.**

48. **DO NOT LIFT PERSONNEL OR ALLOW PERSONNEL TO WORK WHILE STANDING IN THE BUCKET OR ON OTHER ATTACHMENTS. THIS IS NOT A MAN-LIFT.**

OSHA REQUIREMENTS NOW MAKE IT THE EMPLOYER'S RESPONSIBILITY TO FULLY INSTRUCT EACH OPERATOR IN THE PROPER AND SAFE OPERATION OF ALL OPERATIVE EQUIPMENT. BOTH EMPLOYER AND EMPLOYEE SHOULD THOROUGHLY FAMILIARIZE THEMSELVES WITH THE FOLLOWING SECTIONS.

CAUTION!

SOME PICTURES IN THIS MANUAL SHOW SAFETY SHIELDS REMOVED OR OPEN TO SHOW PARTS BEING SERVICED OR FOR CLARITY. ALL SHIELDS SHOULD BE CLOSED OR REPLACED PRIOR TO OPERATING THE MACHINE.

DANGER!

FASTEN SEAT BELT

BEFORE STARTING ENGINE!

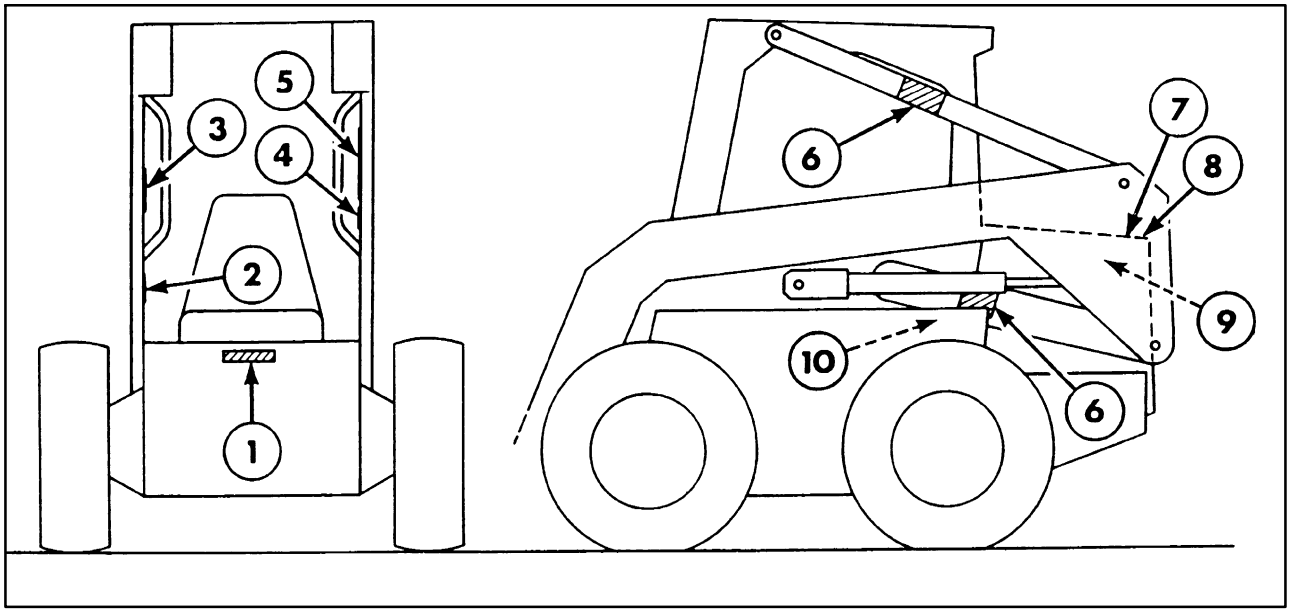
THIS LOADER IS A VERY STABLE UNIT BUT IT CAN BE UPSET IF STOPPED SUDDENLY WHEN THE BUCKET IS RAISED AND LOADED.

THEREFORE, DO NOT START THE ENGINE BEFORE SECURELY FASTENING THE SEAT BELT, AND CARRY THE LOAD LOW.

SAFETY DECALS

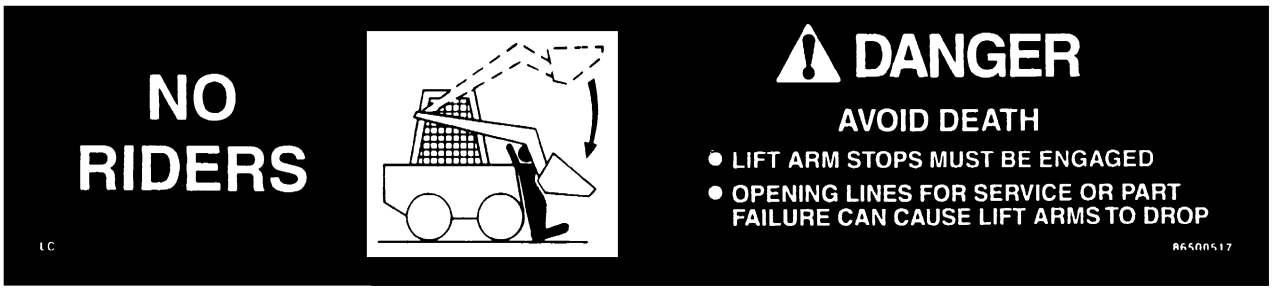
The following safety decals have been placed on your machine in the areas indicated. They are intended for the personal safety of you and those working with you. Please take this manual, walk around your machine and note the content and location of these warning signs. Review these decals with your machine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

Keep the decals legible. If they are not, obtain replacements from your New Holland dealer.



1. **DANGER: DO NOT ALLOW PASSENGERS TO RIDE ON THE LOADER AT ANY TIME. DO NOT GET UNDER BOOM UNLESS SUPPORTED BY THE BOOM LOCK PINS.**

Part #86521685



2. **CAUTION: DO NOT ALLOW ANYONE TO OPERATE THE LOADER WITHOUT PROPER INSTRUCTION.**

Part #86521688

3. **DANGER: BEFORE EXITING THE LOADER, LOWER THE LIFT ARMS AND ATTACHMENT TO THE GROUND OR REST LIFT ARMS ON THE BOOM STOPS. STOP ENGINE AND ENGAGE THE PARKING BRAKE.**

   Part #86521683

4. **WARNING: DO NOT OVERLOAD! NEVER LIFT MORE THAN THE MAXIMUM SAE LOAD RATING OF THE LOADER. NEVER TRANSPORT A LOADED BUCKET AT FULL HEIGHT. OPERATE THE LOADER WITH THE LOAD AS LOW AS POSSIBLE.**

   Part #86521716
   L565, LX565 **- 682 kg/1500 lbs. (Mfg. Rating)**

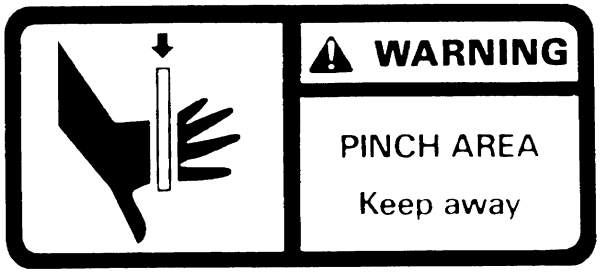
   Part #86521717
   LX665 **- 770 kg/1700 lbs. (Mfg. Rating)**

5. **WARNING: NEVER OPERATE THE LOADER WITHOUT THE SEAT BELT SECURELY FASTENED.**

   Part #86521686

6. **WARNING: KEEP CLEAR OF MOVING PARTS. KEEP BYSTANDERS CLEAR OF THE LOADER AT ALL TIMES UNLESS THE BOOM IS DOWN ON THE GROUND OR THE BOOM IS RESTING ON THE BOOM LOCK PINS AND ENGINE IS OFF. NEVER EXTEND ANY PART OF THE BODY OUTSIDE OF THE OPERATOR'S AREA.**

   Part #86521673

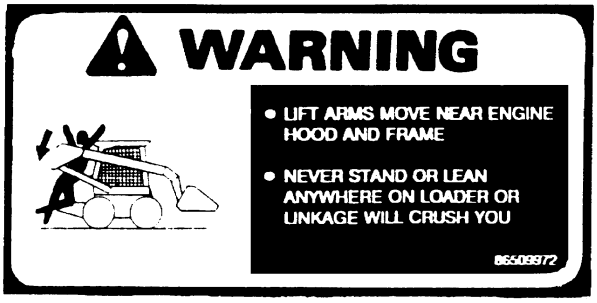


7. **WARNING: KEEP CLEAR! ROTATING FAN - STOP ENGINE.**

   Part #9828825

8. **WARNING: DO NOT ALLOW ANYONE NEAR THE LOADER WHILE THE ENGINE IS RUNNING AND THE LOADER IS OPERATIONAL.**

   Part #86509972



9. **CAUTION: DO NOT SPRAY ETHER INTO AIR INTAKE. EXPLOSION AND INJURY COULD RESULT.**

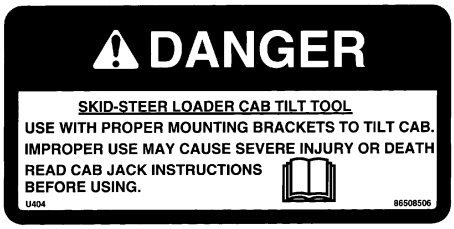
   Part #796286

10. **DANGER: USE ONLY THE NEW HOLLAND CAB JACK KIT TO TILT THE CAB. READ INSTRUCTIONS BEFORE TILTING CAB. DO NOT REMOVE CAB HARDWARE UNTIL CAB JACK IS INSTALLED. FAILURE TO DO SO MAY CAUSE CAB TO FALL CAUSING SERIOUS INJURY OR DEATH.**

    Part #86521713

11. **DANGER: (LOCATED ON THE CAB TILTING JACK) NEW HOLLAND SKID-STEER LOADER CAB TILTING TOOL. READ CAB TILTING INSTRUCTIONS AND USE WITH PROPER MOUNTING BRACKETS BEFORE TILTING CAB.**

    Part #86508506



GENERAL SAFETY INFORMATION

HANDLE FLUIDS SAFELY

When you work around fuel or other flammable material, do not smoke or work near heaters or other fire hazards.

Do not store flammable material in open containers.

Store flammable fluids away from fire hazards.

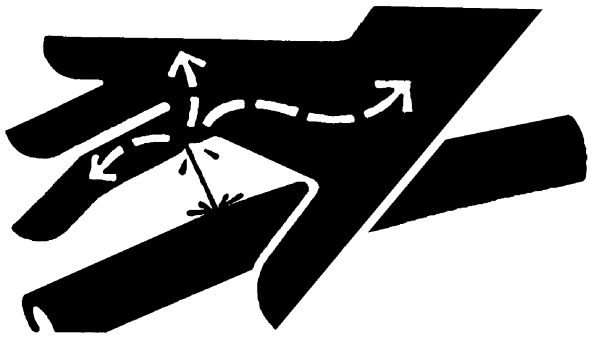
Do not incinerate or puncture pressurized containers.

Make sure machine is clean of dirt, grease, oil, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



USE CARE AROUND HIGH-PRESSURE FLUID LINES

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines.

Tighten all line connections before applying pressure.

Check for leaks with a piece of cardboard.

Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source.

AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.

Do not heat by welding, soldering, or using a torch near pressurized fluid lines.

Pressurized lines can be accidentally cut or damaged when heat goes beyond the immediate flame area.

USE CARE IN HANDLING AND SERVICING BATTERIES

Prevent Battery Explosions

Keep sparks, lighted matches, and open flame away from the top of the battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Do not charge a frozen battery; it may explode. Warm the battery to 60° F (16° C).

WARNING: IF ANY SERVICING OR ADJUSTMENTS REQUIRE THE BATTERY TO BE DISCONNECTED, OR WELDING IS REQUIRED ON THE SKID-STEER LOADER, DISCONNECT THE (-) NEGATIVE GROUND CABLE. FAILURE TO DISCONNECT THE BATTERY MAY RESULT IN DAMAGE TO THE EIC (ELECTRONIC INSTRUMENT CLUSTER) MONITORING SYSTEM AND OTHER ELECTRICAL COMPONENTS.

WARNING: IF WELDING ON AN ATTACHMENT IS REQUIRED, FIRST REMOVE THE ATTACHMENT FROM THE LOADER BOOM ATTACHING PLATE.

WARNING: STARTING AN ENGINE WITH A BOOSTER BATTERY REQUIRES EXTREME CARE AS BATTERIES PRODUCE EXPLOSIVE GASES. THE SLIGHTEST SPARK CAN CAUSE AN EXPLOSION.

FOLLOW THESE SAFETY TIPS:

1. **ALWAYS SHIELD YOUR EYES WHEN CHARGING OR WORKING NEAR A BATTERY. ALWAYS PROVIDE GOOD VENTILATION.**
2. **COVER THE BATTERY WITH A PIECE OF CARPET OR OTHER HEAVY MATERIAL. DO NOT REMOVE THE BATTERY VENT CAPS.**
3. **CONNECT ONE CABLE TO THE (+) POSITIVE TERMINAL OF THE WEAK BATTERY. CONNECT THE OTHER END OF THE CABLE TO THE (+) POSITIVE TERMINAL OF THE STRONGER BATTERY.**
4. **CONNECT THE SECOND CABLE TO THE (-) NEGATIVE TERMINAL OF THE STRONGER BATTERY.**
5. **CONNECT THE REMAINING (-) NEGATIVE CABLE END TO THE ENGINE BLOCK OR STARTER GROUND TERMINAL.**
6. **REVERSE THIS PROCEDURE WHEN DISCONNECTING THE BOOSTER.**

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

Wear close-fitting clothing.

Wear safety glasses or face shield as required.

Wear other safety equipment appropriate to the job.

Wear earplugs or earmuffs as required.

SERVICE MACHINE SAFELY

Use caution when working around moving parts.

If servicing requires the boom to be in the raised position, remove any attachment from the boom mounting plate and support the boom on the boom lock pins. If servicing requires the complete loader to be in the supported position, support the unit with adequate jack stands or blocking with all four wheels off the ground.

BEFORE SERVICING THE LOADER OR ANY OF ITS ATTACHED EQUIPMENT, BE SURE THAT THE ATTACHMENTS ARE LOWERED TO THE GROUND OR THE BOOM ARMS ARE SUPPORTED BY THE BOOM LOCK PINS.

USE PROPER TOOLS

Use tools appropriate for the job.

If tilting of the cab is required, use the proper tools and follow the procedure for tilting the cab in Section 1 of this manual.

REVIEW SAFETY EQUIPMENT, SIGNS AND SHIELDS

Replace missing or damaged safety decals.

Reinstall all shielding removed for servicing.

Replace any damaged or missing shielding.

CONTROLS

Operate unit and check machine functions for proper operation.

Check seat belt for proper operation, wear, and damage - Replace as needed.

Check operator restraint system and EIC for proper operation.

Check boom and bucket spool locks for proper operation.

Check mechanical boom locks for proper operation.

Check parking brake for proper operation and adjustment.

The skid-steer loader model and serial number tag is located on the right front interior of the operator's cab at 1.

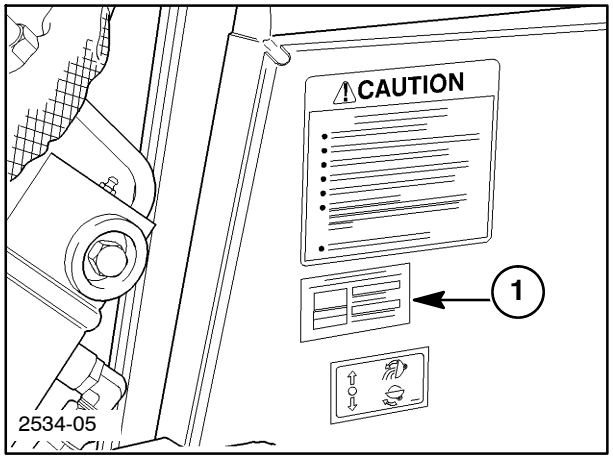


Figure 1-1

The engine model and serial number is located on the left side of the block at 1.

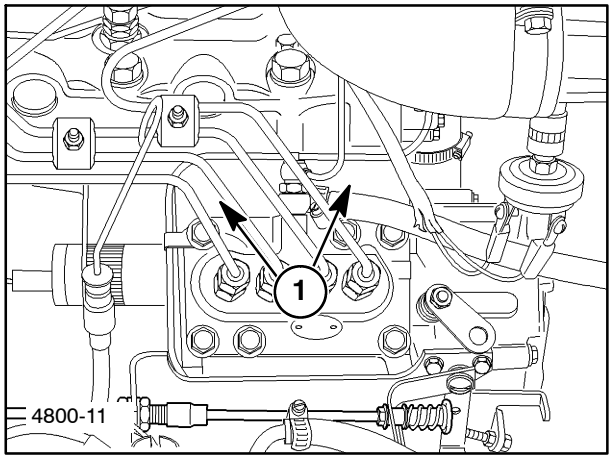


Figure 1-2

For the tightening torques for reassembly, use the following hardware torque chart unless the torque is specified in the instructions.

MINIMUM HARDWARE TIGHTENING TORQUES

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

INCH 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	55* (6.2)	72* (8.1)	86* (9.7)	112* (13)	121* (14)	157* (18)	61* (6.9)	86* (9.8)	1/4
5/16	115* (13)	149* (17)	178* (20)	229* (26)	250* (28)	324* (37)	125* (14)	176* (20)	5/16
3/8	17 (23)	22 (30)	26 (35)	34 (46)	37 (50)	48 (65)	19 (26)	26 (35)	3/8
7/16	27 (37)	35 (47)	42 (57)	54 (73)	59 (80)	77 (104)	30 (41)	42 (57)	7/16
1/2	42 (57)	54 (73)	64 (87)	83 (113)	91 (123)	117 (159)	45 (61)	64 (88)	1/2
9/16	60 (81)	77 (104)	92 (125)	120 (163)	130 (176)	169 (229)	65 (88)	92 (125)	9/16
5/8	83 (112)	107 (145)	128 (174)	165 (224)	180 (244)	233 (316)	90 (122)	127 (172)	5/8
3/4	146 (198)	189 (256)	226 (306)	293 (397)	319 (432)	413 (560)	160 (217)	226 (306)	3/4
7/8	142 (193)	183 (248)	365 (495)	473 (641)	515 (698)	667 (904)	258 (350)	364 (494)	7/8
1	213 (289)	275 (373)	547 (742)	708 (960)	773 (1048)	1000 (1356)	386 (523)	545 (739)	1

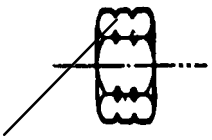
NOTE: Torque values shown with * are inch pounds.

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 MARKS
GRADE B LETTER B
GRADE C LETTER C

GRADE IDENTIFICATION

MINIMUM HARDWARE TIGHTENING TORQUES

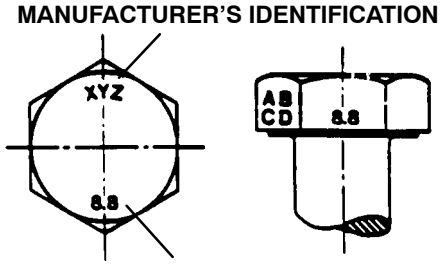
IN FOOT POUNDS (NEWTON-METERS) FOR NORMAL ASSEMBLY APPLICATIONS

METRIC HARDWARE AND LOCKNUTS

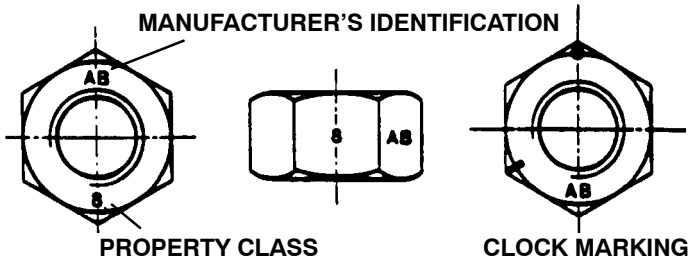
NOMINAL SIZE	CLASS 5.8		CLASS 8.8		CLASS 10.9		LOCKNUT CL.8 W/CL8.8 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	
M4	15* (1.7)	19* (2.2)	23* (2.6)	30* (3.4)	33* (3.7)	42* (4.8)	16* (1.8)
M6	51* (5.8)	67* (7.6)	79* (8.9)	102* (12)	115* (13)	150* (17)	56* (6.3)
M8	124* (14)	159* (18)	195* (22)	248* (28)	274* (31)	354* (40)	133* (15)
M10	21 (28)	27 (36)	32 (43)	41 (56)	45 (61)	58 (79)	22 (30)
M12	36 (49)	46 (63)	55 (75)	72 (97)	79 (107)	102 (138)	39 (53)
M16	89 (121)	117 (158)	137 (186)	177 (240)	196 (266)	254 (344)	97 (131)
M20	175 (237)	226 (307)	277 (375)	358 (485)	383 (519)	495 (671)	195 (265)
M24	303 (411)	392 (531)	478 (648)	619 (839)	662 (897)	855 (1160)	338 (458)

NOTE: Torque values shown with * are inch pounds.

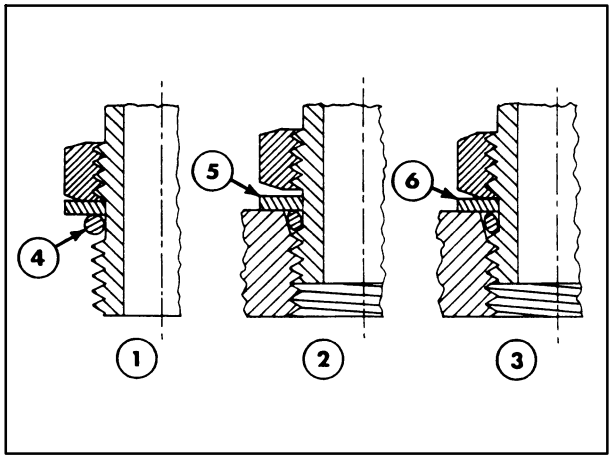
IDENTIFICATION
HEX CAP SCREW AND CARRIAGE BOLTS
CLASSES 5.6 AND UP



HEX NUTS AND LOCKNUTS
CLASSES 05 AND UP



INSTALLATION OF ADJUSTABLE FITTINGS IN STRAIGHT THREAD O RING BOSSES



1. Lubricate the O ring by coating it with a light oil or petroleum. Install the O ring in the groove adjacent to the metal backup washer which is assembled at the extreme end of the groove, 4.
2. Install the fitting into the SAE straight thread boss until the metal backup washer contacts the face of the boss, 5.

   NOTE: Do not over tighten and distort the metal backup washer.
3. Position the fitting by turning out (counterclockwise) up to a maximum of one turn. Holding the pad of the fitting with a wrench, tighten the locknut and washer against the face of the boss, 6.

STANDARD TORQUE DATA FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS FOR 37° FLARED FITTINGS								O RING BOSS PLUGS ADJUSTABLE FITTING LOCKNUTS, SWIVEL JIC - 37° SEATS			
				TORQUE				TORQUE			
SIZE	TUBING OD		THREAD SIZE	NEWTON METERS		FOOT POUNDS		NEWTON METERS		FOOT POUNDS	
	mm	In.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4	6.4	1/4	7/16-20	12	16	9	12	8	14	6	10
5	7.9	5/16	1/2-20	16	20	12	15	14	20	10	15
6	9.5	3/8	9/16-18	29	33	21	24	20	27	15	20
8	12.7	1/2	3/4-18	47	54	35	40	34	41	25	30
10	15.9	5/8	7/8-14	72	79	53	53	47	54	35	40
12	19.1	3/4	1-1/16-12	104	111	77	82	81	95	60	70
14	22.2	7/8	1-3/16-12	122	136	90	100	95	109	70	80
16	25.4	1	1-5/16-12	149	163	110	120	108	122	80	90
20	31.8	1-1/4	1-5/8-12	190	204	140	150	129	158	95	115
24	38.1	1-1/2	1-7/8-12	217	237	160	175	163	190	120	140
32	50.8	2	2-1/2-12	305	325	225	240	339	407	250	300

These torques are not recommended for tubes of 12.7 mm (1/2″) OD and larger with wall thickness of 0.889 mm (0.035″) or less. The torque is specified for 0.889 mm (0.035″) wall tubes on each application individually.

Before installing and torquing 37° flared fittings, clean the face of the flare and threads with a clean solvent or Loctite cleaner and apply hydraulic sealant Loctite no. 569 to the 37° flare and the threads.

Install fitting and torque to specified torque, loosen fitting and retorque to specifications.

PROPERLY SUPPORT A RAISED MACHINE

If servicing neutral adjustment, final drive adjustment or repairs requiring the machine to be raised, securely support the machine with adequate jack stands or blocks as shown.

Support the machine at 1 to the front of the final drive cases and to the rear at 2, making sure the supports are on the flat area of the final drive cases.

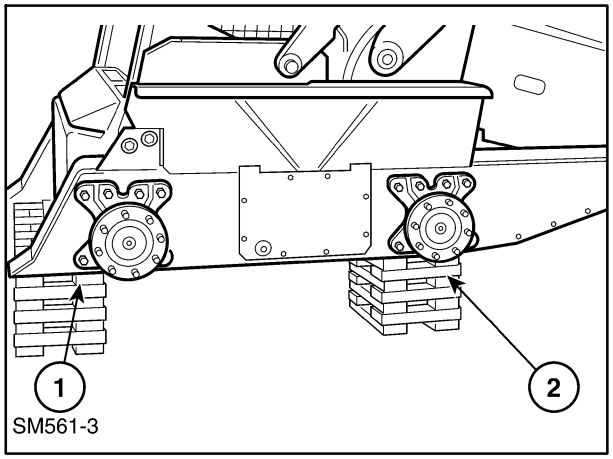


Figure 1-3

PROPERLY SUPPORT BOOM ON BOOM LOCK PINS

Before servicing the machine or any of its attached equipment, be sure that the attachments are lowered to the ground or the boom arms are supported by the boom lock pins, 1.

If the boom is to be raised on the boom lock pins, remove any attachment. Opening a hydraulic line could cause a mounted attachment to dump over unexpectedly.

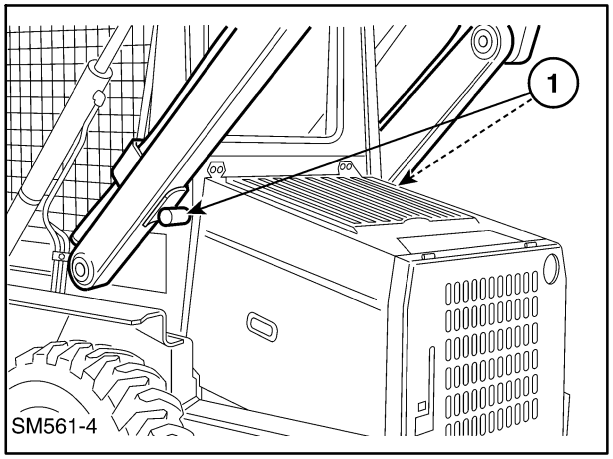


Figure 1-4

MAJOR UNIT OVERHAUL

For a major hydrostatic component or engine repair, the skid-steer loader cab and boom assembly can be tilted forward for easier access to the components area. Figure 1-5 shows the loader properly supported and the cab tilted forward.

WARNING: NEVER ATTEMPT TO TILT THE SKID-STEER LOADER CAB WITHOUT USING THE PROPER TOOL AND INSTRUCTIONS. SEE MORE DETAIL LATER IN THIS SECTION OF THE MANUAL AND/OR CONTACT YOUR NEW HOLLAND DEALER.

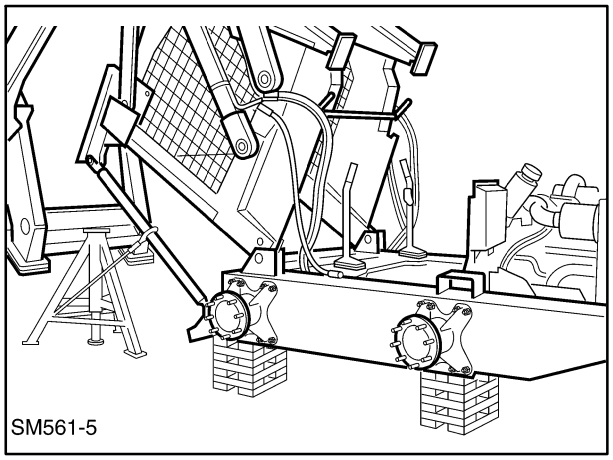


Figure 1-5

CAB AND BOOM TILT PROCEDURE

The cab and boom assembly can be tilted forward for easier access to the major skid-steer loader hydrostatic transmission or engine components. To tilt the cab, the proper cab tilting tool must be used to ensure safety and to prevent damage to the loader frame, cab, and boom structure. Contact your New Holland dealer for major service or repairs of the skid-steer loader. Using the proper cab tilting tool and following these steps, the cab and boom can be tilted forward.

1. Remove any attachment, bucket, etc. from the boom quick-attach plate.

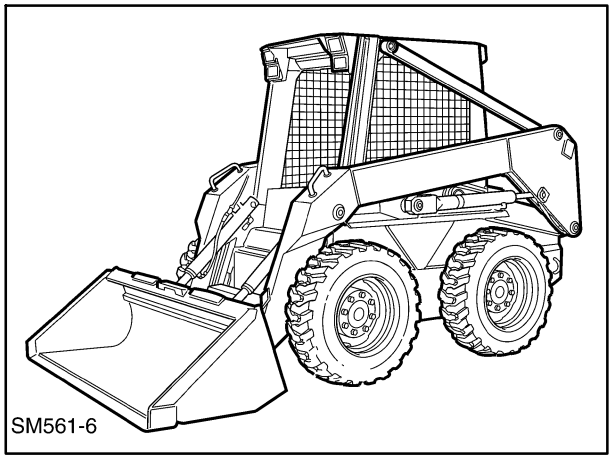


Figure 1-6

2. Raise the boom and lower onto boom lock pins, 1.
   a. Raise boom above boom lock pins.
   b. Engage boom lock pins.
   c. Stop engine, ignition key off position.
   d. Turn ignition key to the on position.
   e. Lower boom onto boom lock pins.
   f. Turn the ignition key to the “OFF” position.

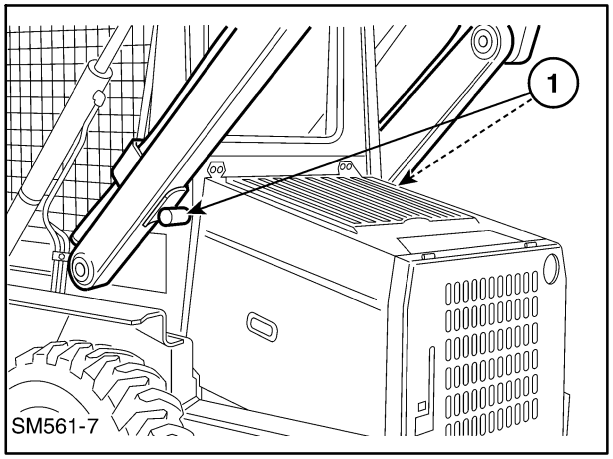


Figure 1-7

3. Jack up the loader and block it securely with all four wheels off the ground, as shown. Position the front blocks, 1, to the front of the final drive housings and the rear blocks, 2, to the rear of the flat area of the final drive housings.

WARNING: NEVER ATTEMPT TO TILT THE SKID-STEER LOADER CAB OVER UNLESS THE LOADER IS SECURELY SUPPORTED.

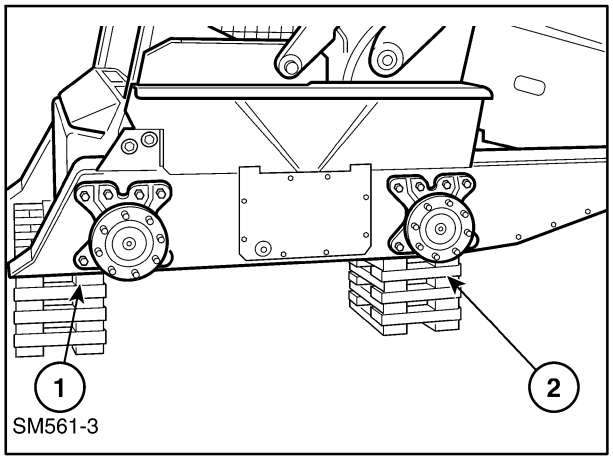


Figure 1-8

4. Open the rear door, 1. Raise the top engine shield, 2, and latch in the raised position.
5. Remove engine side covers, 3.

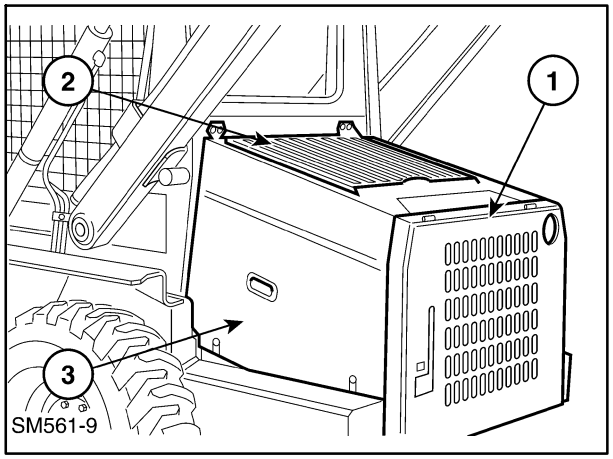


Figure 1-9

6. Disconnect the battery negative (-) cable, 1.

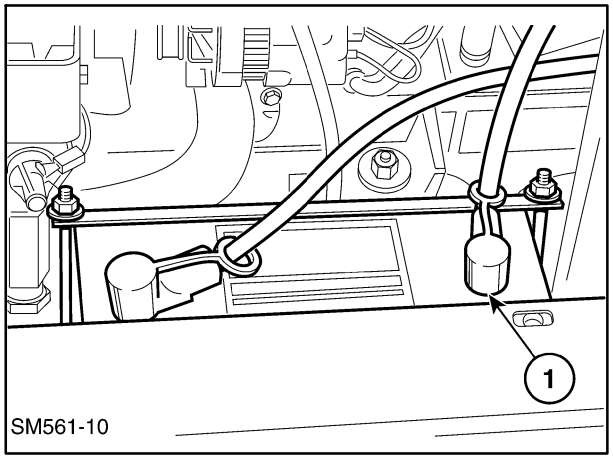


Figure 1-10

7. Remove fenders, 1, right and left sides.
8. Remove foam material, 2, from both sides.
9. Remove the rear fender supports, 3, right and left sides.

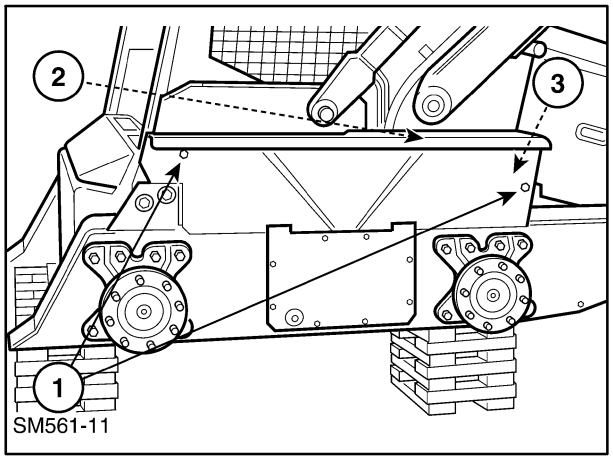


Figure 1-11

10. Raise the seat and lock in the up position, 1. Make sure the seat pan assembly is latched securely.

CAUTION: DO NOT WORK UNDER THE SEAT AND PAN UNLESS IT IS PROPERLY LATCHED IN THE RAISED POSITION.

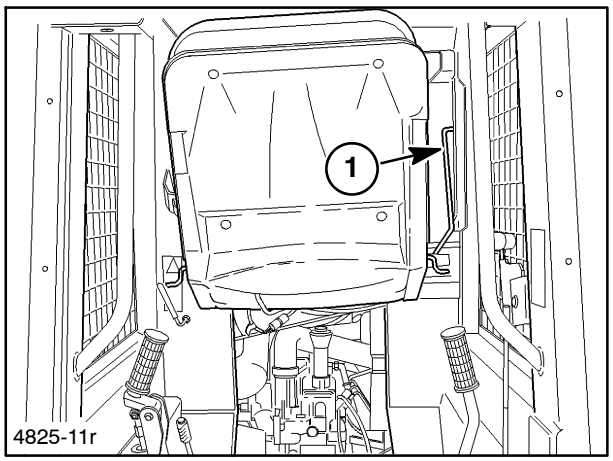


Figure 1-12

11. Remove the front step shield, 1.

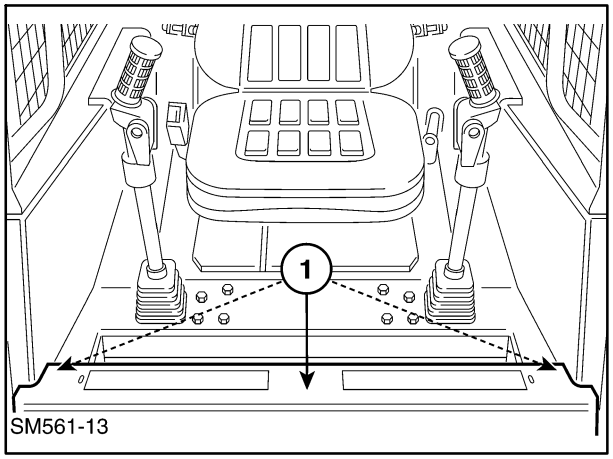


Figure 1-13

12. Remove the cotter pins from the parking brake linkage at 1, unhook link rod, 2, and raise the parking brake lever, 3, to the engaged position.

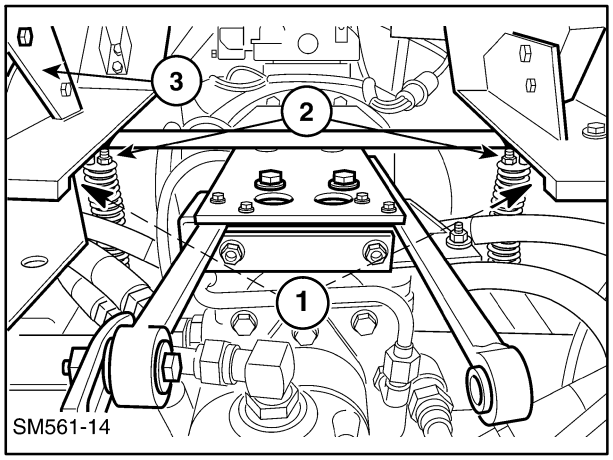


Figure 1-14

13. Install the lower cab jack support, 1. Hook the support over the end of the front left final drive housing and attach with a 1/2″ x 8″ cap screw, two spacers, one each side of housing at 2, and 1/2″ nut.

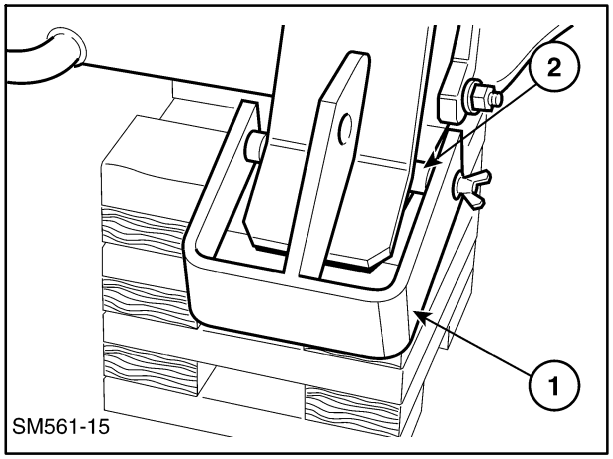


Figure 1-15

14. Install the upper cab jack support, 1. The spacer channel, 2, is used for the L565, LX565, and LX665 models. Pivot the retaining plate, 3, up behind the boom top link and secure with 1/2″ x 1-1/4″ carriage bolt and 1/2″ wing nut. Install retaining bolt, 4, 1/2″ x 2-1/2″ cap screw through side of cab with a large 1/2″ flat washer, 1/2″ wing nut to the inside of cab and tighten.

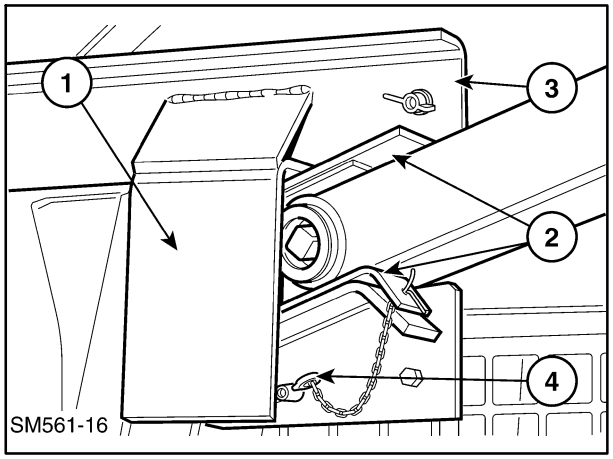


Figure 1-16

15. Install the jack assembly, 1, between the upper and lower supports using two pins and retaining clips.

16. Loosen the front cab mounting bolts, 2, only enough to allow the bolt to rotate in post. Remove the rear front cab bolts, 3.

CAUTION: NEVER REMOVE THE FRONT CAB BOLTS, 2, AS THESE ARE THE PIVOT BOLTS DURING THE CAB TILTING PROCEDURE. REMOVAL OF THESE BOLTS COULD CAUSE THE CAB TO FALL AND MAY CAUSE INJURY AND MACHINE DAMAGE.

17. Remove the four rear cab post bolts, 4. Note the number and position of washers for reassembly.

CAUTION: NEVER LOOSEN OR REMOVE ANY CAB RETAINING HARDWARE BEFORE THE JACK ASSEMBLY IS INSTALLED.

18. Jack cab and boom assembly over with the loader properly supported off the ground. Support the boom at 1 to prevent tipping of the loader when heavy components, engine, hydrostatic pumps, etc. are removed from the lower frame. Jack travel or length of hydraulic hoses will limit the travel of the cab assembly when tilting. Be sure all wire harnesses, hydraulic hoses, and throttle cable clear any obstructions during cab tilting.

WARNING: NEVER ATTEMPT TO TILT THE SKID-STEER LOADER CAB WITHOUT PROPER INSTRUCTIONS AND WITHOUT USING THE PROPER TOOL.

CAUTION: NEVER ATTEMPT TO OPERATE OR MOVE THE SKID-STEER LOADER WITHOUT FIRST INSTALLING AND PROPERLY TIGHTENING ALL CAB RETAINING HARDWARE.

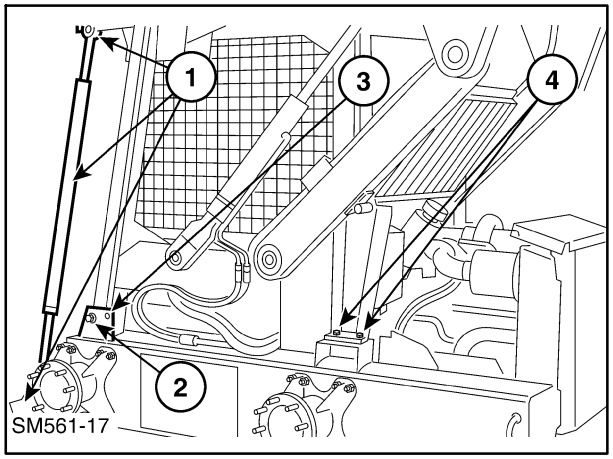


Figure 1-17

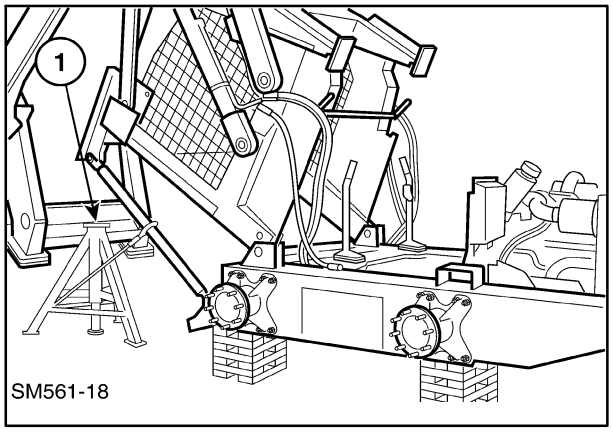


Figure 1-18

To jack the cab and boom assembly back into position:

1. Pull the hydrostat control handles forward and hold in this position with rubber tie straps from the handle to the front cab post.
2. Jack the cab and boom back into position.
3. Keep the wire harness, 1, and throttle cable, 2, in position to prevent damage from setting the cab on them.
4. Pull the wire harness through the loop, 3.

CAUTION: KEEP THE WIRE HARNESS FROM BEING DAMAGED. A DAMAGED WIRE HARNESS COULD RESULT IN DAMAGE TO THE LOADER ELECTRICAL COMPONENTS.

5. Remove rubber tie straps from the hydrostatic control handles.

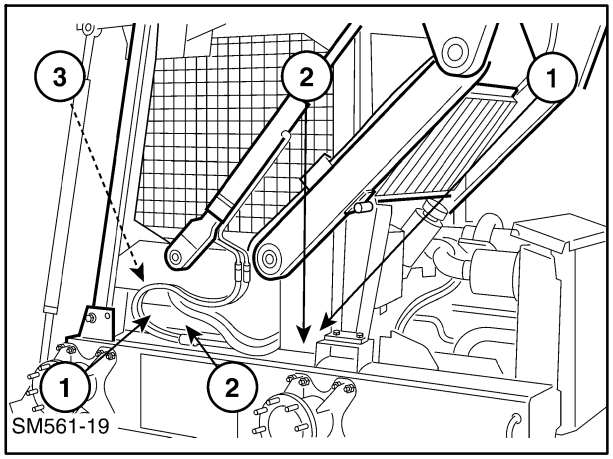


Figure 1-19

6. Reinstall all cab support bolts front and rear.

   Torque the rear bolts, 1, to 108 N·m (80 ft. lbs.). Make sure the washers are the same number and position as removed.
7. Reinstall the parking brake linkage, 2.
8. Position the throttle cable, 3, inside frame.
9. Reinstall the rear fender supports, 4. Do not tighten hardware at this time.

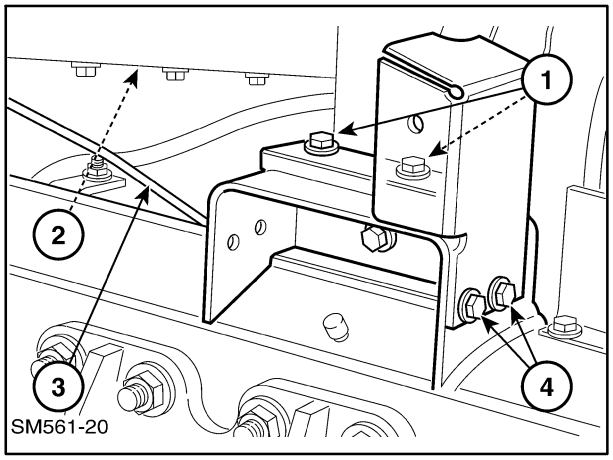


Figure 1-20

10. Torque the front bolts, 1, to 217 N·m (160 ft. lbs.).
11. Reinstall the foam, 2; fenders, 3; and front step shield, 4.
12. Tighten the rear fender supports, 5, at this time.
13. Remove jack and supports.
14. Reconnect the battery cable.

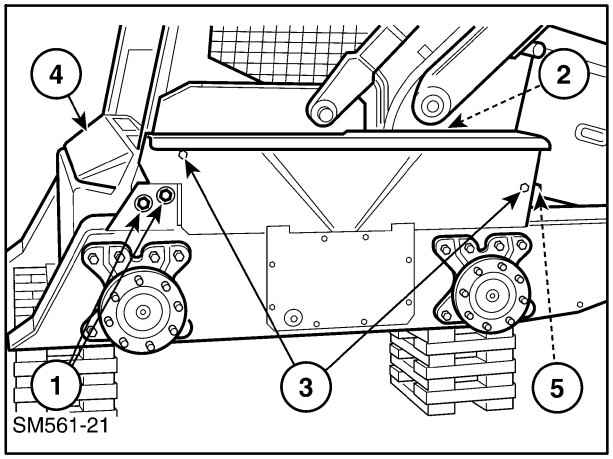


Figure 1-21

WARNING: NEVER ATTEMPT TO OPERATE OR MOVE THE SKID-STEER LOADER WITHOUT FIRST INSTALLING AND PROPERLY TIGHTENING ALL CAB RETAINING HARDWARE.

CRANING THE SKID-STEER LOADER

If the skid-steer loader is inoperative and located in an area where it cannot be loaded onto a truck or trailer, the unit may be craned to load the unit.

To crane the loader, only use chain or cable with a rated capacity to handle the weight of the model skid-steer loader being craned. Refer to “Specifications” in this manual for the operating weight of the model loader being craned. Use three chains minimum of 3.66 m (12′) long to prevent sharp angles and damage to the loader cab, boom, and lifting chains.

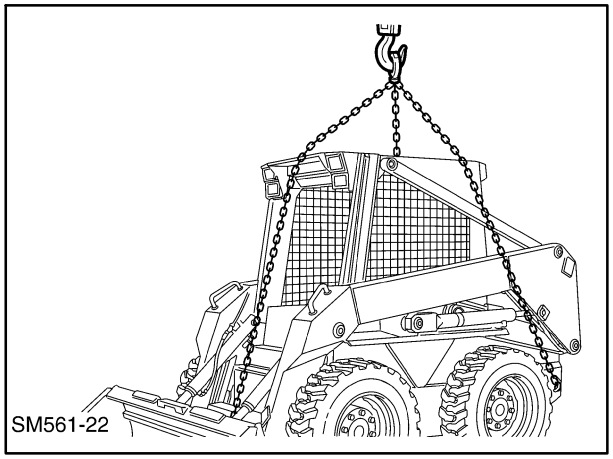


Figure 1-22

Remove any attachment except a standard bucket from the loader boom attaching plate.

CAUTION: DO NOT LIFT ANY ATTACHMENTS ON THE LOADER MOUNTING PLATE THAT WEIGH 272 kg (600 LBS.) OR MORE. LIFT SUCH ATTACHMENTS SEPARATELY.

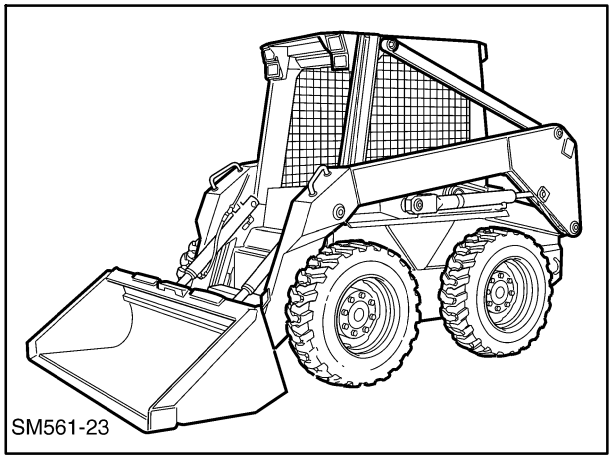


Figure 1-23

The lifting points at the rear of the loader, 1.

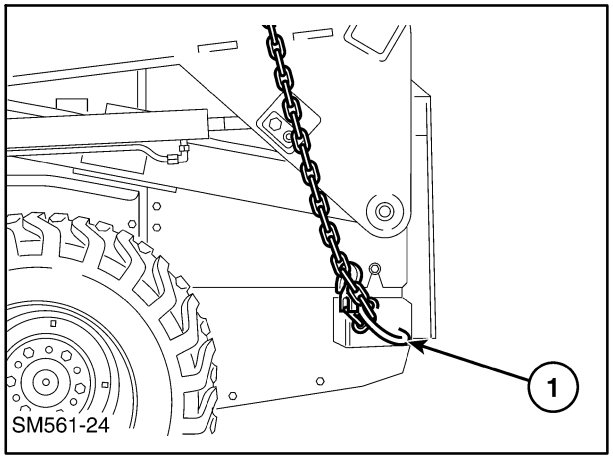


Figure 1-24

The front is located in the center of the main frame, 1.

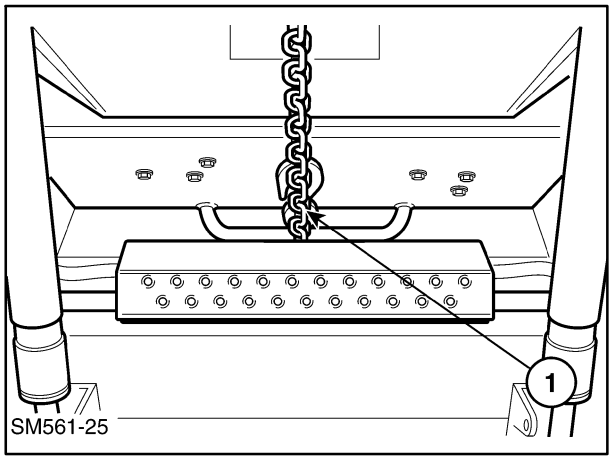


Figure 1-25

The lifting chains or cables must be minimum of 3.66 m (12′). The lifting hook point must be minimum of 1.9 m (75″) above the cab, 1, to prevent the chains or cables from damaging the loader frame or cab.

WARNING: ALWAYS USE PROPERLY RATED LIFTING DEVICES TO PREVENT PERSONAL INJURY OR DAMAGE TO THE LOADER.

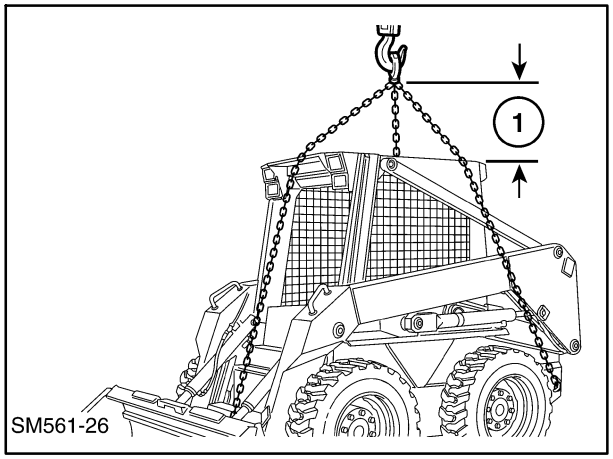


Figure 1-26

When craning (lifting or lowering) a skid-steer loader, observe these “CAUTIONS.”

CAUTION:

1. **NO RIDERS (INCLUDING THE OPERATOR) IN OR ON THE MACHINE WHILE LIFTING OR LOWERING.**
2. **DO NOT LIFT ANY ATTACHMENTS ON THE LOADER MOUNTING PLATE THAT WEIGH 272 kg (600 LBS.) OR MORE. LIFT SUCH ATTACHMENTS SEPARATELY.**
3. **ALWAYS USE A CHAIN OR CABLE CAPABLE OF SAFELY HOISTING THE WEIGHT OF THE SKID-STEER LOADER.**
4. **BEFORE HOISTING THE SKID-STEER LOADER, ALWAYS INSPECT THE LIFTING CHAIN OR CABLE AND THE LIFTING POINTS ON THE LOADER MAIN FRAME TO INSURE THEY ARE IN GOOD CONDITION. IF WORN OR DAMAGED, DO NOT USE.**
5. **DO NOT LIFT THE LOADER WITH ANY FRAME-MOUNTED ATTACHMENTS SUCH AS A BACKHOE OR REAR STABILIZERS.**
6. **DO NOT ATTACH LIFTING DEVICES TO THE LOADER BOOM OR ATTACHMENTS ON THE LOADER.**
7. **MAKE SURE THE LOADER BOOM IS IN THE COMPLETELY LOWERED POSITION.**
8. **MAKE SURE THAT ANY ATTACHMENT TO BE LIFTED ON THE LOADER IS SECURELY FASTENED TO THE LOADER MOUNTING PLATE WITH THE OVER-CENTER HANDLES AND PINS FULLY ENGAGED. PIVOT THE ATTACHMENT FULLY BACK.**
9. **MAKE SURE THAT THE ENGINE IS OFF AND THE PARKING BRAKE IS ENGAGED BEFORE LIFTING.**
10. **KEEP BYSTANDERS AWAY FROM THE MACHINE A SAFE DISTANCE WHILE LIFTING.**

DRILLING HOLES IN OVERHEAD DASH

Always install the rearview mirrors as shown in the mirror instruction sheet. Otherwise, you must unhook the negative battery cable and remove the EIC board and ignition switch panels from the overhead dash. If holes and attaching screws are installed into the dash area, 1, make sure the screws will not contact the EIC board, the ignition switch, or wiring, as electrical system damage will occur. Remove the mounting hardware, 2, and check where to drill first.

IMPORTANT: Failure to unhook the negative battery cable before removal of the EIC board or switch may result in an accidental grounding, causing component damage.

IMPORTANT: Retaining hardware contacting the EIC board or switch may cause an electrical short, damaging the loader electrical system.

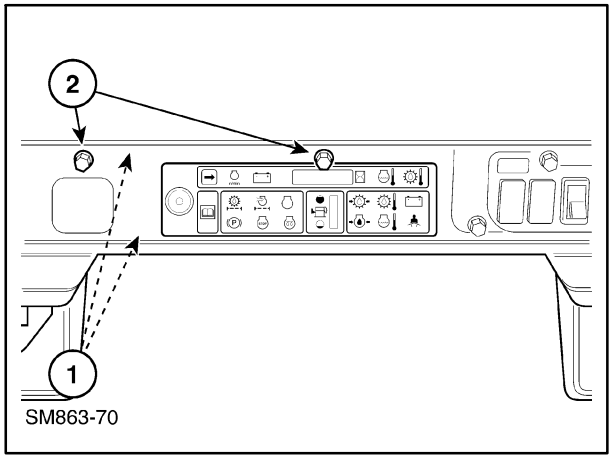


Figure 1-27

ADAPTING ATTACHMENTS REQUIRING 12V ELECTRICAL POWER

There are important rules that must be followed when adapting attachments that require 12 volt electrical power. Proper wiring of electrical devices and power and ground connections is very important to prevent other electrical component damage. Attaching electrical connections to locations other than recommended may allow electric current to feed back through the EIC board, creating false EIC board readings and warnings, or causing EIC board damage or failure.

1. ALWAYS FOLLOW the instructions for New Holland kit installation to ensure proper function and operation.
2. NEVER CONNECT an electrical device to any wires, fuses, switches or grounds inside the cab area. This includes any terminals of the ignition switch, fuse panel, or ground terminal.
3. NEVER INSTALL an electrical device, music radio, two-way radio, or unapproved New Holland attachment into the cab area.
4. ONLY USE the 12-volt accessory power outlet for attachments requiring less than 10 amps. The accessory outlet is connected to the engine fuse/relay panel and protected with a 15 amp fuse.

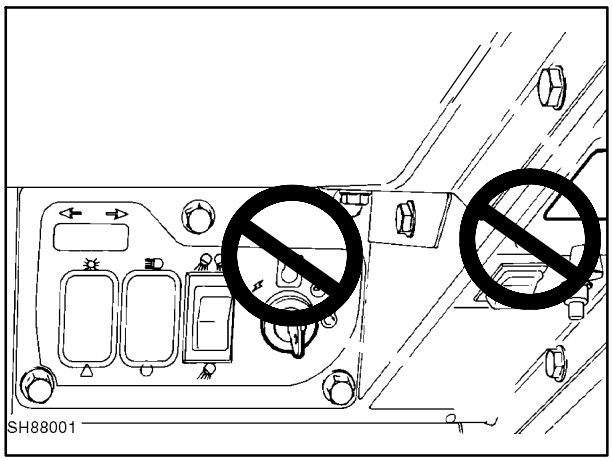


Figure 1-28

5. ALWAYS CONNECT new electrical attachments to the engine fuse/relay panel, 1, and connect the grounds to the engine bell housing. USE ONLY vacant connections and fuses not in use for specified attachments.
6. PLEASE REFER to Service Bulletin 11/95-I4 for more detailed information about higher amperage requirements and making electrical connections.

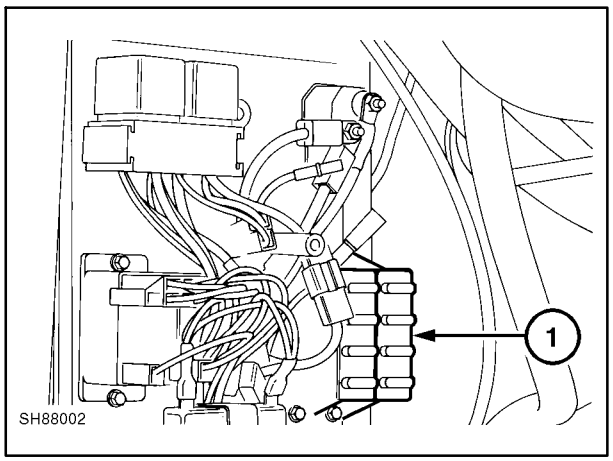
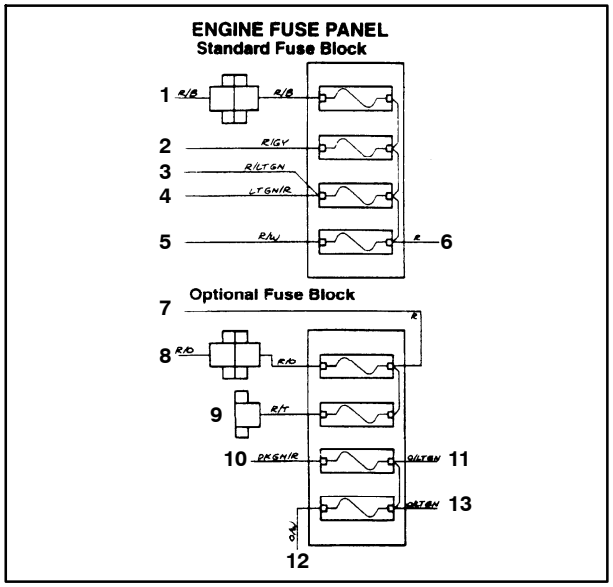


Figure 1-29

Wires and connections are available providing electrical attachments were not previously installed.

Engine Fuse Panel

Ref.	Color	Destination	Fuse	Battery Voltage	Status
1	R/B	To turn signal relay	10-amp	All times	Available
2	R/GY	To accessory relay	25-amp	All times	Available
3	R/LTGN	To EIC board pin #14 P2 connector	5-amp	All times	Occupied
4	LTGN/R	To seat switch(es)	5-amp	All times	Occupied
5	R/W	To key switch (battery terminal)	15-amp	All times	Occupied
6	R	From preheat circuit breaker	20-amp	All times	Occupied
7	R	From start relay		All times	Occupied
8	R/O	To heater power relay	20-amp	All times	Available
9	R/T	Spare	7.5-amp	All times	Available
10	DKGN/R	To high flow, horn, power outlet	15-amp	Key “ON” position	Available
11	O/LTGN	From accessory relay		Key “ON” position	Occupied
12	O/W	To back-up alarm switch	5-amp	Key “ON” position	Available
13	O/LTGN	From road/work light fuse (cab panel)		Key “ON” position	Occupied



HYDRAULIC SYSTEM COMPATIBILITY

There are six general questions that must be answered before adapting attachments that require hydraulic oil power.

1. **What is the hydraulic pressure requirement, minimum and maximum? Are they higher than the maximum pressure of the model?**

Model	Maximum Pressure
L565, Lx565, Lx665	2500 to 2600 PSI (170-176 bar)

2. **What is the hydraulic oil flow requirement? Is it more than the highest total flow rate of the skid-steer loader model?**

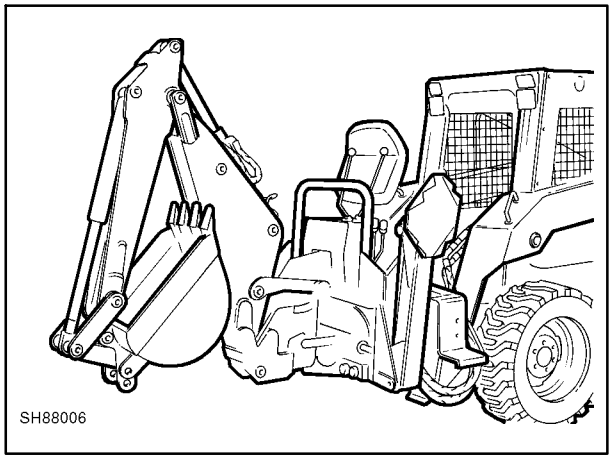


Figure 1-30

Model	Standard Hydraulics	High Flow Hydraulics
L565 Lx565	14.5 GPM (54.9 l/min.) @2900 RPM @1000 PSI (68 bar)	22.2 GPM (84.0 l/min.) @2900 RPM @2300 PSI (156 bar)
Lx665	17.1 GPM (64.9 l/min.) @2900 RPM @1000 PSI (68 bar)	24.2 GPM (91.6 l/min.) @2900 RPM @2300 PSI (138 bar)

NOTE: When using the High-Flow system, 3/4" quick couplers must be used or high system backpressure may result.

3. **Will the attachment accept oil flow in both directions?**

If "YES", nothing is required.

If "NO", install a check valve or cross into the attachment return line to prevent reverse oil flow to the attachment.

Examples: Backhoes and trees spades with a separate control valve do not accept oil flow in both directions.

4. **Must the attachment "Free Wheel" to stop?**

If "YES", a crossover relief connection must be installed on the attachment side to allow the attachment to free wheel to a stop after the skid-steer loader hydraulics are turned off.

If "NO", nothing is required.

Example: Snow blowers must free wheel to a stop.

5. **Will the attachment accept hydraulic system backpressure?**

If "YES", nothing is required.

If "NO", the attachment will not function properly on a New Holland skid-steer loader. Normal backpressure for New Holland skid-steer loaders is between 200 to 250 PSI.

Examples: Post drivers; some breakers; and some hand held hydraulic tools do not accept system backpressure.

NOTE: L565, Lx565, LX665 model loaders must have a minimum of 22.7 l/min. (6 GPM) returning through the main hydraulic system at all times to charge the hydrostatic system.

If all the skid-steer loader oil flow is not required to operate an attachment (e.g., Shaver Post Driver), a flow divider can be installed into the hydraulic oil circuit on the attachment. The flow divider sends the required oil flow to the attachment and the remainder back to the normal skid-steer loader hydraulic circuits.

6. Does the attachment have a separate case drain oil line?

If “NO”, nothing is required.

If “YES”, install a separate case drain line to return the attachment case drain oil directly to the hydraulic oil reservoir.

Example: Cold planners have a separate case drain oil line.

NOTE: Most attachment case drains will not accept backpressure and must drain directly into the reservoir.

NOTE: Skid-steer loaders equipped with High Flow Hydraulics have a separate case drain coupler and return line attached to the right boom arm.

7. Does the attachment require circuit relief in the bucket circuit?

If “NO”, nothing is required.

If “YES”, install a bucket circuit relief valve on front of the control valve.

Example: Some mini-backhoes attach like a bucket, and require bucket circuit relief.

ACCESSORY RELAY AND ENGINE FUSE BLOCK

Later model loaders include an accessory relay, 1, and a second fuse block, 2, to the side of the standard fuse block, 3. The relay and fuse block are included in some accessory kits. The serial number breaks for the factory installed second fuse block are as follows.

EARLIER MODELS - without accessory relay and second fuse block

Model	Serial Number Range
L565	850751 to 999999 and 0001 to 31153
Lx565	847451 to 999999 and 0001 to 38841
Lx665	847851 to 999999 and 0001 to 64384

LATER MODELS - with accessory relay and second fuse block installed from factory

Model	Serial Number Range
L565	31154 to 850750
Lx565	38842 to 847450
Lx665	64385 to 847850

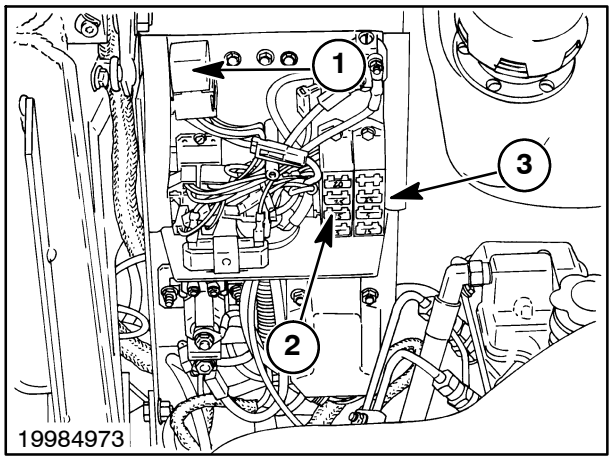


Figure 1-31

SPECIFICATIONS

MODEL	L565-Lx565	Lx665
ENGINE MANUFACTURER	NEW HOLLAND	NEW HOLLAND
MODEL	N844 Diesel	N844T Diesel
CYLINDERS	4	4
ASPIRATION	NATURAL	TURBOCHARGED
CYCLE	4 STROKE	4 STROKE
BORE AND STROKE	84 90 mm (3.31″ 3.54″)	84 90 mm (3.31″ 3.54″)
DISPLACEMENT	1995 cu. cm (121.7 cu. in.)	1995 cu. cm (121.7 cu. in.)
COMPRESSION RATIO	22 to 1	22 to 1
SPEEDS		
-FAST (no load)	3070 to 3150 RPM	3070 to 3150 RPM
-IDLE (no load)	900 to 1000 RPM	900 to 1000 RPM
HORSEPOWER		
(SAE GROSS)	42.5 @2900 RPM	52.0 @2900 RPM
(SAE NET)	40.0 @2900 RPM	50.0 @2900 RPM
TORQUE - (mfg. rating) Gross	126 N·m (93 ft. lbs.)	153 N·m (113 ft. lbs.)
VALVE CLEARANCE		
-Intake (cold).	0.2 mm (0.008 in.)	0.2 mm (0.0008 in.)
-Exhaust (cold).	0.2 mm (0.008 in.)	0.2 mm (0.0008 in.)
FIRING ORDER	1-3-4-2	
FUEL CONSUMPTION (approximate at continuous full load)		L565/Lx565 - 9.5 LPH (2.5 GPH) Lx665 - 12.1 LPH (3.2 GPH)
IGNITION TYPE		Compression
GRADEABILITY (Intermittent duty)		30 Degrees All Directions
AIR CLEANER - Dry type dual element		
Primary element		NH #86504145
Safety element		NH #86504143
FUEL SYSTEM		
Type of fuel		Diesel
Cleaning system		Inline filter replaceable NH#9611973 Inline water trap NH#86504140
CAPACITIES		
Cooling system		10.3 L (10.8 qt.)
Fuel tank		52.9 L (14 gal.)
Hydraulic reservoir		22.7 L (6 gal.)
Chain case (final drive - per side)		7.6 L (8 qt.)
Gearbox (per box)		0.95 L (1 qt.)

ENGINE - EARLY MODEL & SERIAL NUMBER RANGE

L565 - 850751 to 999999 and 0001 to 31279
LX565 - 847451 to 999999 and 0001 to 40190
LX565 High Flow - 847451 to 999999 and 0001 to 40215
Lx665 - 847851 to 999999 and 0001 to 66996
Lx665 High Flow - 847851 to 999999 and 0001 to 67011

Oil type	API SG/CF SAE 10W-30
Filter part #	NH #86546618
Engine crankcase capacity w/filter	6.6 L (7qt.)
Dipstick length	381 mm (15″)

ENGINE - LATER MODEL & SERIAL NUMBER RANGE

L565 - 31280 to 850750
Lx565 - 40191 to 847450
Lx565 High Flow - 40216 to 847450
Lx665 - 66997 to 847850
Lx665 High Flow - 67012 to 847850

Oil type	API SG/CF SAE 10W-30
Filter part #	NH #86546618
Engine crankcase capacity w/filter	7.6 L (8 qt.)
Dipstick length	367 mm (14.4″)

ELECTRICAL SYSTEM

Battery	SAE PC31 - 12V 625 amps @ 0°F (–18°C)
Alternator capacity	40 amps
Starter switch	Key start and relay
Ignition system protection	Fuse 15 amps
Headlights (work) See S/N Break*	NH #9847313
Taillights (work) See S/N Break*	NH #9847313

*Headlight and Taillight Serial Number Break

Model	Serial Number Range
L565	850751 to 999999 and 0001 to 31153
Lx565	847451 to 999999 and 0001 to 38841
Lx665	847851 to 999999 and 0001 to 64384

Headlights (work) See S/N Break**	NH86533429
Taillights (work) See S/N Break**	NH86533429

**Headlight and Taillight Serial Number Break

Model	Serial Number Range
L565	31154 to 850750
Lx565	38842 to 847450
Lx665	64385 to 847850

Taillights (road)	86505510
Amber flasher	NH #529068

HYDRAULIC SYSTEM

Pump - Type		Gear pump
Output	(Standard Flow - L565/Lx565)	15.2 GPM (57.5 LPM) @3050 RPM-@1000 PSI
	(Optional High Flow - L565/Lx565)	25.7 GPM (97.3 LPM) @3050 RPM-@2300 PSI
	(Standard Flow - Lx665)	17.4 GPM (65.9 LPM) @3050 RPM-@1000 PSI
	(Optional High Flow - Lx665)	27.7 GPM (104.9 LPM) @3050 RPM-@2300 PSI
Reservoir		22.7 L (6.5 gal.)
Hydraulic Fluid		SAE 10W-30 - API SG/CF

Control Valve		3 Spool Open Center	
Main system relief		170 - 176.8 bar (2500 - 2600 PSI)	
Circuit relief - boom		238 bar (3500 PSI)	
Filter Spin-on canister		NH #9842392	
BOOM CYLINDERS			
Double-acting		35.1 mm (2.5″) dia. bore 470.0 mm (18.5″) stroke	
Cycle time		Raise	Lower
	L565/Lx565 -	3.5 seconds	3.5 seconds
	Lx665 -	2.7 seconds	2.3 seconds
BUCKET CYLINDERS			
Double-acting		31.8 mm (2.25″) dia. bore 450.8 mm (17.88″) stroke	
Cycle time		Dump	Curl
	L565/Lx565 -	2.8 seconds	2.2 seconds
	Lx665 -	1.75 seconds	1.54 seconds
HYDROSTATIC TRANSMISSIONS			
Pump		Variable displacement piston type	
Motor		Fixed displacement piston type	
Charge Pressure		7.5 bar (110 PSI)	
Relief Pressure (Transmission)		238 bar (3500 PSI)	
Oil Type		SAE 10W-30 API SG/CF	
TRAVEL SPEEDS - 10.00 16.5 Tires			
Forward		12.07 KPH (7.5 MPH)	
Reverse		12.07 PPH (7.5 MPH)	

TIRE SIZES AND INFLATION

Tire	**Tire Pressure**
7.00 15 - CHEVRON TREAD	414 kPa (60 PSI)
7.50 15 - HST-HOLLOW SEGMENTED TIRES	N/A
10.00 16.5 - R4 CLEAT TREAD	345 kPa (50 PSI)
10.00 16.5 HD 2000	345 kPa (50 PSI)
10.00 16.5 - HST-HOLLOW SEGMENTED	N/A
31 15.5 15 - G1 Flotation	276 kPA (40 PSI)

BASIC WEIGHT - With 157 cm (66″) Dirt & Foundry bucket, 79 kg (175-lb.) operator, full fuel tank, battery, and 10.00 16.5 tires

L565	2443 kg (5385 lbs.)
Lx565	2452 kg (5395 lbs.)
Lx665	2456 kg (5405 lbs.)

OPERATING CAPACITY

SAE Operating load capacity per SAE J732, J818, J742 Standard.

L565	680 kg (1500 lbs.) (mfg. rating) 770.4 kg (1695 lbs.) (SAE rating)*
Lx565	680 kg (1500 lbs.) (mfg. rating) 770.4 kg (1695 lbs.) (SAE rating)*
Lx665	771 kg (1700 lbs.) (mfg. rating) 774.9 kg (1705 lbs.) (SAE rating)*

*SAE operating load rating per J818 specifications.

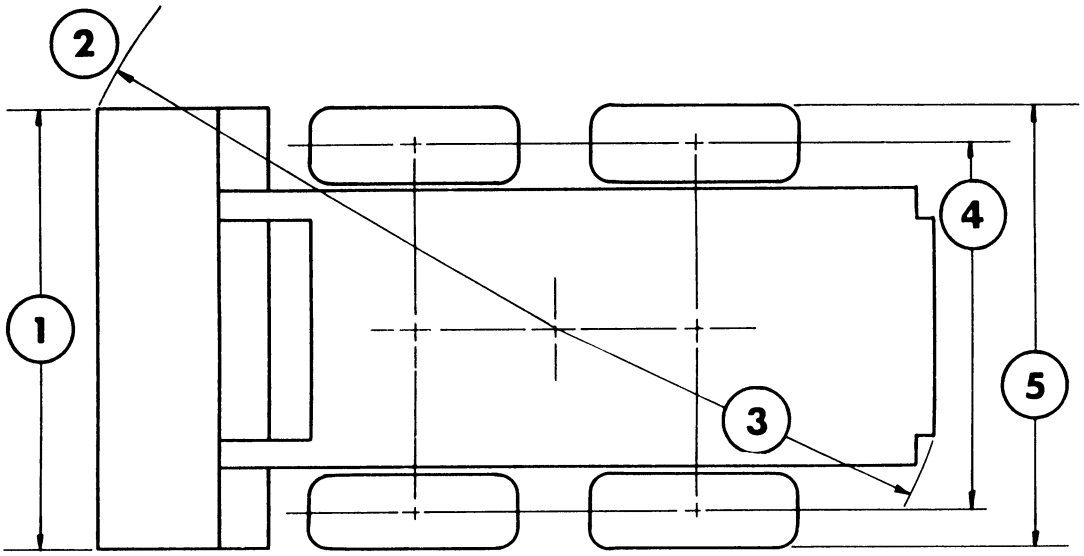


Figure 1-32

DIMENSIONS - L565, Lx565 AND Lx665 WITH 66″ DIRT AND FOUNDRY BUCKET AND 10 x 16.5 TIRES - CM (IN.)

1 - OVERALL WIDTH w/BUCKET . . . . . 168.7 cm (66″)

2 - TURNING RADIUS - FRONT . . . . . 189.2 cm (74″)

3 - TURNING RADIUS - REAR . . . . . 152.4 cm (60″)

4 - WHEEL TREAD w/10 x 16.5 TIRES . . . . . 138.5 cm (56″)

5 - OVERALL WIDTH w/10 x 16.5 TIRES . . . . . 166.7 cm (65.6″)
OVERALL WIDTH w/7 x 15 TIRES . . . . . 152.4 cm (60″)

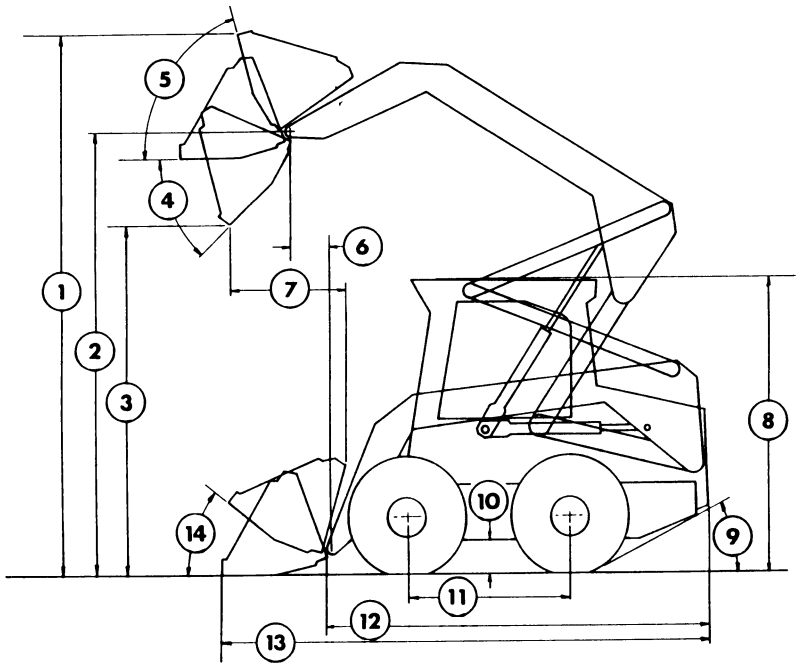


Figure 1-33

DIMENSIONS - L565, Lx565 AND Lx665 WITH 66″ DIRT AND FOUNDRY BUCKET AND 10 x 16.5 TIRES - CM (IN.)

1 - MAXIMUM OPERATING HEIGHT . . . . . 355.7 cm (140.0″)

2 - HEIGHT TO HINGE PIN . . . . . 293.4 cm (115.5″)

3 - DUMP HEIGHT . . . . . 229.6 cm (90.4″)

4 - DUMP ANGLE (MAX.) . . . . . 46 DEGREES

5 - ROLLBACK FULLY RAISED . . . . . 74 DEGREES

6 - BOOM REACH TO PIVOT PIN (At max. reach) . . . . . 37.0 cm (14-9/16″)

7 - DUMP REACH @ MAXIMUM HEIGHT . . . . . 71.1 cm (28.0″)

8 - OVERALL HEIGHT . . . . . 189.9 cm (74.75″)

9 - ANGLE OF DEPARTURE . . . . . 23 DEGREES

10- GROUND CLEARANCE
(CHAIN CASE) . . . . . 19.6 cm (7.7″)
(BELLY PAN) . . . . . 23.6 cm (9.3″)

11- WHEELBASE . . . . . 107.9 cm (42.5″)

12- OVERALL LENGTH WITHOUT BUCKET . . . . . 257.8 cm (101.5″)

13- OVERALL LENGTH w/BUCKET . . . . . 322.0 cm (126.75″)

14- ROLL BACK ANGLE (BOOM DOWN) . . . . . 36 DEGREES

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ENGINE

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GENERAL ENGINE INFORMATION

NEW HOLLAND ENGINES, N844 used in the MODELS L565 and LX565 SKID-STEER LOADERS and N844T TURBOCHARGER ENGINE used in the MODEL LX665 SKID-STEER LOADER:

GENERAL DESCRIPTION

The N844, N844T Series are four-cylinder stroke, liquid-cooled, compression ignition engines, designed for durability, low weight and compactness. The engines are IDI (In Direct Injection). The linerless cylinder block, three-piece helical gear train, and flange-mounted fuel injection pump on the engine cam, reduce frictional power loss and engine weight. The special direct-injection or swirl chamber, along with the small bore multi-cylinder design, offers good fuel consumption, low noise, and excellent start-ability.

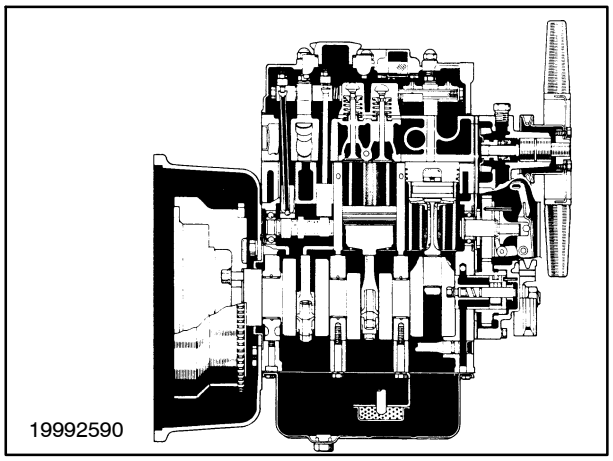

Figure 2-1

COMPONENT ASSEMBLY DESCRIPTION

Cylinder Block

The cylinder block is made from high-grade cast iron with copper and chrome additives and is integral with the crankcase. The crankcase features five main bearings of the tunnel block design, with crankcase walls extending well below the crankshaft centerline for strength and rigidity. The cylinder's bores are plateau honed for oil retention and extended ring life. The non-machined surfaces are sealed to ensure cleanliness.

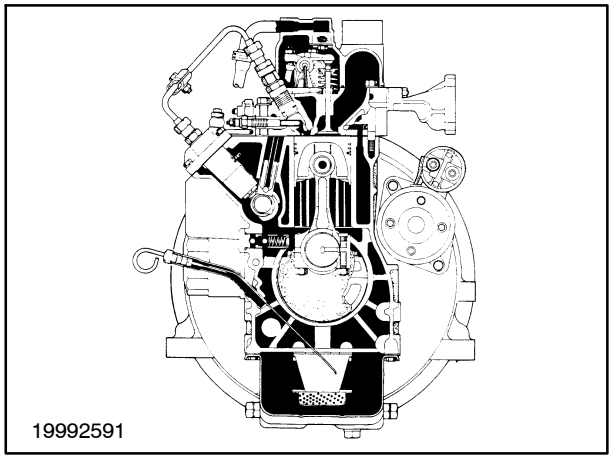

Figure 2-2

Crankshaft

The crankshaft is a chrome-molybdenum steel forging, fully machined, static, and dynamically balanced with integral counterweights. All bearing surfaces are induction hardened. The axial location is by thrust washers at the number five main bearing. The five main journals run in replaceable steel-backed cast copper/lead alloy bearings. The front of the crankshaft is keyed.

Pistons and Connecting Rods

Pistons are cast from high silicon aluminum alloy and are heat-treated for low weight with high strength and good thermal conductivity. The piston is fitted with three rings; two cast iron, chrome-faced compression rings and one steel, chrome-faced controlled oil ring. The fully floating gudgeon pin (wrist pin) is made of chrome molybdenum steel alloy hardened by carburizing and retained by the conventional retaining ring method. The connecting rods are machined from high-strength forged steel. The big end bearings are renewable steel-backed, copper/lead alloy overlay with tin plating. The small end bearings are a press fit plain bushing of tin-backed lead/bronze.

Camshaft

The camshaft is made of forged steel and is induction hardened. Three or four additional lobes at the front operate the fuel injection pump. At the rear, a fuel lift pump eccentric is machined. The camshaft is supported by roller and needle bearings and lubricated by splash feed. The nose of the camshaft supports the cam gear, governor weight cage, and governor slider assembly.

Cylinder Head

The cylinder head is made of high grade copper chrome cast iron, and incorporates replaceable heat-resistant alloy steel valve seats. Inlet and exhaust valves are made of high grade heat-resistant alloy steel with tuftrided stems and induction hardened heads. Each stem is fitted with a chrome molybdenum steel cap for long life.

The valves are operated by cold drawn seamless tube push rods with hardened steel ball and forged cup ends. Flat-based tappets are made from case carburized chrome molybdenum steel operating in machined bores in the cylinder block. The rocker shaft is an induction hardened hollow steel tube. Valve clearances are adjusted by hardened ball-ended screws and locknuts.

Rocker Cover and Inlet Manifold

The cover is made of cast aluminum with an air intake, oil filler, and crankcase breather. It is located in position by rocker pillar studs and secured by cap nuts.

Gear Train

The gear train consists of three helical gears – the crankshaft gear located by a woodruff key, the idler gear houses the lube oil pump, and the cam gear incorporates the governor weight cage.

Fuel System

A flange-mounted, Bosch-type fuel injection pump is mounted in the cylinder block and operated by lobes machined on the engine cam.

Lubricating System

A trochoid lobe oil pump located in the center of the idler gear sends lubricating oil to the main oil galley via a relief valve through a spin-on bypass oil filter to the main oil gallery. The rockers are pressure fed via an externally mounted oil pipe from the main oil gallery to the cylinder head.

Cooling System

A belt-driven centrifugal water pump circulates coolant via the internal water passages. The coolant is radiator cooled and temperature controlled by a conventional thermostat.

ENGINE MODEL AND SERIAL NUMBER LOCATION

The engine model number is located on the right side of the engine block at 1. The engine serial number is located at 2.

Throughout this manual, whenever the left- or right-hand side of the engine is referred to, it is that side of the engine when viewed from the flywheel end.

This publication is produced by New Holland North America, Inc. Every endeavor is made to ensure the information contained in this manual is correct at the date of publication, but due to continuous development, New Holland reserves the right to alter specifications without notice.

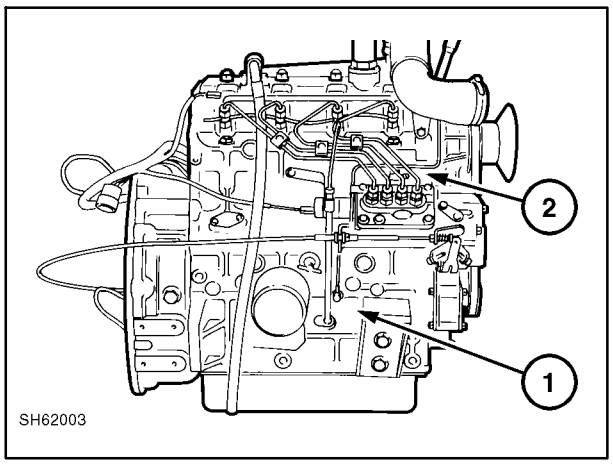

Figure 2-3

COLD ENGINE STARTING PROCEDURE

Check the engine code programmed into the EIC board. The correct engine code must be used to provide the right amount of preheat time (seconds) needed for the engine.

If a gas engine code is used, no preheat time is provided.

Allow the EIC board to preheat the engine. The amount of preheat time is controlled by the EIC board, depending on engine temperature. The warmer the engine (weather also), the less the preheat time.

Procedure:

1. Sit in the seat to power up the EIC board.
2. Fasten the seat belt when the board lights go out.
3. Turn on the ignition switch and monitor the preheat time in seconds. The seconds could be as high as 18 and will count down to zero. Try to start the engine when the beeper sounds one time.
4. If the engine does not start, turn off the ignition switch, turn the switch back on, and allow preheat timer to count down again.
5. Start the engine.

If the engine does not start, check for burned out glow plugs. One or more glow plugs not heating will make the engine harder to start, or if all glow plugs are burned out, the engine may not start. Replace the glow plugs.

TURBOCHARGER LUBRICATION

The turbocharger used on the Lx665 diesel engine may not receive adequate lubrication on cool/cold weather (below 5°C, 40°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 until the EIC “beep” is heard.
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.

SAFETY PRECAUTIONS

THESE SAFETY PRECAUTIONS ARE MOST IMPORTANT:

Do not change the specification of the engine.

Do not smoke when you put fuel in the tank.

Clean away any fuel which has spilled and move material which has fuel contamination to a safe place.

Do not put fuel in the tank during engine operation.

Never clean, lubricate or adjust the engine during operation unless otherwise specified in this manual. Use extreme caution when working around moving parts to prevent injury.

Do not make any adjustments you do not understand.

Ensure the engine is not in a position to cause a concentration of toxic emissions.

Persons in the area must be kept clear during engine and equipment or vehicle operation.

Do not permit loose clothing or long hair near parts which move.

Keep away from parts which turn during operation. Note that fans cannot be seen clearly while the engine is running.

Do not run the engine with any safety guards removed.

Do not remove the radiator cap while the engine is hot and the coolant is under pressure, as dangerous hot coolant can be discharged.

Do not use salt water in the fresh water cooling system or any other coolant which can cause corrosion.

Keep sparks or fire away from batteries (especially while charging) or combustion can occur. The battery fluid can burn and is also dangerous to the skin and especially the eyes.

Disconnect the battery terminals before you make a repair to the electrical system.

Only one person must be in control of the engine.

Ensure the engine is only operated from the control panel or operator's position.

If your skin comes into contact with high-pressure fuel, get medical assistance immediately.

Diesel fuel and used engine oils can cause skin damage to some persons. Use protection on the hands (gloves or special skin protection solutions).

Do not move equipment unless the brakes are in good condition.

Be sure that the transmission drive control is in "Neutral" position before the engine is started.

Do not use ether to start these engines.

GENERAL ENGINE DATA

LOADER MODEL	L565, Lx565	Lx665
Engine Model	N844	N844T
Type	Vertical in-line 4-stroke naturally aspirated	
Basic Thread and Size		
Bore	84 mm (3.31″)	84 mm (3.31″)
Stroke	90 mm (3.54″)	90 mm (3.54″)
Combustion System	IDI (Indirect Injection/Special Swirl)	
Compression Ratio	22:1	22:1
Swept Volume Liter (inch^3)	1,995 (121.7)	1,995 (121.7)
Firing Order	1-3-4-2	1-3-4-2
Rotation	Counterclockwise viewed from flywheel	
Low Idle	900-1000 RPM	900-1000 RPM
High Idle (Full Throttle)	3130-3180 RPM	3130-3180 RPM
Injection Pump	Flange-mounted, Bosch-type plunger and barrel	
Injectors	Bosch-type throttle	
Injector Setting		
Kilograms/sq. cm (kgf/cm^2)	147-157	147-157
Pounds per sq. inch (PSI)	2132-2277	2132-2277
Turbo	NO	YES
Governor	Mechanical all speed	
Cooling System	Liquid with water pump and radiator	
Industrial Cooling System Capacity (less radiator) Liters	3.3	3.6
Thermostat Operating Temperature degrees	180°/203° F (82°/95° C)	160°/180° F (71°/82° C)
Oil Pressure Relief	35-50 PSI 2.5 - 3.5 kgf/cm^2	50-64 PSI 3.5 - 4.5 kgf/cm^2
Oil Pressure Switch	4.3 PSI	4.3 PSI
Electrical System		
Starter	12V	12V
Alternator	12V	12V
Battery (625 CCA)	12V	12V
Weight, Bare Engine (Industrial)	191 kg (421 lbs.)	206 kg (454 lbs.)
Height	767 mm (30.2″)	789 mm (31.1″)
Length	686 mm (27.0″)	666 mm (26.2″)
Width	428 mm (16.8″)	482 mm (19.0″)

Recommended Engine Fluids

Coolant	Clean soft water. Maximum antifreeze concentration 50% (ethanediol base-ethylene glycol with corrosion inhibitor to BS 6850:1985 or ASTM D3306-74 or AS 2108-1977)
Fuel	Cetane number-45 minimum, Viscosity -2.5/4.5 centistokes at 104° F (40° C). Density-0.835/0.855 . kg/liter, Sulfur-0.5% of mass maximum. Distillation 85% at 662° F (350° C). (Aviation fuel JP4 is not recommended; however, JP5 and JET-A are acceptable, providing 5% spindle oil is added).

Lubricating System - Early Model

L565 - 8507751 to 999999 and 0001 to 31279
Lx565 - 847451 to 999999 and 0001 to 40190
Lx565 High Flow - 847451 to 999999 and 0001 to 40215
Lx665 - 847851 to 999999 and 0001 to 66996
Lx665 High Flow - 847851 to 999999 and 0001 to 67011

System	Pressure feed with Trochoid pump
Oil Type	API SG/CF SAE 10W-30 (SAE 5W30 for extended cold weather operation)
Filter Part #	NH #86546618
Engine Crankcase Capacity w/Filter	6.6 L (7 qt.)
Dipstick Length	381 mm (15″)

Lubricating System - Later Model

L565 - 31280 to 850750
Lx565 - 40191 to 847450
Lx565 High Flow - 40216 to 847450
Lx665 - 66997 to 847850
Lx665 High Flow - 67012 to 847850

System	Pressure feed with Trochoid pump
Oil Type	API SG/CF SAE 10W-30 (SAE 5W30 for extended cold weather operation)
Filter Part #	NH #86546618
Engine Crankcase Capacity w/Filter	7.6 L (8 qt.)
Dipstick Length	367 mm (14.4″)

TROUBLESHOOTING

ENGINE WILL CRANK BUT DOES NOT START

CAUSE	CORRECTION
Faulty key switch	Correct the connection and/or replace switch
Blown 5-amp electronic ignition fuse (cab fuse panel)	Replace fuse
Fuel solenoid not operating	Check solenoid for battery voltage and correct
Insufficient charging or complete discharging of the battery	Charge or replace battery
Lack of fuel	Fill fuel tank
Air mixed in the fuel system	Bleed the air
Clogged fuel filter	Replace
Irregular and faulty fuel supply (electric fuel pump)	Check power supply; check fuse in fuse panel; check for corroded internal components (replace pump and in-line filter if corroded)
Irregular and faulty fuel supply (injection pump trouble)	Repair in an authorized service shop
Glow plug not heating	Failure of the glow plug; replace
Improper viscosity of the lubricating oil	Inspect and replace
Clogged air cleaner	Clean or replace
No compression	Repair in a service shop

ENGINE WILL NOT CRANK OR START

CAUSE	CORRECTION
Seat belt not fastened	Buckle seat belt
Faulty key switch	Correct the connection and/or replace switch
Insufficient charging or complete discharging of the battery	Charge or replace battery
Blown 5-amp electronic battery fuse (engine fuse panel)	Replace fuse
Blown 15-amp key main fuse (engine fuse panel)	Replace fuse
Open in W/O (white-orange) wire between the seat/seat belt connector and start interlock relay	Check and repair as required
Faulty start interlock relay	Check and repair as required

IRREGULAR RUNNING OF THE ENGINE

CAUSE	CORRECTION
Air mixed in the fuel system	Bleed the air from the system
Uneven fuel injection (faulty fuel injection pump)	Repair at authorized shop
Clogged fuel filter	Replace
Defective governor	Check and correct
Engine itself defective	Repair in a service shop

ENGINE STOPS DURING OPERATION

CAUSE	CORRECTION
EIC (Electronic Instrument Cluster) shows fault with hydrostatic charge pressure	Check and repair hydrostatic charge pressure
EIC (Electronic Instrument Cluster) shows fault with engine crankcase oil pressure	Check oil level and/or repair engine crankcase oil pressure
Lack of fuel in the tank	Fill fuel tank and bleed air
Clogged fuel filter	Replace
Air mixed in the fuel system	Bleed the air
Faulty function of the engine	Repair in a service shop

OVERHEAT OF THE ENGINE

CAUSE	CORRECTION
Lack of cooling water	Supply water, inspect for leakage and correct
Loose or slipping fan belt	Remove oil, dust, etc. and tighten
Damaged fan belt	Replace
Clogged radiator	Flush the radiator
Clogged radiator fin	Clean
Dust or scale clogged in the cooling water passage	Flush the system
Faulty function of the thermostat	Inspect or replace thermostat
Lack of lubricating oil	Add oil
Overloading	Decrease the load

FAULTY CHARGING

CAUSE	CORRECTION
Loose fan belt	Correct belt tension
Faulty wiring	Inspect and correct
Faulty battery	Repair
Worn out alternator brush	Replace

STARTER MOTOR DOES NOT RUN

CAUSE	CORRECTION
Loose or disconnected wiring	Inspect and tighten
Blown 5-amp electronic battery fuse (engine fuse panel)	Replace fuse
Blown 15-amp key main fuse (engine fuse panel)	Replace fuse
Low voltage of the battery	Charge the battery
Damaged starter motor	Repair in a service shop

OIL PRESSURE LAMP NOT TURNED ON (Key Switch “On” with Engine Not Started)

CAUSE	CORRECTION
Broken lamp bulb	Replace bulb
Broken wire between battery to the lamp	Correct it

OIL PRESSURE LAMP NOT TURNED OFF

CAUSE	CORRECTION
Lack of engine oil	Fill oil to the specified level
Fault in the pressure switch	Replace the switch
Oil leakage from the lubricating system	Inspect and retighten
Clogged oil filter	Replace with new one
Short-circuit between EIC panel and oil pressure switch	Repair

EXCESSIVE SMOKE/ENGINE MISS

CONDITION	CAUSE	CORRECTION
Good power, but misses or smokes at top engine speed	Top engine speed too high	Adjust top engine speed to factory limit
	Timing off	Check and adjust engine timing (refer to Tech Com Video #9701)
White or blue exhaust smoke during all operating conditions	Excess engine oil	Check and correct the level
	Engine oil viscosity too low	Check and replace oil
	Faulty/late injection timing	Correct timing
Blue smoke on cold engine startup	Low combustion temperature	Check fuel injection timing, adjust inlet and exhaust valves, and test the cylinder compression
	Normal warm-up	May be difficult to stop blue smoke on startup completely
Dark exhaust smoke	Fuel cetane rating not optimal	Use only fuel with a cetane rating of 50 or higher
	Excess injection	Inspect and adjust (in service shop)
	Faulty function of the engine	Repair in service
	Overloading	Reduce the load
	Clogged air cleaner	Clean
	Leaks	Seal off all leaks
	Valve cover vent hose kinked or clogged	Shorten hose to 460 mm (18.1″)

ENGINE RUNS - NO POWER TO TRANSMISSION

CAUSE	CORRECTION
Flex plate failure due to rivets shearing	Replace with new design flex plate part #86521866
Flex plate failure due to inadequate lubrication	Replace flex plate (part #86521866) and input shaft, applying Never-Seize on splines

Lx665 TURBOCHARGER BEARING FAILURES

CAUSE	CORRECTION
Lack of lubrication during cold weather startup	Warm up below 1500 RPM for three minutes on start-up and allow to run at low idle for one minute before shutdown

Lx665 ENGINE NOISE/WHISTLING

CAUSE	CORRECTION
Internal muffler restriction	Replace muffler
Turbocharger worn	Inspect turbocharger components

EXCESSIVE OIL CONSUMPTION (OR OIL SMOKE FROM EXHAUST)

CAUSE	CORRECTION
Leaks	Seal all leak sources
Valve cover vent hose kinked or clogged	Shorten hose to 460 mm (18.1″)

NOTE: See Lx665 Oil Consumption below for more extensive troubleshooting procedures.

Lx665 - EXCESSIVE OIL CONSUMPTION DUE TO PISTON SCUFFING

The maximum allowable oil consumption for the turbocharged diesel engine is 0.8%, as measured using a log of fuel consumption to oil consumption.

If a customer complains about excessive engine oil consumption on the Model Lx665 skid-steer loader, the following steps must be taken. If a cause is found, stop and correct the problem. If a cause is not found, continue to the next step.

1. Examine engine for signs of external oil leaks.
   - Check gaskets: oil pan, timing gear case, head, head cover, injection pump, oil gallery, and dipstick.
   - Oil seals: crankshaft, front and rear.
   - Steel tubing and fittings that supply oil to the turbocharger and upper engine.
   - Tubing, hose, and fittings for turbocharger oil drain to block.
   - Damage to oil pan and drain plug.
   - Crankcase breather hose (open and not kinked) preventing proper crankcase breathing.
2. Examine turbocharger area.
   - Remove the hose between the turbocharger inlet and the air cleaner. Examine for signs of dirt in the hose and inlet to the turbocharger blower.

   If carbon, oil, and dust are found, check:

   - Air cleaner assembly for tightness of filter elements.
   - Hose between air cleaner and turbocharger for damage or looseness of clamps.

   If oil residue is evident on the clean air turbine, it might not be due to failed turbocharger bearings.

   NOTE: A film of oil on the clean air side of the turbocharger to the intake manifold is normal for skid-steer loader operation.

   Check the air filter and air intake hose for signs of oil residue.

   Check the exhaust area for leaks:

   - Exhaust manifold gasket and hardware.
   - Turbocharger gasket and hardware.
   - Muffler gasket and hardware.
   - Muffler failure (cracks, misalignment).

   Remove the hose between the turbocharger outlet and the intake manifold. Check for dirt in the hose, turbocharger outlet, and the air intake manifold.

   If there is no dirt at the turbocharger inlet but there is a deposit at the turbocharger blower outlet (which is not due to signs of dirt in the hose and inlet to the turbocharger blower), it may be leakage from the turbocharger seals.

   Check turbocharger shaft specifications:

   Axial movement . . . . . maximum 0.09 mm (0.0035″)
   Radial movement . . . . maximum 0.17 mm (0.0067″)
3. Check the blowby hose (valve cover vent hose) for signs of blockage. If the hose is kinked or the end is blocked by debris, correct by cutting off the end of the hose so it is just below the bottom of the engine oil filter. Refer to Service Bulletin 5/96-I1.
4. If there is no problem found in the 1, 2, and 3 checking points, then go to the next step to log oil consumption.
5. The customer must log oil consumption using the following procedure:
   a. Change the engine oil and filter. Use the oil specified in the loader operator's manual.
   b. Run the engine for two minutes.
   c. Check the dipstick and add oil, if required, so the level is at the full mark.
   d. Fill the fuel tank with fuel.
   e. Record fuel consumption (in gallons), oil added (in quarts), 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 give examples.

Fuel Consumption, Gallons	Oil Consumption, Quarts
50	1.6
100	3.2
200	6.4

A log example is shown in the following table. The hour level is the EIC (Electronic Instrumentation Cluster) reading when fuel is added. Dealer must file oil consumption log with customer file.

Fuel	Oil	Hour Level
Full	Full	100
XX Gallons	X Quart	150
XX Gallons	X Quart	200

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

   $$\% \text{ Consumption} = \frac{(\text{quarts oil}/4) \times 100}{\text{gallons fuel}}$$

   Assume one quart oil is added for 50 gallons fuel.

   $$\% \text{ Consumption} = \frac{(1/4) \times 100}{50} = 0.5\%$$

7. The New Holland dealer must check compression on all four cylinders and record.

   The compression specifications are as follows:

Standard Value	To Be Repaired
More than 429 PSI (29.5 bar) at 200-250 engine cranking RPM	Less than 356 PSI (24.5 bar)

Compression testing can be performed using a special adaptor (see “Special Tools” in the Additional Information Section) through the glow plug ports. Remove all glow plugs and test each cylinder.

This should be a “dry” compression check (do not put any oil in the cylinder).

If compression is low, recheck the air intake system for signs of dirt ingestion.

SPECIFICATIONS

Maintenance Standards Table

Inspection Item	Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
CYLINDER HEAD					
Compression pressure of cylinder		More than 426.6 PSI (30 kg/cm^2)	Less than 355.5 PSI (25 kg/cm^2)		
Tigtening torque of cylinder head		72.3 -75.9 ft. lbs. (98-103 N·m)			
Distortion of face of cylinder head		0.002″ max. (0.05 mm)	0.0047″ (0.12 mm)		
Valve seat depth (Both intake and exhaust) Width Recess Valve Seat		0.026″ - 0.037″ (0.65 mm-0.95 mm)	0.063″ (1.6 mm)		Valve seat angle 45°
Valve seat width (intake)		0.06″-0.08″ (1.5 mm - 2.0 mm)	0.1″ (2.5 mm)		
Valve seat width (exhaust)		0.076″-0.085″ (1.94 mm-2.16 mm)	0.1″ (2.5 mm)		
CYLINDER BLOCK					
Type			Dry type (Unit type)		
Bore	3.307″ (84 mm)	3.307″-3.308″ (84mm-84.019mm)	3.315″ (84.2 mm)	3.354″ (85.2 mm)	Oversize 0.02/.04″ (0.5, 1.0 mm)
Cylinder block type surface warpage		0.002″ max. (0.05 mm)	0.0047″ (0.12 mm)		
PISTON					
Skirt long-diameter size	3.307″ (84 mm)	3.3050″-3.3056″ (83.948-83.963)		3.295″ (83.7 mm)	Oversize 0.02/.04″ (0.5, 1.0 mm)
Clearance with cylinder		0.0015″-0.0028″ (0.038-0.072 mm)		0.01″ (0.25 mm)	68° F (20° C)
Piston pin hole inside diameter	1.1024″ (28 mm)	1.1023″-1.1025″ (27.999-28.003mm)			
Piston pin hole to pin clearance		-0.00004″ ± .00028″ (0.001 ± 0.007 mm)		0.0008″ (0.02 mm)	

Inspection Item		Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
PISTON PIN						
Pin outside diameter		1.1024″ (28 mm)	1.1022″-1.1024″ (27.996-28.0 mm)		1.1016″ (27.98 mm)	
Rod small end bushing to pin clearance			0.0004″-0.00098″ (0.010-0.025 mm)		0.004″ (0.1 mm)	Oil clearance
PISTON RING						
Piston ring groove to ring clearance						
	1st ring		0.0028″-0.0043″ (0.07 -0.11 mm)		0.0098″ max. (0.25 mm)	
	2nd ring		0.0016″-0.0031″ (0.04-0.08 mm)			
	Oil ring		0.0008″-0.0024″ (0.02-0.06 mm)		0.006″max (0.15 mm)	
Ring width						
	1st ring	0.1378″ (3.5 mm)	0.1339″-0.1417″ (3.4-3.6 mm)			
	2nd ring	0.1417″ (3.6 mm)	0.1378″-0.1457″ (3.5-3.7 mm)			
	Oil ring	0.0984″ (2.5 mm)	0.0906″-0.1063″ (2.3-2.7 mm)			
Piston ring end gap						
	1st ring		0.0079″-0.0138″ (0.2-0.35 mm)		0.0394″ (1.0 mm)	
	2nd ring		0.0079″-0.0157″ (0.2-0.4 mm)			
	Oil ring		0.0079″-0.0157″ (0.2-0.4 mm)			

Inspection Item	Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
CONNECTING ROD					
Twist between small and large end holes (per 100 mm)		0.0031″ max. (0.08 mm)		0.0079″ (0.2 mm)	
Straightness at 100mm between small and large end hole		0.0020″max. (0.05 mm)		0.0059″ (0.15 mm)	
Front-to-rear clearance between connecting rod and crank pin		0.004″-0.012″ (0.1-0.3 mm)		0.0276″ (0.7 mm)	
Connecting rod bearing-to-crank pin clearance		0.0014″-0.0033″ (0.035-0.085)		0.0079″ (0.2 mm)	Oil clearance
Crush height of large end bearing		1.0833″-1.0849″ (27.517-27.557)			
Connecting rod bearing (inner diameter x width)	2.1654″ x 0.779″ (55 x 19.8 mm)	2.1654″ x 0.779″ (55 x 19.8 mm)			
Connecting rod bolt torque		36.2-39.8 ft. lbs. (49-54 N·m)			
Weight difference with piston assembly		less than 0.022 lbs. (10 g)			

Inspection Item			Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
CRANKSHAFT							
Diameter of journal			2.677″ (68 mm)	2.6755″-2.6760″ (67.957-67.970)		2.654″ (67.4 mm)	Undersize 0.01″, 0.02″ (0.25, 0.5)
Diameter of pin			2.047″ (52 mm)	2.0458″-2.0463″ (51.964-51.975)		2.024″ (51.4 mm)	Undersize 0.01″, 0.02″ (0.25, 0.5)
Roughness, main journal & crank pin			1.6Z				
Cranshaft deflection				0.0012″ max. (0.03 mm)		0.0024″ (0.06 mm)	
Axial play of crankshaft				0.004″-0.016″ (0.1-0.4 mm)			
Thickness of thrust washer				0.116″-0.118″ (2.95-3.0 mm)		0.110″ (2.8 mm)	
O.D. x I.D. of bushing (journal bearing)			2.8346″x2.6772″ (72x68mm)	2.8346″x2.6772″ (72x68mm)			
Clearance between crankshaft journal bushing				0.0017″-0.0046″ (0.044-0.116)		0.008″ (0.2 mm)	Oil clearance
O.D. x I.D. of center bearing			2.8346″x2.6772″ (72x68mm)	2.8346″x2.6772″ (72x68mm)			
Clearance between crankshaft journal and center bearing				0.0017″-0.0040″ (0.044-0.102)		0.008″ (0.2 mm)	Oil clearance
CAMSHAFT							
Height	For intake/exhaust			1.3411″-1.3433″ (34.065-34.12)		1.3268″ (33.7 mm)	
	For injection pump			1.6512″-1.6559″ (41.94-42.06)		1.6457″ (41.8 mm)	
	For feed pump			1.2559″-1.2598″ (31.9-32.0 mm)		1.1811″ (30.0 mm)	
Camshaft deflection				0.0012″ max. (0.03 mm)		0.004″ (0.1 mm)	
Cam gear backlash				0.00315″ (0.08 mm)		0.01″ (0.25 mm)	
VALVE							
Diameter of intake valve stem			0.2744″ (6.97 mm)	0.2738″-0.2744″ (6.955-6.97 mm)		0.2713″ (6.89 mm)	
Diameter of exhaust valve stem			0.2736″ (6.95 mm)	0.2732″-0.2736″ (6.94-6.95 mm)		0.2693″ (6.84 mm)	
Clearance between valve stem and valve guide	Inlet			0.0012″-0.0024″ (0.03-0.06 mm)		0.008″ (0.2 mm)	
	Exhaust			0.002″-0.003″ (0.05-0.075 mm)		0.01″ (0.25 mm)	
Valve thickness Thickness				0.0364″-0.0423″ (0.925-1.075)		0.02″ (0.5 mm)	
Valve clearance (intake & exhaust)				0.008″ (0.2 mm)	0.02″ (0.5 mm)		Cold
Valve spring	Spring force at 1.2″ (30.4 mm)			17.86 lbs. (8.2 kg)		15.43 lbs. (7 kg)	
	Free height			1.378″ (35 mm)		1.319″ (33.5 mm)	
	Squareness			0.047″ max. (1.2 mm)		0.079″ (2.0 mm)	
Intake valve	Opening angle BTDC		13°				
	Closing angle ABDC		43°				
Exhaust valve	Opening angle BBDC		43°				
	Closing angle ABDC		13°				

Inspection Item		Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
PUSHROD						
Overall length			8.075″-8.106″ (205.1-205.9)			
Outside diameter			0.244″-0.252″ (6.2-6.4 mm)			
ROCKER ARM						
Rocker arm shaft OD			0.5886″-0.5894″ (14.95-14.97)		0.5854″ (14.87 mm)	
Rocker arm to shaft clearance			0.0012″-0.0037″ (0.030-0.093)		0.008″ (0.2 mm)	Oil Clearance
OIL PUMP						
Oil pressure switch actuating pressure		4.266 PSI (0.3 kg/cm^2)	2.844-5.688 PSI (0.2-0.4 kg/cm^2)			
Relief valve opening pressure		45.5 PSI (3.2 kg/cm^2)				
Tip clearance (rotor to vane gap)			0.0004″-0.006″ (0.01-0.15 mm)		0.0098″ (0.25 mm)	
Axial clearance (rotor to cover)			0.004″-0.006″ (0.1-0.15 mm)		0.008″ (0.2 mm)	
INJECTION PUMP						
Pump plunger diameter		0.217″ (5.5 mm)				
Pump plunger stroke		0.276″ (7.0 mm)				
Injection timing	Before top dead center	N844 22° N844T 21°	N844 21°-23° N844 T 20°-22°			
	Piston displacement (BTDC) - N844	0.1743″ (4.426 mm)	0.1533″-0.1837″ (3.895-4.655 mm)			
	Piston displacement (BTDC) - N844T	0.1533″ (3.895 mm)	0.1393″-0.1734″ (3.539-4.426 mm)			
INJECTION NOZZLE						
Injection pressure		2205 PSI (152 kg/cm^2)	2132-2277 PSI (147-157 kg/cm^2)	1849 PSI (130)		
COOLING						
Cooling system		Water cooled forced circulation				
Cooling water quantity (1) (Without radiator)		3.3				
Thermostat opening temperature		180° F (82° C)				
Thermostat full open temperature		203° F (95° C)				
V-belt (fan) slack - 0.2″ (5 kg) at center		0.2″ (5 kg)				
STARTER MOTOR						
Type		NIPPON DENSO (12V-2kw Reduction)				
Pinion gear # teeth		11				
Pinion gear shift system		Magnetic shift				
Commutator diameter wear		1.38″ (35 mm)			1.34″ (34 mm)	
Commutator diameter eccentric wear			0.0008″ (0.02 mm)		0.002″ (0.05 mm)	
Armature shaft bending				0.002″ (0.05 mm)		
Brush length		0.59″ (15 mm)			0.35″ (9 mm)	
Brush spring pressure .		5.9-7.8 lbs. (2.7-3.6 kg)			4.7 lbs. (2.2 kg)	

Inspection Item	Standard Dimension	Standard Value	To Be Repaired	Allowable Limit	Remarks
ALTERNATOR					
Type	MITSUBISHI (12V-40A)				
Rotor shaft bending			0.0028″ (0.07 mm)		
Slip rings					
Diameter	0.894″ (22.7 mm)		0.871″ (22.1 mm)		
Diameter eccentric wear			0.002″ (0.05 mm)	0.08″ (0.02 mm)	
Surface condition			If dirty or damaged correct with emery cloth.		
Brush length	0.728″ (18.5 mm)			2.0″ (5.0 mm)	
Brush spring pressure	1.169 lbs. (530 g)	1.036-1.300 (470-590 g)		0.60 lbs. (270 g)	

TORQUE SPECIFICATIONS

COMPONENT	Setting/Remarks
Bearing holder bolts- hex hole type	18-22 ft. lbs. (24-30 N·m)
- hex bolt type	36-40 ft. lbs. (49-54 N·m)
Rear plate bolts	10-13 ft. lbs. (14-18 N·m)
Flywheel housing bolts	18-21 ft. lbs. (24-28 N·m)
Flywheel bolts	43-51 ft. lbs. (58-69 N·m)
Connecting rod nuts	36-40 ft. lbs. (49-54 N·m)
Suction filter bolt	7-9 ft. lbs. (9-12 N·m)
Sump bolts	7-9 ft. lbs. (9-12 N·m)
Crankshaft pulley nut	203-246 ft. lbs. (275-333 N·m)
Cylinder head bolts	72-76 ft. lbs. (98-103 N·m)/oiled
Injection pump bolts	7-9 ft. lbs. (9-12 N·m)
Injection pump nuts	7-9 ft. lbs. (9-12 N·m)
Rocker arm nuts	20-29 ft. lbs. (27-39 N·m)/4-cylinder engines
Head cover nuts	9-12 ft. lbs. (12-16 N·m)/4-cylinder engines
Cooling fan bolts	7-9 ft. lbs. (9-12 N·m)
Oil pipe banjo bolts	7-9 ft. lbs. (9-12 N·m)
Oil sump drain bolt	22-29 ft. lbs. (30-39 N·m)
Injection nozzle	43-51 ft. lbs. (58-69 N·m) IDI engines
Injection pipe	11-18 ft. lbs. (15-24 N·m)
Thermo switch	18-22 ft. lbs. (24-30 N·m)
Oil pressure switch	11-15 ft. lbs. (15-20 N·m)
Glow plug	11-15 ft. lbs. (15-20 N·m)
Stop solenoid	11-15 ft. lbs. (15-20 N·m)
Oil relief valve	44-51 ft. lbs. (60-69 N·m)
Smokeset nut (max fuel)	15-19 ft. lbs. (20-26 N·m)
Adjusting screw nuts	9-12 ft. lbs. (12-16 N·m)

STARTING SYSTEM ELECTRICAL DIAGRAM

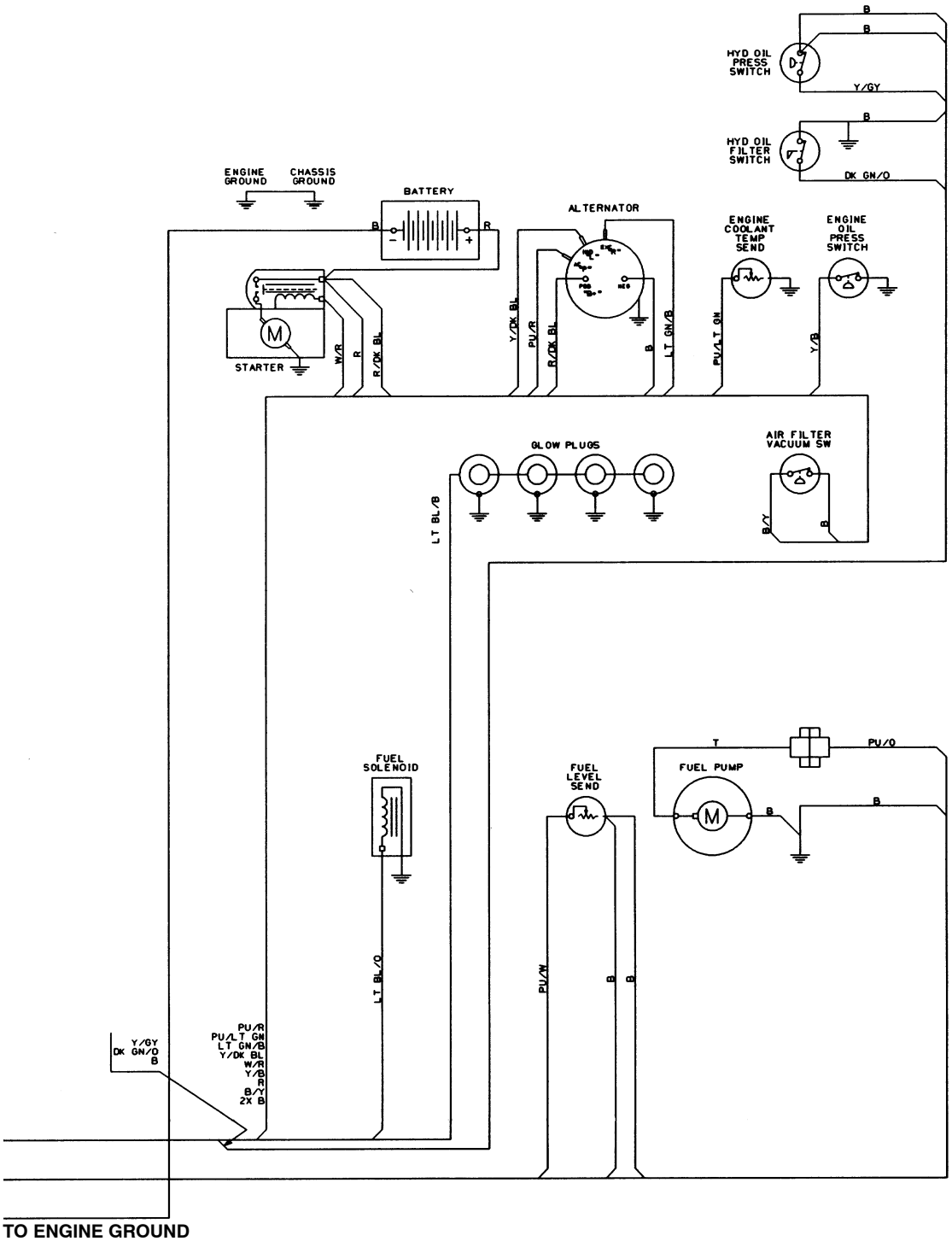

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Figure 2-4

ENGINE REMOVAL

The engine can be removed from the loader by two methods:

Method 1 Removing the rear door, radiator, oil cooler, and support as an assembly.

Method 2 Tilting the cab and boom forward to gain access.

For either method, raise and support the boom on the boom lock pins, 1, to access the engine area.

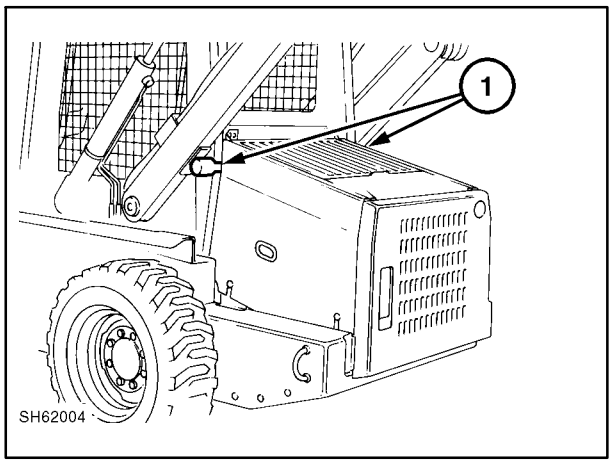


Figure 2-5

METHOD 1
(Without Tilting Cab)

1. Open rear door, 1. Remove the top engine hood, 2, and both the right and left engine side covers.
2. Remove the battery.
3. Drain the cooling system, radiator, and engine block, 3.
4. Remove the upper and lower radiator hoses from the engine block and plug the hoses with plastic plugs.

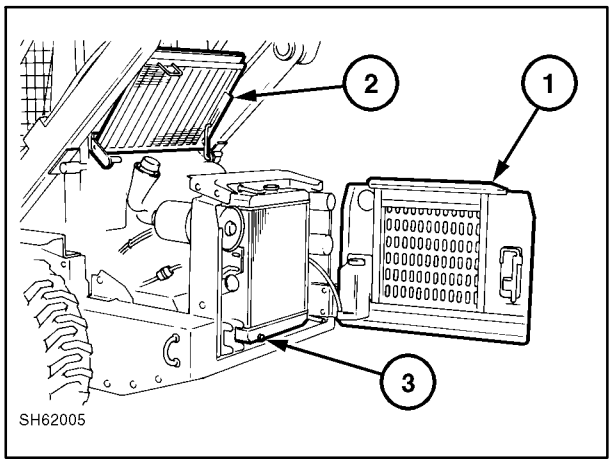


Figure 2-6

5. Remove the air cleaner hose, 1, from the intake manifold and cap.
6. Unplug the engine wire harness from the main harness, 2, and ground wires from the engine bellhousing, 3.
7. Unhook the control valve hydraulic oil return line at the oil cooler and cap, 4.

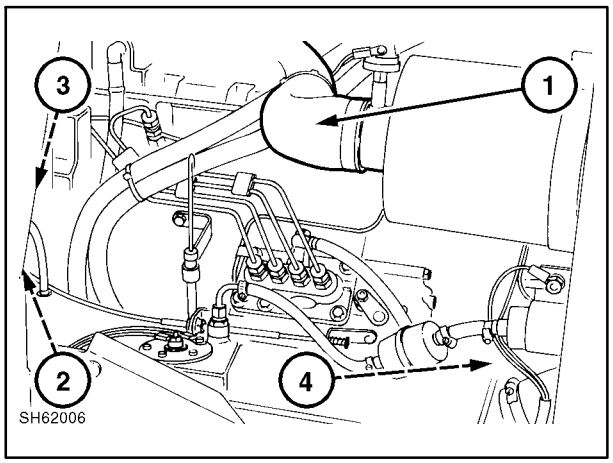


Figure 2-7

8. Unhook the hydraulic oil return line, 1, from the charge check valve and cap.

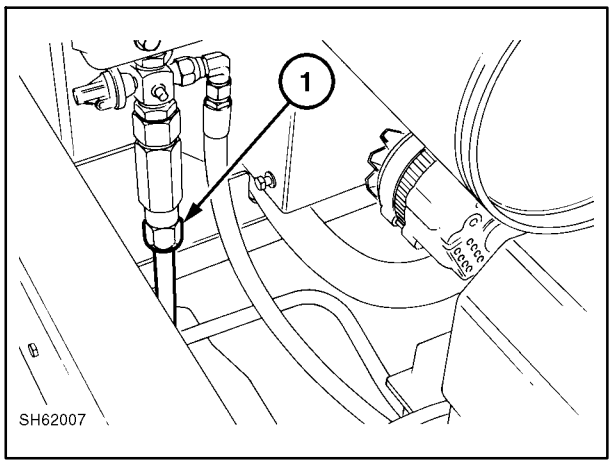


Figure 2-8

9. Remove the eight 1/2″ cap screws from the support at 1, both sides, and remove the radiator and oil cooler assembly.

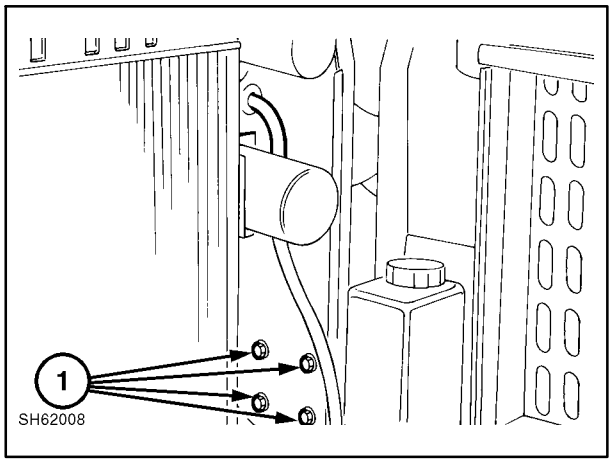


Figure 2-9

The support is shown removed with the air cleaner, radiator, oil cooler, oil filter, and fuel pump attached.

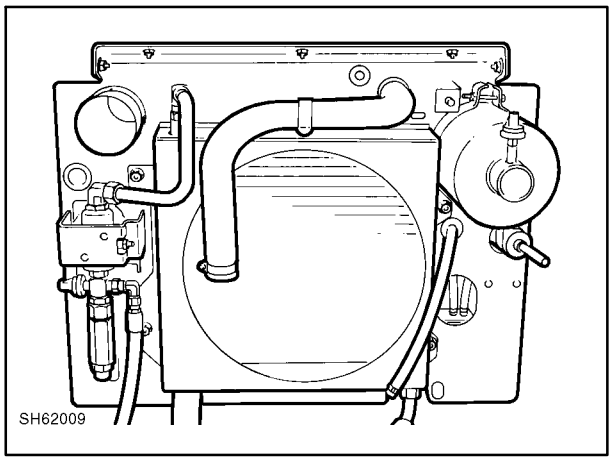


Figure 2-10

10. Raise the seat to the raised latched position, 1, to access the hydrostatic pumps and engine bellhousing. Remove the neutralizer plate return spring and hardware, 2, from the bellhousing and remove plate.

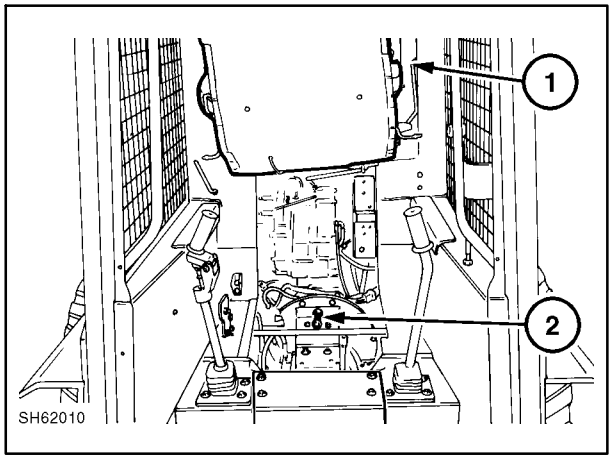


Figure 2-11

Remove the hydrostatic pump to bellhousing and pump support retaining hardware at 1 and 2.

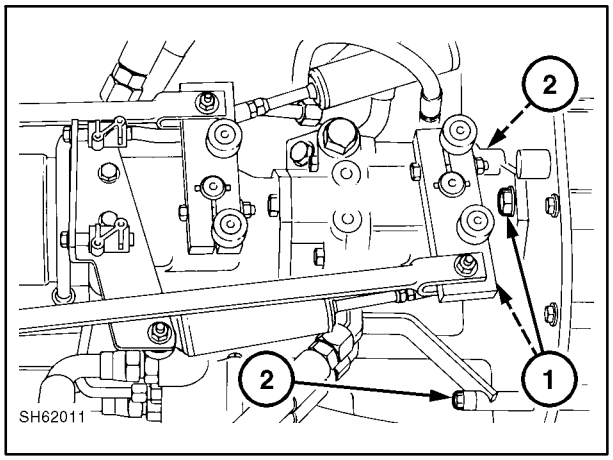


Figure 2-12

11. Attach lifting chains to the engine lift eyes at 1, and hook to the lifting device to support the engine.

12. Remove the engine motor mount hardware and slide the engine to the rear to uncouple the hydrostatic pump assembly from the engine bellhousing. Lift the engine assembly from the skid-steer loader frame.

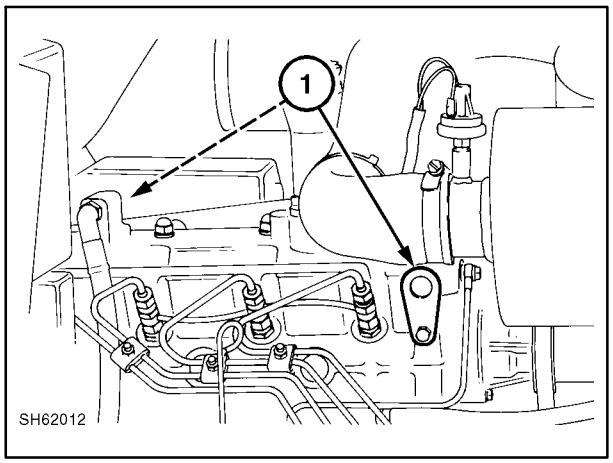


Figure 2-13

METHOD 2
(Tilting Cab and Boom Forward)

Follow the cab tilting procedure in Section 1 of this manual for proper instructions.

1. Remove the muffler from the exhaust manifold, 1.
2. Remove the battery.

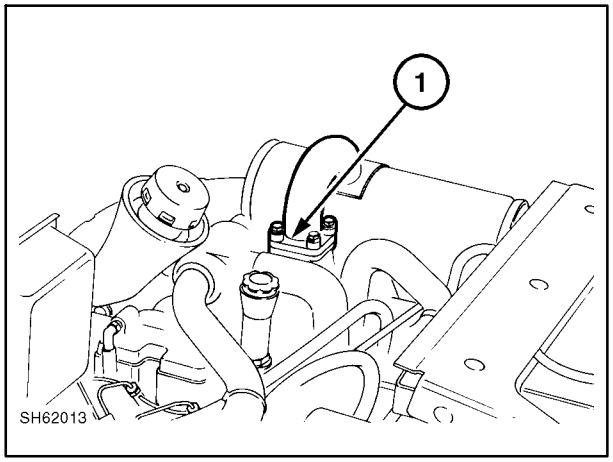


Figure 2-14

3. Drain the cooling system, radiator and engine block, raise handles, 1, moving the radiator to the rear and drain the cooling system from drain plug, 2.
4. Remove the upper and lower radiator hoses from the engine block and plug the hoses with plastic plugs.

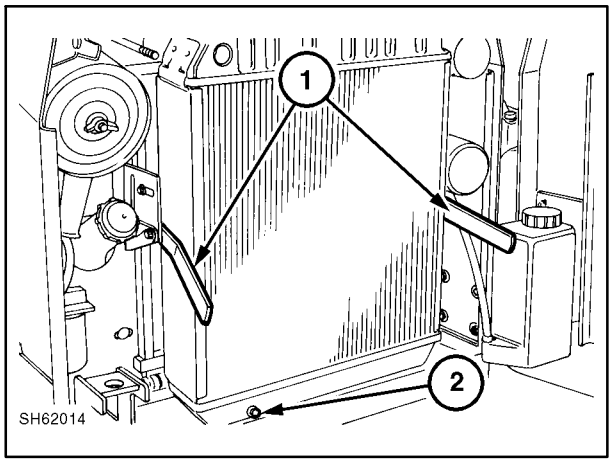


Figure 2-15

5. Remove the air cleaner hose, 1, from the intake manifold and cap.
6. Unplug the engine wire harness, 2, from the main harness and ground wires, 3, from the engine bellhousing.
7. Unhook the control valve hydraulic oil return line at the oil cooler and cap at 4.

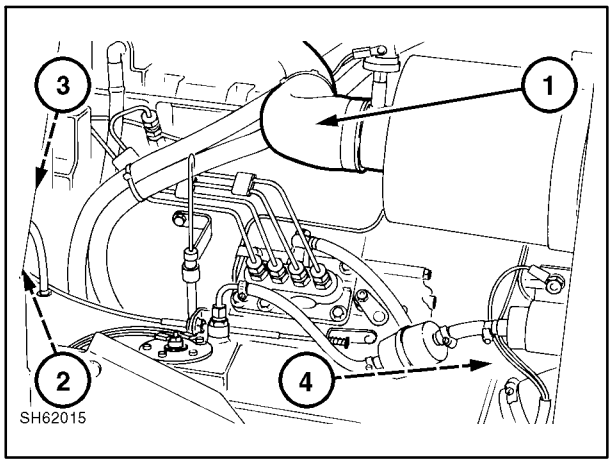


Figure 2-16

8. Unhook the hydraulic oil return line, 1, from the charge check valve and cap.
9. Remove the fan from the water pump shaft.

   NOTE: The L565 and LX565 N844 engine fan is equipped with a cover over the center of the fan.

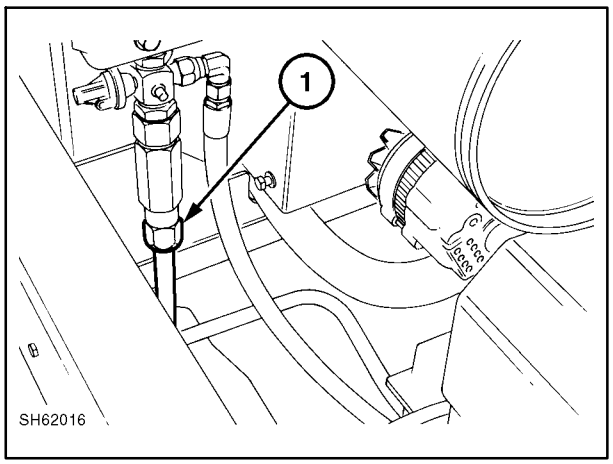


Figure 2-17

10. Remove the neutralizer plate return spring and hardware, 1, from the bellhousing and remove plate, 2.

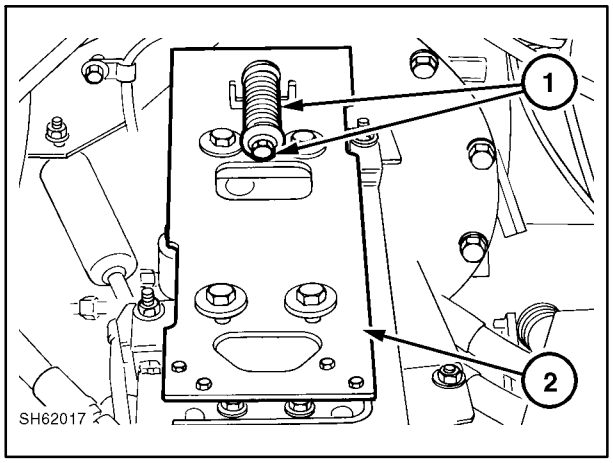


Figure 2-18

11. Remove the hydrostatic pump to bellhousing and pump support retaining hardware at 1 and 2.

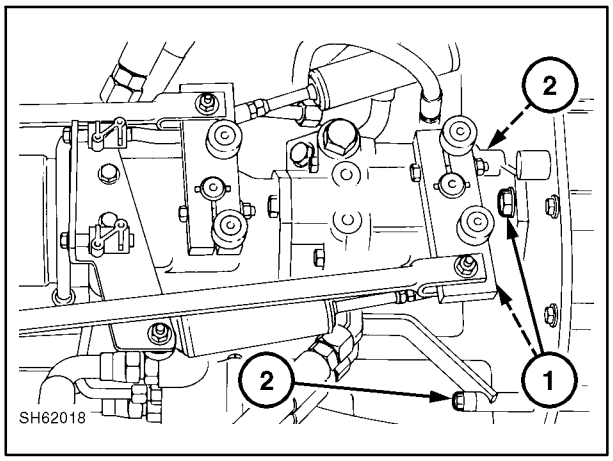


Figure 2-19

12. Attach lifting chains to the engine lift eyes at 1, and hook to the lifting device to support the engine.

13. Remove the fuse panel support hardware and move the panel for clearance.

14. Remove the engine motor mount hardware and slide the engine to the rear to uncouple the hydrostatic pump assembly from the engine bellhousing. Lift the engine assembly from the skid-steer loader frame.

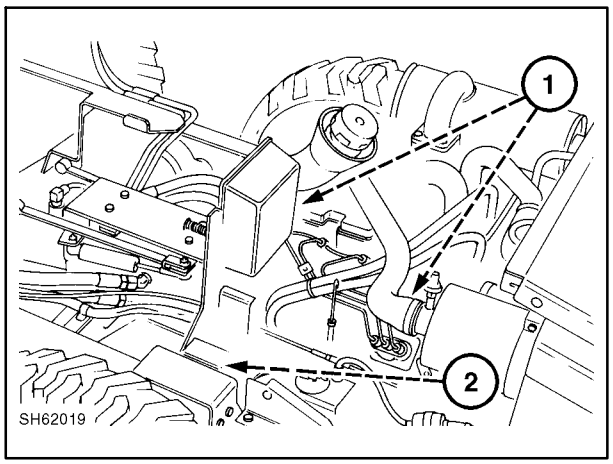


Figure 2-20

ENGINE DISMANTLING SEQUENCE

ALTERNATOR

Disconnect the alternator wire harness and wires, 1.

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

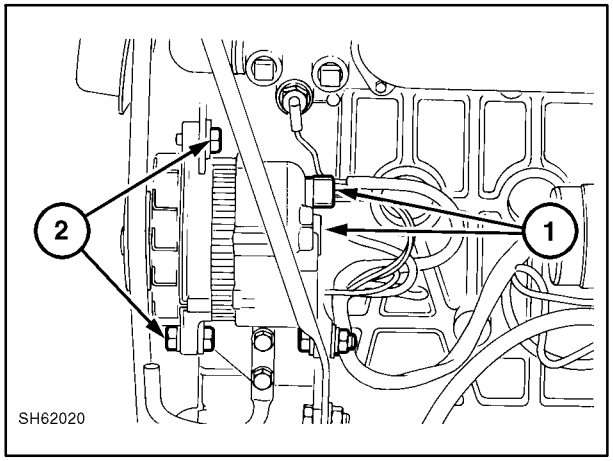


Figure 2-21

REMOVE COOLING FAN AND PULLEY

Remove the fan retaining hardware and spacers. The L565 and LX565 N844 engine fan is equipped with a cover, 1, over the center of the fan.

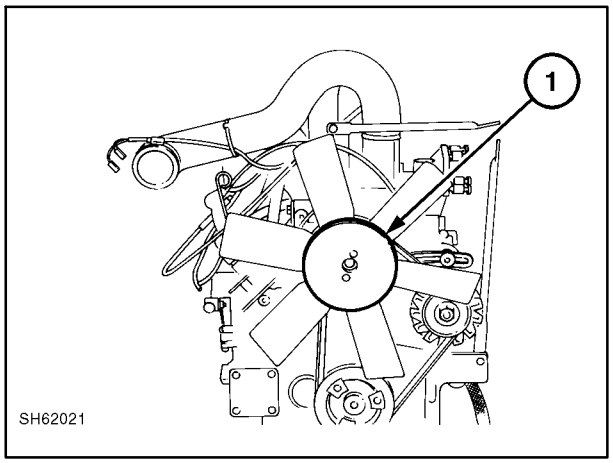


Figure 2-22

FUEL INJECTION PIPE

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.

INJECTOR ASSEMBLY

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.

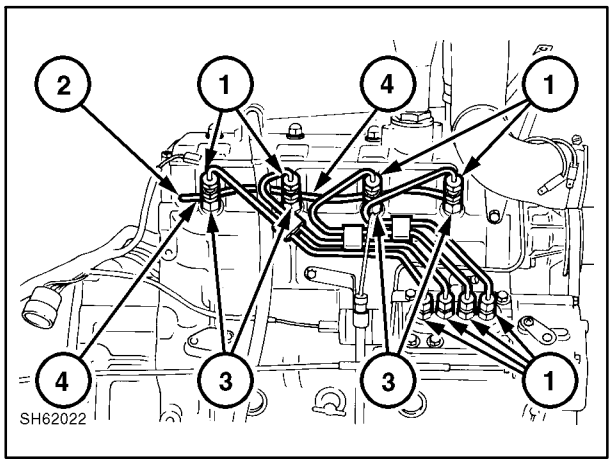


Figure 2-23

WATER PUMP ASSEMBLY

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

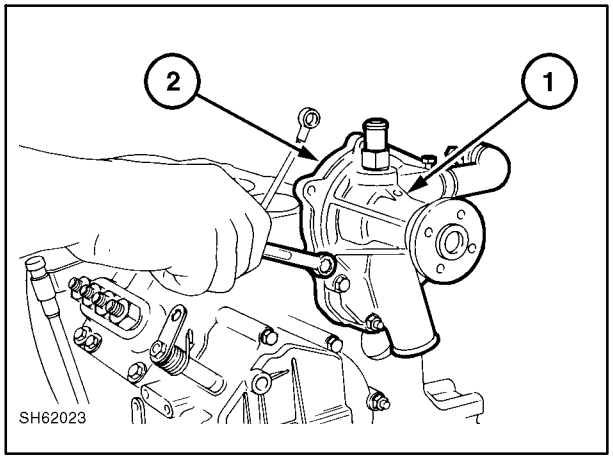


Figure 2-24

ROCKER COVER/INLET MANIFOLD/ EXHAUST MANIFOLD

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

For the N844T turbocharged engine, refer to the turbocharger section of the manual for removal and replacement.

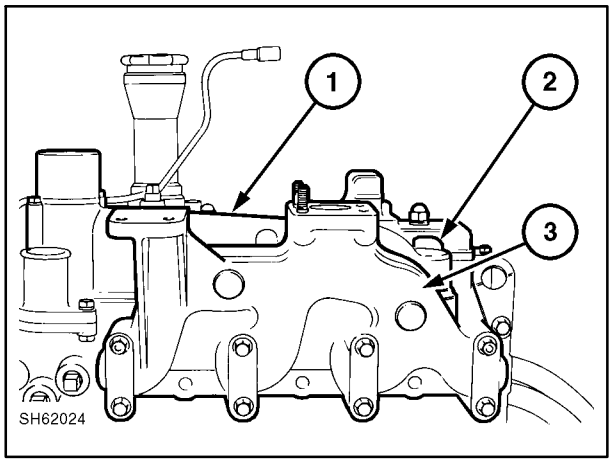


Figure 2-25

Remove the breather hose, 1. Loosen and remove four cap nuts with washers. Remove the rocker cover assembly, 2.

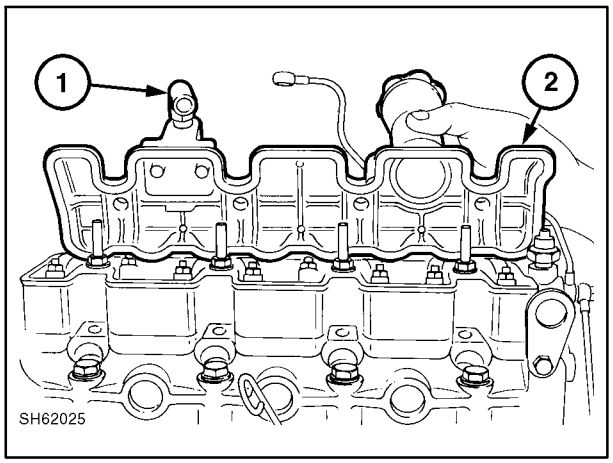


Figure 2-26

EXTERNAL OIL PIPE (L565 - LX565)

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

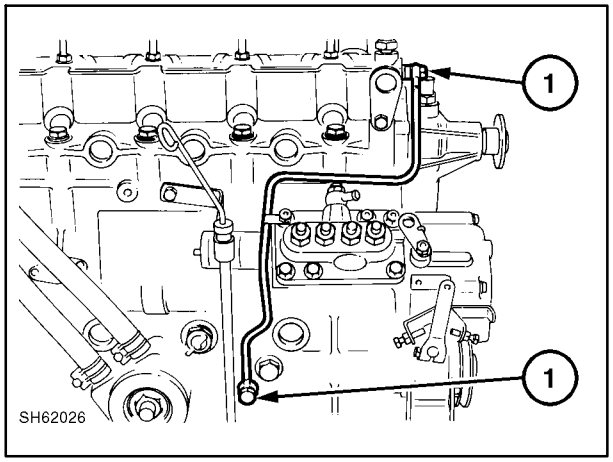


Figure 2-27

EXTERNAL OIL PIPE (LX665)

Loosen and remove the banjo bolts at the turbocharger and the cylinder head assembly.

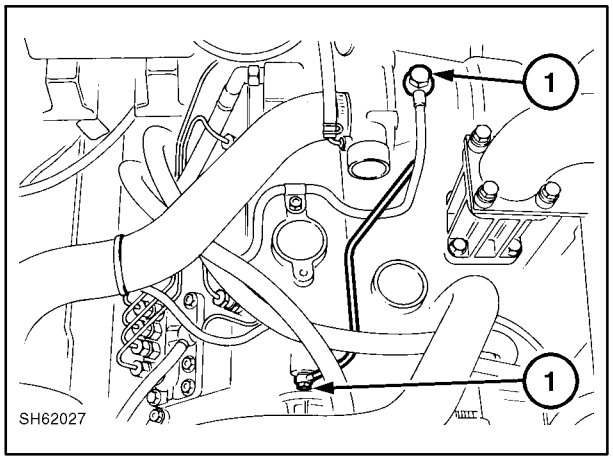


Figure 2-28

ROCKER ASSEMBLY

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.

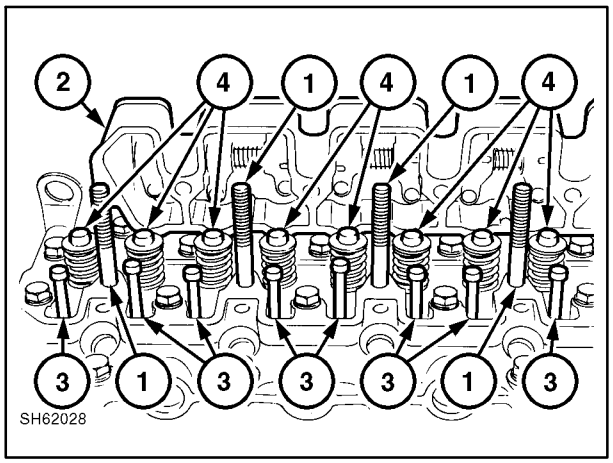


Figure 2-29

CYLINDER HEAD ASSEMBLY

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

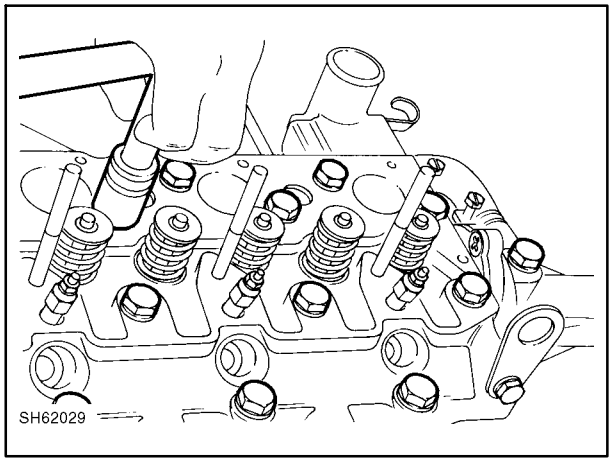


Figure 2-30

TAPPETS

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

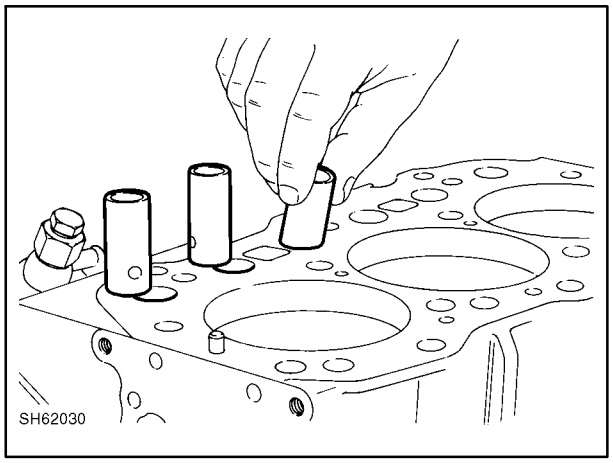


Figure 2-31

STOP SOLENOID

Unscrew the stop solenoid, if fitted.

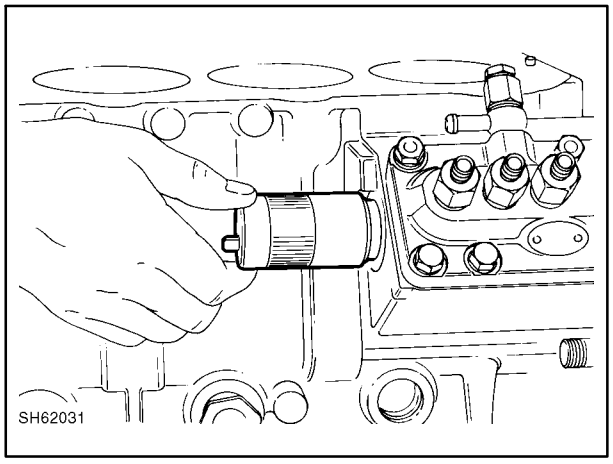


Figure 2-32

FUEL INJECTION PUMP

1. Remove the bolts and nuts securing the fuel injection pump to the cylinder block. Slowly lift and position the fuel injection pump until access to the link snap pin is gained.
2. Remove the snap pin and remove the link from the control rack. Remove the fuel injection pump and shim pack.

   NOTE: Injection timing is determined by the shim pack between the fuel injection pump flange and cylinder block mounting face. The thickness and number of shims should be checked and recorded to aid reassembly.

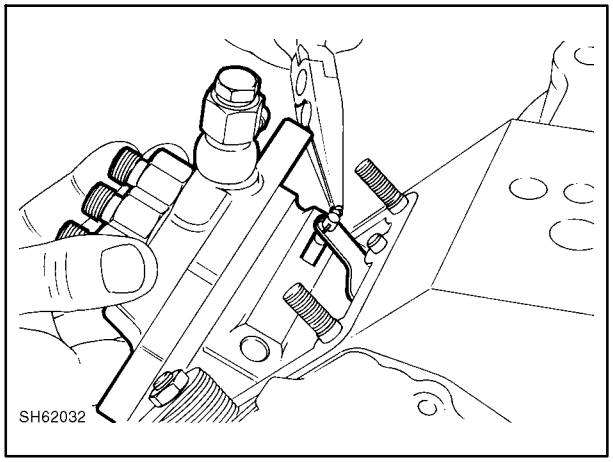


Figure 2-33

CRANK PULLEY

Loosen the pulley nut, 1, and remove the pulley, 2.

OIL FILTER

Remove the spin-on type oil filter and discard.

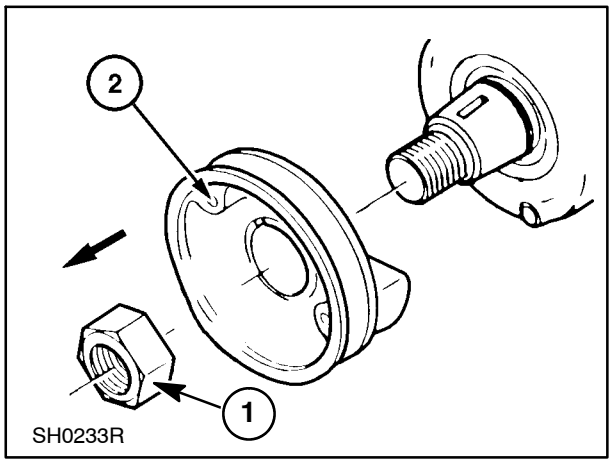


Figure 2-34

GEAR COVER AND GOVERNOR ASSEMBLY

Remove the securing bolts and lift the cover assembly off the locating dowels.

NOTE: Remove the fuel injection pump first.

IDLER GEAR AND OIL PUMP ASSEMBLY

Remove the retaining ring. Remove the entire assembly.

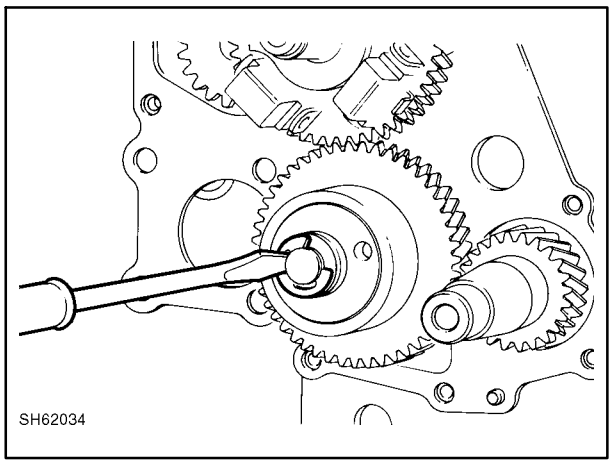


Figure 2-35

CAMSHAFT ASSEMBLY, TACHOMETER DRIVE

1. Using the access hole in the cam gear, remove the keeper plate, 1.
2. Slide the cam shaft, 2, with the flyweight retainer out of the camshaft bore.
3. Pull the tachometer drive shaft, 3, from its bore.

   NOTE: The tachometer drive is not used for the EIC Board Tach.

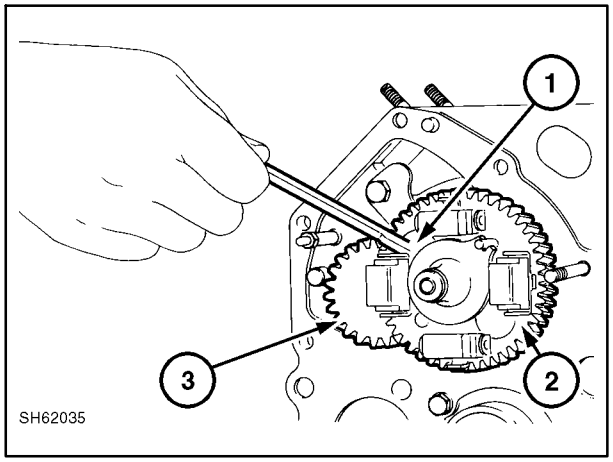


Figure 2-36

FRONT END PLATE ASSEMBLY

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

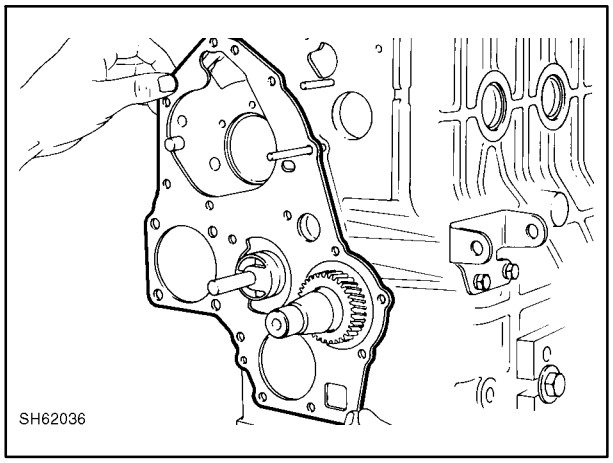


Figure 2-37

Dipstick Assembly

Loosen the retaining bolts and remove the assembly.

Oil Sump

Remove all bolts, lower sump, and discard the gasket.

Suction Pipe and Strainer

Remove two securing bolts. Rotate the suction pipe out of its bore.

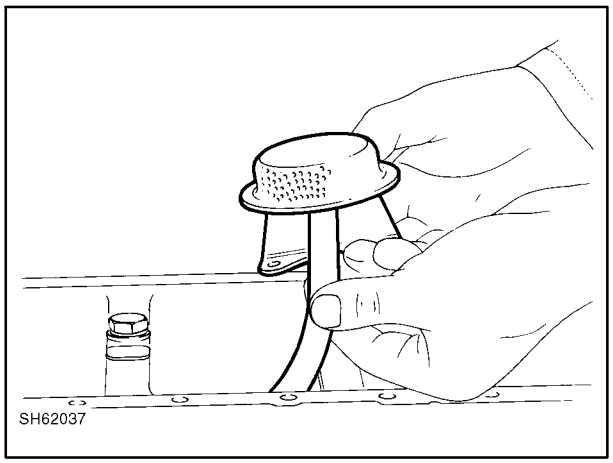


Figure 2-38

Connecting Rod and Piston

1. Loosen the connecting rod nuts and remove the rod cap.
2. Remove carbon from the cylinder bore. Push the piston and connecting rod through the cylinder block. Replace the rod cap to the piston assembly. Keep together in cylinder sequence.

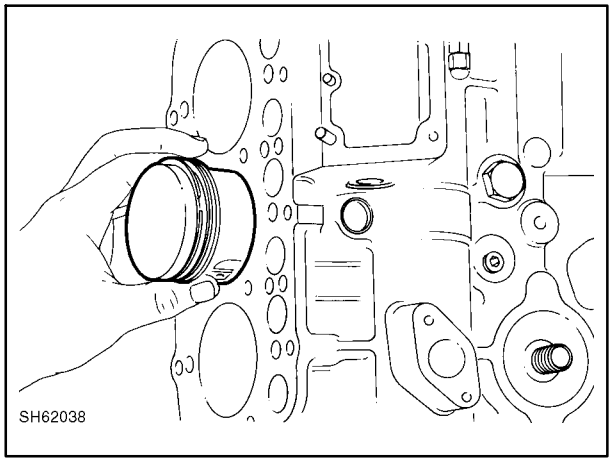


Figure 2-39

Flywheel

Loosen the bolts and remove the flywheel.

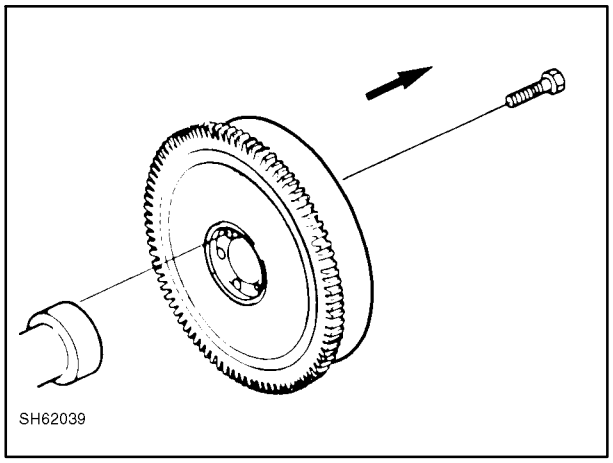


Figure 2-40

Backplate and Rear Oil Seal

1. Loosen the two starter retaining nuts and remove the starter.
2. Loosen the backplate retaining bolts and remove the backplate.
3. Remove the oil seal.

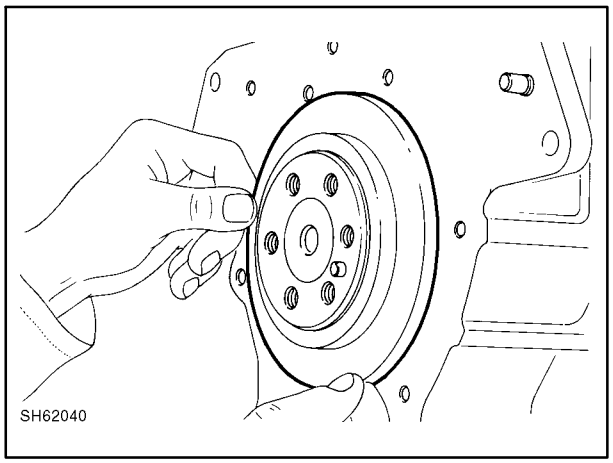


Figure 2-41

Crankshaft and Main Bearing

1. Remove the retaining bolts, 1, through the crankcase cross members.
2. Slide out the crankshaft and main bearing assembly.

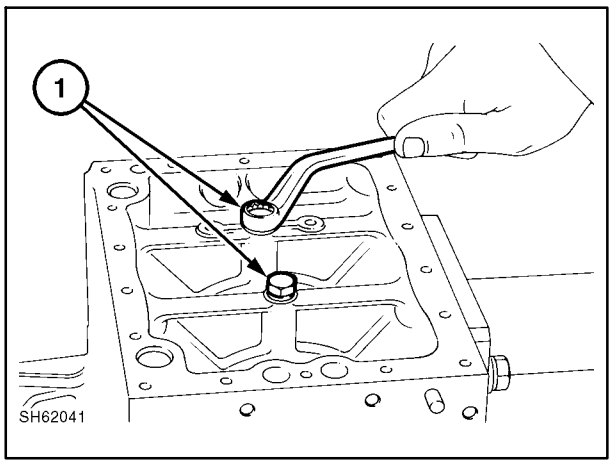


Figure 2-42

3. Remove the relief valve assembly.

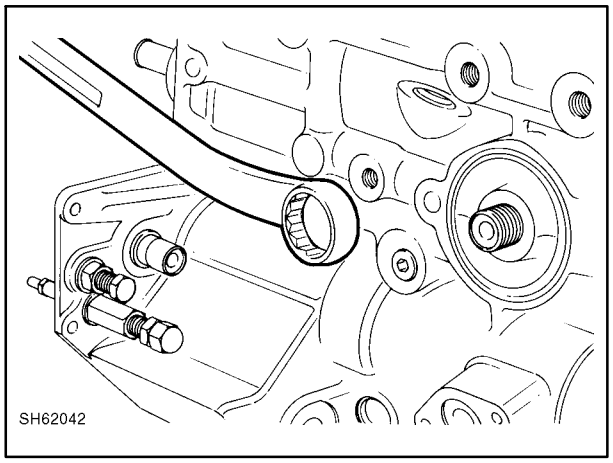


Figure 2-43

DISASSEMBLY, INSPECTION, FITS, AND CLEARANCES OF COMPONENT ASSEMBLIES

ROCKER ARM ASSEMBLY

Disassembly

1. Loosen the M8 bolt at the rocker arm shaft end, if fitted.
2. Remove the screw located in the No. 1 cylinder rocker arm bracket, if fitted.
3. Pull out the rocker arm shaft, 1, springs, 2, and rocker arms, 3.

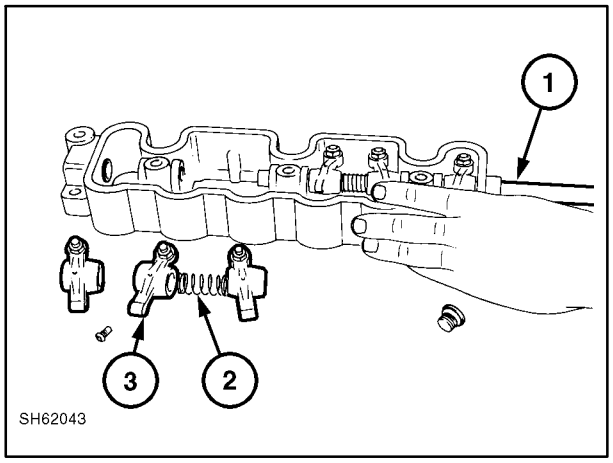


Figure 2-44

Inspection and Correction

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
0.588″ - 0.589″ (14.95 mm - 14.97 mm)	0.585″ max. (14.87 mm)

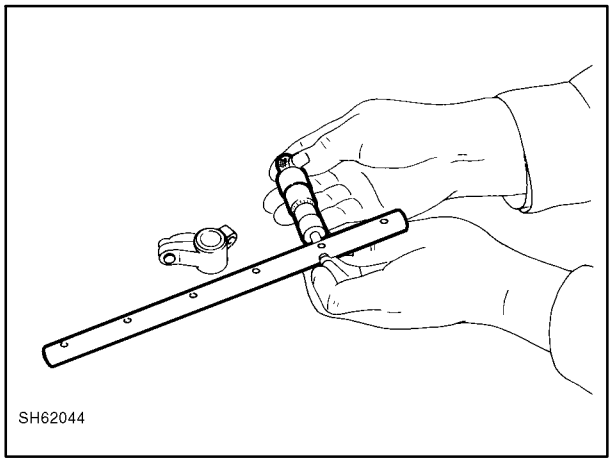


Figure 2-45

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
0.0012″ - .0037″ (0.030 mm - 0.093 mm)	0.008″ (0.2 mm)

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.

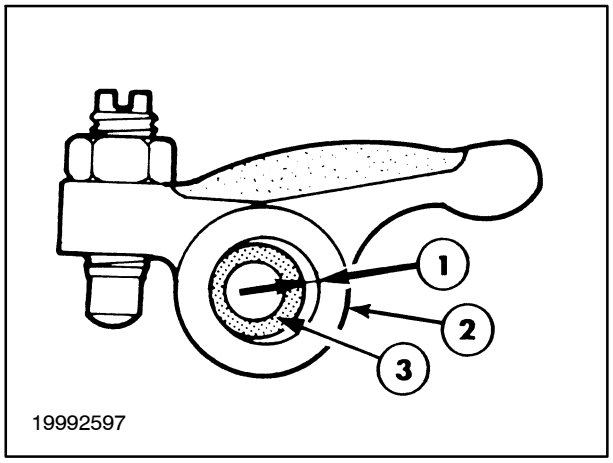


Figure 2-46

CYLINDER HEAD ASSEMBLY

1. Using a valve spring replacer, compress the valve spring to remove the valve keepers, 1; retainer, 2; spring, 3; and valve, 4.
2. Remove the valve guide seals and glow plugs.

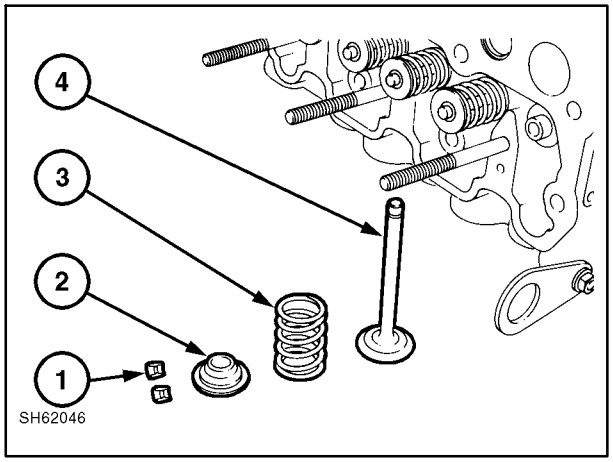


Figure 2-47

Inspection and Correction

Cylinder Head

With a straightedge and a thickness gauge, check for warping of the cylinder head lower face.

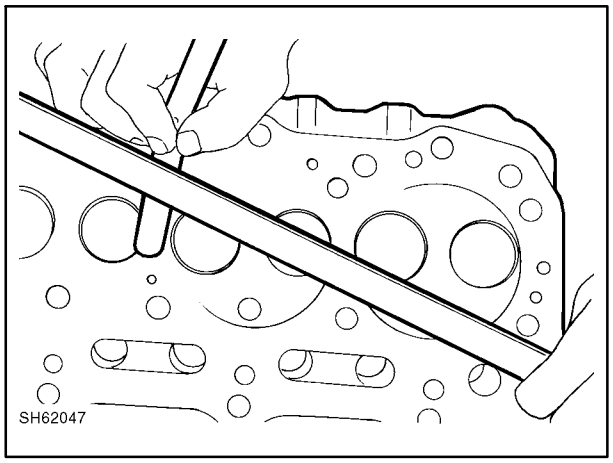


Figure 2-48

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
0.002″ (0.05 mm or less)	0.005″ (0.12 mm)

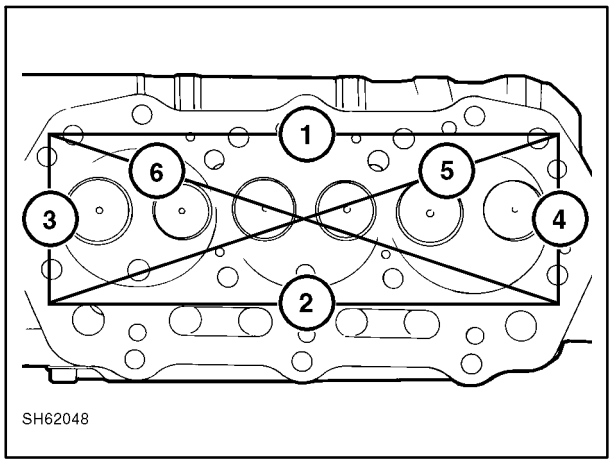


Figure 2-49

Valve Guide and Valve Stem

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
0.2738″ - 0.2744″ (6.955 mm - 6.97 mm)	0.271″ (6.89 mm)

Exhaust Valve

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

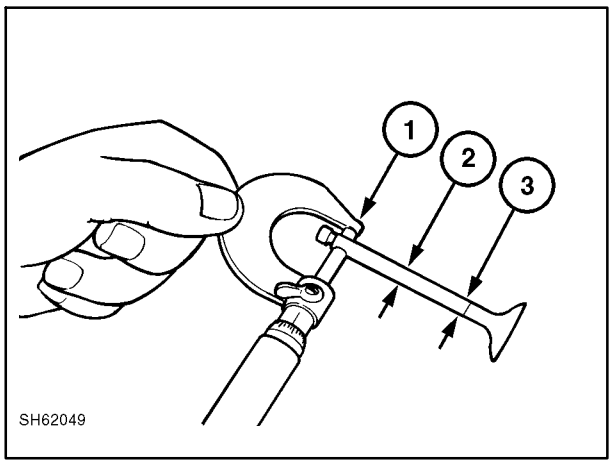


Figure 2-50

Thickness of Valve Head

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

All Engines

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

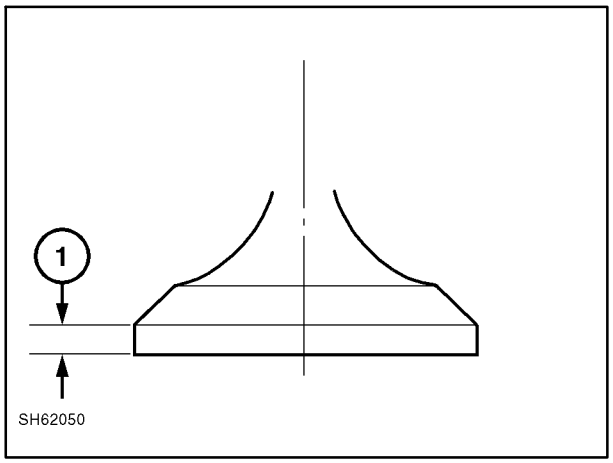


Figure 2-51

Valve to Valve Guide Clearance

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
0.0012″ - 0.0024″ (0.03 mm - 0.06 mm)	Max. 0.008″ (0.2 mm)

Exhaust Valve - All Engines

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

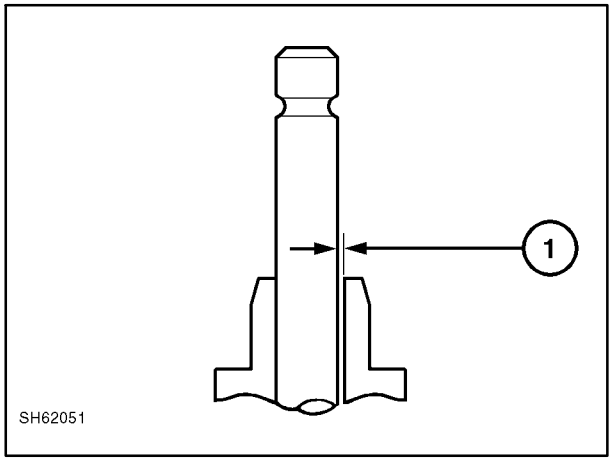


Figure 2-52

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.

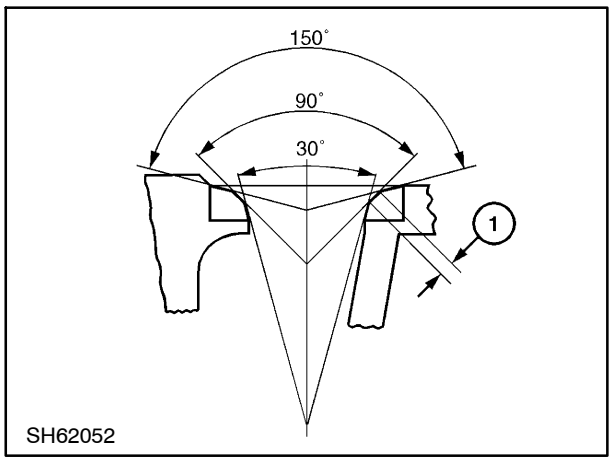


Figure 2-53

Intake

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

Exhaust

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

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
0.026″ - 0.037″ (0.65 mm - 0.95 mm)	0.063″ max. (1.6 mm)

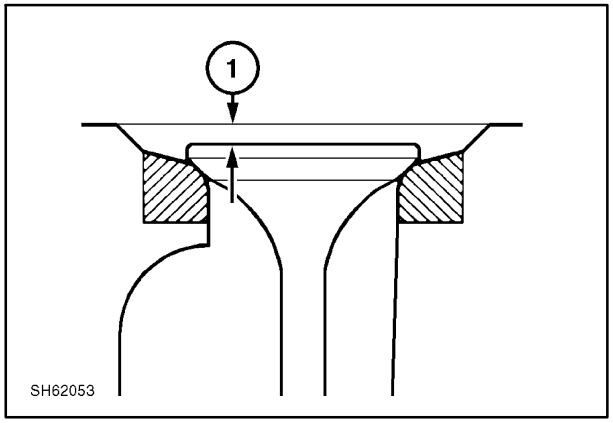


Figure 2-54

Replacement of valve seat insert (where fitted:)

Method 1 Using a gas burner, 1300° F to 1475° F (700° C to 800° C), 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 7,200 lbs. - 10,850 lbs. (1,000 kgf - 1,500 kgf) 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 140° F to 212° F (60° C and 100° C).

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.

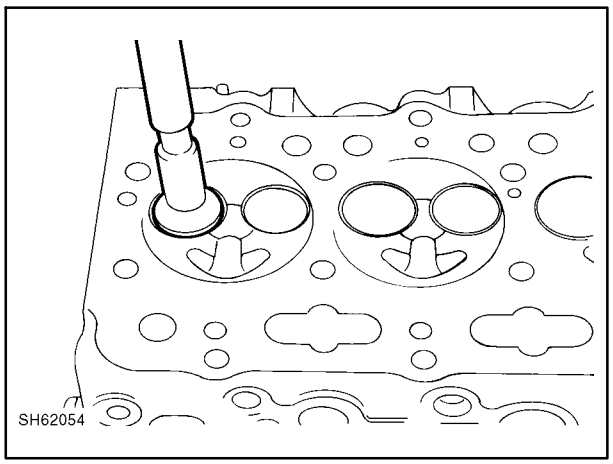


Figure 2-55

Valve Spring

Visually inspect the valve spring for damage.

Position the valve spring on a flat surface and check the squareness of it by using a square at 1, as shown. If it exceeds the allowable limit, replace the spring.

Using a spring tester, check spring force and free length.

Replace, if found to be beyond the allowable limit.

	Standard Value	Allowable Limit
Squareness	0.047″ (1.2 mm)	0.079″ (2.0 mm)
Free length	1.378″ (35 mm)	1.319″ (33.5 mm)
Spring force when compressed to 1.197″ (30.4 mm)	17.9 ft. lbs. (8.1 kg)	15.4 ft. lbs (7 kg)

Inner face of combustion chamber. Check and clean the combustion chamber.

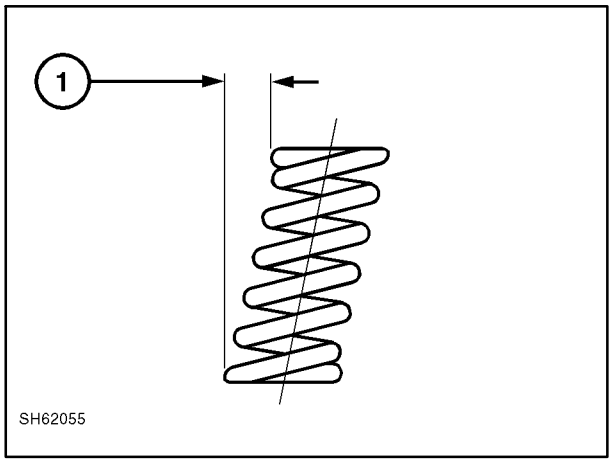


Figure 2-56

Reassembly

Reassemble the parts in the reverse order of disassembly.

NOTE: When assembling the valve spring, retainer, and keepers, take care not to damage the valve guide seal.

Tighten glow plugs to 11 ft. lbs. - 15 ft. lbs. (15 N·m - 20 N·m).

CYLINDER BLOCK

Inspection and Correction

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 0.002″ (0.05 mm)	0.005″ (0.12 mm)

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.

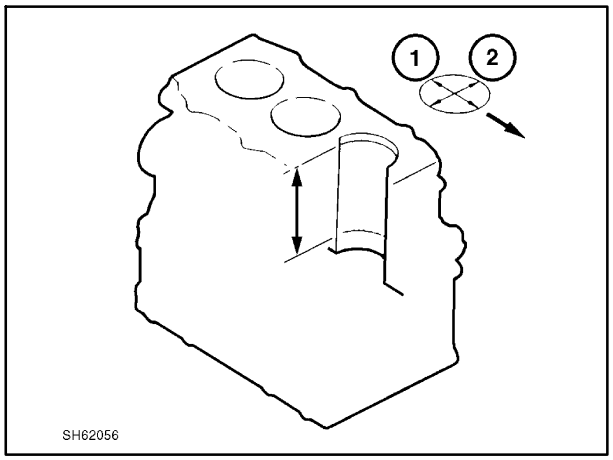


Figure 2-57

3. If the bore is found to be outside the allowable limit, re-bore to the oversize dimension as shown.

   Grinding stone size: 100 L x 4 W
   Speed: 162 RPM
   Feed (shaft direction): 13 m/min.

   Gauge pressure:
   15 kg/cm^2 (5 kg/cm^2 - finish)
   213 PSI [71 PSI - finish]

   Finish stroke: 9

   Honing depth: 0.0016″ (0.04 mm) (diameter)

   Cross hatch angle: 40°

   Surface roughness: 2-4 micron

Bore Specifications:

Standard Bore	Allowable Limit
3.307″ - 3.308″ (84 mm - 84.019 mm)	3.315″ (84.2 mm)
First Re-bore	0.02″ (0.5 mm)

New Standard Bore	Allowable Limit
3.327″ - 3.328″ (84.5 mm - 84.519 mm)	3.335″ (84.7 mm)
Second Re-bore	0.02″ (0.5 mm)
New Standard Bore	Allowable Limit
3.346″ - 3.347″ (85 mm - 85.019 mm)	3.354″ (85.2 mm)

Replace the Block

PISTON AND PISTON RINGS

Disassembly

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

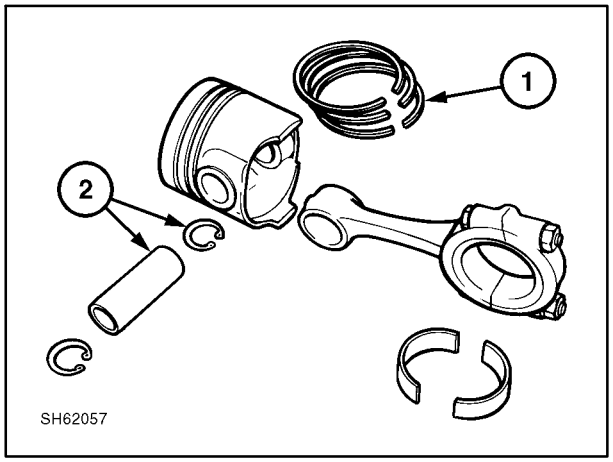


Figure 2-58

Inspection

Piston

If the outer surface of the piston is excessively damaged (cracked, scored, burning, etc.), replace.

Piston Skirt

Check the larger diameter of the piston skirt 0.40″ (10 mm from bottom), and check diameter (thrust direction) of the cylinder. Calculate the clearance between the cylinder and piston. If this clearance is more than allowable, or piston diameter is less than the allowable limit, replace the piston.

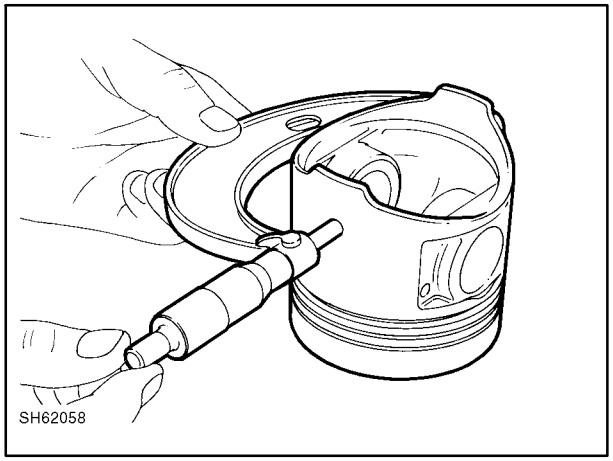


Figure 2-59

Oversized Piston

When the cylinder is oversized, be sure that an oversized piston is used.

Standard Clearance	Allowable Limit
0.0015″ - 0.0028″ (0.038 mm - 0.072 mm)	0.010″ max. (0.25 mm)

Standard Diameter (Piston)	Allowable Limit
3.3050″ - 3.3056″ (83.948 mm - 83.963 mm)	3.2953″ min. (83.7 mm)

Piston Size	Large Diameter of Piston Skirt
Standard	3.3050″ - 3.3056″ (83.948 - 83.963 mm)
0.0197″ (0.5 mm) Oversize	3.3247″ - 3.3253″ (84.448 - 84.463 mm)
0.039″ (1.0 mm) Oversize	3.3444″ - 3.3450″ (84.948 - 84.963 mm)

Clearance between wrist pin hole and wrist pin.

Check the inside diameter of the wrist pin hole and the outside diameter of the wrist pin, and calculate the clearance between them.

If the clearance is more than the allowable limit, replace.

Standard Clearance	Allowable Limit
-0.000039″ to + 0.00028″ (-0.001 mm to + 0.007 mm)	0.0008″ (0.02 mm)

Piston Ring

If the piston ring is worn or damaged, replace it.

Piston Ring Gap

Insert the rings into the cylinder at a right angle to the cylinder bore and measure the gaps with a thickness gauge. If the gap is more than the allowable limit, replace.

	Standard Gap	Allowable Limit
#1 Ring	0.008″ - 0.014″ (0.20 mm - 0.35 mm)	0.039″ (1.0 mm)
#2 Ring	0.008″ - 0.016″ (0.20 mm - 0.40 mm)	0.039″ (1.0 mm)

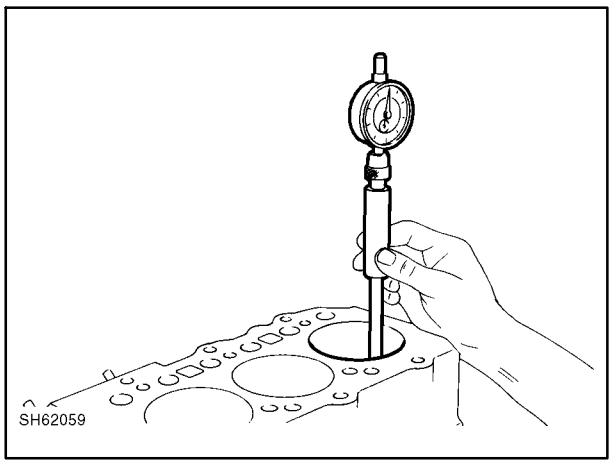


Figure 2-60

Oil Ring	0.008″ - 0 .016″ (0.20 mm - 0.40 mm)	0.039″ (1.0 mm)

Measure the clearance between the piston ring groove and ring. If the clearance exceeds the allowable limit, replace the ring.

	Standard Clearance	Allowable Limit
#1 Ring	0.0028″ - 0.0043″ (0.07 mm - 0.11 mm)	0.0098″ (0.25 mm)
#2 Ring	0.0016″ - 0.0032″ (0.04 mm - 0.08 mm)	0.0098″ (0.25 mm)
Oil Ring	0.0007″ - 0.002″ (0.02 mm - 0.06 mm)	0.0059″ (0.15 mm)

Oversize Piston Ring

If the cylinder is oversized, an oversized piston ring set should be installed.

Mounting Position of the Piston Ring

Confirm the third piston ring is set, as shown here.

ATTENTION: Fit the third ring as follows:

Put the expander, 1, into position in its groove. Ensure the ends of the expander do not overlap.

Fit the upper side rail, 2, on top of the expander. Insert the end of the side rail into the groove and hold it in position with the thumb. Slide the rail into position with the other thumb.

Fit the lower side rail, 3, in a similar manner.

Ensure the side rails are free to move in both directions and the gaps of the expander and the side rails are in the correct positions.

Standard OD	Allowable Limit
1.1022″ - 1.1024″ (27.996 mm - 28.0 mm)	1.1016″ min. (27.98 mm)

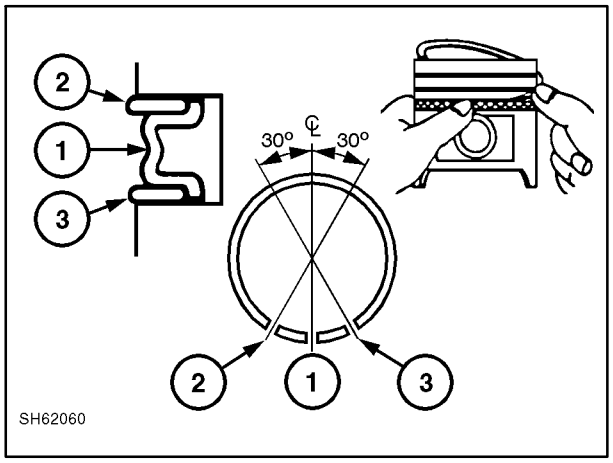


Figure 2-61

Piston Pin

Check the outside diameter of the piston pin. If it is less than the allowable limit, replace.

CONNECTING ROD

Inspection

Distortion or damage

Check the connecting rod for distortion between the large and small ends of the connecting rod with a connecting rod aligner. If the result exceeds the allowable limit, replace.

	Standard Value	Allowable Limit
Distortion (3.937″) (for 100 mm)	Less than 0.003″ (0.08 mm)	0.0078″ (0.2 mm)
Parallel (3.937″) (for 100 mm)	Less than 0.0019″ (0.05 mm)	0.0059″ (0.15 mm)

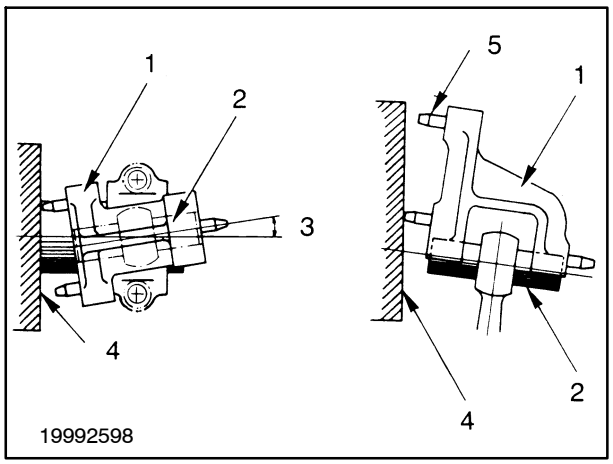


Figure 2-62

1 Gauge
2 Piston pin
3 Distortion
4 Flat surface of the aligner
5 Pin

Clearance between the small end bushing and the piston pin

Measure the inside diameter of the connecting rod small end bushing.

If the clearance exceeds the allowable limit, replace.

Standard Clearance	Allowable Limit
0.0004″ - 0.001″ (0.010 mm - 0.025 mm)	0.003″ (0.08 mm)

Play between the connecting rod and the crankshaft

Assemble the connecting rod to the crankshaft and measure the play in shaft direction. If the play is more than the allowable limit, replace the connecting rod.

Standard Play	Allowable Limit
0.0039″ - 0.0118″ (0.1 mm - 0.3 mm)	0.0275″ (0.7 mm)

Oil Clearance

Using the plasti-gauge, check the oil clearance as follows:

Remove oil or foreign matter from the bearing and crankshaft.

Cut the plasti-gauge to the same width as the bearing. Place it on the crankshaft at 1. Avoid the oil hole.

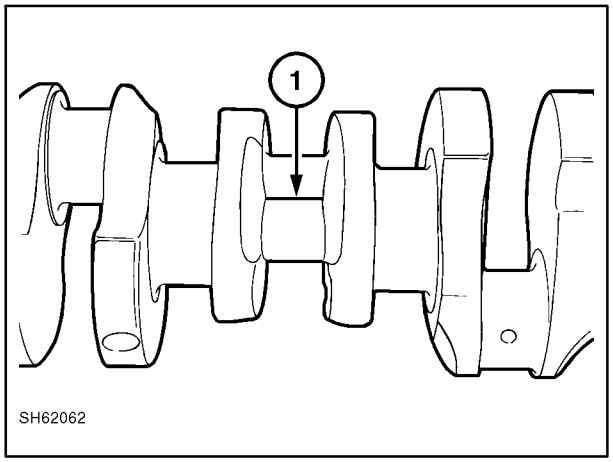


Figure 2-63

Assemble the connecting rod and connecting rod cap and tighten to the specified torque. All engines 36 ft. lbs. - 40 ft. lbs. (49 N·m - 54 N·m).

NOTE: Never rotate the connecting rod.

Remove the connecting rod cap. Measure the oil clearance (plasti-gauge) with the scale printed on the gauge bag.

NOTE: Measure the widest area.

Standard Play	Allowable Limit
0.001″ - 0.003″ (0.035 mm - 0.085 mm)	0.0078″ (0.2 mm)

If the oil clearance exceeds the allowable limit, replace the bearing or grind the crankshaft and use an oversize bearing.

NOTE: When grinding the outside diameter of the crankshaft, be sure that the oil clearance is correct before reassembly.

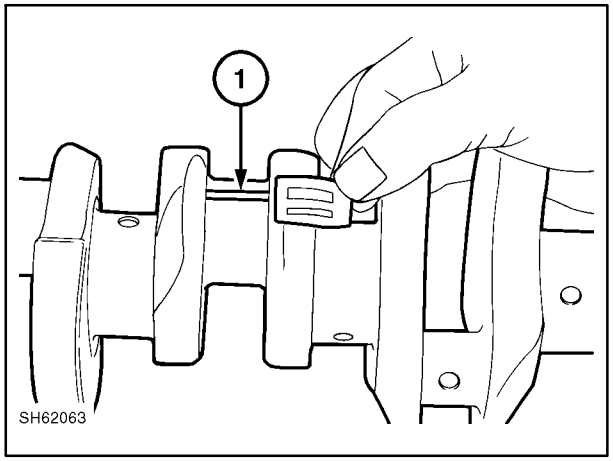


Figure 2-64

Bearing Size	Crankshaft Pin O.D. Dimension (mm)
S.T.D.	2.0458″ - 2.0463″ (51.964 mm - 51.975 mm)
0.010″ U.S. (0.25 mm)	2.0360″ - 2.0364″ (51.714 mm - 51.725 mm)
0.020″ U.S. (0.50 mm)	2.0261″ - 2.0266″ (51.464 mm - 51.475 mm)

Reassembly

1. Reassemble the piston on the connecting rod as follows.
2. With a piston heater or the like, heat the piston to approximately 212° F (100° C). Assemble the piston to the connecting rod by aligning the set marks.
3. Set the “SHIBAURA” marks, or other mark, 1, as shown. Align the set marks on the connecting rod.
4. Replace the piston ring on the piston. Position the scribe mark uppermost.
5. When the connecting rod or piston/piston pin has been replaced, the difference in the weight of the assembly (connecting rod plus piston rings) should not exceed 10 grams between cylinders.

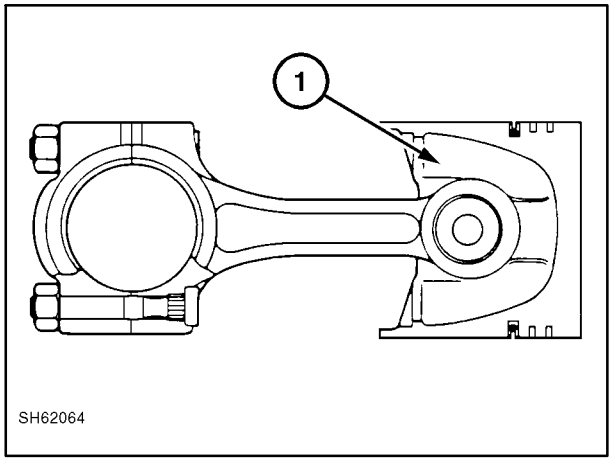


Figure 2-65

BEARING HOLDER

Disassembly and Inspection

Center Bearing

1. Remove the bearing holder and check it for peeling, melting, stepped wear, and other damage. If it is excessively damaged, replace.
2. Using the plasti-gauge, measure the oil clearance between the crankshaft center journal and the bearing.

   If the oil clearance is more than the allowable limit, replace the bearing or grind the crankshaft center journal and use an undersized bearing (refer to “Crankshaft”).

Standard Oil Clearance	Allowable Limit
0.0017″ - 0 .0040″ (0.044 mm - 0.102 mm)	0.0078″ (0.2 mm)

Bearing Size	Crankshaft Center Journal Diameter (mm)
S.T.D.	2.6755″ - 2.6760″ (67.957 mm - 67.970 mm)
0.010″ U.S. (0.25 mm)	2.6656″ - 2.6661″ (67.707 mm - 67.720 mm)
0.020″ U.S. (0.50 mm)	2.6558″ - 2.6563″ (67.457 mm - 67.470 mm)

Thrust Clearance

Check the thrust washer for wear, poor contact, burning, or other defects. Defective washers must be replaced.

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

REASSEMBLY

Reassemble the bearing holder, center bearing, and thrust washer as follows:

1. Face the chamfered part, 1, of the bearing holder toward the front. Install the bearing holder which has a notch, 2. Install the bearing holder on which the thrust washer is to be mounted at the flywheel side.
2. Install the thrust washer, 5. Face its oil groove toward the thrust face of the crankshaft.

   Tightening torque of the bearing holder: 36-40 ft. lbs. (49-54 N·m).
3. Set the bearing with the oil groove, 3, to the upper part, 4, while setting the bearing without the groove to the lower part.

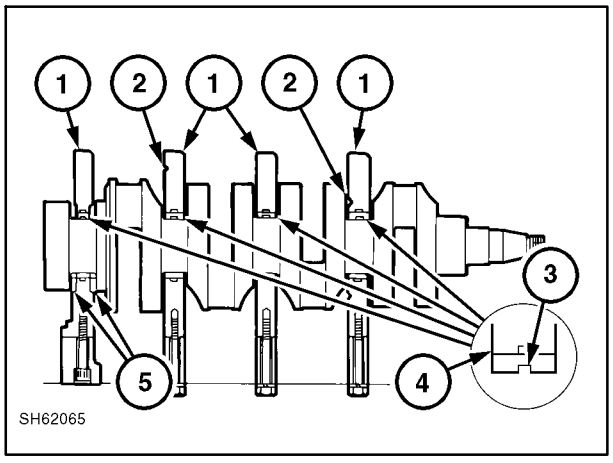


Figure 2-66

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.

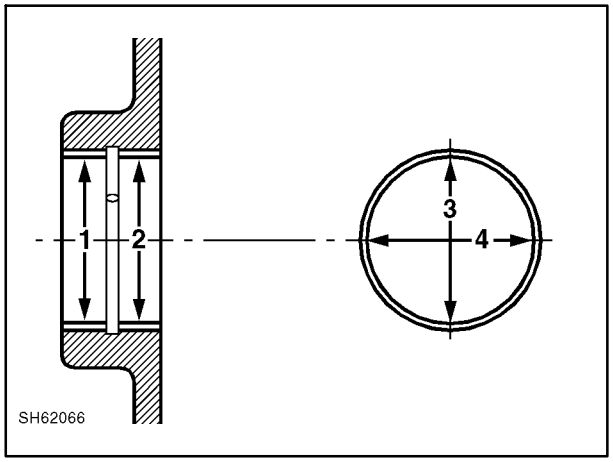


Figure 2-67

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

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.

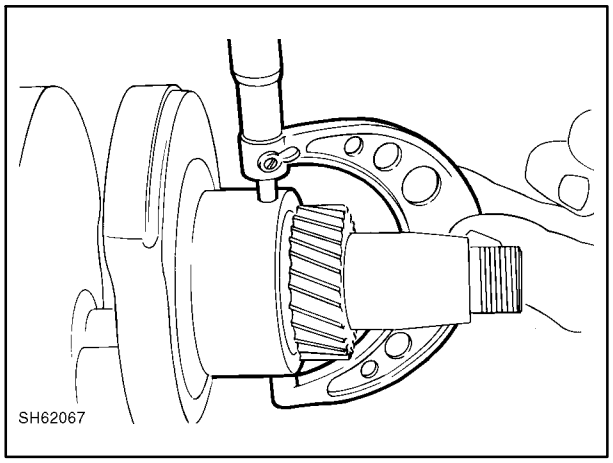


Figure 2-68

Crankshaft Journal (bushing)

Size	Outside Diameter
Standard	2.6755″ - 2.6760″ (67.957 mm - 67.970 mm)
0.0098″ U.S. (0.25 mm)	2.6656″ - 2.6661″ (67.707 mm - 67.720 mm)
0.0196″ U.S. (0.50 mm)	2.6558″ - 2.6563″ (67.457 mm - 67.470 mm)

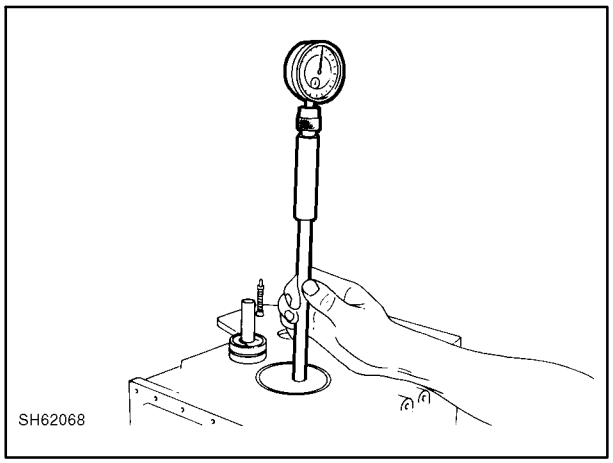


Figure 2-69

How to Replace Bushing

Removal of bushing

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

Press-fitting the bushing

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.
   a. Press in the bushing to the cylinder block from the engine front side.

      NOTE: Do not press in the bushing to the cylinder block from the opposite side.

      The correct pressing side is chamfered, etc., to allow smooth operation.

   b. Align the oil hole, 1, of the housing and bushing.
   c. Install the bushing, confirming the mark and oil groove (hole).
   d. Lubricate at the outer surface of the bushing.
   e. 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.

After grinding the crankshaft journal, check the oil clearance.

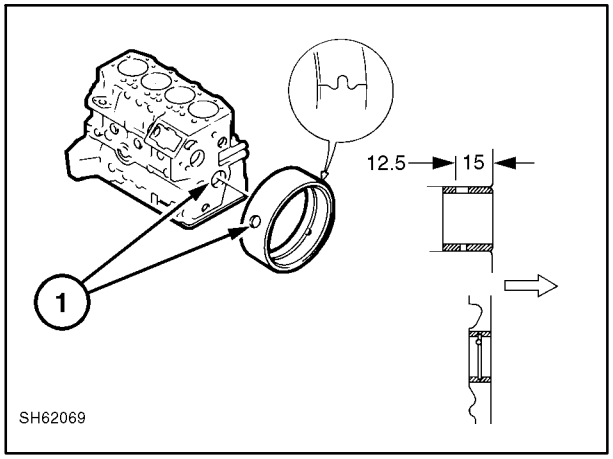


Figure 2-70

CRANKSHAFT

Inspection

Crankshaft Deflection

Support the crankshaft with V-block. Position a dial gauge on the crankshaft center journal and turn the crankshaft gradually by one full turn. If the gauge reading is more than the allowable limit, correction or replacement of the crankshaft is needed.

Standard Deflection	Allowable Limit
0.0011″ (0.03 mm or less)	0.0023″ (0.06 mm)

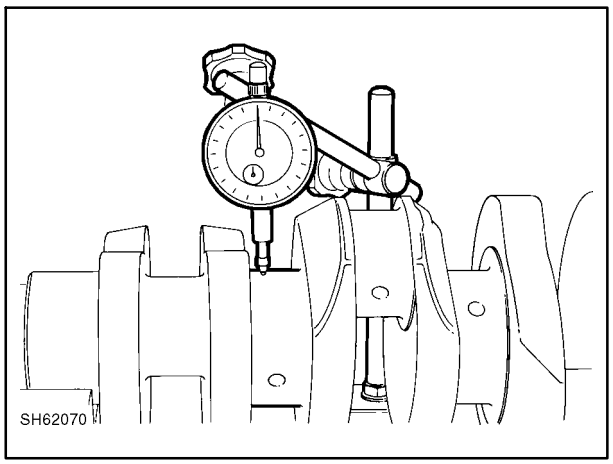


Figure 2-71

Oil Seal Contact Face and Oil Holes

Check the oil seal contact face for damage or wear. Check oil holes for clogging.

Check Crankshaft Journal, 3, and Pin, 4, for stepped wear

Take four measurements (AA and BB diameters at positions 1 and 2). If the maximum difference between the measurements is more than the allowable limit, correction is required.

Allowable Difference (stepped wear)
0.0019″ (0.05 mm)

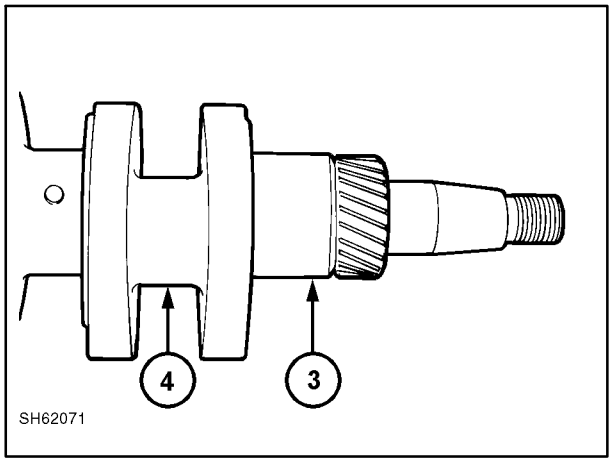


Figure 2-72

Crankshaft Pin Diameter

	Standard Diameter	Allowable Limit
Standard	2.0458″ - 2.0463″ (51.964 mm - 51.975 mm)	2.0433″ (51.90 mm)
U.S. 0.01″ (0.25 mm)	2.0360″ - 2.0364″ (51.714 mm - 51.725 mm)	2.0335″ (51.65 mm)
U.S. 0.02″ (0.50 mm)	2.0261″ - 2.0266″ (51.464 mm - 51.475 mm)	2.0236″ (51.4 mm)

Crankshaft Journal Shaft Diameter

	Standard Diameter	Allowable Limit
Standard	2.6755″ - 2.6760″ (67.957 mm - 67.970 mm)	2.6732″ (67.90 mm)
U.S. 0.01″ (0.25 mm)	2.6656″ - 2.6661″ (67.707 mm - 67.720 mm)	2.6634″ (67.65 mm)
U.S. 0.02″ (0.50 mm)	2.6558″ - 2.6563″ (67.457 mm - 67.470 mm)	2.6535″ (67.40 mm)

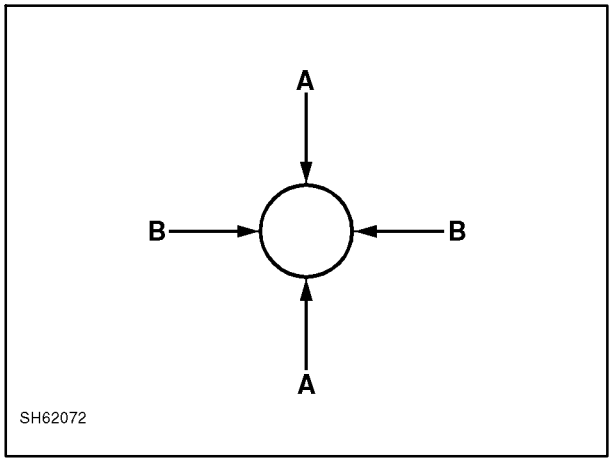


Figure 2-73

NOTE: When grinding the crankshaft, work with the following specifications:

1 Radius at pin/journal
0.118″ ± 0.0078″
(3 mm ± 0.2 mm)

2 Finish precision
1.6Z

3 Radius around oil hole:
0.0787″/2 mm maximum
0.196″/5 mm minimum

Use No. 400 emery cloth for final polishing.

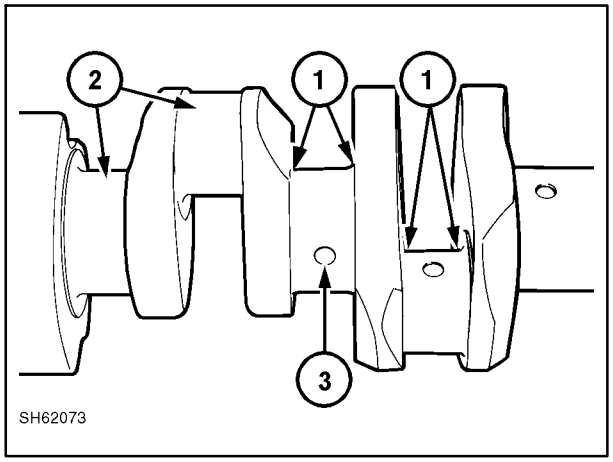


Figure 2-74

FLYWHEEL AND RING GEAR

Inspection

Check the ring gear. If it is excessively damaged or worn, replace it.

When wear is not excessive, remove the ring gear and reinstall 90° from original position. To install, preheat the ring gear up to 248° F - 300° F (120° C - 150° C).

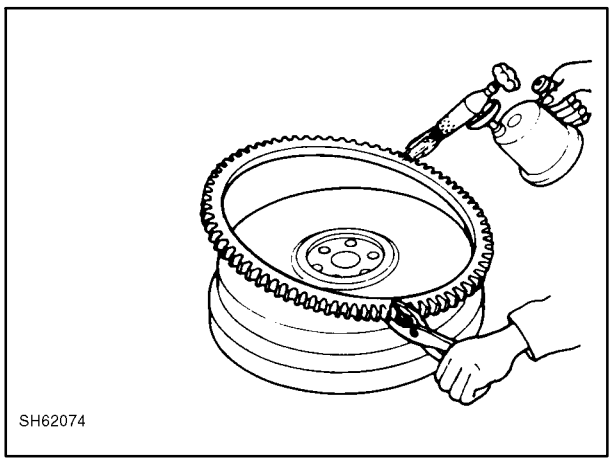


Figure 2-75

CAMSHAFT ASSEMBLY

Inspection

Check the journals and cams for wear and damage. Replace if the allowable limit is exceeded.

Correct uneven wear or small scratches on the cam surface with oil stone.

Cam Height (intake and exhaust cams)

Standard Value	Allowable Limit
1.3411″ - 1.3433″ (34.065 mm - 34.12 mm)	1.3268″ (33.7 mm)

Height of Cam for Injection Pump

Standard Value	Allowable Limit
1.6512″ - 1.6559″ (41.94 mm - 42.06 mm)	1.6457″ (41.8 mm)

Height of Cam for Fuel Feed Pump

Standard Height	Allowable Limit
1.2559″ - 1.2598″ (31.9 mm - 32.0 mm)	1.1811″ (30.0 mm)

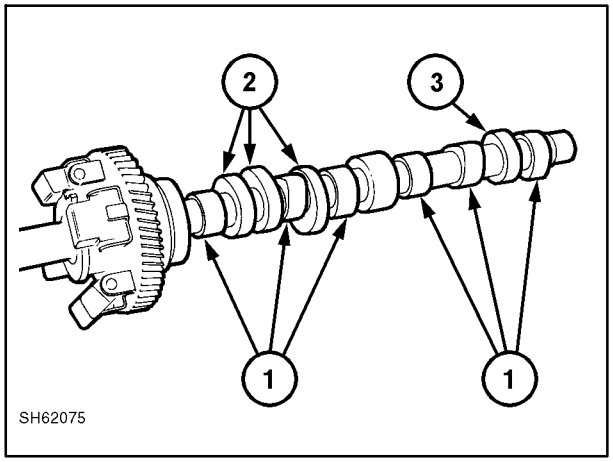


Figure 2-76

Camshaft Gear and Bearing Assembly

2 Camshaft gear
3 Camshaft
4 Tachometer gear
5 Spacer
6 Roller bearing
8 Slider

If these items have been replaced, it is essential that the spacers, shims, etc. are assembled in the order illustrated here.

To replace the camshaft gear assembly, the assembly will require pressing off and on.

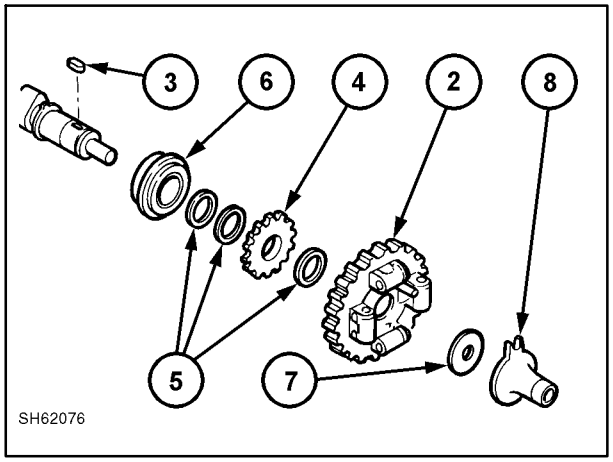


Figure 2-77

TIMING GEAR

Inspection

Check the timing gears for wear and damage on the contact area. Replace if any defect is found.

Measure the backlash of gears with a thickness gauge or dial gauge. If the allowable limit is exceeded, replace all timing gears.

1 Camshaft gear
2 Idler gear
3 Crankshaft gear

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

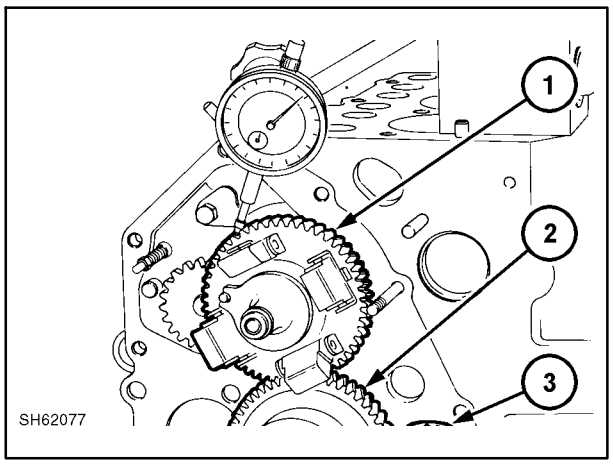


Figure 2-78

OIL PUMP

Disassembly

Remove the snap ring.

Take out the collar spring and shim.

Remove the idler gear vane and oil pump cover together.

Pull out the rotor and thrust washer.

Pull out the oil pump cover from the idler gear.

Remove the spring from the idler gear.

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

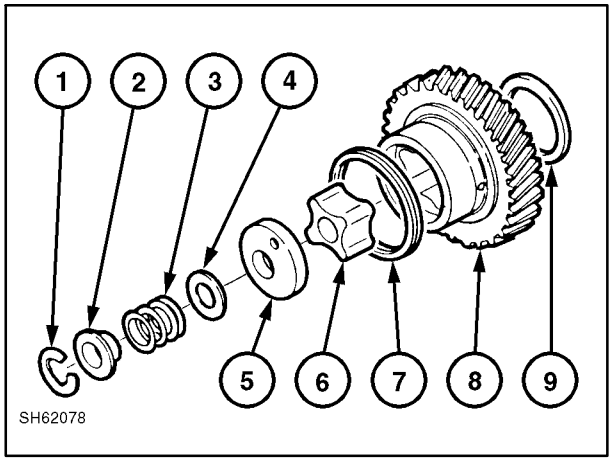


Figure 2-79

Inspection

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

Check the clearance at 1 between the rotor and the vane.

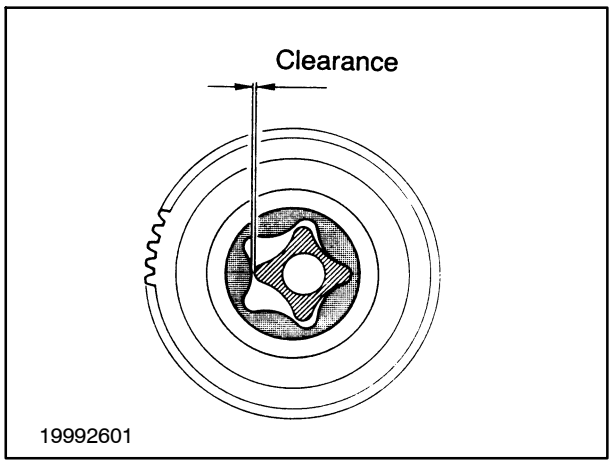


Figure 2-80

Reassembly (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 at 1, between the rotor and the vane is 0.0004″ to 0.006″ (0.01 mm to 0.15 mm) . Allowable limit is 0.009″ (0.25 mm) .

OIL FILTER

Construction and Function

This engine employs a cartridge-type filter.

Pressurized oil 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.

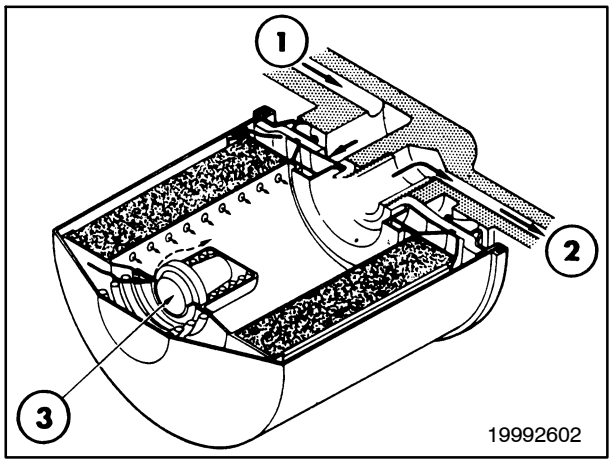


Figure 2-81

Maintenance

The oil filter must be replaced every 100 hours of operation.

When installing a new filter, coat its mounting face with clean oil. Hand-tighten only.

WATER PUMP ASSEMBLY AND THERMOSTAT HOUSING

Disassembly

Remove the backplate and gaskets.

Remove the thermostat and spring from the thermostat housing.

1 Water pump
2 Gaskets
3 Set plate

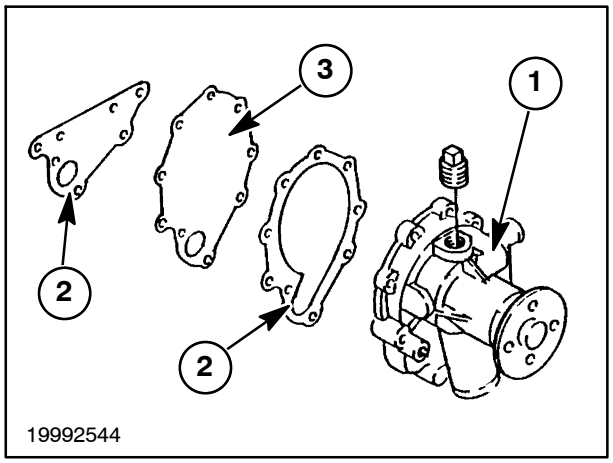


Figure 2-82

Inspection

Thermostat

Replace the thermostat if the valve opens at ambient temperature.

Place the thermostat into water. Raise the water temperature gradually and inspect the valve opening temperature and valve lift. (Standard values are as described in the “Specifications” section.)

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

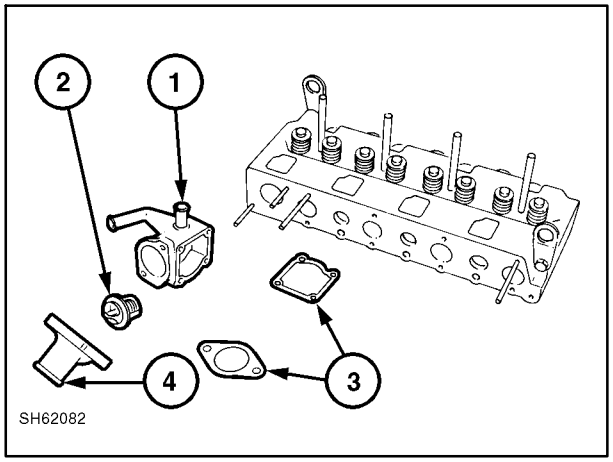


Figure 2-83

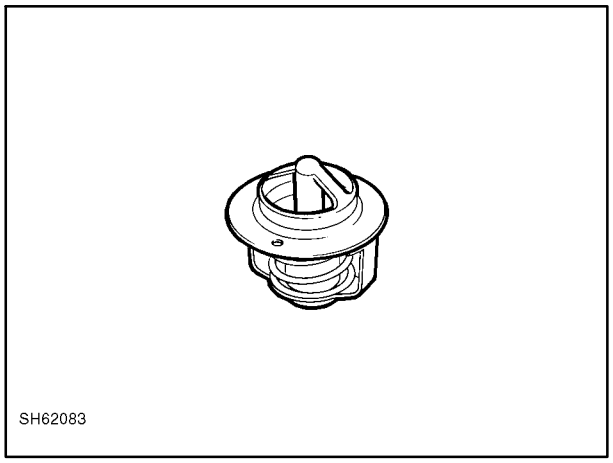


Figure 2-84

	N844	N844T
Type	Wax Pellet Type	Wax Pellet Type
Temperature when starting to open	176° - 183° F (80° - 84° C)	156° - 163° F (69° - 73° C)
Temperature when fully open	203° F (95° C)	180° F (82° C)
Valve lift fully open	0.315″ (8.0 mm)	0.315″ (8.0 mm)

WATER PUMP

Check for cracks, wear, leaks, bearing roughness, or damage. If defective, replace assembly.

Reassembly

Assemble the thermostat and spring in the housing. Install the gasket and backplate on the water pump.

Rotate the fan holder to confirm there is no obstruction or interference.

GOVERNOR

Construction/Function

A mechanical all-speed governor is used. It is housed in the gear case.

A flyweight assembly is mounted on the camshaft. The movement of the flyweight is transmitted to the injection pump control rack by way of the slider, control lever, and link, 1. A spring which is hooked to the arm, 3, and tension lever, 4, regulates the movement of the flyweight.

By changing the set angle of the governor lever, tension on this spring is changed. Thus, the engine speed can be regulated by the governor lever.

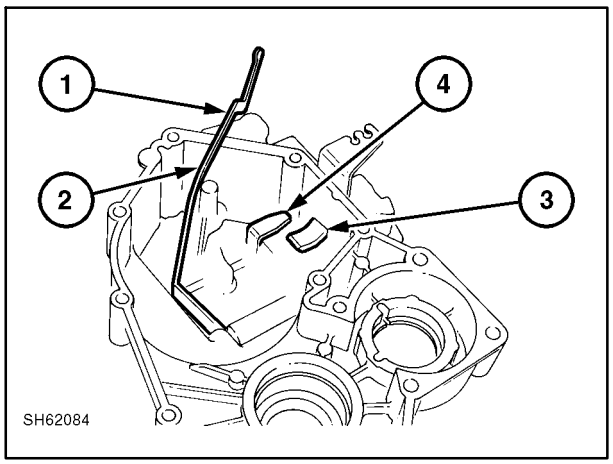


Figure 2-85

Maximum Speed Set Bolt

The set bolt is mounted on the cylinder block. This bolt limits the movement of the arm and has been adjusted and sealed at the factory.

Maximum Fuel and Start Spring

These are built into the cylinder block to regulate fuel injection at high speed. Regulation of fuel injection in the middle speed range is by torque spring to realize higher torque.

A start spring, 2, is placed between the gear case and link. This spring automatically functions to increase fuel during the start mode.

An idling spring at the gear case stabilizes engine idling speed.

The maximum fuel has been adjusted at the factory and sealed.

Reassembly

Precautions Before Assembling

Wash parts before assembling (especially oil gallery, bearings, pistons, and cylinder bores should be washed thoroughly).

Apply new oil to sliding and rotating surfaces of cylinder bores, pistons, and bearings, etc.

Replace gasket, packing, etc. Use liquid gasket to prevent oil leakage where necessary.

Never over-tighten bolts and nuts used on aluminum alloy. Tighten to specified tightening torques.

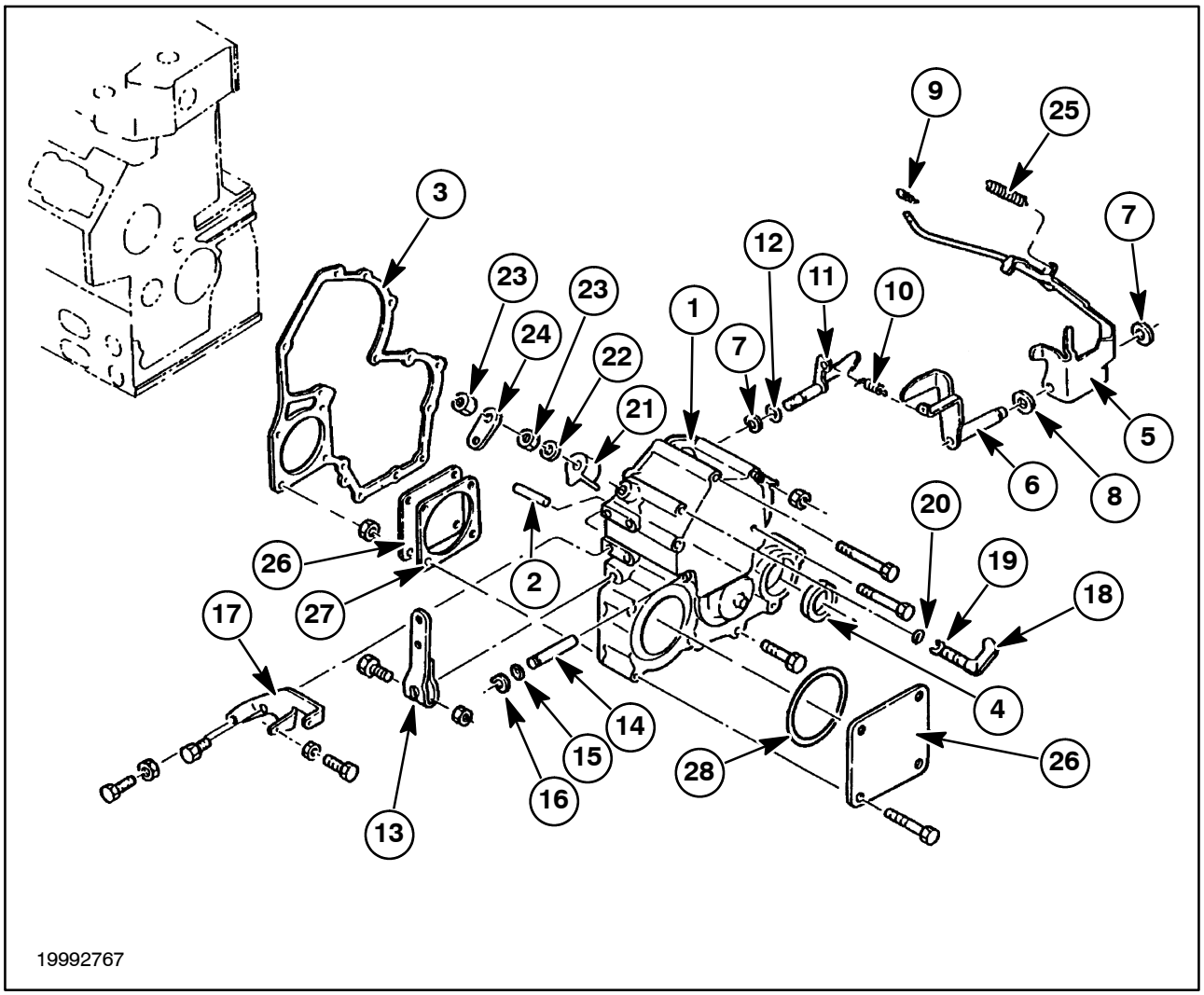


Figure 2-86

1. Timing Gear Cover
2. Pin
3. Gasket
4. Oil Seal
5. Arm Assembly
6. Spring Holder Arm
7. Snap Ring
8. Washer
9. Snap Pin
10. Governor Spring
11. Throttle Arm
12. O Ring
13. Throttle Lever
14. Pivot Shaft
15. O Ring
16. Snap Ring
17. Throttle Stay
18. Shutoff Arm
19. Snap Ring
20. O Ring
21. Return Spring
22. Washer
23. Nut
24. Stop Lever
25. Dampener Spring
26. Cover
27. Gasket
28. O Ring

GOVERNOR OPERATION

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.

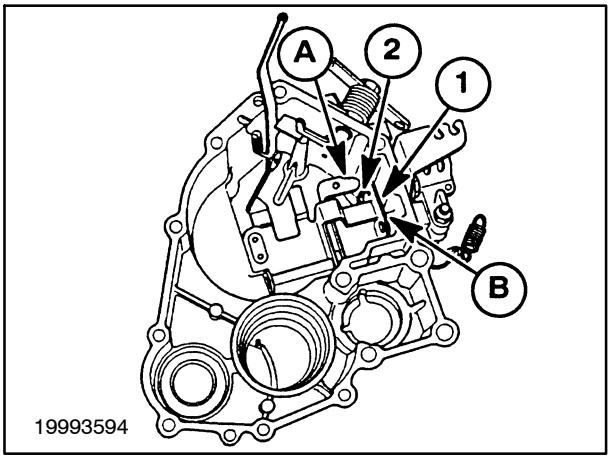


Figure 2-87

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

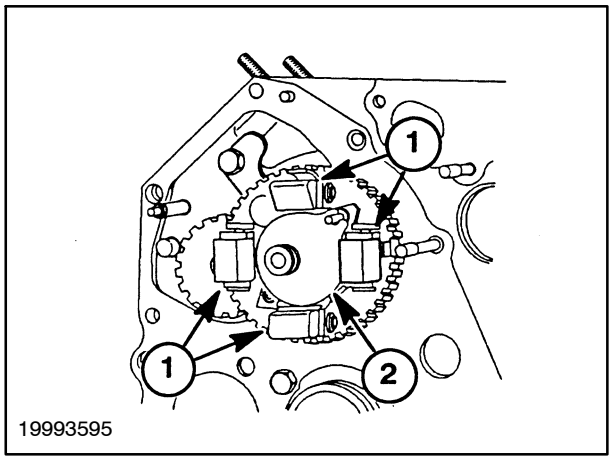


Figure 2-88

The slider cone, 2, Figure 2-88, 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.

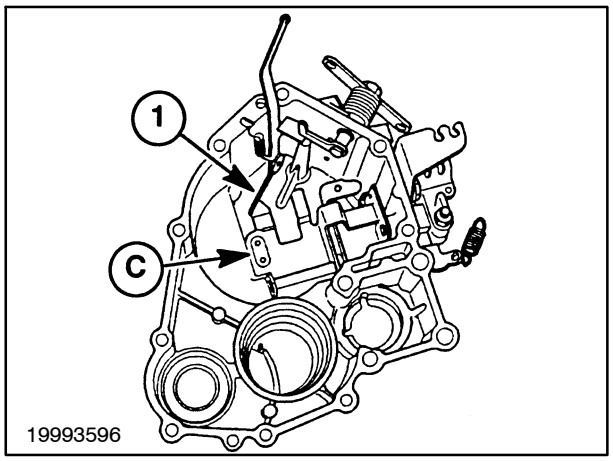


Figure 2-89

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

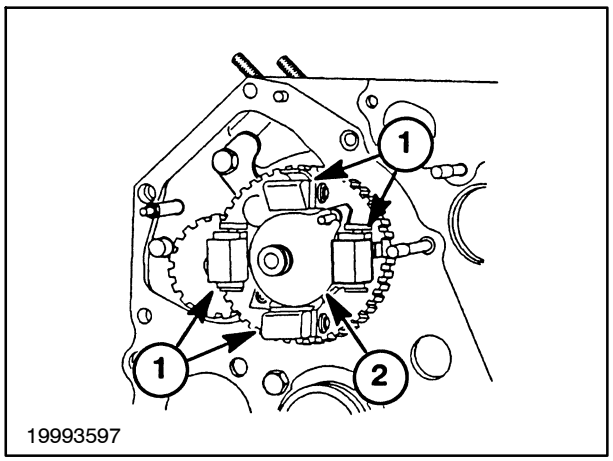


Figure 2-90

As the slider cone, 2, Figure 2-90, 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 the governor linkage parts are located inside the engine timing gear cover. To inspect or replace any of the governor linkage parts, the timing gear case and injection pump must be removed from the engine.

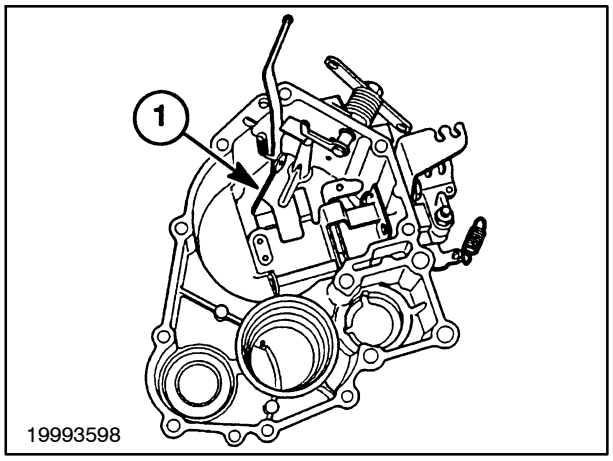


Figure 2-91

RELIEF VALVE ASSEMBLY

Install an O ring on the relief valve assembly.

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

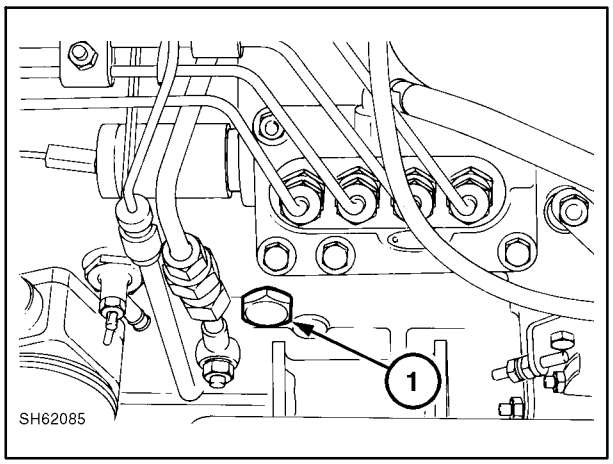


Figure 2-92

CRANKSHAFT AND BEARING HOLDER ASSEMBLY

1. Install the bearing holders on the crankshaft. Insert this in the bushing at the front end of the cylinder block.
2. Align the bolt hole at the lower part of the cylinder block with thread hole on the bearing holder and tighten with bolts. For flywheel end, use two special bolts, hex recess in its head.

   Bearing holder tightening torque:

   Hex hole bolts - 18-22 ft. lbs. (24-30 N·m)
   Hex bolts - 36-40 ft. lbs. (49-54 N·m)
3. Measure crankshaft end float.

Standard Play	Allowable Limit
0.004″ - 0.016″ (0.1 mm - 0.4 mm)	0.020″ (0.5 mm)

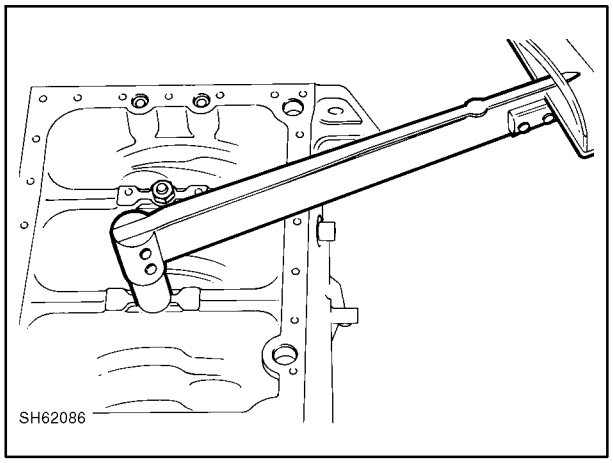


Figure 2-93

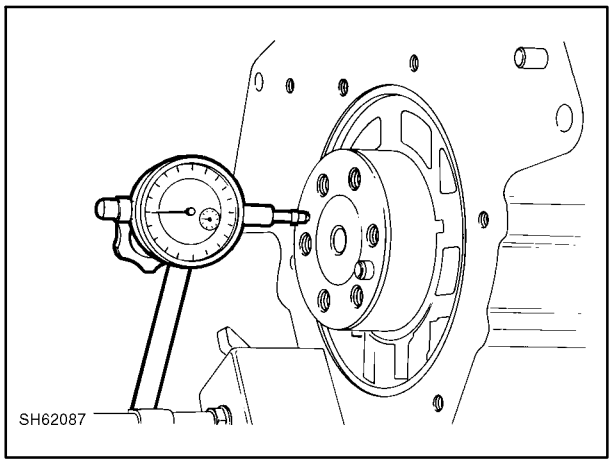


Figure 2-94

REAR OIL SEAL

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

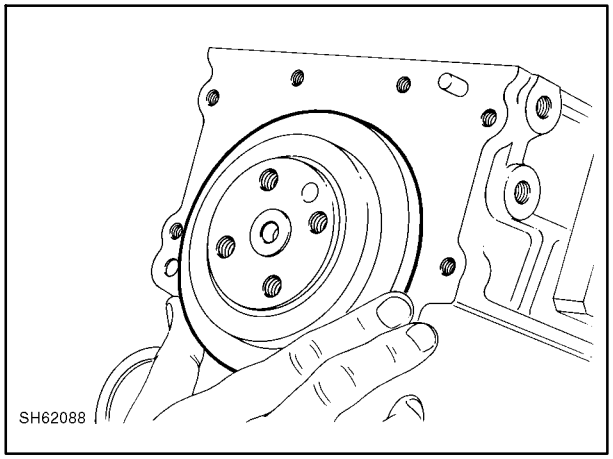


Figure 2-95

BACK PLATE/FLYWHEEL HOUSING

Coat the area around the M8 threaded holes with liquid packing solvent-based sealant and fix the backplate with bolts.

Backplate tightening torque:
10-13 ft. lbs. (14-18 N·m)

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

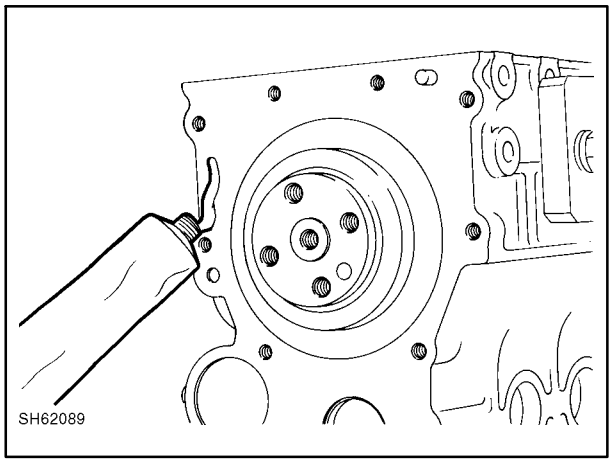


Figure 2-96

FLYWHEEL

Fit the flywheel. Note the location of the spring pin.

Flywheel tightening torque:
43-50 ft. lbs. (58-68 N·m)

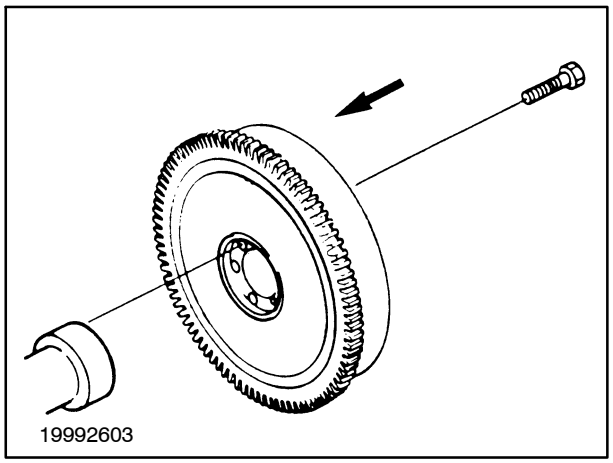


Figure 2-97

PISTON AND CONNECTING ROD

Coat the bearing face, piston, and piston ring with clean engine oil.

Slide the piston ring to permit a sufficient amount of oil to be applied in the groove. Set the piston ring gaps 90° apart from each other. However, do not position these gaps toward the piston pin or the right angle of the pin.

Insert the piston using a ring compressor. Face the reference mark, 1, on the piston toward the injection pump side, 2, as indicated. Also face the connecting rod mark towards the fuel pump side.

NOTE: Install pistons from the front in ascending order.

Tighten the connecting rod cap to the specified torque.

Connecting rod tightening torque:
36-40 ft. lbs. (49-54 N·m)

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

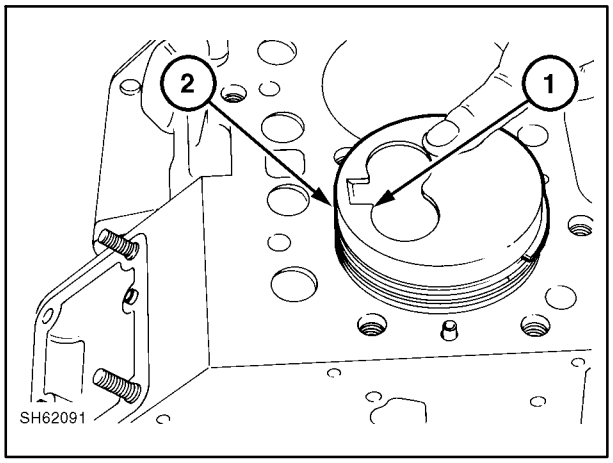


Figure 2-98

Suction Pipe and Suction Filter

Fix an O ring on the suction pipe and insert the pipe into the cylinder block.

Fit the end of the suction pipe to the oil strainer and fix the oil strainer.

Suction filter tightening torque:
6.5 -9.5 ft. lbs. (8.8-12.9 N·m)

Sump

Tighten the bolts diagonally and evenly.

Dipstick and Tube

Install the dipstick and tube using two O rings.

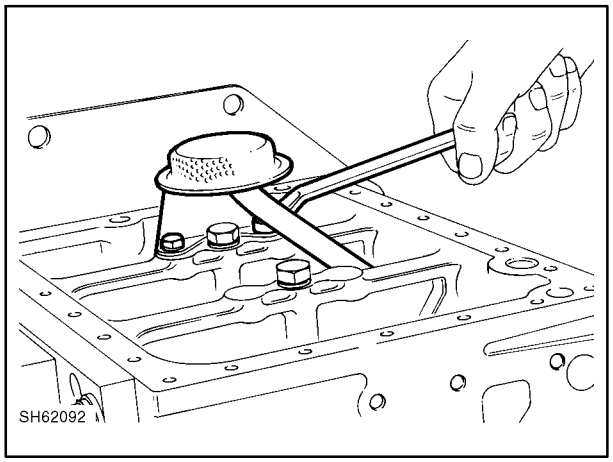


Figure 2-99

Front Plate

Camshaft Assembly, Tachometer, and Plate

1. Install the tachometer shaft.
2. Install the camshaft assembly. Avoid damaging bearings.
3. Fix the tachometer shaft and camshaft with the retaining plate.

   Plate tightening torque:
   6.5-9.5 ft. lbs. (8.8-12.9 N·m)

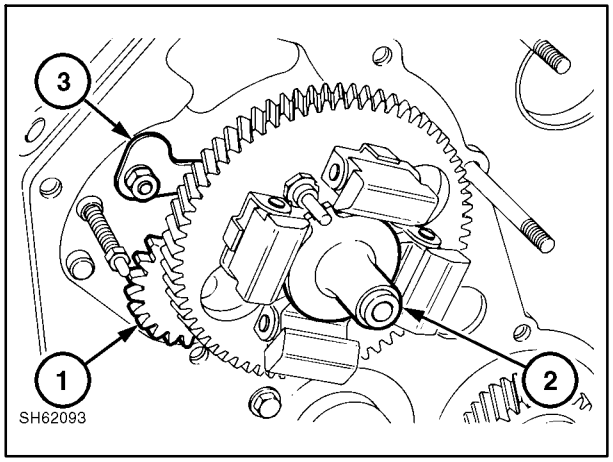


Figure 2-100

Idler Gear and Oil Pump Assembly (See Section IV Oil Pump)

Install the thrust washer on the idler gear shaft.

Assemble the vane, knock pin, and spring on the idler gear.

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

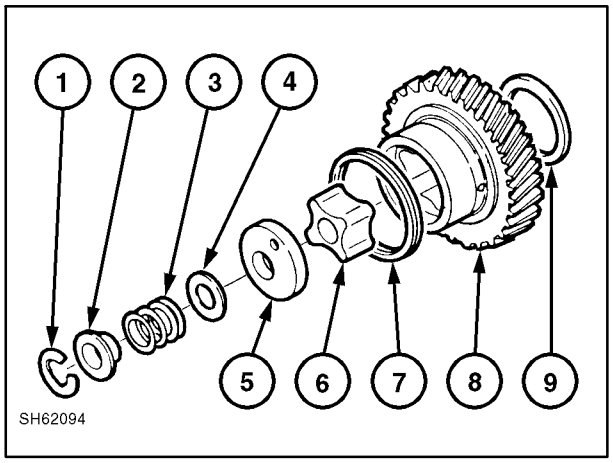


Figure 2-101

Align set marks on the idler gear, crankshaft gear, and camshaft gear, and assemble on the idler gear shaft.

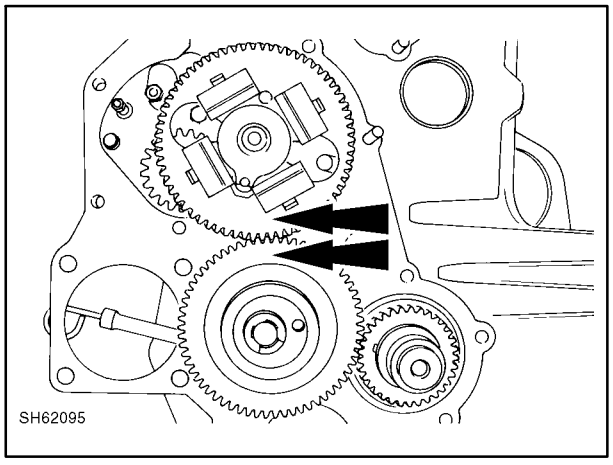


Figure 2-102

Install the rotor.

Install the oil pump cover, shim, spring, and collar. Fix them with the retaining ring.

Adjust with shim 0.1, 0.15, 0.2, 0.5 mm so the axial clearance of the oil pump, rotor, and vane is in the range of 0.004″-0.006″ (0.1 mm to 0.15 mm). The allowable limit is 0.008″ (0.2 mm) .

NOTE: Coat both faces of the rotor and vane with grease for assembly.

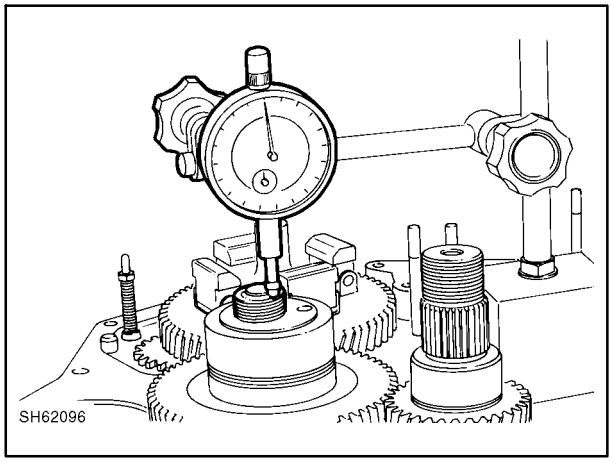


Figure 2-103

NOTE: NEVER TURN the crankshaft until the timing gear case is fitted.

By turning the oil pump cover to either direction, set the spring pin insert hole to the middle position and fit the gear case.

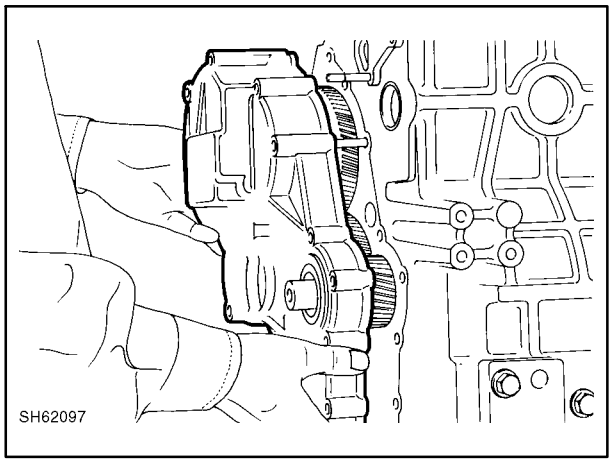


Figure 2-104

Timing Gear Case

Install the start spring.

Insert the link through the hole in the cylinder block. Rotate the oil pump cover to the position spring pin hole to the center position. Install the cover locating pin in the oil pump cover plate (PB094).

NOTE: Do not damage the oil seal when fitting. Turn the mechanical stop lever clockwise to assist assembly.

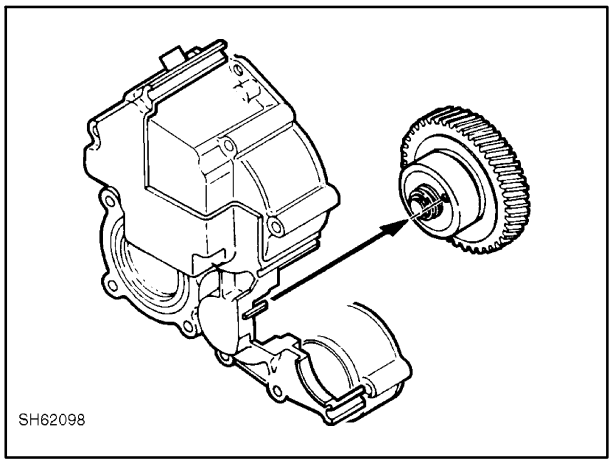


Figure 2-105

Crankshaft Pulley

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

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

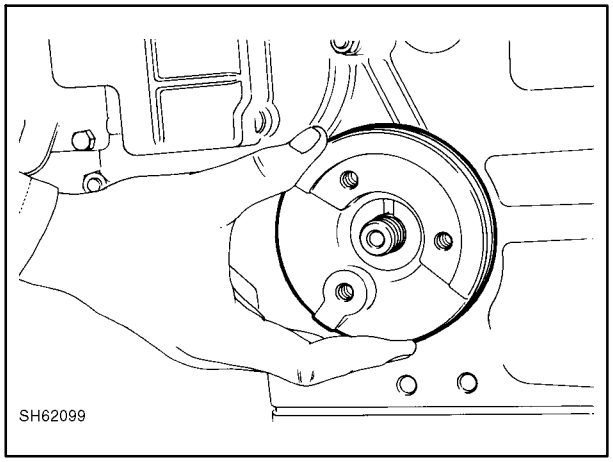


Figure 2-106

Injection Pump Assembly

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

Tighten the injection pump bolts and nuts.

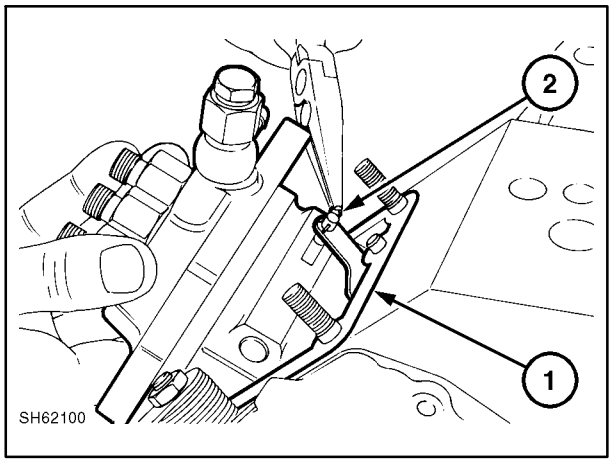


Figure 2-107

Adjusting the Fuel Injection Timing

Normally, this procedure provides correct injection timing. However, when the new injection pump, camshaft assembly, or cylinder block is used, fuel injection timing should be adjusted as explained below.

Reassemble the injection pump according to the procedures above. Use the shim of 0.5 mm thickness.

Remove the delivery valve holder at the front side (radiator side) of the injection pump.

Injection Timing and Crankshaft Positions

Engine Model	Degrees Crank BTDC			
	X	Y	Z	Injection Timing
N844T	21	20	22	20-22
N844	22	21	23	21-23

Pull out the delivery valve, 1, (IN), and reinstall the spring, 2, and delivery valve holder, 3.

NOTE: When reassembling the delivery holder, adjust the location of the delivery valve (OUT) to correct position using a wire, 4.

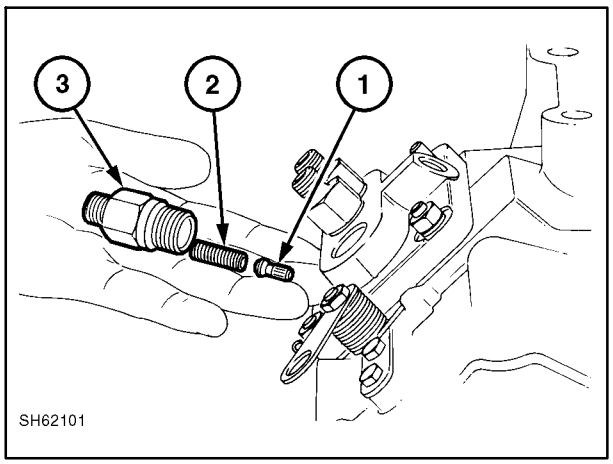


Figure 2-108

Move the governor control lever to “Maximum Fuel” position and send fuel with the No. 1 piston at around “X” degrees BTDC in its compression stroke. At this time, fuel flows from the delivery holder.

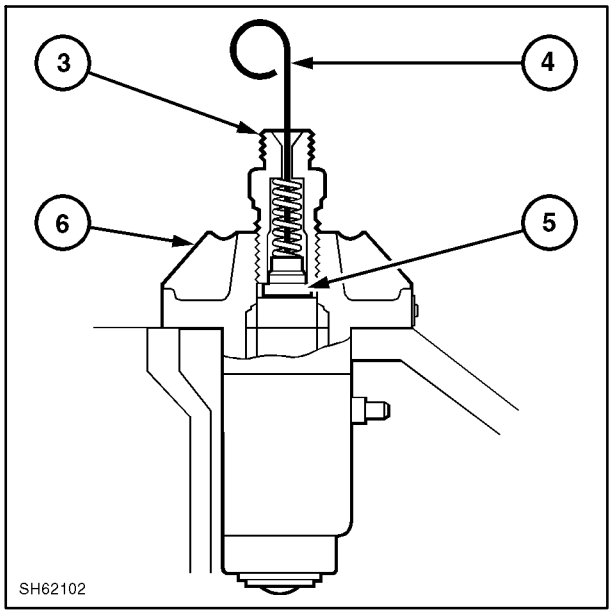


Figure 2-109

Piston Position in Relation to the Crankshaft Angle (BTDC)

N844, N844T

Crankshaft Angle (BTDC)	Position
13	0.0594″ (1.510 mm)
14	0.0689″ (1.749 mm)
15	0.0789″ (2.005 mm)
16	0.0897″ (2.278 mm)
17	0.1011″ (2.569 mm)
18	0.1132″ (2.875 mm)
19	0.1259″ (3.199 mm)
20	0.1393″ (3.539 mm)
21	0.1533″ (3.895 mm)
22	0.1680″ (4.267 mm)
23	0.1833″ (4.655 mm)
24	0.1991″ (5.058 mm)
25	0.2156″ (5.477 mm)
26	0.2328″ (5.912 mm)

Slowly turn the crankshaft clockwise until flowing fuel from the delivery holder is stopped. Check the piston position at this point. If the position is later than “Y” BTDC, use a thinner shim. If the position exceeds “Z” BTDC, use a thicker shim.

Changing the shim thickness by 0.004″ (0.1 mm) will change the timing approximately one degree. Adding shims decreases the angle, while subtracting shims increases the angle.

NOTE: When the shim is not needed, assemble by coating, using liquid sealant.

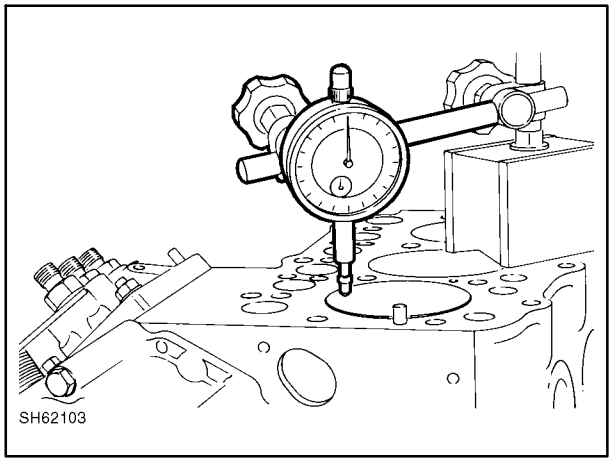


Figure 2-110

SPILL-TIMING PROCEDURE

1. 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 with a dial indicator. If the pulley mark is slightly off, re-mark the pulley and proceed.

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

2. Reinstall the valve spring, keepers, rocker arm assembly, and valve cover.
3. Shut off the fuel supply to the injection pump at the fuel filter.
4. Remove the No. 1 injection line from the No. 1 injector, 1.
5. Remove the lock screw, 2, and remove the injector locking plate, 3.

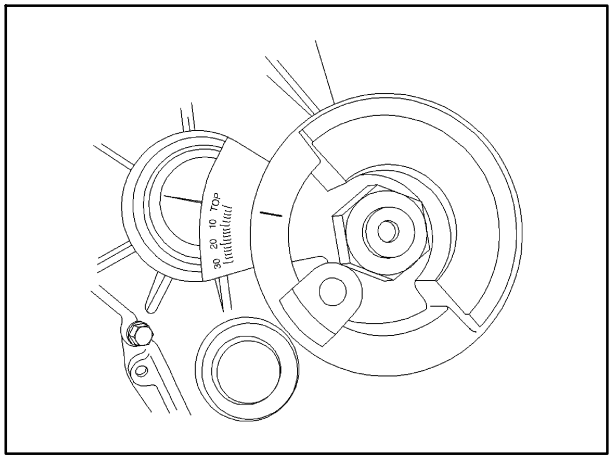


Figure 2-111

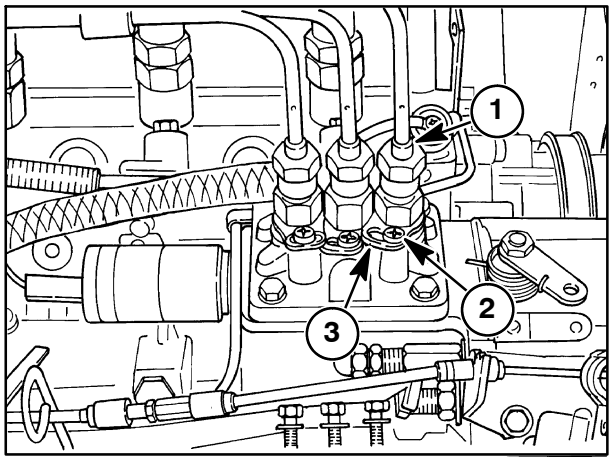


Figure 2-112

6. Remove the delivery valve piston, 1, from the No. 1 delivery valve.

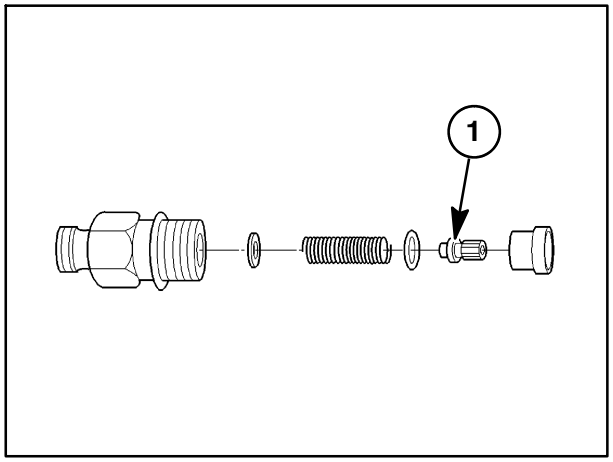


Figure 2-113

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

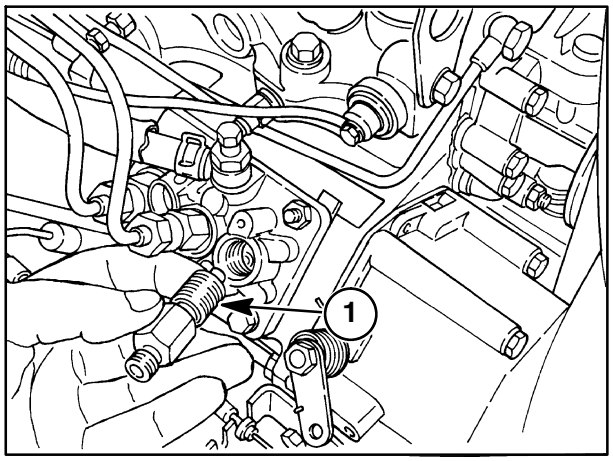


Figure 2-114

8. Fabricate a spill tube, 1, from a discarded injection line and install the tube on the No. 1 port on the injection pump.
9. Remove the fuel shut-off solenoid from the injection pump.

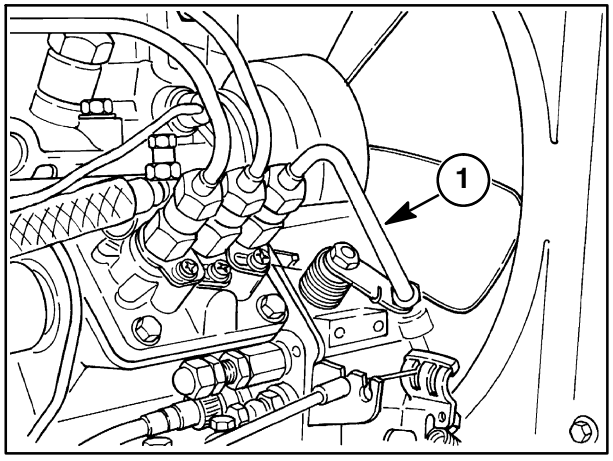


Figure 2-115

10. Rotate the crankshaft counterclockwise (viewed from the front of the engine) approximately 40°.

11. Turn on the fuel supply to the injection pump. Fuel should flow out of the spill tube on the No. 1 cylinder port.

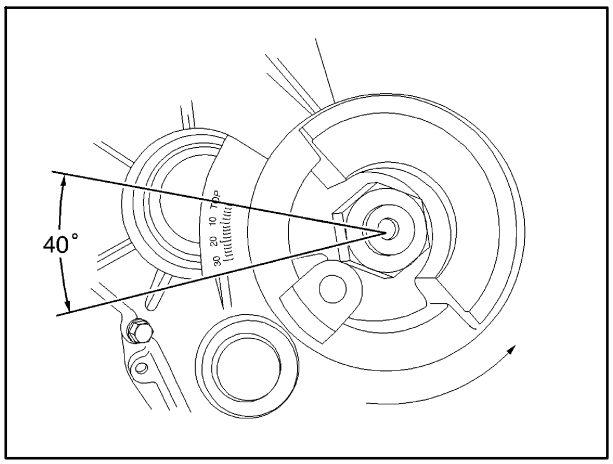


Figure 2-116

12. Rotate the crankshaft clockwise. When the timing mark on the crankshaft pulley, 1, is in line with the 21° (N844T) or 22° (N844) mark on the scale, 2, fuel should stop flowing from the spill tube.

13. If fuel does not stop flowing at the appropriate timing mark, the injection pump timing must be adjusted by adding or removing shims located between the injection pump and the engine block.

14. 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 in.) will change the pump timing by approximately 1°.

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

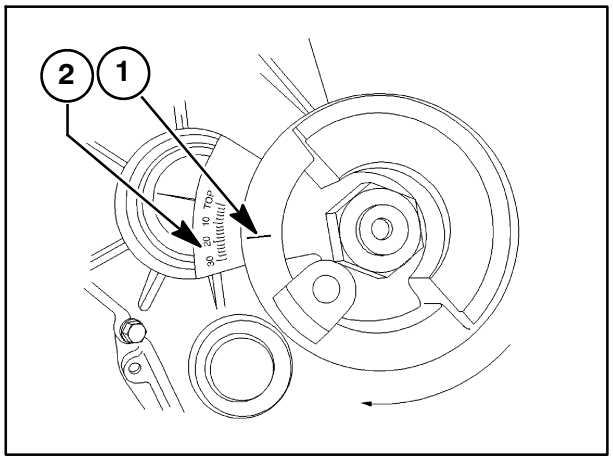


Figure 2-117

Assemble the delivery valve (IN).

NOTE: Delivery holder tightening torques: 29-33 ft. lbs. (39-45 N·m).

Oil Filter

Coat the mounting face with a thin film of oil, and then hand-tighten.

Feed Pump

Insert using securing bolts.

Tappet

Coat the tappet with oil, and then assemble.

Cylinder Head

Set the piston to the top, dead center, and measure the amount of protrusion above the cylinder block with a depth gauge or a dial gauge.

NOTE: Take measurement by pressing the piston lightly.

Measure the protrusions for 4 cylinders. Use the highest reading as a reference.

Ensure the cylinder head gasket meets the tolerance levels.

N844, N 844T

Measurement	Gasket No.	Tightened Thickness
0.019 - 0.023″ (0.5 - 0.6 mm)	111147510	t=0.047″ (t=1.2 mm)
0.023 - 0.031″ (0.6 - 0.8 mm)	111147520	t=0.051″ (t=1.3 mm)

NOTE: The last four digits of code numbers are stamped on the head gasket. Install the head gasket with code numbers at the top.

Tighten the cylinder head in 3-step procedures, in the order shown in the illustration. Finally, tighten with specified torque.

Specified torque:
72-76 ft. lbs. (98-103 N·m)

NOTE: Spring pin is used for positioning.

Coat threads of bolts with grease based with molybdenum disulfide.

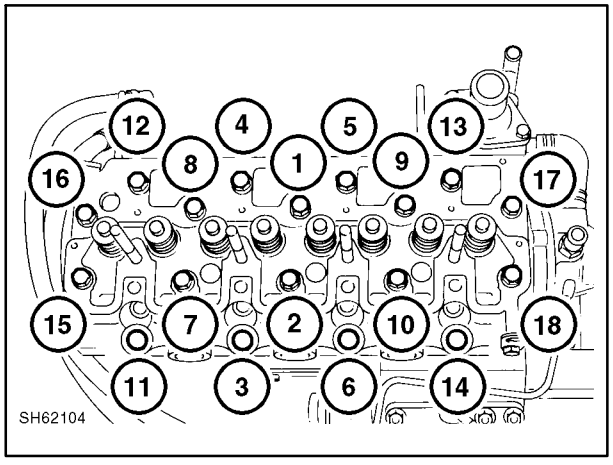


Figure 2-118

Oil Pipe

Eyebolt tightening torque:
7-9 ft. lbs. (9-12 N·m)

L565 - LX565 N844 engine - the oil pipe, 1, will be connected to the block.

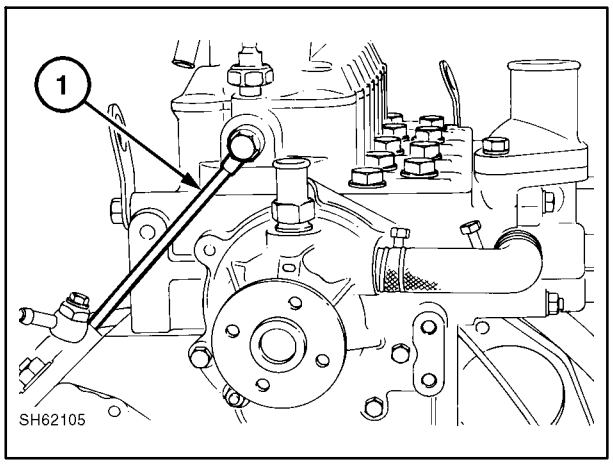


Figure 2-119

LX665, N844T engine - the oil pipe will be connected to the turbocharger.

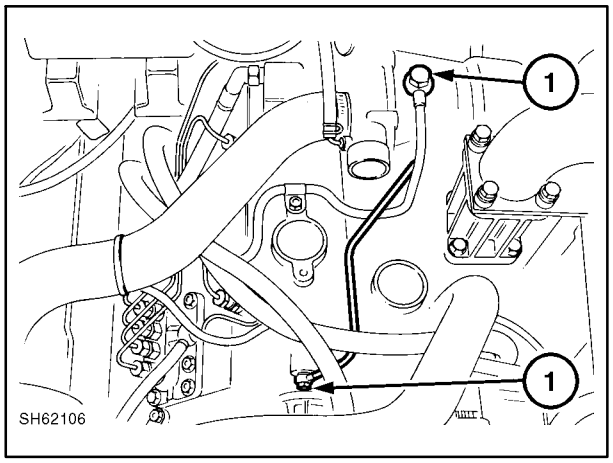


Figure 2-120

Cap, Push Rod, and Rocker Arm Assembly

Install the caps, 1, on the end of the valve stem.

Install the push rods, 2, and rocker arm assembly, 3.

Rocker arm assembly tightening torque:
20-29 ft. lbs. (27-39 N·m). 4-cylinder engines.

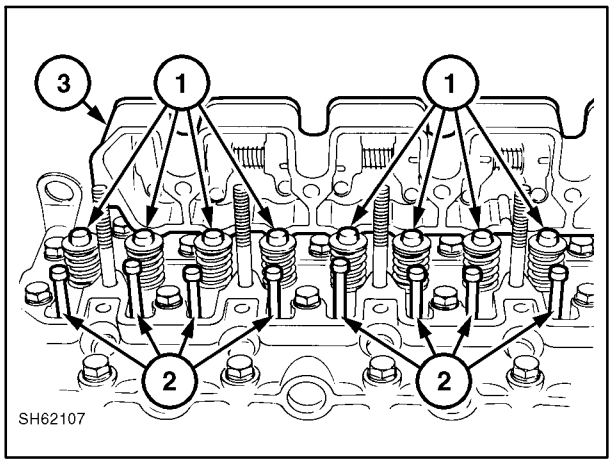


Figure 2-121

Valve Clearance Adjustment

Loosen the nut and adjust the clearance of both the intake and exhaust valves to 0.2 mm (0.0078″) with the adjust screw.

NOTE: Adjust when the engine is cold. Set the No. 1 piston to TDC of compression stroke and adjust the No. 1 cylinder intake, exhaust valves, No. 2 cylinder intake valve, and No. 3 cylinder exhaust valve. Turn the crankshaft 360° in a clockwise direction, viewed from the front, and adjust the remaining valves.

Cylinder Head Cover

Evenly tighten the cylinder head cover. Ensure the oil ring gasket remains in location.

Cylinder head cover tightening torque:
9-12 ft. lbs. (12-16 N·m)

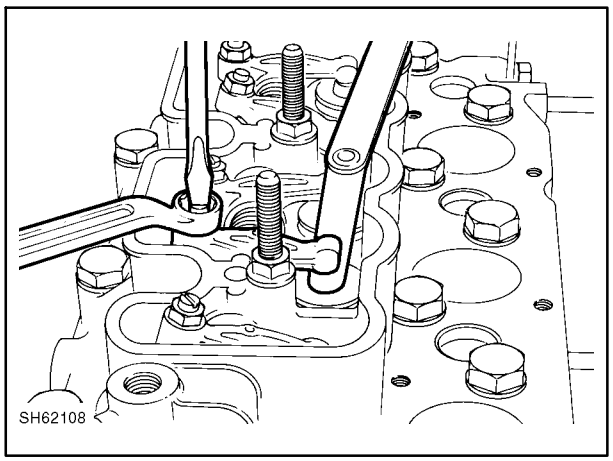


Figure 2-122

Water Pump Assembly and Thermostat Housing

Install in the sequence of the gasket, plate, gasket and water pump assembly.

1 Gasket
2 Plate
3 Gasket
4 Water pump

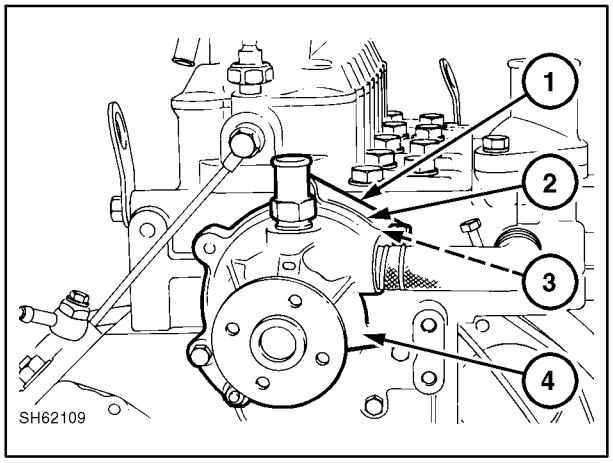


Figure 2-123

Connect the thermostat housing and hoses.

1 Thermostat housing
2 Thermostat
3 Gasket
4 Adapter

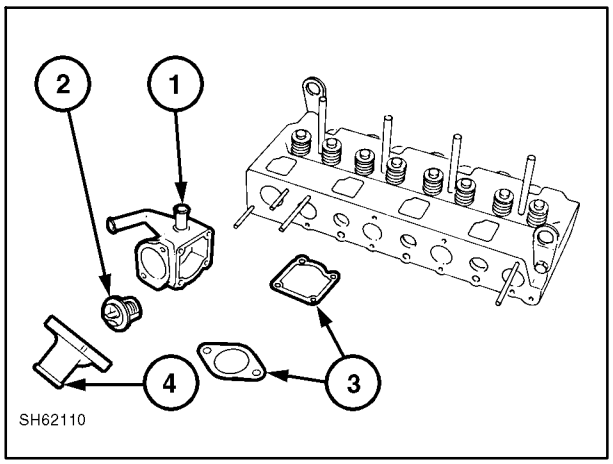


Figure 2-124

Glow Plug and Connector

Glow plug tightening torque:
11-14.5 ft. lbs. (15-20 N·m)

Oil Pressure Switch

Oil pressure switch tightening torque:
11-14.5 ft. lbs. (15-20 N·m)

Nozzle/Holder Assembly

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

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

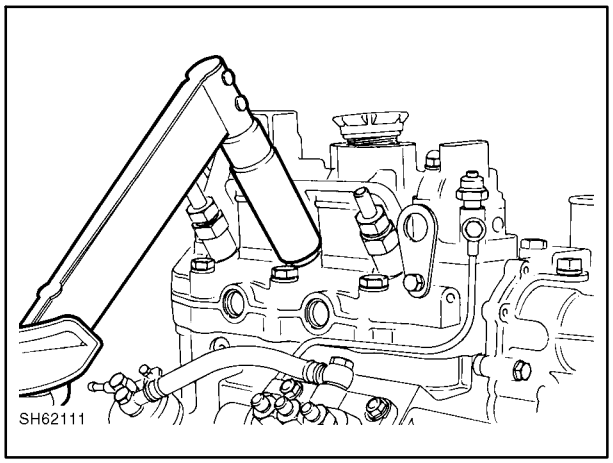


Figure 2-125

Return Pipe and Injection Pipe

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

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

Alternator Assembly

Install the assembly, and check the belt groove alignment.

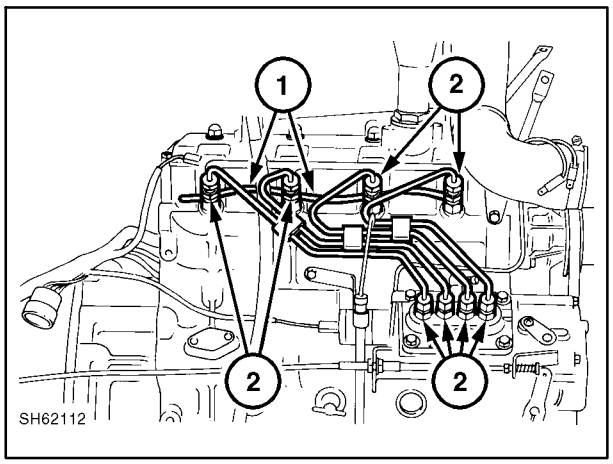


Figure 2-126

V-Belt, Fan Pulley and Cooling Fan

After mounting the fan pulley, cooling fan, spacers, and cover plate on the N844 L565, LX565 engines, install the V belt.

Depress the belt at the center between the crankshaft pulley and the alternator pulley, with a force of approximately 5 kg (2.27 ft. lbs.). The fan belt tension should be adjusted so the deflection becomes 0.2″ (5 mm) upon the above check.

Cooling fan tightening torque:
6.5-9.5 ft. lbs. (8.8-13 N·m)

The Models L565 and LX565 N844 engine fans are equipped with a cover plate, 1, over the center of the fan assembly.

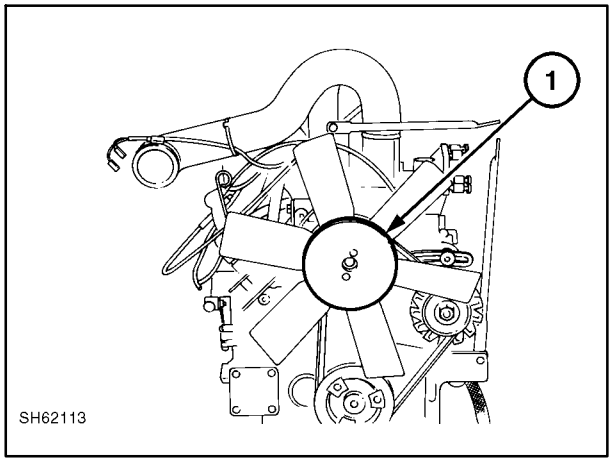


Figure 2-127

Intake/Exhaust Manifolds

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

Install exhaust manifold, 5.

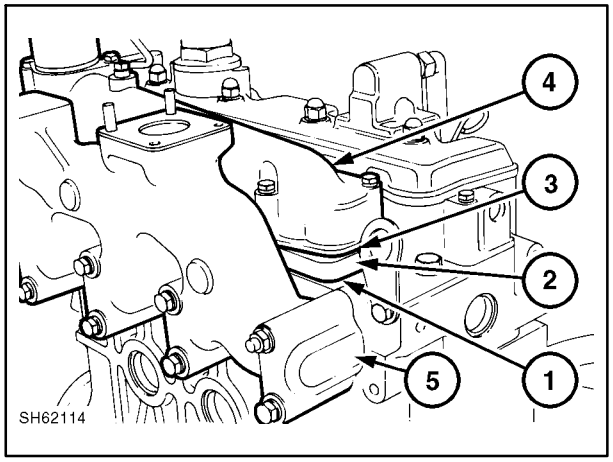


Figure 2-128

REINSTALLATION OF ENGINE INTO LOADER FRAME

NOTE: Inspect the splines, 1, on the hydrostatic pump flex plate and the splines on the input shaft. If flex plate is damaged, replace with new design part #86521866.

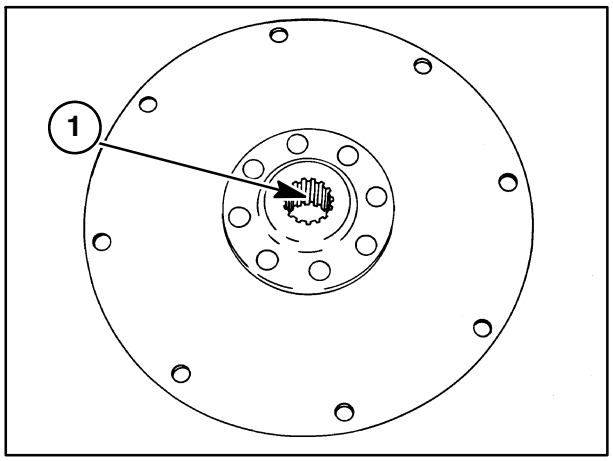


Figure 2-129

1. Reinstall the hydrostatic pump flex plate to the engine flywheel, 1, using eight 5/16″ x 3/4″ G5 cap screws and eight M8 lock washers. Torque to 20 ft. lbs. (26 N·m).

   Reinstall the flex plate with the center hub of the plate away from the flywheel, 2, positioning the slots, 3, in the drive plate.

2. When reconnecting the ground wires at 4, place the largest wire (battery ground cable, 5) next to the ground surface. Then stack the remaining ground wires according to size (smallest to largest wires) and secure.

3. When the engine is reinstalled, make sure the ground strap, 6, between the engine block and loader main frame is reinstalled to prevent engine bearing damage.

   NOTE: Lubricate the splines of the drive plate and hydrostatic pump shaft with never seize or moly coat lubricant.

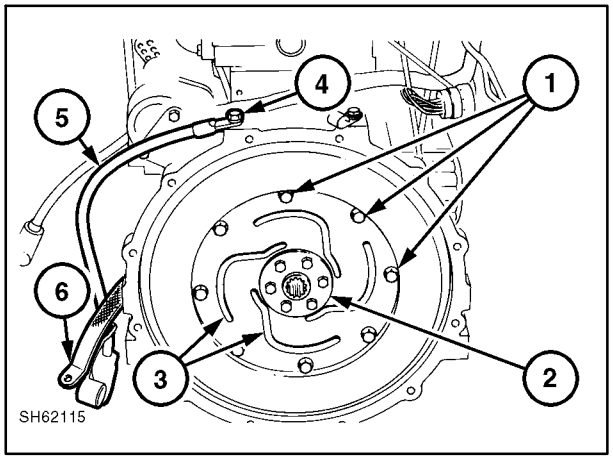


Figure 2-130

4. Check the condition and reinstall or replace the engine isolator mounts. Examine the condition of the rubber mount, 1, and replace the mount if it shows signs of deterioration.
5. Proper assembly of the engine isolator mount.

   1 Isolator mount
   2 Mount retaining hardware
   3 Mount cover
   4 Retaining bolt
   5 Large flat washer (lower)
   6 Small flat washer (upper)
   7 Nut

   Torque the mount retaining hardware, 2, to 26 ft. lbs. (35 N·m).

   Torque the engine block retaining bolt, 4, to 83 ft. lbs. (112 N·m).
6. Attach the hydrostatic pump and support to the engine bellhousing as previously removed.

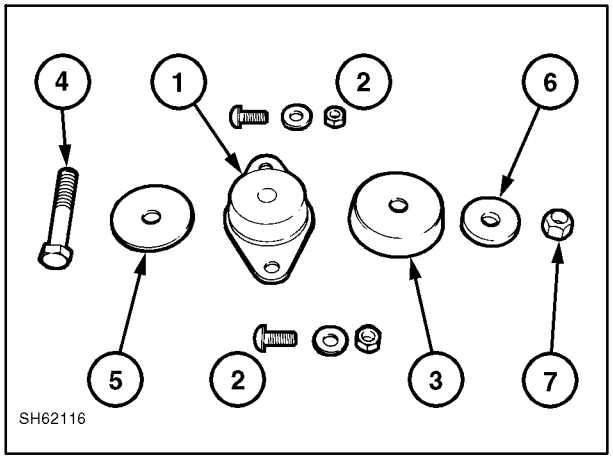


Figure 2-131

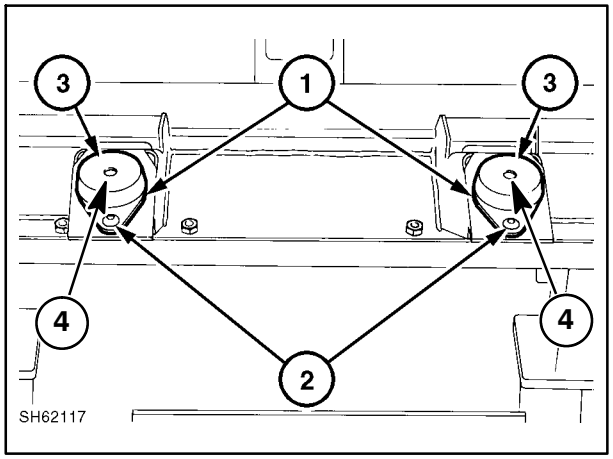


Figure 2-132

7. Reconnect the battery making sure the positive (+) battery cable, 1, on Lx665 models routes away from the turbocharger hose, 2, and the hose clamp, 3.
8. Reverse the clamp, 3, to avoid unnecessary wear on cables and hoses.

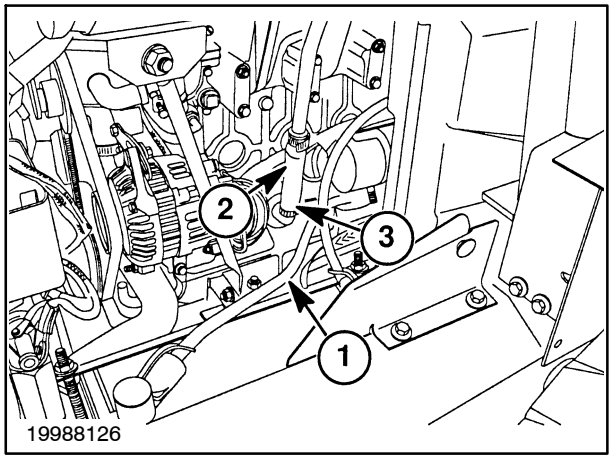


Figure 2-133

HOW TO OPERATE THE ENGINE AFTER OVERHAUL

1. Check the quantity of the coolant, engine oil, and fuel.
2. Disconnect the wiring harness connector at the engine stop solenoid.
3. Move the hand throttle lever to the low, 1/3-throttle position.
4. Turn the key switch to the start position (rotate the starting motor) until the oil pressure lamp goes off (about 20-30 seconds).
5. Connect the wiring harness connector at the engine stop solenoid.
6. Move the hand throttle lever to the 1/3- to 1/2-throttle position, start the engine, and operate at no more than 1500 RPM.
7. Adjust the low speed 1500 RPM with the engine running and warm up for 30 minutes. At the same time:
   - Check for abnormal sound
   - Check for temperature coolant
   - Check temperature of engine oil
   - Check leak of engine oil, coolant, and fuel
   - Check color of exhaust gas

   A gradual running-in of the overhauled engine is necessary for delivery of the lubricating oil to the bearings, etc.
8. Refer to the turbocharger section of this manual for information on operating a turbocharged engine after overhaul.

COOLING SYSTEM

SPECIFICATIONS

Capacity - 10.8 qts. (10.3 L)
Mixture - 50/50 antifreeze/water
Radiator cap - 7 PSI (48.3 kPa)

THERMOSTAT

Opening

180° F (82° C)

Fully Open

203° F (95° C)
EIC starts reading degrees at 113° F (45° C)
or 32° F (0° C)
EIC signals an overheat condition at
216° F (102° C)

OPERATION

The EIC (Electronic Instrument Cluster) monitors the engine coolant temperature during operation and will signal the operator should an overheat condition occur.

The EIC will read COLD at start-up and will start reading in degrees at 113° F (45° C) or 32° F (0° C). The EIC will default from any other monitored function to the coolant function when a overheat condition occurs at 216° F (102° C).

The cooling system has a recovery tank, 1, for coolant expansion.

The radiator can easily be cleaned by raising up the two handles, 2, to slide the radiator to the rear and separate it from the oil cooler for cleaning.

IMPORTANT: Always reposition the radiator before closing the rear door; damage to the radiator or expansion tank may occur.

The cooling system must be filled with a 50/50 mixture of antifreeze and water for winter and summer protection.

IMPORTANT: Always top off the cooling system with a 50/50 antifreeze/water mixture. Always refill a drained cooling system with a 50/50 antifreeze/water mixture.

Add coolant to the recovery tank, not the radiator.

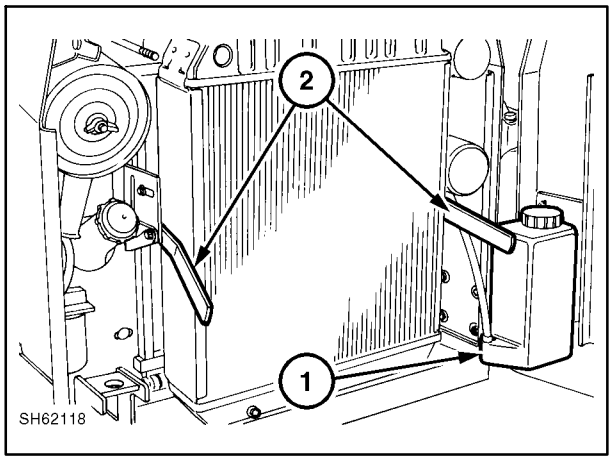


Figure 2-134

DANGER: ALLOW THE ENGINE AND COOLING SYSTEM TO COOL OFF BEFORE ADDING COOLANT TO THE COOLING SYSTEM.

DANGER: ALWAYS ALLOW THE ENGINE AND COOLING SYSTEM TO COOL OFF BEFORE DRAINING THE COOLING SYSTEM.

WATER PUMP ASSEMBLY AND THERMOSTAT HOUSING

Disassembly

Remove the backplate and gaskets.

Take out the thermostat and spring from the thermostat housing.

1 Water pump
2 Gaskets
3 Set plate

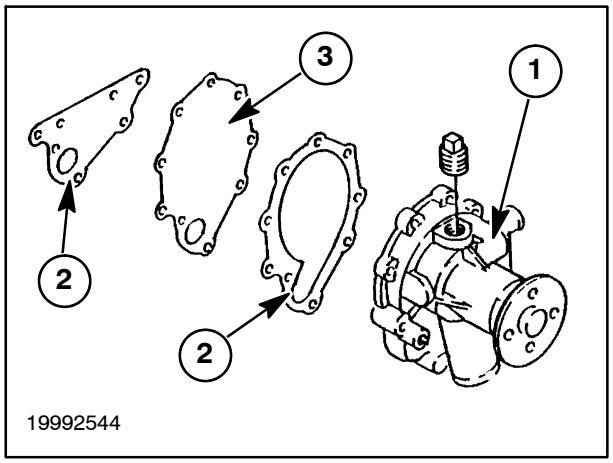


Figure 2-135

THERMOSTAT

Inspection

Replace the thermostat if the valve opens at ambient temperature.

Place the thermostat into water. Raise the water temperature gradually and inspect the valve opening temperature and valve lift. (Standard values are as described in the “Specifications” section.)

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

	N844	N844T
Type	Wax Pellet Type	Wax Pellet Type
Temperature when starting to open	176° - 183° F (80° - 84° C)	156° - 163° F (69° - 73° C)
Temperature when fully open	203° F (95° C)	180° F (82° C)
Valve lift fully open	0.315″ (8.0 mm)	0.315″ (8.0 mm)

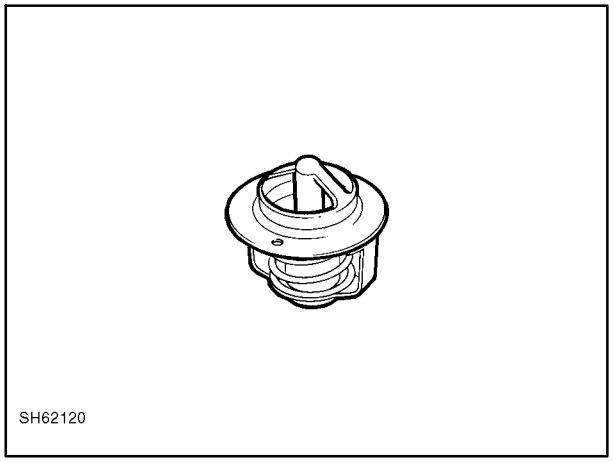


Figure 2-136

WATER PUMP

Check for cracks, wear, leaks, bearing roughness, or damage. If defective, replace assembly.

Reassembly

Assemble the thermostat and spring in the housing. Install the gasket and set plate on the water pump.

Rotate the fan holder to confirm there is no obstruction or interference.

RADIATOR

A pressure-type radiator cap 7 PSI (48.3 kPa) is employed to obtain higher cooling efficiency. When the coolant pressure builds up to the range of 0.8 $\pm$ 0.15 kg/cm2 (6.5 ft. lbs. to 10.8 ft. lbs.), excessive pressure is relieved from the overflow pipe (shown by white arrow).

When coolant temperature falls, coolant pressure may become less than atmospheric pressure. As this may fracture the radiator, the vacuum relief valve opens at 0.04 to 0.05 kg/cm2 (2.9 ft. lbs. to 3.6 ft. lbs.) to protect the radiator (black arrow).

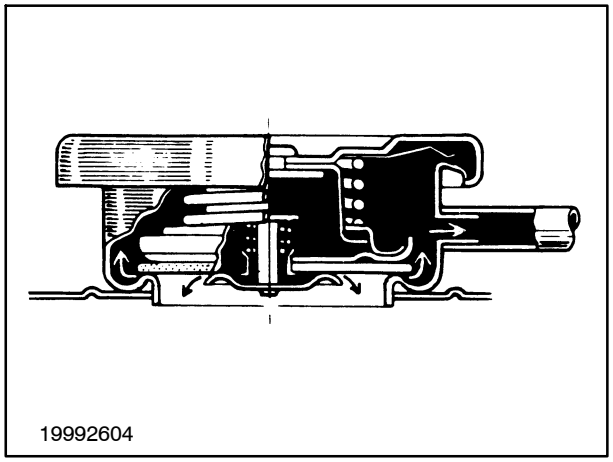


Figure 2-137

Inspection

1. Check the radiator for water leaks. If there are water leaks, repair or replace the radiator.
2. Check radiator fins for clogging by mud and/or other foreign matter. If clogged, clean the fins.
3. Check the pressure cap and vacuum pressure relief cap for operating pressure or contacting condition. Replace if defective.
4. Check the radiator hoses; replace if damaged.

Radiator Removal

Drain the radiator and cooling system by raising up on handles, 1, moving the radiator to the rear. Remove the drain plug, 2, and drain the coolant into a clean container.

Remove the upper and lower radiator hoses.

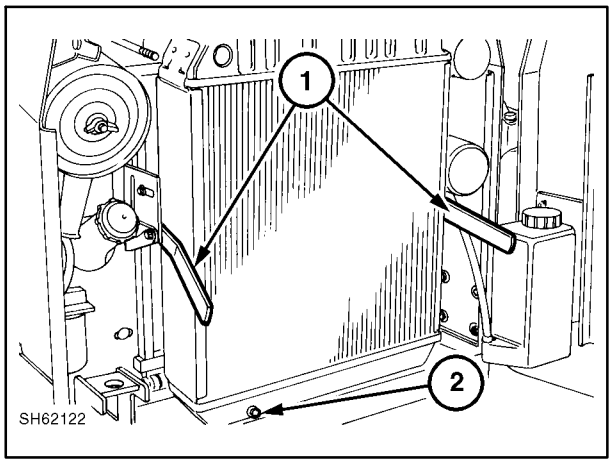


Figure 2-138

Remove the radiator support hardware and handles, 1, from both sides of the radiator. Remove the overflow hose, 2, from the radiator at the cap.

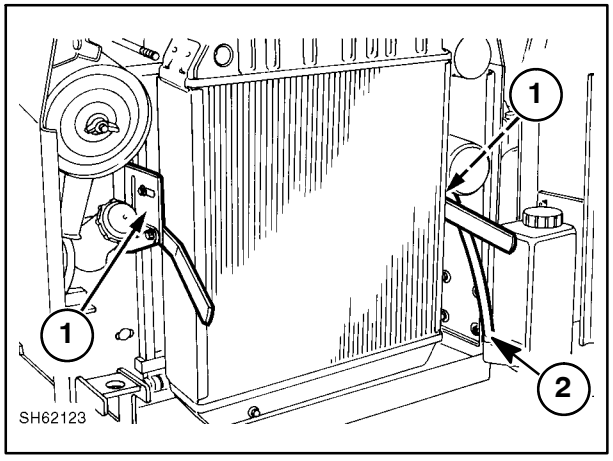


Figure 2-139

FUEL SYSTEM

FUEL SPECIFICATIONS

Fuel tank capacity is 14.3 U.S. gal. (54 L).

DIESEL FUEL

Use clean, quality No.1-D or No. 2-D fuel (ASTM D975).

Use No. 1-D if the ambient temperature is expected to be less than 40° F (4° C) or if the loader is to be used at an altitude exceeding 5000 ft. (1524 m).

The sulfur content of the fuel should be no more than 0.5%.

The sediment and water content should not exceed 0.05%.

To prevent fuel flow problems in cold weather, use No. 1-2 diesel fuel with a pour point of at least 10° F below the expected ambient temperature.

Minimum cetane number is 40. Low temperature or high altitude operation may require the use of fuel with a higher cetane number.

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. When temperatures are extremely cold, use properly mixed winter fuel.

Use New Holland diesel fuel conditioner part #251202 to mix with the diesel fuel. Follow the directions for use as indicated on the container.

DIESEL FUEL STORAGE

NOTE: Diesel fuels stored for a long time may form gum and plug filters.

Keep fuel in a clean container in a protected area. Water and sediment must be removed before fuel gets to the engine. Do not use deicers to remove water from fuel. Do not depend on fuel filters to remove water. If possible, remove water and sediment at the storage tank outlet.

IMPORTANT: Do not store diesel fuel in galvanized containers. Diesel fuel stored in galvanized containers reacts with the zinc coating of the container to form zinc flakes. If fuel contains any water, a zinc gel may also form. The gel and flakes will quickly plug fuel filters and may damage the injector pump and injectors.

FUEL SYSTEM COMPONENTS

The fuel system contains a fuel tank located in the left side of the engine compartment at 1. Fuel tank pickup tube, 2; fuel tank sending unit, 3; in-line fuel filter, 4; electric fuel pump, 5; injection pump, 6; and return fuel line, 7, from the injector bleed off to the tank. The fuel flow is controlled by an electronic fuel solenoid, 8, which is controlled by the EIC (Electronic Instrument Cluster).

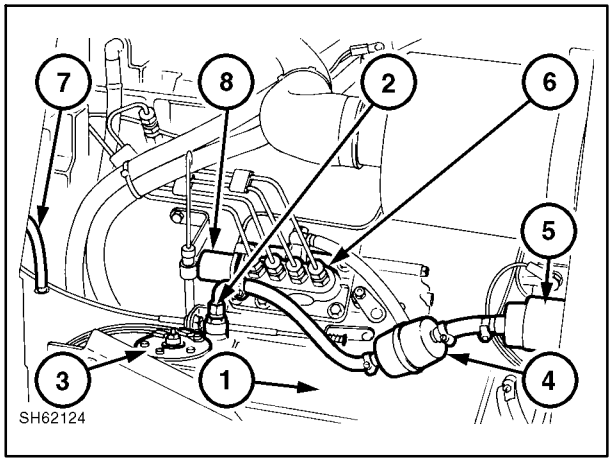


Figure 2-140

Located between the electric fuel pump and the injector pump is an additional fuel filter (water trap), 1. The fuel tank cap, 2, is a vented style.

WARNING: REFUEL THE LOADER OUTDOORS WITH THE ENGINE SHUT OFF. REPLACE THE FUEL CAP SECURELY. USE AN APPROVED FUEL CONTAINER. DO NOT SMOKE WHEN HANDLING FUEL. AVOID SPILLING FUEL.

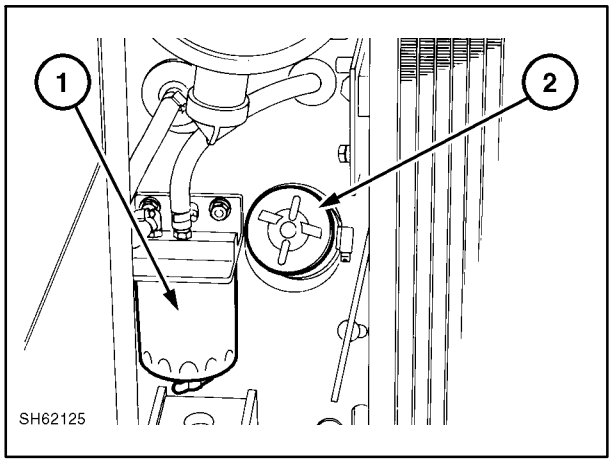


Figure 2-141

FILLING THE FUEL TANK

The fuel tank filler cap, 2, is located at the rear of the skid-steer loader behind the rear door. Wipe the dust and dirt from around the cap before removing the cap to prevent trash from falling into the tank while filling it. Use an approved fuel container and keep it clean. The fuel tank capacity is 14.3 U.S. gal. (54 L).

NOTE: The fuel cap is the vented type. Use only a vented cap to prevent fuel system related problems.

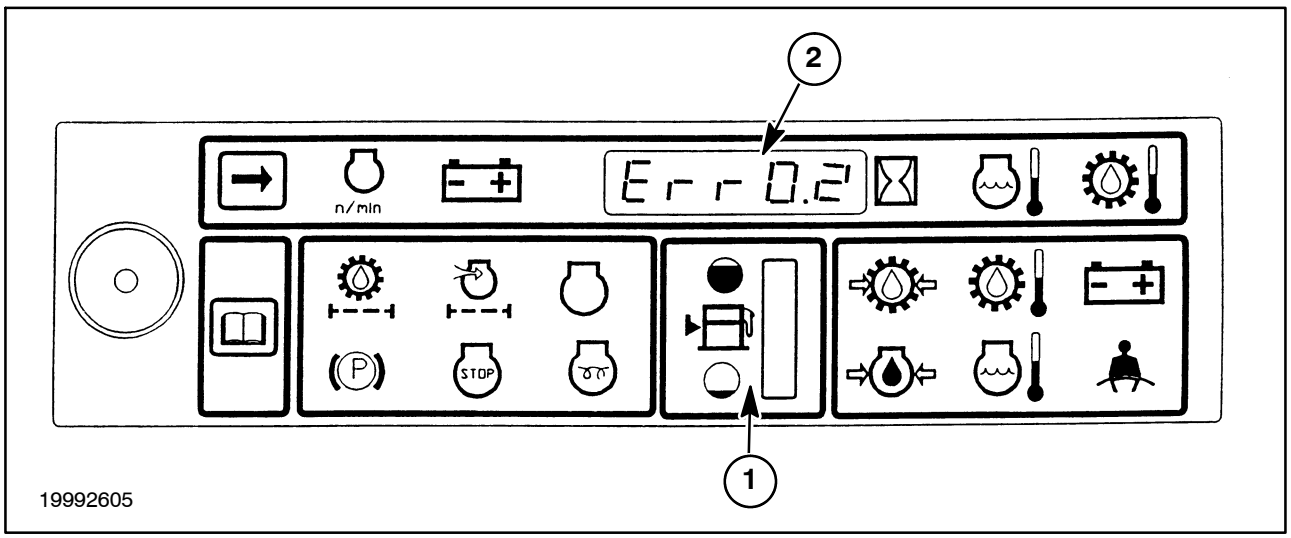


Figure 2-142

FUEL GAUGE

In the center of the EIC panel is the fuel gauge, 1, implemented as a vertical 10-segment green LED bar graph. The lowest segments will flash when the fuel level is low. An audible alarm will accompany the flashing light for about 5 seconds.

The EIC character display, 2, will display certain error messages or fault codes when unusual conditions occur during operation. The following are the fault conditions and the associated error messages or fault codes:

Error Messages

ERR02: Output circuit to the fuel solenoid has shorted/opened.

Fault Codes

F04: Output circuit to fuel solenoid has shorted/opened.

COLD START AID BUTTON

The EIC controls a timed preheat cold start to assist in cold weather starting. This button provides an override for extreme cold weather for additional preheat time if required.

NOTE: Not all models are equipped with a manual preheat button.

CAUTION: NEVER USE THE OVERRIDE SWITCH FOR MORE THAN 15 SECONDS OR THE GLOW PLUGS MAY BE DAMAGED.

STARTING A COLD ENGINE

Move the engine speed control ahead to 1/3 position, maximum 1500 RPM.

Turn the ignition key, 1, to the “RUN” position. The EIC will automatically activate the engine preheat system and the preheat light, 2, will be on, also at this time the character display, 3, will read the seconds remaining to heat. When the light goes off and the display is 0, turn the ignition key to the “START” position. After the engine starts, allow the key to return to the “RUN” position.

The engine must start within 30 seconds; if the engine does not start preheat again. Allow the starter to cool for one minute before engaging the starter motor. To start the preheat sequence again, turn the ignition key off and then on again.

Always allow the engine to operate at a maximum of 1500 RPM to warm up before applying a load.

NOTE: Following the above starting procedures is very important for any engine but especially a turbocharged engine to insure the turbocharger is lubricated properly.

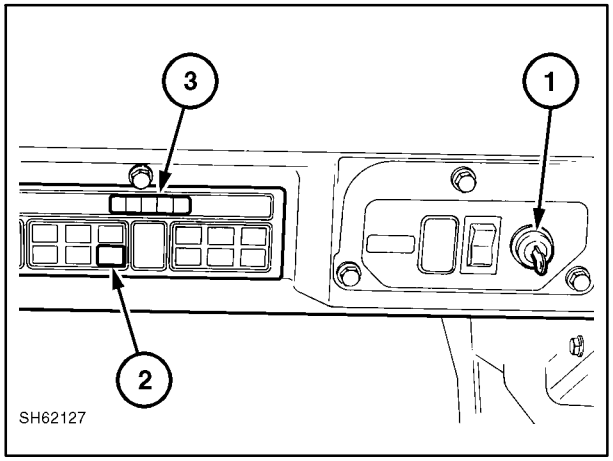


Figure 2-143

FUEL FILTER SYSTEM

The unit is equipped with a fuel filter water trap, 1. Drain the water trap filter every 100 hours of operation, or sooner if water is found in the fuel supply. To drain the water trap, turn the drain cock, 2, on the bottom of the cartridge and allow the water to drain. Replace the filter every 500 hours.

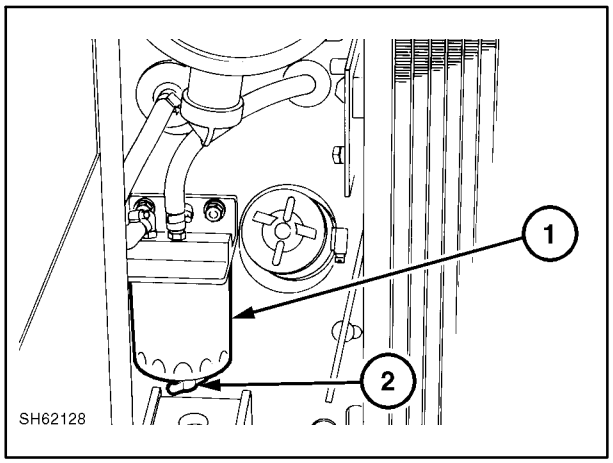


Figure 2-144

Replace the in-line filter, 1, every 250 hours of operation. To remove the filter, remove the two hose clamps, 2, and remove the hoses from the filter. Install a new filter, hoses, clamps and tighten.

WARNING: ALL SERVICE SHOULD BE PERFORMED WITH THE ENGINE SHUT DOWN. IF SERVICING THE LOADER WITH THE BOOM IN THE RAISED POSITION, BE SURE THE BOOM ARMS ARE SUPPORTED BY THE BOOM LOCK PINS.

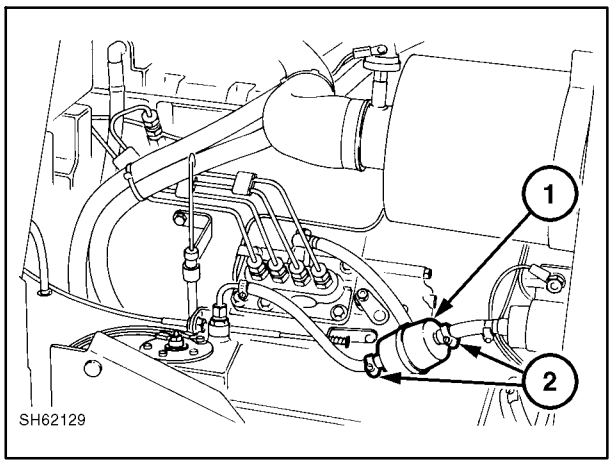


Figure 2-145

ELECTRIC FUEL PUMP

Priming the fuel system:

The skid steer loader is equipped with an electric fuel pump, 1. If the engine has been run out of fuel, add a minimum of 5 gallons (18.9 L) fuel to the tank.

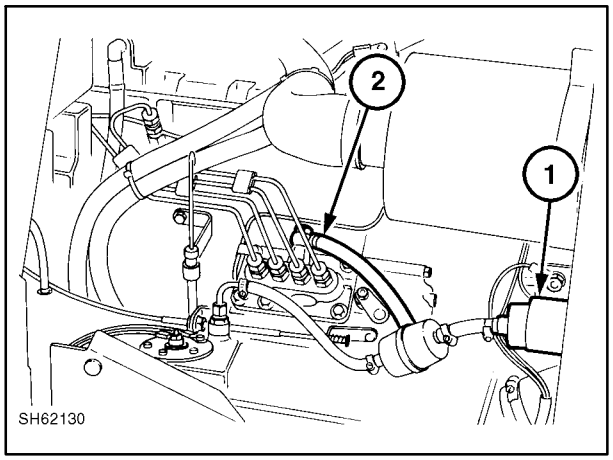


Figure 2-146

Put the Service/Run switch, 1, in the SERVICE position. Remove the fuel line, 2, Figure 2-146, at the injector pump.

Turn the ignition switch to the RUN position and allow the electric fuel pump to pump fuel until a full stream of fuel (no air) flows at 2, Figure 2-146. Reinstall the fuel line. Now start the engine and allow the engine to run until the injection pump self bleeds the air from the pump.

NOTE: The Service/Run switch may be located under the cab fuse panel cover, at 3, on some models.

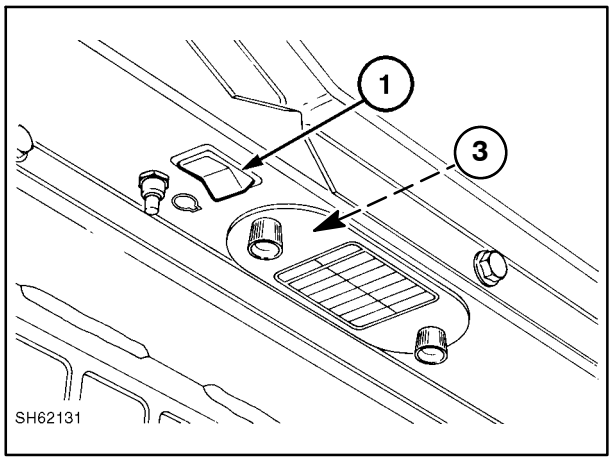


Figure 2-147

FUEL SYSTEM TESTING

ELECTRIC FUEL PUMP

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key “OFF” position	Fuel level in tank	NO YES	Add fuel and bleed system Go to next step
2	Key “ON” position	Fuel pump operating	NO YES	Check power supply (5-amp fuse in cab panel) If OK, replace pump Go to next step
3	Key “ON” position	Fuel pump operating but not pumping fuel	NO YES	Check line to tank, air leak, fuel level, tank pickup tube. If OK, replace pump Go to next step
4	Key “ON” position	Fuel pump operating and pumping fuel	NO Yes	Replace pump Remove fuel line at injector pump and bleed system, if OK go to next step
5	Key “ON” position	Fuel pump operating and pumping fuel	Yes	Check fuel shutoff solenoid for operation

NOTE: Always check fuel level in tank.
Always check fuel filters.

FUEL SHUTOFF SOLENOID

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key “ON” position, service “RUN” switch in “RUN” position	Battery voltage to solenoid	NO YES	Check power wire from EIC to solenoid for open, if OK go to next step Replace solenoid
2	Key “ON” position, service “RUN” switch in “SERVICE” position	Battery voltage to solenoid	NO YES	Check power wire from service run switch to fuel solenoid, if OK go to next step Replace solenoid
3	Key “ON” position, service “RUN” switch in “RUN” position	Check EIC board operation	NO YES	Check power to EIC board Replace EIC board

FUEL TANK SENDING UNIT(Fuel level)

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key “ON” position	EIC gauge and sender operation jumper wire from one terminal to other at sender	NO (bars light up) YES (bars light up)	Check wires from sender to EIC board, if OK, replace EIC board Replace sender

FUEL FLOW

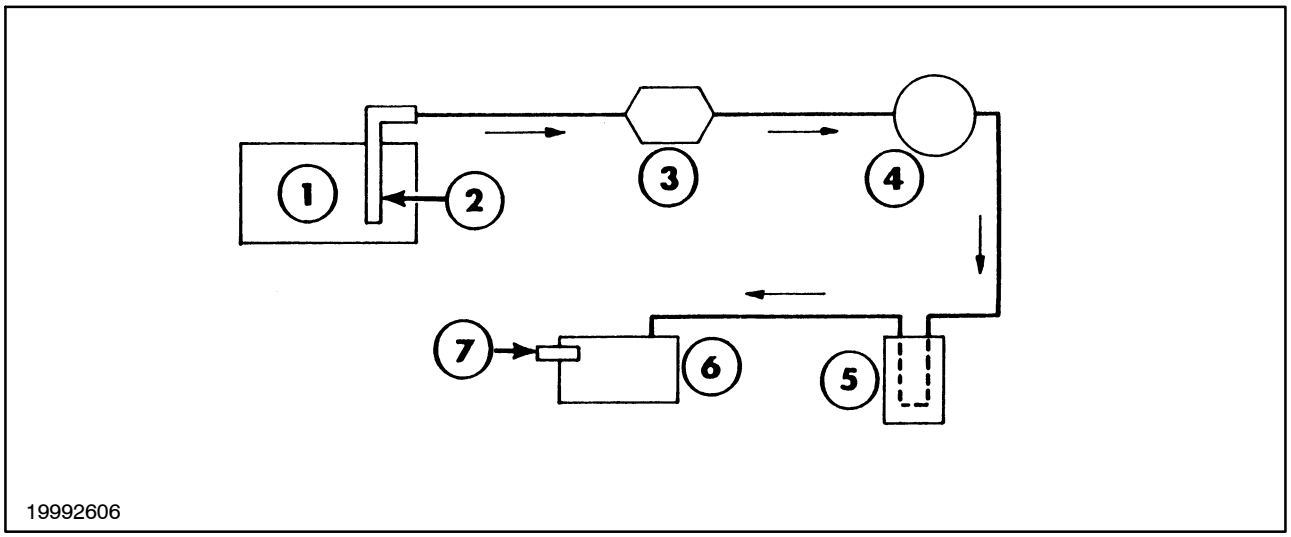


Figure 2-148

1 Fuel tank
2 Tank pick-up
3 In-line fuel filter
4 Electric fuel pump
5 Filter (water trap)
6 Injection pump
7 Fuel shut-off solenoid

FUEL SYSTEM ELECTRICAL DIAGRAM

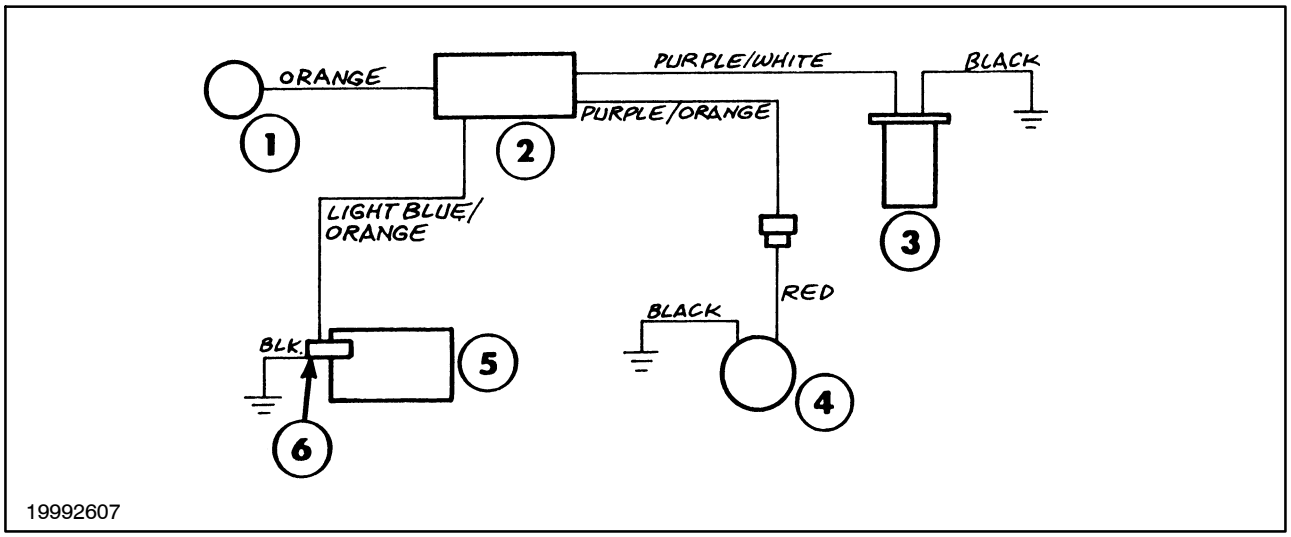


Figure 2-149

1 Key switch
2 EIC board
3 Fuel level sender
4 Electric fuel pump
5 Injector pump
6 Fuel shut-off solenoid

FUEL SYSTEM COMPONENTS

FUEL TANK

Remove and Replace

1. Raise the boom, extend the boom lock pins, 1, and lower the boom down on the lock pins.
2. Stop the engine, turn the ignition key to the “ON” position and operate the boom and bucket control pedals to relieve pressure in the cylinders, turn the key “OFF.”
3. Jack and securely support the loader up off the ground approximately 20″ (508 mm).
4. Remove the engine area belly pan, 2.
5. Remove the left fender, 3.

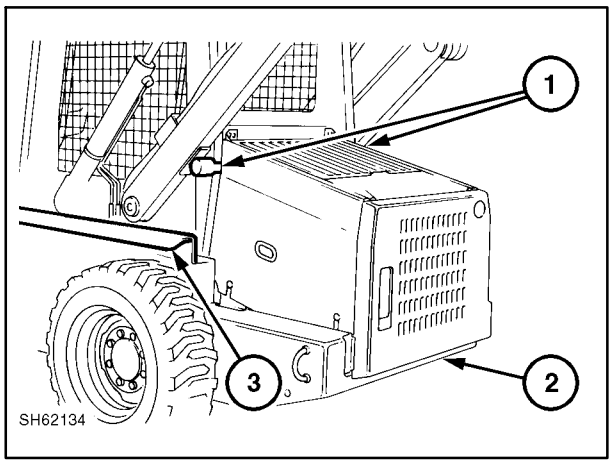


Figure 2-150

6. Open rear door, 1, raise the top shield, 2, and remove the left side shield.
7. Remove the fill neck retaining hose clamp or screw at the tank and remove fill neck, 3.
8. Unhook the suction fuel line, 4, and return fuel line, 5.
9. Remove the wires from the fuel level sender, 6.
10. Remove the lower engine fuse panel support hardware, 7, and move the panel up.

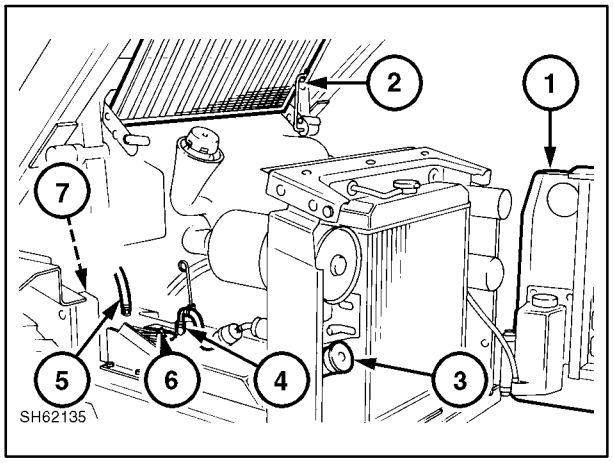


Figure 2-151

11. Remove the connecting hose, 1, and drain the fuel tank into a clean container.
12. Remove the front, 2, and rear, 3, tank support hardware.
13. Remove the fuel tank from the bottom of the engine compartment.

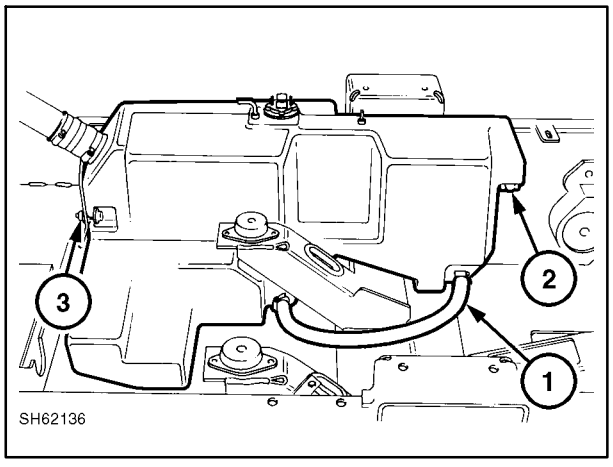


Figure 2-152

FUEL LEVEL SENDER

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Unhook the wires from the sender, 1.
4. Remove the sender retaining screws, 2, and remove the sender, 3, assembly from the tank.

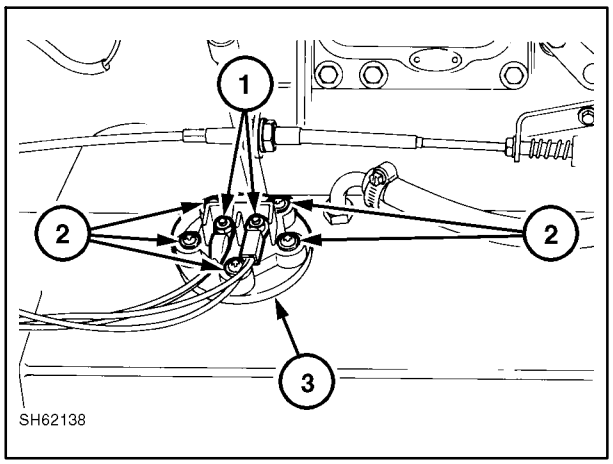


Figure 2-153

FUEL TANK PICKUP TUBE

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Remove the suction line from the pickup tube, 1.
4. Unthread the tube, 2, from the tank.

   Upon reinstallation of the tube, seal the threads with thread sealer.

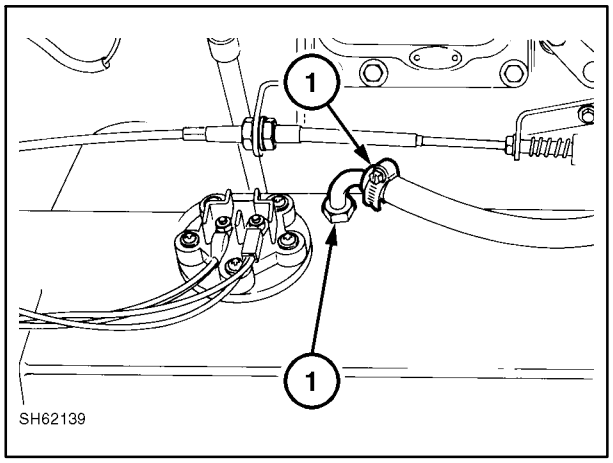


Figure 2-154

ELECTRIC FUEL PUMP

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Remove the hose clamps, 1, from the pump and hoses.
4. Remove the pump support hardware, 2, ground wire, and unplug the power wire.
5. Upon reinstallation of the pump, make sure the pump wires are placed to prevent damage. Make sure the ground wire is making good contact.

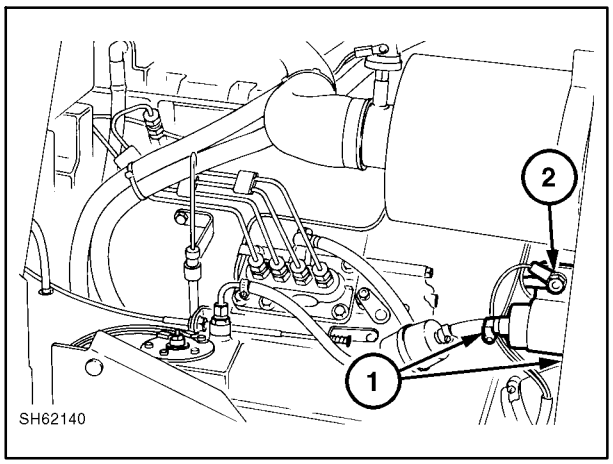


Figure 2-155

GOVERNOR

Construction/Function

A mechanical all-speed governor is used. It is housed in the gear case.

A flyweight assembly is mounted on the camshaft. The movement of the flyweight is transmitted to the injection pump control rack by way of the slider, control lever, and link, 1. A spring which is hooked to the arm, 3, and tension lever, 4, regulates the movement of the flyweight.

By changing the set angle of the governor lever, tension on this spring is changed. Thus, the engine speed can be regulated by the governor lever.

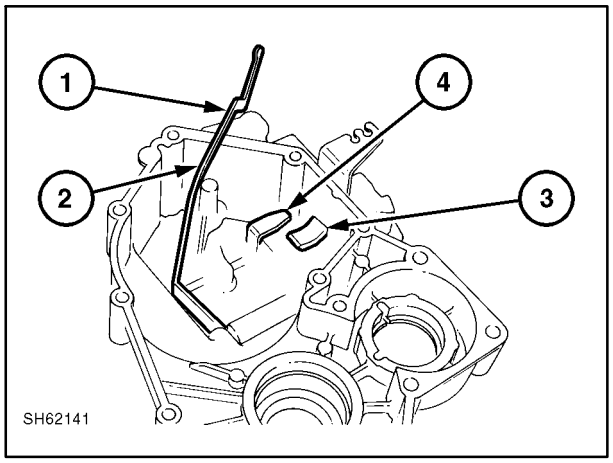


Figure 2-156

Maximum Speed Set Bolt

The set bolt is mounted on the cylinder block. This bolt limits the movement of the arm and has been adjusted and sealed at the factory.

Maximum Fuel and Start Spring

These are built into the cylinder block to regulate fuel injection at high speed. Regulation of fuel injection in the middle speed range is by torque spring to realize higher torque.

A start spring, 2, is placed between the gear case and link. This spring automatically functions to increase fuel during the start mode.

An idling spring at the gear case stabilizes engine idling speed.

The maximum fuel has been adjusted at the factory and sealed.

GOVERNOR OPERATION

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.

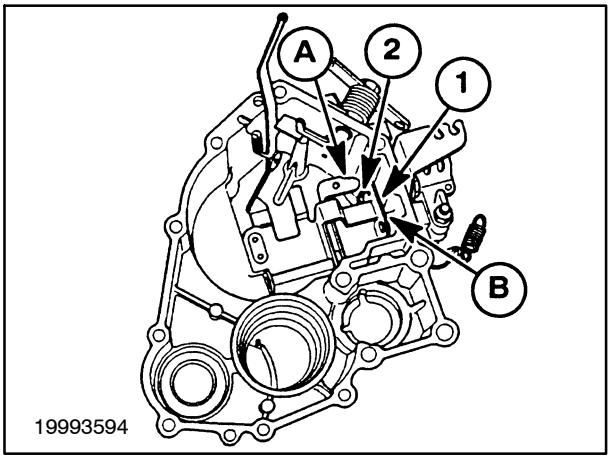


Figure 2-157

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

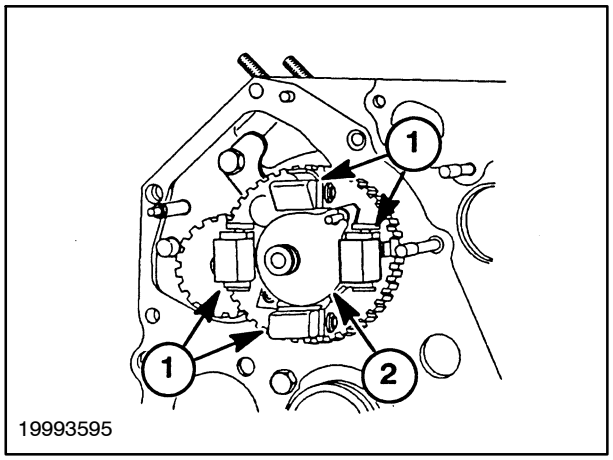


Figure 2-158

The slider cone, 2, Figure 2-158, 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.

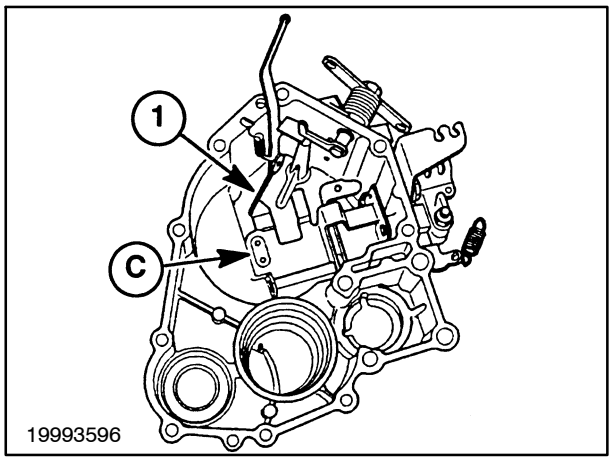


Figure 2-159

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

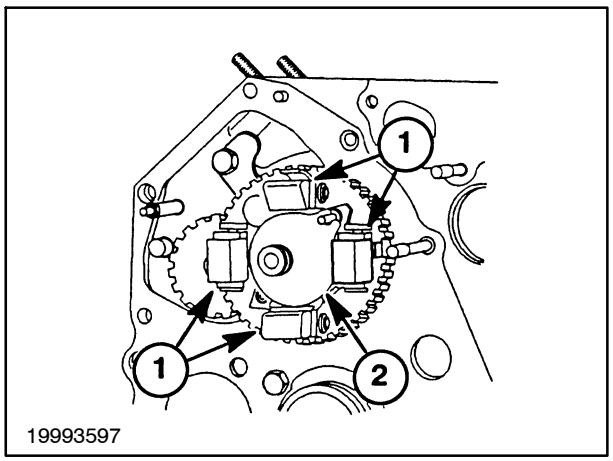


Figure 2-160

As the slider cone, 2, Figure 2-160, 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 the governor linkage parts are located inside the engine timing gear cover. To inspect or replace any of the governor linkage parts, the timing gear case and injection pump must be removed from the engine.

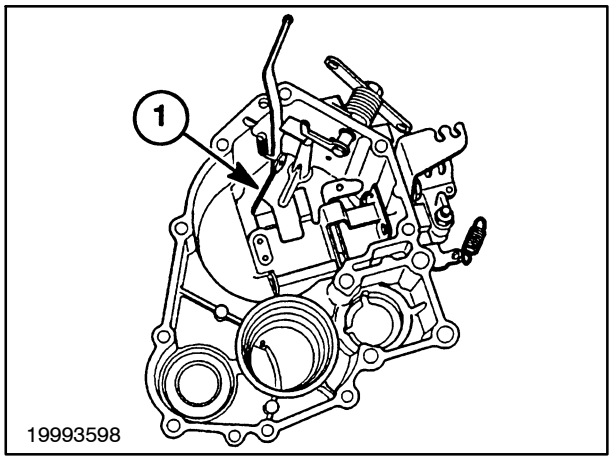


Figure 2-161

NOZZLE AND HOLDER

Specification

Nozzle type	Throttle type
Needle valve diameter	0.16″ (4 mm)
Pintle diameter	0.04″ (1 mm
Valve setting pressure	155-165 kg/cm^2 (153-163 atm)
Spraying angle	4°

Construction/Function

The nozzle has been machined to inject fuel which is pressure-fed from the injection pump to the combustion chamber. Fuel is pressure-fed from the oil hole of the nozzle holder to the nozzle body and sprayed from the nozzle compressing the spring when the pressure exceeds the specified value. Some fuel lubricates and cools the nozzle and nozzle body and returns via the return pipe.

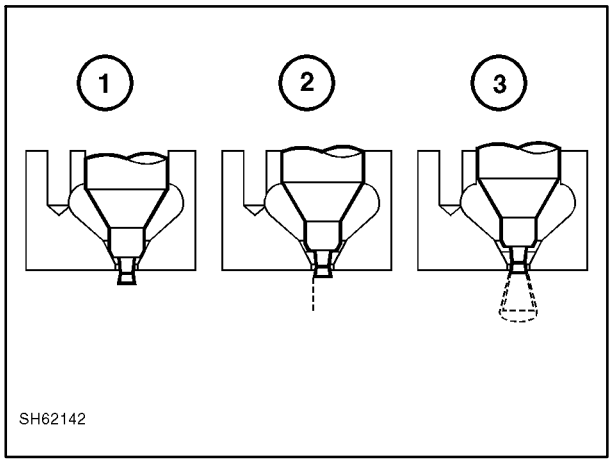


Figure 2-162

Throttle-Type Nozzle

1 Valve closed
2 Valve open
3 Full opening (main jet)

Disassembly/Inspection

1. Place the nozzle holder (body) in a vise and turn the nozzle nut to disassemble.

   NOTE: Care should be taken so the needle valves do not fall when the nozzle is removed.

2. Wash the nozzle body and needle valve and inspect the nozzle for seizure, sticking, and fuel leakage on the seat surface. If fuel leakage is detected, replace the nozzle.
3. Inspect the upper and lower contact surfaces of the distance piece and correct so that positive contact can be obtained.
4. Check the nozzle needle valve-contact surface on the push rod for wear and spring seat for cracks.

Reassembly/Adjustment

1. Before fitting a new nozzle assembly, soak it in heated light oil 120° F -140° F (50° C - 60° C) to remove the anticorrosive agent from the nozzle. Slide the body on the needle valve so they slide smoothly.
2. Turn the nozzle body upside down, fit the shim, spring, rod, spacer and nozzle in this order, and tighten with a nozzle nut.

Throttle-Type Nozzle

1 Gasket
2 Nozzle nut
3 Nozzle
4 Spacer
5 Rod
6 Spring
7 Shims
8 Body tighten torque 22 ft. lbs. - 36 ft. lbs. (30 N·m - 49 N·m)
9 Nut tighten torque 18 ft. lbs. - 22 ft. lbs. (24 N·m - 30 N·m).

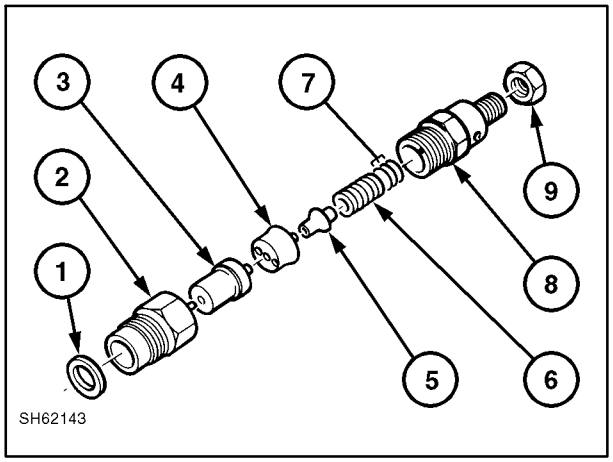


Figure 2-163

3. After reassembly, inspect the injection pressure of the nozzle.

   Adjust the pressure with adjusting shims, using a nozzle tester so the injection starts at 150 kg/cm^2 (throttle type) and 210 kg/cm^2 (hole type). (The pressure increases or decreases about 10 kg/cm^2, 142 PSI, 9.7 atm with a shim of 0.1 mm thick).

4. Spray Condition

   a. Fuel drops should not be mixed in the spray pattern.

   b. Fuel should be sprayed in conical shape with respect to the nozzle axis.

   c. Be sure the fuel is sprayed in a circular shape when tested.

   d. Hold the pressure at 130 kg/cm^2, lower by 20 kg/cm^2, 20 atm than specified (150 kg/cm^2) and check that no test oil drops from the nozzle tip.

FUEL INJECTION PUMP

If trouble has been traced to this pump, disassembly, inspection, assembly, and testing/setting must only be carried out by fuel equipment specialists.

AIR CLEANER

Construction/Function

The cyclonic air cleaner houses a paper element which removes dirt or dust from air drawn in.

Inspection/Replacement

1. When the EIC signals to service the air cleaner, take out the outer element and clean it by blowing compressed air (pressure lower than 100 PSI).

   Do not remove the inner safety element.

2. When operating the machine in a dusty environment, increase service frequency.
3. After cleaning the element, put a light inside the element and check it for cracks, holes, or wear.

   If damage is found or the gasket is broken, replace the element.

4. When the inner safety element is dirty, do not clean. Replace the element.

Injection Timing, Crankshaft Positions, and Spill-Timing Procedure

Engine Model	Degrees Crank BTDC			
	X	Y	Z	Injection Timing
N844T	21	20	22	20-22
N844	22	21	23	21-23

1. Pull out the delivery valve, 1, (IN), and reinstall the spring, 2, and delivery valve holder, 3.

   NOTE: When reassembling the delivery holder, adjust the location of the delivery valve (OUT) to the correct position using a wire, 4.

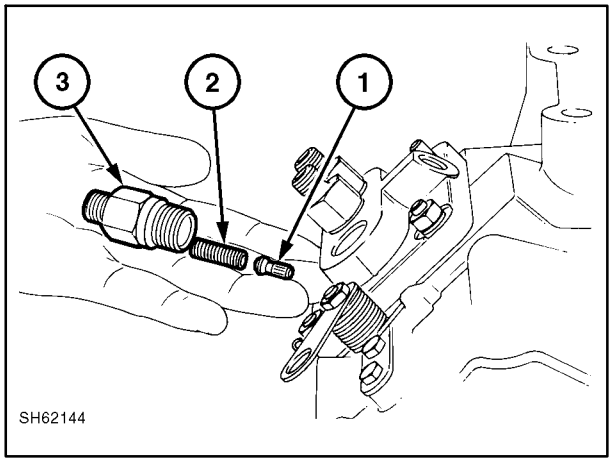


Figure 2-164

2. Move the governor control lever to “Maximum Fuel” position and send fuel with the No. 1 piston at around “X” degrees BTDC in its compression stroke. At this time, fuel flows from the delivery holder.

N844, N844T

Crankshaft Angle (BTDC)	Position
13	0.0594″ (1.510 mm)
14	0.0689″ (1.749 mm)
15	0.0789″ (2.005 mm)
16	0.0897″ (2.278 mm)
17	0.1011″ (2.569 mm)
18	0.1132″ (2.875 mm)
19	0.1259″ (3.199 mm)
20	0.1393″ (3.539 mm)
21	0.1533″ (3.895 mm)
22	0.1680″ (4.267 mm)
23	0.1833″ (4.655 mm)
24	0.1991″ (5.058 mm)
25	0.2156″ (5.477 mm)
26	0.2328″ (5.912 mm)

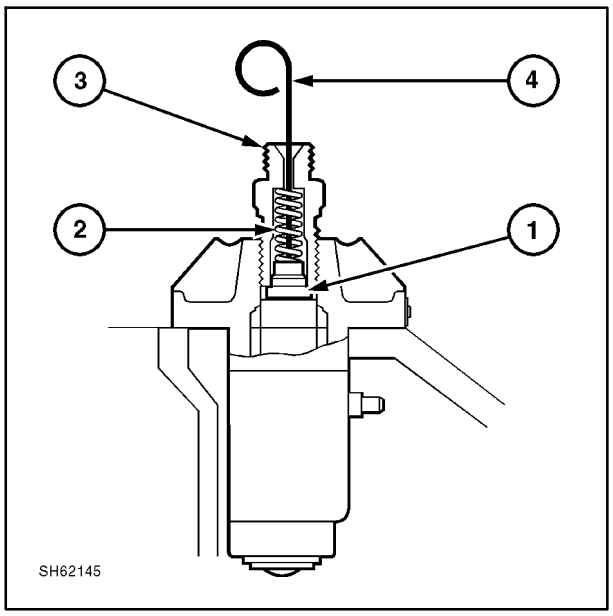


Figure 2-165

3. Slowly turn the crankshaft clockwise until flowing fuel from the delivery holder is stopped. Check the piston position at this point. If the position is later than “Y” BTDC, use a thinner shim. If the position exceeds “Z” BTDC, use a thicker shim.

   Changing the shim thickness by 0.004″ (0.1 mm) will change the timing approximately one degree. Adding shims decreases the angle, while subtracting shims increases the angle.

   NOTE: When the shim is not needed, assemble by coating, using liquid sealant.

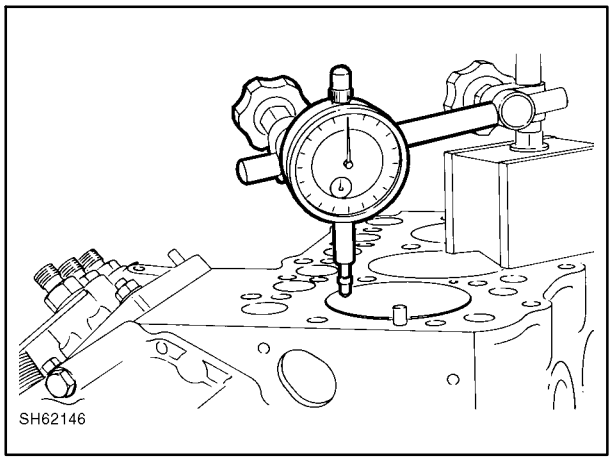


Figure 2-166

4. 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 with a dial indicator. If the pulley mark is slightly off, re-mark the pulley and proceed.

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

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

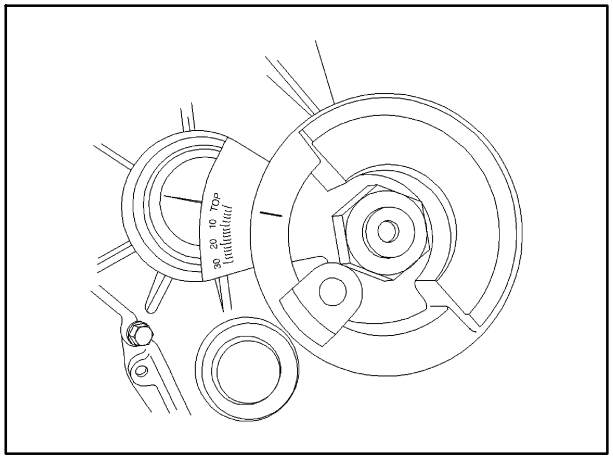


Figure 2-167

7. Remove the No. 1 injection line from the No. 1 injector, 1.
8. Remove the lock screw, 2, and remove the injector locking plate, 3.

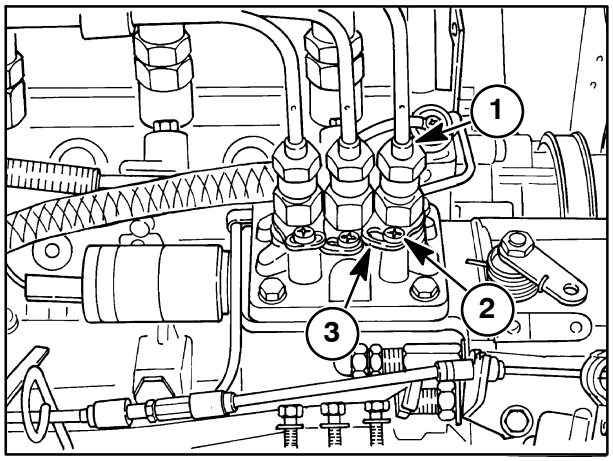


Figure 2-168

9. Remove the delivery valve piston, 1, from the No. 1 delivery valve.

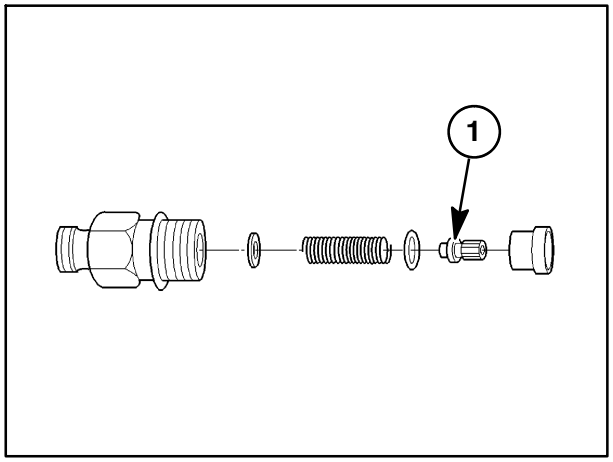


Figure 2-169

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

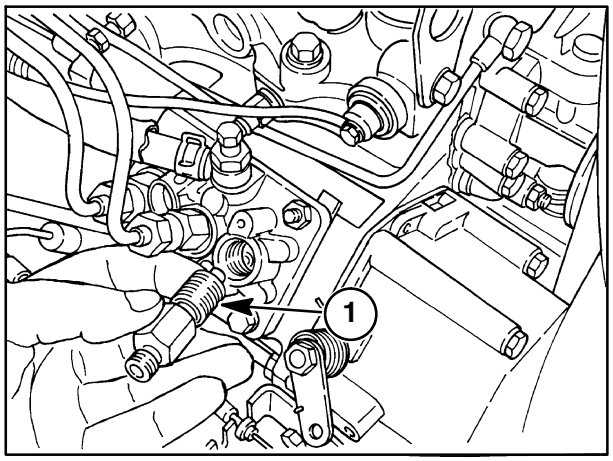


Figure 2-170

11. Fabricate a spill tube, 1, from a discarded injection line and install the tube on the No. 1 port on the injection pump.

12. Remove the fuel shut-off solenoid from the injection pump.

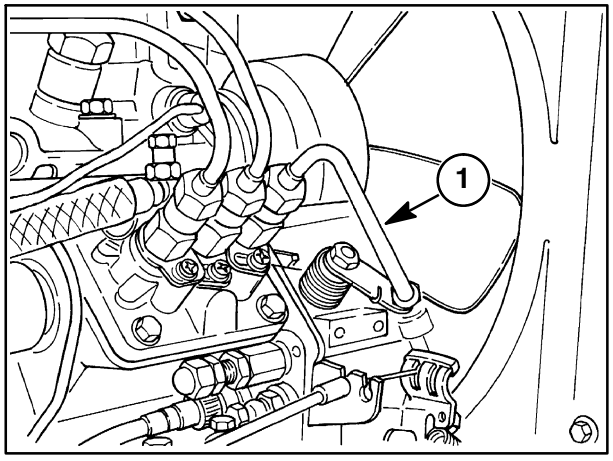


Figure 2-171

13. Rotate the crankshaft counterclockwise (viewed from the front of the engine) approximately 40°.

14. Turn on the fuel supply to the injection pump. Fuel should flow out of the spill tube on the No. 1 cylinder port.

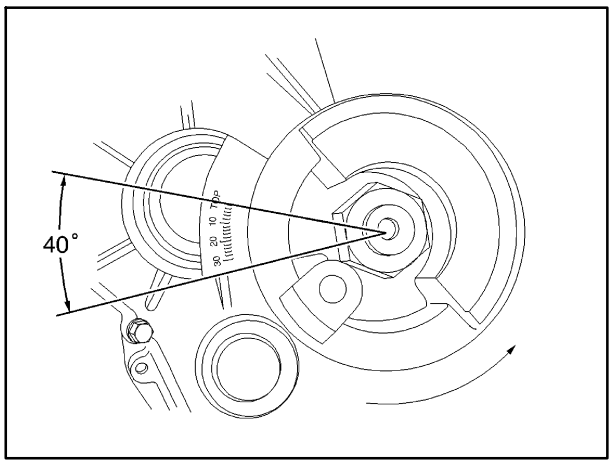


Figure 2-172

15. Rotate the crankshaft clockwise. When the timing mark on the crankshaft pulley, 1, is in line with the 21° (N844T) or 22° (N844) mark on the scale, 2, fuel should stop flowing from the spill tube.

16. If fuel does not stop flowing at the appropriate timing mark, the injection pump timing must be adjusted by adding or removing shims located between the injection pump and the engine block.

17. 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 in.) will change the pump timing by approximately 1°.

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

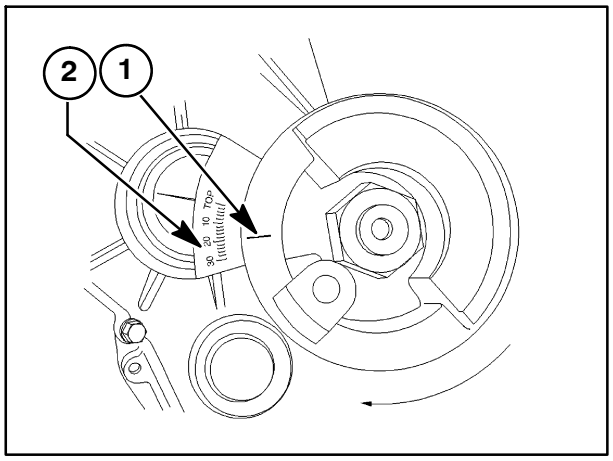


Figure 2-173

NOTE: Delivery holder tightening torques:

29-33 ft. lbs. (39-45 N·m)

TURBOCHARGER - LX665, N844T ENGINE

The LX665 skid-steer loader is equipped with the N844T turbocharged engine.

SPECIFICATIONS

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

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

TURBOCHARGER LUBRICATION

The turbocharger used on the Lx665 diesel engine may not receive adequate lubrication on cool/cold weather (below 5°C, 40°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 until the EIC “beep” is heard.
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. To remove the turbocharger, first remove the muffler from the turbo adapter assembly at 1.

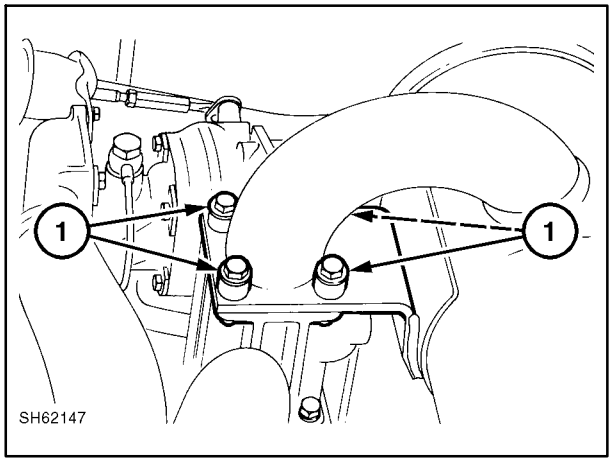


Figure 2-174

2. Remove the turbocharger oil pressure line, 1, at the block and at the turbo housing.

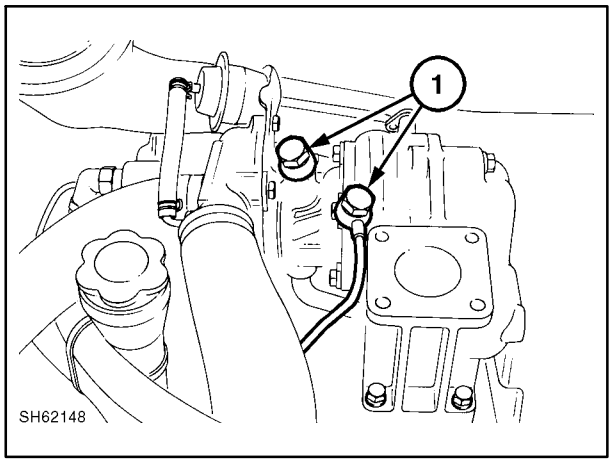


Figure 2-175

3. Remove the turbocharger oil return line, 1, at the top hose clamp, 2, and from the turbo assembly at 3.

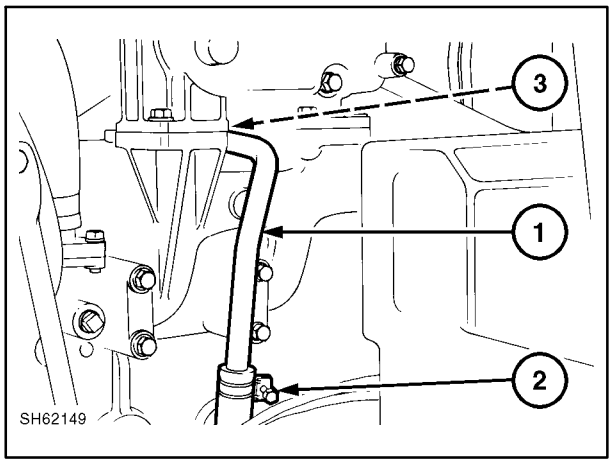


Figure 2-176

4. Remove the turbocharger assembly and adapter from the exhaust manifold, 1, and support, 2.

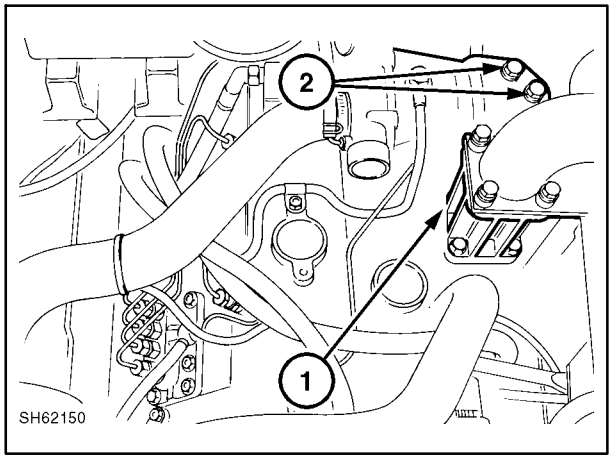


Figure 2-177

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.

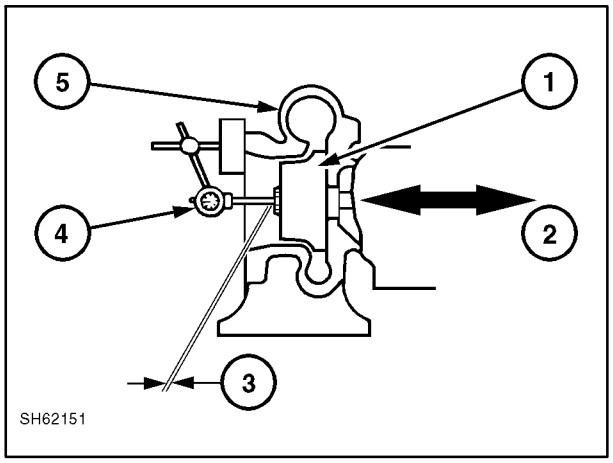


Figure 2-178

END PLAY MOVEMENT

Standard	Allowable Limit
0.001″ - 0.002″ (0.03 mm - 0.06 mm)	0.0035″ (0.09 mm)

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.

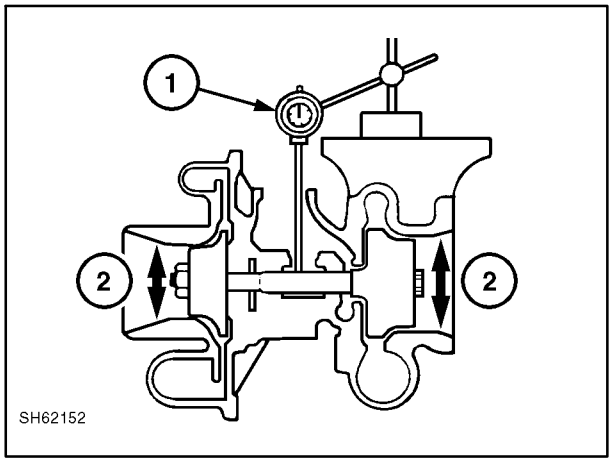


Figure 2-179

RADIAL MOVEMENT

Standard	Allowable Limit
0.003″ - 0.005″ (0.08 mm - 0.13 mm)	0.0067″ (0.17 mm)

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 14 PSI (1 kgf/cm) applied to the control air inlet at 2.

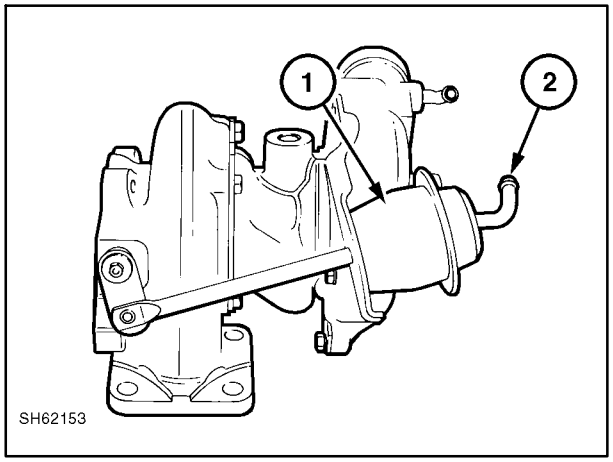


Figure 2-180

2. Separate the blower housing, 1.

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

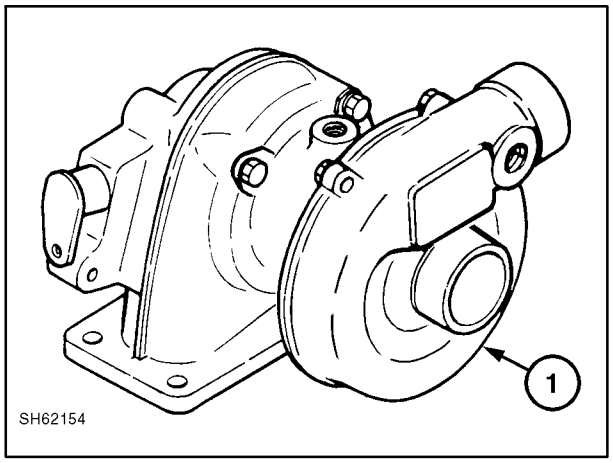


Figure 2-181

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. Separate the turbine housing, 3.

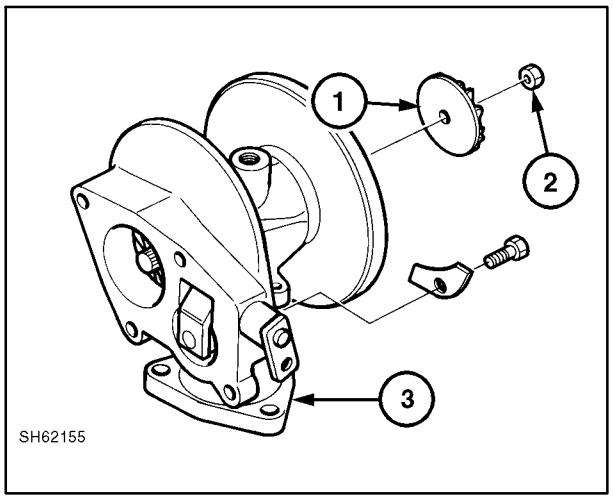


Figure 2-182

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.

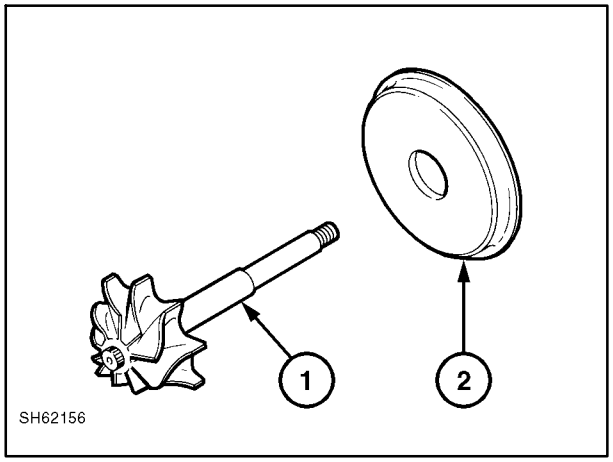


Figure 2-183

6. Remove the seal plate, 1.

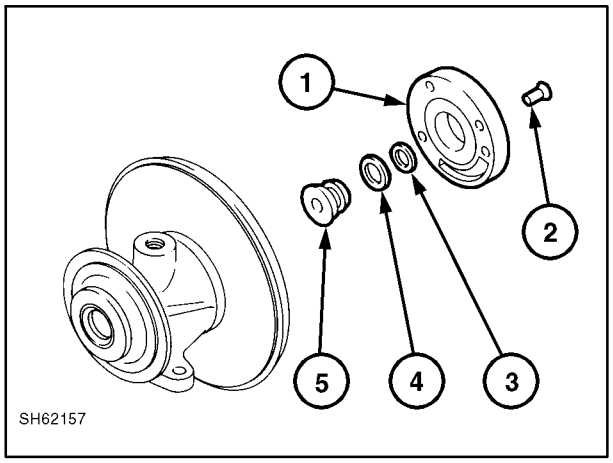


Figure 2-184

7. Remove the thrust bearing, 1, and bushing, 2.
8. Remove the floating bearings, 3.

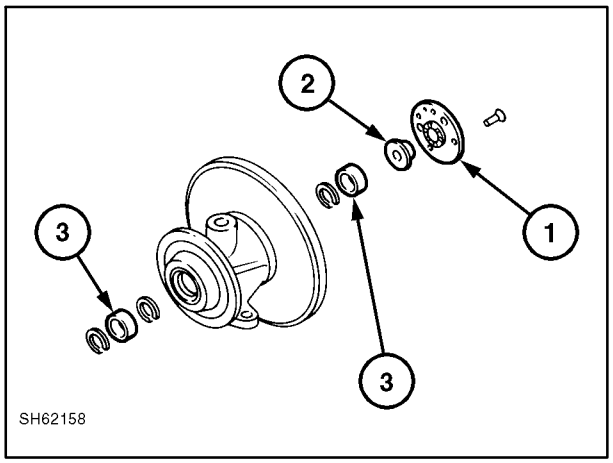


Figure 2-185

9. Remove the seal rings, 1, from the turbine shaft, 2, and oil slinger, 3.

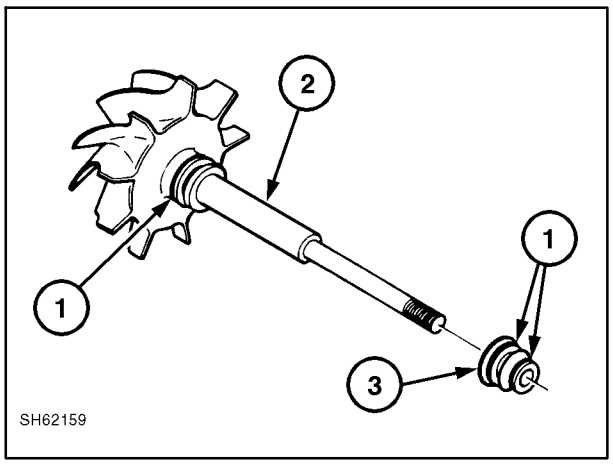


Figure 2-186

Inspection

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

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

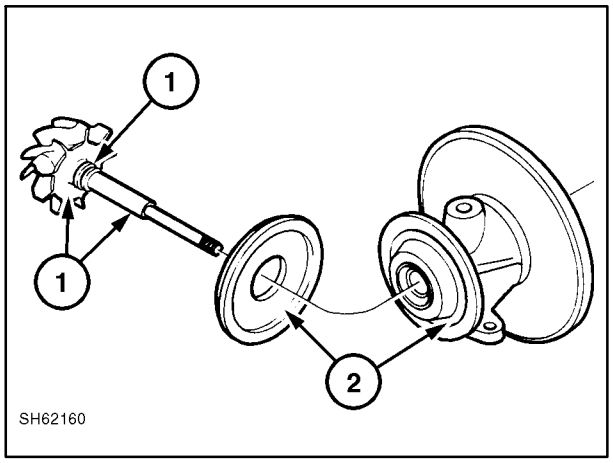


Figure 2-187

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

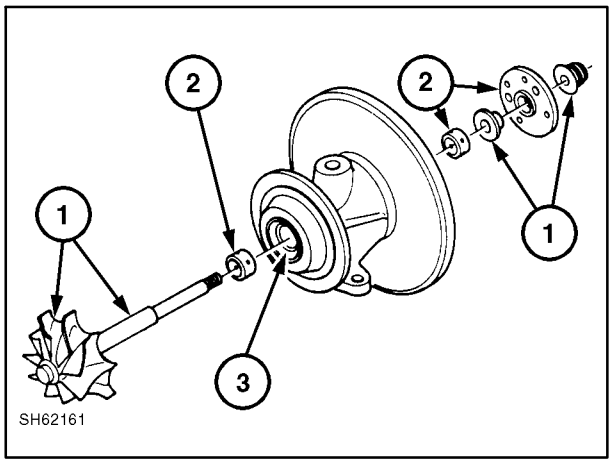


Figure 2-188

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

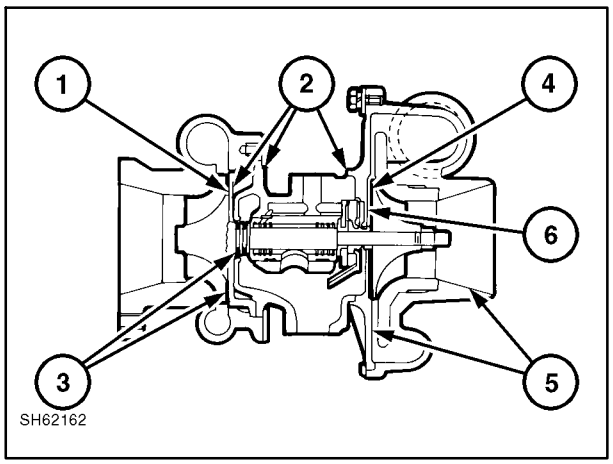


Figure 2-189

Turbine shaft

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

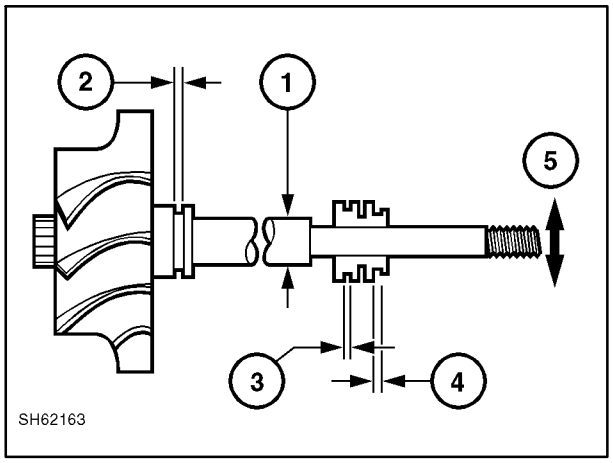


Figure 2-190

Bearings and associated parts

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

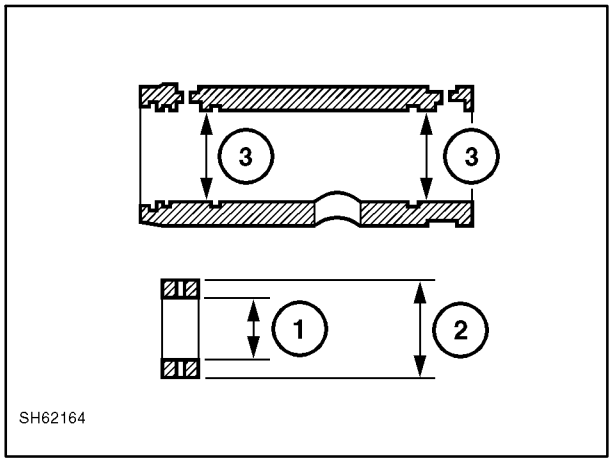


Figure 2-191

Thrust bearing

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

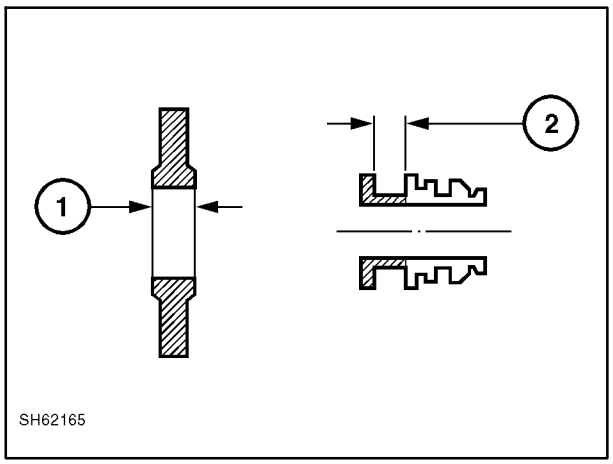


Figure 2-192

Holes for admitting seal ring

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

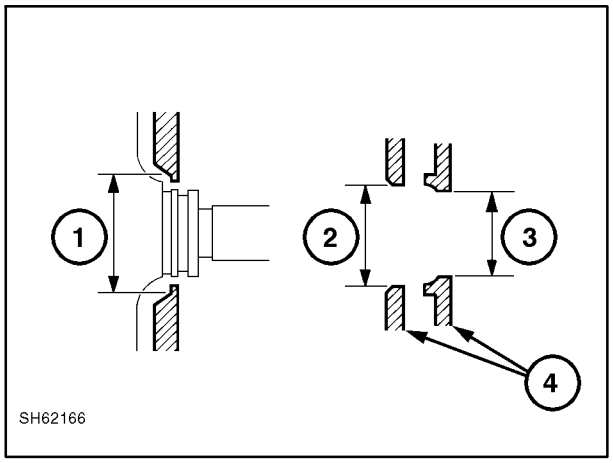


Figure 2-193

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.

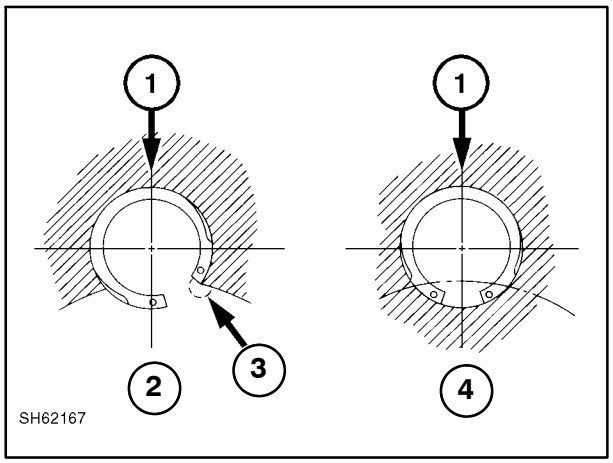


Figure 2-194

Inserting the shaft into bearing casing

Insert the seal ring into the turbine shaft.

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.

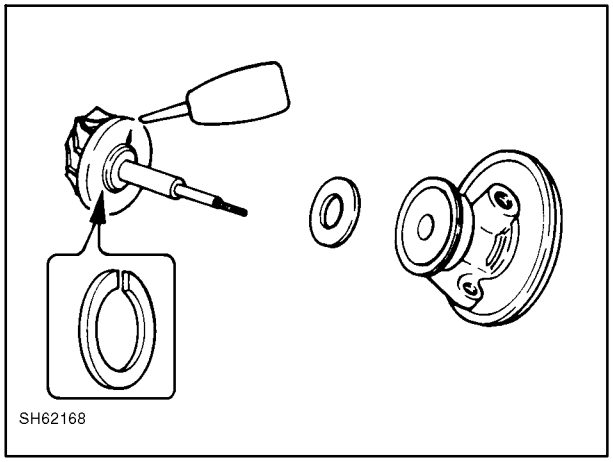


Figure 2-195

Installing the thrust bearing

Run the thrust bushing onto the turbine shaft.

Oil the thrust bearing, and fit it to the bearing casing, securing it by tightening its retaining bolts to 87-94 ft. lbs. (118-127 N·m) torque.

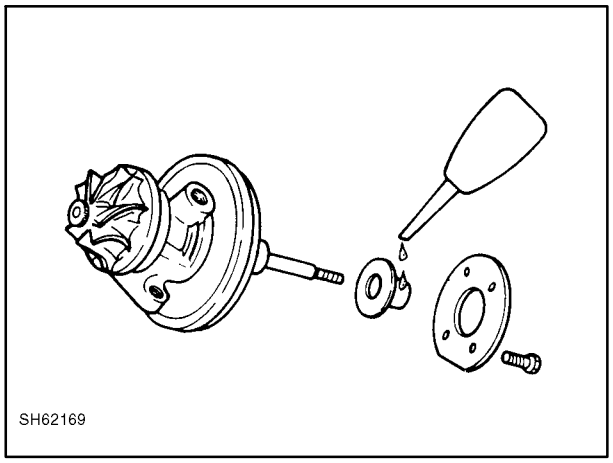


Figure 2-196

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, 2.

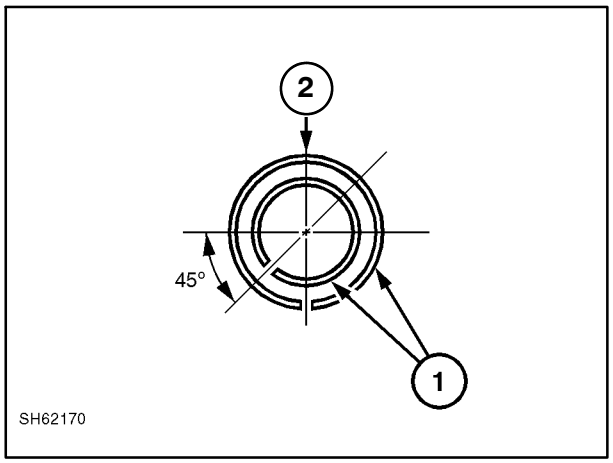


Figure 2-197

Apply the liquid gasket (THREE BOND) 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.

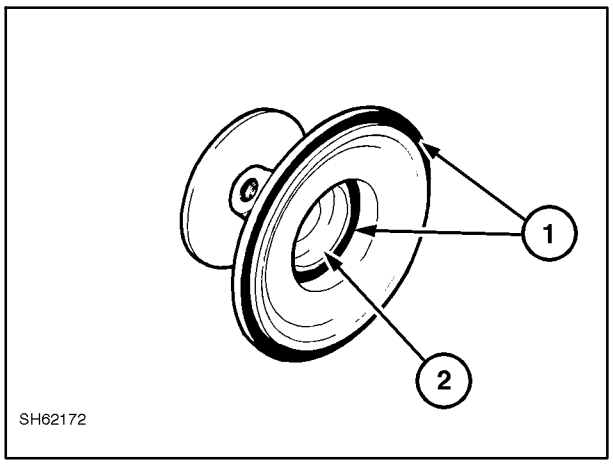


Figure 2-198

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 87-94 ft. lbs. (118-127 N·m).

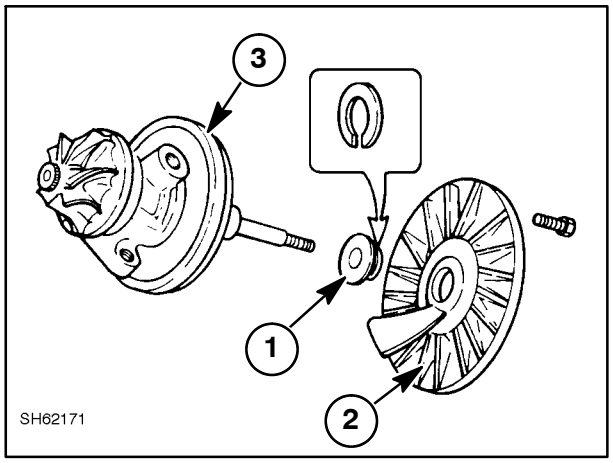


Figure 2-199

Installing the blower wheel

Slide the wheel onto the turbine shaft, and retain it by running the shaft-end nut down the shaft end. Torque nut, 1, to 130-159 ft. lbs. (176-216 N·m).

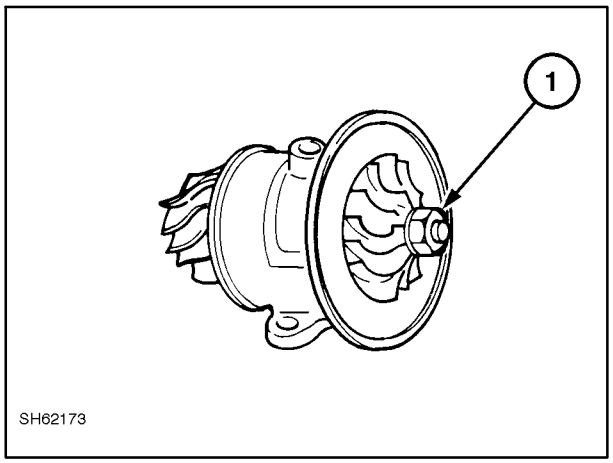


Figure 2-200

Securing the turbine casing

Fit the turbine casing, 1, to the support, 2, bringing the previous aligning marks into alignment, and tighten the securing bolts to 91-99.8 in. lbs. (10.3-11.3 N·m) torque.

NOTE: Apply the antiseize compound to the thread of each hex-head bolt before installing into the casing.

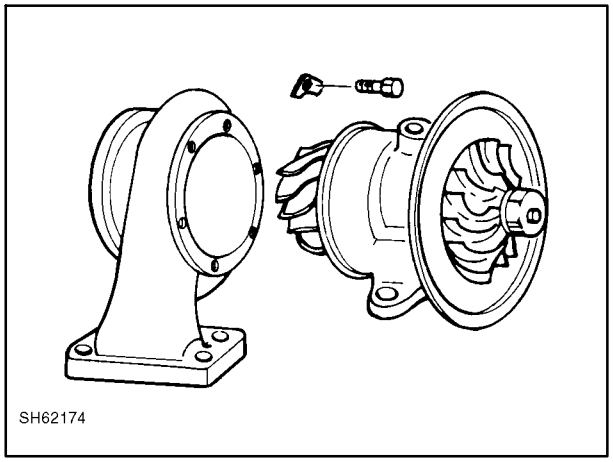


Figure 2-201

Securing the blower casing to the bearing casing

Fit the blower casing in the original angular position by aligning the marks, and secure it in place by tightening the bolts to 34.7-43.4 in. lbs. (3.9-4.9 N·m) torque.

NOTE: Apply the liquid gasket (THREE BOND) 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 0.004″ - 0.008″ (0.1 mm - 0.2 mm).

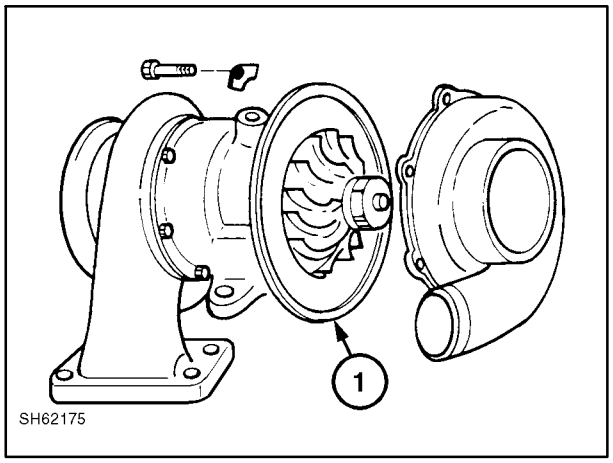


Figure 2-202

Installing the waste gate controller assembly

Install the assembly while applying compressed air of about 14 PSI(1kgf/cm) to the controller air inlet, 1.

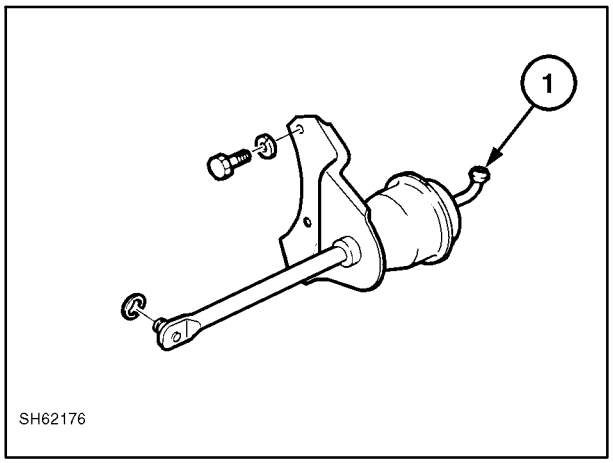


Figure 2-203

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 - 0.001″- 0.0023″ (0.03 mm - 0.06 mm).

Radial movement of rotor - 0.003″ - 0.005″ (0.08 mm - 0.13 mm).

NOTE: A movement reading not coming into the above specification means the turbocharger has been reassembled improperly and must be broken 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.

Lubrication system

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.

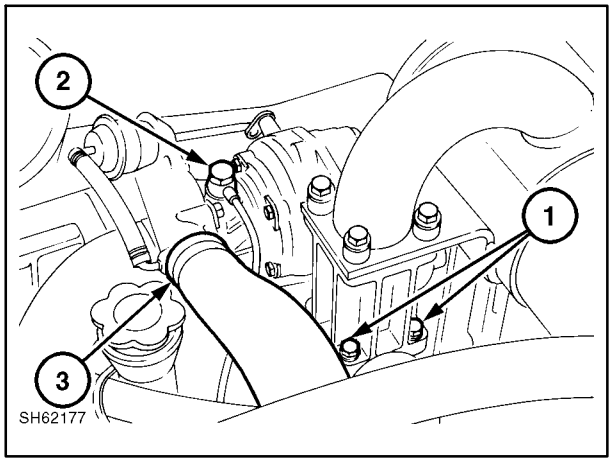


Figure 2-204

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.

Starting the turbocharger for the first time after reinstallation on the engine

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.

ELECTRICAL SYSTEMS - ALTERNATOR AND STARTER

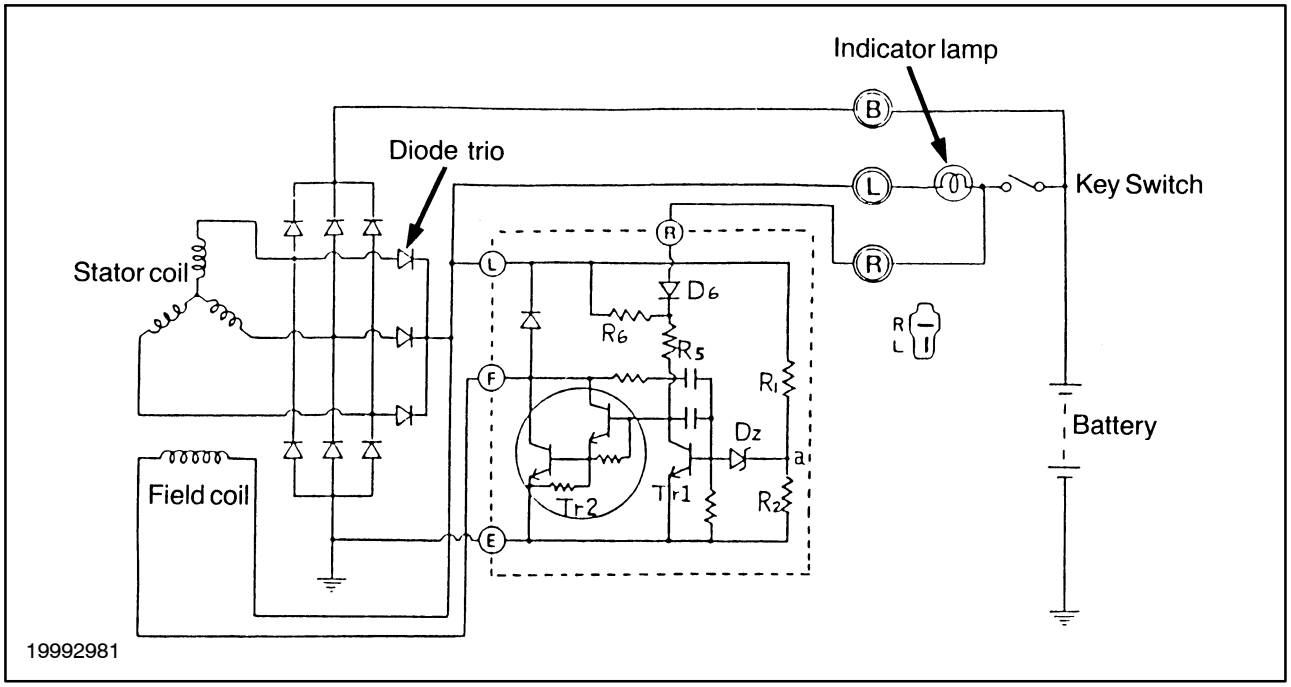


Figure 2-205

ALTERNATOR (40-Amp Version)

CHARGING CIRCUIT

Description

1. The charging circuit and internal connection are shown in the figure above. The charging system consists of an IC regulator built-in alternator, a battery, and connecting wires. Because of the use of IC, the voltage regulator is very compact and is built into the alternator.
2. The field current flows directly from the diode trio to the field coil without passing through the external circuit. Consequently, there are no voltage drops caused by the key switch or the wiring, as with the conventional vibrating-contact regulators mounted separately from the alternator. To help the initial voltage buildup when the engine is started, the field current is supplied through the indicator lamp from the battery.
3. Since the frequency pulse output of 1/10 the alternator speed develops at “P” terminal, this terminal is used for speed detection by the EIC Board for engine RPM readings.

Principle of IC Regulator

The basic circuit of the IC regulator is shown in the figure above.

The part enclosed by a dotted line represents the IC regulator.

The basic function of the IC regulator to make terminal voltage constant by detecting generated voltage and increasing/decreasing field current is not different from that of the vibration-contact regulator.

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 a voltage divider network (R1, R2), a Zener diode (DZ) for voltage reference, and a signal amplifying transistor (Tr1). The output device is a Darlington-type amplifier which is called power transistor (Tr2). The transistor Tr2 is placed in series with the alternator field coil and ground.

The transistor Tr1 senses the generated voltage and turns the 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:

1. When the key switch is closed, current from the battery flows through the indicator lamp and resistor R6, which are in parallel, to the field coil.

   From here it continues to flow on through the field coil to ground, completing the circuit back to the battery.

   Battery — Key Switch < Indicator lamp / Terminal R-Resistor R6

   Alternator terminal L — Field Coil — Tr2 — Ground

2. When the alternator begins to rotate, A.C. voltages are generated in the stator coil. The diodes in the rectifier assembly change the stator A.C. voltages to a D.C. voltage which appears between the ground and terminal, B.

   The stator also supplies D.C. field current through the diode trio, the field coil, Tr2, and then through the diodes in the rectifier assembly, back to the stator.

   Diode trio — Field Coil — Tr2 — Ground

3. 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.

4. As the speed and voltage increases, the voltage at point A also increases until it reaches the limiting value set by 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.

   Regulator Terminal L — R1 — DZ > Tr1 — Ground
   Regulator Terminal R — R6 — R5 > Tr1 — Ground

5. When the generated voltage decreases, the Zener diode (DZ) again turns off and Tr1 also turns off.

   This cycle then 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 is varied to limit the output voltage, but in place of the voltage coil and spring system, there is a potential divider (R1 and R2) and a Zener diode.

ALTERNATOR SERVICE SPECIFICATIONS

ITEM	HOW RATED	STANDARD OR SERVICE LIMIT
Normal Output	(V - A)	**12 - 40**
Polarity		**Negative Ground**
Weight	(lbs., kg)	**8.2 lbs. (3.7 kg)**
Rotational direction (viewed from the pulley)		**Clockwise**
Load characteristics (cold)	Terminal voltage (V)	**13.5**
	Current (A)	**Min. 30**
	Revolution (RPM)	**2500**
Brush length	Original (in-mm)	**0.728″ (18.5)**
	Limit (in-mm)	**0.20″ (5.0)**
Brush spring tension	Original (lbs-g)	**1.036-1.300 lbs. (470-590)**
	Limit (lbs-g)	**0.60 lb. (270 g)**
Slip ring diameter	Original (in-mm)	**0.0894″ (22.7 mm)**
	Limit (in-mm)	**0.871″ (22.1 mm)**
Field coil resistance	ohms at 68° F (20° C)	**2.8**
Adjusting voltage	(V) at 5000 RPM	**14.4-15.0**

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 of 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
	Shortage in stator coil	Replace
	Insufficient brush contact	Repair or replace
	Broken brush or spring	Replace
	Loose connections	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

Construction

Sectional view of the IC alternator

The principal components of the IC alternator are the stator, the rotor, the rectifier assembly, the IC voltage regulator, the front bracket, the rear bracket, and the pulley.

The rectifier assembly consists of two heat sinks, one positive and one negative, and diode trio. The diode trio is used as a field supply diode and is connected to the field coil and terminal L on the alternator.

The built-in IC regulator is a solid-state unit so that it can only be serviced as an assembly.

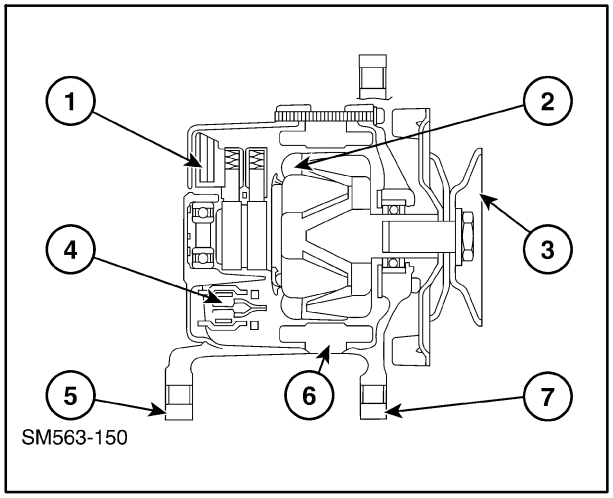


Figure 2-206

1. IC voltage regulator
2. Rotor
3. Pulley
4. Rectifier
5. Rear support bracket
6. Stator
7. Front support bracket

Check on the Equipment

Checking the regulator adjusting voltage.

A. In the case of equipment without an ammeter, connect a test ammeter (50A capacity) at the position shown.

   In the case of equipment with an ammeter, make use of the ammeter on the equipment.

B. Connect a voltmeter between terminal 1 of the alternator and the ground.

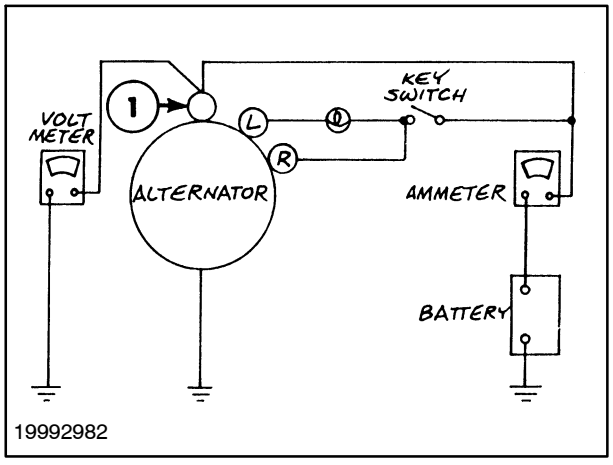


Figure 2-207

1. In this state, confirm the reading on the voltmeter indicates the battery voltage.
2. If the voltmeter reading is zero, the wiring between terminal 1 and the battery is faulty.

3. With the test ammeter terminals short-circuited, start the engine.

   CAUTION: IN THE CASE OF WHERE THE TEST AMMETER IS CONNECTED AT THE POSITION SHOWN IN FIGURE 2-207, MAKE SURE NO STARTING CURRENT IS APPLIED TO THE AMMETER WHEN THE ENGINE IS STARTED.

4. Remove the short circuit across the test ammeter terminals and increase the engine speed immediately to approx. 2000 RPM. Take the ammeter reading.
5. If the ammeter reading is 5A or less, take the voltmeter reading without changing the engine speed (approx. 2000 RPM). The reading is the adjusting voltage.
6. If the ammeter reading is more than 5A, continue to charge the battery until the reading falls to less than 5A or replace the battery with a fully charged one.

   An alternative method is to limit the charging current by connecting a 1/4 (25W) resistor in series with the battery.

Checking Output

If the previous section “A” check is satisfactory, check the output as follows:

1. After opening the battery switch, disconnect terminal B of the alternator and connect an ammeter (50-amp capacity) at the position shown.
2. Connect the voltmeter between terminal B of the alternator and the ground. Confirm the voltmeter indicates the battery voltage.
3. Close the key switch.
4. Start the engine and turn on all the lamps. Immediately accelerate the engine to 2000 RPM or more and measure the maximum value indicated on the ammeter.
5. If this value is more than 70% of the nominal output (refer to the section on “Service Specifications”), the alternator can be considered as working almost satisfactorily.

   NOTE: To make the above judgement more accurate, remove the alternator from the engine and check it on a test bench.

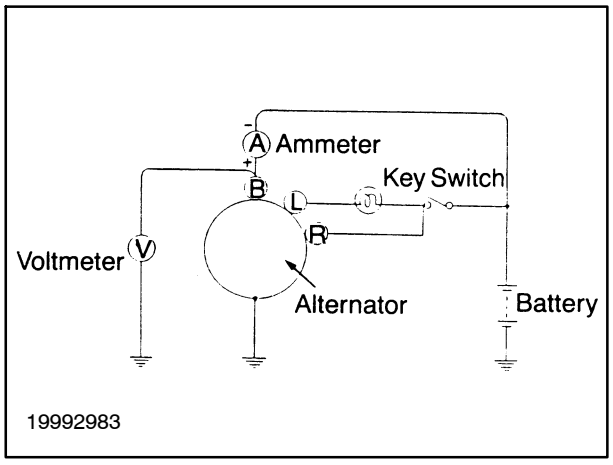


Figure 2-208

Disassembly

1. Mark both brackets and the stator with a scribe mark for assembly.
2. Remove the four through bolts. Pry between the stator and front bracket with the blade of a screwdriver. Carefully separate the front bracket, pulley, and rotor assembly away from the stator and rear bracket assembly.

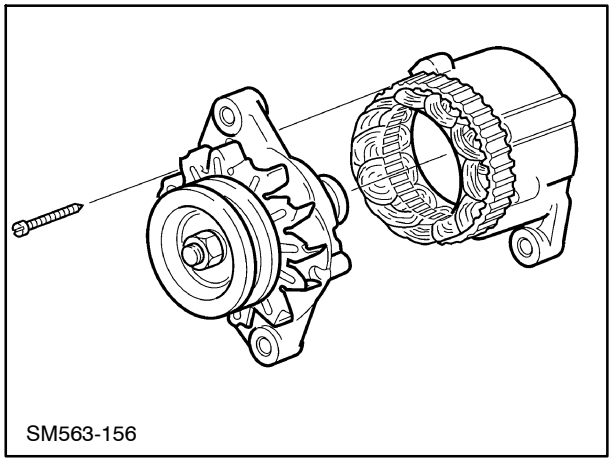


Figure 2-209

3. Place the rotor in a vise with soft jaws and remove the pulley nut, washer, pulley, spacer, and rear bracket from the rotor.

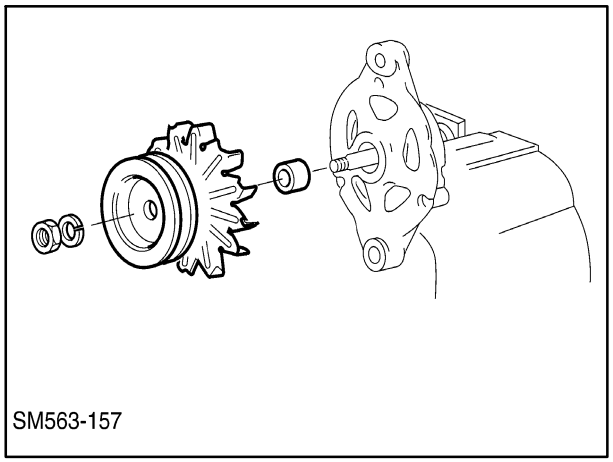


Figure 2-210

Unsolder three stator leads, 1, and remove the stator.

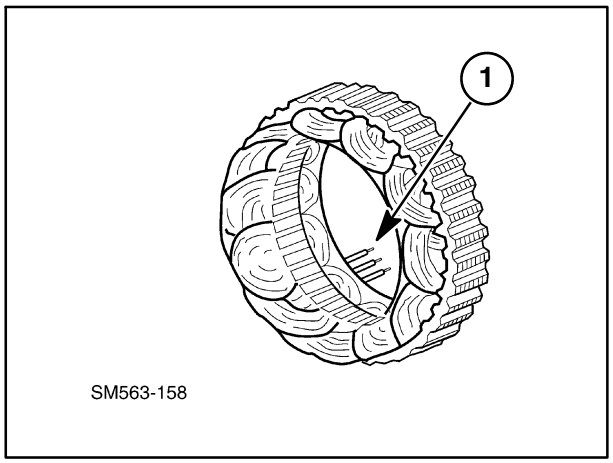


Figure 2-211

4. Remove the voltage regulator assembly, 1, and rectifier assembly, 2.

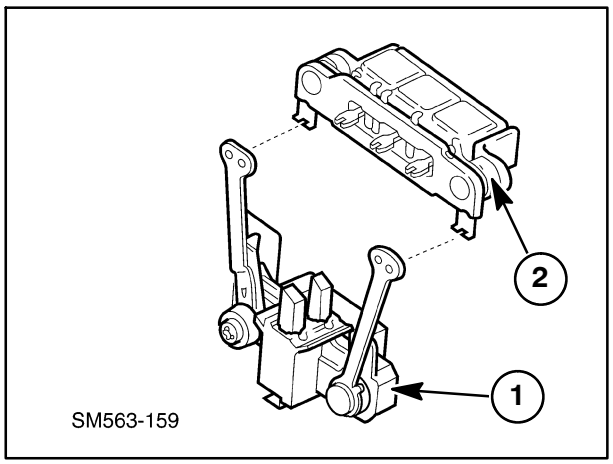


Figure 2-212

Inspection of Parts

Rotor

1. Inspection of slip ring surface, 1.

   Correct stain or scratches on the slip ring surface with a sandpaper of about 400# - 600#.

   A badly roughened slip ring or slip ring worn down beyond the service limit should be replaced.

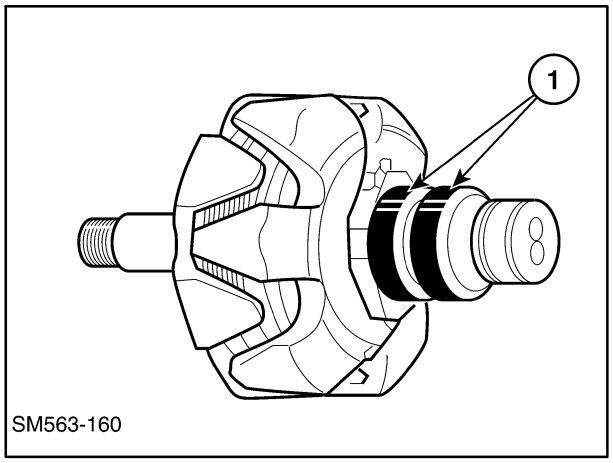


Figure 2-213

2. Check for continuity between both the slip rings. If there is no continuity, the field coil is defective. Replace the rotor assembly.

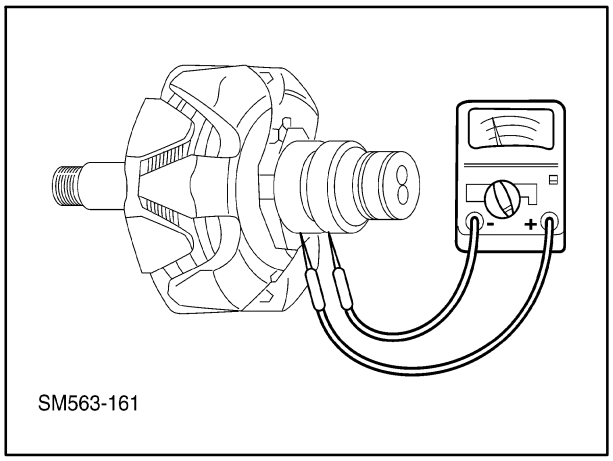


Figure 2-214

3. Check for continuity between the slip ring and shaft (or core). If there is continuity, it means the coil or slip ring is grounded. Replace the rotor assembly.

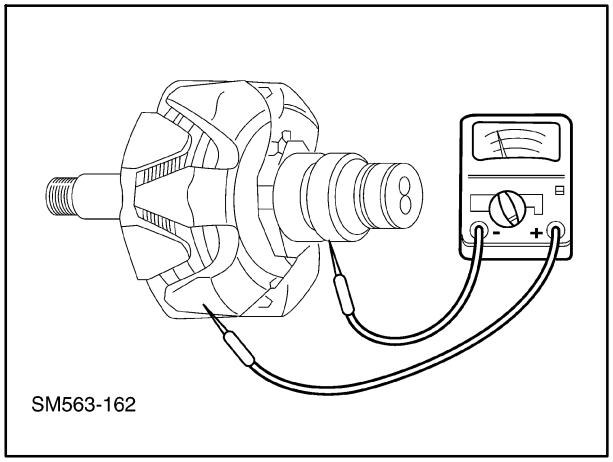


Figure 2-215

Stator

1. Check for continuity between the leads of the stator coil. If there is no continuity, the stator coil is defective. Replace the stator assembly.

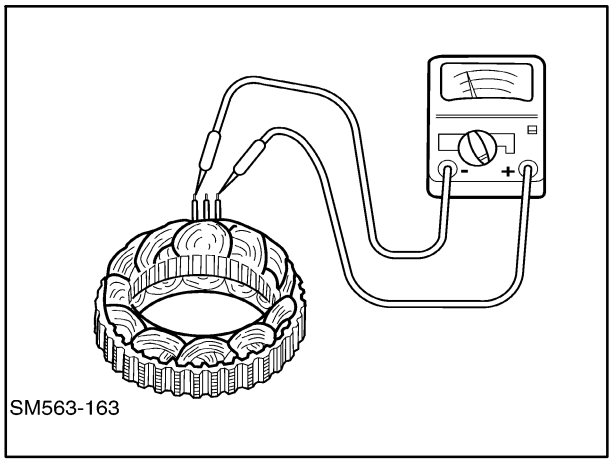


Figure 2-216

2. Check for continuity between any stator lead and stator core. If there is continuity, it means the coil is grounded. Replace the stator assembly.

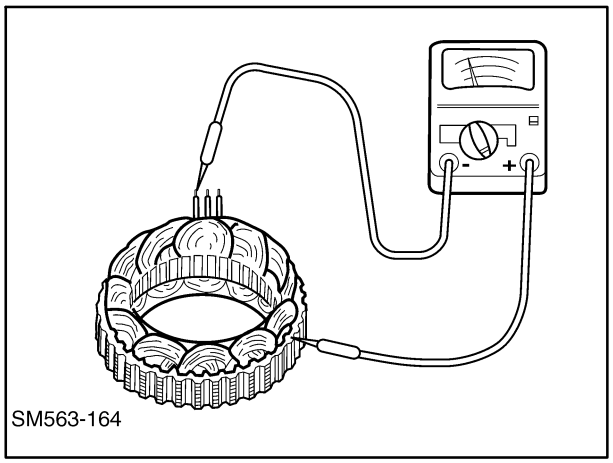


Figure 2-217

Rectifier Assembly

Positive Heat Sink

Check for continuity between the positive (+) heat sink and stator coil lead connection terminal with a circuit tester. If there is continuity in both directions, the diode is short-circuited. Replace the rectifier assembly.

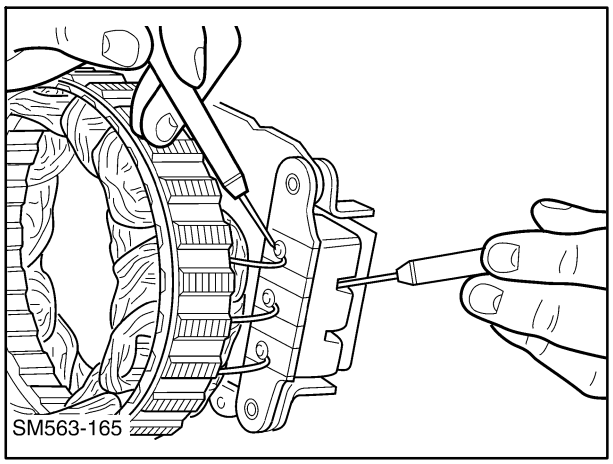


Figure 2-218

Negative Heat Sink

Check for continuity between the negative (-) heat sink and stator coil lead connection terminal. If there is continuity in both directions, the diode is short-circuited. Replace the rectifier assembly.

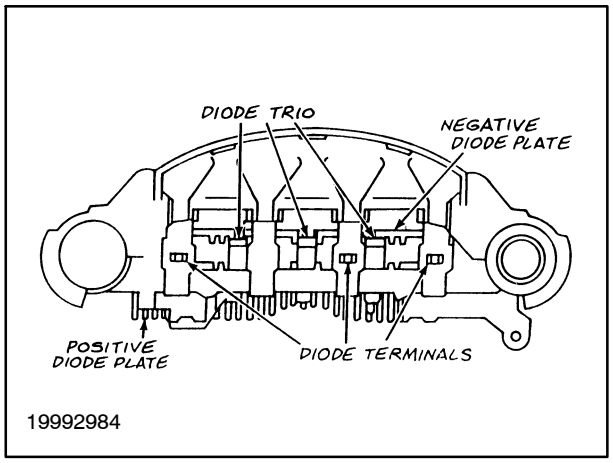


Figure 2-219

Diode Trio

Using a circuit tester, check the three small diodes for continuity in both directions. If there is either continuity or an open circuit in both directions, the diode is defective. Replace the rectifier assembly.

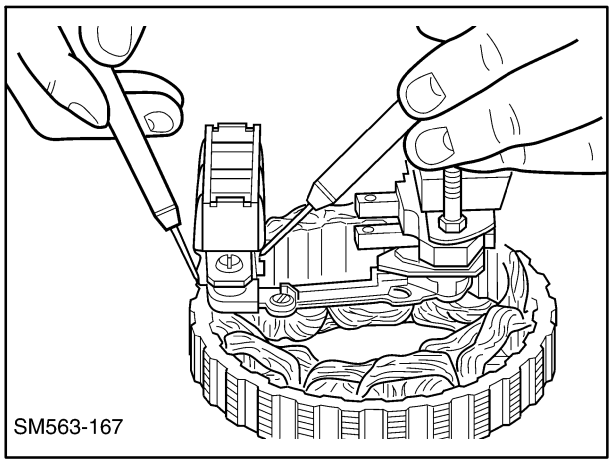


Figure 2-220

Brush and Brush Spring

Check the length of the brush. A brush worn down to the wear limit line should be replaced.

Check the brush spring pressure and make sure the brush moves smoothly in the brush holder.

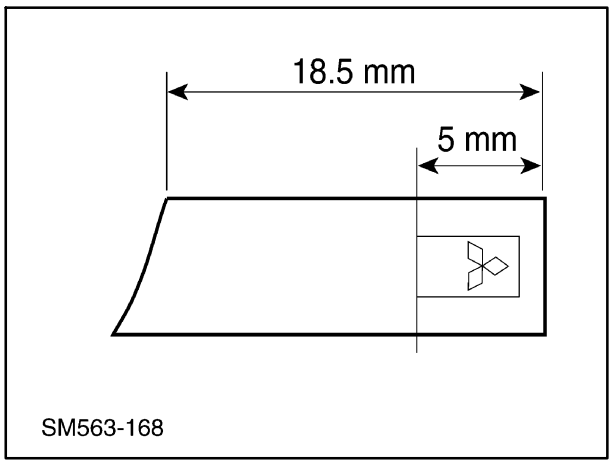


Figure 2-221

Reassembly

Reverse the disassembly, except for the following:

Installing Rotor

1. Push brushes into the brush holder and insert a wire to hold them in the raised position. Install the rotor and remove the wire.

   NOTE: The rear bearing and rear bracket fit is tight; heat the bearing box in the rear bracket to 122° F - 140° F (50° C - 60° C) before installing the rotor.

2. Lubrication to the bearing box. Do not apply grease to a bearing with a resin band. Remove grease and oil from the bearing box in the rear bracket.

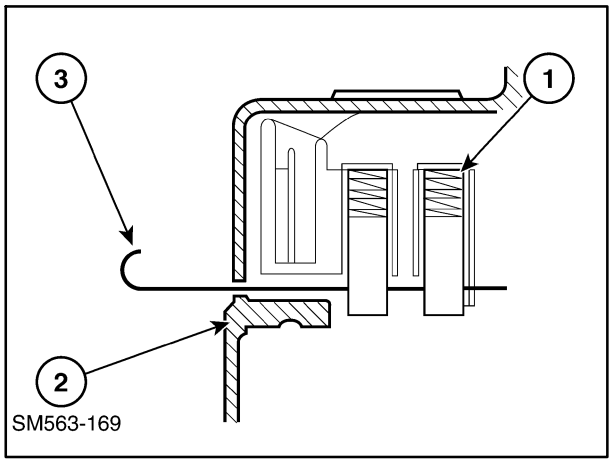


Figure 2-222

Bench Check

To check the alternator on a test bench, proceed as follows:

1. Make the connection as shown, except leave the load resistor disconnected.
2. Slowly increase the alternator speed and observe the voltage.
3. If the voltage is uncontrolled with speed, and increases above 15.5 V, check the alternator.
4. If voltage is below 15.5 V, connect the load resistor as shown.
5. Operate the alternator at 2500 RPM and adjust the load resistor as required to obtain maximum output.
6. Measure the output current. The output must be within the limits shown in the section on “Service Specifications.” If the output is less than the specified value, disassemble and check the alternator.

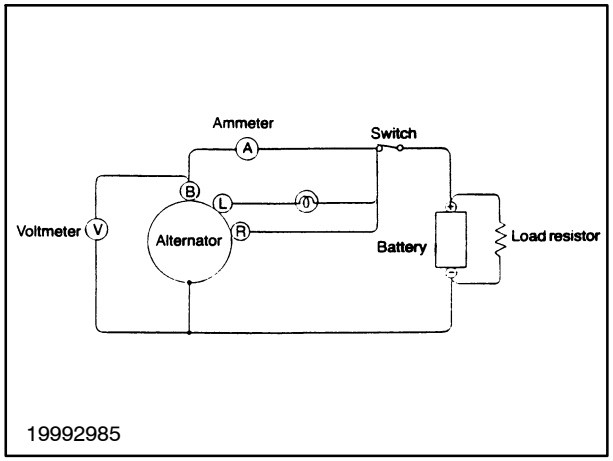


Figure 2-223

IMPORTANT:

1. *Reversed battery connections will damage the alternator and/or wiring.*
2. *When connecting a booster battery, make certain to connect the negative battery terminals together and the positive battery terminals together.*
3. *When a fast charger is used to charge the battery, disconnect the equipment battery cables.*
4. *Grounding of the alternator output terminal will damage the alternator and/or circuit.*
5. *Do not connect a load of over 1A to the terminal L.*
6. *If the alternator is operated with terminal L and B short-circuited, it may damage the diode trio.*

STARTER

STARTER MOTOR TROUBLESHOOTING

Starter Motor Specifications

Rated voltage	12 volts
Output	2 kw
Motor type	Four-pole series wound motor
Engaging system	Magnetic shift
Rotation	Clockwise (viewed from pinion side)
Weight	Approximate 5 kg (11 lbs.)

Starter Motor Service Specifications

ITEM	HOW RATED	STANDARD OR SERVICE LIMIT
No load test	Volts (V)	**11.5 V**
	Current (A)	**130 A Max.**
	Rotating speed (RPM)	**4000 RPM Min.**
Commutator	Outer dia. (mm-in)	**35 mm (1.38″)**
	Service limit (mm-in)	**34 mm (1.34″)**
Brush	Length (mm-in)	**15 mm (0.59″)**
	Service limit (mm-in)	**9 mm (0.35″)**
Brush spring	Tension (kg-lbs)	**2.7 - 3.6 kg (5.9 - 7.8 lbs)**
	Service limit (kg-lbs)	**2.2 kg (4.7 lbs.)**

STARTER MOTOR TROUBLESHOOTING

Use the diagnostic charts as a guide when repairing the starting system. Before diagnosis, be certain the battery is fully charged and inspect the starter and battery cables for clean and tight connections.

IMPORTANT: Do not operate the starter longer than 30 seconds at a time.

Do not disconnect or short any lead wire while the starter is operating.

With key switch in "start" position:

Starter does not crank engine, solenoid switch clicks.

1. Disconnect the three cables from the solenoid.
2. Using an ohmmeter, touch one probe to the solenoid spade terminal and the other to the starter case. There should be continuity.

   If none, the hold-in winding is open-circuited. Replace the solenoid.

   If continuity, the fault is in the starter motor. Refer to repair procedures.

Starter does not crank engine, solenoid does not click.

1. Disconnect battery cable from starter.
2. Connect a jumper wire to the battery positive post. Ensure the negative cable is attached to battery and starter ground.
3. Briefly touch the jumper wire to the spade terminal on the solenoid.

   If the solenoid clicks, the probable cause is in the key switch, relay or wiring.

   If the solenoid does not click, replace it.

Starter cranks engine very slowly.

1. Check battery condition, should be a minimum of 12.5 volts.
2. Check starting system circuit.

   Voltage drop between battery positive post and starter terminal should not exceed 0.2 volts.

   Voltage drop between battery negative post and starter ground should not exceed 0.2 volts.

   If voltage drop exceeds 0.2 volts, clean connections or replace the cable.

3. If battery is charged and voltage is within specification, repair or replace starter.

Engine starts but pinion does not disengage.

1. Check voltage at spade terminal of solenoid. If 12 volts with key switch "off", fault is in the key switch or start circuit.
2. If 0 volts with key switch "off" but starter turns, fault is in the solenoid or overrunning clutch assembly.

STARTER MOTOR REMOVAL AND INSTALLATION

1. The starter can be accessed through the right engine side shield with the boom up or down or from the operator's area with the seat raised.
2. To access the starter, 1, through the right engine side shield, open the rear door, raise the top engine side shield and remove the right engine side shield.

   If the boom is in the raised position, make sure the boom is resting on the boom lock pins.

   CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

3. To access the starter, 1, from the front, raise the seat and seat pan and securely latch in the raised position.

   CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS PROPERLY LATCHED IN THE RAISED POSITION.

4. Disconnect the negative (–) battery cable.
5. Remove the wires from the starter solenoid and starter, noting their location.
6. Remove the starter retaining hardware and remove the starter from the engine bellhousing.

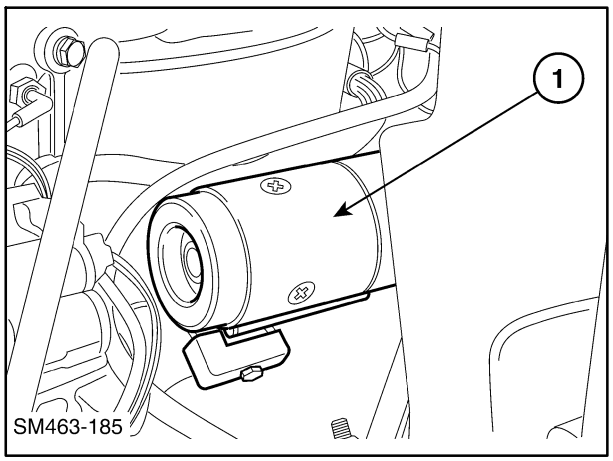


Figure 2-224

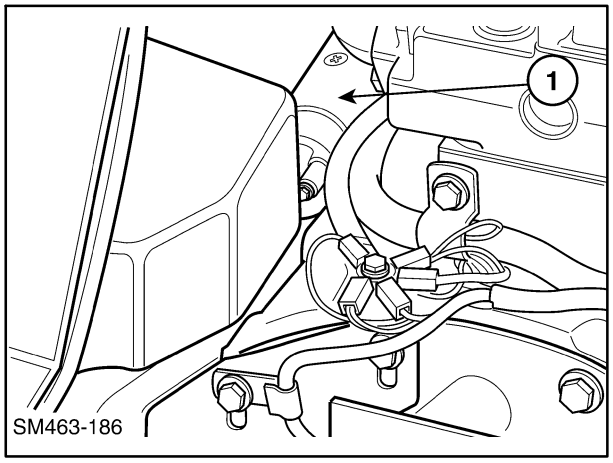


Figure 2-225

STARTER MOTOR DESCRIPTION

1 Drive Gear
2 Housing
3 Field Coil
4 Armature
5 Brush Spring
6 Brush
7 Plunger
8 Electric Solenoid
9 Overrunning Clutch
10 Pinion
11 Idler Gear

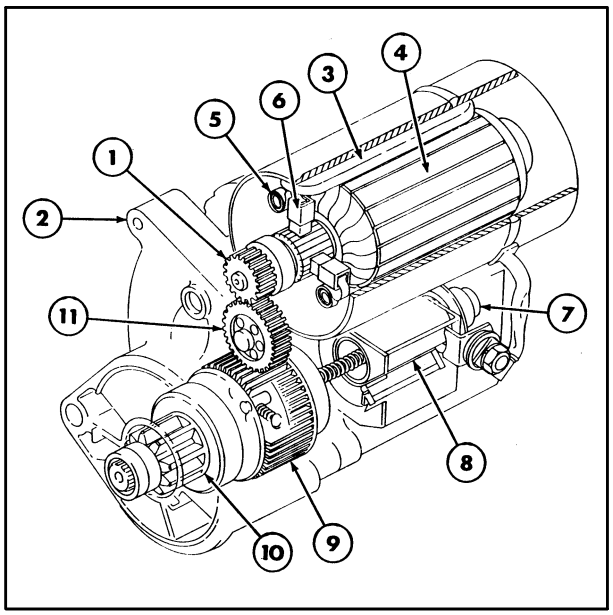


Figure 2-226

The starter assembly is a positive pinion shift, reduction type starter consisting of the motor, reduction gearset, overrunning clutch and electric solenoid.

The reduction type design allows use of a small, high speed, compact motor.

The sliding pinion and the electric solenoid are arranged on the same axis. The sliding pinion mechanism is totally enclosed, preventing dirt and water entry resulting in a more durable mechanism.

STARTER CONSTRUCTION

The reduction type starter consists of the armature, housing, electric solenoid, drive pinion assembly and reduction gears. In a conventional type starter the armature and pinion rotate at the same speed on a common shaft. In a reduction type starter the pinion speed is reduced to about one-fourth armature speed by the reduction gear. Armature, 1, rotation is transmitted to the pinion, 2, via an idler gear, 3, and the overrunning clutch, 4.

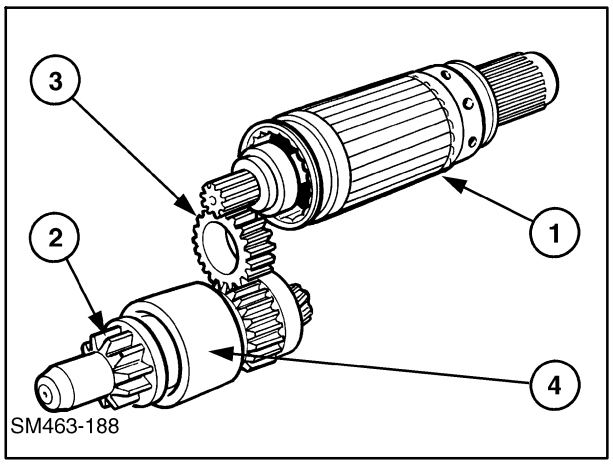


Figure 2-227

The overrunning clutch assembly consists of the pinion, 1, pinion shaft, 2, ball bearings and overrunning clutch which is a conventional design with clutch rollers, 3, and roller springs, 4. Due to the screw splines cut on the pinion shaft, the pinion gear advances while rotating to mesh with the flywheel ring gear.

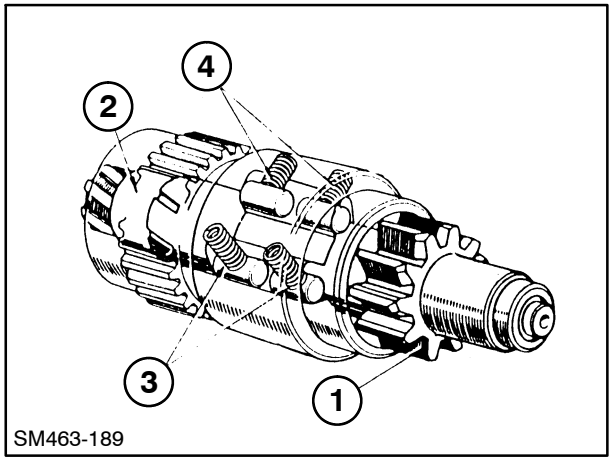


Figure 2-228

STARTER OPERATION

Circuit diagram of reduction type starter.

1 Drive Pinion
2 Idler Gear
3 Field Coil
4 Armature
5 Brush
6 Commutator
7 Ball Bearing
8 Plunger
9 Main Contacts
10 Battery
11 Starter Switch
12 Clutch Gear
13 Overrunning Clutch
14 Flywheel Ring Gear

The field windings are connected in series with the armature windings, through the brushes and commutator segments.

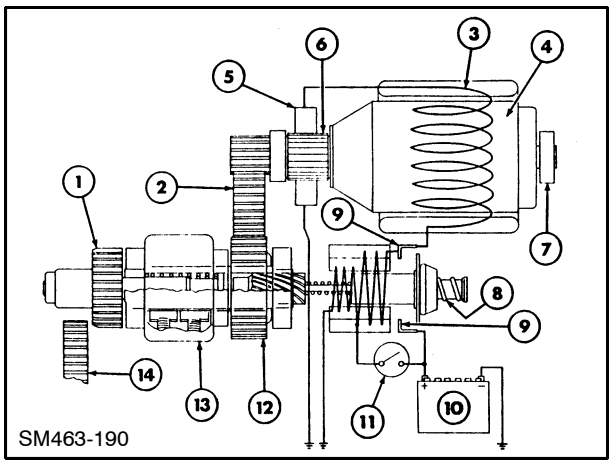


Figure 2-229

Electric Solenoid Operation

The electric solenoid consists of the pull-in coil, 1, hold-in coil, 2, main contacts, 3, plunger, 4 and return spring, 5. The mechanism is sealed against entry of dirt and moisture.

When the starting switch is closed, battery current flows through both the pull-in coil and the hold-in coil. This moves the plunger to the engaged position. When the plunger closes the main contacts in the engaged position, the pull-in coil circuit is opened, leaving the hold-in coil to retain the plunger in the engaged position. At the same time, current flows through the main contacts to the motor.

When the starting switch is released, the magnetic field in the hold-in circuit is reduced allowing the plunger spring to move the plunger out, opening the main contacts.

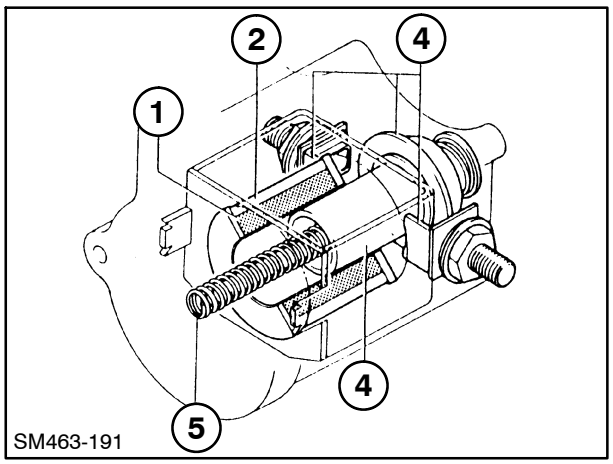


Figure 2-230

Drive Spring Operation

The drive spring, 1, is fitted on the pinion shaft, 2, in order to provide a smooth and positive pinion gear engagement. When the starting switch is closed, the plunger, 3, is pulled in moving the pinion, 4, toward the ring gear, 5. If the gear teeth do not mesh, the spring will be compressed, pressing on the pinion gear. With the first rotation of the pinion, the teeth will line up and the gears will mesh.

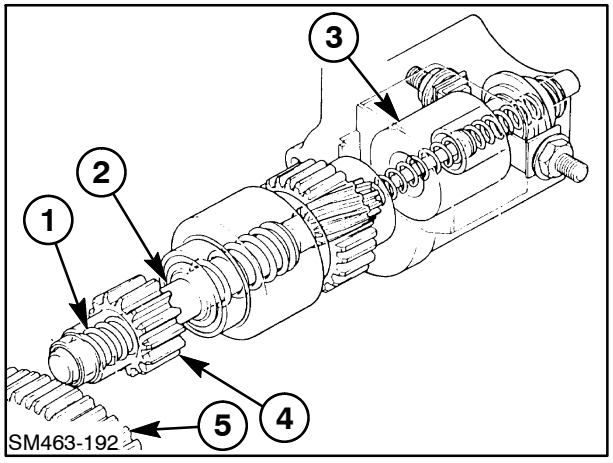


Figure 2-231

STARTER DISASSEMBLY

1. Disconnect the lead wire from the electric solenoid.

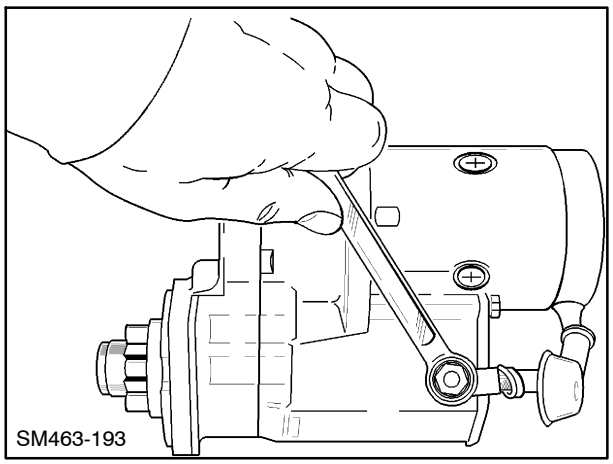


Figure 2-232

2. Scribe a line between the drive housing and motor to aid in proper reassembly. Remove the bolts securing the motor to the drive housing. The motor is now free to be separated from the drive housing.

   NOTE: New starter assembly #SBA185086530 has a different housing with two drawbolts. The testing and overhaul procedures are identical to the prior model (#SBA185086520).

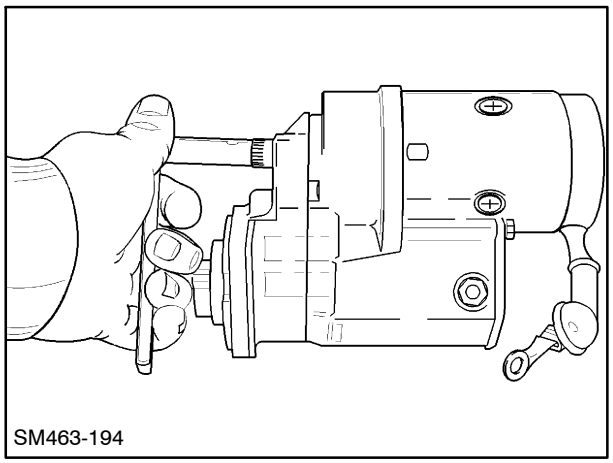


Figure 2-233

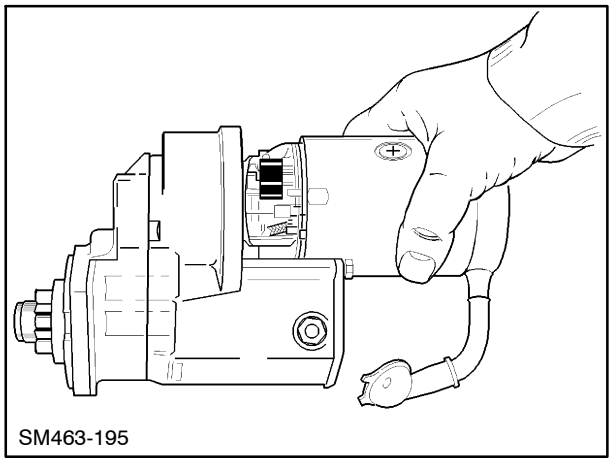


Figure 2-234

3. Extract the insulated brushes, 1, from the brush holders. Hold the springs away and remove the brushes. Slide the brush plate, 2, from the commutator, 3.

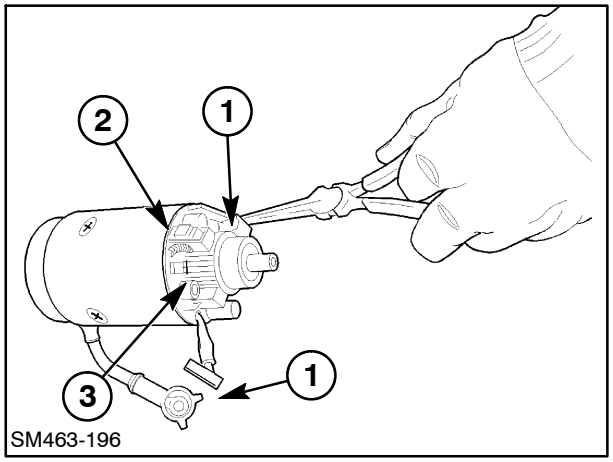


Figure 2-235

4. Remove the armature, 1, from the motor housing, 2. The rear bearing, 3, is a light press fit in the rear housing. It may be necessary to pull the armature from the housing, griping behind the front bearing, 4.

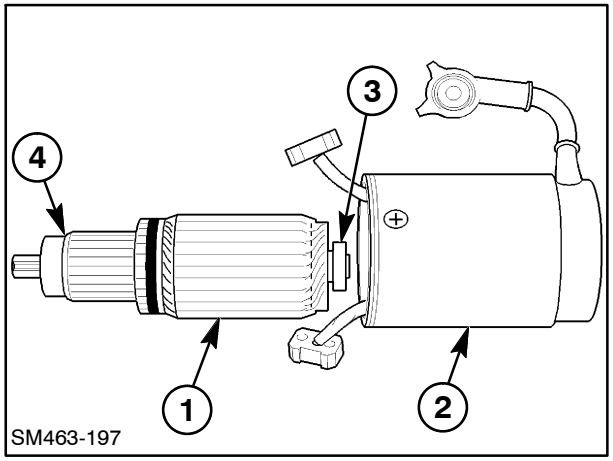


Figure 2-236

5. Remove the screws securing the drive end frame to the solenoid.

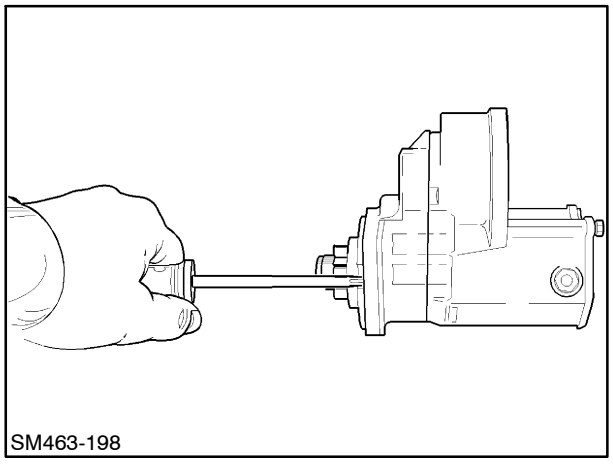


Figure 2-237

6. Remove the drive end frame, 1, from the solenoid, 2. The idler gear with bearings, 3, and the pinion gear, 4, will be free to fall out. Work over a clean bench, using care to avoid losing these pieces.

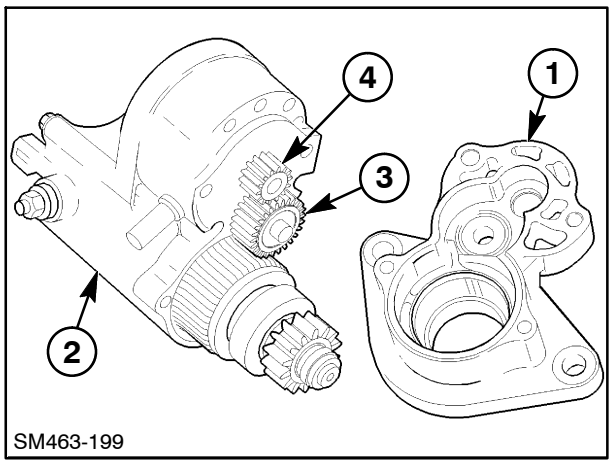


Figure 2-238

7. Remove the overrunning clutch from the drive end frame.

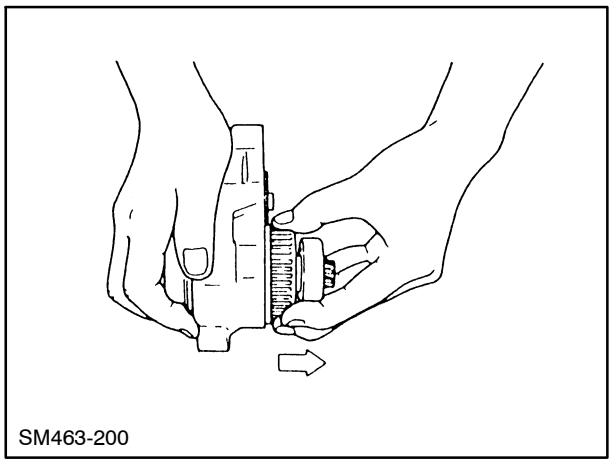


Figure 2-239

8. Remove the steel ball from the center of the overrunning clutch.

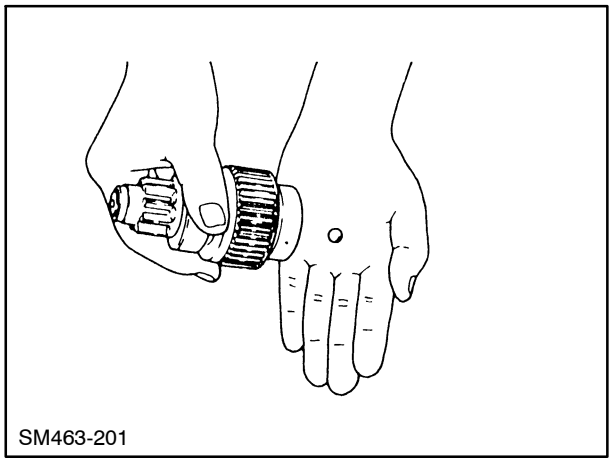


Figure 2-240

9. Remove the idler gear and small pinion from the drive end frame if they were not dislodged when the housing was separated.

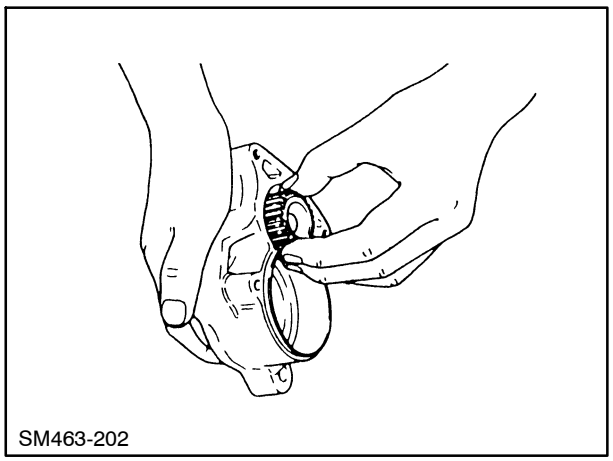


Figure 2-241

10. Remove the idler gear bearing rollers and retainer.

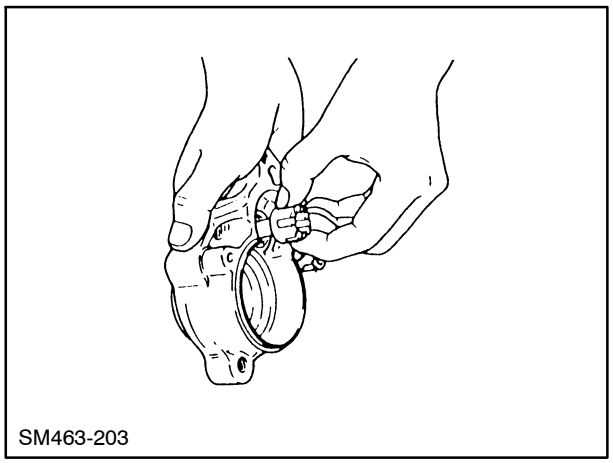


Figure 2-242

11. Remove the return spring from the electric solenoid.

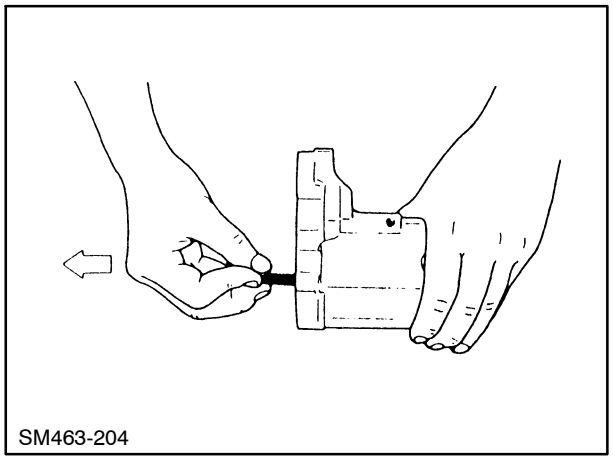


Figure 2-243

INSPECTION AND REPAIR

Inspect the following components, using conventional test methods, and repair or replace as necessary.

Armature

Inspect the armature for internal short circuits with a growler.

Replace the armature if a short circuit is indicated.

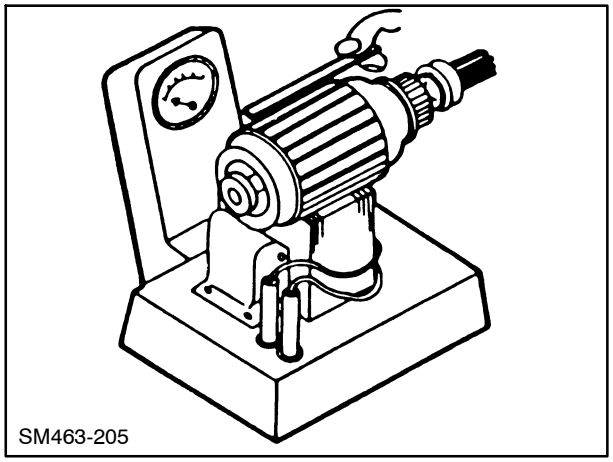


Figure 2-244

Inspect the armature for a short to ground using a continuity tester.

Replace the armature if there is any continuity between the commutator, 1, and armature shaft, 2, or core, 3.

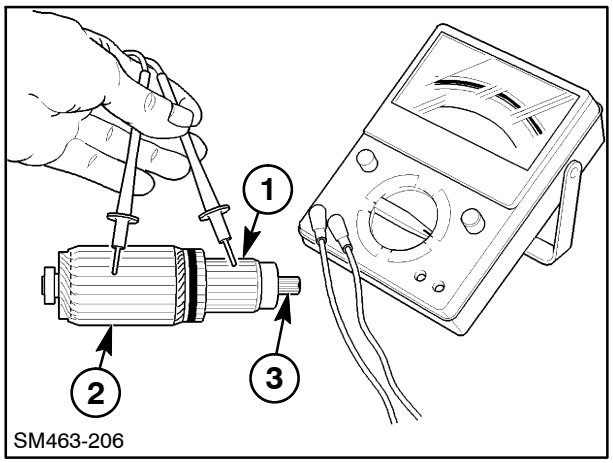


Figure 2-245

Check the armature for runout with a dial indicator and V-blocks. If the commutator is rough, or more than 0.05 mm (0.002″) out of round, turn it down or replace it. Undercut the separators between the segments if the depth is less than 0.2 mm (0.01″). The distance, 1, from the commutator segment and insulation should be between 0.5 mm and 0.8 mm (0.02″ and 0.03″).

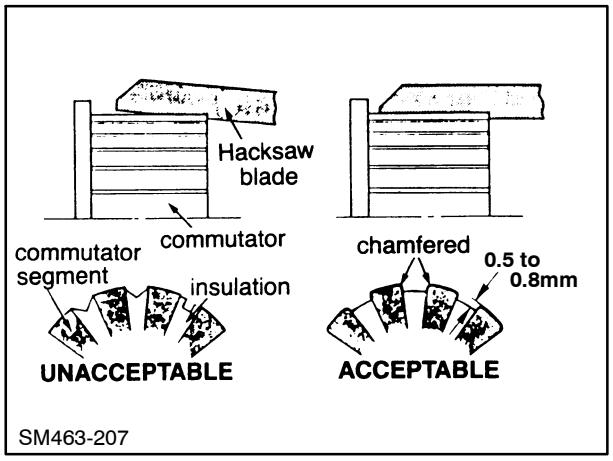


Figure 2-246

Check the spline teeth for wear or damage, and replace the armature as necessary.

Check the bearings for signs of roughness or dryness. Lubricate or replace as necessary.

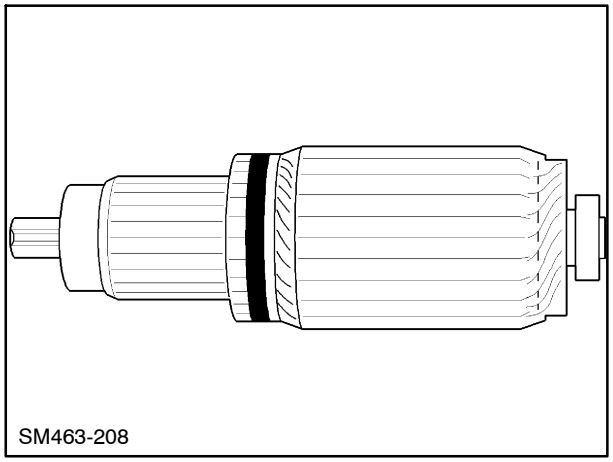


Figure 2-247

Field Coil

Inspect the field coil for an open circuit with a continuity tester. Replace the motor housing if there is no continuity between the two brushes.

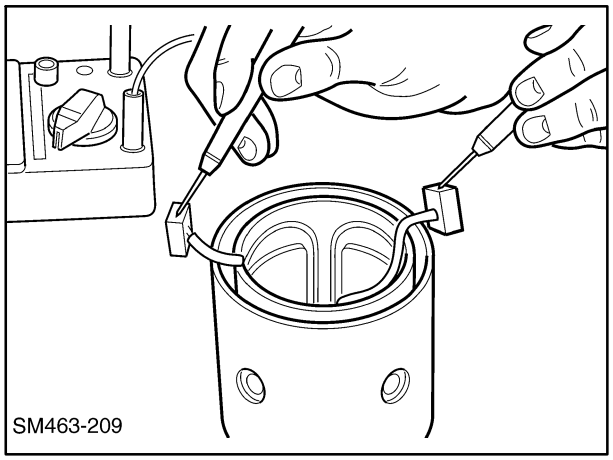


Figure 2-248

Inspect the field coils for short to ground with a continuity tester. If any continuity is noted between the brush and motor housing, locate the fault in the insulation, and repair or replace the motor housing as appropriate.

Check field poles and coils for tightness. Replace the motor housing if loose or improperly seated coils are detected.

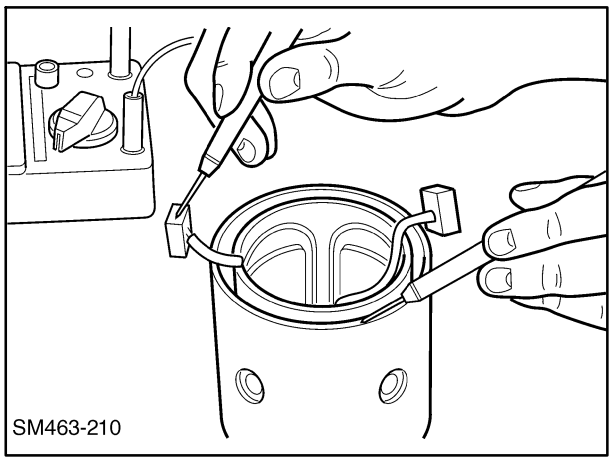


Figure 2-249

Brushes

Clean brushes and adjacent parts, removing carbon particles by wiping with a clean cloth.

Check each brush for wear. Replace brushes if they are worn to the service limit.

The positive brushes are welded to the field windings. If the positive brushes must be replaced, it will be necessary to replace the motor housing.

The negative brushes are welded to the brush plate. If the negative brushes must be replaced, it will be necessary to replace the brush holder assembly.

Standard Length	Service Limit
15 mm (0.59″)	9 mm (0.35″)

Move each brush in the holder to be sure that it is capable of sliding smoothly.

Check brush spring tension. Replace the brush holder assembly if the tension is not within specified limits.

Standard Tension	Service Limit
2.7 - 3.6 kg (5.9 - 7.8 lb)	2.2 kg (4.7 lb)

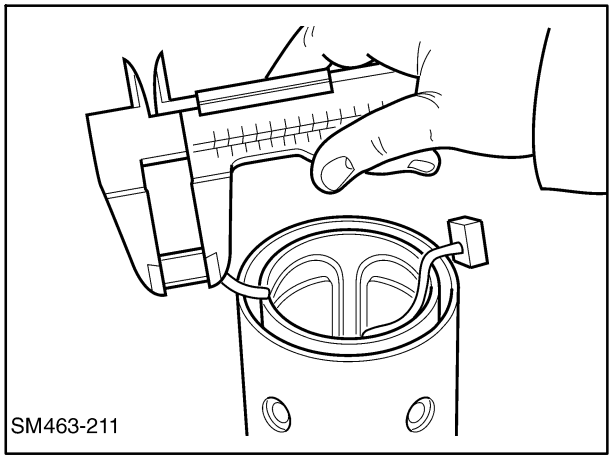


Figure 2-250

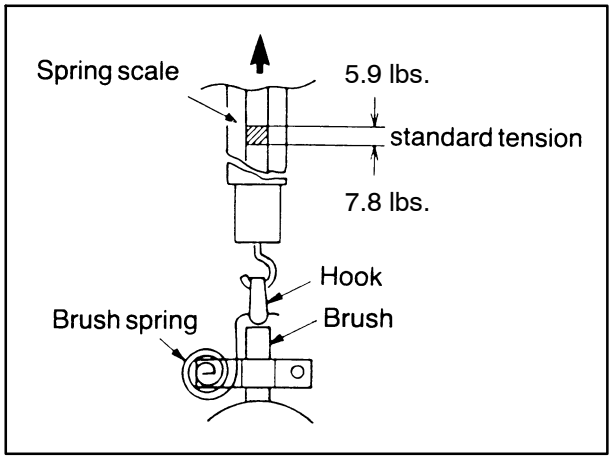


Figure 2-251

Check the brush holder assembly for short to ground. Touch one probe of a continuity tester to the plate and the other to each of the insulated holders. Replace the brush holder assembly if any continuity is noted.

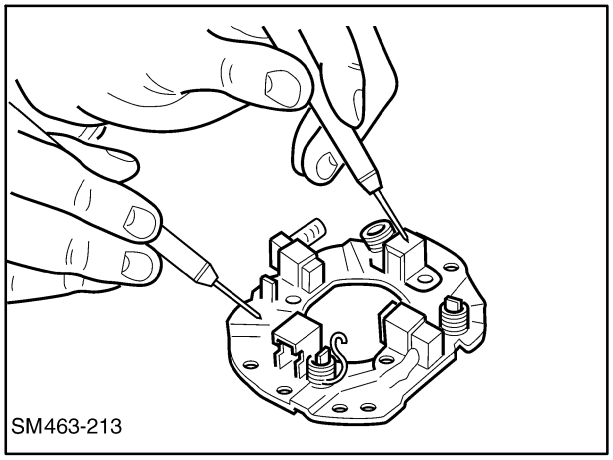


Figure 2-252

Overrunning Clutch

While holding the clutch housing, rotate the pinion. The pinion should rotate smoothly in one direction (not necessarily easily), but should not rotate in the opposite direction. If the clutch does not function properly, replace it.

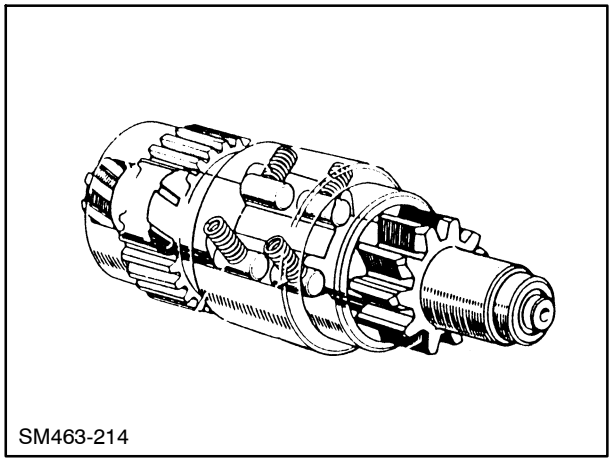

SM463-214

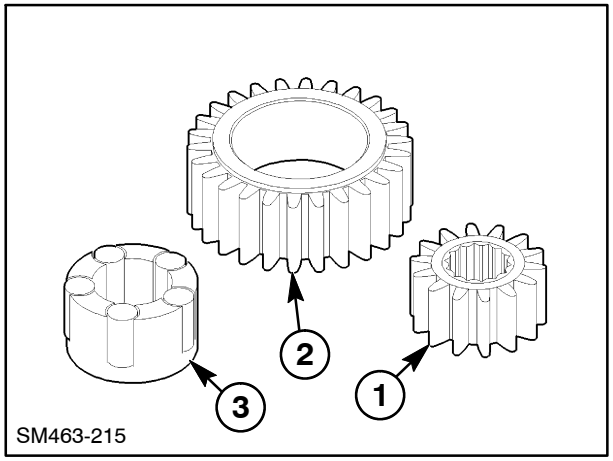
Figure 2-253

Reduction Gears

Inspect the pinion gear, 1, the idler gear, 2, and the overrunning clutch gear for wear or damage.

Inspect the idler gear bearing rollers and retainer, 3.

Replace any parts found worn or damaged.



SM463-215

Figure 2-254

Electric Solenoid

The following tests should be performed with the motor removed from the starter assembly.

Each test should not last more than 3 - 5 seconds to avoid overheating the solenoid.

Tests should be performed with a fully charged 12 volt battery.

Pull-in Test

Connect a lead from the positive battery post to the spade terminal, 1, (starter switch wire) on the solenoid. Connect a lead from the battery negative post to the solenoid housing, 2.

Touch a second negative lead to the heavy solenoid terminal leading to the field coil, 3. This completes the circuit through both the pull-in and hold-in coil windings. The pinion should jump forward.

Remove the negative lead from the field coil terminal, 3. The pinion should stay extended, held by the hold-in coil.

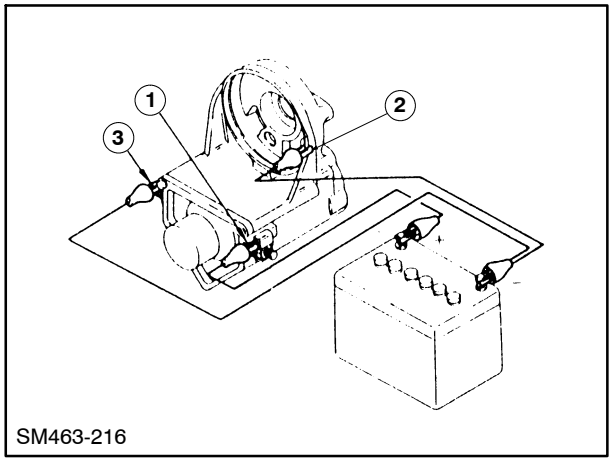


Figure 2-255

Remove the positive lead from the spade terminal. The pinion should retract immediately.

If the solenoid fails to perform as described, replace it.

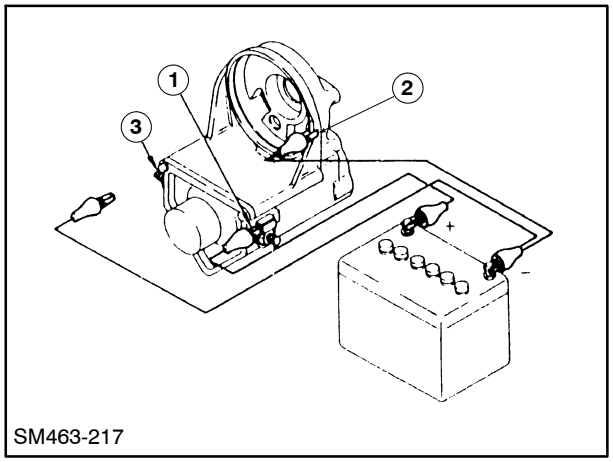


Figure 2-256

REASSEMBLY

Reassemble the starter in the reverse order of disassembly. Observe the following cautions and procedures.

1. Lubricate the following components with a light coating of White Lithium Grease (Part Number RL 666).

   Idler gear retainer and rollers.

   Overrunning clutch.

   Steel ball and return spring.

   Armature bearings.

   Reduction gears.

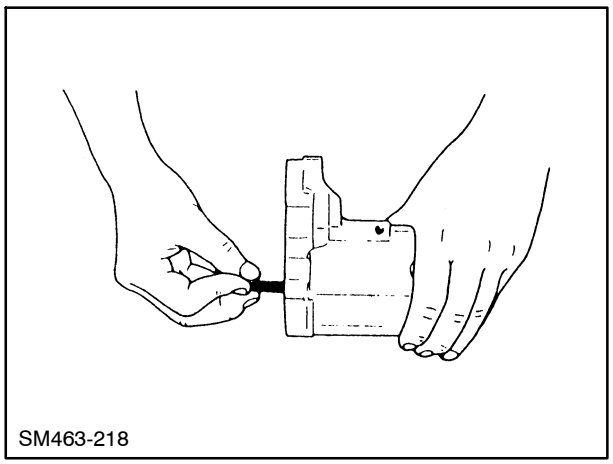

SM463-218

Figure 2-257

2. Install the return spring into the electric solenoid and the steel ball into the center of the overrunning clutch. The ball should be held in place by the coating of grease.

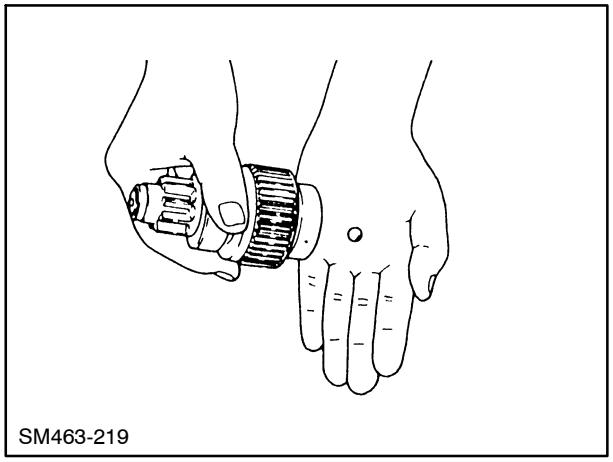

SM463-219

Figure 2-258

3. Install the idler gear bearing rollers and retainer.

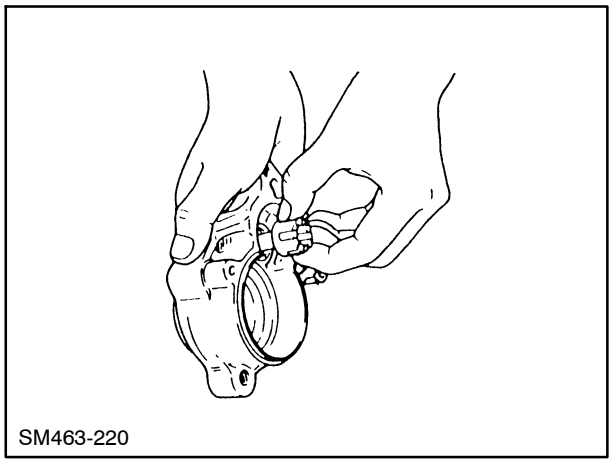

SM463-220

Figure 2-259

4. Install the overrunning clutch assembly part way into the housing. Mesh the idler gear with the driven gear, then fully install both pieces together.

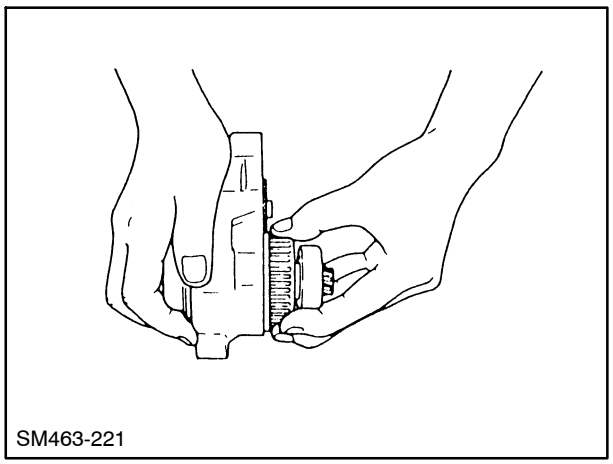


Figure 2-260

5. Position the pinion gear, 1,over the armature hole shaft then install the drive end frame, 2. Install the retaining screws and torque to 7 - 12 N·m (5 - 9 ft. lbs.).

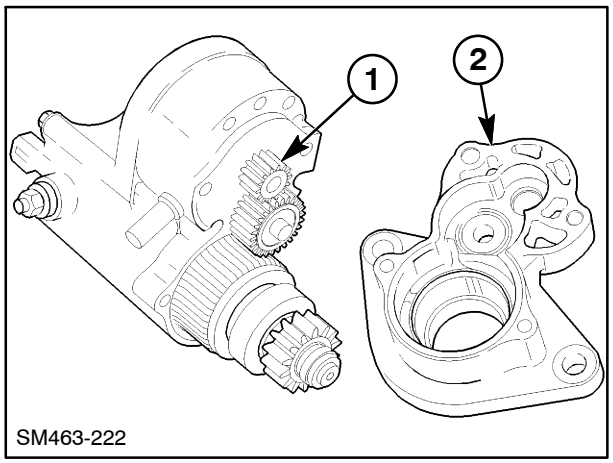


Figure 2-261

6. Install the armature into the motor housing. Gently tap the armature into place with a soft hammer to seat the rear bearing.

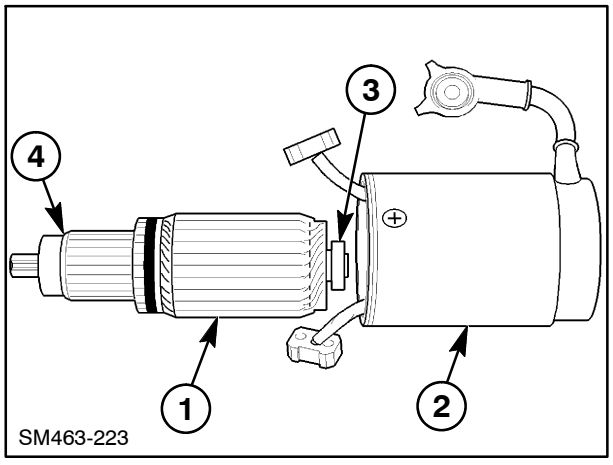


Figure 2-262

7. Install the brush plate onto the motor housing. Install the insulated brushes into the holder. Ensure the insulated brush leads are not grounded. Avoid getting oil or grease on the brushes or commutator.

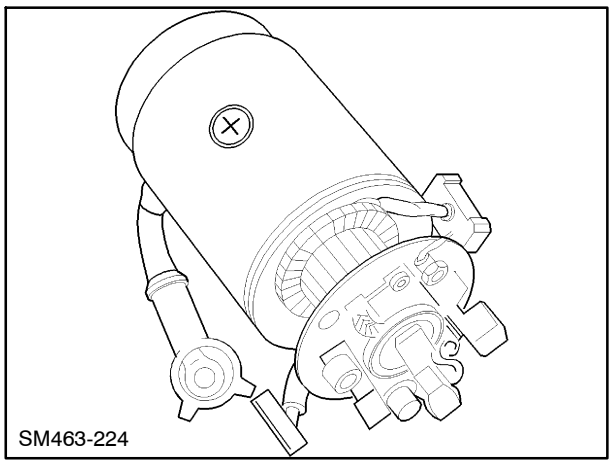


Figure 2-263

8. Install the motor into the drive housing observing the scribe marks. Install the retaining bolts and torque to 7 - 12 N·m (5 - 9 ft. lbs.).

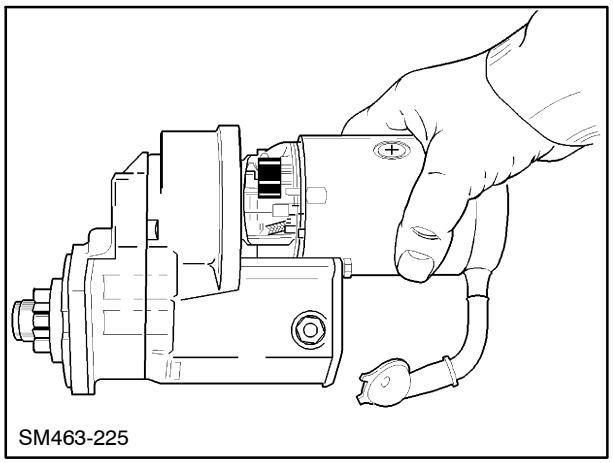


Figure 2-264

9. Reconnect the lead wire from the electric solenoid.

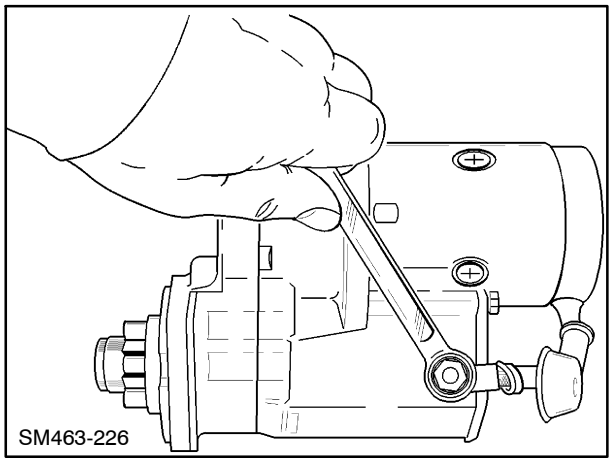


Figure 2-265

Performance Test

After reassembly, a no-load test should be conducted.

Clamp the starter securely in a vise. Connect a heavy wire (jumper cable) from a 12 volt battery positive terminal, through a suitable ammeter, to the battery cable post of the starter, 1. Connect a second cable from the battery negative post to the starter case or vise. Connect a jumper wire from the positive cable to the spade terminal on the solenoid, 2.

The pinion gear should jump forward and the starter turn smoothly. Current draw should not exceed 130 amps.

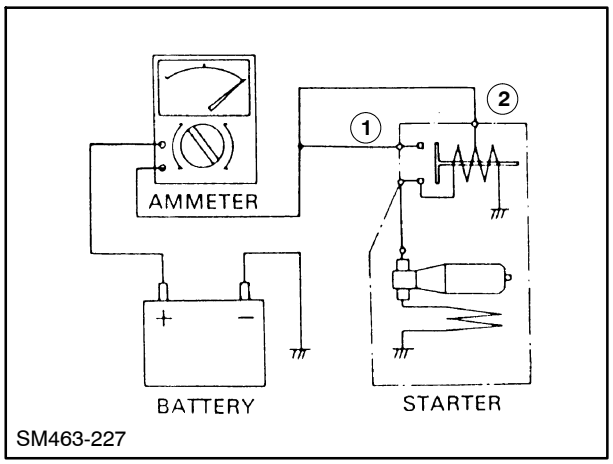


Figure 2-266

Starter Installation

1. Attach the starter to the bellhousing and tighten the hardware, 1. When installing the starter into the bellhousing, make sure it is properly seated before installing and tightening the hardware.
2. Reconnect the wires to the proper terminals, 2, on the starter solenoid and starter.
3. Reconnect the negative (-) battery cable.
4. Reinstall and close any shields removed.

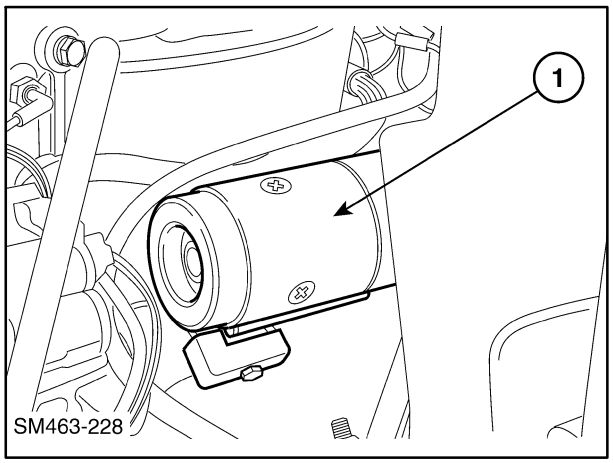


Figure 2-267

GLOW PLUG

A sheathed-type glow plus is employed and provides excellent starting.

Specifications: 11 V; 9.0 A

1	Heat wire	5	Nut
2	Sheath	6	Magnesium oxide powder
3	Asbestos	7	Insulation bushing
4	Body	8	Core

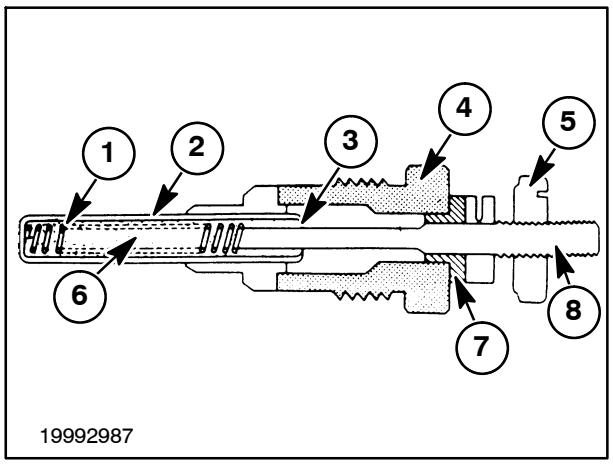


Figure 2-268

Structure

Coiled thin heat wire is placed in the sintered magnesium oxide powder enclosed by stainless sheath. One end of the heat wire is welded to the sheath end and the other end to the central electrode. By setting the key switch to the run position, the glow plug preheats the air in the combustion chamber.

Disconnection of the Glow Plug

The glow plug operates even when any one of the plugs is disconnected because it is connected in parallel. However, when disconnected, preheating time of the glow signal is extremely extended.

Testing a Glow Plug

Check/remove the connector and check the continuity between each plug terminal and body ground. If continuity is not observed, it shows disconnection and the glow plug should be replaced.

The glow plug is of a simple structure and a short circuit is rarely caused. However, if the central electrode, body, sheath, etc. come in contact, wiring of the preheating circuit is burnt during start-up.

Correction: Remove the connector and measure the resistance of each plug terminal and ground with a tester. The tester reading should be 1.0 ± 0.1.

Resistance of 0 indicates a short circuit.

Oil Pressure Switch

Oil Pressure Switch Operating Range:
2.8 PSI - 5.7 PSI (0.2 to 0.4 kg/cm^2)

The oil pressure switch, 1, is a warning device to inform of low engine lubricating oil pressure. When oil pressure becomes less than specified, the warning light is activated.

This pressure switch houses a diaphragm and contact points (max. current draw is 0.42 amps).

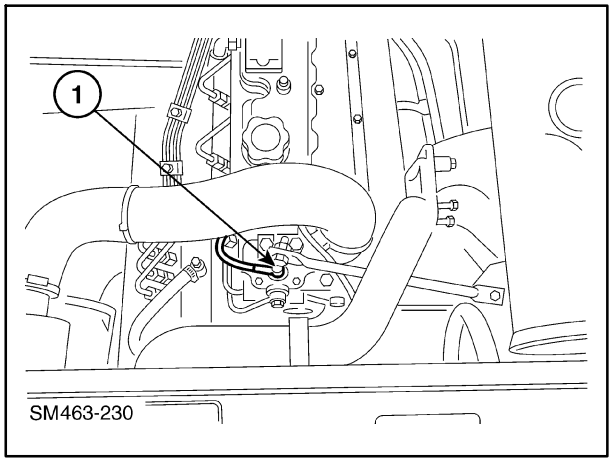


Figure 2-269

Stop Solenoid

Engine stop solenoid is in the normal state if the plunger is drawn into the main body when one terminal is connected to battery +, 1, and the other terminal to the main body, 2.

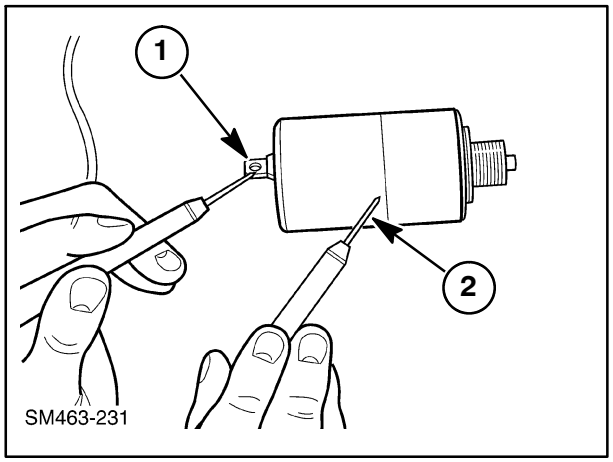


Figure 2-270

MAXIMUM CIRCUIT RESISTANCE

RESISTANCE OF BATTERY CABLES 1, 2, & 3 NOT TO EXCEED 0.0018 OHM

Circuit	Cable No.	Circuit Current	Maximum Circuit Resistance	Maximum Circuit Volt Drop	Rewards
Alternator Charging	4 7,11	35 Amp	0.0143 OHM	0.5 Volt	See Glow Plugs Circuit
Starting Motor Solenoid	4 5 6	15.75 Amp	0.04 OHM	0.63 Volt	See Glow Plugs Circuit See Glow Plugs Circuit
Glow Plugs (Via Glow Signal)	4,5,8,9,10	27 Amp 36 Amp	0.0185 OHM 0.0139 OHM	0.5 Volt 0.5 Volt	3 cyl Engines 4 cyl Engines

19992989

Figure 2-271

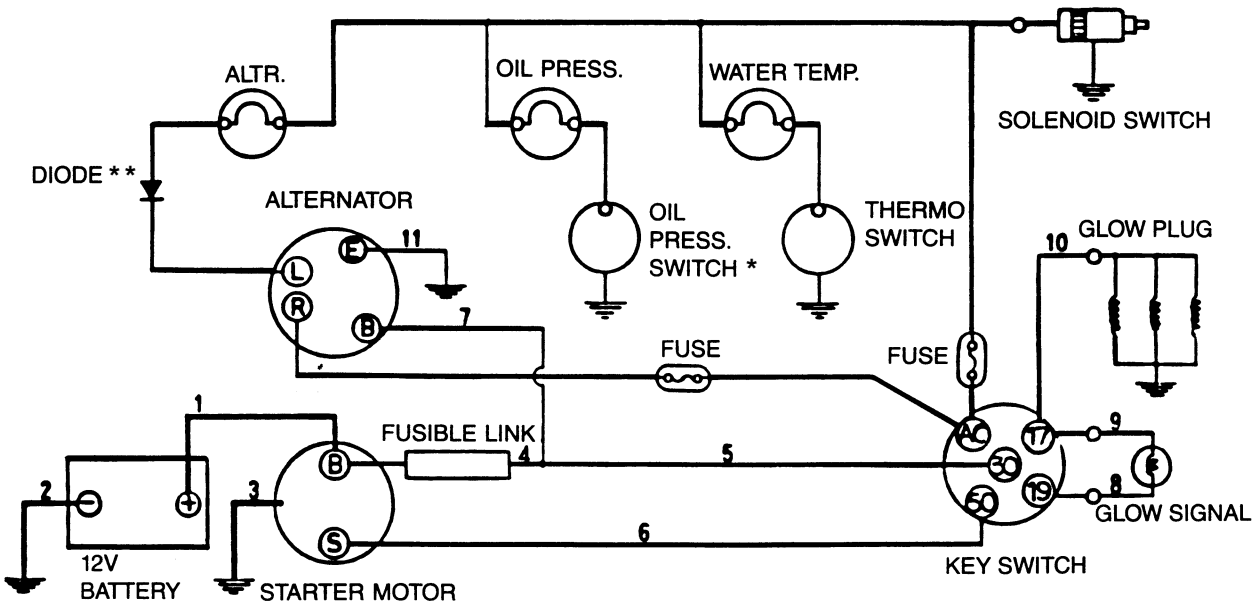


Figure 2-272

* Maximum current draw for oil pressure switch is 0.42 amps (5-watt max. bulb).

** Diode capacity: Current 3 amp. Reverse voltage 600 volt.

SPECIAL TOOLS

ENGINE

- FNH 00011 - Fitting - 1/8 BSPT x 7/16-20 UNF

  Used to test engine oil pressure. Screws in in place of the engine oil pressure sender. Fits normal pressure test line connection.

- FNH 00120 - Compression Test Adapter

  Used to test engine compression. Screws into the glow plug hole, allows compression testing without removing injectors. Use with FNH 02020 Diesel Compression test kit or equivalent.

- FNH 00122 - Compression Test Adapter

  Right angle quick disconnect coupling. Use with FNH 00120 and FNH 02020.

- FNH 00117 - Oil Pump Port Block Installer

Installs engine oil pump port block. Ensures part is installed straight, to the proper depth, with correct oil passage orientation and without damage.

- FNH 11097 - Oil Pump Port Block Remover

Removes engine oil pump port block without removing oil pan.

All of these tools are currently used on various Compact Tractors and may already be in dealerships.

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the amount of time it actually takes to complete a job.

ENGINE REMOVAL FROM SKID-STEER LOADER

Without tilting cab and boom forward. (3.0)
Includes removal of the oil cooler, radiator, oil filter, and air filter as an assembly.

Tilting cab and boom forward. (3.5)
Includes fan removal and loosening of the engine fuse and relay panel.

Remove and replace. (0.5)
Includes draining cooling system, removal of hydrostatic pump attaching hardware. Unplugging electrical wire harness.

ENGINE OVERHAUL

Major overhaul (20.30)

Steam clean and completely dismantle, clean all parts, flush all oil and water passages and replace plugs, check crankshaft for size and wear and inspect all parts.

Hone or replace liners or re-bore as required.

Replace or repair pistons with new rings.

Replace or repair where necessary camshaft and auxiliary drive bushings, main and big end bearings and thrust washers.

Inspect and replace timing gears as necessary. Inspect and repair as required water pump, oil pump, turbocharger, and any cylinder head components.

Reassemble engine completely using new gaskets and seals and tighten to specifications. Set valve clearances. Run engine and check for leaks. Retighten head and reset valve clearances.

Minor overhaul (14.30)

Steam clean engine, dismantle, clean and inspect parts.

Replace or repair pistons and check height. Hone liners, fit new main and big end bearings and thrust washers.

Check and rework/repair valves as necessary.

Completely reassemble and tighten to specification using new gaskets and seals.

Run engine and check for leaks.

Retighten head and reset valve clearances.

Top overhaul (cylinder head or gasket)

Remove cylinder head and gasket.

Remove all traces of jointing compound and old gasket.

Check cylinder head and reseat valves.

Fit new gasket and replace head. (Do not use gasket cement with dry-type gasket).

Check injectors and service as necessary.

Tighten head and set valve clearances.

Run engine, check for leaks.

Retighten head and reset valve clearances.

Additional time - turbocharged engine.

Oil consumption rectification (7.30)

Remove cylinder head, lub. oil sump and oil pump.

Remove all pistons and connecting rods.

Deglaze all cylinder bores using “Flexihone” or similar tool (C.I. liners and bores only).

Clean and check pistons for wear, repairing as necessary and replace all piston rings.

Strip and clean cylinder head.

Reseat valves and service injectors.

Check condition of oil pump and repair if necessary.

Reassemble all parts using new gaskets and seals. Set valve clearances and tighten head to specification.

Run engine and check for leaks.

Retighten head and reset valve clearances.

Additional time - turbocharged engine.

CYLINDER BLOCK

Replace bare block (7.00)

Steam clean complete engine, dismantle, clean and inspect all parts.

Reassemble engine complete into new bare blocks with same or new pistons, using new rings, main and big-end bearings and thrust washers, gaskets and seals, and tighten to correct specifications.

Run engine and check for leaks.

Retighten head and reset valve clearances.

Additional time - turbocharged engine.

Replace rear main lip-seals. (0.25)

(Additional operations may be added when justified).

CYLINDER HEAD

Cylinder head/Cover/Camshaft cover

Remove and replace. (0.10)

Additional time - turbocharged engine.

Rocker shaft assembly

Remove and replace. (1.10)
Includes remove and replace cylinder head cover/camshaft cover.

Dismantle and clean, fitting new levers where necessary. (2.10)
Includes remove and replace rockershaft assembly.

Check/adjust valve clearances. (0.40)
Includes remove and replace cylinder head cover/camshaft cover.

Cylinder head

Remove and replace, fitting new gasket(s). (2.30)
Includes remove and replace rocker shaft assembly and check/adjust valve clearances.

Additional time - turbocharged engine.

Remove, and either reseat and replace, or repair all valves. (3.30)
Includes remove and replace cylinder head, fitting new gaskets

Additional time - cut one valve seat. (0.10)

Additional time - turbocharged engine.

Additional time - replace each valve seat insert as necessary. (0.10)

Valve spring

Change one-head not removed except for “B” engines, includes C6. (0.30)
Includes remove and replace cylinder head cover/camshaft cover.

Change complete set of valve springs-head not removed except for “B” engines, includes C6. (1.20)
Includes remove and replace cylinder head cover/camshaft cover.

PISTON ASSEMBLY

Connecting rod

Replace one. (3.30)
Includes remove and replace cylinder head, fitting new gaskets, and sump and strainer, remove, clean and reassemble with new gaskets and replace.

Additional time - turbocharged engine.

Small end bushing

Remove, replace and ream one. (3.40)
Includes remove and replace connecting rod.

Additional time - turbocharged engine.

Piston

Replace one, checking piston height. (3.30)
Includes remove and replace cylinder head, fitting new gaskets, and sump and strainer, remove, clean and reassemble with new gaskets and replace.

Additional time - turbocharged engine.

Replace all pistons, checking heights. (3.40)
Includes remove and replace cylinder head, fitting new gaskets, and sump and strainer, remove, clean and reassemble with new gaskets and replace.

Additional time - turbocharged engine.

Re-ring all pistons. (5.00)
Includes replace all pistons, checking heights, remove and replace cylinder head, fitting new gaskets, and sump and strainer, remove, clean and reassemble with new gaskets and replace.

Additional time - turbocharged engine.

CRANKSHAFT ASSEMBLY

Replace crankshaft (4.30)

Includes replace rear main lip seal, replace damper and pulley, replace thrust washers, sump and strainer, remove, clean and reassemble with new gaskets and replace, and remove and replace flywheel and flywheel housing.

Replace damper and pulley, as a separate operation from crankshaft replacement. (0.10)

Thrust washers (3.50)

Replace.
Includes remove sump and strainer, remove, clean and reassemble with new gaskets and replace.

CAMSHAFT, TIMING CASE AND GEAR ASSEMBLY

Camshaft

Remove and replace. (1.10)
Includes remove and replace rocker shaft assembly, check/adjust valve clearances, remove sump and strainer, remove, clean and reassemble with new gaskets and replace.
Includes C24 and C5/1 on “B” engines.

Tappets

Remove and replace all. (2.40)
(includes G1, F5 on engine types E, G, H, L, T and Z).
(includes C6 on engine types C and J).
(includes F5 on “B” engines).

Timing gear cover

Remove and replace. (0.30)
Includes remove and replace damper and pulley.

Timing case front seal

Remove and replace. (0.15)
Additional to remove and replace timing gear cover.

Valve timing check (1.15)

Remove cylinder head cover. Set No. 1 inlet valve to specified clearance).
Turn engine to “nip” push rod. Reset valve clearance.
Refit top cover.
Run engine and test.
“Pin check” only on “B” engines.

SUMP ASSEMBLY

Sump and strainer (0.30)

Remove, clean and reassemble with new gaskets and corks and replace.

Suction pipe (0.20)

Remove and replace (oil pump on bench).

Oil pump (1.10)

Remove and replace
Includes remove, clean and reassemble with new gaskets and corks and replace
(includes H3, F13 and F18 on “B” engines).

Relief valve (0.10)

Strip, check, clean and reassemble.
(oil pump on bench).

FUEL SYSTEM

Injection pump (0.40)

Remove and replace.
Includes check and adjust fuel pump timing, and remove and replace high-pressure pipes.

Injection pump timing (1.10)

Check and adjust.

Governor (0.40)

Adjust on running engine.

Left pump (electric pump) (0.15)

Remove and replace.

High-pressure pipes

Remove and replace one. (0.05)
Remove and replace set. (0.20)
Bleed fuel system. (0.15)

Injector

Remove and replace one. (0.10)
Includes remove and replace one high-pressure pipe.

Remove, test and replace all. (0.40)
Includes remove and replace set of high-pressure pipes.

Dismantle and clean one injector. (0.20)
Includes remove and replace one injector.

Dismantle and clean all injectors. (1.20)
Includes remove, test and replace all injectors.

Fuel filter element (0.10)

Change.
Includes bleed the fuel system.

IN-LINE FUEL FILTER

Remove and replace. (0.10)

Fuel pump stop solenoid (0.10)

Remove and replace.

Fuel tank (1.0)

Remove and replace.

Fuel level sender (tank) (0.5)

Remove and replace.

Fuel pickup tube (0.5)

Remove and replace.

Fuel lines complete (0.5)

Remove and replace.

AUXILIARY EQUIPMENT

Alternator (0.20)

Remove and replace.

Alternator pulley (0.15)

Remove and replace.

Oil filter (0.10)

Remove and replace.

Starter motor (0.10)

Remove and replace.

Flywheel and flywheel housing (0.35)

Remove, replace and align.
Includes removal of engine from loader or hydrostatic pump removal.

Thermostat unit (0.20)

Remove, check and replace.

Turbocharger

Remove and replace.

Starter ring (0.15)

Remove and replace.
Includes remove and replace flywheel and flywheel housing.

Glow plugs (0.40)

Remove and replace set.

Starter solenoid (0.15)

Remove and replace.

Fan (0.10)

Remove and replace.

Fan belt (0.10)

Remove and replace.

Water pump (fresh) (0.30)

Remove and replace.

Water pump (1.00)

Dismantle, clean, recondition and reassemble. Includes water pump removal and replacement.

Radiator (0.45)

Remove and replace.

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SECTION 3
ELECTRICAL SYSTEM

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GENERAL ELECTRICAL INFORMATION

The electrical system is a 12-volt negative (-) ground system that provides battery voltage to the Electronic Instrument Cluster (EIC), starting circuit, and other electrical components.

The electrical system is made up of the following components:

1. Battery - Power supply and storage.
2. Alternator/Regulator - Power supply and source to maintain fully charged system.
3. Starter motor - To crank engine for starting.
4. Ignition switch - Used to control electrical circuits and direction of battery voltage.
5. Electronic Instrument Cluster (EIC)
   * Monitors engine and operator functions and signals operator of disruptions or faults in the circuits.
   * Displays monitored functions.
   * Controls engine fuel system (fuel shut off).
   * Provides engine shutdown if fault occurs in engine oil pressure or hydrostatic charge pressure circuits.
   * Provides safety interlock for the boom and bucket control valve spools.
   * Provides a diagnostic mode for checking EIC board circuits.
   * Provides an anti-theft mode to electrically lock the loader boom and bucket; the engine will start with the Service/Run switch in the “SERVICE” position.
6. Fuse blocks/ fuses/ circuit breakers, cab and engine - Used to protect the electrical circuits and glow plug circuit.
7. Fuel pump - Supplies fuel from the tank to the injection pump.
8. Glow plugs - Used to provide aid in cold engine starting.
9. Fuel solenoid - Controls fuel flow and is controlled by the EIC.
10. Switches - Used to control other electrical circuits, lights, etc.

ATTENTION: Do not connect any electrical circuits at the ignition key switch or cab fuse block(s) unless there are written instructions telling you to do so or damage to the EIC board may occur.

ATTENTION: If any servicing or adjustments require the battery to be disconnected, or welding is required on the skid-steer loader, disconnect the negative (-) ground cable. Failure to disconnect the battery may result in damage to the EIC (electronic instrument cluster) monitoring system and other electrical components.

ATTENTION: If the EIC requires removal from the dash area or the skid-steer loader, disconnect the negative (-) ground battery cable. This will shut off power to the EIC and prevent damage to the EIC board, or prevent blowing the 5-amp fuses, if the board is accidentally grounded.

DEFINITION OF TERMS

ALTERNATING CURRENT (A.C.) - A flow of electrons which reverses its direction of flow at regular intervals in a conductor.

AMMETER - Measures the flow of electrical current in amperes. Ammeters are connected in series with the circuit to be tested.

AMPERE - A unit of measure for the flow of current in a circuit. The ampere is used to measure electricity such as “gallons per minute” is used to measure liquid flow.

CIRCUIT - A continuous, unbroken path along a conductor through which electrical current can flow from a source, through various components, and back to the source.

CIRCUIT BREAKER - A device to protect an electrical circuit from overloads and can be reset, or will automatically reset.

COLD CRANK RATING (CCA) - The cranking load capacity of a battery at low temperatures (cold cranking amperes at 0 F).

CONTINUITY - Unbroken path along a conductor through which electrical current can flow.

CURRENT - Movement of electricity along a conductor. Current is measured in amperes.

DIODE - An electrical device that will allow current to pass through itself in one direction only.

DIODE (RESISTOR TYPE) - An electrical device that will allow current to pass through itself in one direction only and will cause resistance as the electricity passes through. The electricity coming from this type diode will be less than what is going in.

DIRECT CURRENT (D.C.) - A flow of electrons moving in the same direction along a conductor from a point of high potential to one of lower potential.

FUSE - A device to protect an electrical circuit from overloads that needs to be replaced when blown.

OHM - The standard unit for measuring resistance to flow of an electrical current.

OHMMETER - An instrument for measuring the resistance in ohms of an electrical circuit.

OPEN CIRCUIT - An open circuit occurs when a circuit is broken which interrupts the flow of current through the circuit.

RELAY - An electrical switch which opens and closes a circuit automatically when activated.

RESISTANCE - The opposing force offered by a circuit. Resistance is measured in ohms.

SHORT CIRCUIT - A part of a circuit that comes in contact with part of the same circuit or unintentionally touches a metallic object.

SOLENOID - A circular coil used for producing a magnetic field.

SWITCHES - A device used to control and direct current to circuits and will remain in this position until changed.

SWITCHES (MOMENTARY) - Momentary switches are used to direct current to circuits and these switches will return to the neutral position when released.

VOLT - A unit of electrical pressure which caused current to flow in a circuit.

VOLTAGE - The force which is generated to cause current to flow in an electrical circuit. Voltage is measured in volts.

VOLTMETER - An instrument for measuring the force in volts of electrical current. Voltmeters are connected in parallel to the points where voltage is to be measured.

The following are common terms used in electrical diagnostics and how they may affect the circuit and electrical components.

The term “OPEN CIRCUIT” means there is no voltage getting from the control point to the operating point. This means the wire carrying the voltage is open/broken and voltage cannot continue to flow. The effect is the operating component will not function.

The term “SHORT CIRCUIT” means there is voltage being lost to another component wire or to ground. This could result in the wrong component being operated or the blowing of the circuit protection device (fuse or breaker).

The term “GROUNDED CIRCUIT” means the voltage is going directly to ground and usually results in no component operation and/or blown fuse-breaker.

To test for an “OPEN CIRCUIT,” use a volt/ohm meter and check from one end of the wire to the other. If voltage is not present, trace the circuit from control point to operating point until the open is found.

To test for a “SHORT CIRCUIT,” use a volt/ohm meter and check for very low resistance in different parts of the circuit or continuity between the circuit wire and ground.

To test for a “GROUNDED CIRCUIT,” use a volt/ohm meter and check for continuity between the circuit wire and ground.

The following chart shows the abbreviations for the various wire colors used to identify the electrical circuits.

WIRE ABBREVIATIONS TO INDICATE WIRE COLOR

WIRE COLOR	DESIGNATION	WIRE COLOR	DESIGNATION
Black	B	White	W
Dark Blue	DKBL	Orange	O
Light Blue	LTBL	Pink	PK
Dark Brown	DKBR	Purple	PU
Gray	GY	Red	R
Dark Green	DKGN	Tan	T
Light Green	LTGN	Yellow	Y

Drilling Holes In Overhead Dash, Electronic Instrument Cluster (EIC) Board, and Ignition Switch Area

Always install the rearview mirrors as shown in the mirror instruction sheet. Otherwise, you must unhook the negative battery cable and remove the EIC board panel, 1, and ignition switch panel, 2, from the overhead dash. If holes and attaching screws are installed into the dash area, 3, make sure the screws will not contact the EIC board, the ignition switch, or wiring, as electrical system damage will occur.

IMPORTANT: Failure to unhook the negative battery cable before removal of the EIC board or switch may result in an accidental grounding, causing component damage.

IMPORTANT: Retaining hardware contacting the EIC board or switch may cause an electrical short, damaging the loader electrical system.

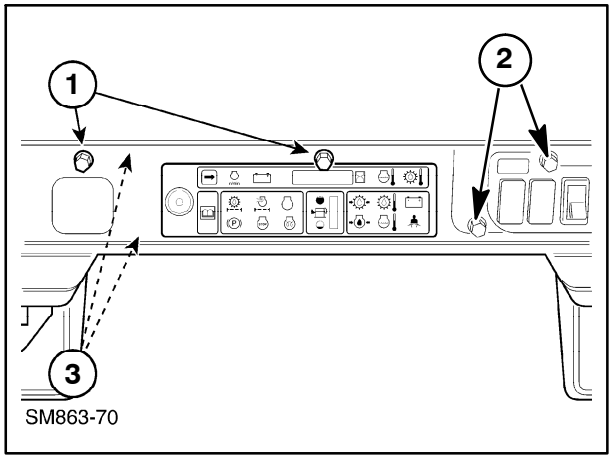


Figure 3-1

ADAPTING ATTACHMENTS REQUIRING 12V ELECTRICAL POWER

There are important rules that must be followed when adapting attachments that require 12 volt electrical power. Proper wiring of electrical devices and power and ground connections is very important to prevent other electrical component damage. Attaching electrical connections to locations other than recommended may allow electric current to feed back through the EIC board, creating false EIC board readings and warnings, or causing EIC board damage or failure.

1. ALWAYS FOLLOW the instructions for New Holland kit installation to ensure proper function and operation.
2. NEVER CONNECT an electrical device to any wires, fuses, switches or grounds inside the cab area. This includes any terminals of the ignition switch, fuse panel, or ground terminal.
3. NEVER INSTALL an electrical device, music radio, two-way radio, or unapproved New Holland attachment into the cab area.
4. ONLY USE the 12-volt accessory power outlet for attachments requiring less than 10 amps. The accessory outlet is connected to the engine fuse/relay panel and protected with a 15 amp fuse.

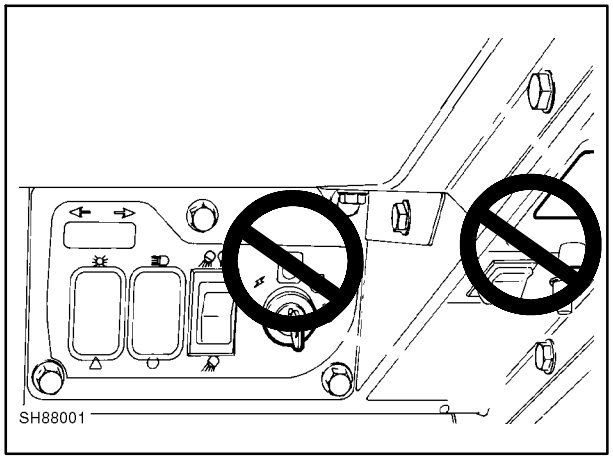


Figure 3-2

5. ALWAYS CONNECT new electrical attachments to the engine fuse/relay panel, 1, and connect the grounds to the engine bell housing. USE ONLY vacant connections and fuses not in use for specified attachments.
6. PLEASE REFER to Service Bulletin 11/95-I4 for more detailed information about higher amperage requirements and making electrical connections.

Wires and connections are available providing electrical attachments were not previously installed.

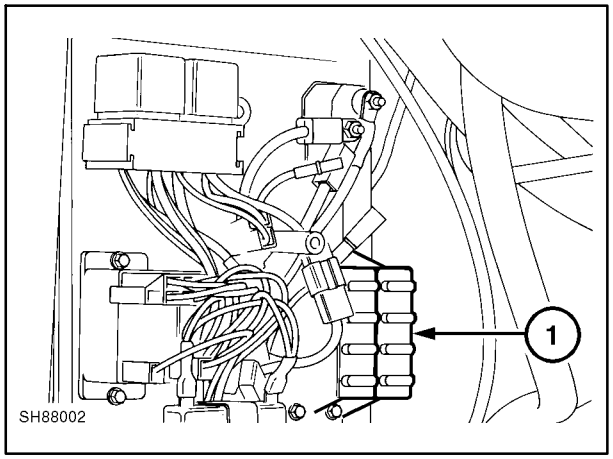


Figure 3-3

Engine Fuse Panel

Ref.	Color	Destination	Fuse	Battery Voltage	Status
1	R/B	To turn signal relay	10-amp	All times	Available
2	R/GY	To accessory relay	25-amp	All times	Available
3	R/LTGN	To EIC board pin #14 P2 connector	5-amp	All times	Occupied
4	LTGN/R	To seat switch(es)	5-amp	All times	Occupied
5	R/W	To key switch (battery terminal)	15-amp	All times	Occupied
6	R	From preheat circuit breaker	20-amp	All times	Occupied
7	R	From start relay		All times	Occupied
8	R/O	To heater power relay	20-amp	All times	Available
9	R/T	Spare	7.5-amp	All times	Available
10	DKGN/R	To high flow, horn, power outlet	15-amp	Key “ON” position	Available
11	O/LTGN	From accessory relay		Key “ON” position	Occupied
12	O/W	To Back-up alarm switch	5-amp	Key “ON” position	Available
13	O/LTGN	From road/work light fuse (cab panel)		Key “ON” position	Occupied

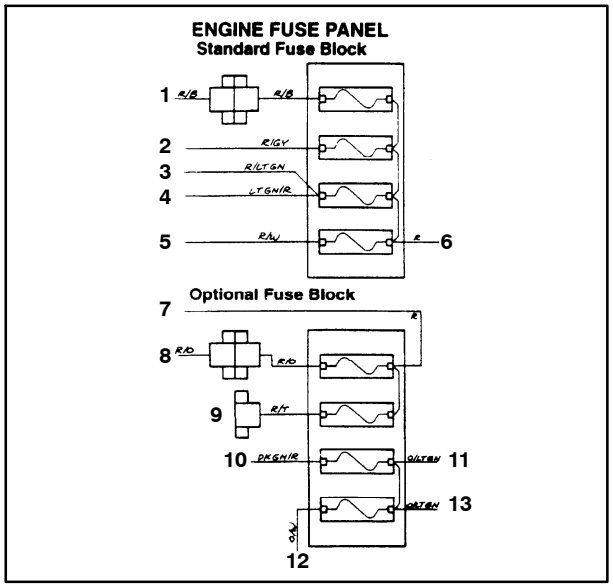


Figure 3-4

Different types of wire connectors are used on these circuits and suitable connectors will need to be used on the attachment/device for proper power supply connection.

Complete new auxiliary wiring circuits can be installed as shown here, depending on electrical requirements.

Mounting holes for the added circuit breakers must be drilled in the panel. Disconnect the battery before drilling and installing new wiring. Protect the panel parts from drill shavings that could cause electrical shorting of components.

Suggested sealed circuit breakers are:

Part Number	Capacity
9827329	15-amp
9828493	20-amp
9840279	25-amp
9840280	30-amp

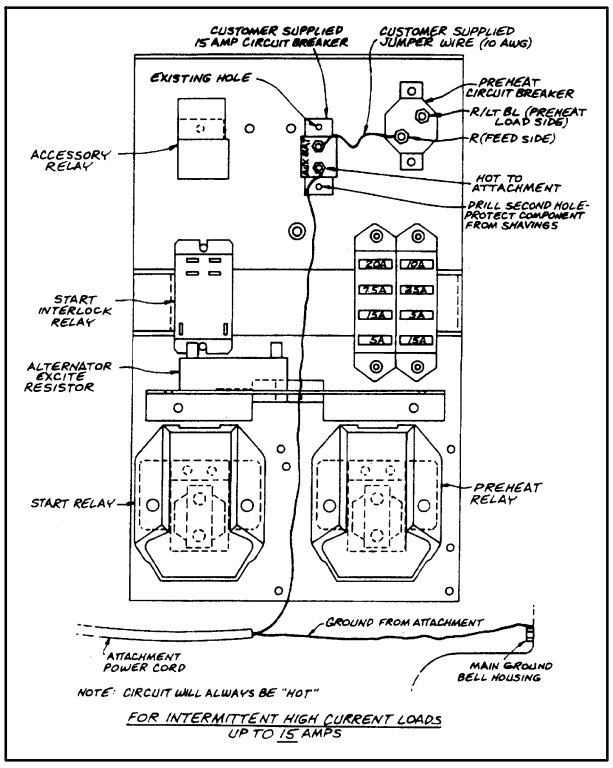


Figure 3-5

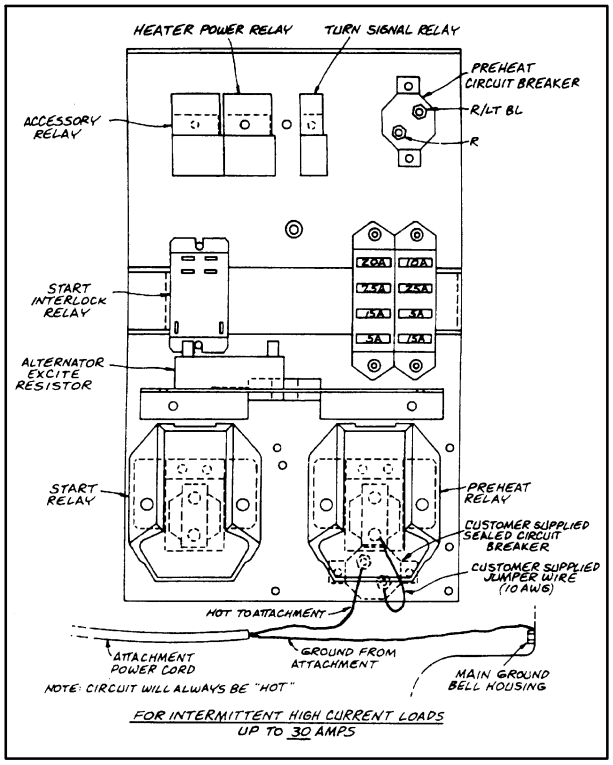


Figure 3-6

SPECIFICATIONS

Alternator . . . . . 40 amp

Tachometer output (“P” terminal) . . . . . 5 to 6.5 AC Volts

Battery . . . . . SAE PC31 - 12 volt - 625 amps @ -18° C (0° F) Top stud

System Ground . . . . . Negative (-)

Protection . . . . . Fuse blocks in cab and engine areas

Cab panel (standard)
- Fuel pump 7.5A
- Electronics ignition 5A
- Wiper 7.5A
- Lights (road/work) 15A

Cab panel (optional)
- Beacon light 7.5A
- Flashing lights (early model) 10A

Engine panel (standard)
- Turn signals 10A
- Accessory 25A
- Electronic (EIC) 5A
- Key main 15A

Engine panel (optional)
- Heater 20A
- Spare 7.5A
- Attach/Horn 15A
- Backup alarm 5A

Electronic Instrument Cluster (EIC)
- Low Voltage . . . . . EIC will fault at 11.9 volts (low)
- High Voltage . . . . . EIC will fault at 16.5 volts (high)

Fuel gauge sensor resistance
- Full tank . . . . . 35 ohms
- Empty tank . . . . . 240 ohms

Fuel shutoff solenoid
- Pull-in amperage . . . . . 1.5 to 1.8 amps
- Hold-in amperage . . . . . 1.3 to 1.7 amps

Engine air filter sensor . . . . . Switch is normally closed
EIC will fault at 1.6″ Mercury or 22″ Water

Engine coolant temperature sensor -
(Silver color borders) . . . . . EIC will read “COLD” until 45° C (113° F)
EIC will fault at 102° C (216° F)

Engine coolant temperature sensor -
(Gold color borders) . . . . . EIC will read “COLD” until 0° C (32° F)
EIC will fault at 102° C (216° F)

Engine coolant temperature sensor resistance . . . . . At 20° C (68° F) 2.21-2.69 K ohms
At 0° -30° C (32° -86° F) 1.65-5.88 K ohms

Engine crankcase oil pressure . . . . . EIC will fault at 0.3 BAR (4.3 PSI)

NOTE: The EIC will not alarm unless coolant temperature is above 64° F or two minutes have passed since starting.

Hydraulic oil temperature sensor . . . . . EIC will read “COLD” until 45° C (113° F)
EIC will fault at 99° C (210° F)

Hydraulic oil temperature sensor resistance . . . . . At 20° C (68° F) 2.21-2.69 K ohms
At 0° -30° C (32° -86° F) 1.65-5.88 K ohms

Hydraulic oil filter sensor (differential between in/out) . . . . . Switch normally closed
EIC will fault at 2.7 ± 0.3 bar (40 PSI ± 4 PSI)
EIC will reset at 2.0 bar (30 PSI)

NOTE: This alarm is locked out until the oil temperature is at 110° F. The switch must be open for over 5 seconds to alarm.

Hydrostatic charge pressure . . . . . EIC will fault at 3.4 bar (50 PSI)

Glow plug resistance . . . . . 55 ohms

Solenoid (boom and bucket spool lock) resistance . . . . . 15 to 18 ohms

Starter Switch . . . . . Key start and relay

Headlights and rear work lights (*Refer to Model S/N Range) . . . . . 37.5 watt halogen
NH#9847313

*Model	Serial Number Range
L565	#850751 to #999999 #0001 to #31153
Lx565	#847451 to #999999 #0001 to #38841
Lx665	#847851 to #999999 #0001 to #64384

Headlights and rear work lights (**Refer to Model S/N Range) . . . . . 37.5 watt halogen
NH#86533429

**Model	Serial Number Range (Snap In Lights)
L565	#31153 to #850751
Lx565	#38841 to #847451
Lx665	#64384 to #847851

Taillights (road) . . . . . 37.5 watt halogen
NH#86505510

Amber Flasher lights . . . . . Sealed
NH#529068

Electronic Instrument panel indicator lamp . . . . . 0.080 amp C-2F

ALTERNATOR SERVICE SPECIFICATIONS (40 amp)

Item	How Rated	Standard Or Service Limit
Normal Output	(V - A)	12 V - 40 A
Polarity		Negative ground
Weight	(kg, lbs.)	3.7 kg (8.2 lbs.)
Rotational direction (viewed from the pulley)		Clockwise
Load characteristics (cold)	Terminal voltage (V)	13.5 V
	Current (A)	Min. 30 A
	Revolution (RPM)	2500 RPM
Brush length	Original (mm-in)	18.5 mm (0.728″)
	Limit (mm-in)	5.0 mm (0.20″)
Brush spring tension	Original (g-lbs)	470 - 590 g (1.36 -1.30 lbs.)
	Limit (g-lbs)	270 g (0.60 lbs.)
Slip ring diameter	Original (mm-in)	22.7 mm (0.0894″)
	Limit (mm-in)	22.1 mm (0.871″)
Field coil resistance	ohms at 20° C (68° F)	2.8 ohms
Adjusting voltage	(V) at 5000 RPM	14.4 - 15.0 V

STARTER MOTOR SPECIFICATIONS (12 volt)

Rated voltage	12 volts
Output	2 kw
Motor type	Four-pole series wound motor
Engaging system	Magnetic shift
Rotation	Clockwise (viewed from pinion side)
Weight	Approximate 5 kg (11 lbs.)

ALTERNATOR SERVICE SPECIFICATIONS (40 amp)

Item	How Rated	Standard Or Service Limit
No Load Test	Volts (V)	11.5 V
	Current (A)	130 A Max.
	Rotating Speed (RPM)	4000 RPM Max.
Commutator	Outer dia. (mm-in.)	35 mm (1.38″)
	Service limit (mm-in.)	34 mm (1.34″)
Brush	Length (mm-in.)	15 mm (0.59″)
	Service limit (mm-in.)	9 mm (0.35″)
Brush spring	Tension (kg-lbs.)	2.7-3.6 kg (5.9-7.8 lbs.)
	Service limit (kg-lbs.)	2.2 kg (4.7 lbs.)

WIRING DIAGRAM

Figure 3-7

Figure 3-8

ADVANCED WARNING SYSTEM

ELECTRONIC INSTRUMENT CLUSTER (EIC) EARLY MODEL - SILVER FRAME

FUNCTION AND OPERATION

The skid-steer loader Electronic Instrument Cluster (EIC), 1, located in the center of the front overhead dash, 2, provides the following:

- Monitors engine and operator functions and signals operator of disruptions or faults in the circuits.
- Displays monitored functions.
- Controls engine fuel system (fuel shutoff).
- Provides engine shutdown if fault occurs in engine oil pressure or hydrostatic transmission charge pressure circuits.
- Provides safety interlock for the boom and bucket control valve spools.
- Provides a diagnostic mode for checking sensor wiring circuits.
- Provides an anti-theft mode to electrically lock the loader boom and bucket.

The EIC employs incandescent lamps to backlight symbols representing monitored functions. Active sensor symbols are backlighted with either yellow (WARNING) or red (FAULT). Inactive sensor symbols are visible as a dim gray outline when the backlighting is not active. An audible alarm accompanies most visual alarm lights.

The instrument cluster has three kinds of visual displays: backlighted symbols, an LED character display, and a segmented bar graph.

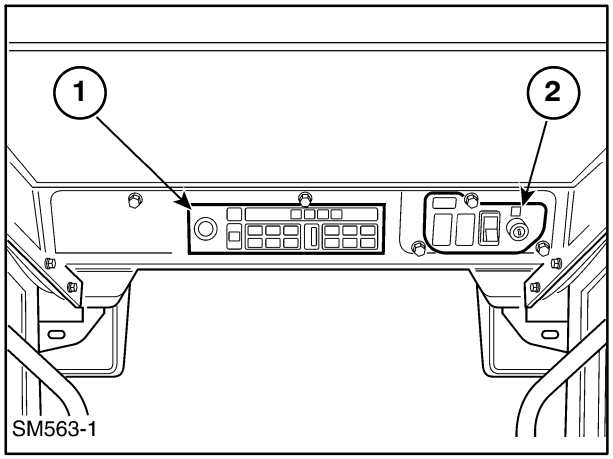


Figure 3-9

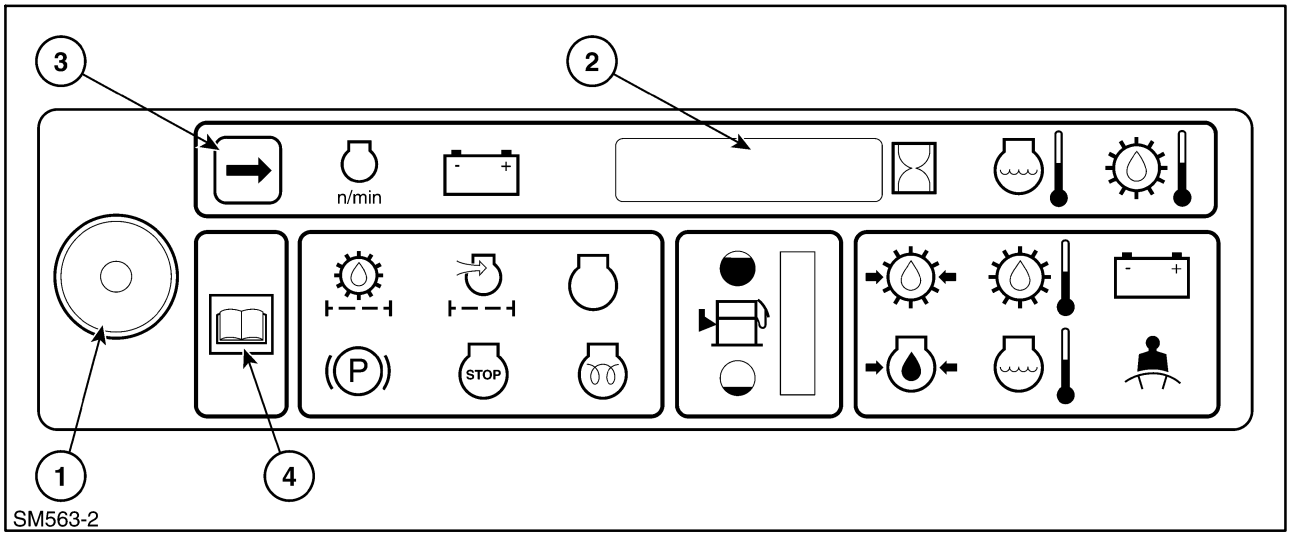


Figure 3-10

The front panel of the instrument cluster has several components and display areas. Read the following paragraphs to understand each item and area.

EIC (ELECTRONIC INSTRUMENT CLUSTER) FRONT PANEL

1 AUDIBLE ALARM

The audible alarm will sound if there is an unusual condition in any of the monitored areas.

2 CHARACTER DISPLAY

The character display will display the item that the operator has chosen to monitor. The display shows one function at a time. After the engine is started, the display defaults to the last function viewed at power off. Any of the other operating functions may be selected by the operator by briefly pressing the “ARROW” selector switch, 3. When the EIC is turned off and then powered up, the display default will be the newly selected function. The new function must be selected with the engine running for about 5 seconds before it becomes the last viewed function on the next engine start-up.

3 RIGHT ARROW DISPLAY SELECTOR SWITCH

The display selector switch, covered with an “ARROW” symbol will cause an audible “chirp” when pressed if the ignition key is in the “RUN” position. Pressing the “ARROW” symbol during operation will select the operating function that the operator chooses to monitor and will be displayed in the character display, 2. Pressing this switch also cancels any audible alarm that is sounding.

4 OPEN BOOK SELECTOR SWITCH

This selector switch, covered with the symbol of an “OPEN BOOK” (instruction manual), is used to select other functional modes of the EIC panel. The “OPEN BOOK” switch has no function during normal operation.

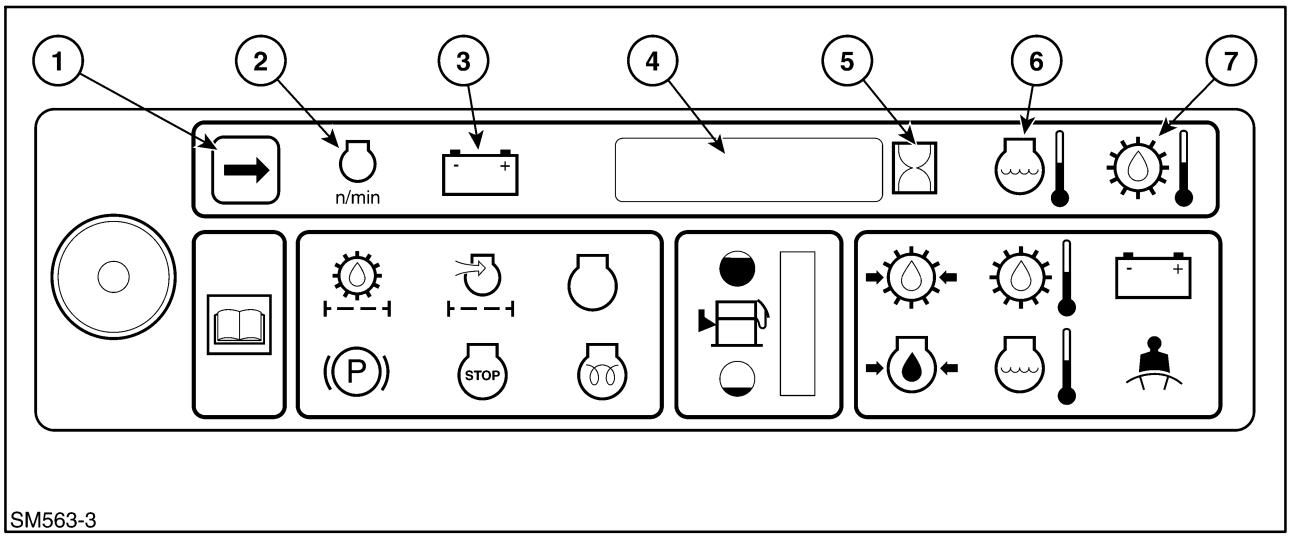


Figure 3-11

EIC FUNCTIONAL GROUPS

The EIC display panel is divided into four functional groups, 1 through 4.

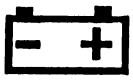
FUNCTIONAL GROUP 1

Those symbols in display group 1 backlighted white are:

1 Right arrow display selector switch.

This switch is used to change the displayed function during normal operation.

2 Loader engine RPM, displayed in increments of 10 RPM.



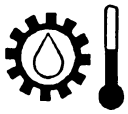
3 Battery voltage, displayed to the nearest 0.1 volt.

4 Character display.

The character display will display the chosen function or the function with the fault.

5 Engine hours, displayed to 0.1 hour (no light).

6 Engine coolant temperature displayed to the nearest degree, expressed as degrees Fahrenheit or degrees Celsius, depending on configuration (C or F). See “Operating Mode“ and “Configuration Mode” later in this section for more information.



7 Transmission/Hydraulic oil temperature to nearest degree, Fahrenheit or Celsius, depending on configuration (F or C).

NOTE: The monitored functions and symbols in group 1 are backlighted in white except the engine hours. When this function is monitored, the symbol is not lit.

NOTE: The engine coolant and hydraulic oil temperatures will show “COLD” until the systems reach 45° C (113° F) coolant and 45° C (113° F) hydraulic oil temperature. At that time the character display will start reading the temperature in Fahrenheit or Celsius degrees, depending how the EIC configuration is set. Refer to “Configuration Mode” later in this section for details.

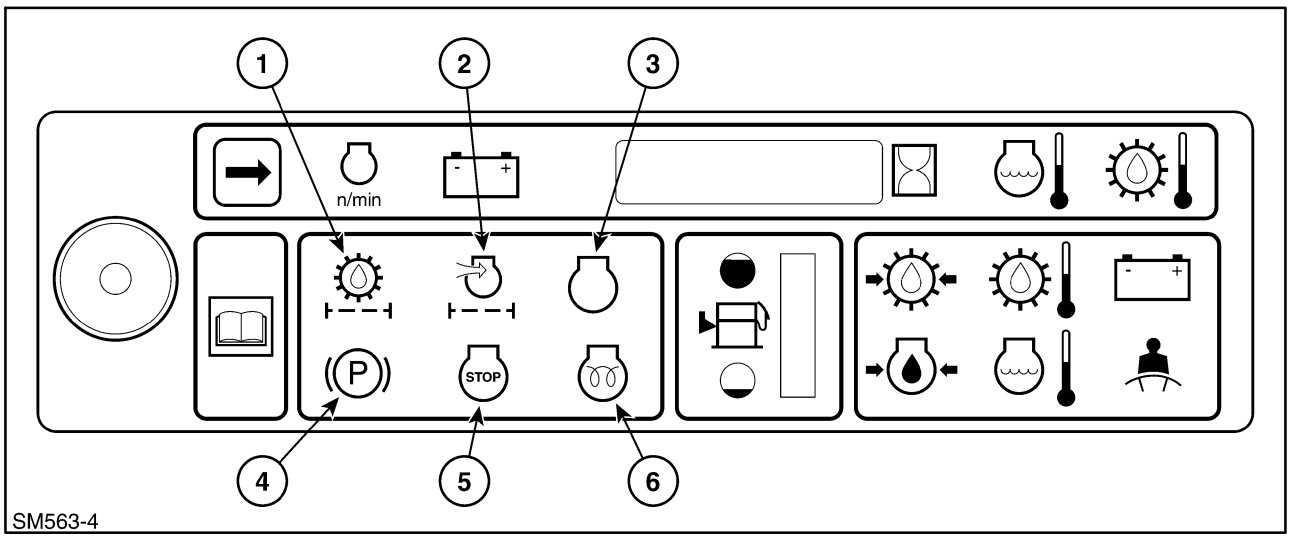


Figure 3-12

FUNCTIONAL GROUP 2

Those symbols in display group 2 backlighted yellow are:

1 Hydraulic oil filter condition.

The EIC continuously monitors the condition of the oil filter. A yellow warning lamp will signal a warning when the filter becomes dirty. The lamp will flash continuously, accompanied by a 5-second audible alarm, when the filter requires replacement.

2 Air filter condition.

When the air filter requires replacement, the lamp will flash to indicate a dirty element.

3 Blank (not used).

4 Parking brake.

Used to remind the operator to engage the parking brake when exiting the loader. An audible alarm will sound when the operator begins to exit the machine with the engine running. The parking brake is NOT electrically connected to the parking brake linkage.

5 Stop engine warning.

A fault in the engine oil pressure circuit or hydrostatic charge pressure circuit will cause this lamp to flash.

When this warning lamp flashes, stop the engine and determine the cause to prevent damage to the engine.

6 Engine preheat symbol (lights when engine is preheating).

The EIC controls a timed preheat system for starting aid.

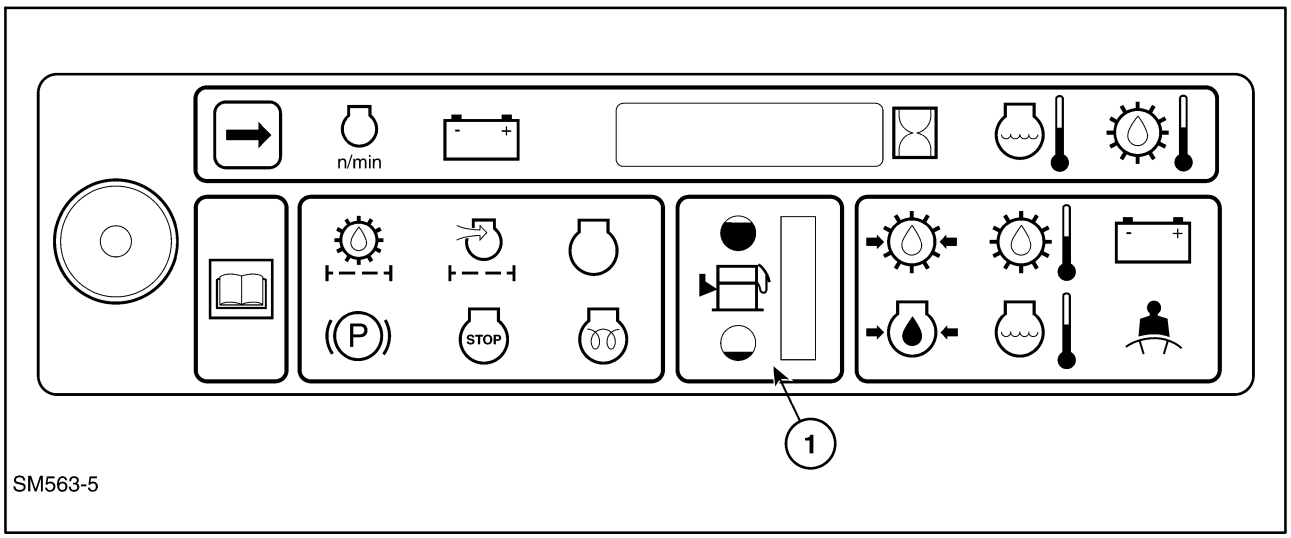
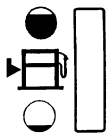


Figure 3-13

FUNCTIONAL GROUP 3

The symbol in display group 3 is:



1 Fuel gauge.

The fuel gauge is a vertical 10-segment green LED bar graph. The lowest segments will flash when the fuel level is low. An audible alarm will accompany the flashing segment for about 5 seconds.

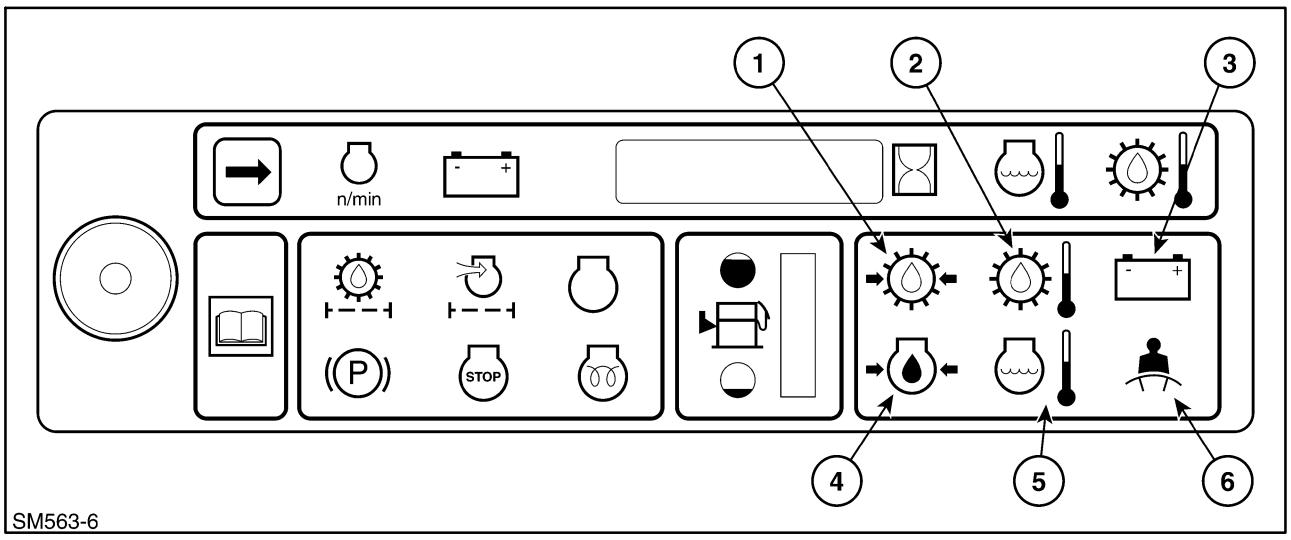


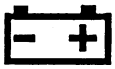
Figure 3-14

FUNCTIONAL GROUP 4

Symbols in display group 4 are backlighted red. When a fault occurs, the flashing lamp is accompanied by the audible alarm.

1 Hydrostatic transmission charge pressure. When the pressure drops below operating pressure of 3.4 bar (50 PSI), the lamp will flash with a continuous alarm. After a fault occurs for 30 seconds, the EIC will cut power to the fuel solenoid valve, stopping fuel flow to the engine and stopping the engine.

2 Transmission/hydraulic oil temperature. When the oil temperature is above normal operating temperature (99° C-210° F), the lamp will flash with a 5-second alarm.



3 Battery voltage. When battery voltage drops below normal operating voltage (11.9 V), the lamp will flash with a 5-second alarm.

4 Engine oil pressure. When the engine oil pressure drops below normal pressure (4.3 PSI or 0.3 bar), the lamp will flash with a continuous alarm. After a fault occurs for 30 seconds, the EIC will cut power to the fuel solenoid valve, stopping fuel flow to the engine and stopping the engine.

5 Coolant temperature. When the engine coolant temperature is above normal operating temperature (102° C - 216° F), the lamp will flash with a 5-second alarm.

6 Operator “FASTEN SEAT BELT” symbol. When the operator is in the seat, the lamp will flash until the seat belt is fastened.

NOTE: If during skid-steer loader operation the engine coolant or hydraulic oil temperatures show an overheat condition, the EIC will display the temperature regardless of the current monitored function. When this happens, remove load from loader operation by running the engine with NO LOAD and allow the systems to cool down to within normal operating temperature ranges. If the temperatures do not cool down, stop operating the unit, find the cause and correct it.

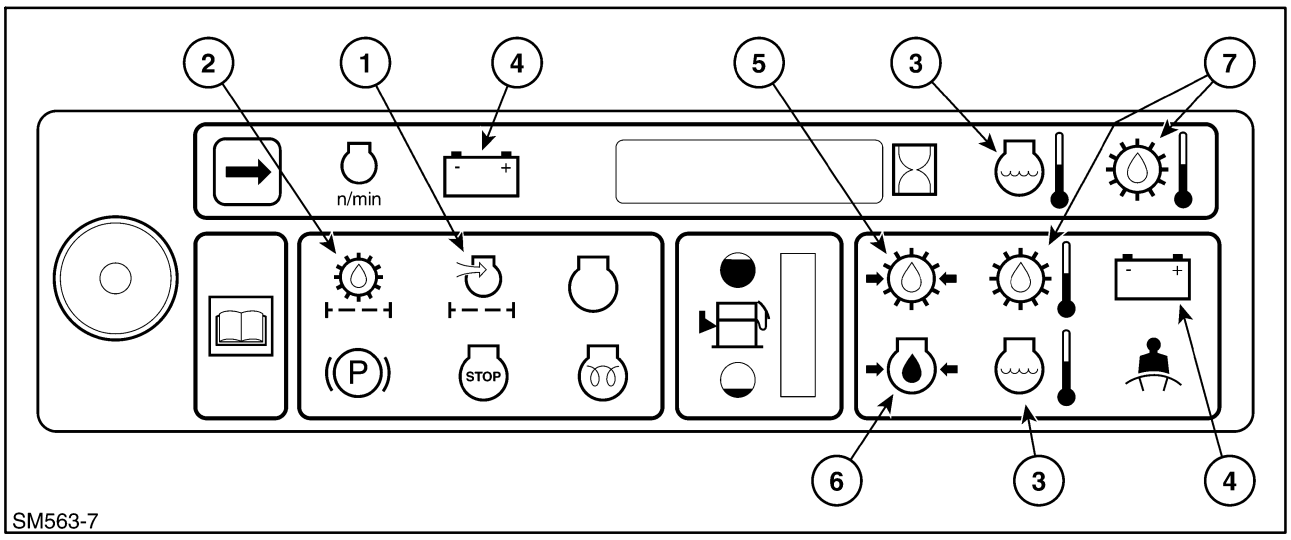


Figure 3-15

CONTINUOUSLY MONITORED ELEMENTS

The following machine elements are continuously monitored by the EIC:

1 Engine air filter.

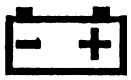
Monitors the condition of the air cleaner element and will signal when the element is dirty and requires replacement.

2 Hydraulic oil filter.

Monitors the condition of the filter and will signal when the filter is dirty and requires replacement.

3 Engine coolant temperature.

When the engine coolant temperature is above normal operating temperature (102° C-216° F), the lamp will flash with a 5-second alarm.



4 Battery Voltage.

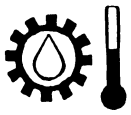
When battery voltage drops below normal operating voltage (11.9 V), the lamp will flash with a 5-second alarm.

5 Hydrostatic charge pressure.

When the pressure drops below normal operating pressure (3.4 bar or 50 PSI), the lamp will flash with a continuous alarm.

6 Engine oil pressure.

When the engine oil pressure drops below normal pressure, the lamp will flash with a continuous alarm.



7 Transmission/hydraulic oil temperature.

When the oil temperature is above operating temperature (99° C-210° F), the lamp will flash with a 5-second alarm.

Whenever the EIC senses any unusual condition in a monitored function, the associated lamp will flash. A complementary audible alarm will “beep” continuously or for 5 seconds.

If either the engine oil pressure or hydrostatic charge pressure fall below certain limits, 0.3 bar (4.3 PSI) engine oil pressure and 3.4 bar (50 PSI) hydrostatic charge pressure, the EIC will remove power from the fuel solenoid after 30 seconds, stopping the engine.

If this condition occurs, turn off the ignition key. Before unbuckling the seat belt, turn the ignition key to the on position and lower the boom and attachment to the ground or rest the boom on the boom lock pins. Turn the ignition key to the “OFF” position.

The operator may immediately restart the engine. Should the function remain faulted, power will again be removed from the fuel solenoid in another 30 seconds and the engine will again stop. During the 30-second alarm period, the “ENGINE STOP” symbol will flash. If this condition continues, locate the fault and repair or contact your New Holland dealer.

WARNING: WHEN THE ENGINE STOP SYMBOL FLASHES FOR THE 30-SECOND PERIOD, IMMEDIATELY LOWER THE BOOM AND MOVE THE LOADER TO A NON-TRAFFIC AREA FOR PROBLEM EVALUATION.

If an alarm is caused by 3, 4, or 7, the CHARACTER DISPLAY will change to show the numeric value of the function that caused the alarm.

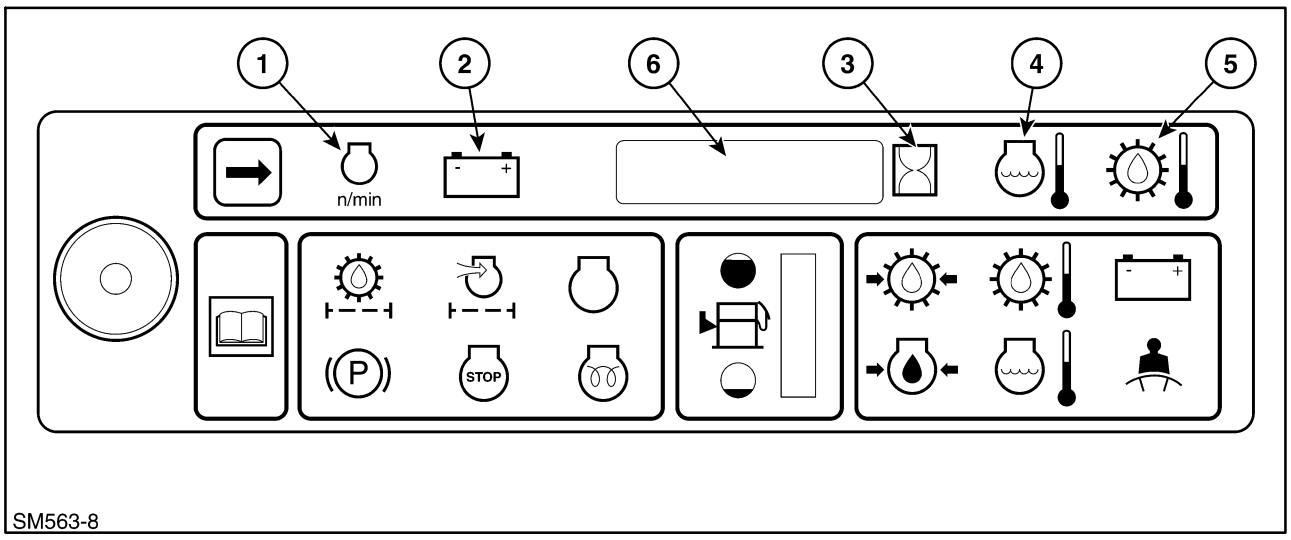


Figure 3-16

EIC MODES

The two push button switches, “ARROW” and “OPEN BOOK” located on the left end of the display panel, can be used independently or in combination to change the EIC mode.

Operating Mode

Pushing the “ARROW” switch during operation selects the function displayed in the character display, 6. You can choose one of the following functions any time during normal operation.

1. Engine RPM.
2. Battery voltage.
3. Engine hours (no backlight).
4. Engine coolant temperature.
5. Transmission oil temperature.

If a fault occurs in one of the other functions that is not being monitored, the EIC will automatically change to the function with the fault and read out in the character display.

Configuration Mode (Metric or English)

To enter the configuration mode, first put the “SERVICE-RUN” switch, 1, in the “SERVICE” position.

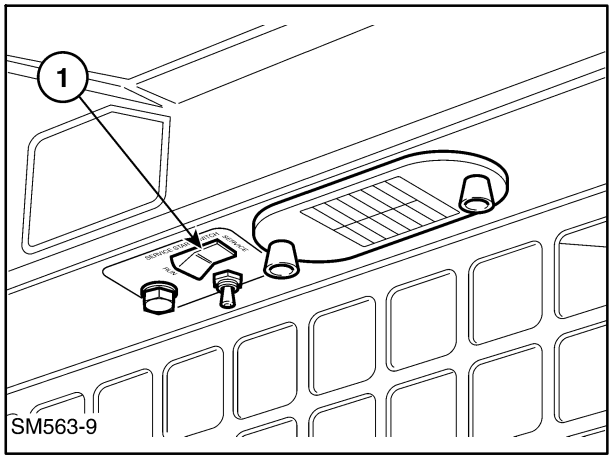


Figure 3-17

Hold down the “ARROW,” 1, and “OPEN BOOK,” 2, switches and turn the ignition key on to place the EIC in the configuration mode. Both switches must be held until the capital letter “C” appears in the left of the character display, 3. After entering configuration mode, release the switches.

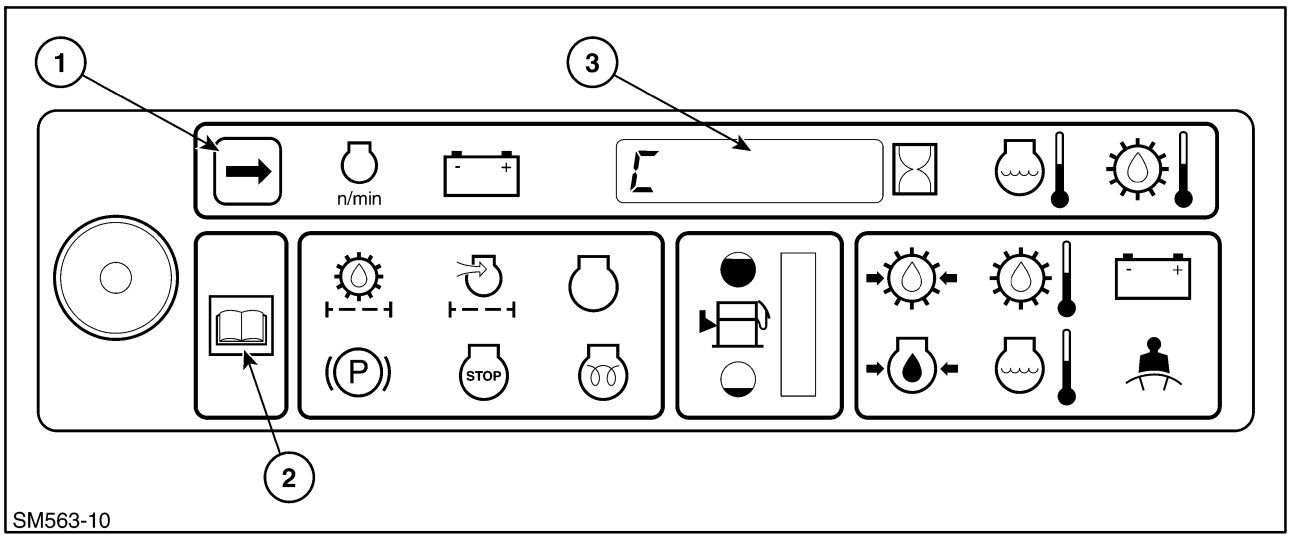


Figure 3-18

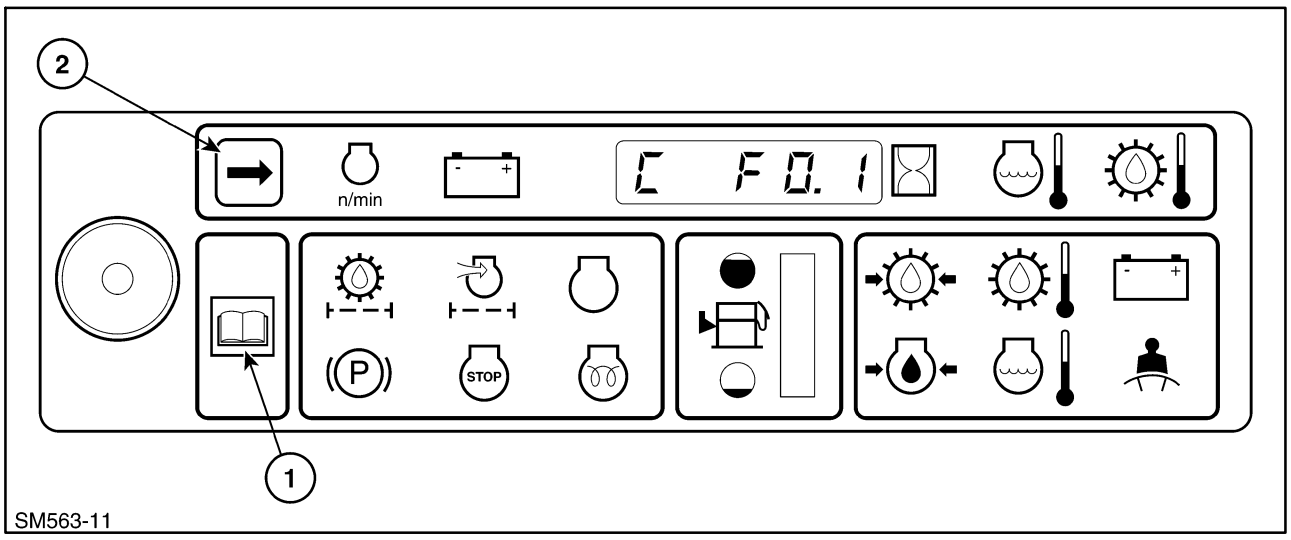


Figure 3-19

L565, Lx565, Lx665 Configuration

Select the configuration “F” 01 for English and four-cylinder diesel engine code or “C” 01 for Metric and four-cylinder diesel engine code. The “F or C” is for English or Metric and the “01” is for the four-cylinder diesel engine.

The “OPEN BOOK” switch, 1, controls the right number 0 to 9 (engine code) and the “ARROW” switch, 2, controls the letter F or C and the left number 0 to 9. Pressing the switches once changes one number.

To select the configuration desired, press the “ARROW” switch until the letter “F or C” and 0 appears, then press the “OPEN BOOK” switch until the “1,” (engine code for the four-cylinder diesel engine) appears. Example: “F 01,” English measurements will appear in the character display. Turning the ignition key off exits this mode and saves the configuration as displayed.

Return the Service-Run switch to the “RUN” position.

NOTE: If the correct engine code is not entered, the EIC will not monitor functions correctly, will give incorrect readings, and will provide incorrect preheat times for cold-weather starting.

EIC INTERLOCKS

EIC controls the fuel solenoid circuit. The operator must be in the seat with the seat belt fastened before the engine will start and continue to run.

The EIC will lock the boom and bucket control valve spools in neutral if the operator unfastens the seat belt, leaves the seat, or turns the ignition key off. If the operator is out of the seat for more than two seconds, the seat belt must be unfastened and refastened to enable the boom and bucket hydraulic systems to function. When the seat belt light, 1, flashes, it indicates the seat belt must be rebuckled to proceed with loader operation.

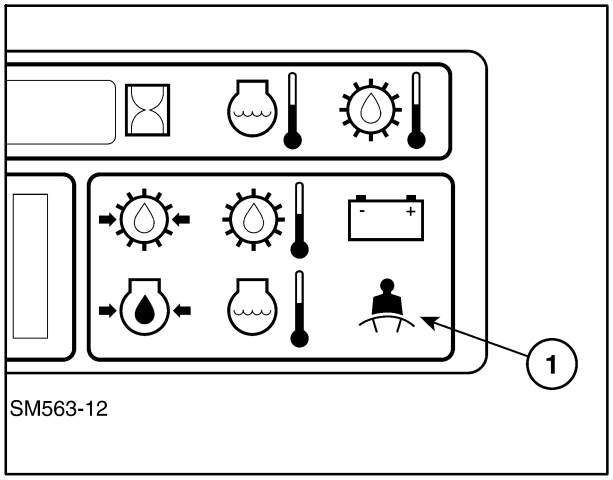


Figure 3-20

The unit is equipped with a “SERVICE/RUN” switch for use during servicing and troubleshooting of the skid-steer loader. When the “SERVICE/RUN” switch is in the “SERVICE” position, the engine will start but the boom and bucket hydraulic system will be inoperative.

IMPORTANT: Do not switch the “Service/Run” switch from “Run” to “Service“ or “Service” to “Run” with the engine running. The engine may shut down or any error 2 may occur if the switch is switched with the engine running.

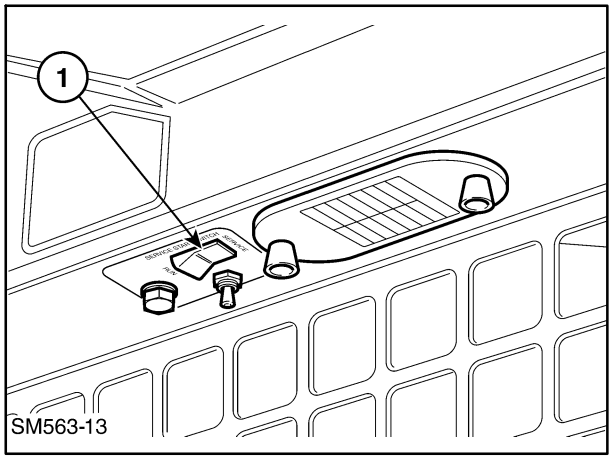


Figure 3-21

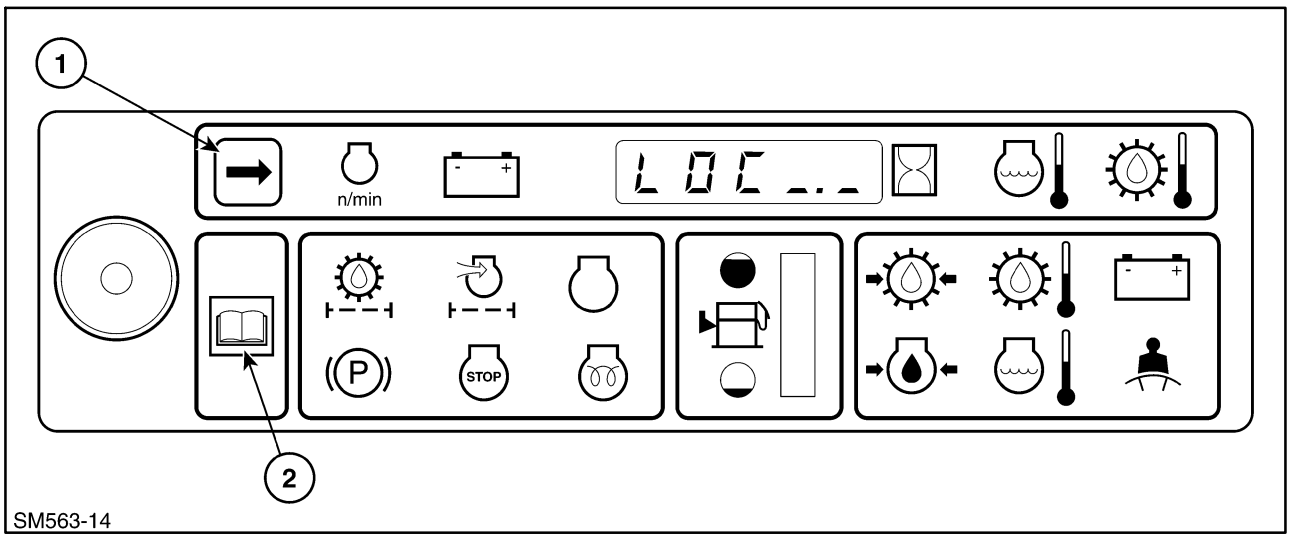


Figure 3-22

EIC LOADER SECURITY

The operator can put a two-digit code into the EIC to prevent unauthorized starting of the engine and prevent the operation of the boom and bucket by doing the following:

1. Lower the boom and bucket to the ground and position the bucket to prevent movement of the loader.
2. Turn off the ignition key.
3. Unbuckle the seat belt, raise your weight off the seat, and wait until all EIC lights are off.
4. While out of the seat, push and hold the “OPEN BOOK” switch, 2. Then sit in the seat. The display will show “LOC” for locked.
5. Release the switch.
6. Turn the ignition key to the “RUN” position; do not engage the starter.
7. Using the right “ARROW” switch, 1, and the “OPEN BOOK” symbol, 2, enter any two-digit number from 01 to 99 to lock the EIC.
8. Turn the ignition key off. The EIC will reset normally, displaying “LOC_,” indicating the loader is locked and prompting for the unlocking code. At this point the loader is locked, and the boom and bucket are inoperable.

To cancel the code:

1. Enter the loader and push and hold the “OPEN BOOK” symbol.
2. Sit in the seat. The display will indicate “LOC_” for locked; release the Open Book switch.
3. Place the ignition key in the “RUN” position, do not engage the starter.
4. Using the right “ARROW” switch and the “OPEN BOOK” switch, enter the same two-digit number used to lock the EIC for the “unlocking” code.
5. Turn the ignition key to the “OFF” position. The EIC will reset to normal operation and normal loader operation is possible.

NOTE: If the unlocking code is forgotten, the operator must contact a New Holland dealer with the skid-steer loader model and serial number for the “MASTER CODE” that will unlock the loader.

NOTE: In the security lock mode, the loader will not start and run with the Service/Run switch in the “RUN” position. However, the Service/Run switch can be switched to the “SERVICE” position and the engine will start and run. The boom and bucket will remain locked and inoperative.

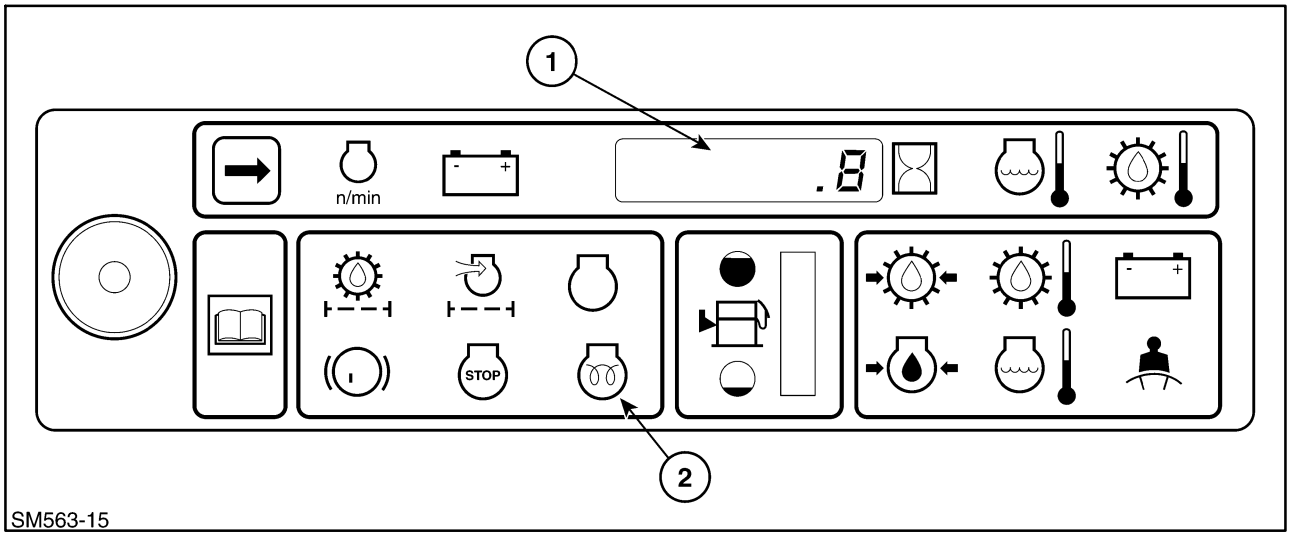


Figure 3-23

EIC ENGINE PREHEAT

The engine preheat is governed automatically by the EIC based on coolant temperature and engine code. Preheat is initiated when the ignition key is turned to the “RUN” position.

Turn the ignition key to the “RUN” position; the EIC character display, 1, will show seconds remaining for engine preheat time and preheat light, 2, will be lit. The operator should wait until the display zeros (“0”) and an audible alarm sounds to start the engine. If the loader does not start, re-cycle the engine preheat timer by turning the ignition key “OFF-ON.” If the EIC is malfunctioning, the engine can be started by putting the “SERVICE/RUN” switch in the “SERVICE” position and using the manual preheat button. Press and hold the preheat button, 2, for varying temperatures, as indicated.

5 seconds: 0° C (32° F) and above

10 seconds: 0° to -18° C (32° to 0° F)

15 seconds (MAX.): -18° C (0° F) and below

Hold the preheat button while cranking the engine for 10 seconds MAXIMUM. If the engine does not start after 10 seconds, wait 3 to 5 minutes to allow the starter to cool and then follow the procedure again.

ATTENTION: Do not hold the preheat override button for more than 15 seconds (10 seconds during cranking), or damage to the preheat system may occur.

CAUTION: DO NOT SPRAY ETHER INTO THE AIR INTAKE AT ANY TIME AS THE GLOW PLUGS ARE AUTOMATIC WHEN THE KEY SWITCH IS TURNED “ON” AND CONTINUES TO PREHEAT WHEN THE STARTER IS ENGAGED. EXPLOSION AND INJURY COULD RESULT.

TROUBLESHOOTING

ELECTRONIC INSTRUMENT CLUSTER (EIC)

PROBLEM	POSSIBLE CAUSE	CORRECTION
EIC board will not light up when operator sits in seat	Service/run switch in service position	Push switch to run position
	Faulty seat switch	Replace switch
	No battery voltage to seat switch	Blown 5-amp fuse electronic battery in engine panel, replace fuse
		Open in power wire from 5-amp fuse to seat switch, repair open in wire
		No battery voltage to 5-amp fuse from supply, check and/or replace battery
	Blown 5-amp fuse (electronic battery) in engine panel	Replace fuse
	No battery voltage from seat switch to EIC board	Open in power wire from seat switch to EIC board, repair open in wire
		Poor or no connection at EIC board, repair connection
	Battery voltage from seat switch to EIC board	If battery voltage from seat switch to board is OK, replace EIC board
EIC board backlighting is dim	Brightness variations due to production differences between models and/or EIC board changes	None -- overlay decal material variations cause differences in brightness
	Backlights dim when the loader worklights are activated	None -- EIC board circuitry automatically dims the backlighting when the work lights are on, to reduce board glare at night
EIC board seat belt light will not go off with seat belt buckled	Seat belt not buckled	Buckle seat belt
	Faulty seat belt buckle switch	Replace seat belt assembly
	No battery voltage from seat switch to seat belt switch	Open in wire from seat switch to seat belt switch, repair open
	No battery voltage from seat belt switch to EIC board	Open in wire from seat belt switch to EIC board, repair open
		Poor or no connection at EIC board, repair connection
	Battery voltage from seat belt switch to EIC board	If voltage OK, Replace EIC board

PROBLEM	POSSIBLE CAUSE	CORRECTION
EIC will not read correct engine RPMs, varies more than ± 50 RPMs	Incorrect engine configuration	Correct configuration
	No AC voltage at tachometer terminal at alternator	Repair alternator
	Loose or corroded connection at tachometer terminal at alternator	Repair connection
	No AC voltage at EIC board from alternator	Open in wire from alternator to EIC board, repair open
	AC voltage from alternator to EIC board	Repair loose or corroded connection at EIC board
	Wire connection from alternator to EIC board	If OK, replace EIC board
EIC will not unlock boom and bucket spool locks	Service/Run switch in “SERVICE” position	Push switch to “RUN” position
	Seat belt unbuckled	Buckle seat belt
	Faulty seat belt buckle	Replace seat belt assembly
	No battery voltage from seat belt switch to EIC	Open in power wire from seat belt switch, repair open
	No battery voltage from EIC to spool lock solenoids	Open in power wire from EIC to solenoids, repair open
	Battery voltage to lock solenoids	If OK, check inoperative solenoids, check solenoid coils, repair or replace

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine will not start and/or run	Seat belt unbuckled	Buckle seat belt
	Incorrect engine configuration (EIC)	Correct configuration
	No battery voltage to start relay	Open in power wire from key switch “start” to relay, or through seat/seat belt circuits to relay, repair open
	No battery voltage from EIC to fuel solenoid	Open in power wire from EIC to fuel solenoid, repair open
	Open in the W/O wire from the seat/seat belt plug to the start interlock relay	Repair open in W/O wire
	Inoperative start interlock relay	Repair or replace (order new “sealed” relay, part #86521256)
	Fuel solenoid inoperative	Repair or replace fuel solenoid
	Inoperative manifold heater system	Incorrect engine configuration, correct configuration
	No power to manifold heater	Manifold heater preheat relay or LTBL/B wire open, repair or replace
		Circuit breaker open, replace
	Inoperative manifold heater	Replace manifold heater
	No fuel to manifold heater	Check fuel feed tube and fuel supply from injection pump
EIC will not read monitored circuits	Incorrect engine configuration	Correct engine configuration
	Open or short in wire from sensor to EIC	Repair open/short
	Faulty sender or sensor	Repair/replace sender or sensor

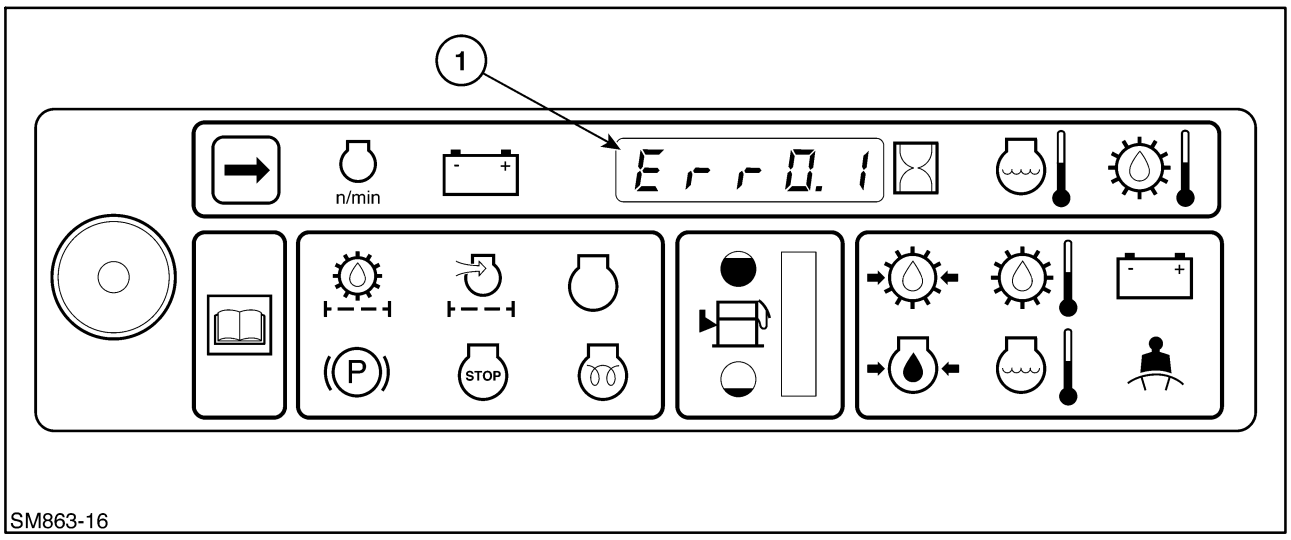


Figure 3-24

EIC ERROR MESSAGES

The EIC character display, 1, will display certain error messages when unusual conditions occur during operation. The “ERROR” messages will only occur when there is a fault in one of the controlled circuits not a monitored function. The following are the fault conditions and the associated error messages:

1. ERR01: Memory store error (engine hours may not be valid).
2. ERR02: Output circuit to the fuel solenoid has shorted/opened.

   NOTE: This will occur when the service/run switch has been moved from “SERVICE” to “RUN” position during normal operation. This is not an indication of a failure.
3. ERR03: Output circuit to the hydraulic solenoid has shorted/opened.
4. ERR04: Output circuit to the engine preheat relay has shorted/opened.

An error message is canceled by pressing the Arrow switch. The system will return to the start-up condition and the operator may then attempt to operate normally again. If an error message reappears, check the circuit for the cause of the error and repair or contact your New Holland dealer for service.

DIAGNOSTICS

When the operator first sits in the operator's seat, the EIC self tests the following:

1. EIC board bulbs
2. EIC board circuits

A software diagnostic tool is integrated within the EIC to test the following:

1. EIC board bulbs
2. EIC board circuits
3. EIC board arrow and open book switches
4. Engine air filter circuit
5. Engine oil filter circuit
6. Hydrostatic charge pressure circuit
7. Engine oil pressure circuit
8. Seat switch
9. Seat belt switch
10. Fuel gauge
11. Coolant temperature circuit
12. Transmission/hydraulic oil temperature circuit

DIAGNOSTIC MODE

To enter the diagnostic mode, use the following sequence:

1. EIC power off, ignition switch in the "Off" position, Service/Run switch in the "RUN" position, operator out of the seat.
2. Depress and hold the Open Book switch, 1.
3. Do not sit in the seat. Support your weight off the center of the seat and turn the ignition key to the "ON" position.

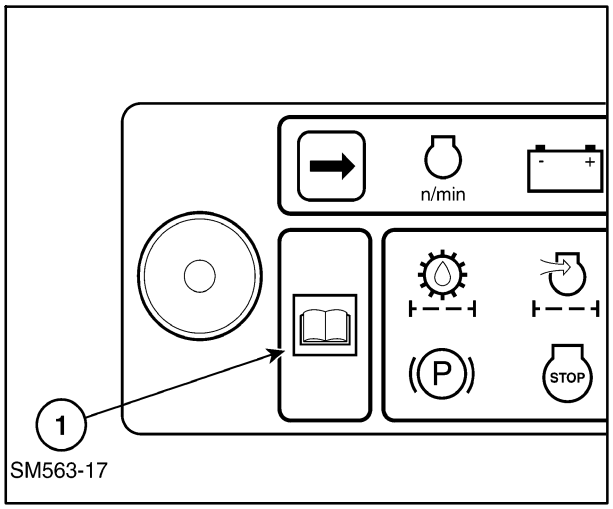


Figure 3-25

4. After the display goes out, the software release level, 1, is shown as long as the Open Book switch is held (example “r0300”). Release the switch; a lower-case “d,” 2, will appear as shown in the left-hand digit in the character display, indicating you are in the diagnostic mode.

   In this mode, all of the display segments are turned on for verification. If all segments do not light, the circuit bulb or wires may be defective. Contact your New Holland dealer for service assistance.

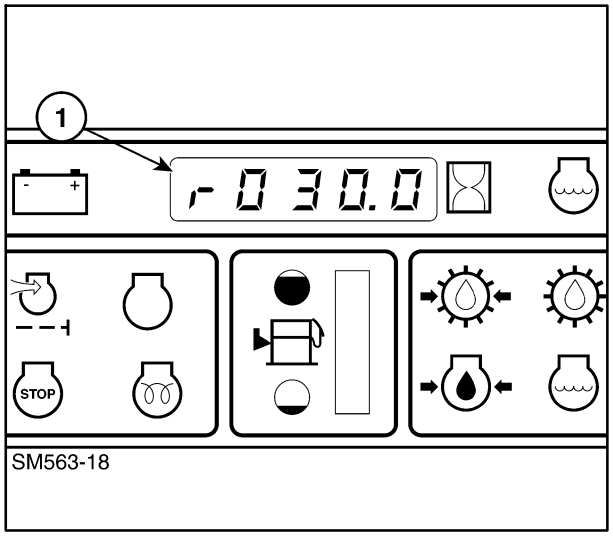


Figure 3-26

   Whenever any of the sensors or switches are toggled “ON” or “OFF,” the audible alarm will briefly “beep.” This indicates that the wire to the sensor or switch is intact, but does not yield any information about the condition of the sensor.

   To exit the diagnostic mode, simply turn the ignition key to the off position.

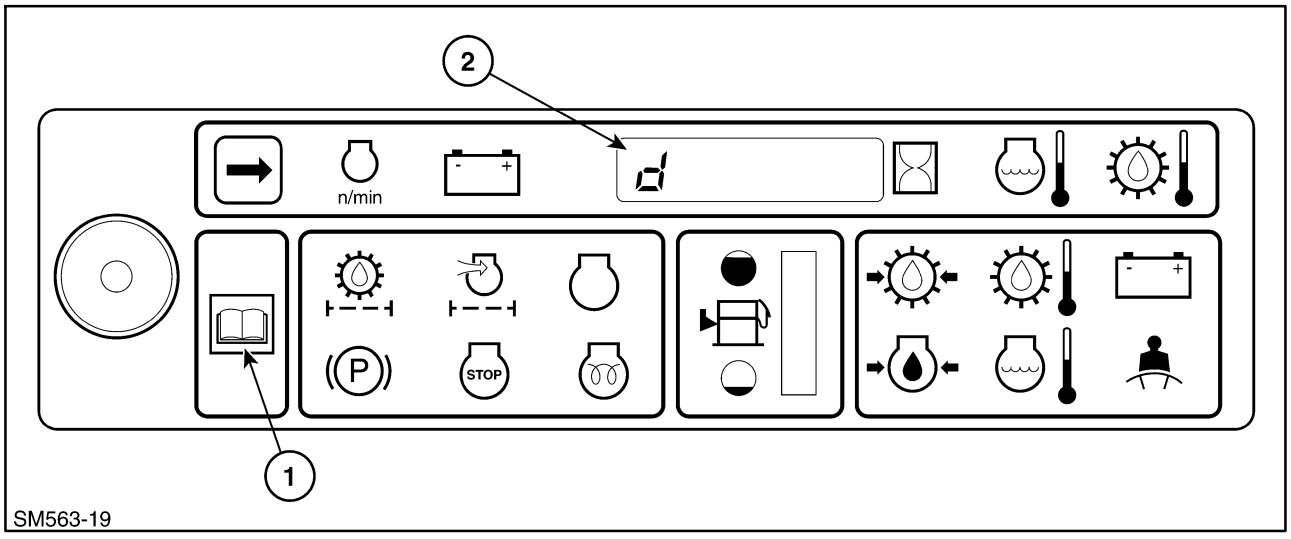


Figure 3-27

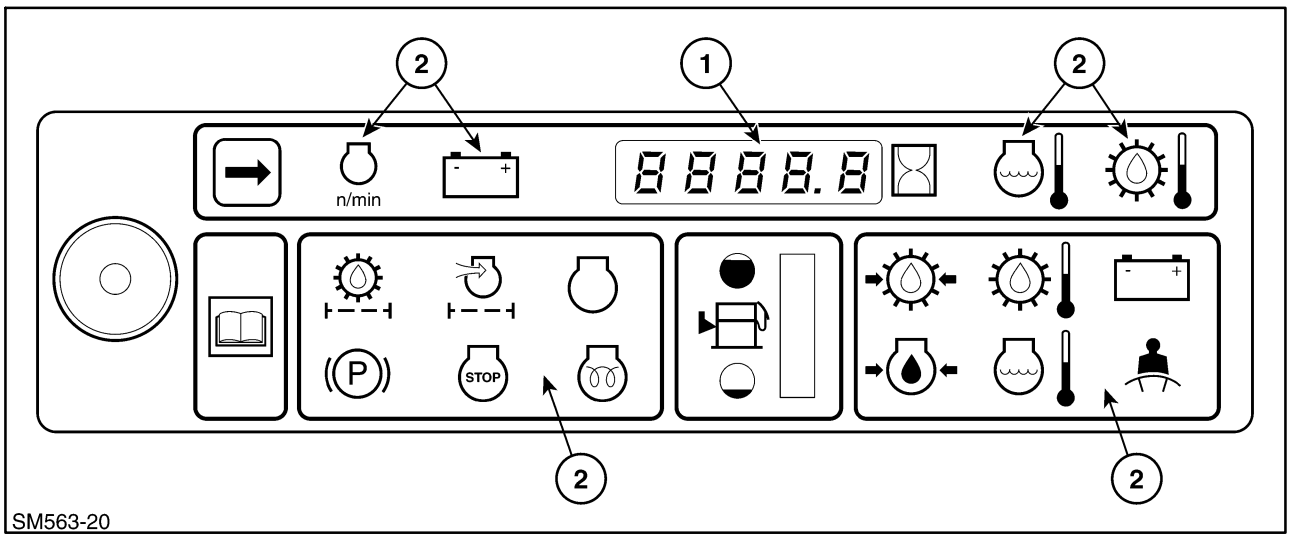


Figure 3-28

PRETESTING THE EIC (Electronic Instrument Cluster) AND CIRCUITS

1. Sit in the operator's seat.

   The EIC board will self test:

   The EIC has software integrated within itself to self test the EIC board, lights, and circuits.

   When the operator first sits in the operator's seat for three to five seconds, the EIC will self test the following:

   - EIC board bulbs
   - EIC board circuits

   If the EIC board lights all function lights and shows all eights (8888.8) in the character display, 1, the board is OK; no further testing is required. If all lights do not light or the character display does not show all eights, further testing is required.

   NOTE: There is no light behind the hour meter decal on the board.

   If the function lights, 2, are not all lit, check the bulbs; replace the bulb if blown. The EIC board must be removed and light sockets removed from the rear of the panel. If the bulbs are OK, testing the circuit with the inoperative bulb is required.

   If during the self test the character display does not show all eights (8888.8), replace the EIC board.

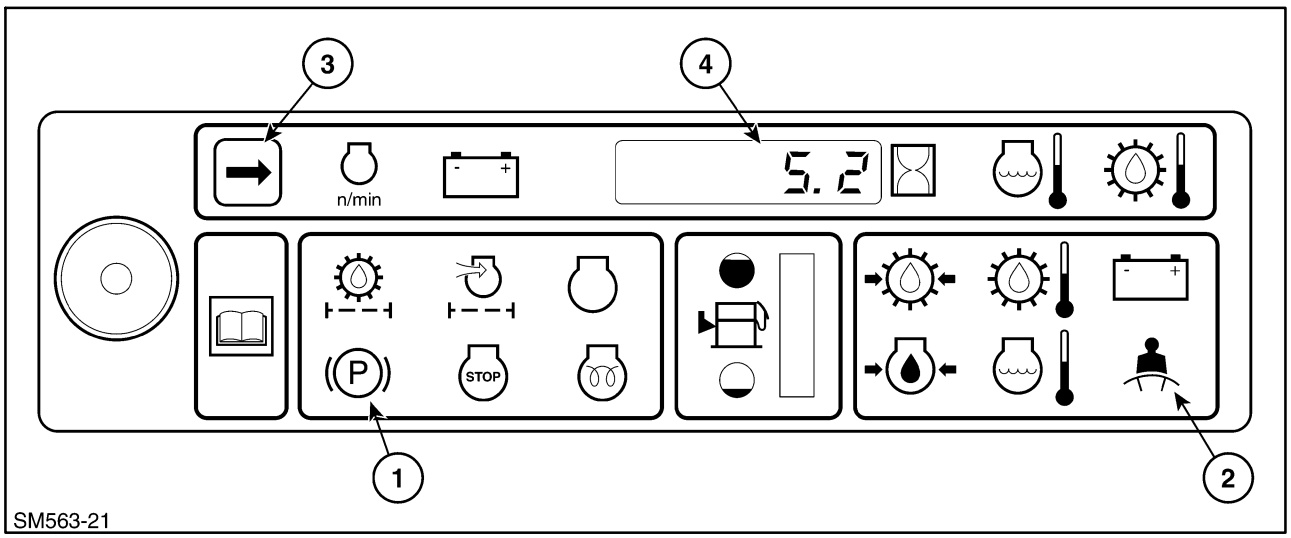


Figure 3-29

2. After the EIC board self test, the EIC board will show the last monitored function at shutdown in the character display. The park brake, 1, and fasten seat belt light, 2, will flash.
3. Buckle the seat belt. The fasten seat belt light, 2, will go off. The park brake light, 1, will continue to flash.
4. Press the “ARROW” switch, 3, to monitor battery voltage unless that was being monitored at the last shutdown. At this time there should be a voltage reading of 5.2 volts in the character display, 4.

   NOTE: The 5.2 volts is the EIC board voltage regulator output level.

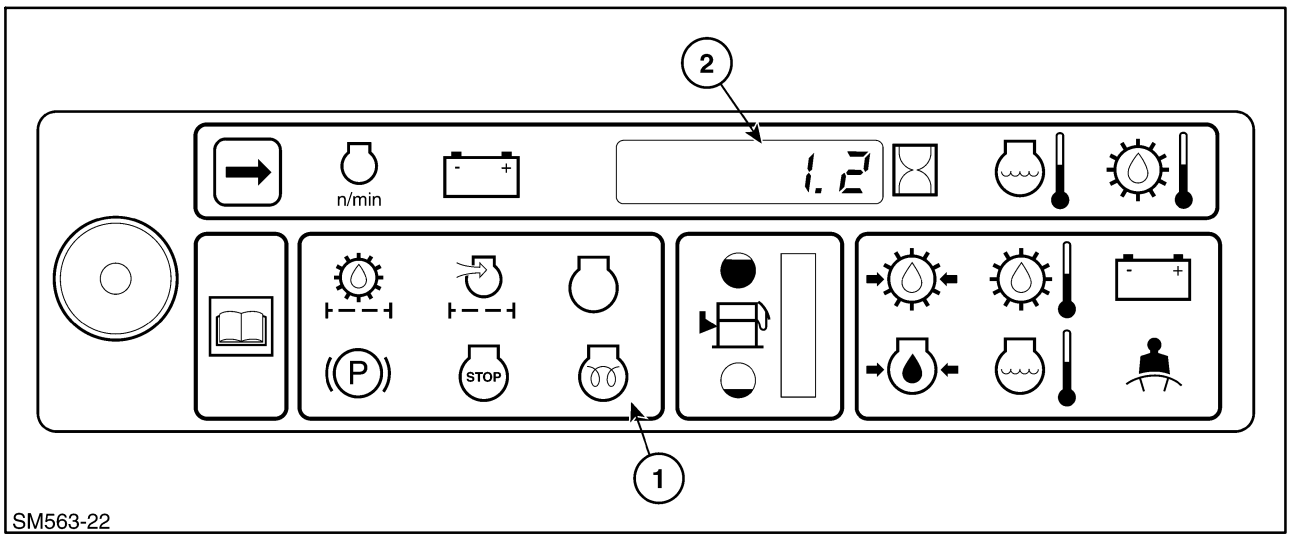


Figure 3-30

5. Turn the ignition key to the “ON” position. The park brake light should go off, and the EIC should start the timed preheat cycle. During the preheat cycle, the EIC will read the seconds remaining in the timed cycle in the character display, 2, and the preheat light, 1, will be “ON.” At the end of the timed cycle, the EIC readout reaches zero (“0”) and the EIC will beep, signaling the operator to start the unit.

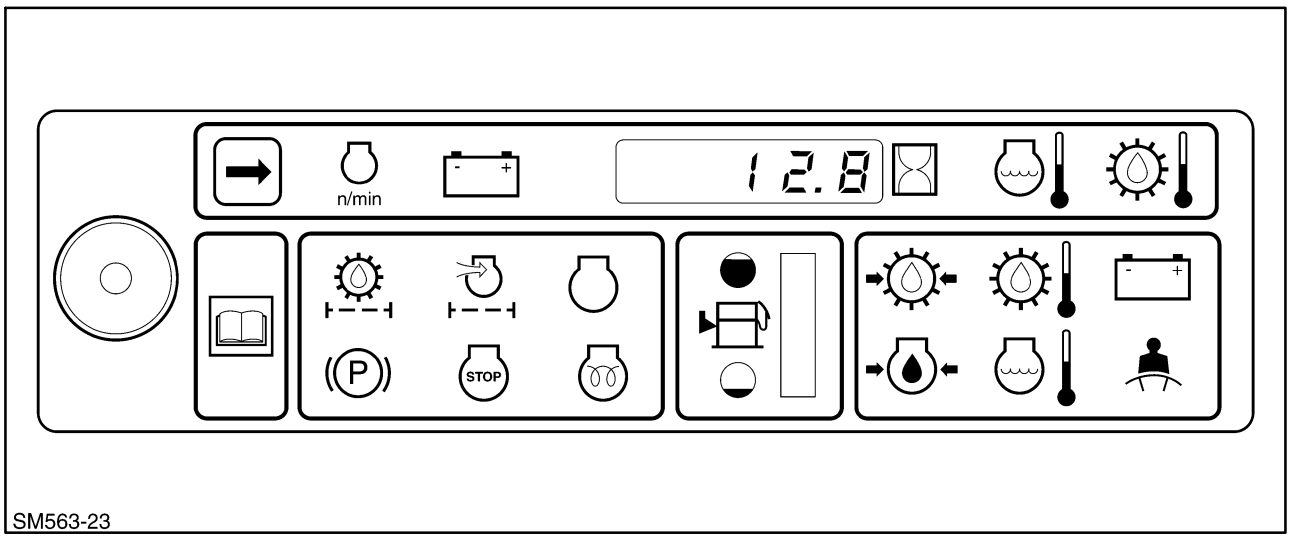


Figure 3-31

6. After the timed preheat cycle is completed, the EIC board will read battery voltage.

   NOTE: The EIC reads battery voltage, not alternator output.

   NOTE: If there is no preheat cycle, check the EIC board for the correct engine configuration setting.

7. After the timed preheat cycle is complete, turn the ignition key to the “START” position and start the loader engine.

8. After the engine is started there should only be one monitored function light on in functional group one. All other lights should be off. The function being monitored at shutdown will be the monitored function at this time.

   NOTE: There is no light behind the hour meter decal on the EIC board.

If the EIC board does not function as described in the pretesting, further testing will be required.

If the EIC board does not function as described in pretesting, check the fuses for proper operation; refer to “Blown Fuse Symptoms and Testing” later in this section.

The individual monitored circuits can be checked and tested while the EIC board is in the diagnostic mode; refer to “EIC Testing Using the Diagnostic Mode” later in this section.

ELECTRONIC INSTRUMENT CLUSTER (EIC) AND STARTER CIRCUITS:

BLOWN FUSE SYMPTOMS AND TESTING

Electronic Ignition Fuse, 1
(Cab Fuse Panel - 5A)
Service/Run Switch "Run" Position

1. Board shows self test (with operator in seat).
2. Board shows 5.2 volts.
3. Board seat belt and park brake lights will flash.
4. Board seat belt light will go off when seat belt is buckled. Park brake light will still flash.
5. Key "ON" position - board will show 5.2 volts and no preheat cycle.
6. Engine will crank but will not start.
7. Toggle Service/Run switch to "SERVICE" position - unit will start.

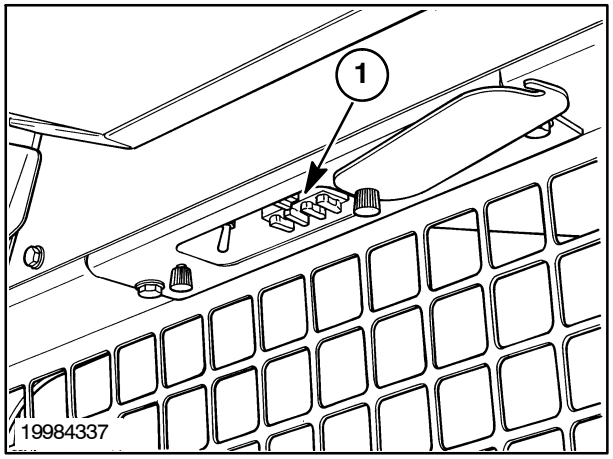


Figure 3-32

Electronic Battery Fuse, 1
(Engine Fuse Panel - 5A)
Service/Run Switch "Run" Position

1. When operator sits in seat, the board will not power up - no readings.
2. Unit will not crank.
3. Toggle Service/Run Switch to - "SERVICE" position - unit will crank and may start if engine is warm, NO preheat is available.

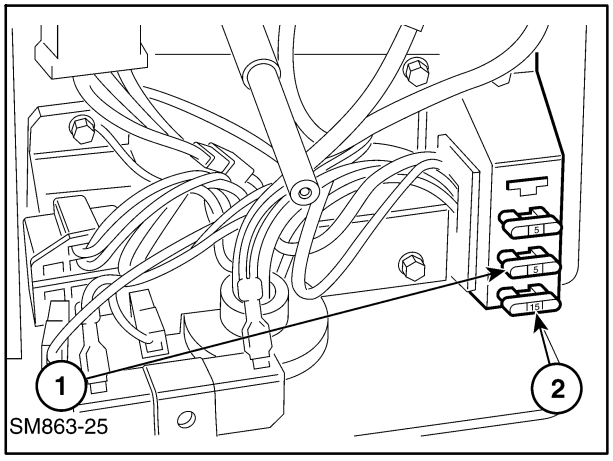


Figure 3-33

Key Main Fuse, 2
(Engine Fuse Panel - 15A)
Service/Run Switch "Run" Position

1. Board will power up and self test.
2. Board seat belt and park brake lights will flash.
3. Board seat belt light will go off when seat belt is buckled; the park brake light will still flash.
4. Key on - system dead.
5. Toggle Service/Run Switch to "SERVICE" position - system dead.

ATTENTION: If any servicing or adjustments require the battery to be disconnected, or welding is required on the skid-steer loader, disconnect the negative (-) ground cable. Failure to disconnect the battery may result in damage to the EIC (Electronic Instrument Cluster) monitoring system and other electrical components.

ATTENTION: If the EIC requires removal from the dash area or the skid-steer loader, disconnect the negative (-) ground battery cable. This will shut off power to the EIC and prevent damage to the EIC board, or prevent blowing the 5-amp fuses, if the board is accidentally grounded.

ATTENTION: Do not use magnetized tools while working around the EIC board or damage to the EIC may occur.

To test for a blown fuse, remove the fuse from the fuse block and visually examine the fuse link. If the fuse link is blown, replace the fuse.

If the fuse link appears OK, check the fuse with an ohmmeter and check for continuity across the fuse legs; if there is continuity, the fuse is OK.

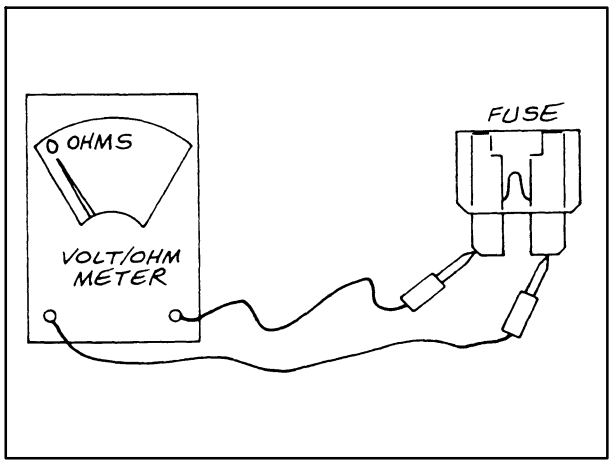


Figure 3-34

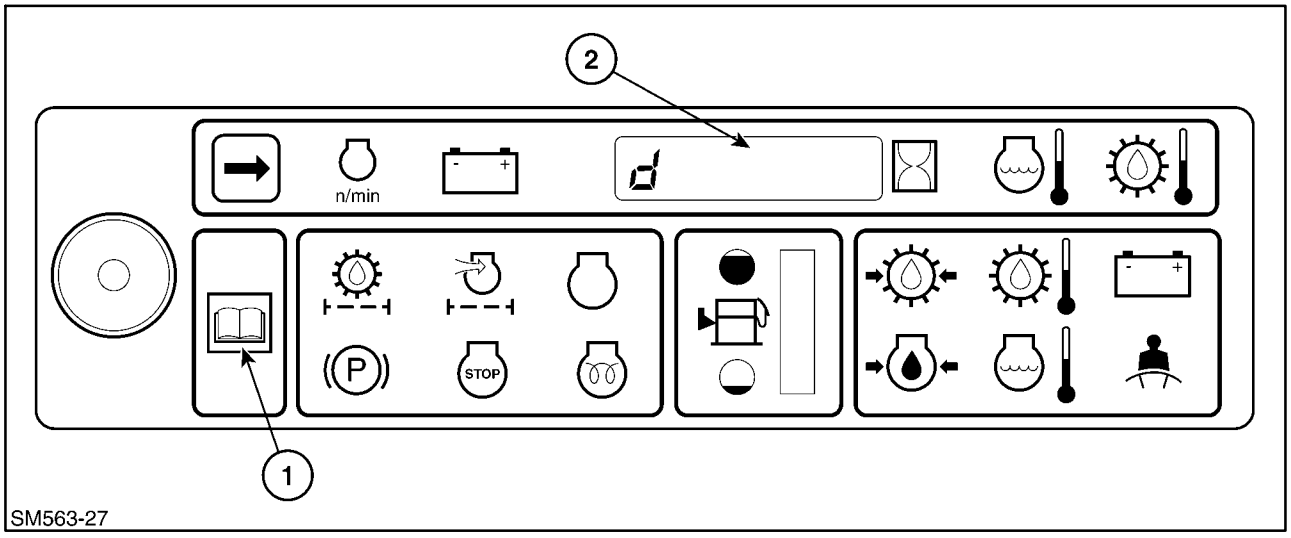


Figure 3-35

EIC TESTING USING THE DIAGNOSTIC MODE:

A software diagnostic tool is integrated within the EIC (diagnostic mode) to test the following:

1. EIC board bulbs
2. EIC board circuits
3. Engine air filter circuit
4. Engine oil filter circuit
5. Hydrostatic charge pressure circuit
6. Engine oil pressure circuit
7. Seat switch
8. Seat belt switch
9. Fuel gauge
10. Coolant temperature circuit
11. Transmission/hydraulic oil temperature circuit

When in the normal operating mode, a fault must occur for 5 seconds. This will enable the EIC to detect and display the fault signal.

DIAGNOSTIC MODE

To enter the diagnostic mode, use the following sequence:

1. EIC power off, ignition switch in the “OFF” position, Service/Run switch in the “RUN” position.
2. Depress and hold “OPEN BOOK” switch, 1.
3. Do not sit in the seat. Support your weight off the center of the seat and turn the ignition key to the “ON” position.
4. After the display goes out, the software release level is shown, example “r0300,” as long as the “OPEN BOOK” switch is held. Release the switch; a lower-case “d” will appear as shown in the left-hand digit in the character display, 2, indicating you are in the diagnostic mode.

   NOTE: The software release level is for New Holland warranty and engineering use only.

5. Sit in the seat.

   NOTE: When the seat switch is activated, the EIC will light all lights and an audible alarm will sound.

ARROW, OPEN BOOK, AND AUDIBLE ALARM TEST:

In this mode, by pressing the “ARROW” or “OPEN BOOK” switches, all of the display segments are turned on for verification and an audible beep sounds. If all segments do not light, the circuit bulb or wires to the switches, sensors or senders may be defective.

To check the individual EIC board circuits and circuits to the switches, sensors, and senders, perform the following tests.

Whenever any of the above sensors or switches are toggled on or off, the EIC board will light and the audible alarm will briefly beep. This indicates that the wire to the sensor or switch is intact, but does not yield any information about the condition of the sensor.

DIAGNOSTIC MODE EIC CIRCUIT TESTS:

To simulate a fault condition while in the diagnostic mode, do the following:

NOTE: When in the diagnostic mode and a circuit is triggered, all the board lights will light up accompanied by an audible beep.

1. Hydraulic Oil Filter Restriction Switch

Remove the DKGN/O filter sensor wire, 1, from the sender.

The EIC board lights will all light up and the board will beep when this test is performed.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wire from the sensor to the EIC board.

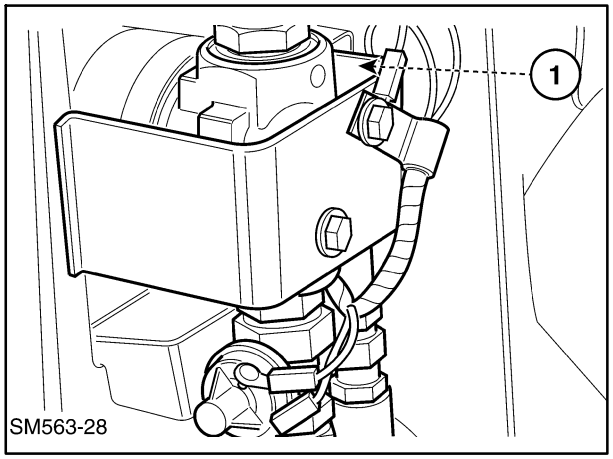


Figure 3-36

2. Air Cleaner Switch

Remove one wire at a time from the sensor switch, 1, on the air cleaner canister. Remove the B wire and the EIC board will light and beep when the wire is removed from the switch. Remove the B/Y wire, and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensors to the EIC board.

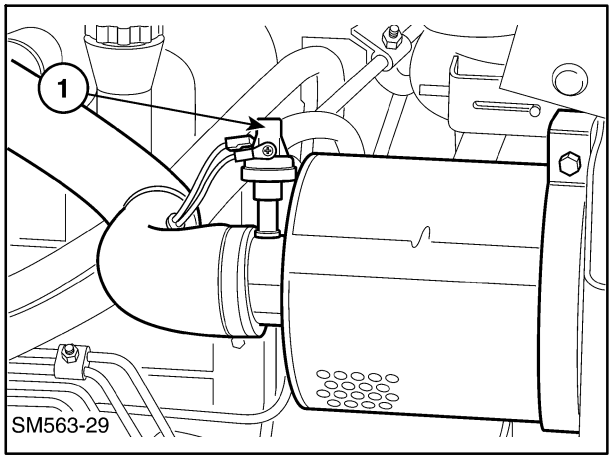


Figure 3-37

3. Hydrostatic Charge Pressure Switch

Remove one wire at a time from the sensor switch, 1, at the charge check valve. Remove the Y/GY wire and the EIC board will light and beep. Remove the B wire and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

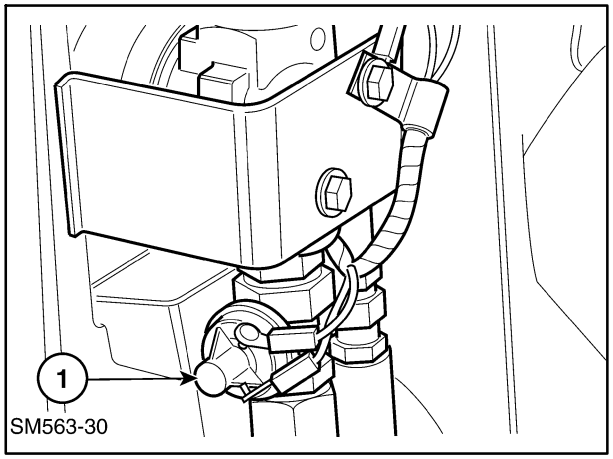


Figure 3-38

4. Engine Oil Pressure Sensor

Remove the Y/B wire from the sensor, 1, and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

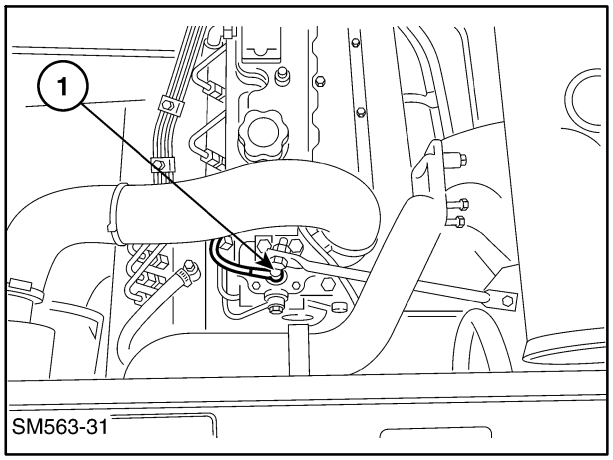


Figure 3-39

5. Coolant Temperature Sensor

Remove the PU/LTGN wire, 1, from the sensor and short the wire to ground.

The EIC board will light and beep when the wire is removed from the sender and grounded.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

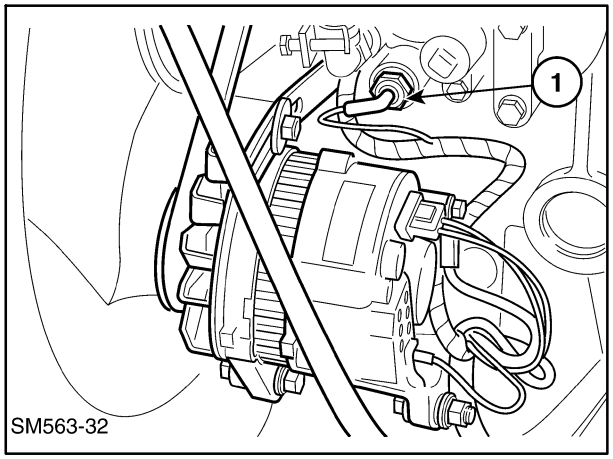


Figure 3-40

6. Transmission/Hydraulic Oil Temperature Sensor

Remove the PU/LTBL wire from the sensor, 1, and short the wire to ground.

The EIC board will light and beep when the wire is removed from the sender and grounded.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

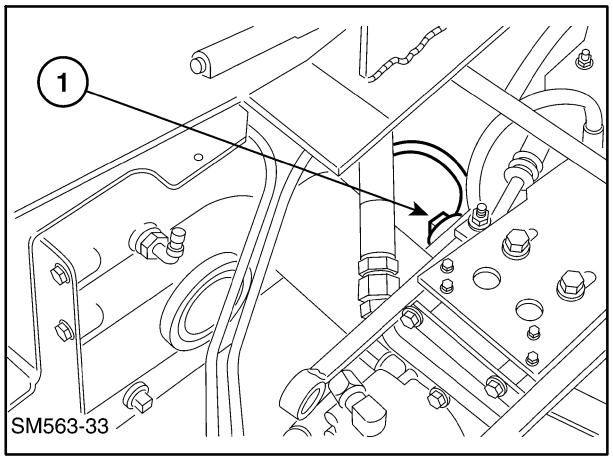
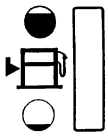


Figure 3-41

7. Fuel Gauge



Disconnect one wire, 1, and use a jumper wire and connect sender terminal to other terminal, 2, and the EIC board will light and beep. If the EIC board lights and beeps, the EIC and circuit wires to the sender are OK. If the EIC board fails to light, check the wires to the EIC board.

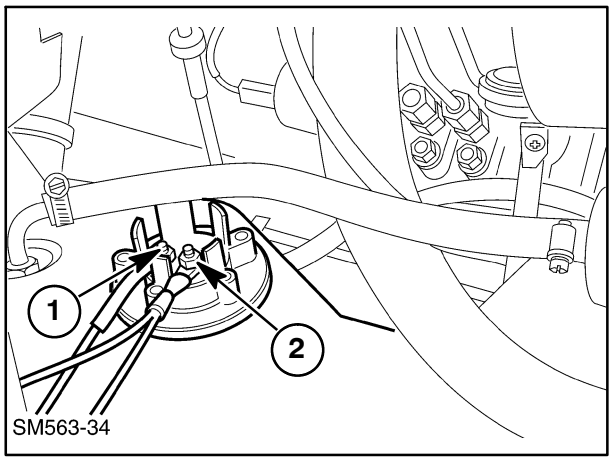


Figure 3-42

8. Seat Switch and Circuit

   Raise your weight off the center of the seat. The EIC board will light and beep. If the board lights and beeps, the switch and circuit are OK. If the board fails to light and beep, check the seat switch and circuit to the seat switch for battery voltage. If there is battery voltage to the switch, check the switch for operation and the circuit from the switch to the EIC board. If there is no battery voltage to the switch, check the circuit to the switch.

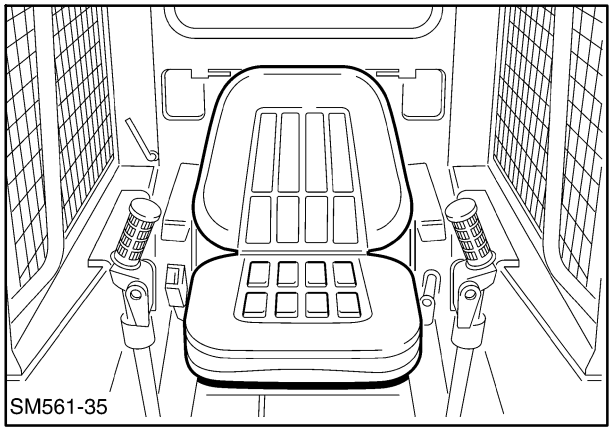


Figure 3-43

9. Seat Belt Switch and Circuit

   The operator must be sitting in the seat.

   Unbuckle the seat belt. The EIC board will light and beep. If the board lights and beeps, the switch and circuit are OK. If the board fails to light and beep, check the seat belt switch and circuit from the seat switch for battery voltage. If there is battery voltage to the switch, check the switch for operation and the circuit from the seat belt switch to the EIC board. If there is no battery voltage from the seat switch, check the seat switch for operation and the wire to the seat belt switch.

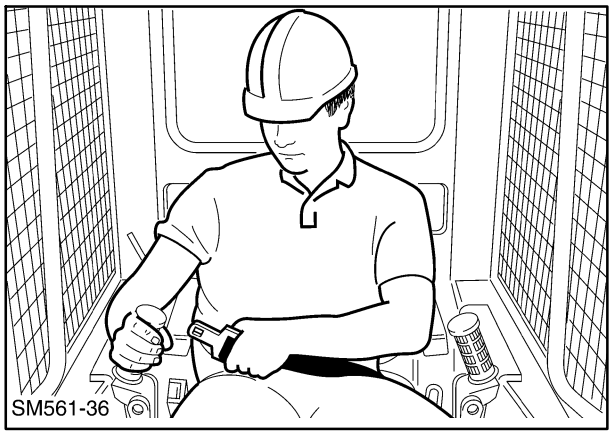


Figure 3-44

To exit the diagnostic mode, simply turn the ignition key to the “OFF” position.

TESTING OTHER EIC FUNCTIONS

NOTE: These tests are performed with the EIC in the normal operating mode and the "SERVICE/RUN" switch in the "RUN" position.

1. Parking Brake Light

Sit in the seat with the seat belt buckled. After the EIC board self test, the parking brake light, 1, should flash. Turn the ignition key to the "ON" position and the light should go off. If the light fails to go off, check the 5-amp fuse in the cab fuse panel.

When exiting the loader, the light should flash for about 2 seconds after the seat belt is unbuckled and the operator is out of the seat.

If the light does not flash when the seat belt is unbuckled, check operation of the seat belt switch and the seat switch.

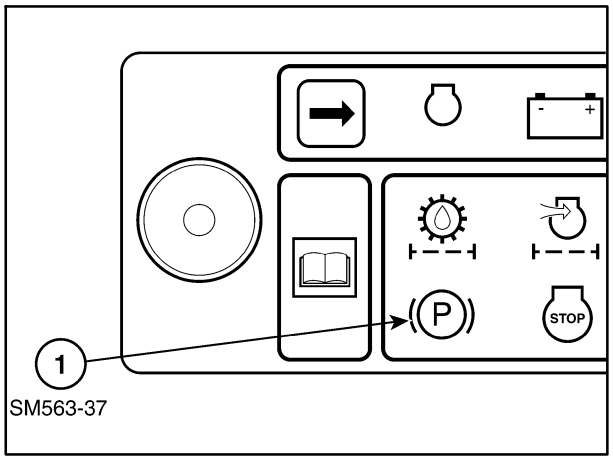


Figure 3-45

2. Seat Belt Light

Sit in the seat. After the EIC board self tests, the seat belt light, 1, will flash until the seat belt is buckled.

If the light continues to flash after the seat belt is buckled, check operation of the seat belt switch.

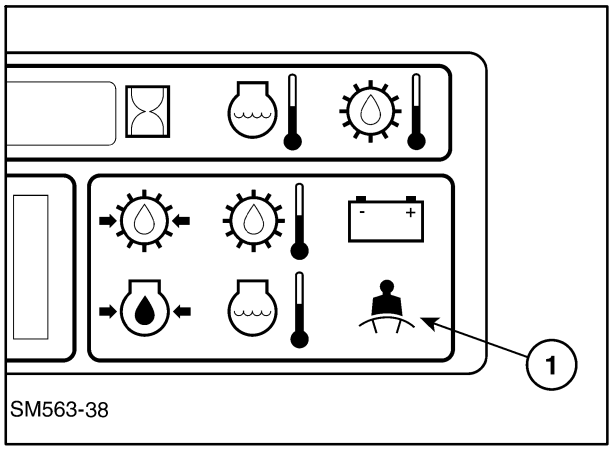


Figure 3-46

3. Boom and Bucket Spool Locks, 1
   (Control valve spools in neutral and boom and bucket resting on the ground)

   a. Sit in the seat. After the EIC board self tests, turn the ignition switch to the “ON” position. The boom and bucket controls should not move. If OK, go to the next step. If the controls can be moved, check the solenoids for operation and check the control linkage and valve spool centering for binding causing the spools not to center to the neutral position.

   b. Sit in the seat, buckle the seat belt and try moving the boom and bucket controls. The controls should not move. If OK, go to the next step. If the controls can be moved, check the solenoids for operation and check the control linkage and valve spool centering for binding causing the spools not to center to the neutral position.

   c. Sit in the seat, buckle the seat belt, and turn the ignition switch to the “ON” position. If the controls move allowing boom and bucket operation, go to the next step. If the controls do not move, check the solenoids for operation and for battery voltage at the solenoids.

   d. Sit in the seat, buckle the seat belt, and turn the ignition switch to the “ON” position. Move the controls and return the controls to the centered (neutral) position. Unbuckle the seat belt. Try moving the controls; they should be locked. Rebuckle the seat belt; the controls should move allowing boom and bucket movement.

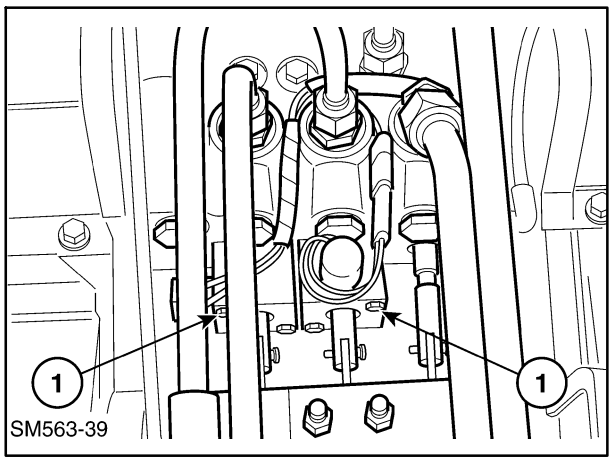


Figure 3-47

4. Boom and Bucket Spool Lock Solenoid Test

(Voltage Test)

To perform the following test, the operator must be sitting in the seat, seat belt buckled, and the ignition “key” switch in the “RUN” position.

a. Unplug one solenoid at a time and check for battery voltage at the main wire harness connector, 1, between the PK/LTBL wire side of the connector and the B wire side of the connector. If there is battery voltage, proceed to checking solenoid resistance.

b. If there is no battery voltage between the PK/LTBL wire and the B wire, check for battery voltage between the PK/LTBL wire and frame ground. If there is battery voltage, check the “B” ground wire of the solenoid circuit for open circuit. If there is no battery voltage, check the PK/LTBL power wire for an open circuit.

(Ohms Test)

With the ignition “key” switch in the “OFF” position:

a. Unplug one solenoid at a time, 1, and check ohms resistance of the solenoid coils, 15 to 18 ohm range.

b. If solenoid coils are not within the ohms resistance range, 15 to 18 ohms, replace the solenoid coil.

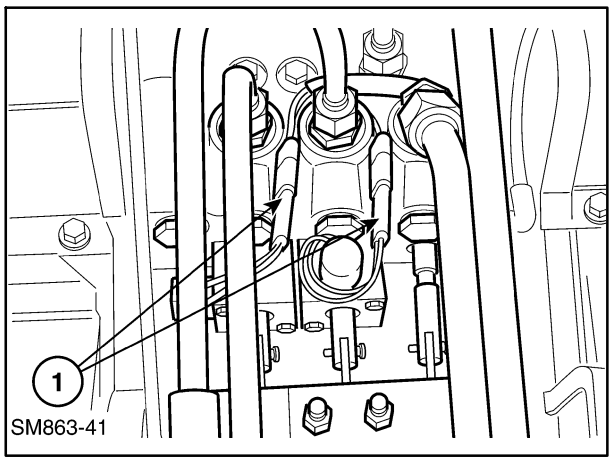


Figure 3-48

EIC CONTROLLED FUNCTIONS

The EIC monitors several engine and operator functions and controls other functions. The controlled functions are:

1. Engine hour meter.
2. Fuel solenoid.
3. Boom and bucket control valve spool locks.
4. Engine preheat system.

EIC ERROR MESSAGES

The EIC character display will display certain error messages when unusual conditions occur during operation. The following are the fault conditions and the associated error messages:

1. ERR01: Memory store error (Engine hours may not be valid).
2. ERR02: Output circuit to the fuel solenoid has shorted/opened.
3. ERR03: Output circuit to the hydraulic solenoid has shorted/opened.
4. ERR04: Output circuit to the engine preheat relay has shorted/opened.

An error message can be cancelled by pressing the “ARROW” switch. The system will return to the start-up condition, and the operator may then attempt to operate normally again. If an error message appears again, check the circuit for the cause of the error and repair or contact a New Holland dealer for service.

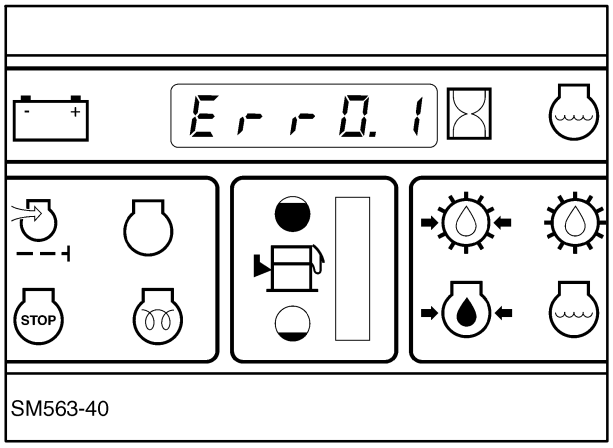


Figure 3-49

TESTING THE ERROR MESSAGE AND CONTROLLED CIRCUITS

Pretest Conditions:

1. The engine “OFF.”
2. Service/Run switch in “RUN” position.
3. Operator sitting in the seat and seat belt buckled when testing ERRO3.

ERRO1 - NOT REQUIRED TO TEST.

ERRO2 - Unplug the fuel solenoid wire at the solenoid and turn the ignition switch to the “ON” position; ERRO2 should appear in the EIC character display.

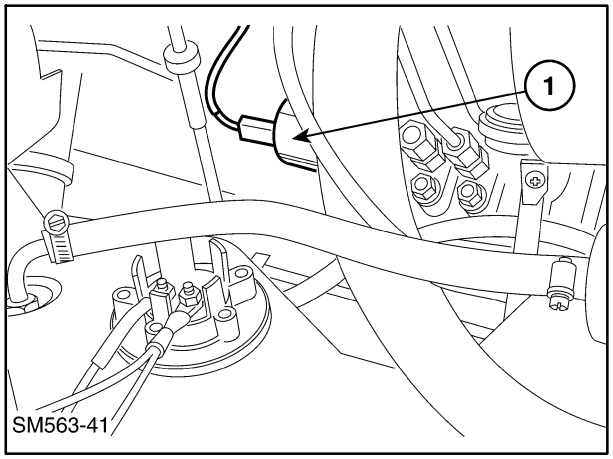


Figure 3-50

ERRO3 - Unplug both the boom and bucket solenoid valves and turn the ignition switch to the “ON” position; ERRO3 should appear in the EIC character display.

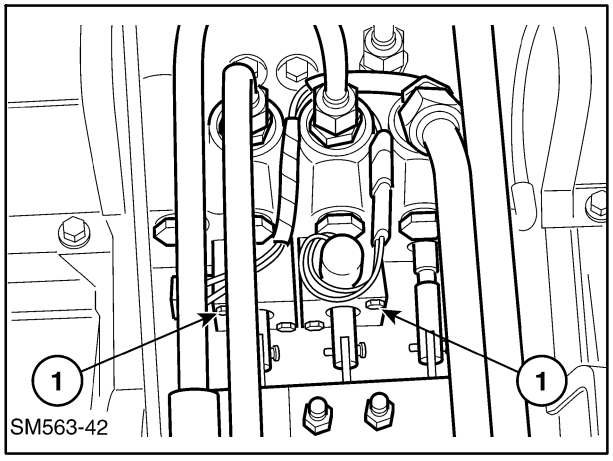


Figure 3-51

ERRO4 - Press and hold the override preheat button, 1, and turn the ignition switch, 2, to the “ON” position; ERRO4 should appear in the EIC character display.

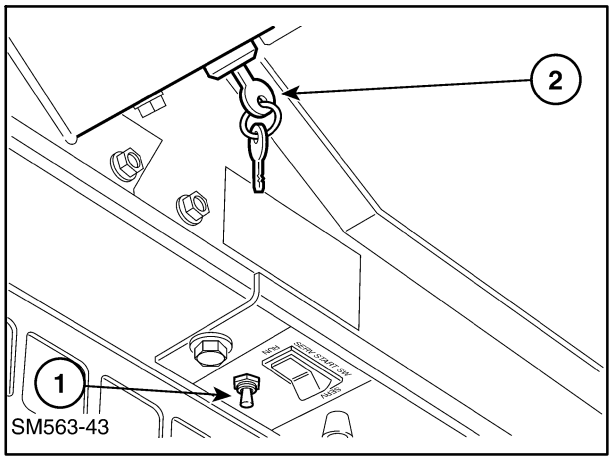


Figure 3-52

PROGRAMMING ENGINE HOURS INTO THE EIC BOARD

To program engine hours into a newly installed EIC board, follow these steps:

IMPORTANT: This information is for dealer technicians only, not to be given to customers.

1. Enter the loader and toggle Service/Run switch, 1, to the “SERVICE” position, while sitting in the operator’s seat. Allow the EIC board lights to all go out and then proceed.
2. Enter the Configuration Mode, as follows, to reprogram the engine hours:
   a. Turn the ignition key switch to the “RUN” position. At this time, the EIC board will completely light up for about 3 seconds.
   b. Push and hold the ARROW and OPEN BOOK switches firmly within the first 3 seconds of turning the ignition switch to the “ON” position.
   c. A capital “C” will appear in the left side of the character display.

      NOTE: If the switches are not pushed within 3 seconds, you will not be able to enter the configuration mode.

   d. Release both switches after the capital “C” appears.
   e. By pressing the ARROW and OPEN BOOK switches, enter code “F99”.
   f. Turn the ignition key switch to the “OFF” position.
   g. Push and hold the ARROW switch firmly.
   h. Turn the ignition switch to the “ON” position. Release the ARROW switch when a capital “H” appears in the character display.
   i. Press the ARROW switch to select the digit to be changed.

      NOTE: The digit that was selected to be changed will be flashing.

   j. Press the OPEN BOOK switch to change the digit to the desired number. After the first number is changed, use the ARROW switch to more to the next digit. Again, use the OPEN BOOK switch to change this number. Repeat this process until the engine hours are corrected.
   k. After the hours are set, turn the ignition key to the “OFF” position. This will put the corrected hours into the EIC memory.
3. Start the loader and operate. Press the ARROW switch and select the hourmeter. Check the hour reading for the corrected setting.

   ATTENTION: This hour reprogramming procedure is for DEALERSHIP PERSONNEL USE ONLY. DO NOT GIVE THIS INFORMATION TO CUSTOMERS.

If a customer wants the hour meter reprogrammed or purchases a new EIC board, remember to check and set the Engine Code/Configuration for the model loader. At that time, the Service Technician can reprogram the engine hours to the previous level of the EIC board being removed.

This reprogramming information is not found in the respective operator’s manuals or service manuals. It is supplied to dealer personnel for their use only.

EIC BOARD READING ACCURACY

EIC board readings for the digital display, including RPM, Battery Voltage, Hourmeter, Engine Coolant Temperature, or Hydraulic Oil Temperature may not be accurate or may have no reading when selected.

Complaints usually follow installation of an optional kit or customer-installed option, or complaints can arise after a machine repair such as engine overhaul or cab tilting. However, occasionally a concern on a standard machine with no modifications is reported.

If the EIC board was operating correctly before any repair or kit installation occurred, the possible cause may be improper electrical system grounding. If working on a new machine, grounding points should be checked before any replacement of components is considered.

THE ONLY ACCEPTABLE GROUND POINTS IN THE CAB AREA ARE TO THE GROUND STUD ON THE ROPS RIGHT SIDE NEAR ELECTRICAL PANEL, 1, OR TO THE AUXILIARY POWER KIT SOCKET WHICH IS WIRED TO THE BELL HOUSING GROUND. NO ACCESSORIES MAY BE GROUNDED TO THE CAB INTERLINER ON THESE SKID-STEER LOADERS BECAUSE SOME OR ALL OF THE CURRENT COULD PASS THROUGH THE EIC.

NOTE: When attaching ground wires to the cab ground stud, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to wire size, largest on the bottom and smallest last.

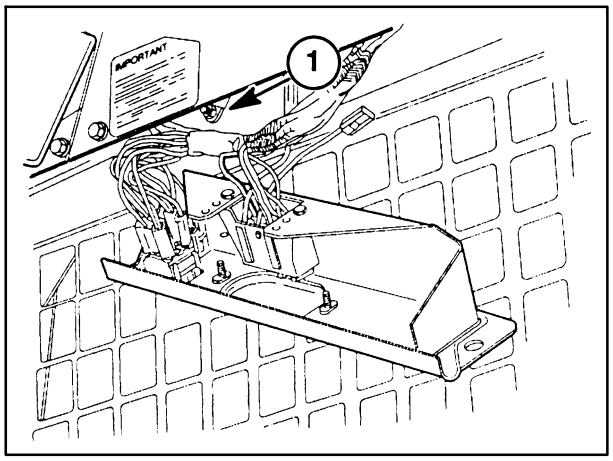


Figure 3-53

All grounding locations should be checked for tight hardware and absence of paint between parts for good connecting, as follows:

1. Check the grounding strap from the engine to main frame, 1.
2. Check the wiring harness from the EIC to the bell housing.

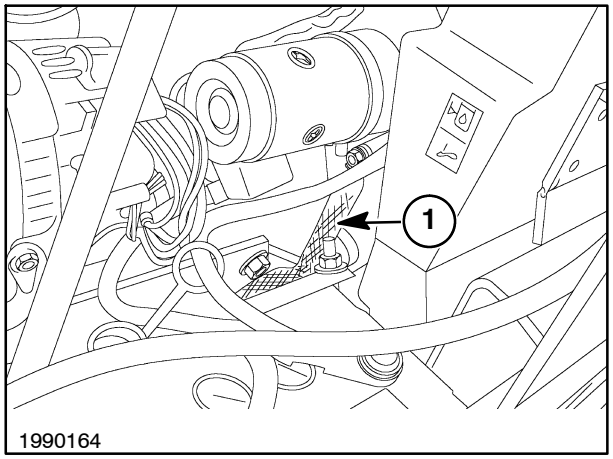


Figure 3-54

3. Check the grounding strap from the cab ROPS structure to main frame, 1.

   On the grounding strap from the ROPS to the main frame, be sure the strap is attached between the ROPS and the main frame (yellow lower frame). DO NOT attach the strap between the cab interliner (cab side screen sections) and the main frame, as the cab interliner on these skid-steer loaders is rubber-mounted to the ROPS and, therefore, insulated from the ROPS. However, a second strap may be added between the cab interliner and the main frame and should cause no ill effect.

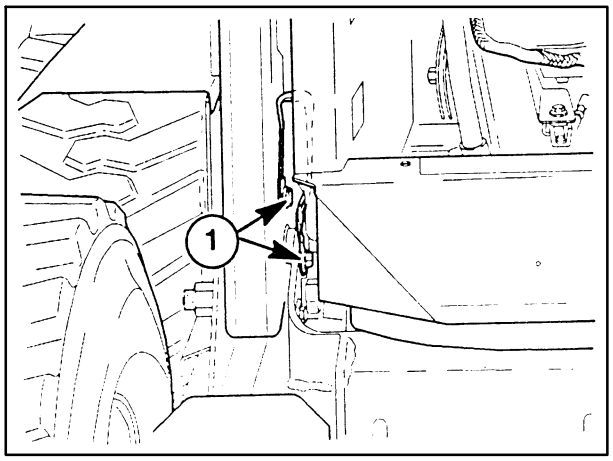


Figure 3-55

4. Check the wiring harness grounds to the bell housing, 1.

   NOTE: When attaching multiple ground wires, always place the heaviest ground wire (battery ground cable) next to the ground surface (bell housing). Stack the remaining ground wires according to wire size, largest on the bottom and smallest last. Two wires in a terminal are considered to be larger than a single wire of the same size.

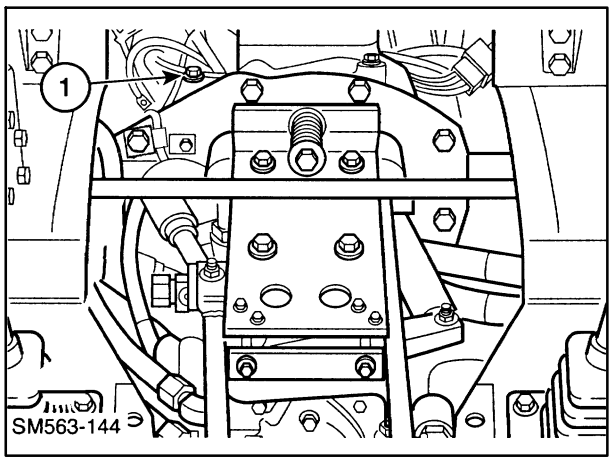


Figure 3-56

EIC BOARD CLAIMS WARRANTY

When filing a warranty claim for a defective EIC (Electronic Instrument Cluster) board, include the part number and serial number on the white tag of the defective board.

The EIC board part number, 1, and this number must be used as the causal part number.

Also include the EIC board serial number located at 2, in the description of failure section of the warranty claim, along with a description of the type of EIC board failure.

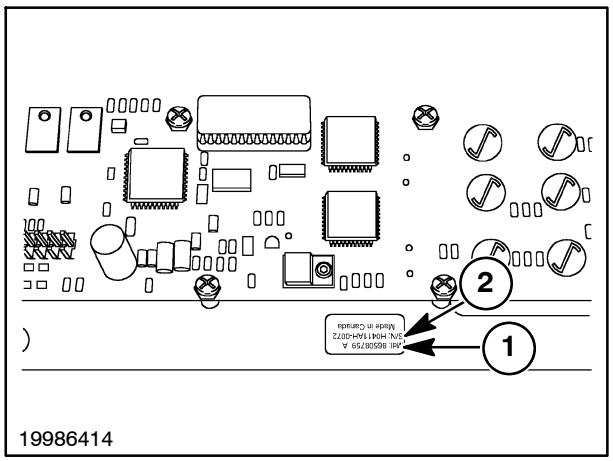


Figure 3-57

Handling the EIC Board:

The EIC board is shipped in an anti-static bag and box. The board must be kept in this bag and box, until required for a repair, to prevent damage to the EIC board.

When returning the EIC board for warranty or repair, it must be returned in the anti-static bag and box to prevent damage.

When installing a new EIC board, always disconnect the negative battery cable to prevent damage to the board from accidental grounding.

The board versions listed below are the EIC boards used on skid-steer loaders.

DO NOT replace a prior version board unless it is defective.

Troubleshoot any problems and only replace the board if it is determined to be the problem.

Boards returned as warranty and determined not to be defective will be debited back. All EIC boards claimed as warranty must be returned for review.

Board Versions:

1 - #9804418
2 - #86508759
3 - #86513936
4 - #86517004
5 - #86518067
6 - #86528256

Refer to Campaign #662 and Service Bulletin 5/95-I10 for detailed information about EIC board troubleshooting and diagnostics.

ADVANCED WARNING SYSTEM

ELECTRONIC INSTRUMENT CLUSTER (EIC) LATER MODEL - GOLD FRAME

The Skid-Steer Loader advanced warning system, 1, monitors engine functions and operator controls and reports conditions to the operator and provides safety interlocks to the hydraulic control valve spools to the boom and bucket.

The instrument cluster has three kinds of visual displays: backlighted symbols, an LED character display, and a segmented bar graph.

The EIC (Electronic Instrument Cluster) board employs incandescent lamps to backlight symbols representing monitored functions. Active sensor symbols are backlighted with either yellow (WARNING) or red (FAULT). Inactive sensor symbols are visible as a dim gray outline when the backlighting is not active. An audible alarm accompanies most visual alarm lights.

The front panel of the instrument cluster has several components and display areas. Read the following paragraphs to understand each item and area.

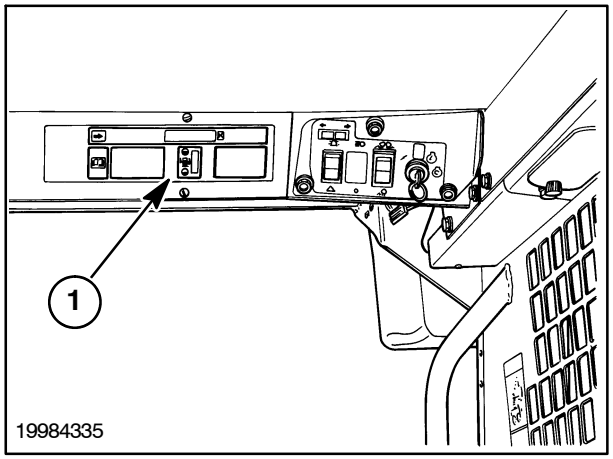


Figure 3-58

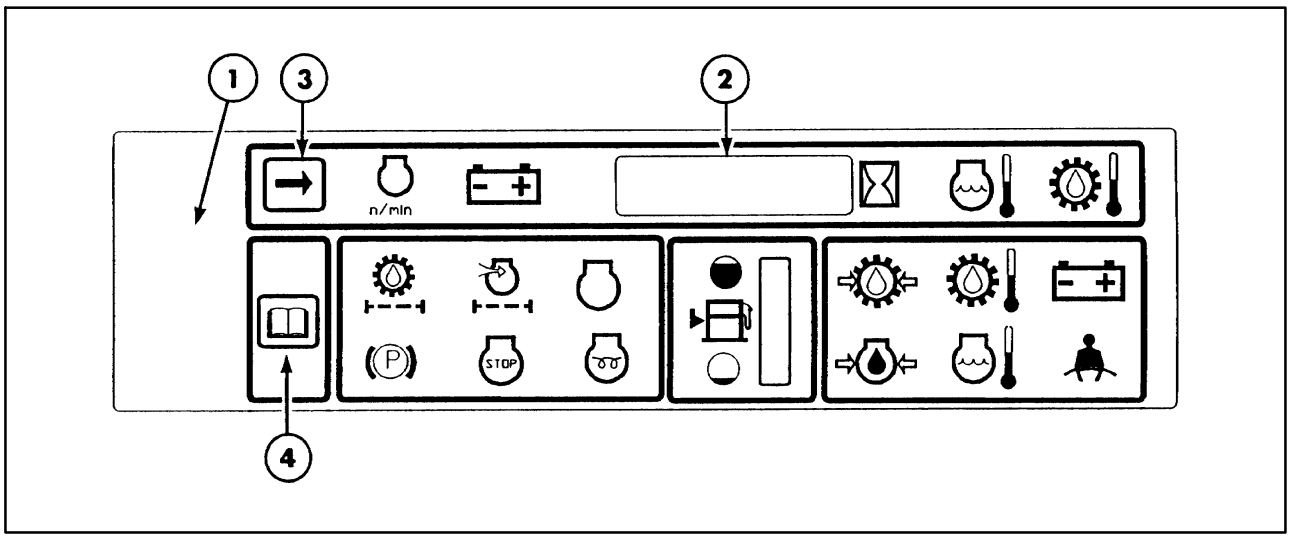


Figure 3-59

EIC (ELECTRONIC INSTRUMENT CLUSTER) FRONT PANEL

1. AUDIBLE ALARM

The audible alarm will sound if there is an unusual condition in any of the monitored areas. The audible alarm is located behind the front panel at 1.

2. CHARACTER DISPLAY

The character display will display the item that the operator has chosen to monitor. The display shows one function at a time. After the engine is started, the display defaults to the last function viewed at power off. Any of the other functions may be selected by the operator during operation by briefly pressing the “ARROW” selector switch, 3. When the EIC is turned off and then powered up, the display default will be the newly selected function.

3. RIGHT ARROW DISPLAY SELECTOR SWITCH

The display selector switch, covered with an “ARROW” symbol, will cause an audible “chirp” when pressed if the ignition key is in the “RUN” position. Pressing the “ARROW” symbol during operation will select the function that the operator chooses to monitor and will be displayed in the character display, 2. If a sensor causes a warning or fault, the appropriate lamp will flash, accompanied by an audible alarm. Pressing this switch also cancels any audible alarm that is sounding.

4. OPEN BOOK SELECTOR SWITCH

This selector switch covered with the symbol of an “OPEN BOOK” (instruction manual) is used to select other functional modes of the EIC panel. The “OPEN BOOK” switch has no function during normal operation.

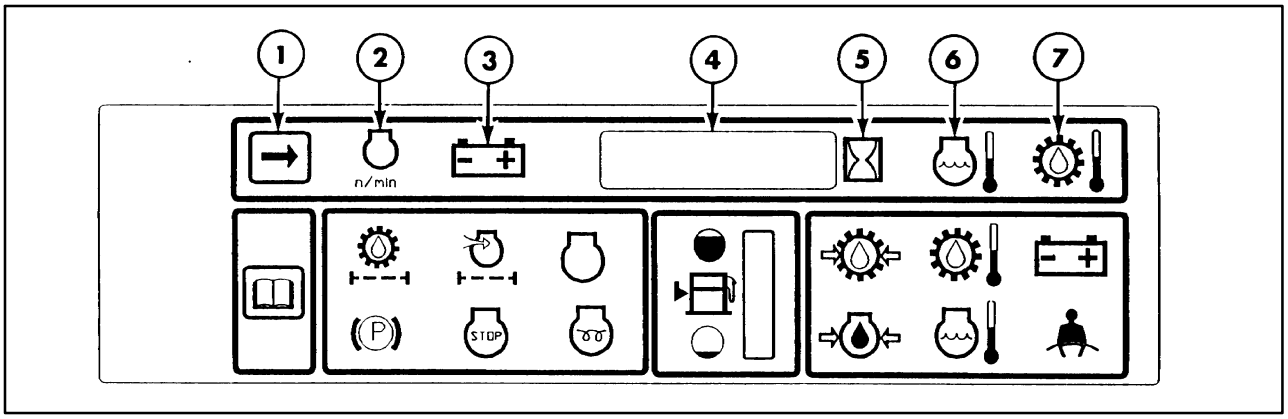


Figure 3-60

EIC FUNCTIONAL GROUPS

The EIC display panel is divided into four functional groups, 1 through 4.

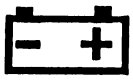
FUNCTIONAL GROUP 1

Those symbols in display group 1, backlighted white are:

1. Right arrow display selector switch. (no light)

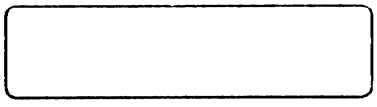
   This switch is used to change the displayed function.

2. Loader engine RPM, displayed in increments of 10 RPM.



3. Battery voltage, displayed to the nearest 0.1 volt.

   NOTE: The EIC monitors battery voltage only, not alternator output.

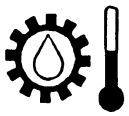


4. Character display.

   The character display will display the chosen function or the function with the fault within this functional group.

5. Engine hours, displayed to 0.1 hours (no light).

6. Engine coolant temperature displayed to the nearest degree, expressed as degrees Fahrenheit or degrees Celsius, depending on setting (C or F).



7. Transmission/hydraulic oil temperature to nearest degree, Celsius or Fahrenheit, depending on setting (C or F).

NOTE: The monitored functions and symbols in group 1 are backlighted in white except the Engine Hours. When this function is monitored the symbol is not lit.

NOTE: The Engine Coolant and hydraulic oil temperatures will show "COLD" until the systems reach 0° Celsius or 32° Fahrenheit operating temperature. At that time the Character display will start reading the temperature in Celsius or Fahrenheit degrees.

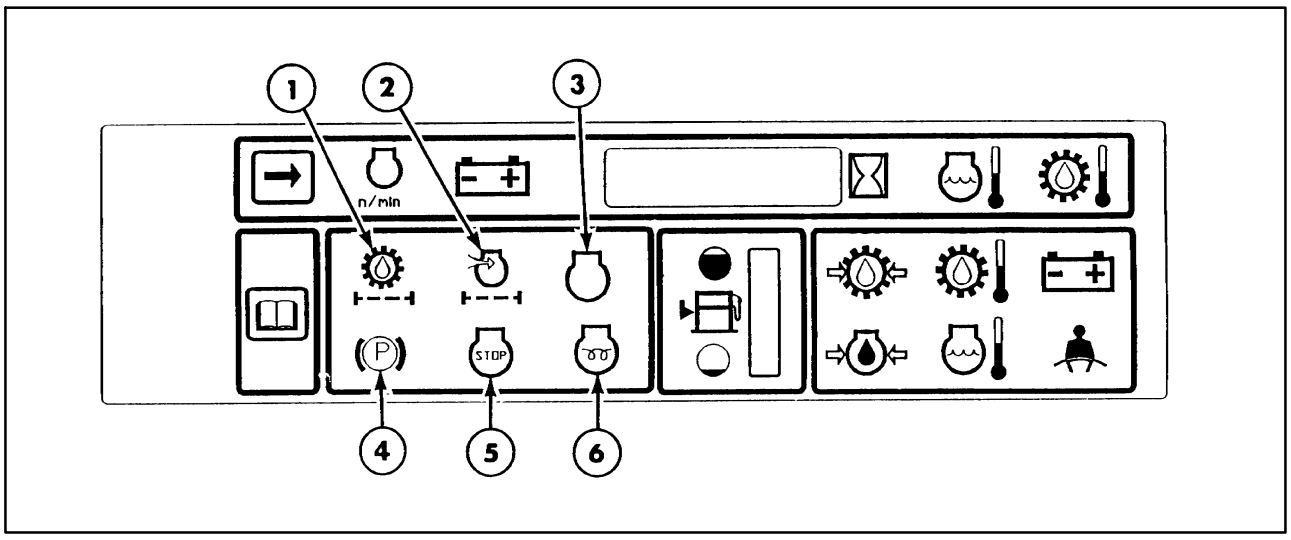


Figure 3-61

FUNCTIONAL GROUP 2

Those symbols in display group 2, backlighted yellow are:

1. Hydraulic oil filter condition.

   The EIC continuously monitors the condition of the oil filter. A yellow warning lamp will signal a warning when the filter becomes dirty. The lamp will flash continuously, accompanied by a 5-second audible alarm, when the filter requires replacement.

2. Air filter condition.

   When the air filter requires replacement, the lamp will flash indicating a dirty element.

3. Blank (not used).

4. Parking brake.

   Used to remind operator to engage the parking brake when exiting the loader. An audible alarm will sound when the operator begins to exit the machine with the engine running.

5. Stop engine warning.

   When this warning lamp flashes, stop the engine and determine the cause to prevent damage to the engine.

6. Engine preheat symbol (lights when engine is preheating).

   The EIC controls a timed preheat system for starting aid.

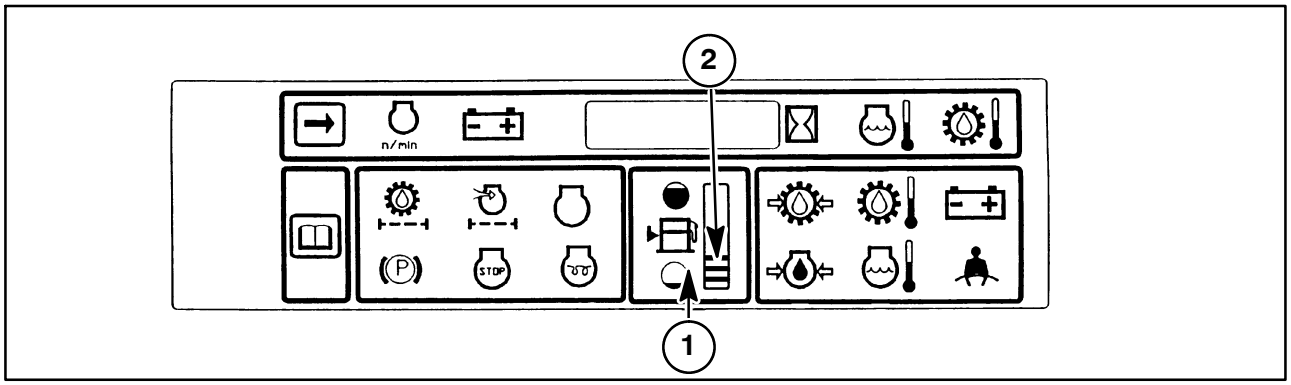
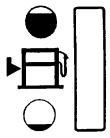


Figure 3-62

FUNCTIONAL GROUP 3

The symbol in display group 3 is:



1. Fuel gauge.

   The fuel gauge, 1, is a vertical 10-segment green LED bar graph. When the fuel level reaches three bars, 2, the segments will flash accompanied by an audible alarm for about 5 seconds.

   When the fuel level reaches two bars, the EIC will signal the operator again with the segments flashing and another 5-second audible alarm.

   NOTE: The lower fuel gauge segments accurately read the lower fuel levels so an operator is less likely to run out of fuel. However, if a machine is operated on a hillside, the fuel gauge should be monitored closely to avoid running out of fuel, as the fuel can still move freely from one end of the tank to the other.

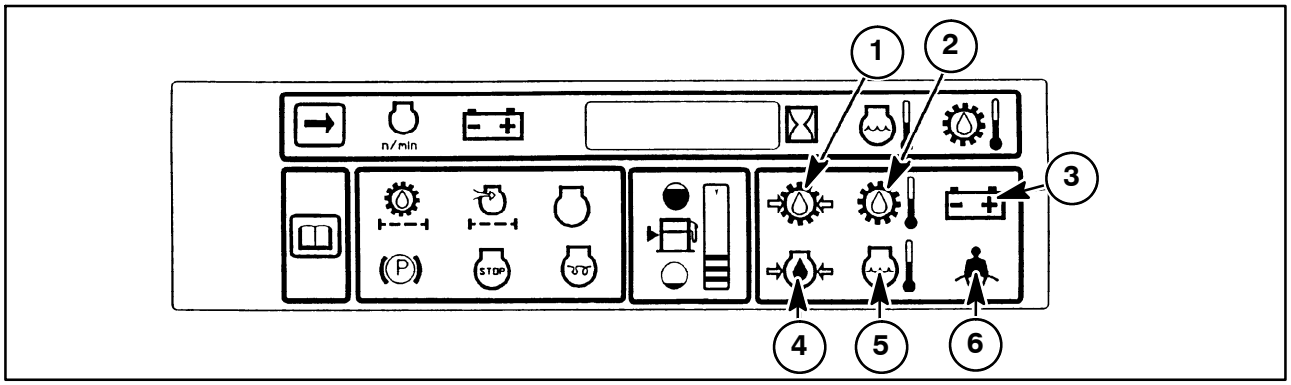


Figure 3-63

FUNCTIONAL GROUP 4

Symbols in display group 4 are backlighted red.

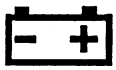
When a fault occurs, the flashing lamp is accompanied by the audible alarm.

1. Transmission charge pressure.

   When the pressure drops below normal operating pressure, the lamp will flash with a continuous alarm.

2. Transmission/Hydraulic oil temperature.

   When the oil temperature is above operating temperature of 99°C (210° F), the lamp will flash with a 5-second alarm.



3. Battery voltage.

   When battery voltage drops below normal voltage, the lamp will flash with a 5-second alarm.

4. Engine oil pressure.

   When the engine oil pressure drops below normal pressure, the lamp will flash with a continuous alarm.

5. Coolant temperature.

   When the engine coolant temperature is above operating temperature of 102°C (216°F) the lamp will flash with a 5-second alarm.

6. Operator “FASTEN SEAT BELT” symbol.

   When the operator is in the seat, the lamp will flash until the seat belt is fastened.

   These symbols are backlighted RED and are intended to complement the audible alarm should a fault occur.

7. Alternator/water pump drive belt warning.

   If the drive belt breaks, the EIC will signal the operator with the battery symbol light, 3, flashing continuously and a 5 second audible alarm.

   NOTE: If during Skid-Steer Loader operation the Engine Coolant or Hydraulic Oil Temperatures show an overheat condition, the EIC will default to that function and read the temperature. When this happens, back off on loader operation and allow the systems to cool down to within normal operating temperature ranges. If the temperatures don’t cool down, stop operating the unit, find the cause and correct.

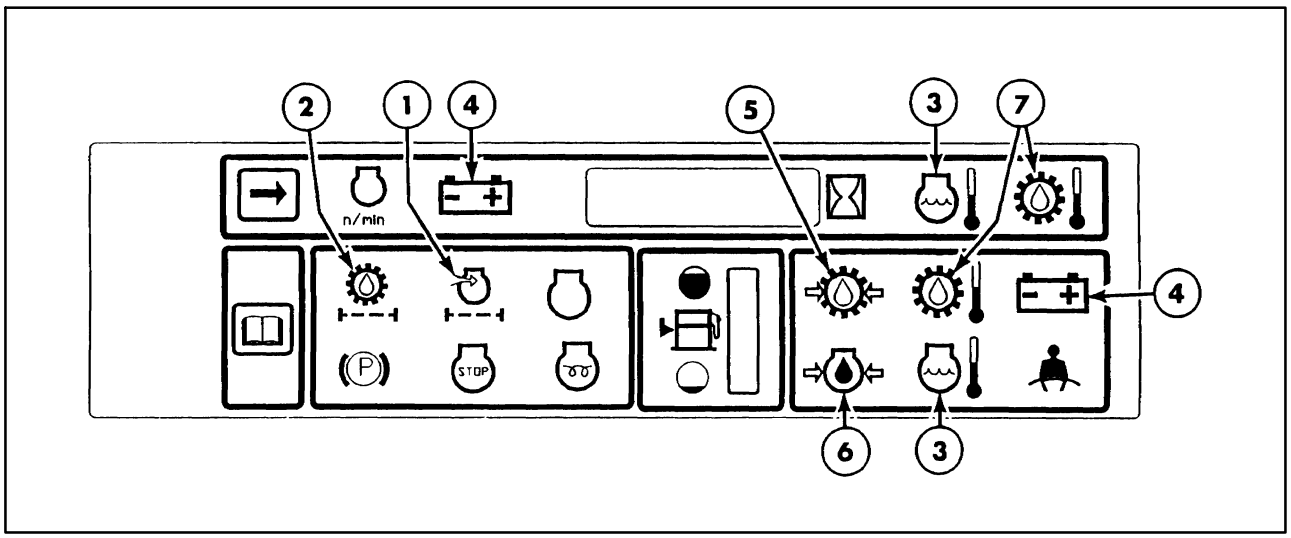


Figure 3-64

CONTINUOUSLY MONITORED ELEMENTS

The following machine elements are continuously monitored by the EIC:

1. Engine air filter.

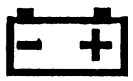
   Monitors the condition of the air cleaner element and will signal when the element is dirty and requires replacement.

2. Hydraulic oil filter.

   Monitors the condition of the filter and will signal when the filter is dirty and requires replacement.

3. Engine coolant temperature.

   When the engine coolant temperature is above operating temperature of 102°C (216°F), the lamp will flash with a 5-second alarm.



4. Battery Voltage.

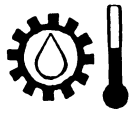
   When battery voltage drops below normal voltage the lamp will flash with a 5-second alarm.

5. Hydrostatic charge pressure.

   When the pressure drops below normal operating pressure the lamp will flash with a continuous alarm.

6. Engine oil pressure.

   When the engine oil pressure drops below normal pressure the lamp will flash with a continuous alarm.



7. Transmission/Hydraulic oil temperature.

   When the oil temperature is above operating temperature of 99°C (210°F), the lamp will flash with a 5-second alarm.

   Whenever the EIC senses any unusual condition in a monitored function, the associated lamp will flash. The audible alarm will “beep” continuously for 5 seconds.

ENGINE PREHEAT

The EIC controls a timed pre-heat cold start aid to assist in cold weather starting. The timed pre-heat cycle will vary from 0 to 40 seconds automatically based on engine coolant temperature. For additional pre-heat if the loader does not start, turn the ignition key to the “OFF” position. Then turn the ignition key back to the “RUN” position again. This will restart the preheat timed cycle.

AUTOMATIC SHUTDOWN

If either the engine oil pressure, or hydrostatic charge pressure fall below certain limits, the EIC will remove power from the fuel solenoid after 30 seconds, stopping the engine.

If this condition occurs, turn off the ignition key. Before unbuckling the seat belt, turn the ignition key to the “ON” position and lower the boom and attachment to the ground or rest the boom on the boom lockpins. Turn the ignition key to the “OFF” position.

The operator may immediately restart the engine again. Should the function remain faulted, power will again be removed from the fuel solenoid in another 30 seconds and the engine will again stop. During the 30-second alarm period, the “ENGINE STOP” symbol will flash. If this condition continues, locate the fault and repair.

IMPORTANT: Use caution when restarting the loader because of the possibility of NO LUBRICATING OILS for the engine and/or the hydrostatic transmission. DO NOT restart the loader more than once or operate the engine at high speeds. Damage to the engine and/or transmissions may occur. Contact your New Holland dealer for assistance.

WARNING: WHEN THE ENGINE STOP SYMBOL FLASHES FOR THE 30-SECOND PERIOD, IMMEDIATELY LOWER THE BOOM AND MOVE THE LOADER TO A NON-TRAFFIC AREA FOR PROBLEM EVALUATION.

If an alarm is caused by 3, 4, or 7, the CHARACTER DISPLAY will change to show the numeric value of the function that caused the alarm.

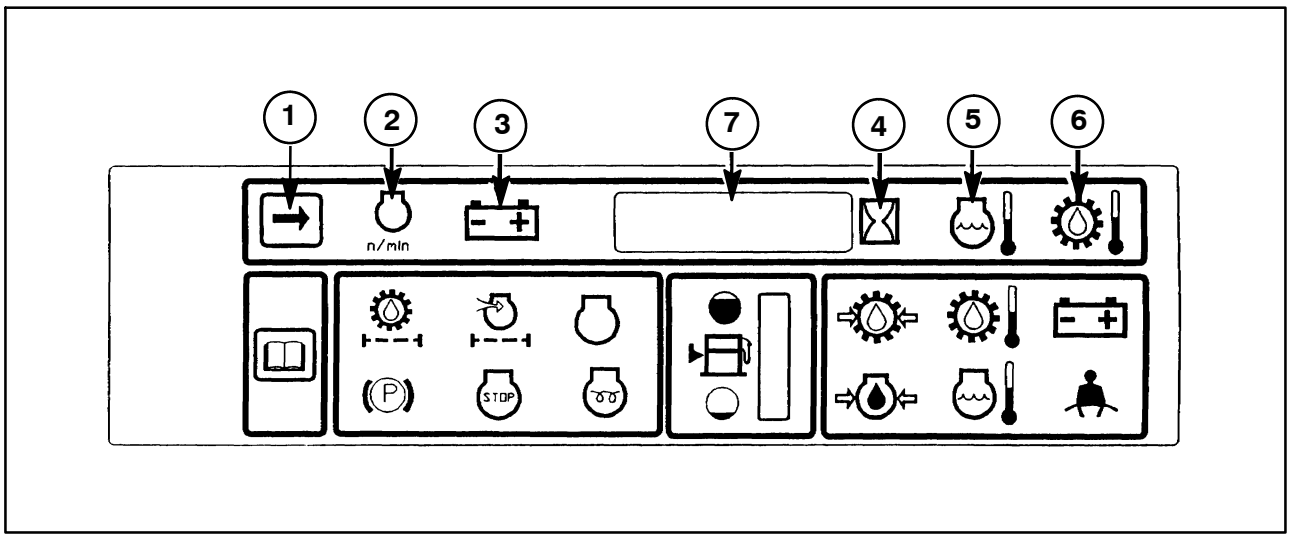


Figure 3-65

OPERATING MODE

By pressing and releasing the “ARROW” switch, 1, during normal skid-steer loader operation, the operator can select a function to be monitored. Only one function can be monitored and displayed at a time in the display, 7. By pressing and releasing the “ARROW” switch once, the EIC will select the next monitored function. Functional symbols are located across the top of the EIC display and will light up when selected. Note that the engine hour symbol, 4, is not illuminated.

Monitored functions are:

2. ENGINE RPM
3. BATTERY VOLTAGE
4. ENGINE HOURS (No Light)
5. ENGINE COOLANT TEMPERATURE - Reads COLD until 0°C (32°F)
6. TRANSMISSION/HYDRAULIC OIL TEMPERATURE - Reads COLD until 0°C (32°F)

If a fault occurs in the following monitored functions, the EIC will automatically show that function’s reading in the character display, accompanied by a flashing light and a five second audible alarm.

FAULT	READING
Battery Voltage (Low & High)	Battery Voltage
Engine Coolant (High)	Temperature in Degrees
Transmission/ Hydraulic Oil (High)	Temperature in Degrees

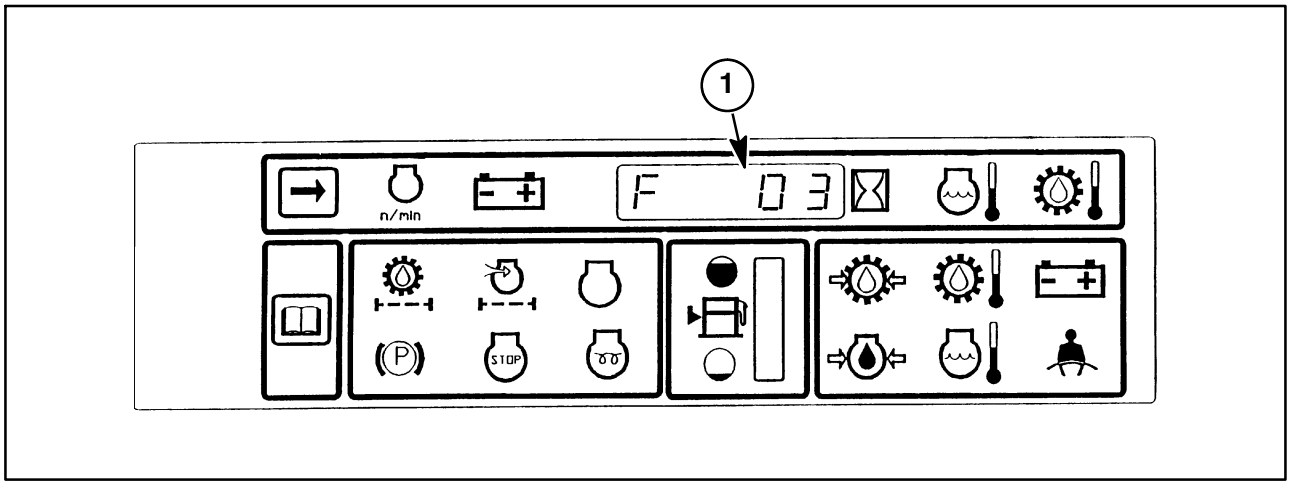


Figure 3-66

If a fault occurs in the following monitored functions a fault code will appear in the EIC character display, 1, accompanied by a five second audible alarm. By turning the ignition key switch to the “OFF” position the EIC will return to the normal operating mode. If when the loader is restarted and the fault still exists, the code will reappear with an alarm indicating there is an open or short in that circuit. Contact your New Holland dealer for assistance.

FAULT	CODE
Hydraulic Boom/Bucket Solenoid	(F0A)
Engine Preheat Relay Coil	(F03)
Fuel Solenoid	(F04)

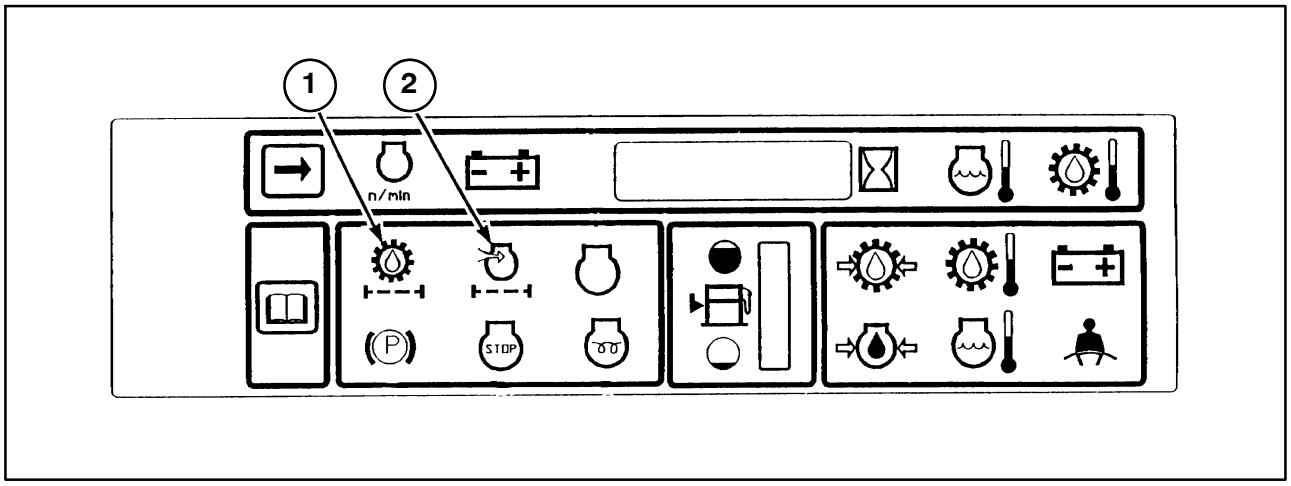


Figure 3-67

If a fault occurs in the following monitored functions the EIC will signal the operator with a flashing light accompanied by a five second audible alarm indicating the filter(s) require service.

FAULT
1. Hydraulic Oil Filter
2. Engine Air Cleaner

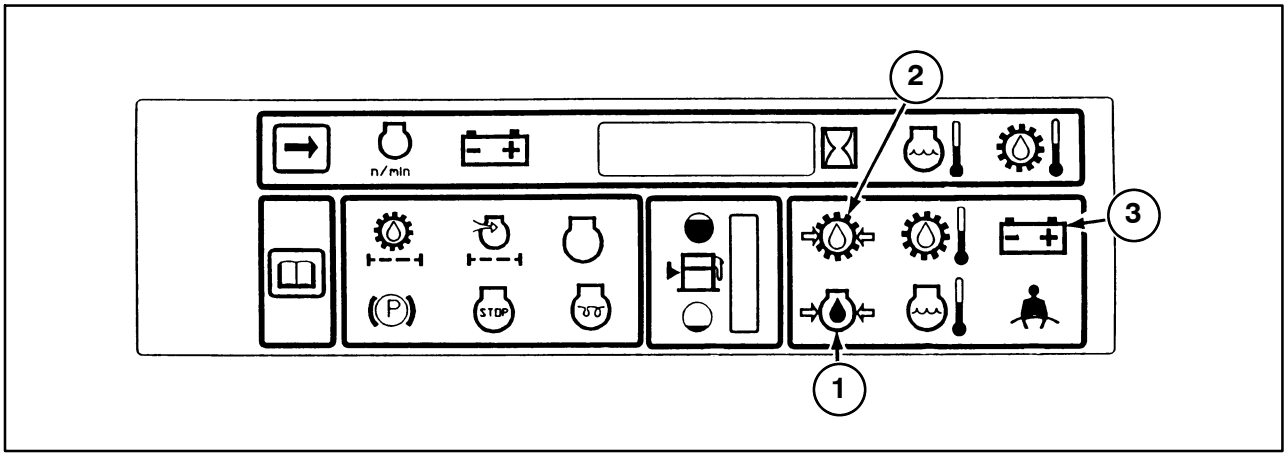


Figure 3-68

If a fault occurs for more than 30 seconds in the following monitored functions the EIC will signal the operator with a flashing light, a continuous audible alarm and will stop the engine after 30 seconds of operation.

FAULT

1. Engine Oil Pressure
2. Hydrostatic Transmission Charge Pressure

If a fault occurs in one of these functions, the engine can be restarted and the skid-steer loader moved to a safe inspection area with the boom resting on the boom lock pins or on the ground. If the fault still exists, the EIC will stop the engine after another 30 seconds.

IMPORTANT: Use caution when restarting the loader because of the possibility of NO LUBRICATING OILS for the engine and/or the hydrostatic transmissions. DO NOT restart the loader more than once or operate the engine at high engine speeds. Damage to the engine and/or transmission may occur. Contact your New Holland dealer for assistance.

BROKEN ALTERNATOR/WATER PUMP BELT WARNING, 3

If the drive belt breaks the EIC will signal the operator with the battery symbol light, 3, flashing, accompanied by an audible alarm.

NOTE: Shut the engine down immediately by turning the ignition key to “OFF” position to prevent engine overheating damage.

FUEL LEVEL

Fuel level is shown to the operator by the fuel gauge bar lights located in the center of the EIC display at 1. The operator will be signaled when the level is at three bars and again at two bars. The bar lights, 2, will flash continuously accompanied by an audible alarm for about five seconds at each signal level.

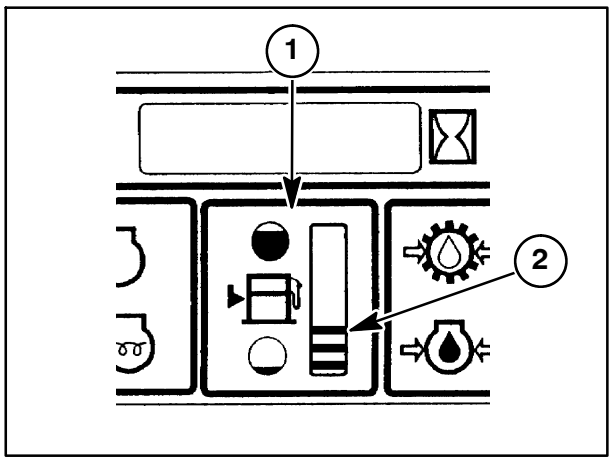


Figure 3-69

EIC INTERLOCKS

EIC controls the fuel solenoid circuit. The operator must be in the seat, with the seat belt fastened before the engine will start and continue to run.

The EIC will lock the boom and bucket control valve spools in neutral if the operator unfastens the seat belt, leaves the seat, or turns the ignition key off. If the operator is out of the seat for more than two seconds, the seat belt must be unfastened and refastened to enable the boom and bucket hydraulic systems to function.

The unit is equipped with a “SERVICE/RUN” switch for use during servicing and troubleshooting of the skid-steer loader. To access the Service/Run switch located under the cab fuse panel cover, 1, loosen the two thumbscrews, 2, and rotate cover, 1, to the side. When the “SERVICE/RUN” switch, 3, is in the “SERVICE” position, the engine will start but the boom and bucket hydraulic system will be inoperative.

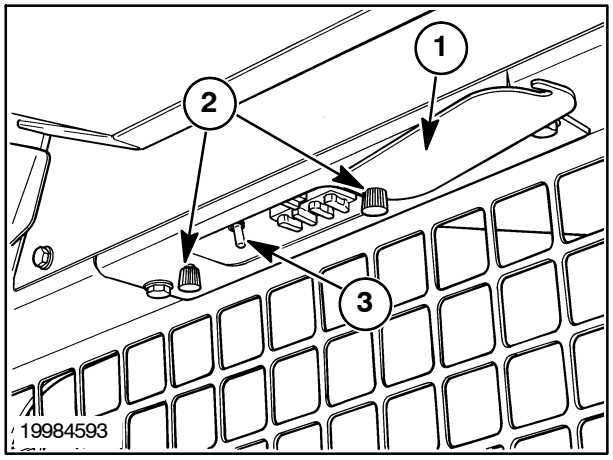


Figure 3-70

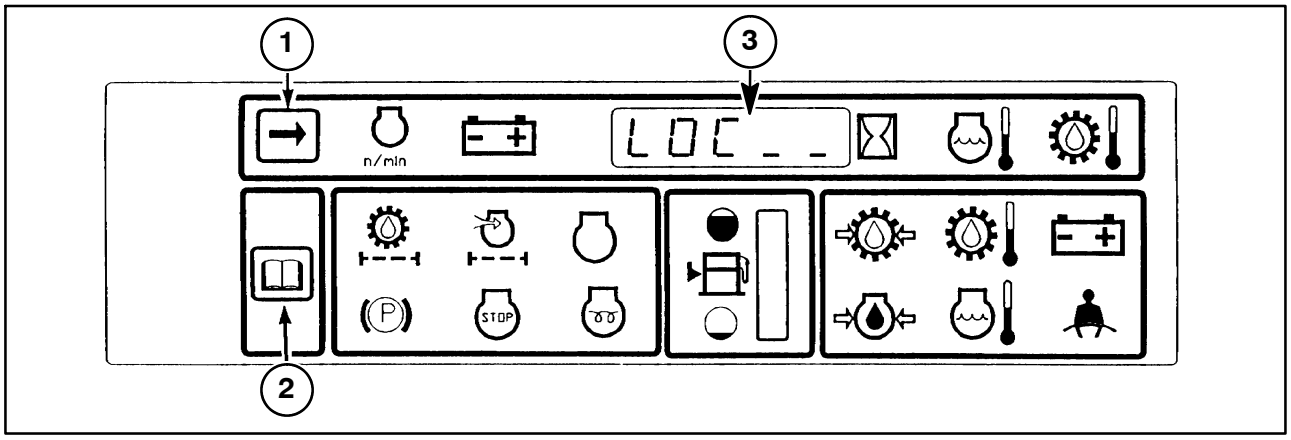


Figure 3-71

EIC LOCK MODE

A two digit code can be entered into the EIC which will lock the boom and bucket spool lock solenoids when the spools are in the neutral position. This will prevent movement of the boom and bucket.

The same two digit code must be reentered to unlock the solenoids and return the loader to normal operation.

To enter a security code:

1. Lower the boom and bucket to the ground and position the bucket to prevent movement of the loader.
2. Turn "OFF" the ignition key.
3. Unbuckle the seat belt, raise your weight off the seat, and wait until all EIC lights are off.
4. While out of the seat, press and hold the "OPEN BOOK" switch, 2, then sit in the seat and turn the ignition key to the "ON" position; Do Not engage the starter.
5. Display, 3, will show the program level of the EIC board (example r0100). At this time release the "OPEN BOOK" switch.
6. Display, 3, will show "LOC_ _" for lock.
7. Press and hold the "OPEN BOOK" switch until two (2) zeros appear "LOC 0 0" with the left zero flashing, then release the "OPEN BOOK" switch.
8. Press and release the "OPEN BOOK" switch and enter any number from "0" to "9" for the left digit.
9. Press and release the "ARROW" switch, 1, the right zero will start to flash.
10. Press and release the "OPEN BOOK" switch and enter any number from "1" to "9" for the right digit.
11. With the two (2) digit code entered, "01 to 99", turn the ignition key to the "OFF" position and exit the loader, allowing all the EIC board lights to go "OFF", locking the EIC.

    When the EIC board lights go off, the lock code will enter the EIC memory, locking the EIC until the same two digit code is reentered.

To reenter the same two (2) digit code to return the loader to normal operation:

1. Sit in the operator's seat.
2. The EIC will display "LOC 0 0" with the left digit flashing.
3. Turn the ignition key switch to the "ON" position; Do Not engage the starter.
4. Press and release the "OPEN BOOK" switch and enter the left number of the code previously used to lock the loader.
5. Press and release the "ARROW" switch, the right zero will flash.
6. Press and release the "OPEN BOOK" switch to enter the right number of the code previously used to lock the loader.
7. Turn the ignition key to the "OFF" position and allow the EIC to return to the operating mode.
8. Buckle the seat belt and proceed with normal skid-steer loader operation.

If the two digit code is forgotten, the EIC can be unlocked by using a **(MASTER CODE).** Contact your NEW HOLLAND dealer for assistance.

The dealer will require your name, address and the skid-steer loader model and serial numbers.

EIC ENGINE PREHEAT

The engine preheat is governed automatically by the EIC based on coolant temperature and engine code. Preheat is initiated when the ignition key is turned to the “RUN” position and the cycle time will vary from 0 to 40 seconds.

Turn the ignition key to the “RUN” position, and the EIC character display, 1, will show seconds remaining for engine preheat time. The preheat indicator light, 2, will be lit during the preheat cycle. The operator should wait until the display zeros “0”, the indicator light goes “off”, and the audible alarm sounds to start the engine. If the loader does not start, re-cycle the engine preheat timer by turning the ignition key “OFF” then “ON”. This will restart the timed preheat cycle.

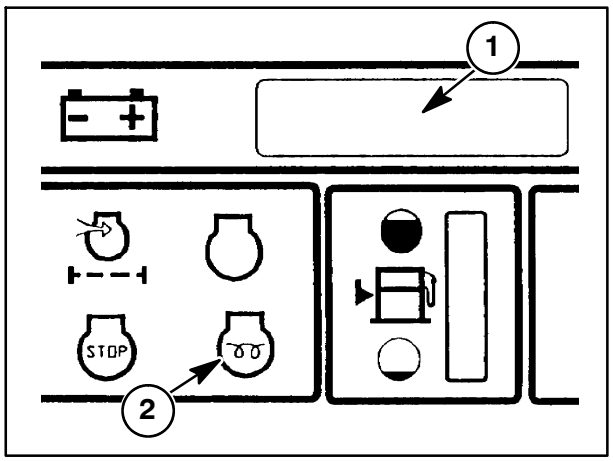


Figure 3-72

TROUBLESHOOTING

ELECTRONIC INSTRUMENT CLUSTER (EIC)

PROBLEM	POSSIBLE CAUSE	CORRECTION
EIC board will not light up when operator sits in seat	Service/run switch in service position	Push switch to run position
	Faulty seat switch	Replace switch
	No battery voltage to seat switch	Blown 5-amp fuse electronic battery in engine panel, replace fuse
		Open in power wire from 5-amp fuse to seat switch, repair open in wire
		No battery voltage to 5-amp fuse from supply, check and/or replace battery
	Blown 5-amp fuse (electronic battery) in engine panel	Replace fuse
	No battery voltage from seat switch to EIC board	Open in power wire from seat switch to EIC board, repair open in wire
		Poor or no connection at EIC board, repair connection
	Battery voltage from seat switch to EIC board	If battery voltage from seat to board is OK, replace EIC board
EIC board backlighting is dim	Brightness variations due to production differences between models and/or EIC board changes	None -- overlay decal material variations cause differences in brightness
	Backlights dim when the loader worklights are activated	None -- EIC board circuitry automatically dims the backlighting when the work lights are on, to reduce board glare at night
EIC board seat belt light will not go off with seat belt buckled	Seat belt not buckled	Buckle seat belt
	Faulty seat belt buckle switch	Replace seat belt assembly
	No battery voltage from seat switch to seat belt switch	Open in wire from seat switch to seat belt switch, repair open
	No battery voltage from seat belt switch to EIC board	Open in wire from seat belt switch to EIC board, repair open
		Poor or no connection at EIC board, repair connection
	Battery voltage from seat belt switch to EIC board	If voltage OK, replace EIC board

PROBLEM	POSSIBLE CAUSE	CORRECTION
EIC will not read correct engine RPMs, varies more than ± 50 RPMs	Incorrect engine configuration	Correct configuration
	No AC voltage at tachometer terminal at alternator	Repair alternator
	Loose or corroded connection at tachometer terminal at alternator	Repair connection
	No AC voltage at EIC board from alternator	Open in wire from alternator to EIC board, repair open
	AC voltage from alternator to EIC board	Repair loose or corroded connection at EIC board
	Wire connection from alternator to EIC board	If OK, replace EIC board
EIC will not unlock boom and bucket spool locks	Service/Run switch in “SERVICE” position	Push switch to “RUN” position
	Seat belt unbuckled	Buckle seat belt
	Faulty seat belt buckle	Replace seat belt assembly
	No battery voltage from seat belt switch to EIC	Open in power wire from seat belt switch, repair open
	No battery voltage from EIC to spool lock solenoids	Open in power wire from EIC to solenoids, repair open
	Battery voltage to lock solenoids	If OK, check inoperative solenoids, check solenoid coils, repair or replace

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine will not start and/or run	Seat belt unbuckled	Buckle seat belt
	Incorrect engine configuration (EIC)	Correct configuration
	No battery voltage to start relay	Open in power wire from key switch “start” to relay, or through seat/seat belt circuits to relay, repair open
	No battery voltage from EIC to fuel solenoid	Open in power wire from EIC to fuel solenoid, repair open
	Open in the W/O wire from the seat/seat belt plug to the start interlock relay	Repair open in W/O wire
	Inoperative start interlock relay	Repair or replace (order new “sealed” relay, part #86521256)
	Fuel solenoid inoperative	Repair or replace fuel solenoid
	Inoperative manifold heater system	Incorrect engine configuration, correct configuration
	No power to manifold heater	Manifold heater preheat relay or LTBL/B wire open, repair or replace
		Circuit breaker open, replace
	Inoperative manifold heater	Replace manifold heater
	No fuel to manifold heater	Check fuel feed tube and fuel supply from injection pump
EIC will not read monitored circuits	Incorrect engine configuration	Correct engine configuration
	Open or short in wire from sensor to EIC	Repair open/short
	Faulty sender or sensor	Repair/replace sender or sensor

DIAGNOSTICS CHANGES WITH GOLD FRAME EIC BOARD

The Operating Mode of the AWS only changed in the reading of the engine coolant and hydraulic/hydrostatic oil temperature. The system conversion from reading COLD in the display to the actual temperature reading changed from 45°C (113°F) to 0°C (32°F). Switching from one monitored function to another did not change. The major changes were made in the Configuration Mode. These changes provide the EIC with more service capabilities, easier to use, enter and make changes.

The following changes and additions were made to the EIC:

1. Lock Mode

   Security Code - Easier to enter and remove.

2. Error Messages replaced with Fault Codes.

   a. ERRO1: Memory store error (engine hours) - Removed.

   b. ERRO2: Output circuit to the fuel solenoid - Changed to F04.

   c. ERRO3: Output circuit to the hydraulic solenoids - Changed to F0A.

   d. ERRO4: Output circuit to the engine preheat relay - Changed to F03

3. Diagnostics Mode - easier to enter.

   a. Diagnostics - Testing unchanged.

   b. Fault/Warning History - Added.

      The fault history includes the number of fault occurrences and the hour level of the last occurrence for a monitored function.

   c. Clear Faults - Added.

      The fault history can be restored to zero.

4. Setup Mode

   a. Engine Code - Easier to enter.

   b. Select Displayed Temperature Units, Fahrenheit or Celsius - Easier to enter.

   c. Adjust Engine RPM - Added

      The EIC can be calibrated to an external tach reading.

   d. Clear Memory - Easier to enter.

      The EIC can be restored to original settings.

   e. Adjust Engine Hour Meter - Easier to enter.

5. Alternator/Water Pump Belt Breakage Warning - Added.

   a. Will signal the operator of a belt failure via the battery symbol light flashing.

Advanced Warning System (AWS)

This skid-steer loader is equipped with an Advanced Warning System (AWS) that provides information to the operator about the operation of the skid-steer loader.

The AWS provides an interlock system with the seat and seat belt to prevent movement of the boom and bucket if the operator is out of the seat or the seat belt is unbuckled and the controls are in neutral.

The AWS provides an automatic engine preheat system to aid in cold weather starting.

The AWS provides information to the operator about the following monitored functions:

- Hydraulic Oil Filter
- Engine Air Filter
- Engine Preheat Relay Coil
- Fuel Level
- Fuel Solenoid
- Engine Coolant Temperature
- Hydrostatic Transmission Charge Pressure
- Transmission/Hydraulic Oil Temperature
- Battery Voltage
- Engine Oil Pressure
- Alternator/Water Pump Belt Breakage Warning
- Operator Seat and Seat Belt
- Hydraulic Boom/Bucket Solenoid
- Engine RPM
- Engine Hours

The AWS provides an engine shut down feature if the engine oil pressure or the hydrostatic transmission charge pressure are low.

The AWS will signal the operator if the alternator/water pump drive belt fails.

The AWS provides a security feature allowing the operator to enter a two digit security code, preventing starting of the engine and movement of the boom and bucket.

The AWS provides the following features for dealer technician use in diagnostics and troubleshooting of the monitored function circuits:

Diagnostics

- Test individual monitored circuits.

Fault/Warning History

- Fault occurrence with hour level of last occurrence.

Clear Faults

- Clear Faults to zero.

Engine Code

- Set EIC to loader engine model.

Select Displayed Temperature Units, Fahrenheit or Celsius

- Temperature displayed in Metric (Celsius) or English (Fahrenheit).

Adjust Engine RPM

- Calibrate EIC display to external RPM tach reading.

Clear Memory

- Return EIC to original factory settings.
- Engine code reset to (01).
- Hours reset to (0000.0) zero.
- Temperature displayed (Fahrenheit).
- Engine RPM calibration cleared.

Adjust skid-steer loader hours

- Change unit hours when installing a new EIC board in a loader.

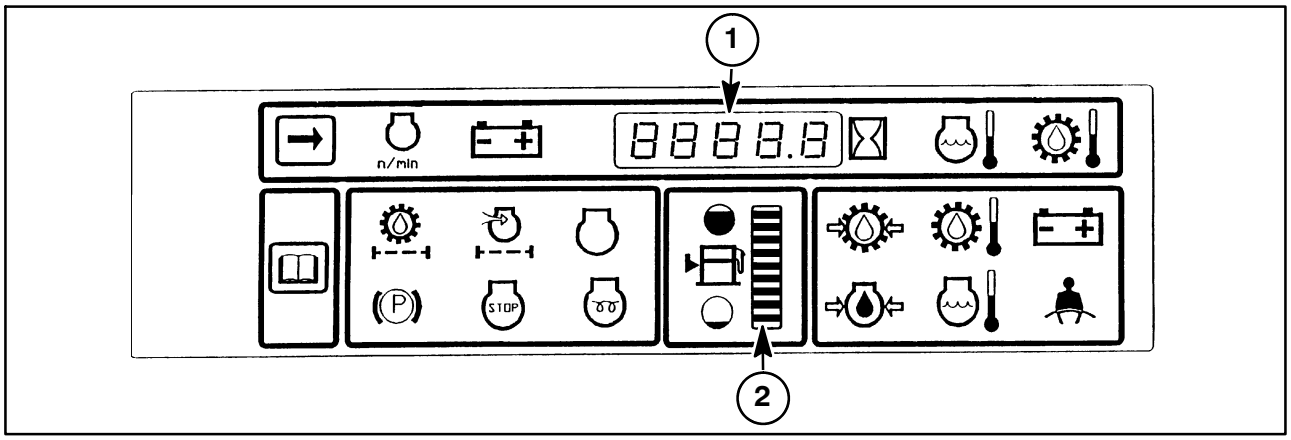


Figure 3-73

EIC Board Self Test

When first sitting in the operator's seat and/or before entering Diagnostics, allow the EIC board to self test. (Service/Run switch in the "RUN" position)

Sit in operator's seat.

1. The EIC board should light all symbol lights.
2. The character display should read "8888.8", 1, and the fuel gauge (light bar), 2, should light showing 9 bars.
3. The EIC will enter the normal start up mode.
4. Turning the ignition key to the "ON" position will start the automatic engine preheat system (if required).

   NOTE: The preheat times will vary from 0 to 20 seconds, depending on engine temperature.

If the EIC does not function as described, check the seat and seat belt switches for proper operation and EIC board power and ground circuits.

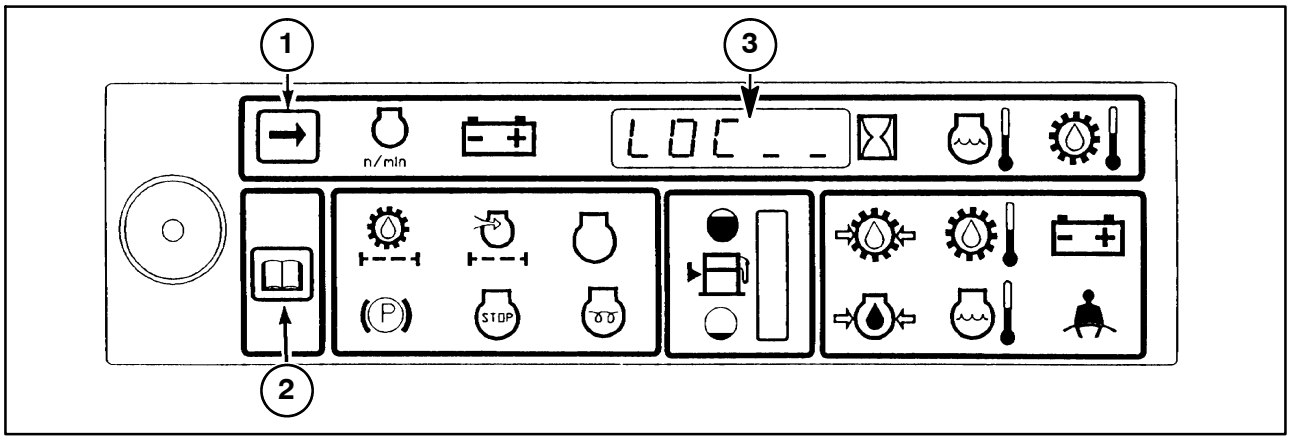


Figure 3-74

DIAGNOSTIC AND SETUP MODES

When in the Diagnostic Mode, the technician can test the individual monitored circuit wiring. When in the Setup Mode, the technician can make changes to the EIC and perform additional troubleshooting.

To Enter Diagnostic Or Setup Mode:

1. Lower the boom and bucket to the ground or remove any attachment and rest the boom on the boom lock pins.
2. Turn “OFF” the ignition key.
3. Unbuckle the seat belt, raise your weight off the seat, and wait until all EIC lights are off.
4. While out of the seat, press and hold the “OPEN BOOK” switch, 2, sit in the seat and turn the ignition key to the “ON” position; Do Not engage the starter.
5. Display, 3, will show the program level of the EIC board (example - r0100); at this time, release the “OPEN BOOK” switch.
6. Display will show “LOC_ _” for lock.
7. Press and release the “ARROW” switch, 1; “dIAg” (for Diagnostic) will appear in the character display.
8. Press and release the “ARROW” switch again will move to the “SEtUP” mode in the display.

Pressing and holding the “OPEN BOOK” switch when in either mode will enter the selected mode for tests or changes to the EIC.

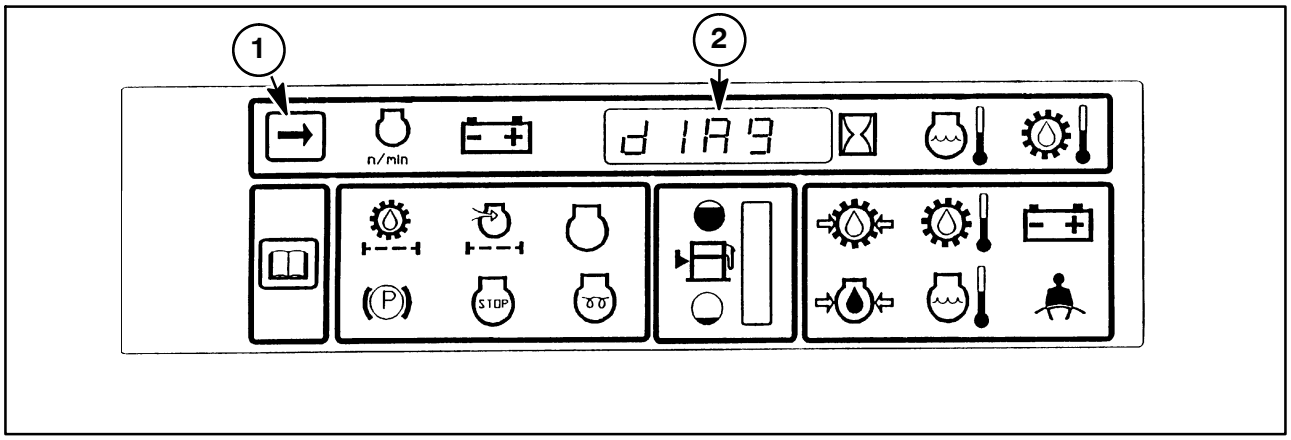


Figure 3-75

EIC Diagnostics and Setup Items

Diagnostics Mode

With display showing “LOC_ _” for lock.

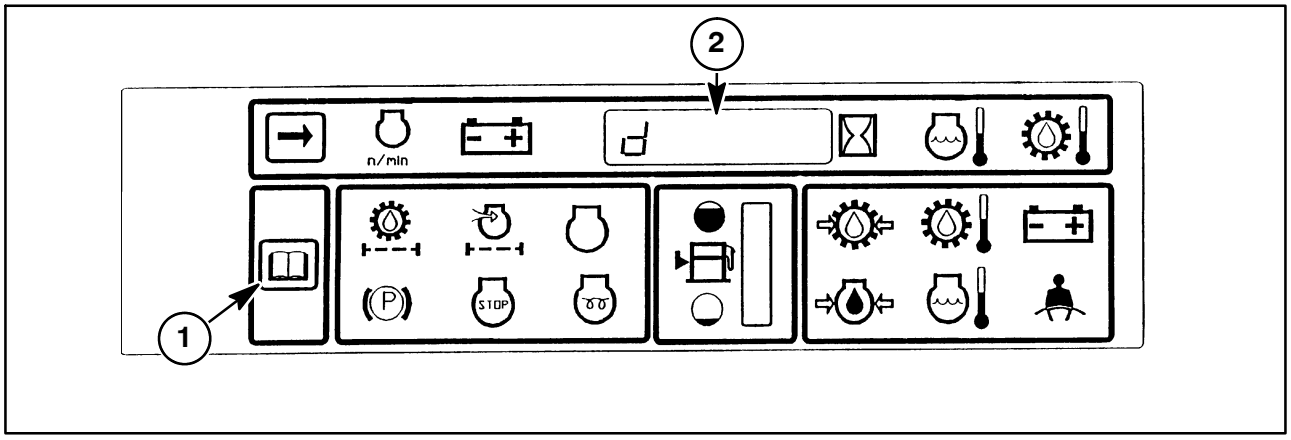


Figure 3-76

2. Press and hold the “OPEN BOOK” switch, 1, until a low case “d” appears in the character display, 2, release the “OPEN BOOK” switch. The EIC is now in Diagnostics.

Each individual monitored circuit can now be tested for proper operation.

When in Diagnostics and any circuit is activated the EIC board will light all lights and an audible alarm will sound.

The Diagnostic test will not verify the performance of a sensor or sender. Only the EIC board and wires to the sender or sensor are tested.

The following circuits can be tested:

1. Press and release the “ARROW” switch, 1; “dIAg” will appear in the character display, 2.

1. EIC board bulbs
2. EIC board circuits
3. EIC board arrow and open book switches
4. Audible beeper
5. Engine air filter circuit
6. Hydraulic oil filter circuit
7. Hydrostatic transmission charge pressure circuit
8. Engine oil pressure circuit
9. Engine Coolant temperature circuit
10. Transmission/hydraulic oil temperature circuit
11. Fuel level circuit
12. Seat switch(es) and circuit
13. Seat belt switch and circuit
14. Service/Run switch

ARROW, OPEN BOOK, AND AUDIBLE ALARM TEST

In this mode, by pressing the “ARROW,” 1, or “OPEN BOOK,” 2, switches, all of the display segments are turned on for verification and at the same time with an audible beep. If all segments do not light the circuit bulb or wires to the switches, sensors or senders may be defective.

To check the individual EIC board circuits and circuits to the switches, sensors, and senders, perform the following “EIC CIRCUIT TESTS”.

Whenever any of the sensors or switches are toggled on or off, the EIC board will light and the audible alarm will briefly beep. This indicates that the wire to the sensor or switch is intact, but does not yield any information about the condition of the sensor.

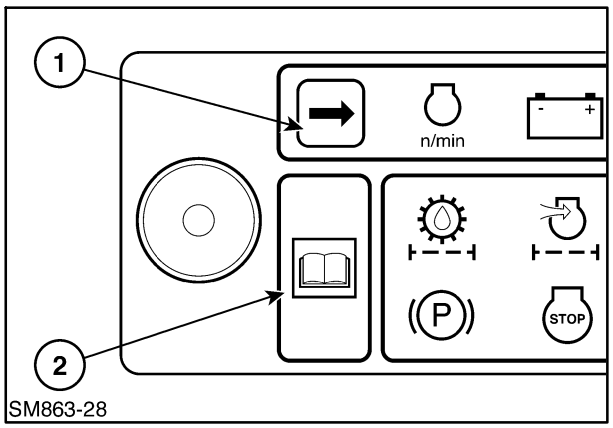


Figure 3-77

DIAGNOSTIC MODE EIC CIRCUIT TESTS

To simulate a fault condition while in the diagnostic mode do the following:

NOTE: When in the diagnostic mode and a circuit is triggered, all the board lights will light up accompanied by an audible beep.

1. Hydraulic Oil Filter Restriction Switch

Remove the DKGN/O filter sensor wire, 1, from the sender.

The EIC board lights will all light up and the board will beep when this test is performed.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wire from the sensor to the EIC board.

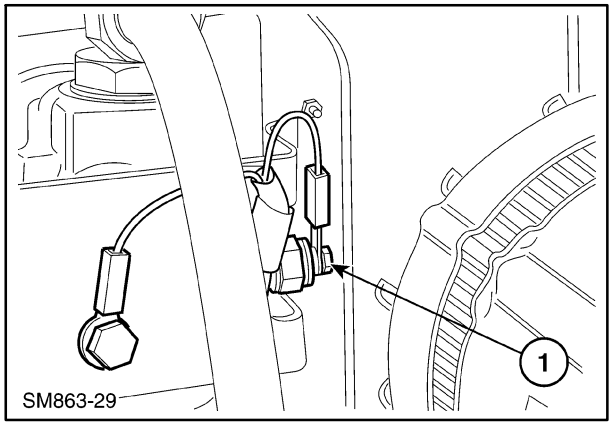


Figure 3-78

2. Air Cleaner Switch

Remove one wire at a time from the sensor switch, 1, on the air cleaner canister. Remove the B wire, and the EIC board will light and beep when the wire is removed from the switch. Remove the B/Y wire, and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensors to the EIC board.

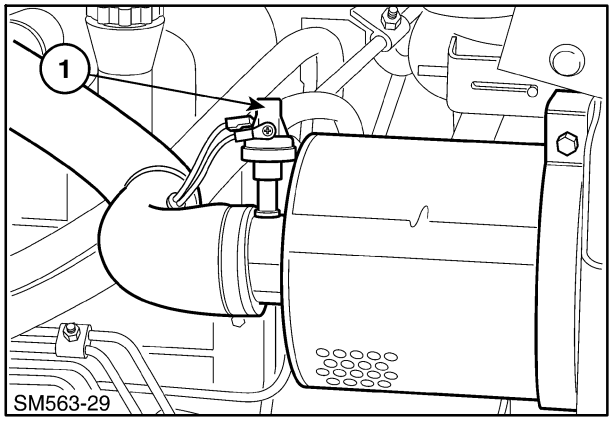


Figure 3-79

3. Hydrostatic Charge Pressure Switch, 1

Remove one wire at a time from the sensor switch at the charge check valve. Remove the Y/GY wire and the EIC board will light and beep. Remove the B wire and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

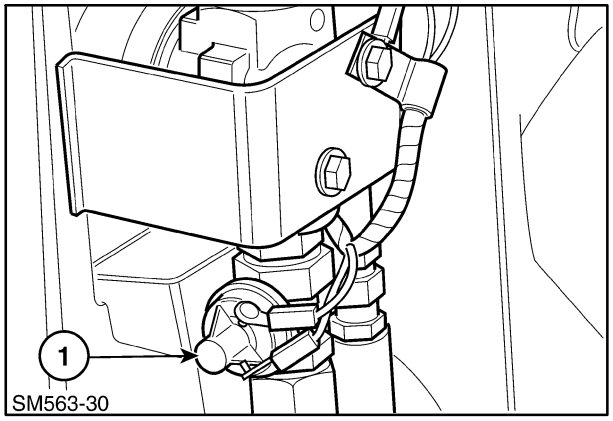


Figure 3-80

4. Engine Oil Pressure Sensor

Remove the Y/B wire, 1, from the sensor and the EIC board will light and beep.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

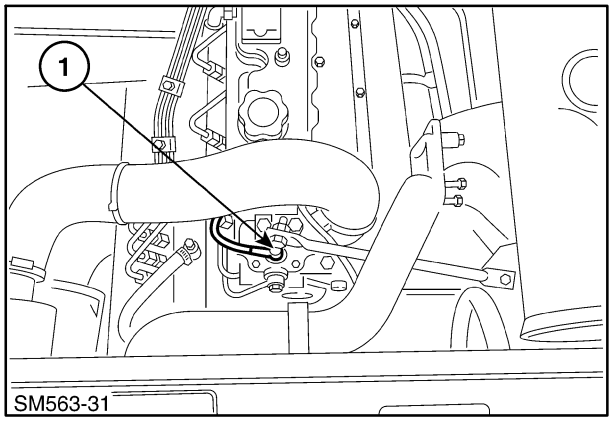


Figure 3-81

5. Coolant Temperature Sensor

Remove the PU/LTGN wire, 1, from the sensor and short the wire to ground.

The EIC board will light and beep when the wire is removed from the sender and grounded.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

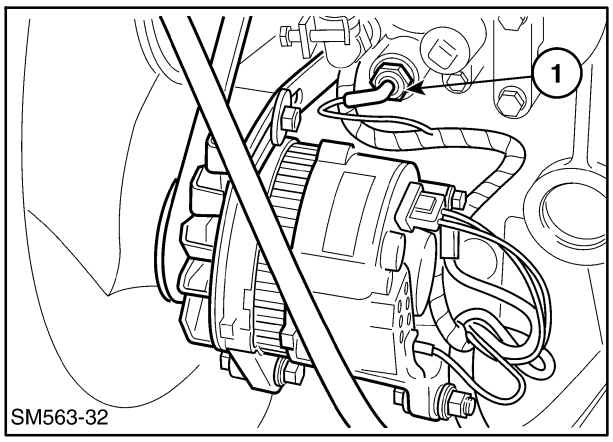


Figure 3-82

6. Transmission/Hydraulic Oil Temperature Sensor

Remove the PU/LTBL wire from the sensor, 1, and short the wire to ground.

The EIC board will light and beep when the wire is removed from the sender and grounded.

If the EIC board lights and beeps, the EIC and circuit wire to the sensor is OK. The problem is in the sensor; replace the sensor. If the EIC board fails to light and beep, check the wires from the sensor to the EIC board.

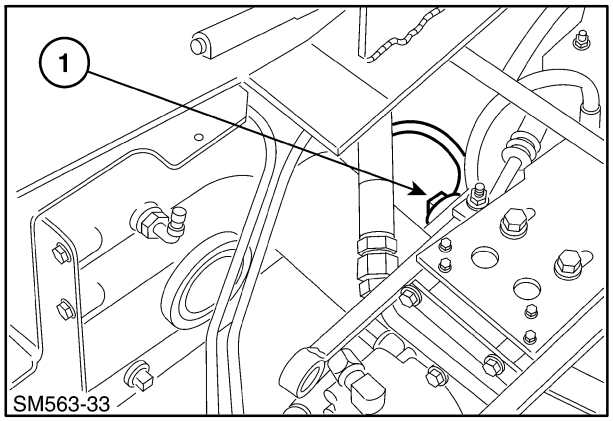
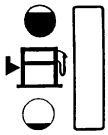


Figure 3-83

7. Fuel Gauge



Disconnect one wire, 1, and use a jumper wire and connect sender terminal to other terminal, 2, and the EIC board will light and beep. If the EIC board lights and beeps, the EIC and circuit wires to the sender are OK. If the EIC board fails to light, check the wires to the EIC board.

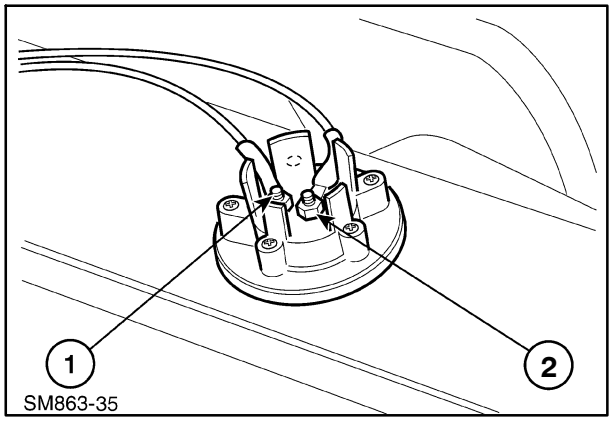


Figure 3-84

8. Seat Switch and Circuit

   Raise your weight off the center of the seat and then sit back on the seat. The EIC board will light and beep. If the board lights and beeps, the switch and circuit are OK. If the board fails to light and beep, check the seat switch and circuit to the seat switch for battery voltage. If there is battery voltage to the switch, check the switch for operation and the circuit from the switch to the EIC board. If there is no battery voltage to the switch, check the circuit to the switch.

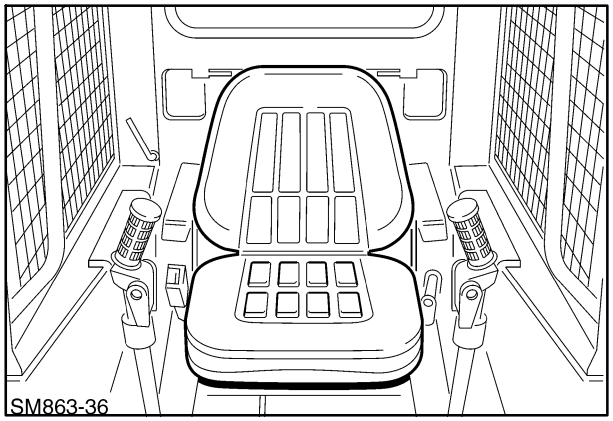


Figure 3-85

9. Seat Belt Switch and Circuit

   The operator must be sitting in the seat.

   Unbuckle and rebuckle the seat belt. The EIC board will light and beep. If the board lights and beeps, the switch and circuit are OK. If the board fails to light and beep, check the seat belt switch and circuit from the seat switch for battery voltage. If there is battery voltage to the switch, check the switch for operation and the circuit from the seat belt switch to the EIC board. If there is no battery voltage from the seat switch, check the seat switch for operation and the wire to the seat belt switch.

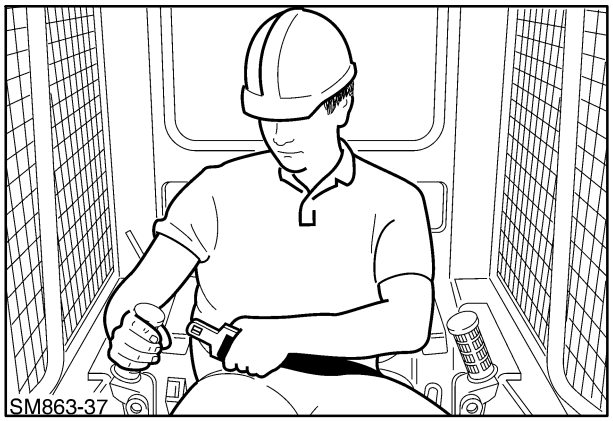


Figure 3-86

10. Service/Run Switch, 1

    The operator must be sitting in the seat.

    Switch between “SERVICE” and “RUN”. The EIC board will light and beep. If the board fails to light and beep, check the switch and circuit for battery voltage.

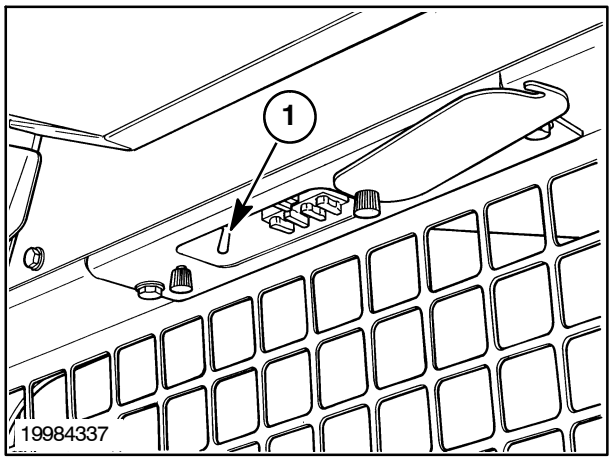


Figure 3-87

To exit Diagnostics and move to the next item, press and hold the "ARROW" switch until "dIAg" is displayed in the character display, then release the switch. Pressing the "ARROW" switch again will move the EIC to the SETUP Mode. To exit and return to the Normal Operating Mode turn the ignition key switch to the "OFF" position.

EIC SETUP MODE

The EIC Setup Mode is made up of several items:

FAULt - Fault/Warning history

- Fault occurrence with hour level of last occurrence.

Eng 0 0 - Engine Code

- Set EIC to loader engine model.

Unit F or Unit C - Select Displayed Temperature Units, Fahrenheit or Celsius

- Temperature displayed in Metric (Celsius) or English (Fahrenheit).

r-CAL - Adjust Engine RPM

- Calibrate EIC display to external RPM tach reading.

CLr F - Clear Faults

- Clear Faults to zero.

HourS - Adjust skid-steer loader hours

- Change unit hours when installing a new EIC board in a loader.

CLr E - Clear Memory

- Return EIC to original factory settings.
- Engine code reset to (01).
- Hours reset to (0000.0) zero.
- Temperature displayed (Fahrenheit).
- Engine RPM calibration cleared.

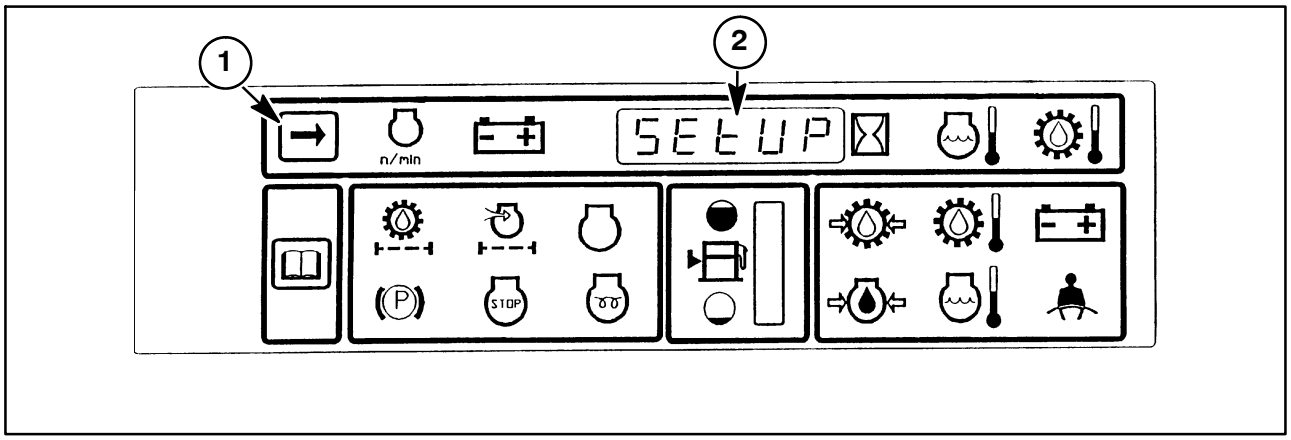


Figure 3-88

FAULt - Fault/Warning history

With display showing “LOC_ _” for lock.

1. Press and release the “ARROW” switch, 1; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display, 2.

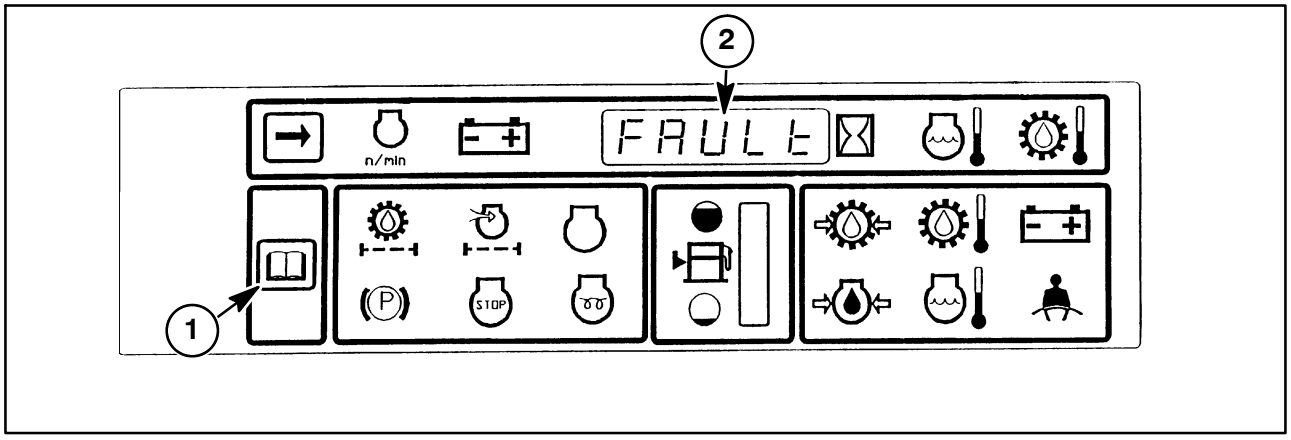


Figure 3-89

2. Press and hold the “OPEN BOOK” switch, 1, until “FAULt” appears in the character display, 2.

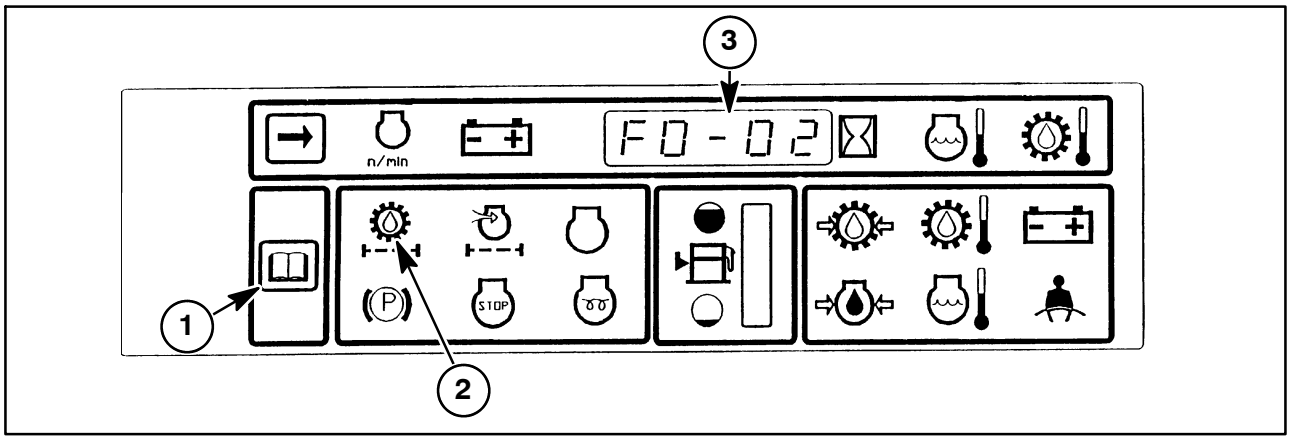


Figure 3-90

Press and hold the “OPEN BOOK” switch, 1, until “F0-XX” appears in the display. The “F0” is the fault and the “XX” is the number of occurrences of that fault since the fault memory was last cleared. The fault code display will be accompanied by an illuminated front panel symbol identifying the fault. Thus, “F0” is identified via the illuminated oil filter symbol, 2, example “F0-02” is showing in display, 3, F0 code with 02 occurrences.

Press and release the “OPEN BOOK” switch will display the hour of the last occurrence, for this code, example “0565.3” hours. Pressing and releasing the “OPEN BOOK” switch will return the EIC to the fault code.

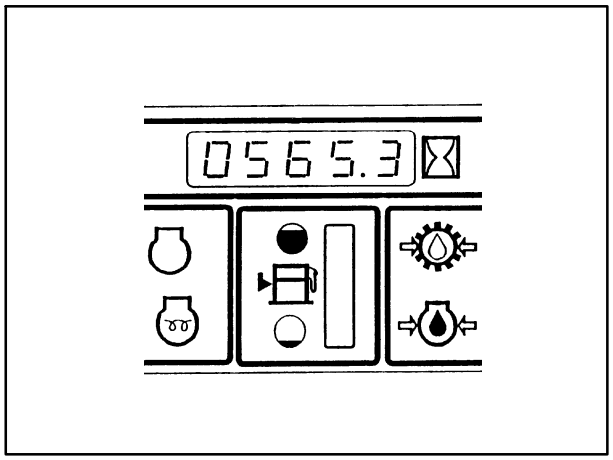


Figure 3-91

Pressing and releasing the “ARROW” switch again will forward to the next fault “F1-00” and pressing and releasing the “OPEN BOOK” switch again will display the hour of the last occurrence if any fault occurrences were shown. Use this procedure to go through all the fault codes:

FAULT CODES	FAULT	SYMBOL LIGHT
F0-00	Hydraulic oil filter	Oil filter
F1-00	Engine air cleaner	Air cleaner
F2-00	Not used	Blank
F3-00	Engine preheat	Preheat
F4-00	Fuel solenoid	Fuel level bar lights
F5-00	Engine coolant temperature	Engine coolant
F6-00	Hydrostatic transmission charge pressure	Charge pressure
F7-00	Transmission/Hydraulic oil temperature	Oil temperature
F8-00	Battery voltage	Battery
F9-00	Engine oil pressure	Oil pressure
FA-00	Hydraulic boom/bucket solenoid	Seat belt

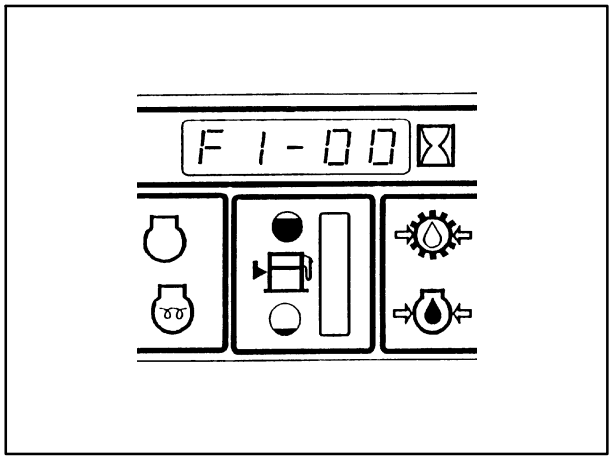


Figure 3-92

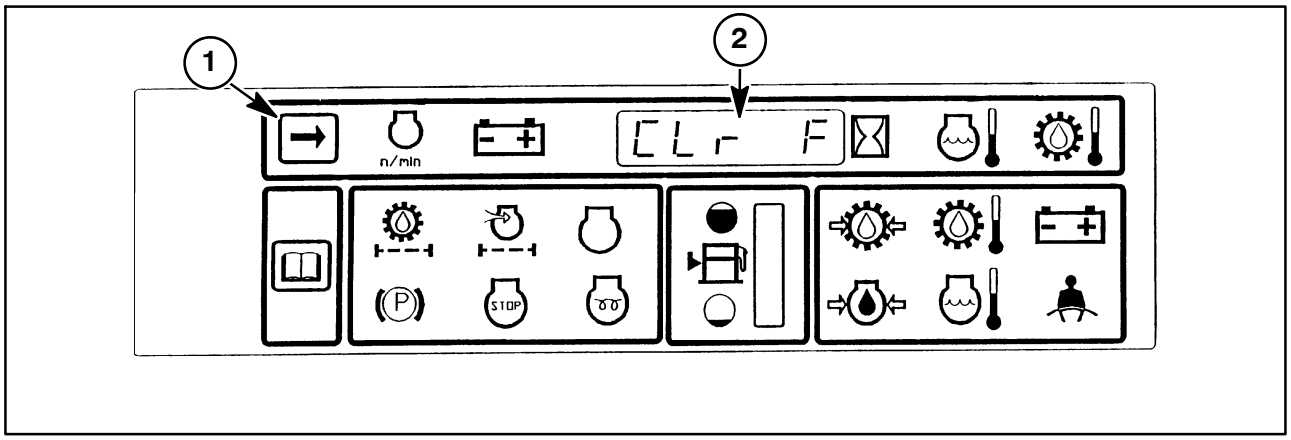


Figure 3-93

Once all faults have been identified, the fault history can be cleared to zero.

To return to “FAULt” and clear the faults, press and hold the “ARROW” switch, 1, until the original “FAULt” item is displayed in the character display.

Press and release the “ARROW” switch, 1, until “CLr F” appears in the character display, 2.

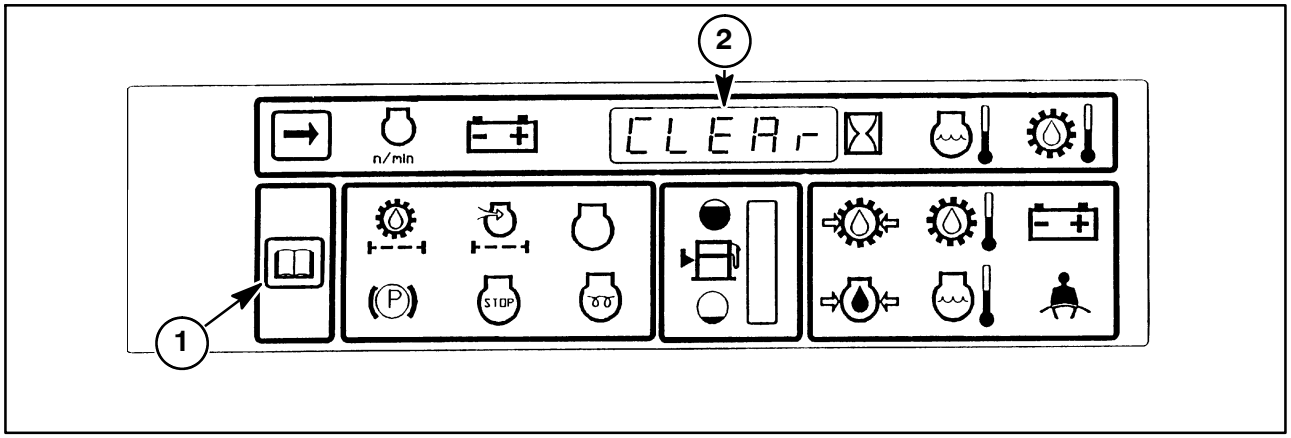


Figure 3-94

Press and hold the “OPEN BOOK” switch, 1, until “CLEAr” appears in the display, 2. Then release the switch to clear all fault occurrences from the fault history memory.

To exit this item, press and hold the “ARROW” switch to return to the “SEtUP” mode, or turn the ignition key switch to the “OFF” position to return the EIC to the Normal Operating Mode.

Eng 0 0 - Engine Code

With display showing “LOC_ _” for lock:

1. Press and release the “ARROW” switch; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display.
2. Press and hold the “OPEN BOOK” switch until “FAULt” appears in the character display; release switch.
3. Press and release the “ARROW” switch until “EngXX” (XX=current engine code) appears in the display, 1.
4. Press and hold the “OPEN BOOK” switch until the left digit starts to flash; release switch.
5. Press and release the “OPEN BOOK” to enter a zero (0) into the left digit of the engine code.
6. Press and release the “ARROW” switch; the right digit will flash.
7. Press and release the “OPEN BOOK” switch to enter the right number of the engine code, example Eng 01 for the L565, Lx565, Lx665 skid-steer loaders as shown in display 1.

The engine codes are as follows.

01 - L565, Lx565, Lx665

To exit this item, press and hold the “ARROW” switch two times to return to the “SEtUP” mode item list, or turn the ignition key switch to the “OFF” position to return the EIC to the normal operating mode.

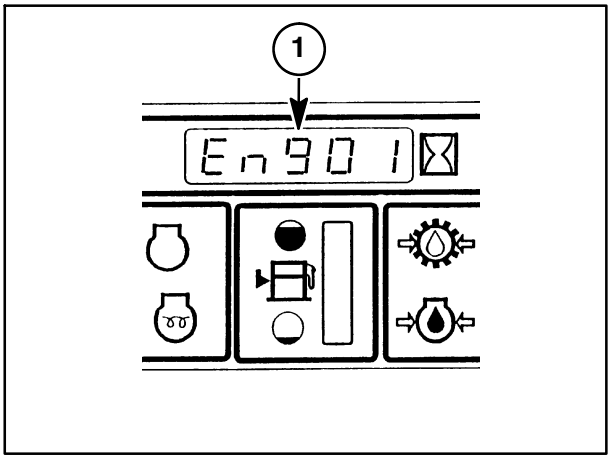


Figure 3-95

Unit F or Unit C (EIC Reading Fahrenheit or Celsius)

With display showing “LOC_ _” for lock.

1. Press and release the “ARROW” switch; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display.
2. Press and hold the “OPEN BOOK” switch until “FAULt” appears in the character display; release switch.
3. Press and release the “ARROW” switch until “Unit F” or “Unit C” appears in the character display, 1.
4. Press and hold the “OPEN BOOK” switch until the rightmost letter flashes, then release the switch.
5. Press and release the “OPEN BOOK” to change from C to F or F to C.

- Unit F will read temperature degrees in Fahrenheit
- Unit C will read temperature degrees in Celsius

To exit this item press and hold the “ARROW” switch two times to return to the “SEtUP” mode item list or turn the ignition key switch to the “OFF” position to return the EIC to the Normal Operating Mode.

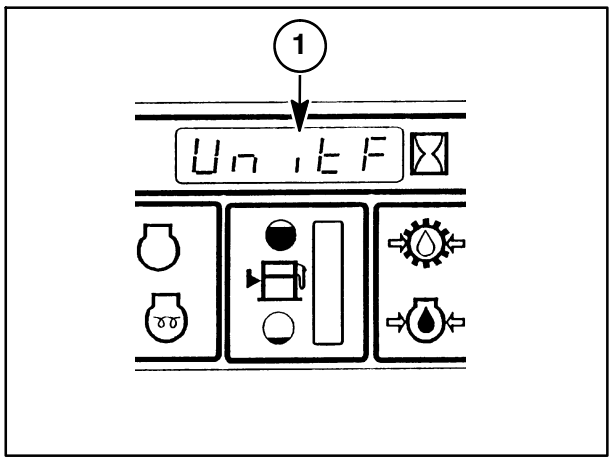


Figure 3-96

r-CAL - Adjust Engine RPMS

With display showing “LOC_ _” for lock.

1. Press and release the “ARROW” switch; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display.
2. Press and hold the “OPEN BOOK” switch until “FAULt” appears in the character display, release switch.
3. Press and release the “ARROW” switch until “r-CAL” appears in the character display, 1.

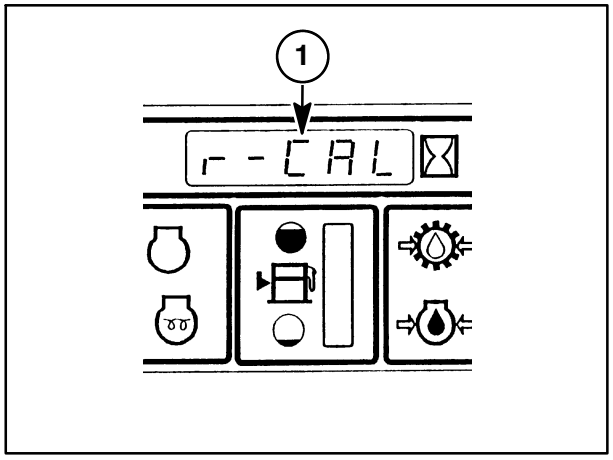


Figure 3-97

4. Press and hold the “OPEN BOOK” switch until all zeros are displayed in the character display. Upon releasing of the switch only the right zero will be showing in display, 1.

5. Buckle the seat belt and start the engine. Using a hand held photo-tach or other accurate measuring device, check the engine RPM at high idle (full throttle). Compare the hand held tach reading to the EIC RPM reading.

6. Press and release the “OPEN BOOK” or “ARROW” switches to change the EIC reading to match the tach at high idle. Pressing the “OPEN BOOK” switch will decrease the reading and pressing the “ARROW” switch will increase the reading.

   For best results, RPM should be calibrated at full throttle only.

NOTE: The “OPEN BOOK” or “ARROW” switches may have to be pressed multiple times to change the reading, this is normal. When changing the high idle reading, the low idle reading will have a slight change.

To exit this item, turn the ignition key switch to the “OFF” position to return the EIC to the Normal Operating Mode.

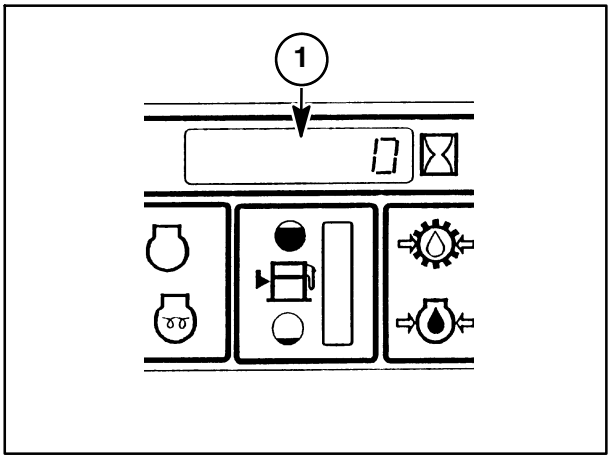


Figure 3-98

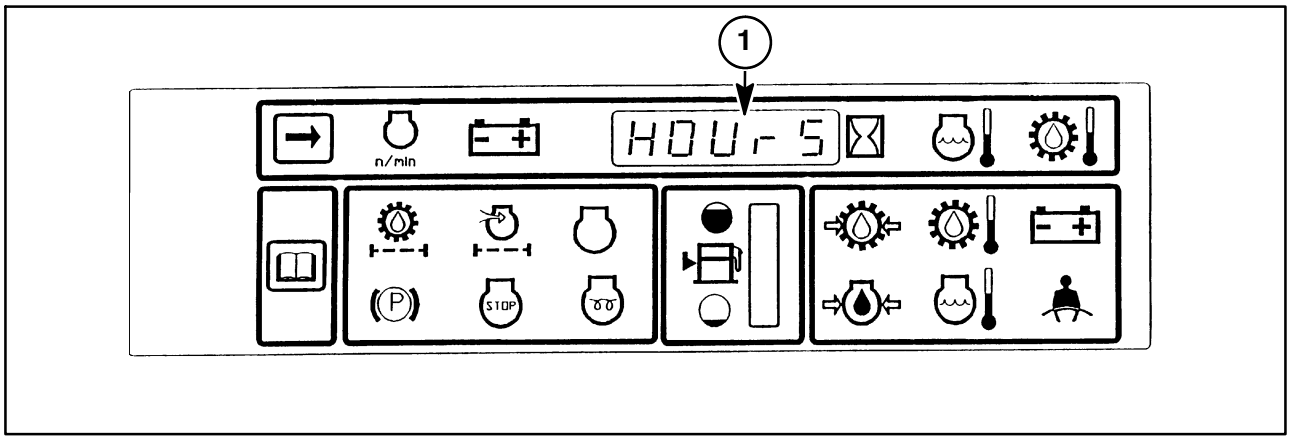


Figure 3-99

DEALERS USE ONLY

HourS - Adjust skid-steer loader hours

With display showing “LOC_ _” for lock.

1. Press and release the “ARROW” switch; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display.
2. Press and hold the “OPEN BOOK” switch until “FAULt” appears in the character display; release switch.
3. Press and release the “ARROW” switch until “HOUrS” appears in the character display, 1.
4. Press and hold the “OPEN BOOK” switch until “LOC 0 0” appears in the character display with the left zero flashing; release the switch. A code number (21) must be entered to get into the menu to adjust the hour reading.
5. Press and release the “OPEN BOOK” to enter a 2.
6. Press and release the “ARROW” switch and the right zero will flash.
7. Press and release the “OPEN BOOK” switch and enter a 1.
8. Press and hold the “ARROW” switch until the hours are displayed in the display with the left most number flashing, release the switch.
9. If this number is to be changed, press and release the “OPEN BOOK” to enter the correct number. If this number is OK press and release the “ARROW” switch and move to the number(s) requiring the change.

Follow this procedure until all digits are corrected.

To exit this item, press and hold the “ARROW” switch two times to return to the “SEtUP” mode item list or turn the ignition key switch to the “OFF” position to return the EIC to the normal operating mode.

DEALERS USE ONLY

CLr E - Clear Memory

With display showing “LOC_ _” for lock.

1. Press and release the “ARROW” switch; “dIAg” will appear in the character display. Then press and release the “ARROW” switch again; “SEtUP” will appear in the display.
2. Press and hold the “OPEN BOOK” switch until “FAULt” appears in the character display; release switch.
3. Press and release the “ARROW” switch until “CLr E” appears in the character display, 1.
4. Press and hold the “OPEN BOOK” switch until “LOC 0 0” appears in the character display with the left zero flashing, release the switch. A code number (21) must be entered to get into the menu to clear the memory and return the EIC original settings.
5. Press and release the “OPEN BOOK” to enter a 2.
6. Press and release the “ARROW” switch and the right zero will flash.
7. Press and release the “OPEN BOOK” switch and enter a 1.
8. Press and hold the “ARROW” switch until “CLEAr” appears in the display, 1, then release the switch clearing the EIC board and returning the board to the original factory setting.

To exit this item, press and hold the “ARROW” switch to return to the “SEtUP” mode list or turn the ignition key switch to the “OFF” position to return the EIC to the normal operating mode.

NOTE: When clearing the EIC boards memory and returning to the original factory settings, all clock hours will be removed. The engine code will return to Eng01, the unit temperature readings will be in English (Fahrenheit) and the engine RPM calibration will be cleared.

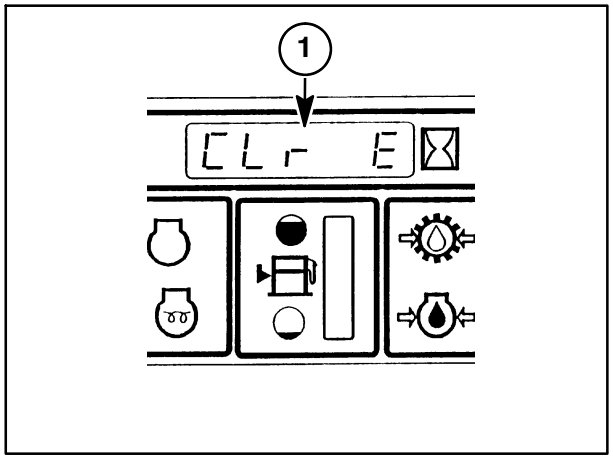


Figure 3-100

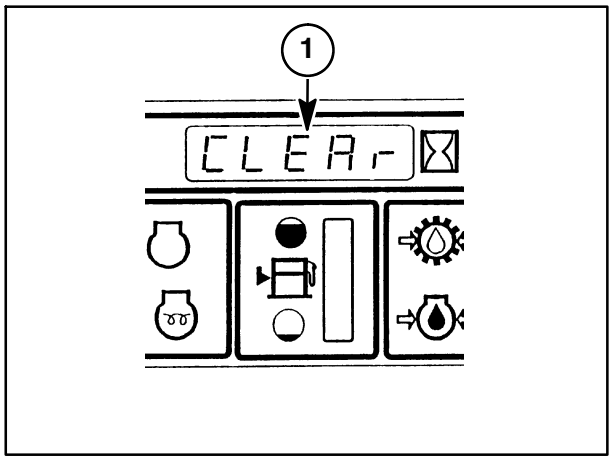


Figure 3-101

ELECTRICAL CIRCUITS

EIC (ELECTRONIC INSTRUMENT CLUSTER)

The EIC board receives power from five different points.

1. Main power circuit, 12-volt battery, from the 5-amp fuse in the engine fuse panel.
2. The ignition switch, 12-volt ignition circuit.
3. Seat switch circuit.
4. The seat belt switch circuit.
5. The ignition switch, 12-volt accessory circuit.

MAIN POWER CIRCUIT TO EIC BOARD

Battery voltage

The power originates at the battery and proceeds through the (R) battery cable to the starter solenoid. From there power continues through the (R) wire to the battery side of the start relay. The power continues through the (R) wire to the preheat circuit breaker, then through the (R) wire to the engine fuse panel (standard fuse block), battery side of the key main 15-amp fuse with a terminal bus to the battery side of the electronics 5A fuse. The power continues through the (R/LTGN) wire to pin number 14 of connector P2 (12-volt battery terminal) at the EIC board.

EIC BOARD GROUND CIRCUIT

The EIC board is grounded from connector P2 terminal 13 through the (B) wire to the engine ground at the bell housing.

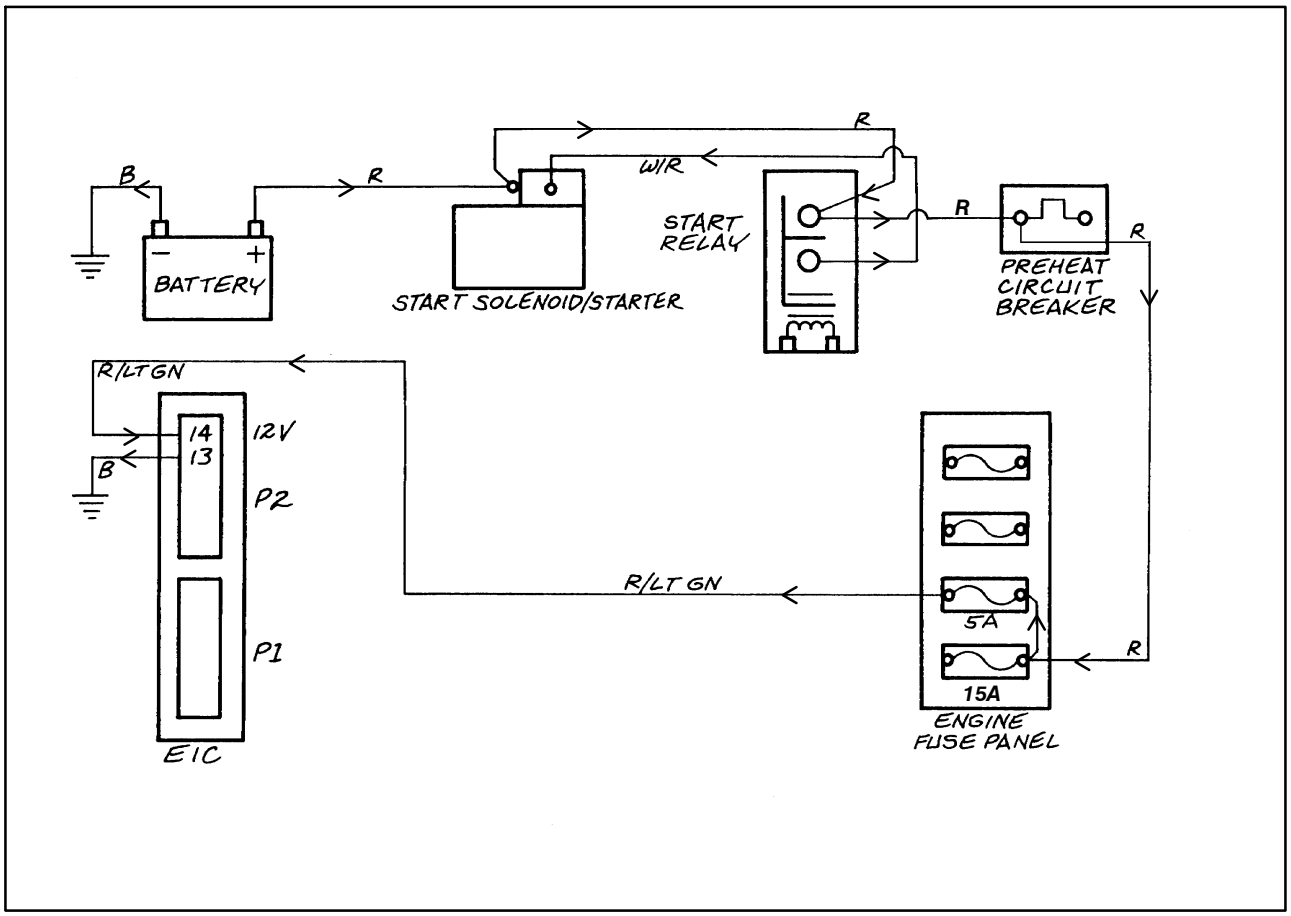


Figure 3-102

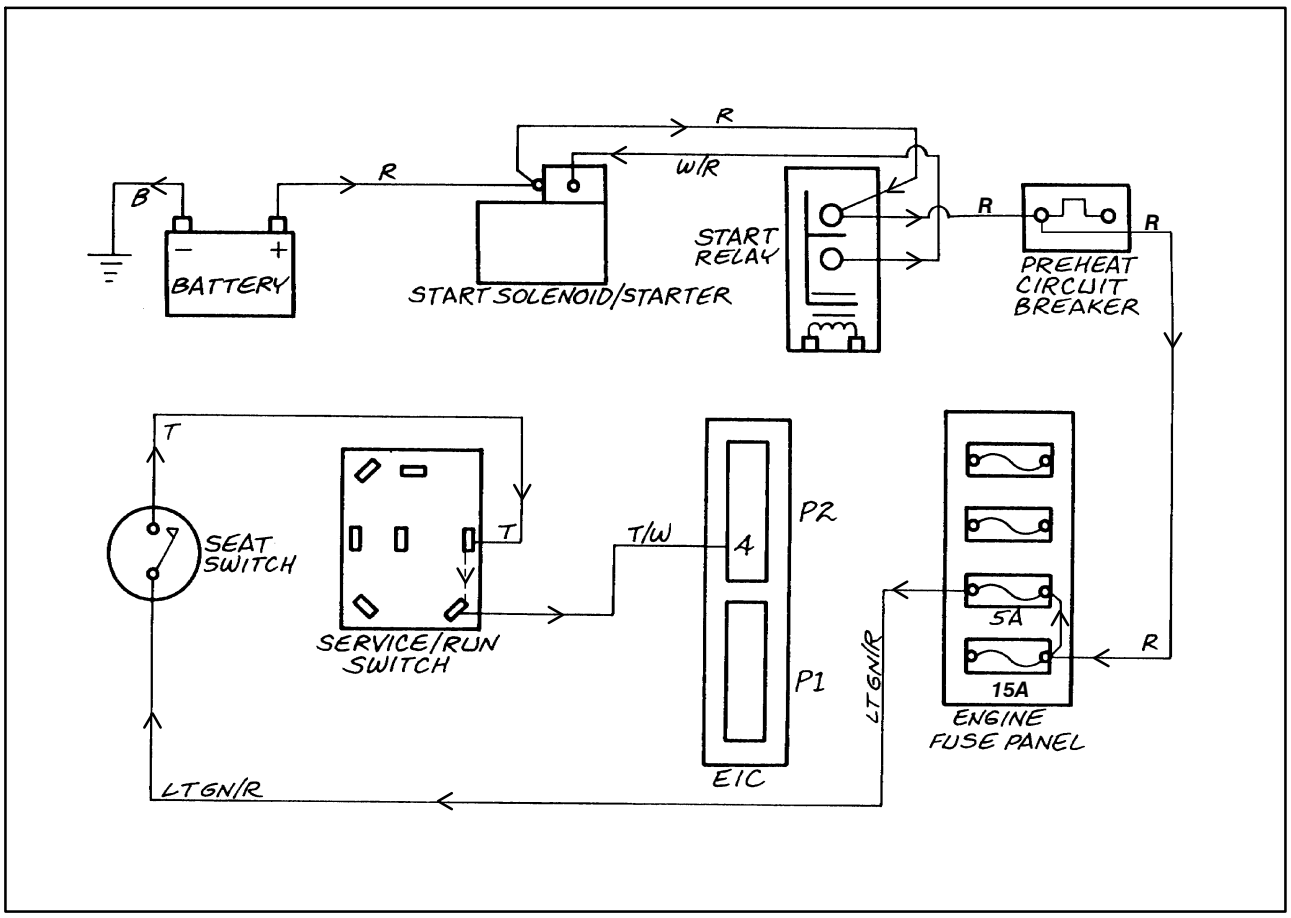


Figure 3-103

SEAT SWITCH CIRCUIT TO EIC BOARD

Battery voltage

The power originates at the battery and proceeds through the (R) battery cable to the starter solenoid.

From there power continues through the (R) wire to the battery side of the start relay.

The power continues through the (R) wire to the preheat circuit breaker, then through the (R) wire to the engine fuse panel (standard fuse block) battery side of the key main 15-amp fuse with a terminal bus to the battery side of the electronics 5A fuse.

The power continues through the (LTGN/R) wire to the seat switch. When one seat switch (only 1 switch needs to be closed as switches are in parallel wiring) is pressed closed, the power then continues through the (T) wire to the Service/Run switch. When the service/run switch is in the “SERVICE” position, the power stops.

With the Service/Run switch in the “RUN” position, the power continues through the (T/W) wire to the EIC board terminal 4 of connector P2.

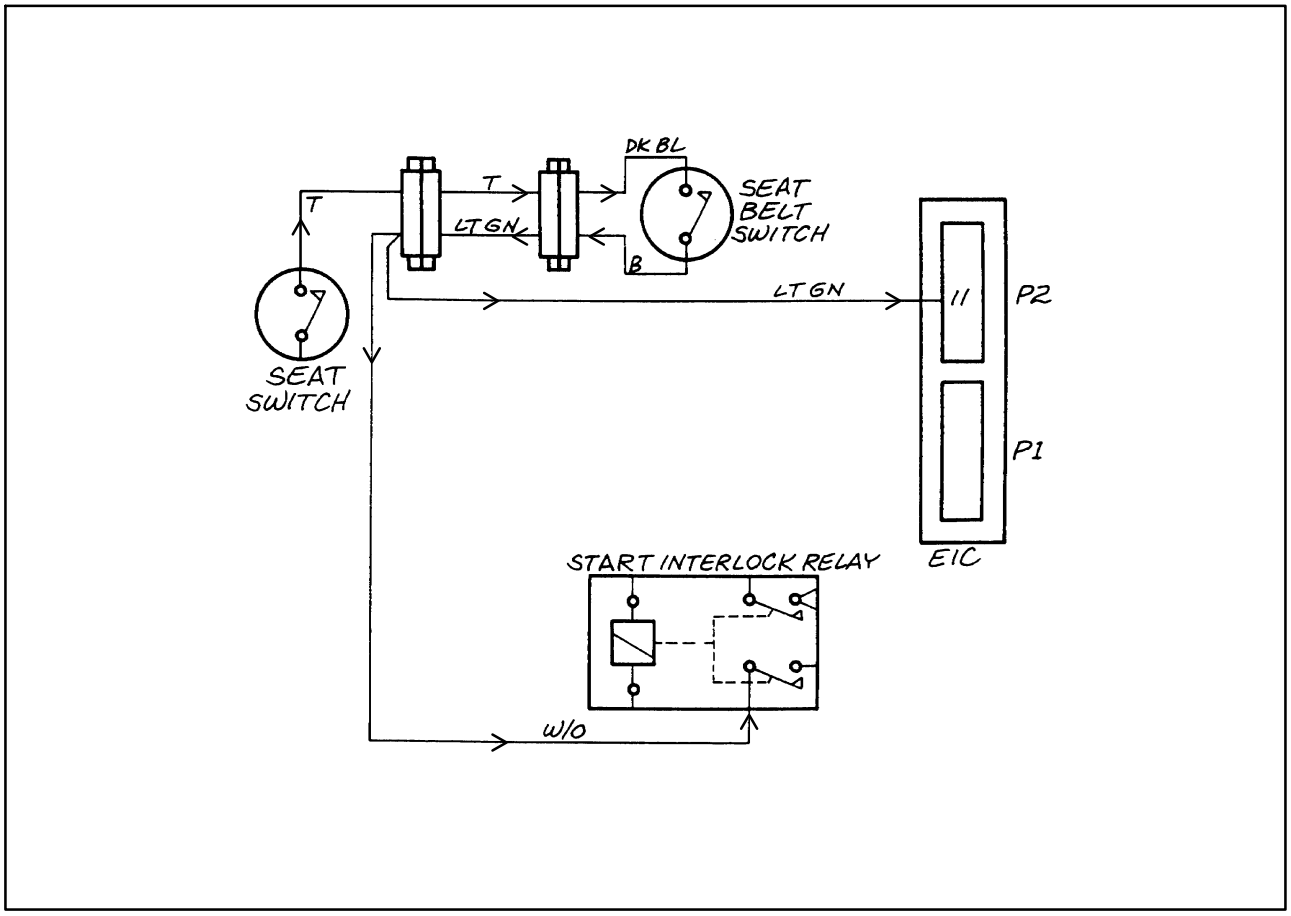


Figure 3-104

SEAT BELT SWITCH CIRCUIT TO EIC BOARD

Battery voltage

The power originates from the seat switch(es) through the (T) wire to the seat belt switch.

When the seat belt is buckled, the power proceeds through the (LTGN) wire to the EIC board terminal 11 of connector P2.

When the seat belt is buckled, power is sent through the (W/O) wire to the start interlock relay. This allows the unit to start when the seat belt is buckled.

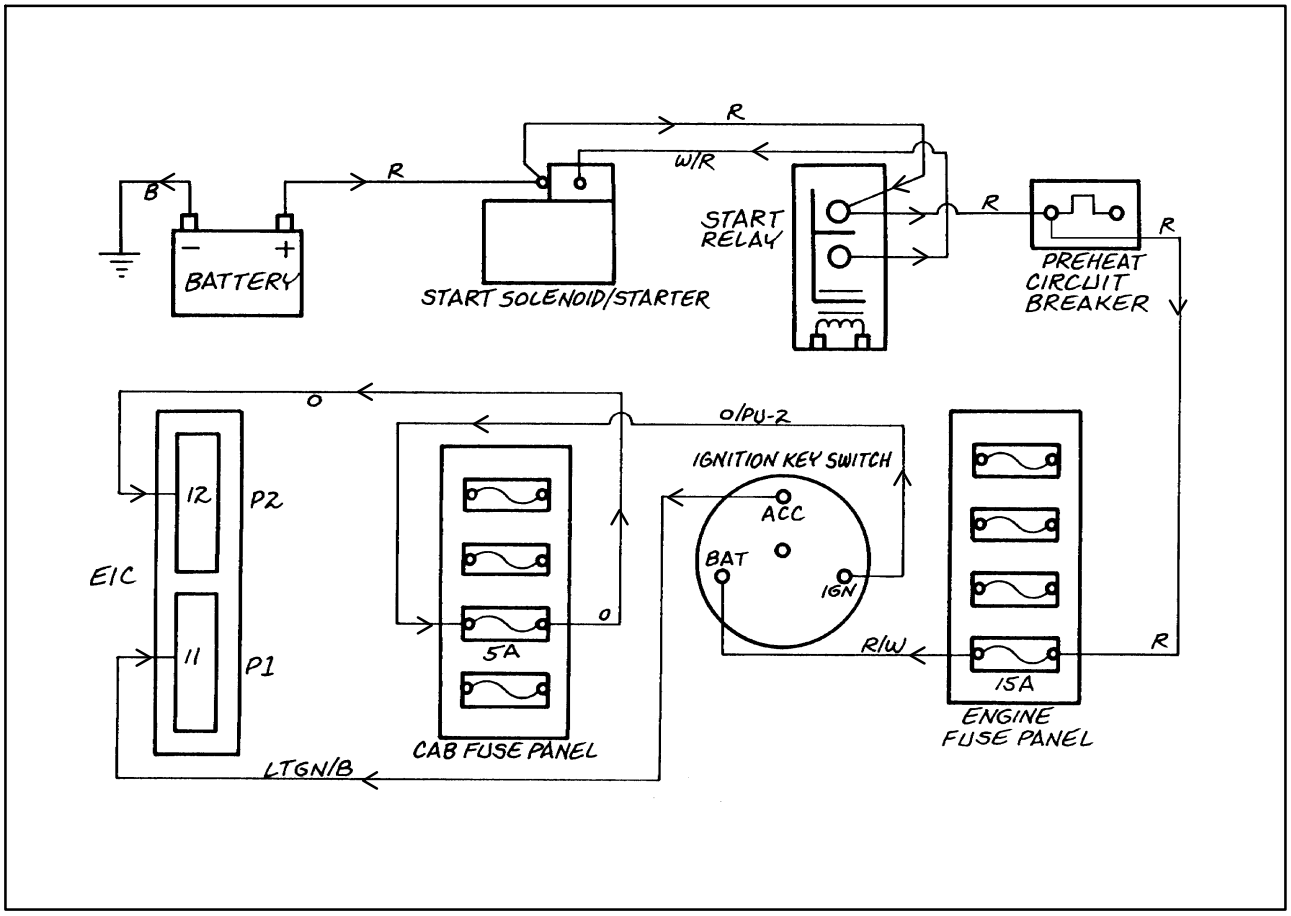


Figure 3-105

IGNITION SWITCH CIRCUIT TO EIC BOARD

Battery voltage

The power originates at the battery and proceeds through the (R) battery cable to the starter solenoid.

From there power continues through the (R) wire to the battery side of the start relay.

The power continues through the (R) wire to the preheat circuit breaker, then through the (R) wire to the engine fuse panel (standard fuse block) battery side of the key main 15-amp fuse.

The power continues through the (R/W) wire to the battery terminal of the ignition switch.

When the ignition key switch is turned to the "ON" position, power continues through the (O/PU-2) wire to the Electronics 5-amp fuse in the cab fuse panel.

The power continues through the (O) wire to terminal 12 of connector P2 at the EIC board.

NOTE: Also, with Key Switch "ON" Engine "OFF," voltage travels from the switch "ACC" terminal via the LTGN/B wire to terminal 11 of connector P1 to provide a warning of Key "ON" should the operator exit the loader.

CRANKING CIRCUIT (STARTER MOTOR)

Operating conditions with "SERVICE/RUN" switch in the "RUN" position:

To start the engine with the "SERVICE/RUN" switch in the "RUN" position, 1, the operator must be in the seat with the seat belt buckled. Then turn the key switch, 2, to the "START" position to activate the starter.

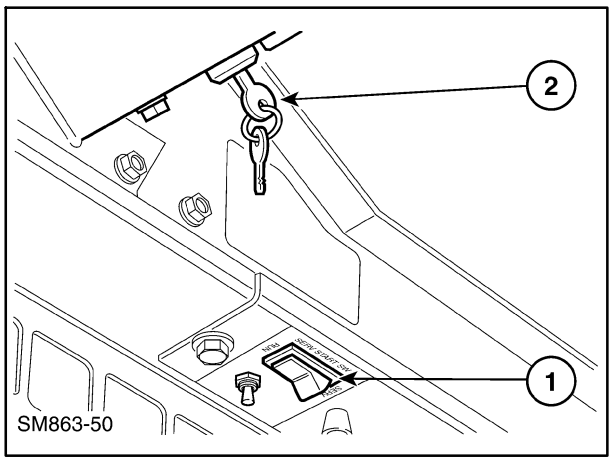


Figure 3-106

NOTE: Late model loaders have a "SERVICE/RUN" toggle switch, 1, under the cab fuse cover in front of the fuses. The forward switch position is "RUN", and the rearward position is "SERVICE".

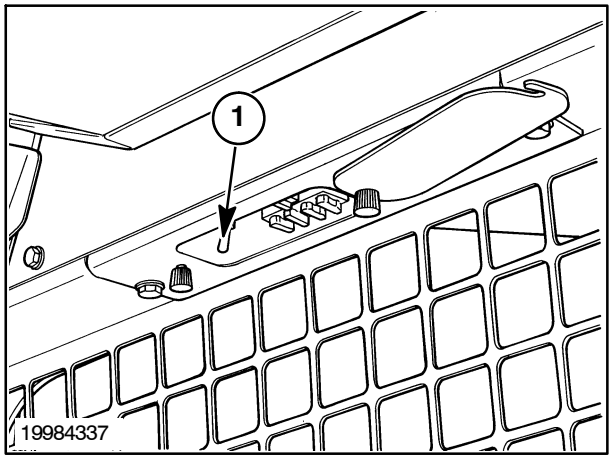


Figure 3-107

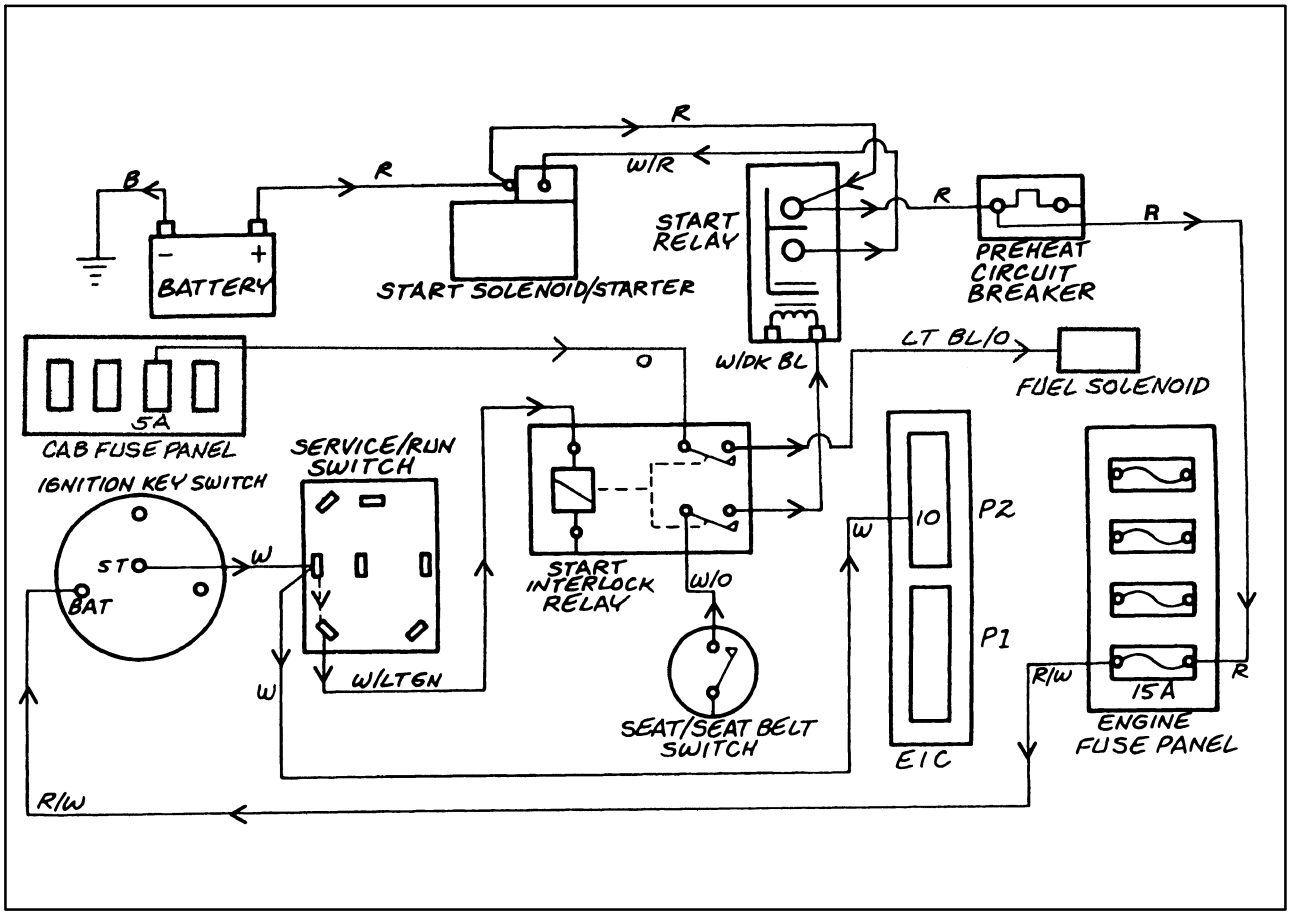


Figure 3-108

"SERVICE/RUN" switch in the "RUN" position

The power originates at the battery and flows through the (R) positive battery cable to the starter solenoid. From here the power flows through the (R) wire to the battery side of the start relay.

The power then flows through the (R) wire to the preheat circuit breaker and to the engine fuse panel to the 15A key main fuse.

The power then flows through the (R/W) wire to the battery terminal on the ignition key switch.

With the key switch in the "START" position, current flows through the (W) wire to the service/run switch. Power also flows through the (W) wire to connector P2 terminal 10-key start at the EIC board.

Power then flows from the service/run switch through the (W/LTGN) wire to the start interlock relay coil terminal.

With the interlock energized, the power from the seat/seat belt circuit (W/O) wire flows through the (W/DKBL) wire to the start relay to activate the relay.

Power also flows from the start interlock relay through the LTBL/O wire to the fuel solenoid to open the solenoid, allowing fuel flow to the injection pump.

When the start relay is activated, power goes through the (W/R) wire to the starter solenoid, which connects battery power to the starter motor.

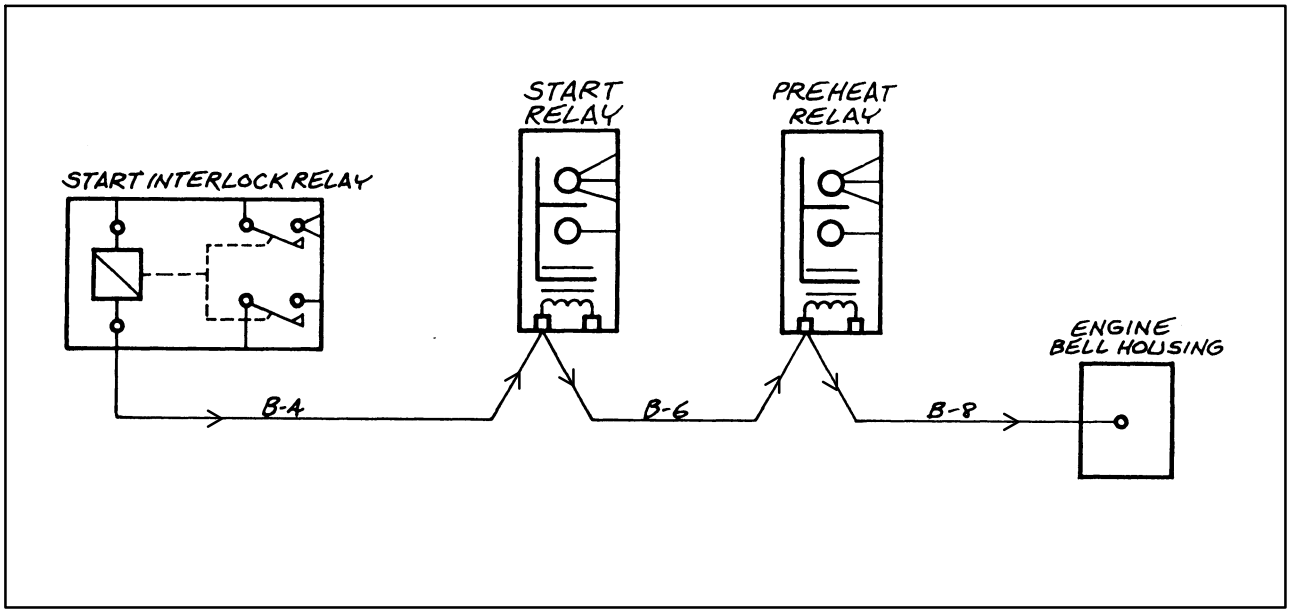


Figure 3-109

Cranking Circuit Ground

The start interlock relay is grounded through the (B-4) wire to the ground terminal on the start relay. The system ground (B-6) wire then goes to the ground terminal of the preheat relay. The system ground (B-8) wire then goes to the engine ground at the bell housing.

Operating Conditions "SERVICE/RUN" switch in the "SERVICE" position

To start the engine with the "SERVICE/RUN" switch, 1, in the "SERVICE" position, the starter will be activated any time the key switch is turned to the "START" position.

NOTE: If manual preheat is required, the operator must be in the seat.

NOTE: The boom and bucket control valve spool locks will remain inoperative with the "SERVICE/RUN" switch in the "SERVICE" position.

NOTE: Late model loaders have a "SERVICE/RUN" toggle switch, 1, under the cab fuse cover in front of the fuses. The forward switch position is "RUN", and the rearward position is "SERVICE".

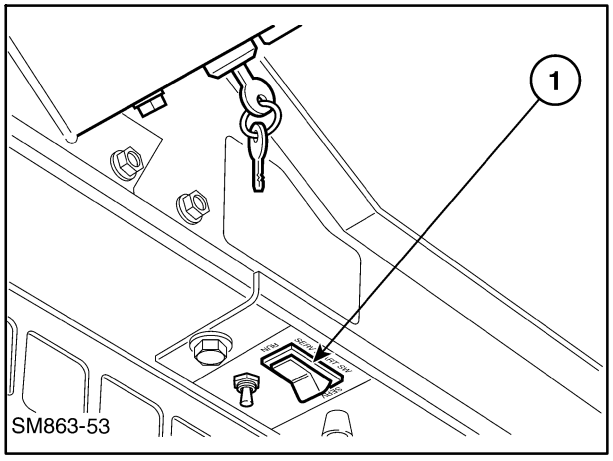


Figure 3-110

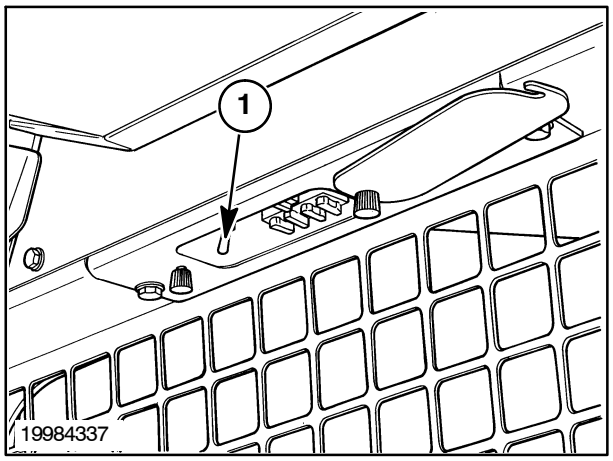


Figure 3-111

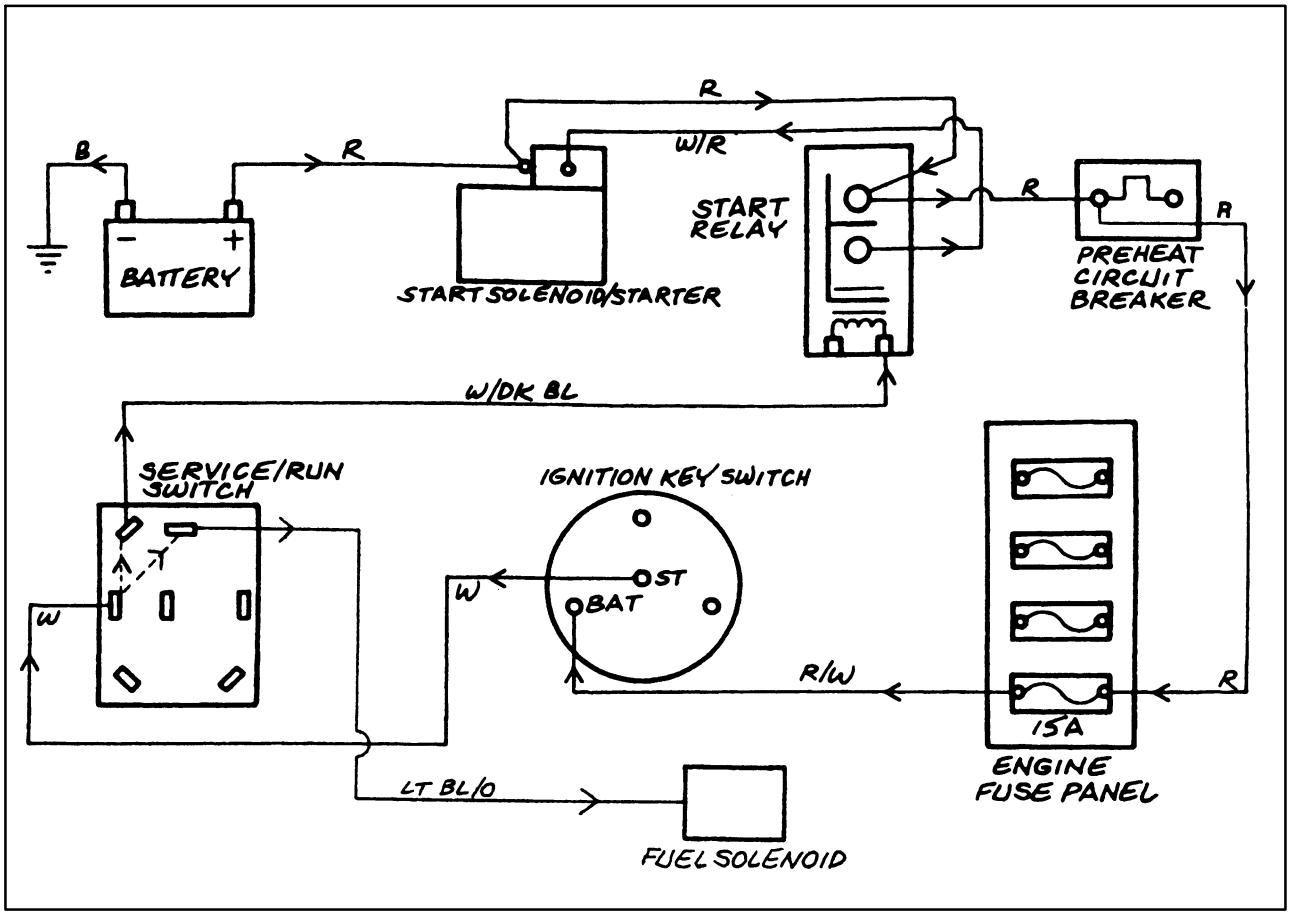


Figure 3-112

Service/Run switch in the "SERVICE" position

The power originates at the battery and flows through the (R) positive battery cable to the starter solenoid. From here the power flows through the (R) wire to the battery side of the start relay.

The power then flows through the (R) wire to the preheat circuit breaker and to the engine fuse panel to the 15A key main fuse.

The power then flows through the (R/W) wire to the battery terminal on the ignition key switch.

With the key switch in the "START" position, current flows through the (W) wire to the service/run switch.

With the service/run switch in the "SERVICE" position, power goes through the (W/DKBL) wire from the service/run switch to the start relay to activate the relay.

When the start relay is activated, power goes through the (W/R) wire to the starter solenoid, which connects battery power to the starter motor.

With the service/run switch in the "SERVICE" position, power goes through the LTBL/O wire from the service/run switch to the fuel solenoid, opening the solenoid to allow the engine to start.

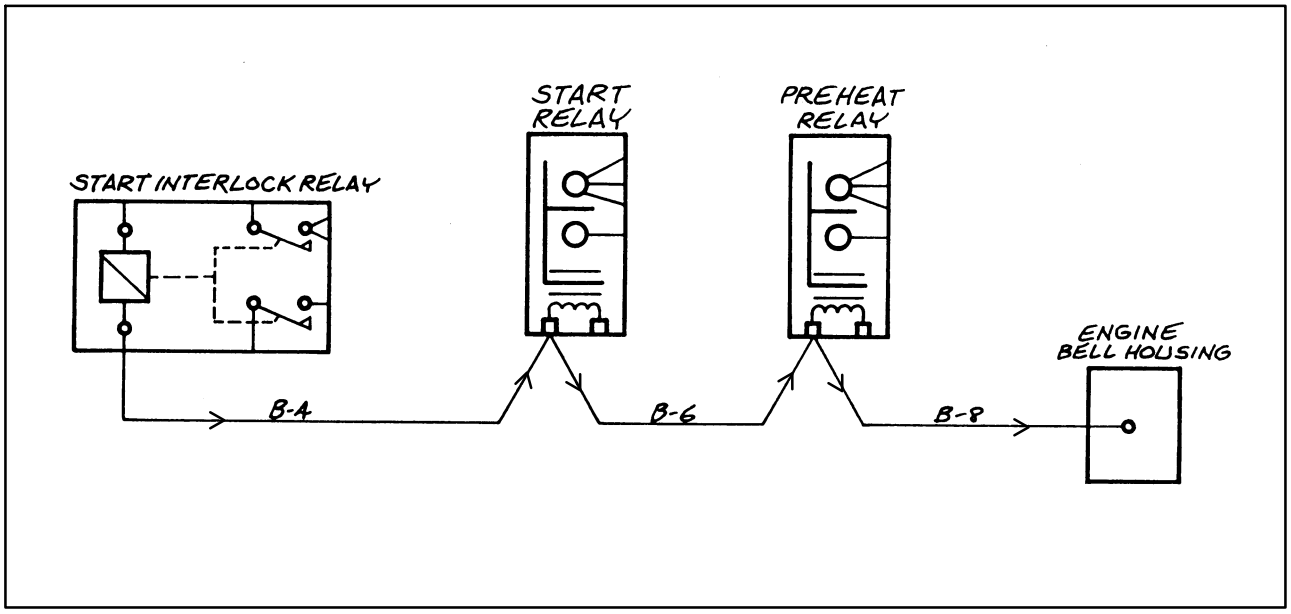


Figure 3-113

Cranking Circuit Ground

The start interlock relay is grounded through the (B-4) wire to the ground terminal on the start relay. The system ground (B-6) wire then goes to the ground terminal of the preheat relay. The system ground (B-8) wire then goes to the engine ground at the bell housing.

Start Relay Operation

The start relay allows for smaller wires to be used in the switch circuits. The larger wires are then only used between the power supply, start relay, and starter motor. The start relay provides a short path for the high current required to pull in the starter solenoid with minimal voltage drop.

The start relay, 1, and the preheat relay, 2, may be wired in either position. Check wire colors for proper relay location.

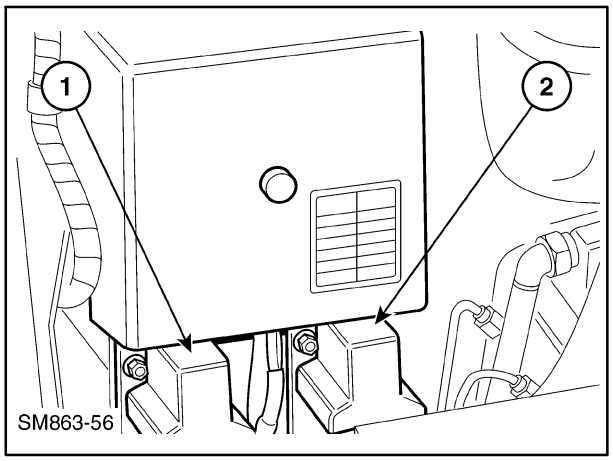


Figure 3-114

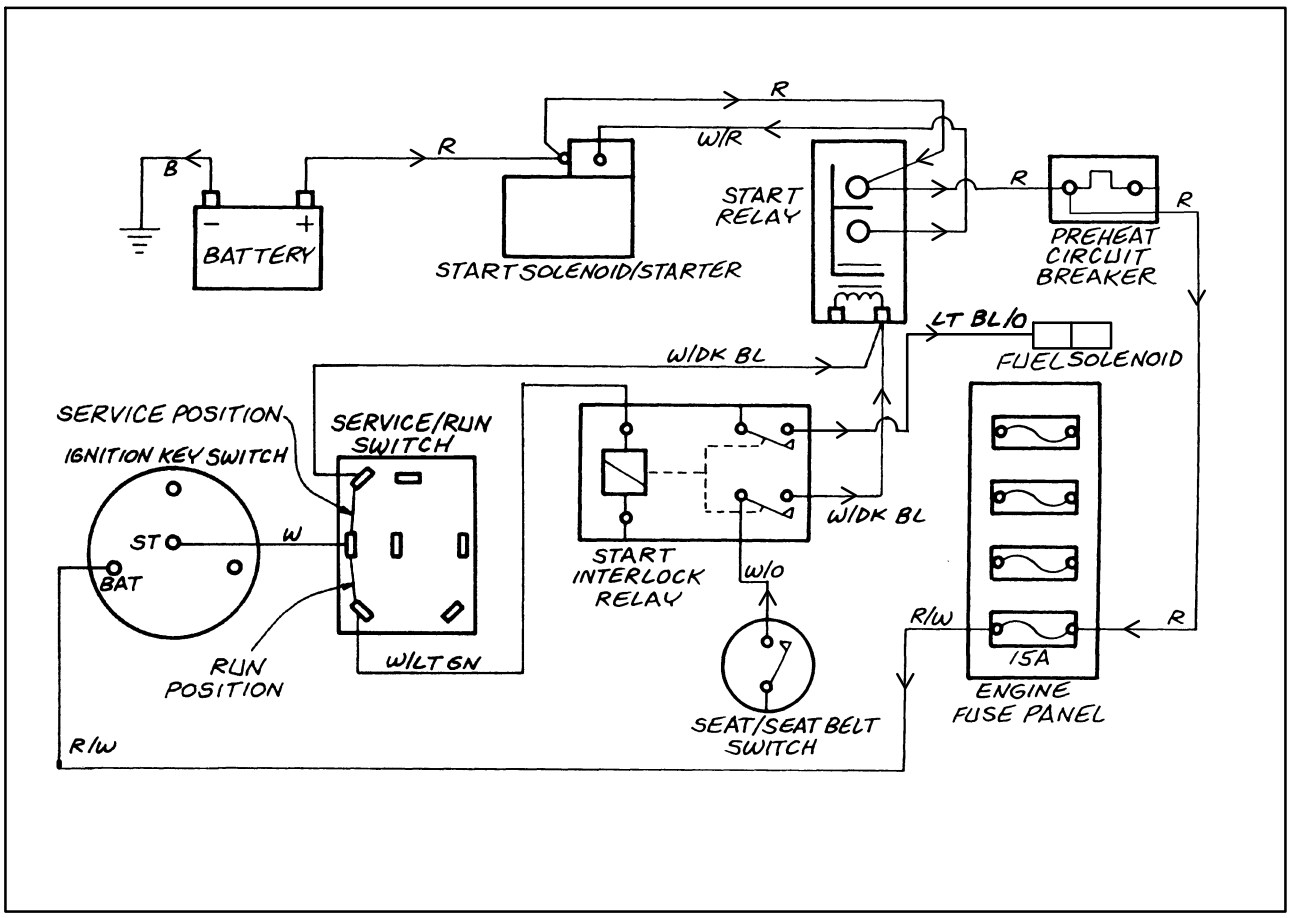


Figure 3-115

Start Relay Circuit

The power originates at the battery and flows through the (R) positive battery cable to the starter solenoid. From here the power flows through the (R) wire to the battery side of the start relay.

The power then flows through the (R) wire to the preheat circuit breaker and to the engine fuse panel to the 15A key main fuse.

The power then flows through the (R/W) wire to the battery terminal on the ignition key switch.

When the service/run switch is in the “RUN” position, the operator is in the seat with the seat belt buckled, and the start interlock relay is energized by the W/LTGN wire from the service/run switch, the start relay receives energizing power from the seat/seat belt circuit via the W/O wire, then the (W/DKBL) wire from the start interlock relay.

When the service/run switch is in the “SERVICE” position, the start relay receives energizing power through the (W/DKBL) wire from the service/run switch.

When the start relay is activated, it connects the battery side of the relay to the start side and sends power to the starter solenoid through the (W/R) wire, activating the starter motor.

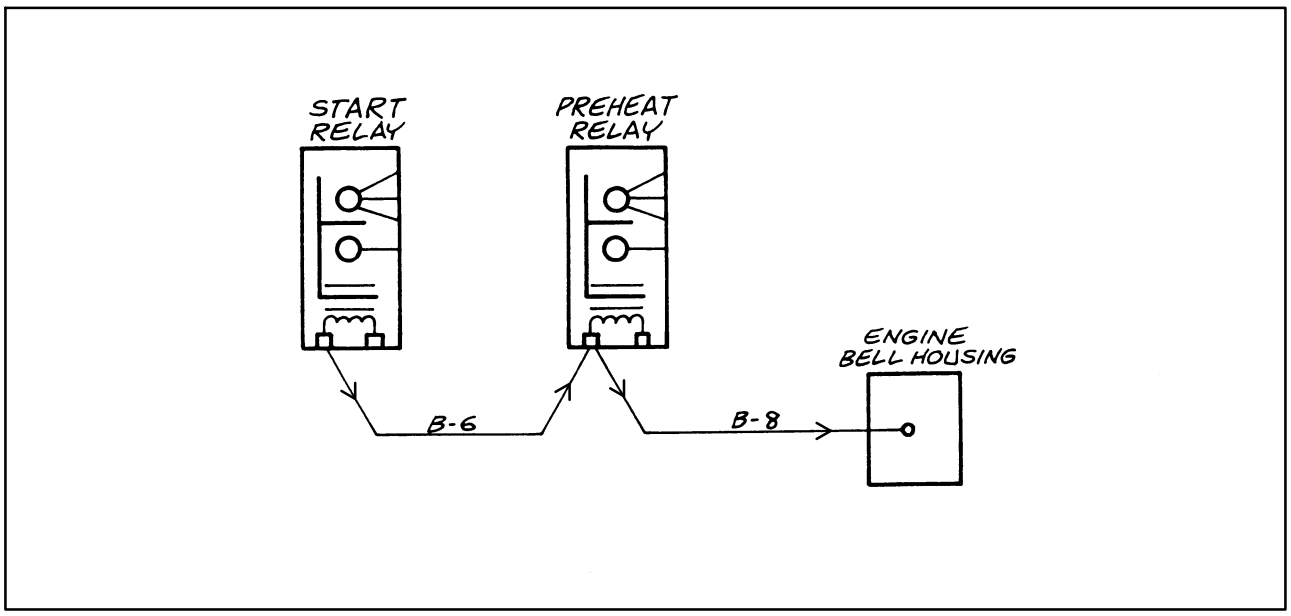


Figure 3-116

Start Relay Ground Circuit

The start relay is grounded through the (B-6) wire to the ground terminal on the preheat relay and then through the (B-8) wire to the engine bell housing.

START INTERLOCK RELAY OPERATION

The start interlock relay, 1, controls the starting circuit when the “SERVICE/RUN” switch is in the “RUN” position, allowing the engine to start.

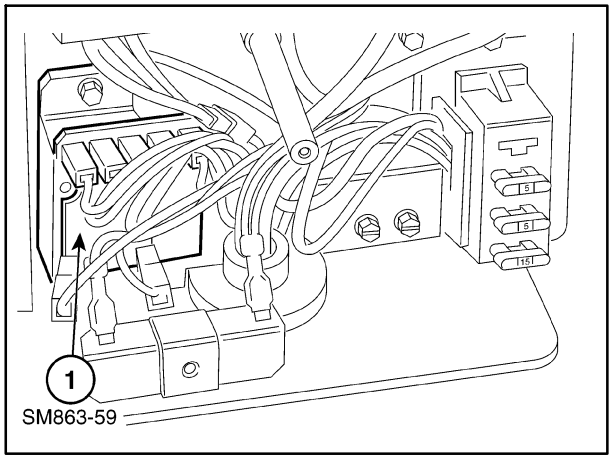


Figure 3-117

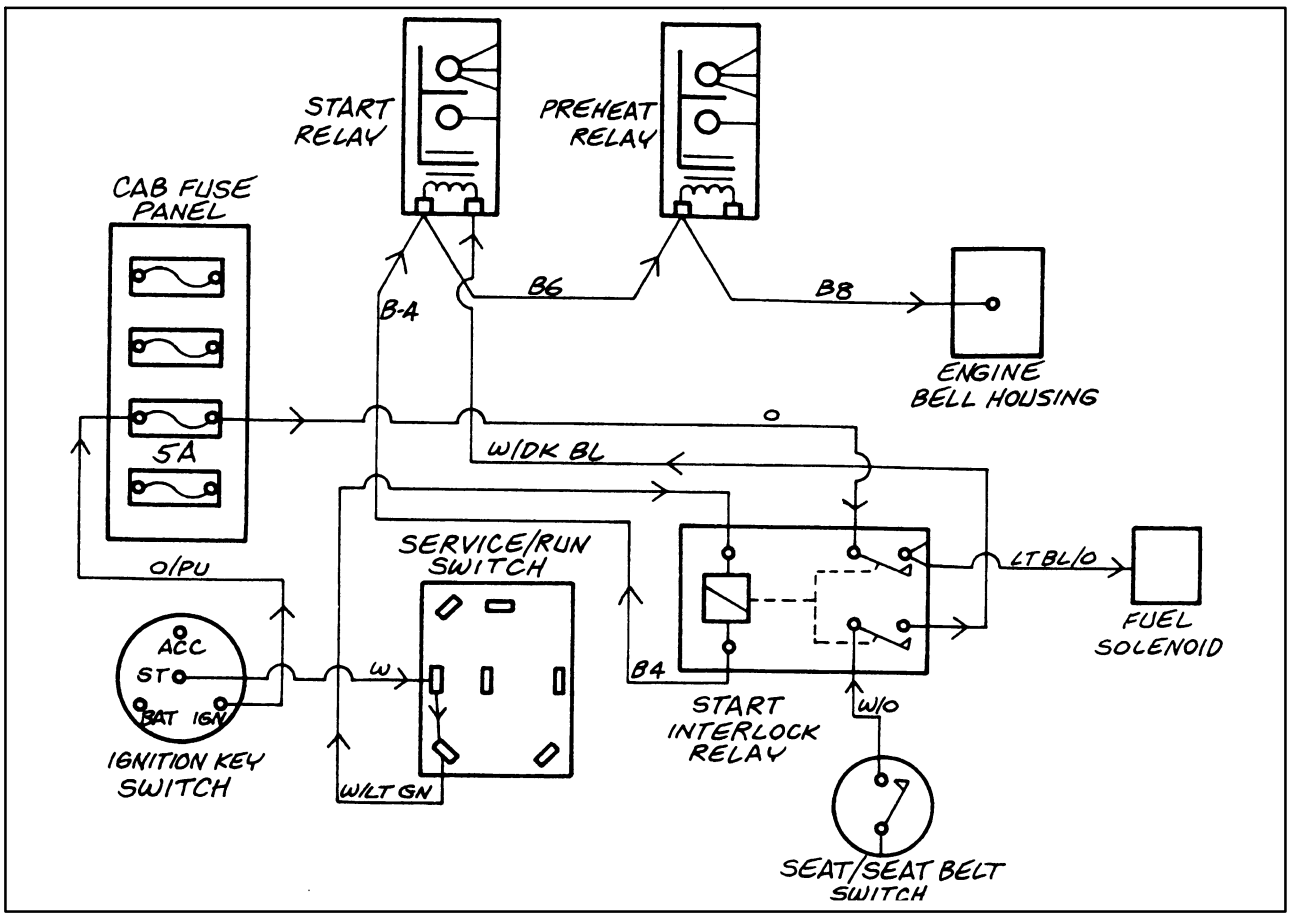


Figure 3-118

Start Interlock Circuit

"SERVICE/RUN" switch in the "RUN" position.

The start interlock relay coil receives power from the service/run switch, with the switch in the "RUN" position, through the W/LTGN wire. The interlock receives power from the seat/seat belt plug when the operator is sitting in the seat with the seat belt buckled through the W/O wire.

When the interlock is "satisfied" that the service/run switch is in the "RUN" position and the operator is sitting in the seat with the seat belt buckled, power will travel through the W/DKBL wire to the start relay and through the LTBL/O wire to the fuel solenoid, allowing the engine to start. The source for the fuel solenoid power is from key switch "Ign," then through the O/PU wire to the cab 5-amp fuse, then via the O wire to the relay.

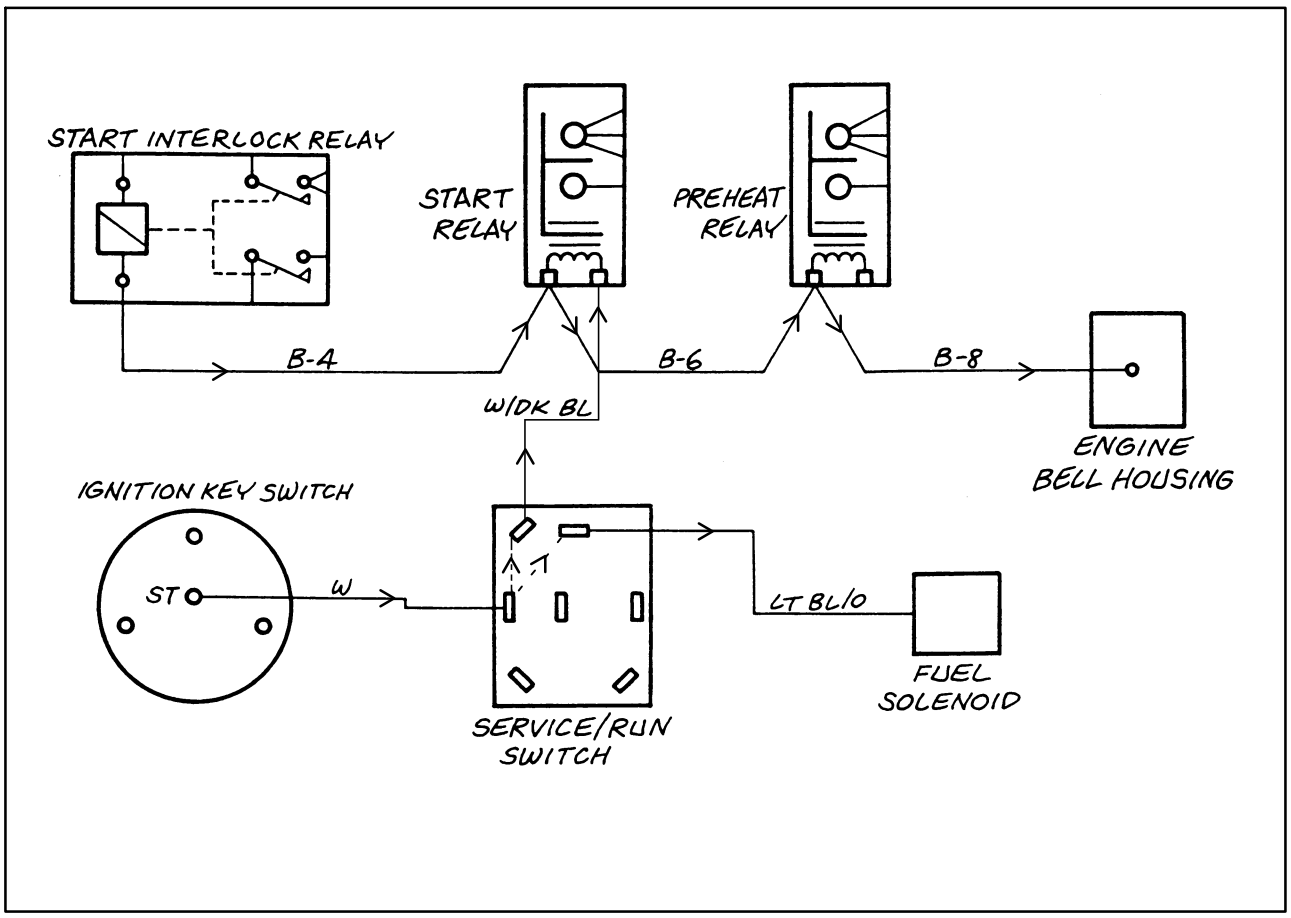


Figure 3-119

Start Interlock Ground Circuit

The interlock is grounded through the B-4 wire to the start relay, through B-6 wire to the preheat relay, through B-8 wire to the engine bell housing ground.

Start Circuit

"SERVICE/RUN" switch in the "SERVICE" position.

The interlock relay is not functional with the service/run switch in the "SERVICE" position. With the switch in the "SERVICE" position, power flows from the key switch "START" terminal via the W wire to the service/run switch, then through the LTBL/O wires to the fuel solenoid, allowing the engine to start and continue to run. The start relay receives power from the service/run switch via the W/DKBL wire to activate the start relay. The EIC plays no supporting role in this mode.

REMOVAL, INSTALLATION AND WIRING OF ELECTRICAL COMPONENTS

This section will show and explain the correct wiring of switches and relays, and when and where battery voltage should be with the key switch (ignition) “ON” or “OFF” for the electrical components.

This section will also explain the removal and installation of the switches, relays, EIC board, and main wire harness.

Before servicing, changing or adding any electrical components, read the following precautionary statements.

ATTENTION: Do not connect any electrical circuits at the ignition key switch or the cab electrical fuse panel unless there are written instructions telling you to do so or damage to the EIC board may occur.

ATTENTION: If any servicing or adjustments require the battery to be disconnected, or welding is required on the skid-steer loader, disconnect the negative (-) ground cable. Failure to disconnect the battery may result in damage to the EIC (Electronic Instrument Cluster) monitoring system and other electrical components.

ATTENTION: If the EIC requires removal from the dash area of the skid-steer loader, disconnect the negative (-) ground battery cable. This will shut off power to the EIC and prevent damage to the EIC board or blowing the 5-amp fuses if the board is accidentally grounded.

ATTENTION: Do not service the EIC board with magnetized tools (wrenches, screwdriver, etc.) or magnets. Severe damage to the EIC board may occur.

BATTERY REMOVAL

1. Raise the boom and rest on the boom lock pins.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

2. Open the rear door and remove the right engine side shield to access the battery.
3. Disconnect the negative (-) battery cable, 1.
4. Disconnect the positive (+) battery cable, 2.
5. Loosen the top muffler support hardware at 3, and remove the lower support hardware, 4, and pivot the support in towards the engine.
6. Remove the battery hold-down hardware, 5, and remove the battery from the loader.

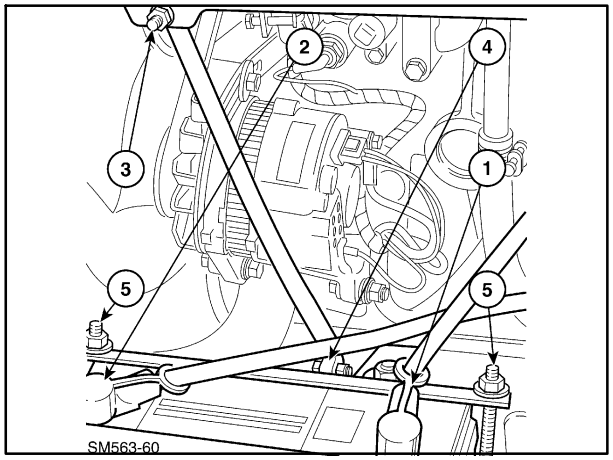


Figure 3-120

BATTERY INSTALLATION

1. Orient the battery with the positive post toward the rear of the loader. Install the battery and the hold-down strap and hardware. Position the hold-down strap to clear other components.
2. Connect the positive (+) RED cable to positive (+) terminals and negative (-) BLACK cable to negative (-) terminals. Do not over tighten. Observe the tightening specifications on the battery label.

   ATTENTION: Crossing of terminals may cause damage to the electrical system, alternator and Advanced Warning System (EIC).

NOTE: Make sure the positive (+) battery cable, 1, on Lx665 models routes outside the hose, 2, and away from the turbocharger hose clamp, 3. Reverse the clamp to avoid unnecessary wear on cables and hoses.

3. Install protective caps over the battery terminals and cable connections.

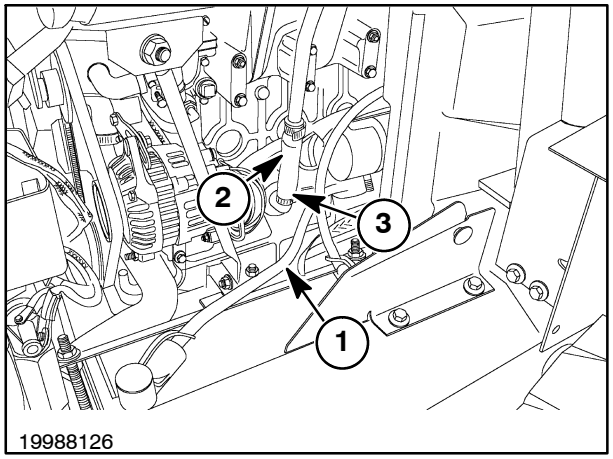


Figure 3-121

EIC (Electronic Instrument Cluster) BOARD REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the retaining hardware, 1, and remove the EIC board from the overhead dash area.

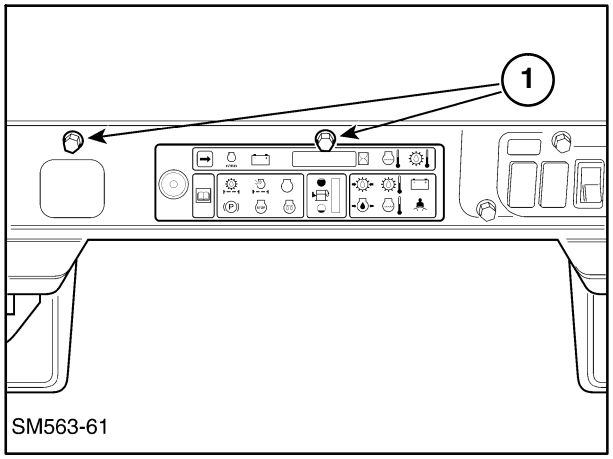


Figure 3-122

3. Unplug the two wire harness connectors, 1, from the EIC, taking care to not stress or bend the plastic locking ramps on the connectors.

   NOTE: Note the positioning of the connectors to the EIC board and reconnect to the new board in the correct position. If the connector is not connected properly, damage to the EIC may occur.

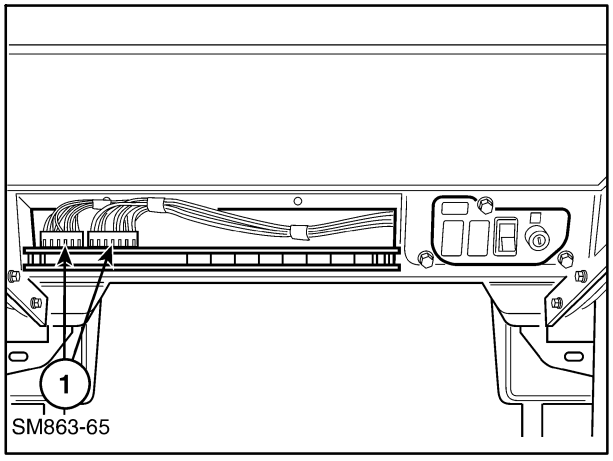


Figure 3-123

EIC (Electronic Instrument Cluster) BOARD LIGHT BULB REPLACEMENT

The bulbs behind the monitored circuits are replaceable. The bulbs, 1, can be removed by rotating the socket assembly counterclockwise using a small non-magnetized screwdriver.

Insert a new bulb and socket assembly #86502182 and rotate it clockwise to lock in position.

NOTE: Part Number EIC Board #86528256 will not have replaceable bulbs as prior EIC boards.

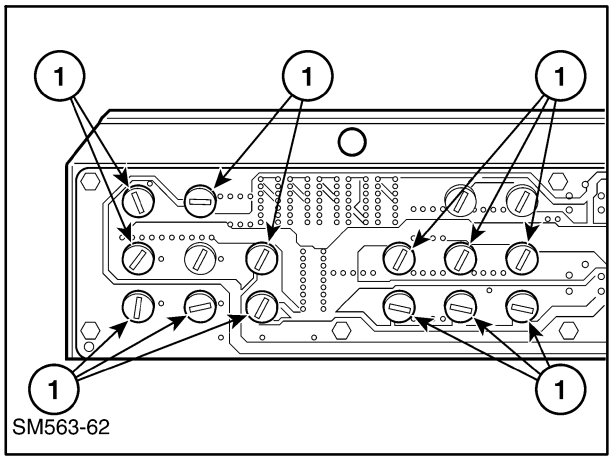


Figure 3-124

EIC (Electronic Instrument Cluster) WIRING

NOTE: There are two different style EIC board connectors as shown here.

Board Connector #1(J1) Pin Number	Wire Color	Harness Connector #1(P1) Pin Number
1	NOT USED	-
2	NOT USED	-
3	NOT USED	-
4	PU/W	1
5	PU/LTGN	2
6	PU/LTBL	3
7	PU/R	4
8	NOT USED	5
9	Y/LTGN	6
10	Y/B	7
11	Y/GY	8
12	DKGR/O	9
13	B/Y	10
14	LTGN/B	11

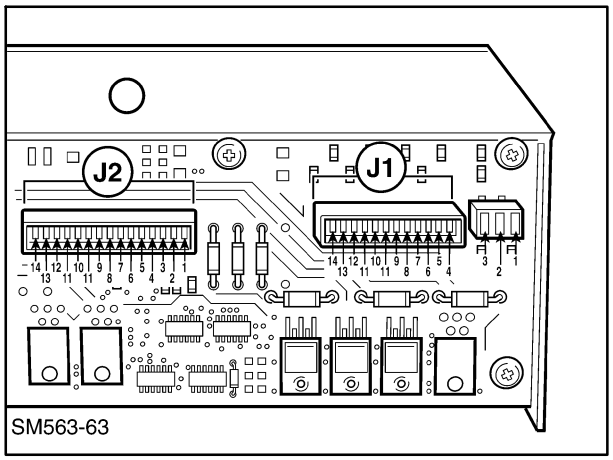


Figure 3-125

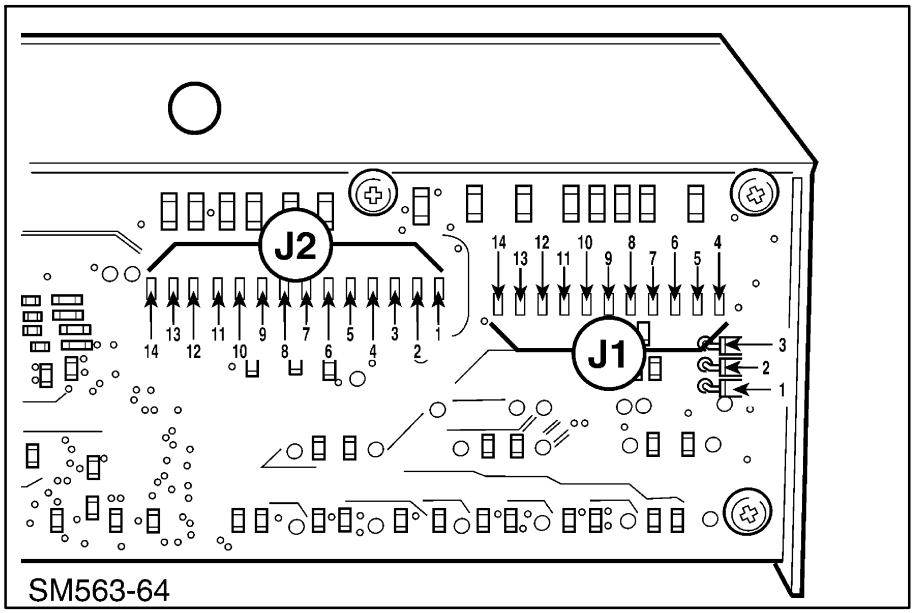


Figure 3-126

Board Connector #2(J2) Pin Number	Wire Color	Harness Connector #2(P2) Pin Number
1	NOT USED	1
2	LTBL/Y	2
3	PK/LTBL	3
4	T/W	4
5	LTBL/O	5
6	NOT USED	6
7	NOT USED	7
8	NOT USED	8
9	PK	9
10	W	10
11	LTGN	11
12	O	12
13	B	13
14	R/LTGN	14

EIC (Electronic Instrument Cluster) BOARD INSTALLATION

1. Connect the wire harness connectors P1 to J1 and P2 to J2 on the EIC board, making sure the connectors are properly aligned and fully seated.

   ATTENTION: If the connector is not connected correctly, damage to the EIC may occur:

   - *Board circuits may burn out.*
   - *Display may not light up.*
   - *Board memory may be lost.*

2. Position the EIC board into the overhead dash flat against the support and secure with the hardware previously removed. Make sure that wires are not pinched between the EIC board and dash frame.
3. Reconnect the negative (-) battery cable.
4. Reconnect the wires to the switch terminals as shown.
5. Reinstall the switch panel to the overhead dash.
6. Reinstall the negative (-) battery cable.

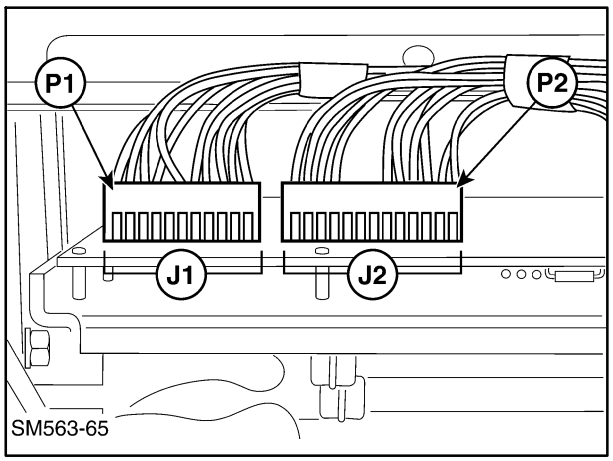


Figure 3-127

IGNITION (Key) SWITCH WIRING

Ref	Color	Destination	Battery Voltage
1	O/LTBL	To Four-Way Flashing lights 10A Fuse (cab panel)- To Beacon Light 7.5A Fuse (cab panel)	Key “ON” position
2	LTGN/B	To EIC Board Pin #11 (small connector)	Key “ON” position
3	LTGN/B	To Accessory Relay (engine panel)	Key “ON” position
4	W	To Service/Run Switch	Key “START” position
5	W	To EIC Board Pin #10 (large connector)	Key “START” position
6	R/W	From 15A Fuse (engine panel)	All times
7	GY/B	Power to dome light (not available)	All times
8	O/PU-2	To Electronics 5A Fuse (cab panel)	Key “ON” position

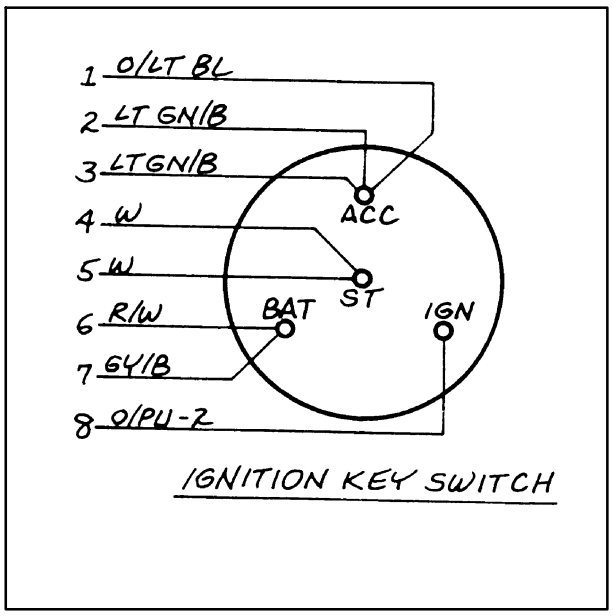


Figure 3-128

IGNITION (Key) SWITCH REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the retaining hardware, 1, and remove the switch panel, 2, from the overhead dash area.
3. Remove the wires from the switch terminals.

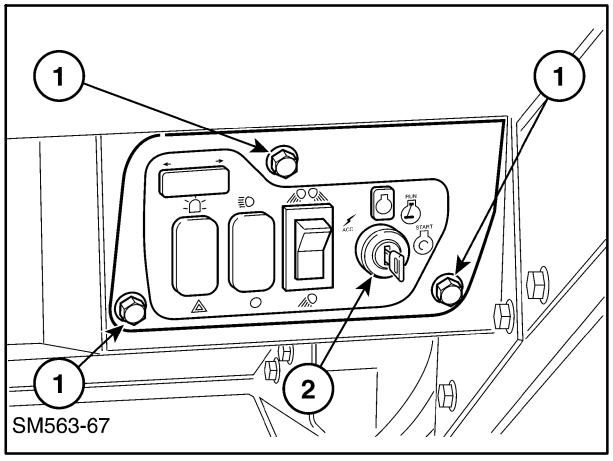


Figure 3-129

4. Remove the switch retaining nut, 1, from the switch and remove the switch from the panel.

IGNITION (Key) SWITCH INSTALLATION

1. Attach the switch to the panel and secure with nut, 1, previously removed.
2. Reconnect the wires to the terminals as shown above.
3. Reinstall the switch panel to the overhead dash.
4. Reinstall the negative (-) battery cable.

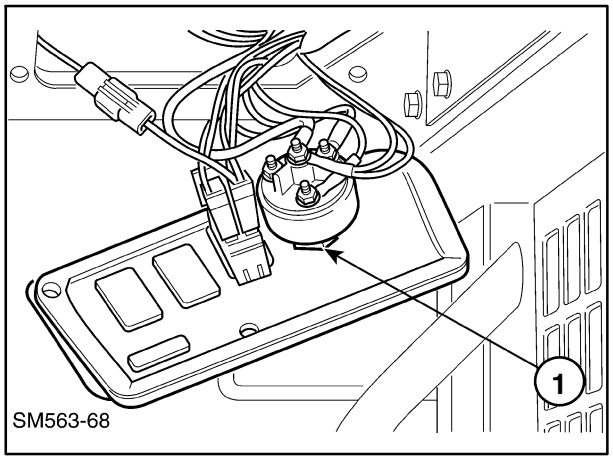
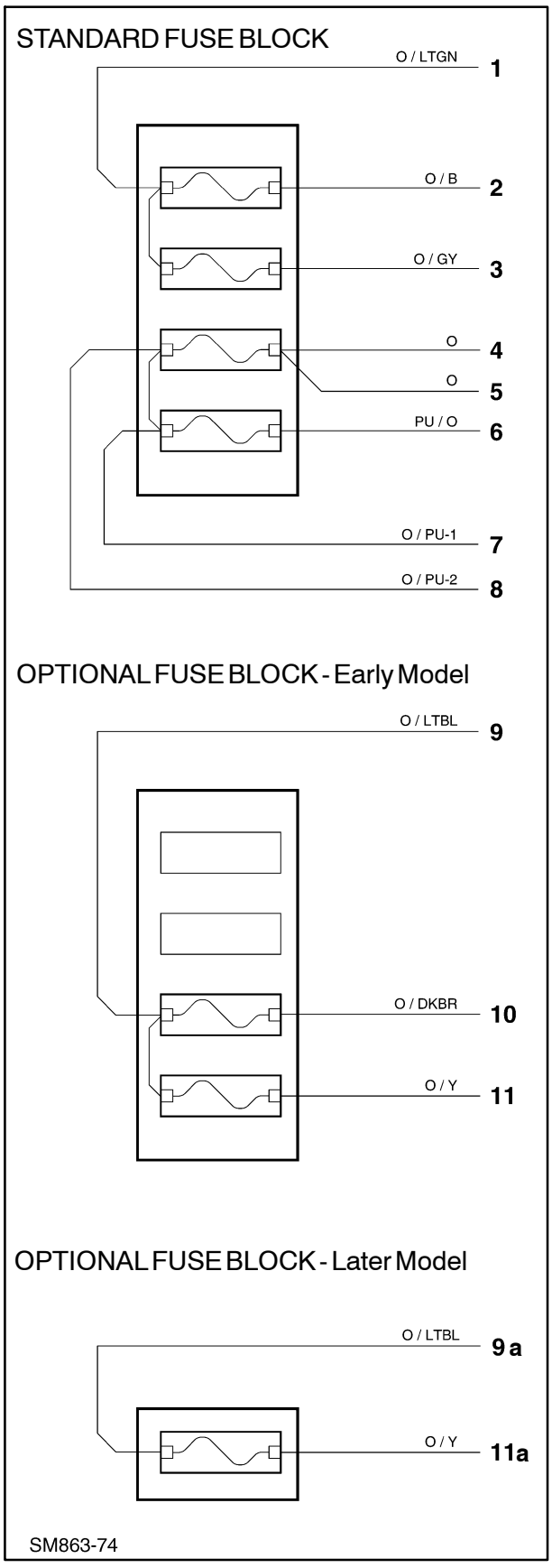


Figure 3-130



Ref	Color	Destination	Battery Voltage
1	O/LTGN	(15A Fuse) From Accessory Relay (engine panel)	Key “ON” position (If equipped with lights or other accessories).
2	O/B	(15A Fuse) To Road/ Work Light Switch	Key “ON” position
3	O/GY	(7.5A Fuse) To Wiper Motor Switch	Key “ON” position
4	O	(5A Fuse) To EIC Board Pin #12 (P2 connector)	Key “ON” position
5	O	(5A Fuse) To Start Interlock Relay (engine panel)	Key “ON” position
6	PU/O	(5A Fuse) To Fuel Pump	Key “ON” position
7	O/PU-1	To Service/Run Switch	Key “ON” position
8	O/PU-2	From Key Switch (Ign. terminal)	Key “ON” position
9	O/LTBL	From Key Switch (Acc. terminal)	Key “ON” position
10	O/DKBR	(10A Fuse) To Turn Signal Relay and Flasher Module	Key “ON” position
11	O/Y	(7.5A Fuse) To Beacon, Four-Way Warning Lights Switch	Key “ON” position

9a	O/LTBL	From Key Switch (Acc. terminal)	Key “ON” position
11a	O/Y	(7.5A Fuse) To Beacon, Four-Way Warning Lights Switch	Key “ON” position

Figure 3-131

CAB FUSE BLOCK AND PANEL REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove panel, 1; retaining hardware, 2; and lower panel from the support. Removal of panel, 3, may be required for easier access.
3. Unplug the wires from the fuse block.
4. Remove the fuse block retaining hardware.

   NOTE: The standard fuse block is part of the main harness and cannot be completely removed.

5. If the optional fuse block is installed, the two blocks will be locked together. Insert a 1/4″ blade screwdriver at the center of the fuse block bases, twist to release the lock and slide the optional block up past the fuses on the standard block to separate.

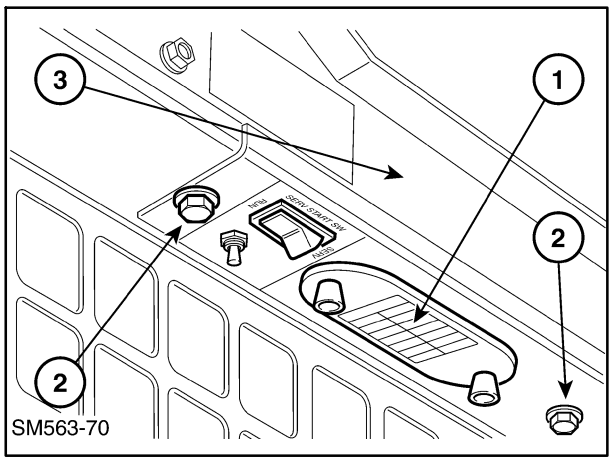


Figure 3-132

CAB FUSE BLOCK AND PANEL INSTALLATION

1. If two fuse blocks are being used and reinstalled, insert the lock tabs, 1, and slide the two blocks together to lock securely at 2.

   The optional block is the inner one and slides down over the standard block.

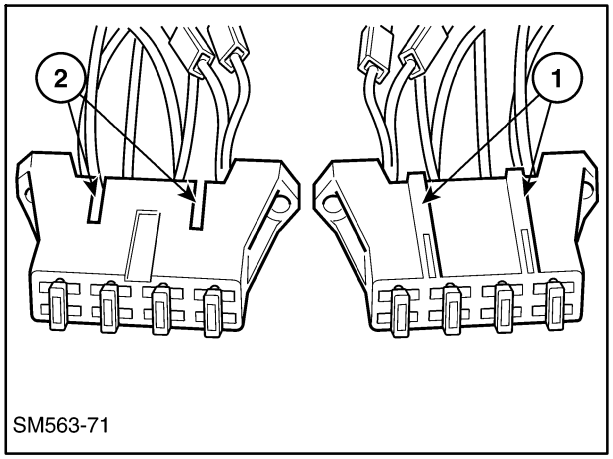


Figure 3-133

2. Attach the wires to the proper side of the fuses as shown at 1 (standard fuse block) and the optional fuse block (if used) will be locked to the standard fuse block at 2.
3. Reinstall the block retaining hardware.
4. Reinstall the panel to the support.
5. Reconnect the negative (-) battery cable.

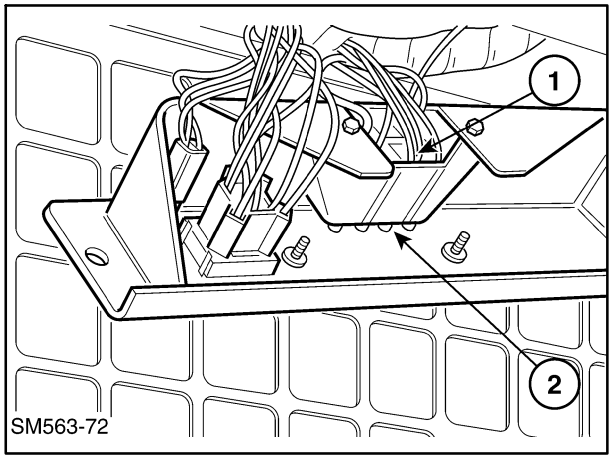


Figure 3-134

SERVICE/RUN SWITCH WIRING

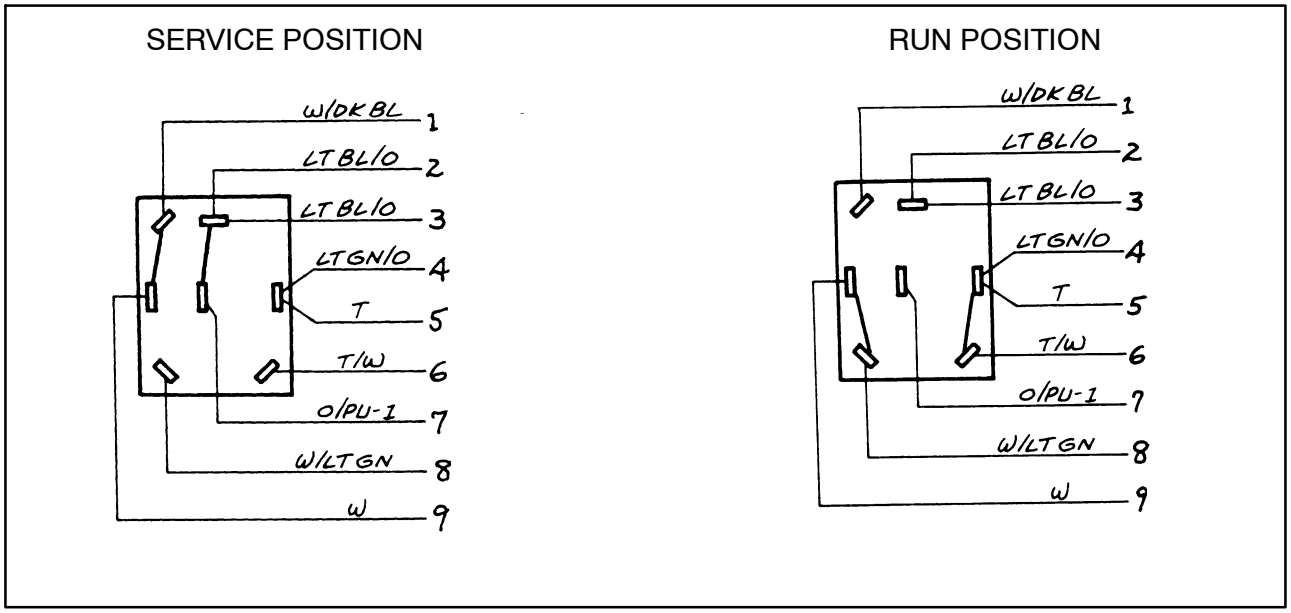


Figure 3-135

SERVICE/RUN SWITCH - RUN POSITION

Ref	Color	Destination	Battery Voltage
1	W/DKBL	To Start Relay (engine panel)	Key “START” position (backfed from start interlock relay)
2	LTBL/O	From EIC Board Pin #5 (large connector)	Key “ON” position (will read 0.5 to 1.0 volt below battery voltage)
3	LTBL/O	To Start Interlock Relay (engine panel)	Key “ON” position (will read 0.5 to 1.0 volt below battery voltage)
4	LTGN/O	To Manual Preheat Switch	Sitting in Seat
5	T	From Seat Switch(es)	Sitting in Seat
6	T/W	To EIC Board Pin #4 (large connector)	Sitting in Seat
7	O/PU 1	From 5A Fuse (spare) (cab panel)	Key “ON” position
8	W/LTGN	To Start Interlock Relay (engine panel)	Key “START” position
9	W	From Key Switch (Ignition)	Key “START” position

SERVICE/RUN SWITCH - SERVICE POSITION

Ref	Color	Destination	Battery Voltage
1	W/DKBL	To Start Relay (engine panel)	Key “START” position
2	LTBL/O	From EIC Board Pin #5 (large connector)	Key “ON” position
3	LTBL/O	To Start Interlock Relay (engine panel)	Key “ON” position
4	LTGN/O	To Manual Preheat Switch	Sitting in Seat
5	T	From Seat Switch(es)	Sitting in Seat
6	T/W	To EIC Board Pin #4 (large connector)	No Voltage Anytime
7	O/PU 1	From 5A Fuse (cab panel)	Key “ON” position
8	W/LTGN	To Start Interlock Relay (engine panel)	No Voltage Anytime
9	W	From Key Switch (ignition)	Key “START” position

SERVICE/RUN SWITCH REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove panel, 1; retaining hardware, 2; and lower panel from the support. Removal of panel, 3, may be required for easier access.
3. Remove the wires from the switch terminals.
4. Push the switch retaining tabs in and remove the switch from the panel.

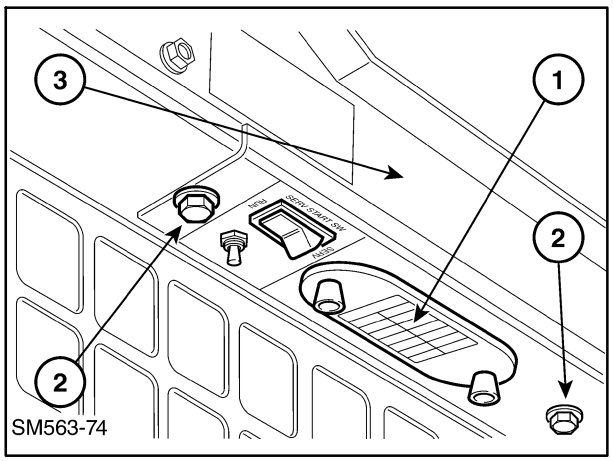


Figure 3-136

SERVICE/RUN SWITCH INSTALLATION

1. Insert the switch into the panel and make sure the locking tabs secure the switch.
2. Reconnect the wires to the proper terminals as shown in the “SERVICE/RUN SWITCH WIRING” figure above.
3. Reinstall the panel to the support.
4. Reconnect the negative (-) battery cable.

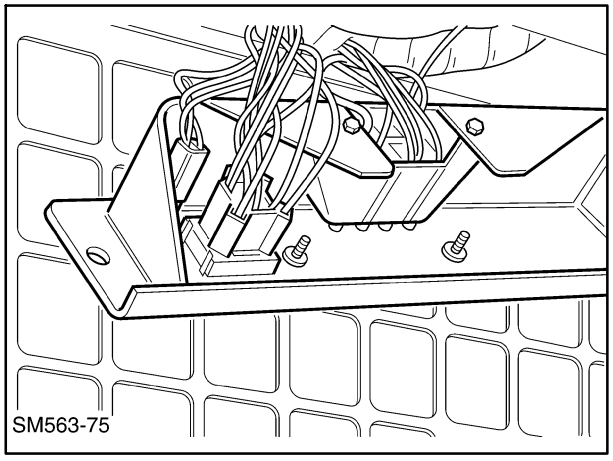


Figure 3-137

MANUAL PREHEAT SWITCH WIRING

Service/Run Switch - Run Position Or Service Position

Ref	Color	Destination	Battery Voltage
1	LT GN/O	From Service/Run Switch	Sitting in Seat
2	LTBL/Y	From EIC Board Pin #2 (large connector)	Push Button *
3	LTBL/Y	To Preheat Relay (engine panel)	Push Button *

* (Also during preheat countdown, but 0.5 to 1.0 volt lower).

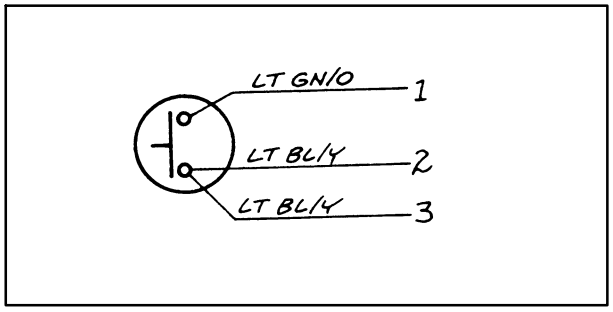


Figure 3-138

MANUAL PREHEAT SWITCH (Cold Start Aid)

The EIC controls a timed preheat cold start to assist in cold-weather starting. This button provides an override for cold weather if the EIC controlled preheat cycle time is malfunctioning. Later units do not have manual preheat switches.

MANUAL PREHEAT SWITCH REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove panel, 1; retaining hardware, 2; and lower panel from the support. Removal of panel, 3, may be required for easier access.
3. Remove the wires and connector from the switch terminals.
4. Remove switch retaining nut, 4, and remove the switch from the panel.

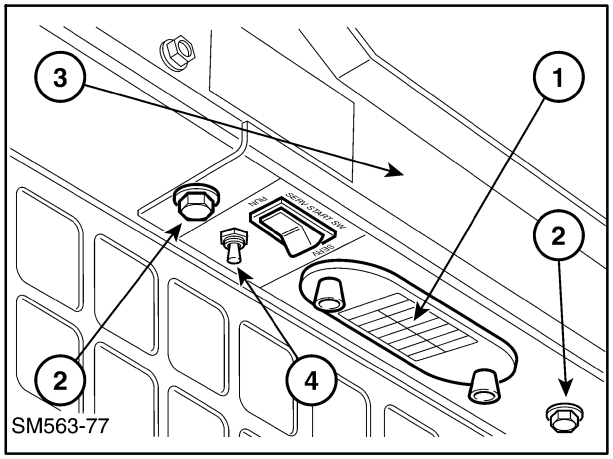


Figure 3-139

MANUAL PREHEAT SWITCH INSTALLATION

1. Insert the switch into the panel and secure with nut previously removed.
2. Attach wires and connector to the switch terminals, 1.
3. Reinstall the panel to the support.
4. Reconnect the negative (-) battery cable.

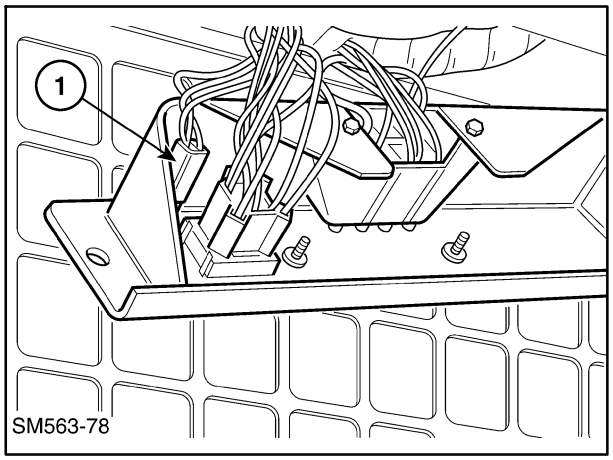


Figure 3-140

SEAT AND SEAT BELT SWITCH WIRING

Ref	Color	Destination	Battery Voltage
1	LTGN	To EIC Board Pin #11 (large connector)	Seat Belt Buckled
2	T	From Seat Switch(es)	Sit in Seat
3	T	To Seat Belt switch	Sit in Seat
4	LTGN/R	From Electronics 5A Fuse (engine panel)	All Times
5	T	To Service/Run Switch	Sit in Seat

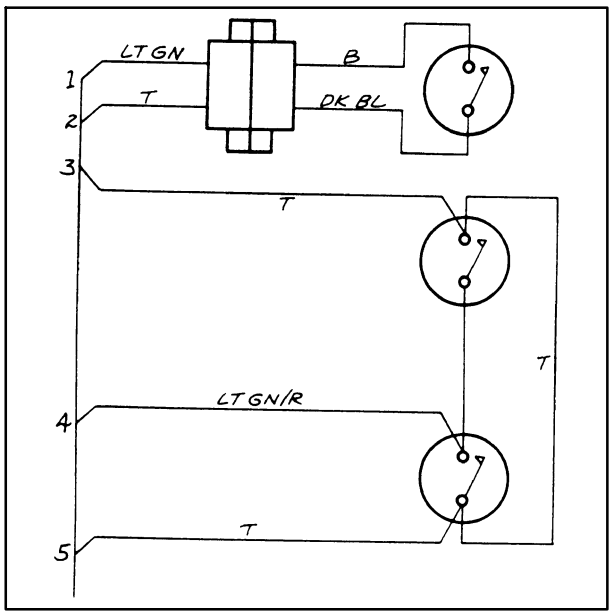


Figure 3-141

SEAT SWITCH REMOVAL

1. Disconnect the negative (-) battery cable.
2. Raise the seat and securely latch in the raised latched position, 1.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

3. Remove the seat retaining hardware, 2.
4. Holding the seat in place, lower the seat pan and seat and unplug the seat switch(es).
5. Remove the seat from the loader.
6. Disconnect the wire harness from the switch(es) by releasing the latch away from the switch.
7. Remove the switch(es) from the seat pan. The standard seat uses one switch, 1, and the deluxe seat uses two switches, 2.

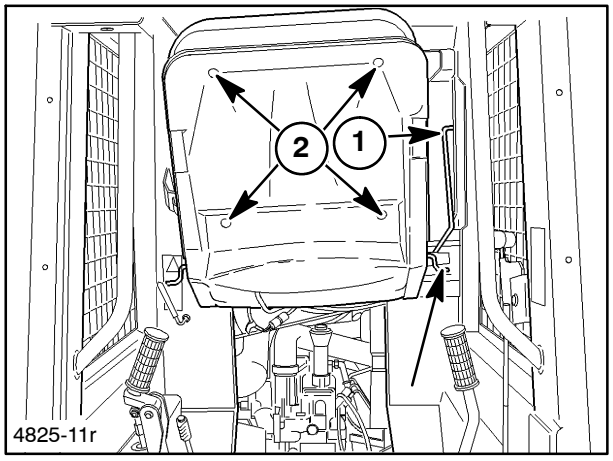


Figure 3-142

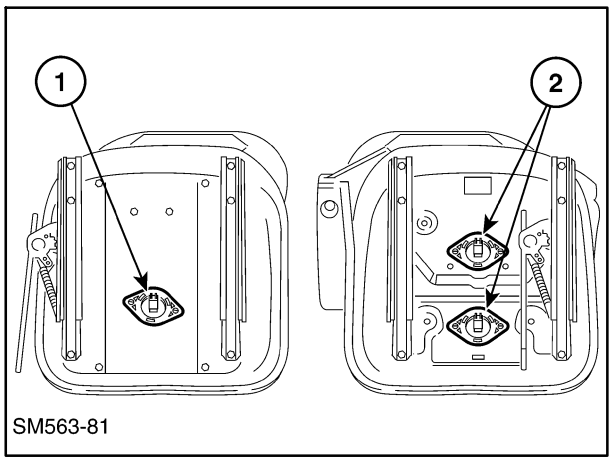


Figure 3-143

SEAT SWITCH INSTALLATION

1. Install the switch(es) into the seat pan, making sure the switch is seated into the hole in the seat pan, 1.

   ATTENTION: If the switch is not seated properly when the retaining hardware is tightened, the switch flange will be broken.

2. Reconnect the wire harness to the switch(es) and reinstall the seat retaining hardware. Make sure the harness connector latches are engaged.
3. Reconnect the negative (-) battery cable.

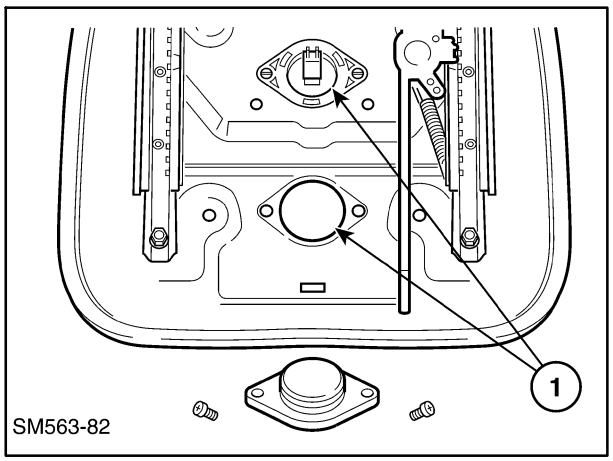


Figure 3-144

SEAT BELT BUCKLE AND SWITCH ASSEMBLY REMOVAL

1. Disconnect the negative (-) battery cable.
2. Unplug the seat belt wire harness, 1.
3. Remove the clamp hardware and clamp, 2, and save for reuse.
4. Remove the seat belt retaining hardware, 3.

SEAT BELT BUCKLE INSTALLATION

1. Reinstall the seat belt buckle retaining hardware. Tighten the locknut to hold the belt in position that will allow the belt assembly to move front or rearward.
2. Reconnect the wire harness.
3. Reinstall clamp holding harness above seat track.
4. Reconnect the negative (-) battery cable.

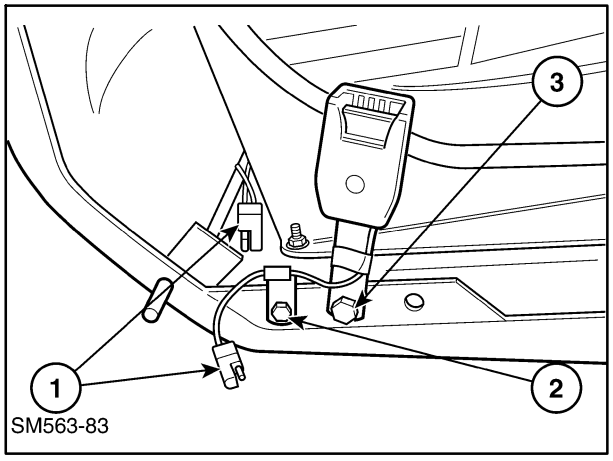


Figure 3-145

ROAD LIGHT AND WORK LIGHT SWITCH WIRING

Switch Pushed in at Top

Ref	Color	Destination	Battery Voltage
1	PK/B	To Taillights	Yes
2	DKBL/W	To Front Road/Work Light	Yes
3	DKBL/W	To Front Road/Work Light	Yes
4	DKBL	To Rear Work Light	Yes
5	O/B	From 15A Fuse (cab panel)	Key “ON” position
6	PK	To EIC Board Pin #9 P2 connector (to dim EIC board lights)	Yes

Switch Pushed in at Bottom

Ref	Color	Destination	Battery Voltage
1	PK/B	To Taillights	Yes
2	DKBL/W	To Front Road/Work Light	Yes
3	DKBL/W	To Front Road/Work Light	Yes
4	DKBL	To Rear Work Light	NO
5	O/B	From 15A Fuse (cab panel)	Key “ON” position
6	PK	To EIC Board Pin #9 P2 connector (to dim EIC board lights)	Yes

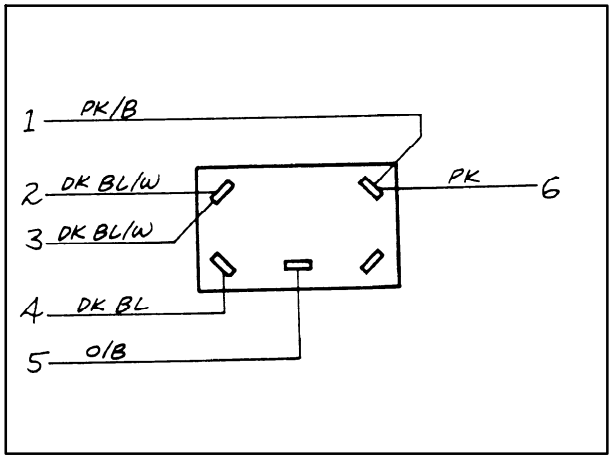


Figure 3-146

ROAD LIGHT AND WORK LIGHT SWITCH REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the switch panel retaining hardware, 1, and lower the panel.
3. Remove the wires and connector from the switch terminals.
4. Press in the switch retaining tabs and remove the switch from the panel.

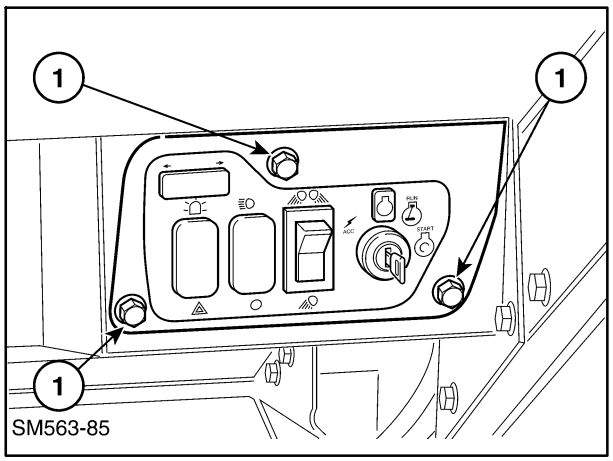


Figure 3-147

ROAD LIGHT AND WORK LIGHT SWITCH INSTALLATION

1. Insert the switch into the panel and insure the locking tabs secure the switch, 1.
2. Reconnect the wires and connector to the proper terminals with the PK/B and PK wires toward the top of the panel.
3. Reattach the switch panel to the overhead dash.
4. Reconnect the negative (-) battery cable.

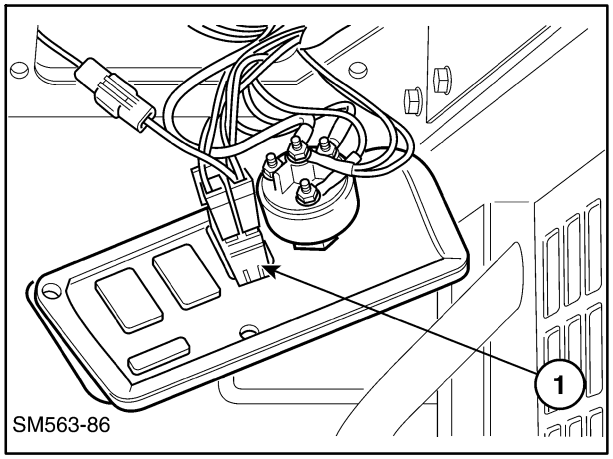


Figure 3-148

ENGINE FUSE AND RELAY PANEL

The engine panel electrical components are shown here:

1. Accessory relay (if equipped)
2. Heater power relay (if equipped)
3. Preheat circuit breaker
4. Start interlock relay
5. Optional fuse block (if equipped)
6. Standard fuse block
7. Alternator excite resistor
8. Start relay
9. Preheat relay

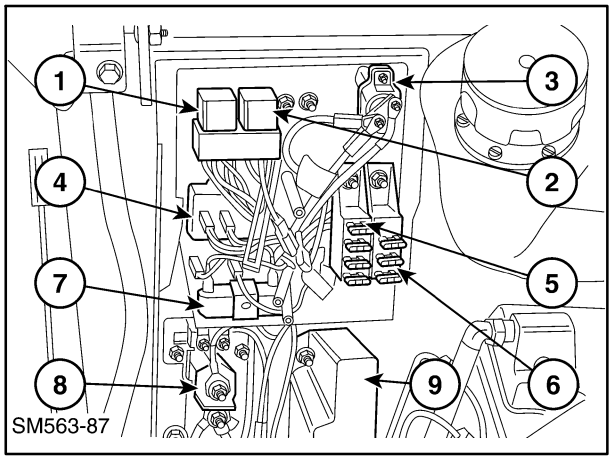


Figure 3-149

To access the electrical components in the engine compartment, raise the boom and rest it on the boom lock pins.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

ACCESSORY RELAY WIRING

Ref	Color	Destination	Battery Voltage
1	O/LTGN	To Attachment/Horn 15A Fuse	Key “ON” position
2	LTGN/ B-2	To Turn Signal Relay or Heater Power Relay	Key “ON” position
3	LTGN/B	From Key Switch (accessory terminal)	Key “ON” position
4	B-7	To Turn Signal Relay or Heater Power Relay	Ground Circuit
5	B-5	To Start Relay	Ground Circuit
6	R/GY	From Accessory 25A Fuse	All Times

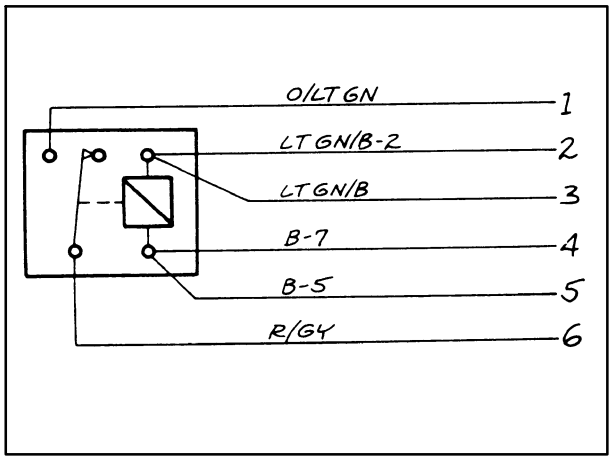


Figure 3-150

ACCESSORY RELAY REMOVAL

1. Disconnect the negative (-) battery cable.
2. Unplug the relay, 1, from the socket, 2. The corners provide an area to insert screwdriver and twist to assist removal.

ACCESSORY RELAY INSTALLATION

1. Insert new relay fully into socket.
2. Reconnect the negative (-) battery cable.

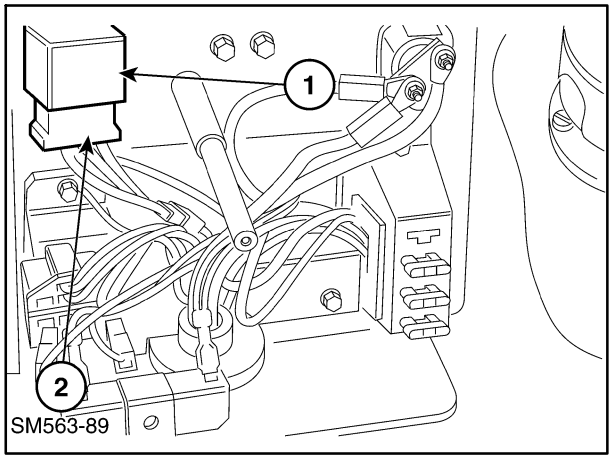


Figure 3-151

PREHEAT CIRCUIT BREAKER WIRING

Ref	Color	Destination	Battery Voltage
1	R/LTBL	To Preheat Relay	All Times
2	R	To Start Relay	All Times
3	R	From 15A Key Main Fuse Engine Fuse Block	All Times

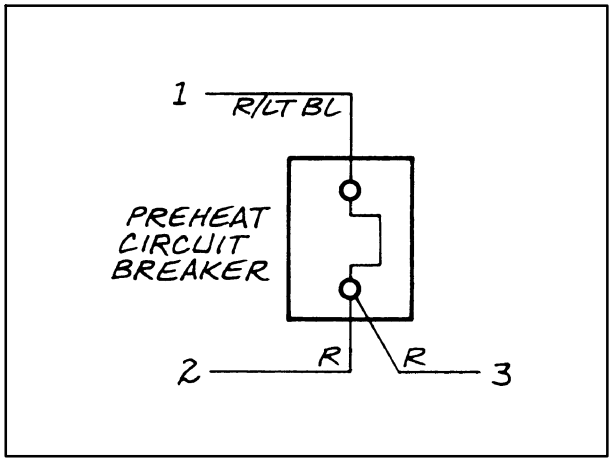


Figure 3-152

PREHEAT CIRCUIT BREAKER REMOVAL

1. Disconnect the negative (-) battery cable.
2. Disconnect wires from the terminals, 1.
3. Remove the circuit breaker retaining hardware.

PREHEAT CIRCUIT BREAKER INSTALLATION

1. Reinstall the retaining hardware.
2. Reconnect the wires to the proper terminals.
3. Reconnect the negative (-) battery cable.

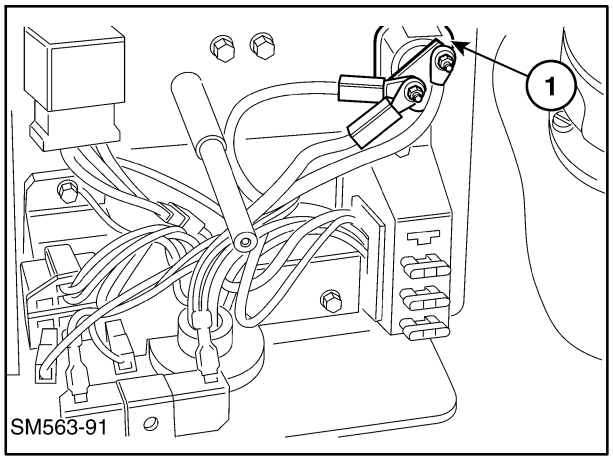


Figure 3-153

START INTERLOCK RELAY WIRING

Service/Run Switch - Run Position

Ref	Color	Destination	Battery Voltage
1	W/LTGN	From Service/Run Switch	Key “START” position
2	O	From Cab Fuse Panel 5A Electronic Ignition Fuse	Key “ON” position
3	LTBL/O	To Fuel Solenoid	Key “ON” position *
4	LTBL/O	From EIC Board Pin #5, P2 connector	Key “ON” position *
5	W/DKBL	To Start Relay	Key “START” position Sitting in Seat with Seat Belt Buckled
6	W/O	From Connector at Boom/Bucket Control Valve	Key “START” position Sitting in Seat with Seat Belt Buckled
7	B-4	To Start Relay	Ground Circuit

* Voltage will be 0.5 to 1.0 volt below battery voltage.

Service/Run Switch - Service Position

Ref	Color	Destination	Battery Voltage
1	W/LTGN	From Service/Run Switch	No Voltage Anytime
2	O	From Cab Fuse Panel 5A Electronic Ignition Fuse	Key “ON” position
3	LTBL/O	To Fuel Solenoid	Key “ON” position
4	LTBL/O	From EIC Board Pin #5	Key “ON” position
5	W/DKBL	To Start Relay	Key “START” position
6	W/O	From Connector at Boom/Bucket Control Valve	Sitting in Seat with Seat Belt Buckled
7	B-4	To Start Relay	Ground Circuit

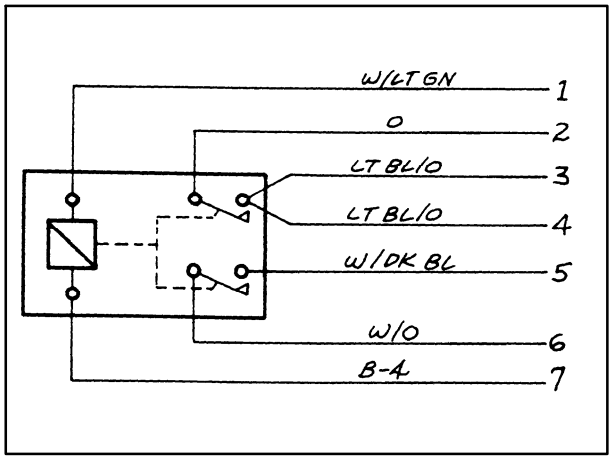


Figure 3-154

START INTERLOCK RELAY REMOVAL

1. Disconnect the negative (-) battery cable.
2. Disconnect the wires from the terminals, 1.
3. Remove the interlock relay retaining hardware.

NOTE: A new, "sealed" relay is now available (part #86521256).

START INTERLOCK RELAY INSTALLATION

1. Reinstall the retaining hardware.
2. Reconnect the wires to the proper terminals as shown in the "START INTERLOCK RELAY WIRING" figure above.
3. Reconnect the negative (-) battery cable.

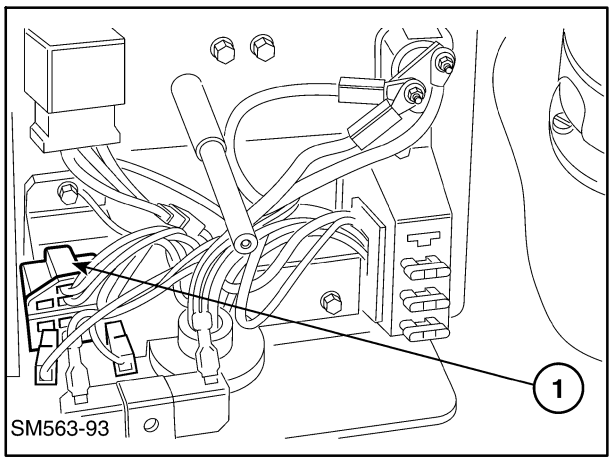
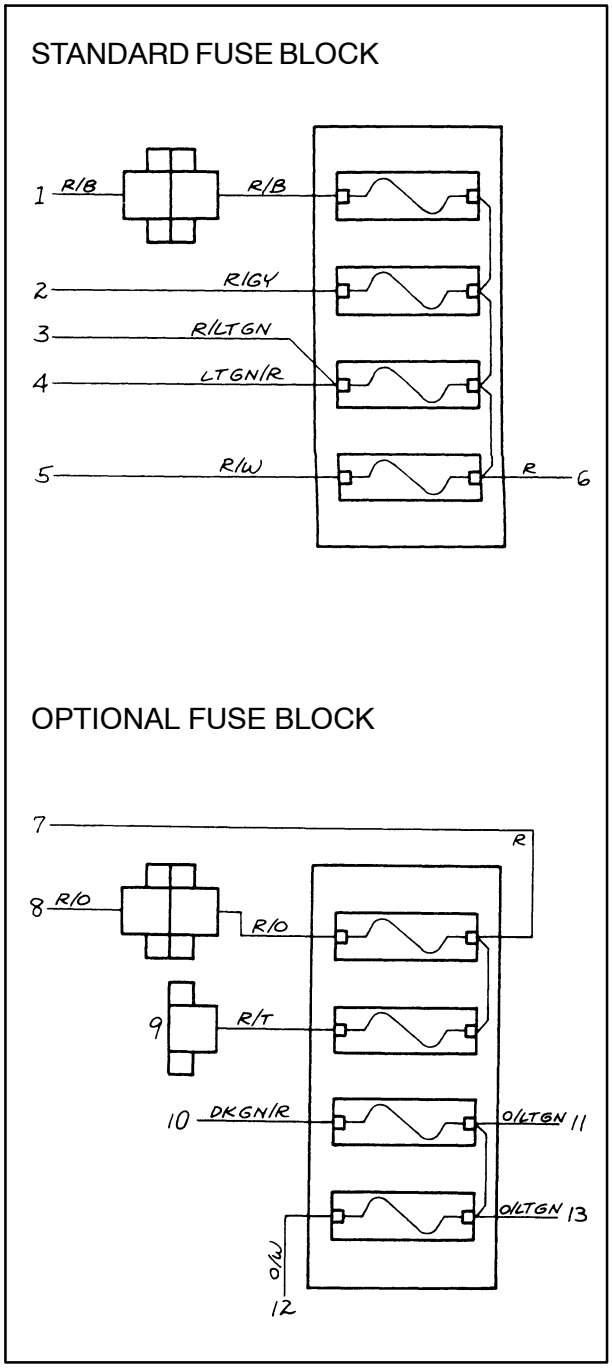


Figure 3-155

ENGINE FUSE PANEL WIRING



Ref	Color	Destination	Battery Voltage
1	R/B	(10A Fuse) To Turn Signal Relay	All Times
2	R/GY	(25A Fuse) To Accessory Relay	All Times
3	R/LTGN	(5A Fuse) To EIC board Pin #14 P2 connector.	All Times
4	LTGN/R	(5A Fuse) To Seat Switch(es)	All Times
5	R/W	(15A Fuse) To Key Switch (Battery Terminal)	All Times
6	R	From Preheat Circuit Breaker	All Times
7	R	From Start Relay	All Times
8	R/O	(20A Fuse) To Heater Power Relay	All Times
9	R/T	(7.5A Fuse) Spare	All Times
10	DKGN/R	(15A Fuse) To High Flow, Horn, Power Outlet	Key “ON” position
11	O/LTGN	From Accessary Relay	Key “ON” position
12	O/W	(5A Fuse) To Back Up Alarm Switch	Key “ON” position
13	O/LTGN	From Road/Work light fuse (cab panel)	Key “ON” position

Figure 3-156

ENGINE FUSE BLOCK REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the fuse block retaining hardware.

   NOTE: The standard fuse block, 1, is part of the main harness and cannot be completely removed.

3. If the optional fuse block is installed, the two blocks will be locked together. Insert a 1/4″ blade screwdriver at the center of the fuse block bases and twist to release the lock. Slide the optional block up past the fuses on the standard block to separate.
4. Unplug the wires from the fuse block assembly.

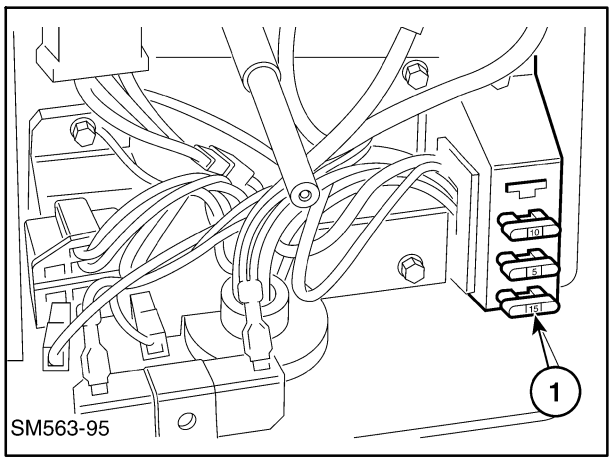


Figure 3-157

ENGINE FUSE BLOCK INSTALLATION

1. If two fuse blocks are being used and reinstalled, insert the lock tabs, 1, into slots, 2, and slide the two blocks together to lock securely as shown.

   NOTE: The optional fuse block slides down over the standard block guides and is positioned toward the center of the panel.

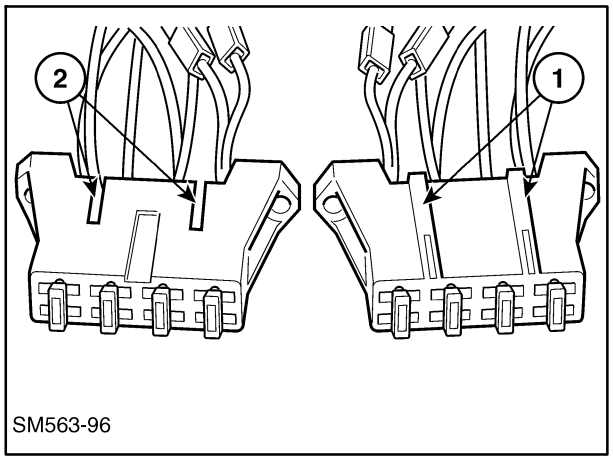


Figure 3-158

2. Attach the wires to the proper side of the fuses as shown in the “ENGINE FUSE PANEL WIRING“ figure above.
   1 Standard fuse block
   2 Optional fuse block
3. Reinstall the block retaining hardware.
4. Reconnect the negative (-) battery cable.

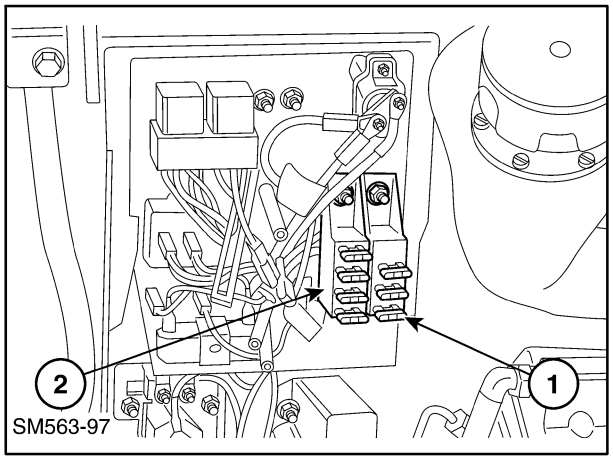


Figure 3-159

ALTERNATOR EXCITE RESISTOR WIRING

Ref	Color	Destination
1	Y/DKBL	To Alternator
2	LTGN/B-1	From Accessory Relay
3	LTGN/B-3	To Alternator

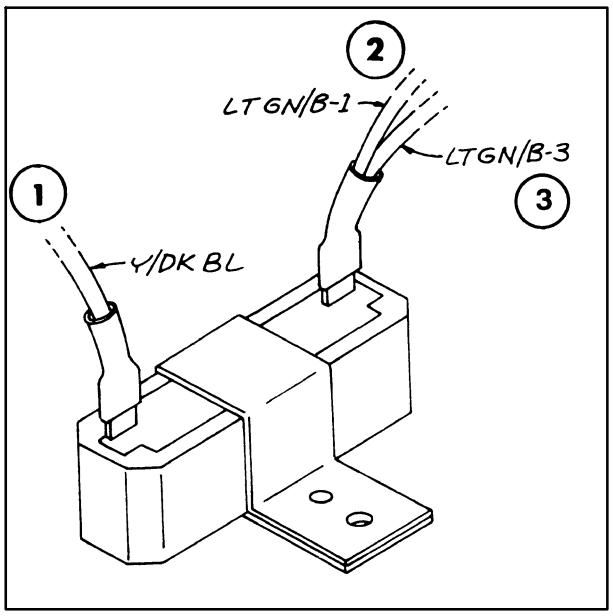


Figure 3-160

ALTERNATOR EXCITE RESISTOR REMOVAL

1. Disconnect the negative (-) battery cable.
2. Unplug the wires from the resistor terminals.
3. Remove the resistor, 1, retaining hardware.

   Testing the resistor using an ohmmeter, the resistance should read approximately 50 ohms ± 5 ohms.

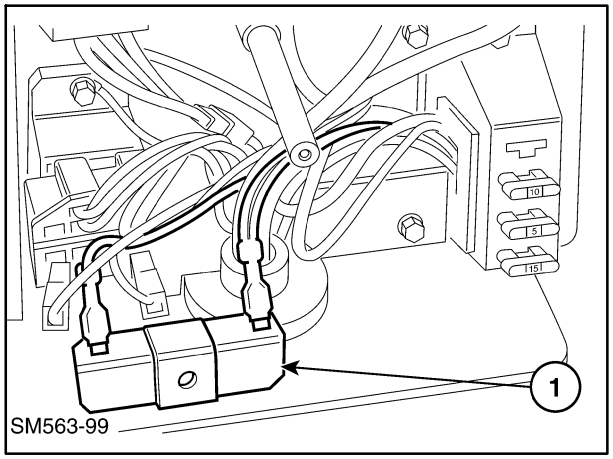


Figure 3-161

ALTERNATOR EXCITE RESISTOR INSTALLATION

1. Reinstall the resistor retaining hardware.
2. Reconnect the wires to the proper terminals.

START RELAY WIRING

Ref	Color	Destination	Battery Voltage
1	R	To 20A Heater Fuse (optional fuse block)	All Times
2	R	To Preheat Circuit Breaker	All Times
3	R	From Starter Solenoid	All Times
4	W/R	To Starter Solenoid	Key “START” position
5	W/DKBL	From Start Interlock Relay	Key “START” position
6	W/DKBL	From Service/Run Switch	Key “START” position
7	B-4	To Start Interlock Relay	Ground Circuit
8	B-5	To Accessory Relay	Ground Circuit
9	B-6	To Preheat Relay	Ground Circuit

START RELAY REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the relay cover, 1, attaching hardware and cover.
3. Remove the wires from the relay terminals.
4. Remove the relay retaining hardware.
5. Remove the barrier from between the large terminals and install on new relay.

START RELAY INSTALLATION

1. Reattach the relay, 1, to the support.
2. Reconnect the wires to the proper relay terminals.
3. Reinstall the relay cover.
4. Reconnect the negative (-) battery cable.

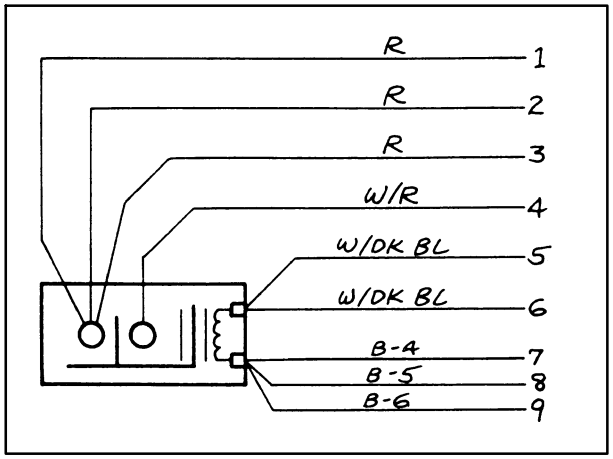


Figure 3-162

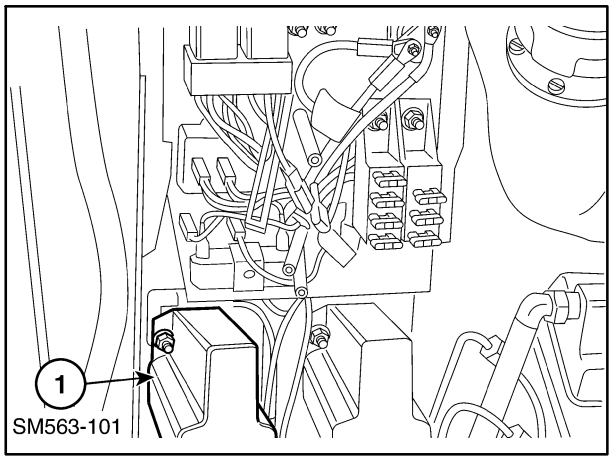


Figure 3-163

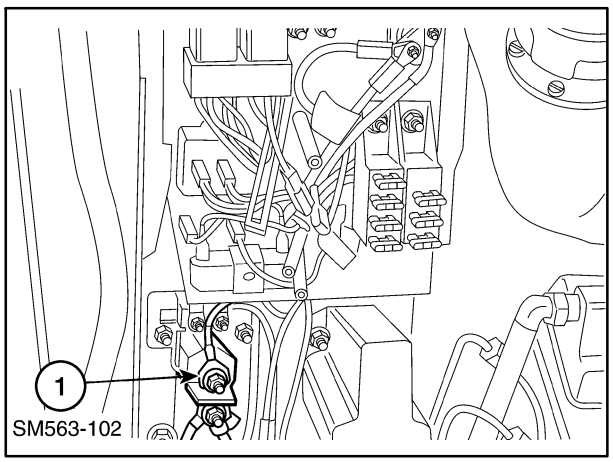


Figure 3-164

PREHEAT RELAY WIRING

Service/Run Switch - Service Position

Ref	Color	Destination	Battery Voltage
1	R/LTBL	From Preheat Circuit Breaker	All Times
2	LTBL/B	To Glow Plugs	Push Button
3	LTBL/Y	From Manual Preheat Button	Push Button
4	B-6	To Start Relay	Ground Circuit
5	B-8	To Engine Bellhousing Ground	Ground Circuit

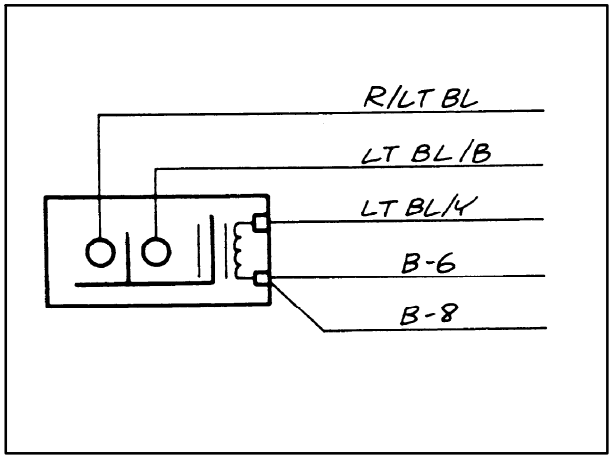


Figure 3-165

Service/Run Switch - Run Position

Ref	Color	Destination	Battery Voltage
1	R/LTBL	From Preheat Circuit Breaker	All Times
2	LTBL/B	To Glow Plugs	EIC Preheat Cycle
3	LTBL/Y	From Manual Preheat Button	EIC Preheat Cycle (Voltage will be 0.5 to 1.0 volt less than battery voltage).
4	B-6	To Start Relay	Ground Circuit
5	B-8	To Engine Bellhousing Ground	Ground Circuit

PREHEAT RELAY REMOVAL

1. Disconnect the negative (-) battery cable.
2. Remove the relay cover, 1, attaching hardware and cover.
3. Remove the wires from the relay terminals.
4. Remove the relay retaining hardware.
5. Remove the barrier from between the large terminals and install on new relay.

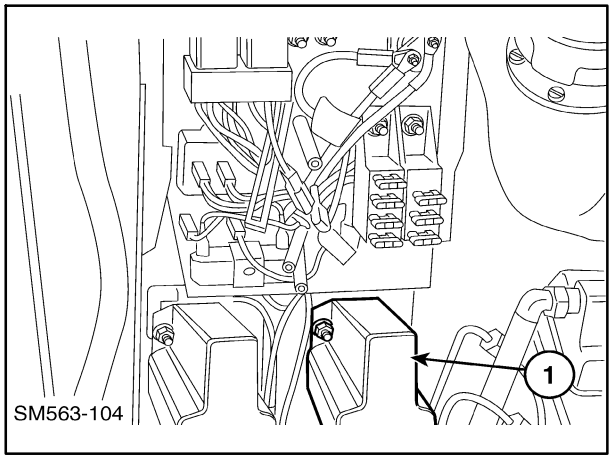


Figure 3-166

PREHEAT RELAY INSTALLATION

1. Reattach the relay, 1, to the support.
2. Reconnect the wires to the proper relay terminals.
3. Reinstall the relay cover.
4. Reconnect the negative (-) battery cable.

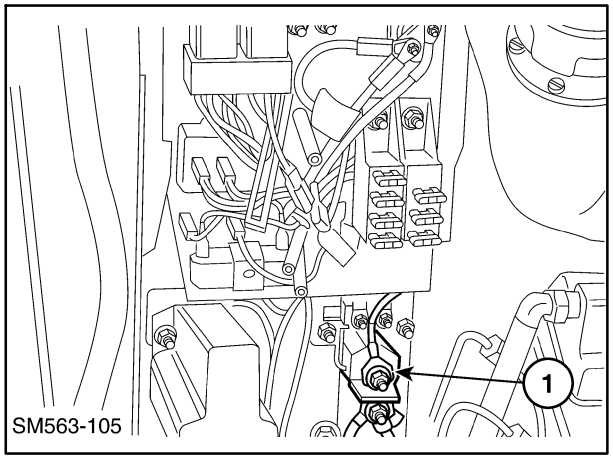


Figure 3-167

PREHEAT GLOW PLUG REMOVAL

1. Disconnect the negative (-) battery cable.
2. Disconnect the LTBL/B wire, 1, from the glow plug bus bar.
3. Remove the bus bar retaining nuts, 2, and remove the bus bar from the glow plugs.
4. Remove glow plugs from the head.

PREHEAT GLOW PLUG INSTALLATION

1. Install glow plugs into the head and, using new sealing washers, tighten to 15 - 19 N·m (11 - 14 ft. lbs.).
2. Reinstall the bus bar onto the glow plugs.
3. Reconnect the LTBL/B wire to glow plug bus bar.
4. Reconnect the negative (-) battery cable.

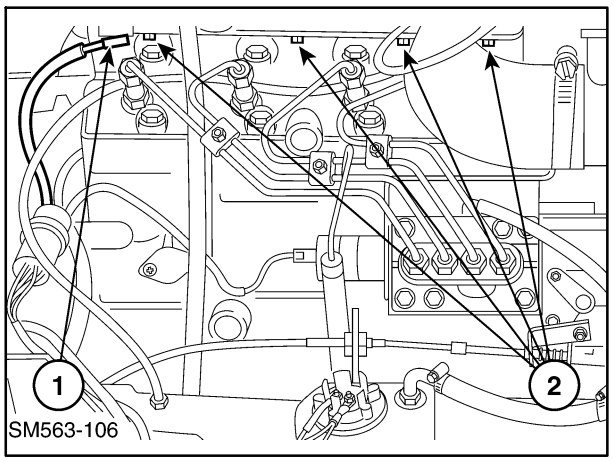


Figure 3-168

FUEL SYSTEM COMPONENTS

The fuel system consists of a fuel tank located in the left side of the engine compartment at 1; fuel tank pickup tube, 2; fuel tank sending unit, 3; in-line fuel filter, 4; electric fuel pump, 5; injection pump, 6; and return fuel line, 7, from the injector bleed off to the tank. The fuel flow is controlled by an electric fuel solenoid, 8, which is controlled by the EIC (Electronic Instrument Cluster).

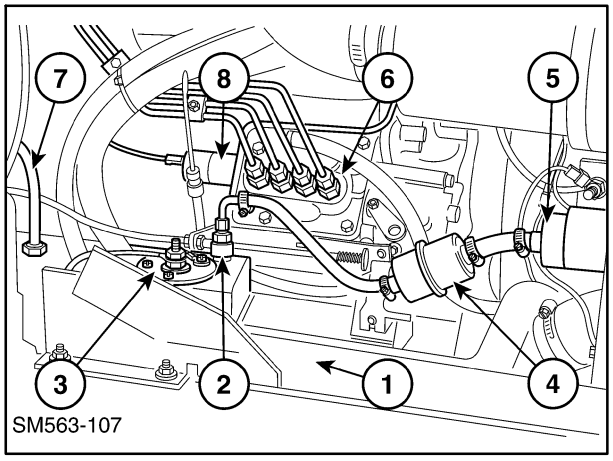


Figure 3-169

FUEL GAUGE

In the center of the EIC panel is the fuel gauge, implemented as a vertical 10-segment green LED bar graph. The lowest segments will flash when the fuel level is low. An audible alarm will accompany the flashing light for about 5 seconds.

FUEL TANK SENDING UNIT (Fuel level)

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key "ON" position Symptom: No bars lit	EIC gauge and sender operation Jumper wire from one terminal to other at sender	NO bars light up YES (bars light up)	Check wires from sender to EIC board. If OK, replace EIC board Replace sender
2	Symptom: Fuel level does not read lower on gauge (too many bars lit)	Disconnect PU/W wire	Bars stay lit Bars go out	Check for PU/W wire shorted to ground. If OK, replace EIC board. Replace sender

FUEL SYSTEM ELECTRICAL DIAGRAM

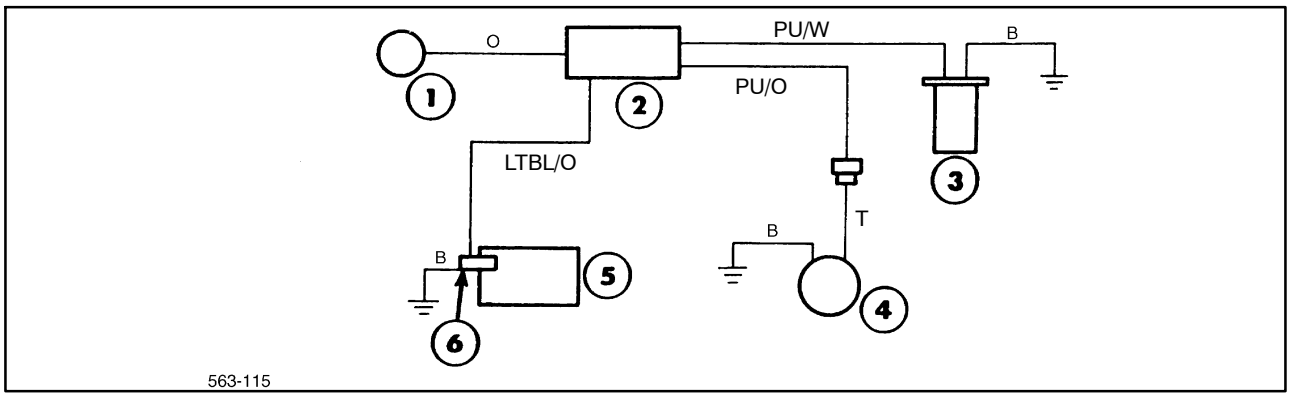


Figure 3-170

1 - Key switch
2 - EIC board
3 - Fuel level sender
4 - Electric fuel pump
5 - Injector pump
6 - Fuel shutoff solenoid

TESTING FUEL GAUGE IN DIAGNOSTIC MODE

Use a jumper wire and connect sender terminals, 1, and the EIC board will light and beep. If the EIC board lights and beeps, the EIC and circuit wires to the sender are OK. If the EIC board fails to light, check the wires to the EIC board.

If the fuel gauge is not working and the wiring and the fuel sender are found to be good, the complete EIC board will require replacement.

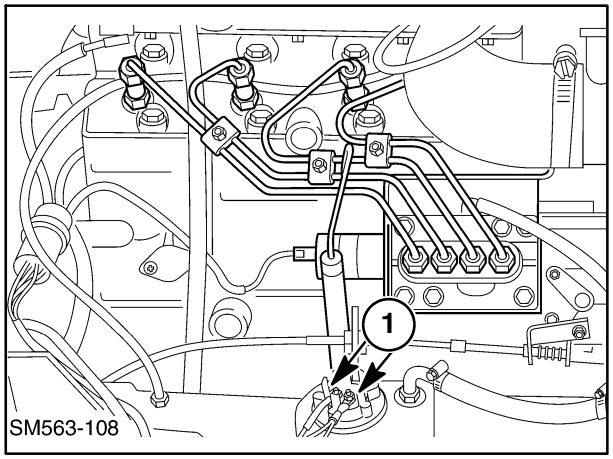


Figure 3-171

REMOVAL OF FUEL LEVEL SENDER

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Disconnect the wires from the sender, 1.
4. Remove the sender retaining screws, 2, and remove the sender, 3, assembly from the tank.

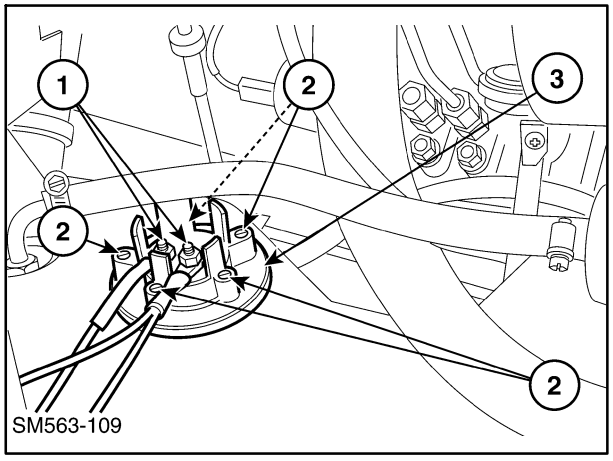


Figure 3-172

TESTING OF THE FUEL LEVEL SENDER

Using a volt/ohmmeter, put one lead on one terminal and the second lead on the other terminal. Rotate the sender from full tank to empty tank, and the ohms reading should be between 35 ohms full and 240 ohms empty.

If the fuel gauge is not working and the wiring and the fuel sender are found to be good, the complete EIC board will require replacement.

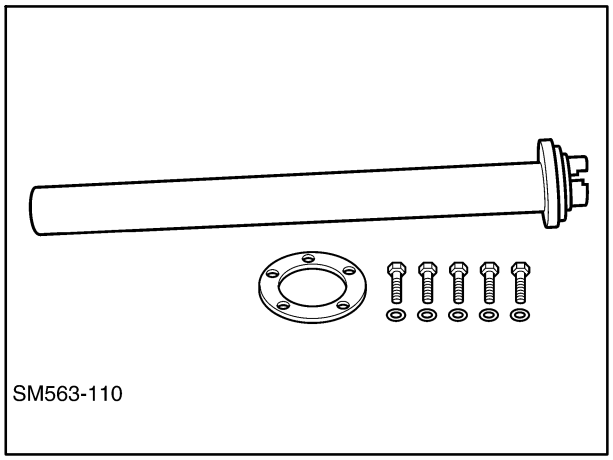


Figure 3-173

ELECTRIC FUEL PUMP

The electric fuel pump, 1, is located in the left side of the engine compartment.

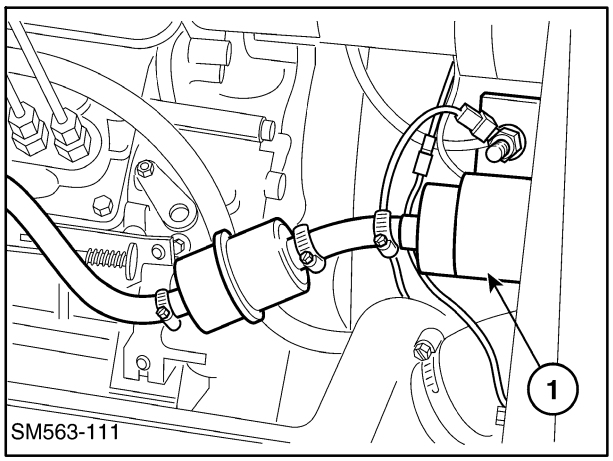


Figure 3-174

ELECTRIC FUEL PUMP

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key “OFF” position	Fuel level in tank	NO YES	Add fuel and bleed system Go to next step
2	Key “ON” position	Fuel pump operating	NO YES	Check power supply (5-amp fuse in cab panel) If OK, check ground; if OK, replace pump Go to next step
3	Key “ON” position	Fuel pump operating but not pumping fuel	NO YES	Check line to tank, air leak, fuel level, tank pickup tube; if OK, replace pump Go to next step
4	Key “ON” position	Fuel pump operating and pumping fuel	NO YES	Replace pump Remove fuel line at injector pump and bleed system; if OK, go to next step
5	Key “ON” position	Fuel pump operating and pumping fuel	YES	Check fuel shutoff solenoid for operation

NOTE: Always check fuel level in tank.
Always check fuel filters.

REMOVAL ELECTRIC FUEL PUMP

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Remove the hose clamps, 1, from the pump and hoses.
4. Remove the pump support hardware, 2, ground wire, and unplug the power wire, 3.
5. Upon reinstallation of the pump, make sure the pump wires are placed to prevent getting damaged. Make sure the ground wire is making good contact.

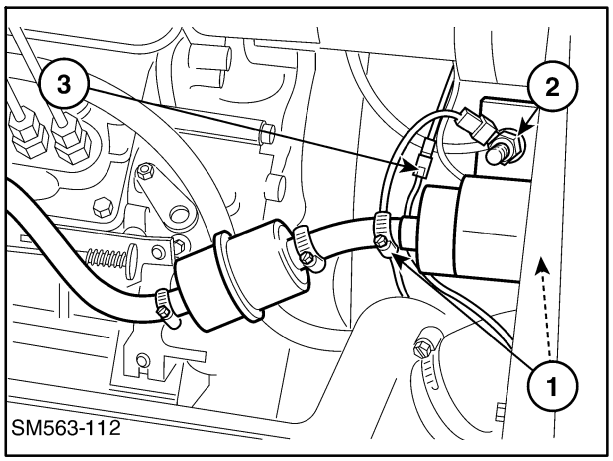


Figure 3-175

FUEL SHUTOFF SOLENOID

The fuel shutoff solenoid is located at the injection pump at 1. The solenoid is controlled through the starting circuit during cranking. After the engine is started, the EIC takes control of the solenoid for normal operation.

If a fault occurs in either the engine oil pressure or the hydrostatic charge pressure circuits, the EIC will remove power from the solenoid, stopping the engine within 30 seconds.

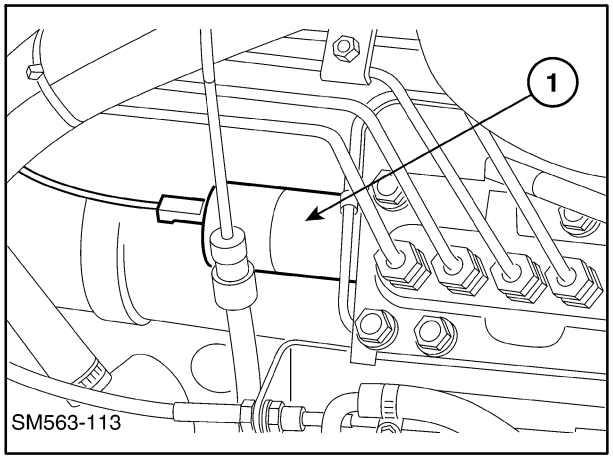


Figure 3-176

FUEL SHUTOFF SOLENOID

STEP	PRETEST INSTRUCTIONS	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Loader on level with parking brake engaged, key "ON" position, service "RUN" switch in "RUN" position	Battery voltage to solenoid	NO YES	Check power wire from EIC to solenoid for open; if OK, go to next step Replace solenoid
2	Key "ON" position, service "RUN" switch in "SERVICE" position	Battery voltage to solenoid	NO YES	Check power wire from service/run switch to fuel solenoid; if OK, go to next step Replace solenoid
3	Key "ON" position, "SERVICE/RUN" switch in "RUN" position	Check EIC board operation	NO YES	Check power to EIC board. Check 5-amp electronics Ign. fuse in cab fuse panel. Replace EIC board

REPLACEMENT OF FUEL SHUTOFF SOLENOID

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield.
3. Remove the power wire from the solenoid, 1.
4. Remove the solenoid from the injection pump.
5. Solenoid pull-in amperage 1.5 to 1.8 amps. Solenoid hold-in amperage 1.3 to 1.7 amps.
6. Reinstall the solenoid and tighten securely. Reinstall the power wire.

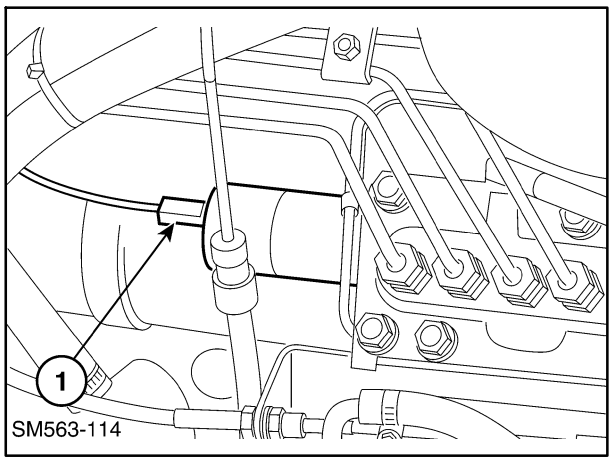


Figure 3-177

AIR FILTER RESTRICTION INDICATOR SWITCH REMOVAL

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the left engine side shield to access the sender.
3. Remove the B/Y, 1, and B, 2, wires from the sender.
4. Remove the sender, 3, from the air cleaner tube.

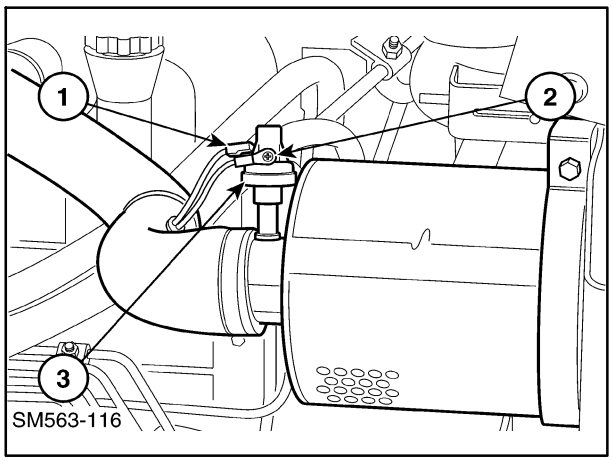


Figure 3-178

AIR FILTER RESTRICTION INDICATOR SWITCH INSTALLATION

Install the sender and reinstall the B/Y and B wires to the sender terminals.

ENGINE COOLANT TEMPERATURE SENDER REMOVAL

1. Support the boom on the boom lock pins.
2. Open the rear door and remove the right engine side shield to access the sender.
3. Remove the PU/LTGN wire, 1, from the sender terminal.
4. Drain the cooling system down below the sender level to prevent loss of coolant.
5. Remove the sender, 2, from the engine block.

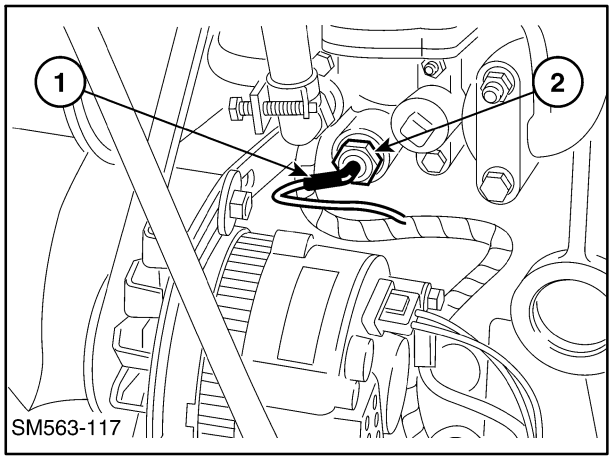


Figure 3-179

ENGINE COOLANT TEMPERATURE SENDER INSTALLATION

1. Remove and clean the engine block thread area.
2. Apply pipe sealant to the threads of the sender.
3. Install the sender into the engine block.
4. Reinstall the PU/LTGN wire to the sender terminal.
5. Refill the cooling system with coolant previously removed or a 50/50 mixture of a permanent-type antifreeze.
6. Operate the unit to remove air from the cooling system and recheck the coolant level.

ENGINE OIL PRESSURE SWITCH REMOVAL

1. Support the boom on the boom lock pins.
2. Open the rear door and raise the top engine shield to access the switch.
3. Remove the Y/B wire, 1, from the switch terminal.
4. Remove the switch, 2, from the engine head.

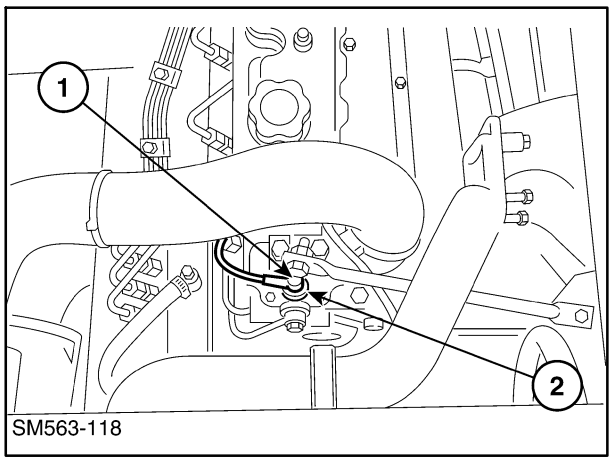


Figure 3-180

ENGINE OIL PRESSURE SWITCH INSTALLATION

1. Install the switch.
2. Attach the Y/B wire to the switch terminal.

HYDROSTATIC CHARGE PRESSURE SWITCH REMOVAL

1. Support the boom on the boom lock pins.
2. Open the rear door, raise the top engine shield and remove the right engine side shield to access the switch.
3. Remove the Y/GY wire, 1, and B wire, 2.
4. Remove the charge pressure switch, 3, from the return line tee.

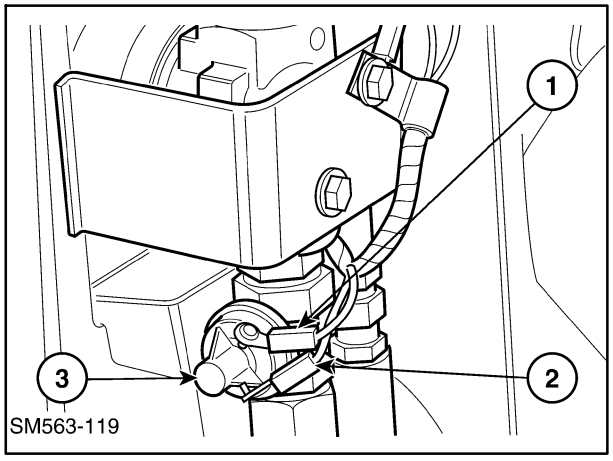


Figure 3-181

HYDROSTATIC CHARGE PRESSURE SWITCH INSTALLATION

1. Install the charge pressure switch into the tee.
2. Reinstall the Y/GY and B wires to the switch.

HYDRAULIC OIL FILTER RESTRICTION SWITCH REMOVAL

1. Support the boom on the boom lock pins.
2. Open the rear door, raise the top engine shield and remove the right engine side shield to access the switch.
3. Remove the DKGN/O wire, 1.
4. Remove the restriction switch, 2, from the filter base.

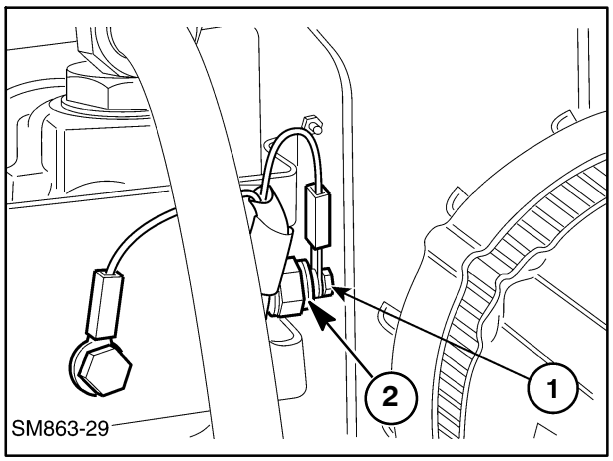


Figure 3-182

HYDRAULIC OIL FILTER RESTRICTION SWITCH INSTALLATION

1. Install the switch into the filter base.
2. Attach the DKGN/O wire to the switch terminal.

HYDRAULIC OIL TEMPERATURE SENDER REMOVAL

1. Remove any attachment from the boom face plate and support the boom on the boom lock pins.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

2. Raise the operator's seat and latch in the raised latched position.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

3. Drain the hydraulic reservoir.

   Remove the rear engine belly pan hardware, 1, and lower the pan from the loader.

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN AND PREVENT SERIOUS INJURY.

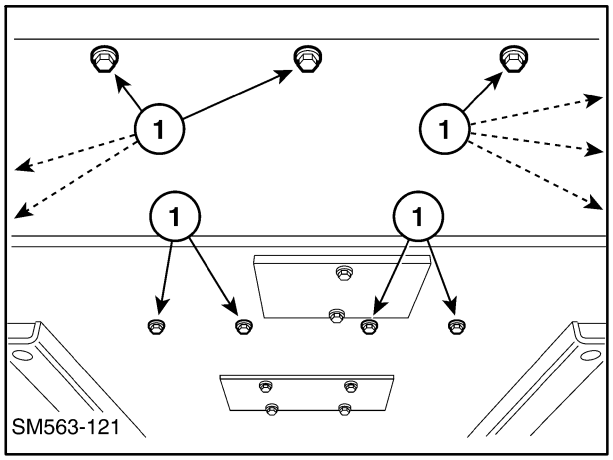


Figure 3-183

4. Loosen the return line clamp at 1.
5. Remove the return line at 2, and rotate the line so the oil drains into a clean suitable pan for reuse.
6. After the reservoir is drained, reconnect the return lines and tighten all fittings and connections.

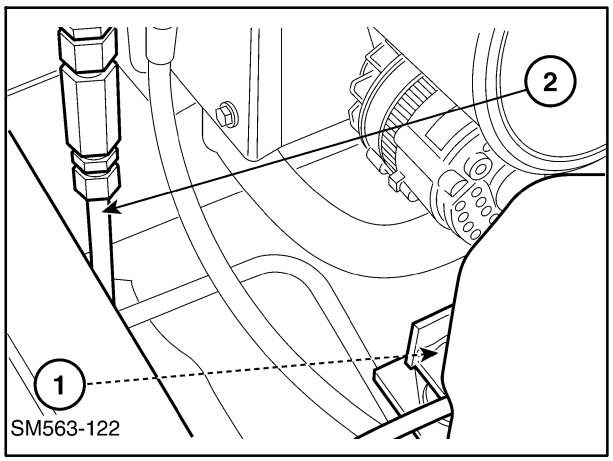


Figure 3-184

7. Remove the PU/LTBL wire and B wire from the sender, 1.
8. Remove the sender from the reservoir by rotating the sender counterclockwise.
9. Remove the grounding ring and washer from the old sender.

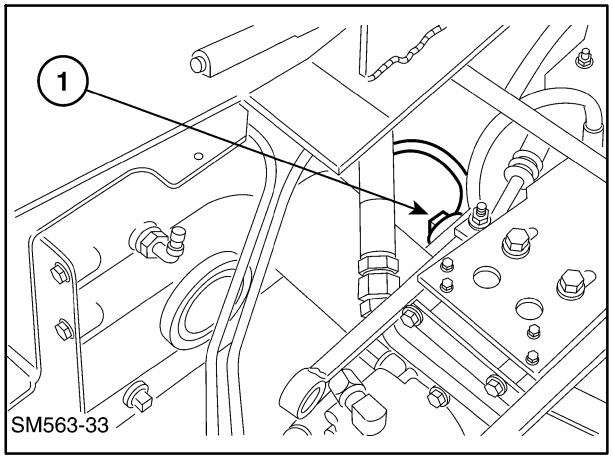


Figure 3-185

HYDRAULIC OIL TEMPERATURE SENDER INSTALLATION

1. Install grounding ring and washer over threads of sender.
2. Use hydraulic thread sealant on the sender threads and install the sender, 1, into the reservoir.

   ATTENTION: Do not over tighten the sender or damage to the reservoir threads may occur resulting in oil leakage.

3. Reconnect the sender wires, B wire on the ground blade, and the PU/LTBL wire to the center sender terminal.

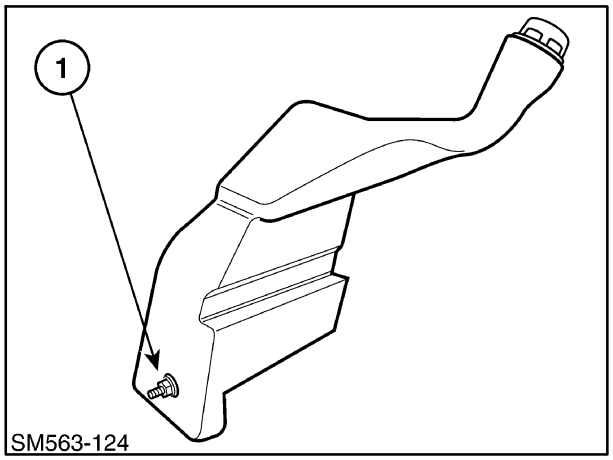


Figure 3-186

4. Refill the hydraulic reservoir with the oil previously removed or new SAE 10W/30 API Service SG-CE motor oil.
5. Reinstall the engine belly pan, and tighten the retaining hardware.
6. Operate the unit and check for leaks. Repair if required.

BOOM/BUCKET CONTROL VALVE SPOOL LOCK SOLENOIDS

Removal

1. Remove any attachment from the loader attaching plate.
2. Raise the boom and support on the boom lock pins.
3. Stop the engine, turn the ignition key to the “RUN” position and operate the boom and bucket controls to relieve pressure in the boom and bucket circuits. Turn “OFF” the key.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

4. Raise the operator’s seat and latch in the raised latched position.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

5. Remove the step shield to access the control valve area.
6. Unplug the solenoid coil wires, 1, and remove the coils, 2, from the control valve spool blocks, 3.

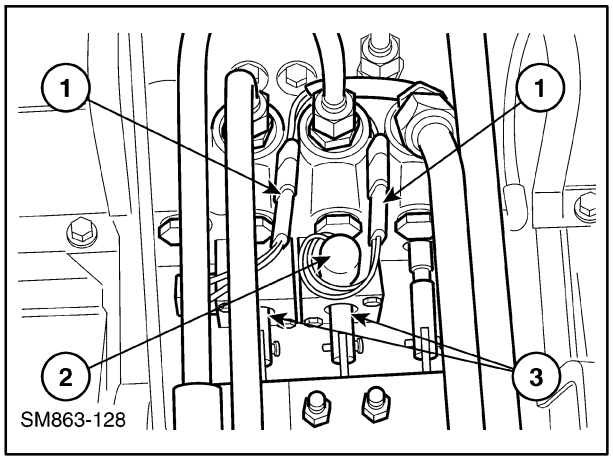


Figure 3-187

Installation

1. Thoroughly clean the control valve block.
2. Install the solenoid coil into block and tighten the coils to 15 N·m (11 ft. lbs.).
3. Reconnect the coil wires to the main wire harness.
4. Reinstall the step shield.
5. Lower the seat to the operate position and securely latch.

CAUTION: DO NOT OPERATE THE LOADER UNLESS THE SEAT/SEAT SUPPORT IS PROPERLY LATCHED IN THE LATCHED POSITION.

WIRE HARNESS

MAIN WIRE HARNESS REMOVAL

1. Remove any attachment from the loader attaching plate.
2. Raise the boom and support on the boom lock pins.
3. Stop the engine, turn the ignition key to the “RUN” position and operate the boom and bucket controls to relieve pressure in the boom and bucket circuits. Turn “OFF” the key.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

4. Disconnect the negative (-) battery cable.
5. Unplug the seat and seat belt wire harness at connector, 1, behind the seat assembly.

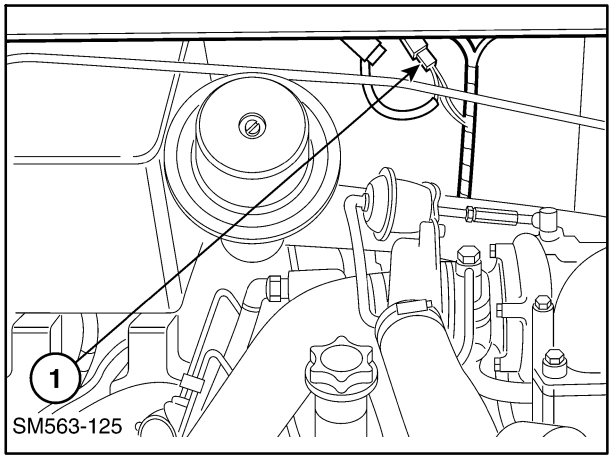


Figure 3-188

6. Remove the rear window and frame assembly retaining hardware, 1.

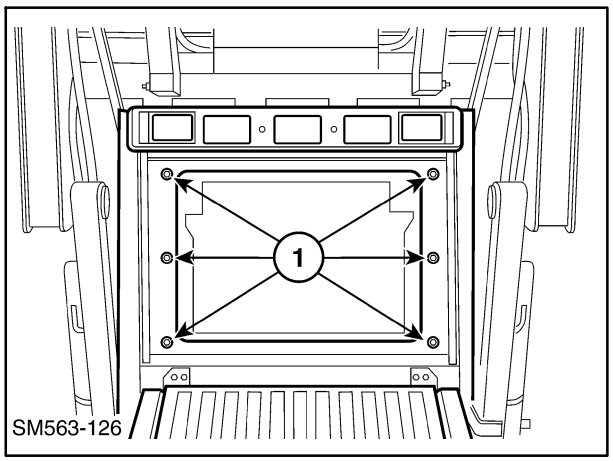


Figure 3-189

7. Remove the right side plate, 1, and headliner, 2, if equipped. Unhook all wire connections at the service/run switch, preheat button, and fuse block(s) at this time. Removal of fuse block/switch panel, 3, may be required for easier switch access.

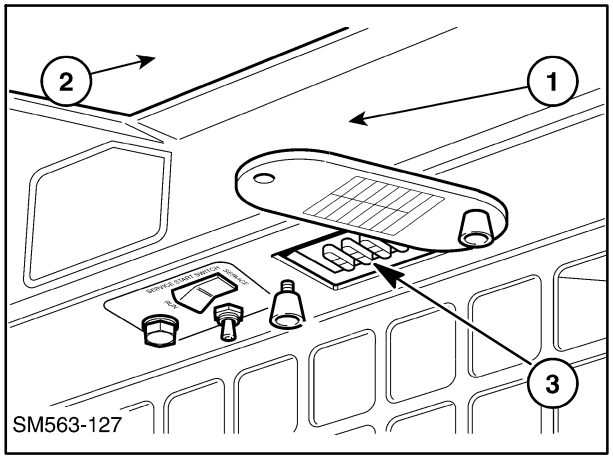


Figure 3-190

8. Remove the upper rear support retaining hardware, 1, right and left side and remove support, 2.

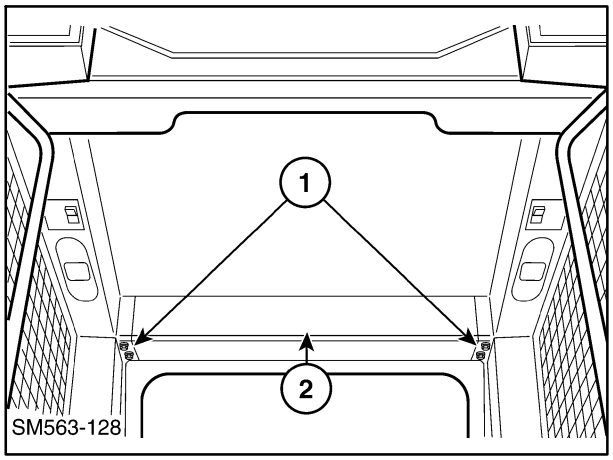


Figure 3-191

9. Remove the EIC board retaining hardware, 1, unplug the EIC board and remove from the dash. Remove the ignition key switch panel, 2, and remove wires from the switches. Remove the panel. Loosen the front support (dash) retaining hardware, 3, and remove the hardware from the right side.

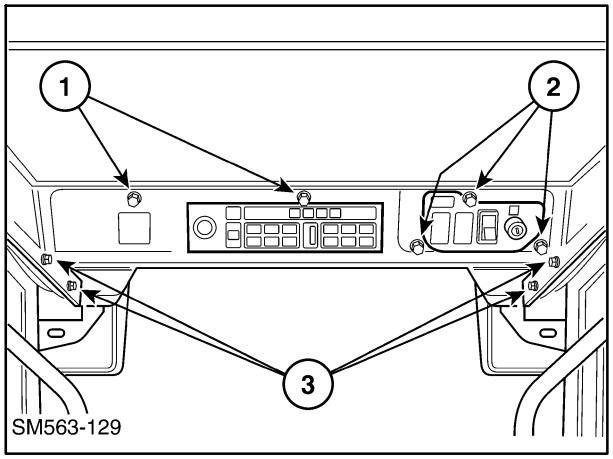


Figure 3-192

10. Unplug the seat wire harness from the main harness.
11. Remove the seat and seat pan assembly retaining hardware, 1, unlatch the seat assembly at 2, and remove the assembly from the loader.

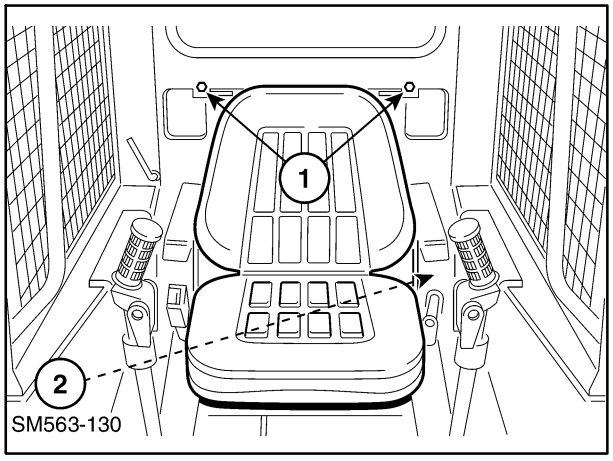


Figure 3-193

12. Remove the four retaining screws from the front shield, 1, and the eight retaining bolts from the step shield, 2. Remove both shields from the loader.

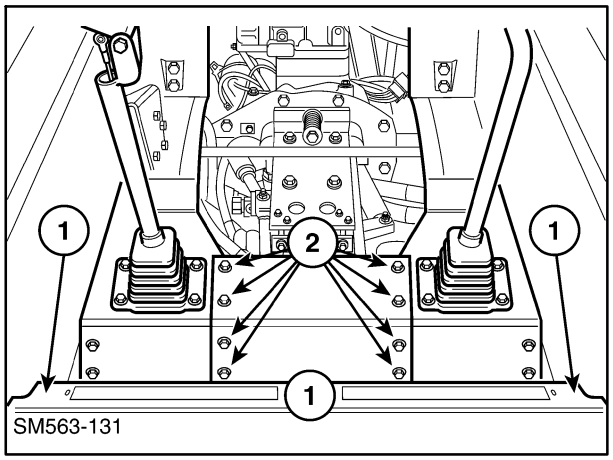


Figure 3-194

13. Remove the rear seat support, 1, hardware at 2, and the isolator mount hardware, 3.

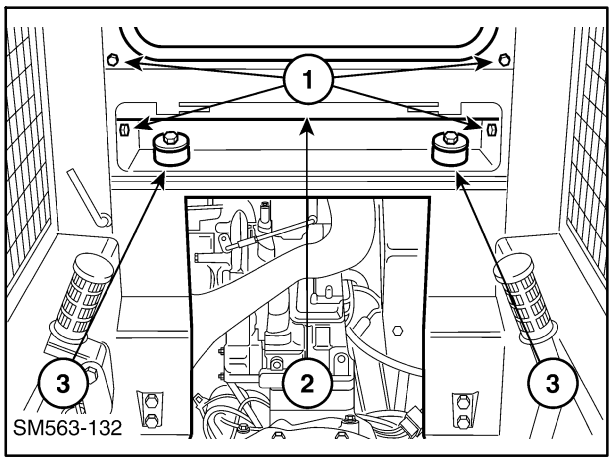


Figure 3-195

14. Remove the right hydrostatic control handle assembly, 1, retaining hardware, 2. Unhook the hydrostatic control linkage and auxiliary boom hydraulic linkage (if equipped). Lift the control assembly from the loader.

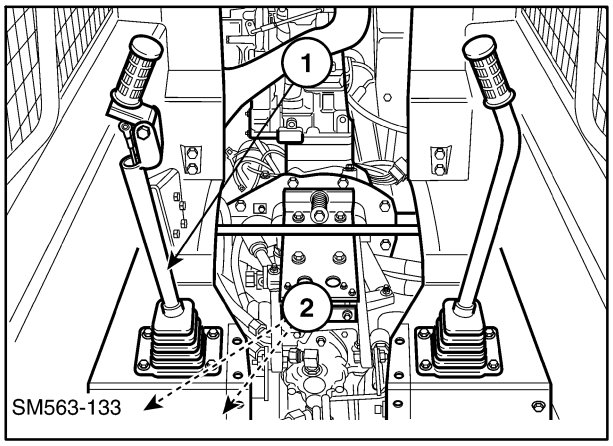


Figure 3-196

15. Remove the right fender to access and loosen the right front isolator mount bolt, 1.

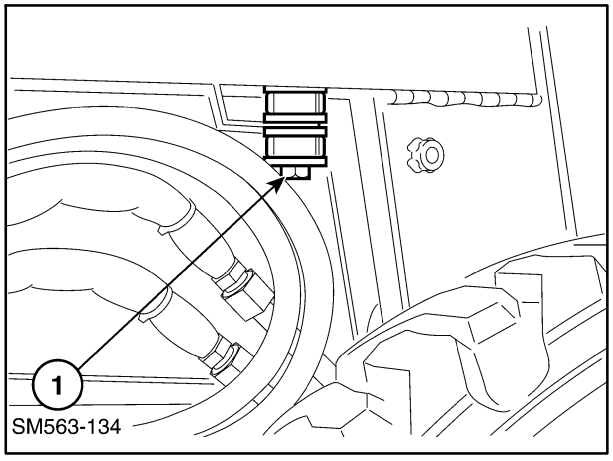


Figure 3-197

16. Remove the left fender.

17. Remove all wire harness retaining clamps from the main wire harness at the rear and left side of the loader frame, 1 and 2.

    (Cut wire ties along the right side of the rear window if so equipped and any ties retaining the optional harness to the main harness. Cut the wire tie at the keeper bar at the left front to rear of cab pivot).

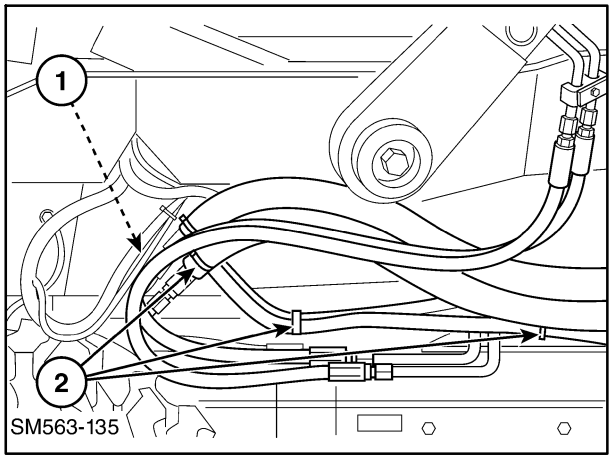


Figure 3-198

18. Remove harness from left rear of engine area after disconnecting wires from fuel sender, 1, and fuel pump, 2. Remove tubing from the harness that is located in fuel tank groove, 3.

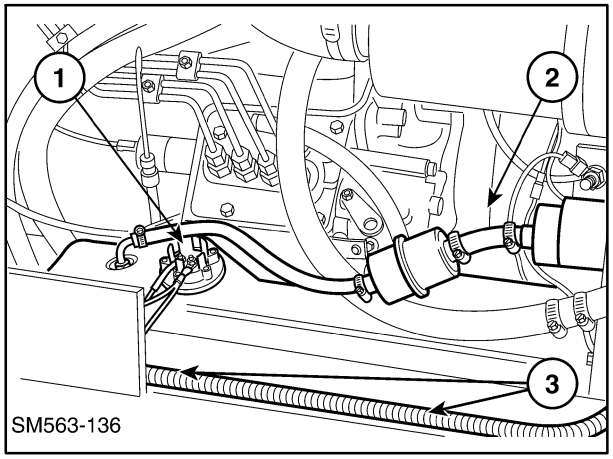


Figure 3-199

19. Thoroughly clean the connector between the main and engine harness. Make sure the connector is dry.

20. Unplug the main wire harness from the engine wire harness, 1, and remove the ground wires from the engine bellhousing ground stud, 2. Remove wires from the engine fuse and relay panel, 3.

21. Remove the hydraulic oil temperature sender wires, 4, and remove the harness from the clamp on the face of bellhousing, 5. Remove the remaining bellhousing clamps.

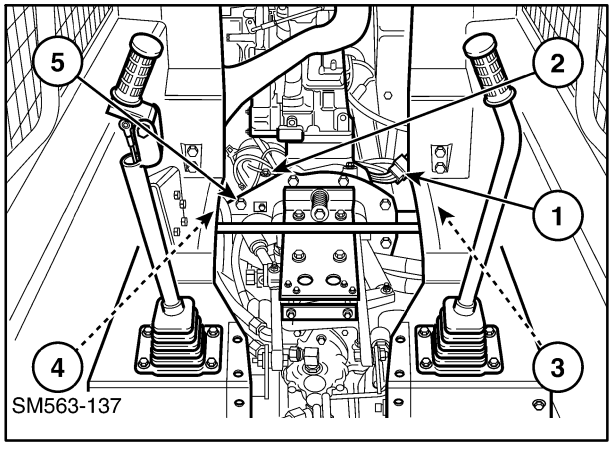


Figure 3-200

22. Disconnect the control valve connectors, remove the harness from the J clamp on the valve and pull the harness out through the left fender area.

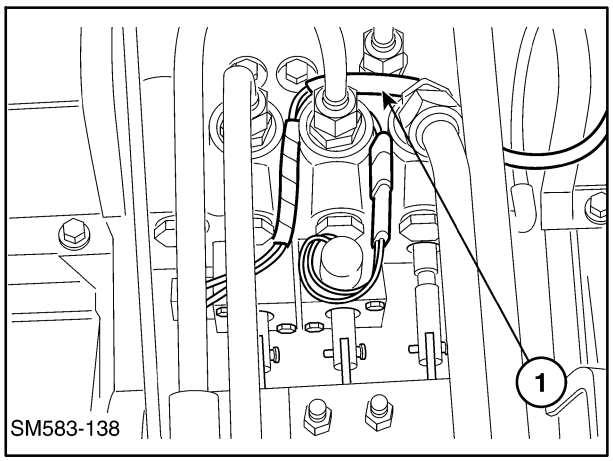


Figure 3-201

23. Now the right side panel, 1, can be pivoted into the center of the cab area at the rear and the wire harness can be removed from the corner of the side panel.

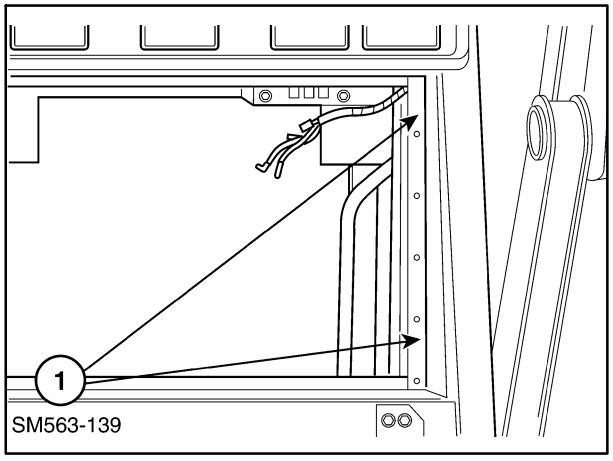


Figure 3-202

MAIN WIRE HARNESS INSTALLATION

1. Install the wire harness up the right rear corner of the side panel with the EIC board connector toward the front of the loader cab. Position the service/run and fuse block connectors at their location. Place the wire in the upper rear corner of the cab side panel at 1, to prevent the wire harness from contacting the cab panel retaining hardware. Install two wire ties or clamp at the upper right side of the rear window and one tie at the bottom to hold the harness up and maintain clearance from the cab panel hardware and headliner support.

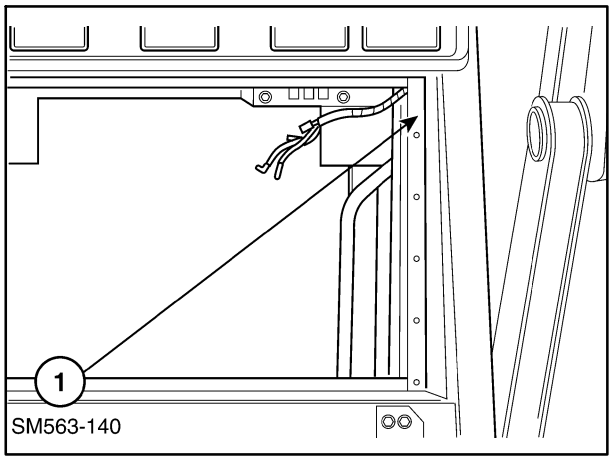


Figure 3-203

2. Place the main wire harness to the front side of the boom lock linkage at 1, and reinstall the wire clamps. Route the harness across the loader to the left side of the loader.

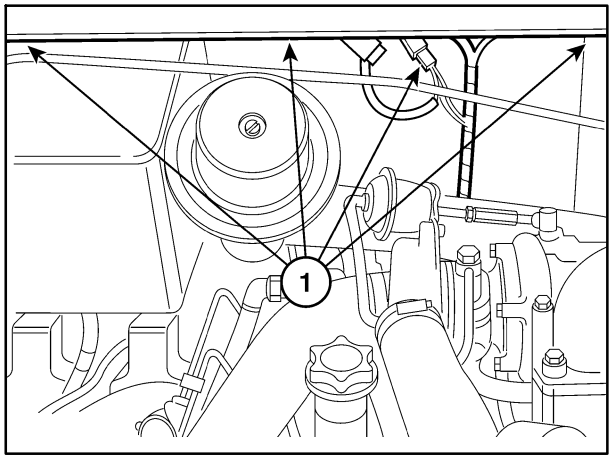


Figure 3-204

3. Route the wire harness to the front of the loader on the left side, 1 and 2, and install wire clamps where previously installed. Place the harness into the loop (keeper) and secure with a wire tie at 1, and then along the top of the lower frame to the rear of the loader to the engine fuse/relay panel area.
4. Route the harness branch to the inside of the frame with the hydraulic lines and down to the floor and front of the control valve. Refasten in the J clamp and route the connectors between valve bosses and plug in solenoids. Tuck the connectors between valve bosses to protect the harness.

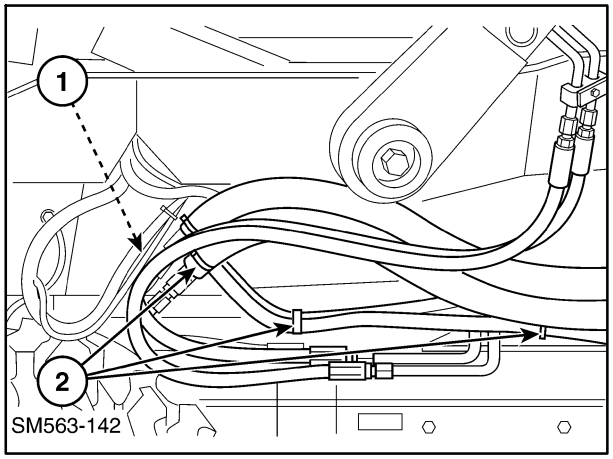


Figure 3-205

5. Connect the main wire harness connector to the engine wire harness, 1. Reconnect the wires to the proper components in the panel.
6. Route the harness branch along the fuel tank groove, 2, install tubing over the harness and connect to the fuel sender, 3, and fuel pump.

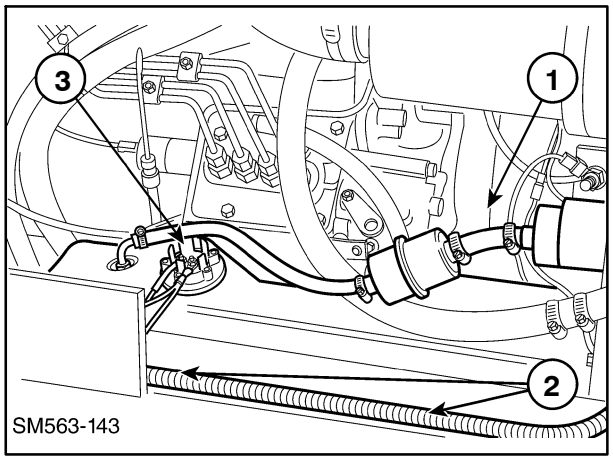


Figure 3-206

7. Attach the ground wires at the engine bellhousing ground stud, 1.

   NOTE: When attaching ground wires, always place the heaviest ground wire (battery ground cable) next to the ground surface (bellhousing). Then stack the remaining ground wires according to wire size; largest on bottom, smallest on top of the heaviest wire.

8. Continue harness routing to the hydraulic temperature switch and secure in the bell housing clamp, 2. Clamp harnesses to the bellhousing.

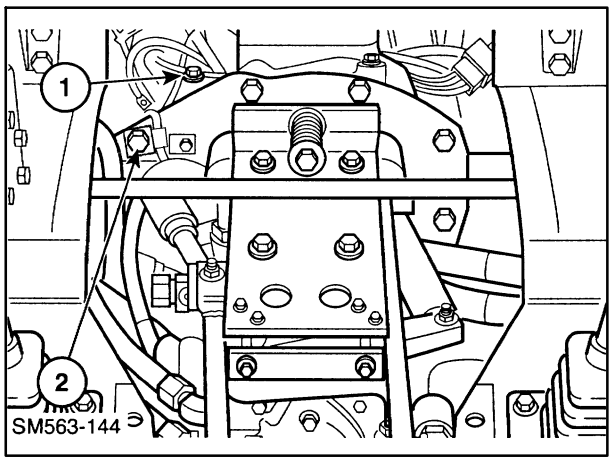


Figure 3-207

9. Reattach the wires to the service/run switch, 1; fuse block(s), 2; preheat switch, 3; and any ground wires if removed at 4.

   NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to wire size on top of the heaviest wire.

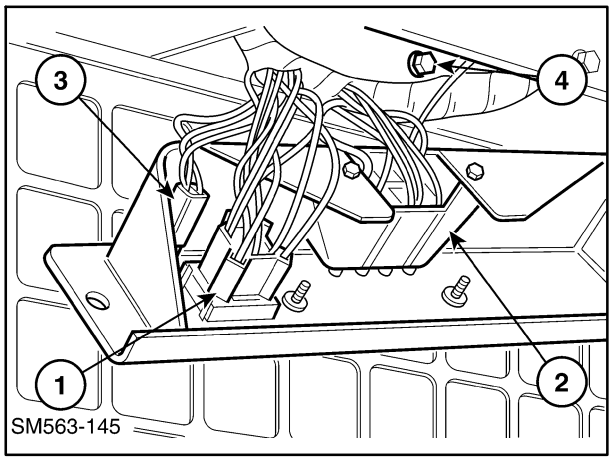


Figure 3-208

10. Reposition the right side panel, 1, and reinstall the front dash support hardware.
11. Reinstall the right front isolator, 2, if removed.
12. Reinstall the upper rear support.
13. Reinstall the lower rear support, 3, and the isolators, 4. Tighten all cab support and side shield hardware at this time.

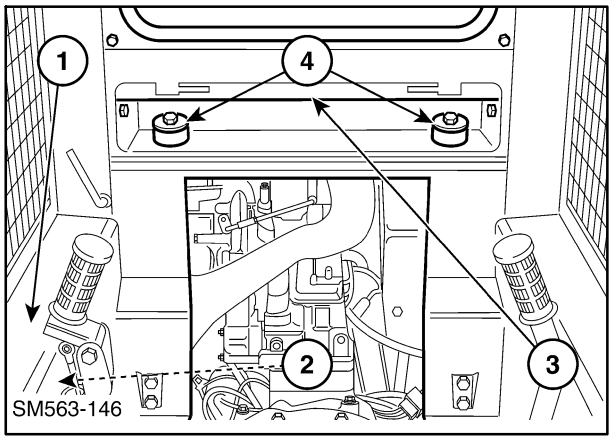


Figure 3-209

14. Reinstall all wire harness clamps previously removed, position the wire harness to prevent damage, and tighten the clamp hardware at this time.

15. Reinstall the seat and seat pan assembly and tighten the hardware. Reconnect the seat harness to the main harness. Check the loop for clearance when the seat is raised and lowered.

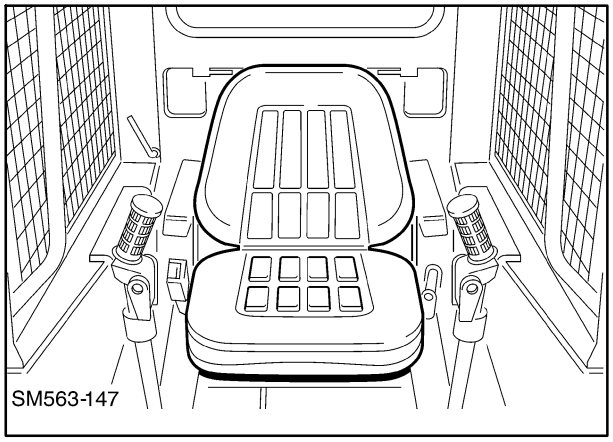


Figure 3-210

16. Route the wire harness to the front of the cab to the ignition switch and EIC board area. Attach the wires to the ignition switch and position the wire harness to prevent damage. Reinstall the switch panel, 1.

17. Attach the wire harness connectors, 2, to the proper EIC board connector and position the wire harness across the front of the dash area to prevent damage. Reinstall the EIC board.

18. Reconnect the negative (-) battery cable.

19. Check the electrical system for proper operation.

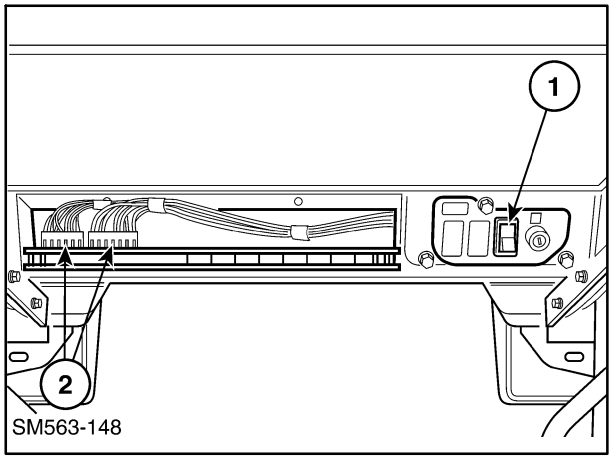


Figure 3-211

ELECTRICAL SYSTEMS - ALTERNATOR AND STARTER

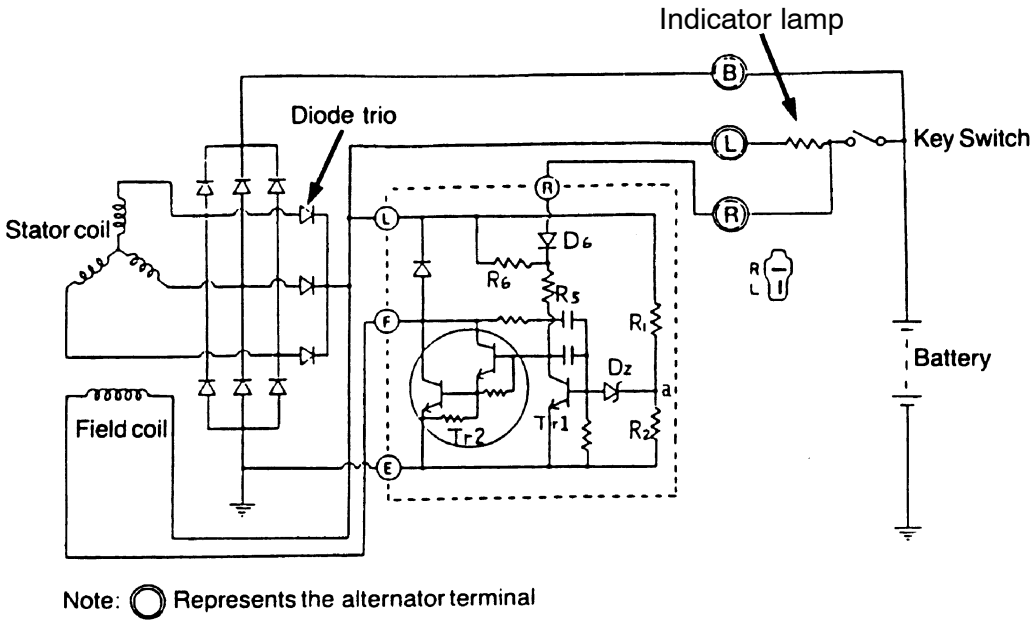


Figure 3-212

ALTERNATOR (40-Amp Version)

CHARGING CIRCUIT

Description

1. The charging circuit and internal connection are shown here. The charging system consists of an IC regulator built-in alternator, a battery, and connecting wires. Because of the use of IC, the voltage regulator is very compact and is built into the alternator.
2. The field current flows directly from the diode trio to the field coil without passing through the external circuit. Consequently, there are no voltage drops caused by the key switch or the wiring, as with the conventional vibrating-contact regulators mounted separately from the alternator. To help the initial voltage buildup when the engine is started, the field current is supplied through the indicator lamp from the battery.
3. Since the frequency pulse output of 1/10 the alternator speed develops at “P” terminal, this terminal is used for speed detection by the EIC board for engine RPM readings.

Principle of IC Regulator

The basic circuit of the IC regulator is shown here.

The part enclosed by a dotted line represents the IC regulator.

The basic function of the IC regulator to make terminal voltage constant by detecting generated voltage and increasing/decreasing field current is not different from that of the vibration-contact regulator.

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 a voltage divider network (R1, R2), a Zener diode (DZ) for voltage reference, and a signal amplifying transistor (Tr1). The output device is a Darlington-type amplifier which is called power transistor (Tr2). The transistor Tr2 is placed in series with the alternator field coil and ground.

The transistor Tr1 senses the generated voltage and turns the 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:

1. When the key switch is closed, current from the battery flows through the indicator lamp and resistor R6, which are in parallel, to the field coil.

   From here it continues to flow on through the field coil to ground, completing the circuit back to the battery.

   Battery — Key Switch < Indicator lamp / Terminal R-Resistor R6

   Alternator terminal L — Field Coil — Tr2 — Ground

2. When the alternator begins to rotate, A.C. voltages are generated in the stator coil. The diodes in the rectifier assembly change the stator A.C. voltages to a D.C. voltage which appears between the ground and terminal, B.

   The stator also supplies D.C. field current through the diode trio, the field coil, Tr2, and then through the diodes in the rectifier assembly, back to the stator.

   Diode trio — Field Coil — Tr2 — Ground

3. 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.

4. As the speed and voltage increases, the voltage at point A also increases until it reaches the limiting value set by 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.

   Regulator Terminal L — R1 — DZ > Tr1 — Ground
   Regulator Terminal R — R6 — R5 >

5. When the generated voltage decreases, the Zener diode (DZ) again turns off and Tr1 also turns off.

   This cycle then 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 is varied to limit the output voltage, but in place of the voltage coil and spring system, there is a potential divider (R1 and R2) and a Zener diode.

ALTERNATOR SERVICE SPECIFICATIONS

ITEM	HOW RATED	STANDARD OR SERVICE LIMIT
Normal Output	(V - A)	**12 V - 40 A**
Polarity		**Negative Ground**
Weight	kg (lbs.)	**3.7 kg (8.2 lbs.)**
Rotational direction (viewed from the pulley)		**Clockwise**
Load characteristics (cold)	Terminal voltage (V)	**13.5 V**
	Current (A)	**Min. 30 A**
	Revolution (RPM)	**2500 RPM**
Brush length	Original (mm-in)	**18.5 mm (0.728″)**
	Limit (mm-in)	**5.0 mm (0.20″)**
Brush spring tension	Original (g-lbs)	**470-590 g (1.036-1.300 lbs.)**
	Limit (g-lbs)	**270 g (0.60 lb.)**
Slip ring diameter	Original (mm-in)	**22.7 mm (0.0894″)**
	Limit (mm-in)	**0.22.1 mm (871″)**
Field coil resistance	ohms at 20° C (68° F)	**2.8 ohms**
Adjusting voltage	(V) at 5000 RPM	**14.4 - 15.0 V**

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 of 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
	Shortage in stator coil	Replace
	Insufficient brush contact	Repair or replace
	Broken brush or spring	Replace
	Loose connections	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

Construction

Sectional view of the IC alternator

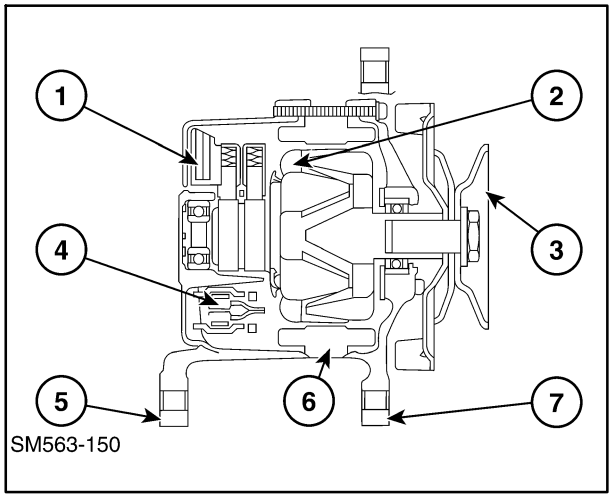


Figure 3-213

The principal components of the IC alternator are the stator, the rotor, the rectifier assembly, the IC voltage regulator, the front bracket, the rear bracket, and the pulley.

The rectifier assembly consists of two heat sinks, one positive and one negative, and diode trio. The diode trio is used as a field supply diode and is connected to the field coil and terminal L on the alternator.

The built-in IC regulator is a solid-state unit so that it can only be serviced as an assembly.

1 IC voltage regulator
2 Rotor
3 Pulley
4 Rectifier
5 Rear support bracket
6 Stator
7 Front support bracket

Check on the Equipment

Checking the regulator adjusting voltage.

A. In the case of equipment without an ammeter, connect a test ammeter (50A capacity) at the position shown.

   In the case of equipment with an ammeter, make use of the ammeter on the equipment.

B. Connect a voltmeter between terminal 1 of the alternator and the ground.

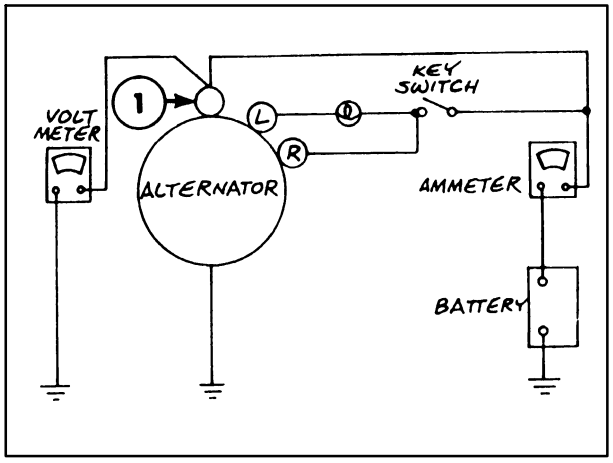


Figure 3-214

1. In this state, confirm the reading on the voltmeter indicates the battery voltage.
2. If the voltmeter reading is zero, the wiring between terminal 1 and the battery is faulty.

3. With the test ammeter terminals short-circuited, start the engine.

CAUTION: IN THE CASE OF WHERE THE TEST AMMETER IS CONNECTED AT THE POSITION SHOWN IN FIGURE 2-214, MAKE SURE NO STARTING CURRENT IS APPLIED TO THE AMMETER WHEN THE ENGINE IS STARTED.

4. Remove the short circuit across the test ammeter terminals and increase the engine speed immediately to approximately 2000 RPM. Take the ammeter reading.
5. If the ammeter reading is 5A or less, take the voltmeter reading without changing the engine speed (approximately 2000 RPM). The reading is the adjusting voltage.
6. If the ammeter reading is more than 5A, continue to charge the battery until the reading falls to less than 5A or replace the battery with a fully charged one.

   An alternative method is to limit the charging current by connecting a 1/4 (25W) resistor in series with the battery.

Checking Output

If the previous section “A” check is satisfactory, check the output as follows:

1. After opening the battery switch, disconnect terminal B of the alternator and connect an ammeter (50-amp capacity) at the position shown.
2. Connect the voltmeter between terminal B of the alternator and the ground. Confirm the voltmeter indicates the battery voltage.
3. Close the key switch.
4. Start the engine and turn on all the lamps. Immediately accelerate the engine to 2000 RPM or more and measure the maximum value indicated on the ammeter.
5. If this value is more than 70% of the nominal output (refer to the section on “Service Specifications”), the alternator can be considered as working almost satisfactorily.

   NOTE: To make the above judgement more accurate, remove the alternator from the engine and check it on a test bench.

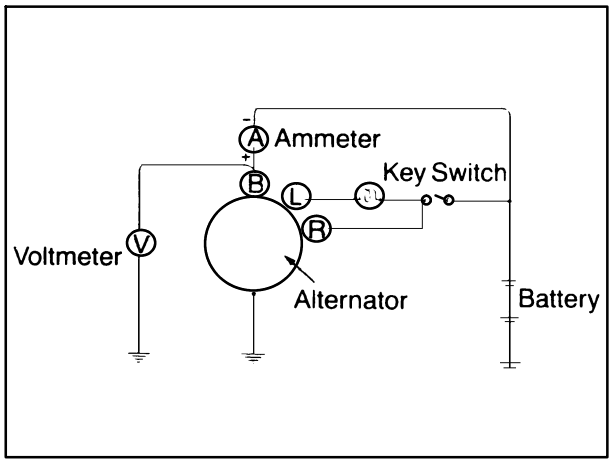


Figure 3-215

Alternator Removal

1. Open the rear door, 1, raise the top engine shield, 2, and remove the right engine side shield, 3, to access the alternator.
2. For easier access, remove any attachment from the loader boom face plate and raise the boom and rest it on the boom lock pins.

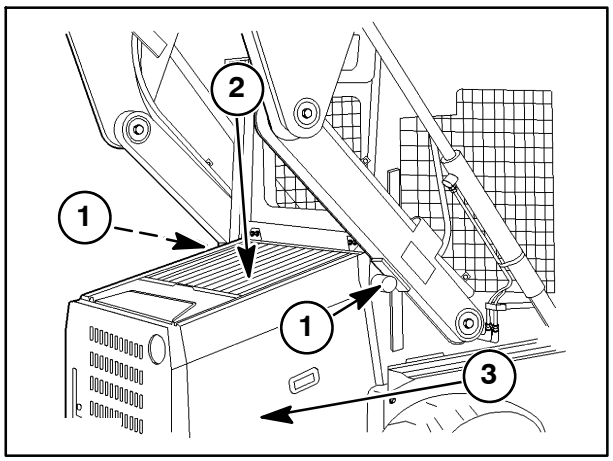


Figure 3-216

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

3. Disconnect the negative (-) battery cable to prevent possible damage to the alternator and electrical system.
4. Disconnect the wire connections from the alternator noting their location.
5. Remove the top strap retaining hardware, 1, and lower pivot, 2.

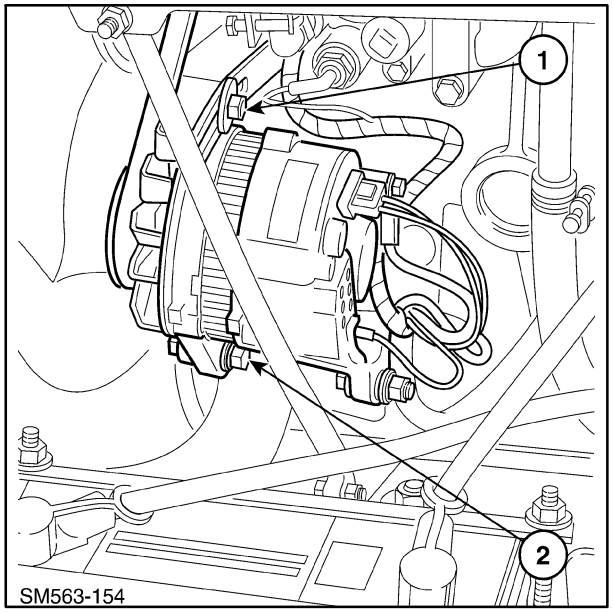


Figure 3-217

Alternator Installation

1. Attach the alternator to the lower pivot, 1, and the upper support strap, 2.
2. Reattach the wires to the alternator terminals.
3. Pivot the alternator to tighten the belt to obtain proper belt tension. The belt is tightened properly when a force of 1 kg (2 lbs.) is applied perpendicular to the belt at the center of the span, 3, with a 3 mm (1/8”) deflection.
4. Reconnect the negative (-) battery cable, 4.
5. Reinstall the engine side shield, close the top engine cover and rear door.

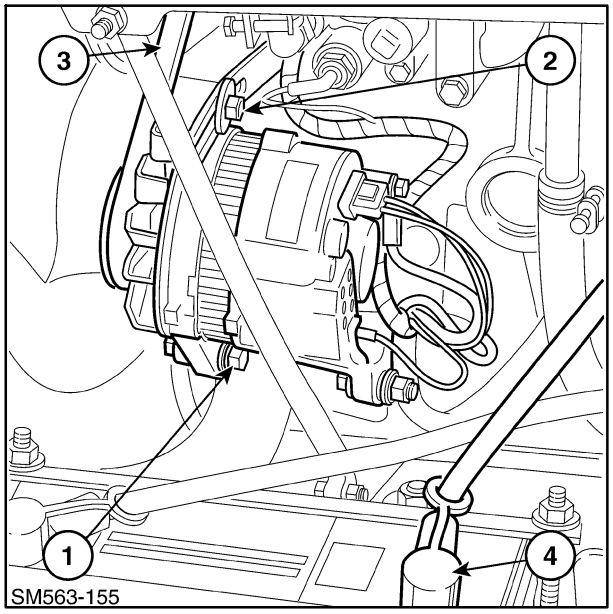


Figure 3-218

Disassembly

1. Mark both brackets and the stator with a scribe mark for assembly.
2. Remove the four through bolts. Pry between the stator and front bracket with the blade of a screwdriver. Carefully separate the front bracket, pulley, and rotor assembly away from the stator and rear bracket assembly.

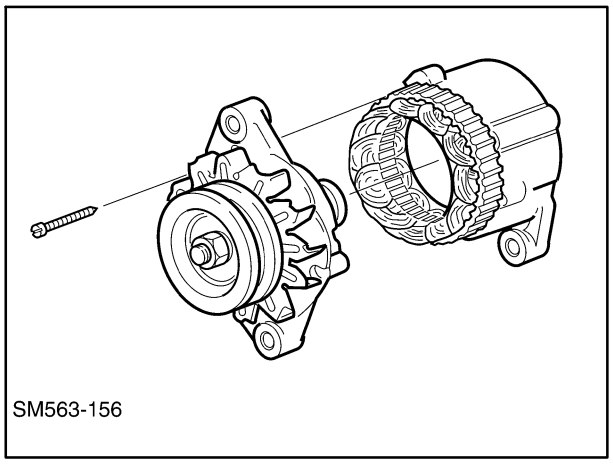


Figure 3-219

3. Place the rotor in a vise with soft jaws and remove the pulley nut, washer, pulley, spacer, and rear bracket from the rotor.

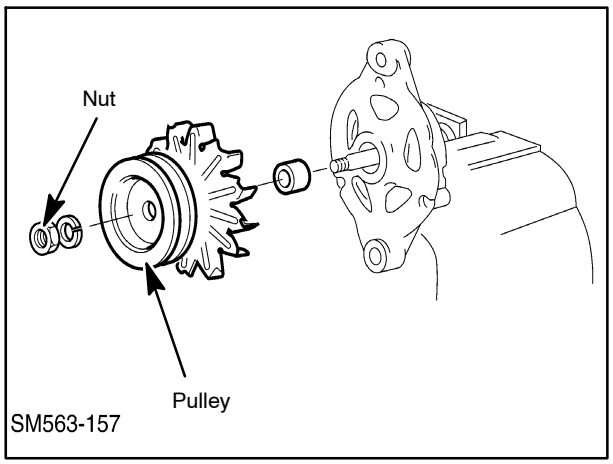


Figure 3-220

Unsolder three stator leads, 1, and remove the stator.

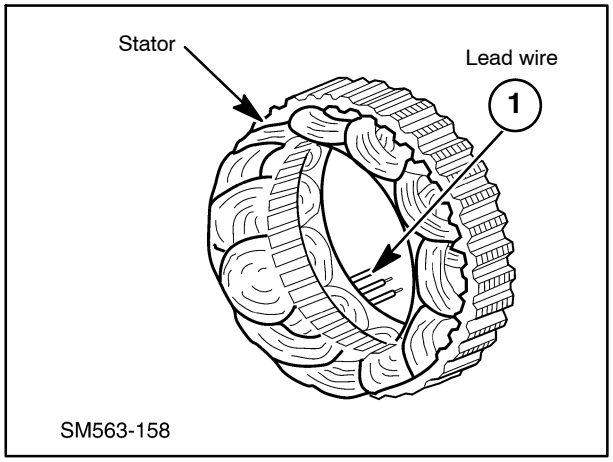


Figure 3-221

4. Remove the voltage regulator assembly, 1, and rectifier assembly, 2.

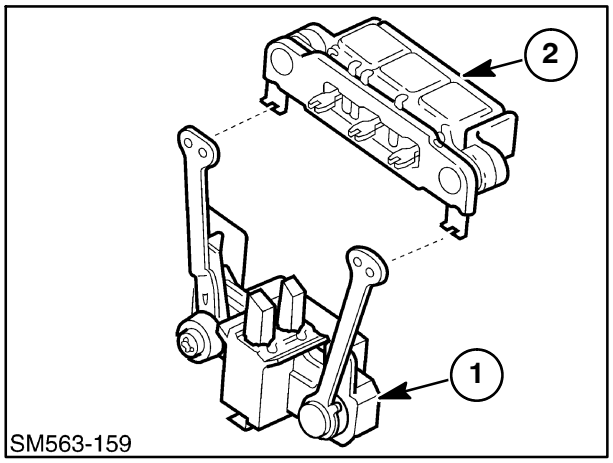


Figure 3-222

Inspection of Parts

Rotor

1. Inspection of slip ring surface, 1.

   Correct stain or scratches on the slip ring surface with a sandpaper of about 400# - 600#.

   A badly roughened slip ring or slip ring worn down beyond the service limit should be replaced.

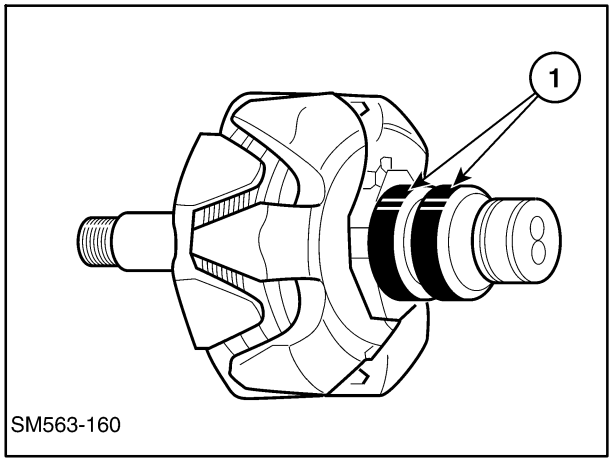


Figure 3-223

2. Check for continuity between both the slip rings. If there is no continuity, the field coil is defective. Replace the rotor assembly.

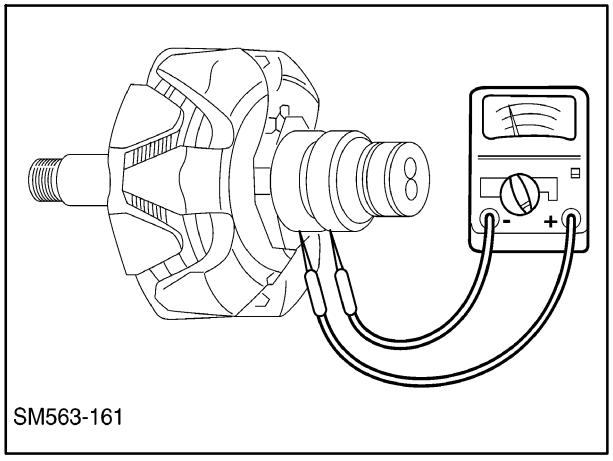


Figure 3-224

3. Check for continuity between the slip ring and shaft (or core). If there is continuity, it means the coil or slip ring is grounded. Replace the rotor assembly.

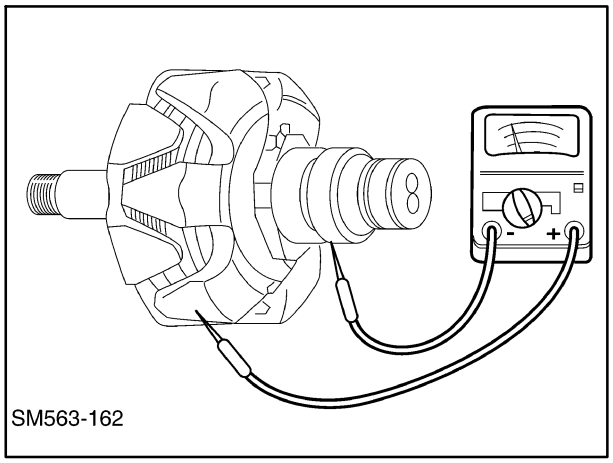


Figure 3-225

Stator

1. Check for continuity between the leads of the stator coil. If there is no continuity, the stator coil is defective. Replace the stator assembly.

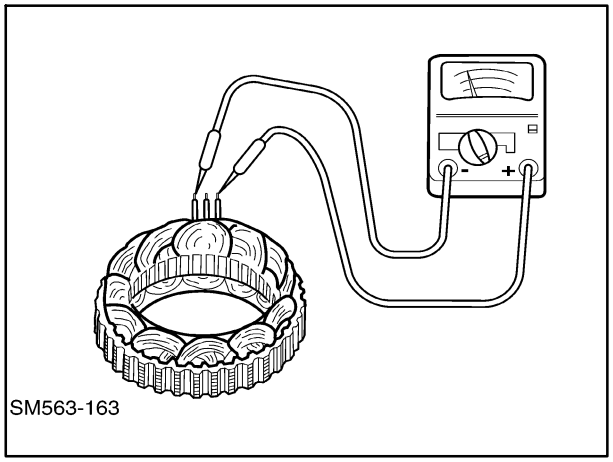


Figure 3-226

2. Check for continuity between any stator lead and stator core. If there is continuity, it means the coil is grounded. Replace the stator assembly.

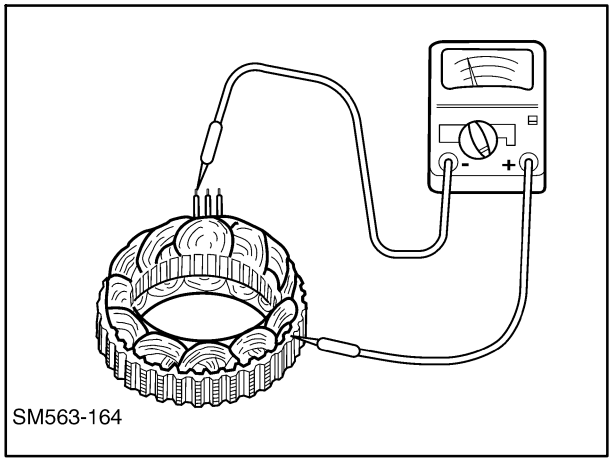


Figure 3-227

Rectifier Assembly

Positive Heat Sink

Check for continuity between the positive (+) heat sink and stator coil lead connection terminal with a circuit tester. If there is continuity in both directions, the diode is short-circuited. Replace the rectifier assembly.

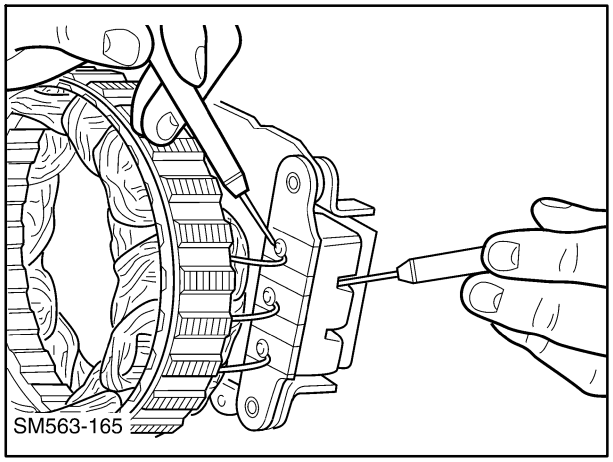


Figure 3-228

Negative Heat Sink

Check for continuity between the negative (-) heat sink and stator coil lead connection terminal. If there is continuity in both directions, the diode is short-circuited. Replace the rectifier assembly.

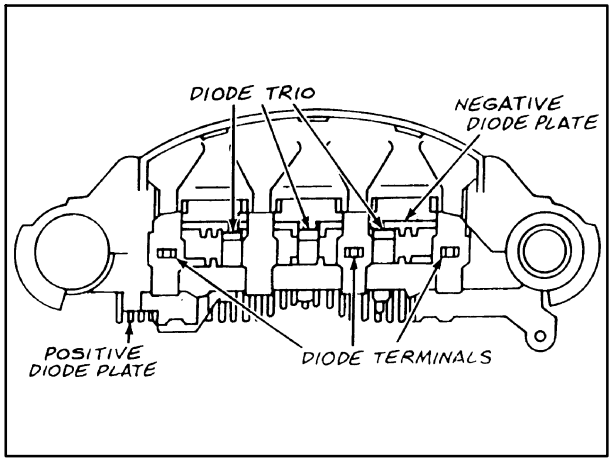


Figure 3-229

Diode Trio

Using a circuit tester, check the three small diodes for continuity in both directions. If there is either continuity or an open circuit in both directions, the diode is defective. Replace the rectifier assembly.

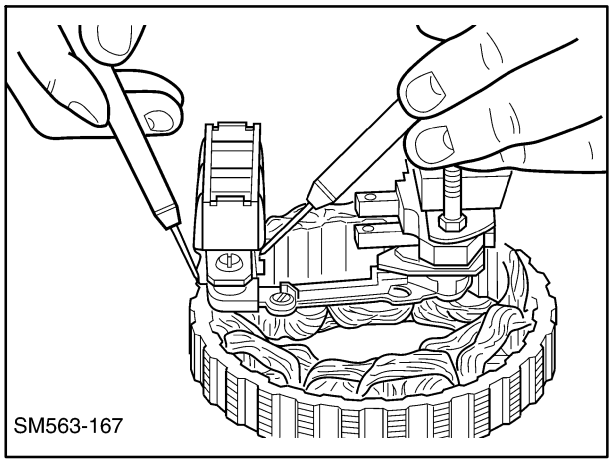


Figure 3-230

Brush and Brush Spring

Check the length of the brush. A brush worn down to the wear limit line should be replaced.

Check the brush spring pressure and make sure the brush moves smoothly in the brush holder.

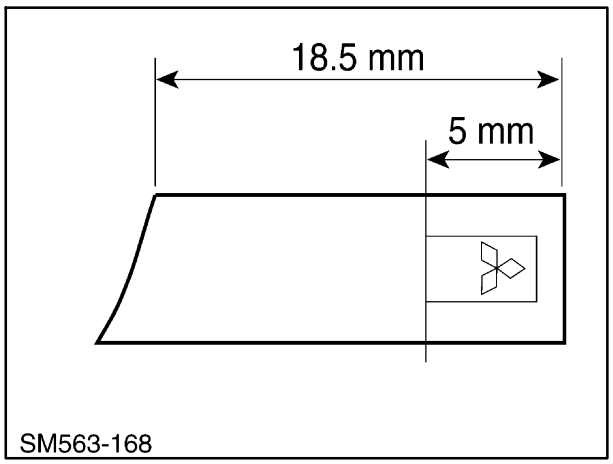


Figure 3-231

Reassembly

Reverse the disassembly, except for the following:

Installing Rotor

1. Push brushes, 1, into the brush holder and insert a wire, 2, to hold them in the raised position. Install the rotor and remove the wire.

   NOTE: The rear bearing and rear bracket, 3, fit is tight; heat the bearing box in the rear bracket to 50° - 60° C (122° - 140° F) before installing the rotor.

2. Lubrication to the bearing box. Do not apply grease to a bearing with a resin band. Remove grease and oil from the bearing box in the rear bracket.

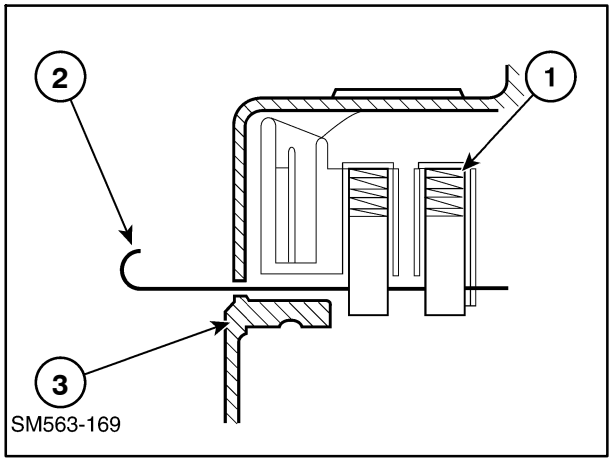


Figure 3-232

Bench Check

To check the alternator on a test bench, proceed as follows:

1. Make the connection as shown, except leave the load resistor disconnected.
2. Slowly increase the alternator speed and observe the voltage.
3. If the voltage is uncontrolled with speed, and increases above 15.5 V, check the alternator.
4. If voltage is below 15.5 V, connect the load resistor as shown.
5. Operate the alternator at 2500 RPM and adjust the load resistor as required to obtain maximum output.
6. Measure the output current. The output must be within the limits shown in the section on “Service Specifications.” If the output is less than the specified value, disassemble and check the alternator.

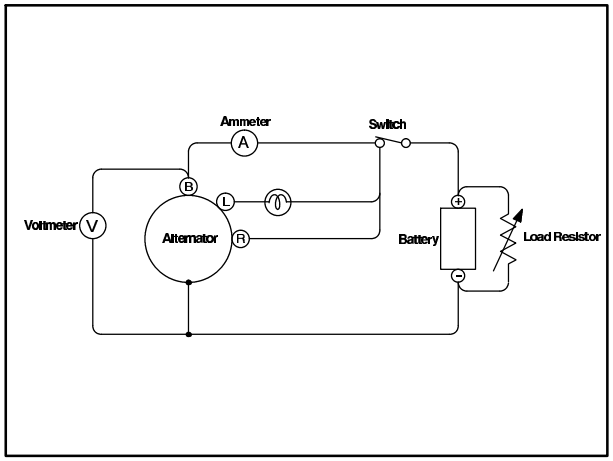


Figure 3-233

IMPORTANT:

1. *Reversed battery connections will damage the alternator and/or wiring.*
2. *When connecting a booster battery, make certain to connect the negative battery terminals together and the positive battery terminals together.*
3. *When a fast charger is used to charge the battery, disconnect the equipment battery cables.*
4. *Grounding of the alternator output terminal will damage the alternator and/or circuit.*
5. *Do not connect a load of over 1A to the terminal L.*
6. *If the alternator is operated with terminal L and B short-circuited, it may damage the diode trio.*

STARTER

STARTER MOTOR TROUBLESHOOTING

Starter Motor Specifications

Rated voltage	12 volts
Output	2 kw
Motor type	Four-pole series wound motor
Engaging system	Magnetic shift
Rotation	Clockwise (viewed from pinion side)
Weight	Approximate 5 kg (11 lbs.)

Starter Motor Service Specifications

ITEM	HOW RATED	STANDARD OR SERVICE LIMIT
No load test	Volts (V)	**11.5 V**
	Current (A)	**130 A Max.**
	Rotating speed (RPM)	**4000 RPM Min.**
Commutator	Outer dia. (mm-in)	**35 mm (1.38″)**
	Service limit (mm-in)	**34 mm (1.34″)**
Brush	Length (mm-in)	**15 mm (0.59″)**
	Service limit (mm-in)	**9 mm (0.35″)**
Brush spring	Tension (kg-lbs)	**2.7 - 3.6 kg (5.9 - 7.8 lbs)**
	Service limit (kg-lbs)	**2.2 kg (4.7 lbs.)**

STARTER MOTOR TROUBLESHOOTING

Use the diagnostic charts as a guide when repairing the starting system. Before diagnosis, be certain the battery is fully charged and inspect the starter and battery cables for clean and tight connections.

IMPORTANT: Do not operate the starter longer than 30 seconds at a time.

Do not disconnect or short any lead wire while the starter is operating.

With key switch in "start" position:

Starter does not crank engine, solenoid switch clicks.

1. Disconnect the three cables from the solenoid.
2. Using an ohmmeter, touch one probe to the solenoid spade terminal and the other to the starter case. There should be continuity.

   If none, the hold-in winding is open-circuited. Replace the solenoid.

   If continuity, the fault is in the starter motor. Refer to repair procedures.

Starter does not crank engine, solenoid does not click.

1. Disconnect battery cable from starter.
2. Connect a jumper wire to the battery positive post. Ensure the negative cable is attached to battery and starter ground.
3. Briefly touch the jumper wire to the spade terminal on the solenoid.

   If the solenoid clicks, the probable cause is in the key switch, relay or wiring.

   If the solenoid does not click, replace it.

Starter cranks engine very slowly.

1. Check battery condition, should be a minimum of 12.5 volts.
2. Check starting system circuit.

   Voltage drop between battery positive post and starter terminal should not exceed 0.2 volts.

   Voltage drop between battery negative post and starter ground should not exceed 0.2 volts.

   If voltage drop exceeds 0.2 volts, clean connections or replace the cable.
3. If battery is charged and voltage is within specification, repair or replace starter.

Engine starts but pinion does not disengage.

1. Check voltage at spade terminal of solenoid. If 12 volts with key switch "off", fault is in the key switch or start circuit.
2. If 0 volts with key switch "off" but starter turns, fault is in the solenoid or overrunning clutch assembly.

STARTER MOTOR REMOVAL AND INSTALLATION

1. The starter can be accessed through the right engine side shield with the boom up or down or from the operator's area with the seat raised.
2. To access the starter, 1, through the right engine side shield, open the rear door, raise the top engine side shield and remove the right engine side shield.

   If the boom is in the raised position, make sure the boom is resting on the boom lock pins.

   CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

3. To access the starter, 1, from the front, raise the seat and seat pan and securely latch in the raised position.

   CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS PROPERLY LATCHED IN THE RAISED POSITION.

4. Disconnect the negative (–) battery cable.
5. Remove the wires from the starter solenoid and starter, noting their location.
6. Remove the starter retaining hardware and remove the starter from the engine bellhousing.

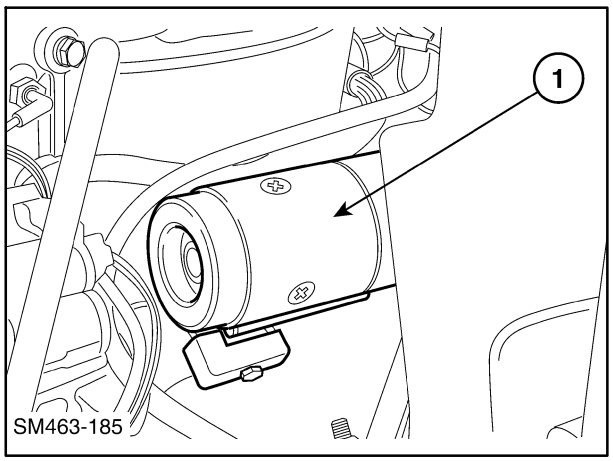


Figure 3-234

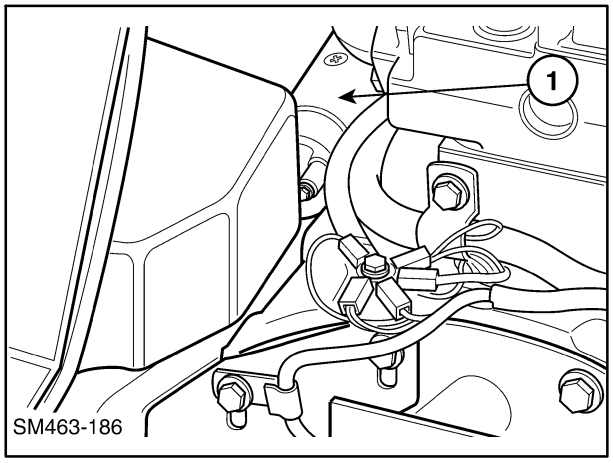


Figure 3-235

STARTER MOTOR DESCRIPTION

1 Drive Gear
2 Housing
3 Field Coil
4 Armature
5 Brush Spring
6 Brush
7 Plunger
8 Electric Solenoid
9 Overrunning Clutch
10 Pinion
11 Idler Gear

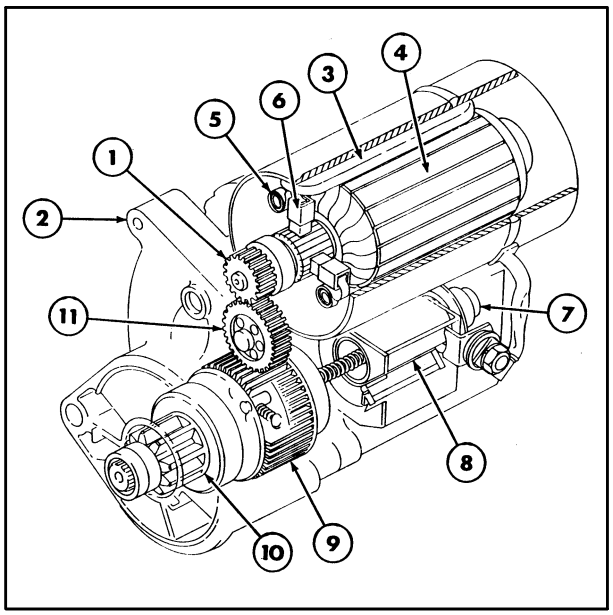


Figure 3-236

The starter assembly is a positive pinion shift, reduction type starter consisting of the motor, reduction gearset, overrunning clutch and electric solenoid.

The reduction type design allows use of a small, high speed, compact motor.

The sliding pinion and the electric solenoid are arranged on the same axis. The sliding pinion mechanism is totally enclosed, preventing dirt and water entry resulting in a more durable mechanism.

STARTER CONSTRUCTION

The reduction type starter consists of the armature, housing, electric solenoid, drive pinion assembly and reduction gears. In a conventional type starter the armature and pinion rotate at the same speed on a common shaft. In a reduction type starter the pinion speed is reduced to about one-fourth armature speed by the reduction gear. Armature, 1, rotation is transmitted to the pinion, 2, via an idler gear, 3, and the overrunning clutch, 4.

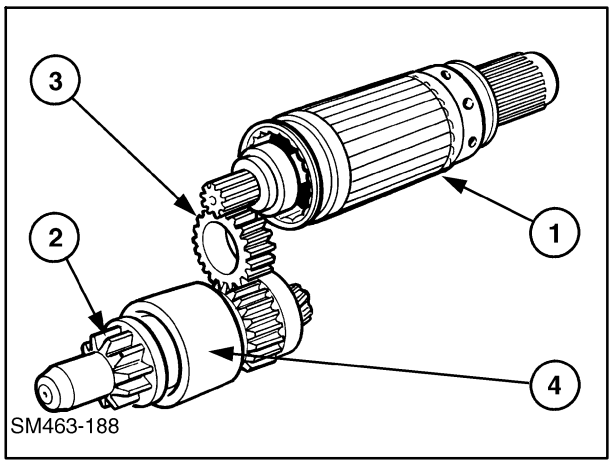


Figure 3-237

The overrunning clutch assembly consists of the pinion, 1, pinion shaft, 2, ball bearings and overrunning clutch which is a conventional design with clutch rollers, 3, and roller springs, 4. Due to the screw splines cut on the pinion shaft, the pinion gear advances while rotating to mesh with the flywheel ring gear.

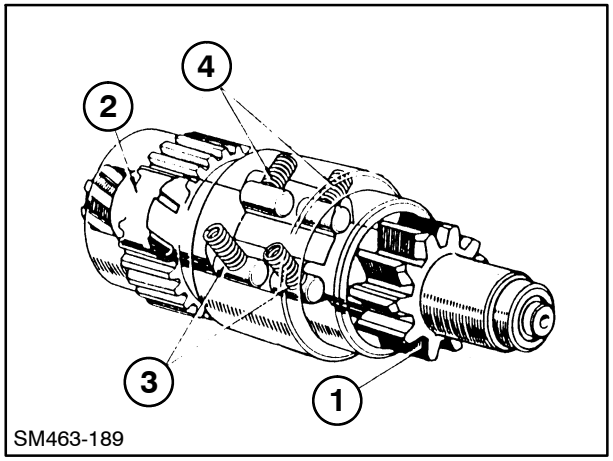


Figure 3-238

STARTER OPERATION

Circuit diagram of reduction type starter.

1 Drive Pinion
2 Idler Gear
3 Field Coil
4 Armature
5 Brush
6 Commutator
7 Ball Bearing
8 Plunger
9 Main Contacts
10 Battery
11 Starter Switch
12 Clutch Gear
13 Overrunning Clutch
14 Flywheel Ring Gear

The field windings are connected in series with the armature windings, through the brushes and commutator segments.

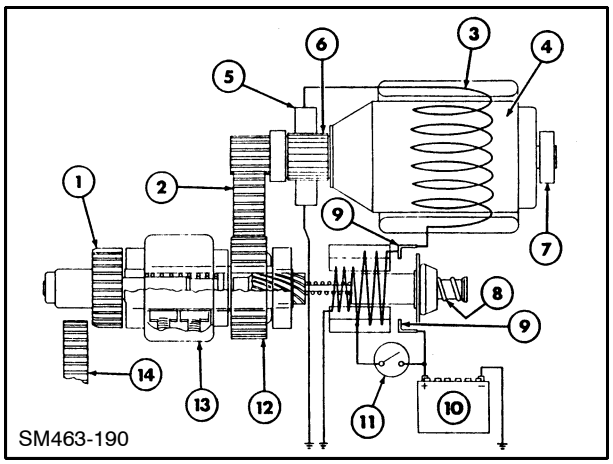


Figure 3-239

Electric Solenoid Operation

The electric solenoid consists of the pull-in coil, 1, hold-in coil, 2, main contacts, 3, plunger, 4 and return spring, 5. The mechanism is sealed against entry of dirt and moisture.

When the starting switch is closed, battery current flows through both the pull-in coil and the hold-in coil. This moves the plunger to the engaged position. When the plunger closes the main contacts in the engaged position, the pull-in coil circuit is opened, leaving the hold-in coil to retain the plunger in the engaged position. At the same time, current flows through the main contacts to the motor.

When the starting switch is released, the magnetic field in the hold-in circuit is reduced allowing the plunger spring to move the plunger out, opening the main contacts.

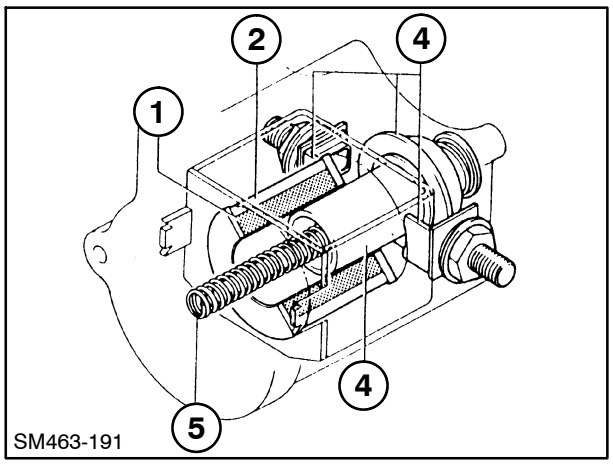


Figure 3-240

Drive Spring Operation

The drive spring, 1, is fitted on the pinion shaft, 2, in order to provide a smooth and positive pinion gear engagement. When the starting switch is closed, the plunger, 3, is pulled in moving the pinion, 4, toward the ring gear, 5. If the gear teeth do not mesh, the spring will be compressed, pressing on the pinion gear. With the first rotation of the pinion, the teeth will line up and the gears will mesh.

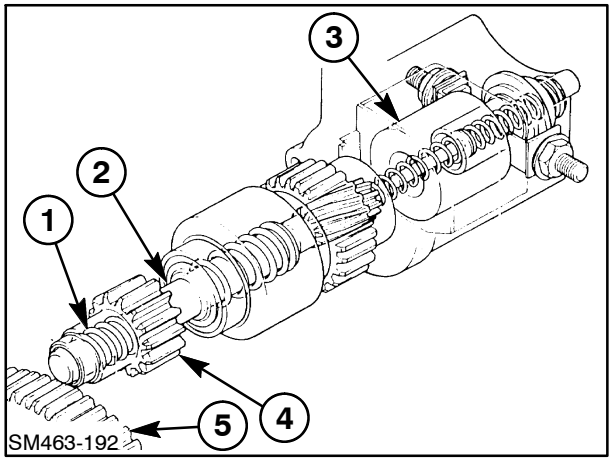


Figure 3-241

STARTER DISASSEMBLY

1. Disconnect the lead wire from the electric solenoid.

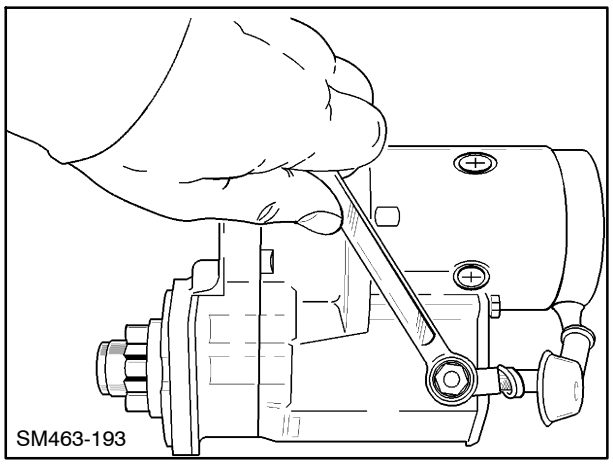


Figure 3-242

2. Scribe a line between the drive housing and motor to aid in proper reassembly. Remove the bolts securing the motor to the drive housing. The motor is now free to be separated from the drive housing.

   NOTE: New starter assembly #SBA185086530 has a different housing with two drawbolts. The testing and overhaul procedures are identical to the prior model (#SBA185086520).

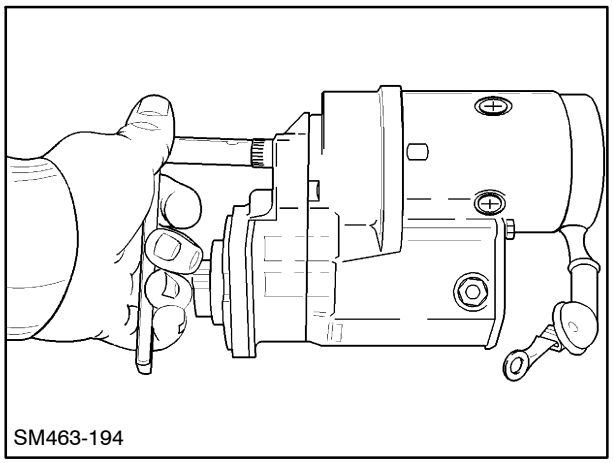


Figure 3-243

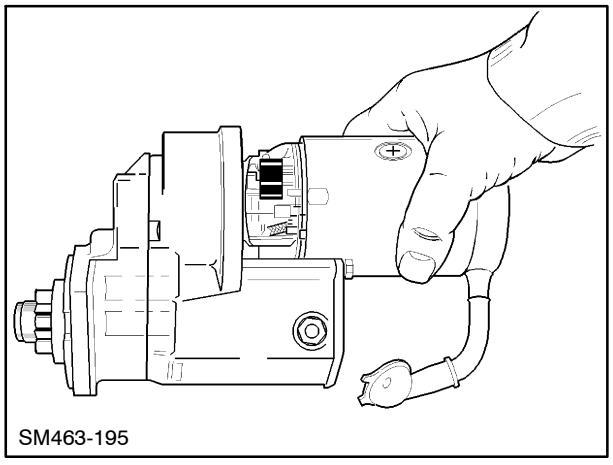


Figure 3-244

3. Extract the insulated brushes, 1, from the brush holders. Hold the springs away and remove the brushes. Slide the brush plate, 2, from the commutator, 3.

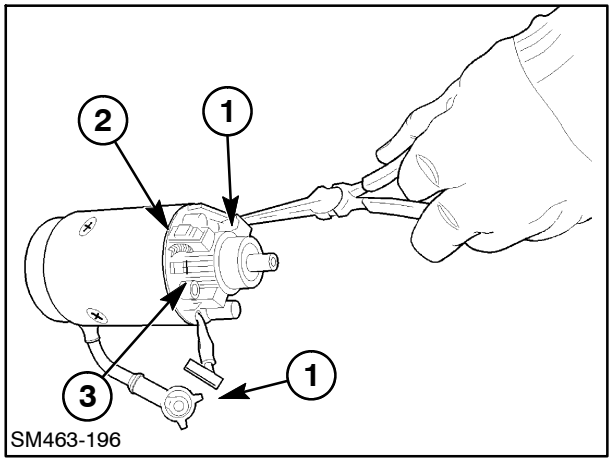


Figure 3-245

4. Remove the armature, 1, from the motor housing, 2. The rear bearing, 3, is a light press fit in the rear housing. It may be necessary to pull the armature from the housing, griping behind the front bearing, 4.

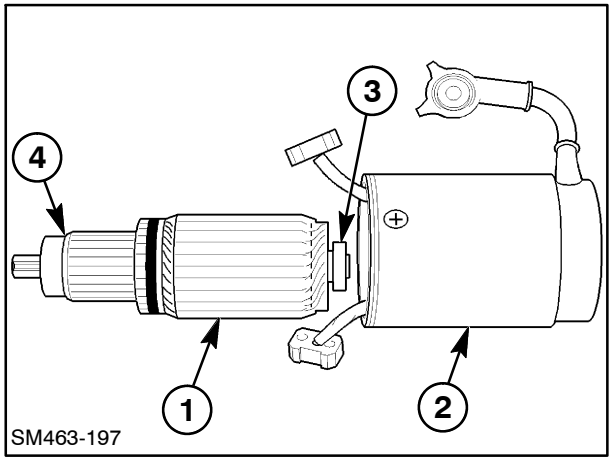


Figure 3-246

5. Remove the screws securing the drive end frame to the solenoid.

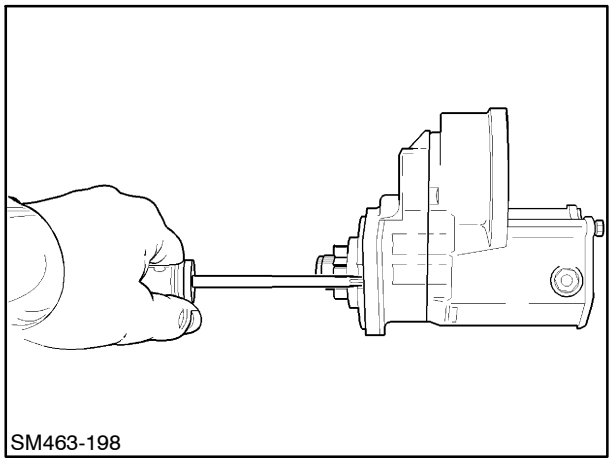


Figure 3-247

6. Remove the drive end frame, 1, from the solenoid, 2. The idler gear with bearings, 3, and the pinion gear, 4, will be free to fall out. Work over a clean bench, using care to avoid losing these pieces.

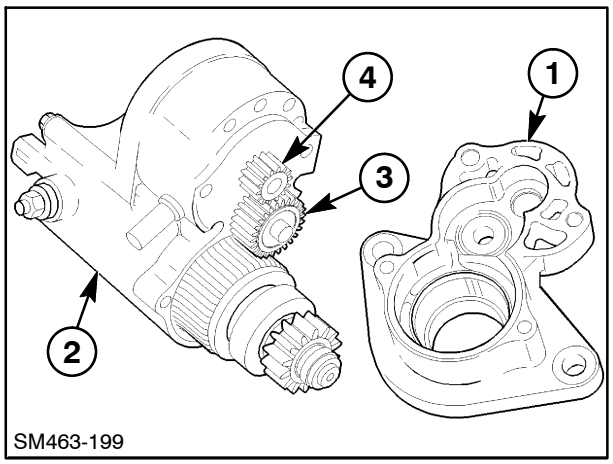


Figure 3-248

7. Remove the overrunning clutch from the drive end frame.

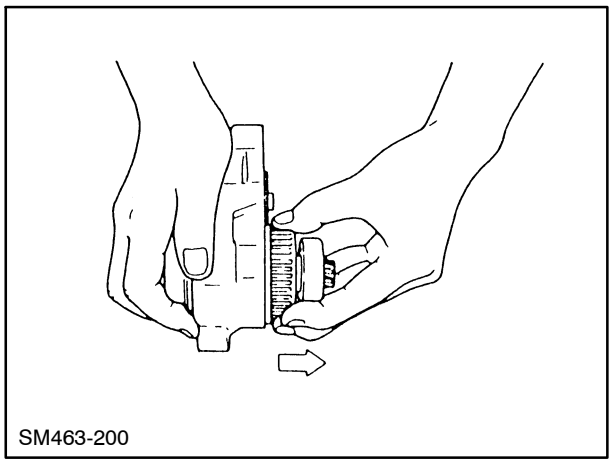


Figure 3-249

8. Remove the steel ball from the center of the overrunning clutch.

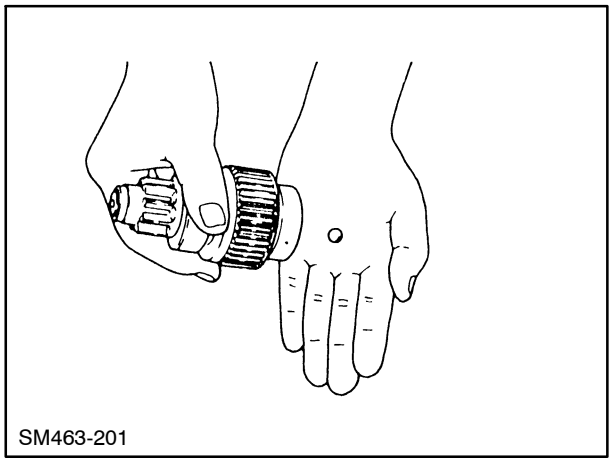


Figure 3-250

9. Remove the idler gear and small pinion from the drive end frame if they were not dislodged when the housing was separated.

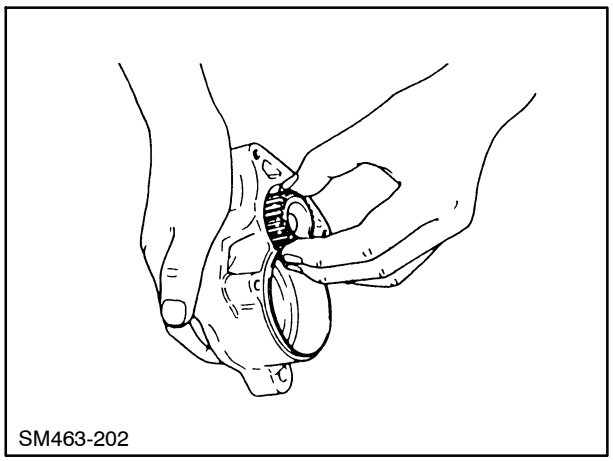


Figure 3-251

10. Remove the idler gear bearing rollers and retainer.

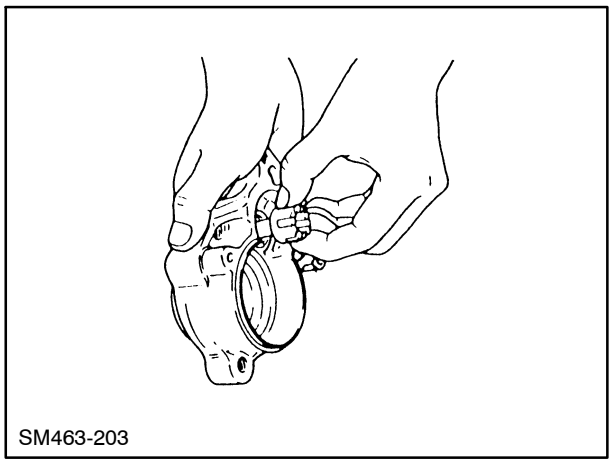


Figure 3-252

11. Remove the return spring from the electric solenoid.

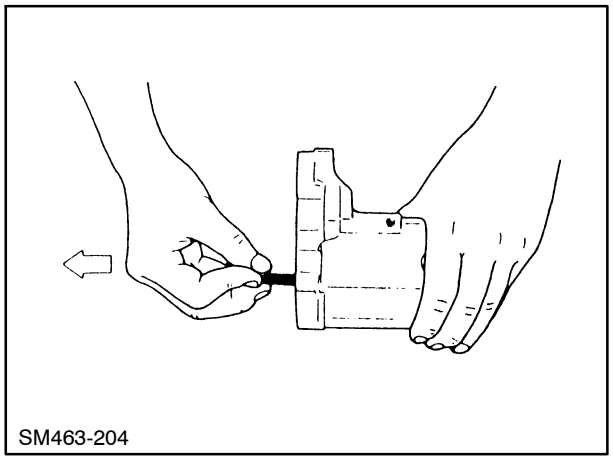


Figure 3-253

INSPECTION AND REPAIR

Inspect the following components, using conventional test methods, and repair or replace as necessary.

Armature

Inspect the armature for internal short circuits with a growler.

Replace the armature if a short circuit is indicated.

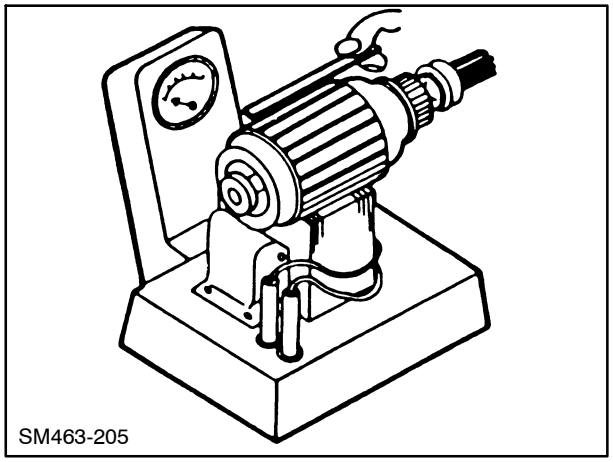


Figure 3-254

Inspect the armature for a short to ground using a continuity tester.

Replace the armature if there is any continuity between the commutator, 1, and armature shaft, 2, or core, 3.

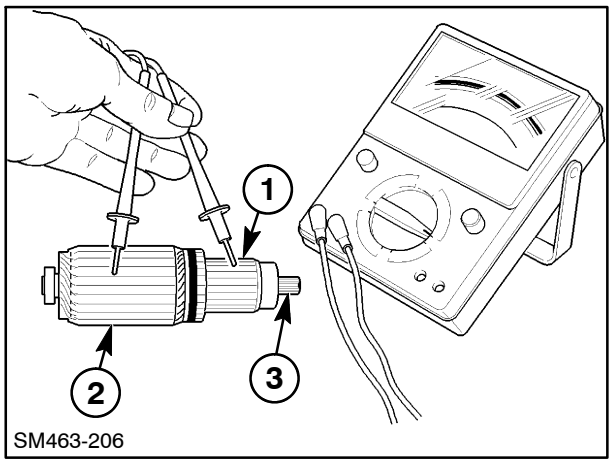


Figure 3-255

Check the armature for runout with a dial indicator and V-blocks. If the commutator is rough, or more than 0.05 mm (0.002″) out of round, turn it down or replace it. Undercut the separators between the segments if the depth is less than 0.2 mm (0.01″). The distance, 1, from the commutator segment and insulation should be between 0.5 mm and 0.8 mm (0.02″ and 0.03″).

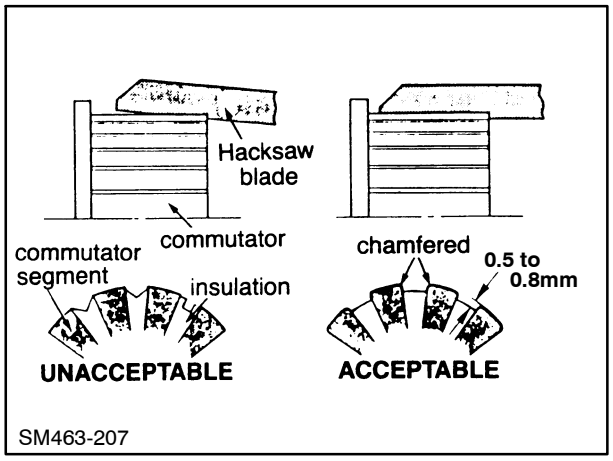


Figure 3-256

Check the spline teeth for wear or damage, and replace the armature as necessary.

Check the bearings for signs of roughness or dryness. Lubricate or replace as necessary.

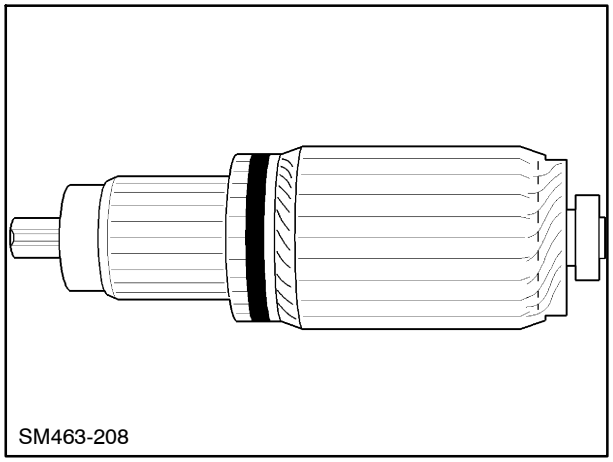


Figure 3-257

Field Coil

Inspect the field coil for an open circuit with a continuity tester. Replace the motor housing if there is no continuity between the two brushes.

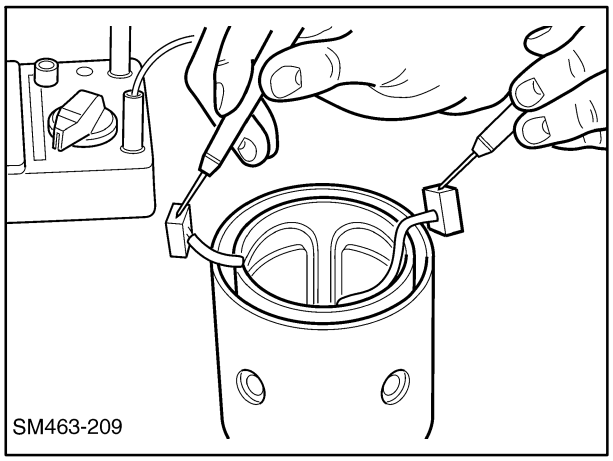


Figure 3-258

Inspect the field coils for short to ground with a continuity tester. If any continuity is noted between the brush and motor housing, locate the fault in the insulation, and repair or replace the motor housing as appropriate.

Check field poles and coils for tightness. Replace the motor housing if loose or improperly seated coils are detected.

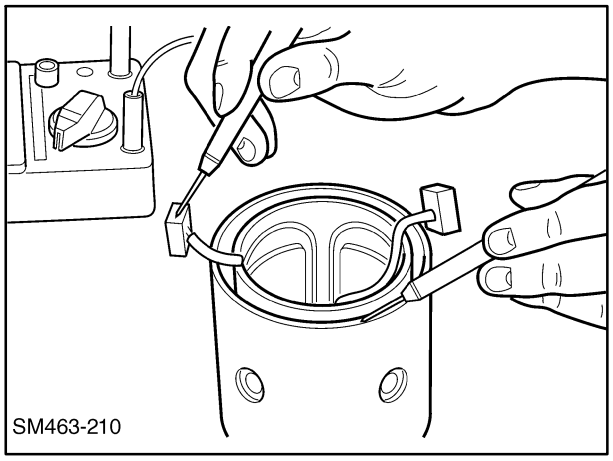


Figure 3-259

Brushes

Clean brushes and adjacent parts, removing carbon particles by wiping with a clean cloth.

Check each brush for wear. Replace brushes if they are worn to the service limit.

The positive brushes are welded to the field windings. If the positive brushes must be replaced, it will be necessary to replace the motor housing.

The negative brushes are welded to the brush plate. If the negative brushes must be replaced, it will be necessary to replace the brush holder assembly.

Standard Length	Service Limit
15 mm (0.59″)	9 mm (0.35″)

Move each brush in the holder to be sure that it is capable of sliding smoothly.

Check brush spring tension. Replace the brush holder assembly if the tension is not within specified limits.

Standard Tension	Service Limit
2.7 - 3.6 kg (5.9 - 7.8 lb)	2.2 kg (4.7 lb)

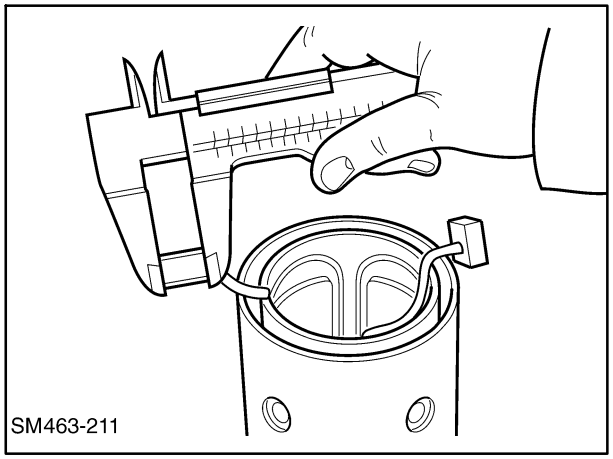


Figure 3-260

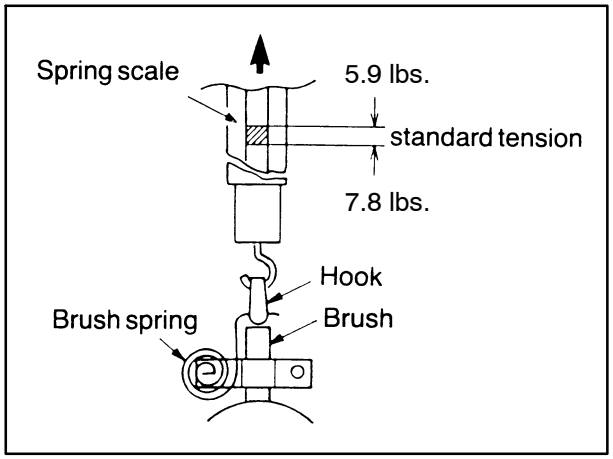


Figure 3-261

Check the brush holder assembly for short to ground. Touch one probe of a continuity tester to the plate and the other to each of the insulated holders. Replace the brush holder assembly if any continuity is noted.

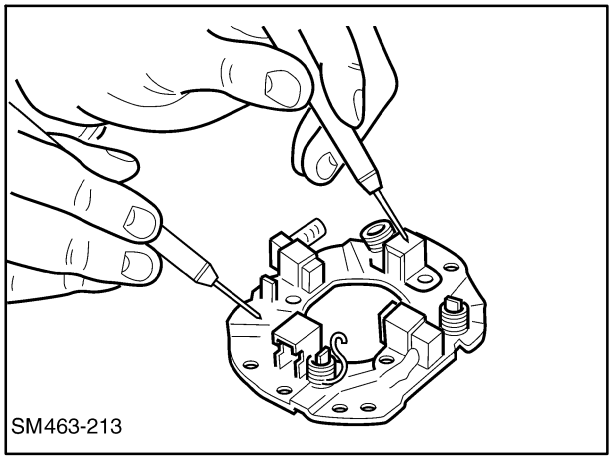


Figure 3-262

Overrunning Clutch

While holding the clutch housing, rotate the pinion. The pinion should rotate smoothly in one direction (not necessarily easily), but should not rotate in the opposite direction. If the clutch does not function properly, replace it.

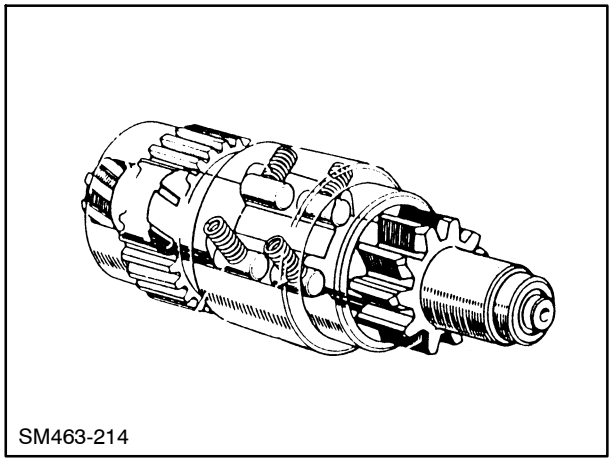

SM463-214

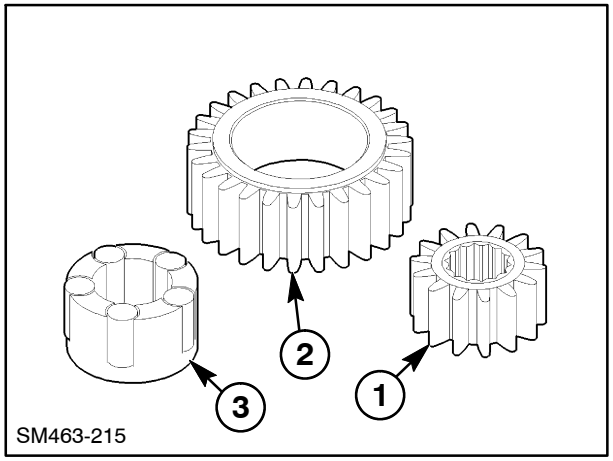
Figure 3-263

Reduction Gears

Inspect the pinion gear, 1, the idler gear, 2, and the overrunning clutch gear for wear or damage.

Inspect the idler gear bearing rollers and retainer, 3.

Replace any parts found worn or damaged.



SM463-215

Figure 3-264

Electric Solenoid

The following tests should be performed with the motor removed from the starter assembly.

Each test should not last more than 3 - 5 seconds to avoid overheating the solenoid.

Tests should be performed with a fully charged 12 volt battery.

Pull-in Test

Connect a lead from the positive battery post to the spade terminal, 1, (starter switch wire) on the solenoid. Connect a lead from the battery negative post to the solenoid housing, 2.

Touch a second negative lead to the heavy solenoid terminal leading to the field coil, 3. This completes the circuit through both the pull-in and hold-in coil windings. The pinion should jump forward.

Remove the negative lead from the field coil terminal, 3. The pinion should stay extended, held by the hold-in coil.

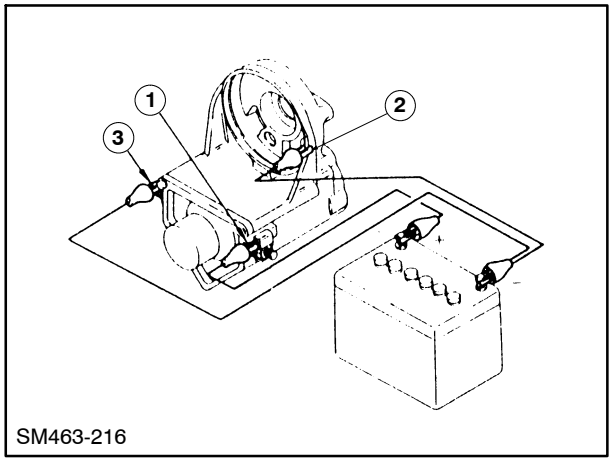


Figure 3-265

Remove the positive lead from the spade terminal. The pinion should retract immediately.

If the solenoid fails to perform as described, replace it.

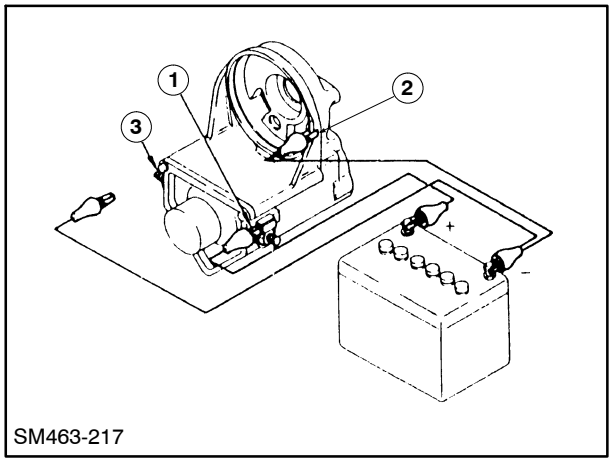


Figure 3-266

REASSEMBLY

Reassemble the starter in the reverse order of disassembly. Observe the following cautions and procedures.

1. Lubricate the following components with a light coating of White Lithium Grease (Part Number RL 666).

   Idler gear retainer and rollers.

   Overrunning clutch.

   Steel ball and return spring.

   Armature bearings.

   Reduction gears.

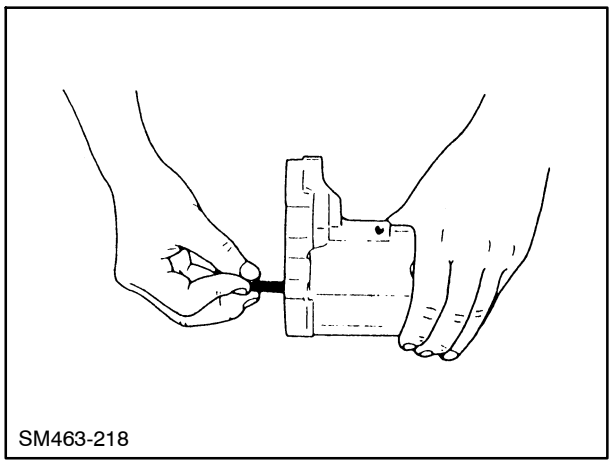

SM463-218

Figure 3-267

2. Install the return spring into the electric solenoid and the steel ball into the center of the overrunning clutch. The ball should be held in place by the coating of grease.

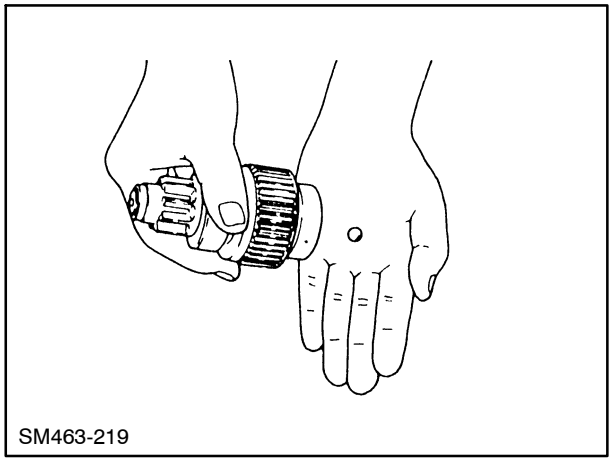

SM463-219

Figure 3-268

3. Install the idler gear bearing rollers and retainer.

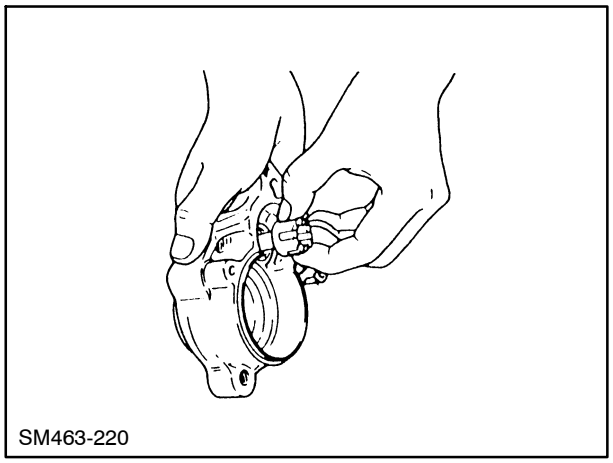

SM463-220

Figure 3-269

4. Install the overrunning clutch assembly part way into the housing. Mesh the idler gear with the driven gear, then fully install both pieces together.

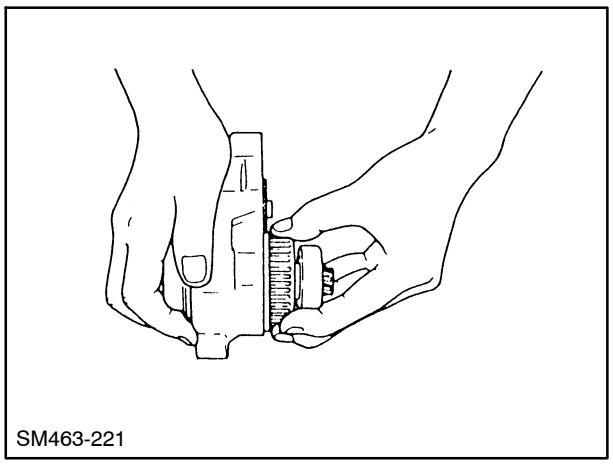


Figure 3-270

5. Position the pinion gear, 1,over the armature hole shaft then install the drive end frame, 2. Install the retaining screws and torque to 7 - 12 N·m (5 - 9 ft. lbs.).

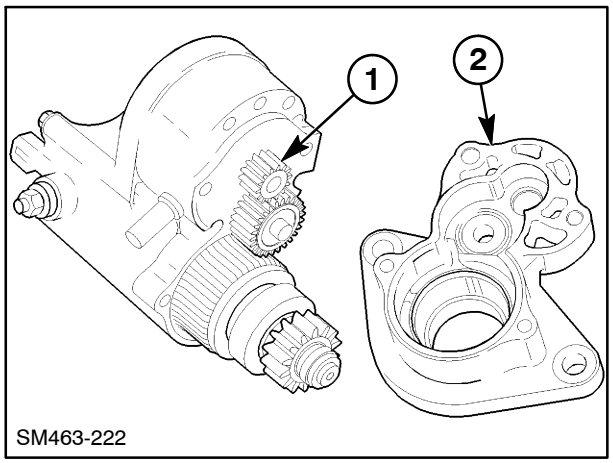


Figure 3-271

6. Install the armature into the motor housing. Gently tap the armature into place with a soft hammer to seat the rear bearing.

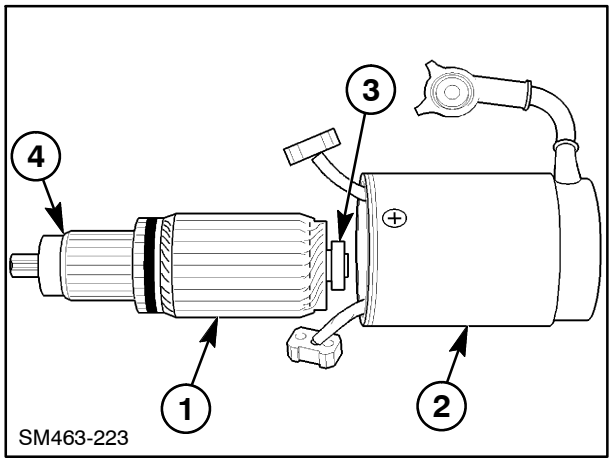


Figure 3-272

7. Install the brush plate onto the motor housing. Install the insulated brushes into the holder. Ensure the insulated brush leads are not grounded. Avoid getting oil or grease on the brushes or commutator.

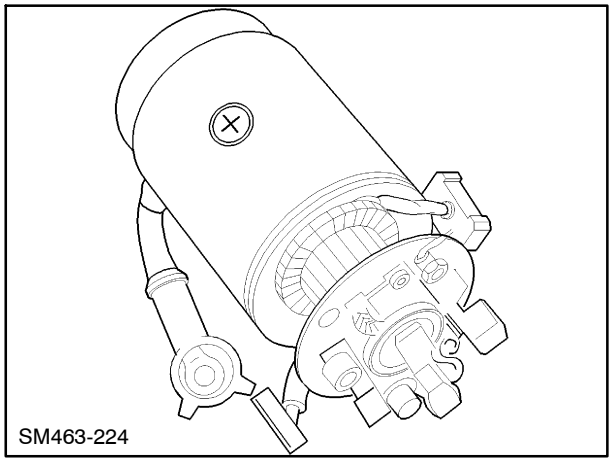


Figure 3-273

8. Install the motor into the drive housing observing the scribe marks. Install the retaining bolts and torque to 7 - 12 N·m (5 - 9 ft. lbs.).

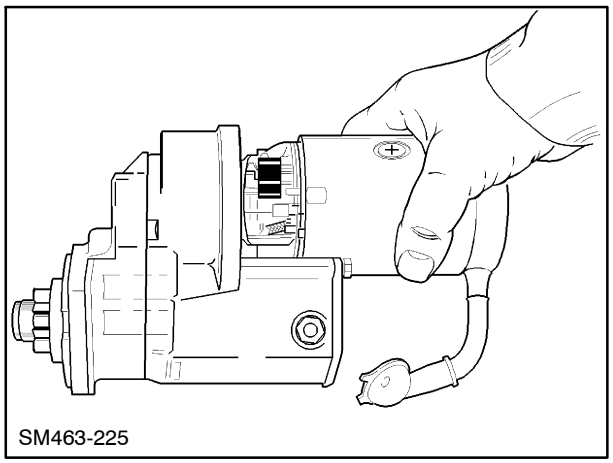


Figure 3-274

9. Reconnect the lead wire from the electric solenoid.

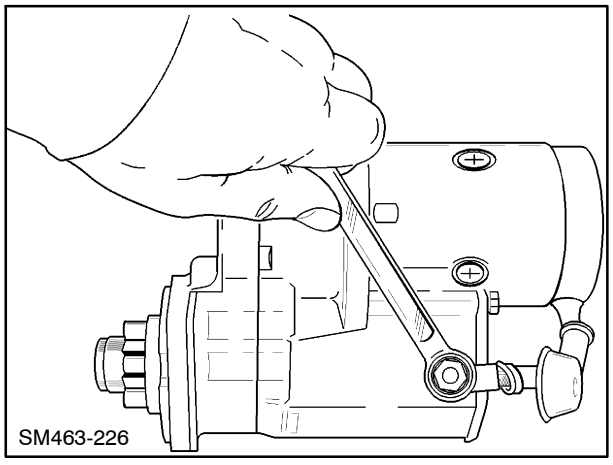


Figure 3-275

Performance Test

After reassembly, a no-load test should be conducted.

Clamp the starter securely in a vise. Connect a heavy wire (jumper cable) from a 12 volt battery positive terminal, through a suitable ammeter, to the battery cable post of the starter, 1. Connect a second cable from the battery negative post to the starter case or vise. Connect a jumper wire from the positive cable to the spade terminal on the solenoid, 2.

The pinion gear should jump forward and the starter turn smoothly. Current draw should not exceed 130 amps.

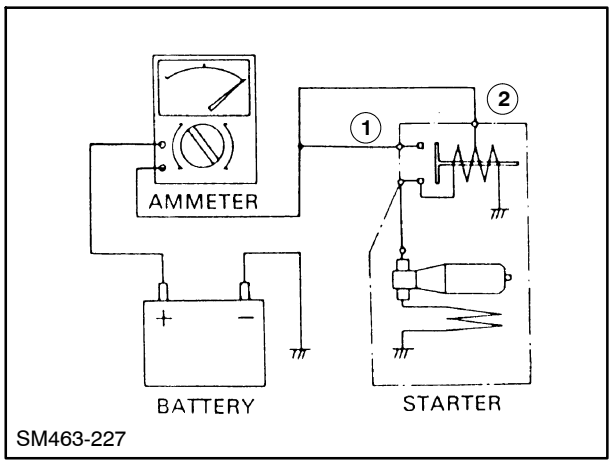


Figure 3-276

Starter Installation

1. Attach the starter to the bellhousing and tighten the hardware, 1. When installing the starter into the bellhousing, make sure it is properly seated before installing and tightening the hardware.
2. Reconnect the wires to the proper terminals, 2, on the starter solenoid and starter.
3. Reconnect the negative (-) battery cable.
4. Reinstall and close any shields removed.

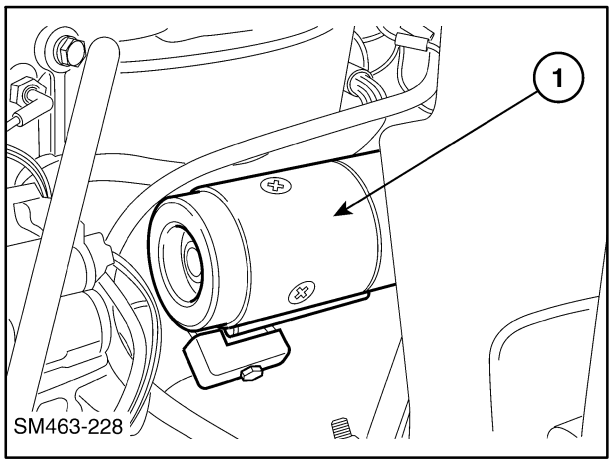


Figure 3-277

MAXIMUM CIRCUIT RESISTANCE

RESISTANCE OF BATTERY CABLES 1, 2, & 3 NOT TO EXCEED 0.0018 OHM

Circuit	Cable No.	Circuit Current	Maximum Circuit Resistance	Maximum Circuit Volt Drop	Rewards
Alternator Charging	4 7,11	35 Amp	0.0143 OHM	0.5 Volt	See Glow Plugs Circuit
Starting Motor Solenoid	4 5 6	15.75 Amp	0.04 OHM	0.63 Volt	See Glow Plugs Circuit See Glow Plugs Circuit
Glow Plugs (Via Glow Signal)	4,5,8,9,10	27 Amp 36 Amp	0.0185 OHM 0.0139 OHM	0.5 Volt 0.5 Volt	3 cyl Engines 4 cyl Engines

Figure 3-278

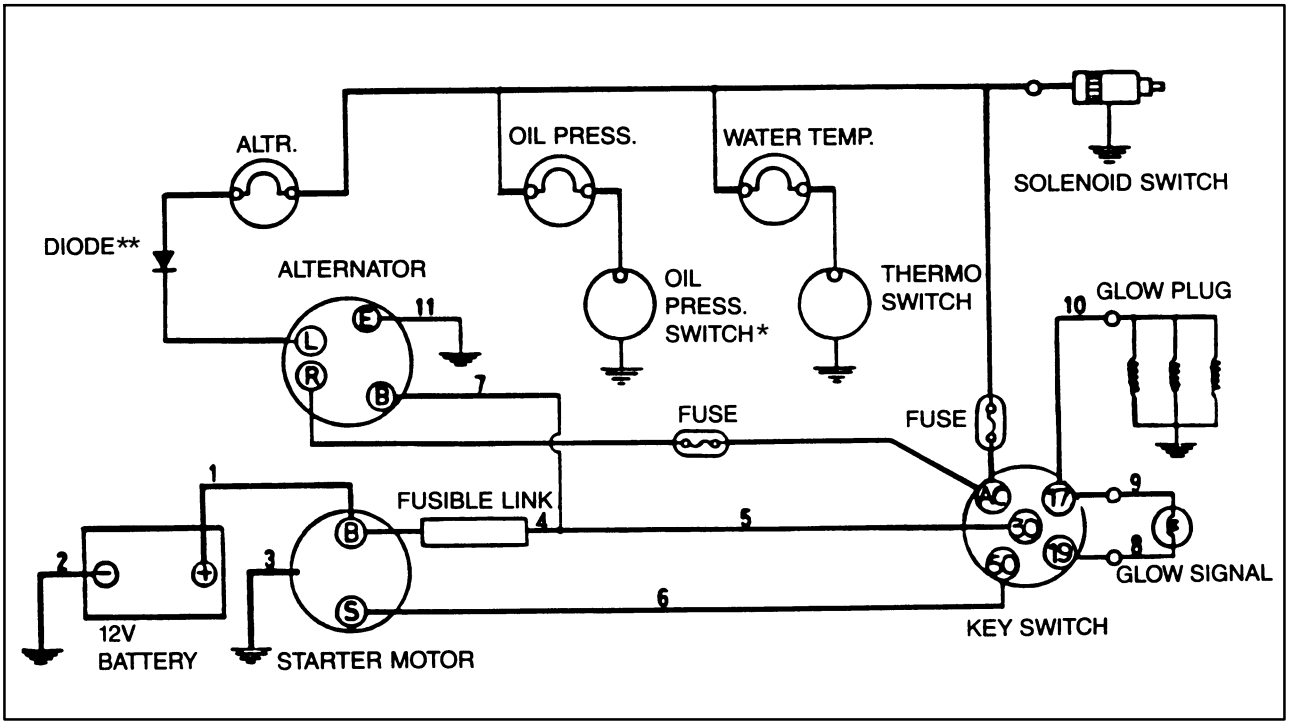


Figure 3-279

* Maximum current draw for oil pressure switch is 0.42 amps (5-watt max. bulb).

** Diode capacity: Current 3 amp. Reverse voltage 600 volt.

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job Description	Hours
Air filter sensor, remove and replace	0.5 hr.
Alternator, remove and replace	0.5 hr.
Battery, remove and replace	0.25 hr.
Electronic instrument cluster	0.25 hr.
Engine coolant sensor, remove and replace	0.25 hr.
Engine oil pressure sender, remove and replace	0.25 hr.
Fuel level sender, remove and replace	0.5 hr.
Fuel pump, remove and replace	0.5 hr.
Fuel shutoff solenoid, remove and replace	0.25 hr.
Hydraulic oil temperature sensor, remove and replace	2.0 hrs.
Hydraulic oil filter sensor, remove and replace	0.5 hr.
Hydrostatic charge pressure sensor, remove and replace	0.5 hr.
Ignition (key) switch, remove and replace	0.25 hr.
Light (road/work) switch, remove and replace	0.25 hr.
Preheat manual switch, remove and replace	0.5 hr.
Preheat circuit breaker, remove and replace	0.5 hr.
Preheat relay, remove and replace	0.5 hr.
Resistor, alternator charge circuit, remove and replace	0.5 hr.
Road/work/taillight bulb, remove and replace	0.25 hr.
Seat belt (buckle) switch, remove and replace	0.25 hr.
Seat switch(es), remove and replace	0.5 hr.
Service/run switch, remove and replace	0.5 hr.
Solenoid, control valve spool locks, remove and replace	0.5 hr.
Start interlock relay, remove and replace	0.5 hr.
Starter, remove and replace	0.75 hr.
Starter relay, remove and replace	0.5 hr.
Wire harness (main), remove and replace	6.0 hrs.
Wire harness (engine), remove and replace	1.5 hrs.
Wire harness (seat/seat belt), remove and replace	1.0 hr.

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SECTION 4

FINAL DRIVE, AXLES, BRAKES, GEARBOXES

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GENERAL INFORMATION

The power is transmitted to the final drive from the engine which is connected to the hydrostatic pumps, 1, with a flex plate drive coupler. The hydrostatic pumps then transmit hydraulic power to the hydrostatic motors, 2, which are connected to gearboxes, 3, located on the inside of the final drive cases. The left and right drives are separate from each other and are operated independently.

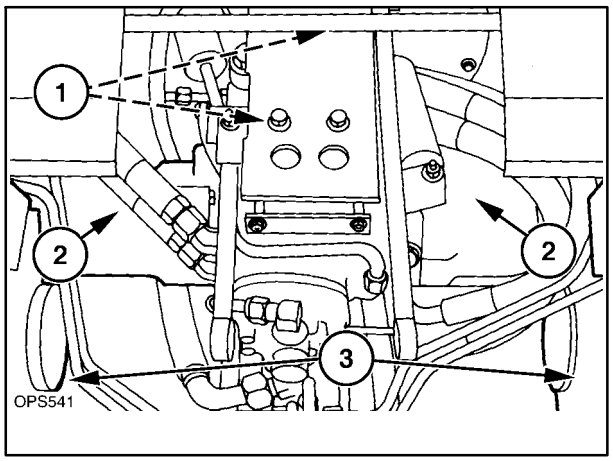

Figure 4-1

The power is then transmitted through gears to a double drive sprocket, 1, in the final drive case. The drive sprocket is connected to the axle sprockets, 2, with chains, 3, one endless chain to the front axle and one endless chain to the rear axle.

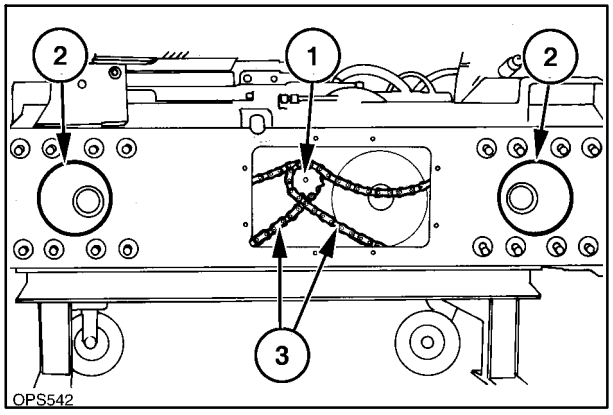

Figure 4-2

The axle sprocket, 1, is splined to the axle shaft and hub assembly, 2. A large O ring, 3, seals the assembly to the frame.

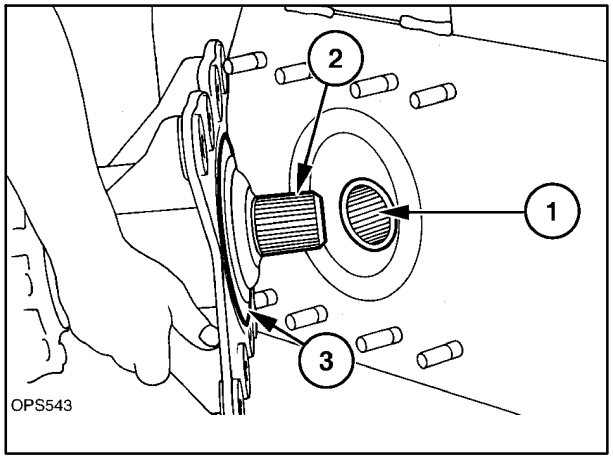

Figure 4-3

The parking brake discs are connected to the hydrostatic motor coupler shafts at 1. The parking brake is made up of two discs, actuator shaft, pads, and control linkage. The hydrostatic system is the primary braking system, and the parking brake is used when the unit is stopped.

CAUTION: ALWAYS ENGAGE THE PARKING BRAKE BEFORE EXITING THE LOADER.

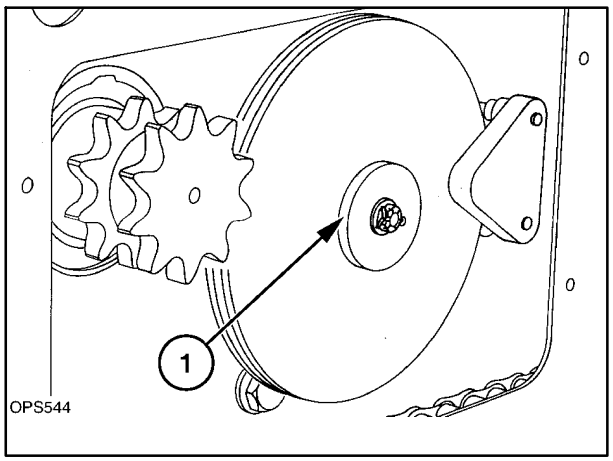

Figure 4-4

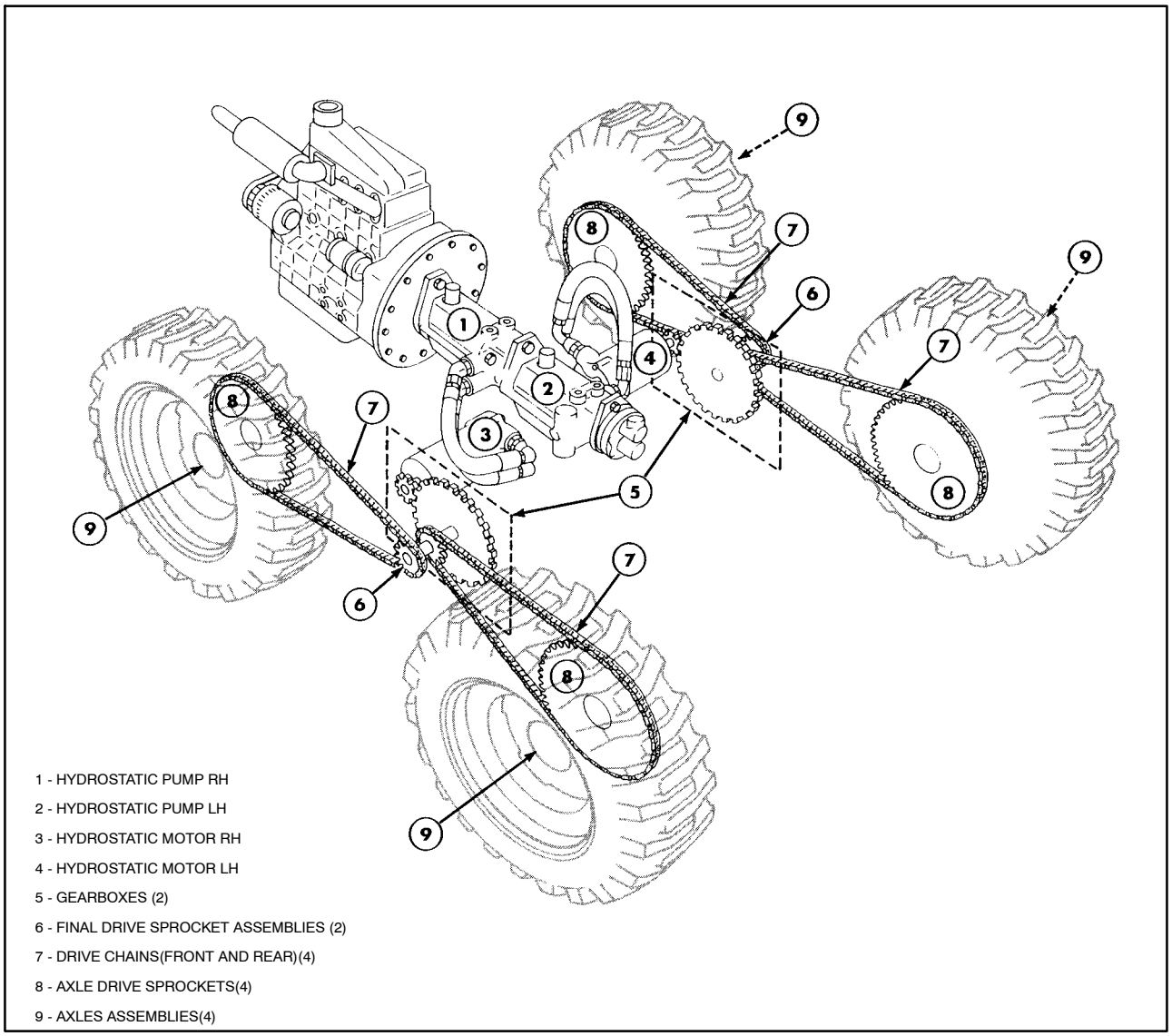

Figure 4-5

SPECIFICATIONS

Drive Axles

Wheel Nut Torque	170 N·m (125 ft. lbs.)
Mounting Bolt Torque (Axle housing to case)	190 N·m (140 ft. lbs.)
Lubrication	High temperature lithium grease

Chain Case

Side Cover Bolt Torque	15 N·m (11 ft. lbs.)
Brake Caliper Mounting Bolt (center) Torque	20 N·m (15 ft. lbs.)
Brake Caliper Mounting Bolts (outer) Torque	70 N·m (52 ft. lbs.)
Drive Chain	#80
Front Chain Length (68 pitches)	1727.2 mm (68″)
Rear Chain Length (66 pitches)	1676.4 mm (66″)
Chain Tension	0 – 6 mm (0 - 1/4″® movement at tire tread
Lubrication	7.6 liters (2 gal.) each side - 10W-30API service SG-CE Oil

Gearbox

Mounting Bolt Torque	170 N·m (125 ft. lbs.)
Drive Motor Mounting Bolt Torque	85 N·m (63 ft. lbs.)
Brake Disc to Gearbox Shaft Bolt Torque	35 N·m (26 ft. lbs.)
Front Cover Plate Bolt Torque	20 N·m (15 ft. lbs.)
Lubrication	1.9 liters (2 qts.) each side - 80W-90 API Service GL-5 Gear Oil

Other Materials

Description	Use
Ultra/Blue Silicone sealer	Gearbox mounting bolts Axle housing bolts Chain case cover and bolts Gearbox to chain case Brake caliper bolts Gearbox cover and bolts
Sealing Material	NH Ultra Blue silicone sealer NH #L81724 - 3.35-oz. tube (cord) NH #L82519DS - 8-oz. tube NH #L58775 - 10.2-oz. cartridge
Hydraulic Oil	SAE10W-30 motor oil-API Service SG-CE NH #9613313 - 1 qt. NH #9613314 - 2 1/2 gal. NH #9613358 - 1 L NH #9613360 - 20 L
Gear Oil	80W-90 API Service GL-5 Gear Oil NH #9613295 - 1 qt. NH #9613294 - 5 gal. NH #9613375 - 4 L
Grease	High viscosity lithium base NH #9613310 tube

NOTE: Always use a noncorrosive silicone sealer to seal where required to prevent corrosion during the silicone curing process.

GEARBOX OIL LEVEL/FILLING

The gearbox can be overfilled, causing oil to drain from the breather during operation.

If the skid-steer loader gearbox(es) is equipped with a crimped-style breather, part #46566, 1, the gearbox will not breath properly. Replace with the spring-loaded breather, part #572820.

1. Raise the operator's seat and latch in the "raised" position.
2. Remove the step shield to gain access to the gearboxes.
3. Remove the breather, #46566, and install a spring-loaded breather, part #572820. This will allow the gearbox to breathe easier and oil to enter the gearbox. The spring-loaded breather will allow the oil to pass between the gear and brake disc sections of the gearbox quicker. When checking the gearbox oil level after operation, allow a few minutes for the oil to stabilize in the gearbox.

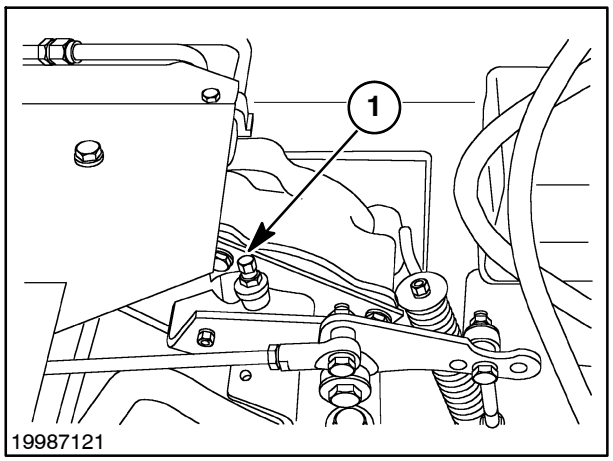

Figure 4-6

BOTTOM CHAIN CASE DRAIN PLUGS

A bottom drain plug, 1, has been added to each chain case. The 3/8″ plug, part #236622, screws into a welded threaded hub at the front of each chain case. This plug makes draining chain cases easier.

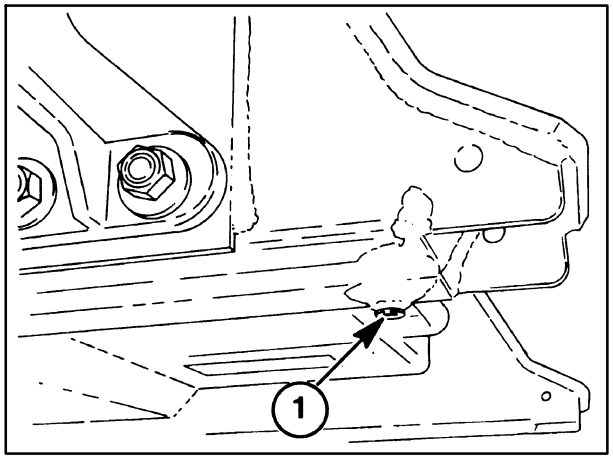

Figure 4-7

TROUBLESHOOTING

FINAL DRIVE SYSTEM

Before servicing or adjusting on the final drive system, the skid-steer loader should be jacked up with the wheels off the ground.

Remove any attachment from the skid-steer loader boom, bucket, etc. Lower the boom to the lowered position or, if servicing requires the boom to be in the raise position, support the boom on the boom locks.

Raise the boom and lower onto boom lock pins, 1.

a. Raise boom above boom lock pins.

b. Engage boom lock pins.

c. Stop engine, ignition key “OFF” position.

d. Turn ignition key to the “ON” position.

e. Lower boom onto boom lock pins.

f. Turn the ignition key to the “OFF” position.

CAUTION: NEVER EXIT THE LOADER WITH THE BOOM IN THE RAISED POSITION UNLESS THE BOOM IS SUPPORTED ON THE BOOM LOCK PINS.

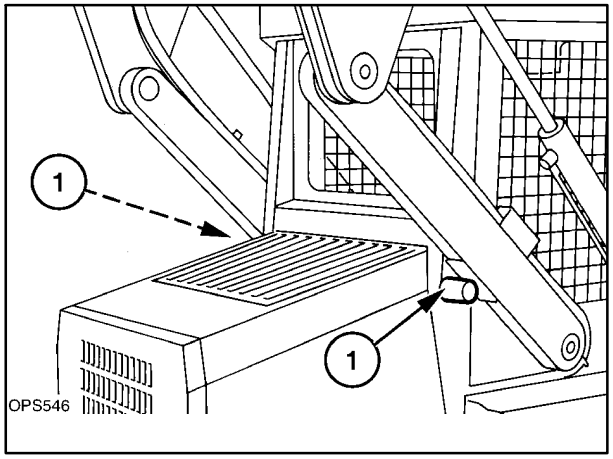

Figure 4-8

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT MOUNTED. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

Jack up the loader and support the loader with the wheels off the ground using adequate jack stands or blocks to securely support the loader.

Support the loader at the front of the final drive cases at 1, and at the rear at 2.

CAUTION: NEVER SERVICE A RAISED LOADER UNLESS IT IS SECURELY SUPPORTED WITH ADEQUATE JACK STANDS OR BLOCKS.

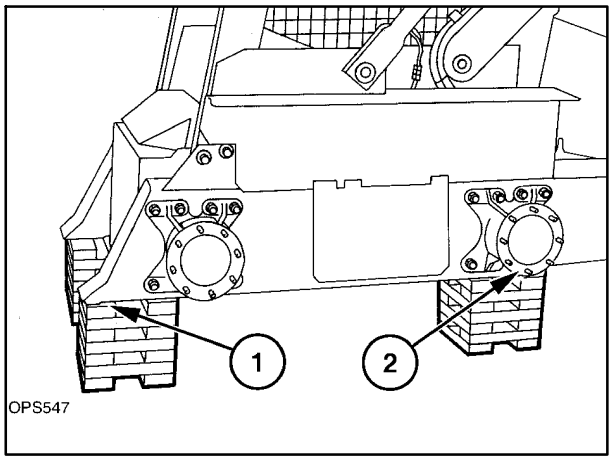

Figure 4-9

FINAL DRIVE SYSTEM

PROBLEM	POSSIBLE CAUSES	CORRECTION
Both drive wheels on one side not powered	No hydrostatic motor shaft rotation	Check for pump to motor oil flow and repair
	No gearbox output drive	Check gearbox shaft rotation and repair
	Broken drive chains	Check chains and repair
One drive wheel not powered	Broken drive chain	Check chain and repair
	Axle or drive sprocket splines worn	Check axle and sprocket, replace
Chain case noise	Loose drive chains	Check and adjust chains
	No oil in final drive	Check oil level
	Worn drive sprockets	Check sprockets and repair
	Bearing failure	Check axle and gearbox bearings and repair
Excessive axle play	Bearing failure on axle shaft	Check bearings and repair
	Snap ring failure on axle shaft	Check axle bearing pre-load, repair
Noise in gearbox	No or low oil in gearbox	Check oil level
	Bearing failure	Check shafts and bearings, repair
	Bearing or shaft failure in drive motor	Check drive motor and repair
	Gears in gearbox worn	Check and replace
Axle outer bearing failure	Prolonged operation in liquid or semi-liquid material	Decrease lubrication interval to every 500 hours

PARKING BRAKE SYSTEM

PROBLEM	POSSIBLE CAUSES	CORRECTION
Parking brake will not hold loader	Park brake not engaged	Engage parking brake
	Brake not adjusted properly	Adjust parking brake
	Handle not operating or latching	Check handle components repair or replace
	Loose brake linkage	Inspect and repair linkage
	Worn brake pad	Inspect and repair brake pad
Parking brake will not release	Brake not adjusted properly	Adjust parking brake
	Handle not operating properly	Check handle components repair or replace
	Brake caliper not releasing	Check brake caliper and repair
Parking brake handle will not move or release	Handle not operating properly	Check handle components repair or replace
	Control linkage not moving	Check and repair linkage
	Brake caliper not releasing	Check brake caliper and repair
Grinding noise when operating	Handle not releasing properly	Check handle components repair or replace
	Brake not adjusted properly	Adjust parking brake
	Brake caliper not releasing	Check brake caliper and repair

TESTING

FINAL DRIVE

Pre-test instructions:

* Operator in seat with seat belt buckled.

* Engine running at high idle (full throttle).

* Park brake disengaged position.

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Push both drive controls forward equally and loader should move in a straight line.	YES	Drive system OK.
		NO	Engine stalls, wheels appear locked, check parking brake for engaged. If OK go to step 2.
			Slow or no power, Refer to hydrostatic drive section.
2			Check final drive chain, broken repair.
3	Pull both drive controls rearward equally and loader should move in a straight line.	YES	Drive system OK.
		NO	Engine stalls, wheels appear locked, go to step 1.
			Wheels rotate slow or no power, go to step 1.
			One side of loader drags, go to step 2.

Pre-test instructions:

* Lower boom and attachment to the ground.

* Stop engine.

* Jack loader with wheels off the ground.

* Release parking brake.

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Rotate each tire by hand, tires move less than 1/4″ at tread.	YES	Drive system OK.
		NO	Tires move more than 1/4″ at tread, check chain tension.
2			One tire rotates freely, broken chain, or axle spline worn.
3			Both tires on one side rotate freely together, inspect drive gearboxes. If OK, check drive motor.
4	Tires rotate but are noisy.	YES	Check drive chains, axle bearings.
		NO	Drive system OK.

PARKING BRAKE

Pre-test instructions:

* Operator in seat with seat belt buckled.

* Engine running at 1500 RPM.

* Park brake disengaged position.

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Push both drive controls forward equally and loader should move without restriction.	YES NO	Brake system OK. Parking brake not releasing, check control handle. If OK go to next step.
2			Parking brake linkage not free, check for loosen or binding linkage. If OK go to next step.
3			Parking brake not releasing check caliper and brake pad and repair.

Pre-test instructions:

* Operator in seat with seat belt buckled.

* Engine running at 1500 RPM.

* Park brake engaged position.

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Push both drive controls forward equally and loader should not move.	NO YES	Parking brake OK. Parking brake not adjusted properly. If OK go to next step.
2			Parking brake linkage loose or broken. If OK go to next step.
3			Parking brake caliper not operating properly. Check and repair.

AXLES

AXLE HOUSING ASSEMBLY REMOVAL

The axle housings must be removed to service axle seals, axle bearings, drive chains, drive sprockets, and axle housing mounting bolts.

NOTE: The axle housings may be removed without removing the final drive side cover or draining the case oil.

1. Lower the boom and attachment to the ground.
2. If the work is going to be done with the boom in the raised position, remove the attachment, raise the boom, and rest on the boom lock pins, 1.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

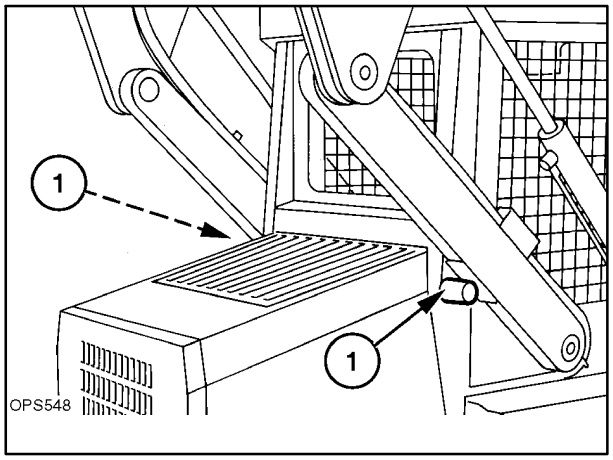

Figure 4-10

3. Securely block the skid-steer loader with all four wheels off the ground, refer to Section 1 for more information on properly supporting a skid-steer loader.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

NOTE: When repairing a rear axle, the front of the unit should be supported slightly higher than the rear for easier rear axle assembly reinstallation.

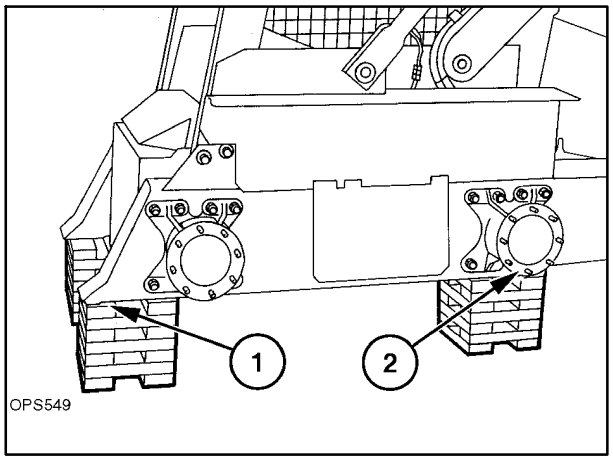

Figure 4-11

4. Remove the tire and wheel from the axle being serviced.
5. Clean the axle and final drive area to prevent debris from entering the final drive case.
6. Remove the eight axle housing retaining nuts and washers, 1.
7. Slide the axle housing from the retaining studs and lift the assembly from the final drive case.

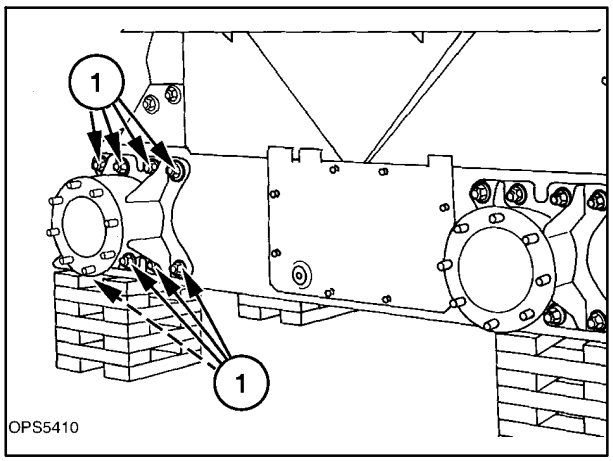

Figure 4-12

CAUTION: AXLE ASSEMBLY IS HEAVY AND MAY REQUIRE TWO PERSONS TO ADEQUATELY SUPPORT IF HANDLING MANUALLY.

NOTE: When the axle assembly is removed, the drive sprocket and chain will drop slightly to the bottom of the case.

8. There is a large O ring at 1 that seals the axle housing to the side of the final drive case. Remove the O ring from the case or the axle housing.

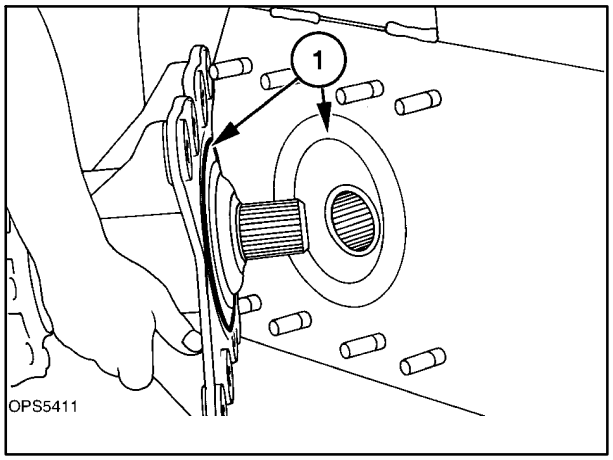

Figure 4-13

AXLE DISASSEMBLY

NOTE: A press is required to remove the axle shaft and hub assembly from the housing.

1. Remove the retaining ring, 1, from the axle shaft.
2. Remove the shims, 2. Note the thickness and number of shims.
3. Place the housing assembly in a press, support the housing as close to the center housing as possible to prevent damage to the housing.
4. Press the axle and hub assembly, 3, from the housing.

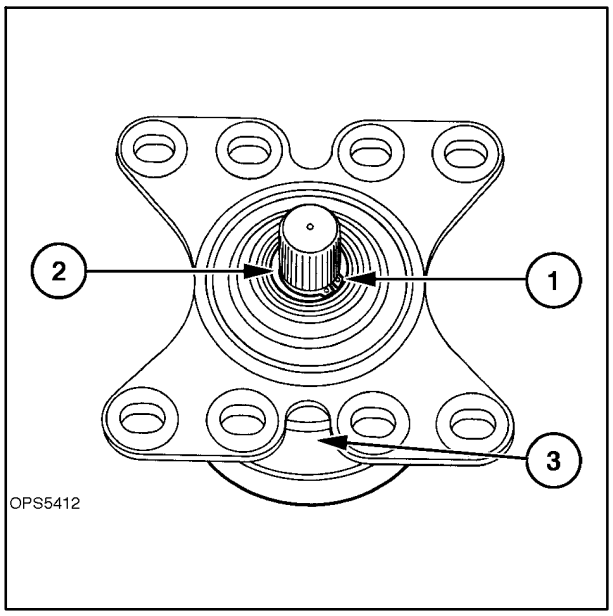

Figure 4-14

5. The outer axle seal, 1, may be replaced at this time without further disassembly. The seal can be replaced without removing the bearing, 2.
6. Install a bearing separator/puller and remove the outer axle bearing, 2.

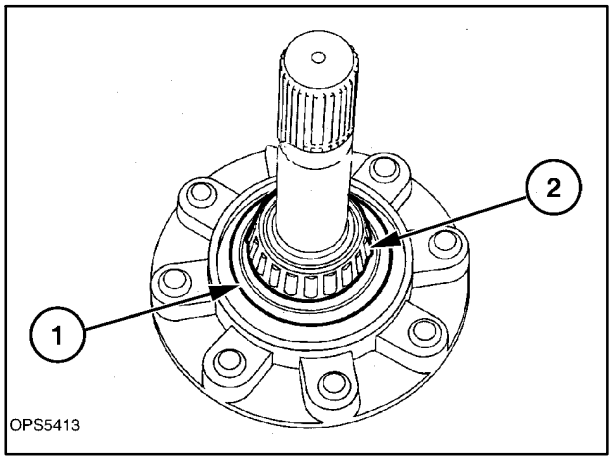

Figure 4-15

7. Remove the inner bearing race, 1, by driving it from the housing with a suitable hammer and driver.

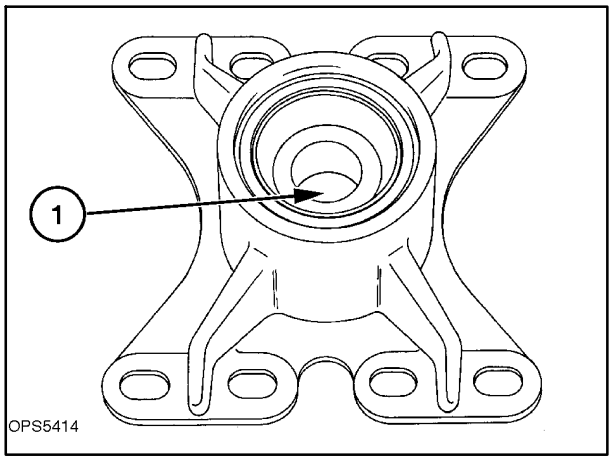

Figure 4-16

8. Remove the outer replaceable seal sleeve, 1, by prying it from the axle housing.
9. Remove the outer bearing race, 2, and seal, 3, by driving them from the housing with a suitable hammer and driver.

   Note the positioning of the oil seal before removal, as the replacement seal should be located in the same position.

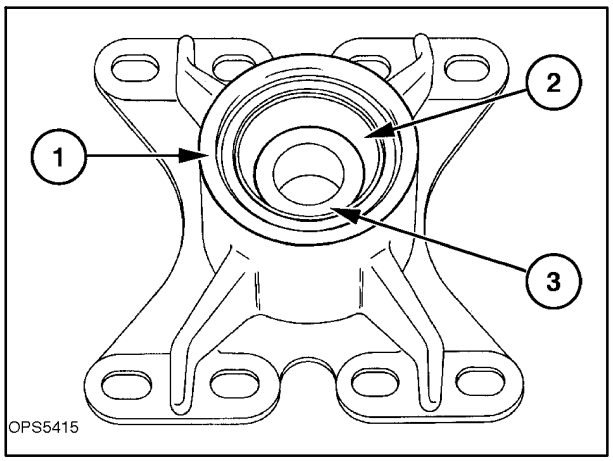

Figure 4-17

10. The axle hub wheel studs, 1, can be removed from the hub, by pressing them from the hub.

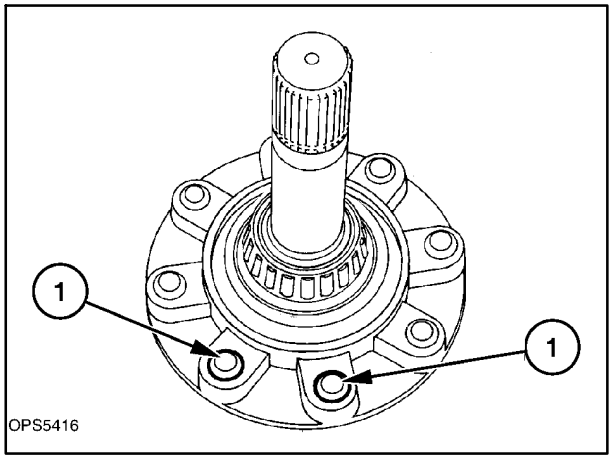

Figure 4-18

11. Shown here are the related parts used in the axle assembly.

Ref.	Description
1	Housing
2	Axle and hub assembly
3	Outer seal
4	Outer bearing assembly
5	Inner bearing assembly
6	Shims
7	Retaining ring
8	Inner seal
9	Outer seal sleeve
10	O ring

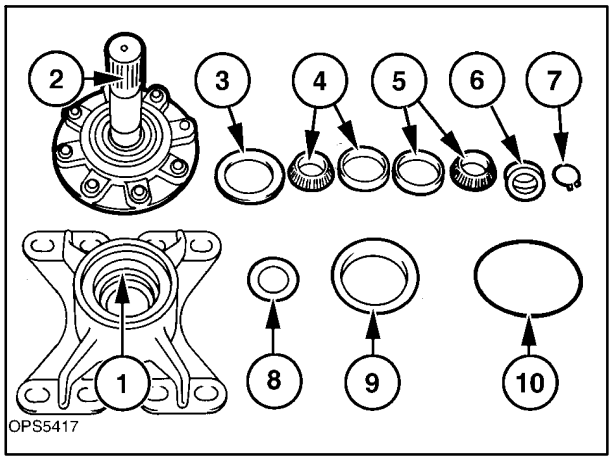

Figure 4-19

PARTS INSPECTION

Thoroughly clean all parts before inspection.

1. Inspect the housing flange, 1, and bearing race areas, 2. Replace the seals and replaceable seal sleeve if worn or damaged.

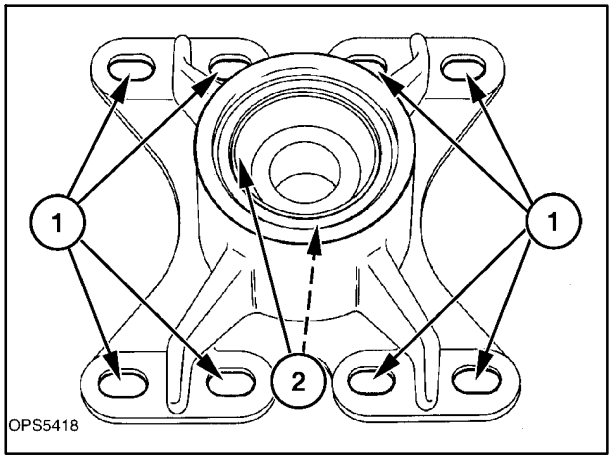

Figure 4-20

2. Inspect the axle shaft and hub assembly.
   a. Inspect the bearing areas, 1, for wear.
   b. Inspect the splines, 2, and retaining groove, 3, for wear.
   c. Inspect the seal area.
   d. Inspect the wheel lug studs for damaged threads or looseness in the hub, replace studs if required.

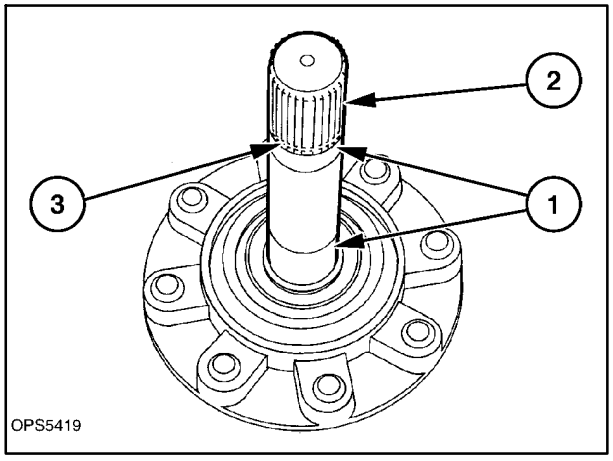

Figure 4-21

AXLE REASSEMBLY

1. Install the outer seal, 1, as shown, on the axle-hub assembly. Fill the grooves in the seal with grease.
2. Pack the bearing with grease and install the outer bearing, 2, with a suitable bearing driver.
3. Wrap the axle in the retaining ring groove area, 3, with a single layer of plastic tape to prevent damage to the seal during assembly.

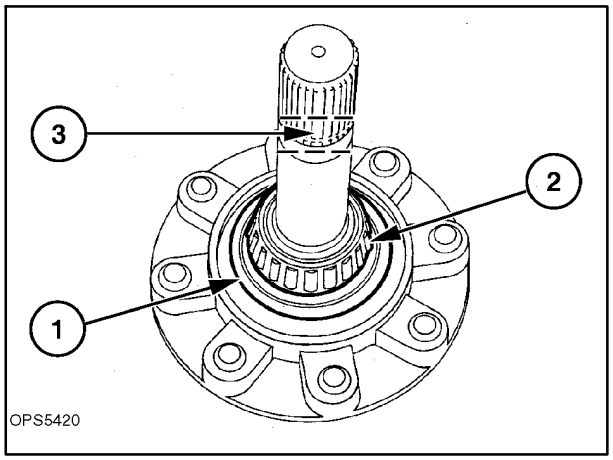

Figure 4-22

4. Install inner seal, 1, in housing as shown with the flat side of seal to the center of housing and retainer and lip of seal to the outside.
5. Install bearing race, 2.
6. Install replaceable seal sleeve, 3, in housing.

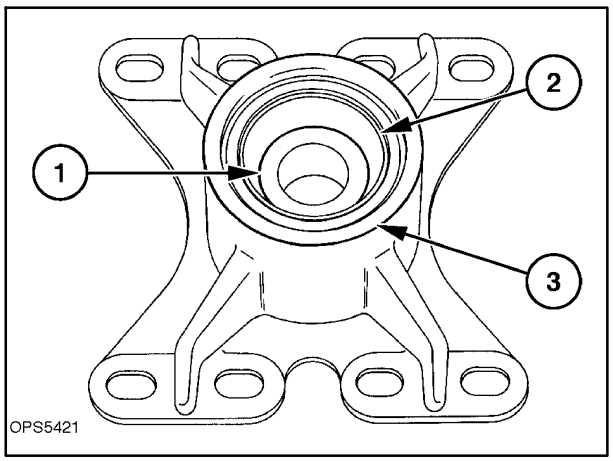

Figure 4-23

7. Place the housing over the axle and hub assembly making sure the outer bearing is seated in race properly.
8. Remove tape from axle shaft.
9. Install the inner bearing race, 1, into housing.

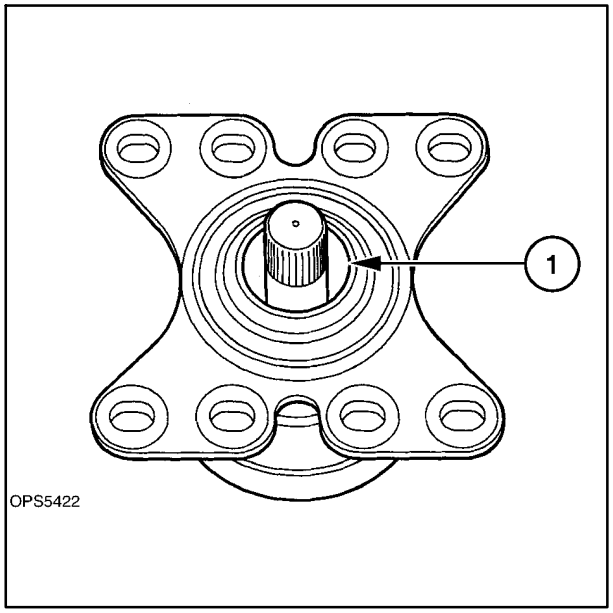

Figure 4-24

10. Pack the bearing with grease and install the inner bearing, 1.

    Press the inner bearing on axle shaft and into the housing to obtain housing rolling torque of 4 - 7 kg (9 - 15 lbs.).

    NOTE: To check housing rolling torque, hook a spring scale in one of the housing flange slots, 2, and pull on the scale to rotate the housing.

11. Add shims to fill the space between the bearing race, 3, and retaining ring, 4.

12. Install the retaining ring in groove, 5.

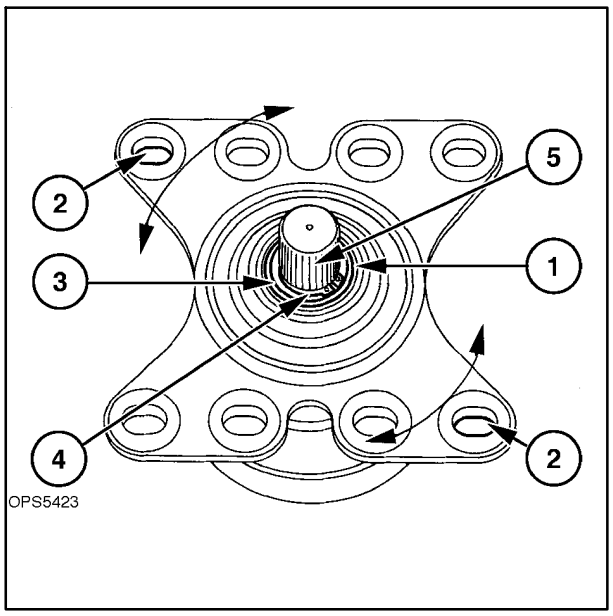

Figure 4-25

13. Fill the outer seal area with grease until the grease appears around the hub at 1; spin the axle housing while adding grease.

    NOTE: If bearing failed because of contamination, use green Loctite 609 on the seal housing to axle shoulder press-fit joint. If the axle shoulder is worn from previous seal rotation, use a new axle, seal, and loctite in place. When reinstalling the axle into the axle housing, be sure both bearings are packed with grease. The cavity in between the triple lip seal and axle seal, where the outer bearing is positioned, must be full of grease. If any old/hardened grease is in a housing that will be reused, be sure to clean the housing and fill it with new grease.

14. Install the O ring in the groove in the axle housing flange at 2, wipe a layer of grease over the O ring to help hold the O ring in place during assembly.

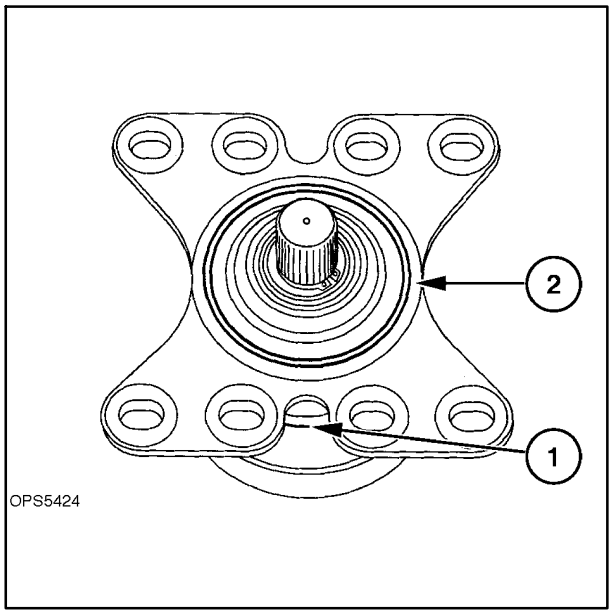

Figure 4-26

AXLE HOUSING REINSTALLATION

1. Clean the final drive case.
2. Inspect the axle opening in the case to insure it is flat for a good seal between the case and axle housing. To check surface flatness, lay a straightedge across the axle opening in the horizontal and vertical planes, 1. Straighten if required.
3. Inspect the axle assembly retaining bolts, 2, and replace if damaged.
   a. To replace a stud, the old stud can be driven out with a hammer and suitable driver.
   b. Thoroughly clean the inside and outside of case in stud area.
   c. Wipe the new stud with a wicking-type sealant. The new stud can be installed into case, using 3/4″ thick spacer over the stud and then use the nut and a flat washer to pull the stud in place.
   d. Wipe around the stud with a wicking-type sealant to insure an oiltight seal.
4. If there are any cracks in the frame, professionally weld the cracks, making sure the axle will align correctly on the horizontal and vertical planes. To prevent future cracks, add a reinforcement plate, 1, as detailed in Service Bulletin 8/95 - I9, but only within the following serial number ranges:

Model	Serial Number Ranges
L565	850751 - 894256
Lx565	847451 - 894256
Lx665	847851 - 895091

Later model loaders went to a 1/4″ housing plate to prevent cracks. A reinforcement plate should NOT be needed on later model loaders within the following serial number ranges:

Model	Serial Number Ranges
L565	894256 - 999999 and 0001 - 850750
Lx565	894256 - 999999 and 0001 - 847450
Lx665	895091 - 999999 and 0001 - 847850

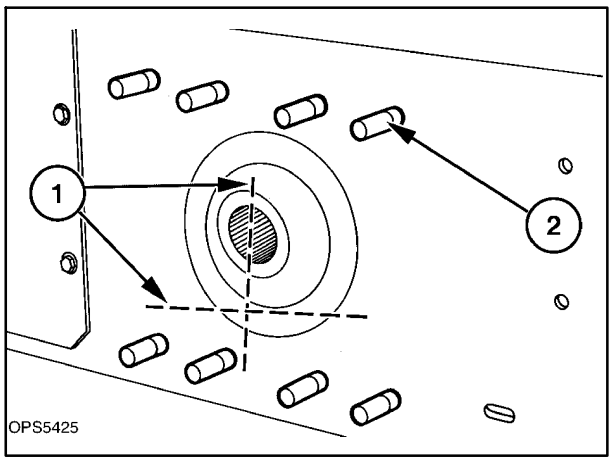

Figure 4-27

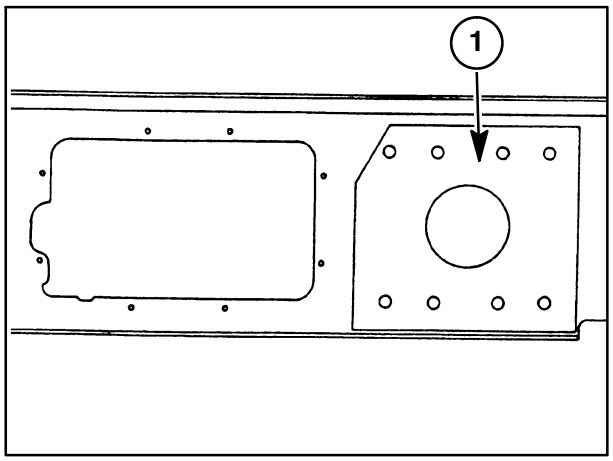

Figure 4-28

5. Slide the drive sprocket and chain to the center of the case and inspect the inner replaceable plastic low friction bearing, 1. Replace the bearing if missing or damaged.

   NOTE: If there is no plastic low friction bearing, make sure the final drive is not the later-model design as shown in Figure 4-30 before attempting to install a new bearing. The center hole will not have a large enough outside diameter to accept a bearing.

   a. The bearing can be replaced by pulling the bearing from the inside of the case.

   b. Install the new bearing by aligning it with the support hole in case and bumping the bearing with your hand to press it in place.

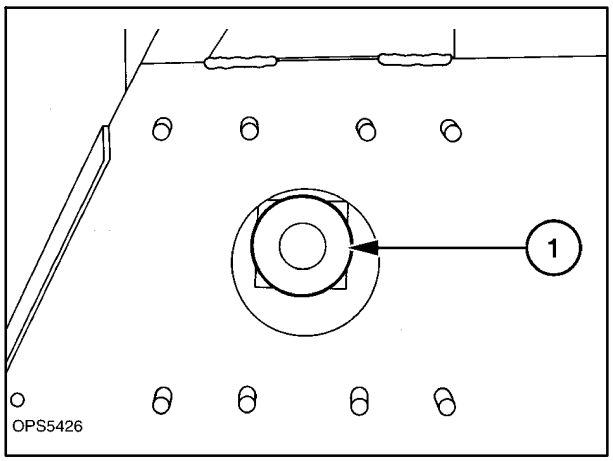

Figure 4-29

NOTE: Later-model loaders have a new design plate, 1, that does not include a bearing. If there was no plastic bearing in the case when the case was removed, do not attempt to install a plastic bearing.

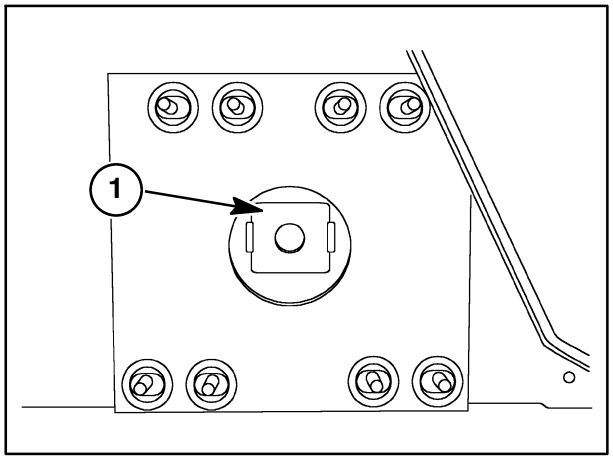

Figure 4-30

6. Position the drive sprocket, 1, in the axle opening. Make sure the drive sprocket is placed in the drive chain properly.
7. Lift the axle housing assembly and mate the splines on the axle shaft, 2, and the drive sprocket and slide together. Lifting the axle housing assembly over the retaining studs pilot the center of the housing, 3, into the hole in the case and slide housing tight against the case.

   NOTE: When installing the final drive axle, the axle housing must lay flat against the frame and the pilot must rest on the edge of the frame opening.

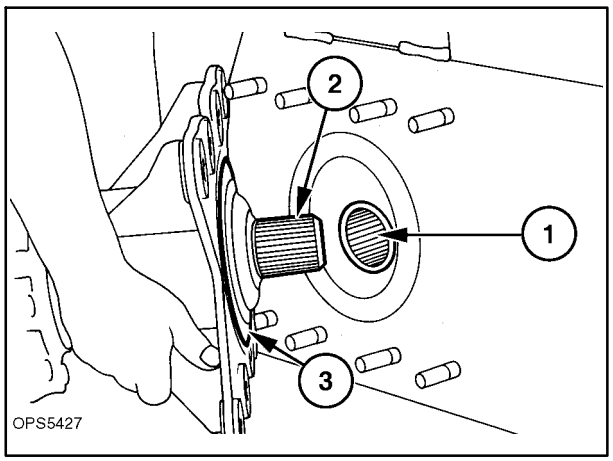

Figure 4-31

8. With the axle housing, 1, tight against the case, install the retaining nuts and flat washers, 2, to hold the housing against the case.
9. Slide the axle housing assembly to tighten the drive chains.

   NOTE: The chains are properly tensioned when there is 0 - 6 mm (0 - 1/4″) movement at the outer edge of tire tread.
10. Torque the axle retaining hardware to 190 N·m (140 ft. lbs.).

CAUTION: WHEN TIGHTENING THE AXLE RETAINING HARDWARE, THE AXLE HOUSING MUST BE TIGHT AGAINST THE CASE AT 1, OR DAMAGE TO THE CASE MAY OCCUR.

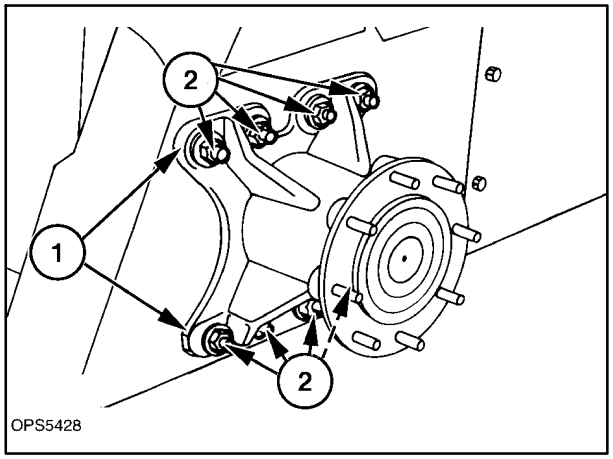

Figure 4-32

11. Check the final drive case oil level at check plug, 1; add SAE 10W-30 oil as required.

    Replace any shields that were removed for the repair.

    The skid-steer loader can now be lower to the ground.

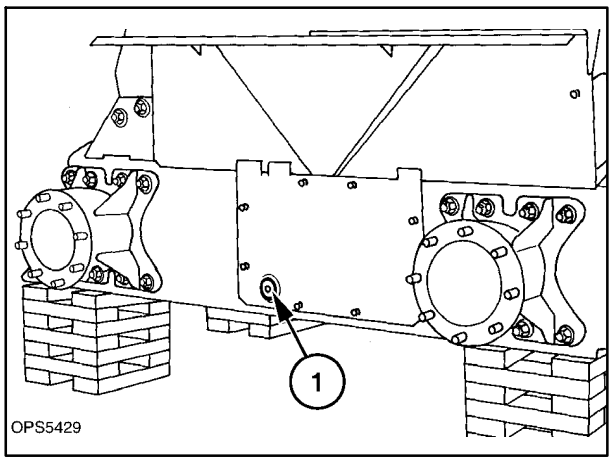

Figure 4-33

FINAL DRIVE

DRIVE CHAIN AND SPROCKET REMOVAL

The axle housing assemblies and final drive case cover will need to be removed to access the drive chains and drive sprockets.

The four final drive chains are an endless design, with no connector link.

Removal

1. Lower the boom and attachment to the ground.
2. If the work is going to be done with the boom in the raised position, remove the attachment and raise the boom and rest on the boom lock pins, 1.

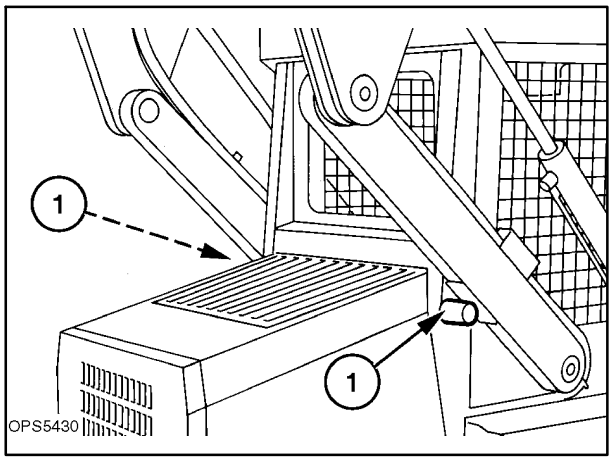

Figure 4-34

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

3. Securely block the skid-steer loader with all four wheels off the ground. Refer to Section 1 for more detail information on properly supporting a skid-steer loader.

   Support the loader at the front of the final drive cases at 1, and at the rear at 2.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

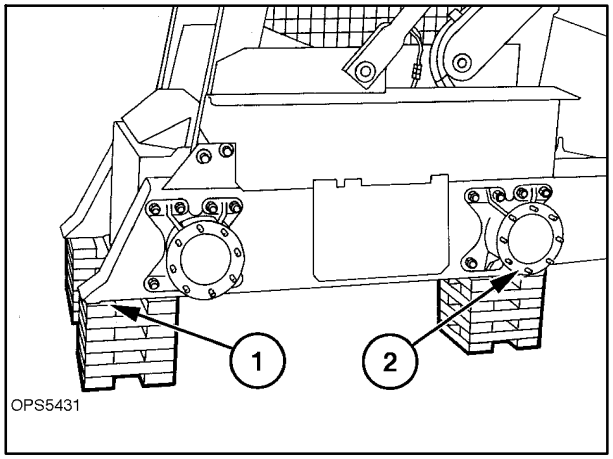

Figure 4-35

4. Remove the tires and wheels from the final drive being serviced.
5. Clean the axle and final drive area to prevent debris from entering the final drive case.
6. Remove the eight axle housing retaining nuts and washers, 1, from each axle.
7. Slide the axle housing from the retaining studs and lift the assembly from the final drive case.

   NOTE: When the axle assembly is removed, the drive sprocket and chain will drop slightly to the bottom of the case.

8. Remove the final drive cover, 2.

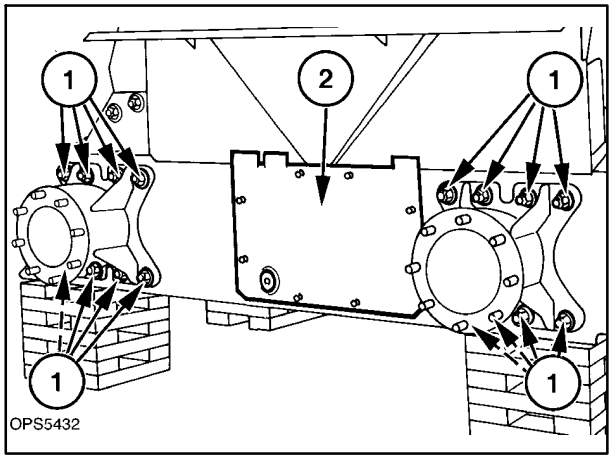

Figure 4-36

9. There is a large O ring that seals the axle housing to the side of the final drive case, 1. Remove the O ring from the case or the axle housing.

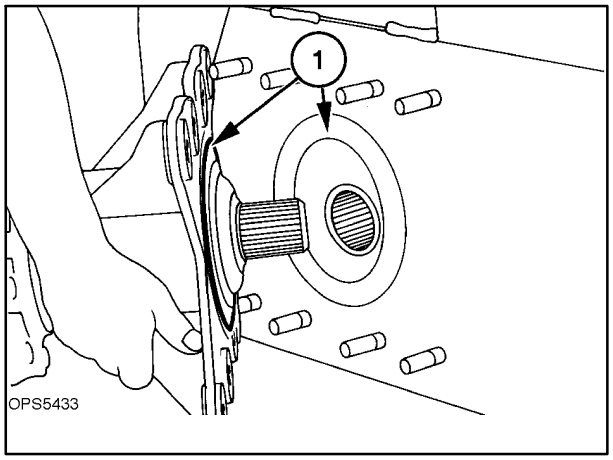

Figure 4-37

Drive Chain And Sprocket Removal

10. Remove the drive chains from the drive sprocket, 1.

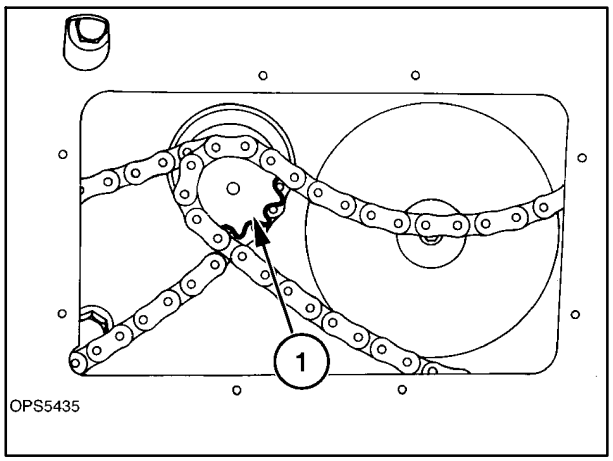

Figure 4-38

Rear Drive Sprocket and Chain

11. To remove the rear chain and sprocket, the parking brake disc and caliper will need to be removed first.

Brake Disc Removal

a. Engage the parking brake.

b. Remove the center brake disc retaining bolt and washer, 1.

c. Disengage the parking brake.

d. Remove the caliper retaining hardware, 2, from the inside of cab. Thread the two bolts from the outside caliper, 3.

e. Remove the outside disc, 4.

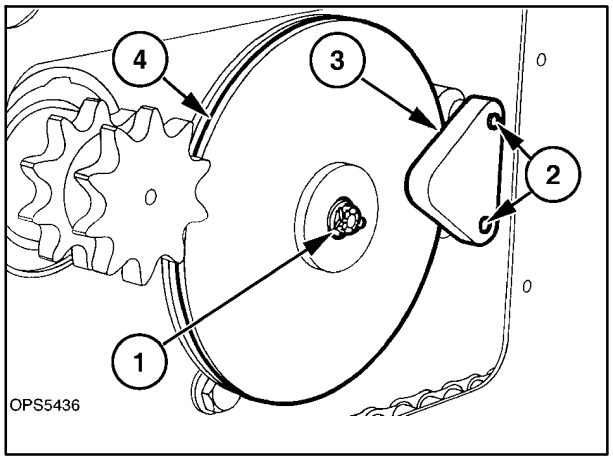

Figure 4-39

f. Remove center section of caliper, 1, spacers, 2, and retaining bolts.

g. Remove inside disc, 3.

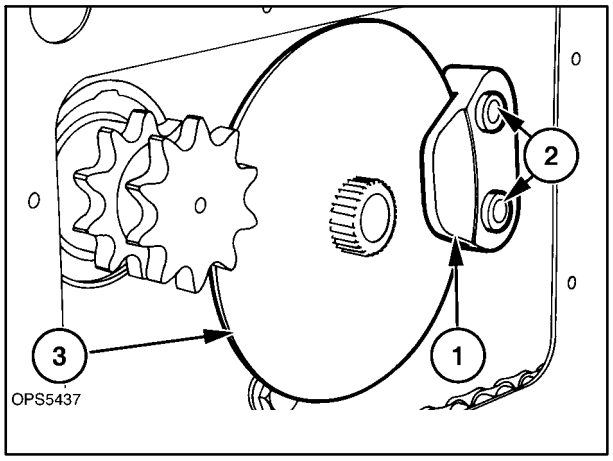

Figure 4-40

h. Remove brake friction puck, 1, and spacer plate, 2.

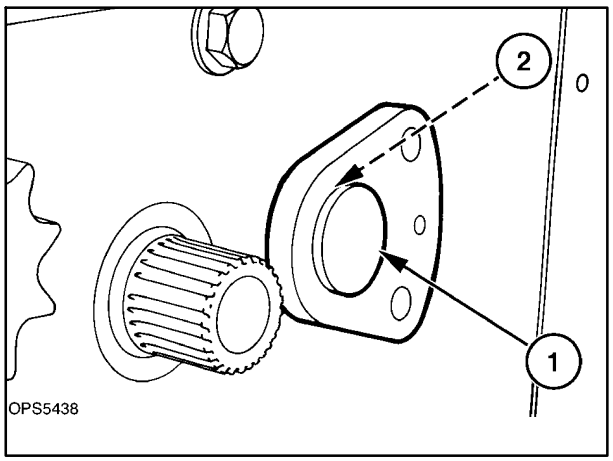

Figure 4-41

12. Slide the rear chain and sprocket to the case opening and remove the chain from the sprocket and the case.

13. Remove the drive sprocket and note the position of the center hub, 1 (long - short shoulder in or out).

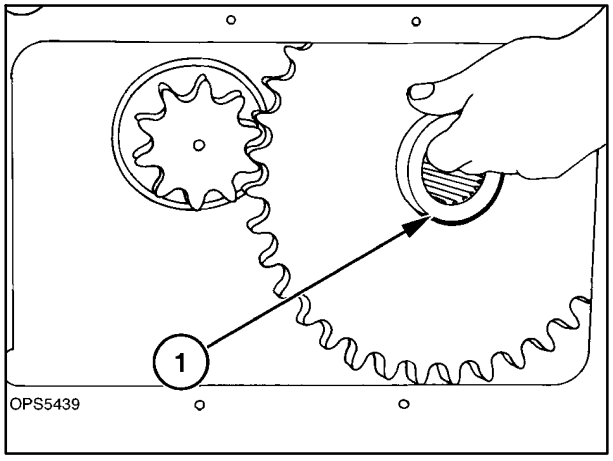

Figure 4-42

NOTE: On early production units, the drive sprocket with wider center hubs will not clear the brake disk coupler shaft, 1. The hydrostatic motor and coupler must be moved in, to the center of the unit, by loosening the motor mounting hardware.

NOTE: Replacement sprockets from service parts will be of the narrow center hub style.

To Move Motor For Clearance

a. Remove retaining ring, 2, from coupler, 1.

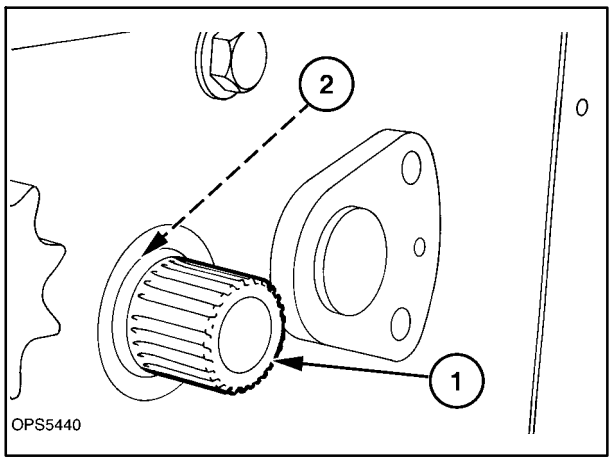

Figure 4-43

b. Remove the two motor retaining bolts, 1, and slide the motor, 2, and coupler shaft to the inside about 13 mm (1/2″) to gain clearance.

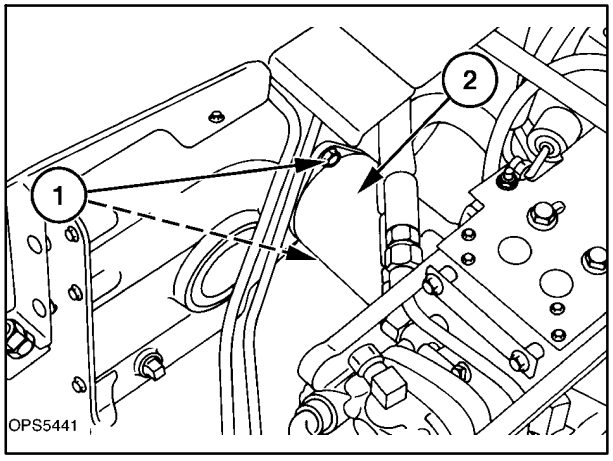

Figure 4-44

Front Drive Sprocket and Chain

14. Remove the front chain from the drive sprocket.

15. Slide the chain and sprocket to the center case opening. Remove the chain from the sprocket and remove the chain from the case.

16. Remove the sprocket from the case and note the position of the center hub, 1 (long - short shoulder in or out).

    NOTE: On early production units, the drive sprocket with wider center hubs do not clear the double drive sprocket, 2. The sprocket will require removal from the gearbox.

    NOTE: Replacement sprockets from service parts will be of the narrow center hub style.

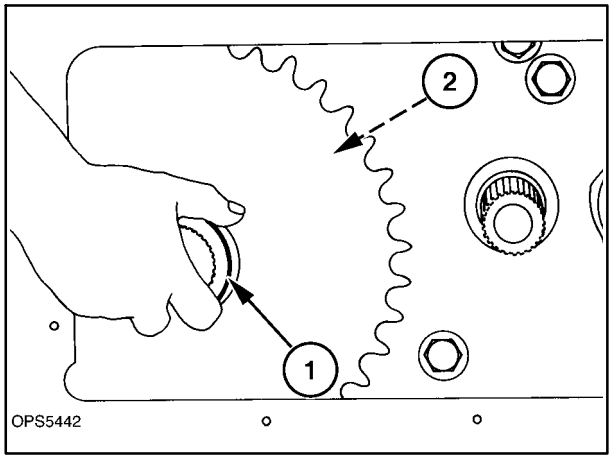

Figure 4-45

To Remove Drive Sprocket For Clearance

a. Remove the cover, 1, from the gearbox.

b. Remove the retaining ring, 2, from shaft.

c. Drive the shaft and sprocket assembly from the gearbox with a suitable hammer and driver.

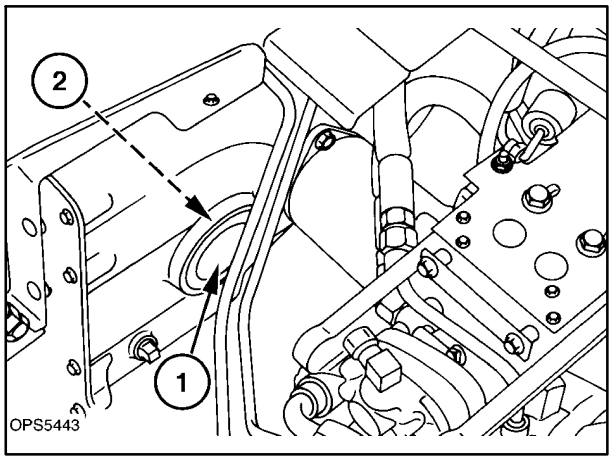

Figure 4-46

17. Shown here are the final drive components.

Ref. Description

1 Drive sprockets (2 each side)
2 Front drive chain
3 Rear drive chain

NOTE: The front drive chain is 68 links and the rear chain is 66 links.

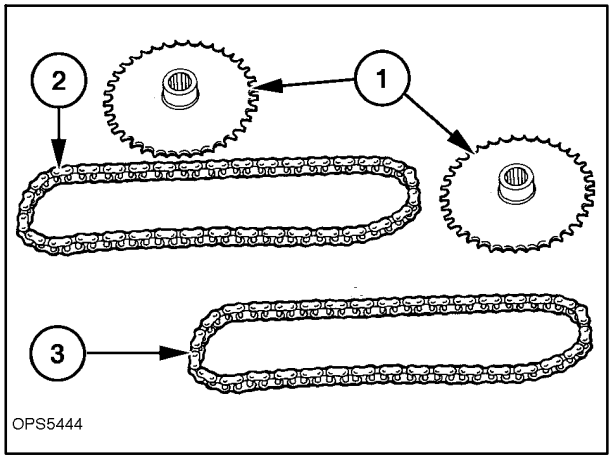

Figure 4-47

FINAL DRIVE PARTS INSPECTION

Thoroughly clean all parts before inspection.

1. Inspect the drive sprockets in the center spline area, 1, for excessive wear and the tooth area, 2, for wear.

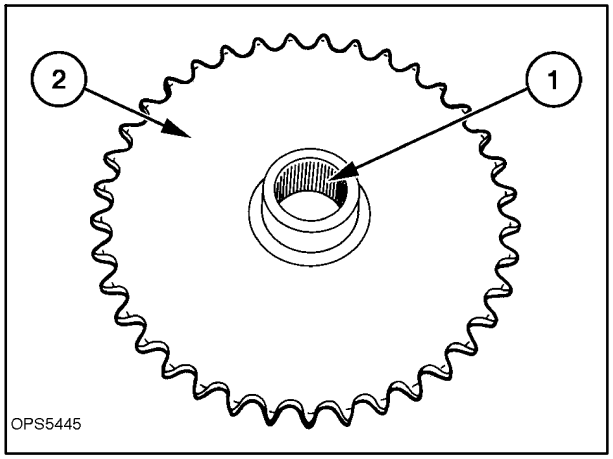

Figure 4-48

2. Inspect the drive chains for broken or cracked rollers, 1.
3. Inspect the drive chains for cracked or broken side bars, 2.
4. Inspect the side bar to pin wear or looseness at 3.
5. Inspect the drive chains for excessive stretch (bushing wear).

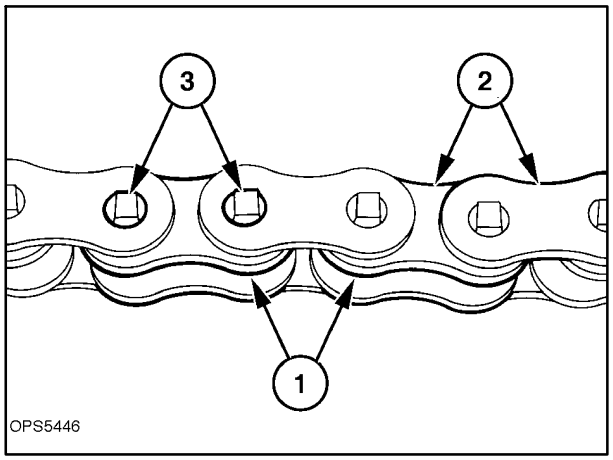

Figure 4-49

FINAL DRIVE REASSEMBLY

1. Clean all surfaces of old silicone sealer, dirt, etc. that will require resealing.
2. If the oil requires replacement, the oil will have to be syphoned from the case. Thoroughly clean the inside of the case to remove all debris.
3. Install the front drive sprocket with the longer center hub, 1, to the outside of the case.

   NOTE: The drive sprockets are not centered on the splined hub. The front sprocket is installed with the longer center hub, 1, to the outside and rear is installed with the longer center hub to the inside of case.

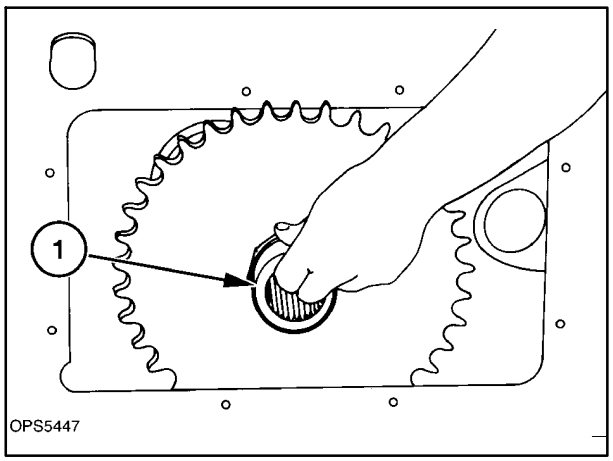

Figure 4-50

4. Install the front drive chain, 1.

   NOTE: The front drive chain is longer than the rear drive chain.

5. Place the chain over the inside drive sprocket, 2.

   NOTE: If the double drive sprocket, 3, and shaft were removed, it will require reinstallation.

Double Drive Sprocket Installation

   a. Align the shaft with gearbox bearings and drive gear, insert the shaft, 3, through the bearings and gear.

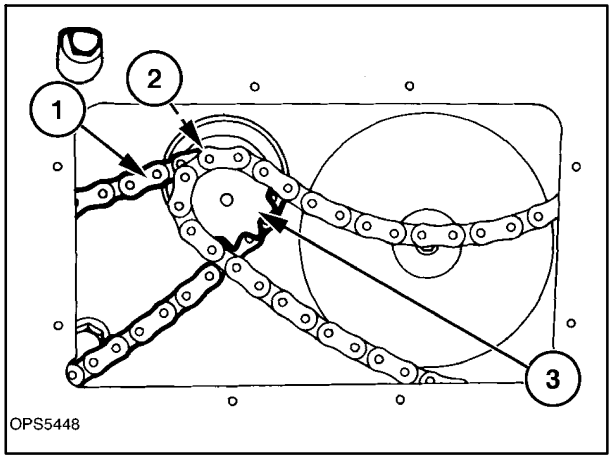

Figure 4-51

b. Install the spacer, 1, with recess towards the gear, and the tapered side, 2, to the outside of gearbox. Install the unsealed bearing and retaining ring previously removed.

c. Reseal the cover with a bead of noncorrosive silicone sealer and install the cover.

NOTE: The gearbox is shown removed from the unit.

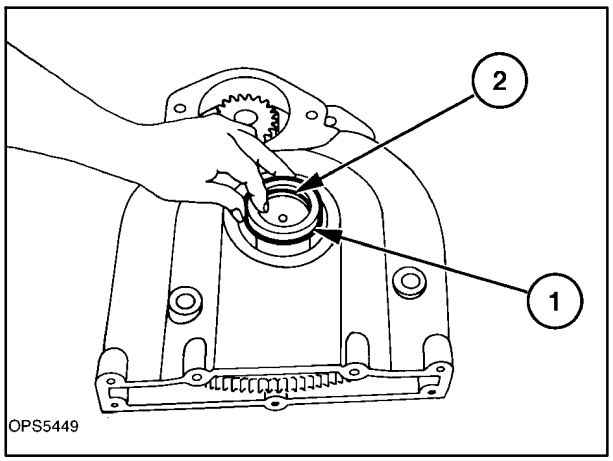

Figure 4-52

6. Install the rear drive sprocket, with the long center hub to the inside of the case, and the short hub to the outside as shown at 1.
7. Install the rear drive chain, the shorter chain, over the sprocket and slide the chain and sprocket to the rear.
8. Place the drive chain over the outside drive sprocket.

NOTE: If the hydrostatic motor and coupler was moved to gain clearance, the motor will require repositioning.

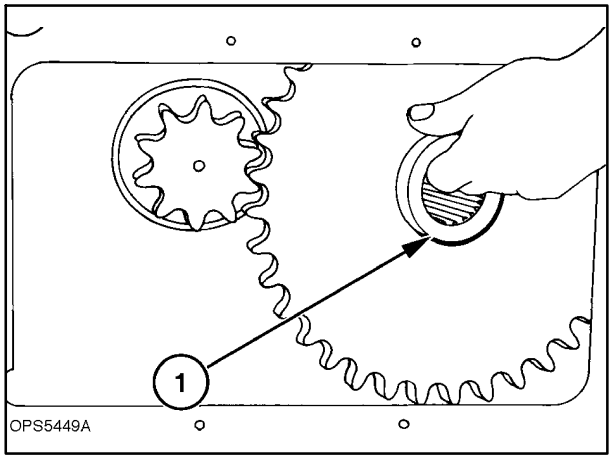

Figure 4-53

Motor Repositioning

a. Clean the old sealant from the motor and gearbox housing.

b. Put a bead of noncorrosive silicone sealer around the motor flange.

c. Slide the motor and coupler, 1, into position and install the motor retaining hardware, torque to 101 N·m (75 ft. lbs.).

d. Reinstall the coupler retaining ring, 2.

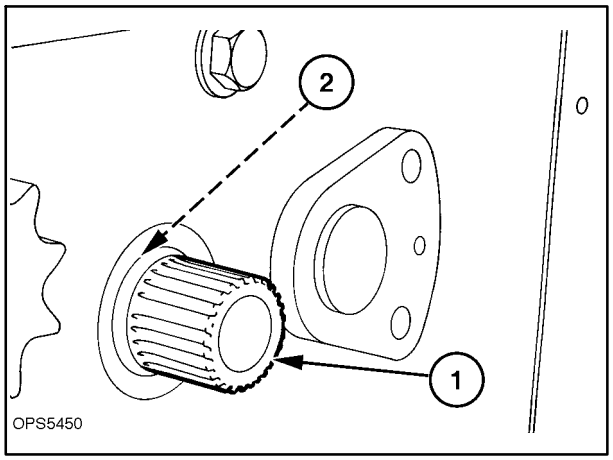

Figure 4-54

9. Reassemble the parking brake:

   a. Clean the old sealant from the brake hardware.

   b. Install the spacer plate, 2, and brake friction puck, 1, into caliper at 3.

      NOTE: The spacer plate is thinner than the brake friction puck and must be inserted into the caliper first.

      NOTE: The friction puck must be the steel design.

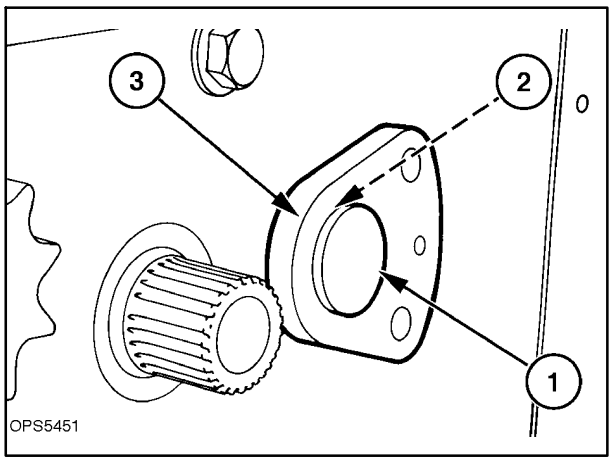

Figure 4-55

   c. Install the inside brake disc, 1.

   d. Put a bead of noncorrosive sealant around the head of the caliper bolts and install from the inside of loader.

   e. Install spacers, 2, on bolts and center section of caliper, 3.

   f. Install outer brake disc, 4.

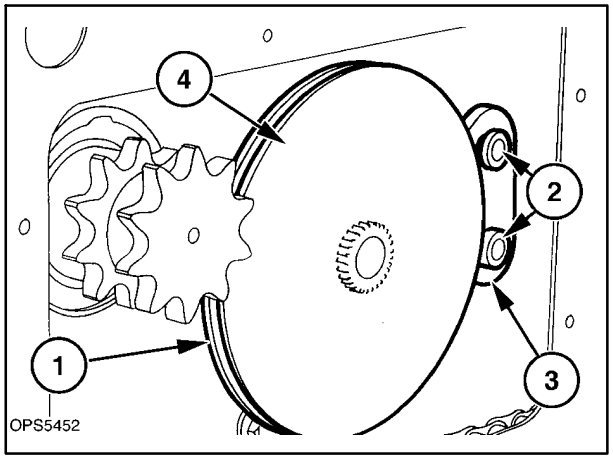

Figure 4-56

   g. Install outer section of caliper, 1, and attach with hardware previously installed and tighten to 70 N·m (52 ft. lbs.).

   h. Put a bead of sealer around the end of the motor coupler and install the brake disc retaining bolt and flat washer, 2, and tighten.

   i. Engage the parking brake and torque the retaining bolt to 35 N·m (26 ft. lbs.).

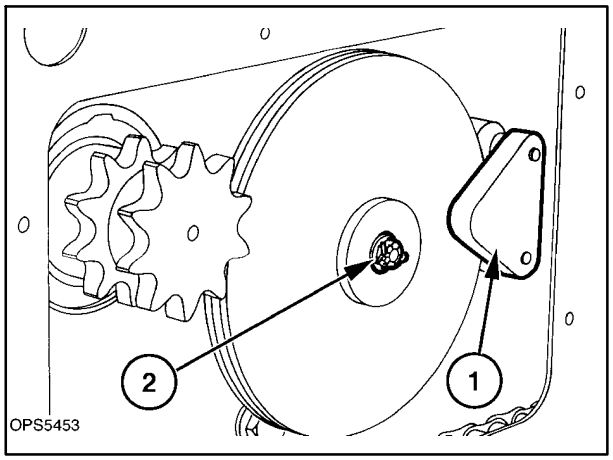

Figure 4-57

10. Install the axle housings, 1, and tighten the drive chains. Refer to the “Axle Housing” section of this manual for details.

11. Put a bead of sealer around the cover hole in final drive case and install the cover, 2.

12. Check the final drive oil level at the check plug, 3, and add SAE 10W-30 oil as required.

13. Reinstall all shields removed for the repair.

14. Lower the loader to the ground.

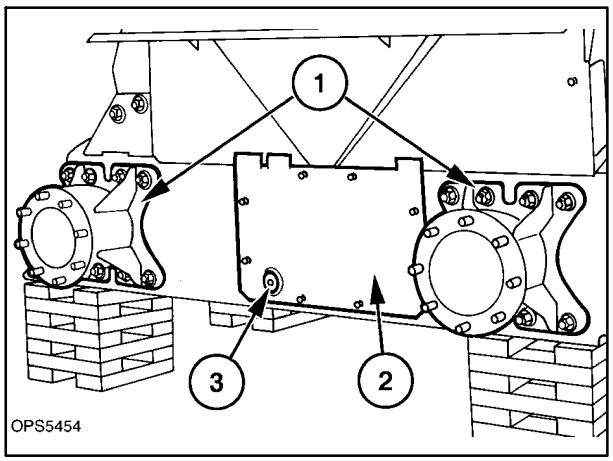

Figure 4-58

PARKING BRAKE

OPERATION

The parking brake system is a mechanically activated double disc brake system. The brake discs are attached to the hydrostatic motor shafts with a separate system located in each final drive case. Both brake systems are activated by a single control lever.

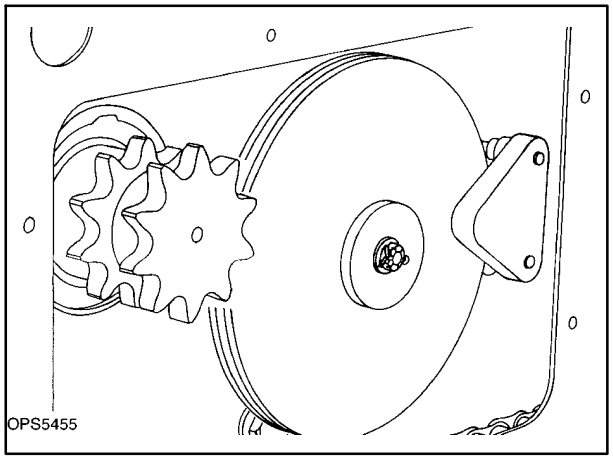

Figure 4-59

The parking brake control lever, 1, is located to the right of the operator's seat. When the lever is in the lower unlatched position, the brake is disengaged. When the lever is in the raised latched position, the brake is engaged.

When the parking brake is engaged and the hydrostatic control levers are stroked, the skid-steer loader should not move if the brake is adjusted properly.

The hydrostatic system is the primary brake for the skid-steer loader when the unit is in operation. The parking brake system is only for a stopped machine, to hold the unit in place and prevent rolling or creeping when parked.

The parking brake should always be engaged before exiting the skid-steer loader.

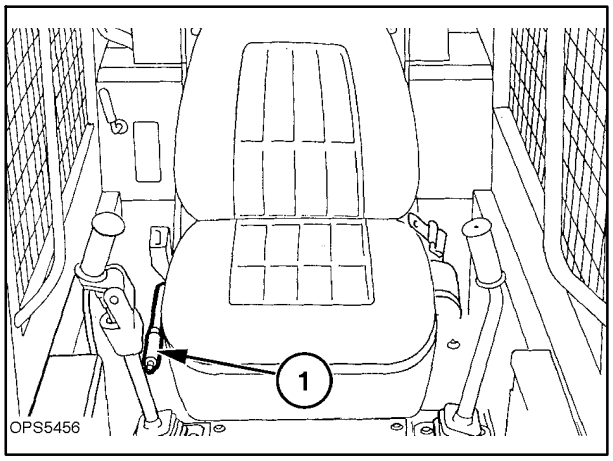

Figure 4-60

CAUTION: ALWAYS ACTIVATE THE PARKING BRAKE BEFORE LEAVING THE OPERATOR STATION. NEVER OPERATE THE SKID-STEER LOADER UNLESS THE BRAKE IS RELEASED.

PARKING BRAKE REMOVAL AND INSPECTION

To access and remove the parking brake control linkage, the seat can be raised and latched in the raised position. To access the brake disc and caliper assembly, the final drive inspection cover will need to be removed.

Removal

1. Lower the boom and attachment to the ground.
2. If the work is going to be done with the boom in the raised position, remove the attachment and raise the boom and rest on the boom lock pins, 1.

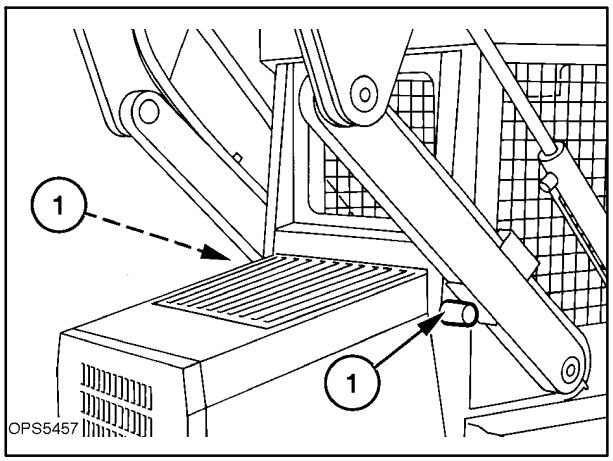

Figure 4-61

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

3. Securely block the skid-steer loader with all four wheels off the ground. Refer to Section 1 for more detailed information on properly supporting the skid-steer loader.

   Support the loader at the front of the drive cases at 1, and at the rear at 2.

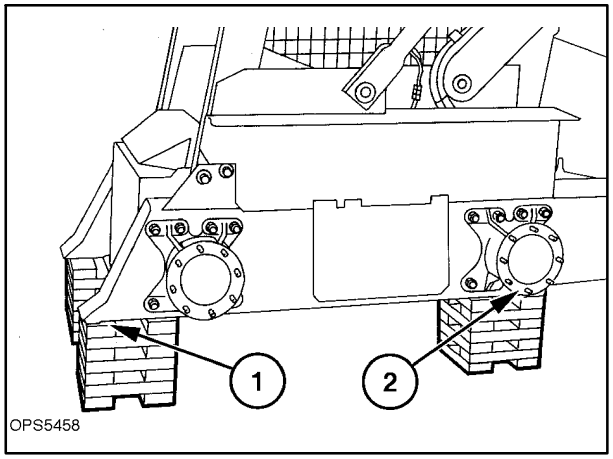

Figure 4-62

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

4. Slide the seat to the most rear position and unlatch the seat pan and raise the seat and pan assembly to the raised latched position.

CAUTION: BEFORE WORKING UNDER A RAISED SEAT MAKE SURE IT IS SECURELY LATCHED AT 1, IN THE RAISED POSITION.

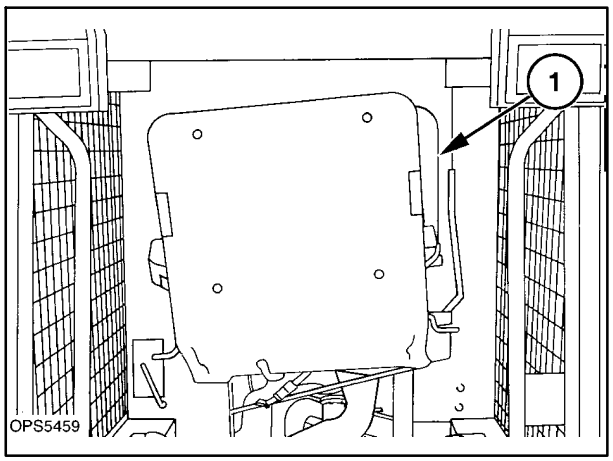

Figure 4-63

5. Remove the rear tire and wheel from the final drive and brake being serviced.
6. Clean the rear axle and final drive area to prevent debris from entering the final drive case.
7. Loosen the eight axle housing retaining nuts and washers, 1, on the rear axle and slide the axle forward to loosen the drive chain.
8. Remove the fender retaining hardware at 2, and remove the fender to access the spring and linkage.
9. Remove the final drive case center cover, 3.

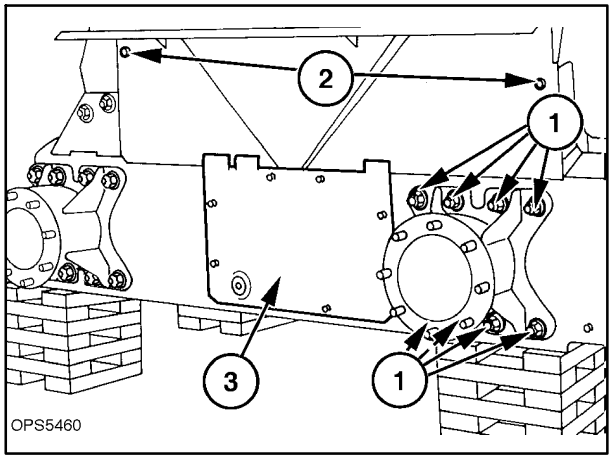

Figure 4-64

Brake Control Linkage Removal

1. Remove the handle retaining bolts, 1, slide the handle, button and spring, and latch plate assembly, 2, from the link, 3.

   Note the positioning of the internal latch plate for reassembly.

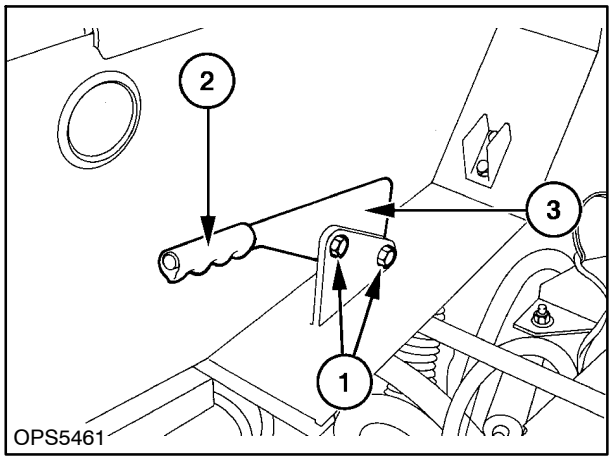

Figure 4-65

2. To remove the control rod assembly, 1, remove the cotter pins from the spring links, 2.
3. Remove the left support bracket and hardware, 3, then pivot the rod assembly down and slide the control rod from the right support bracket.

   Remove the pivot bushings from supports and friction pad from rod.
4. Remove the lower cotter pin, 4, and remove the spring assemblies, 5, from the brake caliper actuator arm, 6.

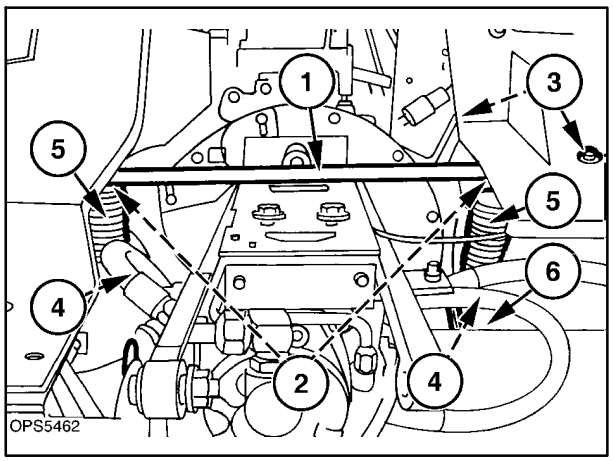

Figure 4-66

Parking Brake Control Linkage and Related Parts

Ref.	Description
1	Control handle and related parts
2	Control shaft, bearings, support
3	Spring assembly
	a. Spring
	b. Spring links (2)
4	Arm
5	Friction pad

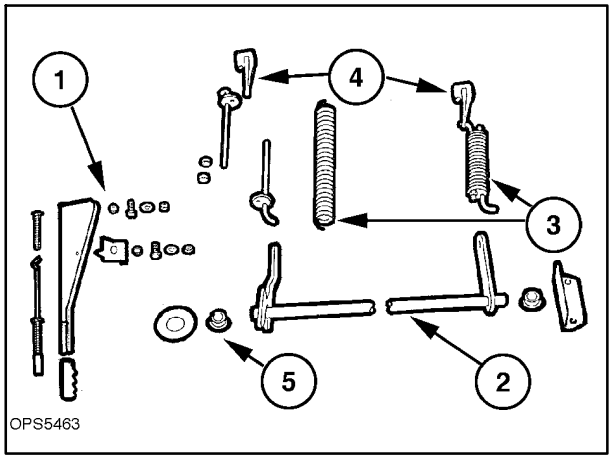

Figure 4-67

Inspection of Control Linkage Parts

1. Examine the latch plate. If the latch plate looks like 1, replace with a new latch plate, 2, part #9844477.
2. Inspect the spring, 3, for correct free spring length, 66.7 ± 3.2 mm (2-5/8 ± 1/8″), 4. Replace if not within specification.
3. Inspect the button and rod assembly, 5. If worn in the hook area of the rod, replace.
4. Inspect the latch plate pivot bushing, 6. Replace if worn.

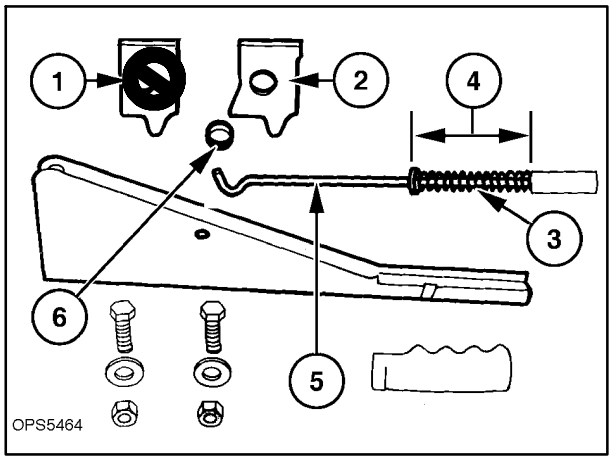

Figure 4-68

5. Inspect the control rod assembly, 1, friction pad, 2, and pivot bushings, 3, for wear. If worn, replace.
6. Inspect the spring assembly and check the spring free length, 335.0 ± 12.7 mm (13-3/16 ± 1/2″). Replace if not within specification.

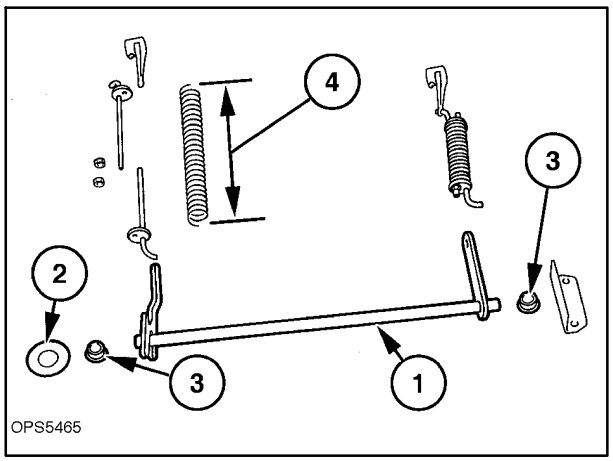

Figure 4-69

Installation of Brake Control Linkage

1. Install the control rod assembly, 1, friction pad, 2, on right end of rod. Insert pivot bushing, 3, into supports, and slide the right end into support and pivot link, 3, up and install the left support, 4.

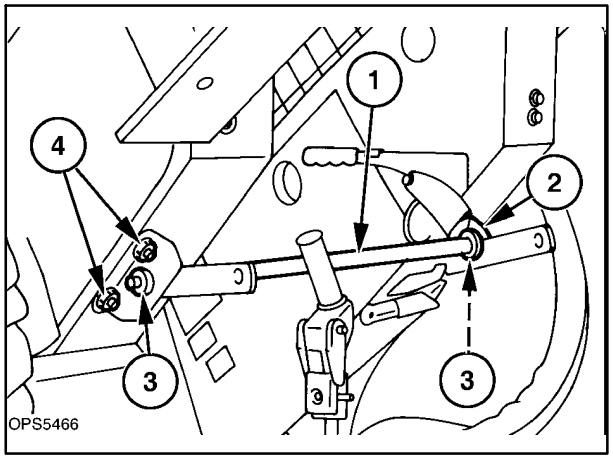

Figure 4-70

2. Insert the button rod, 1; spring, 2; and flat washer, 3, into lever at 4.
3. Insert the latch plate, 5, and bushing, 6, with the extended area, 7, as shown to the rear (engine side) of lever and position the button rod so the hook is back of the latch plate at 8. Reinstall the two retaining bolts, nuts and washers, through the lever assembly and the control rod.

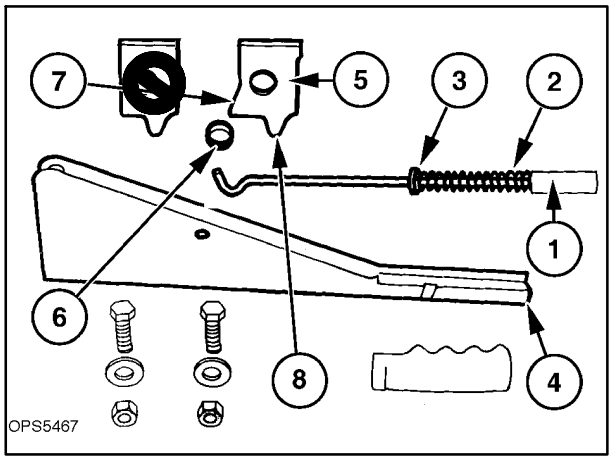

Figure 4-71

4. Reassemble the spring, 1, and rod assemblies, 2. Adjust the two rod nuts, 3, equally to obtain a spring length of 152 mm (6″) as shown at 4. Reconnect the spring assemblies between the control rod and caliper shaft and install cotter pins.

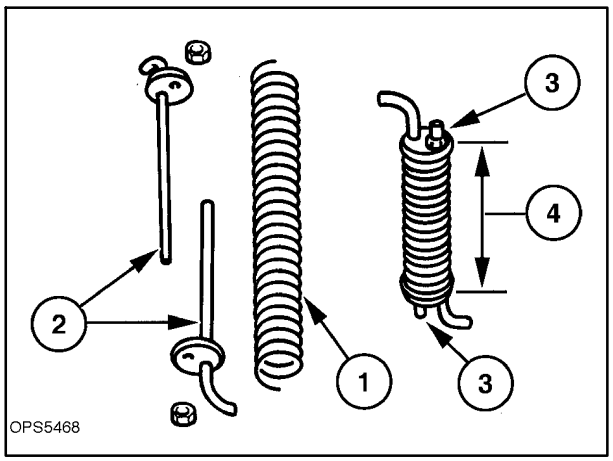

Figure 4-72

Brake Caliper and Disc Removal

The loader must be properly supported with all four wheels off the ground.

1. Remove the rear axle assembly.
2. Remove the rear drive chain from the drive sprocket and push chain to the rear.
3. Engage the parking brake.
4. Remove the center brake disc retaining bolt and washer, 1.
5. Disengage the parking brake.
6. Loosen the caliper retaining hardware, 2, from the inside of cab. Thread the two bolts from the outside caliper assembly, 3. DO NOT remove bolts from caliper support at this time.
7. Remove the outside disc, 4.

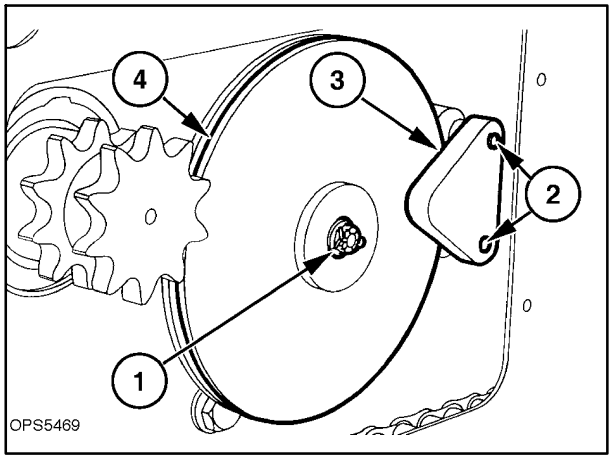

Figure 4-73

8. Remove center section of caliper, 1, spacers, 2, and now remove the retaining bolts.
9. Remove inside disc, 3.

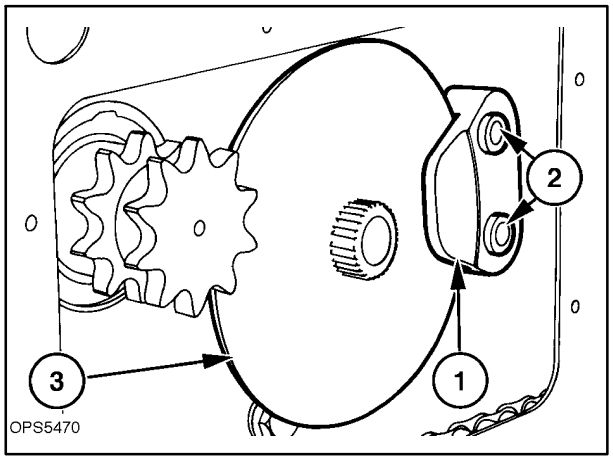

Figure 4-74

10. Remove brake friction puck, 1, and spacer plate, 2.

    NOTE: The spacer plate is thinner than the friction puck and must be inserted into brake caliper first upon reassembly.

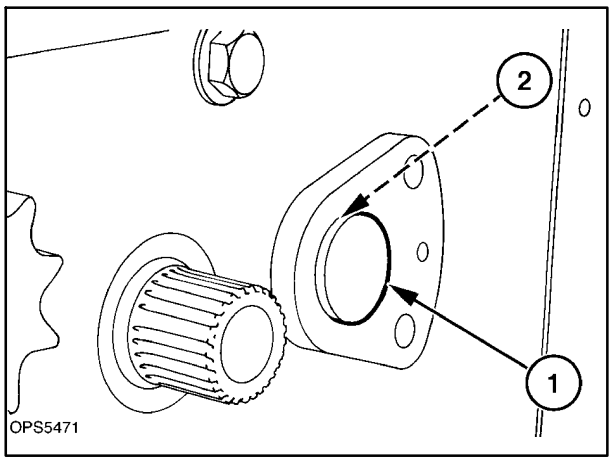

Figure 4-75

11. Remove the caliper support retaining bolt, 1, and remove the support from the loader.
12. Remove the setscrew, 2, from the arm, 3, and slide the arm from the shaft, 4.
13. Rotate the caliper shaft, 4, from the support.

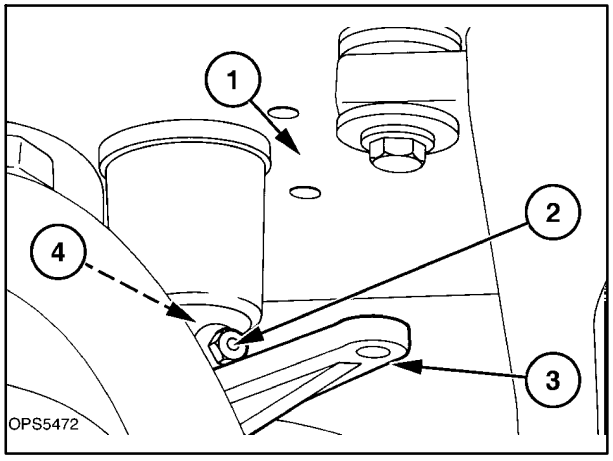

Figure 4-76

Brake Caliper and Disc Parts Inspection

Thoroughly clean all parts of sealing material etc. before inspection.

Brake caliper and related parts

Ref.	Description
1	Brake disc retaining hardware
2	Brake disc (2)
3	Brake puck (1)
4	Spacer plate (1)
5	Caliper support and hardware
6	Shaft
7	Center caliper plate
8	Bushings and hardware
9	Outer caliper section

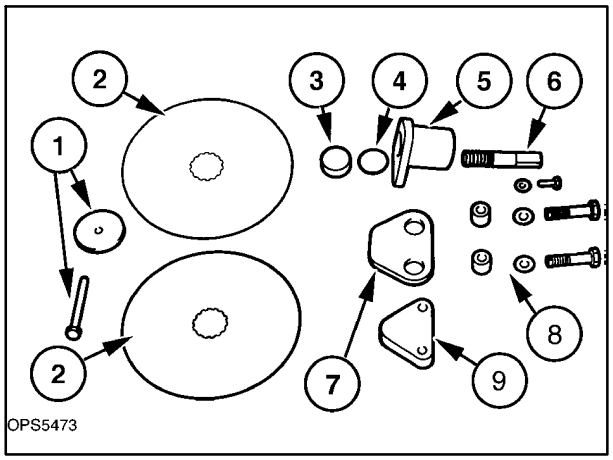

Figure 4-77

1. Inspect the brake disc for wear in the clamp area, 1, and splines, 2. The disc should also be flat. If worn severely or bent, replace.

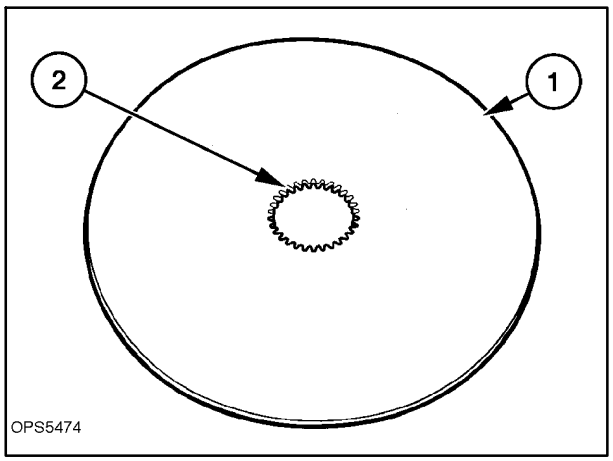

Figure 4-78

2. Inspect the brake friction puck, 1. If worn severely, replace.

   NOTE: The brake friction puck is made from steel; it should not be made of a fiber-type material.

3. The spacer plate, 2, will show a small amount of wear in the center next to the shaft at 3. This is normal.

   NOTE: The spacer plate, 2, must be installed into the caliper support, 4, first during reassembly.

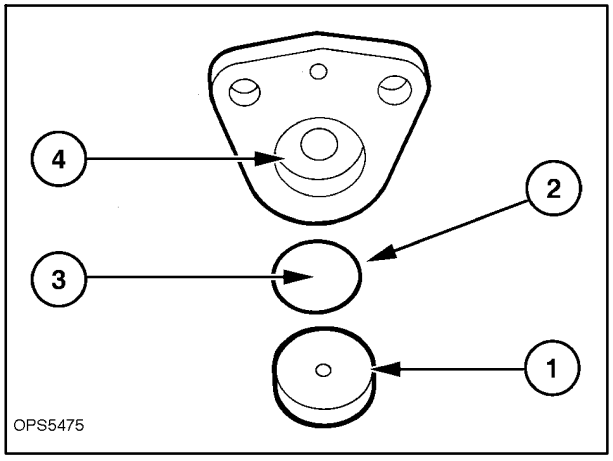

Figure 4-79

4. Inspect the caliper center plate, 1, and bushings, 2, for wear. Replace if worn.

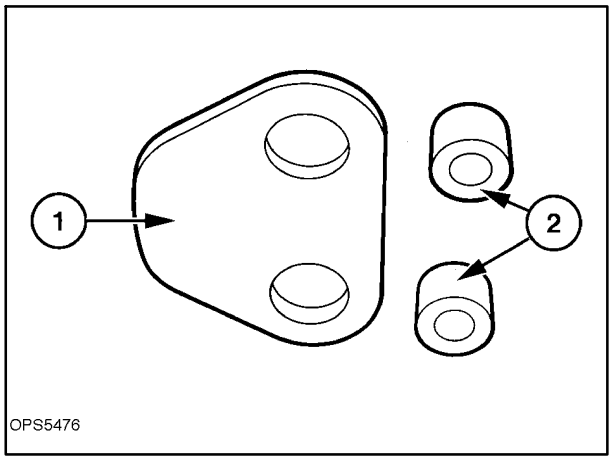

Figure 4-80

Inspect the caliper outer plate for wear. Replace if worn.

Inspect the thread area, 2, and if damaged, replace outer plate.

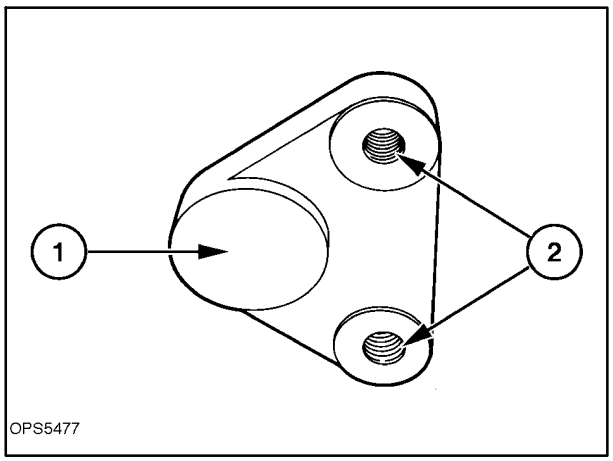

Figure 4-81

5. Inspect the caliper support, 1, and shaft thread area, 2. If damaged and shaft rotates hard in support, replace the damaged part. Inspect the shaft seal, 3; replace if damaged. Inspect the control arm, 4, for damaged splines; replace as required.

   NOTE: The brake caliper support and shaft will be right or left thread depending which side of machine it is from. The right threaded assembly is for the right side of unit; the left threaded assembly is for the left.

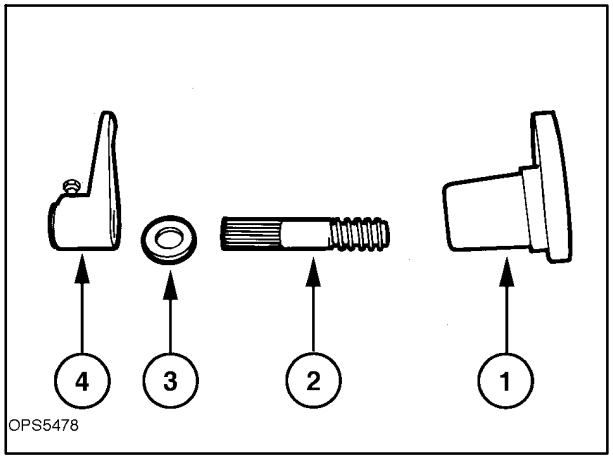

Figure 4-82

Brake Caliper and Disc Reassembly

1. Install a new seal, 1, in support at 2, if required. Apply a coating of never-seize lubricant on the threads of the shaft, 3, and in the support and thread the shaft into the support at 2. Put a bead of noncorrosive silicone sealer around the end of support at 4.

   NOTE: The brake caliper support and shaft will be right or left thread depending which side of machine it is from. The right threaded assembly is for the right side of unit; the left threaded assembly is for the left.

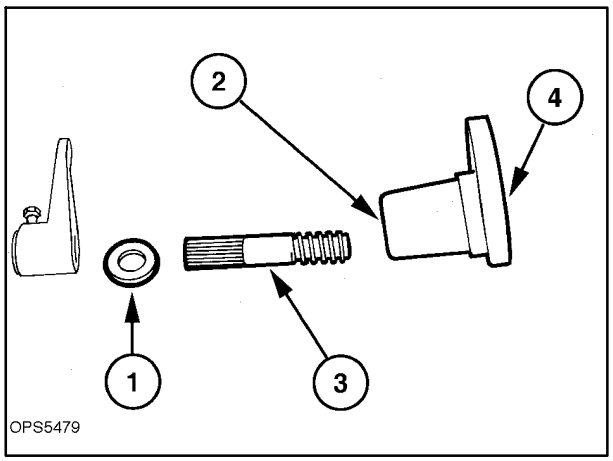

Figure 4-83

2. Install the correct, right or left, caliper support, 1, in the final drive case. Position and install retaining bolt, 2, and tighten to 12 N·m (9 ft. lbs.).

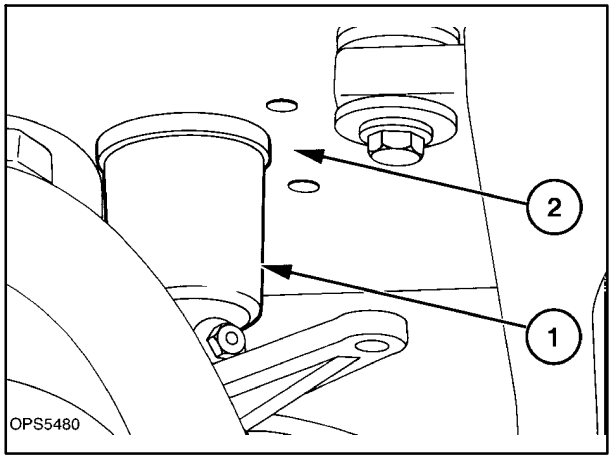

Figure 4-84

3. Install the spacer plate, 2, next to the end of shaft, then the brake friction puck, 1.

   NOTE: The thin spacer plate must be inserted into the caliper support first, then the friction puck, to insure proper brake operation.

   NOTE: The friction puck must be the steel design.

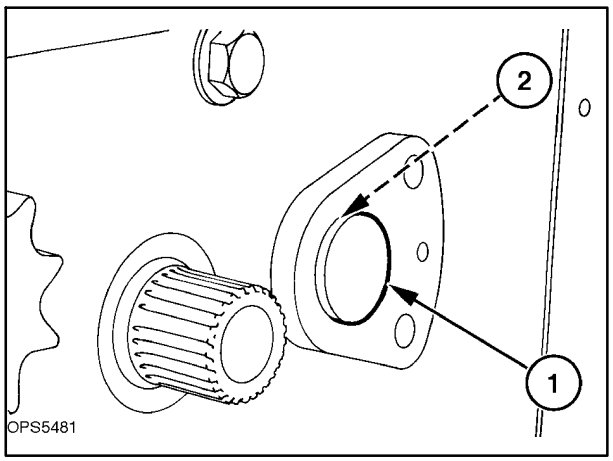

Figure 4-85

4. Install the inside brake disc, 1, onto splined motor coupler shaft.
5. Put a bead of silicone sealer around the caliper retaining bolts and insert in support.
6. Slide the spacers, 2, and center of caliper, 3, over bolts.

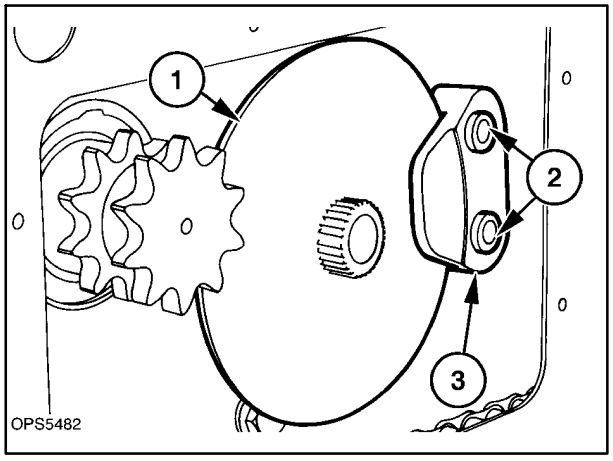

Figure 4-86

7. Install outer brake disc, 1, on motor shaft.
8. Thread caliper retaining bolts into outer section of caliper, 2, and tighten to 70 N·m (52 ft. lbs.). Check the center section of the caliper, 3, to make sure it is free to move.

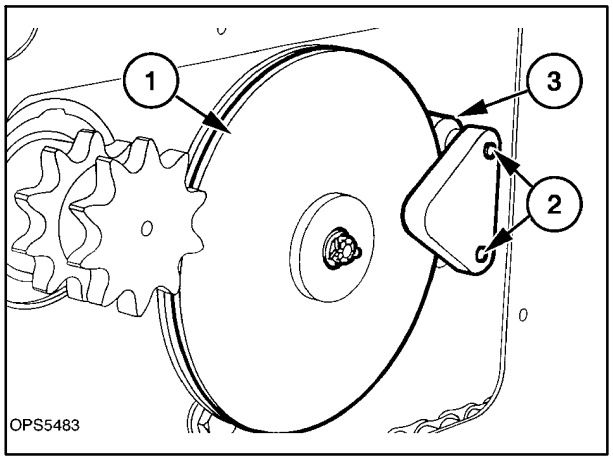

Figure 4-87

9. Put a bead of sealer on end of motor coupler and install the brake disc retaining bolt and large flat washer, 1. Tighten to 35 N·m (26 ft. lbs.).

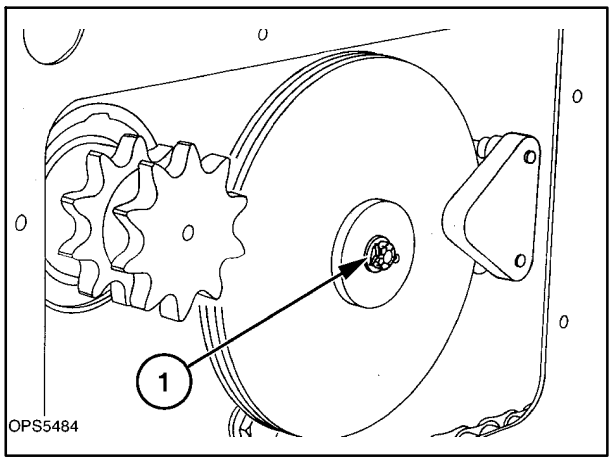

Figure 4-88

10. Thread the shaft, 1, into the support, 2, to remove all play in brake caliper and disc.
11. Rotate and position the control arm, 3, so the spring link can be reconnected at 4.
    a. Then slide the control arm onto the shaft.
    b. Position the control arm on the shaft for clearance between arm and other components when the brake is engaged and disengaged.
    c. Tighten the retaining screw, 5, in the control arm.
    d. Install cotter pin in spring link at 4.

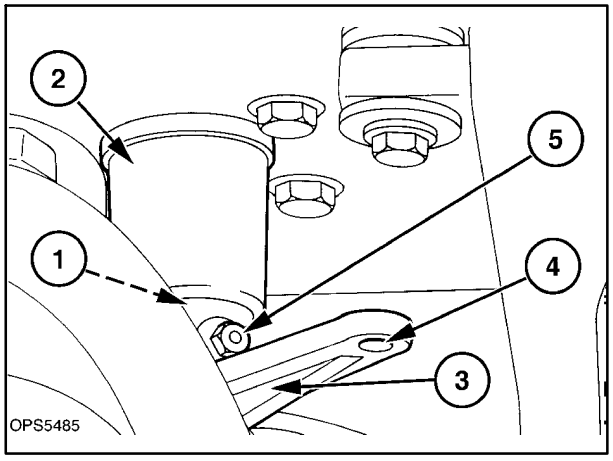

Figure 4-89

12. Reinstall the drive chain over the drive sprocket at 1.

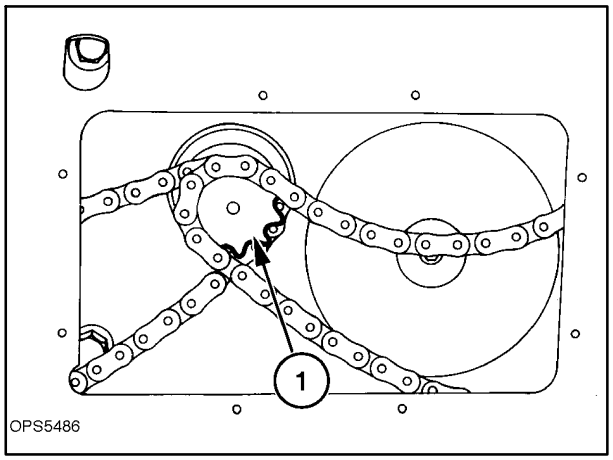

Figure 4-90

13. Install the rear axle assembly. Slide the axle assembly to the rear and tighten the drive chain to obtain a movement of 0 - 1/4″ movement at the outer tire tread.

    Tighten the retaining bolts, 1, to 190 N·m (140 ft. lbs.).

14. Reseal and install the final drive cover, 3.

15. Check the final drive case oil level and add as required, 4.

16. Reinstall fender, 5, and all other shields removed for the repair.

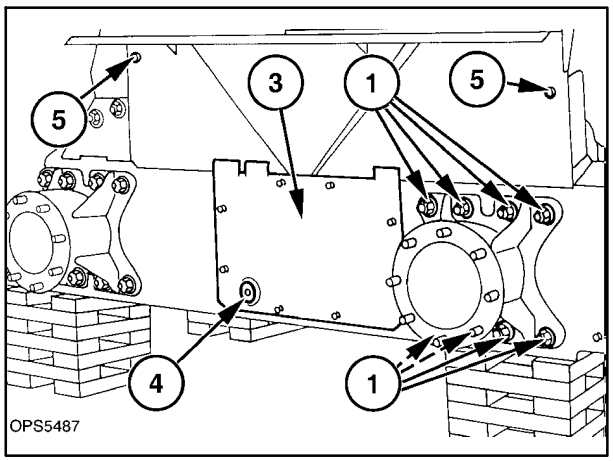

Figure 4-91

Parking Brake and Linkage Adjustment

When the parking brake is properly adjusted and engaged it will hold a powered loader.

Spring Adjustment

Parking brake in the disengaged position.

1. Measure the spring length from the top to the bottom of the spring retainer at 1.
2. Adjust the nuts, 2, equally on each end of the spring to obtain a spring length of 152 mm (6″).

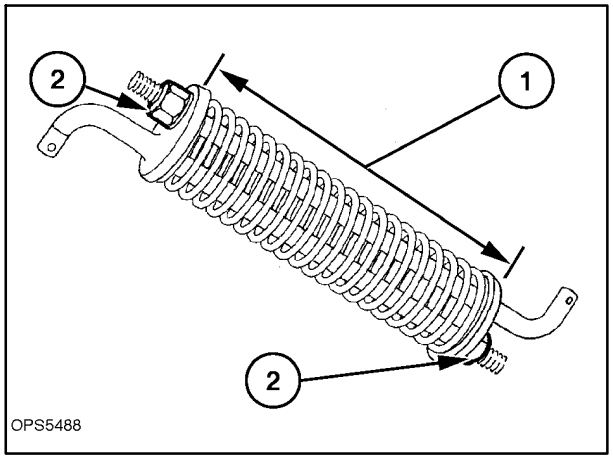

Figure 4-92

Caliper Adjustment

Parking brake in the disengaged position.

1. Unhook the lower pin of the spring assembly, 1, from the control arm at 3.
2. Push the arm, 2, down to turn the shaft into the caliper support to remove any play in caliper and disc.
3. Loosen the setscrew in arm at 4, and slide arm off the shaft.
4. Rotate the arm up so the spring can be rehooked and slide the arm on the corresponding shaft splines.
5. Position the control arm on the shaft for clearance between arm and other components when the brake is engaged and disengaged.
6. Tighten the retaining screw in the control arm.
7. Connect the spring to the arm and install cotter pin in spring link at 3.

   NOTE: The parking brake control lever must be in the lower (disengaged position) for parking brake adjustment.

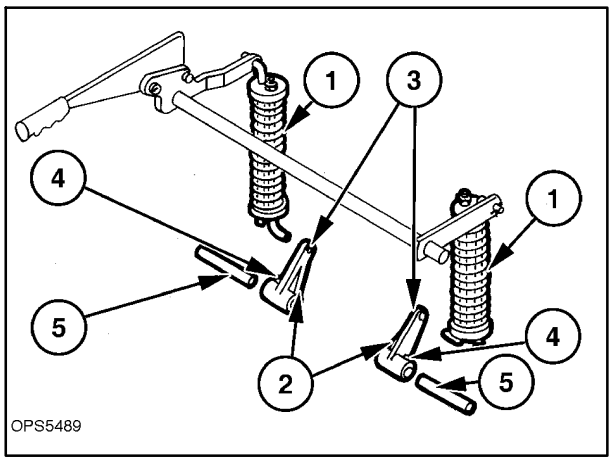

Figure 4-93

GEARBOXES

GEARBOXES REMOVAL AND INSPECTION

The hydrostatic motor is connected to the gearbox and the gears in the gearbox transmit power to the final drive chains.

The boom and cab may be tilted forward for gearbox access. Refer to Section 1 of this manual for the “Tilting the Cab and Boom Procedure.”

Gearbox Removal Without Tilting the Cab

The seat will need to be raised, step shield and hydrostatic control lever assemblies removed. The axle housing assemblies will require loosening and the final drive case cover will need to be removed to access the gearboxes.

1. Lower the boom and attachment to the ground.
2. If the work is going to be done with the boom in the raised position, remove the attachment and raise the boom and rest on the boom lock pins, 1.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

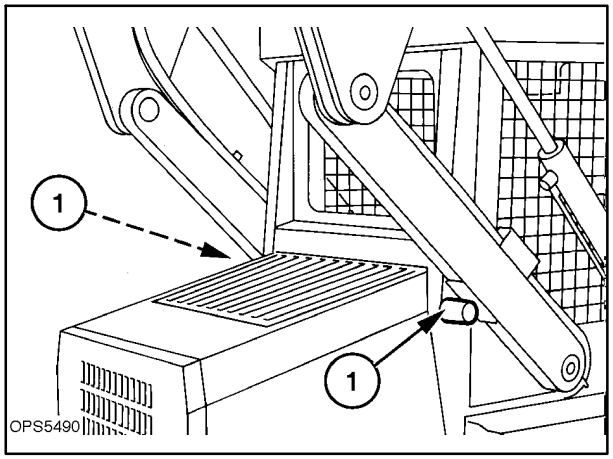

Figure 4-94

3. Securely block the skid-steer loader with all four wheels off the ground. Refer to Section 1 for more detailed information on properly supporting the skid-steer loader. Support the loader at the front of the final drive cases at 1, and at the rear at 2.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

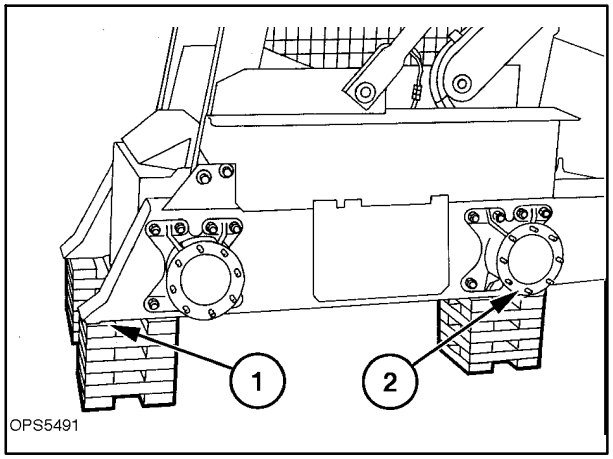

Figure 4-95

4. Slide the seat to the rearmost position, unlatch the seat pan, and raise the seat and pan assembly to the raised latched position, 1.

CAUTION: BEFORE WORKING UNDER A RAISED SEAT MAKE SURE IT IS SECURELY LATCHED IN THE RAISED POSITION.

5. Remove the step shield, 2.

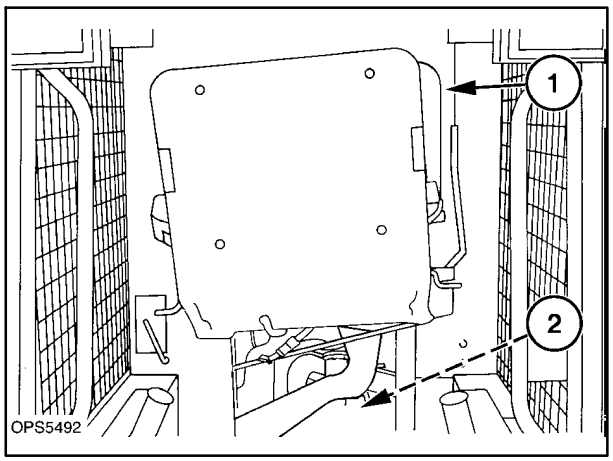

Figure 4-96

6. Remove the hydrostatic control lever assemblies, 1, to access the gearboxes.
   a. Remove the linkage at 2.
   b. Unhook electrical wires, horn, high flow switch, etc.
   c. Unhook control linkage to the auxiliary or boom and bucket control at 3.
   d. Remove the support retaining hardware, 4, and lift the control lever assemblies from the loader.

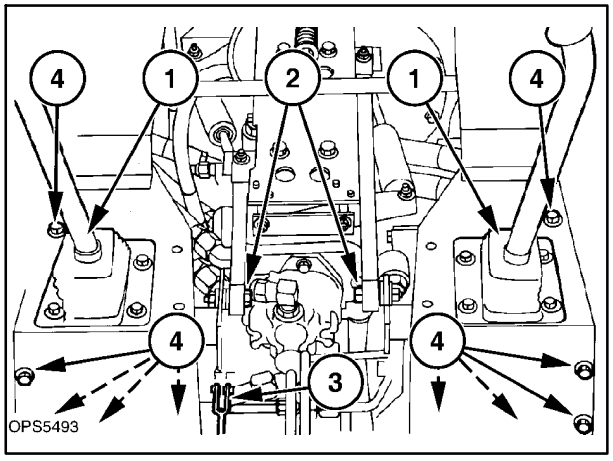

Figure 4-97

7. Remove the tires and wheels from the final drive being serviced.
8. Clean the axle and final drive area to prevent debris from entering the final drive case.
9. Loosen the axle retaining hardware, 1, and remove the axles.
10. Remove the fender and retaining bolts, 2.
11. Remove final drive inspection cover, 3.

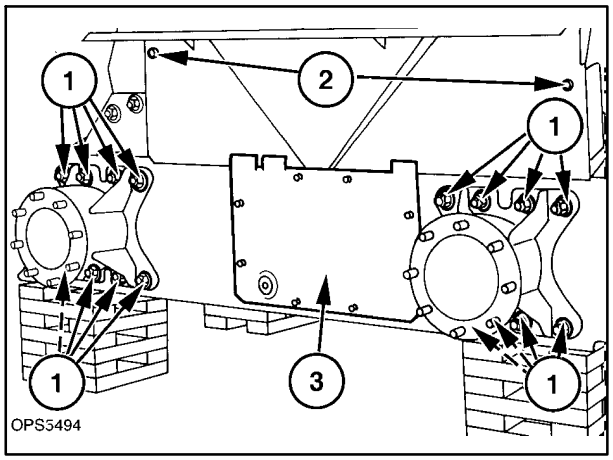

Figure 4-98

12. Remove the drive chains from the double drive sprocket, 1.
13. Parking brake engaged, remove the brake disc retaining bolt and washer, 2.
14. Release the parking brake.
15. Loosen the caliper retaining hardware, 3, from the inside of the cab. Thread the two bolts from the outside caliper assembly, 4. DO NOT remove bolts from caliper support at this time.
16. Remove the outside disc, 5.

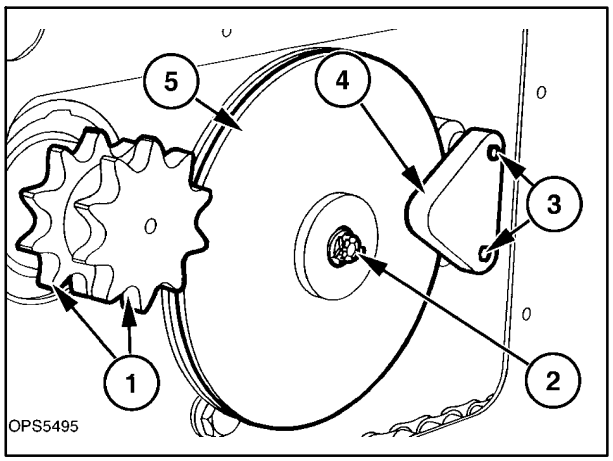

Figure 4-99

17. Remove center section of caliper, 1, spacers, 2, and now remove the retaining bolts.
18. Remove inside disc, 3.

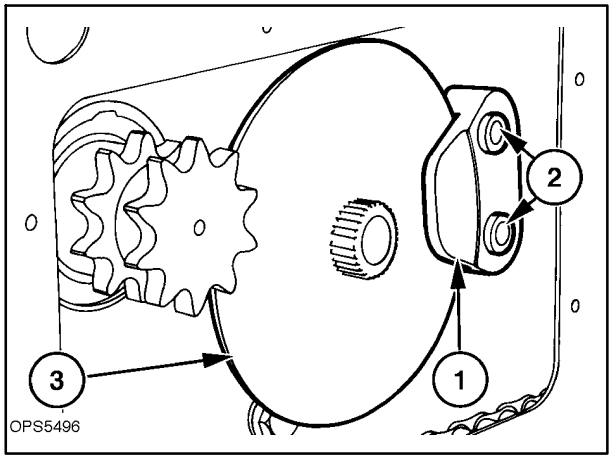

Figure 4-100

19. Remove brake friction puck, 1, and spacer plate, 2.

    NOTE: The spacer plate is thinner than the friction puck and must be inserted into brake caliper first upon reassembly.

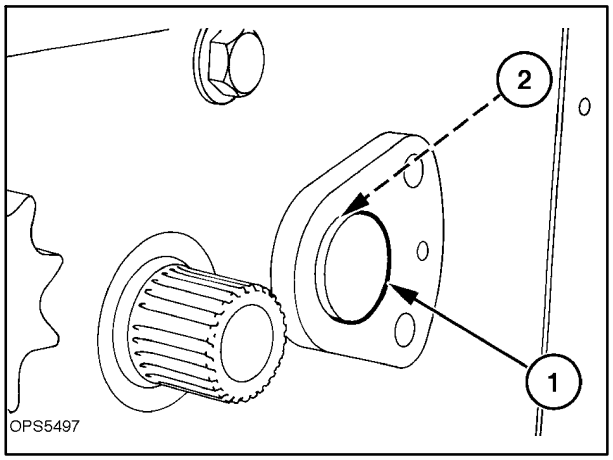

Figure 4-101

20. Remove the hydrostatic motor retaining hardware, 1.

    NOTE: For clearance, the high pressure lines may require removal. If lines are removed, cap lines and fittings to prevent loss of oil and contamination of the hydrostatic system.

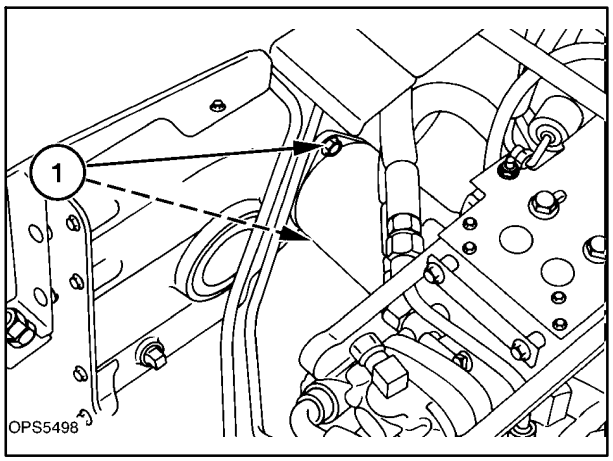

Figure 4-102

21. Install a flat bearing puller in the groove in the motor coupler at 1. Install a bolt in the end of the motor shaft at 2. Attach another puller to the flat puller and push the hydrostatic motor loose from the coupler. Remove the motor from the gearbox.

    NOTE: The motor shaft and the coupler have tapered splines.

    IMPORTANT: DO NOT drive on the motor shaft with a hammer to remove the motor from the coupler or internal damage to the motor may occur.

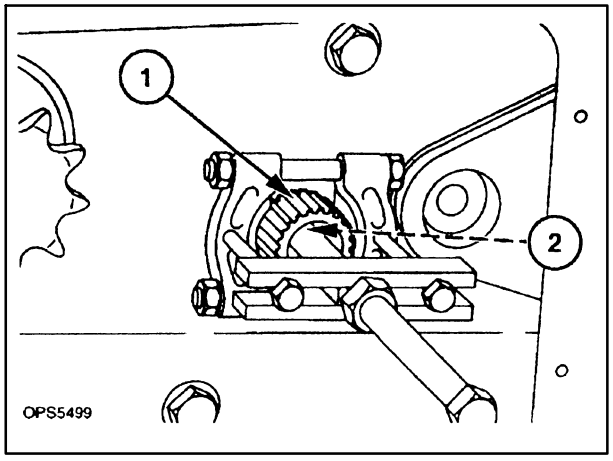

Figure 4-103

22. Remove the gearbox mounting hardware, 1; this will allow the gearbox oil to drain into the final drive case. Remove the remaining bolts, 2, from the final drive case and gearbox.

23. With a suitable hoist, lift the gearbox from the loader.

CAUTION: THE GEARBOX IS HEAVY AND A SUITABLE HOIST/LIFT SHOULD BE USED.

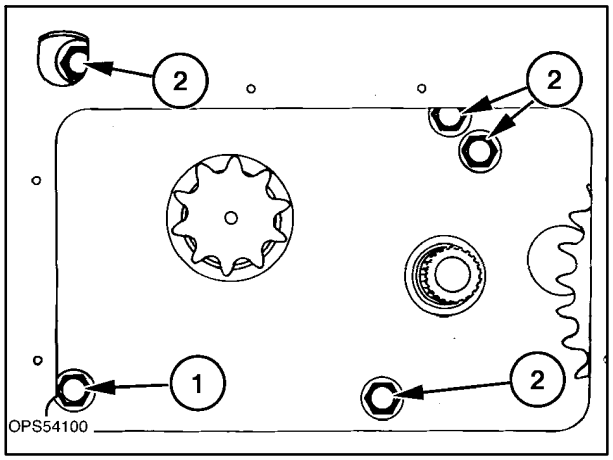

Figure 4-104

GEARBOX DISASSEMBLY

1. Thoroughly clean the gearbox.
2. Remove the cover, 1.
3. Remove the shaft cover, 2, by prying it from the gearbox housing.
4. Remove the gearbox breather, 3.

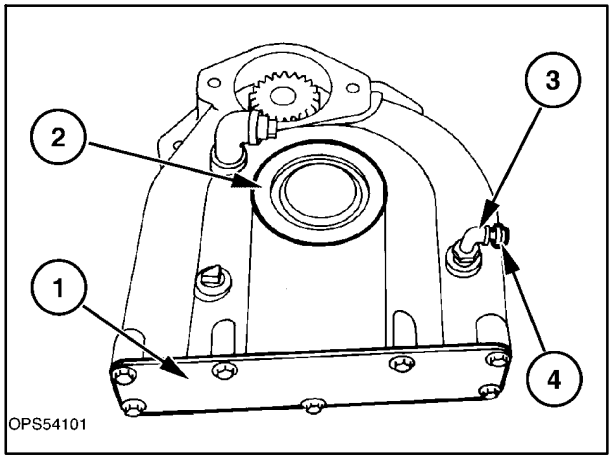

Figure 4-105

5. Remove the external snap ring, 1.

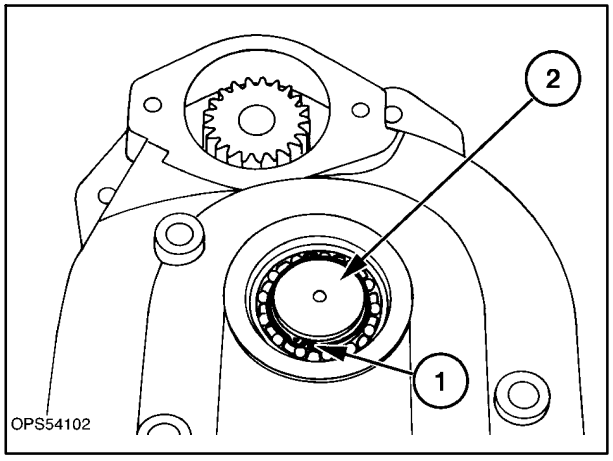

Figure 4-106

6. Place the gearbox in a press, support the gearbox housing next to the sprocket and shaft assembly at 1 as close as possible and press the shaft assembly, 2, from the snap ring side of gearbox and shaft, 2, Figure 4-106.

   The shaft sprocket and sealed bearing, 3, will come from the gearbox as an assembly.
7. Remove the two bearings from the housing.
8. Remove the spacer.
9. Remove the large gear, 4, from the housing.
10. Remove the small gear and shaft assembly from the gearbox.

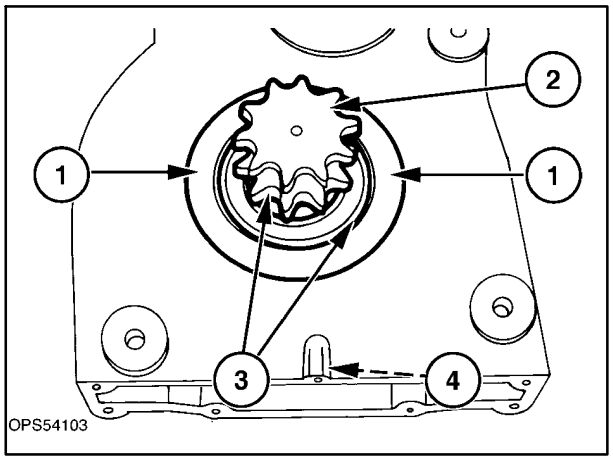

Figure 4-107

11. Remove the external snap ring, 1, from the shaft. With a bearing separator puller, remove the small sealed bearing, 2, from the shaft.

12. With a bearing separator puller, remove the large sealed bearing, 3, from the shaft and sprocket assembly.

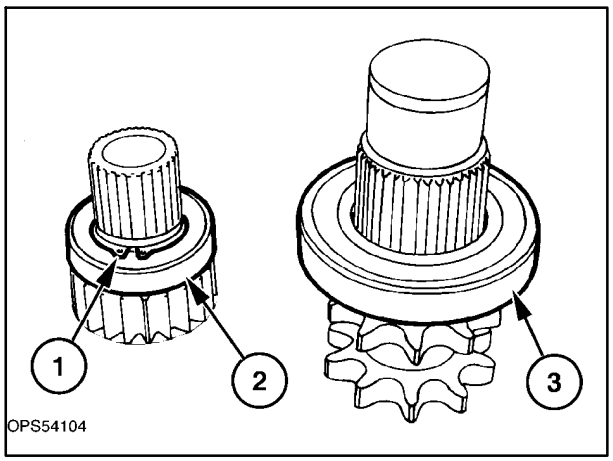

Figure 4-108

Gearbox And Related Parts

Ref.	Description
1	Gearbox housing
2	Small gear and shaft
3	Small sealed bearing
4	Retaining ring
5	Drive sprocket and shaft assembly
6	Large sealed bearing
7	Spacer
8	Bearing (no seals)
9	Retaining ring
10	Cover
11	Breather
12	Gear
13	Cover
14	Fill and check plug

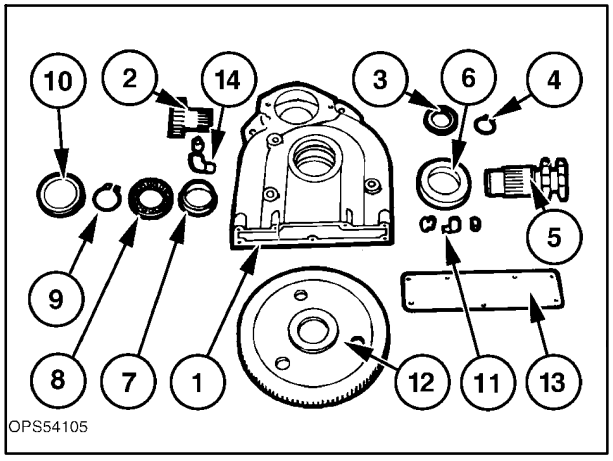

Figure 4-109

Gearbox Parts Inspection

1. Thoroughly clean all parts of old sealant, oil, etc., before inspection.
2. Examine the shaft bearing surfaces for wear.
3. Check the shaft splines for wear.
4. Check the operation of the gearbox breather.
5. Check the gearbox housing for any cracks, etc., as a result of pressing shaft out.

6. Inspect the gearbox housing bearing areas for severe wear.

   NOTE: The bearings, 1, are a hand press fit into the housing, not an interference fit.

7. Examine the mounting bolt threads for damage to prevent secure gearbox retention.

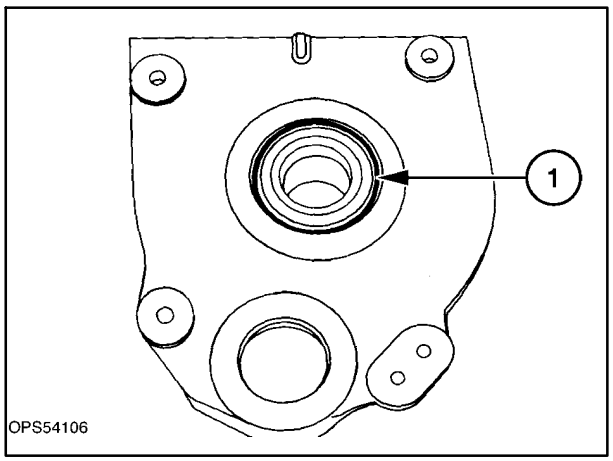

Figure 4-110

Gearbox Reassembly

1. Press the small sealed bearing, 1, onto shaft and gear assembly.
2. Install external snap ring, 2, making sure it is seated properly in groove.
3. Press the large sealed bearing, 3, onto sprocket and shaft assembly.

   NOTE: The bearings are sealed on both sides, so bearings can be installed with either side up.

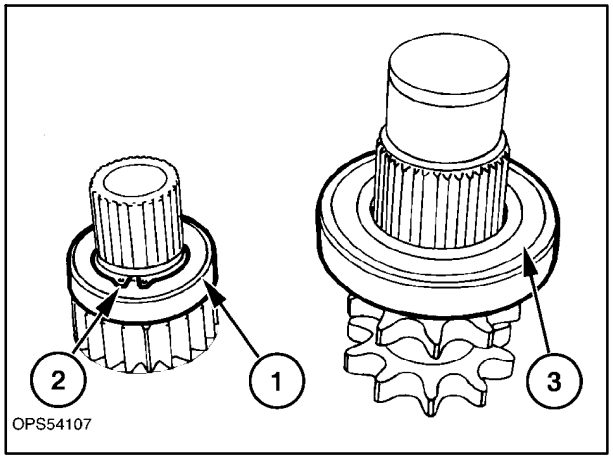

Figure 4-111

4. Place the motor coupler shaft and gear assembly, 1, into housing.

   Thoroughly clean the bearing surface, 2, and outer surface of the large sealed bearing with Loctite cleaner.

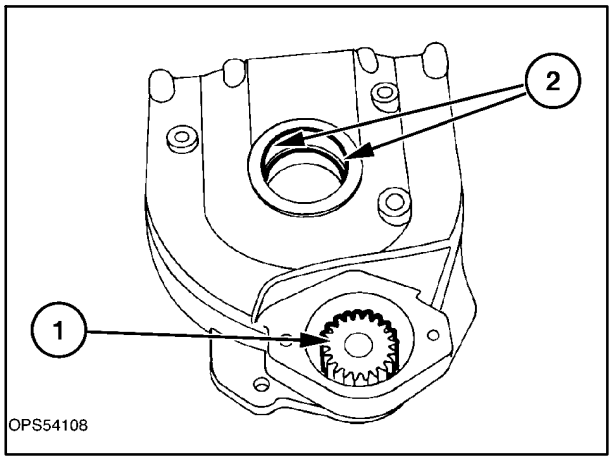

Figure 4-112

5. Insert the large gear, 1, into the gearbox; note the gear will fit only one way.
6. Put a bead of medium-strength Loctite around the outer surface of the bearing at 1, between the bearing race and gearbox surface, 2, Figure 4-112.
7. Slide the sprocket, shaft and bearing assembly, 3, into the gearbox, aligning shaft splines with gear splines.

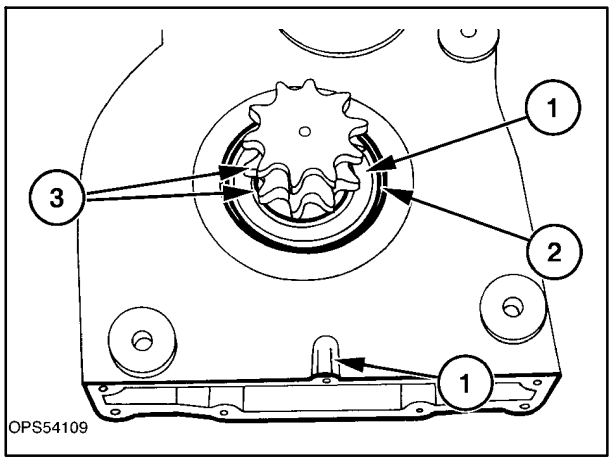

Figure 4-113

8. Place the shaft spacer, 1, recess side towards the gear. Place the spacer over the end of the splines on the shaft. The tapered side of the spacer, 2, should be to the outside of the gearbox housing.

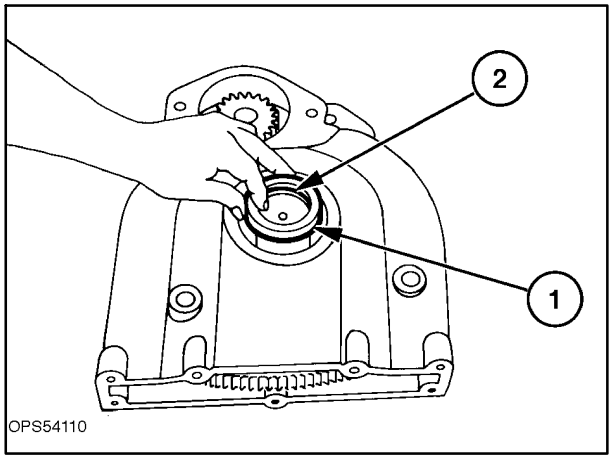

Figure 4-114

9. Place the unsealed bearing, 1, over the end of the shaft.
10. Install the large external snap ring, 2, in groove on shaft, making sure it is properly seated into the groove.

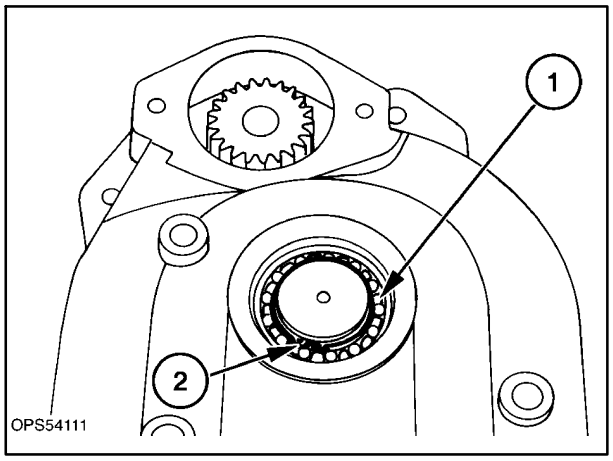

Figure 4-115

11. Put a bead of noncorrosive silicone sealer around the outer lip of the shaft cover, 2, and place the cover in the gearbox on the unsealed bearing side of the gearbox. Tap the cover with a hammer to seat in the gearbox.

12. Put a bead of noncorrosive silicone sealer around the end of the gearbox and install the cover, 1. Tighten hardware to 20 N·m (15 ft. lbs.).

13. Reinstall the gearbox breather, 3, if removed.

    NOTE: The breather, 4, must be a breather with a spring-loaded center pin, part #572820.

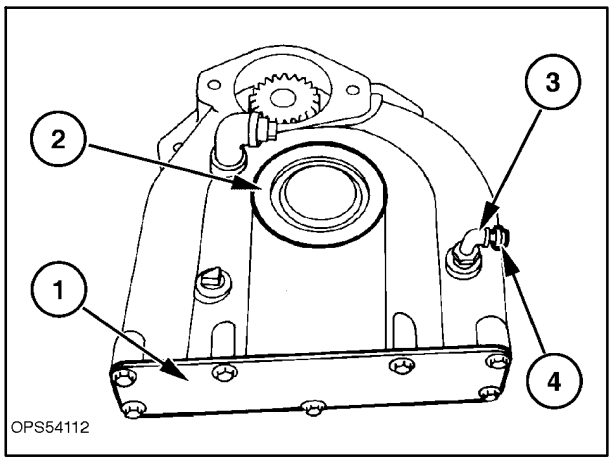

Figure 4-116

Gearbox Installation:

1. Clean the mating surfaces of the final drive case and hydrostatic motor. Clean the oil, etc., from the final drive case.

2. Put a bead of noncorrosive silicone sealer around the bearings at 1 and the mounting holes, 2.

3. Using a hoist, place the gearbox assembly back into the loader.

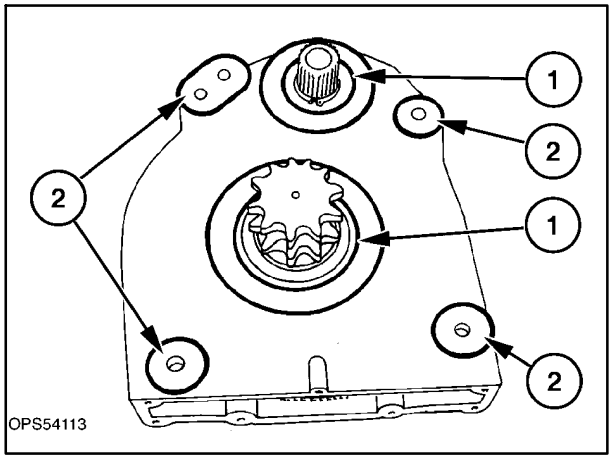

Figure 4-117

4. Position the gearbox against the final drive case, put a bead of noncorrosive silicone sealer around the heads and the threads of the retaining bolts, 1. Install the retaining bolts and torque to 170 N·m (125 ft. lbs.).

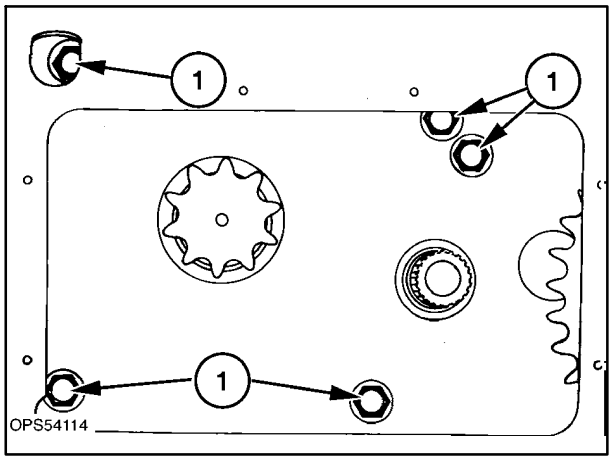

Figure 4-118

5. Put a bead of noncorrosive silicone sealer around the flange of the hydrostatic motor. Align the motor splines with coupler splines and place motor shaft into coupler. Install the motor retaining bolts, 1, and torque to 85 N·m (63 ft. lbs.).

   IMPORTANT: DO NOT force the hydrostatic motor shaft into the coupler. If the splines are not aligned, damage to the motor housing may occur.

6. Reconnect the high pressure lines, if removed.

7. Fill the gearboxes with 80/90 gear oil to the proper level at check plug, 2.

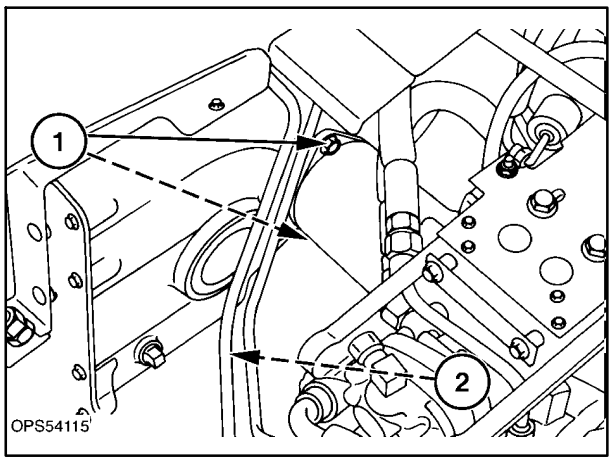

Figure 4-119

8. Reinstall the hydrostatic control assemblies, 1, and connect all linkages, 2 and 3, and electrical connections removed. Tighten the support retaining hardware, 4, securely.

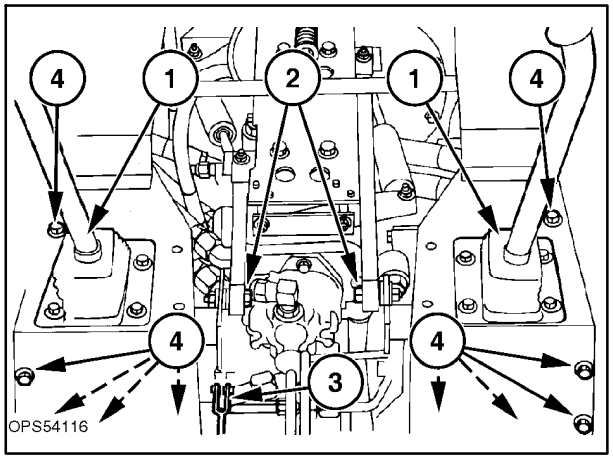

Figure 4-120

Reassemble the Parking Brake

9. Install the spacer plate, 2, next to the end of shaft, then the brake friction puck, 1.

   NOTE: The friction puck must be the steel design.

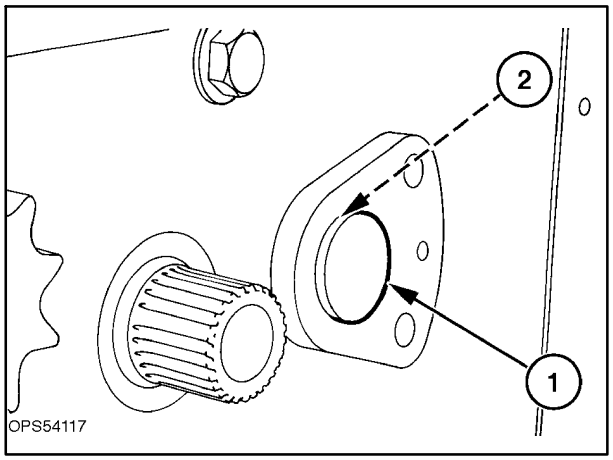

Figure 4-121

10. Install the inside brake disc, 1, onto splined motor coupler shaft.
11. Put a bead of silicone sealer around the caliper retaining bolts and insert in support.
12. Slide the spacers, 2, and center of caliper, 3, over bolts.

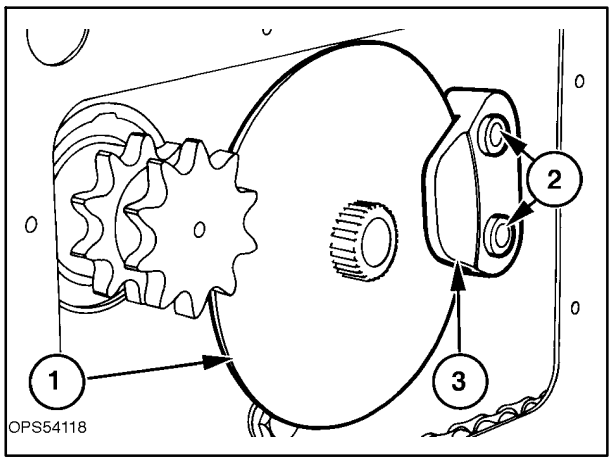

Figure 4-122

13. Install outer brake disc, 5, on motor shaft.
14. Thread caliper retaining bolts, 3, into outer section, 4, of caliper and tighten to 70 N·m (52 ft. lbs.). Check the center section of the caliper to insure it is free to move.
15. Put a bead of sealer on end of motor coupler. Install the brake disc retaining bolt and large flat washer at 2. Tighten to 35 N·m (26 ft. lbs.).
16. Reinstall the drive chains over the drive sprocket, 1.

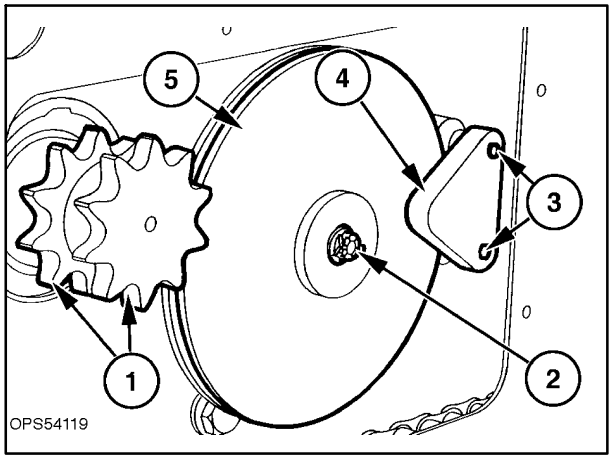

Figure 4-123

17. Install the final drive axles. Slide each axle assembly to tighten the drive chain to obtain a movement of 0 - 6 mm (0 - 1/4″) movement at the outer tire tread.

    Tighten the retaining bolts, 1, to 190 N·m (140 ft. lbs.).
18. Reseal and install the final drive cover, 2.
19. Check the final drive case oil level at 3, and add as required.
20. Reinstall all shields (step, fenders, tires, etc.) removed for the repair.
21. Remove the loader from the blocking.

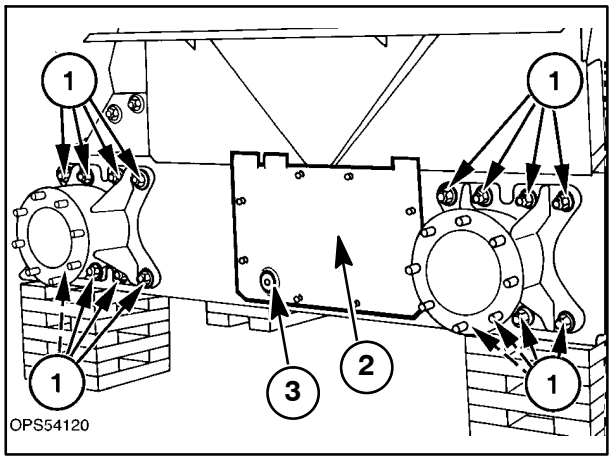

Figure 4-124

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time the job actually takes to complete each job.

Job Description	Hours
Axle	
Remove and replace	0.5 hr.
Rebuild	1.0 hr.
Brake	
Handle - remove, rebuild, replace	1.0 hr.
Spring - remove, rebuild, replace	0.5 hr.
Disc - remove and replace	1.0 hr.
Caliper - remove and replace	1.5 hrs.
Friction Disc (puck) - remove and replace	1.0 hr.
Adjust parking brake	0.5 hr.
Final Drive	
Drive chain, sprocket (front) - replace	1.5 hrs.
Drive chain, sprocket (rear) - replace	3.0 hrs.
Gearbox	
Remove and replace	2.0 hrs.
Rebuild	1.5 hrs.

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SECTION 5

HYDROSTATIC SYSTEM AND STEERING SYSTEM

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GENERAL INFORMATION

The hydrostatic system provides a means to transfer power from the engine to the final drive for the wheels. It provides infinitely variable speed forward and reverse and steering of the skid-steer loader.

The hydrostatic pumps receive power from the engine through a flex plate drive. The pumps transfer hydraulic power to the motors and then through gearboxes to the final drives, axles, and wheels.

The hydrostatic pumps are controlled separately from each other and power each side independently.

OPERATION

The hydrostatic system is a closed loop fluid power system that provides smooth transition of power from the engine to the wheels. The hydrostatic system is made up of two piston pumps, 1, and two piston motors, 2. The hydrostatic charge system is a back pressure valve in the hydraulic system return line located in the engine compartment. This provides replenishing oil for the oil that is lost due to leakage for lubrication and cooling purposes.

Steering is controlled by two hand levers, 3, located in the operators cab. These hand levers control direction forward and reverse and amount of oil flow for speed of the skid-steer loader by rotation of the pump cam plates in the individual pumps. The further the control levers are pushed from neutral the greater the cam plate angle. More oil is pumped to the motors increasing the wheel speed. The greatest wheel torque is when the control levers are closer to neutral. When operating the skid-steer loader, more power (torque) is available by destroking the control levers, thus increasing the loader efficiency.

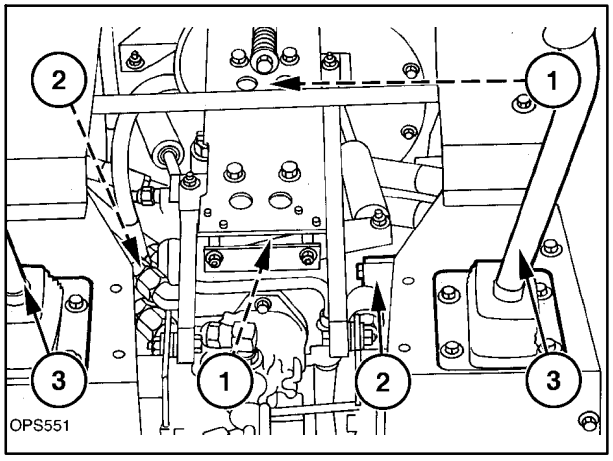

Figure 5-1

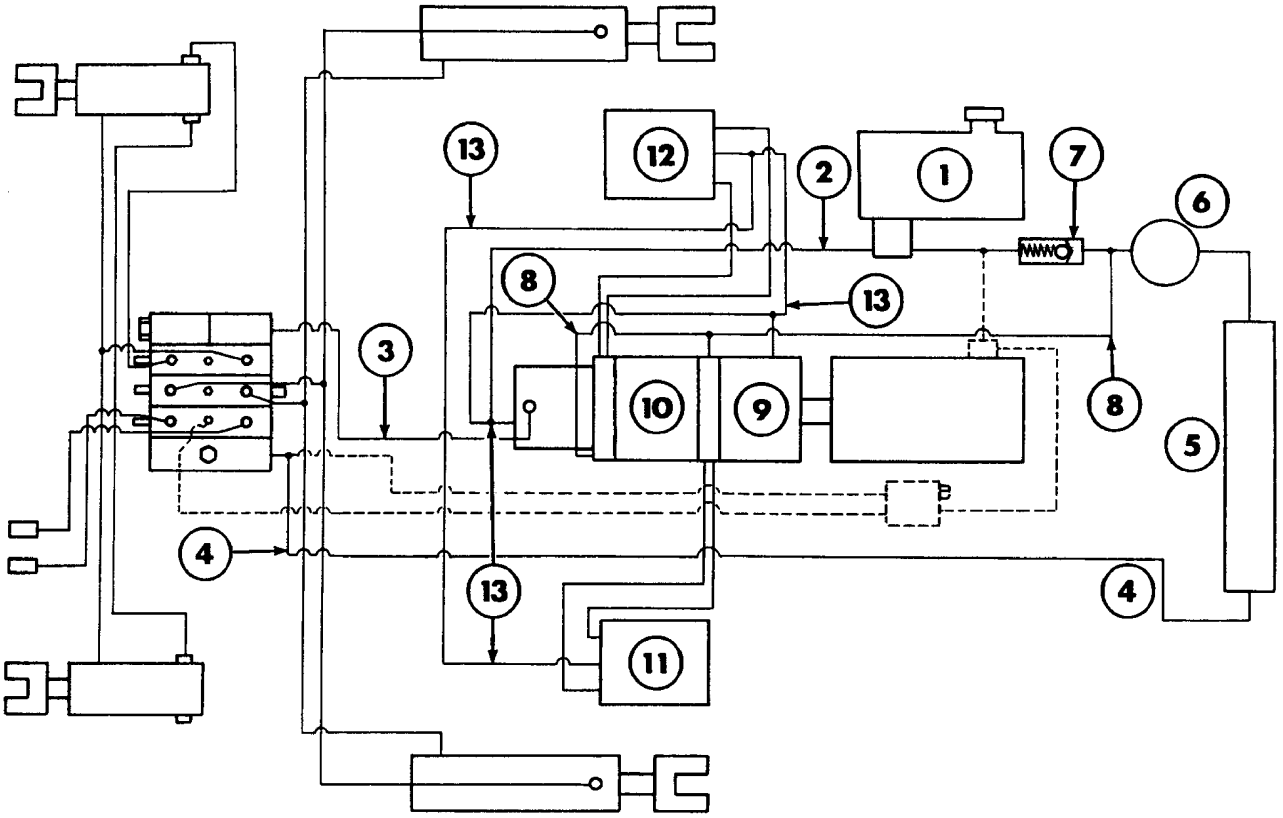

Figure 5-2

The hydrostatic system consists of the following components:

1 Hydraulic reservoir - Right front of engine compartment

2 Suction line - From reservoir to the gear pump under the operator's seat.

3 Pressure line - From the gear pump to the control valve under the operator's seat.

4 Return line - From control valve to oil cooler.

5 Oil cooler - Engine side of radiator in engine compartment.

6 Oil filter - After the oil cooler engine compartment rear door.

7 Charge check valve - In return line between oil filter and reservoir.

8 Hydrostatic transmission charge line - From the charge check valve to the hydrostatic pumps under the operator's seat.

9 Hydrostatic pump for left drive - Under operator's seat.

10 Hydrostatic pump for right drive - Under operator's seat.

11 Hydrostatic motor for left drive - Under operator's seat.

12 Hydrostatic motor for right drive - Under operator's seat.

13 Hydrostatic system case drain line - From pumps and motors to the suction line fitting at gear pump under operator's seat.

SPECIFICATIONS

HYDROSTATIC PUMPS

Type	Variable Displacement Piston Pump
Displacement	82.3 L/min (21.47 GPM) @ 2000 RPM
Pressure Relief Setting	238 bar (3500 PSI)
Minimum Pump Efficiency	80%
Maximum Pump Case Drain	5.7 L/min (1.5 GPM) per pump
Maximum Pump Case Pressure	1.7 bar (25 PSI)

HYDROSTATIC MOTORS

Type	High Torque Axial Piston Motors
Minimum Motor Efficiency	80%
Maximum Motor Case Drain	5.7 L/min (1.5 GPM) per motor
Maximum Motor Case Pressure	1.7 bar (25 PSI)

CHARGE PRESSURE SYSTEM

Back Pressure Valve Setting	7.5 bar (110 PSI)

OIL REQUIREMENTS

Type and Specification	SAE 10W-30

TORQUE SPECIFICATIONS

Pump Seal Cover Screws	5 N·m (48 in. lbs.)
Pump Relief Valve Caps	135 N·m (100 ft. lbs.)
Pump Valve Plate Cap Screws	39 N·m (29 ft. lbs.)
Pump to Pump Cap Screws	77 N·m (57 ft. lbs.)
Motor Mounting Cap Screws	101 N·m (75 ft. lbs.)
Motor Valve Plate Cap Screws	23 N·m (17 ft. lbs.)
Flywheel Cover Plate	61 N·m (45 ft. lbs.)

OTHER MATERIALS

Sealing Material	NH Ultra Blue silicone sealer NH #L81724 - 3.35 oz. tube (cord) NH #L82519DS - 8 oz. tube NH #L58775 - 10.2 oz. cartridge
Hydraulic Oil	SAE10W-30 motor oil-API Service SG-CE NH #9613313 - 1 qt. NH #9613314 - 2 1/2 gal. NH #9613358 - 1 L NH #9613360 - 20 L

NOTE: Always use a noncorrosive silicone sealer to prevent damage to the components being sealed during the silicone curing process.

TROUBLESHOOTING

When performing tests on the hydrostatic system, use the proper test procedures and test equipment.

Before testing, lower the attachment to the ground or remove attachment from the loader.

If testing is to be performed with a raised boom, make sure the boom is raised above and resting on the boom lock pins, attachment removed.

Before opening the hydraulic system, clean the area thoroughly to prevent contaminating the system.

Before opening the hydraulic system, relieve all pressure from the system.

Before testing the hydrostatic system, check the hydraulic oil level.

Before testing the hydrostatic system, the oil must be at normal operating temperature.

If testing requires the skid-steer loader to be raised, use adequate blocking and/or jack stands to securely support the loader.

CAUTION: WHEN CONNECTING TEST EQUIPMENT INTO THE HYDROSTATIC SYSTEM, RELIEVE THE PRESSURE IN THE SYSTEM. STOP THE ENGINE, WITH SEAT BELT FASTENED TURN THE IGNITION SWITCH TO THE "ON" POSITION AND OPERATE ALL HYDRAULIC CONTROL VALVE CIRCUITS TO RELIEVE PRESSURE. TURN THE IGNITION SWITCH TO THE "OFF" POSITION.

WARNING: GAUGES, GAUGE FITTINGS, AND HOSES MUST HAVE OPERATING PRESSURE RATINGS OF AT LEAST 25% HIGHER THAN THE HIGHEST PRESSURES OF THE SYSTEM.

NEVER ADJUST OR REPLACE THE RELIEF VALVES TO GET HIGHER PRESSURES THAN THOSE SPECIFIED BY THE EQUIPMENT MANUFACTURER.

WARNING: FLUID UNDER PRESSURE CAN HAVE SUFFICIENT FORCE TO PENETRATE THE SKIN, CAUSING SERIOUS PERSONAL INJURY. ALWAYS PROTECT THE SKIN AND EYES FROM ESCAPING FLUID UNDER PRESSURE.

BEFORE DISCONNECTING LINES OR FITTINGS, BE SURE TO TURN OFF THE SKID LOADER ENGINE AND RELIEVE ALL PRESSURE. BEFORE APPLYING PRESSURE TO THE SYSTEM, BE SURE ALL CONNECTIONS ARE TIGHT AND THAT LINES, PIPES, AND HOSES ARE NOT DAMAGED.

IF INJURED BY ESCAPING FLUID, OBTAIN MEDICAL ASSISTANCE AT ONCE. SERIOUS INFECTION OR REACTION CAN DEVELOP IF MEDICAL TREATMENT IS NOT ADMINISTERED IMMEDIATELY.

REMOVE ANY ATTACHMENT FROM THE MOUNTING PLATE BEFORE LOOSENING OR DISCONNECTING ANY HYDRAULIC LINES.

CAUTION: USE ADEQUATE BLOCKING AND/OR JACK STANDS TO INSURE THAT THE LOADER IS SAFELY SUPPORTED WITH ALL FOUR WHEELS OFF THE GROUND.

HYDROSTATIC DRIVE SYSTEM

PROBLEM	POSSIBLE CAUSE	CORRECTION
Machine will not move either direction	Parking brake engaged	Release parking brake
	Engine to hydrostatic drive coupler	Check and repair or replace
	Low hydraulic oil	Check oil level
	Low charge pressure	Check charge pressure/repair
	Incorrect oil	Drain and replenish with proper oil
	Air in system	Purge air and repair system
	Water in system	Drain, clean, and replace oil
	Output pressure too low	Check pressure/replace relief valve
	Internal pump or motor damaged	Check pump/motor case drain flow
	Linkages loose or broken	Check and repair
One side moves, other side does not	Relief valve stuck open	Check and repair
	Internal pump or motor damaged	Check pump/motor case drain flow
	Brake engaged on one side	Check parking brake system and repair
	Linkage loose or broken	Check and repair
	Broken drive chain	Check and repair
	Gearbox damaged	Check and repair
Noisy pump or motor	Air in system	Purge air and repair system
	Wrong kind of oil	Drain, clean system and replace oil
	Water in system	Drain, clean, and replace oil
	Internal pump or motor damaged	Check pump/motor case drain flow
	Linkage loose or broken	Check and repair
	Parking brake engaged	Release parking brake
Low power	Low hydraulic oil	Check oil level
	Low charge pressure	Check charge pressure/repair
	Relief valve stuck open	Check and repair
	Air in system	Purge air and repair system
	Output pressure too low	Check pressure replace relief valve
	Internal pump or motor damaged	Check pump/motor case drain flow
Sluggish response to changes in speed	Relief valve stuck open	Check and repair
	Air in system	Purge air and repair system
	Output pressure too low	Check pressure/replace relief valve
	Linkage loose or broken	Check and repair
	Oil to heavy, cold weather	Allow unit to warm up before operating
	Wrong kind of oil	Drain, clean system and replace oil

STEERING LEVER INTERFERENCE

More effort is needed to push/pull the steering levers if there is interference between parts. Check the transmission steering/neutral linkage for clearance:

1. Between steering control arms and top of transmission (cover bolts).
2. Between cams and neutralizer plate.
3. Loose hardware in guides or neutralizer plate not sitting at 90° to bell housing, allowing binding at guide, 3. If the guide plate is not formed at 90°, replace the plate and install new guides at 3. The front guide pin support should also measure 90°, as shown. If not, replace the part.

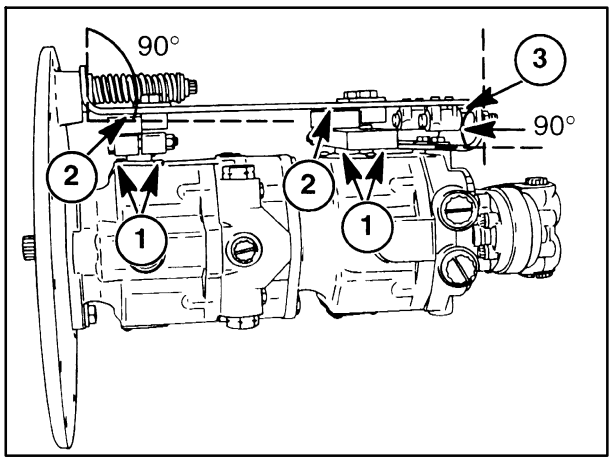

Figure 5-3

Some loaders were built with multiple flat washers between the bolt head and spring bushing at 1.

L565, Lx565, and Lx665 loaders need only one washer for proper operation. Excess washers increases steering efforts and does not affect transmission neutral.

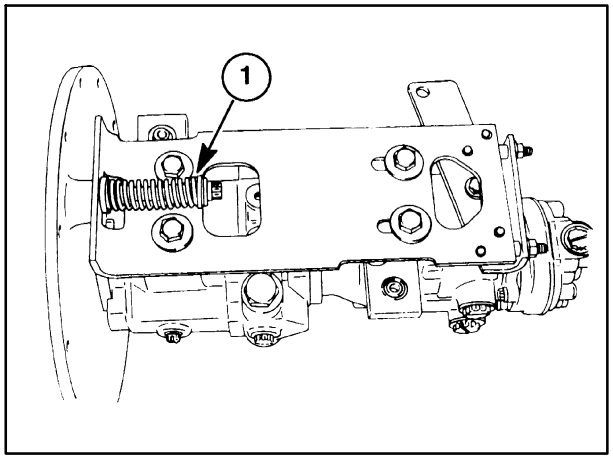

Figure 5-4

HYDROSTATIC DRIVE SYSTEM TESTING

Hand controls - forward and reverse

Pretest instructions:

* Operator in seat
* Seat belt buckled
* Service/Run switch in “RUN” position
* Key switch in the “OFF” position

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Levers should move freely	NO	Check control linkage from levers to the pumps.
		YES	System OK
2	Stroke both levers forward or reverse, the levers should return to neutral position	YES	System OK
		NO	Check neutralizer system for binding or adjustment.
3	Stroke both levers forward or reverse and release one lever, both levers should stay in direction stroked	YES	System OK
		NO	Check neutralizer system for binding or adjustment

Hand controls - forward and reverse

Pretest instructions:

* Operator in seat
* Seat belt buckled
* Service/Run switch in “RUN” position
* Parking brake disengaged
* Key switch in the “RUN” position
* Engine operating at low idle speed

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Control levers in neutral, unit should not move	YES	System OK
		NO	Check and adjust for neutral
2	Stroke both levers forward or reverse, unit should accelerate smoothly	YES	System OK
		NO	Check for loose or damaged control linkage, if OK go to next step.
3			Check hydraulic oil level and add as required, if OK go to next step.
4			Check hydrostatic hoses, tubing, and connections for leaks, if OK go to next step.
5			Check parking brake for being engaged or adjustment, if OK go to next step.
6			Check hydrostatic charge pressure, if OK go to next step.
7			Check forward or reverse relief valve operation and pressure settings.
8	Control levers in neutral park brake engaged, pumps should be quiet	YES	Control System OK
		NO	Check and adjust for neutral, if OK go to next step.
9			Check for loose or damaged control linkage, if OK go to next step.
10	Control levers in full forward, machine should go in straight line	YES	Control System OK
		NO	Reset control lever stops

HYDROSTATIC DRIVE SYSTEM TESTING

Before performing any hydraulic test, operate the skid-steer loader to get the hydraulic oil to operating temperature (about 38°C or 100° F above ambient temperature).

For access to hydrostatic testing, remove any attachment from the loader attaching face plate and support the boom on the lockpins.

1. Raise the boom, extend the boom lockpins, 1, and lower the boom down on the lockpins.

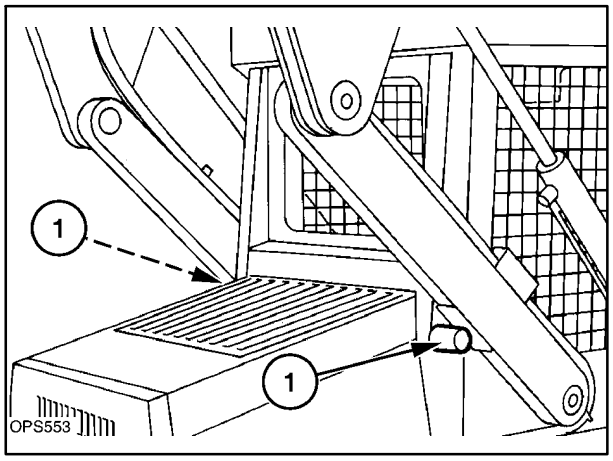

Figure 5-5

2. Stop the engine, turn the ignition key to the run position, and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.
3. Raise and support the skid-steer loader with all four wheels off the ground. Support the front of the loader at 1 to the front of the final drive case and at 2 to the rear of the case.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

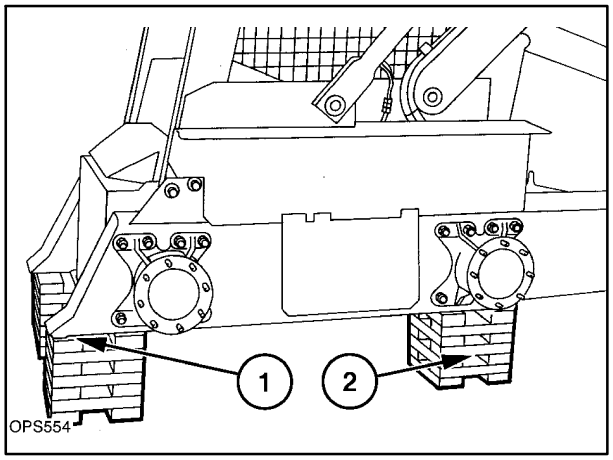

Figure 5-6

4. Put the “SERVICE/RUN” switch, 1, in the “SERVICE” position.

NOTE: The Service/Run Switch may be located under the fuse panel cover at 2.

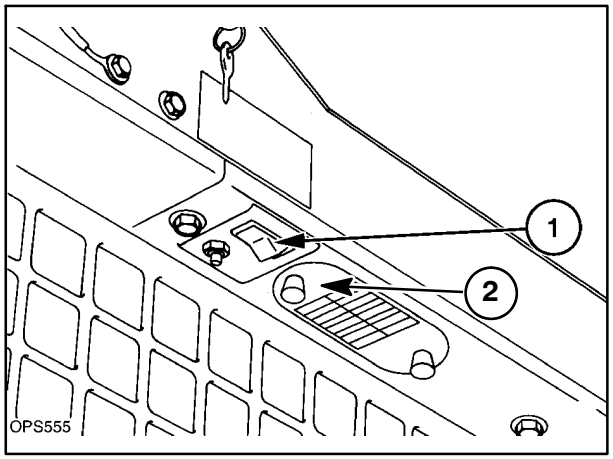

Figure 5-7

NOTE: Late model loaders have a "SERVICE/RUN" toggle switch, 1, under the cab fuse cover, 2, in front of the fuses. The forward switch position is "RUN", and the rearward position is "SERVICE."

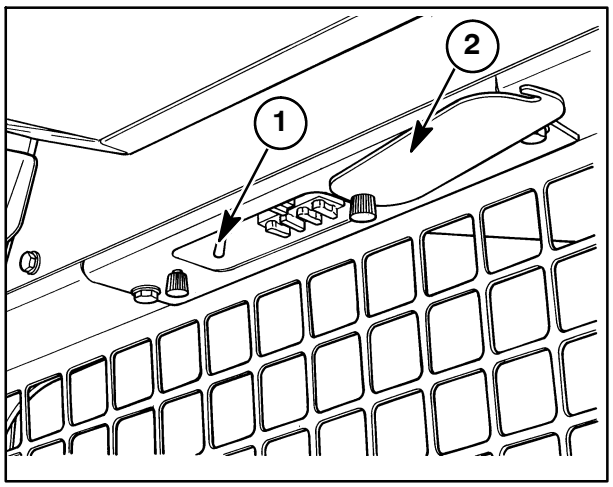

Figure 5-8

5. Raise the operator's seat and latch in the raised position, 1.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

6. Check the hydraulic oil level and add, if required, to proper level.

WARNING: GAUGES, GAUGE FITTINGS, AND HOSES MUST HAVE OPERATING PRESSURE RATINGS OF AT LEAST 25% HIGHER THAN THE HIGHEST PRESSURES OF THE SYSTEM.

NEVER ADJUST OR REPLACE THE RELIEF VALVES TO GET HIGHER PRESSURES THAN THOSE SPECIFIED BY THE EQUIPMENT MANUFACTURER.

WARNING: FLUID UNDER PRESSURE CAN HAVE SUFFICIENT FORCE TO PENETRATE THE SKIN, CAUSING SERIOUS PERSONAL INJURY. ALWAYS PROTECT THE SKIN AND EYES FROM ESCAPING FLUID UNDER PRESSURE.

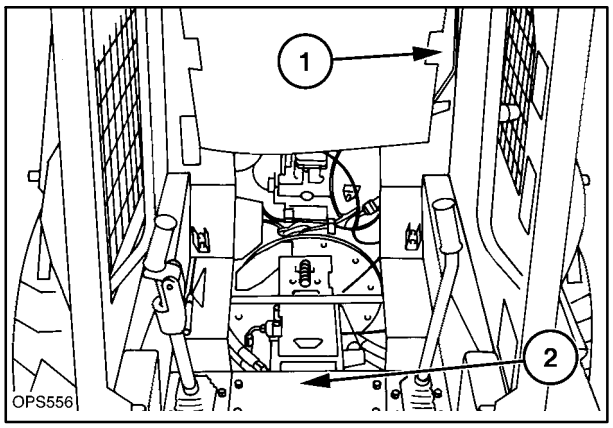

Figure 5-9

BEFORE DISCONNECTING LINES OR FITTINGS, BE SURE TO TURN OFF THE SKID LOADER ENGINE AND RELIEVE ALL PRESSURE. BEFORE APPLYING PRESSURE TO THE SYSTEM, BE SURE ALL CONNECTIONS ARE TIGHT AND THAT LINES, PIPES, AND HOSES ARE NOT DAMAGED.

IF INJURED BY ESCAPING FLUID, OBTAIN MEDICAL ASSISTANCE AT ONCE. SERIOUS INFECTION OR REACTION CAN DEVELOP IF MEDICAL TREATMENT IS NOT ADMINISTERED IMMEDIATELY.

REMOVE ANY ATTACHMENT FROM THE MOUNTING PLATE BEFORE LOOSENING OR DISCONNECTING ANY HYDRAULIC LINES.

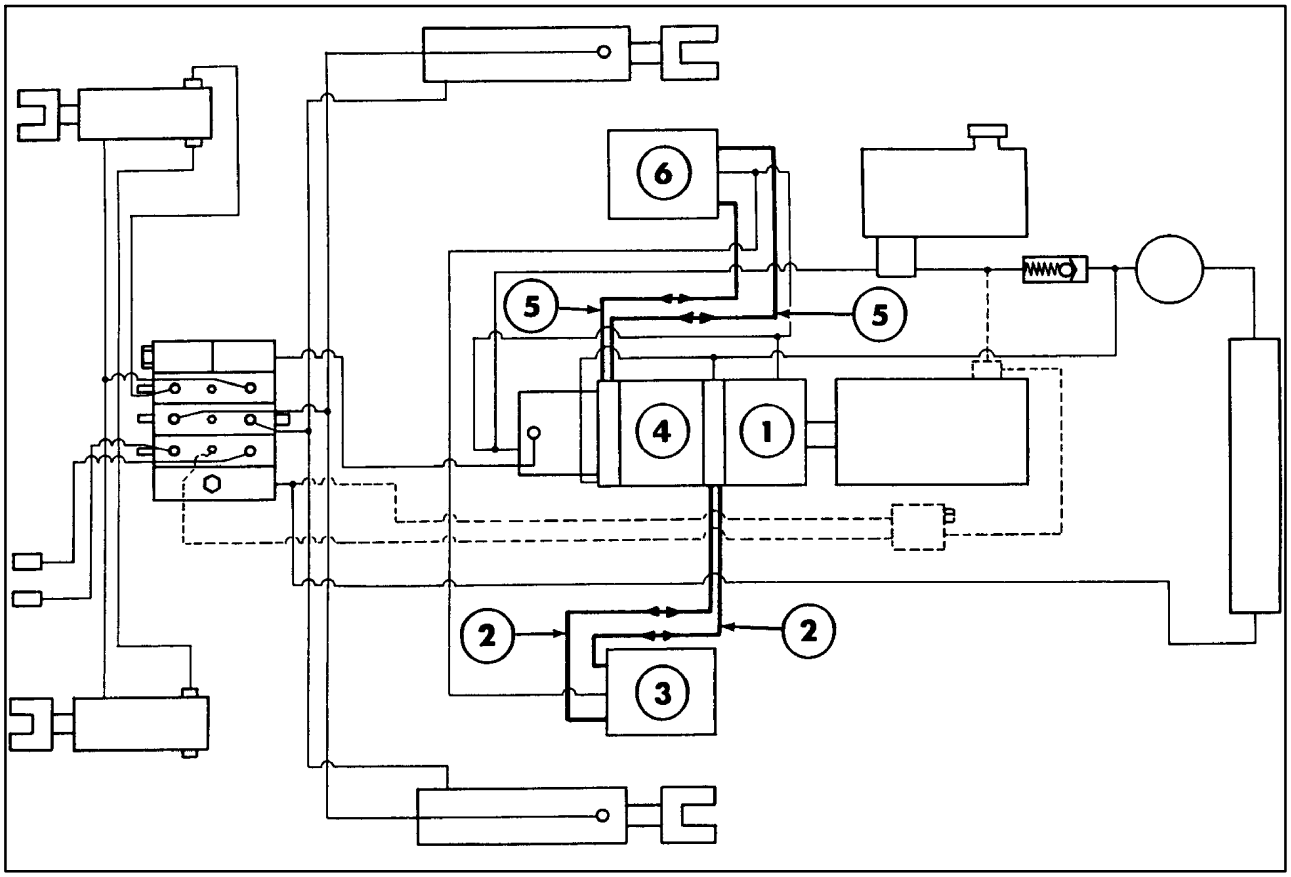

Figure 5-10

HYDROSTATIC SYSTEM OIL FLOW

Hydrostatic Pumps and Motors High-Pressure Flow

The hydrostatic pumps are driven by the engine through a flex plate drive coupler.

The rear hydrostatic pump, 1, supplies high-pressure oil through high-pressure lines, 2, to the left hydrostatic motor, 3, when the left forward/reverse control lever is stroked in either direction.

The front hydrostatic pump, 4, supplies high-pressure oil through high-pressure lines, 5, to the right hydrostatic motor, 6, when the right forward/reverse control lever is stroked in either direction.

The hydrostatic system is protected by four high-pressure relief valves, two each pump, one for forward and one for reverse. All four high-pressure relief valves are the same and factory set at 238 bar (3500 PSI). Do not try changing the pressure setting of these relief valves. If during testing the relief valves are found to be incorrectly set, replace the complete valve cartridge.

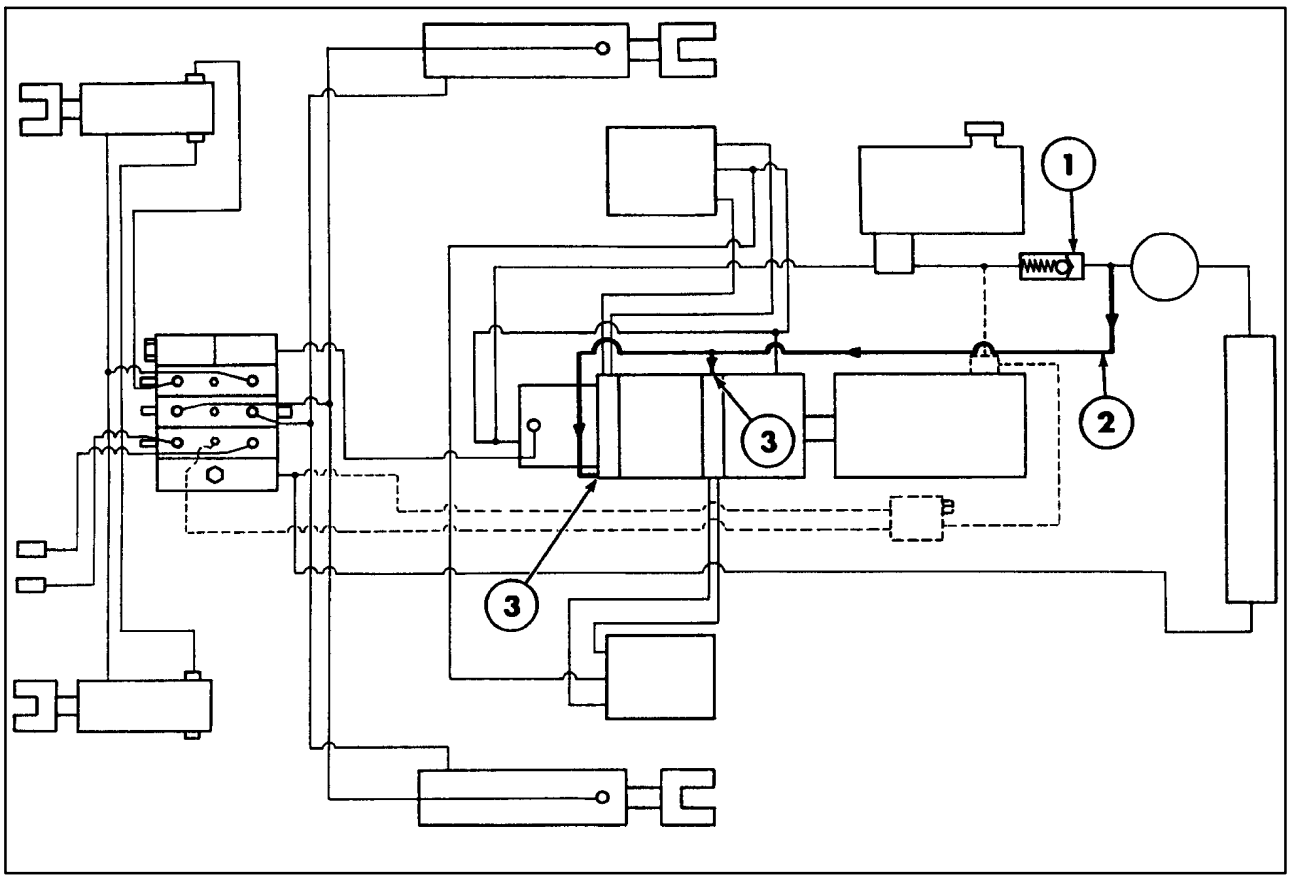

Figure 5-11

Hydrostatic Pump and Motor Charge Pressure Oil Flow

During the operation of the hydrostatic pumps and motors, oil from the high-pressure system is used for lubrication of the internal rotating parts of the pumps and motors. The lubrication oil drains into the pump and motor housings.

A charge check valve in the return line after the filter at 1, builds back pressure in the return circuit and forces oil through the charge line, 2, into the hydrostatic pump back plates at 3. This charge oil provides replacement oil in the high-pressure circuits that was used for lubrication purposes.

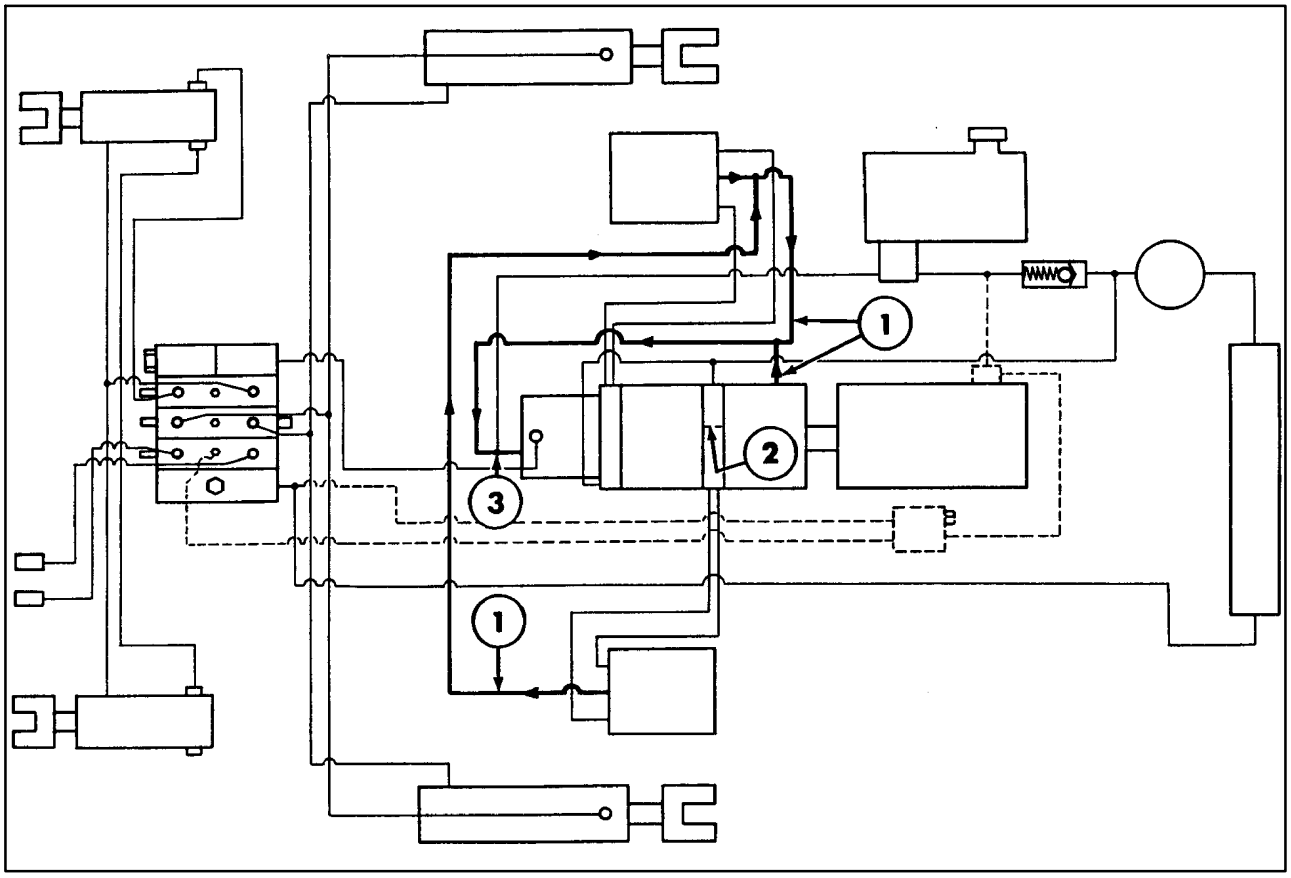

Figure 5-12

Hydrostatic Pump and Motor Case Drain Flow

During operation of the hydrostatic pumps and motors, oil from the high-pressure circuit used for lubrication oil drains into the pump and motor housings.

The lubrication oil will fit the housings approximately half full. This oil then becomes cooling oil and will drain from the pumps and motor housings (cases) through drain lines, 1.

The front hydrostatic pump drains internally to the rear pump at 2. The oil will drain from the rear pump and tees into the drain lines from the motors. The case drain oil returns to the suction side of the main system gear pump at 3, returning the hot case oil into the hydraulic system to be cooled and filtered.

HYDROSTATIC CHARGE SYSTEM PRESSURE TEST

Hydrostatic charge pressure oil is the return oil from the boom, bucket, and auxiliary hydraulic circuits from the return side of the control valve. This oil is required for replenishing oil to the hydrostatic system for lubrication and cooling of the hydrostatic pumps and motors.

ATTENTION: Do not change the route of the return oil from the main control valve or the hydrostatic system may be damaged.

The charge pressure can be checked at the test port, 1, near the charge check valve, 2.

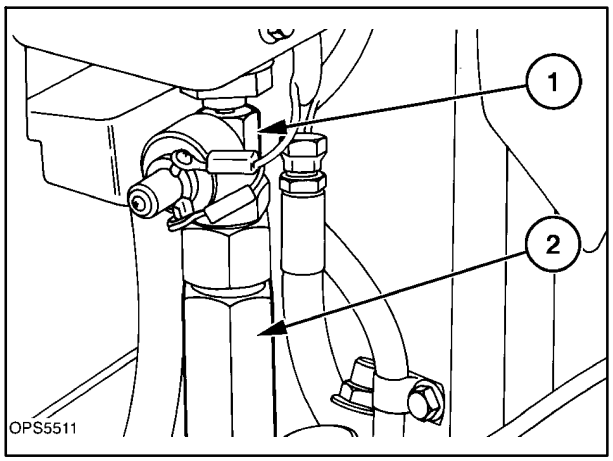

Figure 5-13

The charge system pressure is factory set. Changes to the settings should not be necessary. The charge check relief valve is located at 2. If there is some reason to suspect incorrect pressure, check the pressure as follows:

Checking Charge System Pressure

Fittings and gauge required:

1. 22 bar (300 PSI) gauge (minimum)
2. 1/8″ pipe to gauge

Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the “SERVICE/RUN” switch in the “SERVICE” position.
3. Disengage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground. Support the front of the loader at 1, to the front of the final drive case and at 2, to the rear of the case.

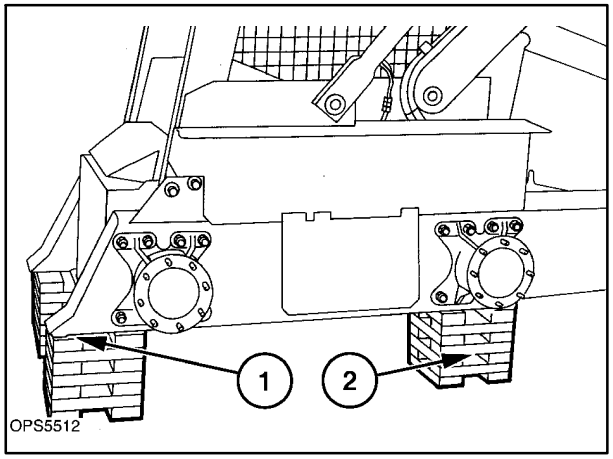

Figure 5-14

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Remove the right engine side shield to access the charge check valve and test port.
6. Install the pressure test gauge in the test port at 1.

   IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

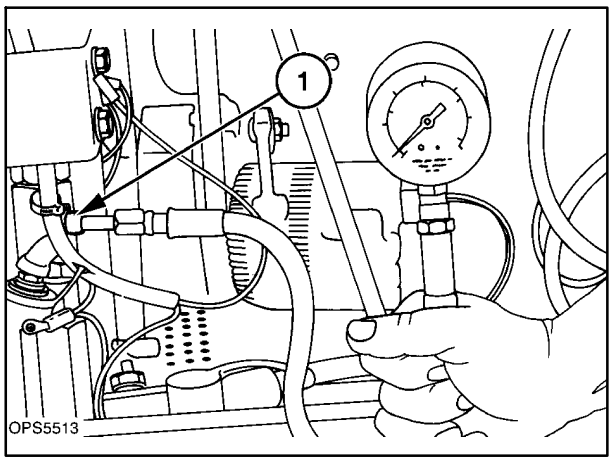

Figure 5-15

7. Start the engine and run it at full throttle (3070 - 3150 RPM) and take a pressure reading, 7.5 - 8.2 bar (110 - 120 PSI).
8. Operate the hydrostatic control levers in forward and reverse until the system bypasses and take a pressure reading. Return the controls to neutral. The pressure should be 6.8 - 8.2 bar (100 - 120 PSI).

   CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

9. The check valve is not adjustable. Replace the check valve, 2, if the pressure is not within specifications in step 7. If the pressure is not correct in step 8, further testing is required, refer to pump case drain testing.

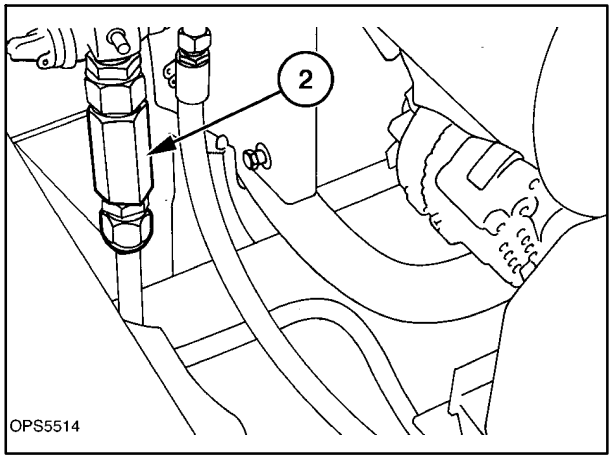

Figure 5-16

HYDROSTATIC PUMP CASE DRAIN TEST

The hydrostatic pump drain oil can be checked by a pressure test and/or oil flow drain test.

Pump Case Pressure Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the Service/Run switch in the “SERVICE” position.
3. Engage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Raise the operator’s seat and latch in the raised position, 1.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

6. Remove the step shield, 2, to access the hydrostatic pumps and motors.

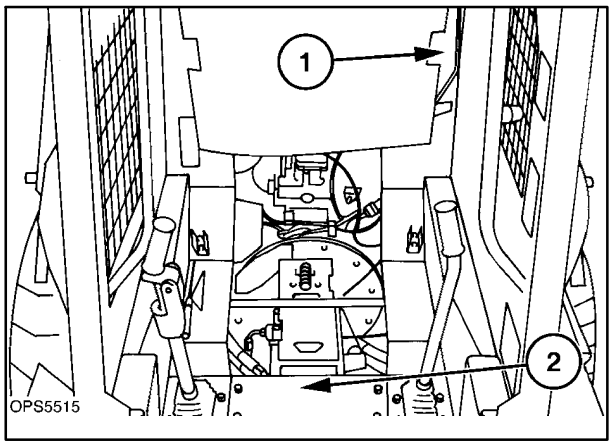

Figure 5-17

7. To check the pump case pressure, tee in a 7 bar (100 PSI) gauge at the pump drain line, 1. The tee must be at the drain port of the pump housing not in the combined line from the motors.

   NOTE: The front pump drains internally to the rear pump so the oil from this pump drain line will be oil from both pumps.

   IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

8. Start the engine and run it at full throttle (3070 - 3150 RPM) and take a reading, 0 - 41.2 kPa (0 - 6 PSI) allowable range.

9. Stroke the hydrostatic control levers forward and reverse and take a pressure reading in both directions; the pressure should not exceed 172 kPa (25 PSI). If the pressure exceeds 172 kPa (25 PSI) there is excessive leakage from the forward and/or reverse high pressure loops. If the pressure is within specifications, the problem may be in the motors.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

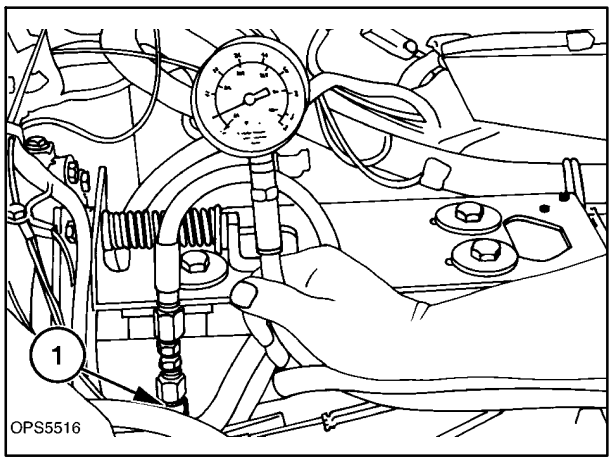

Figure 5-18

Pump Case Drain (Oil Flow) Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the Service/Run switch in the “SERVICE” position.
3. Engage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Raise the operator’s seat and latch in the raised position.
6. Remove the step shield.
7. Remove the pump case drain line at 1, from the pump housing and cap. Connect a hose into the pump housing and run into a container.

   IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

   NOTE: The front pump drains internally to the rear pump so the oil from this pump drain line will be oil from both pumps.

8. Hold the hose, or hoses, over a container, 1, and start the engine and run it at full throttle (3070 - 3150 RPM). Take a flow reading, maximum 1.5 GPM each pump, 3 GPM total from both pumps.
9. Stroke the hydrostatic control levers forward and reverse and take a flow reading in both directions. If the flow exceeds the maximum 1.5 GPM per pump, there is excessive leakage from the forward and/or reverse high pressure loops. If the pressure is within specifications, the problem may be in the motors.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

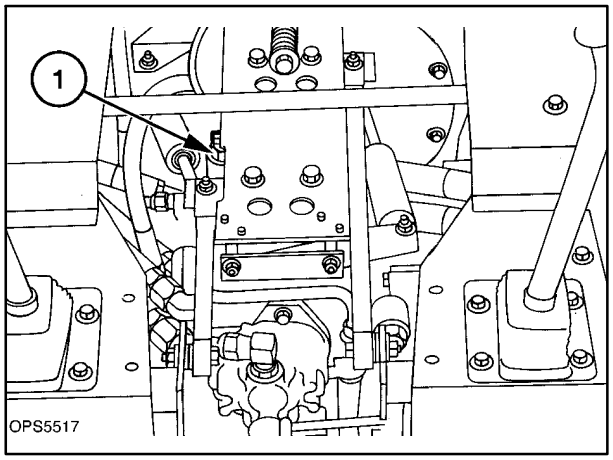

Figure 5-19

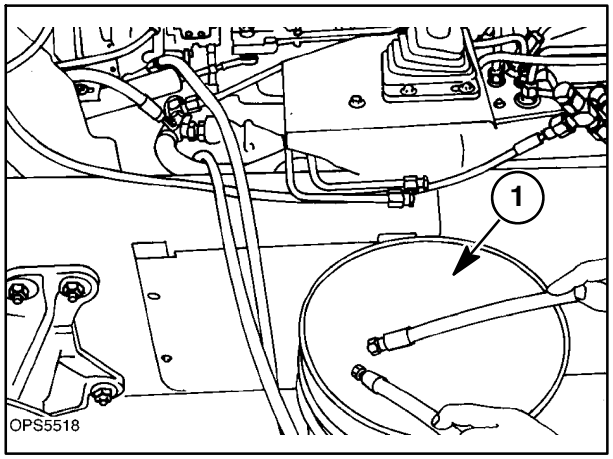

Figure 5-20

HYDROSTATIC PUMP HIGH-PRESSURE TEST

The hydrostatic drive system has a high-pressure relief valve for forward and reverse, two relief valves per pump or side. The relief valves, 1, for both pumps and for forward and reverse are the same and the same setting, 238 bar (3500 PSI).

If one relief valve is in question, the valve can be switched with a known good valve; if the problem follows the switched valve, replace the suspect valve. Switching forward and reverse relief valves on the same pump should reverse the problem if a relief valve is the problem. If the problem remains, the problem is most likely internally in the pump or motor. Refer to the pump case drain test for further testing to locate the problem.

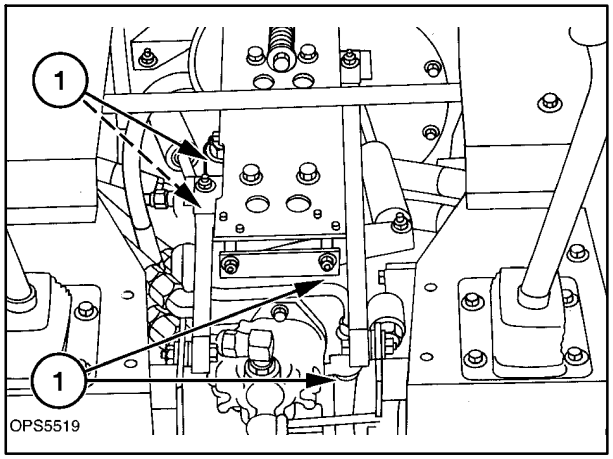

Figure 5-21

Relief Valve Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the Service/Run switch in the “SERVICE” position.
3. Engage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Raise the operator’s seat and latch in the raised position.
6. Remove the step shield.
7. Install a tee fitting in the high-pressure loop being tested as shown at 1, motor fitting and install a 340 bar (5000 PSI) pressure gauge.

   IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

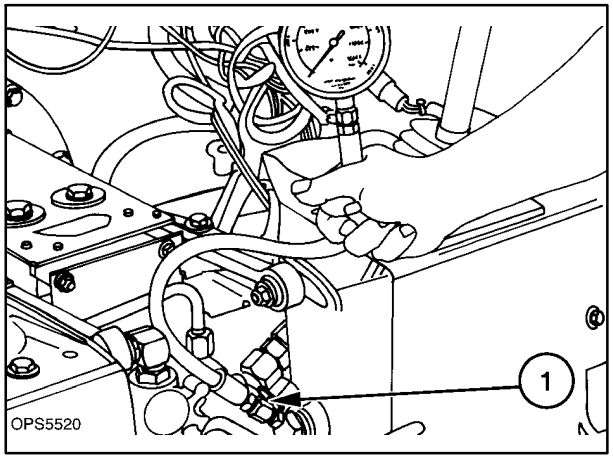

Figure 5-22

The following pump relief valves protect the direction of motor (tire) rotation forward or reverse.

Front pump controls right motor.

1 - Forward (top)

2 - Reverse (bottom)

Rear pump controls left motor.

3 - Forward (bottom)

4 - Reverse (top)

8. Start the engine and run it at full throttle (3070 - 3150 RPM).
9. Stroke the hydrostatic control lever on the side being tested and in the direction being tested and take a pressure reading, the pressure should be 238 bar (3500 PSI). If the pressure is not at specification, 238 bar (3500 PSI), replace the suspect relief valve.

   NOTE: All four directional relief valves can be tested in this manner.

   If the pressure is within specification, refer to the pump/motor case drain test for further testing to locate the problem.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

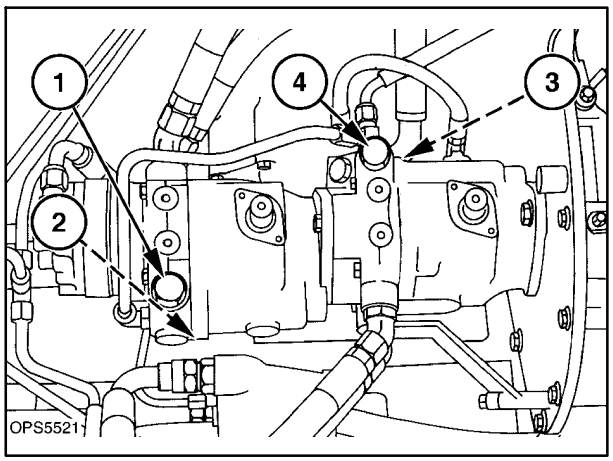

Figure 5-23

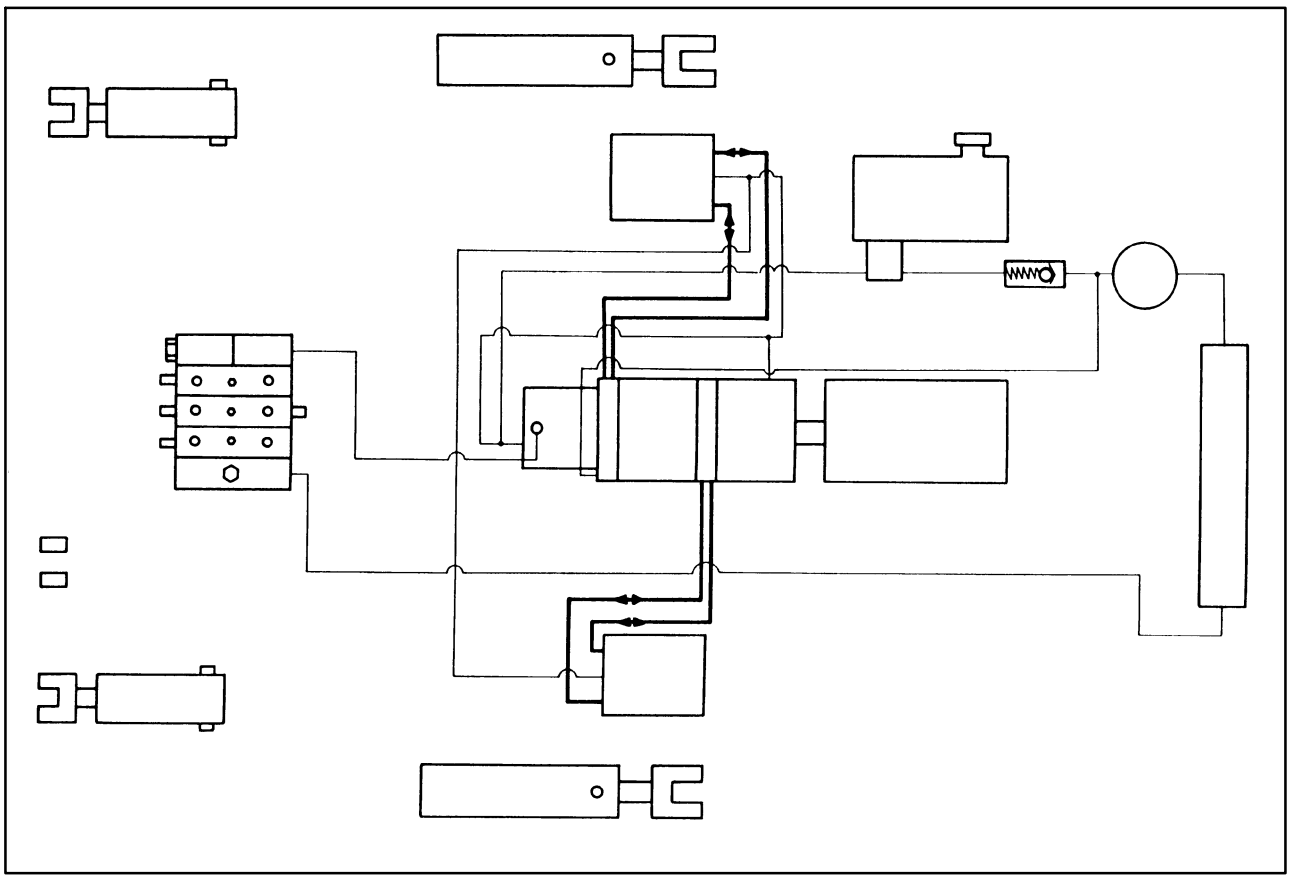

Figure 5-24

HYDROSTATIC PUMP EFFICIENCY TEST

This test can be used to check the operating efficiency of the pump.

IMPORTANT: When connecting a flowmeter into the pump circuit, make sure the meter is connected properly and the control lever is stroked in the direction being tested. If not, the hydrostatic system and/or flowmeter may be damaged.

Efficiency Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the Service/Run switch in the "SERVICE" position.
3. Disengage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Raise the operator's seat and latch in the raised position.
6. Remove the step shield.
7. Remove the high-pressure line from the pump, for the direction to be tested.
8. Connect the test hose from the fitting on the pump to the inlet side of the flowmeter and the line from the motor to the outlet side of the flowmeter. Turn the pressure regulator valve out on the flowmeter to zero pressure.

The following pump ports control direction of motor (tire) rotation forward or reverse.

Front pump controls right motor.

1 - Forward (top)

2 - Reverse (bottom)

Rear pump controls left motor.

3 - Forward (bottom)

4 - Reverse (top)

IMPORTANT: Check and make sure the flowmeter is connected properly, so when the pump is stroked the flow from the pump goes to the inlet side of the flowmeter.

IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

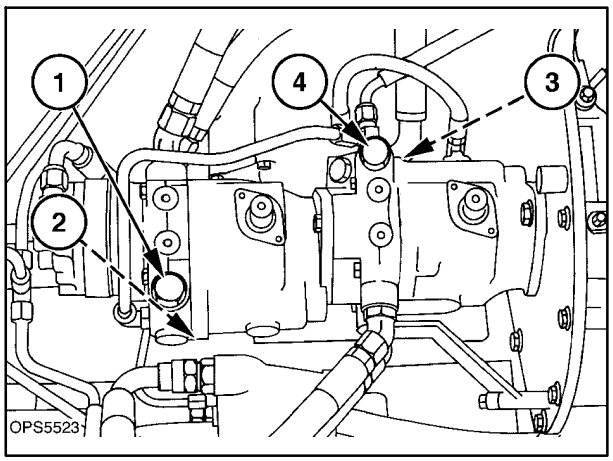

Figure 5-25

9. Using the EIC or a photo tach, set the engine speed to 2900 RPM.
10. With the flowmeter regulator valve completely opened, 1, stroke the control lever for the direction to be tested and take a free flow reading and record. The pump free flow is at “0” pressure.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

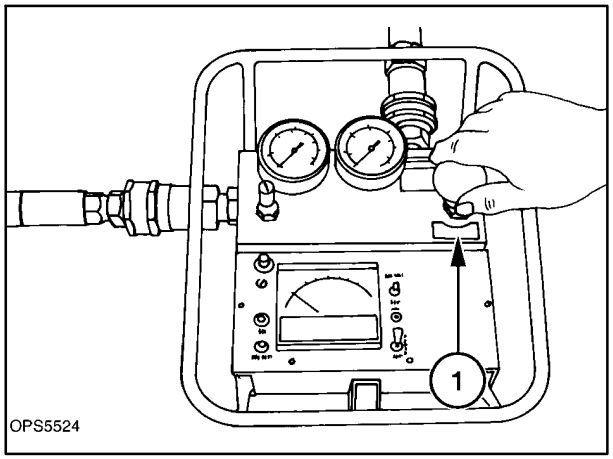

Figure 5-26

11. Turn the pressure regulator valve, 1, in on the flowmeter until a pressure reading of 136 bar (2000 PSI) is obtained and record.

12. Pump efficiency specifications:

    When figuring the pump efficiency it should not be less than 80%. The pump free flow should not be less than 81 LPM (21.2 GPM).

    a. Pump flow recorded at 136 bar (2000 PSI) divided by the free flow reading at zero pressure will determine the pump efficiency.

       EXAMPLE:

       Pump free flow - 23.5
       Pump flow at 2000 PSI - 22.4

       Pump efficiency: $\frac{22.4}{23.5}$ = 0.95 or 95%

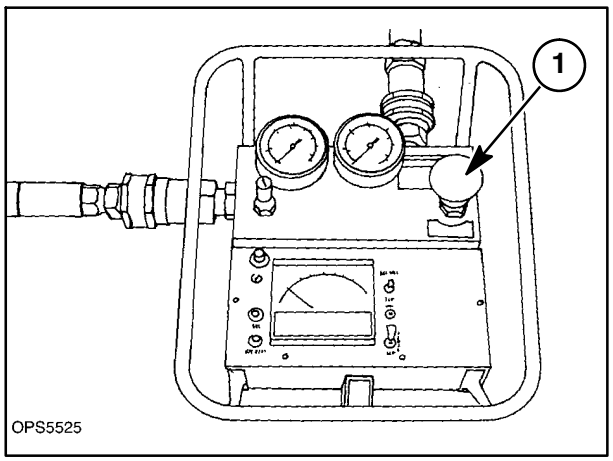

Figure 5-27

HYDROSTATIC MOTOR CASE DRAIN TEST

The motors can be checked for excessive internal leakage which will cause a unit to be weak in the ground drive. The excessive leakage is caused by damage to the motor rotating group or camp plate to allow high-pressure oil to leak into the case.

Motor Case Drain Test Procedure

1. Raise the boom and rest it on the boom locks.
2. Put the Service/Run switch in the "SERVICE" position.
3. Engage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.
5. Raise the seat to the raised latched position.
6. Remove the step shield to access the hydrostatic motor.
7. Unhook the case drain line from the motor being tested at 1 and cap the line.
8. Connect another line in the port of the motor and allow the hose to drain into a suitable container.

   IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

9. Start the engine and set engine speed at 2900 RPM using the EIC or a photo tach.
10. Stroke the control lever for the side being tested, forward and reverse and take a flow reading, MAXIMUM 1.5 GPM.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

11. Return control lever to neutral and stop the engine.
12. If the test results are within specification, the problem may be in the pump. If the results are over the specification, remove and repair or replace the motor.

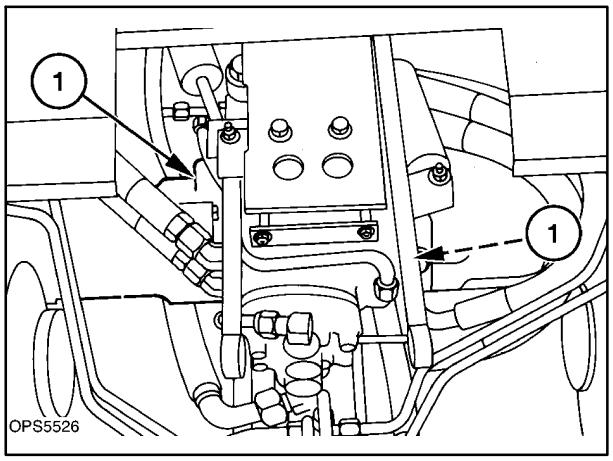

Figure 5-28

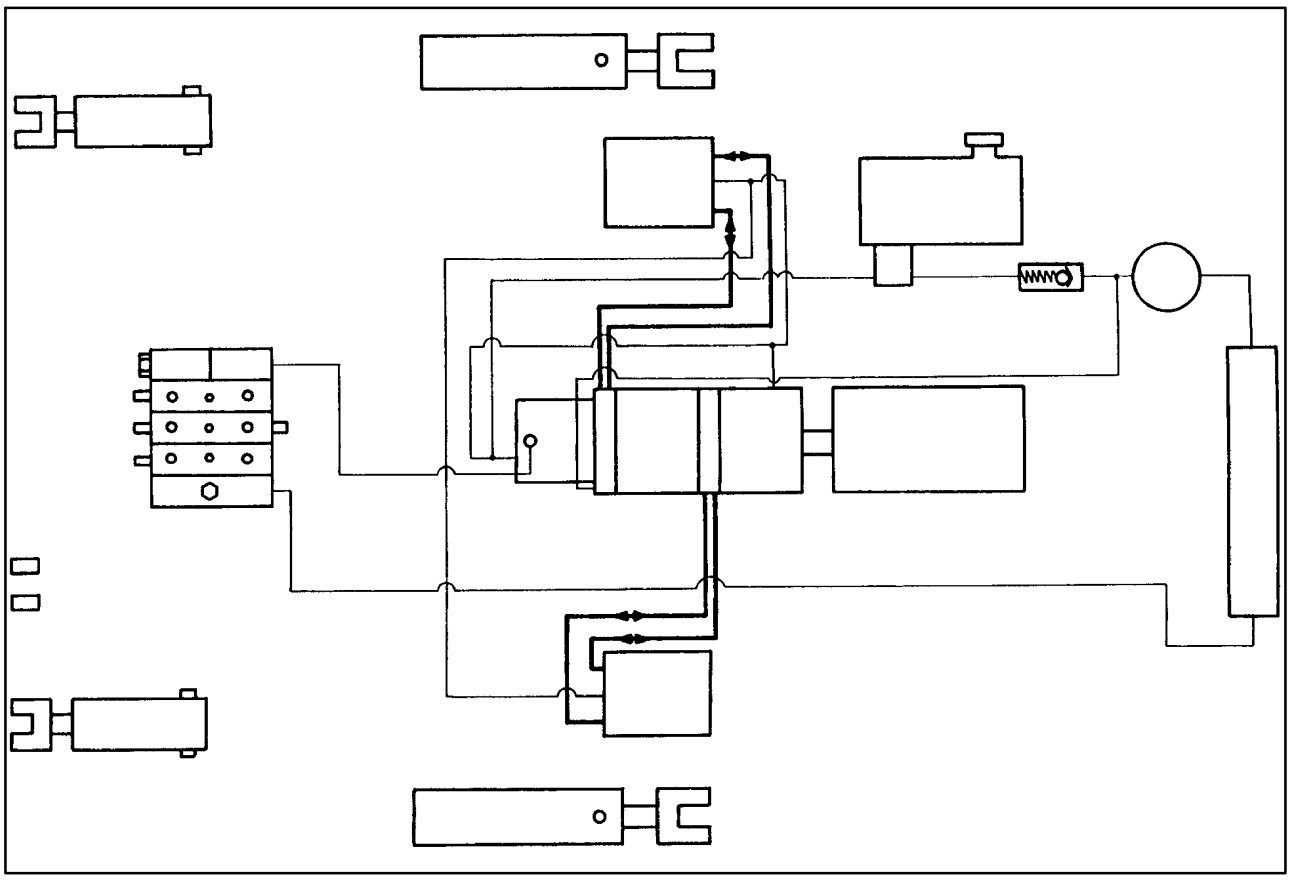

Figure 5-29

HYDROSTATIC MOTOR EFFICIENCY TEST

This test can be used to check the operating efficiency of the motor.

IMPORTANT: When connecting a flowmeter into the pump/motor circuit, make sure the meter is connected properly and the control lever is stroked in the direction being tested. If not, the hydrostatic system and/or flowmeter may be damaged.

Efficiency Test Procedure

1. Raise the boom and rest on the boom locks.
2. Put the Service/Run switch in the "SERVICE" position.
3. Disengage the parking brake.
4. Securely block the skid-steer loader with all four wheels off the ground.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER DURING TESTING CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

5. Raise the operator's seat and latch in the raised position.
6. Remove the step shield to access the hydrostatic motors.
7. Remove the high-pressure line from the pump for the direction to be tested.
8. Connect the test hose from the fitting on the pump to the outlet side of the flowmeter and the line from the motor to the inlet side of the flowmeter. Turn the pressure regulator valve on the flowmeter to zero pressure.

The following pump ports control direction of motor (tire) rotation forward or reverse.

Front pump controls right motor.

1 - Forward (top)
2 - Reverse (bottom)

Rear pump controls left motor.

3 - Forward (bottom)
4 - Reverse (top)

IMPORTANT: Check and make sure the flowmeter is connected properly, so when the pump is stroked the flow from the pump goes to the motor and to the inlet side of the flowmeter.

IMPORTANT: Check the hydraulic oil level and add if required to insure sufficient oil for the test.

9. Using the EIC or a photo tach, set the engine speed to 2900 RPM.
10. Stroke the control lever for the direction to be tested and take a free flow pressure reading and record.

CAUTION: ALWAYS STAY CLEAR OF MOVING PARTS DURING TESTING OR SERIOUS INJURY COULD OCCUR.

11. Turn the pressure regulator valve, 1, in on the flowmeter until a pressure reading of 136 bar (2000 PSI) is obtained and record.
12. Motor efficiency specifications:

    When figuring the motor efficiency, it should not be less than 80%. The motor free flow should not be less than 81 LPM (21.2 GPM).

    a. Motor flow recorded at 136 bar (2000 PSI) divided by the free flow reading at zero pressure will determine the motor efficiency.

       EXAMPLE:

       Motor free flow - 25.5
       Motor flow at 2000 PSI - 22.6

       Pump efficiency: $\frac{22.6}{25.5}$ = 0.886 or 89%

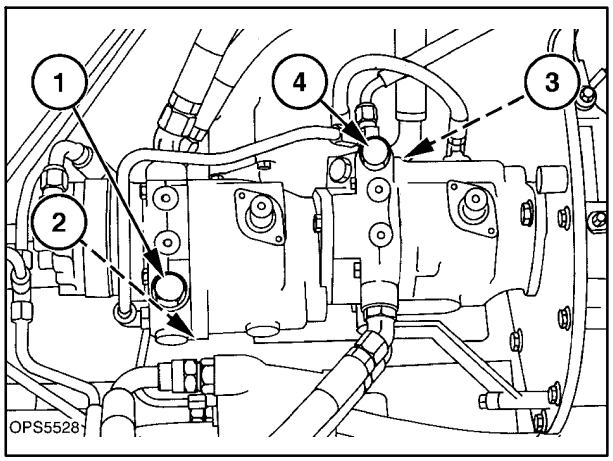

Figure 5-30

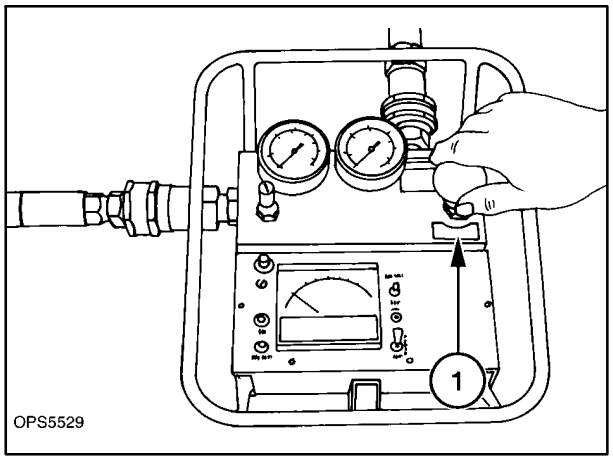

Figure 5-31

HYDRAULIC, HYDROSTATIC SYSTEM AIR INGRESS TEST

Hydraulic system air ingress, causing oil aeration, can affect performance of the hydraulic oil. This may be evident on a machine by jerky or uneven movement of the loader boom or bucket.

To assist in testing and finding leaks, a tool has been developed (part #FNH22ESS95). This tool comprises a cap which replaces the reservoir filler breather for testing purposes, a pressure gauge and a relief valve. The cap has fittings for air pressure to be applied to the hydraulic reservoir.

CAUTION: DO NOT START THE ENGINE WITH THE TEST TOOL INSTALLED, AS THE HYDRAULIC SYSTEM MUST BE ABLE TO BREATHE.

Test Procedure:

1. Remove the filler/breather cap.
2. Remove the self-tapping screws around the cap base and screen assembly.
3. Remove the base, screen and gasket assembly, clean all sealing surfaces.
4. Re-install new gaskets and base, taking care not to overtighten the screws.
5. Make sure the tank has 10W-30 oil visible.
6. Pressurize the tank using an air pressure line. The tool is equipped with a 3 PSI relief valve and a pressure gauge. The reservoir should not be pressurized beyond 4 PSI.

The following checks should then be performed to trace the source of the air ingress.

- Examine the suction tubes and fittings to the hydraulic gear pump and the return tubes from the filter to the reservoir.
- Examine the transmission case drain tubes/hoses and fittings from the hydraulic motors and pumps to the suction side of the hydraulic pump. Also check the cam plate shaft seals and the pump and motor casing gaskets.
- Potential leakage areas could also be input shaft seals in the engine bell housing, gearbox or output shaft seals in motors and gearboxes and the chain case.
- It may be necessary in some instances (where leakage is occurring on shaft seals into gearboxes or bell housing), to pressurize the reservoir for 2 - 4 hours and monitor the oil level in the gearboxes.
- If the prior checks do not locate the source of the leak, it may be necessary to pressurize each hydrostatic component individually.

  To do this it will be necessary to disconnect each case drain line in turn and pressurize using an air line to a maximum pressure of 10 PSI.

NOTE: A check valve can be installed in the case drain tube which maintains a 5 PSI pressure in the pump and motor cases. This helps prevent air ingress into the system.

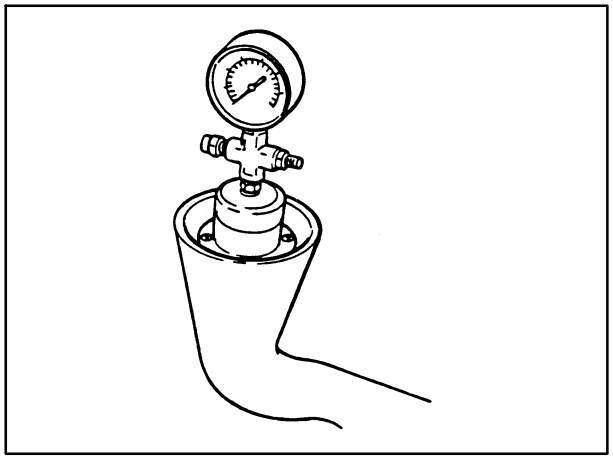

Figure 5-32

HYDROSTATIC PUMPS

HYDROSTATIC PUMP REMOVAL

The hydrostatic pump assembly can be removed from the top and front or the cab and boom can be tilted forward for more access, refer to Section 1 for the cab tilting procedure.

To remove the hydrostatic pump assembly without tilting the cab forward:

1. Lower the boom and bucket to the lowered position, resting on the ground or remove any attachment and raise the boom and rest on the boom lock pins, 1.

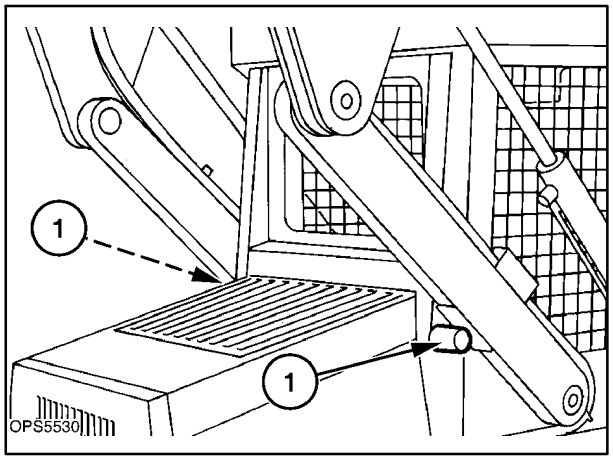

Figure 5-33

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.
3. Put the Service/Run switch in the “SERVICE” position.
4. Engage the parking brake.
5. Securely block the skid-steer loader at 1 and 2, with all four wheels off the ground. Refer to Section 1 for more detailed information on properly supporting a skid-steer loader.

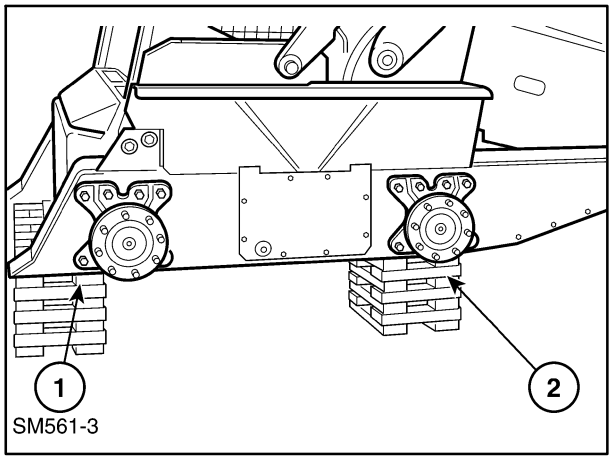

Figure 5-34

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

6. Raise the operator's seat and latch in the raised position, 1.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

7. Remove the step shield, 2, to access the hydrostatic pump area. For more access, remove the right and left hydrostatic control handle assembly.
8. Relieve all pressure in the hydraulic and hydrostatic systems.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEMS TO AVOID SERIOUS INJURY.

Draining the hydraulic oil reservoir is not required if the suction and return lines are capped to prevent loss of oil unless the hydraulic system requires cleaning.

9. Remove the rear engine belly pan hardware, 1, and remove the belly pan.

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN TO PREVENT SERIOUS INJURY.

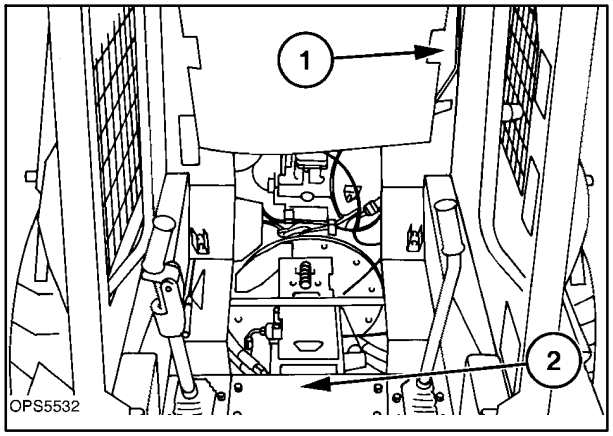

Figure 5-35

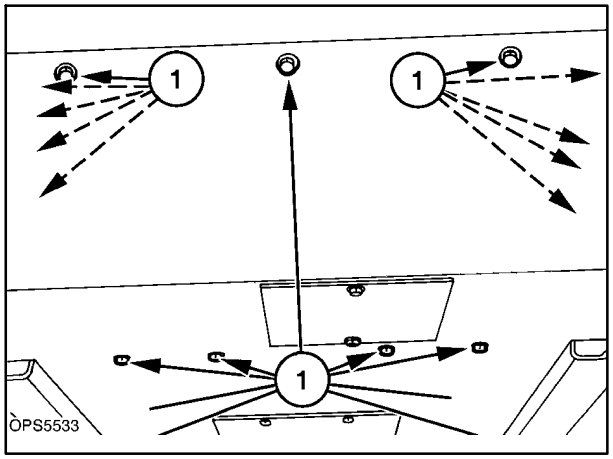

Figure 5-36

10. Drain the hydraulic reservoir.
    a. Loosen the return line clamp, 1.
    b. Remove the return line at 2, and rotate the line into a suitable drain pan.

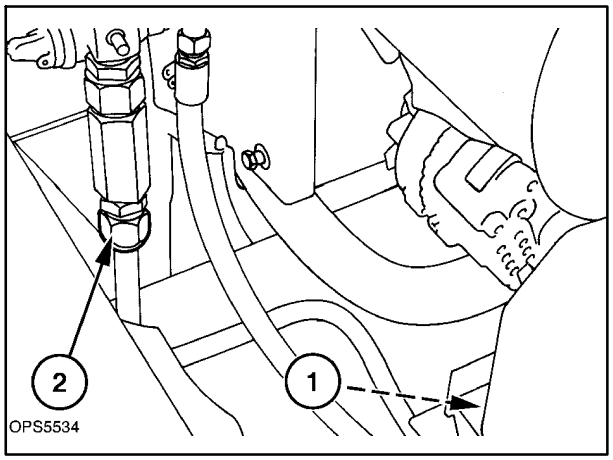

Figure 5-37

11. Remove the four screws from the front supports, 1; remove the return spring retaining bolt, 2; and remove the neutralizer plate, 3. The hydrostatic control lever assemblies, 4, can be removed for more access.

    NOTE: The neutralizer spring will be under a small amount of tension when removing.

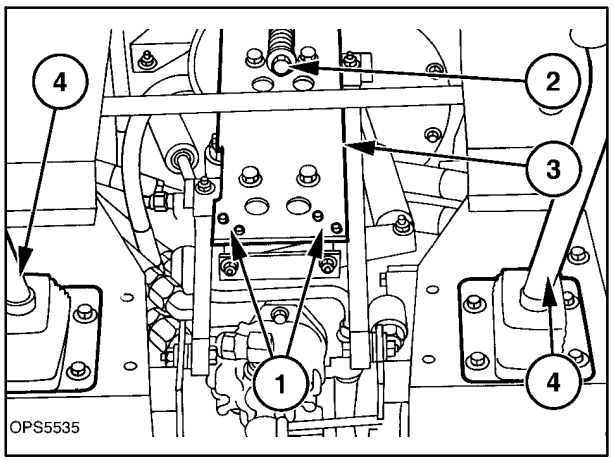

Figure 5-38

12. Remove the dampeners, 1, and control linkage, 2.
13. Remove the suction line, 3, from the gear pump and cap to prevent loss of oil.
14. Remove the pressure line, 4, from the gear pump and cap to prevent loss of oil.
15. Remove the case drain line, 5, from the suction fitting on the bottom of the gear pump and cap.
16. Mark hose location and remove all high-pressure lines, 6, from the hydrostatic pumps and cap.

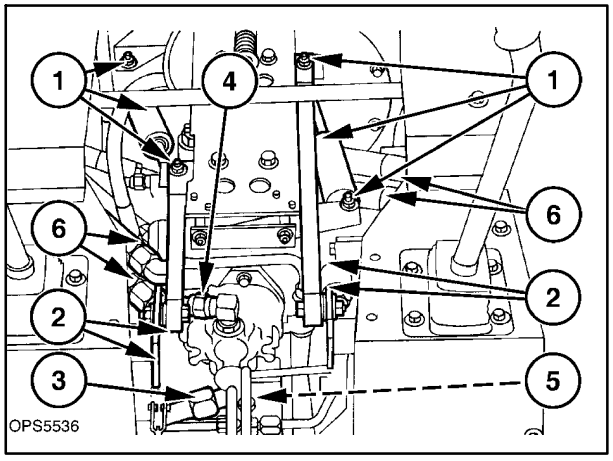

Figure 5-39

17. Remove the inspection plate, 1, from under the center of the loader frame to access the front hydrostatic pump support.
18. Remove the hydrostatic pump support bolt from the main frame and the pump support plate.

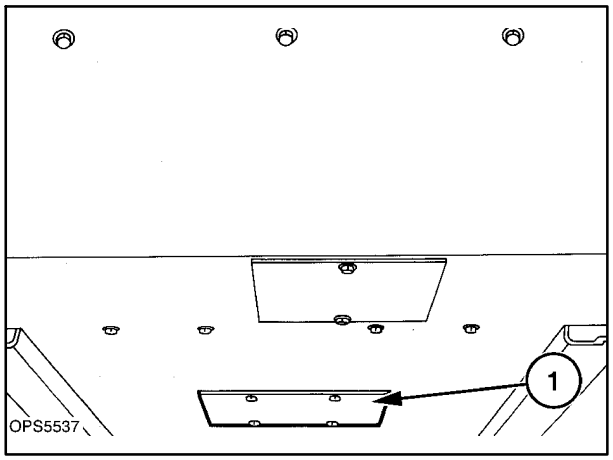

Figure 5-40

19. Support the front of the engine (flywheel end) and remove the hydrostatic pump support plate hardware, 1.

20. Remove the pump to bellhousing hardware, 2, and slide the pump assembly forward from the engine drive coupler.

21. Remove the pump assembly from the loader.

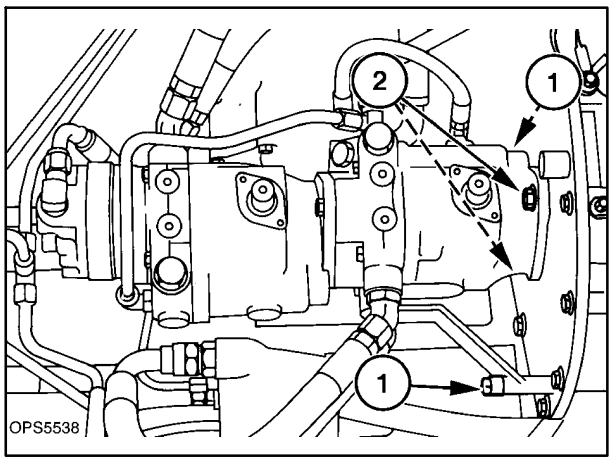

Figure 5-41

22. Remove the pump support plate from the pump assembly by removing the four plate cap screws, 1.

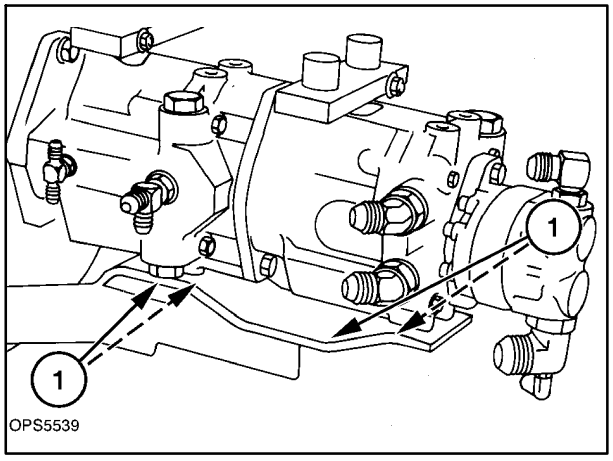

Figure 5-42

HYDROSTATIC PUMP DISASSEMBLY

1. Thoroughly clean complete pump assembly before teardown; plug ports so dirt and solvent do not enter the transmission.

   The complete hydrostatic pump assembly consists of these main components - left pump, 1; left back plate, 2; right pump, 3; and right back plate, 4.

   The back plates carry high-pressure oil from the pumps to the motors via high-pressure hoses. The low-pressure return oil from the motors flows back to the pumps through the back plates to complete the closed loop circuit.

   NOTE: Dealer warranty adjustment requests for any hydrostatic component repair must include the machine model, serial numbers, the transmission model number, and date codes. These codes are stamped in the flange of the pump housings, 5.

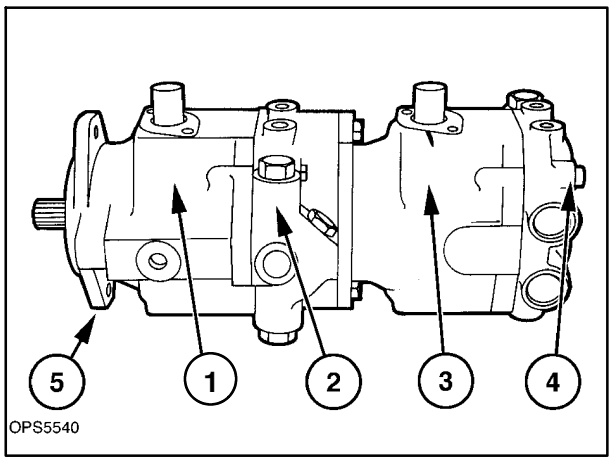

Figure 5-43

2. To ensure proper reassembly, use a marker to scratch lines across the pump housing and back plates as shown by the dotted lines. Also mark the location of the pintle arms, 1, for proper reassembly.
3. As the transmission pump is being overhauled, lay the parts on a clean wooden bench top or heavy cardboard to prevent damage to the machined surfaces.
4. Remove the two bolts, 2, and tap the housings with a plastic or rubber mallet to separate the two pumps.

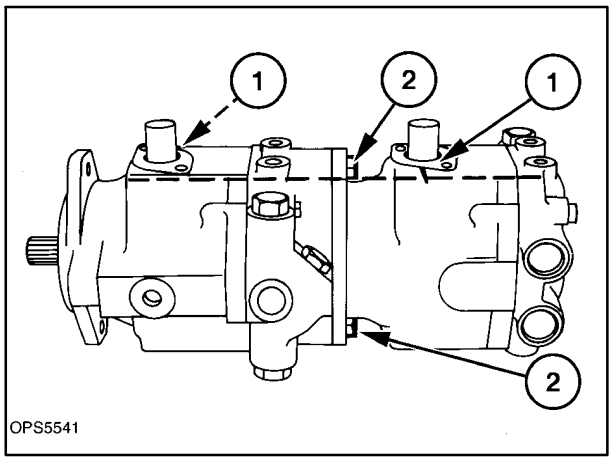

Figure 5-44

5. The pumps are coupled with coupler, 1, which will remain on one of the splined shafts. The O ring, 2, fits over flange, 3, and should be replaced on reassembly.

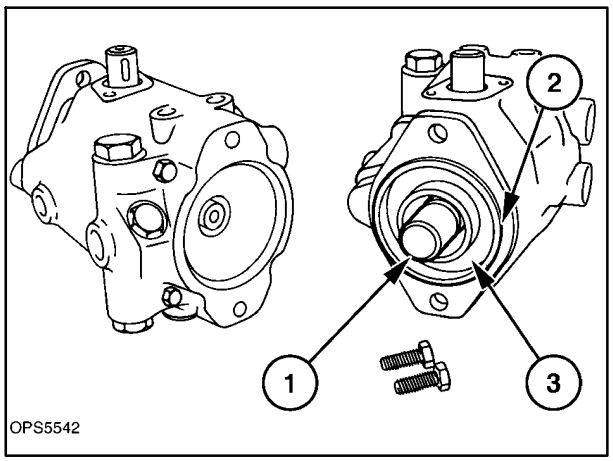

Figure 5-45

6. To separate the back plate from the pump housing, remove the four bolts, 1, and tap the back plate, 2, with a plastic or rubber mallet to separate it from pump housing, 3.

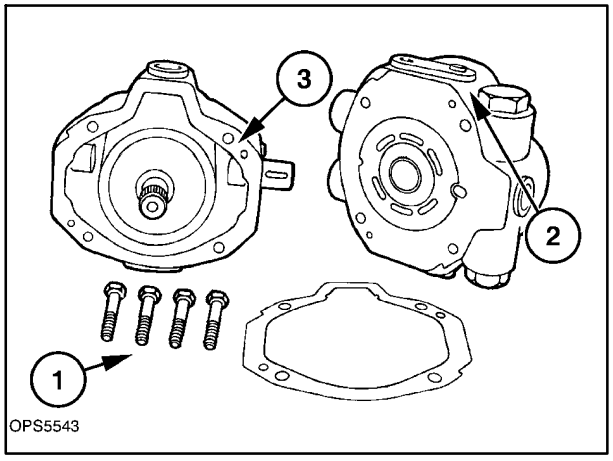

Figure 5-46

NOTE: The pump housing has two alignment dowel pins, 1.

There is a replaceable bearing plate located on the valve plate at 2. Remove the bearing plate from the back plate.

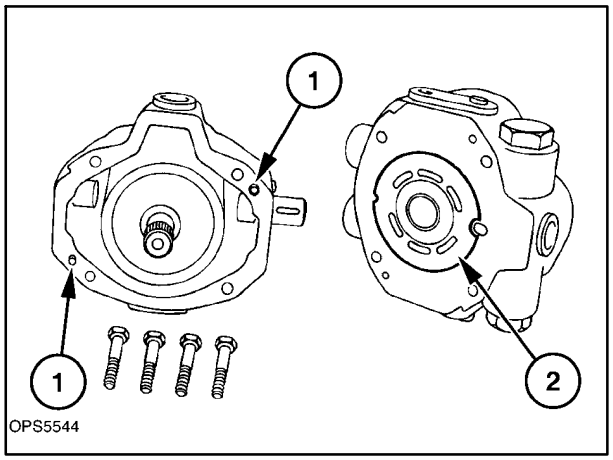

Figure 5-47

7. Hold the rotating piston block, 1, in one hand and tilt the open end of the housing down. Turn the rotating piston block and pull it out as a complete unit without scratching or burring the parts.

   NOTE: Keep the rotating group in an assembly at this time.

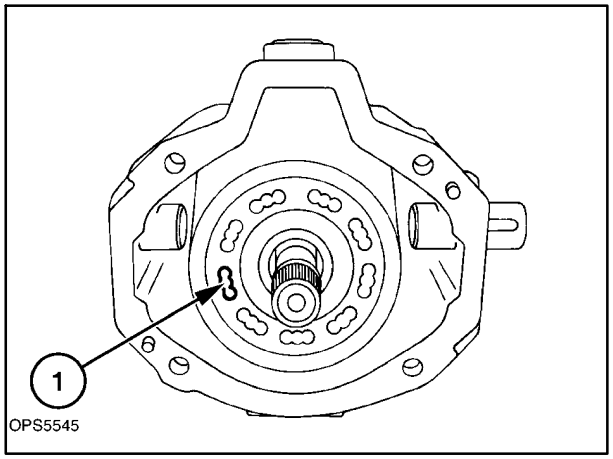

Figure 5-48

8. Lift the rotating group parts out of the pump rotating block and carefully lay them on cardboard to avoid damage. Mark the holes the piston came from with a soft marker (do not scratch a surface) so it can be inspected and the pistons can be reassembled in the same holes in the block.

   1. Piston block
   2. Piston and shoe assembly
   3. Shoe plate
   4. Spherical washer

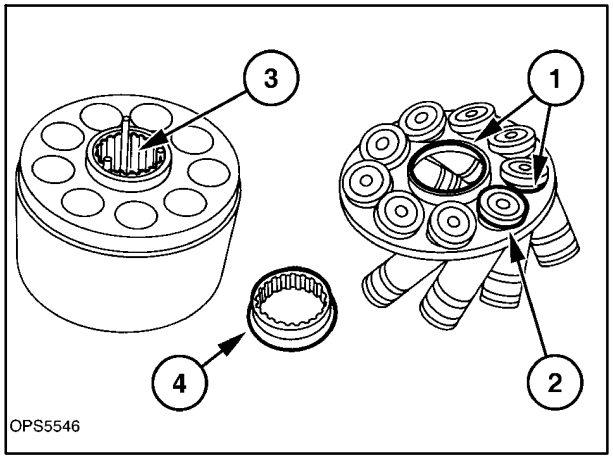

Figure 5-49

9. The pump shaft is shown at 1. To remove the pump shaft:

   a. Remove the large snap ring, 2.

   b. Remove seal, 3; the seal will be damaged during removal.

   c. Use an arbor press or tap with a soft face hammer to remove the shaft, oil seal, and thrust bearing from the housing. The shaft is pressed out toward the snap ring.

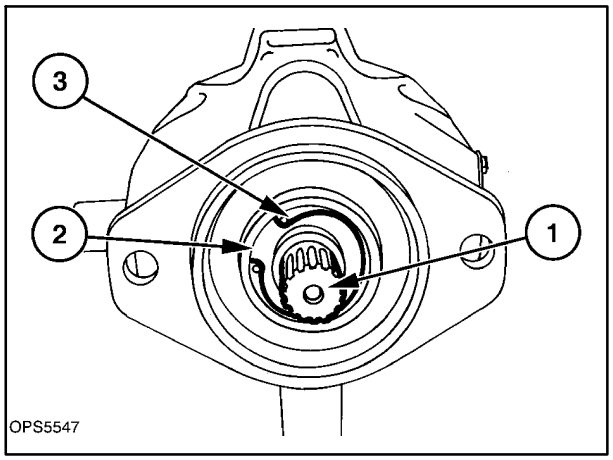

Figure 5-50

d. The shaft is shown as a complete assembly with thrust bearing races, 1, and retaining rings, 2, after removal.

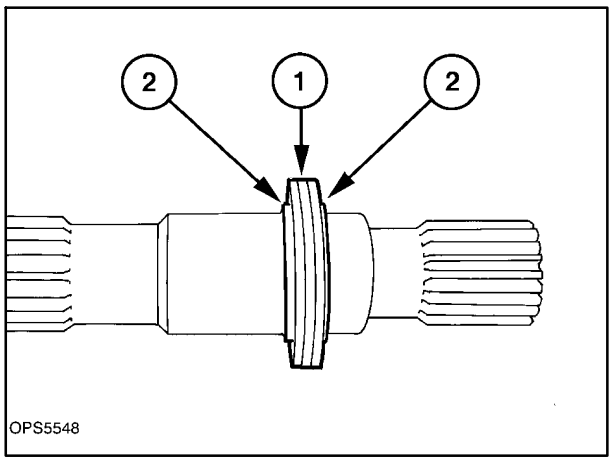

Figure 5-51

The pump housing and needle bearing are shown after the shaft is removed. To remove the needle bearing, 1, press the bearing from the inside after the cam plate is removed.

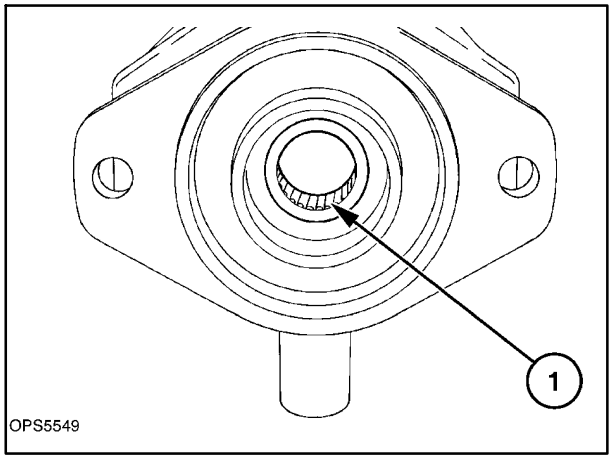

Figure 5-52

The shaft and related parts.

1 Shaft

2 Snap rings

3 Thrust washers

4 Needle thrust bearing

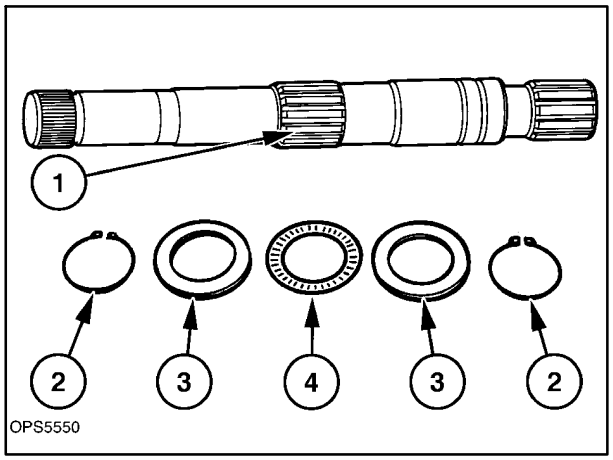

Figure 5-53

10. To remove cam plate, 1:

    a. Remove the #25 torx head screws, 2, and cover plate, 3.

    b. Remove O ring cover, 4; O ring, 5; and washer, 6.

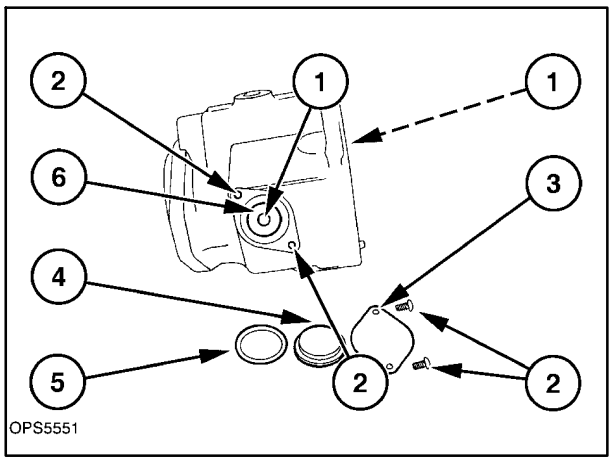

Figure 5-54

    c. Remove the torx head screws, 1, and cover plate, 2, from the pintle shaft side.

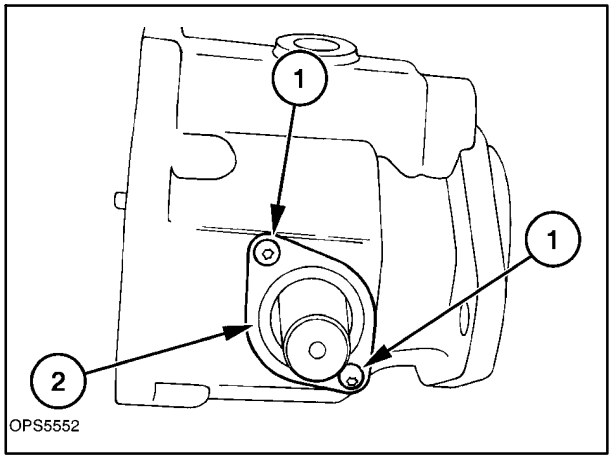

Figure 5-55

    d. Remove seal, 1, and washer, 2.

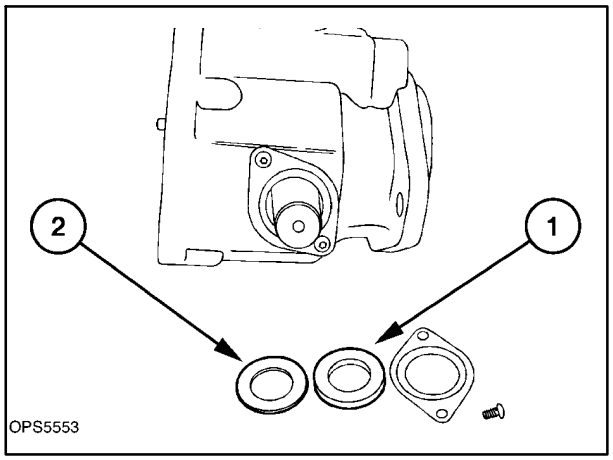

Figure 5-56

e. Remove bearing race, 1, and bearings, 2. These can be easily removed by sliding cam plate, 3, back and forth until the bearings can be grasped and removed from the outside of the housing.

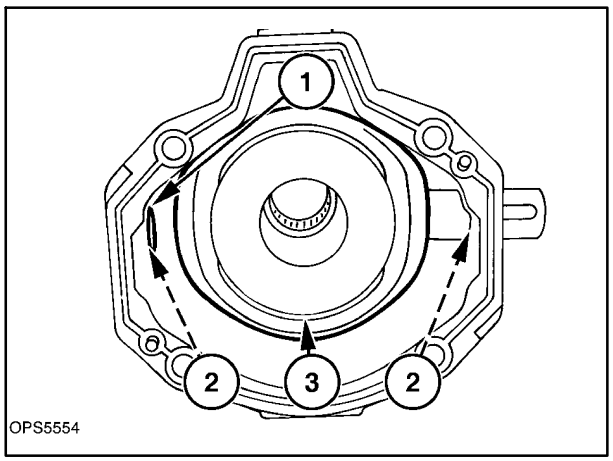

Figure 5-57

f. Remove the cam plate by cocking the cam plate and sliding the short side of the cam plate out of the pump housing first. All cam plate parts are shown.

1. Solid cover plate and hardware
2. Spacer plate, O ring, and washer
3. Inner race (1)
4. Bearings (2)
5. Cam plate
6. Washer
7. Seal
8. Open cover plate and hardware

NOTE: A bearing race is not used on the pintle shaft side of the cam plate.

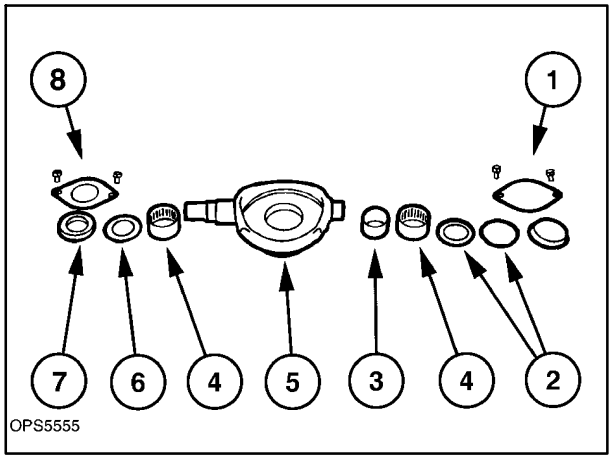

Figure 5-58

The pump housing is shown with all parts removed.

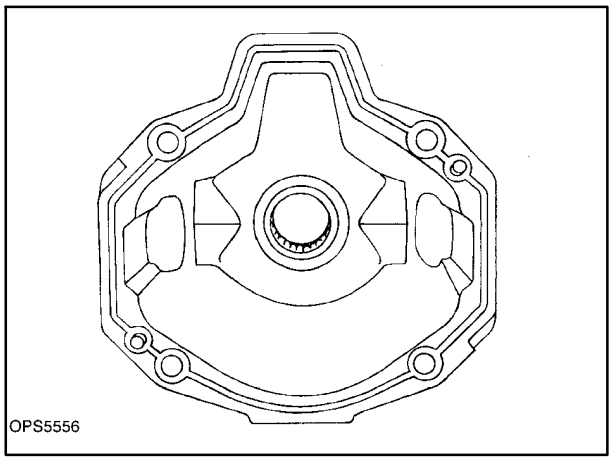

Figure 5-59

11. The back plate relief valves, 1, have been removed. These are nonadjustable and should be replaced if not operating properly or not within specifications during testing. The relief pressures are marked on the side of each valve cartridge.

    NOTE: The spring is located over the larger end of the relief cartridge at 2. The shorter tapered end, 3, of the relief cartridge must be inserted into the back plate first.

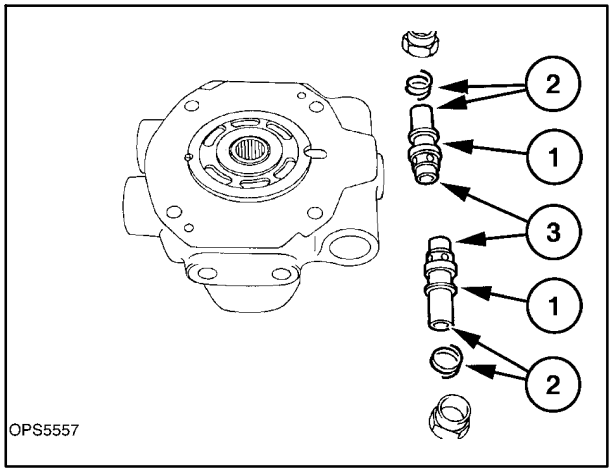

Figure 5-60

HYDROSTATIC PUMP PARTS INSPECTION

1. Pump Housing

   a. Shaft needle bearings, 1, are a tight press-fit in housing. Inspect for a loose bearing in the housings. Also check for loose or missing needles in the bearing housing.

   b. All oil seals and O rings should be changed upon reassembly.

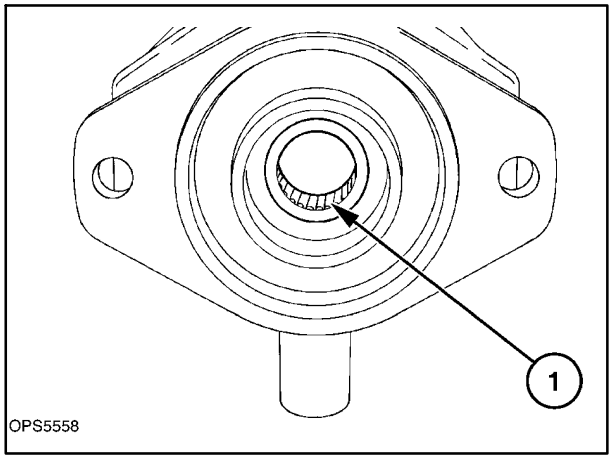

Figure 5-61

2. Pump Shafts

   a. Check areas contacting the needle roller bearings, 1, for wear and a rough bearing.

   b. Check for a bent or worn shaft.

   c. Check the spline areas, 2, for wear or twist.

   d. Check the thrust bearing, 3; races, 4; and retaining rings and groove, 5. If bearing or races show wear or roughness they must be replaced.

   e. All oil seals should be changed upon reassembly.

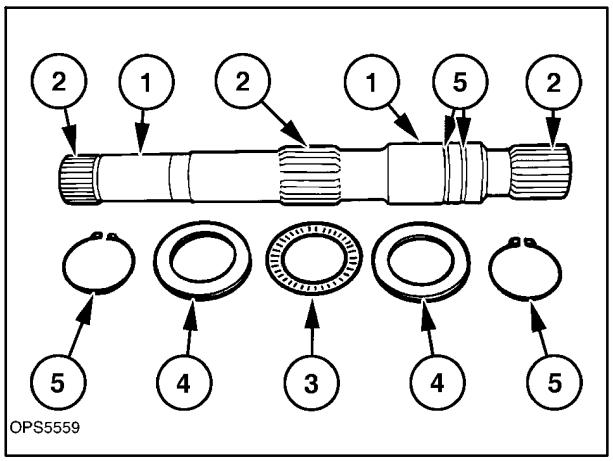

Figure 5-62

3. Cam Plates

   a. Shoes of the pump pistons rotate at high speed against the cam plate surface at 1. The surface must be smooth with no metal flaked away and no scoring. Circular scratches centered on this machined surface are due to contamination. If scratches can be felt with your thumbnail, replace the cam plate.

   b. Check the cam plate surface, 1, for smearing. This surface must be smooth and bright with no discolor or brass color in flat surface.

   c. Inspect the bearing surfaces, 2, for wear.

   d. Inspect bearings, 3, and races, 4, for wear, looseness or roughness; replace if damaged.

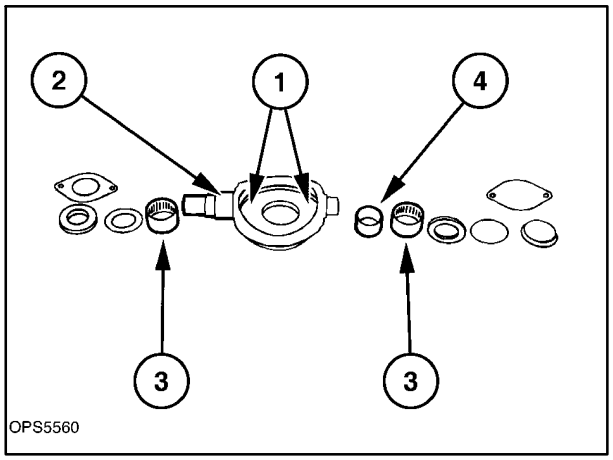

Figure 5-63

4. Piston and Shoe Assemblies

   Replace the rotating groups if:

   a. The piston skirt area, 1, shows signs of scratches or wear.

   b. The edges of the shoes, 2, are worn (shoe roll) from contact with the cam plate.

   c. There is wear on the underside of the slipper between the slipper and shoe plate at 3.

   d. The shoes are a loose, sloppy fit on the ball end of the piston at 4.

   e. The flat surfaces of the shoes, 5, show metal flaking or are deeply scratched. Light or shallow scratches in the shoes will not cause any harm. Do not lap the shoes.

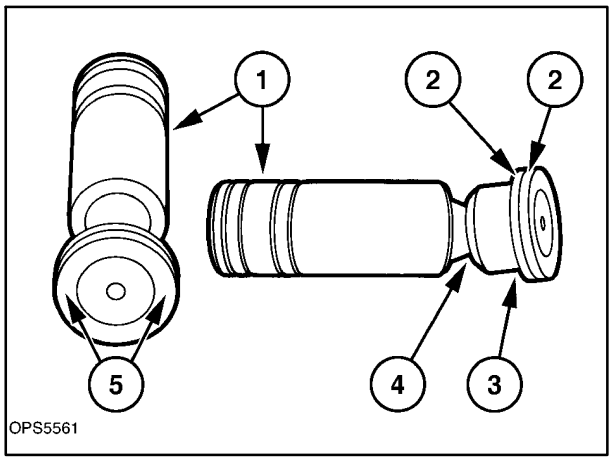

Figure 5-64

5. Shoe Plate

   a. Check for cracks at the holes for the spherical washer or shoes. The shoe plate is only available as part of the rotating group.

   b. Check for wear in the area of the slippers, 1. This area should be flat, smooth, and have no grooves.

   c. Check the internal splines of the piston block, 2, for wear.

6. Spherical Washer (pivot), 3

   a. Check for wear on the top surface where the shoe plate fits. The spherical washer is only available as part of the rotating group.

   b. Check the sides, rolled area for cracks.

7. Rotating Piston Block

   Replace the rotating group if:

   a. Cylinders, 1, are worn or scored so the pistons do not move freely.

   b. Surface, 2, is worn or grooved or shows metal buildup. Nicks must not extend from the cylinders to the edge of the raised area, 3.

   NOTE: Cylinder ports may be milled, 4, or drilled (two types of blocks).

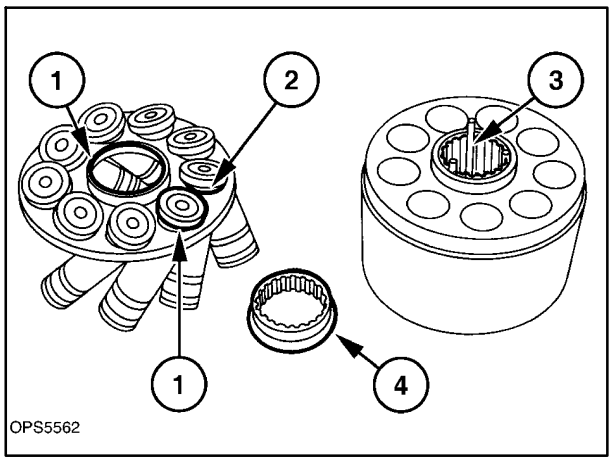

Figure 5-65

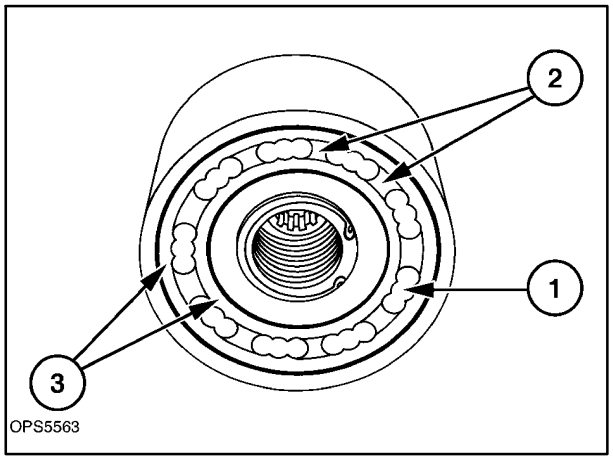

Figure 5-66

d. The pistons have side play in the piston block.

e. The three block loading pins, 1, are spring loaded. They are held in place by the pin keeper (split bushing), 2.

Check loading pins.

1) The pins should be the same height.

2) The pins should be seated in the special grooves.

3) The head of the pins should be seated between the washer and block.

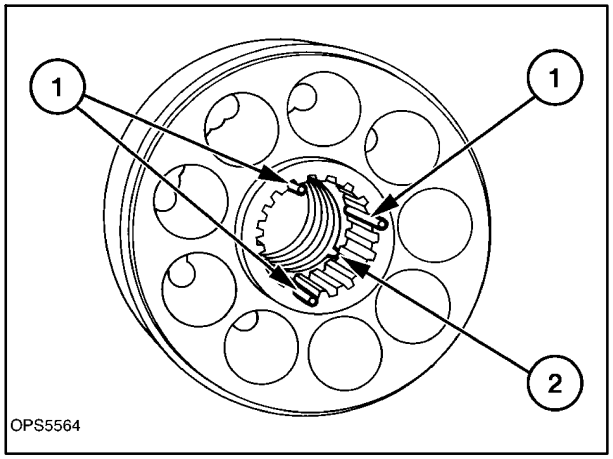

Figure 5-67

8. Replaceable bearing plate

a. Check for flatness.

b. Check for scratches on the brass side of the plate, extending across the area where the piston block contacts the plate at 1.

c. Check for scratches between the kidney ports at 2.

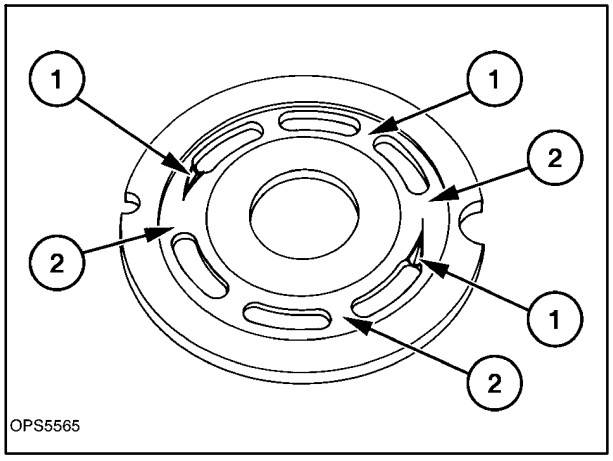

Figure 5-68

9. Back Plates

a. Check the needle bearings for wear, 1. These bearings are pressed into the back plate with bearing numbers to the outside of the back plate.

b. Check the back plate for flatness, 2.

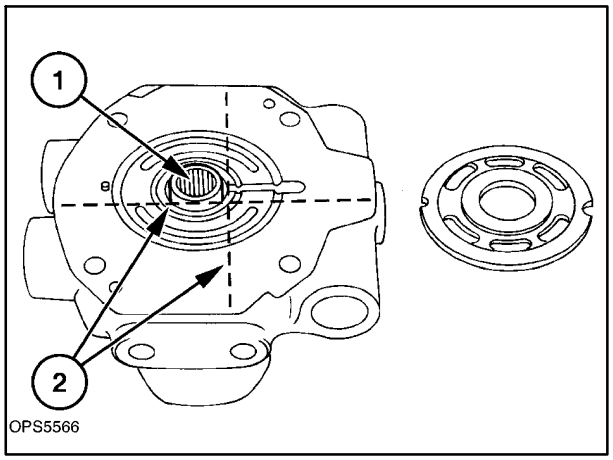

Figure 5-69

c. Two directional relief valves, 1, are located in each transmission. These relief valves limit the maximum system pressure to 3500 PSI. Relief valve pressure is factory set and should not be readjusted.

d. Check the relief valves for scratches in the seat areas, 2. Check for broken springs, 3. The springs should be the same length.

e. Check the seat area, 4, in the back plate for scratches that will prevent the relief valves from sealing properly.

f. Check the caps and springs.

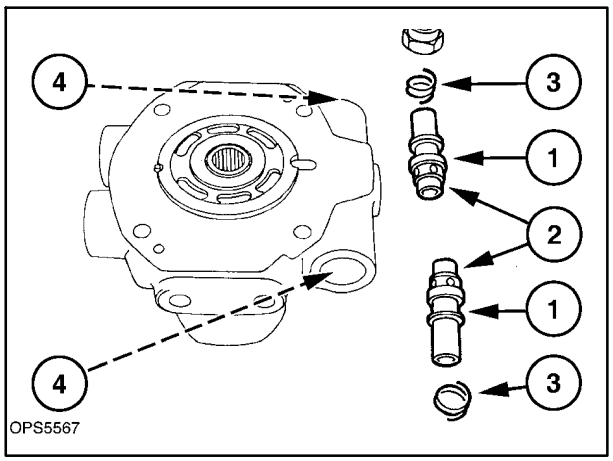

Figure 5-70

HYDROSTATIC PUMP REASSEMBLY

1. Use a suitable solvent to thoroughly clean all parts. Lay the parts on a clean cardboard and air dry.

   IMPORTANT: Due to tight tolerances and finish of pump internal surfaces, it is very important to maintain absolute cleanliness during reassembly.

2. Use a clean SAE 10W-30 oil to lubricate all moving parts as they are reassembled. Fill the transmission cases with oil through the case drain hole after completing assembly of the component.

   IMPORTANT: Lubrication of the pump components during assembly is required to insure lubrication oil for start-up.

3. Install the new gaskets, O rings, seals, and snap rings included with the repair kit.

4. If required, install a new needle bearing, 1, in the pump housing with numbered end, 2, of the bearing to the outside of the housing.

   NOTE: Replace the shaft seal in the rear pump (next to the engine); the front pump does not have a shaft seal.

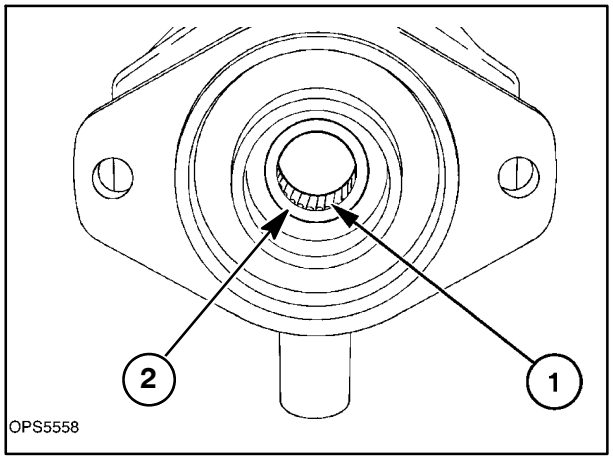

Figure 5-71

5. Place the cam plate into the housing with the long trunnion, 1, toward the boss as marked during disassembly.

   NOTE: The machined surface of cam plate, 2, should face the open end of the housing.

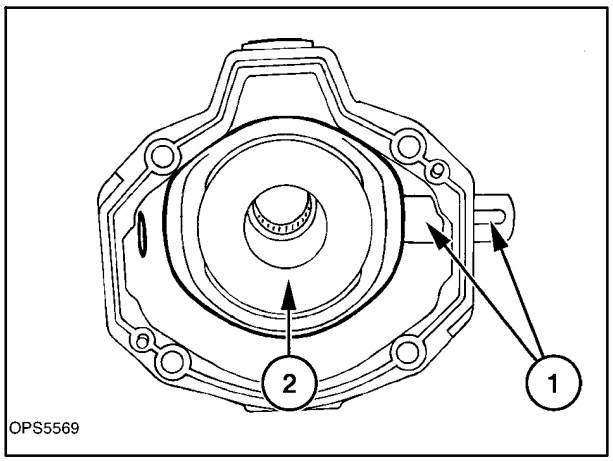

Figure 5-72

6. Insert the needle bearing, 1, and inner race, 2, over the short shaft end of the cam plate. The numbered end of the race and bearing should face outward, 3, and the chamfered ID of the race inward. Install washer, 4; new O ring, 5; end plate, 6; and outer cover plate, 7, and torx screws.

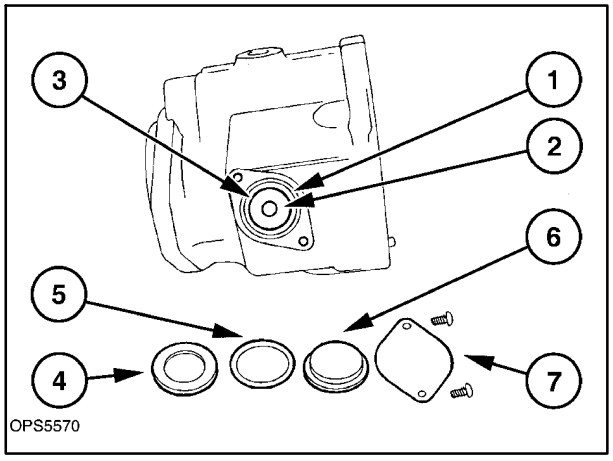

Figure 5-73

7. Install bearing, 1; washer, 2; new seal, 3; and outer cover plate, 4, with torx screws. Tighten all four torx screws to 4.8 N·m (40 in. lbs.).

   NOTE: After the cover plate hardware is tightened, the covers may have a slight bow, especially the top cover over the lip seal.

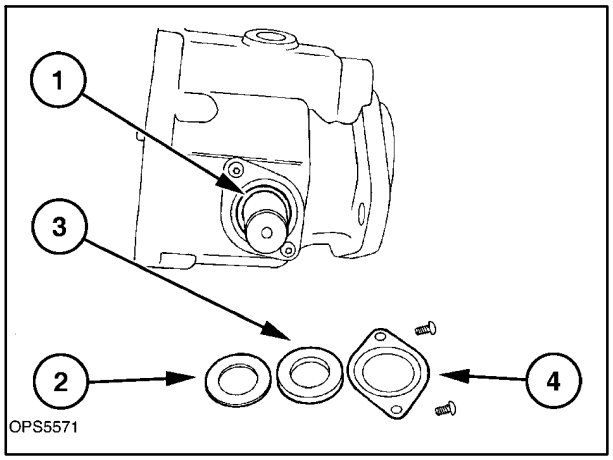

Figure 5-74

8. Install retaining ring, 1, on shaft. Install thrust washer, 2; thrust bearing, 3; and second thrust washer, 4. Secure with second retaining ring, 5.

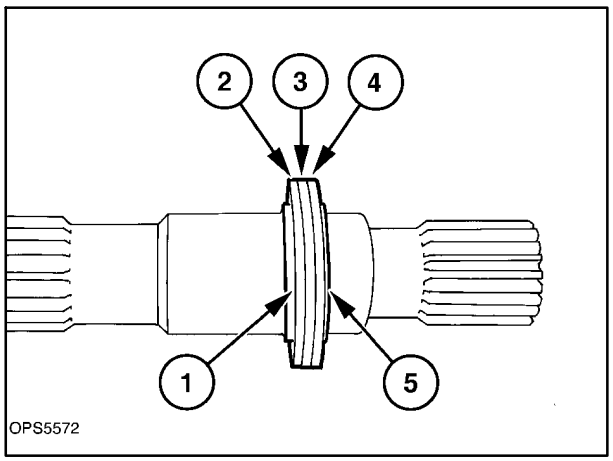

Figure 5-75

9. Install shaft and bearing assembly, 1, into the housing. Install the washer and new shaft seal, 2; secure with retaining ring, 3.

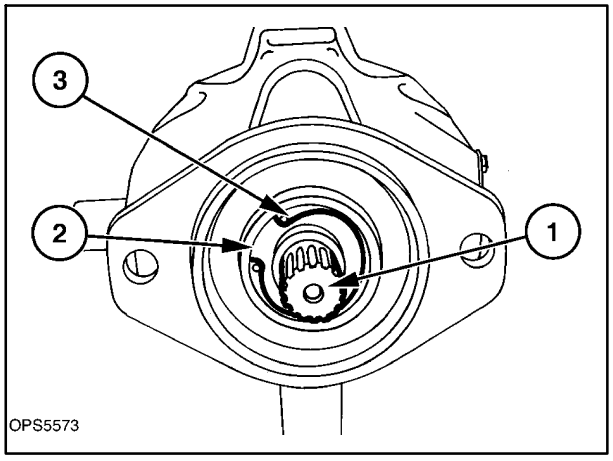

Figure 5-76

10. Check the three piston block loading pins, 1. Make sure they are seated properly in the oversize grooves in the splines and held in place with the retaining ring, 2.

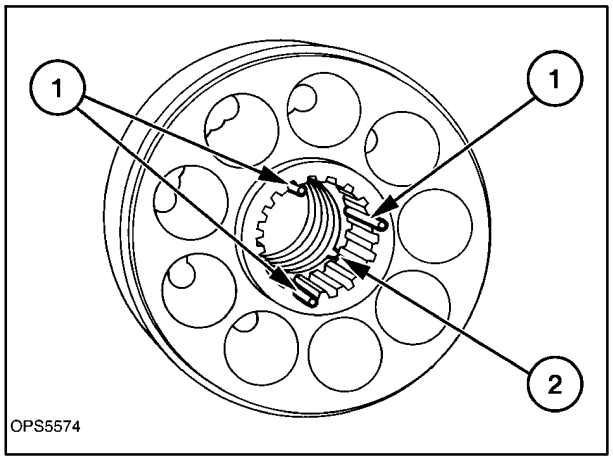

Figure 5-77

Reinstall the pistons, piston plate, 1, and pivot, 2, into the block with the pivot resting on the loading pins, 3.

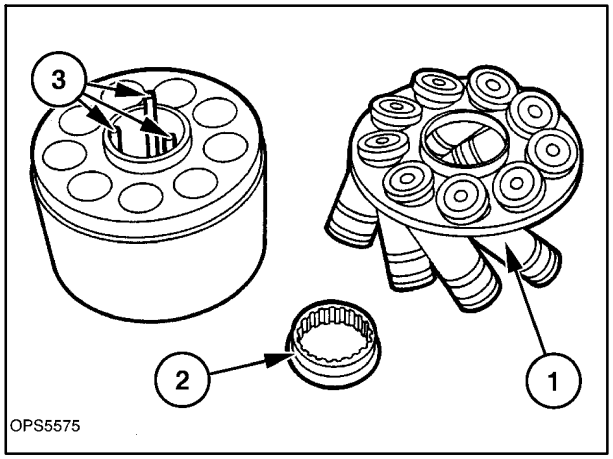

Figure 5-78

11. Invert the housing and insert the rotating piston block assembly, 1, into the housing.

    NOTE: Piston shoes must contact the cam plate. Be sure all parts are in their proper position before proceeding.

    NOTE: If the rotating group assembly will not easily slide over the splined shaft, DO NOT FORCE. One or more of the three loading pins may be out of their groove or the pin head is not seated properly between the washer and block. Forcing the rotating group may cause pin failure and early transmission failure.

    IMPORTANT: Make sure all mating surfaces are well lubricated with SAE 10W-30 motor oil to insure proper lubrication for start-up.

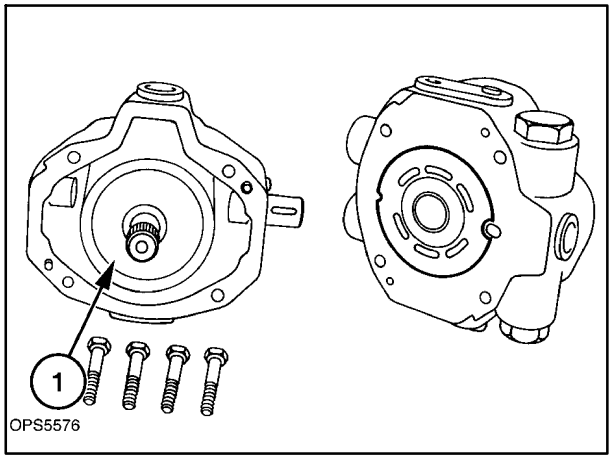

Figure 5-79

12. Install a new bearing in the back plate if required. Install the bearing with the numbers facing the center of the pump assembly, pressing the bearing down to 3/32″ above the plate at 1. The bearing is a pilot for the bearing plate, 2, during assembly.

    NOTE: When installing bearings in the plate or housing, be careful not to damage the outer bearing race. If the outer race is damaged, this could cause an early bearing and shaft failure.

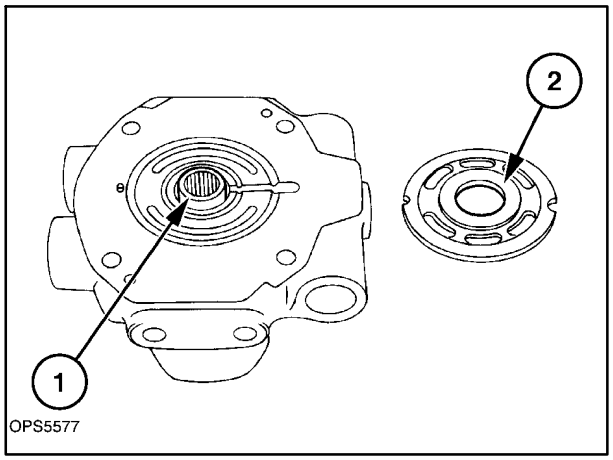

Figure 5-80

13. Lubricate the replaceable valve plate, 1, and place the steel side to the back plate aligning small groove with pin, 2. The brass side of the valve plate, 3, should be next to the piston block when assembled.

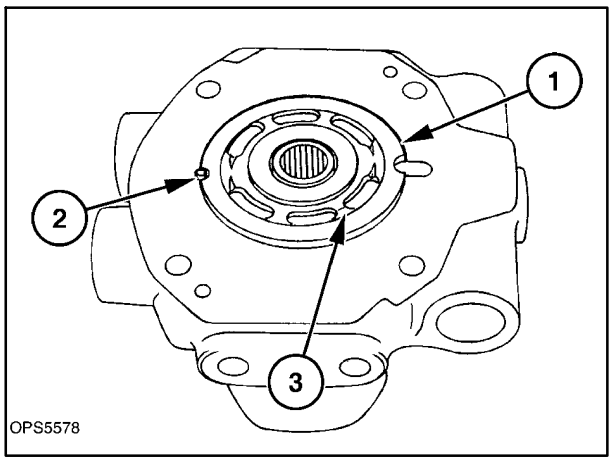

Figure 5-81

14. Attach the back plate, 1, to the pump housing making sure the replaceable plate, 2, stays in position; a small amount of Vaseline between plate and housing will help hold it in place. Install a new gasket, 3, between the plate and housing. Install the four cap screws and torque the pump housings to back plate bolts to 37 - 42 N·m (27 - 31 ft. lbs.).

    NOTE: When the back plate assembly is in place before inserting bolts, a small gap (1/8″ approximately) between the housing gasket and valve plate is normal. Tightening the bolts brings the housing against the rotating group spring resulting in an internal spring load to valve plate and piston slippers. After torquing the housing bolts, the shaft should be turned easily with an 8″ pliers. The shaft should have some rolling resistance but should not be tight (locked down) or rotate easily. If these conditions occur, the pump is assembled incorrectly and requires teardown and reassembly.

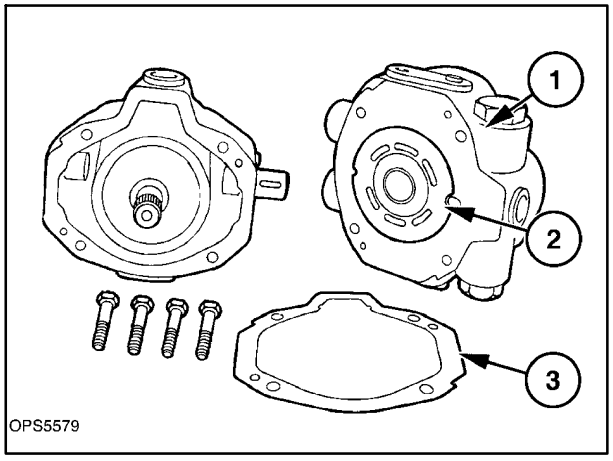

Figure 5-82

15. Install new O rings on the relief valve caps and install the valves into the valve plate with springs and caps, torque to 135 N·m (100 ft. lbs.).

    NOTE: The spring is located over the larger end of the relief cartridge at 1. The shorter tapered end, 2, of the relief cartridge must be inserted into the valve plate first at 3.

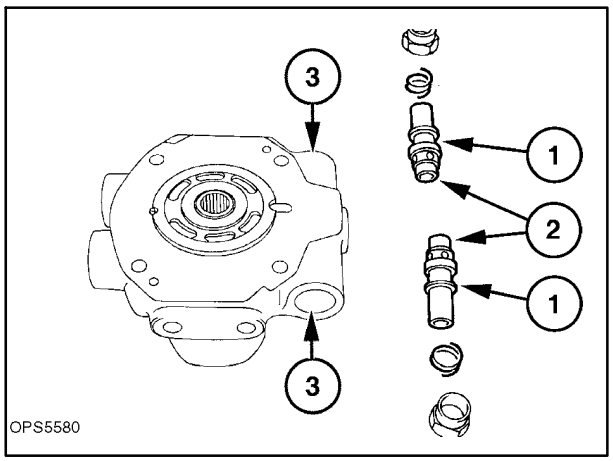

Figure 5-83

16. Place the coupler, 1, on the spline shaft of one of the pumps and install a new O ring over the pump flange at 2. Slide the two pump assemblies together and install the two 1/2″ x 1-1/4″ cap screws, two lock washers and torque to 77 N·m (57 ft. lbs.). Install the main gear pump to the front hydrostatic pump with O ring and two 3/8″ x 1″ cap screws and torque to 23 N·m (17 ft. lbs.).

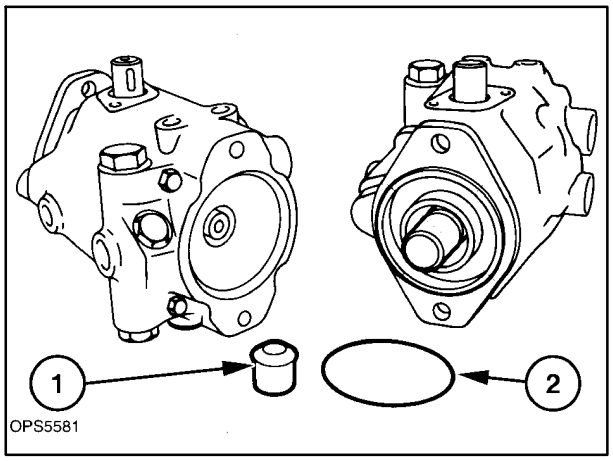

Figure 5-84

17. Fitting Installation

    1. Install the four 3/4″ - 37° flare x 7/8″-14 O ring 45° elbows, 1.
    2. Install the 3/8″ - 37° flare x 1/2″-20 O ring 90° elbow at 2.
    3. Install the 1/2″ - 37° flare x 3/4″-16 O ring run tee at 3.
    4. Install the crossover tube; align fittings, 4, with tube and tighten.
    5. Install the 3/8″ - 37° flare x 1/2″-20 O ring branch tee at 5.

    Do not tighten the fitting nuts at this time, aligning hoses and fittings will be required.

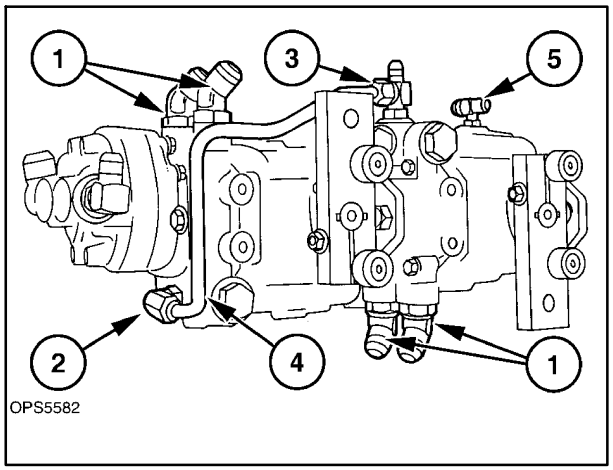

Figure 5-85

18. Before installing the hydrostatic pumps, fill both pumps with oil through the case drain port at 1, before installing the fitting. Remove the relief valve caps, 2, and cartridges and fill the closed loop with SAE 10W-30 motor oil.

    Refer to the “Hydraulic System Cleaning Procedure After Transmission Overhaul” section of this manual before installing the pump assembly in the loader.

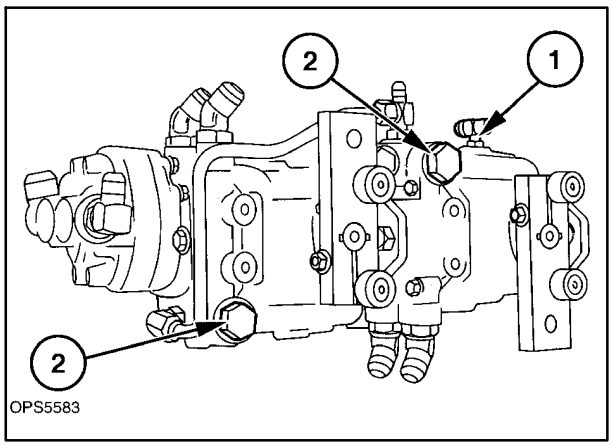

Figure 5-86

HYDROSTATIC PUMP INSTALLATION

1. Lubricate the flex plate splines, 1, and pump splines with MOLY COATE GN PASTE or NEVER SEIZE.
2. Reinstall the pump assembly to the engine bellhousing. Align the spline pump shaft with the drive coupler. Do not force the shaft into the drive coupler. Secure with two 1/2″ x 1-1/4″ cap screws and two lock washers, and torque to 61 N·m (45 ft. lbs.). With the pump assembly attached, now install the pump support plate, 2, to the bellhousing at 3, and to the pump assembly at 4, and torque to 40 N·m (30 ft. lbs.).

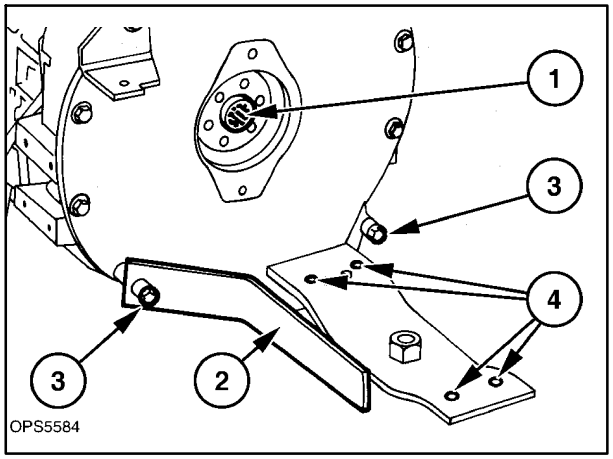

Figure 5-87

3. Install the keys in slots on the trunnion shafts, 1, and assemble cam arms, 2, onto shafts. Secure with 3/8″ x 2-1/2″ Grade 8 cap screws, lock washers and nuts at 3, torque to 65 N·m (48 ft. lbs.). Position the cam arms, 2, flush or 1/32″ below the trunnion shafts at 4.
4. Reinstall hydraulic lines and tighten securely. When tightening fittings, first align hoses and tubes for clearance and tighten to seat to fittings, then loosen and retorque.

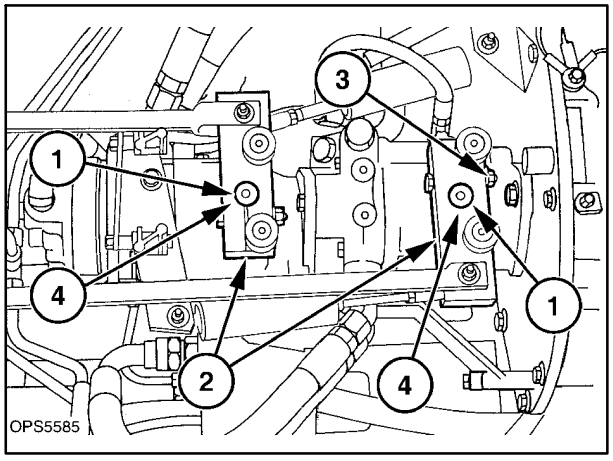

Figure 5-88

5. Reconnect all steering linkages and neutralizer plate.
6. Reinstall the control levers if removed. Refer to the operator's manual for neutral adjustment procedure and adjust the steering control levers for neutral.
7. Refer to the "Start-Up Procedure" after a rebuild section of this manual for the start-up procedure.
8. Put the Service/Run switch in the "SERVICE" position.
9. Operate the unit and check for oil leaks and repair.

CAUTION: SECURELY SUPPORT THE SKID-STEER LOADER WITH ALL FOUR WHEELS OFF THE GROUND, OR MOVEMENT OF THE LOADER MAY CAUSE SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

10. Tilt the cab and boom back into position, if tilted forward.
11. Reinstall the step shield, fenders, etc. removed for the repair.
12. Fill the hydraulic system (reservoir) with SAE 10W-30 oil.

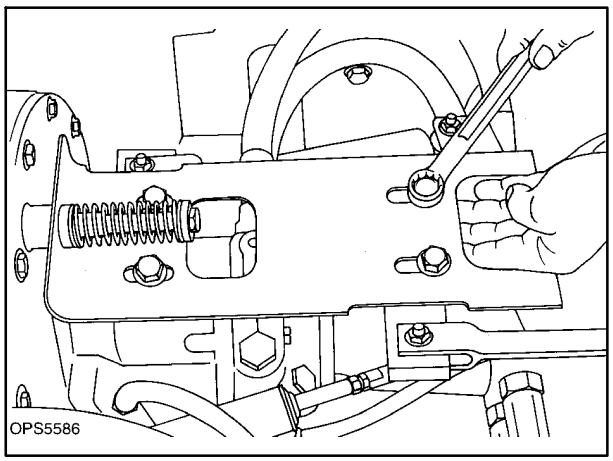

Figure 5-89

HYDROSTATIC MOTOR

HYDROSTATIC MOTOR REMOVAL

The hydrostatic motor assembly can be removed from the top and front or the cab and boom can be tilted forward for more access, refer to Section 1 for the cab tilting procedure.

To remove the hydrostatic motor assembly without tilting the cab forward:

1. Lower the boom and bucket to the lowered position, resting on the ground or remove any attachment and raise the boom and rest on the boom lock pins, 1.

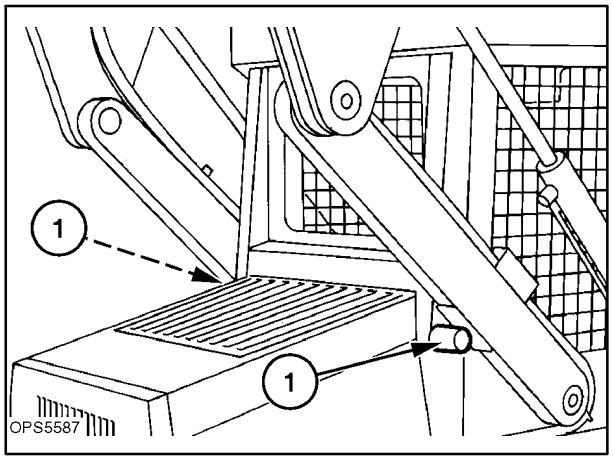

Figure 5-90

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.
3. Put the Service/Run switch, 1, in the “SERVICE” position.
4. Engage the parking brake.

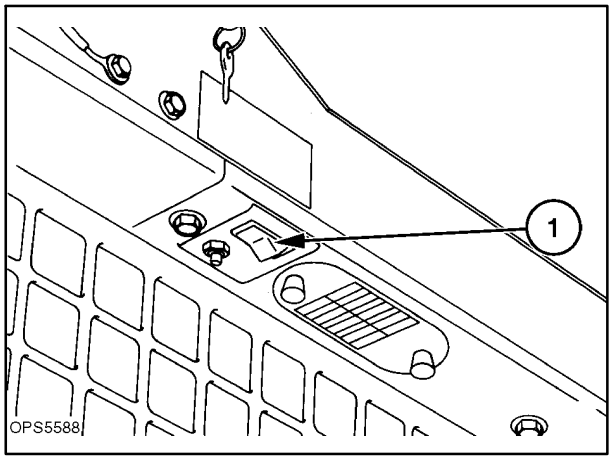

Figure 5-91

5. Securely block the skid-steer loader with all four wheels off the ground. Refer to Section 1 for more information on properly supporting a skid-steer loader.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

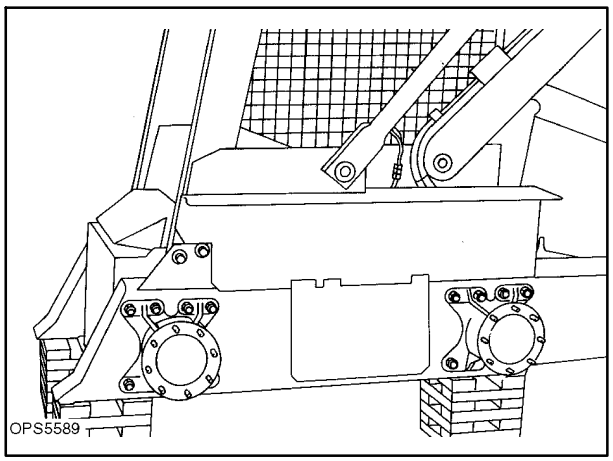

Figure 5-92

6. Raise the operator's seat and latch in the raised position, 1.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

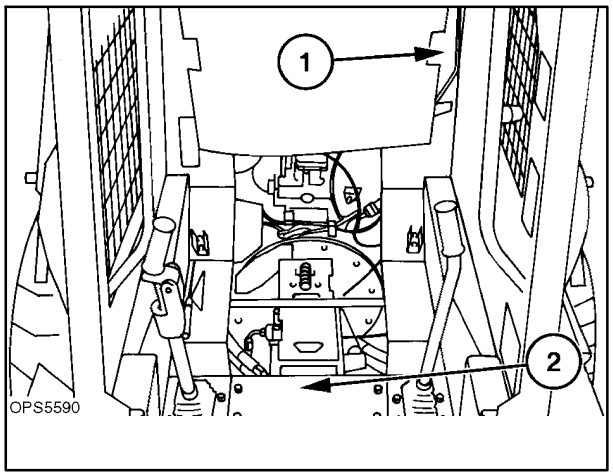

Figure 5-93

7. Remove the step shield, 1, to access the hydrostatic pump and motor area. For more access, remove the right or left hydrostatic control handle assembly, 1 or 2.
8. Relieve all pressure in the hydraulic and hydrostatic systems.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEMS TO AVOID SERIOUS INJURY.

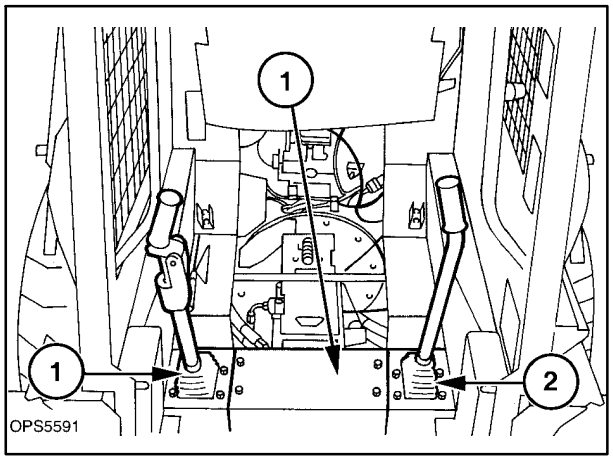

Figure 5-94

Draining the hydraulic oil reservoir is not required if the suction and return lines are capped to prevent loss of oil unless the hydraulic system requires cleaning.

9. Remove the rear engine belly pan hardware, 1, and remove the belly pan.

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN TO PREVENT SERIOUS INJURY.

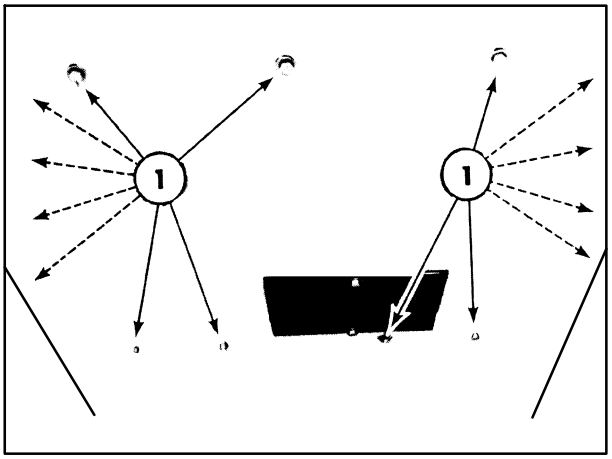

Figure 5-95

10. Drain the hydraulic reservoir.
    a. Loosen the return line clamp, 1.
    b. Remove the return line at 2, and rotate the line into a suitable drain pan.

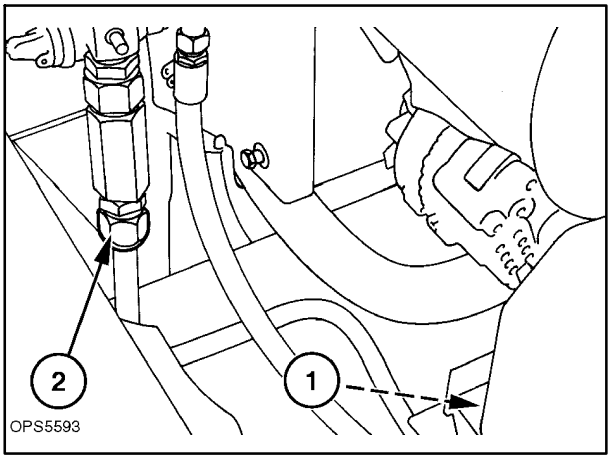

Figure 5-96

11. Remove the fender, 1, on the side the motor is being removed from. Remove the final drive cover, 2, to access the parking brake. Engage the parking brake.

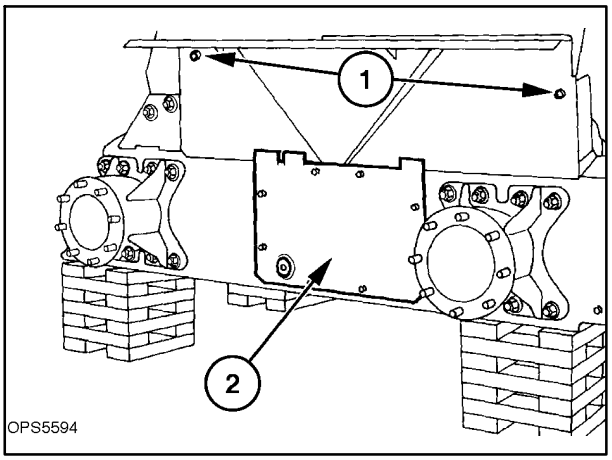

Figure 5-97

12. For more access to the final drive, remove the tires and loosen the rear axle retaining hardware. Slide the axle to the center to loosen the drive chain. Loosen the brake disk retaining bolt, 3.

    Disengage the parking brake at this time.

13. Remove the brake caliper bolts, 2, from inside the unit and remove the disk from the splined coupler.

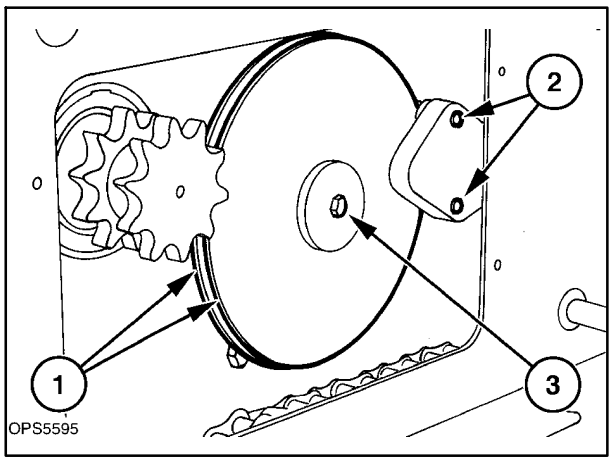

Figure 5-98

14. Remove the high-pressure and case drain lines from the motor and cap to prevent loss of oil. Remove the two motor retaining bolts, 1, right side shown.

    NOTE: The large fittings may need to be removed for clearance.

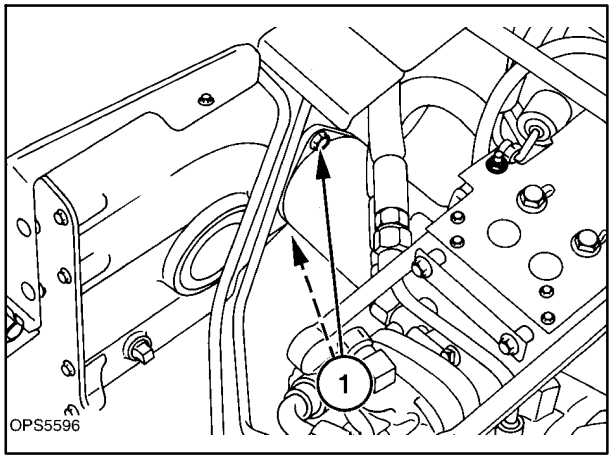

Figure 5-99

15. With the brake disc removed from the coupler, locate a groove, 1, in the coupler and place a flat bearing puller in the groove. Place a nut or heavy flat washer inside the coupler next to the end of the motor shaft at 2. Insert a second puller into the coupler and hook over the flat puller. Now tighten the puller and push the motor shaft free of the coupler.

CAUTION: DO NOT USE A HAMMER AND DRIVE ON THE MOTOR SHAFT TO REMOVE FROM THE COUPLER. SEVERE DAMAGE TO THE MOTOR MAY OCCUR.

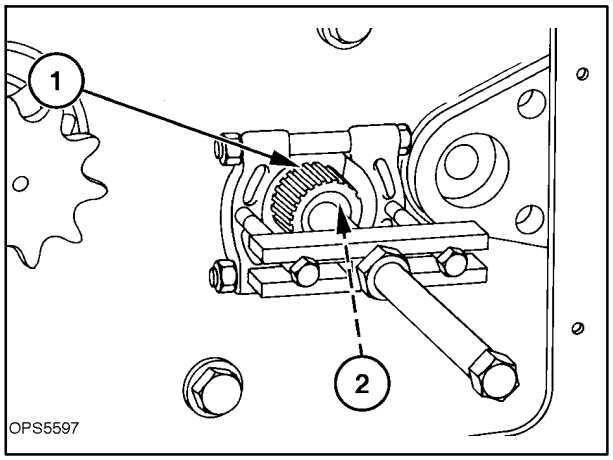

Figure 5-100

16. Remove the motor from the loader.

Thoroughly clean the motor before disassembly.

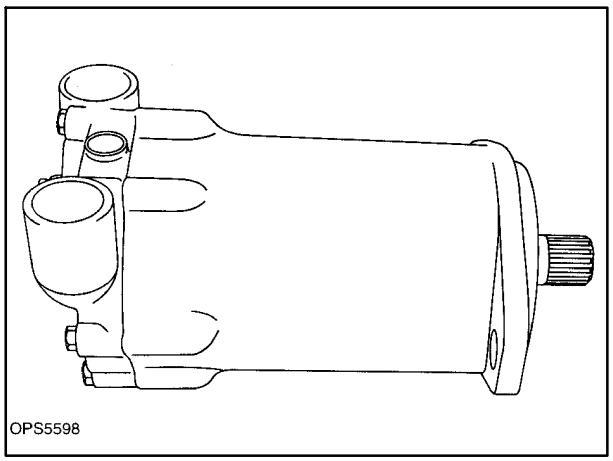

Figure 5-101

HYDROSTATIC MOTOR DISASSEMBLY

This section describes the basic overhaul information for the high torque motor. This motor consists of one rotating block with pistons on either end that travel on replaceable cam plates. This motor must be shimmed on rebuilding to insure proper hydrostatic braking of the loader.

NOTE: Dealer adjustment requests for oil leak repairs, other repairs, or overhaul of the transmission motor must include the model number of the transmission motor and the date code. These are stamped in the flange of the motor housing, 1.

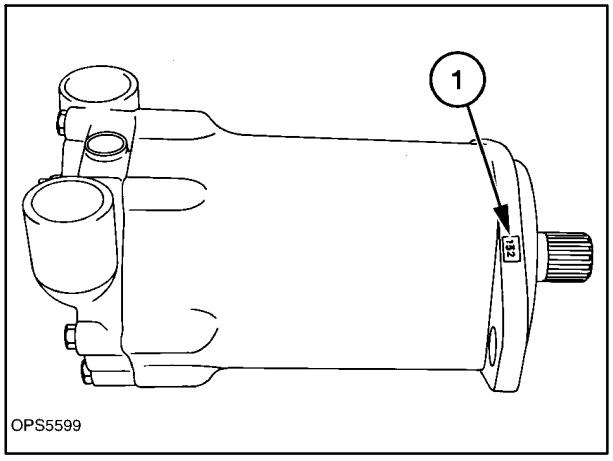

Figure 5-102

1. Thoroughly clean the outside of the motor housing before disassembly. Plug the ports to prevent dirt and solvent from entering the motor housing.
2. Remove the snap ring, 1, from the housing, and remove the seal, 2; the seal will be damaged upon removal.

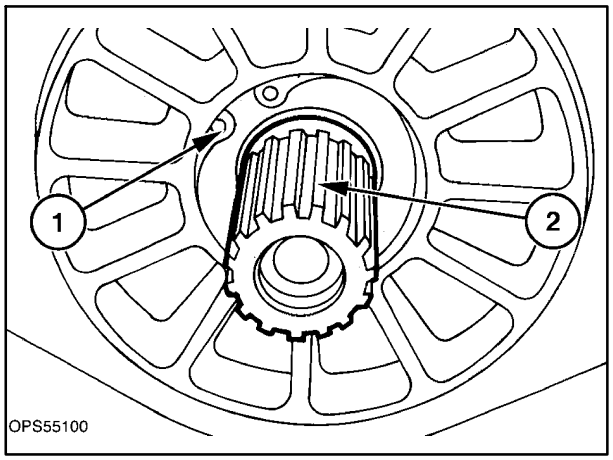

Figure 5-103

3. Mark the motor housing, as indicated at 1, for proper reassembly of the motor. Clamp the motor in a vise, as shown, on the housing flange.
4. Remove the cap screws, 2, from the back plate assembly, and lift the plate straight from the housing to prevent damage to the shaft and bearings.

   NOTE: The back plate assembly should pop up with the removal of the six cap screws. If the plate does not pop up, use a plastic mallet and tap on the ports to remove the back plate assembly.

   IMPORTANT: The motor housing is aluminum and can be easily damaged. Do not use sharp objects to pry the back plate from the housing or damage to the machined surfaces may occur.

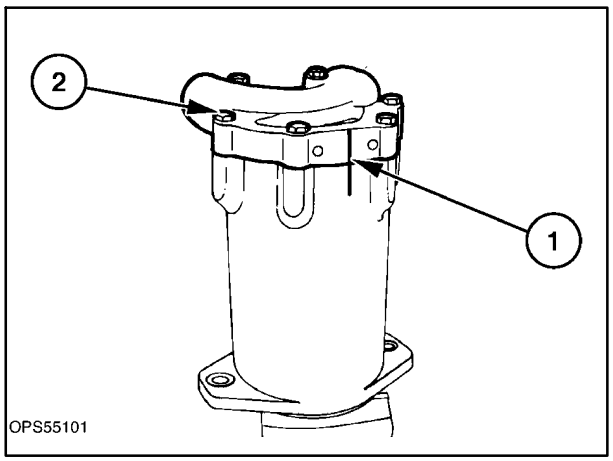

Figure 5-104

5. After the back plate is removed, there is a shim washer, thrust bearing, 1, and two races, 2, on the end of the shaft. The shim washer, bearing, and one race may remain in the back plate as shown at 1.

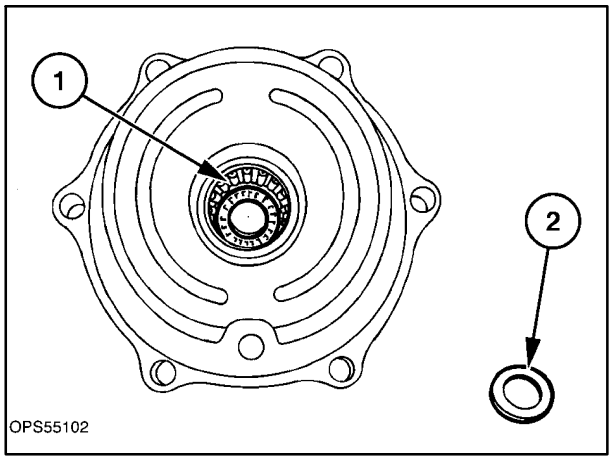

Figure 5-105

6. Remove connector plate, 1, after noting how it is installed in the spider assembly, raised area, 2, towards the back plate and flat side towards the pistons.

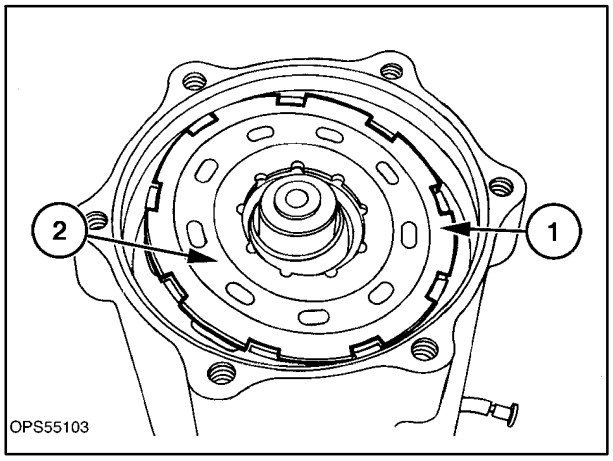

Figure 5-106

7. Remove two pistons noting the holes they are from, then remove the spider and remaining piston assembly. Be sure to lay all parts being removed from the motor on clean cardboard to prevent contamination. Do not drop any parts on removal or reassembly, as the parts may be damaged.

   NOTE: When reassembling, the piston must be reinstalled in the same holes due to fit and wear.

   IMPORTANT: Do not drop any parts from the motor or damage may occur.

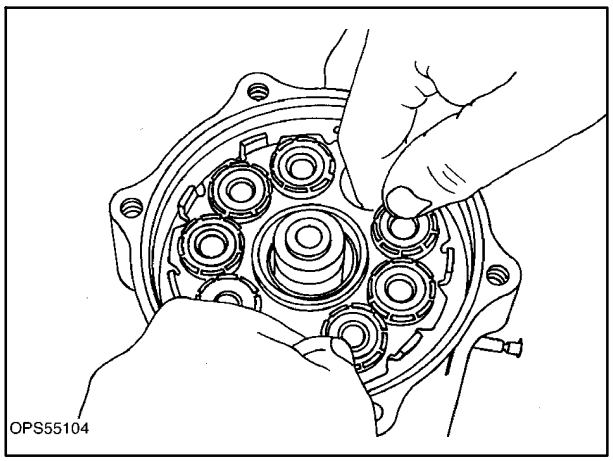

Figure 5-107

8. Remove the pilot assembly, 1.
9. Remove the pivot assembly, 2.
10. Remove any shim washers, 3, and spring, 4.
11. Remove snap ring collar, 5.

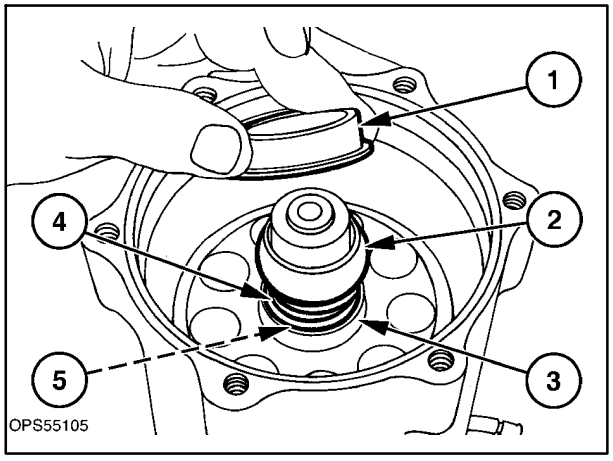

Figure 5-108

12. Remove the motor assembly from the vise and position a hand around the shaft, as shown. This will prevent the solid pistons remaining in the rotating block from sliding out when the block is turned.

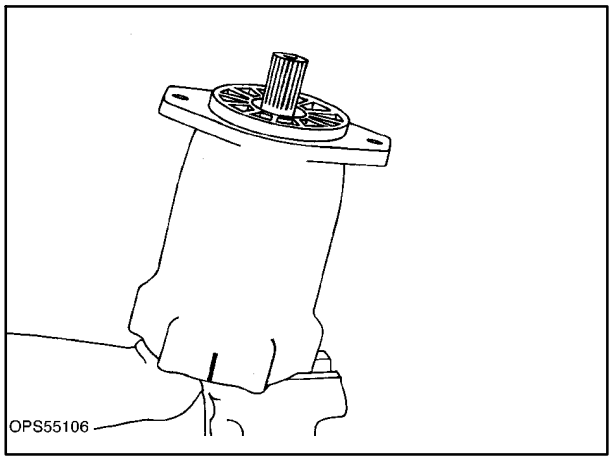

Figure 5-109

13. Pull the case straight up and remove it from the shaft. The heavy thrust bearing, 1, and piston race, 2, can now be removed.

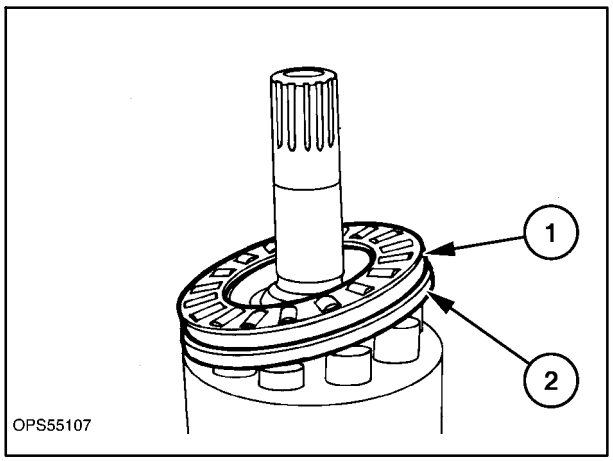

Figure 5-110

14. A replaceable bearing race, 1, is installed in the housing assembly and will normally remain in the housing when other parts are removed. This race should be checked for any signs of scoring or turning in the housing. Replace the race as necessary. Be sure to clean the case thoroughly for reassembly.

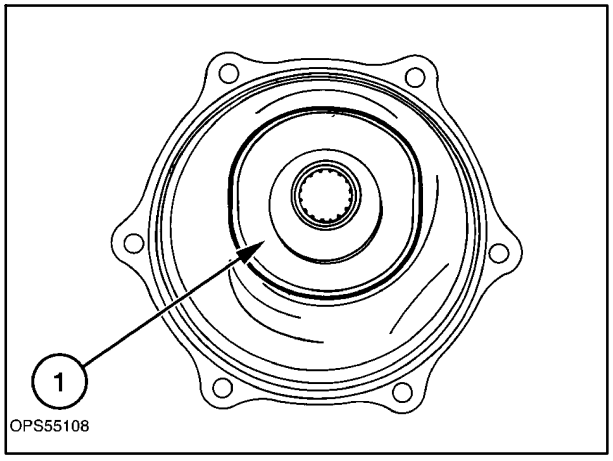

Figure 5-111

15. Remove pivot, 1, and spacer, 2.

16. The nine solid pistons, 3, can now be removed. Remove the pistons from the snap ring end of the piston block. Note that the tapered end of the piston faces the bearing race previously removed.

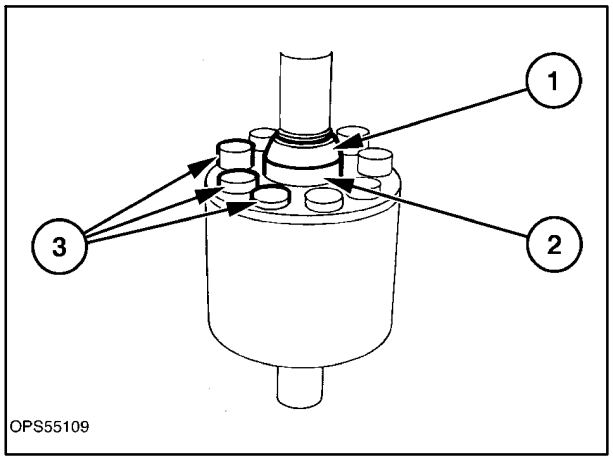

Figure 5-112

IMPORTANT: There is a burr around the holes in the piston block at 1; this is normal, do not remove. DO NOT place the piston block on the ends or the burr around the holes may be damaged, causing a piston to stick during operation.

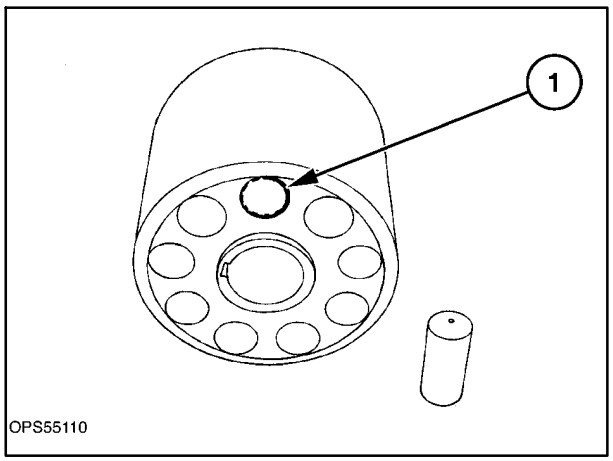

Figure 5-113

17. The piston block can be removed from shaft, 1. The block is keyed onto the shaft with a long, square key, 2. Remove the snap ring, 3, from the shaft if it requires replacement.

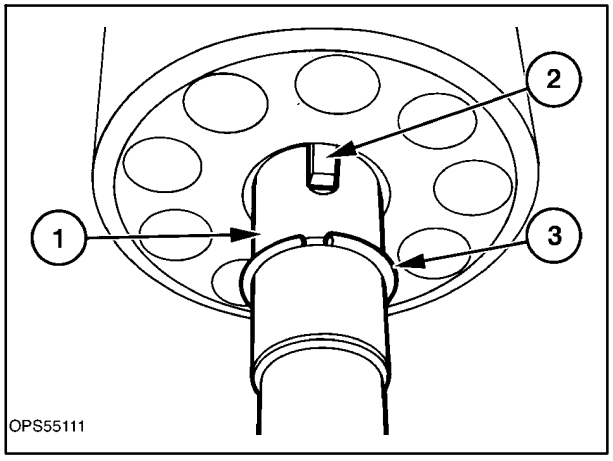

Figure 5-114

18. A complete layout of the parts used in the hydrostatic motor is shown.

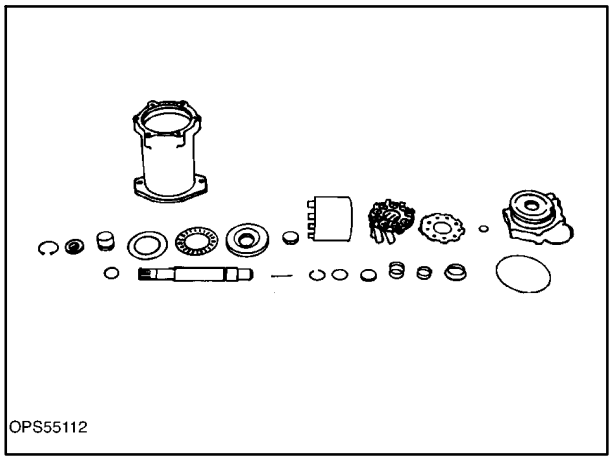

Figure 5-115

HYDROSTATIC MOTOR PARTS INSPECTION

Clean all parts in a suitable solvent and air dry prior to inspection.

IMPORTANT: Due to close tolerances and finish of motor internal surfaces, it is important to maintain absolute cleanliness during inspection and reassembly or damage to the components may occur.

1. Examine the needle bearing in the housing assembly and the back plate assembly, 1, for excessive play in the needles. If the needles are free from excessive play and remain in the bearing case, there is no need to replace the bearing. Inspect the thrust bearing, 2, and races, 3, for scratches and wear.
2. Inspect the flat surface of the back plate around the kidney ports for scratches. Inspect the area between the kidney ports, 4; there should be no scratches that you can catch a fingernail in. Wear in this area will cause loss of hydraulic power to the wheels.

   When a back plate assembly must be replaced, the connector plate should also be replaced.

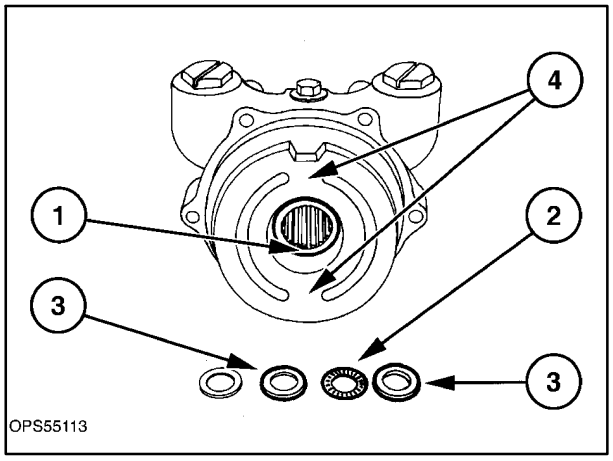

Figure 5-116

3. Inspect the shaft for any wear in the bearing or seal areas, 1. If wear is noted, the shaft should be replaced. Also check the shaft splines, 2, and key, 3, areas for wear.

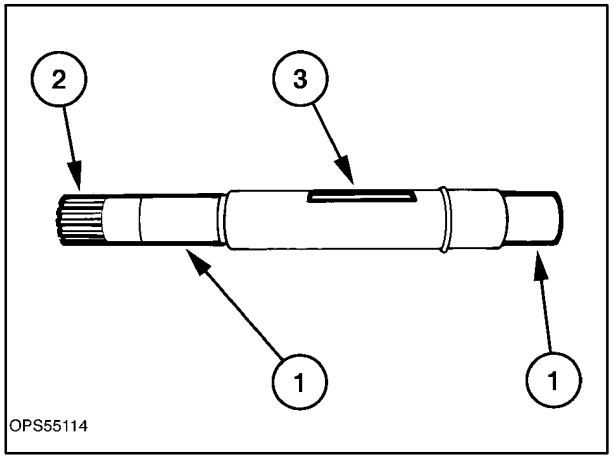

Figure 5-117

4. Inspect the piston block for any wear in the key or shaft area, 1.
5. The hollow pistons with slippers must be installed into the piston block holes on the side of the block with the tapered shaft opening, 2. Examine the holes in the block for scoring and wear. If the pistons' skirts show scoring, the corresponding hole in the block will be worn.
6. The pistons should be free to move in the block bore. Check each individual piston in a block hole to be sure it moves freely when well lubricated. If it does not move freely, check the piston for scoring or block bore for wear or contamination.

   NOTE: There is a burr around each hole at 3; be careful not to damage the burr.

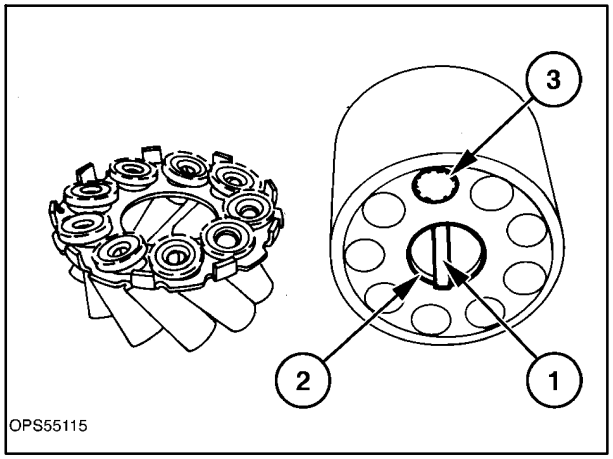

Figure 5-118

7. The outside of the pistons, 1, should not show any deep scratches or wear. It is normal to see minor scratches, such as brush marks, that cannot be felt with a fingernail. The piston shoes, 2, should fit snugly on the ball end, 3, of the piston. There should not be any wear to the outside edge of the shoe at 5, which can be noted by a rolled edge. If necessary, replace the piston assemblies.

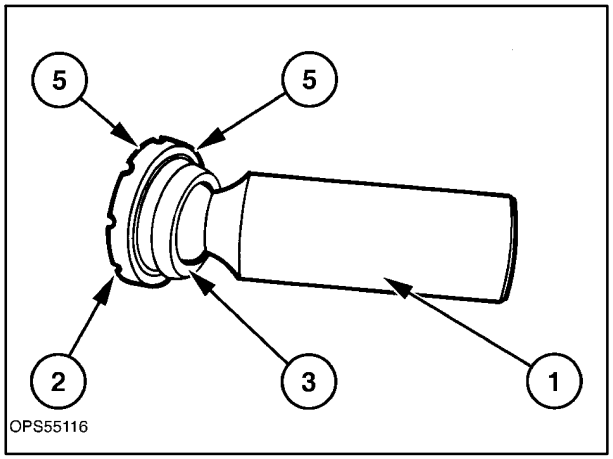

Figure 5-119

8. Check the internal opening in each piston to be sure it is open for oil flow, 1. The flat surface of the piston shoe should be smooth and not show any scratches, 2.

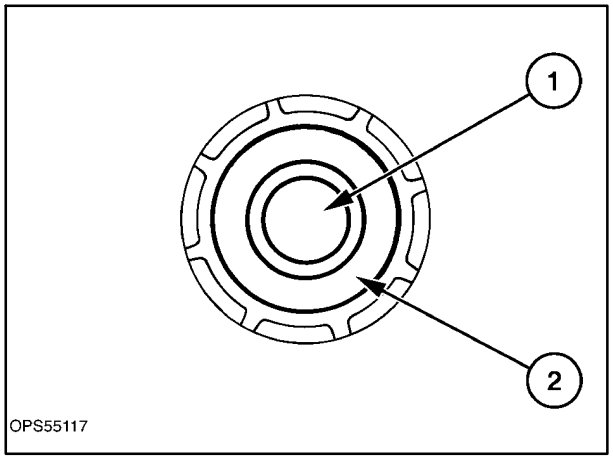

Figure 5-120

9. The solid piston assemblies should be individually checked in the block bores to be sure they move freely when lubricated. The solid pistons go in the end of the block with the shoulder, 1. Install the solid pistons from the tapered end of the block, 2, with the tapered end of the piston, 3, towards the shoulder end of block, 1. Check the tapered end of the piston and the piston race for wear. If the pistons do not move freely in the bores, replace the pistons or block as needed.

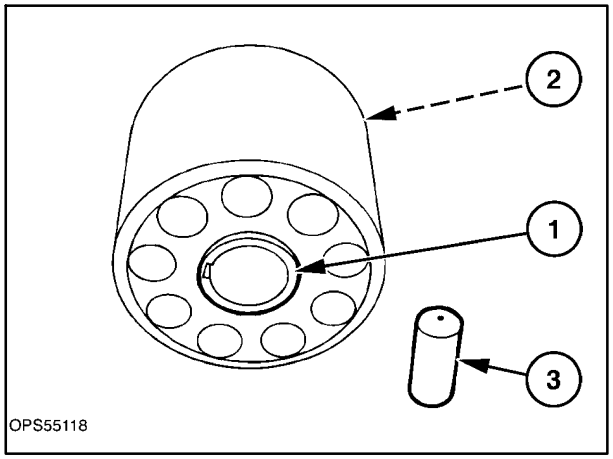

Figure 5-121

10. Check the connecter plate for wear in the band area, 1, or any connecting scratches between the kidney ports, 2.

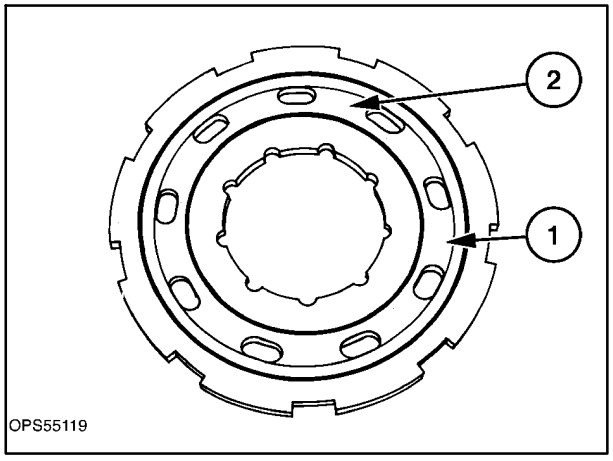

Figure 5-122

11. Check the bearing races and bearing for scratches or damage to the bearings or the flat surfaces. A race failure due to a sticking solid piston will result in a broken race. Check the solid piston for interference with the piston block. This type failure is normally caused by contamination in the hydrostatic system.

    If the bearing race, 1, is removed and is in two or three pieces, it will require replacement.

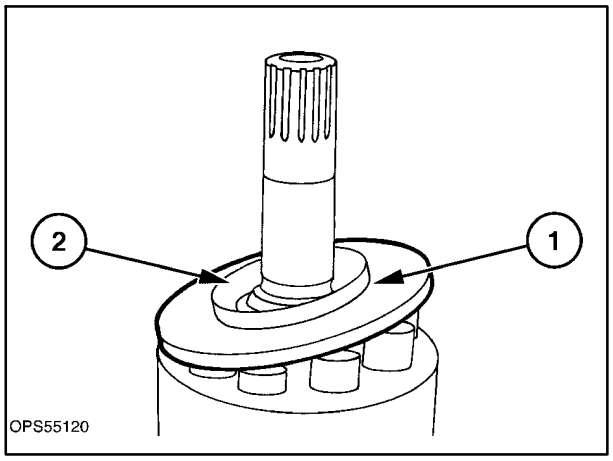

Figure 5-123

HYDROSTATIC MOTOR REASSEMBLY

IMPORTANT: Due to close tolerances and finish of motor internal surfaces, it is important to maintain absolute cleanliness during inspection and reassembly or damage to the components may occur.

Be sure all parts are clean and air-dried before reassembly. Prior to assembling the motor, dip all parts in the oil, 10W-30, that will be used in the hydraulic reservoir. This motor must be shimmed during reassembly. The shim kit gauge block used to determine the shim pack is included in the seal kit for the motor assembly.

1. Install the key, 1, in the shaft and the round retaining ring, 2, in the groove.

   Slide the piston block on the shaft with the 45° chamfer, 3, in the inside diameter of the piston block toward the round retaining ring, 2, on the shaft.

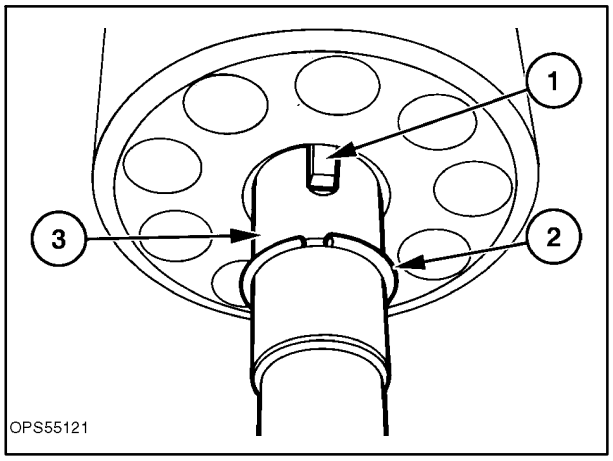

Figure 5-124

2. Lubricate the solid pistons, 1, with system oil and install them in the piston block bores from the tapered end of the block, 2, with the tapered ends facing outward. Be sure each piston moves freely in its bore. It is suggested that the assembly be held with one hand, as shown, so the pistons do not fall completely through the block.

   IMPORTANT: Do not damage the burr around the piston holes in the block.

3. Slide spacer, 3, and pivot, 4, over the shoulder on the shaft. Be sure the block assembly is resting on the snap ring on the opposite end of the shaft.

   NOTE: If the spacer and pivot assembly are not completely down over the shoulder on the shaft as a result of the block being off the snap ring, the shimming procedure and motor operation will be incorrect.

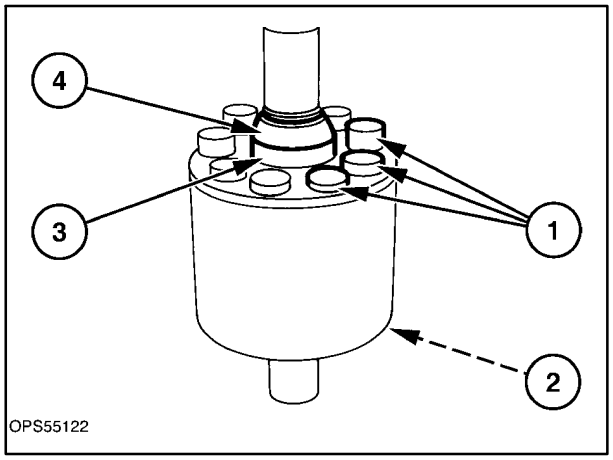

Figure 5-125

4. Lubricate the piston race assembly, 1, and place it on the pivot, as shown, with the bearing locating ring, 2, up.

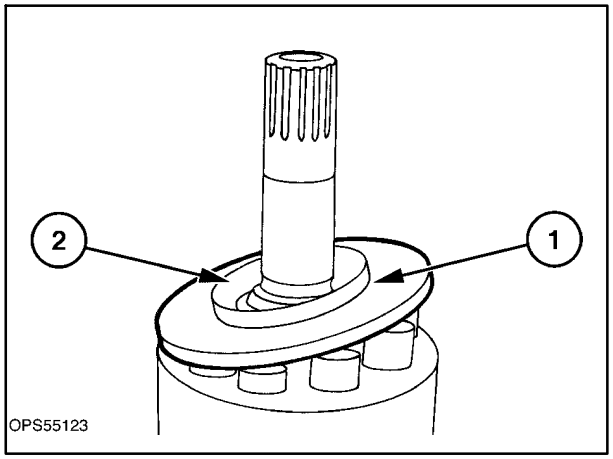

Figure 5-126

5. Lubricate the thrust bearing, 1, and install it over the bearing race at 2.

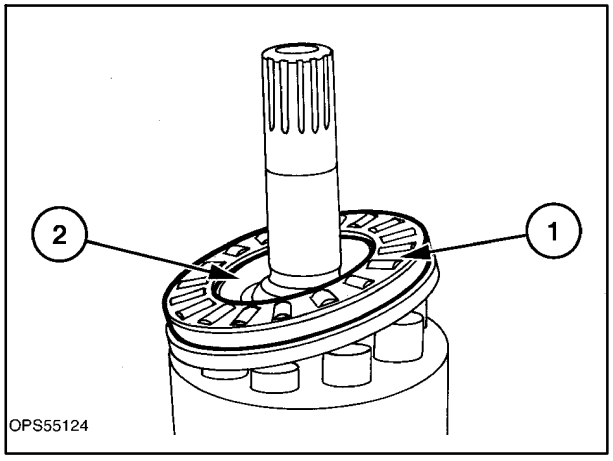

Figure 5-127

6. Insert the outer bearing race into the housing, 1. The bearing race must be inserted squarely into the recess in the housing.

   NOTE: The dull or unfinished side of the bearing race MUST be inserted into the housing first.

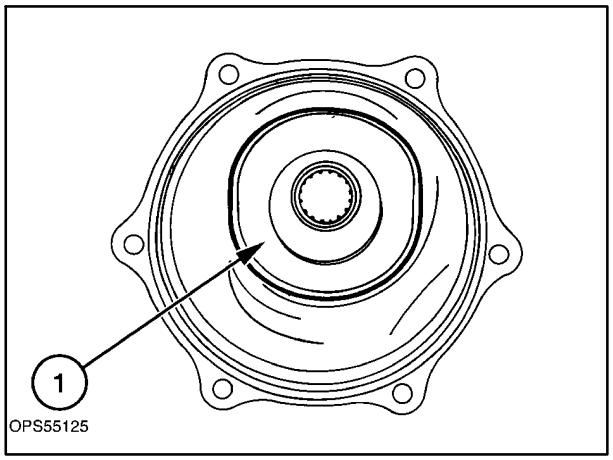

Figure 5-128

Slide the housing down over the complete shaft assembly. Be sure the shaft extends through the housing approximately 1-1/2″. If the shaft does not protrude through the housing the distance shown, the spacer and/or pivot is installed incorrectly.

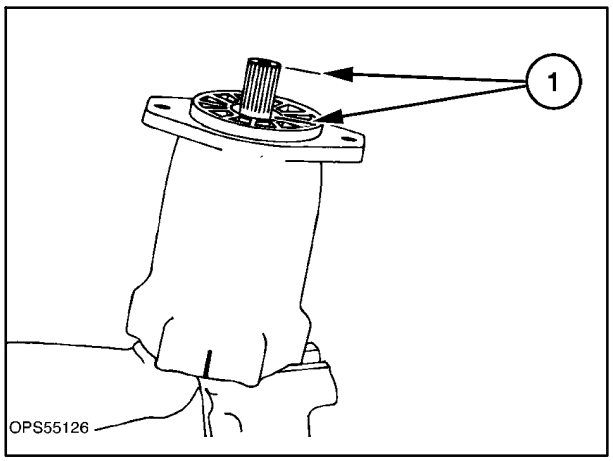

Figure 5-129

7. Turn over the housing and clamp it in a vise on the flanged end of the housing.

   Inspect the piston block and the retaining ring to be sure they are seated properly in the taper of the block at 1.

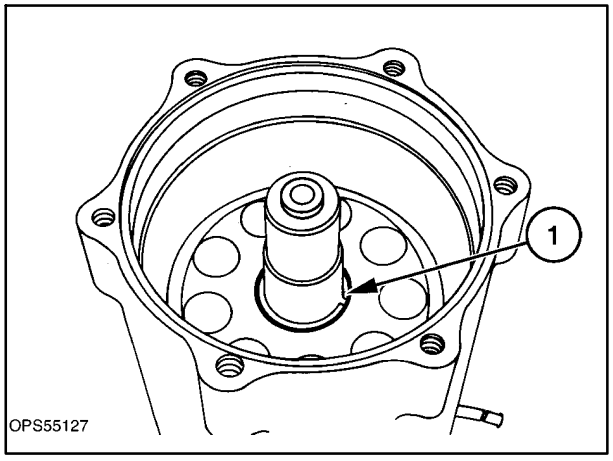

Figure 5-130

Motor Shimming Procedure

1. Place a spring collar over the shaft and snap ring at 1. Place the gauge block marked XDB-1756 or 74600-624 over the shaft and next to the collar previously installed.

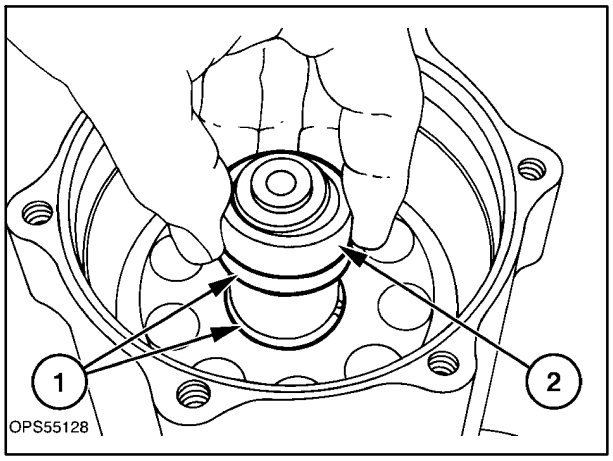

Figure 5-131

Install spring, 1, over the shaft. Lubricate pivot 2, with STP, and make sure it slides easily over the shoulder on the shaft, 3. Install pilot, 4, over the pivot assembly.

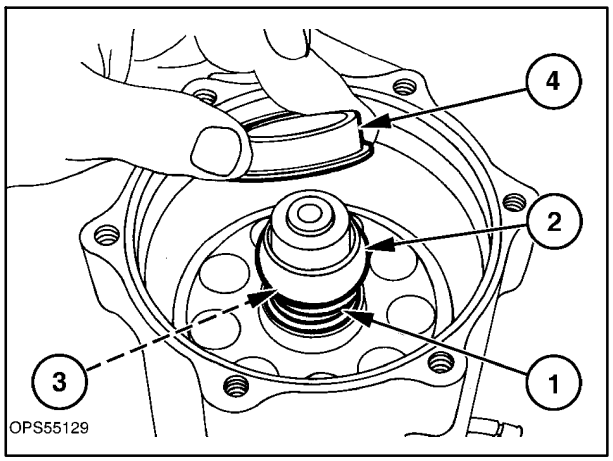

Figure 5-132

2. Lubricate the pistons with SAE 10W-30 oil and install the pistons and spider assembly, 1, making sure the spider plate is properly positioned over the pivot support, 2.

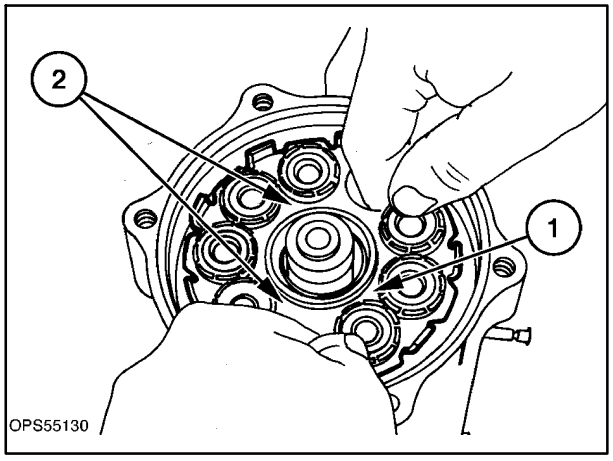

Figure 5-133

3. Lubricate both sides of the connector plate and install it as shown with the flat side next to the pistons and the raised side up.

   NOTE: Be sure the connector plate sits inside the locators on the spider at 1.

4. Set the connector plate and spider, 2, at the angle to match the fixed angle of the back plate. Center the connector plate, spider, and pivot around the shaft at 3.

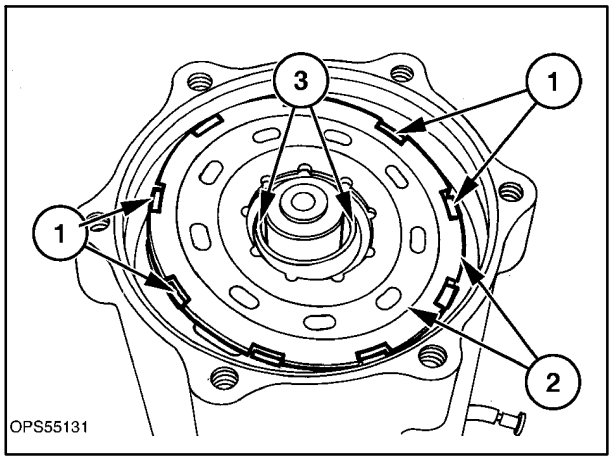

Figure 5-134

5. Lubricate the small thrust bearing and races with a thin coating of STP and stack race, 2; bearing, 3; race, 4; and thin shim washer, 5, on the end of the shaft at 1.

   NOTE: Reinstall the thin shim washer at 5, if one was previously removed.

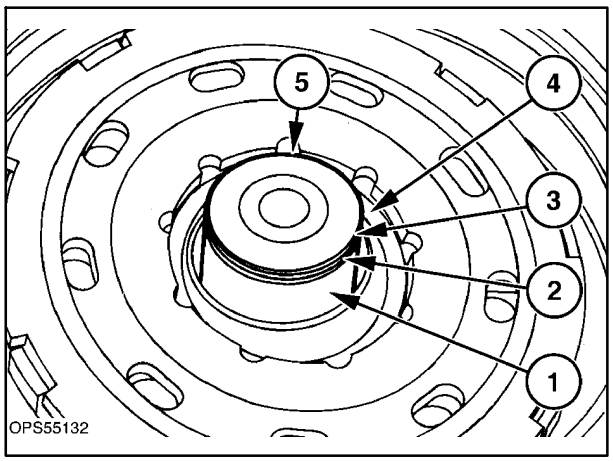

Figure 5-135

6. Install the back plate assembly and pull down evenly with two hands until the pivot, 2, Figure 5-132, is felt to move over the shoulder of the shaft. This will enable the back plate to move within approximately 3 mm (1/8″) of the housing assembly at 1. If there is more than 1/8″ clearance, remove the back plate and check the assembly.

   IMPORTANT: DO NOT force; damage to the pivot, pilot, or spider plate may occur.

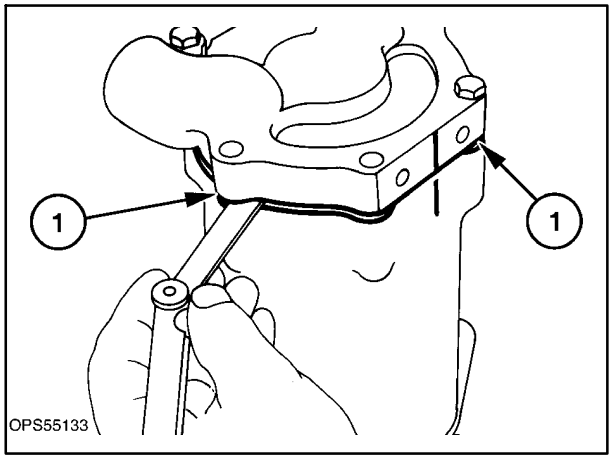

Figure 5-136

7. While holding the back plate assembly against the spring load, install two bolts opposite each other as shown at 1. Torque these two cap screws evenly to 3.5 N·mm (20 in. lbs.).

   NOTE: The 3.5 N·m (20 in. lb.) torque must be accurately gauged for the correct shim pack to be installed.

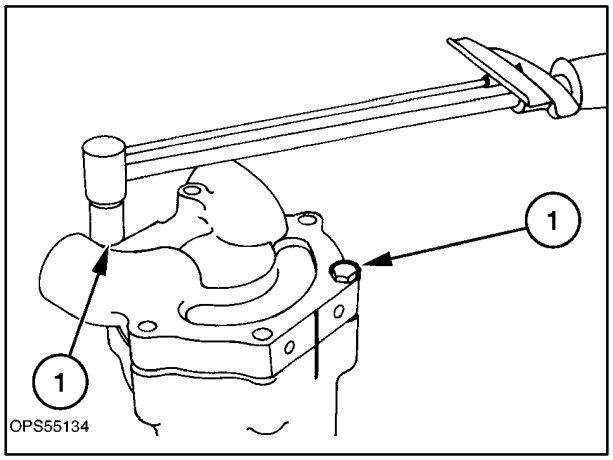

Figure 5-137

8. With a feeler gauge, measure the gap between the two opposite pads, 1. If either gap is over 5 mm (0.200″), the motor has been incorrectly assembled and must be disassembled before further shimming.

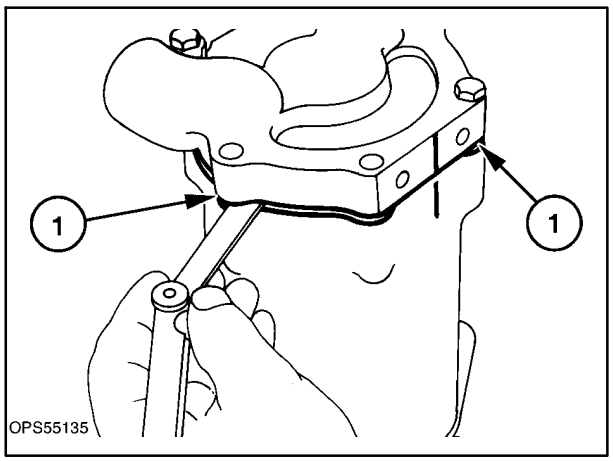

Figure 5-138

9. Shim pack calculation:

   a. Add the two feeler gauge figures obtained in step 8.

   Example:

0.155″	3.94 mm
+ 0.145″	+ 3.68 mm
0.300″	7.62 mm

   b. Divide the total by 2.

$$\text{Example: } \frac{0.300''}{2} = 0.150''$$

$$\frac{7.62 \text{ mm}}{2} = 3.81 \text{ mm}$$

   c. A constant of 7.14 mm (0.281″) is used to complete the calculation. Subtract the total from 7.14 mm (0.281″) to determine the correct shim pack.

   Example:

0.281″	7.14 mm
- 0.150″	- 3.81 mm
0.131″	3.33 mm

   d. The shim kit includes two 1.91 mm (0.075″) shims and four 0.38 mm (0.015″) shims. Use a combination of these shims to obtain the shim pack calculated in step c.

   NOTE: Shim pack specifications are ± 0.25 mm (± 0.010″). When possible, shim to the +0.25 mm (+0.010″) side of the shim pack calculated in step c.

   Example: To obtain the 3.3 mm (0.131″) dimension calculated in step c, use one 1.91 mm (0.075″) shim and four 0.38 mm (0.015″) shims.

0.075″	1.91 mm
0.015″	0.38 mm
0.015″	0.38 mm
0.015″	0.38 mm
0.015″	0.38 mm
0.135″	3.43 mm

10. Disassemble and replace the shim gauge block, 1, with the required number of shims from the seal kit at 1. When two 1.91 mm (0.075″) shims are used, the 0.38 mm (0.015″) shims must be placed between them. When only one 1.91 mm (0.075″) shim is used, place the 1.91 mm (0.075″) shim against the spring, as shown.

11. Complete reassembly of the motor by checking the snap ring and piston block are properly seated at 2. Install the collar, 3, over the snap ring. Install shims at 1, spring, 4.

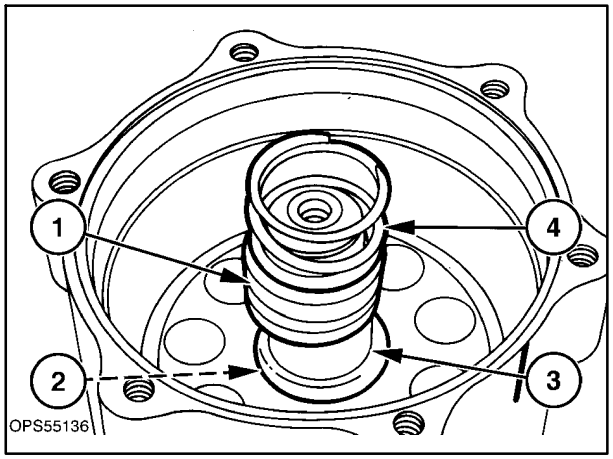

Figure 5-139

12. Install the pivot, 1, and the pilot, 2.

    IMPORTANT: Lubrication of the motor components during assembly is required to insure lubrication oil for start-up.

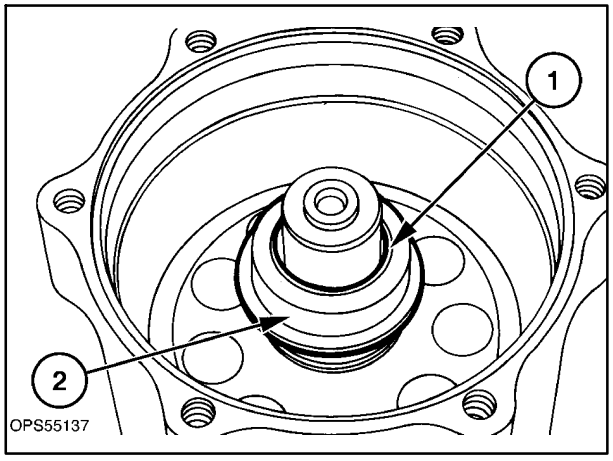

Figure 5-140

13. Install the spider and piston assembly as shown, making sure the spider is seated over the pivot as shown at 1. Lubricate the piston slippers with a thin coating of STP for a good sliding surface.

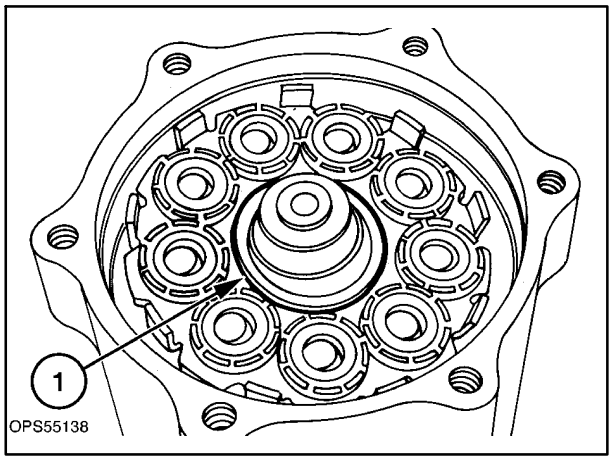

Figure 5-141

14. Install the connector plate, 1, and lubricate both sides with a thin coating of STP. Install it as shown with the flat side next to the pistons and the raised side up. Check the connector plate and make sure it is seated over the locating tabs, 2, on the spider plate.

15. Set the connector plate and spider, 1, at the angle to match the fixed angle of the back plate. Center the connector plate, spider, and pivot around the shaft at 3.

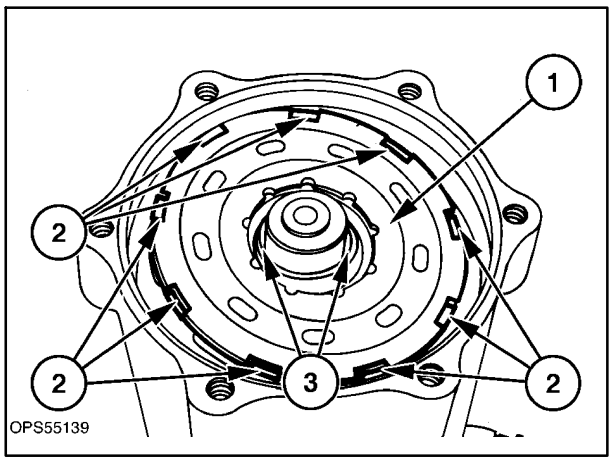

Figure 5-142

16. Lubricate the small thrust bearings and races with a thin coating of STP and stack race, 2; bearing, 3; race, 4; and thin shim washer, 5, on the end of the shaft, 1.

    NOTE: Reinstall the thin shim washer at 5 if one was previously removed.

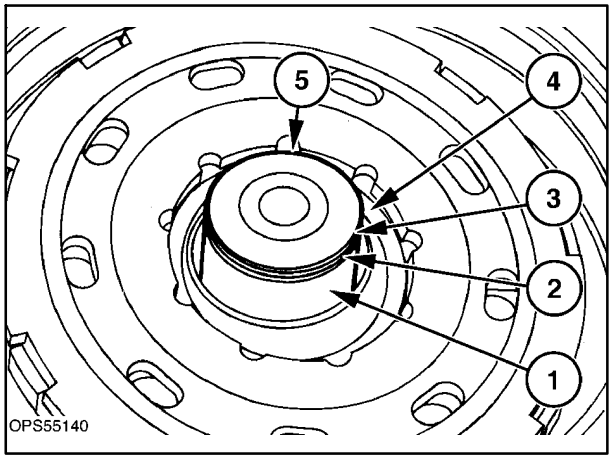

Figure 5-143

17. Install the back plate assembly with a new O ring. Tighten the six bolts, 1, down evenly using opposite bolts and torque to 23 N·m (17 ft. lbs.). Use caution not to disturb the thrust bearing. Align the marks on the back plate and housing to insure correct assembly.

    NOTE: Push the back plate by hand to insure the pivot seats over the shoulder on the shaft properly; DO NOT force.

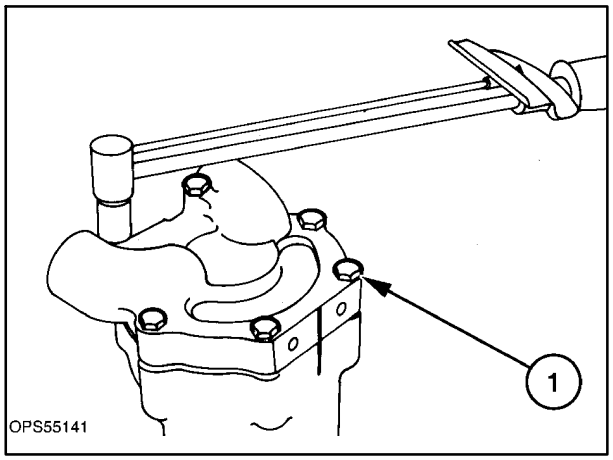

Figure 5-144

18. Install a bolt in the drive end of the motor shaft and use an inch pound torque wrench to check the rolling torque of the motor shaft. If the rolling torque exceeds 6.8 N·m (5 ft. lbs.) or 10.5 N·m (60 in. lbs), the motor is too tight; the assembly and shimming procedure must be rechecked and recalculated.

    NOTE: Check the spider, connector plate, and pivot for proper assembly if the motor is too tight.

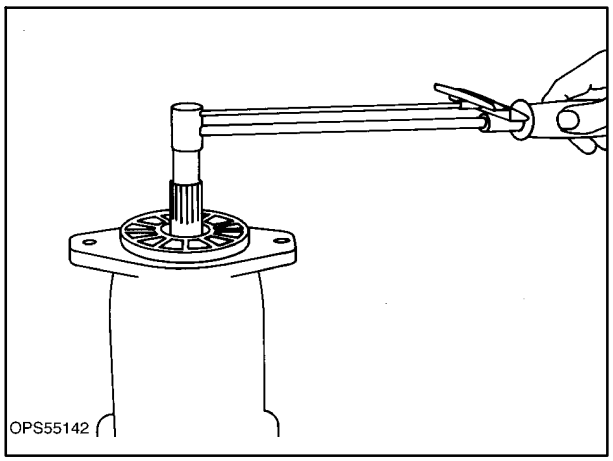

Figure 5-145

19. Install a new seal, 1, and snap ring, 2, in the housing at 3. Fill the motor housing with 10W-30 oil to the case drain level to insure lubrication oil on start-up.

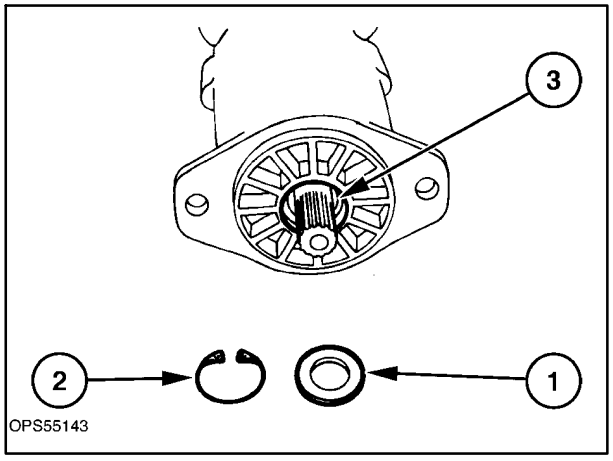

Figure 5-146

20. Using a dial indicator, check the end movement of the motor shaft, 1. If the end movement is over 1.02 mm (0.040″), add a shim washer on the end of the shaft at 5, Figure 5-143, between the back plate and thrust bearing race.

    The motor assembly is now ready for installation in the loader.

    Refer to the “Hydraulic System Cleaning Procedure After Transmission Overhaul” section of this manual before installing the motor assembly in the loader.

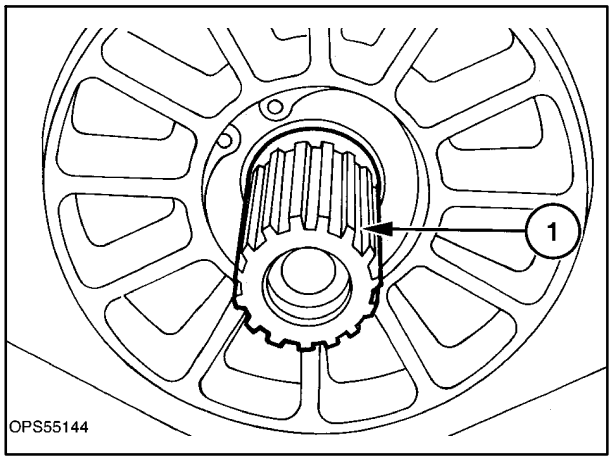

Figure 5-147

HYDROSTATIC MOTOR INSTALLATION

1. Clean all previously sealed surfaces, motor to gearbox, final drive cover, brake disk retaining bolt and washer.

   When resealing, use a noncorrosive silicone sealer to prevent rust and corrosion of parts after assembled.

2. Place a bead of New Holland Ultra-Blue silicone sealer around the face of the motor housing.

3. Align the motor assembly tapered splines with the coupler splines in the gearbox and slide the motor shaft into the coupler. Install two 1/2″ x 1-1/2″ cap screws and washers, torque to 101 N·m (75 ft. lbs.).

   IMPORTANT: The motor shaft and coupler splines are tapered. Use caution to insure that the splines mate properly during assembly. DO NOT FORCE or damage could occur to the motor housing.

4. Reinstall the motor fittings if removed.

5. Reinstall the brake disc, 1, and caliper, 2.

6. Put a bead of silicone sealer around the end of the coupler and install the retaining bolt and washer, 3. Engage the parking brake and check the retaining bolt, torque to 44 N·m (33 ft. lbs.).

7. Reinstall the drive chain on the drive sprocket if removed.

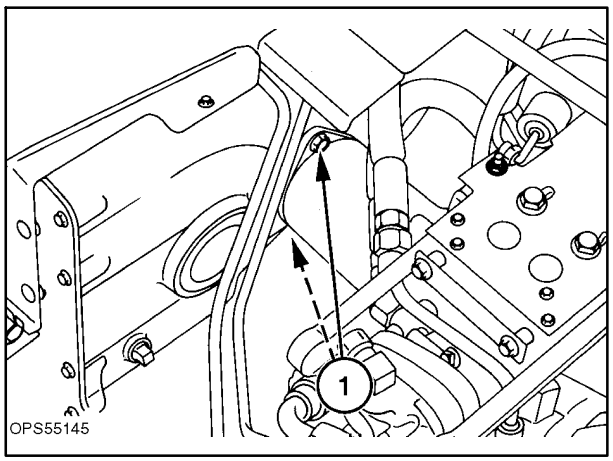

Figure 5-148

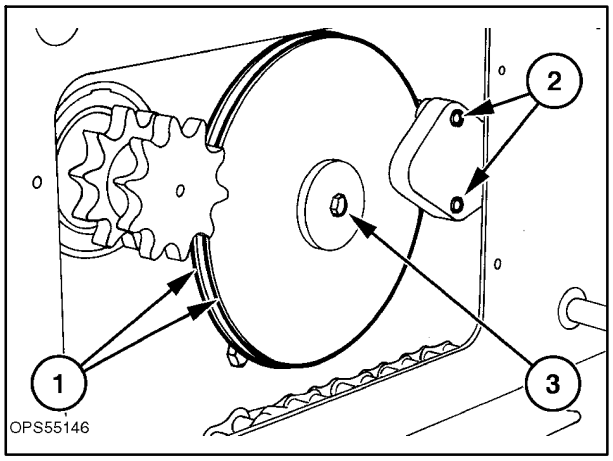

Figure 5-149

8. Slide the axle assembly to the rear and tighten the drive chain, and torque the axle retaining hardware, 1, to 190 N·m. (140 ft. lbs.).
9. Reseal the final drive cover plate, 2, and install.
10. Check the final drive oil level with check plugs, 3, and add SAE 10W-30 oil as required.

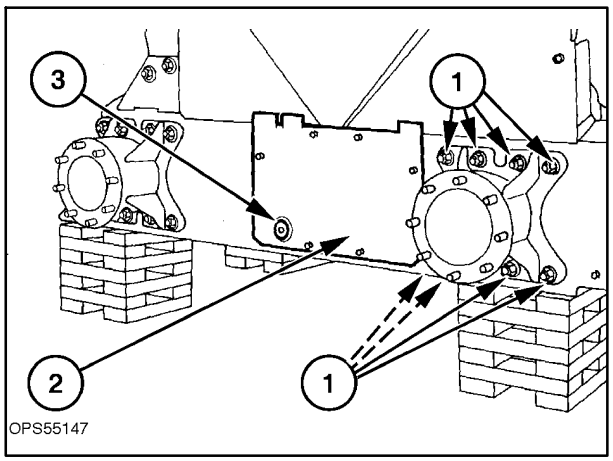

Figure 5-150

11. Reinstall the motor high-pressure hoses and case drain line. Tighten the connections to seat the fittings and loosen and retorque.

    NOTE: Be sure that the hoses are connected to the correct ports. If the hoses are reversed at the pump or motor, the wheels will turn opposite the control handle direction.

12. Reinstall the hydrostatic control lever that was removed. Reconnect all control linkage. Refer to the operator's manual for neutral adjustment procedures.
13. Refer to the "Start-Up Procedure" after a rebuild section of this manual for the start-up procedure.
14. Put the Service/Run switch in the "SERVICE" position.
15. Operate the unit and check for oil leaks and repair.

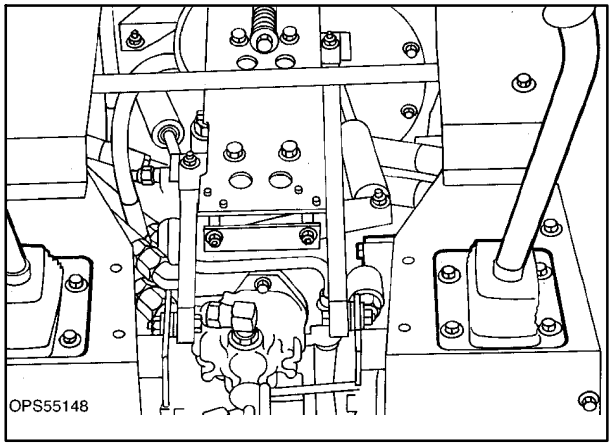

Figure 5-151

CAUTION: SECURELY SUPPORT THE SKID-STEER LOADER WITH ALL FOUR WHEELS OFF THE GROUND, OR MOVEMENT OF THE LOADER MAY CAUSE SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

16. Return the cab and boom to the operating position if the cab was tilted.
17. Install the step shield and fender.
18. Check and refill the hydraulic system to the proper oil level.

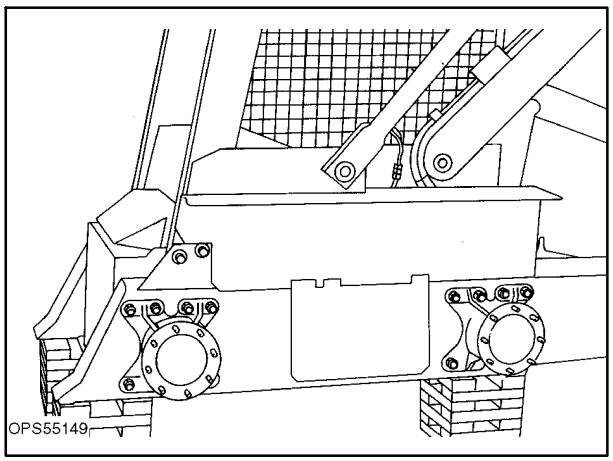

Figure 5-152

Hydraulic System Cleaning Procedure After a Hydraulic System or Transmission Overhaul

The hydraulic/hydrostatic system must be cleaned if during repair the cause was from contamination and the transmissions show wear on the pistons and shoes, rotating piston blocks, valve plate or cam plate.

ATTENTION: Do not use the gear pump and charge pump to flush the system with solvent. The solvent will not provide enough lubrication to protect moving parts inside the transmissions or gear pump.

1. Drain all remaining oil from the hydraulic system.
2. Remove fill cap, 1, and screen by removing the six retaining screws, 2, from the reservoir fill. Thoroughly clean the screen and fill breather cap in solvent.

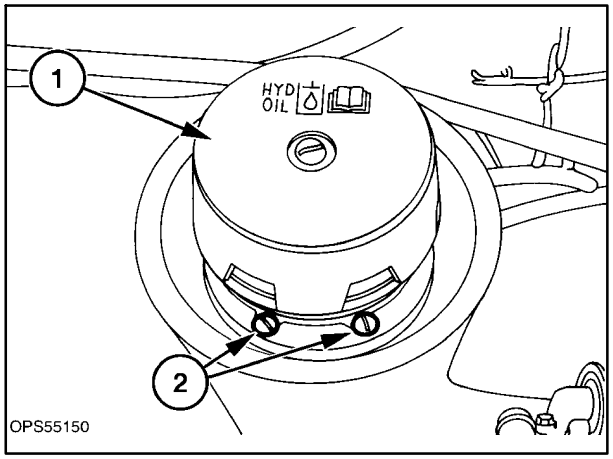

Figure 5-153

3. Drain and flush the hydraulic oil reservoir.
   a. Remove the rear engine belly pan, 1.

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN TO PREVENT SERIOUS INJURY.

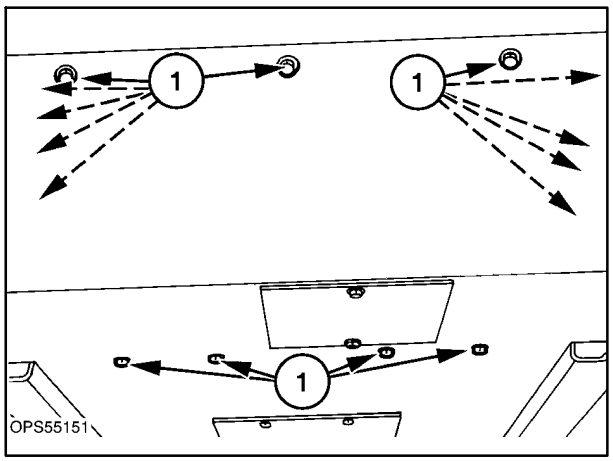

Figure 5-154

   b. Loosen the return line clamp, 1.

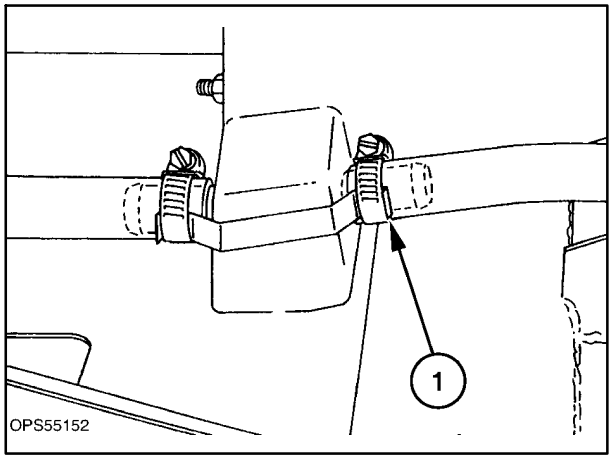

Figure 5-155

   c. Remove the return line at 1, and rotate the line into a suitable drain pan. Thoroughly flush the reservoir with a suitable clean solvent or clean 10W-30 oil.

4. Remove the charge check valve, 2, and thoroughly flush the oil cooler with solvent by forcing the solvent through the cooler.

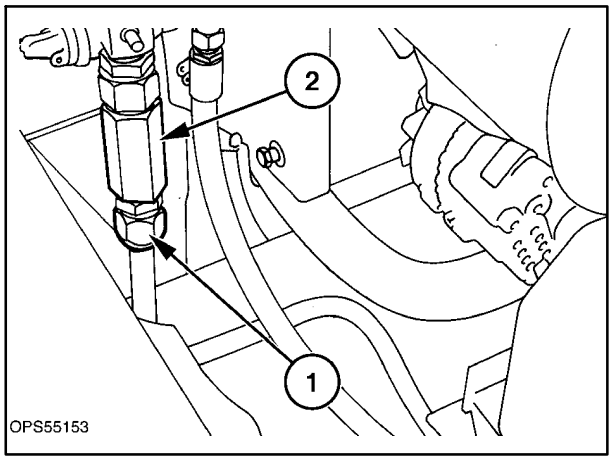

Figure 5-156

5. Disassemble the check valve by removing the snap ring, 1; washer, 2; spring, 3; and plunger, 4. Clean the check valve parts thoroughly.

   NOTE: The spring in the check valve will be slightly compressed, use caution when removing the snap ring.

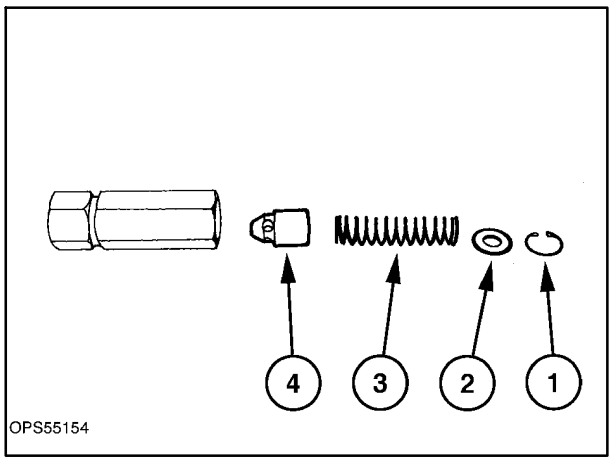

Figure 5-157

6. Remove the filter and base, clean the base, and check the bypass valve, 1, for operation.
7. Clean and flush all hydraulic lines. If the failure was hydrostatic, be sure to flush and clean the high-pressure hoses from the pumps to the motors.

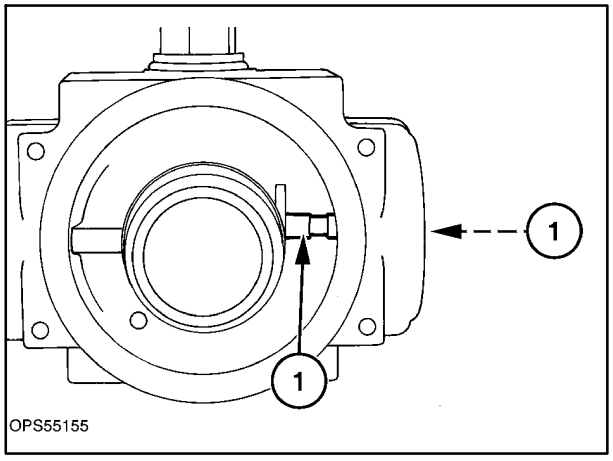

Figure 5-158

8. After the system is cleaned, thoroughly flush the solvent used to clean the system with fresh clean SAE 10W-30 oil.
9. Reconnect all lines removed for cleaning.
10. Install a new oil filter, 1.
11. Before start-up, fill the hydraulic system, pumps, motors, etc., as full as the case drain lines permit with system oil, SAE 10W-30 oil.
12. Fill the hydraulic reservoir with SAE 10W-30 oil.

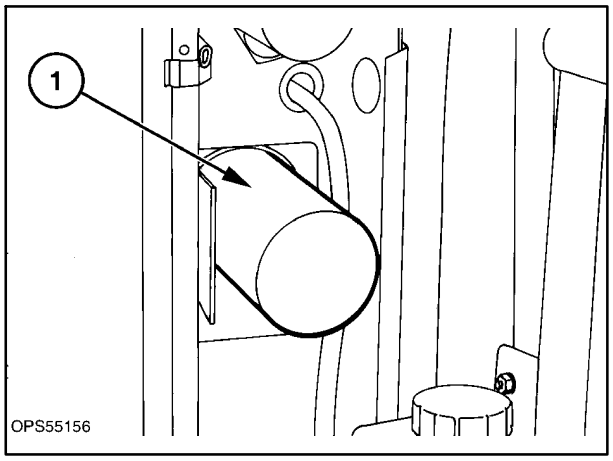

Figure 5-159

Start-up Procedure After Pump or Motor Replacement

1. Fill the reservoir with SAE 10W-30 oil to the proper level.
2. Install a 21 bar (300 PSI) gauge in charge pressure test port, 1.

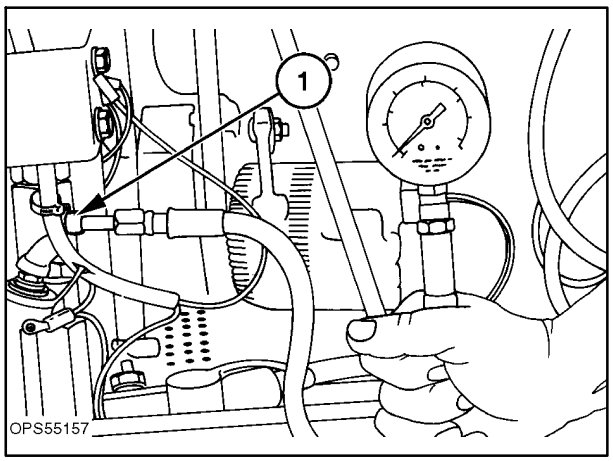

Figure 5-160

3. Remove the fuel solenoid power wire, 1, to prevent the engine from starting.

CAUTION: NEVER CRANK THE STARTER FOR MORE THAN 30 SECONDS OR DAMAGE TO THE STARTER MAY OCCUR. CRANK THE STARTER FOR 30 SECONDS AND COOL 1 MINUTE.

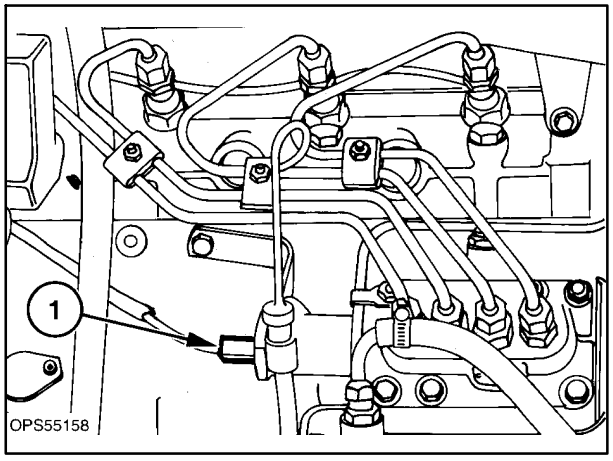

Figure 5-161

4. Put the Service/Run switch, 1, in the “SERVICE” position.
5. Put the steering levers in the neutral position.
6. Turn the ignition key, 2, to the start position and allow the engine to crank for 30 seconds at a time until the pressure gauge starts to move. If after trying three times and the gauge does not move, loosen the gear pump pressure line at the control valve to bleed the air from the hydraulic system.

   Re-crank the engine until the gauge moves. After the gauge moves, stop cranking and reconnect the fuel solenoid.

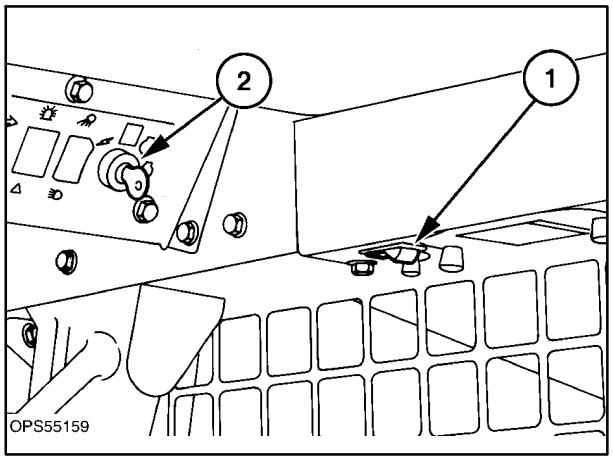

Figure 5-162

7. Start the engine and monitor the charge pressure gauge to ensure charge oil for the hydrostatic system; the pressure reading should be 6.8 - 8.2 bar (100 - 120 PSI).

   IMPORTANT: If charge pressure remains below 3.4 bar (50 PSI) for more than 10 seconds, stop the engine and locate the cause. If the unit is operated with low or no charge pressure, severe damage will occur to the hydrostatic system.

   Do not stroke the hydrostatic controls or operate the boom and bucket control at this time.

8. Allow the engine to operate at 1500 RPM for about 30 minutes. Stop the engine; check the oil level and fill as required.
9. Start the engine and operate at 1500 RPM and slowly operate the hydrostatic system to remove air, monitor the charge pressure. Operate the boom and bucket for a few cycles to remove the air from the hydraulic system.
10. Stop the engine; recheck the hydraulic system oil level and add as required.
11. Remove the charge pressure test gauge.

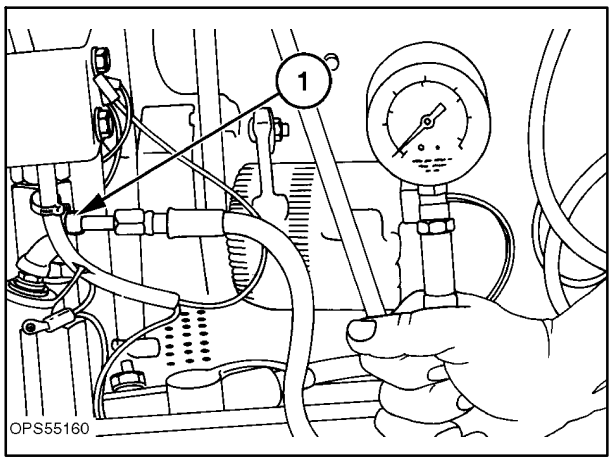

Figure 5-163

12. Adjust the neutral system if required; refer to the operator's manual for procedures.
13. Run the engine at 1500 RPM for an additional 30 minutes to filter the oil. Stop the engine and change the oil filter.
14. Check for oil leaks and repair as required.
15. Reinstall all shields removed for repair.
16. Lower the skid-steer loader to the ground and operate.

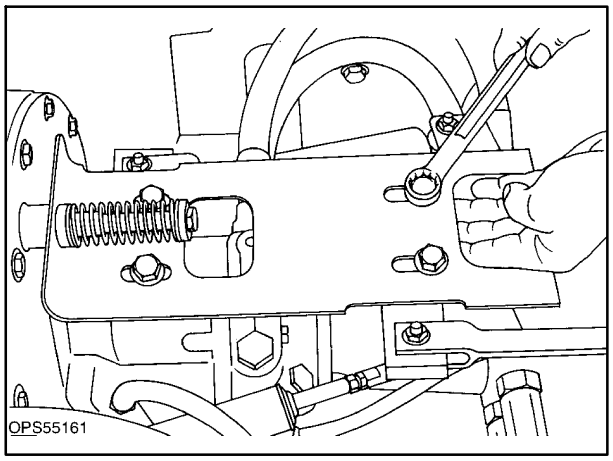

Figure 5-164

CHARGE CHECK VALVE REMOVAL AND REPLACEMENT

1. Lower the boom and bucket to the lowered position, resting on the ground, or remove any attachment and raise the boom and rest on the boom lock pins, 1.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

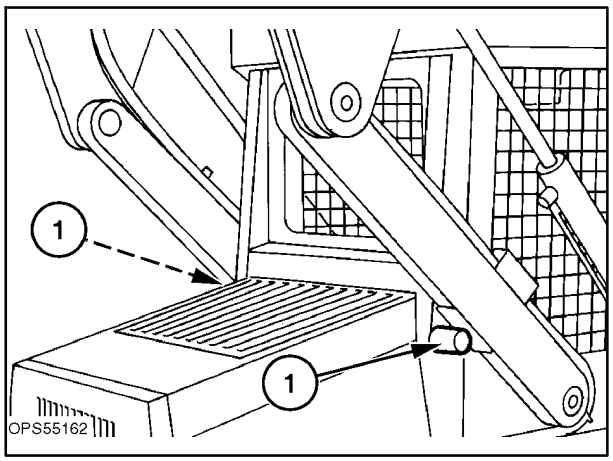

Figure 5-165

2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.
3. Put the Service/Run switch, 1, in the “SERVICE” position.
4. Engage the parking brake.

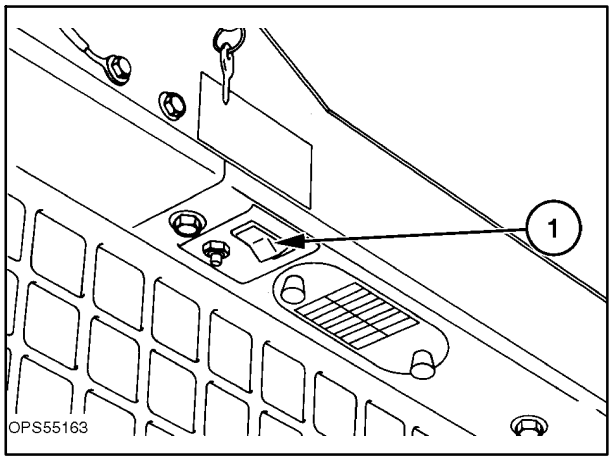

Figure 5-166

5. Securely block the skid-steer loader at 1 and 2 with all four wheels off the ground. Refer to Section 1 for more information on properly supporting a skid-steer loader.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

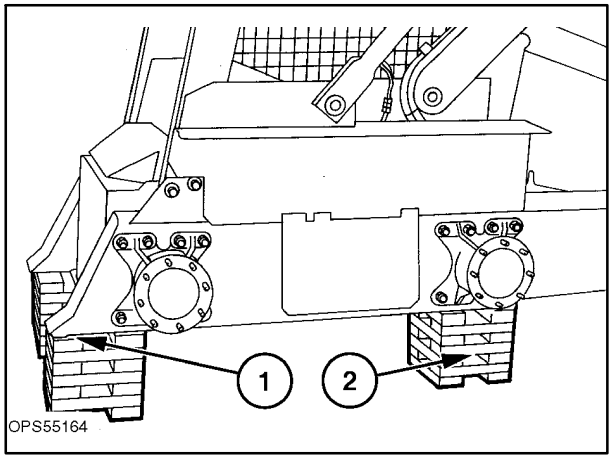

Figure 5-167

6. Remove the right engine side shield to access the check valve, 1.
7. Remove the return line at 2, and cap to prevent the loss of oil.
8. Remove the check valve from the oil filter base at 3.

   The charge check valve is nonadjustable or serviceable. If the valve does not operate, it will need to be replaced. The only procedure you can perform on the valve is to clean the valve assembly.

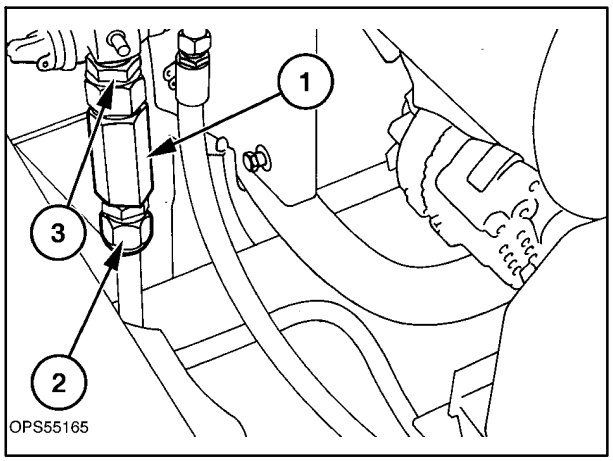

Figure 5-168

9. Remove the snap ring, 1. Disassemble and clean the check valve.
10. The check valve is marked for oil flow for installation.

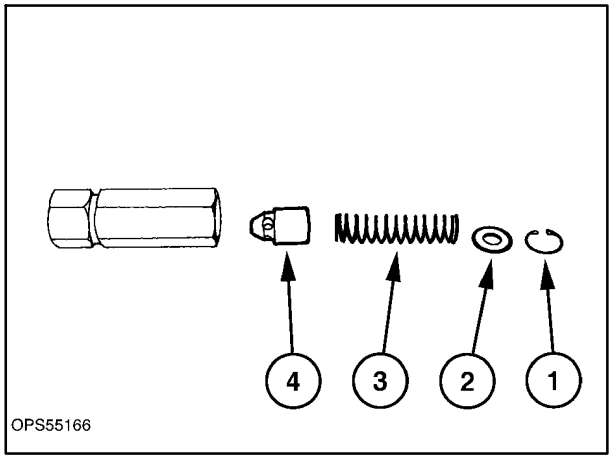

Figure 5-169

STEERING SYSTEM

HYDROSTATIC SYSTEM CONTROLS

Before any control linkage adjustments or repairs are made to the skid-steer loader, do the following:

1. Lower the boom and bucket to the lowered position, resting on the ground, or remove any attachment and raise the boom and rest on the boom lock pins, 1.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.
3. Put the Service/Run switch, 1, in the “SERVICE” position.
4. Engage the parking brake.

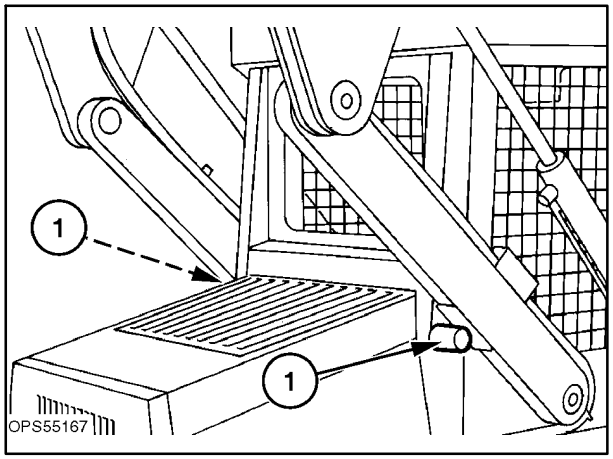

Figure 5-170

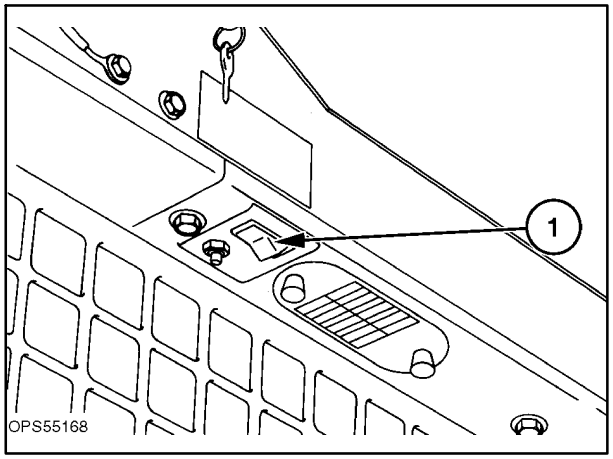

Figure 5-171

5. Securely block the skid-steer loader at 1 and 2 with all four wheels off the ground. Refer to Section 1 for more information on properly supporting a skid-steer loader.

CAUTION: FAILURE TO SECURELY SUPPORT THE SKID-STEER LOADER COULD RESULT IN MOVEMENT OF THE LOADER CAUSING SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT.

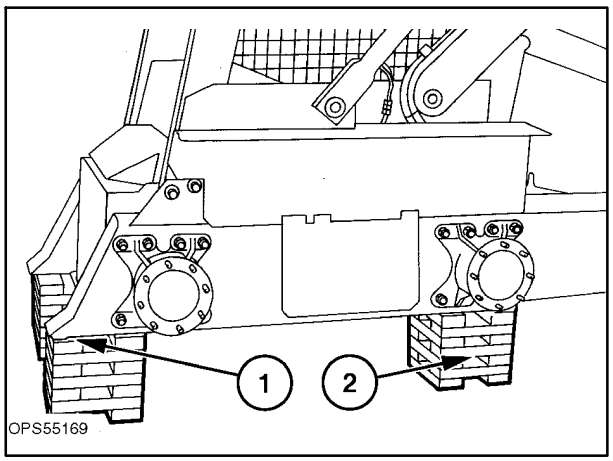

Figure 5-172

6. Raise the operator's seat and latch in the raised position.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

7. Remove the step shield, 1, to access the control linkages.

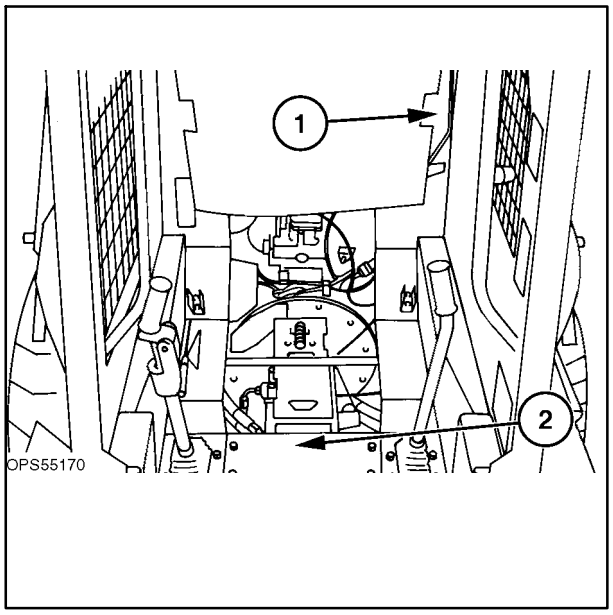

Figure 5-173

NEUTRALIZER AND CONTROL LINKAGE REMOVAL AND PARTS INSPECTION

Neutralizer Removal

1. Remove the four screws, 1, attaching the front of the plate to the plastic guides.
2. Remove the centering spring, 2, from the engine bellhousing. When removing the retaining bolt, 3, the spring will be under slight pressure. Lift the plate from the unit.

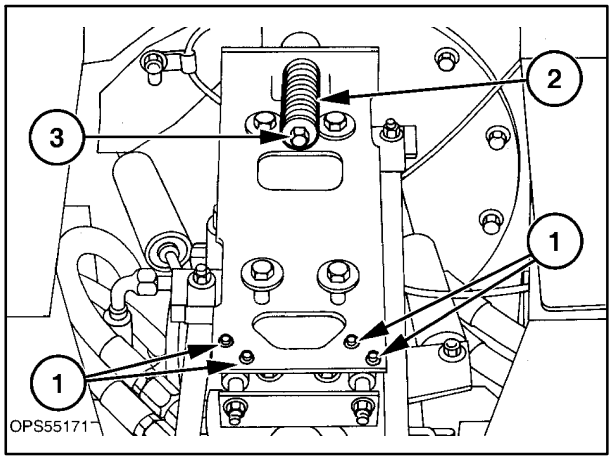

Figure 5-174

Neutralizer Parts Inspection

1. Inspect the plastic guides, 1, for breakage and wear. If worn or damaged, replace.
2. Inspect the guide pins, 2, for excessive wear. If worn, replace.
3. Inspect the cam blocks, 3, for wear in the area where the cams contact. If worn, rotate the cam blocks to the unused side.
4. Inspect the neutralizer plate for wear in the centering bolt area, 4. If worn, replace the plate.
5. Inspect the spring, 5, for proper free length: 114.3 ± 2.4 mm (4.5″± 3/32″). If not within specification, replace the spring.
6. Inspect spring guides, 6; if worn, replace.
7. Inspect the spring bolt for wear in the guide area; if worn, replace.

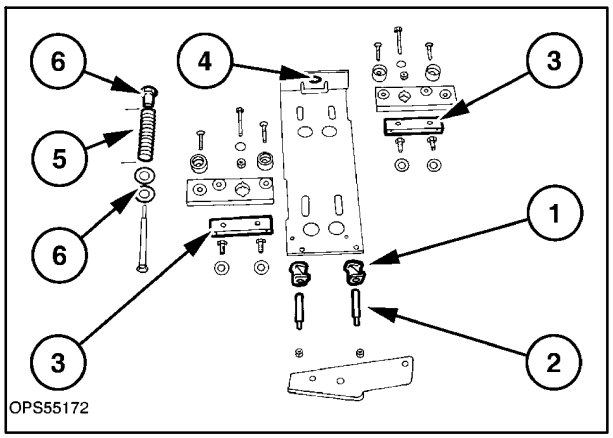

Figure 5-175

Control Linkage Removal

With the neutralizer plate removed:

1. Remove the control links, 1 and 2, at the control handle, 3.
2. Remove the links, 1 and 2, at the pintle arms, 4.
3. Remove the pintle arms, 5, from the cam plate shafts by loosening the clamp bolts, 6.
4. Remove the dampener attaching hardware at 7.

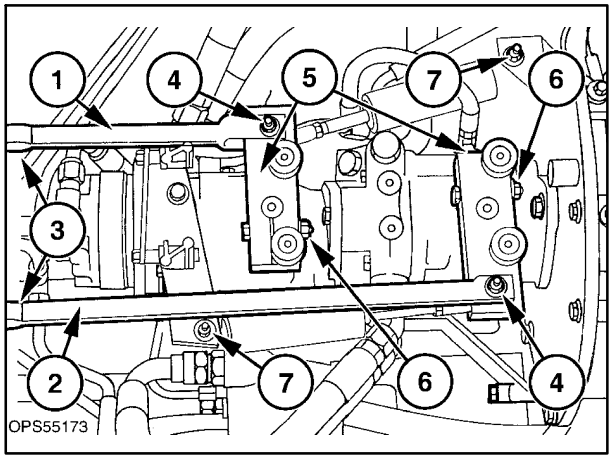

Figure 5-176

Control Linkage Parts Inspection

1. Inspect the bushings, 1, in the control links; replace if worn, loose, or damaged.

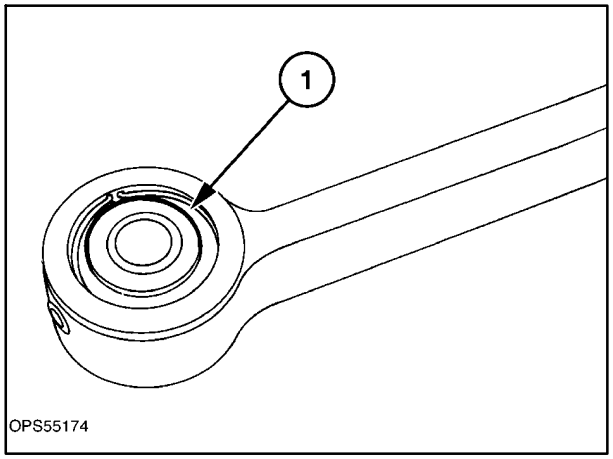

Figure 5-177

2. Inspect the cams, 2, on the pintle arms for wear. If worn, rotate to a new area and retighten in place.

   NOTE: The cams, 2, shown are tapered at 1, and retained with tapered head screws, 4. These cams and retaining hardware should be replaced with square recessed cams and Grade 5-3/8 x 1″ cap screws. The cams should be clamped tight to the arms and not rotate.

3. Inspect the rubber bushings, 3, in the pintle arms; if loose or worn, replace. Inspect the pintle arms in the clamping area for wear or damage; if worn or damaged, replace.

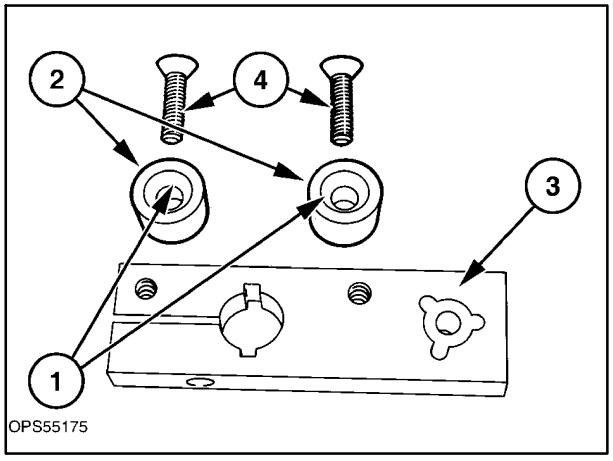

Figure 5-178

NOTE: Later model loaders have sealed bearings, 1, instead of solid cams. The roller bearings spin on small bushings, 2, between the bearing and the pintle arm, 3. Inspect the roller bearings and bushings and replace if damaged.

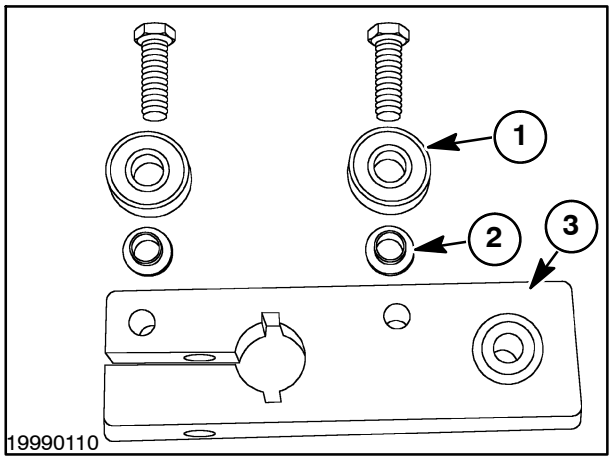

Figure 5-179

4. Inspect the blocks, 1, on the underside of the neutralizer plate. If worn, turn around for a new surface or replace the blocks.

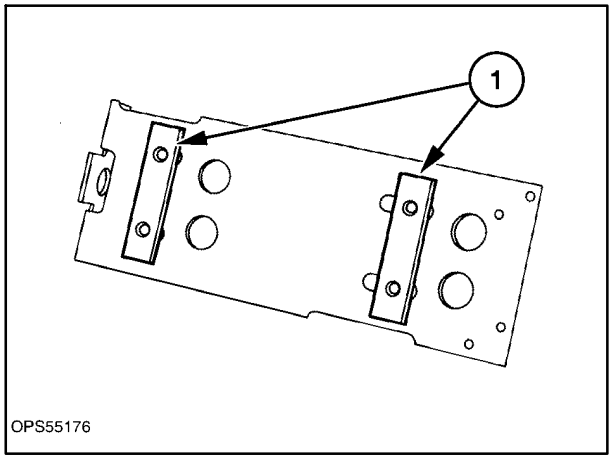

Figure 5-180

5. Inspect the dampeners for equal pressures, leakage, and binding shafts. If damaged, replace.

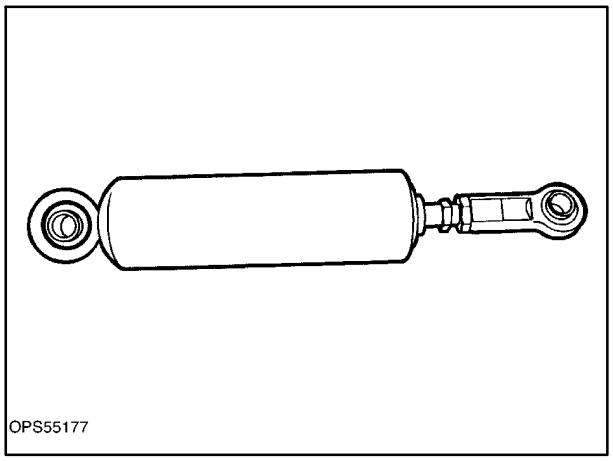

Figure 5-181

Control Handle Removal

1. Remove the control link at 1.
2. Remove the attaching hardware, 2.
3. Remove the auxiliary control linkage or boom and bucket hand control linkage if unit is so equipped.
4. Unplug any electrical wires, horn, high flow switch, etc., if unit is so equipped.
5. Lift the control assembly from the loader.

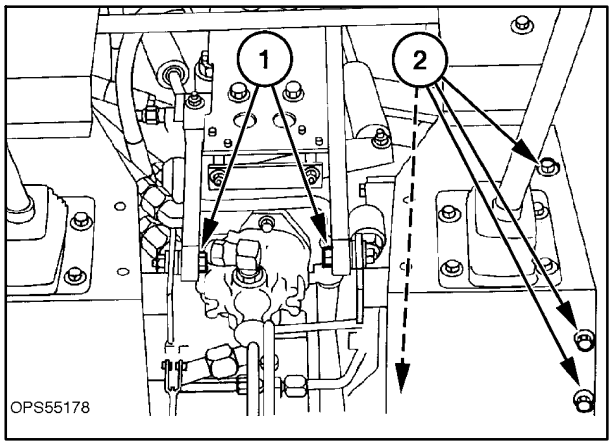

Figure 5-182

6. To remove the handle from the support:
   a. Remove the rubber boot hardware, 1.
   b. Remove roll pin and shim washers, 2.
   c. Remove the pivot bearing hardware, 2, and remove the bearings.
   d. Unhook the control link at 4, if the unit is equipped.
   e. Remove the pivot handle retaining setscrew at the top of the handle, if the unit is equipped.
   f. Remove the handle, 5, from the support.

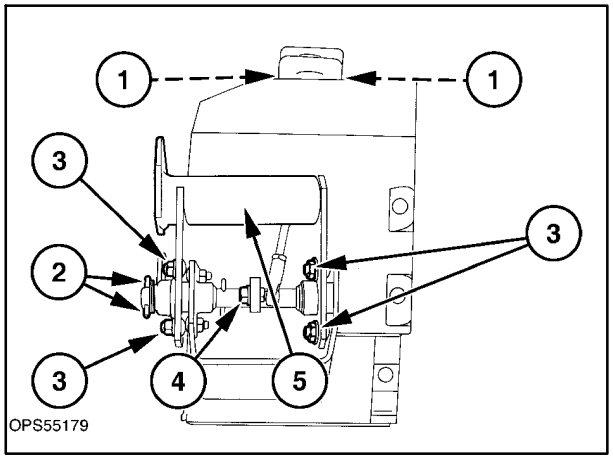

Figure 5-183

Control Handle Parts Inspection

1. Inspect the handle pivot bearings; replace if worn or damaged.

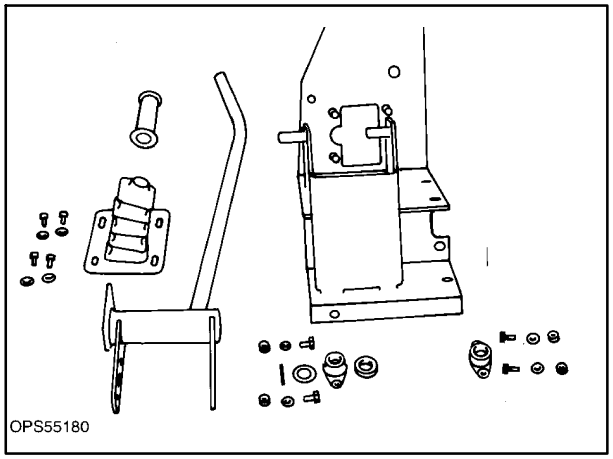

Figure 5-184

2. Inspect the pivot handle linkage for looseness in the ball joints; replace if worn.
3. Inspect the plastic pivot handle; replace if worn or damaged.

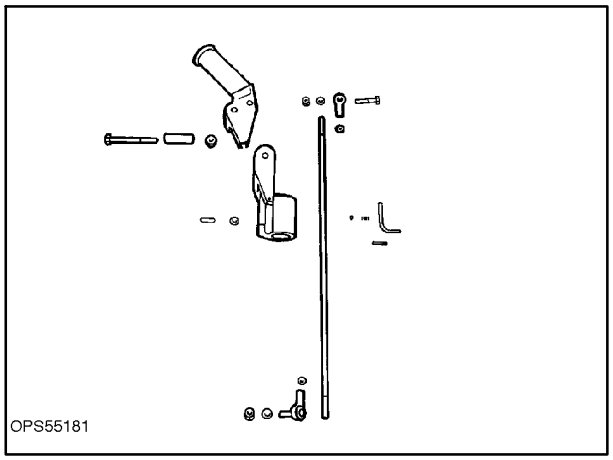

Figure 5-185

NEUTRALIZER AND CONTROL LINKAGE INSTALLATION AND ADJUSTMENT

Control Handle Reassembly-Adjustment

1. Insert the handle through the support and slide it over pins, 1.
2. Install two bearings, 2, and install shim washers as required at 3, to center the control handle in slot, 4, of the support.
3. Install shim washers as required at 5, to remove side play in the handle on pins, 1, and install roll pin, 6.
4. To install a new handle grip, 7, lubricate the grip with liquid hand soap and slide it over the end of the lever.

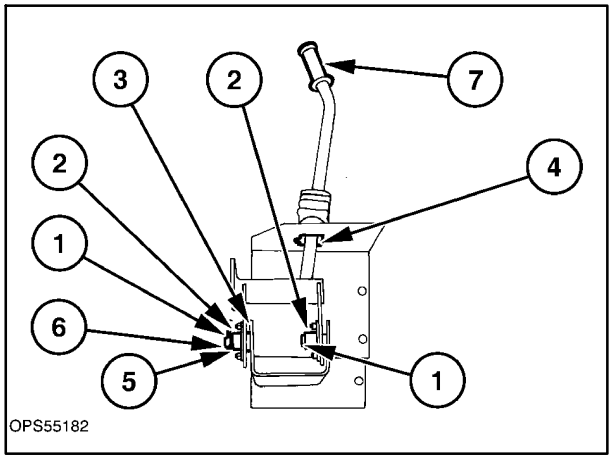

Figure 5-186

Assembly and adjustment of boom and bucket hand controls or auxiliary boom hydraulic controls:

1. To install a new handle grip, 1, lubricate the grip with liquid hand soap and slide it over the end of the plastic handle.
2. Attach the plastic handle, 2, to the support, 3, with a 3/8″ x 2-1/2″ cap screw, locknut and spacer, 4. Tighten the hardware to remove all side movement in the handle but allow the handle to pivot.
3. Attach the handle assembly by aligning the hole in the handle with the hole in the lever using the setscrew and jam nut at 5.
4. Insert rod, 6, through the lever, attach the ball joint end to the rod and attach to the handle at 7.
5. Insert spring and ball at 1.
6. Insert the L-pin at 2 and drive the roll pin in flush at 3, to retain the L-pin.

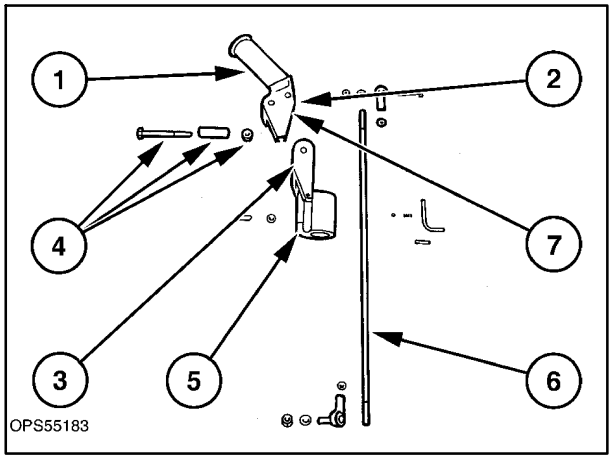

Figure 5-187

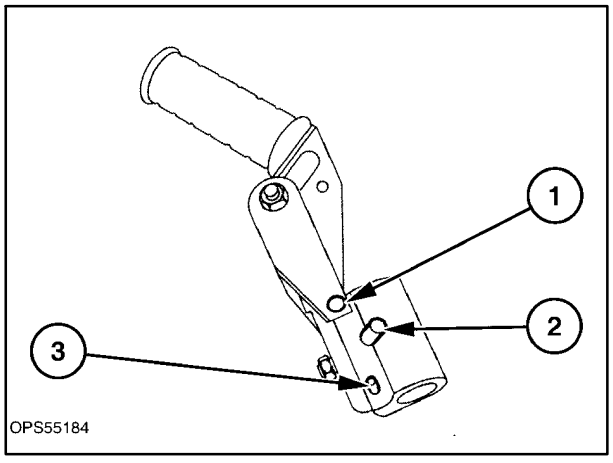

Figure 5-188

7. First slide shaft, 1, into support and link, 2. Attach shaft and lever assembly, 1, to support with two bearings, 3. Attach link, 2, to shaft with roll pin, 4.
8. Attach ball joint end to rod, 5, and attach to link at 6.
9. Adjust the length to rod, 5, with ball joints so when the hydrostatic control lever is stroked to forward or reverse, there is no movement in link, 2.

Refer to Section 8 - “Optional Equipment” of this manual for more information on auxiliary boom hydraulic, boom and bucket hand controls, etc.

The control handle can now be reinstalled into the loader. Install all retaining hardware previously removed.

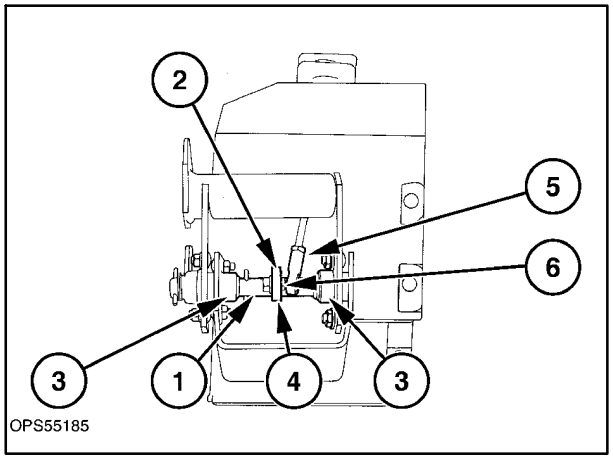

Figure 5-189

Cam or Sealed Bearing Installation

Cam Style—Install the cam, 1, over the hole in the pintle arm. Install either the tapered head screws (countersunk cams) or the cap screws (recessed cams), 2, into the pintle arm.

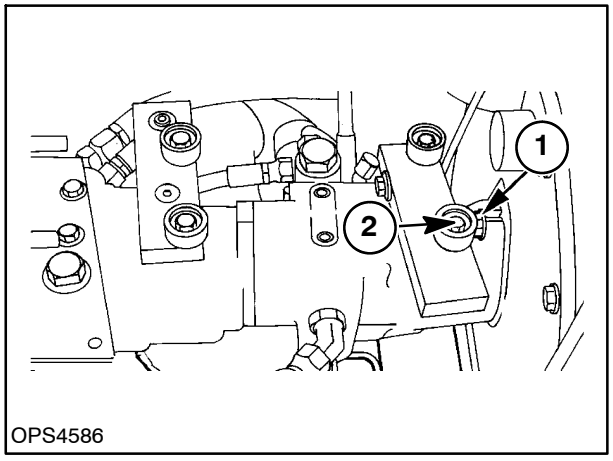

Figure 5-190

Bearing Style—Install the bushing, 1, and sealed bearing, 2, over the hole in the pintle arm. Install the capscrews, 3, into the pintle arm.

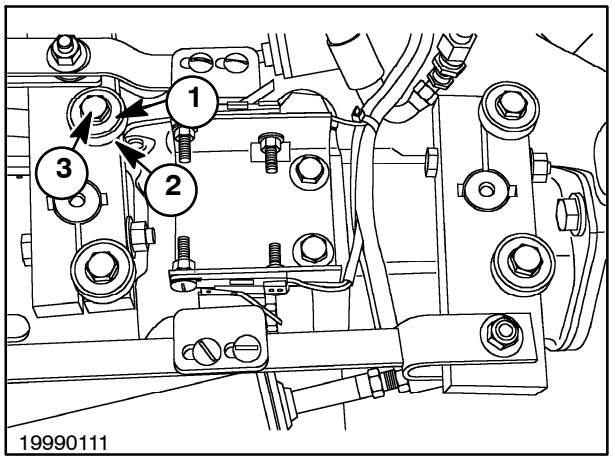

Figure 5-191

Bearing Style—Make sure the bearing, 1, sits on top of the bushing, 2, over the pintle arm.

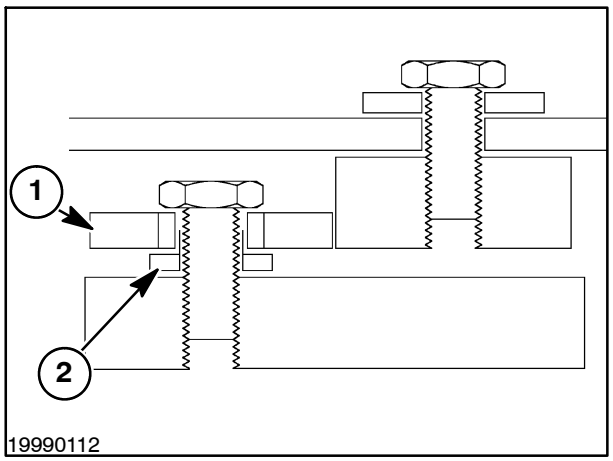

Figure 5-192

Control Linkage Reassembly and Adjustment

1. Tighten the cam hardware, 1, to 55 N·m (40 ft. lbs.).
2. Install the keys into the cam plate shafts, 2.
3. Slide the pintle arm assemblies onto the cam plate shafts flush or below 1/32″ end of shaft. The cams should be to the engine side of the pintle shaft. Install 3/8″ x 2-1/2″ Grade 8 bolts and locknuts, 3; torque to 65 N·m (48 ft. lbs.).

   NOTE: If the arms are above the end of the shaft, the cams may interfere with the neutralizer plate.
4. Connect the links to the pintle arms and install the dampeners. Note there are spacers between the arm and the dampener at 4. Attach the other end of links to the control levers at 5. Connect the other end of the dampeners to the support plates, 6. The right dampener support is adjustable; position the support to align the dampener. Tighten the hardware securely.
5. Slide the plastic guides over guide pins, 7.

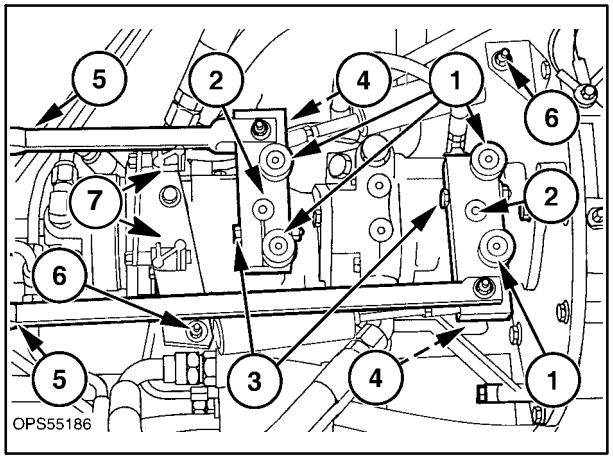

Figure 5-193

Neutralizer Reassembly and Adjustment

1. Loosely install the blocks, 1, to the neutralizer plate with 1/2″ x 3/4″ cap screws and large 1/2″ flat washers.

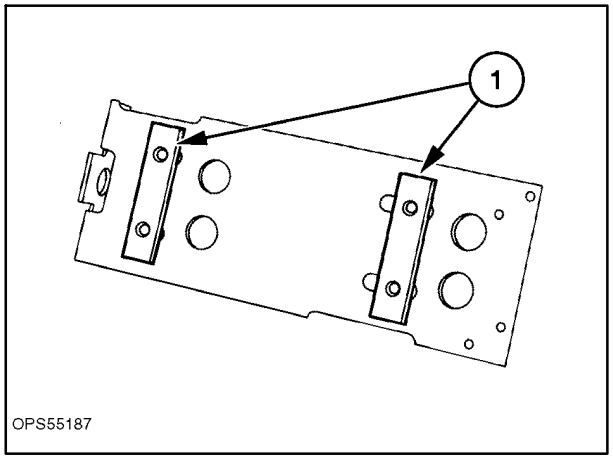

Figure 5-194

2. Slide the plastic guides over the guide pins, 2.
3. Place the neutralizer plate on the plastic guides and against the boss area on the bellhousing cover, 1 and 2.

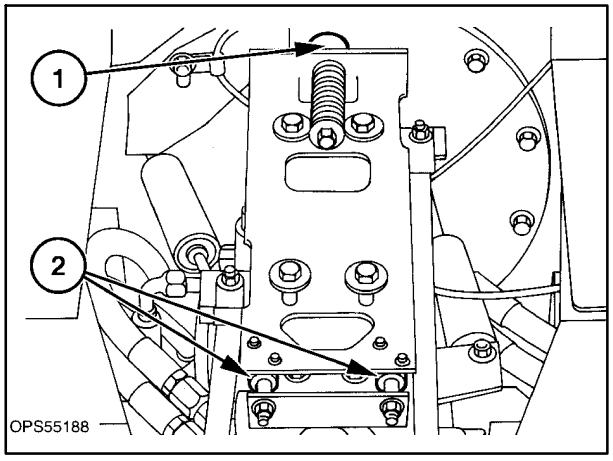

Figure 5-195

4. Assemble the neutral return spring assembly, slide the short spring retainer, 1, over the shoulder bolt first, spring, 2, and longer retainer, 3.

   NOTE: If there was a thick flat washer removed at 4, it should be installed at this time.

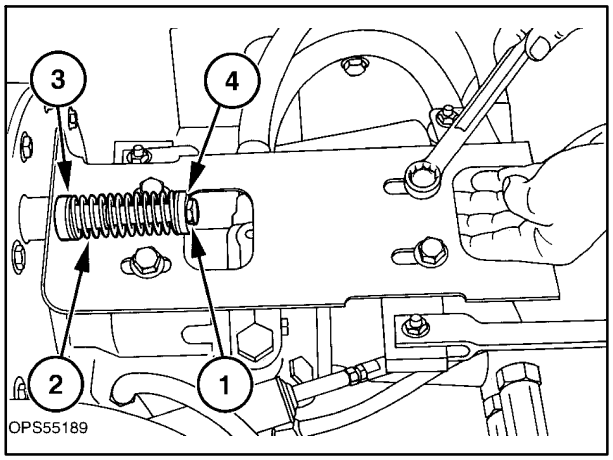

Figure 5-196

5. Install the neutral return assembly through the neutralizer plate at 1, and into the bellhousing cover at 2. The spring will require some compression before the bolt can be installed; it can be compressed by hand. Tighten the bolt until it bottoms and torque to 55 N·m (40 ft. lbs.).
6. Attach the front of the neutralizer plate to the plastic guides with four panhead self-tapping screws and star washers at 3. Do not over tighten screws; the plastic guides may be damaged as a result.

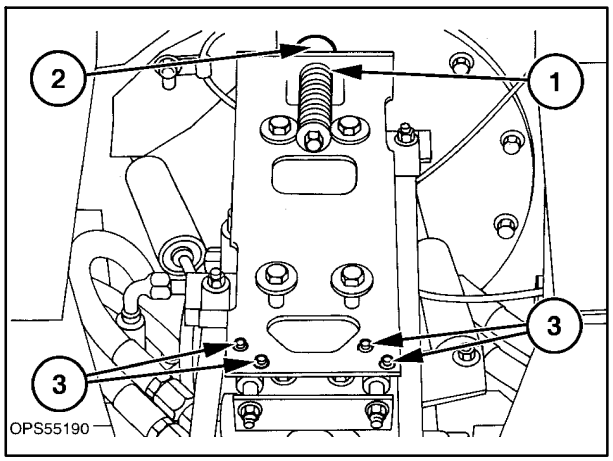

Figure 5-197

DRIVE CONTROL ADJUSTMENT PROCEDURE

If the machine creeps (tires rotate slowly with steering control in neutral) and the transmissions make a noise indicating they are being slightly stroked, a neutralizing adjustment is required.

CAUTION: TO MAKE A NEUTRALIZER ADJUSTMENT, BLOCK THE MACHINE OFF THE GROUND SO THAT THE WHEELS TURN FREELY. RAISE THE BOOM AND PLACE IT ON THE BOOM LOCKPINS. WHEN THE ENGINE IS RUNNING, STAY CLEAR OF THE ROTATING WHEELS.

To make any transmission control linkage adjustments, first block the loader off the ground with the boom in the raised position resting on the boom lockpins. Unlatch the seat and raise it to the up locked position to access the transmission area.

CAUTION: NEVER WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

Control lever, 1; link, 2; and arm, 3, control the right side. Control lever, 4; link, 5; and arm, 6 control the left side. There are shock absorbers, 7, connected to the steering linkage to dampen the hydraulic vibration from the control levers and the operator's hands. The neutralizer plate, 8, is spring loaded to return the arms, 3 and 6, to their neutral position.

When the operator strokes both control levers in the same direction, the operator can release one lever and the unit will still run straight until the levers are stroked differently to change direction or both levers are released and then the unit will neutralize.

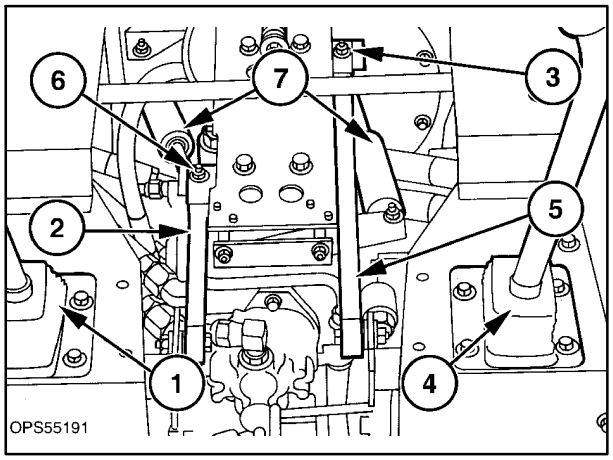

Figure 5-198

Neutral Adjustment

Before making any adjustments, make sure there is no binding in the control linkage, shocks, or neutralizer plate. The neutralizer plate, 1, should be free to move on the spring retaining bolt at the engine bellhousing and on the front slides. The neutralizer plate should be against the stop on the engine bellhousing at 2.

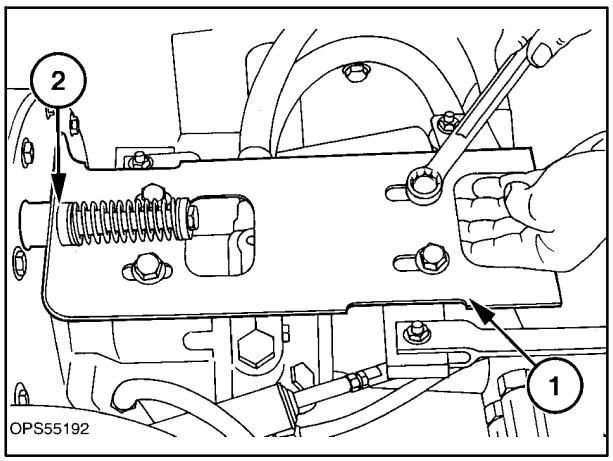

Figure 5-199

The loader must be raised and supported with the tires off the ground. Use adequate blocking or jack stands to securely support the loader.

The engine must be started and running to make neutral adjustments. Place the Service/Operate Switch, 1, in the “SERVICE” position to allow the engine to be started.

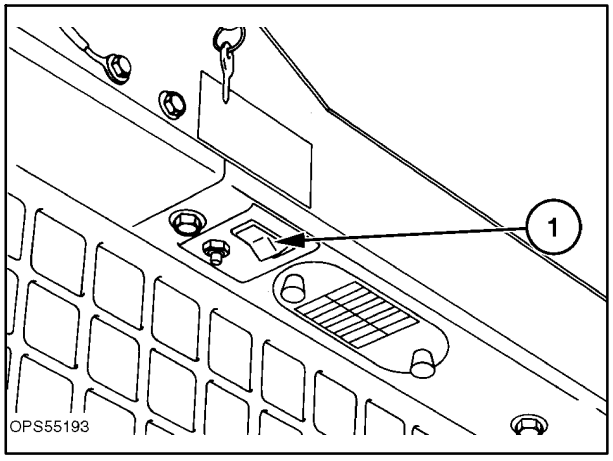

Figure 5-200

To adjust the left side, loosen the block retaining bolts, 1, slightly and move the control arm, 2, to stop wheel rotation. Now move the block so it contacts both cams on arm, 2, and tighten the retaining bolts, 1.

To adjust the right side, loosen the block retaining bolts, 3, slightly and move the control arm, 4, to stop wheel rotation. Now move the block so it contacts the cams on arm, 4, and tighten the retaining bolts, 3.

Stop the engine after adjustments are made and recheck hardware torque.

NOTE: The blocks must be set square and firmly contact both cams on the arms. If the block is not square against both cams on the arms, the unit may creep after neutral adjustments are made.

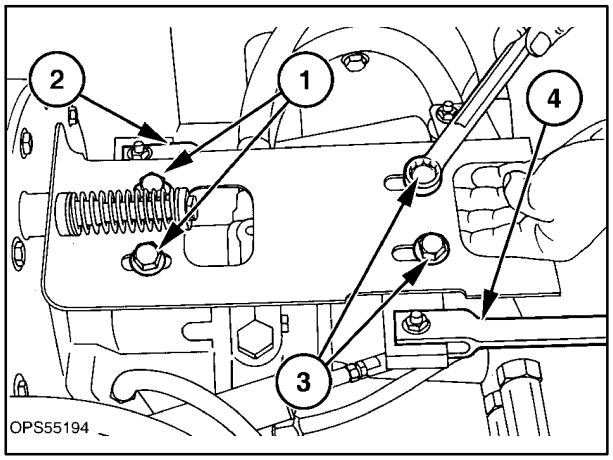

Figure 5-201

Control Lever Parallel Adjustment

The control levers, 1 and 2, are set at the factory at 9° to the front. The levers can be set for operator comfort and adjusted so the two levers are parallel. To adjust the levers, loosen bolts, 3, and move the levers to the desired position and retighten hardware. Moving the control levers too far one direction will change maximum speeds.

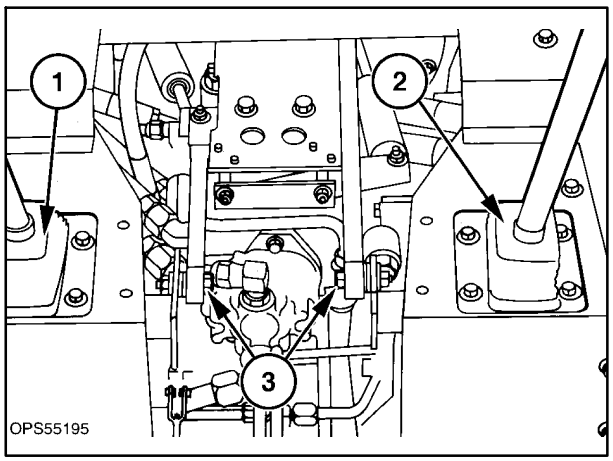

Figure 5-202

Control Lever Stop Adjustment

If the control lever location has been changed for any reason, the control lever stops will require adjustment. The control lever stops must be adjusted properly to prevent damage to the linkage and internal transmission components. The lever stops are the lower control lever boot assembly, 1.

To adjust the stops follow these steps:

1. Loosen the four cap screws, 2, each lever stop.
2. Pull the control lever forward until the internal transmission stop is felt and hold the linkage against the internal stop.
3. Slide the boot stop assembly, 1, to the rear to contact the control lever and then push the stop and lever another 1/32″. This will insure that when the control levers are fully stroked the lever will contact the external stop and not the internal transmission stop.
4. Check wheel speed using a hand tach from side to side and slow down the faster side by moving the boot stop and lever to the rear on the fast side.

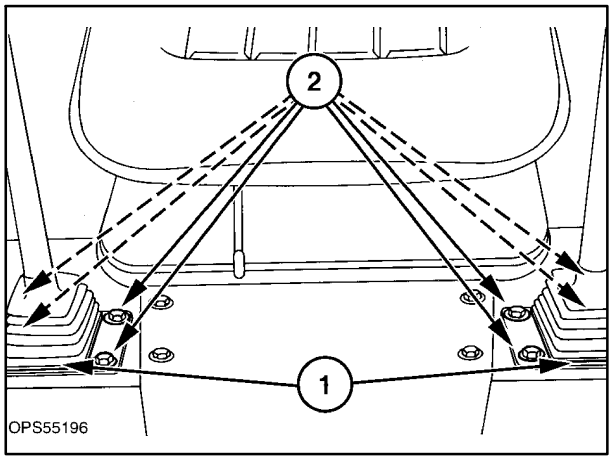

Figure 5-203

CAUTION: THE LOADER MUST BE RAISED AND SUPPORTED WITH THE TIRES OFF THE GROUND. USE ADEQUATE BLOCKING OR JACK STANDS TO SECURELY SUPPORT THE LOADER.

5. Check and tighten all control lever linkage hardware.

   IMPORTANT: If the external control lever stops are not adjusted properly, the control linkage and transmission may be damaged.

6. Reinstall the shields removed for the repair.
7. Lower the skid-steer loader off the blocks.
8. Operate the loader and check the unit for straight travel; readjust if required.

LABOR GUIDE

HYDROSTATIC SYSTEM AND STEERING SYSTEM

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job	Hours
Hydrostatic pump - RH & LH assembly - remove/replace	4 hrs.
Hydrostatic pump - repair	1 hr.
Hydrostatic motor RH - remove/replace	3 hrs.
Hydrostatic motor LH - remove/replace	3 hrs.
Hydrostatic motor - repair	1 hr.
Charge check valve - remove/replace	0.5 hr.
Neutralizer plate assembly - remove/replace	0.5 hr.
Hydrostatic control handle assembly - remove/replace one assembly	0.25 hr.
Neutral adjustment	0.5 hr.
Time required to tilt cab and boom	1 hr.

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SECTION 6
HYDRAULIC SYSTEM

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GENERAL INFORMATION

The hydraulic system provides hydraulic oil to the boom and bucket, and the return oil provides charge oil for the hydrostatic drive system. On loaders equipped with the auxiliary boom hydraulic kit, system oil will be provided to quick couplers at the front of the boom to operate hydraulic attachments. The hydraulic system is an open center type system. The gear pump provides continuous oil flow through the system to the boom, bucket circuits, auxiliary boom circuit, if equipped, and the hydrostatic drive charge circuit.

A open center system means the first control valve function has priority over the next function in line.

NOTE: The return oil must follow the normal return path from the control valve to the oil cooler/filter and back to the hydrostatic charge pressure inlet on the transmissions or severe damage to the hydrostatic system may occur.

Figure 6-1 shows the hydraulic circuit and components for the L565, LX565, and LX665 loaders.

The hydraulic system is built with the following components and their location.

1 Hydraulic reservoir - Right front of engine compartment

2 Suction line - From reservoir to the gear pump under operator's seat

3 Gear pump - Under the operator's seat

4 Pressure line - From gear pump to control valve

5 Control valve (three spool) - Under operator's step shield

6 Main system relief valve - In control valve

7 Return line - From control valve to oil cooler

8 Oil cooler - Engine side of radiator in engine compartment

9 Filter - Right rear of engine compartment through rear door

10 Charge check valve - After filter and before the reservoir

11 Bucket cylinders

12 Boom cylinders

13 Auxiliary boom hydraulics - Standard on LX models

14 Optional high flow kit - Dealer installed kit - Refer to Section 8 - "Optional Equipment" for more information.

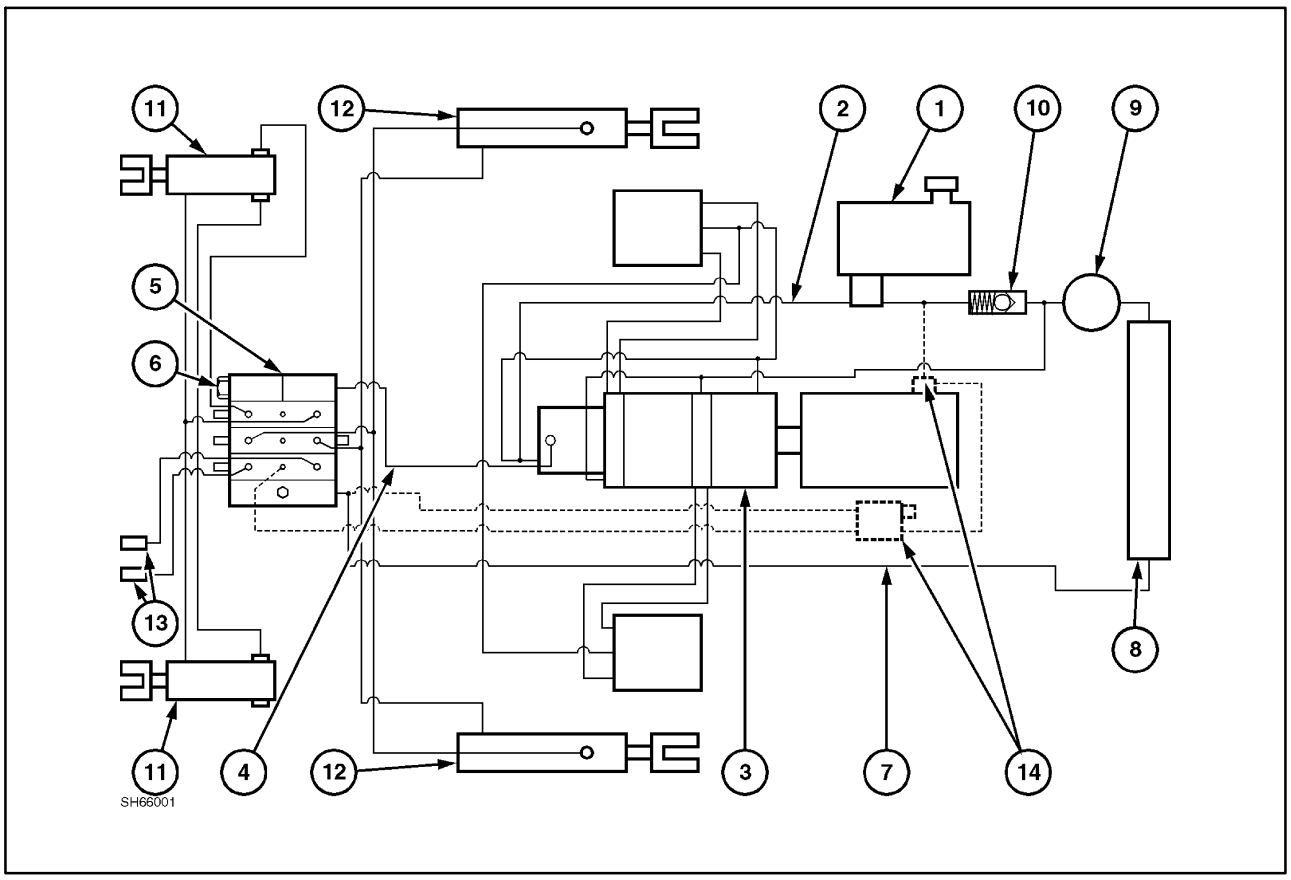


Figure 6-1

HYDRAULIC SYSTEM COMPATIBILITY

There are six questions that must be answered before adapting attachments that require hydraulic oil power.

1. **What is the hydraulic pressure requirement, minimum and maximum? Are they higher than the maximum pressure of the model?**

Model	Maximum Pressure
L565, Lx565, Lx665	170-176 bar (2500 - 2600 PSI)

2. **What is the hydraulic oil flow requirement? Is it more than the highest total flow rate of the skid-steer loader model?**

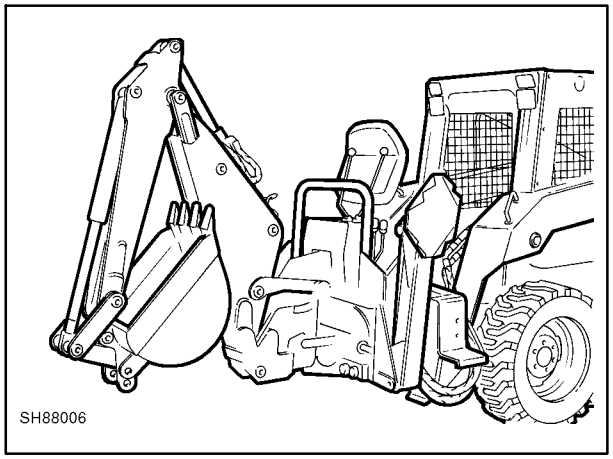


Figure 6-2

Model	Standard Hydraulics	High Flow Hydraulics
L565 Lx565	14.5 GPM (54.9 l/min.) @2900 RPM @1000 PSI (68 bar)	22.2 GPM (84.0 l/min.) @2900 RPM @2300 PSI (156 bar)
Lx665	17.1 GPM (64.9 l/min.) @2900 RPM @1000 PSI (68 bar)	24.2 GPM (91.6 l/min.) @2900 RPM @2300 PSI (156 bar)

NOTE: When using the High-Flow system, 3/4″ quick couplers must be used or high system backpressure may result.

3. **Will the attachment accept oil flow in both directions?**

   If “YES”, nothing is required.

   If “NO”, install a check valve or cross into the attachment return line to prevent reverse oil flow to the attachment.

   Examples: Backhoes and trees spades with a separate control valve do not accept oil flow in both directions.

4. **Must the attachment “Free Wheel” to a STOP?**

   If “YES”, a crossover relief connection must be installed on the attachment side to allow the attachment to free wheel to a stop after the skid-steer loader hydraulics is turned off.

   If “NO”, nothing is required.
   Example: Snow blowers must free wheel to a stop.

5. **Will the attachment accept hydraulic system backpressure?**

   If “YES”, nothing is required.

   If “NO”, the attachment will not function properly on a New Holland skid-steer loader. Normal backpressure for New Holland skid-steer loaders is between 200 - 250 PSI.

   Examples: Post drivers, some breakers, and some hand held hydraulic tools do not accept system backpressure.

   If all the skid-steer loader oil flow is not required to operate an attachment (e.g., shaver post driver), a flow divider can be installed into the hydraulic oil circuit on the attachment. The flow divider sends the required oil flow to the attachment and the remainder back to the normal skid-steer loader hydraulic circuits.

Model L565, Lx565, Lx665 loaders must have a minimum of 22.7 l/min. (6 GPM) returning through the main hydraulic system at all times, required to charge the hydrostatic system.

6. Does the attachment have a separate case drain oil line?

If “NO”, nothing is required.

If “YES”, install a separate case drain line to return the attachment case drain oil directly to the hydraulic oil reservoir.

Example: Cold planners have a separate case drain oil line.

NOTE: Most attachment case drains will not accept backpressure and must drain directly into the reservoir.

NOTE: Skid-steer loaders equipped with High Flow Hydraulics have a separate case drain coupler and return line attached to the right boom arm.

7. Does the attachment require circuit relief in the bucket circuit?

If “NO”, nothing is required.

If “YES”, install a bucket circuit relief valve on front of the control valve.

Example: Some mini-backhoes attach like a bucket, and require a bucket circuit relief.

BOOM CYLINDER PIVOT PINS

When the main boom, upper and lower boom links and cylinders are removed, the following figures and charts may be used for proper pin placement.

The figure and chart show the boom and cylinder tapered and straight pivot pins, location/description, quantity used, part number, and model skid-steer loader the pin is used on.

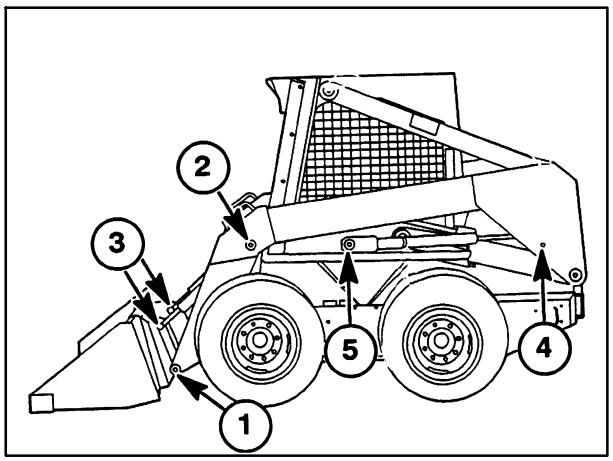


Figure 6-3

BOOM AND CYLINDER PIVOT PIN LOCATION AND MACHINE USAGE

Ref.#	Description	Qty.	Part Number
1	Mounting Plate Pivot	2	86501434
2	Upper Bucket Cylinder Pivot	2	86501430
3	Lower Bucket Cylinder Pivot	2	9614349
4	Upper Boom Cylinder Pivot	2	9841182
4	Upper Boom Cylinder Pivot	2	86521982*
5	Lower Boom Cylinder Pivot	2	86504316

***NOTE: LOADERS EQUIPPED WITH HEAVIER UPPER BOOM CYLINDER PIVOT PIN BOSS AREA OR UNITS UPDATED WITH THE BOOM CYLINDER PIN PIVOT KITS.**

CONTROL VALVE POWER BEYOND

Control valve, used on all skid-steer loaders, has a plugged power-beyond port, 1. This port is not normally used with New Holland-supplied attachments, as these can be operated through the auxiliary boom hydraulics (the third control valve spool), 2.

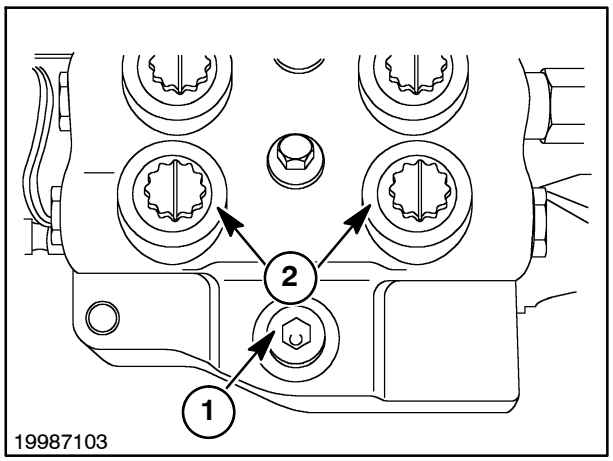


Figure 6-4

To use the power-beyond port for a second oil supply to additional attachments, remove the factory power-beyond plug to access inner hole, 1. This hole must be plugged to divert oil to the power beyond instead of normal oil flow to the out port.

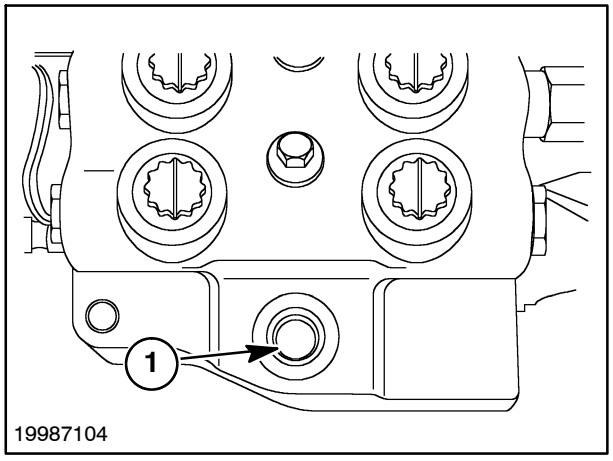


Figure 6-5

Install part #236622 allen head type pipe plug in the inner port, 1. Tighten the plug securely. A regular O ring type fitting can now be inserted in the power-beyond port.

ATTENTION: Once the power-beyond fitting and plug is installed, oil must be constantly returned from the attachment valve into the return line, 2. If oil is blocked at the power-beyond port, hydraulic system overheating and component damage could occur. Also, engine horsepower requirements will increase. A tee fitting can be inserted in the return line at 2, for attachment oil return.

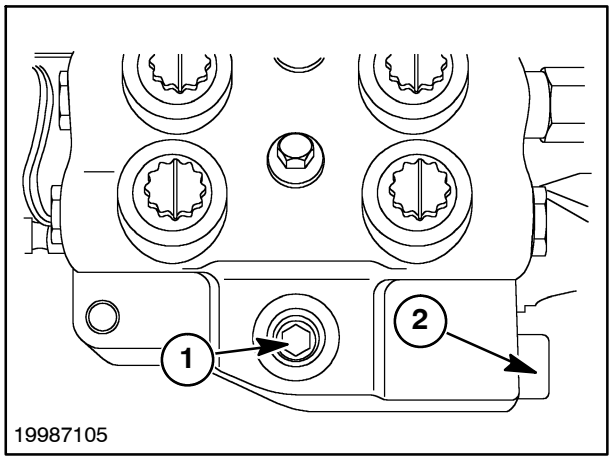


Figure 6-6

BOOM LIFT POWER

In heavy, high-lift applications, the boom cylinders seem to run out of power near the top of the lift cycle. Additionally, if the boom is stopped when lifting a heavy load, it may not lift any higher until the boom is lowered and lifted again.

The circuit relief valve, part #86507511, used on the boom spool circuit on these loaders was factory set at 2750 PSI. This circuit relief valve is installed in the back of the main 3-spool control valve in the middle spool porting (boom circuit).

A new circuit relief is now available through Parts for more power in the near full lift. The new valve, part #86529091, is factory set at 3500 PSI.

If the loader is being used in an overloaded condition, the new circuit relief may improve top end lift, but still not allow the loader to lift to full height.

NOTE: DO NOT OVERLOAD. Weigh the load and keep within Operator's Manual and machine decal lift specifications.

Do not attempt to adjust the old cushion valve from 2750 - 3500 PSI. Order a new factory-set valve.

Do not attempt to adjust the control valve main system relief valve to higher pressure. This #86507522 relief valve is factory set at 2500 PSI. If the pressure is checked and the setting is low, install a new relief valve.

SPECIFICATIONS

MAIN CONTROL VALVE

Type . . . . . 3-spool open center

Relief Valve . . . . . 170 - 177 bar (2500 - 2600 PSI) Nonadjustable

Circuit Relief (boom) - Early Model . . . . . 189 bar (2750 PSI) Nonadjustable

Circuit Relief (boom) - Later Model (and all replacement valves) . . . . . 238 bar (3500 PSI) Nonadjustable

Electrical solenoid boom and bucket spool locks (controlled by the EIC) will lock the control valve spools when the operator is out of the seat or the ignition key is in the “OFF” position with the spools in the neutral position.

HYDRAULIC PUMP

Type . . . . . Gear pump

	L565, LX565	**LX665**
Output @ 2900 RPM - @ 1000 PSI	14.5 GPM (54.9 LPM)	17.1 GPM (64.7 LPM)

BOOM CYLINDERS - TYPE 1 AND TYPE 2

Type . . . . . Double Acting

Bore Diameter . . . . . 63.5 mm (2.5″)

Stroke . . . . . 470.15 mm (18.51″)

Cycle Times (Seconds)	**L565, LX565**	**LX665**
Raise	3.5	2.7
Lower	3.5	2.3

BUCKET CYLINDERS

Type . . . . . Double Acting

Bore Diameter . . . . . 57.15 mm (2.25″)

Stroke . . . . . 454.15 mm (17.88″)

Cycle Times (Seconds)	**L565, LX565**	**LX665**
Curl back	2.2	1.54
Curl down (dump)	2.8	1.75

RESERVOIR

Capacity . . . . . 6 gal. (22.7 L)

Fluid Type . . . . . SAE 10W-30 API Service SG-CE motor oil

Filter Spin-on Canister . . . . . 10 micron

TORQUE SPECIFICATIONS

Control Valve

Control Valve Retaining Hardware	24 N·m (18 ft. lbs.)
Control Valve Plugs (large)	38 N·m (28 ft. lbs.)
Control Valve Plugs (small)	31 N·m (23 ft. lbs.)
Circuit Relief Valve (boom)	38 N·m (28 ft. lbs.)
Spool Lock Solenoids	15 N·m (11 ft. lbs.)
Solenoid Mounting Block Hardware	16 N·m (12 ft. lbs.)
Main System Relief Valve	51 N·m (38 ft. lbs.)
Spool Cap Assembly Hardware	16 N·m (12 ft. lbs.)
Plug, PYD Port	38 N·m (28 ft. lbs.)

Boom Cylinders

Piston Locknut Torque - Type 1 and Type 2	230 N·m (170 ft. lbs.)
Cylinder Bearing Nut Torque - Type 1	230 N·m (170 ft. lbs.)
Cylinder Gland Torque - Type 2	306 N·m (225 ft. lbs.)
Lower Pivot Pin Hardware	338 N·m (250 ft. lbs.)
Upper Pivot Pin Hardware	38 N·m (28 ft. lbs.)

Bucket Cylinders

Piston Cap Screw Torque	386 N·m (285 ft. lbs.)
Cylinder Head Torque	285 N·m (210 ft. lbs.)
Lower Pivot Pin Hardware	38 N·m (28 ft. lbs.)
Upper Pivot Pin Hardware	108 N·m (80 ft. lbs.)

Gear Pump

Pump Mounting Hardware	39 N·m (29 ft. lbs.)
Pump Body Hardware	35 N·m (26 ft. lbs.)

OTHER MATERIALS

Sealing Material	NH Ultra Blue silicone sealer NH #L81724 - 3.35 oz. tube (cord) NH #L82519DS - 8 oz. tube NH #L58775 - 10.2 oz. cartridge
Hydraulic Oil	SAE10W-30 motor oil-API Service SG-CE NH #9613313 - 1 qt. NH #9613314 - 2 1/2 gal. NH #9613358 - 1 L NH #9613360 - 20 L

NOTE: Always use a noncorrosive silicone sealer to prevent damage to the components being sealed during the silicone curing process.

TROUBLESHOOTING

When performing a test on the hydraulic system, use the proper test procedures and test equipment.

Before testing, lower the attachment to the ground or remove the attachment from the loader.

If testing is to be performed with a raised boom, make sure the boom is raised above and resting on the boom lock pins.

Before opening the hydraulic system, clean the area thoroughly to prevent contaminating the system.

Before opening the hydraulic system, relieve all pressure from the system.

Before testing the hydraulic system, check the hydraulic oil level.

Before testing the hydraulic system, the oil must be at normal operating temperature.

If testing requires the skid-steer loader to be raised, use adequate blocking and/or jack stands to securely support the loader.

CAUTION: WHEN CONNECTING TEST EQUIPMENT INTO THE HYDRAULIC SYSTEM, RELIEVE THE PRESSURE IN THE SYSTEM. STOP THE ENGINE, TURN THE IGNITION SWITCH TO THE "ON" POSITION AND OPERATE ALL HYDRAULIC CONTROL VALVE CIRCUITS TO RELIEVE PRESSURE. TURN THE IGNITION SWITCH TO THE "OFF" POSITION.

WARNING: GAUGES, GAUGE FITTINGS, AND HOSES MUST HAVE OPERATING PRESSURE RATINGS OF AT LEAST 25% HIGHER THAN THE HIGHEST PRESSURES OF THE SYSTEM.

NEVER ADJUST OR REPLACE THE RELIEF VALVES TO GET HIGHER PRESSURES THAN THOSE SPECIFIED BY THE EQUIPMENT MANUFACTURER.

WARNING: FLUID UNDER PRESSURE CAN HAVE SUFFICIENT FORCE TO PENETRATE THE SKIN, CAUSING SERIOUS PERSONAL INJURY. ALWAYS PROTECT THE SKIN AND EYES FROM ESCAPING FLUID UNDER PRESSURE.

BEFORE DISCONNECTING LINES OR FITTINGS, BE SURE TO TURN OFF THE SKID LOADER ENGINE AND RELIEVE ALL PRESSURE. BEFORE APPLYING PRESSURE TO THE SYSTEM, BE SURE ALL CONNECTIONS ARE TIGHT AND THAT LINES, PIPES, AND HOSES ARE NOT DAMAGED.

IF INJURED BY ESCAPING FLUID, OBTAIN MEDICAL ASSISTANCE AT ONCE. SERIOUS INFECTION OR REACTION CAN DEVELOP IF MEDICAL TREATMENT IS NOT ADMINISTERED IMMEDIATELY.

REMOVE ANY ATTACHMENT FROM THE MOUNTING PLATE BEFORE LOOSENING OR DISCONNECTING ANY HYDRAULIC LINES.

CAUTION: USE ADEQUATE BLOCKING AND/OR JACK STANDS TO INSURE THAT THE LOADER IS SAFELY SUPPORTED WITH ALL FOUR WHEELS OFF THE GROUND.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Noisy system pump	Oil level too low	Add proper oil and amount
	Oil of incorrect viscosity	Replace oil and filter
	Suction line plugged	Clean or replace line
	Reservoir air vent plugged	Clean reservoir cap
	Air leaks at pump inlet line fittings	Tighten or replace line and fittings
		Check for air leak in hydrostatic pump case drain line from hydrostatic pumps to section side of gear pump
Hydraulic reservoir oil foaming/milky	Air or water in system	Check for air leak on suction side of pump and check reservoir fill neck for leak to allow water to enter system
		Check for air leak in hydrostatic pump case drain line from hydrostatic pumps to section side of gear pump
Low system pump oil flow, under pressure	Plugged inlet line	Clean or replace line
	Low oil level in reservoir	Add proper oil and amount
	Air leaks at pump inlet line and fittings	Tighten or replace line and fittings
		Check for air leak in hydrostatic pump case drain line from hydrostatic pumps to section side of gear pump
	Worn pump body	Replace body if ID of body exceeds acceptable limits. Refer to service manual.
No system pressure	Inoperative relief valve	Replace valve
	Plugged inlet line	Clean or replace inlet line
	Worn hydraulic pump	Rebuild or replace pump
	Pump shaft broken	Replace relief valve and replace or repair pump
	Internal leakage in control valve or cylinders	Rebuild components
Boom and bucket will not function	Service/Run switch in the service position	Put Service/Run switch in the run position
	Boom and bucket solenoids malfunctioning	Check solenoid operation
	Pump shaft broken	Replace relief valve and replace or repair pump

PROBLEM	POSSIBLE CAUSE	CORRECTION
Boom arms will not raise or raise slowly	Low oil flow from pump	Plugged inlet line or worn pump
	Low relief valve pressure	Check pressure, replace valve if pressure is not correct
	Control linkage binding	Free linkage
	Boom solenoid malfunctioning	Check solenoid operation
	Boom and bucket overloaded	Reduce load
	Cylinder shafts are bent	Rebuild or replace cylinders
	Boom arms are binding at pivots	Remove binding and lubricate linkage
	Boom circuit relief valve malfunctioning	Check circuit relief valve pressure setting
	Bucket tilt valve spool is not returning to center position, binding	Correct binding, spool centering spring damaged.
	Auxiliary hydraulic handle locked in detent position	Return handle to neutral position
Boom or bucket leaks down or low pressure	Control valve O rings leaking on plugs or circuit relief valve	Repair control valve with seal kit and replace O rings and back-up rings
Boom and/or bucket will not move smoothly, jerky.	Air leaks at pump line and fittings	Tighten or replace line and fittings
Bucket will not tilt back, tilts back slowly or tilts forward slowly	Low oil flow from pump	Plugged inlet line, clean or replace line
	Worn or damaged pump	Check pump flow, rebuild or replace pump as necessary
	Valve spool is not in correct position, spool binding	Free control linkage, centering spring damaged
	Bucket solenoid malfunctioning	Check solenoid operation
	Cylinder shafts are bent	Rebuild or replace cylinders
	Cylinder seals are leaking	Rebuild cylinders
	Bucket is overloaded	Reduce load
	Auxiliary hydraulic handle locked in detent position	Return handle neutral
Bucket cylinder pin will not take grease	Pin drilled incorrectly	Replace with new pin

PROBLEM	POSSIBLE CAUSE	CORRECTION
Hydraulic system hot	Low oil flow pump	Plugged inlet line, clean or replace line
	Main control valve linkage or spool binding or damaged	Check and correct linkage
	Auxiliary boom hydraulic control not in neutral	Lock handle in neutral when not in use
	Hydraulic oil cooler restricted	Clean oil cooler
	Leaking cylinder packing	Repair cylinders
	Main system relief valve low pressure	Check main system pressure
	Hydraulic attachment being over used	Back off and let system cool down, DO NOT operate at or close to relief pressure
Oil filter indicator light stays on	Oil filter clogged	Change filter
	Incomplete circuit	Check the DkGn/O wire and connections
	Undersize tubes, hoses, or fittings	Replace any undersize tubes, hoses, or fittings
	Filter base	Replace if pressure differential across filter is over 40 PSI

HYDRAULIC SYSTEM TESTING

Foot or hand controls and control valve spool locks:

Pretest instructions:
* Hydraulic oil reservoir oil at proper oil level
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “OFF” position

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Foot and/or hand controls, (boom and bucket) Controls should not move	NO YES	System OK Check linkage to control valve spools, if OK go to next step.
2			Check control valve spools for centering, if OK go to next step.
3			Check for bent control valve spools, if OK go to next step.
4			Check spool lockout solenoid operation, if not OK refer to solenoid testing

Foot or hand controls and control valve spool locks:

Pretest instructions:
* Hydraulic oil reservoir oil at proper oil level
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Foot and/or hand controls, (boom and bucket) Controls should move	YES NO	System OK Check linkage to control valve spools, if OK go to next step.
2			Check control valve spools for centering, if OK go to next step.
3			Check for bent control valve spools, if OK go to next step.
4			Check spool lockout solenoid operation, if not OK refer to solenoid testing

Foot or hand control and control valve spool lock solenoids:

Pretest instructions:
* Hydraulic oil reservoir oil at proper oil level
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Solenoid Solenoid plunger should move from valve spool.	YES NO	System OK Check for battery voltage at solenoid wire connection, if OK replace solenoid. If not OK go to next step.
			Set in seat and buckle seat belt in sequence, if not OK check operation of seat belt buckle. If OK go to next step.
			Check wires from solenoid to EIC board, if OK go to next step.
			Check EIC board operation

Electronic instrument cluster (EIC) hydraulic oil temperature light:

Pretest instructions:
* Hydraulic oil reservoir oil at proper oil level
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Electronic instrument cluster (EIC) Hydraulic oil temperature light should be off	YES NO	System OK Check hydraulic oil temperature, if OK go to step 3. If not OK go to next step.
2			Check oil cooler and radiator for restricted air flow.
3			Check oil temperature sender for proper operation.

Electronic instrument cluster (EIC) hydraulic oil filter light:

Pretest instructions:
* Hydraulic oil reservoir oil at proper oil level
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Electronic instrument cluster (EIC) Hydraulic oil filter light should be off.	YES NO	System OK Replace oil filter, if problem still exists go to next step.
2			Check filter sender and wires.

Boom operation:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Boom movement Boom should move freely through full range when the foot or hand controls are moved.	YES NO	System OK Check for binding in boom linkage, if OK go to next step.
2			Check for bent cylinders, if OK go to next step.
3			Check hydraulic system oil flow and pressure, if OK go to next step.
4			Check cylinders for internal damage.
5	Boom movement Boom should raise smoothly with no jerking	YES NO	System OK Check for air in the hydraulic system. Check, tighten, or replace suction line and fittings. Check for air leak in hydrostatic pump case drain line from the hydrostatic pumps to the suction side of gear pump.

Boom lift check test:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Boom stopped midrange and restarted, the boom should start raising without dropping first	YES NO	System OK Check for a leaking lift check valve, broken spring, or scored plunger and/or seat. If OK go to next step.
2			Check cylinders for leaking packing.
3			Check O ring and backup washer on circuit relief valve and O ring on front plug in control valve.

Boom drift down test:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Boom stopped midrange should hold in position with no visual movement	YES NO	System OK Check control valve spool for centering, if OK go to next step.
2			Check for leaking packing on cylinders, if OK go to next step.
3			Check boom circuit relief valve, if OK go to next step.
4			Check control valve for leakage.
5			Check O ring and backup washer on circuit relief valve and O ring on front plug in control valve.

Bucket operation:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Bucket movement Bucket should move freely through full range when the foot or hand controls are moved.	YES NO	System OK Check for binding in the bucket pivots, if OK go to next step.
2			Check for bent cylinders, if OK go to next step.
3			Check hydraulic system oil flow and pressure, if OK go to next step.
4			Check cylinders for internal damage.
5	Boom movement Boom should raise smoothly with no jerking	YES NO	System OK Check for air in the hydraulic system. Check, tighten, or replace suction line and fittings. Check for air leak in hydrostatic pump case drain line from the hydrostatic pumps to the suction side of gear pump.

Bucket lift check test:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Bucket stopped midrange and restarted, the bucket should not drop first	YES NO	System OK Check for a leaking lift check valve, broken spring, or scored plunger and/or seat. If OK go to next step.
2			Check cylinders for leaking packing.
3			Check O ring and backup washer on front and rear plug in control valve.

Bucket drift down test:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position
* Engine running half throttle, 1500 RPMs

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Bucket stopped midrange should hold in position with no visual movement	YES NO	System OK Check control valve spool for centering, if OK go to next step.
2			Check for leaking packing on cylinders, if OK go to next step.
3			Check boom circuit relief valve, if OK go to next step.
4			Check control valve for leakage.
5			Check O ring and backup washer on front and rear plug in control valve.

Spool lock solenoid test:

Pretest instructions:
* Operator in seat
* Service/Run switch in “RUN” position
* Seat belt fastened
* Ignition switch in the “ON” position

STEP	TEST	RESULT	PROBABLE CAUSE AND CORRECTION
1	Battery voltage at solenoid	YES NO	System OK, go to step 5. Check seat belt operation, if OK go to next step.
2			Check wires to the solenoid valves for open circuit, if OK go to next step.
3			Check EIC board operation, if OK go to next step.
4			Check EIC board operation, if not OK refer to ELECTRICAL SECTION of the SERVICE MANUAL.
5			Remove solenoid coil and check operation, if OK go to next step.
6			Check control valve spools for centering, binding, and binding between solenoid and block, if OK replace solenoid valve.

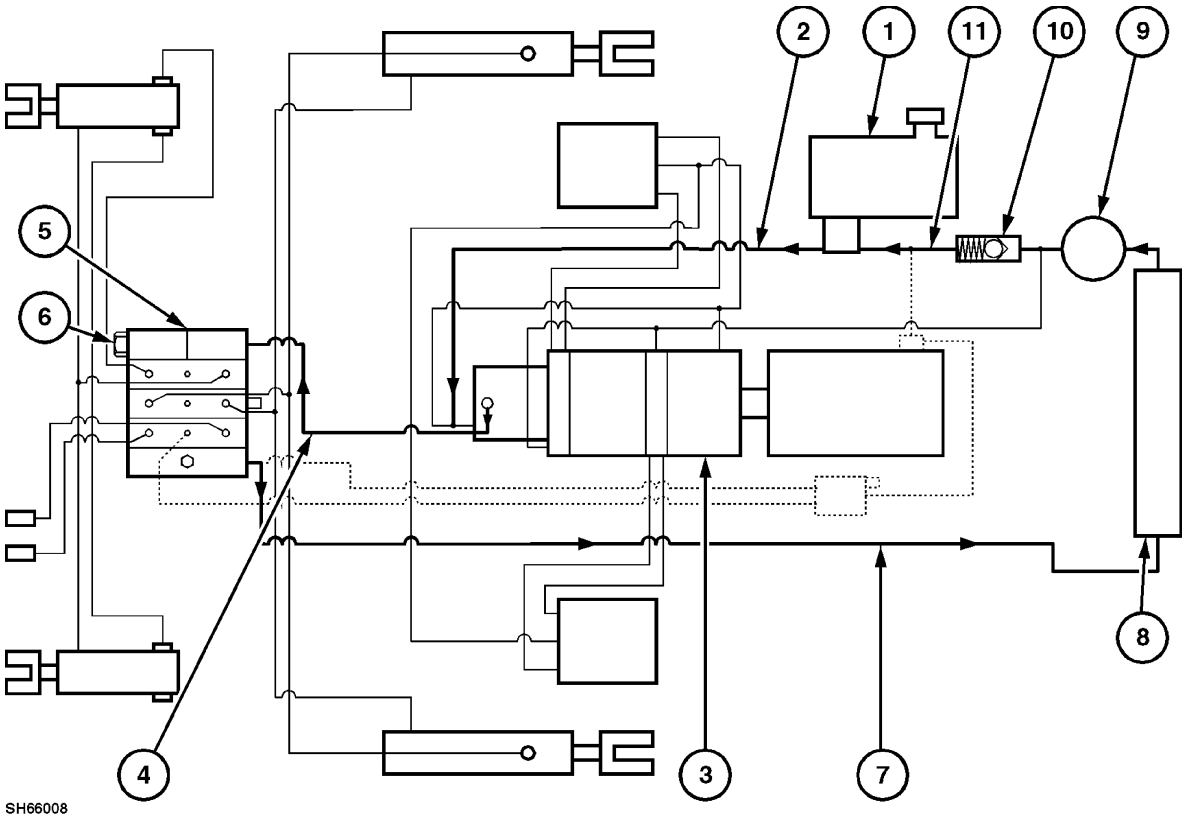


Figure 6-7

HYDRAULIC SYSTEM OIL FLOW

Control Valve - Spools in Neutral Position

1. Hydraulic oil reservoir, 1, storage for system oil.
2. Oil flows through suction line, 2, from reservoir, 1, to gear pump, 3.
3. Oil flows from gear pump, 3, through pressure line, 4, to control valve, 5.
4. Control valve, 5, is equipped with a system relief valve, 6.
5. With the control valve spools in neutral position, the oil flows through center of control valve, 5, to return line, 7.
6. The oil flows through return line, 7, to oil cooler, 8.
7. Oil passes through the oil cooler, 8, being cooled with the air blast from engine fan through the cooler.
8. Oil flows from the oil cooler, 8, through filter, 9, and check valve, 10, to return line, 11, and reservoir, 1.

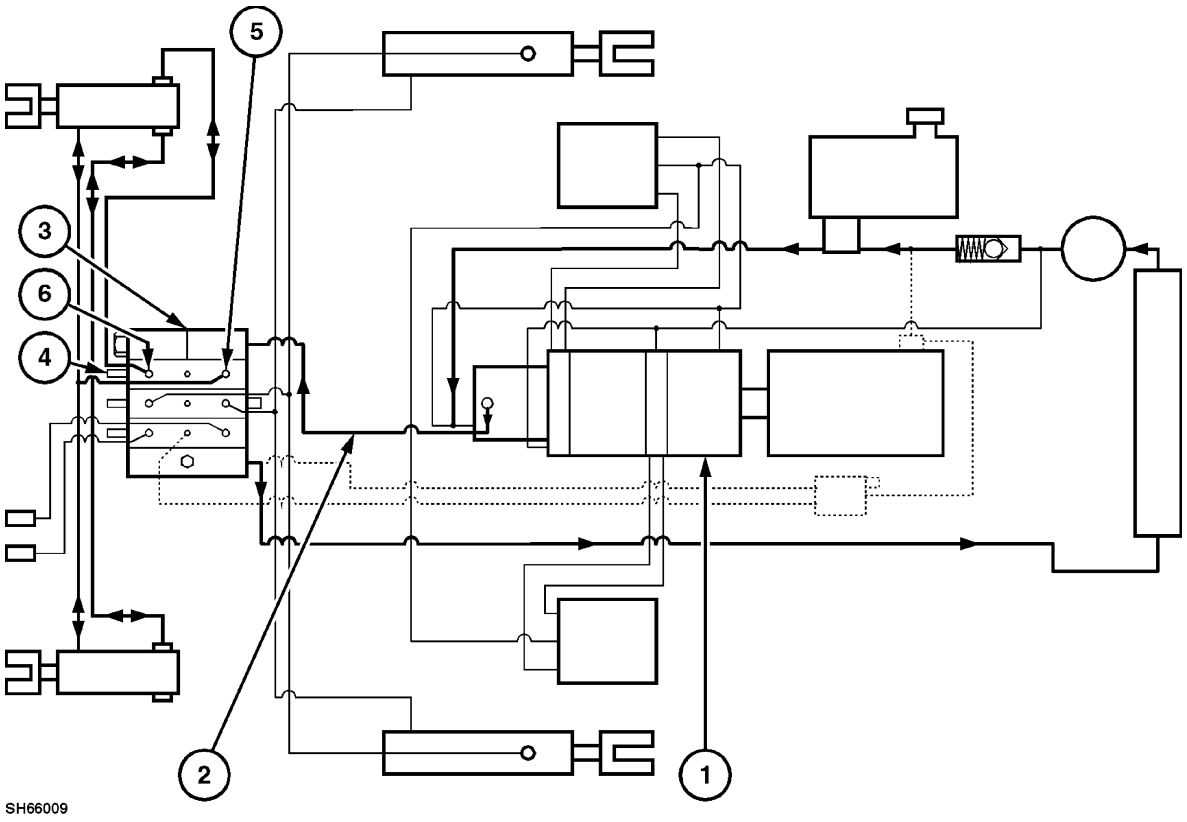


Figure 6-8

CONTROL VALVE - BUCKET SPOOL SHIFTED

Bucket Control Operation

Foot Controls

When the toe of the control pedal is pushed down, it will shift the control valve spool in, dumping the bucket. When the heel of the control pedal is pushed down, it will shift the control valve spool out curling the bucket back.

Hand Controls

When the right control handle is pivoted up it will shift the control valve spool in, dumping the bucket. When the right control handle is pivoted down it will shift the control valve spool out, curling the bucket back.

1. Oil flows from the gear pump, 1, through pressure line, 2, to control valve, 3.
2. When the bucket valve spool, 4, is pulled out, the oil flows from the rear work port, 5, to the shaft side of the bucket cylinder to curl the bucket back.
3. When the bucket valve spool, 4, is pushed in, the oil flows from the front work port, 6, to the base (piston) end of bucket cylinder to dump the bucket.
4. When the bucket circuit is operated to maximum pressure or cylinders are bottomed, the main system relief valve will relieve the high pressure oil into the return oil galley in the control valve, returning the oil to the reservoir.
5. The return oil from the opposite side of the cylinder being pressured will return through the control valve to the reservoir.

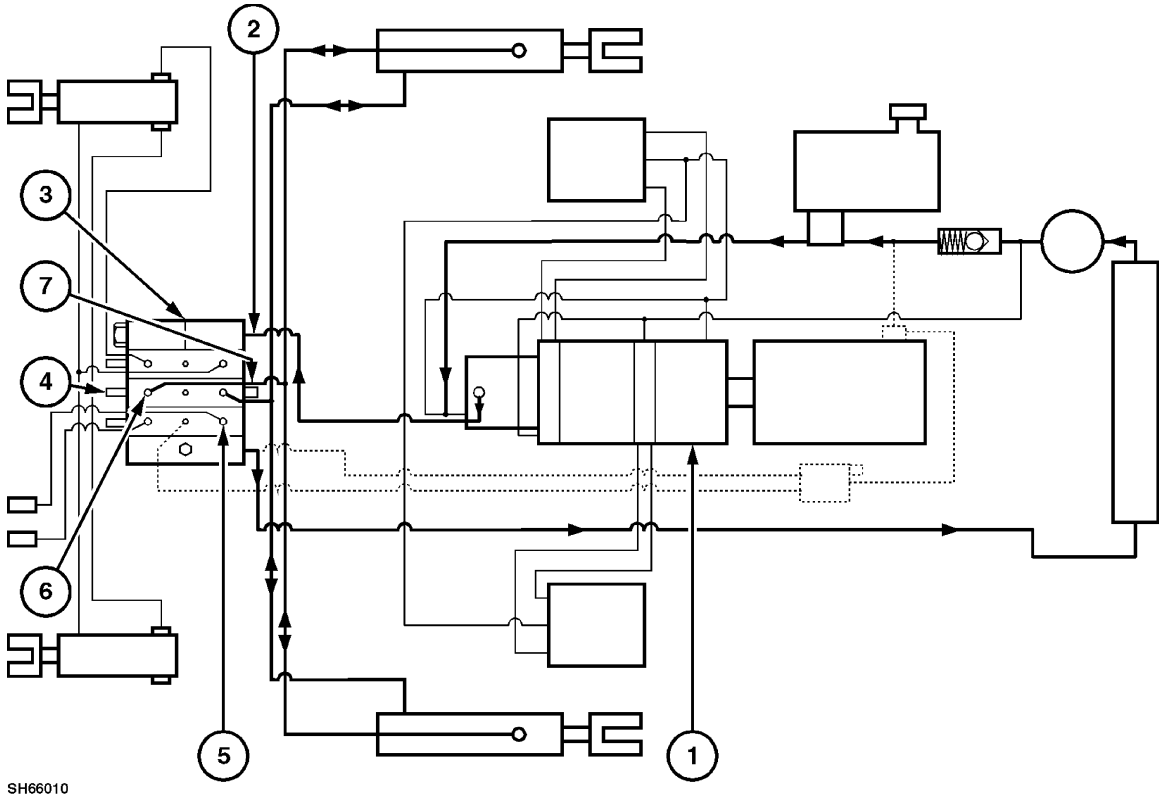


Figure 6-9

CONTROL VALVE - BOOM SPOOL SHIFTED

Boom Control Operation

Foot Controls

When the toe of the control pedal is pushed down, it will shift the control valve spool in, lowering the boom. When the heel of the control pedal is pushed down it will shift the control valve spool out, raising the boom.

Hand Controls

When the left control handle is pivoted down, it will shift the control valve spool in, lowering the boom. When the left control handle is pivoted up, it will shift the control valve spool out, raising the boom.

1. Oil flows from the gear pump, 1, through pressure line, 2, to control valve, 3.
2. When the boom valve spool, 4, is pulled out, the oil flows from the rear work port, 5, to the base (piston) end of the boom cylinder raising the boom.
3. When the boom valve spool, 4, is pushed in, the oil flows from the front port, 6, to the shaft end of boom cylinders, to lower the boom.
4. When the boom circuit is operated to maximum pressure or cylinders are bottomed, the main system relief valve will relieve the high pressure oil into the return oil valley in the control valve, returning the oil to the reservoir.
5. The return oil from the opposite side of cylinders being pressured will return through the control valve to the reservoir.
6. When the boom cylinders are extended, the boom control valve spool is in neutral, and a load is put on the boom cylinders causing them to retract the circuit. Relief valve, 7, will relieve the pressure in the base (piston) side of cylinders protecting the cylinder and lines. The oil relieved from the circuit relief valve enters the return oil galley in the control valve and returns to the reservoir.
7. When the boom valve spool, 4, is pushed in all the way, it will put the spool into detent position, holding the spool, opening both work ports 5 and 6 to the return allowing the boom to float.

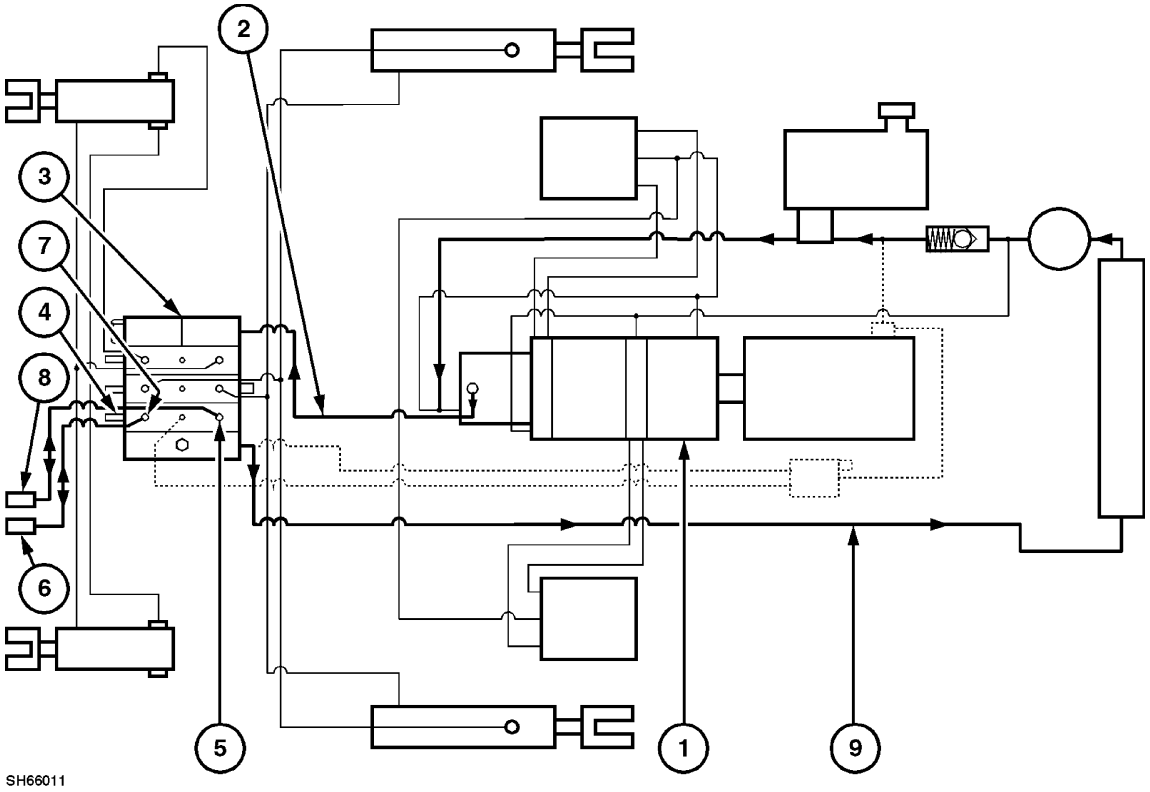


Figure 6-10

CONTROL VALVE - AUXILIARY SPOOL SHIFTED

Auxiliary Control Operation

Hand Controls

When the right control handle is pivoted down, it will shift the control valve spool in, supplying oil to the male quick coupler. When the right control handle is pivoted up, it will shift the control valve spool out, supplying oil to the female quick coupler.

Foot Control

When the toe of the control pedal is pushed down, it will shift the control valve spool in, supplying oil to the male quick coupler. When the heel of the control pedal is pushed down, it will shift the control valve spool out, supplying oil to the female quick coupler.

1. Oil flows from the gear pump, 1, through pressure line, 2, to control valve, 3.
2. When the auxiliary valve spool, 4, is pulled out, the oil flows from the rear work port, 5, and supplies oil to the female quick coupler, 6, at the front of the boom.
3. When the auxiliary valve spool, 4, is pushed in, the oil flows from the front work port, 7, and supplies oil to the male quick coupler, 8, at the front of the boom.
4. When the auxiliary circuit is operated to maximum pressure, the main system relief valve will relieve the high pressure oil into the return oil galley in the control valve, returning the oil to the reservoir.
5. The return oil from the opposite quick coupler being pressured will return through the control valve to the reservoir.

   NOTE: The return oil from the quick couplers must be returned through the normal return line, 9, to replenish the hydrostatic system; hydrostatic charge oil is required for lubrication of the hydrostatic pumps and motors.
6. When the auxiliary valve spool, 4, is pushed in all the way, it will put the spool into detent position, holding the spool for continuous oil flow to the male quick coupler.

MAIN SYSTEM PRESSURE TESTS

Check the main system pressure to insure the main relief valve is within specifications to provide adequate working pressure to the hydraulic system.

The main system pressure can be checked at the base end of the boom cylinders at 1.

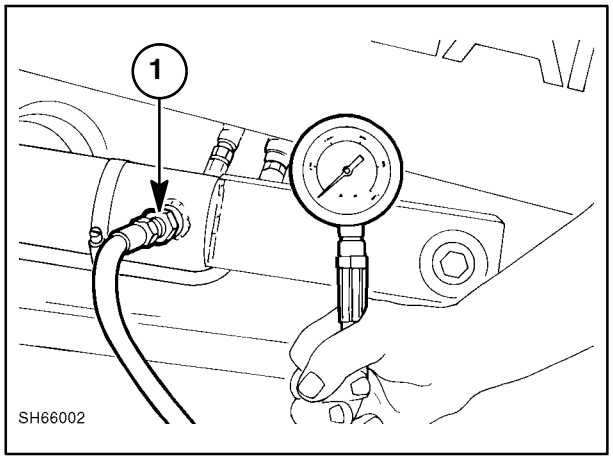


Figure 6-11

The main system pressure can also be checked at the base end of the left bucket cylinder at 1 or at the auxiliary boom hydraulic quick couplers, 2, if equipped.

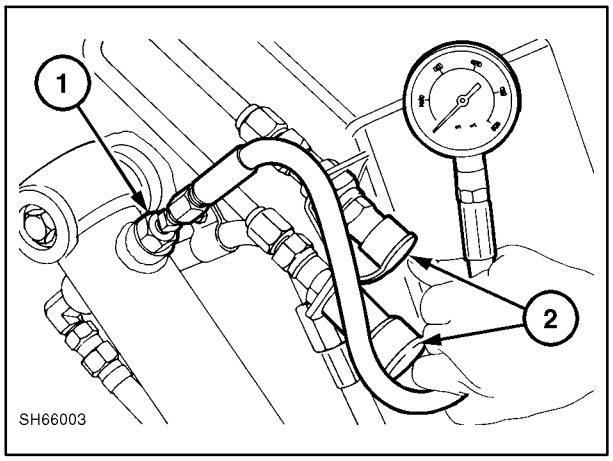


Figure 6-12

To check main system pressure at the boom cylinders, the boom must be up and resting on the boom lockpins, 1.

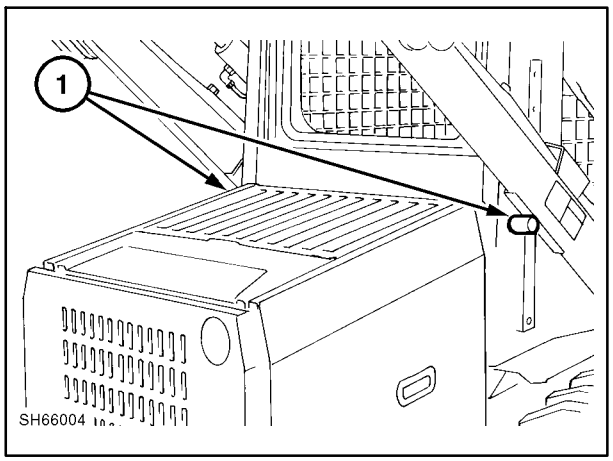


Figure 6-13

The hydraulic system pressures are factory set. Changes to the settings should not be necessary.

To access the control and relief valve area, remove the step shield, 1.

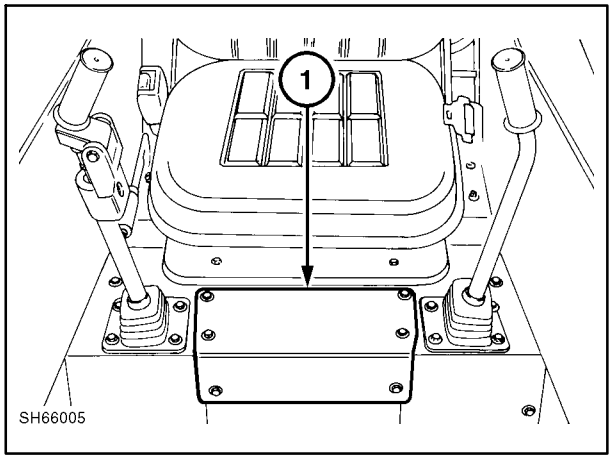


Figure 6-14

Raise the seat and seat pan to the raised latched position, 1. Be sure the seat support rod is latched securely at 2, before working under a raised seat.

CAUTION: DO NOT WORK UNDER RAISED SEAT UNLESS SECURELY LATCHED IN THE RAISED POSITION.

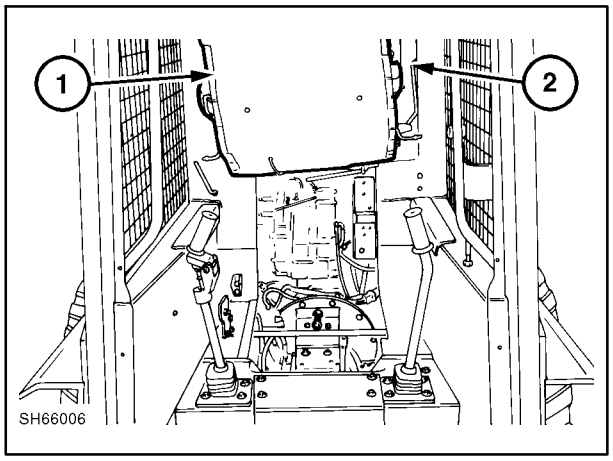


Figure 6-15

The main system relief valve, 1, is located in the control valve. If there is some reason to suspect incorrect pressure, check the pressures as follows:

WARNING: GAUGES, GAUGE FITTINGS, AND HOSES MUST HAVE OPERATING PRESSURE RATINGS OF AT LEAST 25% HIGHER THAN THE HIGHEST PRESSURES OF THE SYSTEM.

NEVER ADJUST OR REPLACE THE RELIEF VALVES TO GET HIGHER PRESSURES THAN THOSE SPECIFIED BY THE EQUIPMENT MANUFACTURER.

WARNING: FLUID UNDER PRESSURE CAN HAVE SUFFICIENT FORCE TO PENETRATE THE SKIN, CAUSING SERIOUS PERSONAL INJURY. ALWAYS PROTECT THE SKIN AND EYES FROM ESCAPING FLUID UNDER PRESSURE.

BEFORE DISCONNECTING LINES OR FITTINGS, BE SURE TO TURN OFF THE SKID LOADER ENGINE AND RELIEVE ALL PRESSURE. BEFORE APPLYING PRESSURE TO THE SYSTEM, BE SURE ALL CONNECTIONS ARE TIGHT AND THAT LINES, PIPES, AND HOSES ARE NOT DAMAGED.

IF INJURED BY ESCAPING FLUID, OBTAIN MEDICAL ASSISTANCE AT ONCE. SERIOUS INFECTION OR REACTION CAN DEVELOP IF MEDICAL TREATMENT IS NOT ADMINISTERED IMMEDIATELY.

REMOVE ANY ATTACHMENT FROM THE MOUNTING PLATE BEFORE LOOSENING OR DISCONNECTING ANY HYDRAULIC LINES.

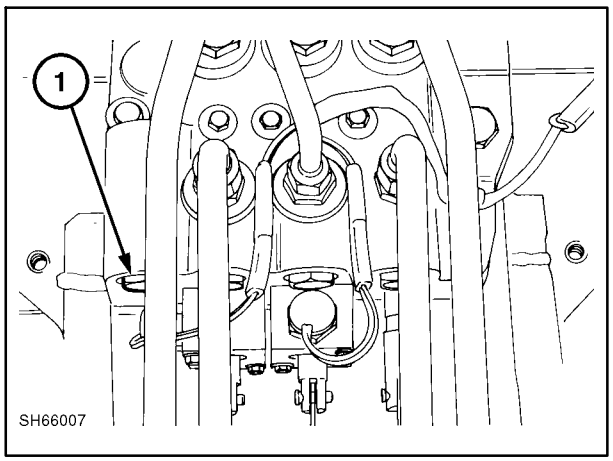


Figure 6-16

CHECKING MAIN SYSTEM PRESSURE AT BOOM CYLINDERS

NOTE: Before performing any hydraulic test, operate the skid-steer loader to get the hydraulic oil to operating temperature (about 55° C [100° F] above ambient temperature).

Fittings and gauge required:

1. 238 bar (3500 PSI) gauge (minimum)
2. 3/4″ - 16 UNF O ring fitting

Test Procedure

1. Raise the boom, extend the boom lockpins, 1, and lower the boom down on the lockpins.
2. Stop the engine, turn the ignition key to the run position, and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.
3. Install the pressure test gauge in the boom cylinder at 1.
4. Start the engine and run it at full throttle (3070 - 3150 RPM) to bring the hydraulic oil to operating temperature.
5. Operate the boom control to raise the boom to the fully raised position until the system bypasses and take a pressure reading. Lower the boom down to the boom lockpins and relieve pressure in the system.
6. The pressure should be from 177 - 190 bar (2600 - 2800 PSI) when the hydraulic oil is at operating temperature.

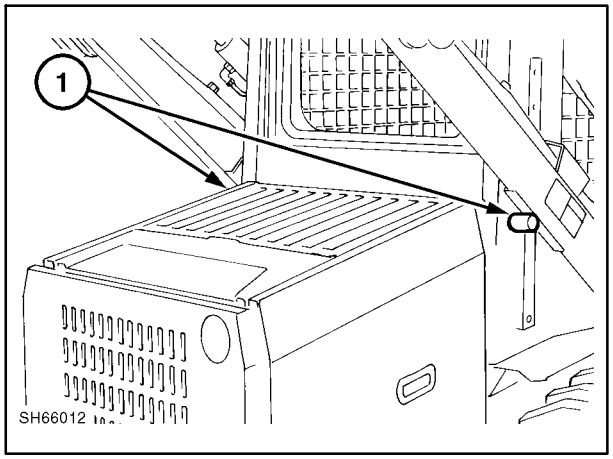


Figure 6-17

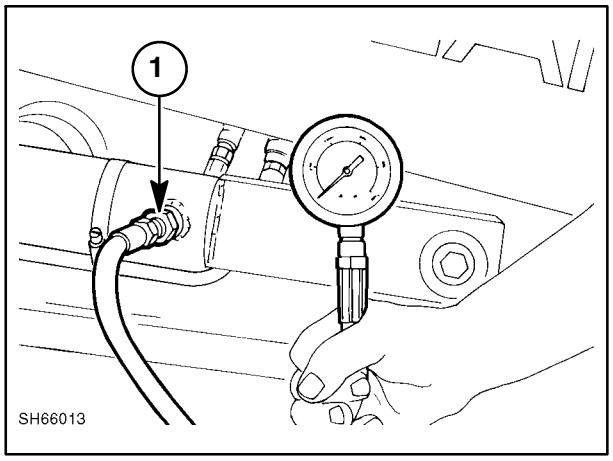


Figure 6-18

7. The relief valve is a cartridge type and is not adjustable. Replace the relief valve cartridge, 1, if the pressure is not within specifications.

CAUTION: DO NOT ATTEMPT TO CHANGE THE PRESSURE SETTING OR ALTER THE PRESSURE TO A HIGHER SETTING AS THE HYDRAULIC COMPONENTS, HOSES, TUBES, AND CYLINDERS MAY BE DAMAGED AND COULD CAUSE INJURY.

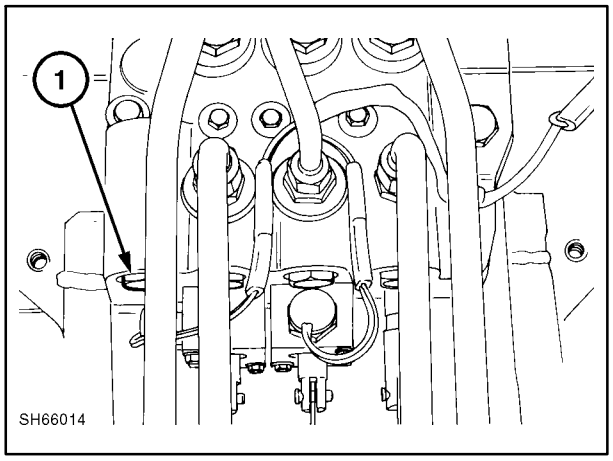


Figure 6-19

CHECKING MAIN SYSTEM PRESSURE AT BUCKET CYLINDERS

Fittings and gauge required:

1. 238 bar (3500 PSI) gauge (minimum)
2. 3/4″ - 16 UNF O ring fitting

Test Procedure

1. Lower the boom and attachment to the ground.
2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.

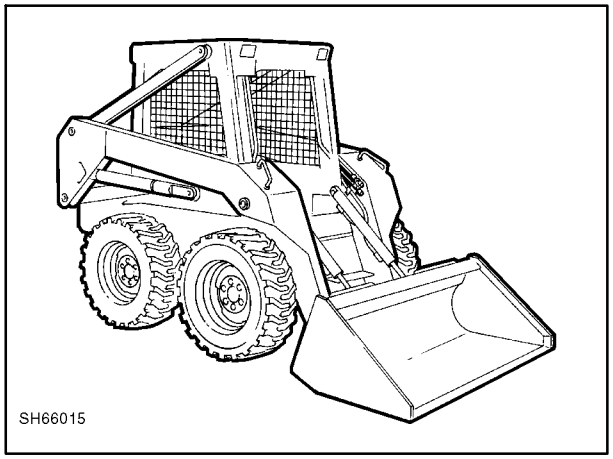


Figure 6-20

3. Install the pressure test gauge in the left bucket cylinder at 1.
4. Start the engine and run it at full throttle (3070 - 3150 RPM).
5. Operate the bucket control to dump the bucket to the fully dumped position until the system bypasses and take a pressure reading. Curl the bucket back to relieve pressure in the system.
6. The pressure should be from 177 - 190 bar (2600 - 2800 PSI) when the hydraulic oil is at operating temperature.

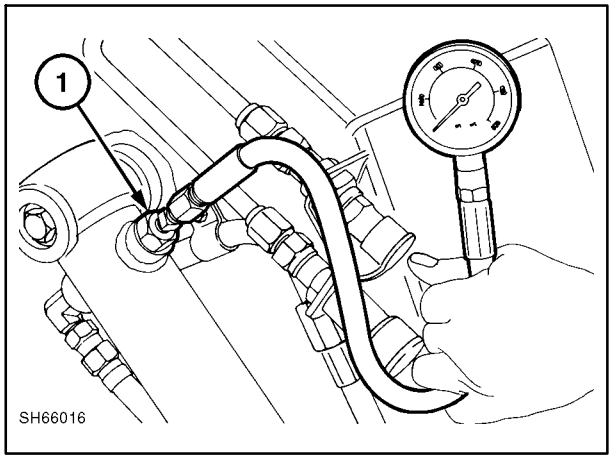


Figure 6-21

7. The relief valve is a cartridge type and is not adjustable. Replace the relief valve cartridge, 1, if the pressure is not within specifications.

CAUTION: DO NOT ATTEMPT TO CHANGE THE PRESSURE SETTING OR ALTER THE PRESSURE TO A HIGHER SETTING AS THE HYDRAULIC COMPONENTS, HOSES, TUBES, AND CYLINDERS MAY BE DAMAGED AND COULD CAUSE INJURY.

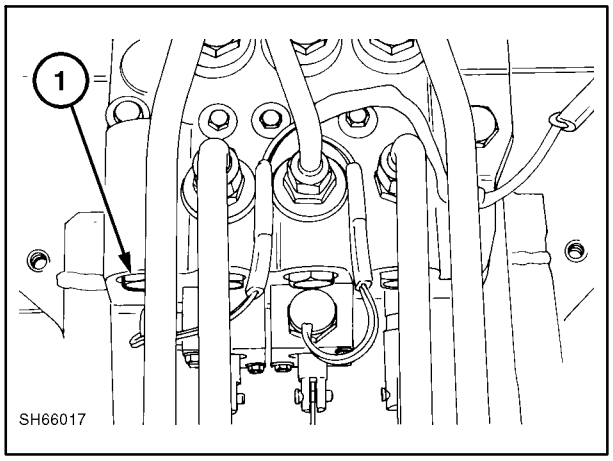


Figure 6-22

CHECKING MAIN SYSTEM PRESSURE AT AUXILIARY BOOM HYDRAULIC QUICK COUPLERS

Fittings and gauge required:

1. 238 bar (3500 PSI) gauge (minimum)
2. 1/2″ quick coupler fitting

Test Procedure

1. Lower the boom and attachment to the ground.
2. Stop the engine, turn the ignition key to the run position and operate the boom, bucket, and auxiliary controls to relieve pressure in the systems. Turn off the key.

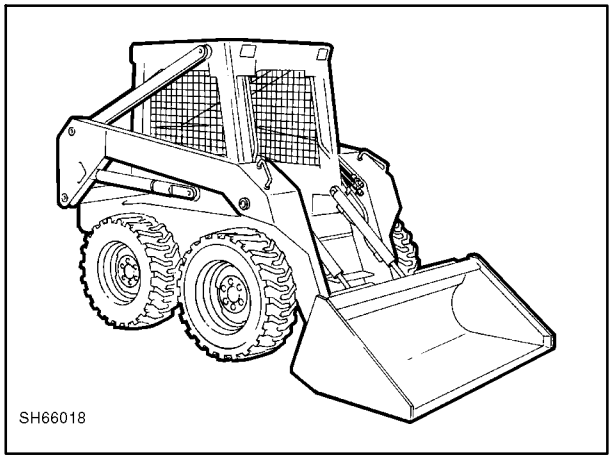


Figure 6-23

3. Install the pressure test gauge in one of the quick couplers at 2.
4. Start the engine and run it at full throttle (3070 - 3150 RPM).
5. Operate the auxiliary control to pressurize the auxiliary circuit until the system bypasses and take a pressure reading. Move the control handle in the opposite direction to relieve pressure in the system.

   NOTE: Pivoting the control handle down supplies oil to the male quick coupler.

6. The pressure should be from 177 - 190 bar (260 - 2800 PSI) when the hydraulic oil is at operating temperature.

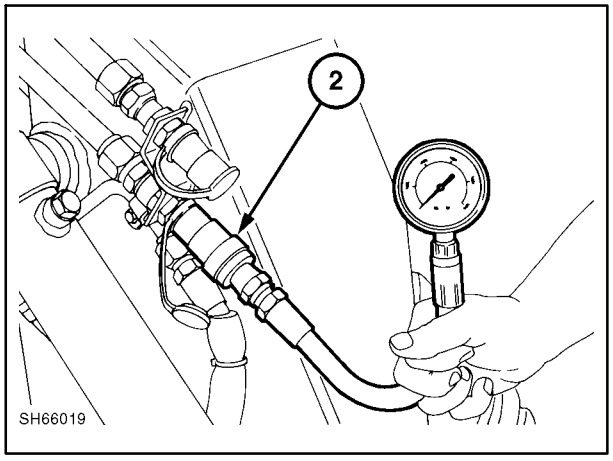


Figure 6-24

7. The relief valve is a cartridge type and is not adjustable. Replace the relief valve cartridge, 1, if the pressure is not within specifications.

CAUTION: DO NOT ATTEMPT TO CHANGE THE PRESSURE SETTING OR ALTER THE PRESSURE TO A HIGHER SETTING AS THE HYDRAULIC COMPONENTS, HOSES, TUBES, AND CYLINDERS MAY BE DAMAGED AND COULD CAUSE INJURY.

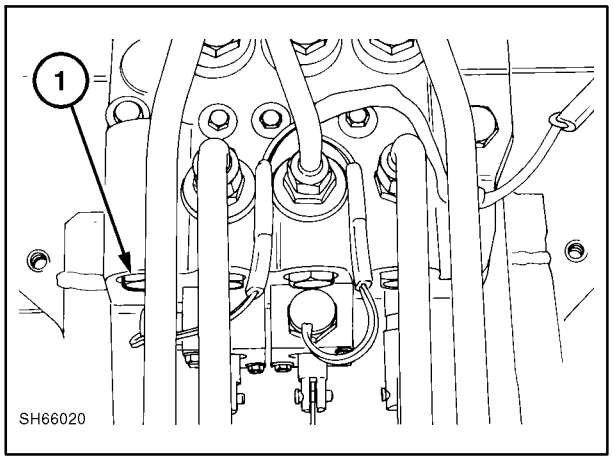


Figure 6-25

BOOM CIRCUIT RELIEF VALVE TEST

The boom circuit is equipped with a circuit relief valve, 1, located in the boom control valve. This valve will protect the cylinders and lines when the control valve spool is in the neutral (centered) position.

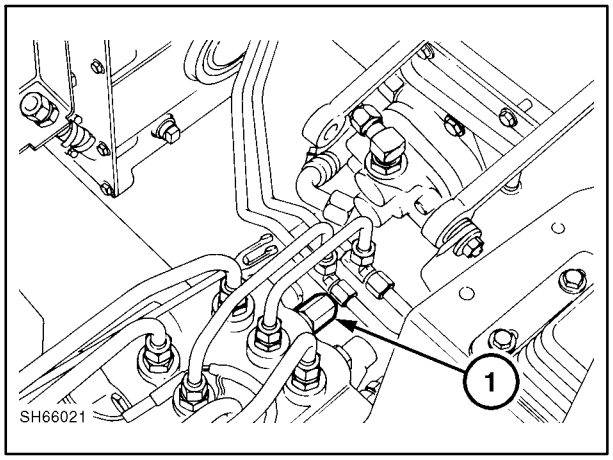


Figure 6-26

Fittings and gauge required:

1. 238 bar (3500 PSI) gauge (minimum)
2. 3/4″ - 16 UNF O ring fitting
3. Hydraulic hand pump

NOTE: The relief valve is factory set at either:

- **186 ± 3 bar (2700 ± 50 PSI) - early models**
- **241 ± 3 bar (3500 ± 50 PSI) - later models**

Both of these boom circuit relief valves are not adjustable. All replacement valves are set at 3500 PSI.

Test Procedure

1. Lower the boom and attachment to the ground.
2. Stop engine, turn ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.
3. Remove the step shield, 1, to access the control valve and circuit relief valve area.

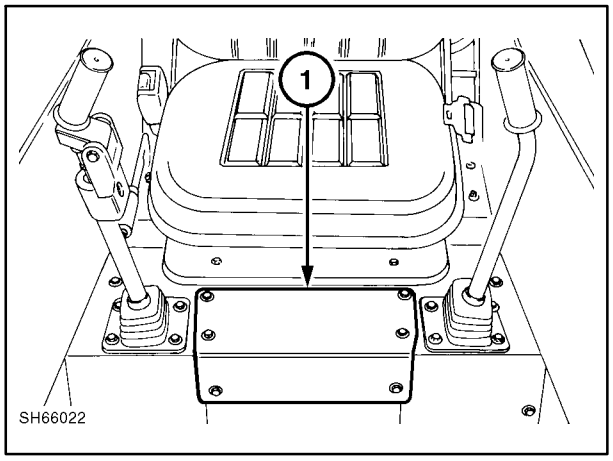


Figure 6-27

4. Boom control valve spool in the neutral (centered) position.
5. Remove the rear boom hydraulic line, 1, and cap the line. Install the hydraulic hand pump and pressure gauge to the rear port in the control valve.
6. Using the hand pump, build pressure against the circuit relief valve and monitor the pressure gauge to read the pressure at the point the relief valve starts to open.

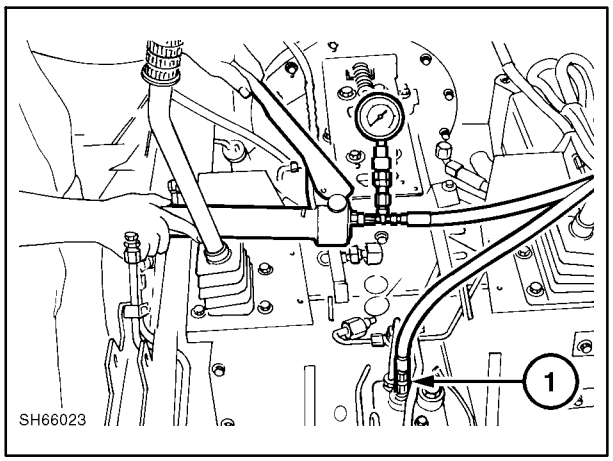


Figure 6-28

CAUTION: DO NOT INCREASE PRESSURE OVER 3800 PSI. IF THE RELIEF VALVE DOES NOT OPEN WHEN PRESSURE REACHES 3600 PSI, DISCONTINUE THE TEST AND REPLACE THE VALVE.

7. If there is an operational complaint and the boom circuit relief valve releases pressure under 235 bar (3400 PSI), replace the valve, 1. If the valve does not release pressure by 248 bar (3600 PSI), also replace the valve. All replacement boom circuit relief valves are set at 241 bar (3500 PSI) and are not adjustable.

   NOTE: If there is not an operational complaint and the valve releases pressure between 184 - 204 bar (2700 - 3000 PSI), the relief valve may be the earlier model 2700 PSI valve operating normally.

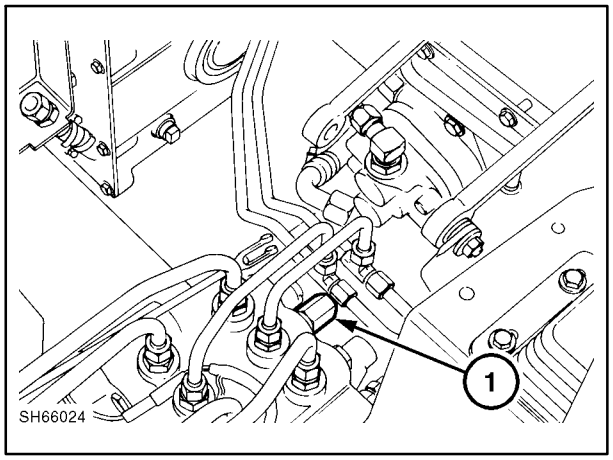


Figure 6-29

GEAR PUMP FLOW EFFICIENCY TEST

Fittings and gauges required:

1. Hydraulic flow tester (30 GPM capacity).
2. Male and female 1/2″ quick couplers for units equipped with auxiliary boom hydraulics.
3. Two male 3/4″ UNF 37 flare to tester fittings for units without auxiliary boom hydraulics.

Test Procedure

Gear pump flow test with units equipped with auxiliary boom hydraulics.

1. Lower the boom and bucket to the lowered position, resting on the ground.
2. Stop engine, turn ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.
3. Attach the pressure (inlet) hose from the flow tester with the female quick coupler to the male half on the loader at 1.
4. Attach the return (outlet) hose from the flow tester with the male coupler to the female half on the loader at 2.

   ATTENTION: Make sure the flow tester is connected into the hydraulic system properly for proper oil flow through the tester to prevent damage to the hydraulic test equipment or hydraulic system.

CAUTION: NEVER POSITION TESTER BETWEEN THE GEAR PUMP AND CONTROL VALVE AS THE SYSTEM RELIEF VALVE WILL BE OUT OF THE TEST CIRCUIT, AND PUMP OVER PRESSURE MAY CAUSE A PUMP FAILURE BY SPLITTING THE CENTER SECTION OR TWISTING OFF THE INPUT SHAFT.

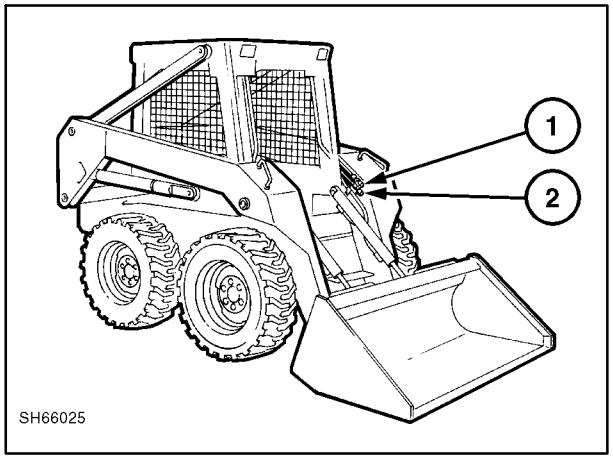


Figure 6-30

5. Turn the resistance valve on tester to “O” setting.
6. Start the engine and run it at full throttle (2900 RPM).
7. Operate the auxiliary control handle by pivoting down to pressurize the male quick coupler and inlet hose to tester.
8. Take a free flow and pressure reading and record it. The flow at this time is oil flow through the hydraulic system and the pressure reading at this point is force required to pump the oil through the system. The pressure is called back pressure.
9. Turn the resistance valve, 1, on the tester to apply resistance in the hydraulic system to obtain the following specifications:

   A. L565, LX565
   2900 RPM (engine)
   68 bar (1000 PSI) - 14.5 GPM (54.9 LPM)

   B. LX665
   2900 RPM (engine)
   68 bar (1000 PSI) - 17.1 GPM (64.7 LPM)

If the gear pump flow in step 9 is not at least 80% of the pump flow in step 8, remove and repair or replace the pump.

EXAMPLE:

14 GPM free flow Step 8.

10.5 GPM flow Step 9.

80% of 14 GPM = 11.2 GPM

The pump is not at least 80% of free flow. Repair or replace pump.

NOTE: The oil must be at operating temperature before any hydraulic testing.

If the pressure cannot be obtained, replace the main system relief valve.

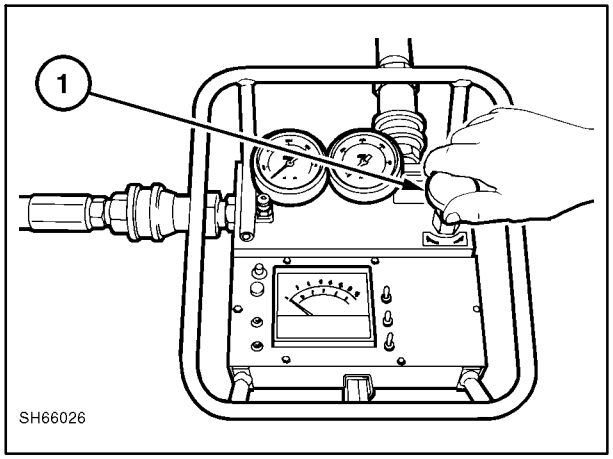


Figure 6-31

Test Procedure

Gear pump flow test with units NOT equipped with auxiliary boom hydraulics.

1. Lower the boom and bucket to the lowered position, resting on the ground.
2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the cylinders. Turn off the key.
3. Unhook line, 1, from the base end of the bucket cylinder, cap cylinder port.
4. Attach the pressure (inlet) hose from the flow tester to line, 1, with 3/4″ UNF 37 flare fitting to tester.
5. Unhook line, 2, and cap the hose fitting.
6. Attach the return (outlet) hose from the flow to line, 2, with 3/4″ UNF 37 flare fitting to tester.

   ATTENTION: Make sure the flow tester is connected into the hydraulic system properly for proper oil flow through the tester to prevent damage to the hydraulic test equipment or hydraulic system. Refer to the test equipment manufacturer's Operator's Manual.

7. Turn the resistance valve, 1, on the tester to "O" setting.
8. Start the engine and run it at full throttle (2900 RPM).
9. Operate the bucket control to dump the bucket for proper oil flow to the inlet hose and tester.
10. Take a free flow and pressure reading and record it. The flow at this time is oil flow through the hydraulic system and the pressure reading at this point is force required to pump the oil through the system. The pressure is called back pressure.

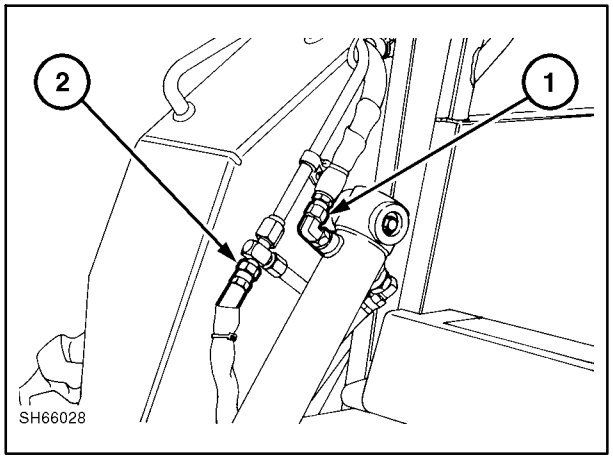


Figure 6-32

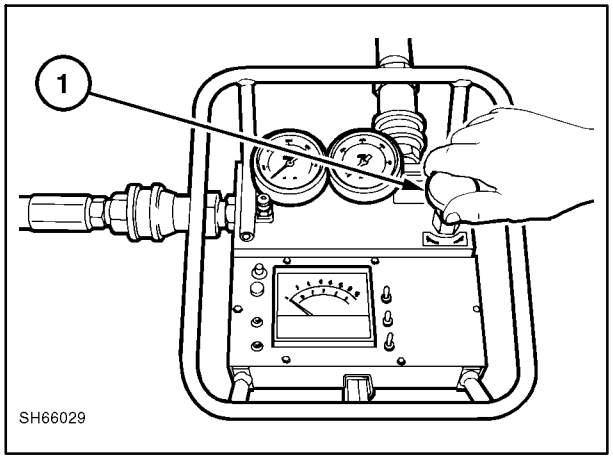


Figure 6-33

11. Turn the resistance valve on the tester to apply resistance in the hydraulic system to obtain the following specifications:

    A. L565, LX565
    2900 RPM (engine)
    68 bar (1000 PSI) - 14.5 GPM (54.9 LPM)

    B. LX665
    2900 RPM (engine)
    68 bar (1000 PSI) - 17.1 GPM (64.7 LPM)

If the gear pump flow in step 9 is not at least 80% of the pump flow in step 8, remove and repair or replace the pump.

EXAMPLE:

14 GPM free flow Step 8.

10.5 GPM flow Step 9.

80% of 14 GPM = 11.2 GPM

The pump is not at least 80% of free flow. Repair or replace pump.

NOTE: The oil must be at operating temperature before any hydraulic testing.

If the pressure cannot be obtained, replace the main system relief valve.

BOOM AND BUCKET SPOOL LOCK SOLENOID TEST

The boom and bucket control valve solenoid spool locks are controlled by the EIC (Electronic Instrument Cluster). The operator must be in the operator's seat with the seat belt buckled for the EIC to unlock the control valve spool lock solenoids.

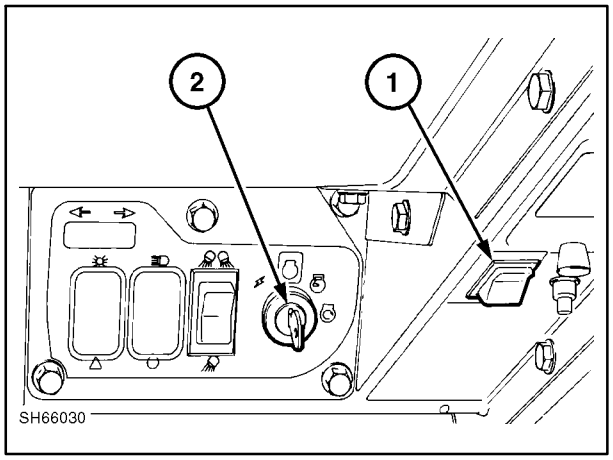


Figure 6-34

Operational check procedure:

1. Service/Run switch, 1, in "RUN" position.
2. Sit in seat.
3. Turn ignition key switch, 2, to the "ON" position.
4. Attempt to move boom and bucket foot or hand controls. The controls should not move the control valve spools from the neutral position.
5. Fasten the seat belt.
6. Attempt to move boom and bucket foot or hand controls. The controls should move the control valve spools from the neutral position.

   NOTE: If the EIC shows an Erro3 in the readout display, this is an indication of a shorted/open circuit to the solenoid locks.

Electrical test procedure:

1. Lower the boom and attachment to the ground or rest the boom on the boom lock pins, 1; remove attachment if on boom locks.

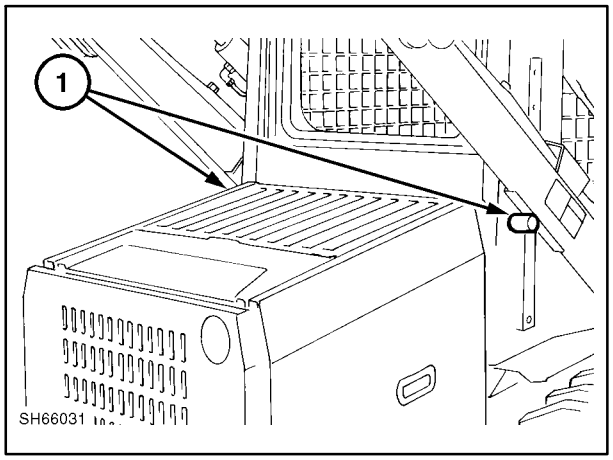


Figure 6-35

2. Raise the seat and latch securely in the raised latch position, 1. Remove the step shield, 2, from over the control valve to access the solenoid locks.

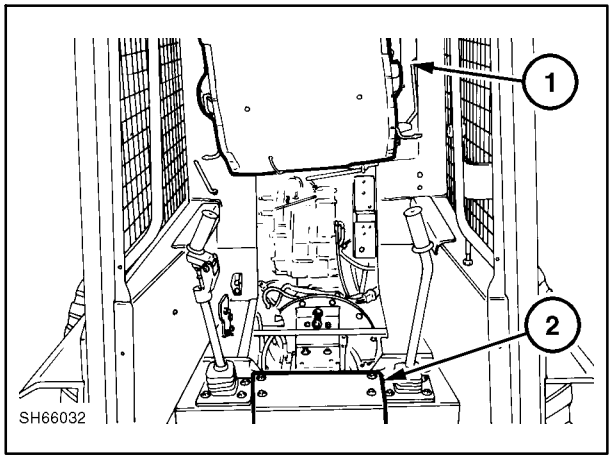


Figure 6-36

3. Unplug one solenoid, 1, at a time and check for battery voltage at the main wire harness plugs, pink/light-blue and black wires. The operator must be in the seat with the seat belt buckled and the ignition key in the “ON” position.

   NOTE: If both solenoids are unplugged, the EIC will show an Erro 3 and there will be no voltage from the EIC to the solenoids.

4. If there is battery voltage at the solenoids, remove the coils and check their operation. If the plunger moves in when power is applied, check for binding when the coil is threaded into the body. Check for spool centering to allow the coil plunger to seat into the groove in the spool.

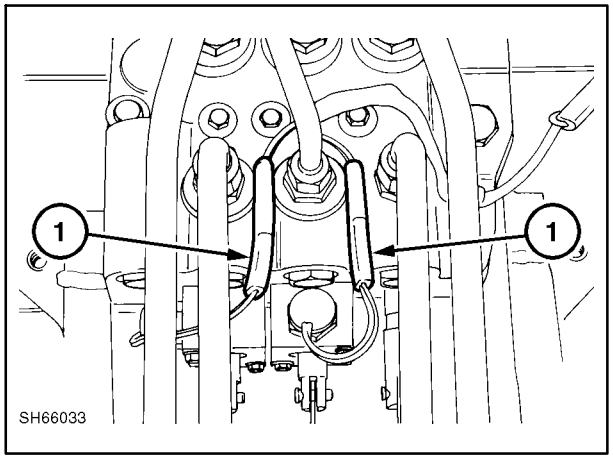


Figure 6-37

DANGER: IF THE LOCKOUT SOLENOIDS ARE LOOSENED OR REMOVED FROM THE CONTROL VALVE BODY, THE PEDAL(S) ARE NO LONGER LOCKED. PEDAL OR HAND CONTROL MOVEMENT WILL RESULT IN SPOOL MOVEMENT AND BOOM/BUCKET MOVEMENT.

HYDRAULIC, HYDROSTATIC SYSTEM AIR INGRESS TEST

Hydraulic system air ingress, causing oil aeration, can affect performance of the hydraulic oil. This may be evident on a machine by jerky or uneven movement of the loader boom or bucket.

To assist in testing and finding leaks, a tool has been developed (part #FNH22ESS95). This tool comprises of a cap which replaces the reservoir filler breather for testing purposes, a pressure gauge and a relief valve. The cap has fittings for air pressure to be applied to the hydraulic reservoir.

CAUTION: DO NOT START THE ENGINE WITH THE TEST TOOL INSTALLED, AS THE HYDRAULIC SYSTEM MUST BE ABLE TO BREATHE.

Test Procedure:

1. Remove the filler/breather cap.
2. Remove the self-tapping screws around the cap base and screen assembly.
3. Remove the base, screen and gasket assembly. Clean all sealing surfaces.
4. Re-install new gaskets and base, taking care not to overtighten the screws.
5. Make sure the tank has 10W-30 oil visible.
6. Pressurize the tank using an air pressure line. The tool is equipped with a 3 PSI relief valve and a pressure gauge. The reservoir should not be pressurized beyond 4 PSI.

The following checks should then be performed to trace the source of the air ingress.

- Examine the suction tubes and fittings to the hydraulic gear pump and the return tubes from the filter to the reservoir.
- Examine the transmission case drain tubes/hoses and fittings from the hydraulic motors and pumps to the suction side of the hydraulic pump. Also check the cam plate shaft seals and the pump and motor casing gaskets.
- Potential leakage areas could also be input shaft seals in the engine bell housing, gearbox or output shaft seals in motors and gearboxes and the chain case.
- It may be necessary in some instances (where leakage is occurring on shaft seals into gearboxes or bell housing) to pressurize the reservoir for 2 - 4 hours and monitor the oil level in the gearboxes.
- If the prior checks do not locate the source of the leak, it may be necessary to pressurize each hydrostatic component individually. To do this it will be necessary to disconnect each case drain line in turn and pressurize using an air line to a maximum pressure of 10 PSI.

NOTE: A check valve can be installed in the case drain tube which maintains a 5 PSI pressure in the pump and motor cases. This helps prevent air ingress into the system.

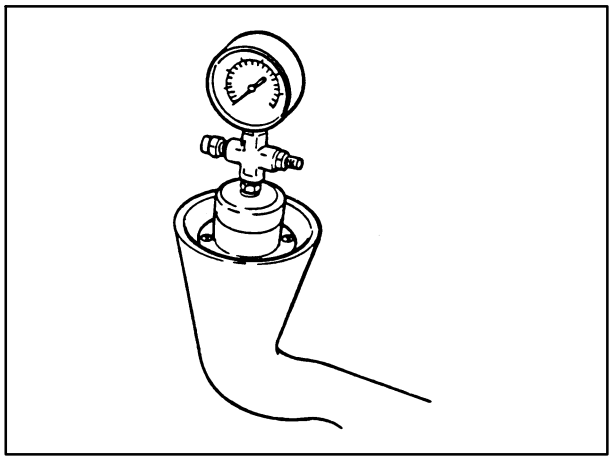


Figure 6-38

CONTROL VALVE (with Bolt-On Solenoid Blocks)

REMOVAL, DISASSEMBLY, INSPECTION, REASSEMBLY

Specifications

Type	3-spool open center
Relief Valve	170 - 177 bar (2500 - 2600 PSI) Nonadjustable
Circuit Relief (boom)	187 bar (2750 PSI) or 241 bar (3500 PSI)
Electrical Solenoid Spool Locks	Bucket and boom

Torque Specifications

Control Valve Retaining Hardware	24 N·m (18 ft. lbs.)
Control Valve Plugs (large)	38 N·m (28 ft. lbs.)
Control Valve Plugs (small)	31 N·m (23 ft. lbs.)
Circuit Relief Valve (boom)	38 N·m (28 ft. lbs.)
Spool Lock Solenoids	15 N·m (11 ft. lbs.)
Solenoid Mounting Block Hardware	16 N·m (12 ft. lbs.)
Main System Relief Valve	51 N·m (38 ft. lbs.)
Spool Cap Assembly Hardware	16 N·m (12 ft. lbs.)
Plug, BYD Port	38 N·m (28 ft. lbs.)

Labor Required

Remove and Replace	0.75 hour
Repair	1.0 hour

REMOVAL

1. Lower the boom and bucket to the lowered position (resting on the ground), or remove any attachment and raise the boom and rest on the boom lock pins, 1. Roll the attachment plate to the fully “DUMPED” position.
2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.

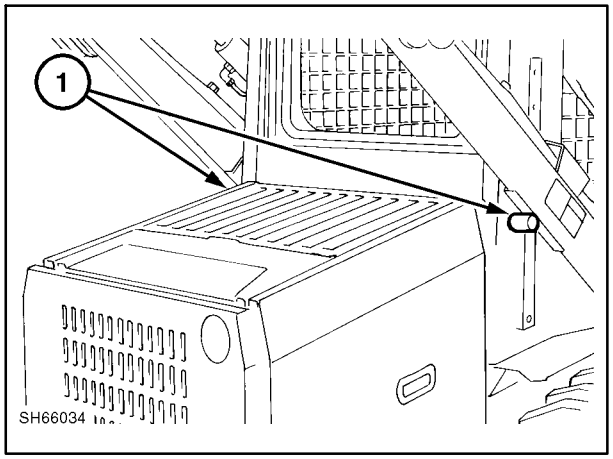


Figure 6-39

3. Raise the seat and seat pan to the raised latched position, 1.
4. Remove the step shield, 2, to access the control valve area. For more access, remove the right, 3, or left, 4, hydrostatic control handle assembly.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

CAUTION: DO NOT WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED LATCHED POSITION.

Draining the hydraulic oil reservoir is not required if the suction and return lines are capped to prevent loss of oil, unless the hydraulic system requires cleaning.

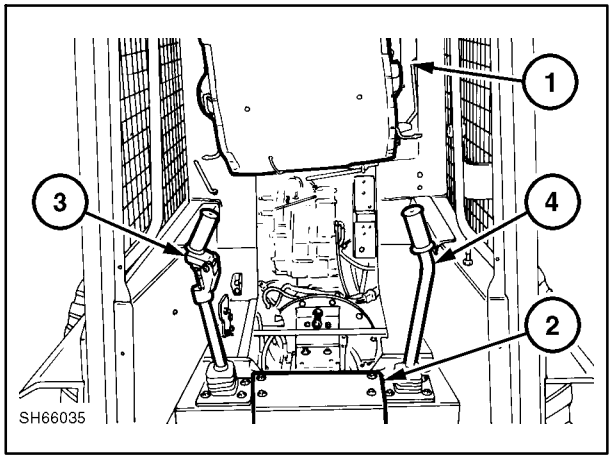


Figure 6-40

5. Remove the rear engine belly pan hardware, 1, and remove the belly pan.

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN TO PREVENT SERIOUS INJURY.

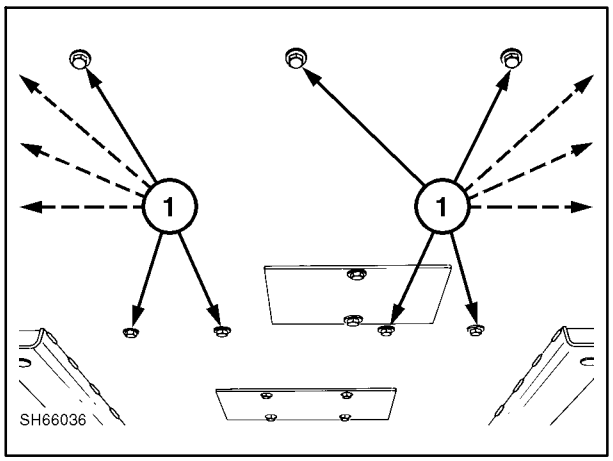


Figure 6-41

6. Drain the hydraulic reservoir.
   a. Loosen the return line, 1, at clamp, 2.
   b. Remove the return line at 3, and rotate the line into a suitable drain pan.

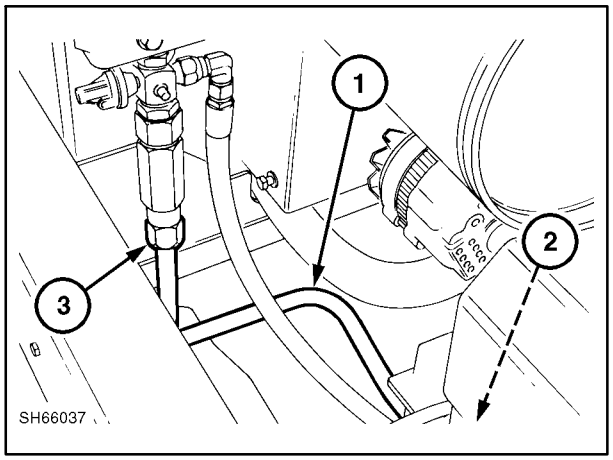


Figure 6-42

7. Unplug the spool lock solenoids, 1.
8. Remove the pressure line, 2, and return line, 3; cap both lines to prevent loss of oil and contamination from entering the hydraulic system.
9. Remove the hydraulic lines connected to the work ports of the control valve, 4, four or six lines, if unit is equipped with auxiliary boom hydraulics and cap.
10. Remove the line from the power beyond port, 5, if equipped with auxiliary hydraulics and cap.
11. Unhook the control linkage from the control valve spools at 6.
12. Remove the control valve retaining hardware, 7. Lift the control valve assembly from the loader.

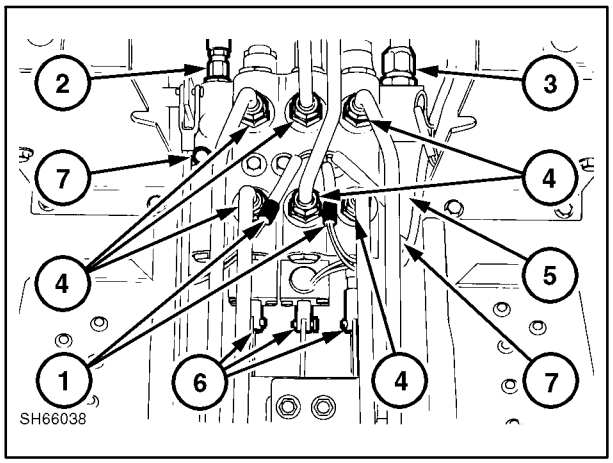


Figure 6-43

DISASSEMBLY AND INSPECTION

Main System Relief Valve

The nonrepairable, nonadjustable, cartridge-type main system relief valve, 1, is set at 170 - 177 bar (2500 - 2600 PSI) and should not be replaced with a valve of a higher pressure setting, as structural damage to the boom and/or main frame may occur and damage to the hydraulic system may occur.

CAUTION: COMPONENT FAILURE FROM OVER PRESSURING COULD RESULT IN INJURY.

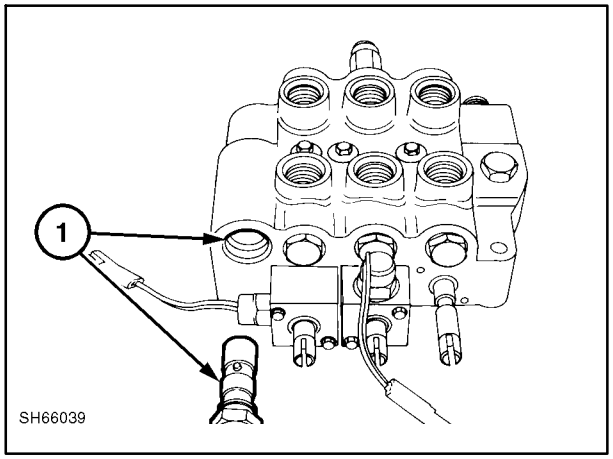


Figure 6-44

Lift Check Valves

There is a lift check valve in each circuit, bucket, boom and auxiliary.

The only time the lift check valves, 1, serve a function is after the control spools have been shifted. If the valves are operating properly, they prevent any movement of either the boom or bucket, until pressure opens the lift checks.

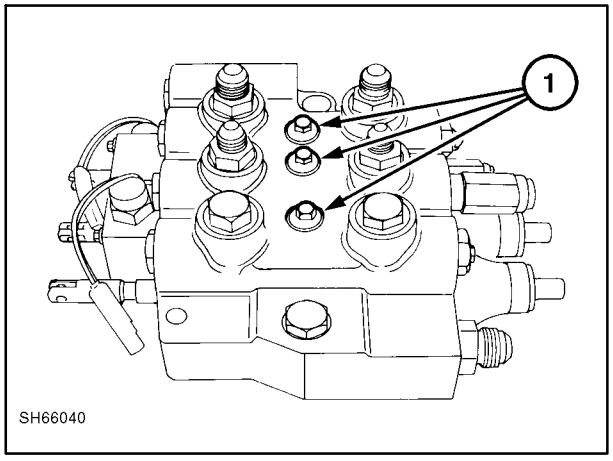


Figure 6-45

If it is determined there is a problem in any circuit, the lift check can be easily removed and inspected for damage to the seat, 1; plunger, 2; spring, 3; or cap, 4.

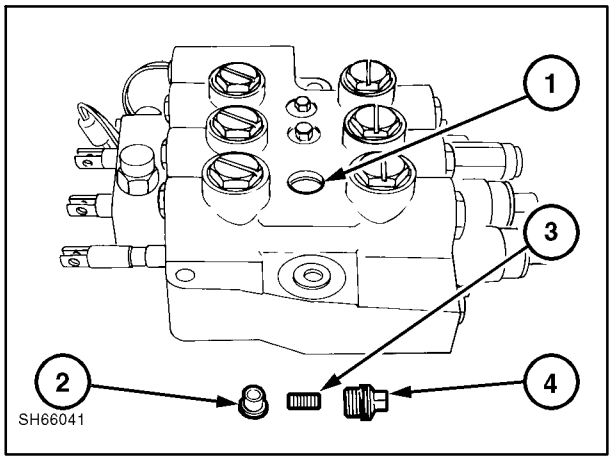


Figure 6-46

Boom Circuit Relief Valve

Remove the boom circuit relief valve, 1, from the valve body.

NOTE: The boom circuit relief valve protects the lift circuit against high pressure related damage caused by external forces acting against the boom. Early model valves are factory set at 189 bar (2750 PSI), are nonadjustable, and must be replaced if malfunctioning. Later model loaders have a 241 bar (3500 PSI) valve. All replacement valves are factory set to 241 bar (3500 PSI) and are nonadjustable.

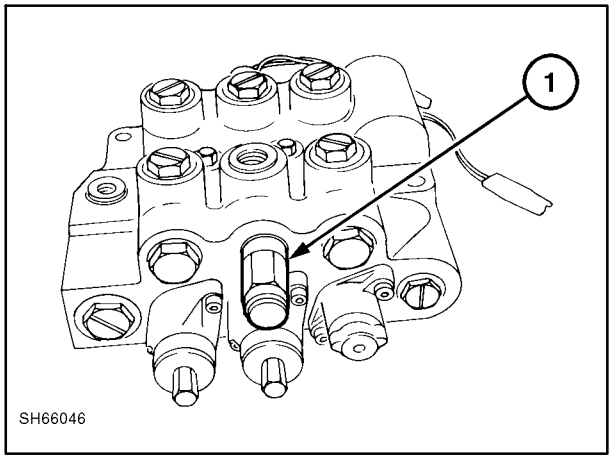


Figure 6-47

Spool Locks (boom and bucket)

Remove the solenoid plunger assemblies, 1, from blocks, 2. Remove the block retaining hardware, 3, and slide the blocks off the spools.

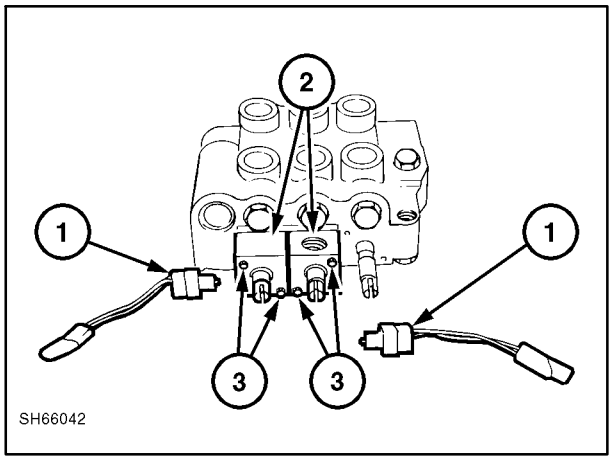


Figure 6-48

Spools, Caps, and O Rings

Oil is directed through the housing to the different ports by way of the spools; bucket spool, 1; boom spool, 2; and auxiliary spool, 3. Some oil is circulated around the spools for lubrication and smooth operation. If an oil leak appears on the outside of the valve and all lines connected to the ports are tight, check the O rings on each end of the spools. The spools can be pulled from the control valve housing while the valve is still in the loader by disconnecting the control linkage and removing the spool caps.

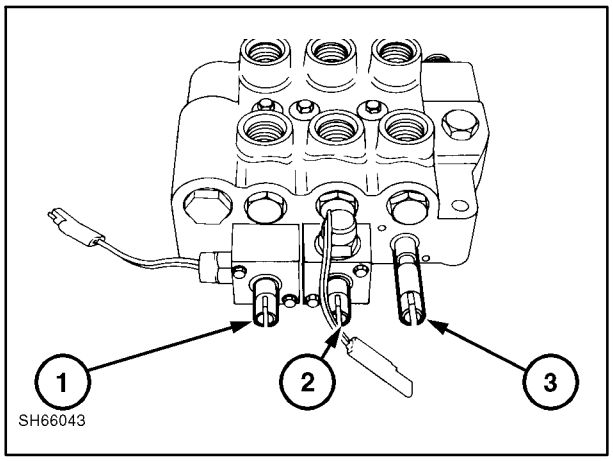


Figure 6-49

CAUTION: IF THE SPOOL CAPS ARE REMOVED WITH THE CONTROL VALVE IN THE LOADER, BE SURE TO RELIEVE ALL THE PRESSURE IN THE THREE CIRCUITS.

1. Thoroughly clean the control valve and remove the caps from the rear of the valve. The bucket spool has a plain cap, 1. The boom spool, 2, and auxiliary spool, 3, are equipped with detent caps to hold the spools in position for float position boom circuit or continuous oil flow in the auxiliary circuit.
2. Remove the spool caps, noting the position of each cap (plain or detent).

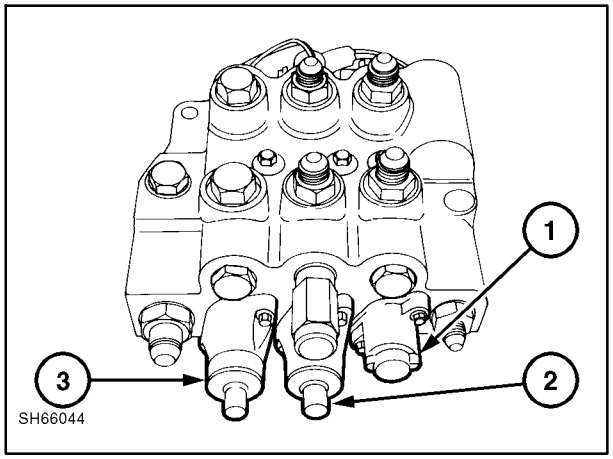


Figure 6-50

3. Remove the spool, 1, from the rear of the valve.

   NOTE: Before the spools are removed from the valve, make sure the exposed portion of the spool is free from any paint or corrosion which could damage the internal porting of the valve.

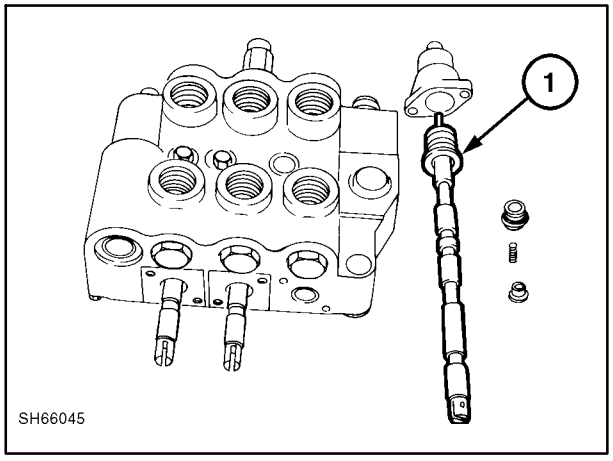


Figure 6-51

4. Remove the O rings, 1, located in the front and rear of the valve. Inspect the O ring seating area for burrs, and remove them before installing new O rings.

   NOTE: The rear spool O rings will be removed with the spools.

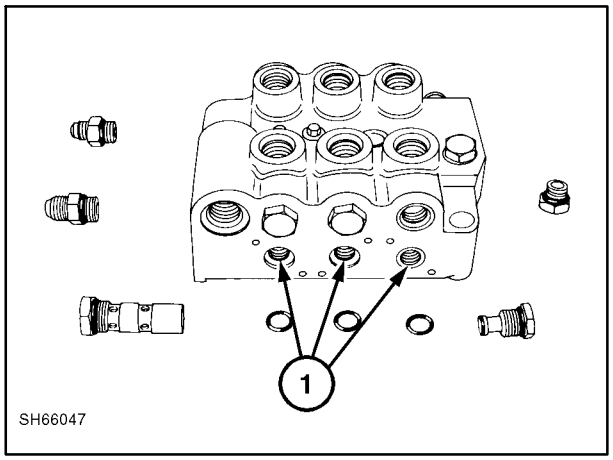


Figure 6-52

5. Here is a layout of the control valve parts:

   1 Main system relief valve

   2 Plugs (5)

   3 Boom circuit relief valve

   4 Bucket plain centering cap

   5 Boom and auxiliary detent caps

   6 Centering springs and hardware

   7 Bucket spool

   8 Boom spool

   9 Auxiliary spool

   10 Boom lower circuit orifice plate

   11 Lift check, springs and caps

   12 Bucket and boom solenoids and blocks

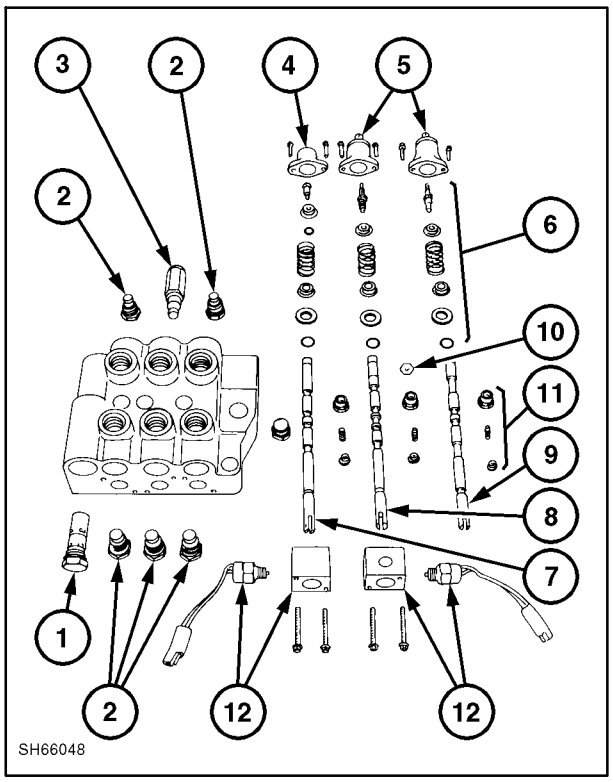


Figure 6-53

PARTS INSPECTION

Inspect the control valve components thoroughly for scratches or nicks, weak centering springs, weak lift check springs, scored lift checks or valve seats.

Valve Body, 1

a. Check for cracks in casting that allow an oil leak.

b. Check the lift check seats, 2.

c. O ring seating surfaces.

d. Damaged fitting thread areas.

Spools, 3

a. Check the spool lands for scratches.

b. Spool straightness.

IMPORTANT: The spools are matched to the control valve body. If excessively worn or damaged, replace the control valve assembly.

NOTE: The three spools are different. Do not mix spools and return spring assemblies during reassembly.

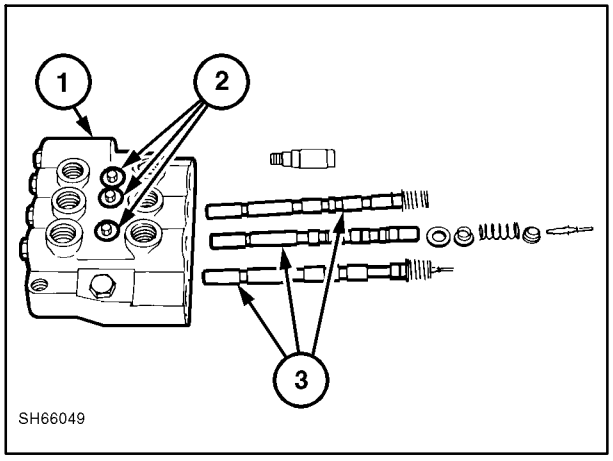


Figure 6-54

Detent Caps, 3

a. Check the detent pins and springs for proper operation. All pins should move freely and return to position with spring pressure.

b. Clean the caps thoroughly and lubricate the pins with a light grease.

Lift Checks, 4

a. Check the lift check seat surface for wear or scratches.

b. Check the lift check springs.

c. Check the caps to ensure free movement of lift checks into the caps.

Orifice Plate, 5

a. Check the flat surface for scratches.

b. Check the hole in the plate for dirt and clean.

Solenoid Spool Locks and Blocks, 6

a. Check solenoid operation.

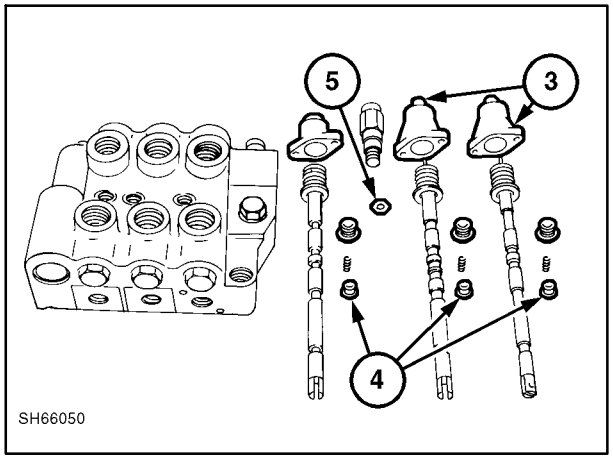


Figure 6-55

REASSEMBLY

1. Install new O rings in the valve at 1.
2. Install a new wiper seal in the auxiliary spool at 2.
3. Install new O rings on all fittings, 3, and power beyond plug, 4.
4. Install a new O ring on the main system relief valve, 5.
5. Install new O rings on the lift check caps, 6.
6. Install new O rings on all plugs at 7 and new O rings and backup washers at 8.

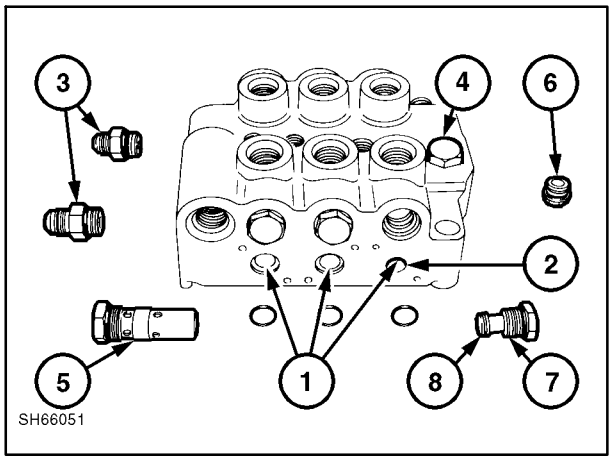


Figure 6-56

7. Install new O ring, 1; backup seal, 2; and O ring, 3, on all plugs, 4.
8. Install new O ring, 5; backup seal, 6; and O ring, 7, on boom circuit relief valve, 8.

   NOTE: The backup seals and O rings must not be damaged in any way to prevent leaks.

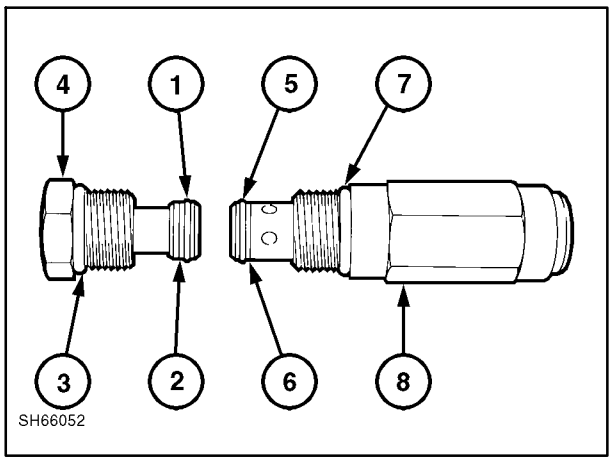
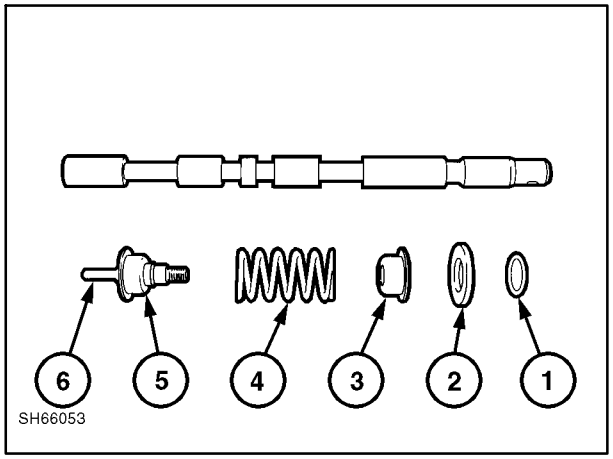


Figure 6-57

9. Install new O rings on spools at 1.
10. Reinstall washer, 2; spring retaining plate with small hole, 3; centering spring, 4; spring plate with large hole, 5, and screw, 6.
11. Reinstall washer, spring retaining plate with small hole, centering spring, spring plate with large hole and detent on both the boom and auxiliary spools.

    NOTE: The spring retaining plate with the small hole must go next to the valve. The plate with the large hole must be over the pin at 5 for proper spool operation.

    NOTE: The three spools are different. Do not mix spools and return spring assemblies during reassembly.
12. Reinstall the spools into the valve body.



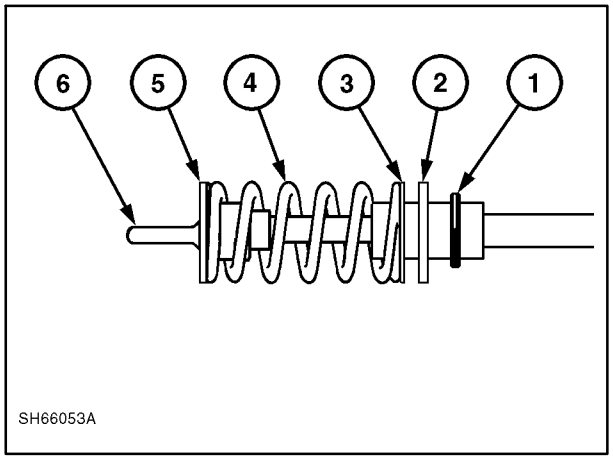


Figure 6-58

13. Reinstall the lift checks, springs, and caps, 3.

14. Reinstall the boom lower orifice plate, 4, with the slot towards the fitting in port, 5.

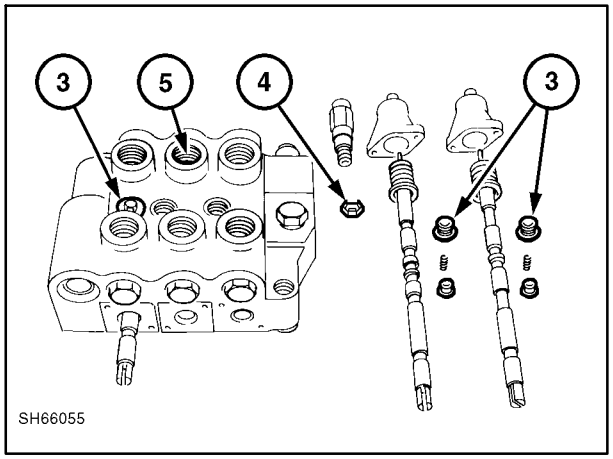


Figure 6-59

15. Reinstall the plain cap on the bucket spool at 1, and install the detent caps, 2, on the boom and auxiliary spools.

16. Reinstall the solenoid blocks over the bucket and boom spools, 3.

    NOTE: With the spool caps and solenoid blocks retaining hardware finger tight, shift the spool to align the caps and blocks, then tighten the retaining hardware.

    NOTE: If any spool binds in the housing, rotate the spool 180° and check it. If the binding remains, check the solenoid blocks and end caps for proper alignment. If the spools continue to bind, replacing the control valve is required as the spools cannot be purchased separately from the housing.

    NOTE: Binding can also be caused by over tightening the mounting hardware (valve to main frame).

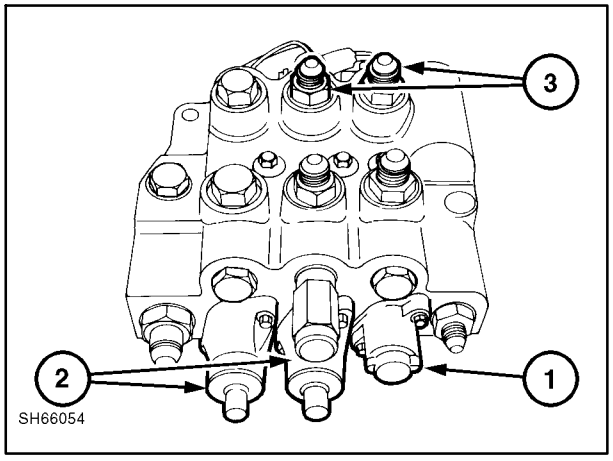


Figure 6-60

REINSTALLATION OF VALVE INTO LOADER

1. Reinstall the control valve into the loader with the retaining hardware previously removed. Align the valve with the control linkage, 1, and torque the valve retaining hardware, 2, to 24 N·m (18 ft. lbs.).
2. Reconnect the control linkage, 1, and wiring harness to the lockout solenoids.
3. Reinstall the line to the power beyond port, 3, if equipped with auxiliary hydraulics.
4. Reinstall the work port hydraulic lines, 4, pressure line, 5, and return line, 6. Tighten to seat the fittings, then loosen the liner and retighten.
5. Plug the spool lock solenoids into the wiring harness, 7.
6. Refill the hydraulic reservoir with 10W-30 oil.
7. With the unit supported off the ground, start the unit and check for any oil leaks and repair.
8. Reinstall the step shield.
9. Recheck the hydraulic oil level and add as required.

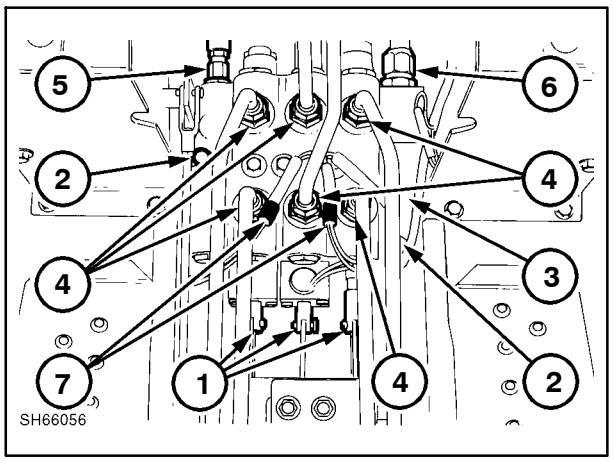


Figure 6-61

CONTROL VALVE (with Threaded Solenoid Ports)

REMOVAL, DISASSEMBLY, INSPECTION, REASSEMBLY

Specifications

Type	3-spool open center
Relief Valve	170-177 bar (2500-2600 PSI) Nonadjustable
Circuit Relief (boom)	241 bar (3500 PSI)
Electrical Solenoid Spool Locks	Bucket and Boom

Torque Specifications

Control Valve Retaining Hardware	24 N·m (18 ft. lbs.)
Control Valve Plugs (large)	38 N·m (28 ft. lbs.)
Control Valve Plugs (small)	31 N·m (23 ft. lbs.)
Circuit Relief Valve (boom)	38 N·m (28 ft. lbs.)
Spool Lock Solenoids	15 N·m (11 ft. lbs.)
Main System Relief Valve	51 N·m (38 ft. lbs.)
Spool Cap Assembly Hardware	16 N·m (12 ft. lbs.)
Plugs, BYD Port	38 N·m (28 ft. lbs.)

Labor Required

Remove and Replace	1.5 hours
Repair	1.0 hour

REMOVAL

1. Lower the boom and bucket to the lowered position (resting on the ground), or remove any attachment and raise the boom and rest on the boom lock pins, 1. Roll the attachment plate to the fully “DUMPED” position.
2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.

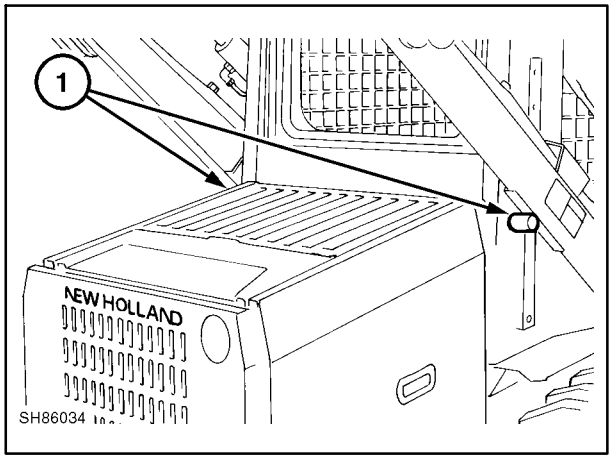


Figure 6-62

3. Raise the seat and seat pan to the raised latched position, 1.
4. Remove the step shield, 2, to access the gear pump area. For more access, remove the right or left hydrostatic control handle assembly, 3 or 4.

CAUTION: DO NOT WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED LATCHED POSITION.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

Draining the hydraulic oil reservoir is not required if the suction and return lines are capped to prevent loss of oil. Drain the reservoir when the hydraulic system requires cleaning.

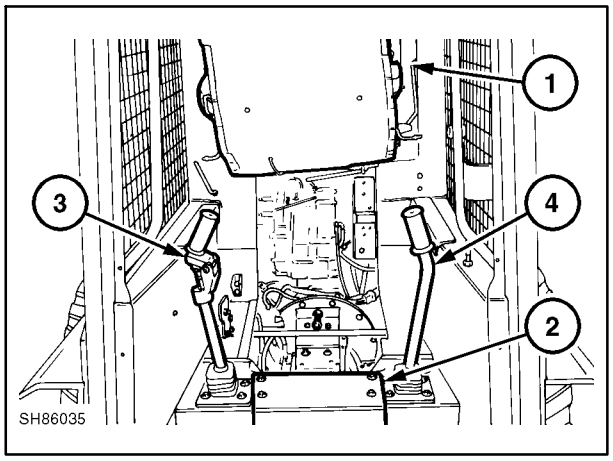


Figure 6-63

5. To drain the system, remove the small access door, 1, at the front right corner of the engine belly pan by removing the two rear bolts, 2, loosening the front two bolts, 3, and sliding the door rearward.

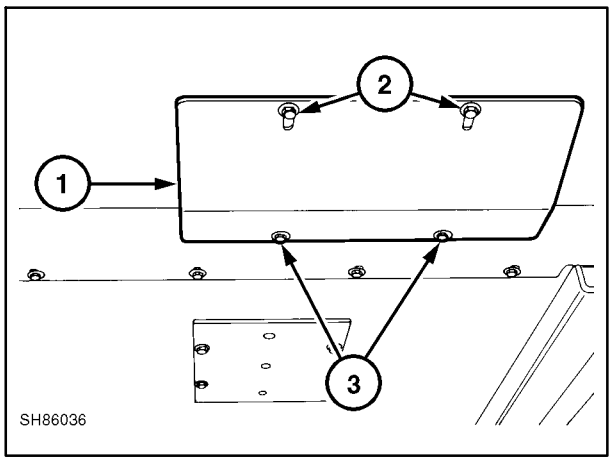


Figure 6-64

6. Drain the hydraulic reservoir by disconnecting the return line, 1, at tee, 2, and drain the oil into a suitable container.

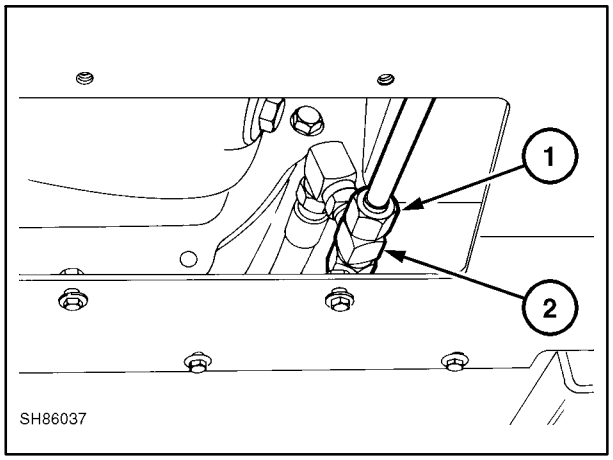


Figure 6-65

7. Unplug the spool lock solenoids, 1.
8. Remove the pressure line, 2, and return line, 3; cap both lines to prevent loss of oil and contamination from entering the hydraulic system.
9. Remove the hydraulic lines connected to the work ports of the control valve, 4, four or six lines, if unit is equipped with auxiliary boom hydraulics and cap.
10. Remove the line from the power beyond port, 5, if equipped with auxiliary hydraulics and cap.
11. Unhook the control linkage from the control valve spools at 6.
12. Remove the control valve retaining hardware, 7. Lift the control valve assembly from the loader.

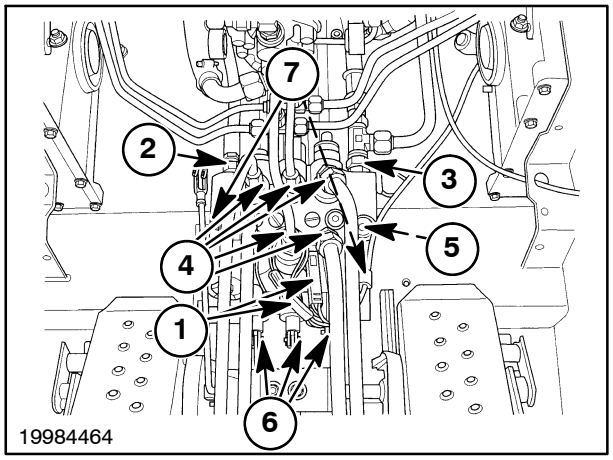


Figure 6-66

DISASSEMBLY AND INSPECTION

Main System Relief Valve

The non-serviceable, non-adjustable, cartridge-type main system relief valve, 1, is set at 170 - 177 bar (2500 - 2600 PSI). The relief valve should not be replaced with a valve of a higher pressure setting, as structural damage to the boom and/or main frame or internal damage to hydraulic system may occur.

CAUTION: COMPONENT FAILURE FROM HIGH HYDRAULIC PRESSURE COULD RESULT IN INJURY.

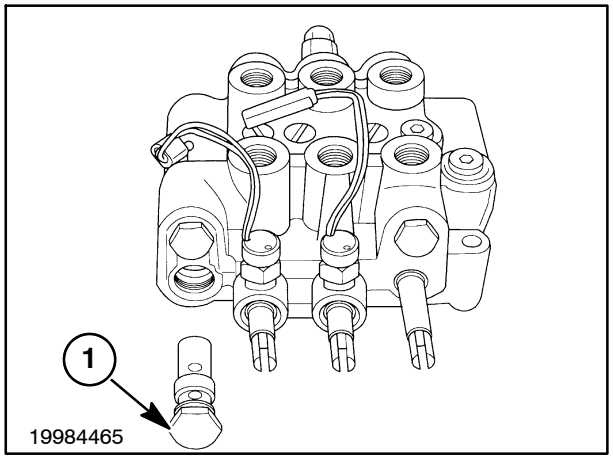


Figure 6-67

Lift Check Valves

There is a check valve in each circuit - bucket, boom, and auxiliary.

The only time the check valves serve a function is after the control spools have been shifted. If the valves are operating properly, they prevent any movement of either the boom or bucket until pressure opens the lift checks.

Inspect the lift check components for damage to the seat, 1, spring, 2, or cap, 3.

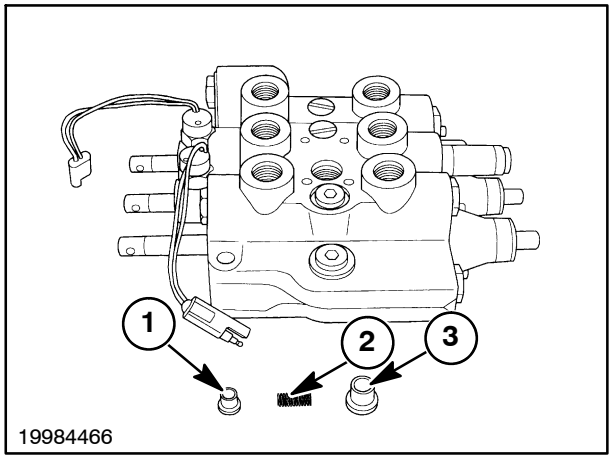


Figure 6-68

Spool Locks (Boom and Bucket)

Remove the solenoid plunger assemblies, 1, from the ports, 2, over the control spool ends.

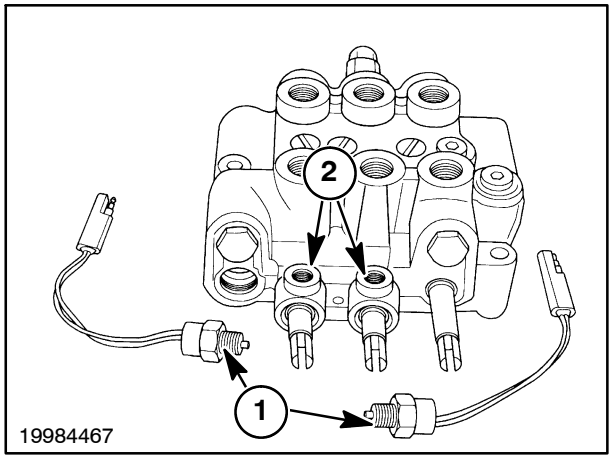


Figure 6-69

Remove the boom circuit relief valve, 1, from the valve body.

NOTE: The boom circuit relief valve protects the lift circuit against high pressure related damage caused by external forces acting against the boom. The valve is factory set at 241 bar (3500 PSI), is nonadjustable, and must be replaced if malfunctioning.

Remove the plugs, 2, over the bucket and auxiliary spool caps.

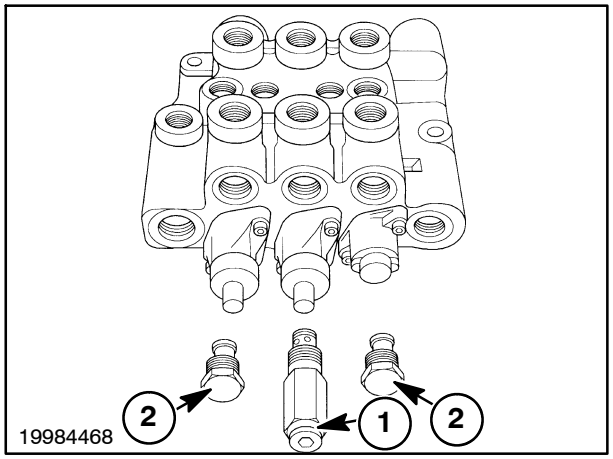


Figure 6-70

Remove the plug, 1, from the port, 2, over the main relief valve port. Remove the plug, 3, from the port, 4, over the auxiliary control spool.

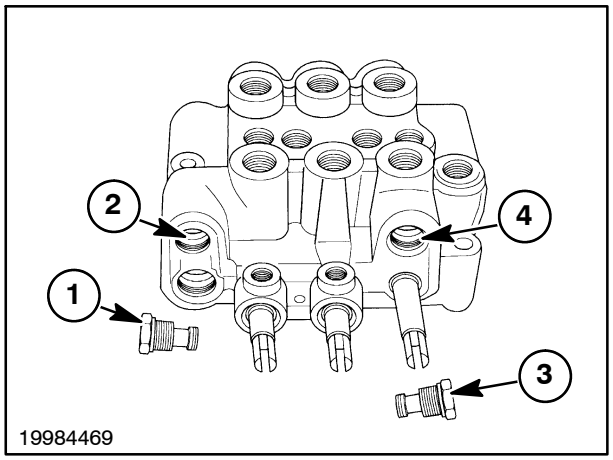


Figure 6-71

Spools, Caps, and O Rings

Oil is directed through the housing to the different ports by way of the spools: the bucket spool, 1, the boom spool, 2, and the auxiliary spool, 3.

Some oil circulates around the spools for lubrication and smooth operation. If an oil leak appears on the outside of the valve and all lines connected to the ports are tight, check the O rings on each end of the spools. The spools can be pulled from the control valve housing while the valve is still in the loader by disconnecting the control linkage and removing the spool caps.

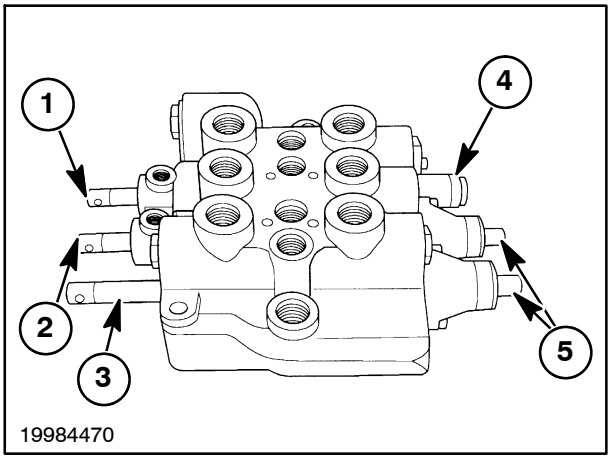


Figure 6-72

CAUTION: IF REMOVING SPOOL CAPS ON THE TRACTOR, MAKE SURE ALL SYSTEM PRESSURE HAS BEEN RELIEVED FIRST.

Notice that the bucket spool has a plain cap, 4. The boom spool and auxiliary spools have detent caps, 5, to hold the spools in position for float position boom circuit or continuous flow auxiliary circuit operation.

1. Thoroughly clean the control valve and unscrew the allen head capscrews, 1, on the caps.
2. Remove the caps, 2, from the rear of the valve body.

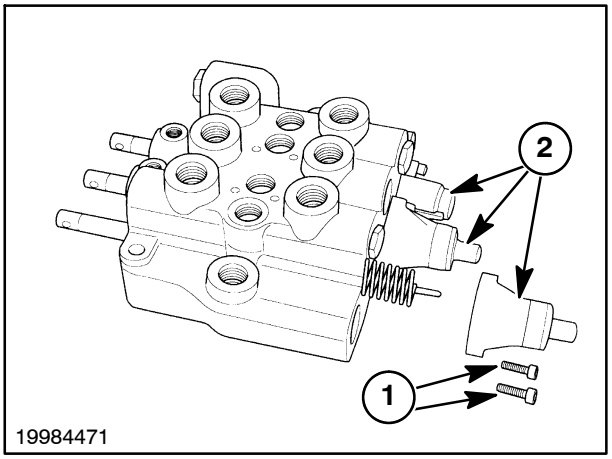


Figure 6-73

NOTE: Before removing the spools, make sure the exposed portion of the spool is free from any paint or corrosion which could damage the internal porting of the valve.

3. Remove the spools, 1, from the valve body.

   NOTE: Each spool is different. Make sure to replace the correct spool in the correct part of the valve body.

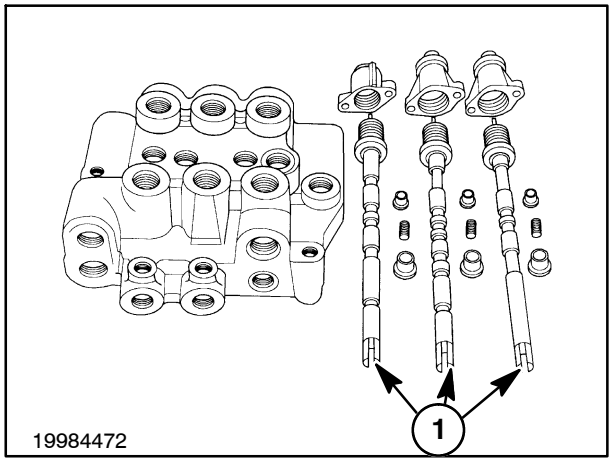


Figure 6-74

4. Remove the O rings from the spool ports. Inspect the O ring seating area for burrs, and remove them before installing new O rings.

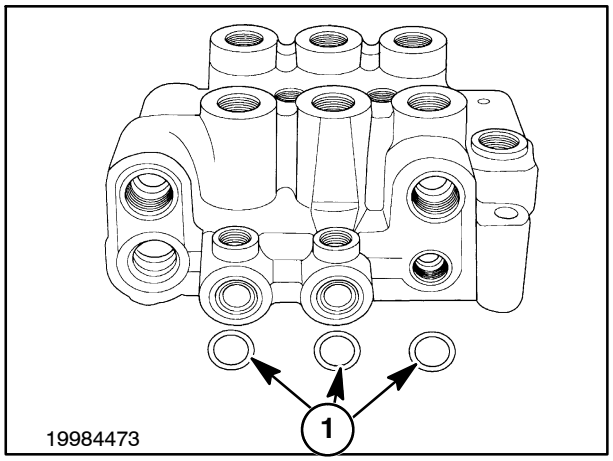


Figure 6-75

5. The complete control valve components include:
   1. Main system relief valve
   2. Boom circuit relief valve
   3. Plugs
   4. Caps
   5. Plain control spool cap
   6. Detent control spool caps
   7. Centering springs and hardware
   8. Bucket control spool
   9. Boom control spool
   10. Auxiliary control spool
   11. Lift check, springs, and caps
   12. Bucket and boom solenoids
   13. Boom lower circuit orifice plate

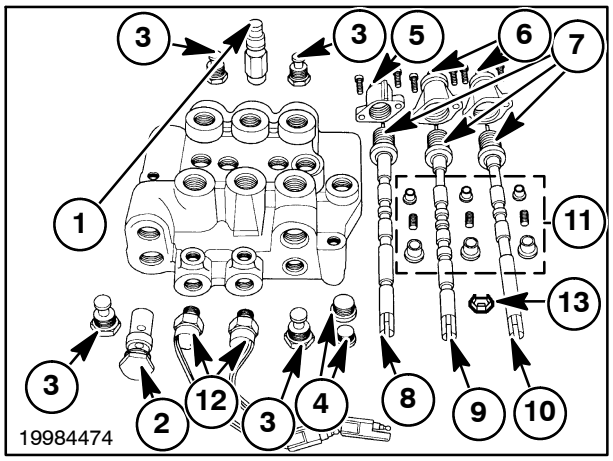


Figure 6-76

PARTS INSPECTION

Inspect the control valve components thoroughly for scratches or nicks, weak centering springs, weak lift check springs, and scored lift checks or valve seats.

Valve Body, 1

a. Check for cracks in casting that allow an oil leak.

b. Check the lift check seats, 2.

c. Check O ring seating surfaces.

d. Damaged fitting thread areas.

Control Spools, 3

a. Check the spool lands for scratches.

b. Check spool straightness.

IMPORTANT: The spools are matched to the control valve body. If excessively worn or damaged, replace the control valve assembly.

NOTE: The three spools are different. Do not mix spools and return spring assemblies during reassembly.

Detent Caps, 3

a. Check the detent pins and springs for proper operation. All pins should move freely and return to position with spring pressure.

b. Clean the caps thoroughly and lubricate the pins with a light grease.

Lift Checks, 4

a. Check the lift check seat surface for wear or scratches.

b. Check the lift check springs.

c. Check the caps to ensure free movement of lift checks into the caps.

Orifice Plate, 5 (Boom Lower Circuit)

a. Check the flat surface for scratches.

b. Check the hole in the plate for dirt and clean.

Solenoid Spool Locks

a. Check solenoid operation

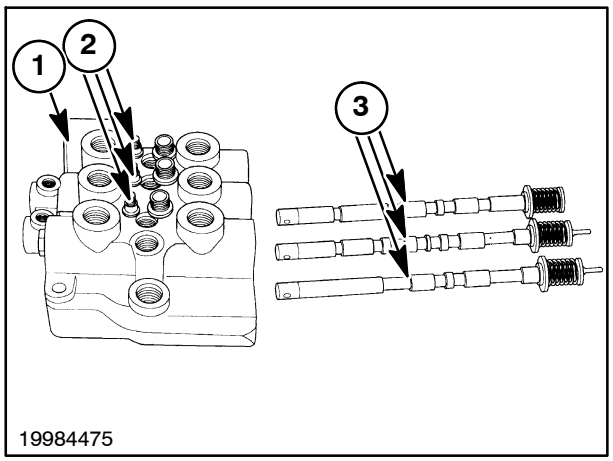


Figure 6-77

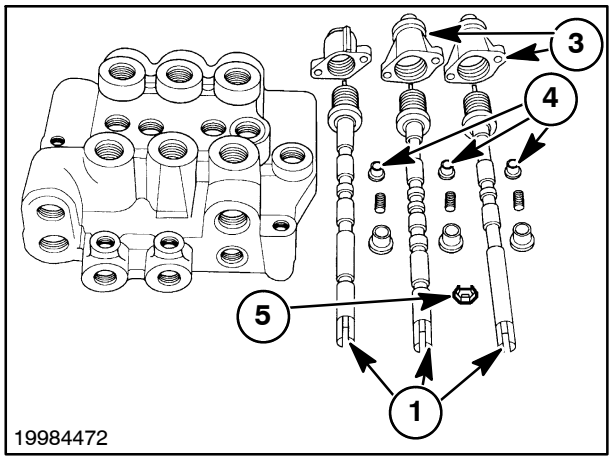


Figure 6-78

REASSEMBLY

1. Install O rings, 1, in the boom control spool ports, the bucket control spool ports, and auxiliary control spool ports.

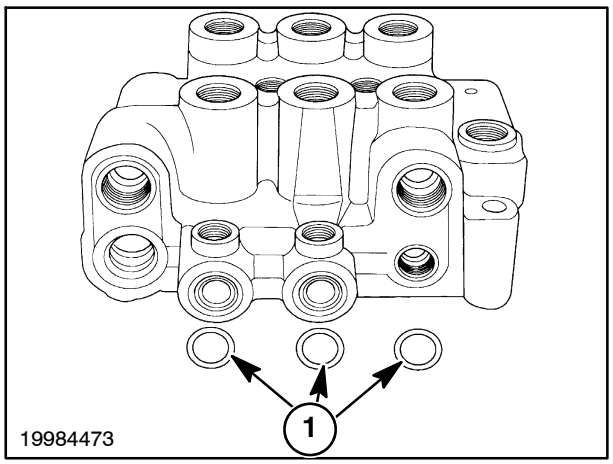


Figure 6-79

2. Install the O ring seals, 1, on the boom circuit relief valve, 2, and all the plugs, 3.
3. Install small O rings, 4, and backup rings, 5, on the relief valve and plugs.

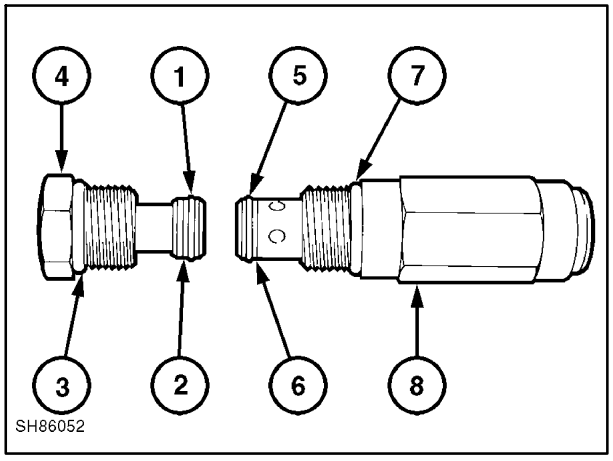


Figure 6-80

4. Install the boom circuit relief valve, 1, into the valve body.
5. Install the plugs, 2, over the bucket and auxiliary spool caps.

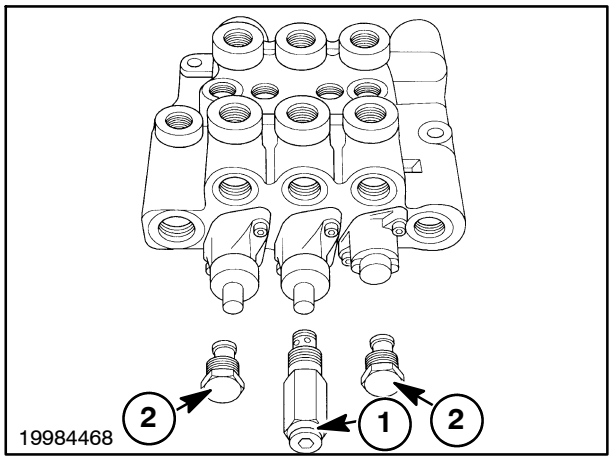


Figure 6-81

6. Install the plug, 1, into the port, 2, over the main relief valve port. Install the plug, 3, into the port, 4, over the auxiliary control spool.

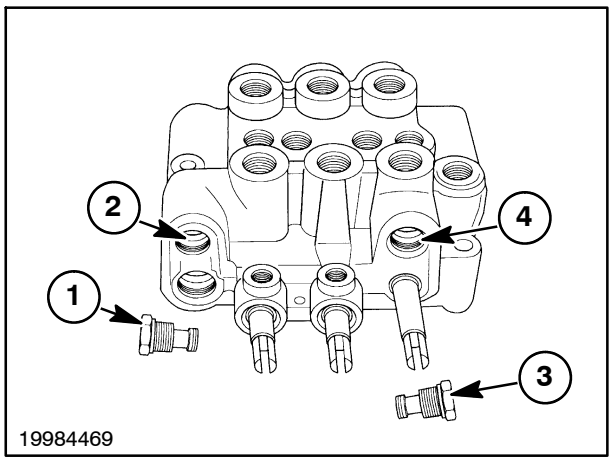


Figure 6-82

7. Install new O rings, 1, on the spools.
8. Install the washers, 2, spring retaining plate with small hole, 3, centering spring, 4, spring plate with large hole, 5, and end screw, 6, on each spool.

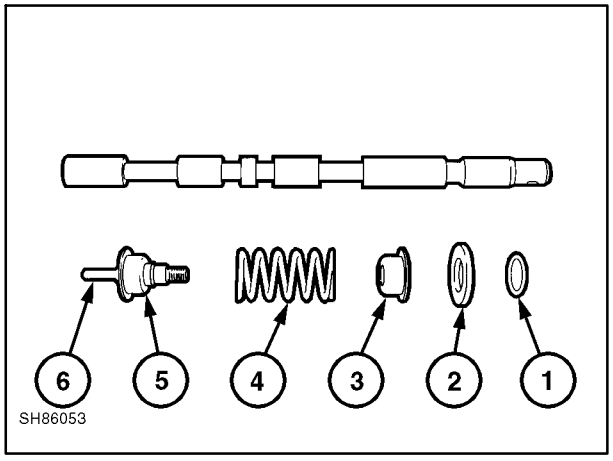


Figure 6-83

NOTE: The spring retaining plate with the small hole must go next to the valve. The plate with the large hole, 5, must be over the end pin, 6, for proper spool.

9. Tighten the end screw, 6, securely.

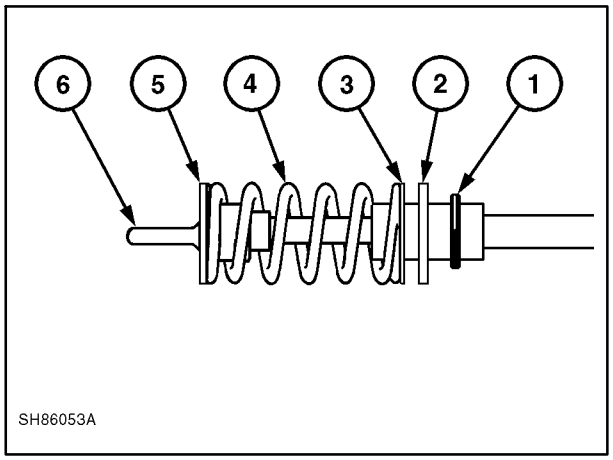


Figure 6-84

10. Install the control spools into the valve body - bucket, 1, boom, 2, auxiliary, 3.

11. Reinstall the boom lower orifice plate, 4, with the slot towards the fitting in port, 5.

    NOTE: The three spools are different. Do not mix spools and return spring assemblies during reassembly.

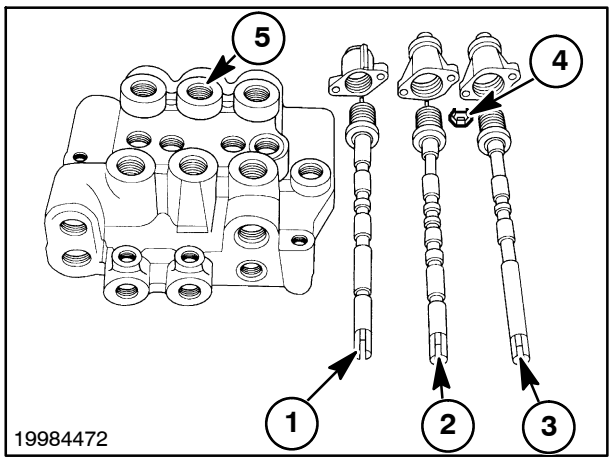


Figure 6-85

12. Install the plain cap, 1, over the bucket control spool and the detent caps, 2, over the boom and auxiliary control spools. Tighten the allen head screws, 3, securely.

    NOTE: If any spool binds in the housing, rotate the spool 180° and check it. If the spool still binds, check the end caps for proper alignment. If a spool still binds, the complete control valve must be replaced.

    NOTE: On the tractor, binding can be caused by mounting hardware that is too tight (valve to main frame).

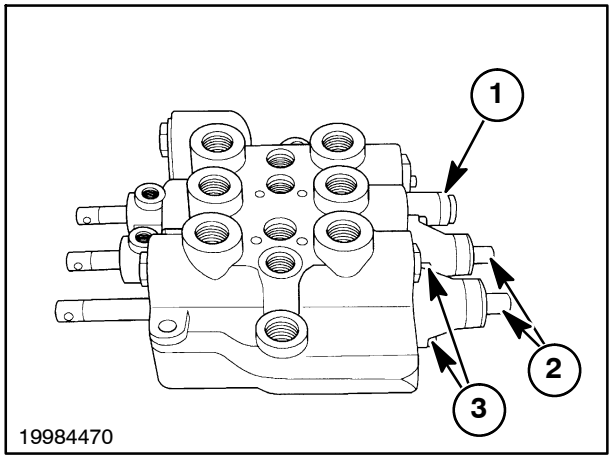


Figure 6-86

13. Install the solenoid plunger assemblies, 1, into the ports, 2, over the control spool ends.

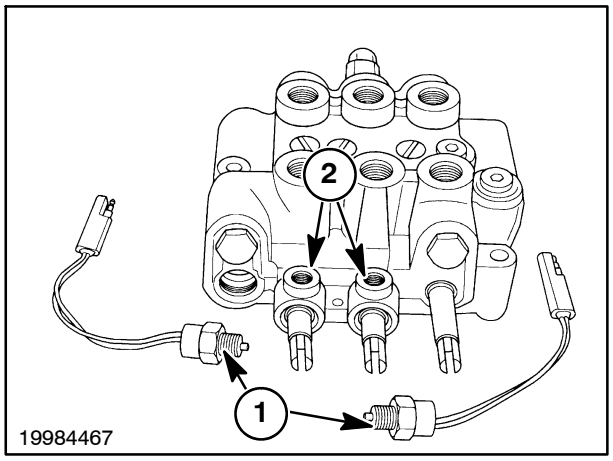


Figure 6-87

14. Add O rings to the lift check valve caps, 1. Install the lift checks, 2, springs, 3, and caps.

15. Install the two caps, 4, with O rings into the valve body.

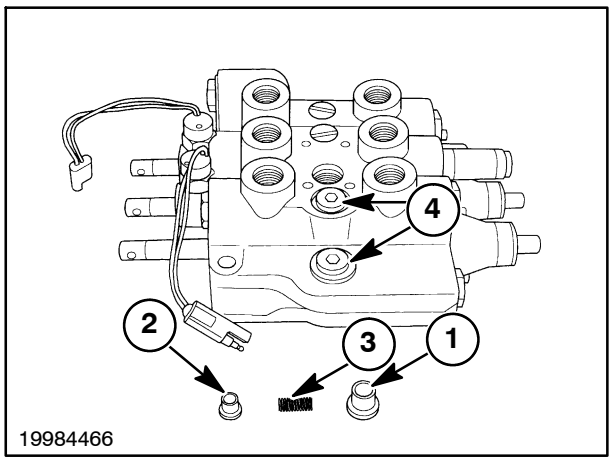


Figure 6-88

16. Install an O ring on the main system relief valve, 1, and install into the valve body.

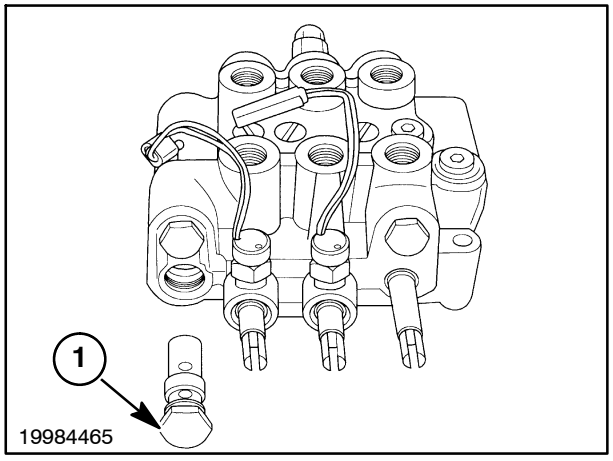


Figure 6-89

REINSTALLATION OF VALVE INTO LOADER

1. Place the rubber isolation mount, 1, in place under the control valve space.
2. Reinstall the control valve into the loader with the retaining hardware previously removed. Align the valve with the control linkage and torque the valve retaining hardware to 24 N·m (18 ft. lbs.).
3. Reconnect the control linkage and wiring harness to the lockout solenoids.
4. Reinstall the hydraulic lines and tighten to seat the fittings, then loosen the lines and retorque.
5. Refill the hydraulic reservoir with 10W-30 oil.
6. With the unit supported off the ground, start the unit and check for any oil leaks and repair.
7. Reinstall the step shield and belly pan.
8. Recheck the hydraulic oil level and add as required.

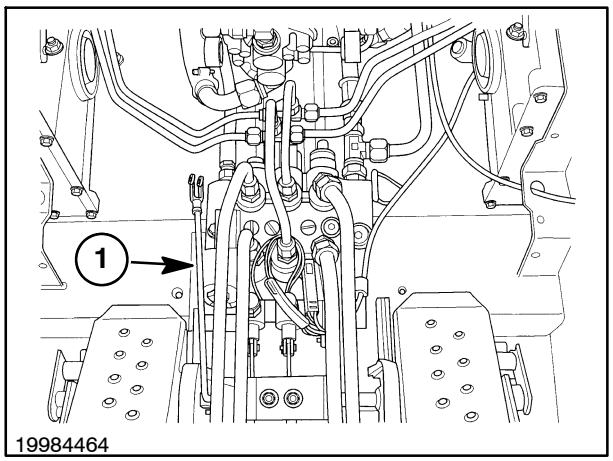


Figure 6-90

HYDRAULIC PUMP

REMOVAL, DISASSEMBLY, REASSEMBLY

Specifications	25000 Series	26000 Series
Type	Gear Pump	Gear Pump
L565, Lx565 Output @2900 RPM - 69 bar (1000 PSI)	54.9 L/min (14.5 GPM)	57.5 L/min (15.2 GPM)
Lx665 Output @2900 RPM - 69 bar (1000 PSI)	64.7 L/min (17.6 GPM)	65.9 L/min (17.4 GPM)
Rotation (Viewed from shaft end)	Clockwise	Clockwise
Gear teeth	10 per gear	13 per gear
Wear plate	Steel with bronze face to gears	Black, powdered metal with Teflon coating
Bushings	Steel	Teflon coated
Internal lubrication system	Pressure side	Inlet (suction) side
Labor Required		
R&R Pump	1.5 hrs.	1.5 hrs.
Disassembly, Inspection and Reassembly	0.5 hrs.	0.5 hrs.

The hydraulic pumps used on these model skid-steer loaders have been upgraded from the previous 25000 series Eaton pump to the new 26000 series Eaton “Quiet Pumps.” While the outer appearance of the pumps is similar, the 26000 series pumps use different service parts and seal kits.

Identify the pump by the two series of numbers and letters on the pump flange at 1.

25 / 26 = Series

0 = Features 0-Standard Single Gear Pump

08 = Displacement Code

L = Rotation (left or counterclockwise)

A = Catalog No.

A = Shaft, Port, Type, and Size

B = Revision Level

96 = Year Built

06 = Month Built

17 = Day Built

LJ = Tester

NOTE: On any warranty work or requests for information about gear pumps, please list these two lines of information.

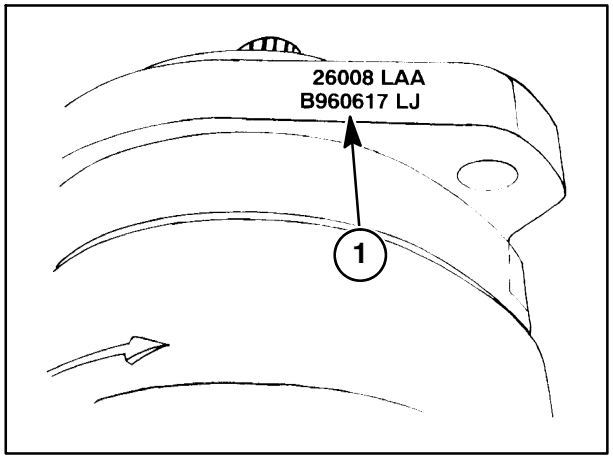


Figure 6-91

REMOVAL

1. Lower the boom and bucket to the lowered position (resting on the ground), or remove any attachment and raise the boom and rest on the boom lock pins.
2. Stop the engine, turn the ignition key to the run position and operate the boom and bucket control pedals to relieve pressure in the boom and bucket circuits. Turn off the key.
3. Raise the seat and seat pan to the raised latched position.
4. Remove the step shield, 1, to access the gear pump area. For more access remove the right or left hydrostatic control handle assembly.

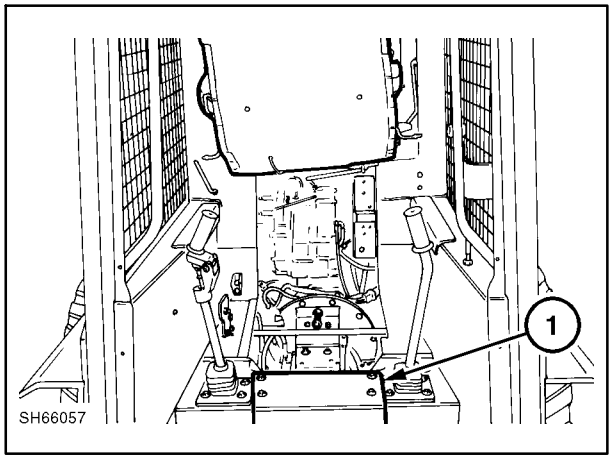


Figure 6-92

CAUTION: DO NOT WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED LATCHED POSITION.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

Draining the hydraulic oil reservoir is not required if the suction and return lines are capped to prevent loss of oil unless the hydraulic system requires cleaning.

5. Remove the rear engine belly pan hardware, 1, and remove the belly pan.

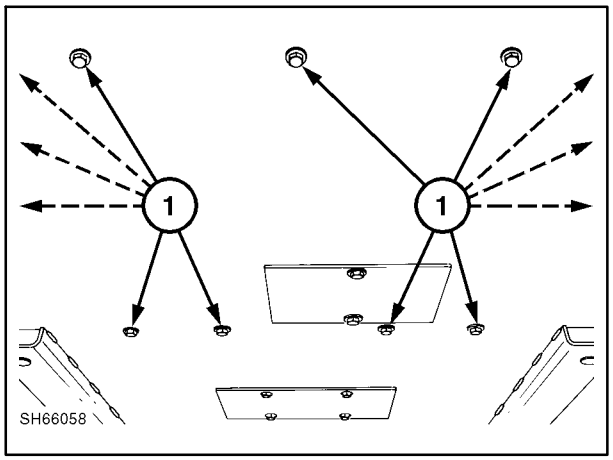


Figure 6-93

CAUTION: USE A FLOOR JACK TO SUPPORT THE BELLY PAN TO PREVENT SERIOUS INJURY.

6. Drain the hydraulic reservoir.
   a. Loosen the return line, 1, at clamp, 2.
   b. Remove the return line at 3, and rotate the line into a suitable drain pan.

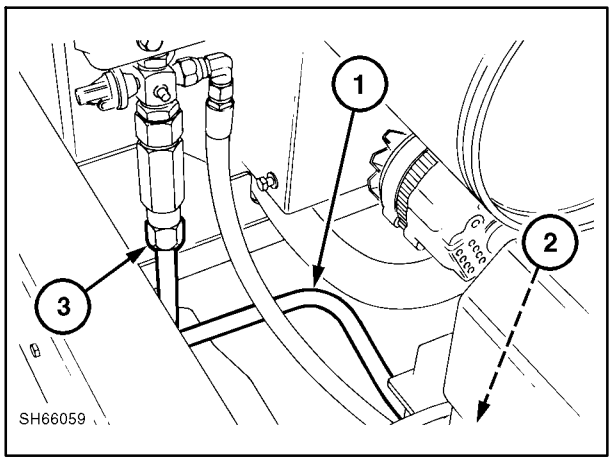


Figure 6-94

7. Remove the suction line, 1, and cap to prevent loss of oil.
8. Remove the pressure line, 2, and cap.
9. Remove the case drain line, 3, and cap.
10. Remove the gear pump retaining hardware, 4, and remove the gear pump from the loader.

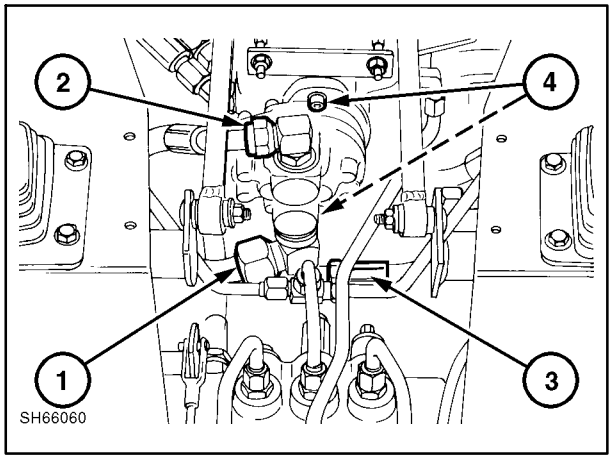


Figure 6-95

DISASSEMBLY AND INSPECTION - 25000 SERIES

1. Clean the pump thoroughly and mark the pump assembly, 1, to ensure proper reassembly.
2. Remove the pump housing hardware and separate the end caps and center section.

   IMPORTANT: The pump body is aluminum and can be easily damaged. BE CAREFUL not to damage machined surfaces. DO NOT use a screwdriver or other hard, sharp objects to pry the pump body from the plate.

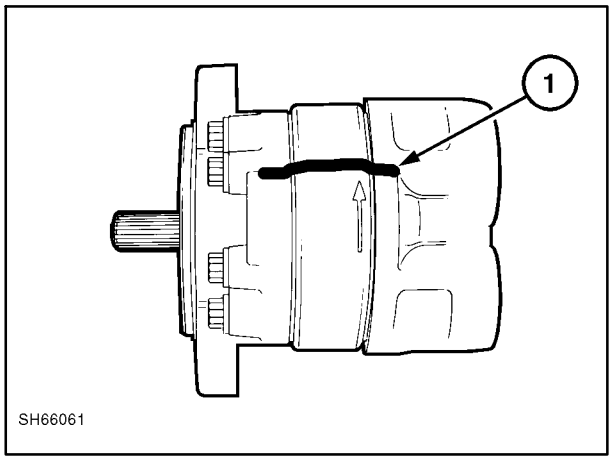


Figure 6-96

3. Identify the pump by the two series of numbers and letters on the pump flange at 1.

25 or 26	= Series
0	= Features 0-Standard Single Gear Pump
08	= Displacement Code (cm^3/rev., $in.^3$/rev.)
L	= Rotation (left, counterclockwise)
A	= Catalog No.
A	= Shaft, Port, Type, and Size
B	= Revision Level
96	= Year Built
06	= Month Built
17	= Day Built
LJ	= Tester

NOTE: On any warranty work or requests for information about gear pumps, please list these two lines of information.

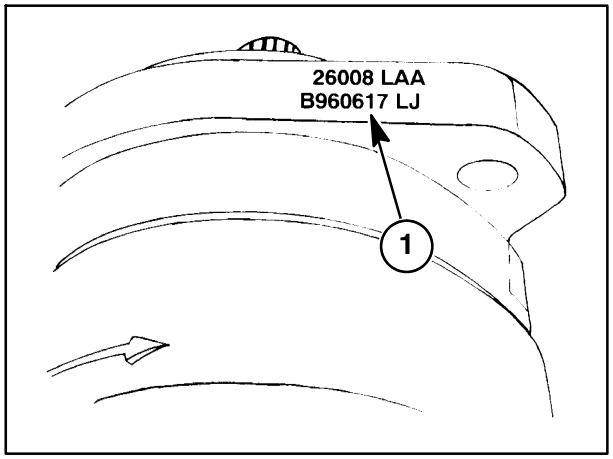


Figure 6-97

4. Gear pump parts layout:

1 Pump housing hardware outer (4)

2 Pump housing hardware inner with sealing washers (4)

3 Drive end cap

4 Center section

5 Manifold end cap

6 End cap O ring seals (2)

7 Pump gears

8 Bearing plate seal

9 Seal

10 Seal

11 Bearing plate

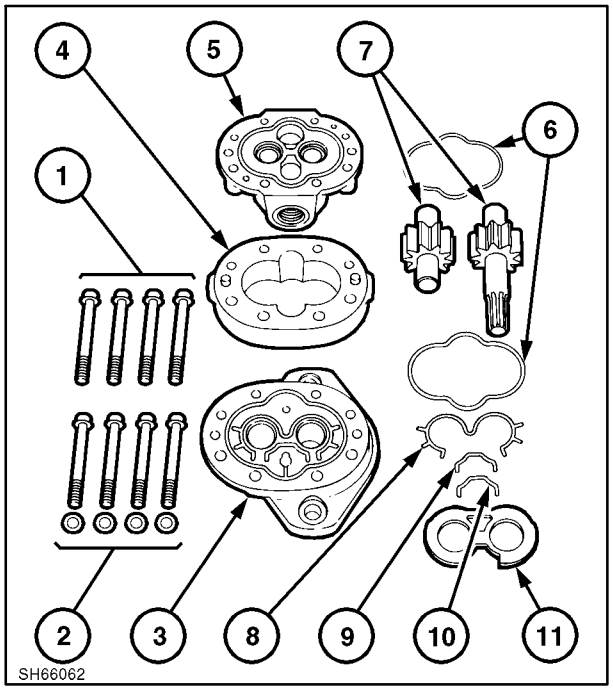


Figure 6-98

PARTS INSPECTION - 25000 SERIES

1. Inspect the manifold end cap for wear in the bearing areas, 1.
2. Inspect the flat surface, 2, of end cap for flatness, scratches and wear.
3. Inspect the seal and seal area for scratches or damage that could prevent a good seal.

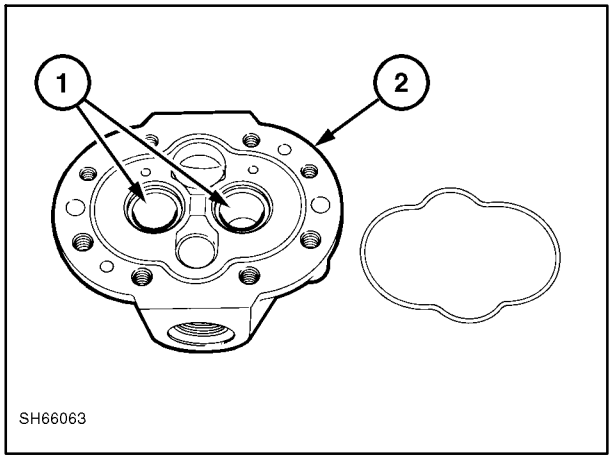


Figure 6-99

4. Inspect the drive end cap bearing areas, 1.
5. Inspect the seal areas, 2, for scratches or damage that could prevent a good seal.
6. Inspect the bearing plate, 3, for gear wear and scratches to prevent a good seal between the plate and the side of the gears.
7. Inspect the bearing plate seal, 4, for a nicks that could prevent a good seal.
8. Inspect the seal areas for damage that could prevent a good seal.

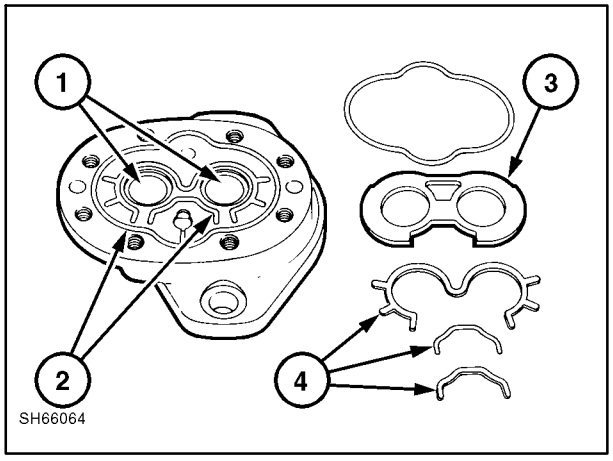


Figure 6-100

9. Inspect the gear sides, 1, for scratches and the gear teeth for wear, 2.
10. Inspect the bearing area, 3, of gear shafts for wear.
11. Inspect the gear keys and retaining rings, 4, to ensure they are not sheared.
12. Inspect the input shaft splines, 5, for wear and twisting.

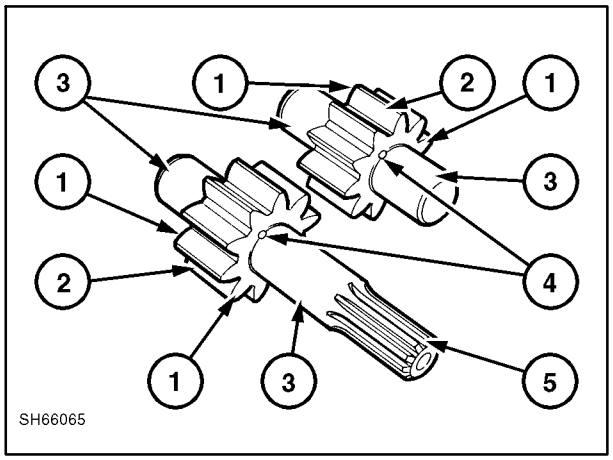


Figure 6-101

REASSEMBLY - 25000 SERIES

1. Install a new shaft seal in drive plate end cap at 1.

   NOTE: Some gear pumps will have a thin flat washer between the seal and housing at 2. This washer is used to keep lubrication oil from contacting the seal.

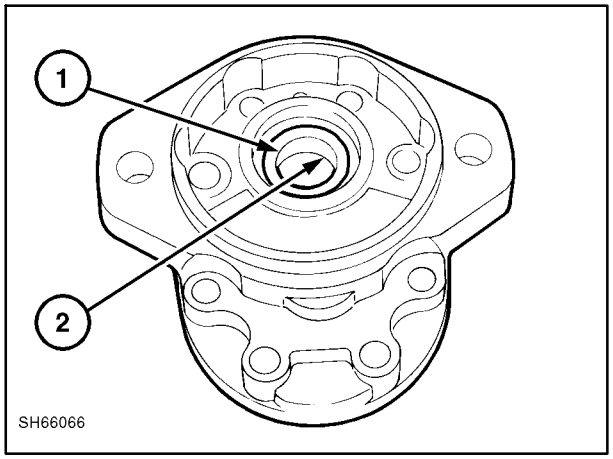


Figure 6-102

2. Install bearing plate seal, 1, into end cap groove, lubricate the seal with 10W-30 oil.
3. Install new round seal, 2, into end cap groove.
4. Install new flat seal, 3, in end cap groove, over top of seal, 2, lubricate the seals with 10W-30 oil.
5. Install end cap seal, 4, into groove in end cap.

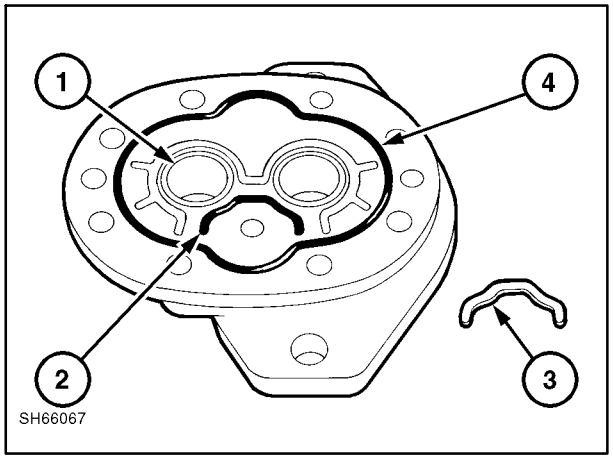


Figure 6-103

6. Install center section, 1, on drive end cap, 2, aligning marks on end cap and center section, 3.
7. Install bearing plate into center section with brass side of plate to center of pump at 4.

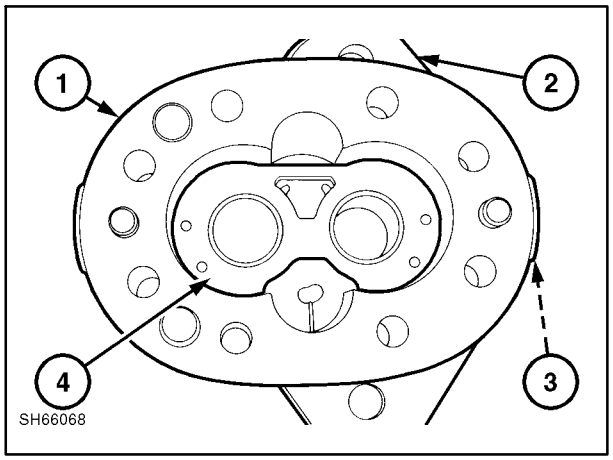


Figure 6-104

8. Install gear, 1, into drive end cap. Lubricate shaft bearings with 10W-30 oil.
9. Install input gear, 2, into drive end cap.

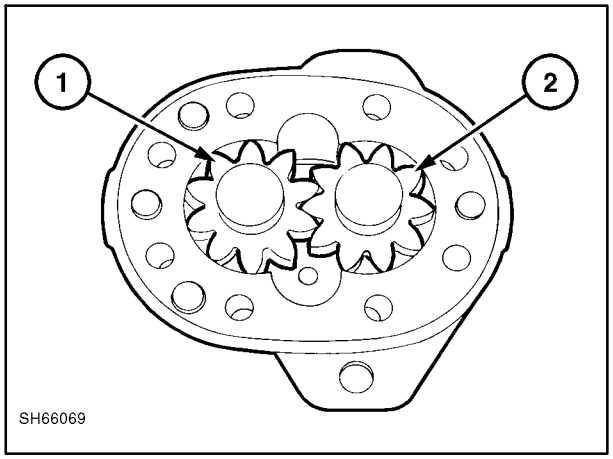


Figure 6-105

10. Install new seal, 1, into the groove in end cap at 2, and lubricate the seal and shaft bearings with 10W-30 oil.

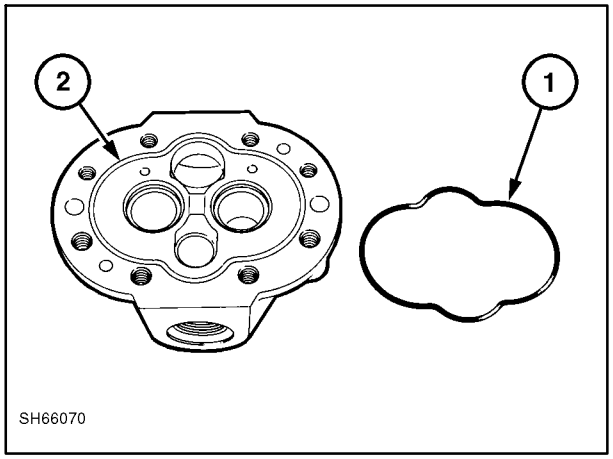


Figure 6-106

11. Install end cap over gear shafts and align the mark with marks on the center section.

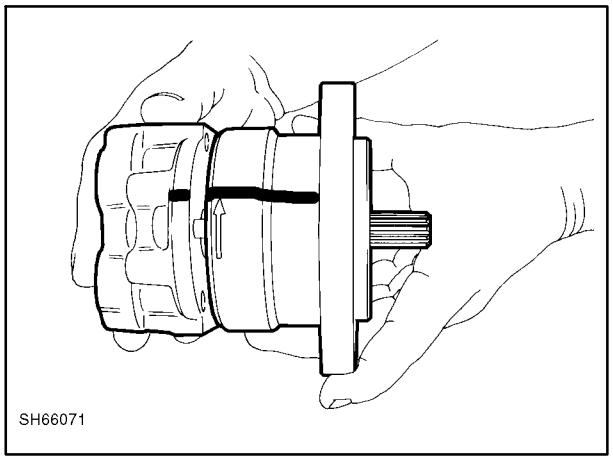


Figure 6-107

12. Install the housing hardware with the four sealing washers, 1, on the inside bolt holes, 2, with the remaining bolts installed on the outside holes, 3. Torque the bolts evenly in a criss-cross pattern to 34 - 38 N·m (25 - 28 ft. lbs.).

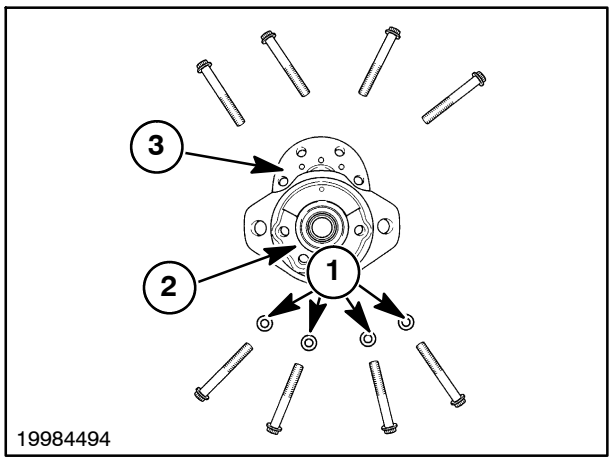


Figure 6-108

DISASSEMBLY AND INSPECTION - 26000 SERIES

Identify the pump by the two series of numbers and letters on the pump flange at 1.

25 / 26	= Series
0	= Features 0-Standard Single Gear Pump
08	= Displacement Code
L	= Rotation (left, counterclockwise)
A	= Catalog No.
A	= Shaft, Port, Type, and Size
B	= Revision Level
96	= Year Built
06	= Month Built
17	= Day Built
LJ	= Tester

NOTE: On any warranty work or requests for information about gear pumps, please list these two lines of information.

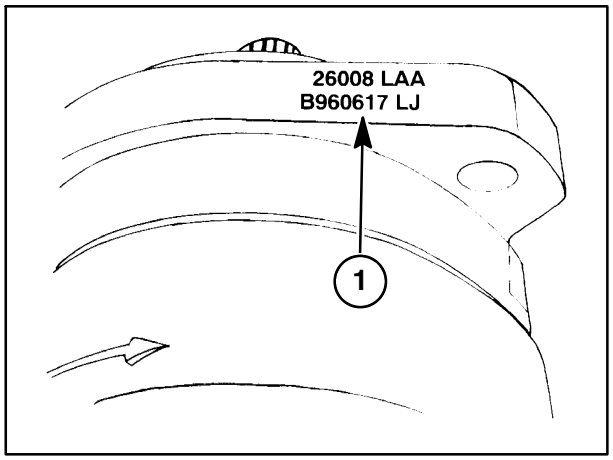


Figure 6-109

Clean the pump thoroughly and mark the pump assembly, 1, to ensure proper reassembly.

Remove the pump housing hardware and separate the end plates and body section.

IMPORTANT: The pump body is aluminum and can be easily damaged. BE CAREFUL not to damage machined surfaces. DO NOT use a screwdriver or other hard, sharp objects to pry the pump from the plate.

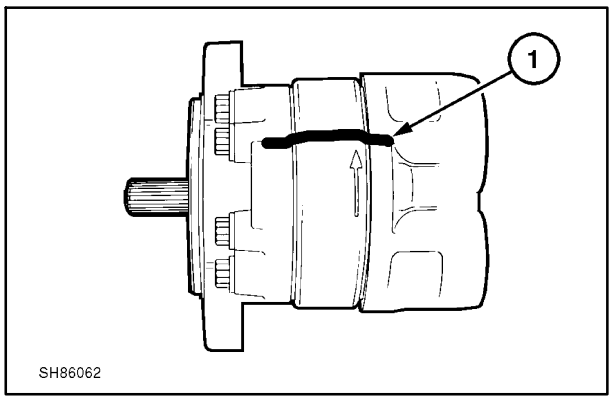


Figure 6-110

The 26000 gear pump components consist of:

1. Capscrews
2. Pump front plate (drive end)
3. Pump body
4. Pump back plate
5. End cap O ring seals (2)
6. Pump idler gear assembly
7. Pump drive gear assembly
8. Wear plate
9. Backup gasket
10. Seal

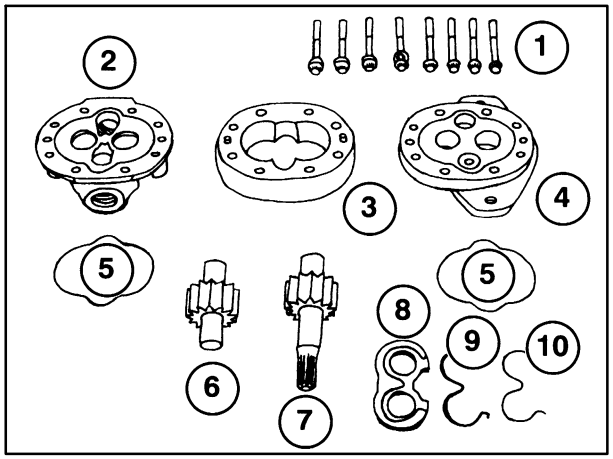


Figure 6-111

PARTS INSPECTION - 26000 SERIES

1. Inspect the pump front plate (drive end) for excessive wear. The oil grooves in the bushings in the front plate should be in line with the dowel pinholes and 180° apart, 1. If the bushing oil grooves are not positioned as noted, the bushings have turned in the plate - the plate should be replaced.

   The bushings in the front plate should be at 3.20 mm (0.126″) above the surface of the plate, 2. Replace the front plate if the I.D. of the bushing exceed 19.2 mm (0.755″).

2. Check the seal areas, 3, for scratches or damage that could prevent a good seal.

3. The plug, 4, does not have to be removed unless damaged. The plug can be removed by threading a 3/8″ UNC bolt into the plug center. This plug MUST be in place for proper pump operation.

4. Inspect the pump back plate for excessive wear. The oil grooves in the back plate bushings should be at approximately 37° to the pressure side, 1. If the bushing oil grooves are not positioned as noted, the bushings have turned in the plate, and the plate should be replaced.

   Replace the back plate if the I.D. of a bushing exceeds 19.2 mm (0.755″). Check for scoring on the face of the back plate, 2. Replace the back plate if wear exceeds 0.038 mm (0.0015″).

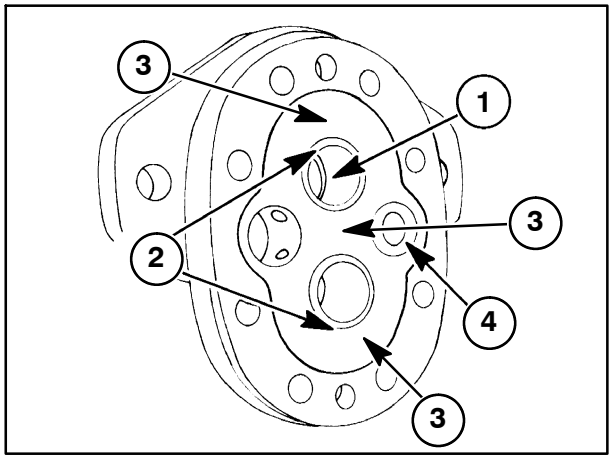


Figure 6-112

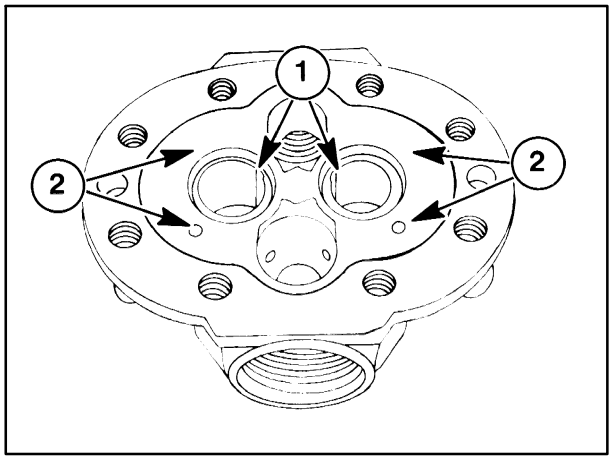


Figure 6-113

5. Inspect the pump body for excessive wear. Check the pump body inside the gear pockets, 1, for excessive scoring or wear.

   Replace the pump body if the I.D. of gear pockets exceed 43.7 mm (1.719″).

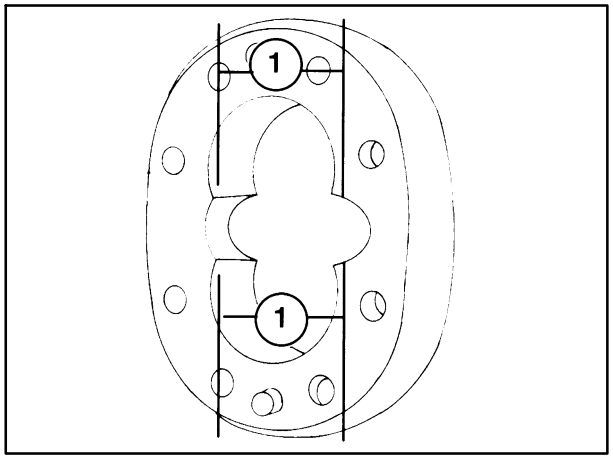


Figure 6-114

6. The wear plate, 1, should be replaced when the pump is rebuilt. The flat Teflon-coated surface towards the gears should not show any scratches or grooves that can be caught with a fingernail.
7. The wear plate, 1, has a backup gasket, 2, and a seal, 3, that should be replaced when the pump is rebuilt. Inspect for damage, such as nicks and tears, to determine if any problem exists.

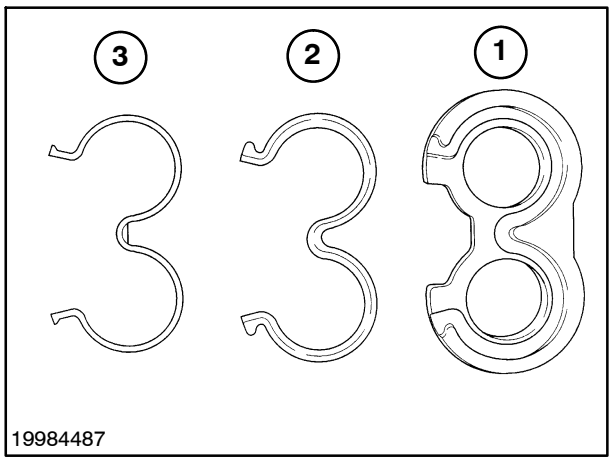


Figure 6-115

8. Inspect the pump gears for excessive wear. Check for obvious twisted or broken shaft splines, 1, on the drive gear. Replace if damage is found. Inspect the gear keys and retaining rings, 2, to ensure they are not sheared. Replace if found twisted or sheared.

   The gear shaft assemblies should measure greater than or equal to 19.0 mm (0.748″) in the bushing area, 3. If the shaft measures less then the specified diameter, replace the gear assembly.

   The gear width, 4, should be close to the following specs. If the gears measure less than the specified width, the gear pump will not develop sufficient flow or pressure for loader application.

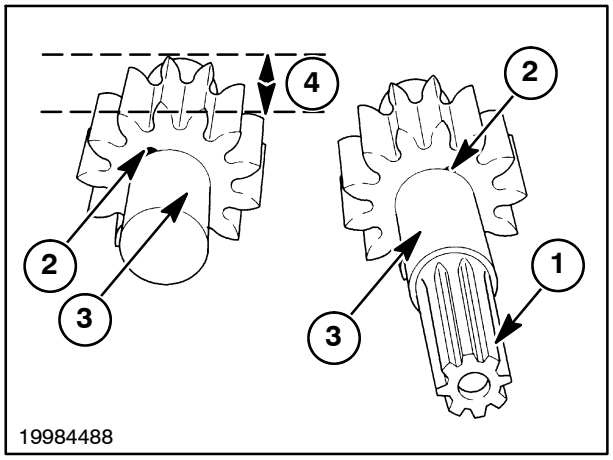


Figure 6-116

Part #	Eaton Model #	Gear Width
86528338	26005-RAQ	16.15 mm (0.636 in.)
86528339	26007-RAA	22.56 mm (0.888 in.)
86528340	26008-RAA	25.76 mm (1.014 in.)
86528341	26008-LAA	25.76 mm (1.014 in.)

NOTE: If replacement of the gear assemblies is necessary, the gear assemblies should be replaced in pairs.

REASSEMBLY - 26000 SERIES

1. Coat all parts with a thin coat of petroleum jelly or oil to aid in reassembly.
2. Install a new washer, 1, and shaft seal, 2, in the pump front plate (drive end), 3. The seal is pressed into the housing to a depth of 6.35 mm (0.25″) from the outer seal housing lip.

   NOTE: Once the seal is installed, make sure that the washer can rotate freely. If the washer cannot rotate, reinstall the seal to a lesser depth to obtain freedom of movement for the washer.

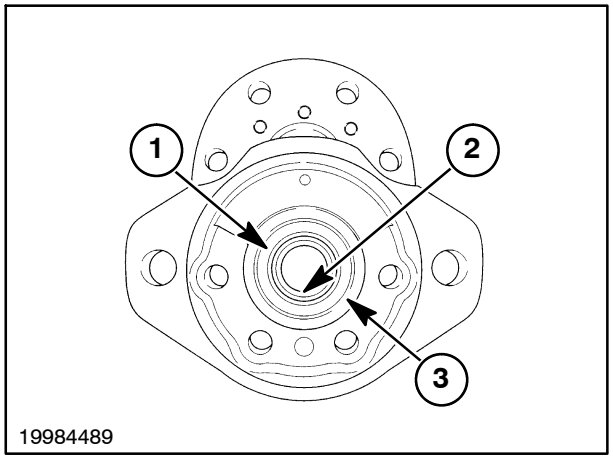


Figure 6-117

3. Install new O rings, 1, in the pump front and back plates. Ensure that the plug, 2, is installed on the pressure side of the pump front plate (drive end), 3.

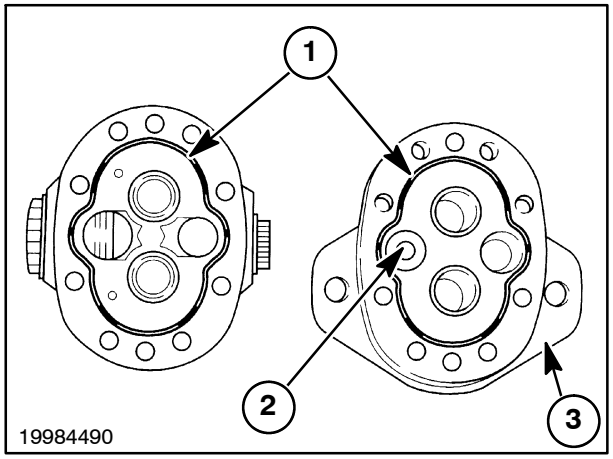


Figure 6-118

4. Make sure the dowel pins, 1, are in place and install the body on the pump front plate (drive end) with the half-moon cavities in the body facing away from the pump front plate. Check that the reference marks made during disassembly align correctly.

   NOTE: The small half-moon cavity, 2, must be on the pressure side (plugged side) of the pump.

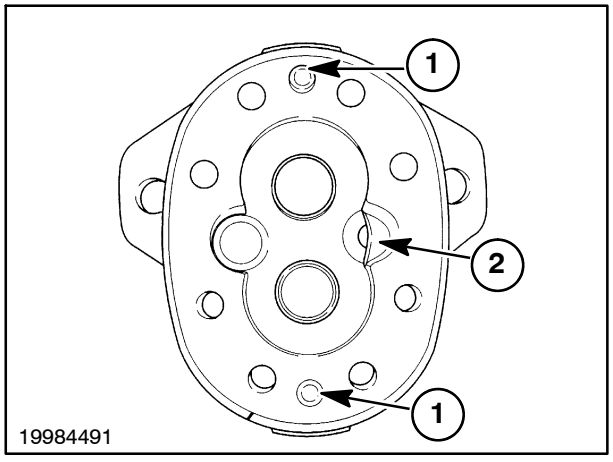


Figure 6-119

5. Install the seal, 1, and backup gasket 2, on the wear plate, 3. BE SURE that the flat area, 4, on the gasket AND seal, 5, are properly aligned and lay flat when installed in the wear plate.

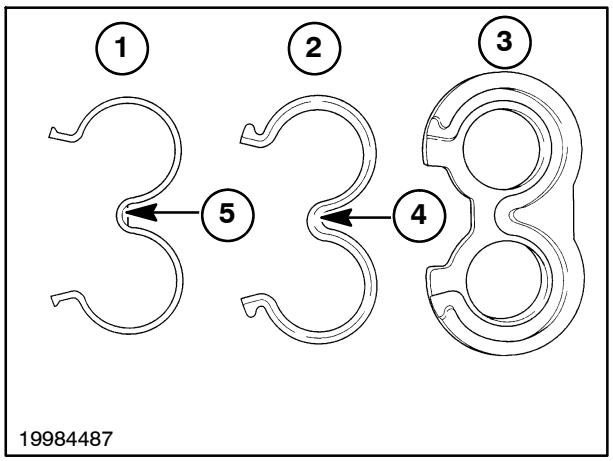


Figure 6-120

NOTE: The gasket AND seal must align and lay flat at 4 when installed in the wear plate.

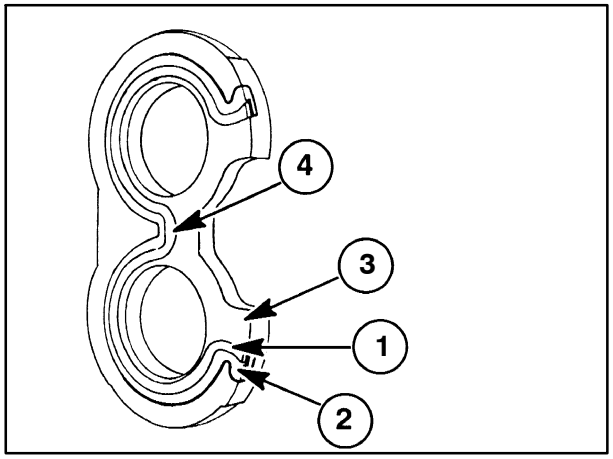


Figure 6-121

6. Install the wear plate assembly, 1, with the gasket/seal side towards the pump front plate, into the body cavity with the mid section cut away on the suction side (large half moon cavity), 2, of the pump.

NOTE: To best accomplish the installation of the wear plate, hold the pump body/front plate assembly upside down while sliding the wear plate assembly up into the housing until it is seated against the front plate. This helps ensure that the seal and backup gasket stay in place.

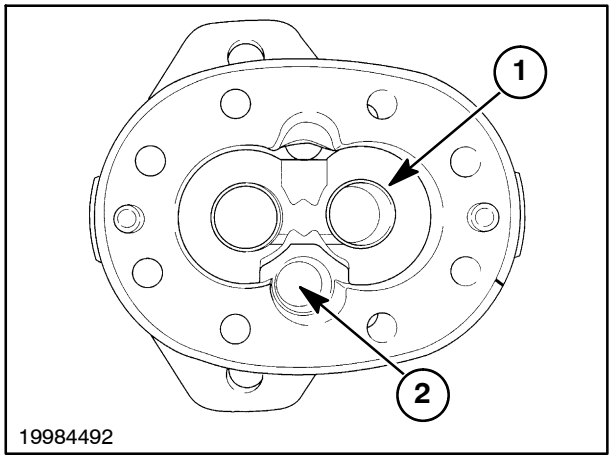


Figure 6-122

7. Install the drive gear, 1, into the housing, 2. Install the idler gear, 3, into the housing. Rotate the gears to help slide them into the gear pockets.

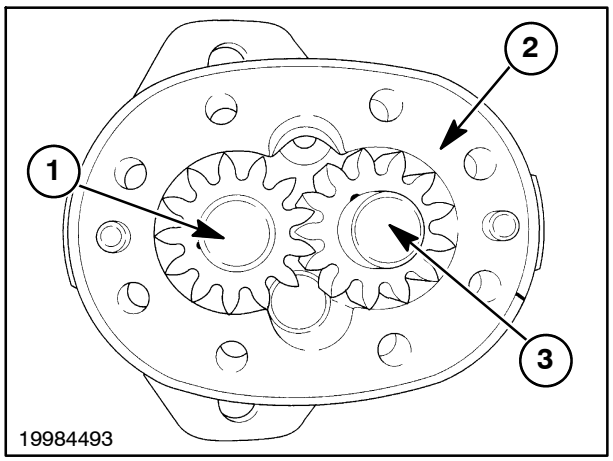


Figure 6-123

8. Install the pump back plate, 1, over the gear shafts. Check that the reference marks made during disassembly align correctly.

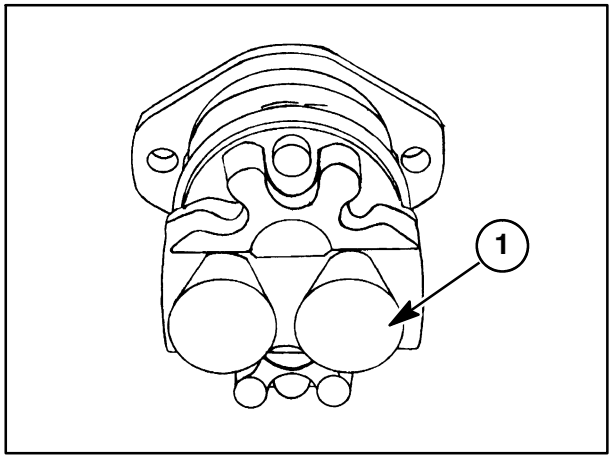


Figure 6-124

9. Install the housing hardware with the four bolts with sealing washers, 1, on the inside bolt holes, 2, with the remaining bolts installed in outside holes, 3. Torque the bolts evenly in a criss-cross pattern to 34 - 38 N·m (25 - 28 ft.lbs.).

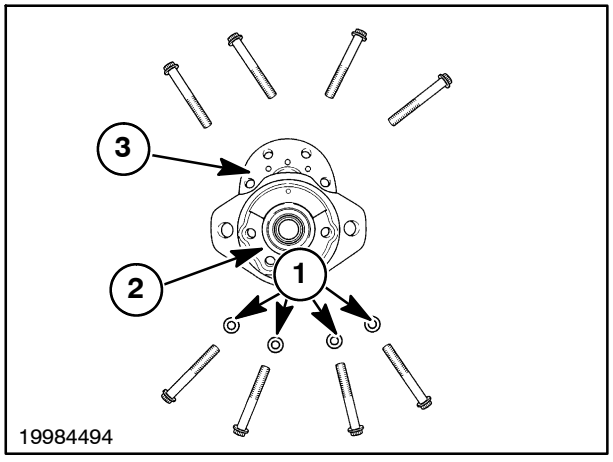


Figure 6-125

REINSTALLATION OF GEAR PUMP INTO LOADER

1. Install a new O ring on the pump housing at 1.

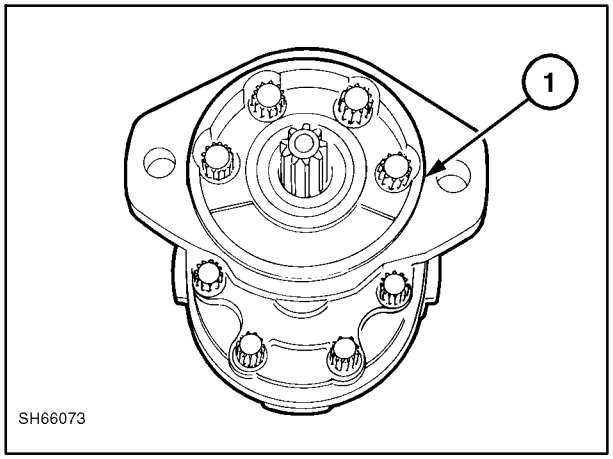


Figure 6-126

2. Reinstall the pump into the loader by attaching it to the hydrostatic pump at 2, and torque the mounting hardware to 39 N·m (29 ft. lbs.). Do not damage O ring at 1, during assembly.
3. Reinstall the case drain line, 3; pressure line, 4; and suction line, 5, making sure when the lines are tightened they are positioned to prevent contact with other components.

   NOTE: Make sure all hoses are tightly clamped to fittings where clamps are used. Make sure all fittings are properly seated and tight. Loose fittings on hoses and the suction case drain lines can cause oil aeration. Loose pressure lines will cause an external oil leak.

4. Refill the hydraulic reservoir with 10W-30 oil.
5. Reinstall the hydrostatic control lever assembly, if removed, and install the step shield.
6. With the unit supported off the ground, start the unit and check for any oil leaks and repair.
7. Check the hydraulic oil level and add as required.

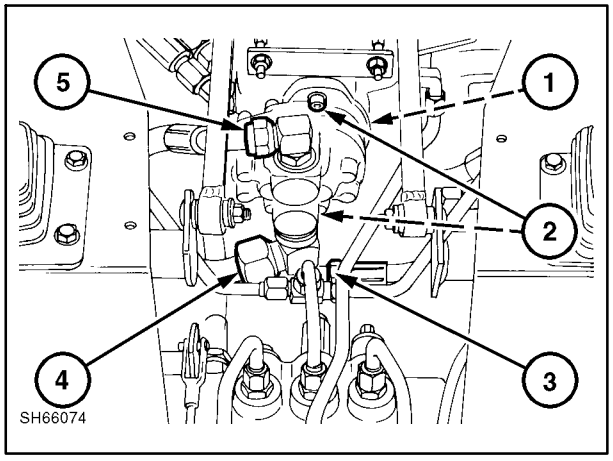


Figure 6-127

GEAR PUMP START-UP PROCEDURE

This procedure must be performed if the gear pump has been removed for repair purposes or any gear pump hydraulic lines have been removed.

1. Fill the reservoir with SAE 10W-30 oil to the proper level.
2. Loosen suction line, 1, at the gear pump. When oil flows from the connection, tighten the connection.
3. Start the engine and run it at 1500 RPM. Operate all hydraulic controls to remove remaining air from the system.
4. Check reservoir level and add oil as necessary.

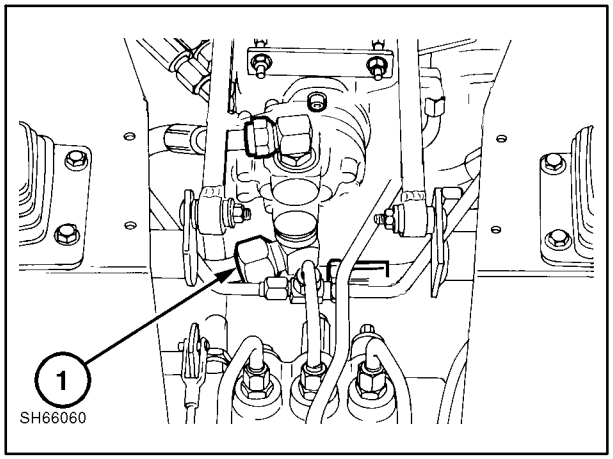


Figure 6-128

CYLINDERS, BOOM AND BUCKET

REMOVAL, DISASSEMBLY, REASSEMBLY

BOOM CYLINDERS

Specifications

Bore Diameter ..... 63.5 mm (2.5″)

Stroke ..... 470.15 mm (18.51″)

Cycle Times (seconds)	L565, LX565	LX665
Raise	3.5	2.7
Lower	3.5	2.3

Torque

Piston Locknut Torque - Type 1 and Type 2 ..... 230 N·m (170 ft. lbs.)

Cylinder Bearing Nut Torque - Type 1 ..... 230 N·m (170 ft. lbs.)

Cylinder Gland Torque - Type 2 ..... 306 N·m (225 ft. lbs.)

Lower Pivot Pin Hardware ..... 338 N·m (250 ft. lbs.)

Upper Pivot Pin Hardware ..... 38 N·m (28 ft. lbs.)

Labor Required

Remove and Replace (1) ..... 0.5 hour

Repair (1) ..... 0.5 hour

BUCKET CYLINDERS

Bore Diameter ..... 57.15 mm (2.25″)

Stroke ..... 454.15 mm (17.88″)

Cycle Times (seconds)	L565, LX565	LX665
Curl Back	2.2	1.54
Curl Down (dump)	2.8	1.75

Torque

Piston Cap Screw Torque ..... 386 N·m (285 ft. lbs.)

Cylinder Head Torque ..... 285 N·m (210 ft. lbs.)

Lower Pivot Pin Hardware ..... 38 N·m (28 ft. lbs.)

Upper Pivot Pin Hardware ..... 108 N·m (80 ft. lbs.)

Labor Required

Remove and Replace (1) ..... 0.5 hour

Repair (1) ..... 0.5 hour

CYLINDER REMOVAL - BOOM

CAUTION: BEFORE REMOVING THE BOOM CYLINDERS, THE BOOM MUST BE IN THE UP, LOCKED POSITION SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

1. Remove any attachment from the loader boom attaching plate, bucket, etc.
2. Raise the boom above the boom lock pins, extend the boom lock pins, and lower the boom on the boom lock pins, 1.
3. After stopping the engine and before removing the seat belt and dismounting from the loader, turn the ignition switch to the “RUN” position.
4. Push both the boom and bucket pedals to relieve all residual hydraulic pressure in both hydraulic circuits.

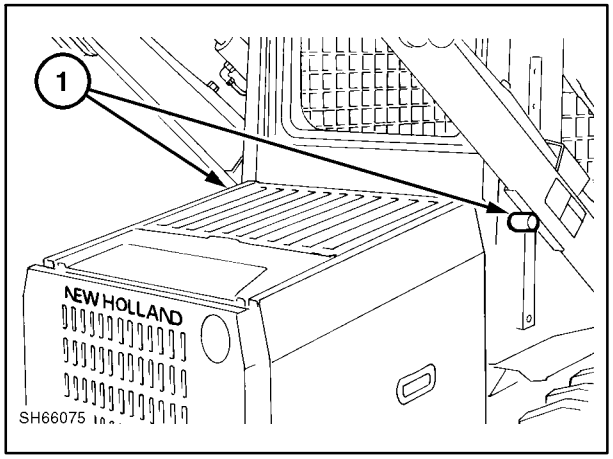


Figure 6-129

5. Turn off the ignition switch.
6. Disconnect both the upper, 1, and lower, 2, boom hydraulic hoses from the cylinder.

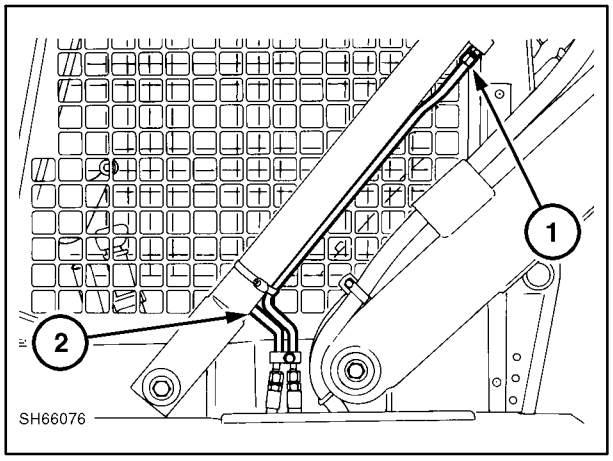


Figure 6-130

7. Using a screwdriver, remove the plastic plug, 1, from inside the cab to access the lower cylinder pivot retaining hardware.
8. Loosen the LOWER boom pin retaining hardware.

   NOTE: DO NOT remove the retaining hardware at this time.

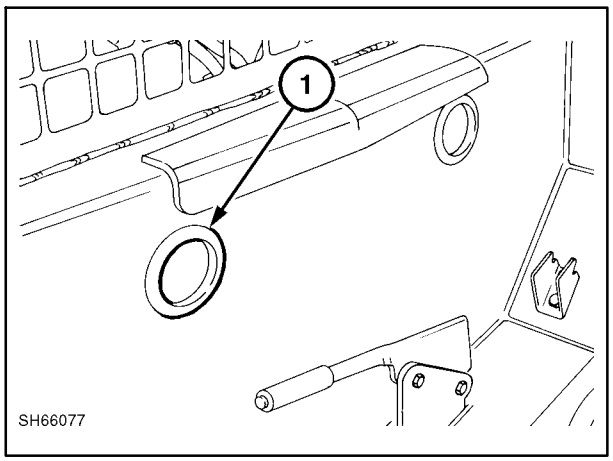


Figure 6-131

9. Support the cylinder and with a hammer strike the cylinder at the base area, 1, to loosen the tapered pivot pin from the loader main frame.

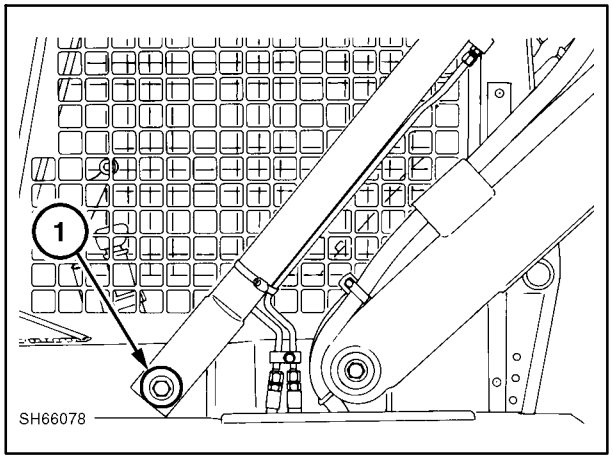


Figure 6-132

10. Remove the UPPER boom pin retaining bolt, 1, and boom pin, 2.
11. Remove the cylinder.

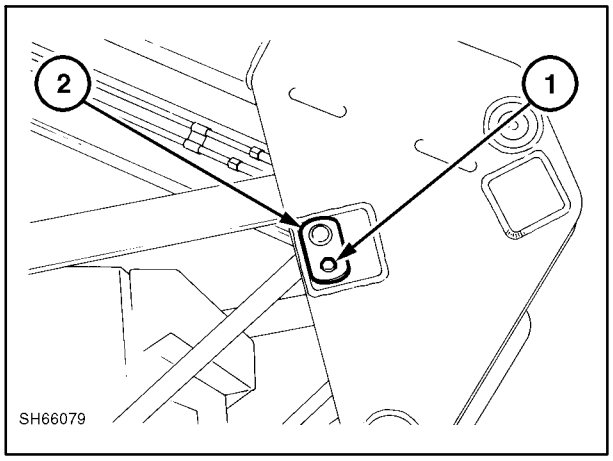


Figure 6-133

12. Shown here is the boom cylinder, 1, lower tapered pivot pin and hardware, 2, and the upper pivot pin and retaining hardware, 3.

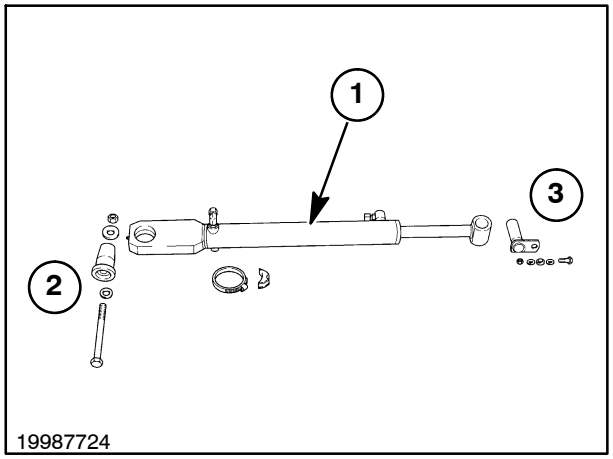


Figure 6-134

BOOM CYLINDER DISASSEMBLY

Two types of boom cylinders have been used on these skid steer loaders. They will be referred to as boom cylinder Type 1 and Type 2 throughout the remainder of this section.

The Type 2 cylinder replaced the Type 1 cylinder in late-model L565, Lx565, and Lx665 loaders. The longer barrel gives better cylinder rod support when the cylinder is fully extended. A piston rod spacer in the Type 2 cylinder makes the stroke the same as the Type 1 cylinder.

NOTE: If a Type 1 cylinder fails, replace both boom cylinders with Type 2 cylinders and replace the appropriate hydraulic tubes.

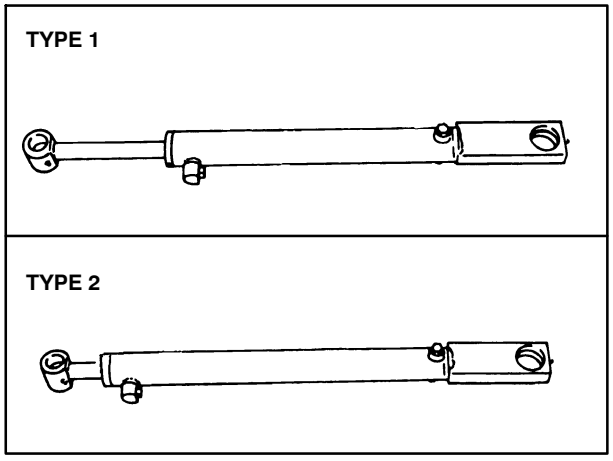


Figure 6-135

Type 1: Shorter barrel
Retaining ring and bearing nut retained cylinder head (gland), 1
Bore diameter - 63.5 mm (2.5″)
Stroke - 470 mm (18.5″)
No internal rod spacer

Type 2: Longer barrel
Threaded cylinder head (gland), 2
Bore diameter - 63.5 mm (2.5″)
Stroke - 470 mm (18.5″)
Internal piston rod spacer

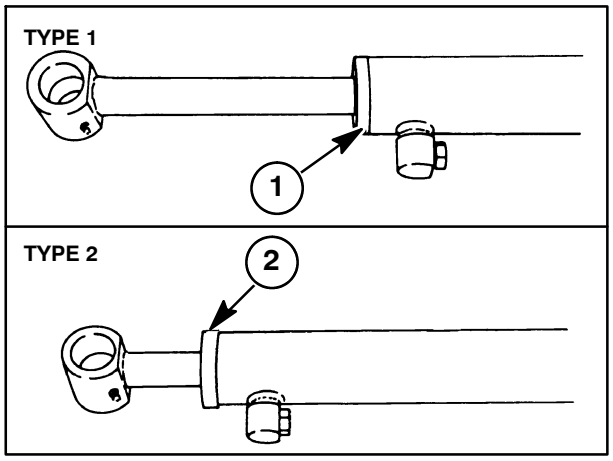


Figure 6-136

DISASSEMBLY - TYPE 1

1. Thoroughly clean the outside of the cylinder.
2. Pull the piston rod out slowly to drain oil from the cylinder barrel.
3. Clamp the barrel of the cylinder in a vise at 1, to put pressure against the gland to prevent the gland from turning.
4. Use a wrench to unscrew the cylinder gland retaining nut, 2.

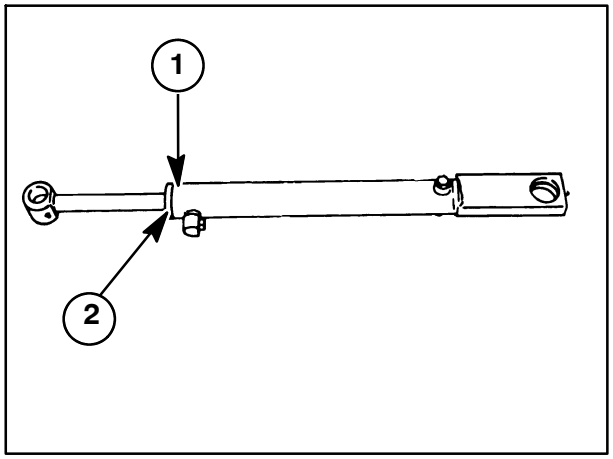


Figure 6-137

5. Loosen the cylinder in the vise and, with a hammer and punch, drive the gland into the cylinder barrel far enough to remove the retaining ring as shown at 1.

   NOTE: Do not drive the gland into the barrel far enough to allow the gland seal to enter the cylinder pressure port, 2.

6. Pull piston rod, 3, and gland out of barrel.

   NOTE: When removing the rod, piston, and gland assembly from the barrel, pull it by the retaining ring groove in the barrel quickly to prevent the O ring from expanding into the retaining ring groove.

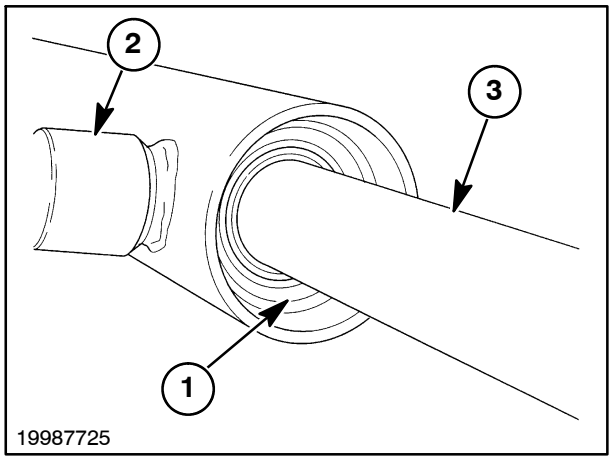


Figure 6-138

7. Remove piston locknut, 1; piston, 2; and cylinder head, 3; retaining ring, 4; and gland retaining nut, 5, from rod, 6.

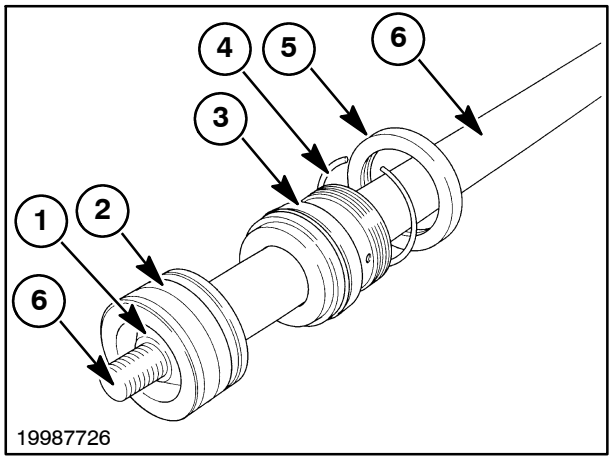


Figure 6-139

8. Remove wiper seal, 1, and gland seal, 2, from the inside of the cylinder gland. Remove the outer seal, 3, and backup ring, 4.

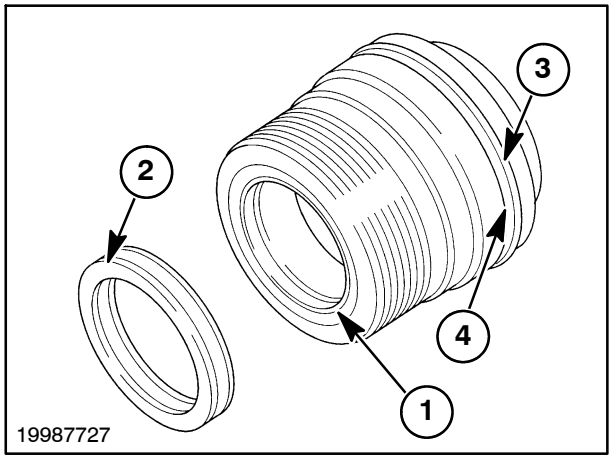


Figure 6-140

PARTS INSPECTION - TYPE 1

1. Thoroughly clean all parts and remove all nicks and burrs with a fine emery cloth.
2. Inspect the inner diameter of the barrel assembly for excessive wear or scoring. Inspect the retaining groove, 1, for a rolled edge and remove.
3. Inspect the outer diameter of the barrel for damage and flat spots that may damage the piston seal.

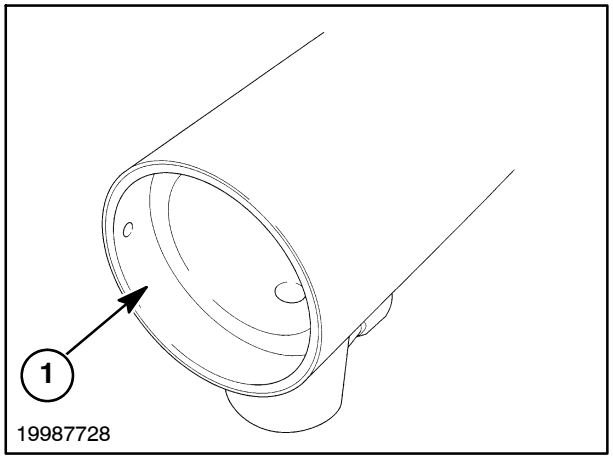


Figure 6-141

4. Inspect the piston, 1, for scoring or excessive wear. If the piston is not worn, do not replace.

   NOTE: Inspect the outer diameter of the piston for scoring or excessive wear. If scoring is present, the inside of the barrel must be thoroughly inspected.

   Replace the seals, 2, whenever the cylinder is serviced.

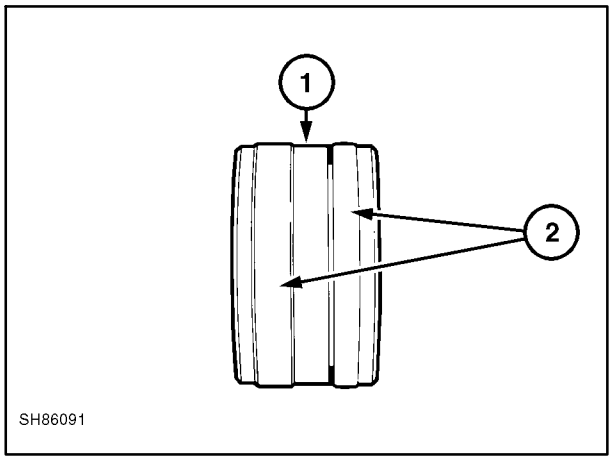


Figure 6-142

NOTE: The seal kit replaces the one single-piece crown seal with a "T" seal, 1, and two backup seals, 2.

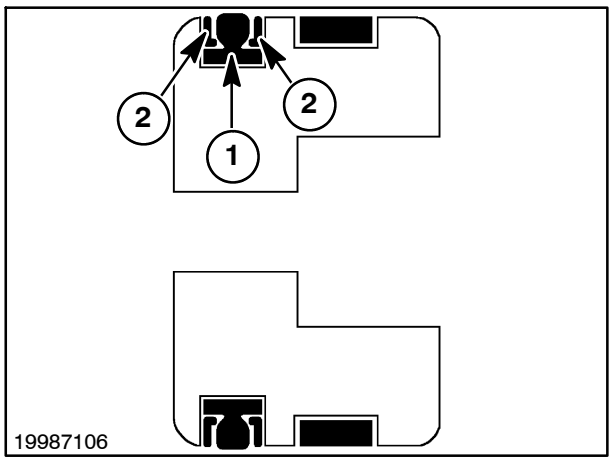


Figure 6-143

5. Inspect the cylinder head (gland) inner and outer seal areas, 1 and 2, for sharp edges and scoring. Inspect the threaded area of the gland, 3, for damaged threads that would prevent proper tightening of the retaining nut. Replace the gland if necessary. All seals, 4, should be replaced during reassembly.

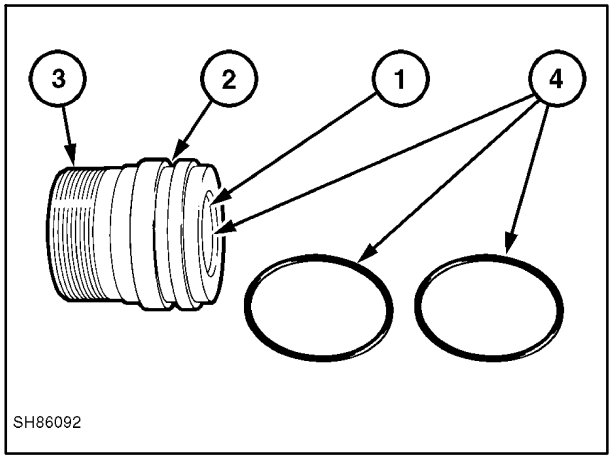


Figure 6-144

6. A replaceable bushing, part #86521725, has been added to the barrel pivot on the loader boom cylinder.

   If an older loader cylinder without the bushings is worn, the base end hole, 1, can be machined out to 65.080 - 65.118 mm (2.5622″ - 2.5637″) to accept the new bushing.

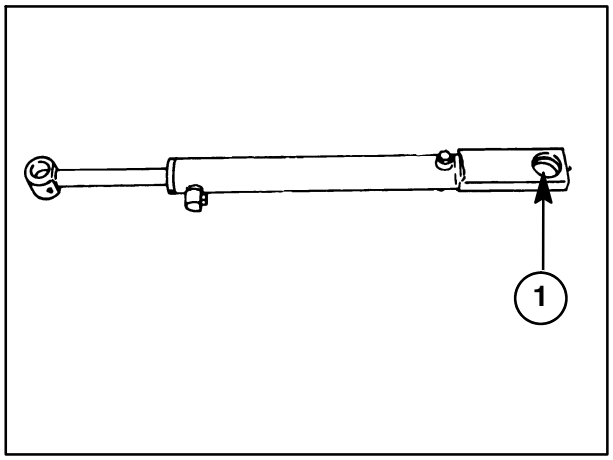


Figure 6-145

REASSEMBLY - TYPE 1

1. Clean and dry all parts. The metal parts should be lightly oiled prior to assembly.
2. Install a new O ring, 1; backup ring, 2; and shaft oil seal, 3, on the cylinder head.

   NOTE: Shaft oil seal, 3, should be installed with the lip of the seal facing the piston.

3. Install a new shaft wiper seal, 4, into the gland.

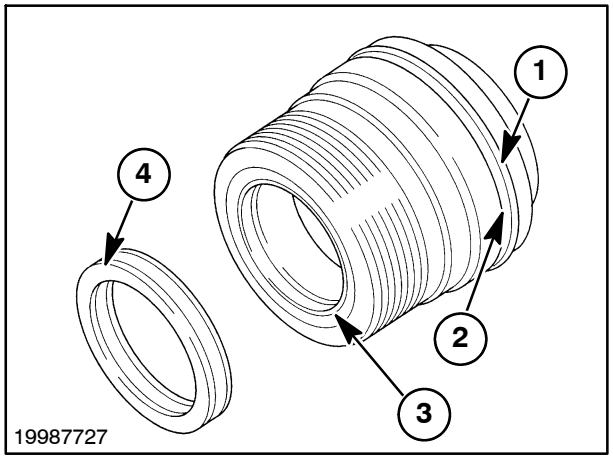


Figure 6-146

4. Examine the piston assembly prior to installation. The wear ring, 1, and T-seal, 2, should be firmly in their grooves and snug against the piston. Insert the L shaped back-up rings, 3, on both sides of the T-seal with the short leg of the L shaped back-up rings towards the T-seal as shown.

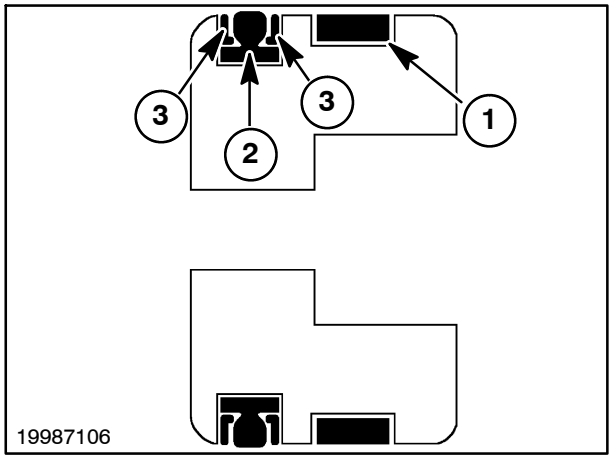


Figure 6-147

5. Slide the gland retaining nut, 1, retaining ring, 2, and cylinder head, 3, onto the piston rod, 4.
6. Clean the area, 5, between the piston and rod, and apply hydraulic sealant.

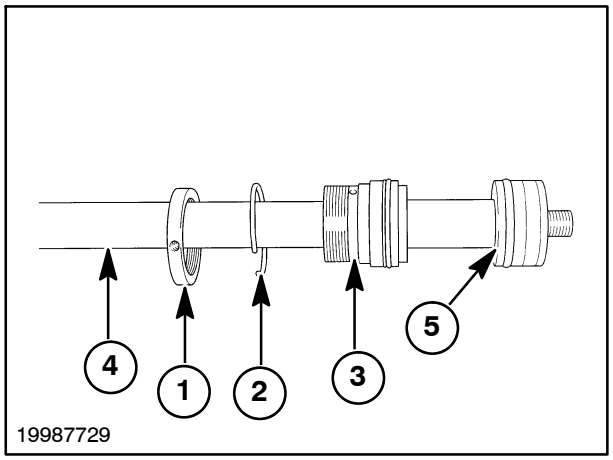


Figure 6-148

7. Install the piston, 1, and locknut, 2, on the rod, 3. The wear ring must be toward the threaded end of the rod, with the locknut fitting into the recessed area of the piston.

   NOTE: The piston orientation must be correct, as the effective length of the piston rod must be maintained.

8. Tighten the locknut to 230 N·m (170 ft. lbs.).

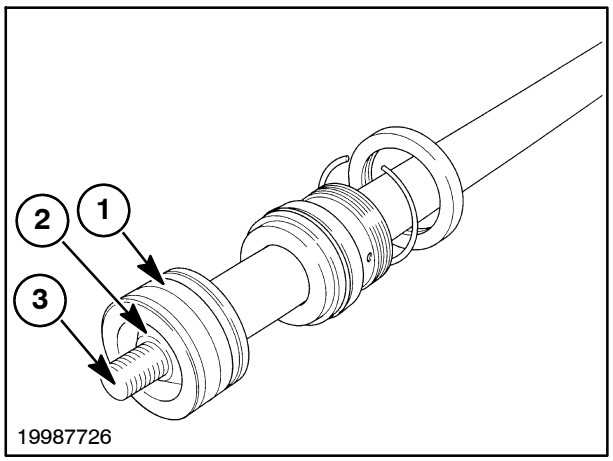


Figure 6-149

9. Lubricate the piston assembly with 10W-30 oil and install the piston rod assembly into the barrel.
10. Install the gland retaining ring, 1, into the groove in the barrel and pull the gland, 2, to the retaining ring.
11. Tighten the cylinder head retaining nut, 3, to 230 N·m (170 ft. lbs.).

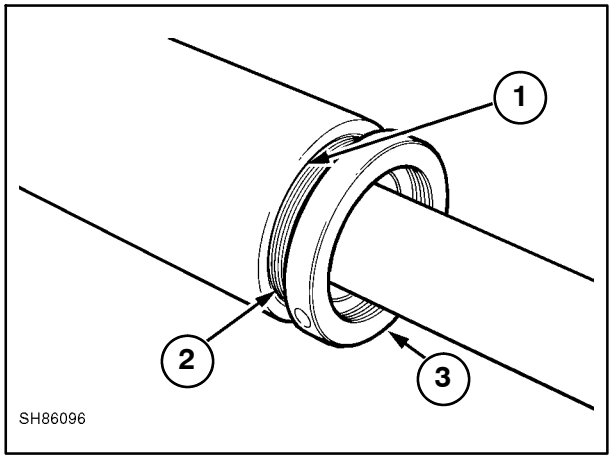


Figure 6-150

DISASSEMBLY - TYPE 2

1. Thoroughly clean the outside of the cylinder.
2. Pull the piston rod out slowly, and drain the oil from the barrel into a suitable container.
3. Clamp the base of the cylinder in a vise at 1, and unscrew the cylinder head (gland), 2.

   NOTE: Do not clamp the cylinder barrel in the vise to unscrew the cylinder head. Flattening of the barrel will cause damage to the piston and piston seals.

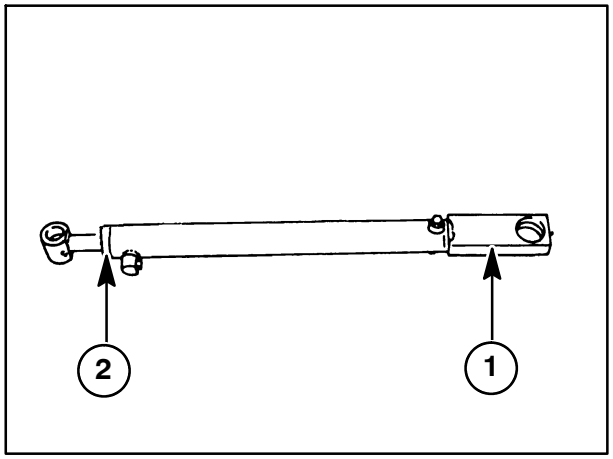


Figure 6-151

4. Remove the piston rod assembly, 1, from the barrel, 2.

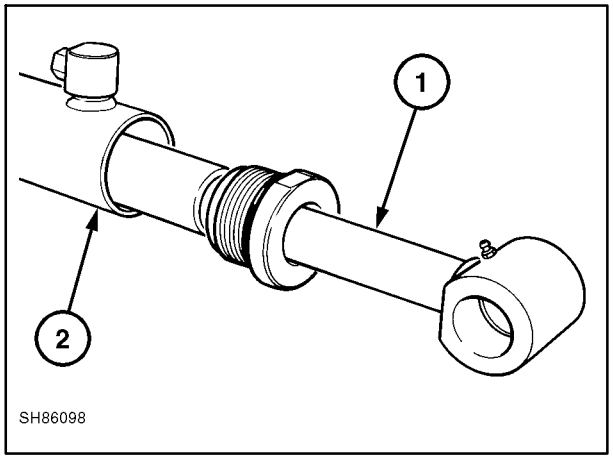


Figure 6-152

5. Remove the piston retaining nut, 1; the piston, 2; spacer, 3; and cylinder head (gland), 4, from the piston rod, 5.

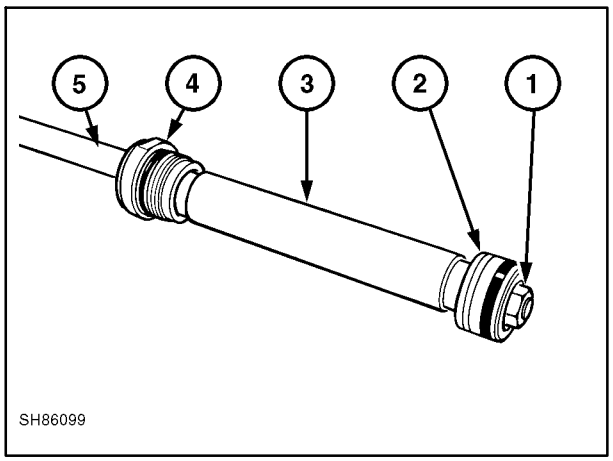


Figure 6-153

6. Remove the wiper seal, 1; O ring and backup washer, 2; and inner seal and wear ring, 3, from the cylinder head (gland), 4.

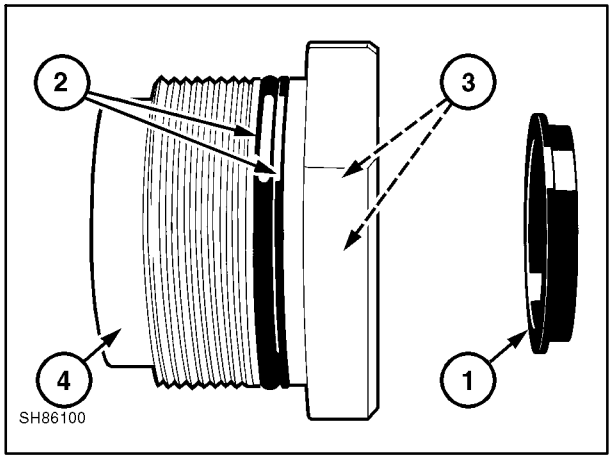


Figure 6-154

7. Remove the wear ring, 1, and seal, 2, from the piston, 3.

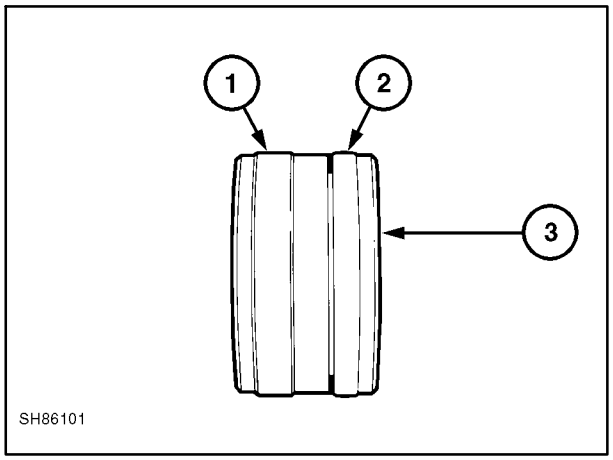


Figure 6-155

PARTS INSPECTION - TYPE 2

1. Thoroughly clean all parts and remove any nicks or burrs with a fine emery cloth.
2. Inspect the inner diameter of the barrel, 1, for excessive wear or scoring.
3. Inspect the threaded area of the barrel, 2, for damaged threads that would prevent proper tightening of the cylinder head.
4. Inspect the O ring seal area, 3, and remove any burrs or nicks that could damage or prevent the O ring from sealing properly.

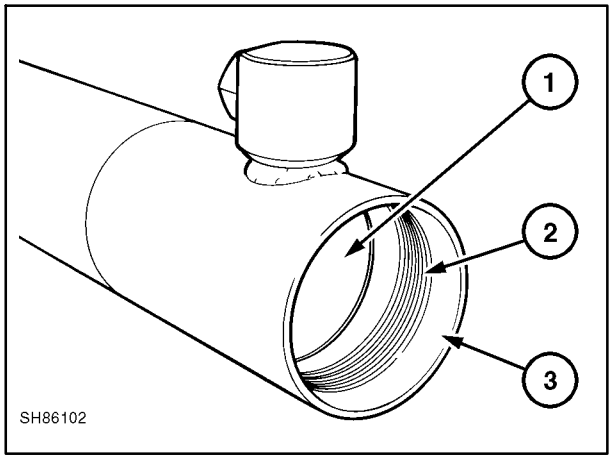


Figure 6-156

5. Inspect the outer diameter of the piston, 1, for excessive wear or scoring. If the piston is damaged, the inner surface of the barrel will also most likely be damaged. Inspect the barrel thoroughly. If the piston is not damaged, do not replace.

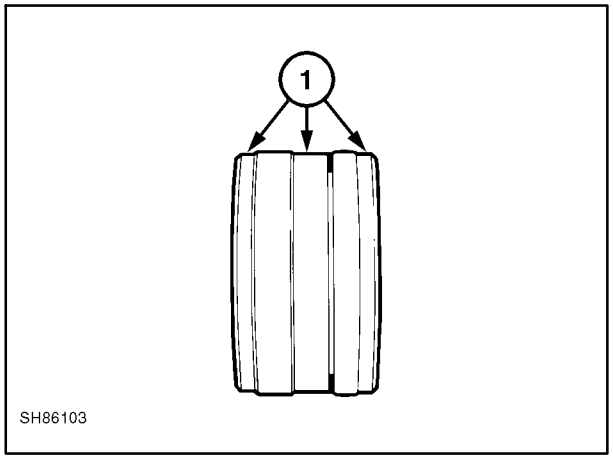


Figure 6-157

NOTE: The seal kit replaces the one single-piece seal with a "T" seal, 1, and two backup seals, 2.

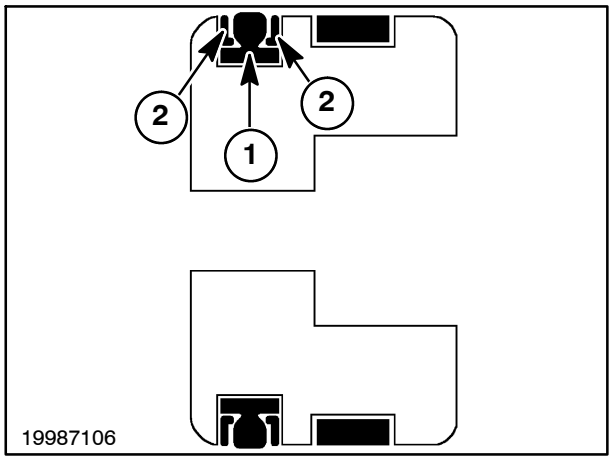


Figure 6-158

6. Inspect the cylinder head (gland) inner and outer seal areas, 1 and 2, for sharp edges and scoring. Inspect the threaded area of the gland, 3, for damaged threads that would prevent proper tightening of the retaining nut. Replace the gland if necessary. All seals should be replaced during reassembly.

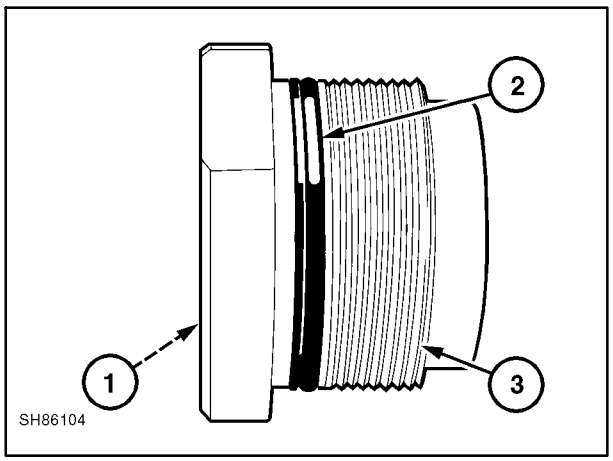


Figure 6-159

REASSEMBLY - TYPE 2

1. Clean and dry all parts. The metal parts should be lightly oiled prior to assembly.
2. Install a new O ring, 1, and backup washer, 2, in the outer groove of the cylinder head, 3. Install a new shaft seal, 4, and wear ring, 5, in the inner grooves.

   NOTE: Install the shaft oil seal, 4, with the lip of the seal facing the piston.

3. Install a new shaft wiper seal, 6, into the cylinder head. The seal lip should face outward.

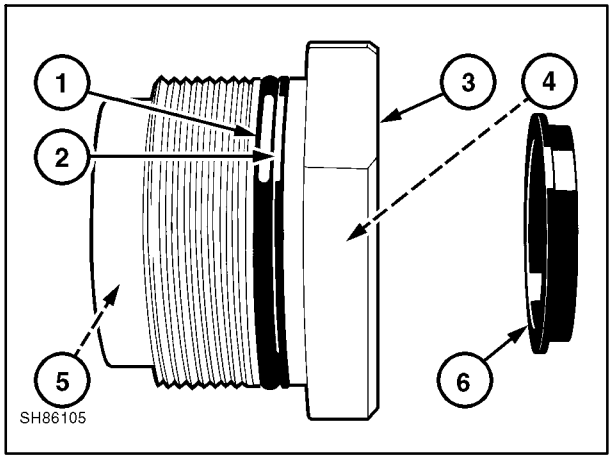


Figure 6-160

4. Examine the piston assembly prior to installation. The wear ring, 1, and T-seal, 2, should be firmly in their groove and snug against the piston, 3. Insert the L shaped back-up rings, 3, on both sides of the T-seal with the short leg of the L shaped back-up rings towards the T-seal as shown.

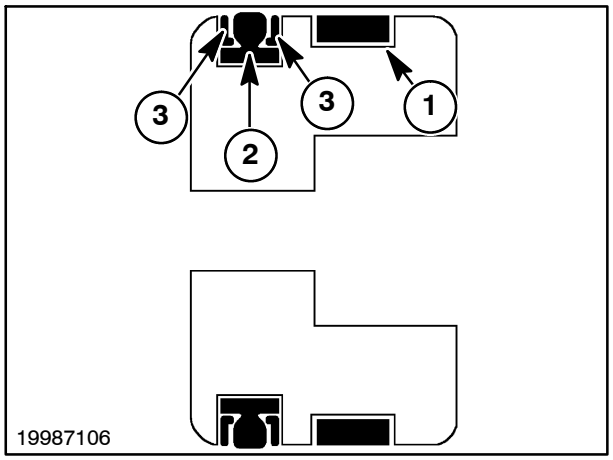


Figure 6-161

5. Install the cylinder head assembly, 1, and spacer, 2, onto the piston rod, 3.
6. Prior to installing the piston, clean and apply a bead of hydraulic sealant between the piston and piston rod at 4. Install the piston assembly, 5, and new locknut, 6. The wear ring on the piston should be toward the threaded end of the rod.

   NOTE: The flat side of the piston must face the spacer, and the recessed side must face toward the end of the rod. The effective length of the piston rod must be maintained, with the locknut fitting into the recessed area of the piston.

7. Torque the locknut to 230 N·m (170 ft. lbs.).

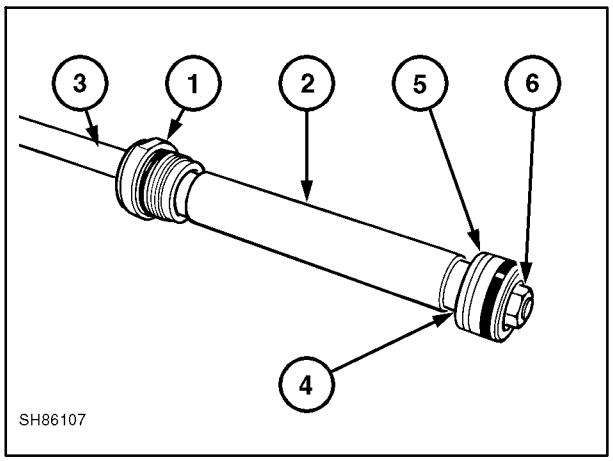


Figure 6-162

8. Lubricate the piston and cylinder head assemblies with 10W-30 oil and install the piston rod assembly, 1, into the barrel, 2.
9. Prior to threading the cylinder head into the barrel, apply a coat of grease around the cylinder head, in the area between the backup washer and the cylinder head flange at 3.
10. Torque the cylinder head assembly to 338 N·m (250 ft. lbs.).

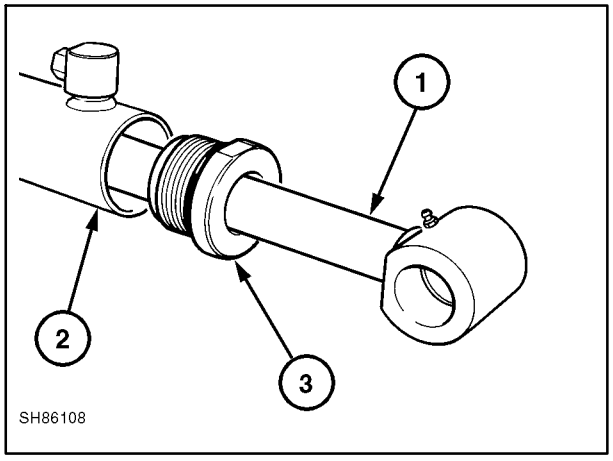


Figure 6-163

REINSTALLATION OF THE BOOM CYLINDER

1. Lubricate the boom pivot pins, 1, with an antiseize-type lubricant.
2. Install the cylinder onto the loader.

   NOTE: Refer to Service Bulletins 5/96 - I6 and 7/96 - I6 for updated pivot pin support information and proper pin, spacer, and bolt part numbers.

3. Install a 3/8″ bolt, 2; flat washer, 3; and spacer, 4, through the pivot pin retaining strap and boom side plate. Secure with flat washer, 5, and locknut, 6.
4. Torque the upper pivot pin hardware to 38 N·m (28 ft. lbs.).

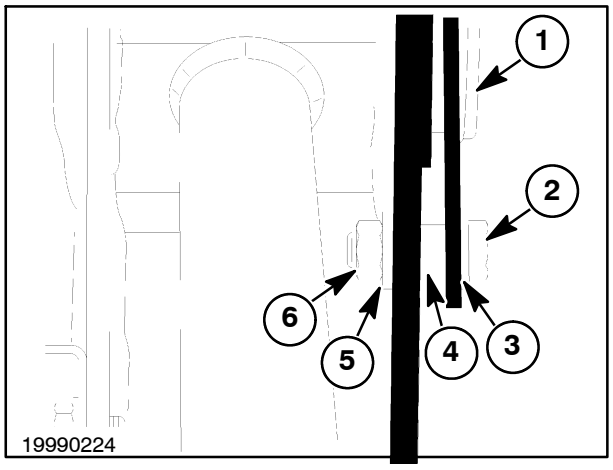


Figure 6-164

5. Torque the lower pivot pin hardware, 1, to 338 N·m (250 ft. lbs.).
6. With a six-pound hammer and using a piece of 2 x 4 hardwood to protect the pin, hit the pivot pin and retaining hardware to properly seat the tapered pin and retorque to 338 N·m (250 ft. lbs.).
7. Reinstall lines, 2, and position to prevent contact with other components, fenders, etc. at 3.
8. Reinstall the plastic plug into the cap inner shell.
9. Cycle the boom several times to remove the air from the system and check the cylinder for leaks.

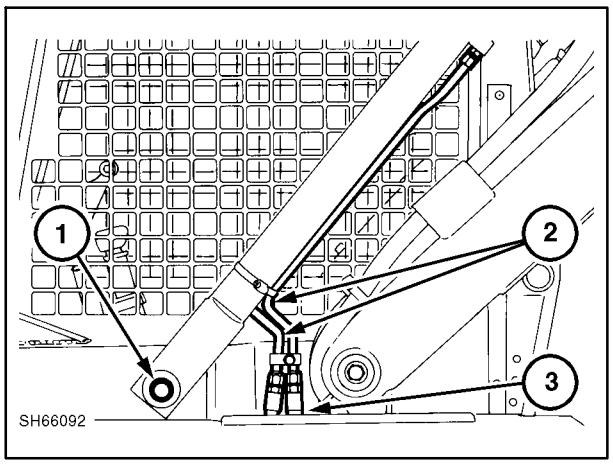


Figure 6-165

CYLINDER REMOVAL - BUCKET

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

1. Remove any attachment, bucket, etc. from the boom attaching plate and lower the boom to the lowered position.
2. Extend the cylinder, 1, to the fully extended position.
3. After stopping the engine and before removing the seat belt and dismounting from the loader, turn the ignition switch to the “RUN” position.
4. Push both the boom and bucket pedals to relieve all residual hydraulic pressure in both circuits.
5. Turn off the ignition switch.

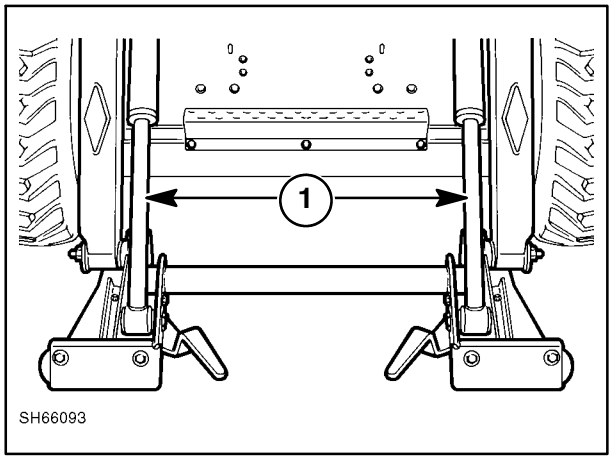


Figure 6-166

6. Remove the hydraulic hoses from both ends of the cylinder, 1, and cap the lines to prevent loss of oil.
7. Remove the retaining bolt and pin, 2, from the lower end of the cylinder.
8. Loosen the upper tapered pivot pin retaining hardware, 3.
9. Support the cylinder and, with a hammer, strike the cylinder at the base area, 4, to loosen the tapered pivot pin.
10. Remove the cylinder.

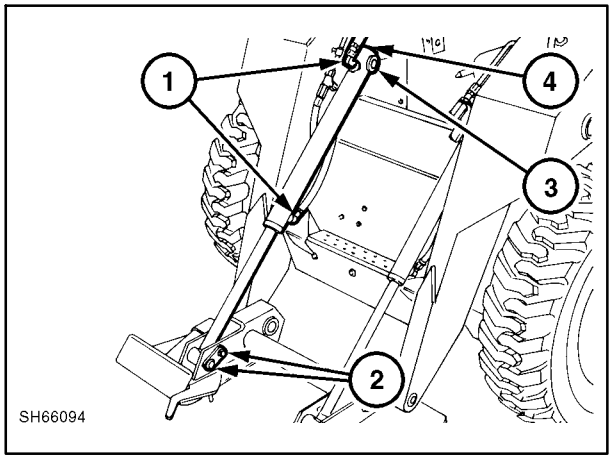


Figure 6-167

11. Shown here is the bucket cylinder,1, with the upper tapered pivot pin, 2, and hardware.

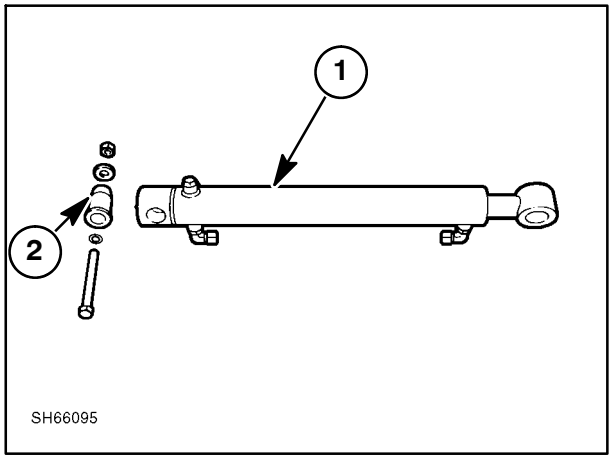


Figure 6-168

DISASSEMBLY

There are two designs of bucket cylinders, and the parts are not interchangeable between designs. The piston rods are a different length, and a different seal repair kit is required.

1. Clean the outside of the cylinder and clamp the cylinder base, 1, in a vise.
2. Use a spanner wrench to remove the cylinder gland, 2. The gland is threaded into the cylinder.
3. Pull the cylinder rod assembly from the barrel.

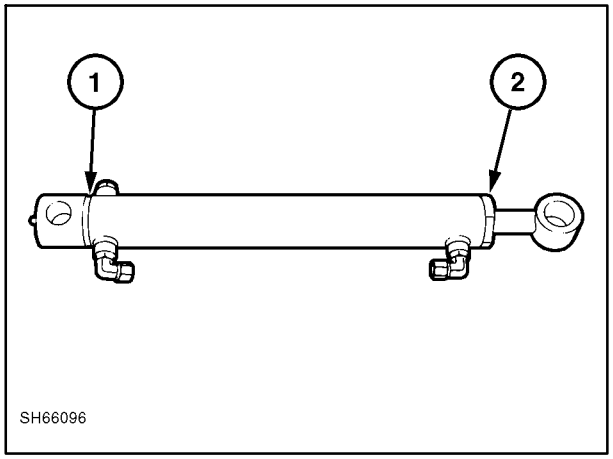


Figure 6-169

4. Remove piston retaining stud, 1, from the cylinder rod, piston, 2, and gland, 3, from the piston rod.

   NOTE: There are two piston designs. One style piston will be flat on both ends; the other will be recessed on one end, and the recess will be positioned over the end of the piston rod.

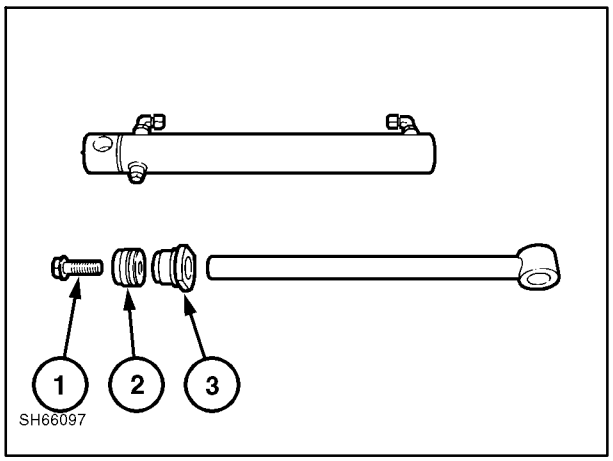


Figure 6-170

5. Remove seals from the gland, the outer O ring seal and backup ring, 1, the inner shaft seal, 2, and the wiper seal, 3.

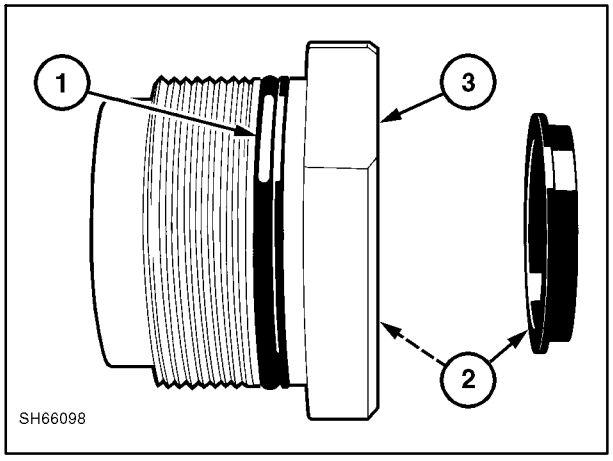


Figure 6-171

PARTS INSPECTION

1. Thoroughly clean all parts and remove all nicks and burrs with a fine emery cloth.
2. Inspect the inner diameter of the barrel for excessive wear or scoring.
3. Inspect the gland thread area, 1, for damaged threads that would prevent proper tightening of the gland.
4. Inspect the O ring seal area, 2, and remove burrs or nicks that would prevent the O ring from sealing properly.

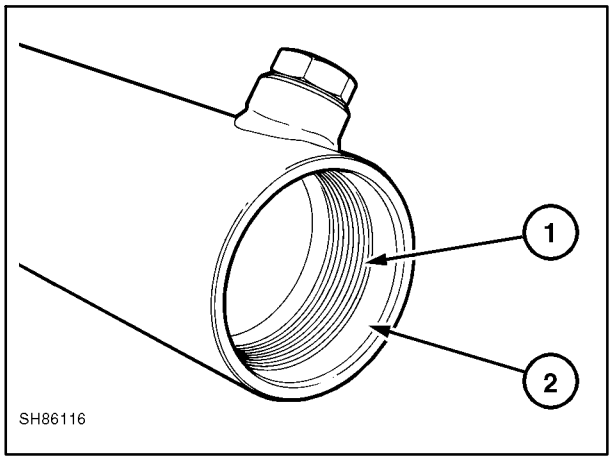


Figure 6-172

5. Inspect the outer diameter of the piston, 1, for excessive wear or scoring. If the piston is damaged, the inner surface of the barrel will also most likely be damaged. Inspect the barrel thoroughly. If the piston is not damaged, do not replace.

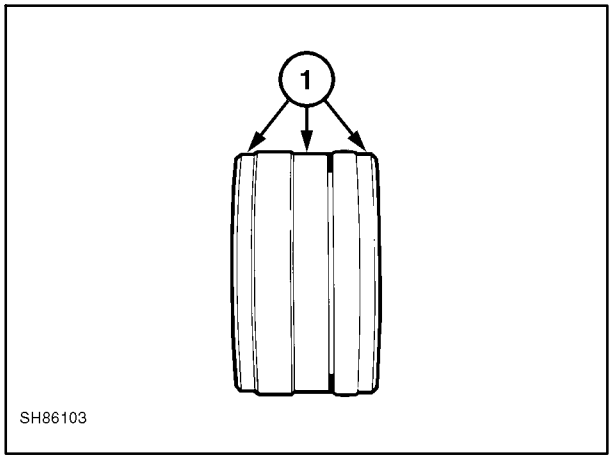


Figure 6-173

NOTE: The seal kit replaces the one single-piece seal with a "T" seal, 1, and two backup seals, 2.

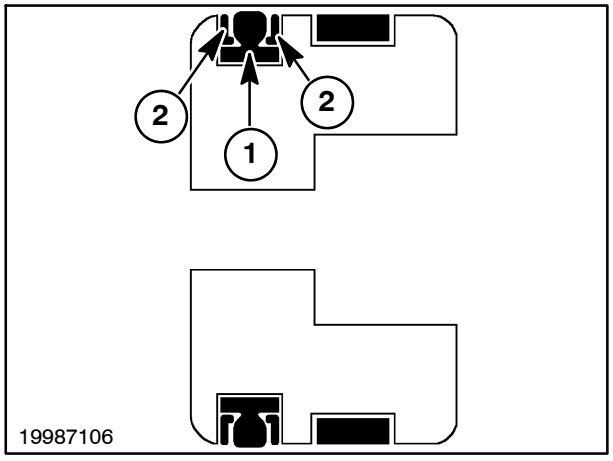


Figure 6-174

6. Inspect the cylinder head (gland) inner and outer seal areas, 1 and 2, for sharp edges and scoring. Inspect the threaded area of the gland, 3, for damaged threads that would prevent proper tightening of the retaining nut. Replace the gland if necessary. All seals should be replaced during reassembly.

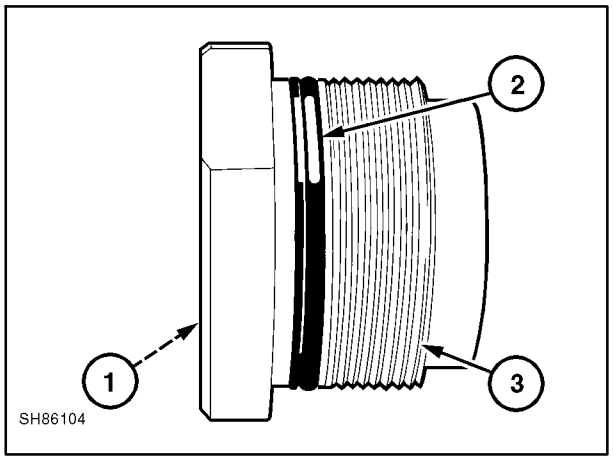


Figure 6-175

REASSEMBLY

1. Clean and dry all parts. The metal parts should be lightly oiled prior to assembly.

   NOTE: The design of the piston will determine the seal kit used.

2. Shown here are the two styles of pistons - flat piston, 1, and recessed piston, 2.

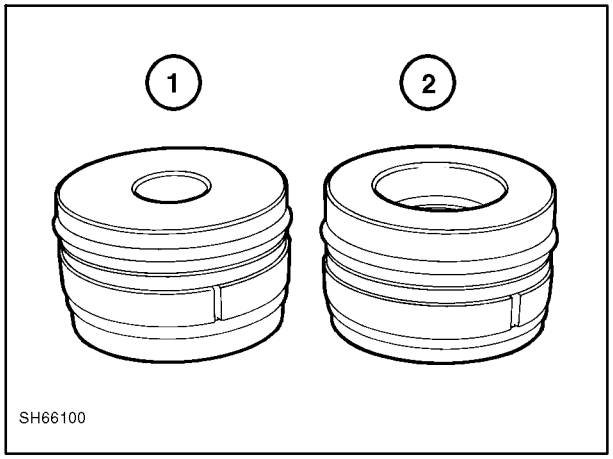


Figure 6-176

3. Install a new shaft seal, 1.
4. Install a wiper seal, 2.

   NOTE: Install shaft wiper seal, 1, with the lip of the seal facing the piston.

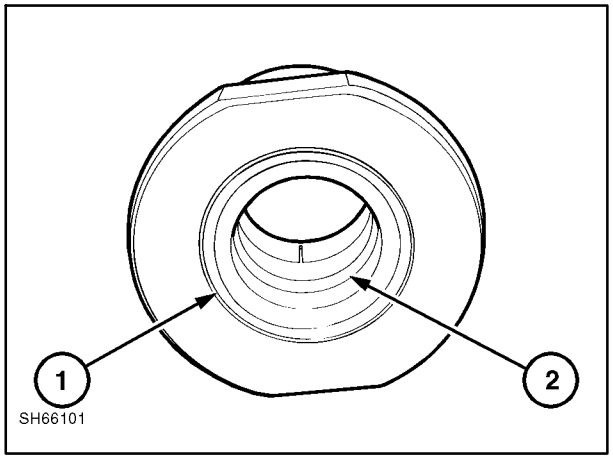


Figure 6-177

5. Install O ring, 1, and backup washer, 2, on the cylinder gland.

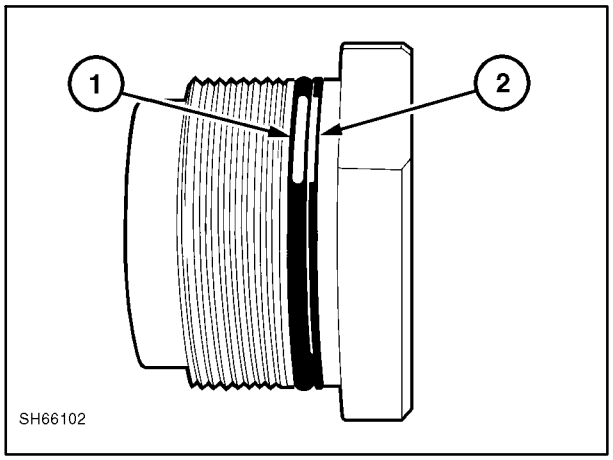


Figure 6-178

6. Slide cylinder gland, 1, and new piston with seals installed, 2, onto the piston rod.

   NOTE: The piston design with the recess requires the recess be positioned over the end of the rod, with the locknut inside the recess.

   NOTE: Seals, 3, should be clamped with a ring compressor and chilled before being installed in the barrel.

7. Use a hydraulic sealant to seal the piston and rod. Install piston retaining stud, 4, with medium-strength 242 Loctite® and torque to 386 N·m (285 ft. lbs.).

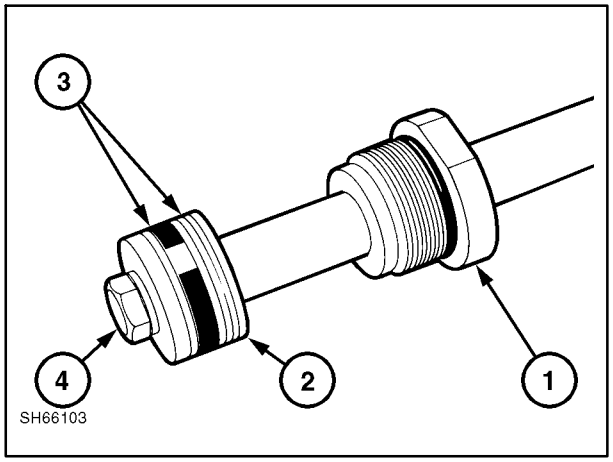


Figure 6-179

8. Liberally oil the piston and place it inside the barrel, being careful not to damage the seals.
9. Thread the cylinder gland into the barrel, 1, and torque to 285 N·m (210 ft. lbs.).

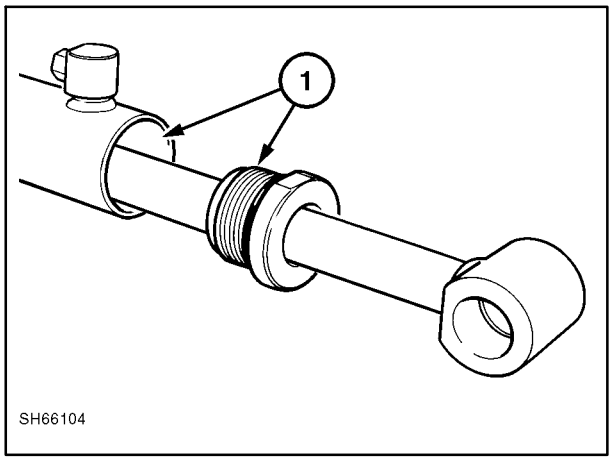


Figure 6-180

REINSTALLATION OF THE BUCKET CYLINDER

1. Lubricate the pivot pins with a never seize type lubricant.
2. Install the cylinder on the loader.
3. Torque the upper pivot pin hardware to 108 N·m (80 ft. lbs.).
4. With a hammer and using a piece of 2 x 4 hardwood to protect the pin, hit the pivot pin and retaining hardware at 1, to properly seat the tapered pin and retorque to 108 N·m (80 ft. lbs.).
5. Torque the lower pivot pin hardware to 38 N·m (28 ft. lbs.).
6. Cycle the boom several times to remove the air from the system and check the cylinder for leaks.
7. Check the hydraulic oil level and add 10W-30 oil as required.

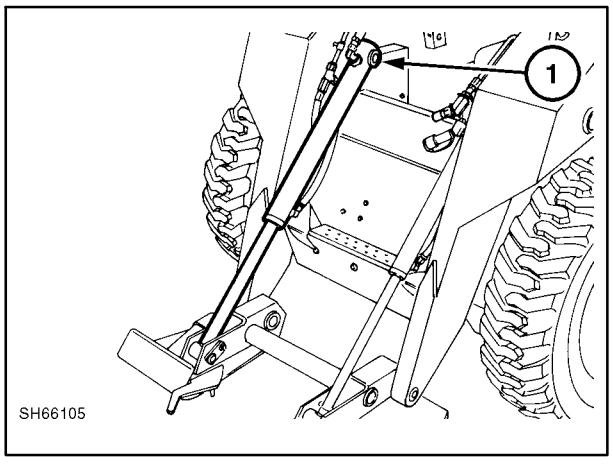


Figure 6-181

HYDRAULIC COOLING, FILTER, RESERVOIR SYSTEM

OIL COOLER

Specifications

Filter (spin-on canister) . . . . . 10 micron

Reservoir (filter screen at fill cap) capacity . . . . . 22.7 L (6 gal.)

Labor Required

Remove and replace oil filter . . . . . 0.5 hour

Remove and replace filter and base . . . . . 1.0 hour

Remove and replace oil cooler . . . . . 2.0 hours

Remove and replace reservoir . . . . . 2.5 hours

FILTER SYSTEM

The skid-steer loader is equipped with a single spin-on filter canister type located at 1, to the right of the engine radiator. The filter is a 10-micron element.

NOTE: Allow the hydraulic oil to cool before changing the filter.

CAUTION: THE HYDRAULIC OIL FILTER WILL BE UNDER PRESSURE WHEN THE OIL IS AT OPERATING TEMPERATURE.

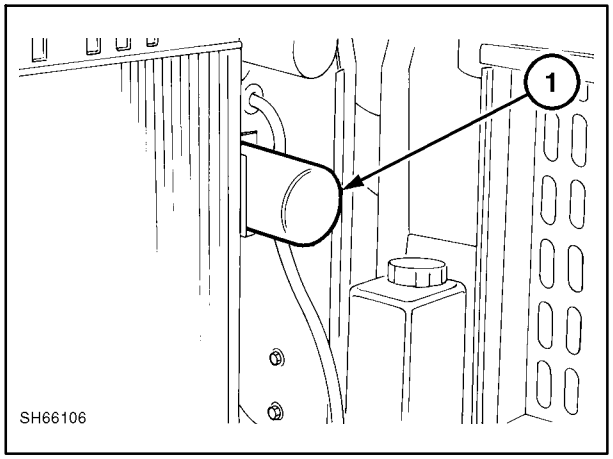


Figure 6-182

The filter base is equipped with a bypass valve, 1, to allow cold oil to bypass the filter without damaging the filter or starving the hydrostatic system of lubrication oil during cold weather start-ups.

In cold weather start-ups, allow the hydraulic oil to warm up before operating the boom, bucket, or the hydrostatic ground drive system, to prevent possible damage to the systems.

The filter base is also equipped with a pressure sensor that is monitored by the EIC (Electronic Instrument Cluster) to signal the operator of a plugged oil filter.

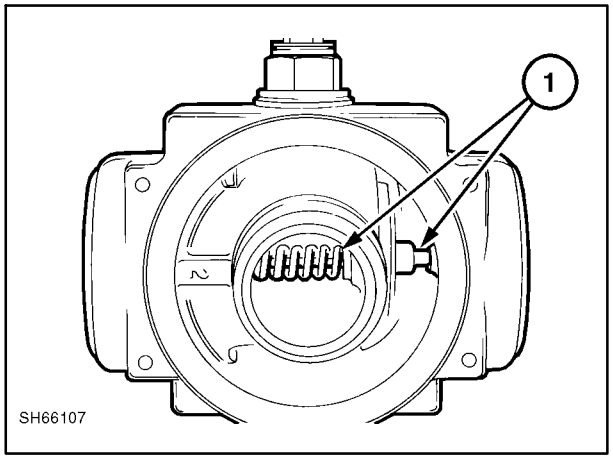


Figure 6-183

FILTER AND BASE REMOVAL

The filter base can be removed by opening the rear door and removing the right engine side panel.

1. Remove the sensor wires, 1.
2. Remove the inlet, 2, and outlet, 3, oil lines and cap to prevent loss of oil.
3. Remove the filter base mounting hardware, 4.
4. Remove the filter assembly from the unit.

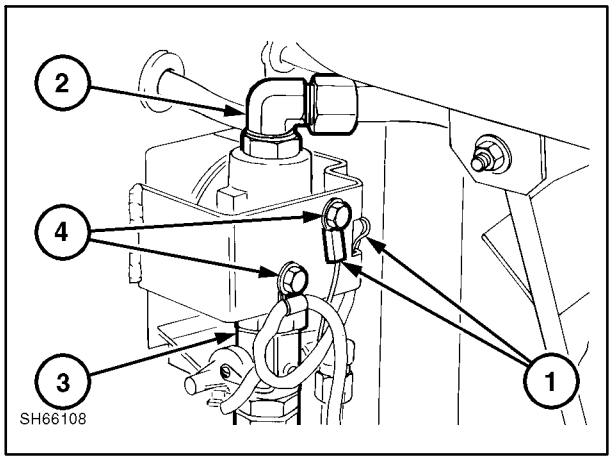


Figure 6-184

REASSEMBLY

1. Reinstall the filter base with the hardware previously removed and reconnect the ground wire, 1. Torque the mounting hardware to 20 N·m (15 ft. lbs.).
2. Reinstall the hydraulic lines, tighten the lines to seat line on fittings and loosen and retorque.
3. Reinstall the filter sensor and connect the sensor wires, 2.
4. Reinstall a new filter, coat the filter seal ring with 10W-30 oil, and tighten the filter unit until it contacts the base, and then tighten another half to three-quarter turn.

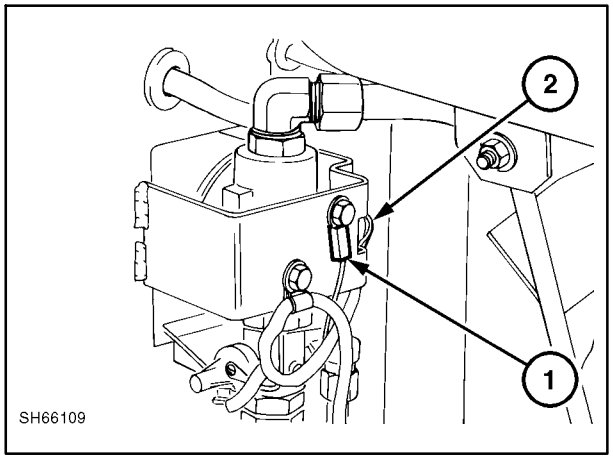


Figure 6-185

OIL COOLER

The hydraulic oil cooler is located to the inside of the radiator next to the engine cooling fan.

To access the cooler for cleaning, move the radiator to the rear by lifting up on the two handles, 1, to gain clearance between the radiator and cooler at 2.

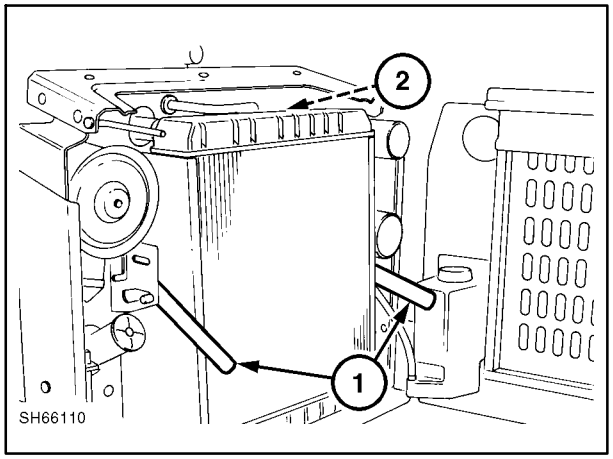


Figure 6-186

OIL COOLER REMOVAL

1. Drain the engine cooling system.
2. Unhook the inlet line to the reservoir and cap to prevent loss of oil.
3. Unhook the return (outlet) line and cap to prevent loss of oil.
4. Remove the radiator to engine hoses.
5. Remove the filter sender wires.
6. Remove the radiator overflow hose, 1, to the overflow tank.
7. Remove the eight bolts from the support at 2, four bolts each side, and lift the radiator and cooler assembly from the loader frame.

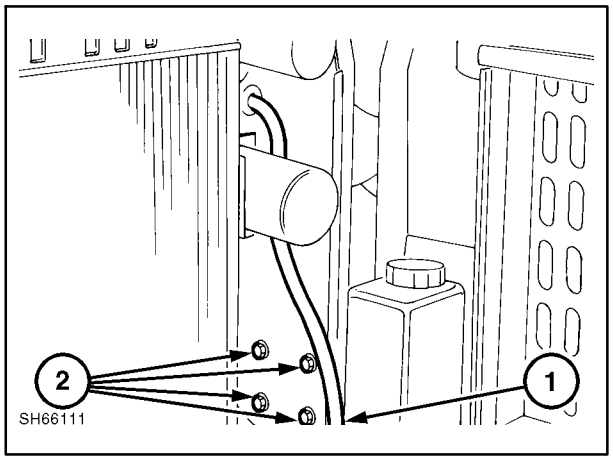


Figure 6-187

8. Remove the fan shroud retaining hardware, 1, to access the oil cooler.
9. Remove the oil cooler, 2, retaining hardware to separate the cooler from the radiator.

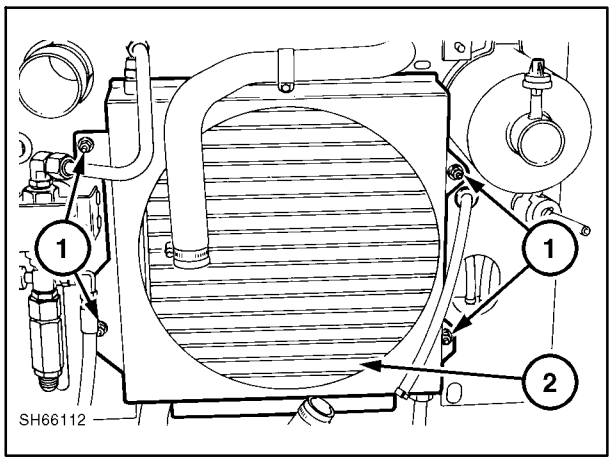


Figure 6-188

REASSEMBLY

1. Reattach the oil cooler to the support with the previously removed hardware.
2. Reinstall the support with the oil cooler and radiator attached into the frame.
3. Position the support square with the loader frame at 1, and install retaining hardware and tighten securely.
4. Reconnect the hydraulic lines to the cooler. Tighten the lines to seat to fittings, then loosen lines and retorque.
5. Reconnect the radiator lines and refill cooling system with 50/50 water-antifreeze mixture.
6. Reconnect the filter hydraulic lines. Tighten the lines to seat to fittings, then loosen lines and retorque.
7. Reconnect the filter sensor wires.
8. Check hydraulic oil level and add 10W-30 oil if required.
9. Start the unit, operate the hydraulic system, check for oil leaks and coolant leaks, and repair as required.
10. Check the oil level and engine coolant level and add as required.

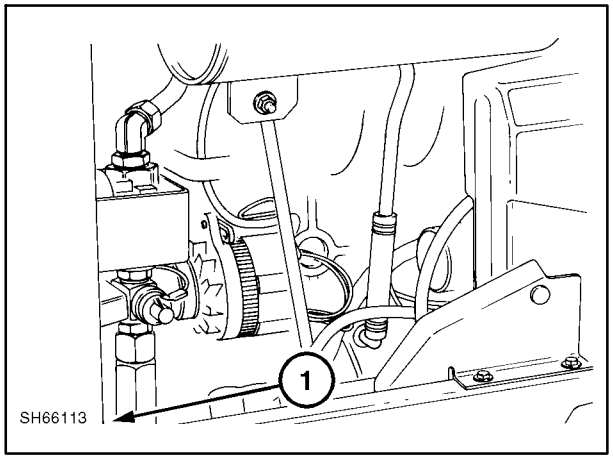


Figure 6-189

OIL RESERVOIR

The hydraulic oil reservoir fill is accessed through the top engine shield. The fill cap assembly is the hydraulic system breather and is equipped with a screen to help prevent contamination into the system.

To clean the breather cap, 1, remove the cap from the reservoir and back flush the cap assembly with a clean solvent. Blow dry with low- pressure air.

To clean the fill screen, remove the six screws and washers, 2, and lift the screen assembly from the reservoir neck.

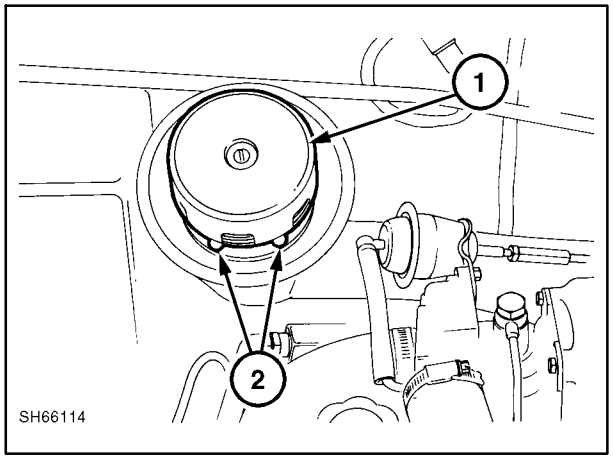


Figure 6-190

Back flush the screen, 1, with a clean solvent and blow dry with low-pressure air.

Reinstall the screen assembly making sure the screen is sealed between the screen and reservoir neck with gaskets, 2. Use a silicone sealer with gaskets to seal between the screen and reservoir is recommended.

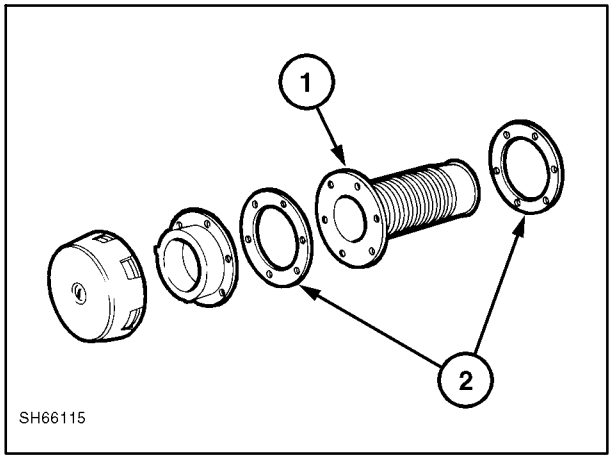


Figure 6-191

The hydraulic reservoir is equipped with a temperature sender, 1, which allows the EIC (Electronic Instrument Cluster) to monitor the hydraulic oil temperature and signal the operator of an oil overheat condition.

IMPORTANT: Do not over tighten the sender or damage to the reservoir may occur.

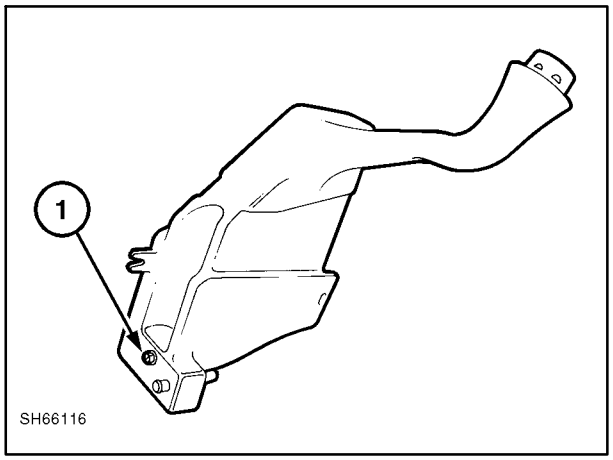


Figure 6-192

OIL RESERVOIR REMOVAL

To access the reservoir, open the rear door and remove the right engine side shield.

To remove the reservoir from the loader, the cab and boom must be tilted forward. Refer to “Section 1” For the cab tilting procedure.

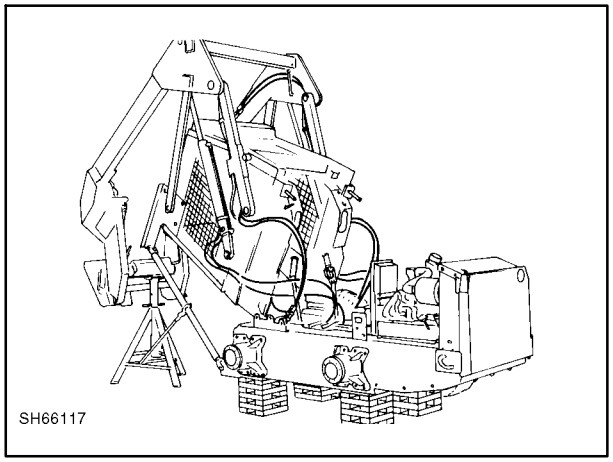


Figure 6-193

With the cab tilted forward:

1. Drain the reservoir by lowering the engine belly pan, removing the return line from the charge check valve and rotating the line into a container. Allow the oil to drain.
2. Remove the hydraulic oil temperature sender wires, 1.
3. Remove the suction and return lines, 2, from the reservoir.
4. Remove the front and rear mounting hardware, 3.
5. Lift the reservoir from the loader.

   NOTE: If the reservoir tank should leak due to a hole or crack, DO NOT repair. Replace the tank, as the type of material used in the molded tank is not reliably fixed.

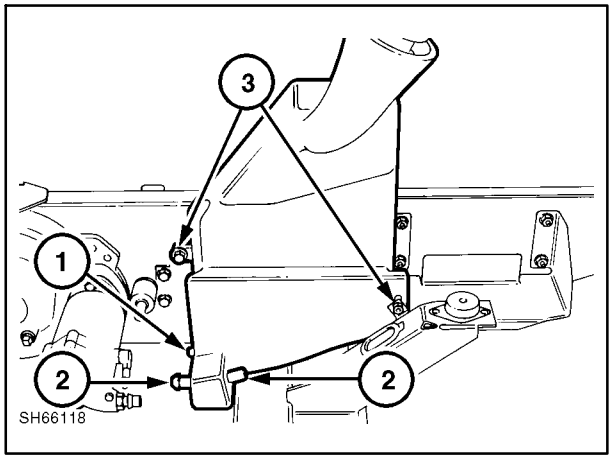


Figure 6-194

REASSEMBLY

1. Reinstall the reservoir into the loader frame, position and reinstall the tank retaining hardware.
2. Reattach the suction and return lines and tighten the hose clamps securely.
3. Refill the reservoir with 10W-30 oil and operate the hydraulic system to remove all air from the system. Check for oil leaks, repair as required.
4. Check the oil level, fill as required.
5. Reinstall the engine belly pan.
6. Tilt the cab and boom back into operating position.
7. Reinstall all shields previously removed.

AUXILIARY HYDRAULICS

Flat-faced quick couplers are now used on all current production skid-steer loaders that are equipped with boom hydraulics or Hi-Flow hydraulics. Use the following information to convert the couplers, 1, currently installed on the loader. Please refer to the correct section to adapt the couplers (shown here with caps).

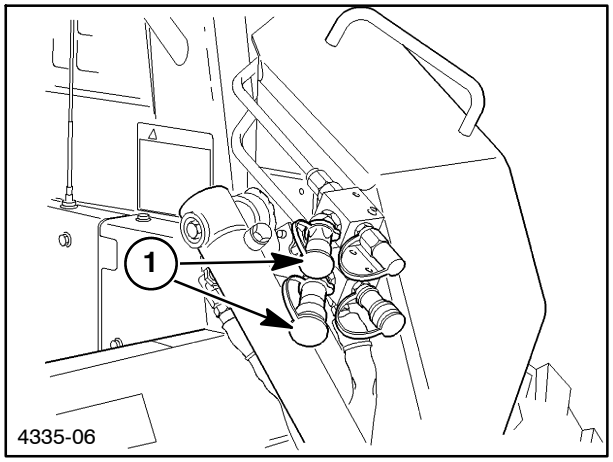


Figure 6-195

Flat-faced couplers offer several advantages over pin-type and ball-type couplers, including:

1. Flat-faced couplers are less likely to leak.
2. The flat-face design has less surface area for dirt contamination and is easily cleaned.
3. Within a given size, flat-faced couplers have a higher rate of flow and less pressure drop than pin-style or ball-style couplers.
4. Flat-faced couplers are easier to connect and disconnect under pressure than pin-type and ball-type couplers.

Additionally, flat-faced quick couplers will be included in new dealer-installed kits as follows:

New Kit#	Old Kit#	Description	Models
9864103	9862330	Boom hydraulic kit	L565
9864100	9828030	Hi-Flow hydraulic kit	L565, Lx565, Lx665

PARTS (Factory-Installed Flat-Faced Couplers)

All models use these parts:

#Used	Part Number	Description	Item#
2	86513098	Bulk head union 45E-10/37°	1
2	86537648	Ferrule O ring connector	2
1	86537658	1/2″ SAE 12 O ring-type male coupler	3
1	86537659	1/2″ SAE 12 O ring-type female coupler	4

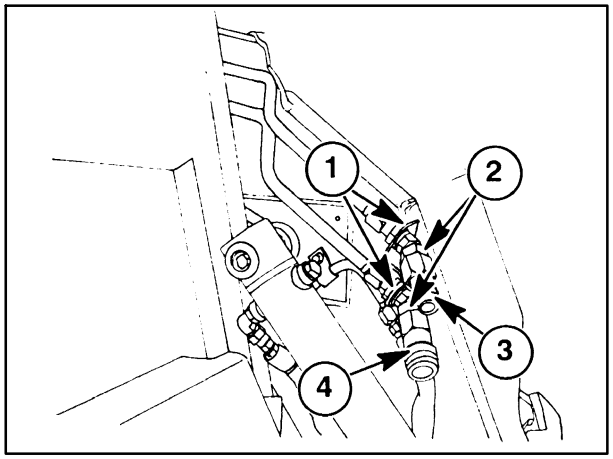


Figure 6-196

These parts will be included in the boom hydraulic kits listed above.

O RING-TYPE COUPLER INSTALLATION ON OLDER LOADERS ORIGINALLY EQUIPPED WITH BALL/PIN-TYPE COUPLERS

Weld-on coupler support, 1, Figure 6-197, will be replaced in the future by bolt-on support, 1, Figure 6-198.

Currently, bolt-on supports are only used with the Hi-Flow Kit installation.

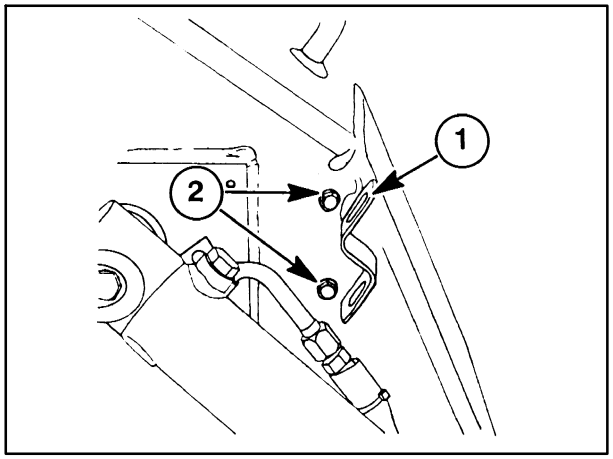


Figure 6-197

PARTS FOR ADDING O RING-TYPE COUPLERS TO OLDER LOADERS

All models use these parts:

#Used	Part Number	Description	Item#
1	86538175	Bracket	1
2	280483	5/16″ × 1″ HH cap screw	
2	322358	M8 lock washer	
2	86513098	Bulkhead union, 45E-10/37°	2
2	86537648	Female O ring connector	3
1	86537658	1/2″ SAE 12 O ring-type male coupler	4
1	86537659	1/2″ SAE 12 O ring-type female coupler	5

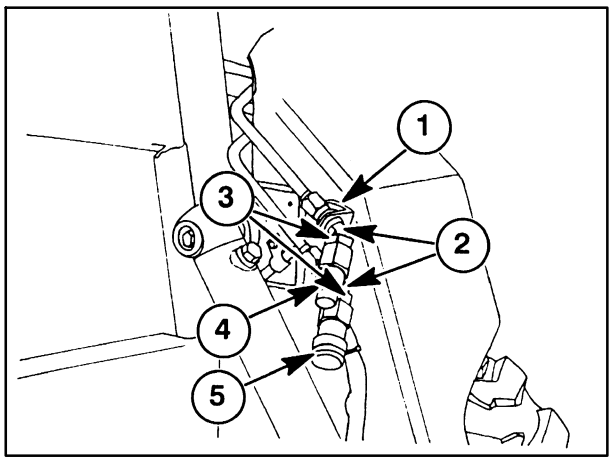


Figure 6-198

PIPE THREAD-TYPE COUPLER INSTALLATION ON OLDER LOADERS ORIGINALLY EQUIPPED WITH BALL/PIN-TYPE COUPLERS

Remove original couplers, 1 and 2. Use Teflon tape or pipe sealant on threads and install couplers.

All models use these parts:

#Used	Part Number	Description	Item#
1	86537660	1/2″ pipe thread-type male coupler	1
1	86537647	1/2″ pipe thread-type female coupler	2

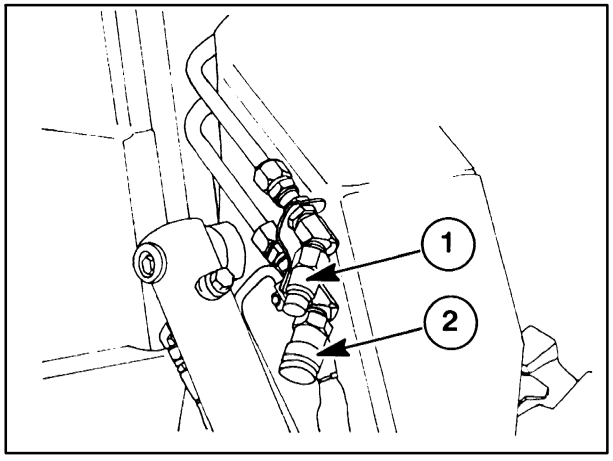


Figure 6-199

ADAPTING ATTACHMENTS WITH PREVIOUS-STYLE NH-SUPPLIED BALL/PIN COUPLERS TO FLAT-FACED COUPLERS

If the attachment to be used has the 1/2″ ball/pin-type couplers, adaptors, 1 and 2, can be used to attach to the loader flat-faced couplers.

Part Number	Description	Item#
86539404	1/2″ male flat-faced/ 1/2″ female ball/pin-type	1
86539403	1/2″ female flat-faced/ 1/2″ male ball/pin-type	2

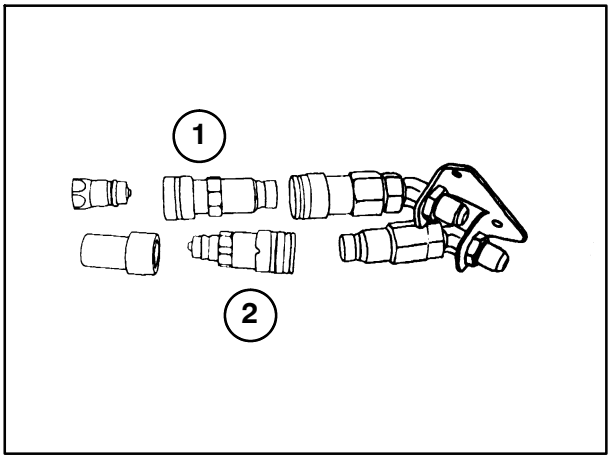


Figure 6-200

NOTE: These adaptors are useful for occasionally adapting attachments; however, they significantly lengthen the coupler assembly and make assembly more likely to be damaged in usage. It is preferred for heavy attachment usage to convert the attachment quick couplers or loader quick couplers to the flat-faced style.

HI-FLOW HYDRAULIC KITS

The Hi-Flow hydraulic factory-installed kits, as well as dealer-installed kits, will no longer use the union blocks.

Flat-faced coupler installation includes:

All models use these parts:

#Used	Part Number	Description	Item#
2	86513100	Bulkhead tee	1
4	86537649	Female O ring connector	2
1	86537647	1/2″ SAE 12 O ring-type male coupler	3
1	86537600	1/2″ SAE 12 O ring-type female coupler	4
1	86537746	3/4″ SAE 12 O ring-type male coupler	5
1	86537745	3/4″ SAE 12 O ring-type female coupler	6
1	86537654	Bracket	7
2	9635884	5/16″ × 1″ HH cap screw	
2	322358	M8 lock washer	
2	219605	45° elbow	8
1	85999239	3/8″ SAE 6 O ring male case drain coupler (not shown-not supplied in kits, attachment side)	
1	85999238	3/8″ SAE 6 O ring female case drain coupler	

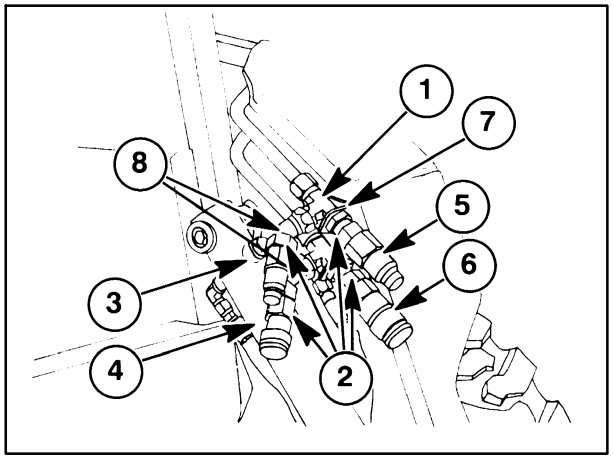


Figure 6-201

SEAL KITS/DUST CAPS

Seal kits are available for coupler seal repair. A special tool must be used to disassemble the couplers. It is recommended each dealer have this tool for coupler repair. Also, dust caps are available for the 1/2″ couplers only.

Part Number	Description
86539430	1/2″ male coupler seal kit
86539431	1/2″ female coupler seal kit
86539432	Coupler repair tool
86539389	1/2″ male coupler dust cap
86539390	1/2″ female coupler dust cap

LABOR GUIDE

HYDRAULIC SYSTEM

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job	Hours
Remove and replace control valve	1.50 hr.
Repair control valve	1.0 hr.
Remove and replace gear pump	1.0 hr.
Repair gear pump	0.5 hr.
Remove and replace one boom cylinder	0.5 hr.
Repair one boom cylinder	1.0 hr.
Remove and replace one bucket cylinder	0.5 hr.
Repair one bucket cylinder	0.5 hr.
Remove and replace oil filter	0.5 hr.
Remove and replace filter and base	1.0 hr.
Remove and replace oil cooler	3.0 hrs.
Remove and replace hydraulic reservoir	2.5 hrs.

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SECTION 7

SEAT, CAB, ROPS, BOOM LOCK, BOOM, ATTACHMENT MOUNTING PLATE

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GENERAL INFORMATION

SEAT AND SEAT PAN SUPPORT

Incorporated in the seat and seat belt buckle are switches that tie the seat and seat belt into the EIC (Electronic Instrument Cluster) Advanced Warning System. When the seat belt is unbuckled and/or the operator is out of the operator's seat, the boom and bucket control valve spools will be locked in the neutral position. The operator will have to properly sequence the system to unlock the controls, sit in the seat and buckle the seat belt.

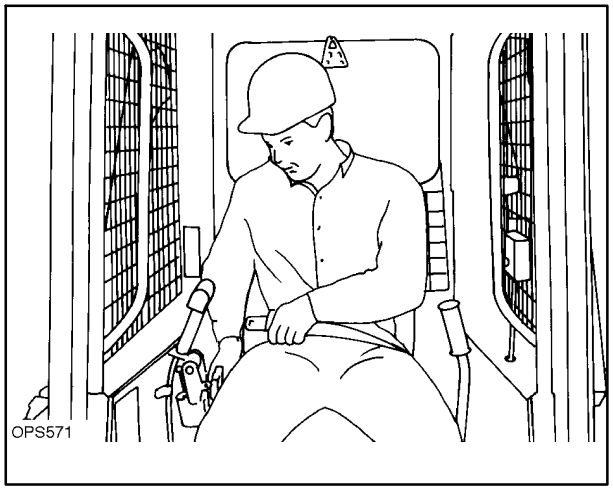

Figure 7-1

The seat and seat pan support can be locked up in the raised position as shown at 1.

CAUTION: DO NOT WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

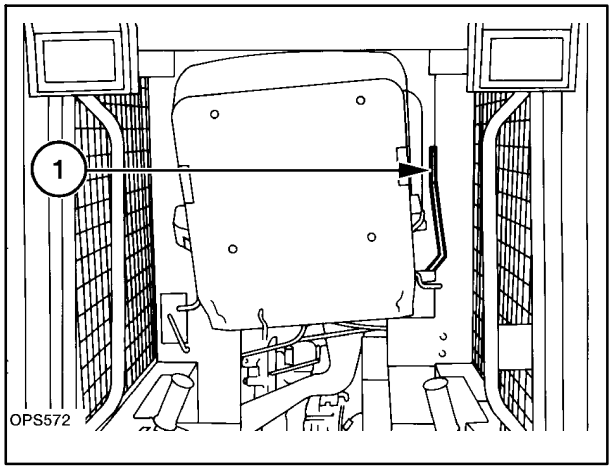

Figure 7-2

The seat/pan support assembly support rod, 1, is shown in the raised latched position at 2.

To lower the seat assembly, raise the seat upward to the top of the cab and pull the support rod, 1, forward to unlatch and lower the seat assembly.

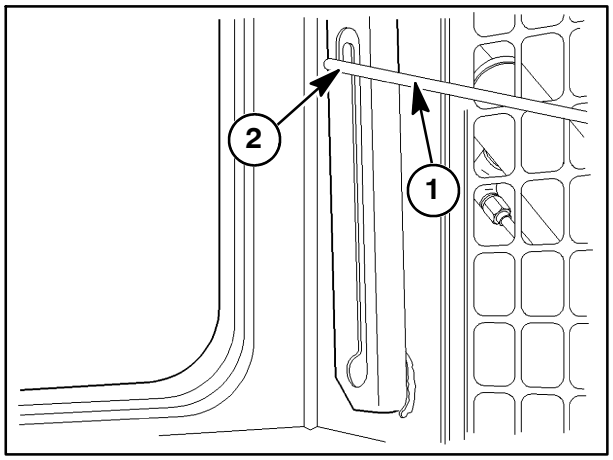

Figure 7-3

When the operator's seat is returned to the operating position, make sure it is securely latched at 1.

CAUTION: DO NOT OPERATE THE SKID-STEER LOADER UNLESS THE OPERATOR'S SEAT IS SECURELY LATCHED IN THE OPERATING POSITION.

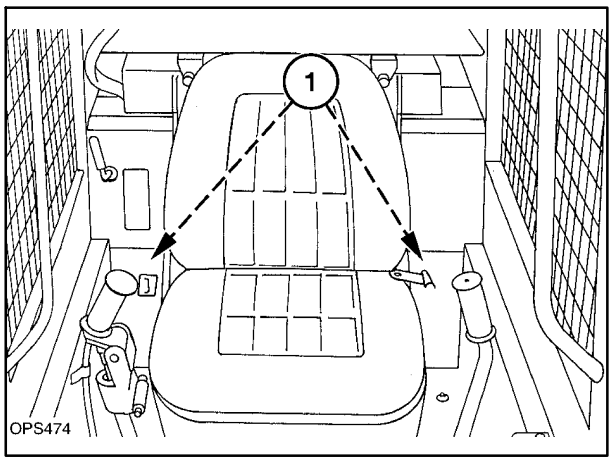

Figure 7-4

CAB INNER SHELL

The operator's seat and inner shell assembly (shown removed) are isolated on rubber mounts located at 1, one each side at front and at 2, one each side at rear.

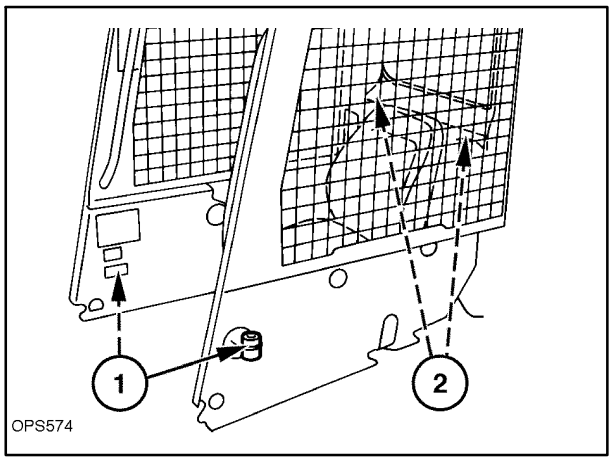

Figure 7-5

ROPS

The ROPS is a welded frame structure to provide rollover protection for the operator and pivot point locations for the boom assembly.

Shown here is the loader and ROPS with the inner shell removed.

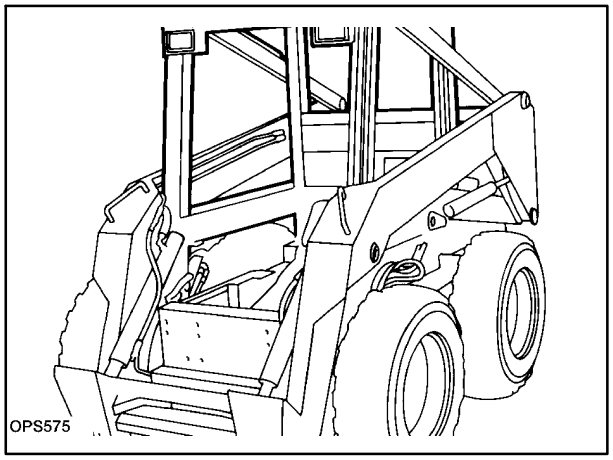

Figure 7-6

BOOM LOCK PIN LINKAGE

The operator can engage the boom lock pins from the operator's seat. The control is located to the right rear of the operator's seat at 1. Pivoting the handle towards the outside of the cab extends and engages the lock pins. Pivoting the handle in will retract the lock pins.

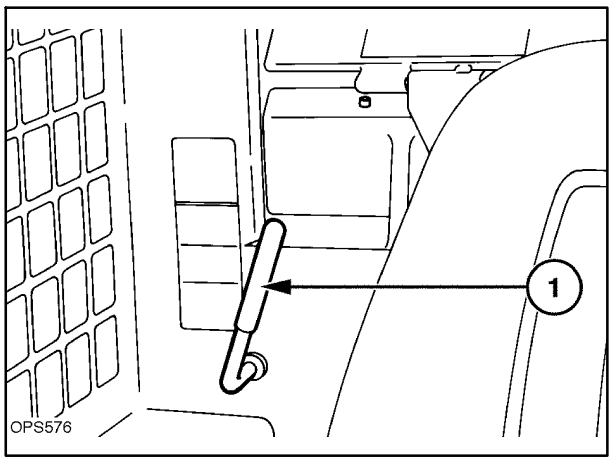

Figure 7-7

To engage the boom lock pins:

1. Raise the boom above the boom lock pins and engage the pins.
2. Turn the ignition key to the "OFF" position to stop the engine.
3. Turn the ignition key to the "ON" position and operate the boom and bucket hydraulic controls to lower the boom until it rests on the lock pins, 1, and relieves pressure in the boom and bucket hydraulic circuits.
4. Turn the ignition key to the "OFF" position.

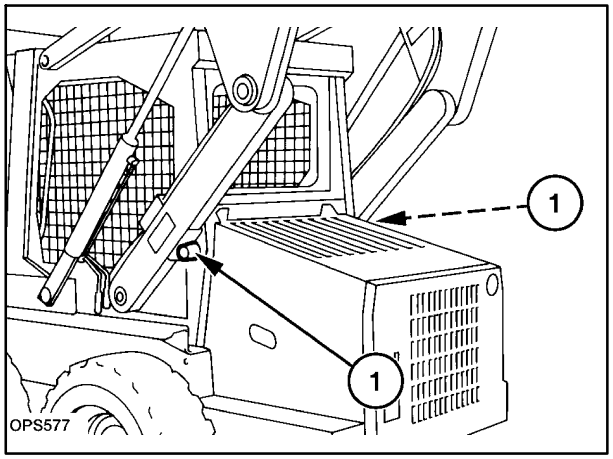

Figure 7-8

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS THE BOOM IS RESTING ON THE BOOM LOCK PINS, 1.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT, ALWAYS REMOVE ANY ATTACHMENT FROM THE LOADER MOUNTING PLATE.

BOOM

The boom assembly consists of:

1 - Main boom frame

2 - Lower link, right and left

3 - Upper link, right and left

The boom and links are supported on the ROPS main frame with tapered pivot pins at all pivot locations.

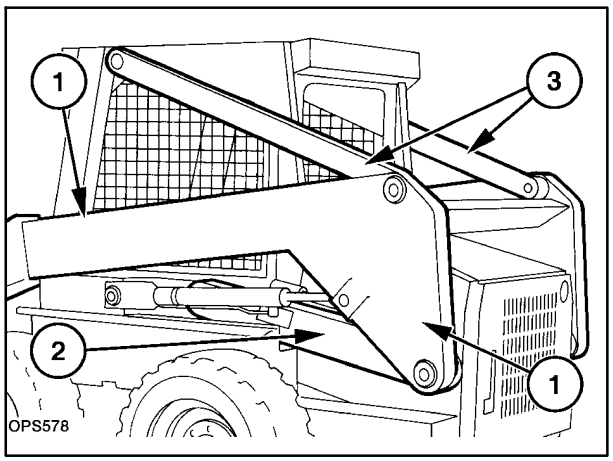

Figure 7-9

ATTACHMENT MOUNTING PLATE

The attaching plate is attached to the main boom frame with two tapered pivot pins. The attachments used on the skid-steer loader can be easily attached or removed from the loader with the over center levers and pins. The control levers and pins are spring loaded to hold the levers over center when unlatched to assist in changing attachments. When the control levers are in the latched position the spring-loaded pins are forced into the latch points on the attachment. The control levers and pins are shown in the latched position.

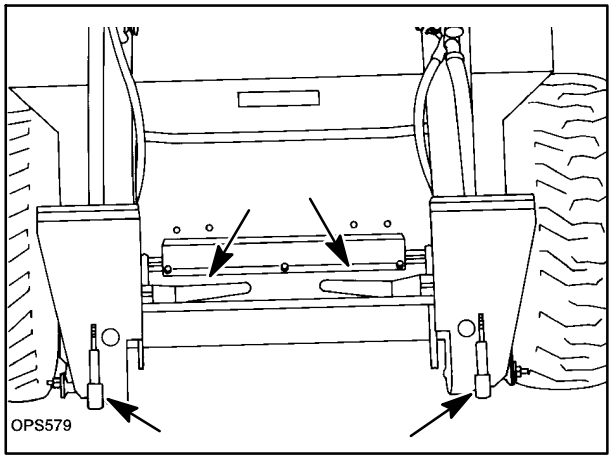

Figure 7-10

BOOM AND CYLINDER PIVOT PINS

When the boom, upper and lower boom links and cylinders are removed, the following figures and charts may be use for proper pin placement. The following charts and figures list the pivot pin, part number, location, and size for identification and locations.

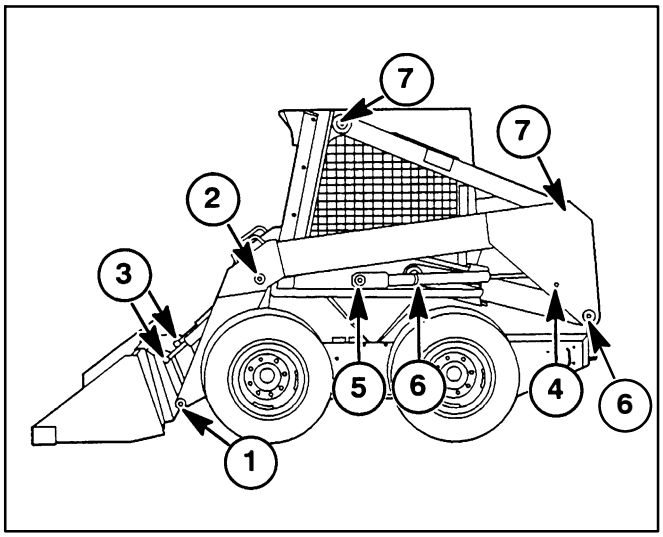

Figure 7-11

BOOM AND CYLINDER PIVOT PIN LOCATION AND MACHINE USAGE

Ref.#	Description	Qty.	Part Number	Torque
1	Mounting Plate Pivot	2	86501434	108 N·m (80 ft. lbs.)
2	Upper Bucket Cylinder Pivot	2	86501430	108 N·m (80 ft. lbs.)
3	Lower Bucket Cylinder Pivot	2	9614349	38 N·m (28 ft. lbs.)
4	Upper boom Cylinder Pivot	2	9841182	38 N·m (28 ft. lbs.)
4	Upper boom Cylinder Pivot	2	86521982*	38 N·m (28 ft. lbs.)
5	Lower boom Cylinder Pivot	2	86504316	338 N·m (250 ft. lbs.)
6	Boom Lower Link Pivot	4	86501422	338 N·m (250 ft. lbs.)
7	Boom Upper Link Pivot	4	86501420	338 N·m (250 ft. lbs.)

***NOTE: LOADERS EQUIPPED WITH HEAVIER UPPER BOOM CYLINDER PIVOT PIN BOSS AREA OR UNITS UPDATED WITH THE BOOM CYLINDER PIN PIVOT KITS.**

NOTE: After the tapered pivot pin retaining hardware is torqued, the pins must be properly seated. Using a hammer, strike the head of the bolt and pin several times to seat the tapered pin in the taper of the boom and/or ROPS. Retorque the hardware to the specified torque. Repeat this process until the torque is maintained.

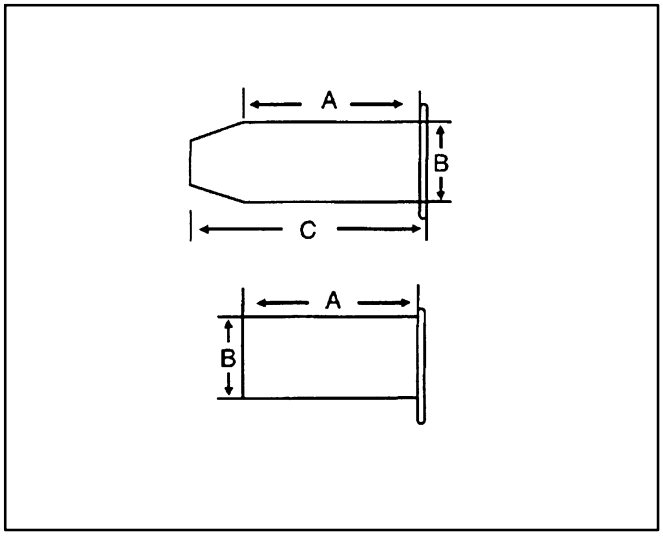

Figure 7-12

BOOM/CYLINDER PIVOT PINS SIZE

PART NUMBER	A	B	C
9614349	95 mm (3-3/4″)	38 mm (1-1/2″)	
9841182	103 mm (4-3/64″)	38 mm (1-1/2″)	
86501420	49 mm (1-15/64″)	60.3 mm (2-3/8″)	113 mm (4-29/64″)
86501422	77 mm (3-1/32″)	60.3 mm (2-3/8″)	141 mm (5-9/16″)
86501430	72.3 mm (2-7/8″)	38.10 mm (1-1/2″)	112.5 mm (4-7/16″)
86501434	57.8 mm (2-9/32″)	38.1 mm (1-1/2″)	92 mm (3-5/8″)
86504316	40.0 mm (1-5/32″)	60.3 mm (2-3/8″)	113 mm (4-7/16″)
*86521982	117 mm (4-39/64″)	38.1 mm (1-1/2″)	

***NOTE: LOADERS EQUIPPED WITH HEAVIER UPPER BOOM CYLINDER PIVOT PIN BOSS AREA OR UNITS UPDATED WITH THE BOOM CYLINDER PIN PIVOT KITS.**

SEAT

This section describes how to remove the seat and seat pan support assembly.

SEAT AND SEAT PAN SUPPORT REMOVAL

1. Disconnect the negative (-) battery cable.

   IMPORTANT: Disconnect the (-) negative ground cable. Failure to disconnect the battery may result in damage to the EIC (Electronic Instrument Cluster) monitoring system and other electrical components.

2. Disconnect the seat and seat belt wire harness connector, 1.

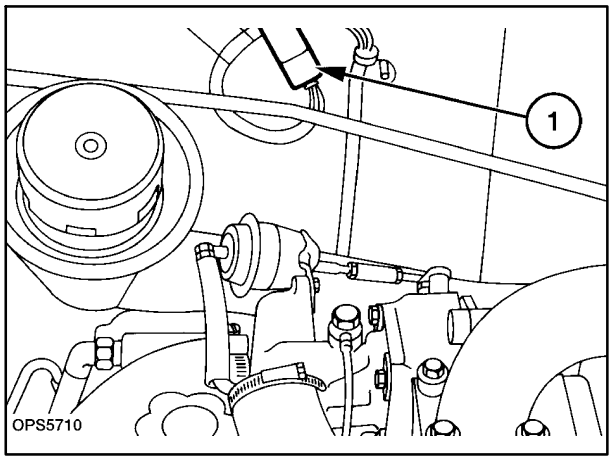

Figure 7-13

3. Remove retaining pin from latch rod at 1 and remove rod.
4. Remove the seat pan support hardware at 2.
5. Unlatch the seat pan support at 3, and lift the seat and pan support assembly from the loader.

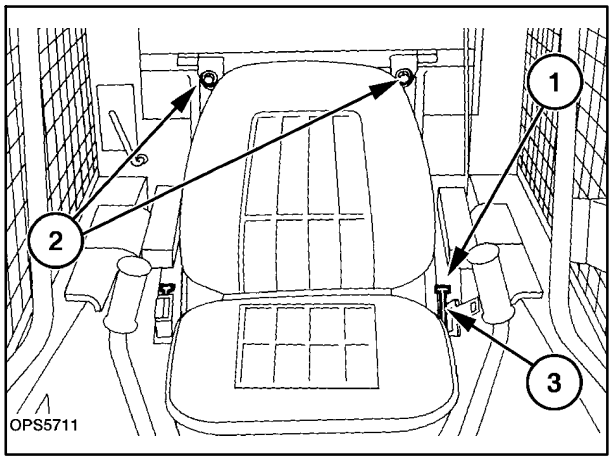

Figure 7-14

6. The right side of the seat and pan support holds the seat belt buckle, 1, wire harness, 2, and seat latch rod, 3.
7. To remove the seat belt buckle, remove the wire harness retaining clamp, 4, and buckle hardware, 5.

   NOTE: When reinstalling the seat belt buckle hardware, 5, tighten the pivot bolt tight enough to hold the belt in a set position but still allow movement of the buckle to the front or rear as required by the operator.

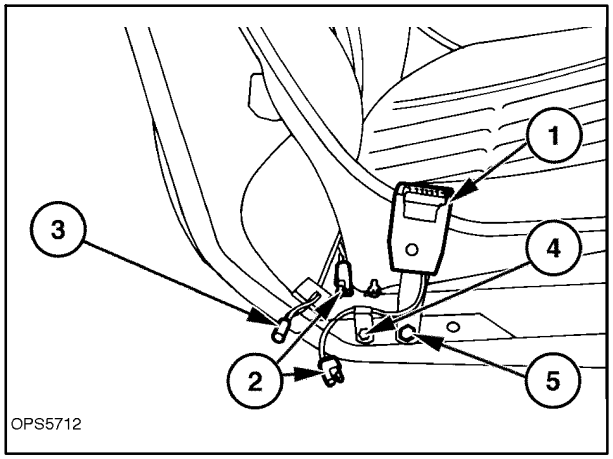

Figure 7-15

8. Remove the seat retaining hardware, 1, to separate the seat and seat track from seat pan support. Remove the wire clamp at 2, if the seat/seat belt wire harness is being replaced.
9. Holding the seat in place, unplug the seat switch(es). Disconnect the wire harness from the switch(es) by releasing the latch away from the switch.

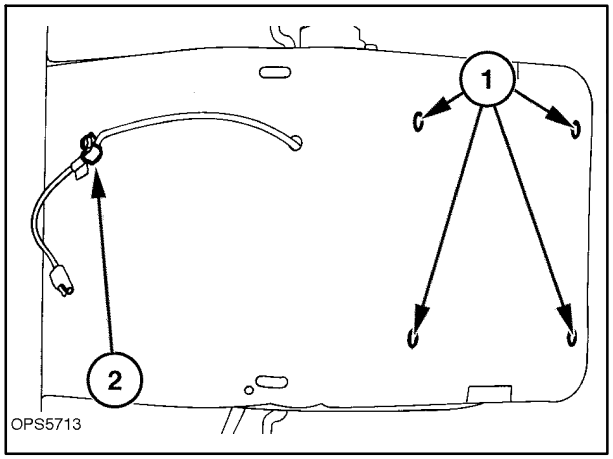

Figure 7-16

10. To remove the seat tracks from the seat assembly remove the track retaining hardware, 1.
11. Remove the switch(es) from the seat pan, 2. Note the standard seat uses one switch and the deluxe seat uses two switches as shown.

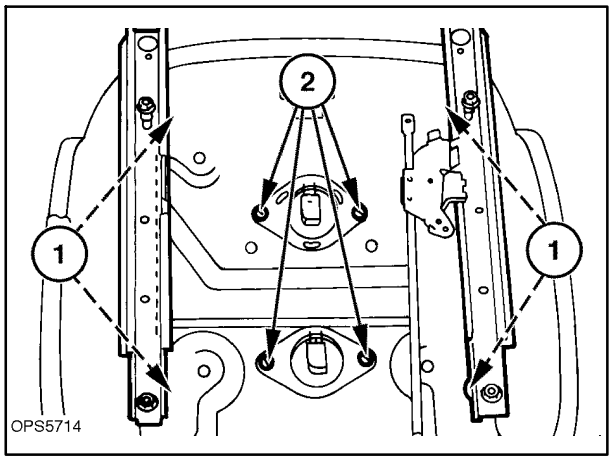

Figure 7-17

12. To remove the seat/seat belt wire harness, remove the grommet at 1, and pull the harness from the seat pan.

13. Remove the seat pan latch rod, 2, remove the retaining hardware, 3.

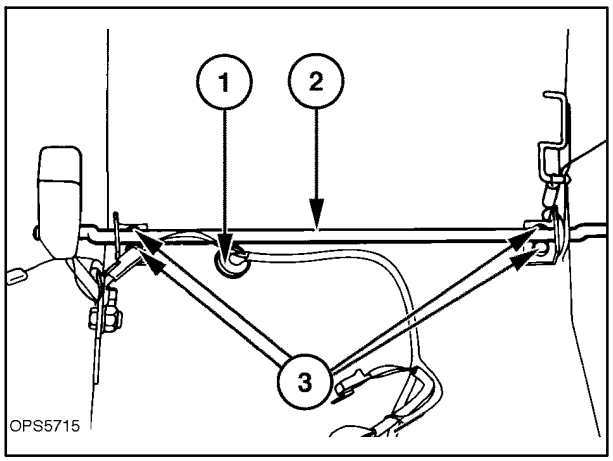

Figure 7-18

SEAT, SWITCH AND PAN INSTALLATION

1. Install the switch(es) into the seat pan, making sure the switch is seated into the hole in the seat pan, 1.

   IMPORTANT: If the switch is not seated properly when the retaining hardware is tightened, the switch flange will be broken.

2. Reconnect the wire harness to the switch(es) and reinstall the seat retaining hardware. Make sure the harness connector latches are engaged.

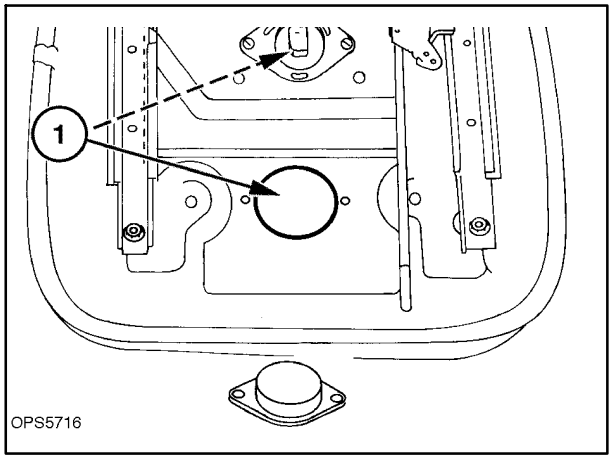

Figure 7-19

3. Reattach the seat to the seat pan support with retaining hardware at 1.

   NOTE: If the seat/seat belt wire harness was removed, reinstall the wire grommet in seat pan at 2, and wire clamp on back of seat, 3, to retain the wire harness.

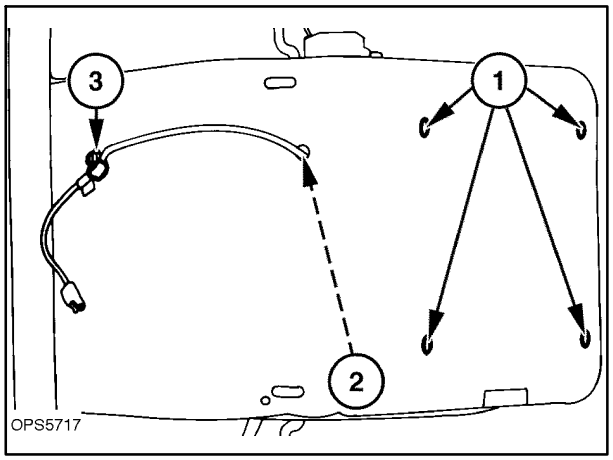

Figure 7-20

4. Reinstall the seat and seat pan support assembly into the loader and attach with hardware at 1.

   If the seat pan latch rod, 2, or latch plates, 3, were removed, they may require adjustment to ensure proper seat latching.

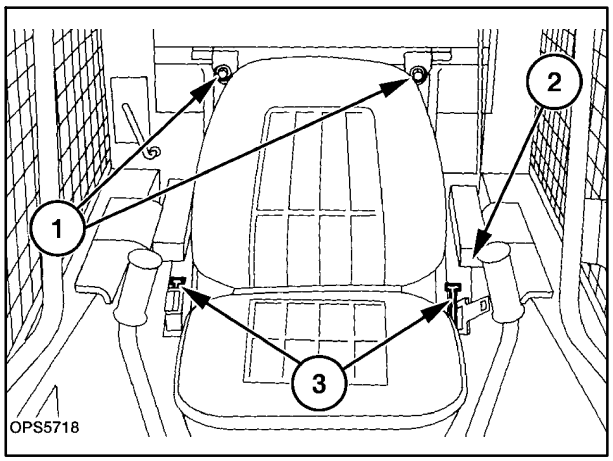

Figure 7-21

5. To adjust the latches, 1, lower the seat down to the operating position and slide the latches, 1, to obtain full engagement of latches and latch rod. After the latches are adjusted, release latch rod, raise seat and lower seat to operating position. Try lifting on the front of the seat to verify seat pan support is latched securely.

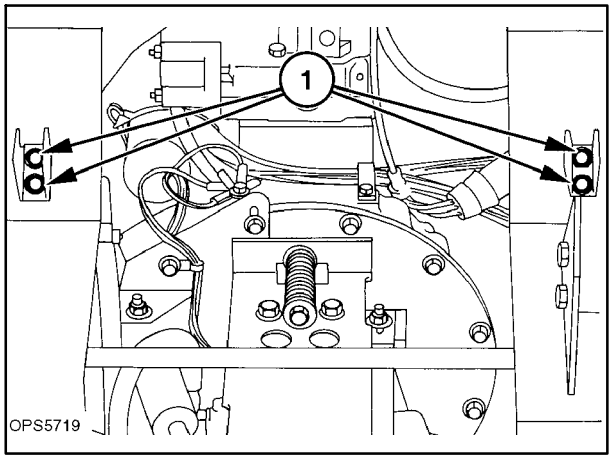

Figure 7-22

6. Reconnect the seat/seat belt wire harness connector to the main wire harness behind the seat at 1.

   NOTE: Position the seat/seat belt and main wire harness to the front of the boom lock linkage, 2, to prevent interference. If the wires are to the back side of the linkage, the wires will not stay connected when the seat is raised.

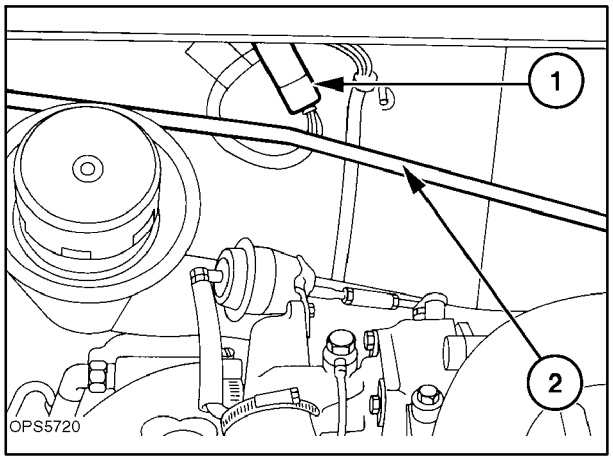

Figure 7-23

CAB INNER SHELL

This section describes how to remove and install the cab inner shell.

CAB INNER SHELL REMOVAL

1. Disconnect the negative (-) battery cable.

   IMPORTANT: Disconnect the (-) negative ground cable. Failure to disconnect the battery may result in damage to the EIC (Electronic Instrument Cluster) monitoring system and other electrical components.

2. Disconnect the seat and seat belt wire harness connector, 1.

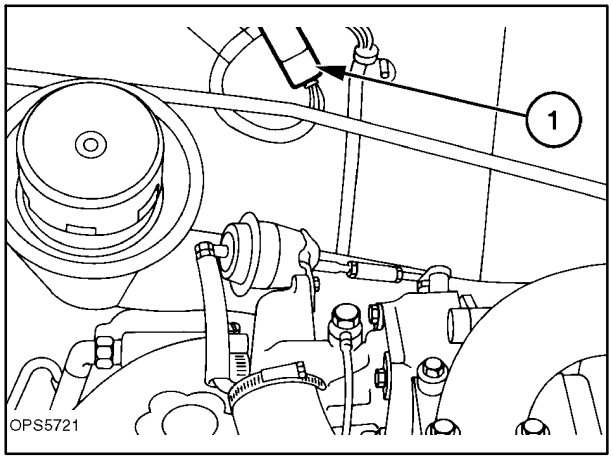

Figure 7-24

3. Remove the EIC board retaining hardware, 1, and remove the EIC board from the overhead dash area.

4. Unplug the two wire harness connectors from the EIC, taking care to not stress or bend the plastic locking ramps on the connectors.

   NOTE: Note the positioning of the connectors to the EIC board, and reconnect in the correct position during installation. If the connector is not connected properly, damage to the EIC may occur.

   IMPORTANT: Do not service the EIC board with magnetized tools, wrenches, screwdrivers, etc., or magnets. Severe damage to the EIC board may occur.

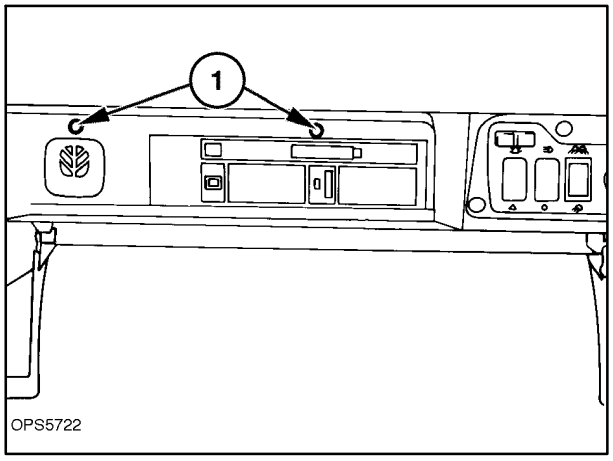

Figure 7-25

5. Remove the right and left headliner supports retaining hardware, 1, right side shown, and remove both supports and headliner.

   NOTE: The standard L___ units will not be equipped with the removable headliner.

6. Remove the fuse panel retaining hardware, 2, and lower the fuse panel.

   DO NOT remove any wires from any switches or fuse blocks.

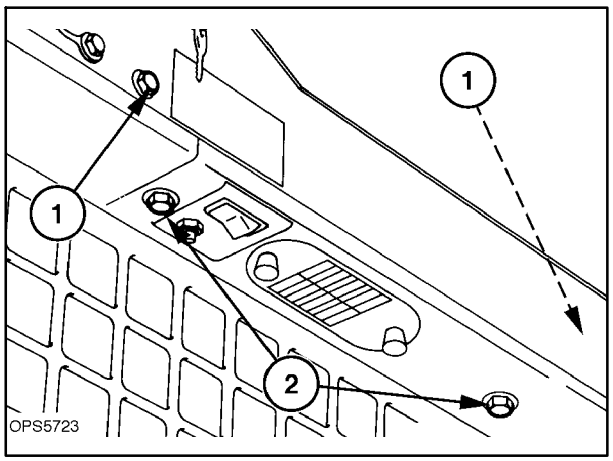

Figure 7-26

7. Remove the ignition switch panel hardware, 1, and lower the switch panel.

   DO NOT remove any wires from any switches.

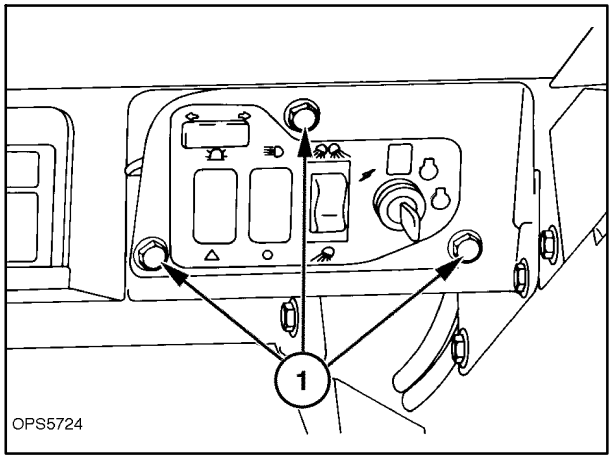

Figure 7-27

8. Remove any ground wires attached to cab ground terminal at 1.
9. Remove any wire harness ties or clamps in the upper cab area at this time. Remove the wire harness, fuse and switch panels from the right cab side sheet.
10. If the unit is equipped with front lights, the light harness and light bulbs must be removed.

    IMPORTANT: Touching the light bulb element may damage the element and cause a premature failure.

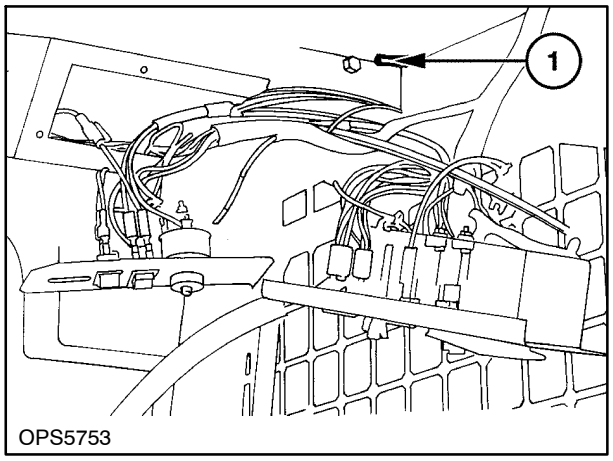

Figure 7-28

11. Remove the front light pods, 1, from the cab at 2.

    NOTE: To access the new style light pod retaining hardware, remove the light lens from the support.

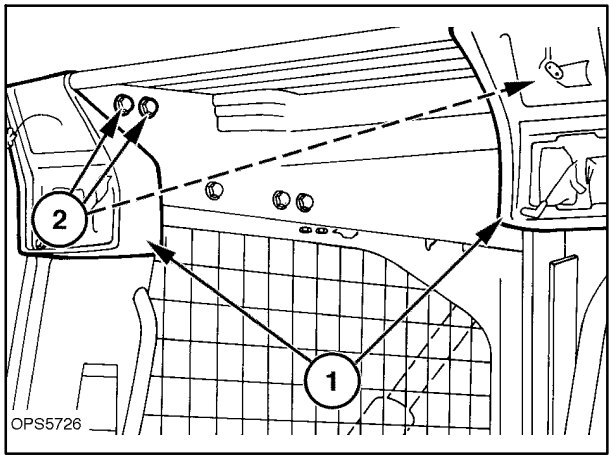

Figure 7-29

12. Remove the front cross support, 1, by removing hardware, 2, separating the cross member from the right and left side panels.

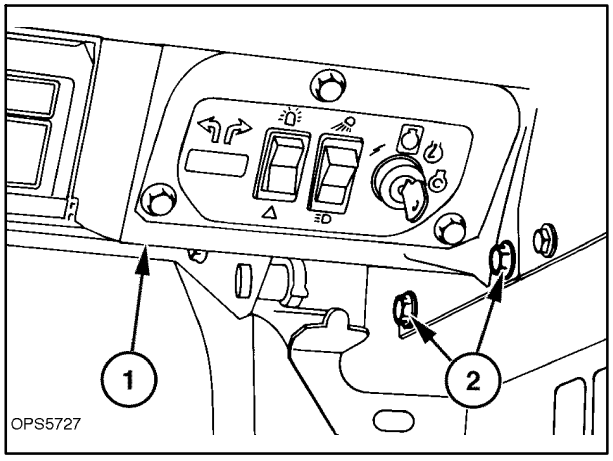

Figure 7-30

13. Remove the rear window and frame assembly retaining hardware, 1, and lift the window and frame from the loader.

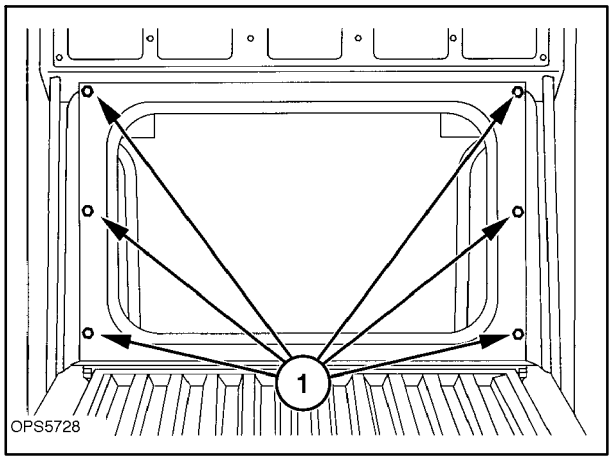

Figure 7-31

14. Remove the retaining pin from latch rod at 1, and remove the rod.

15. Disconnect the seat/seat belt wire harness from the main harness, unless previously unplugged. Remove the seat pan support hardware at 2.

16. Unlatch the seat pan support at 3, and lift the seat and pan support assembly from the loader.

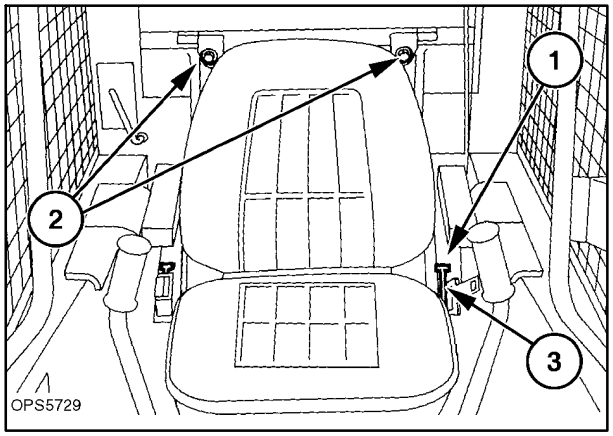

Figure 7-32

17. Remove the four retaining screws from the front shield, 1, and the eight retaining bolts from the step shield, 2. Remove both shields from the loader.

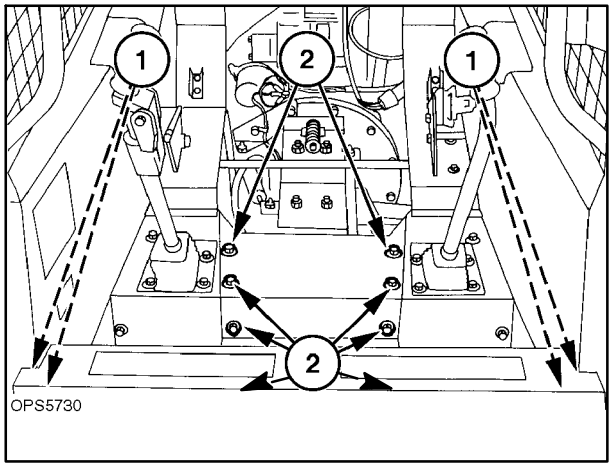

Figure 7-33

18. Remove the retaining hardware, 1, of the right and left fenders to access the front isolator mount bolts and wire harness.

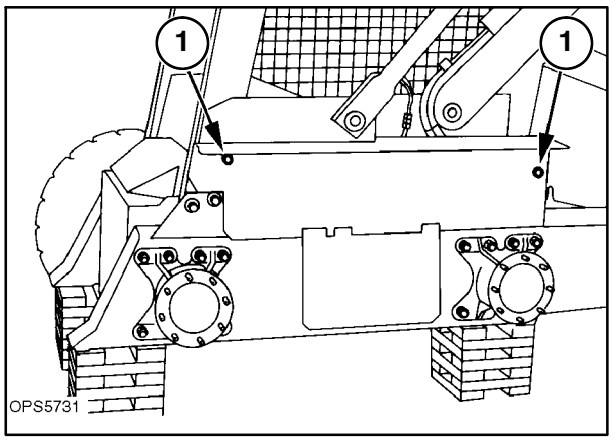

Figure 7-34

19. Remove all wire harness retaining clamps and ties, 1, from the side panels.

    Cut wire tie at keeper bar at left front to rear of cab pivot.

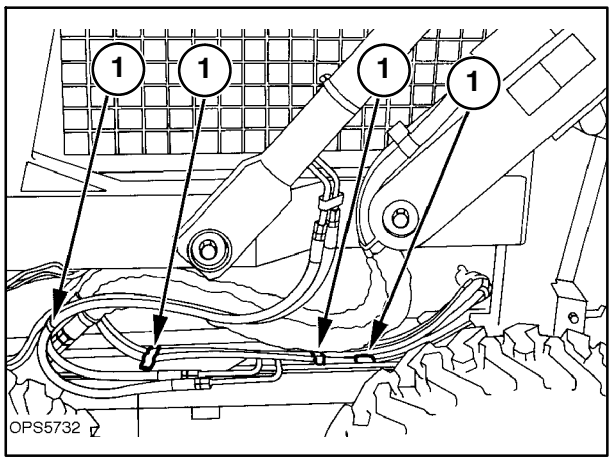

Figure 7-35

20. Remove any wire harness clamps and cut wire ties along the rear of the seat support and side panels, 1.

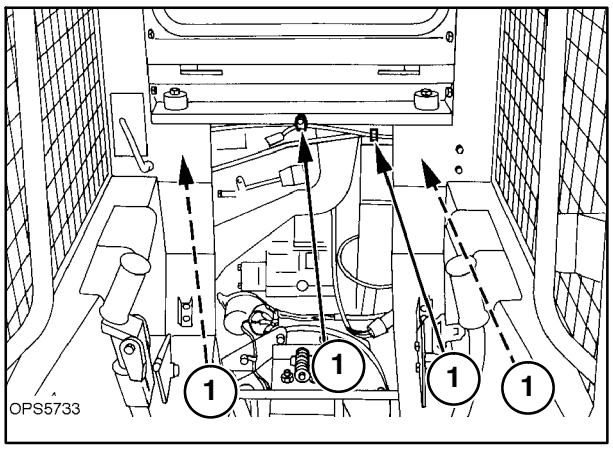

Figure 7-36

21. Remove the upper rear support retaining hardware, 1, right and left side and remove support.

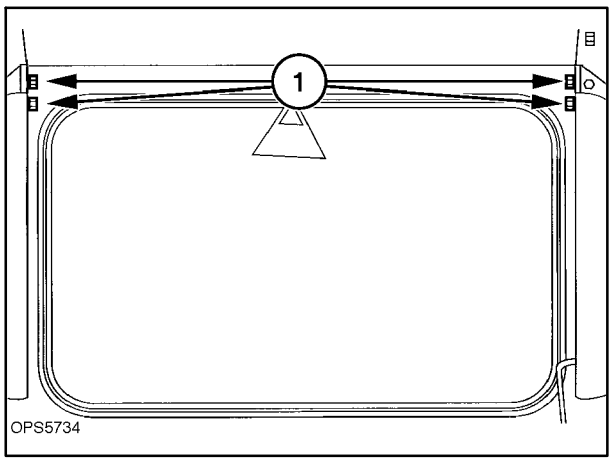

Figure 7-37

22. Remove the rear seat support, 1, hardware at 2, and the isolator mount hardware, 3.

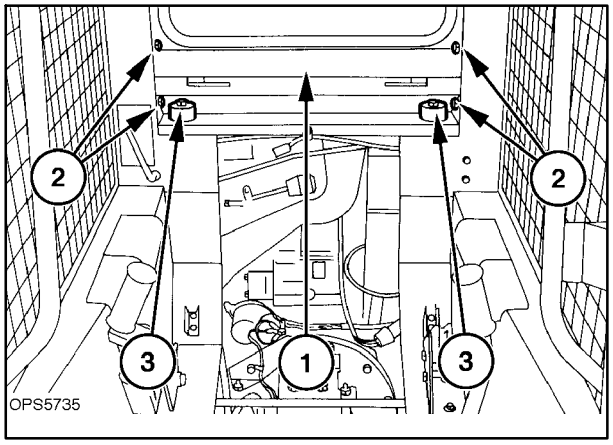

Figure 7-38

23. Remove the right and left hydrostatic control handle assembly retaining hardware, 1. Unhook the hydrostatic control linkage and auxiliary boom hydraulic linkage (if equipped). Unplug any electrical connections, and lift the control assemblies from the loader.

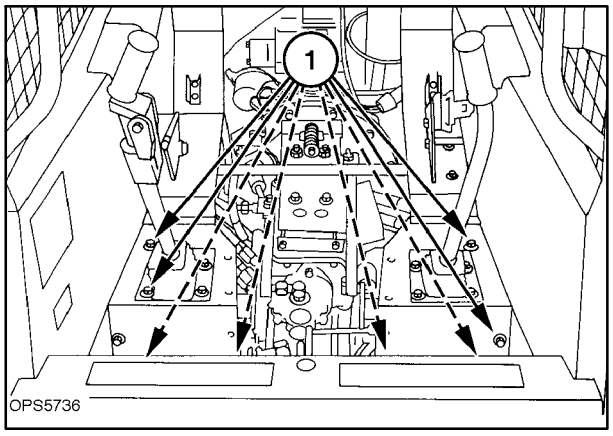

Figure 7-39

24. Remove the left and right side shield isolator and hardware at 1 (right side shown).

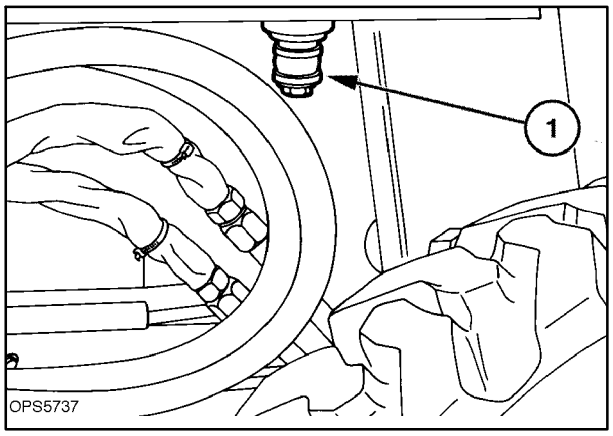

Figure 7-40

25. Lift the wire harness, 1, with the switch and fuse panels from the right side shield. Remove any remaining wire ties or clamps from the wire harness and right side shield, if not previously removed.

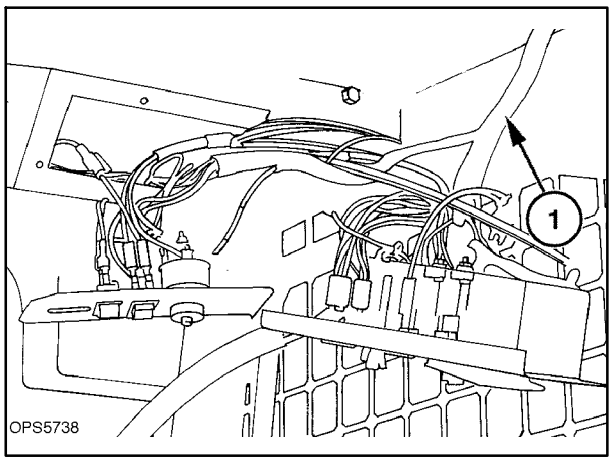

Figure 7-41

26. Remove the throttle control cable, 1, from the control lever at 2. Remove the cable retaining nut, 3, and slide the cable down through the right side shield at 4.

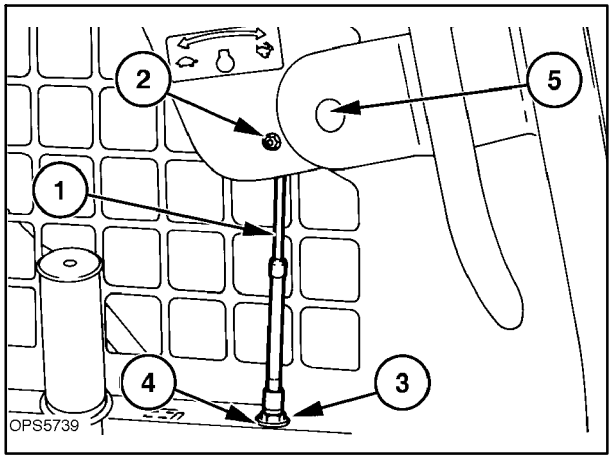

Figure 7-42

27. Remove the cotter pins from the parking brake control link spring at 1. Unhook the spring link from the control rod, 2.
28. Remove the control rod support hardware.
29. Remove the control lever hardware.
30. Rotate the control rod down to remove link from the side shield, and slide the rod from the support.

Now the side shields can be removed from the loader ROPS frame.

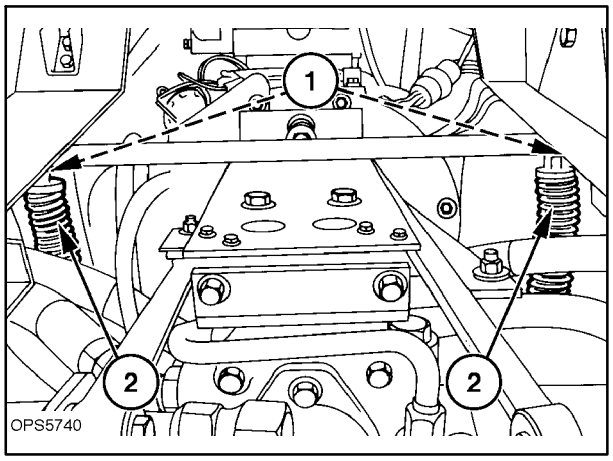

Figure 7-43

Cab inner shell removed from the loader ROPS.

1. Right side shield
2. Left side shield
3. Headliner supports
4. Upper rear support
5. Lower seat support
6. Front support (dash) not shown

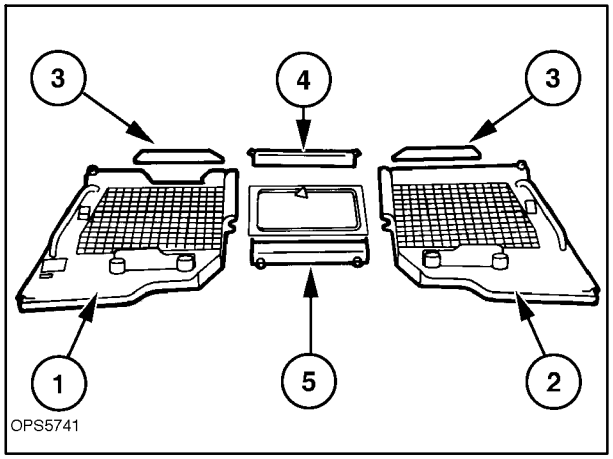

Figure 7-44

The loader ROPS with the seat and inner shell removed.

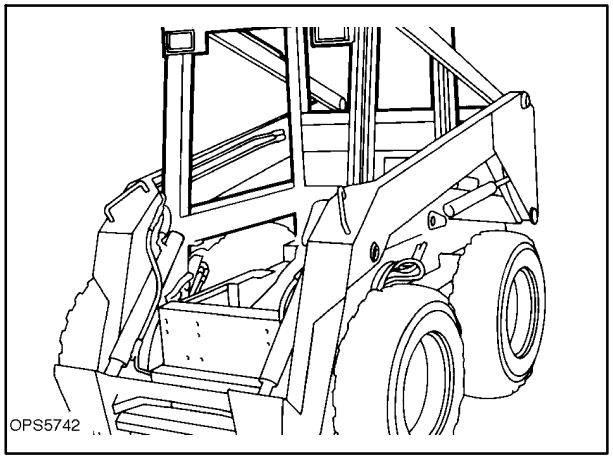

Figure 7-45

CAB INNER SHELL INSTALLATION

1. Position the right and left side shields inside the loader frame.
2. Install the front side isolators and retaining hardware, 1. Do not tighten at this time.

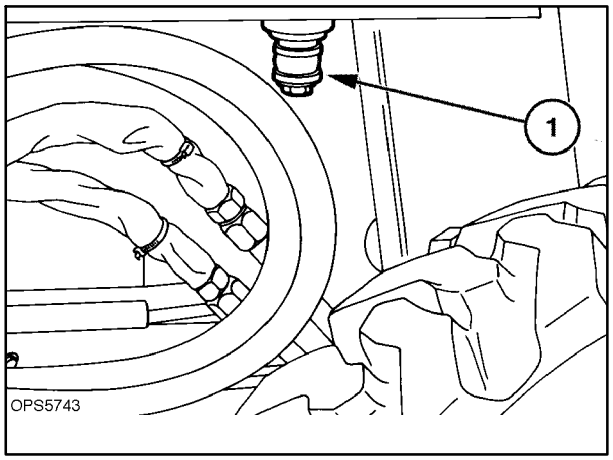

Figure 7-46

3. Lay the main cab wire harness along the inside of the right side shield, 1, at the top and right rear corner.

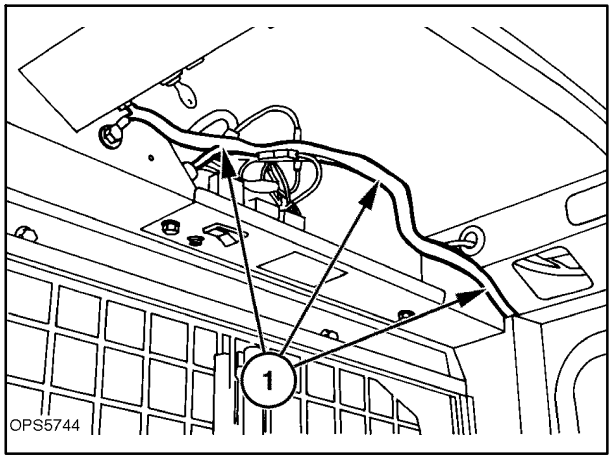

Figure 7-47

4. Position the side shields and install the rear lower support hardware, 1, isolators and retaining hardware, 2. Do not tighten at this time.

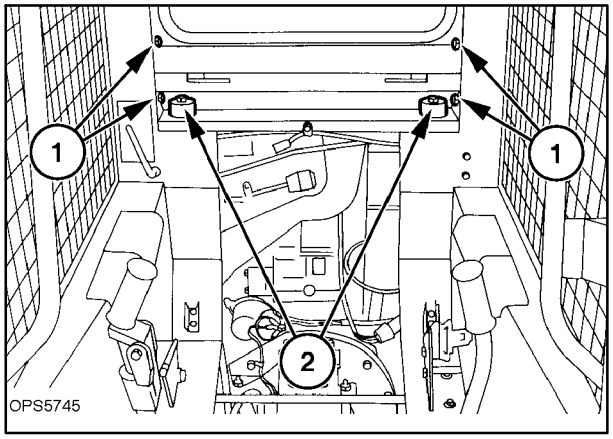

Figure 7-48

5. Install the upper rear support, 1, and hardware, 2. Do not tighten at this time.

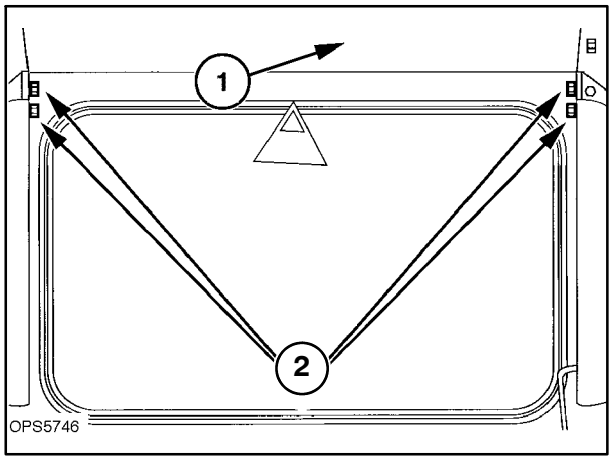

Figure 7-49

6. Install the front cross member, 1, and retaining hardware. Do not tighten at this time.
7. Position the inner shell assembly squarely with the ROPS frame. Make sure the wire harness, 2, is positioned to prevent damage to the harness when the inner shell isolators and support hardware are tightened.
8. Tighten the front support hardware.

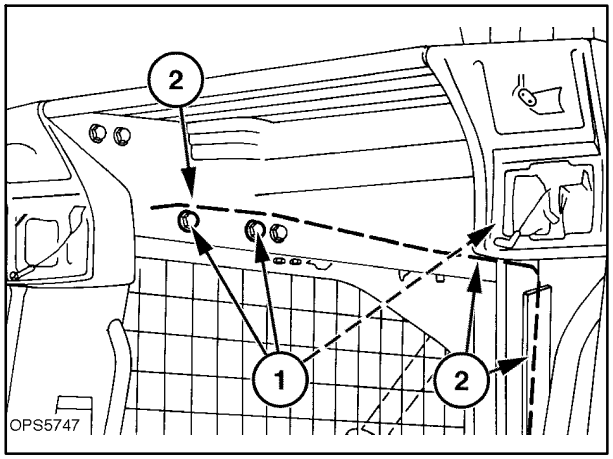

Figure 7-50

9. Tighten the hardware, 1, for the upper rear support, 2.

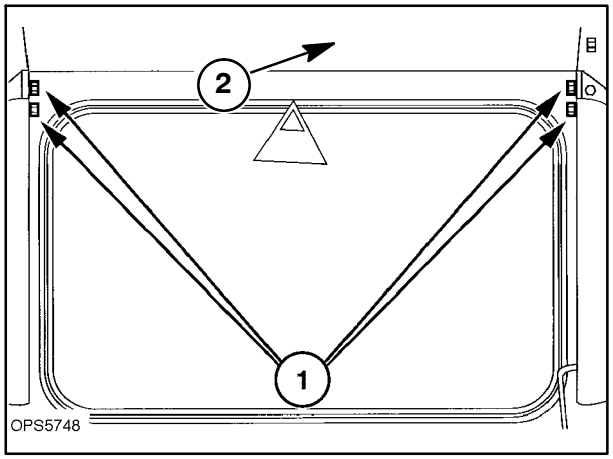

Figure 7-51

10. With the inner shell positioned and cross supports securely tightened, tighten the front, 2, and rear, 3, isolator support hardware at this time.

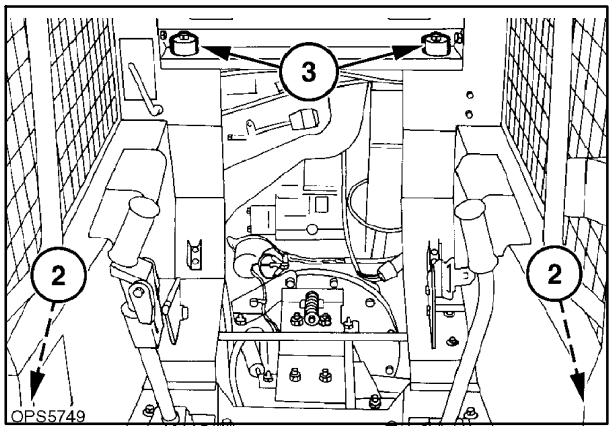

Figure 7-52

11. Reinstall all wire harness retaining clamps and plastic ties to secure the harness, 1, in the upper right rear corner of the operator's cab.

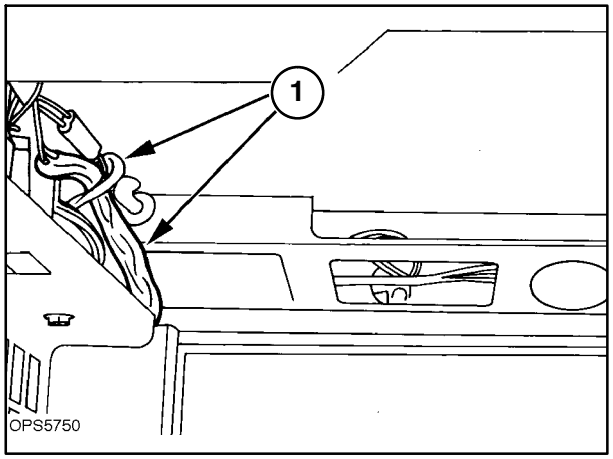

Figure 7-53

12. Reinstall the wire harness clamps and ties along the rear of the operator's seat. Make sure the harness is positioned to the inside of the boom lock linkage at 2 to prevent interference.

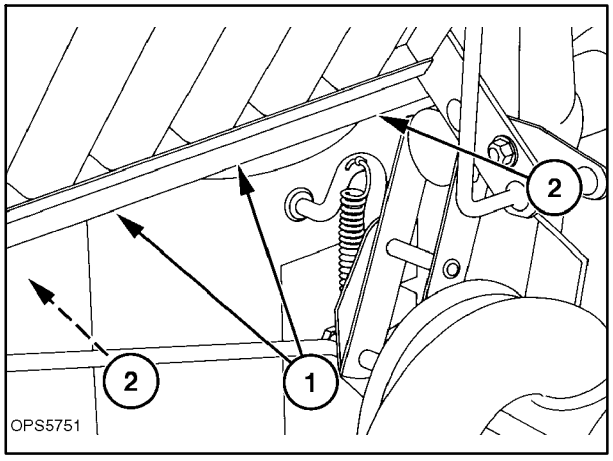

Figure 7-54

13. Reinstall the wire harness clamps and ties along the left side of the operator's cab at 1.

14. Position the rear of the harness and engine relay/fuse panel and install harness clamps and ties at 2.

15. With the harness positioned pull a loop (excess) of harness through the support at 3, to retain the excess wire harness.

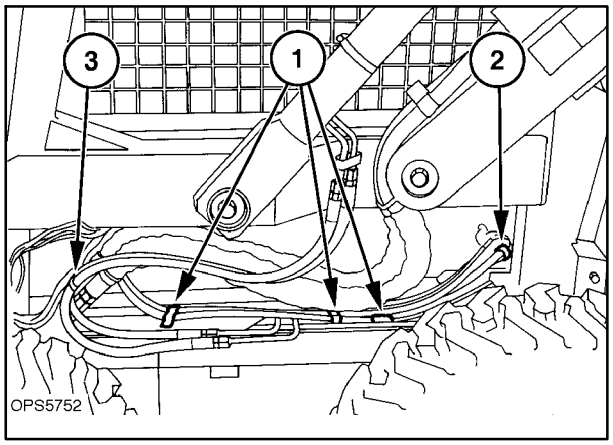

Figure 7-55

16. Reinstall the light pods, light wire harness and lights.

17. Reconnect the wire harness to all switches and EIC (Electronic Instrument Cluster) previously removed.

    NOTE: Plug the two wire harness connectors into the EIC, noting the correct positioning of the connectors. If the connectors are not connected properly, damage to the EIC may occur.

    IMPORTANT: Do not service the EIC board with magnetized tools, wrenches, screwdrivers, etc., or magnets. Severe damage to the EIC board may occur.

18. Remove any paint from the ground surface and attach ground wires at 1.

    NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to size on top of the heaviest wire.

19. Remove any paint from the ground surface and attach the ground strap, 1, from the cab inner shell to the lower main frame.

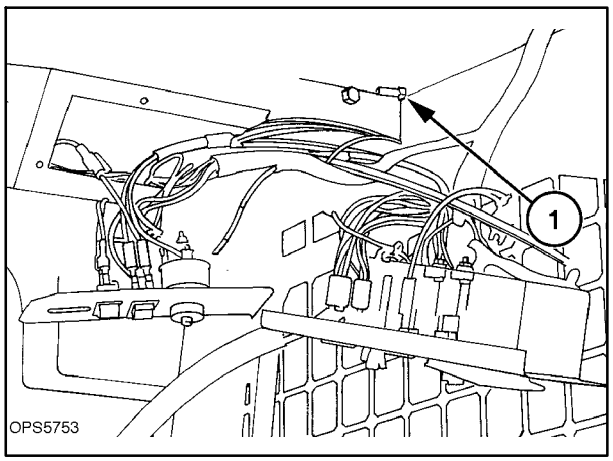

Figure 7-56

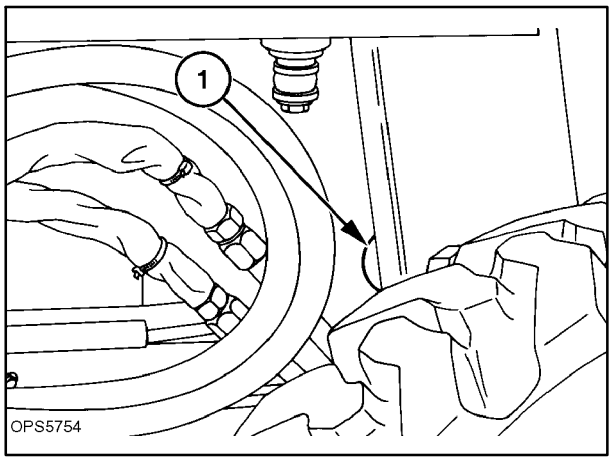

Figure 7-57

20. Reinstall the wire harness along the right side shield at 1. Install wire clamps and ties to prevent harness damage. Install the service/run switch, fuse panel and ignition switch panel.

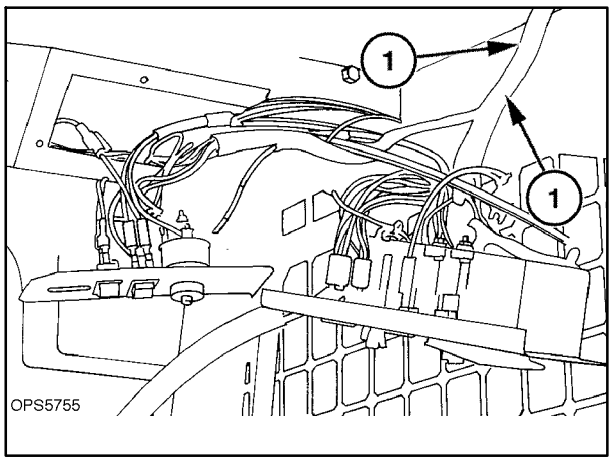

Figure 7-58

21. Reinstall the parking brake control rod and pivot bearings. Install the right bearing into the right support, 1.

    Slide control rod, 2, into right bearing, place the left bearing and support over rod at 3, and rotate control rod link into cab at 4. Attach the left bearing support to the cab at 5.

    Assembly the brake handle and attach to the control link at 6.

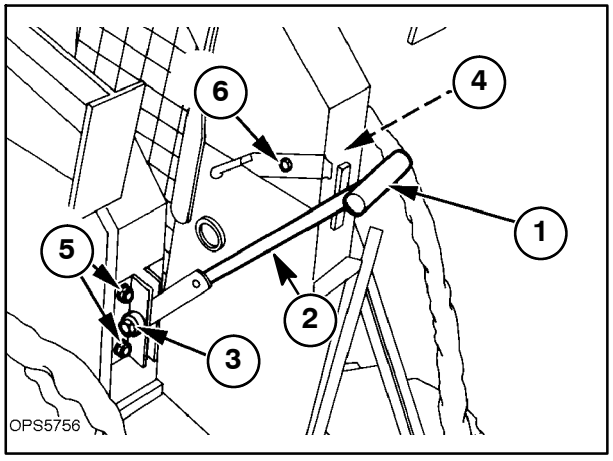

Figure 7-59

22. Slide the spring, 1, and washer, 2, over the end of rod, 3. Insert the rod and spring assembly into the handle at 4. Insert bushing, 5, into latch plate, 6, and insert the latch plate into handle at 7, with the extended area, 8, to the rear (engine side) of lever and position the rod assembly, 3, so the hook is back of the latch plate at 9.

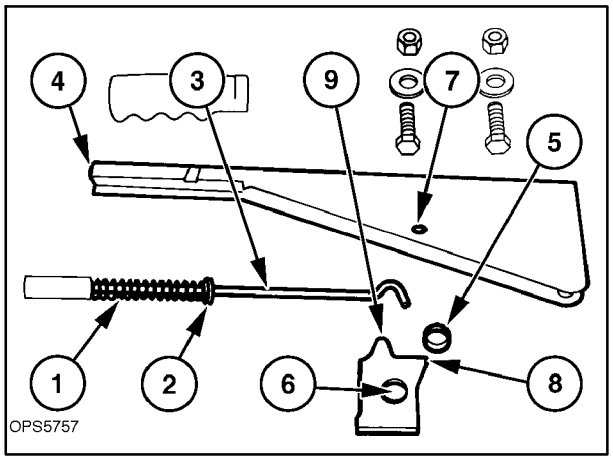

Figure 7-60

23. Attach the handle assembly, 1, to the control link at 2. Slide the handle grip, 3, over end of handle, 1. Use silicone or weather strip glue to hold grip in position.

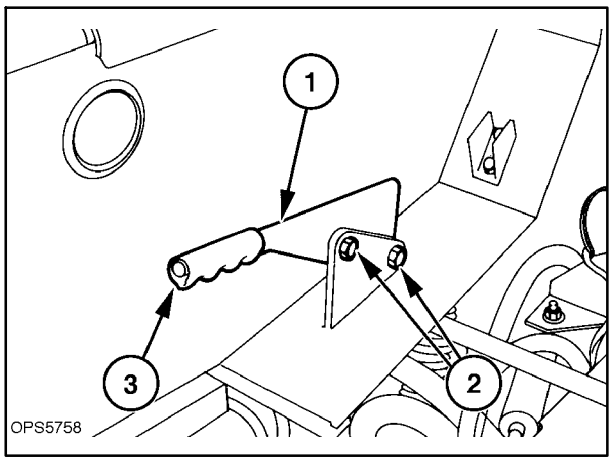

Figure 7-61

24. Reconnect the spring links, 1, to the control rod at 2 and install the cotter pins.

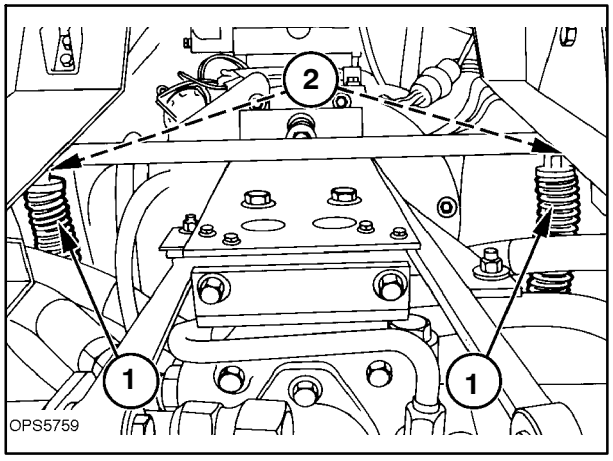

Figure 7-62

25. Reinstall the seat/seat pan support assembly and connect the seat/seat belt wire harness to the main wire harness, 1. Make sure the wire harness, 2, is to the inside of the boom lock linkage to prevent interference when the seat pan support assembly is pivoted up to the raised, latched position.

26. Reinstall the headliner and supports.

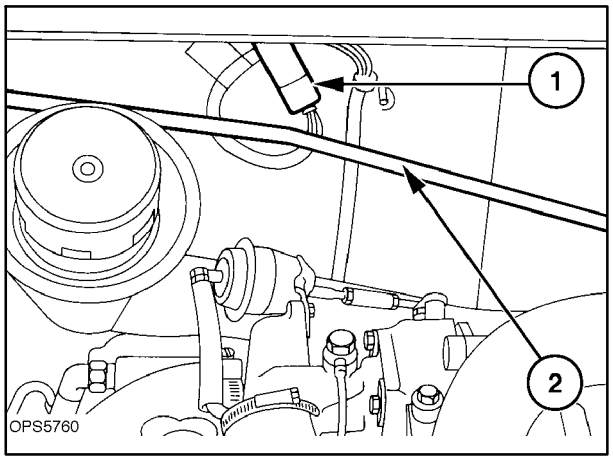

Figure 7-63

27. Reinstall the right and left hydrostatic control lever assemblies.

    After the assemblies are installed, check the levers for parallel, external stop, and neutral adjustment. If adjustment is required, refer to the operator's manual for detailed adjustment information.

28. Reinstall the rear window assembly.

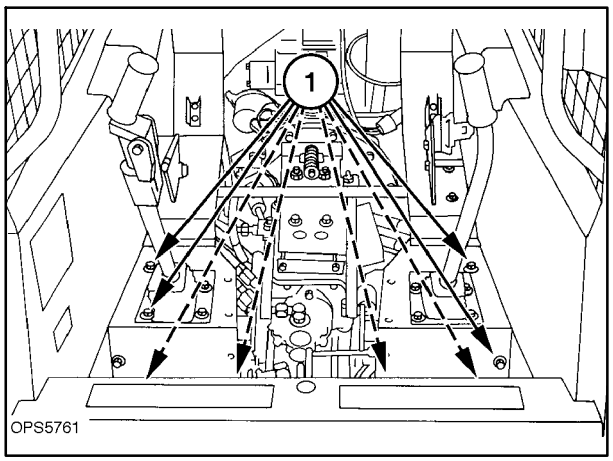

Figure 7-64

29. Slide the throttle cable up through the hole in the left cab panel and secure with retaining nut at 1. Attach the control lever, 2, to the cab panel at 3, with 3/8″ x 1-1/2″ cap screw; friction disc, 4; spring, 5; 3/8″ flat washer; and locknut. Tighten the pivot hardware to hold the control lever in set position. Over tightening will require more effort to set throttle.

30. Reconnect the (-) negative ground battery cable.

31. Reinstall any shields and fenders previously removed.

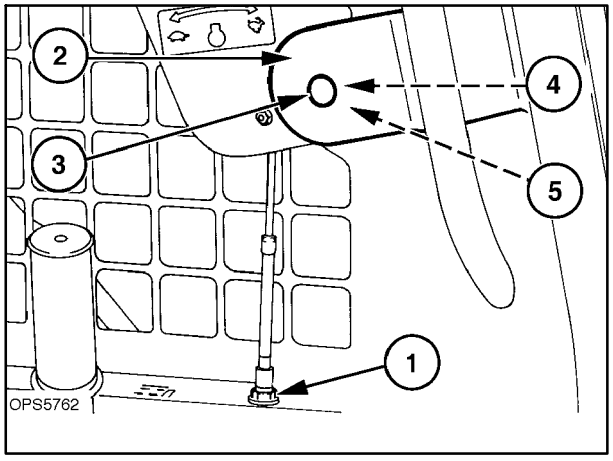

Figure 7-65

ROPS FRAME

ROPS REMOVAL

The ROPS can be removed from the lower frame with the cab inner shell and boom attached in place or removed.

To remove the ROPS with the inner shell and boom removed:

Follow the instructions for “Cab Inner Shell Removal” and “Boom, Upper and Lower Link Removal.”

1. Remove the rear attaching bolts, 1, left and right sides. If there are washer spacers under the bolt heads, make sure to replace them on installation for proper torquing.

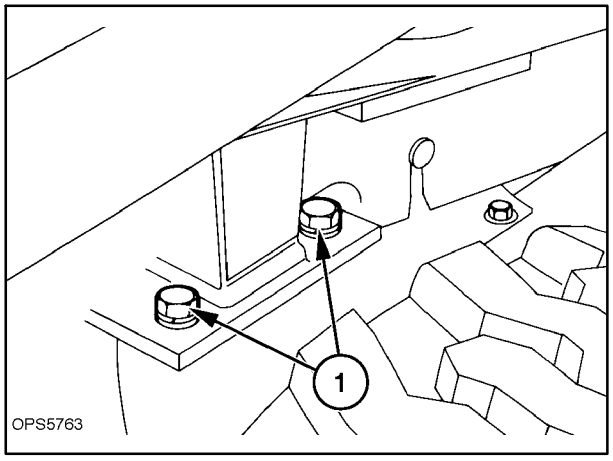

Figure 7-66

2. Support the ROPS with a suitable lifting device and remove the front attaching bolts, 1, two each side.
3. Lift the ROPS frame from the lower main frame and move to a level area. Lower the ROPS to the floor.

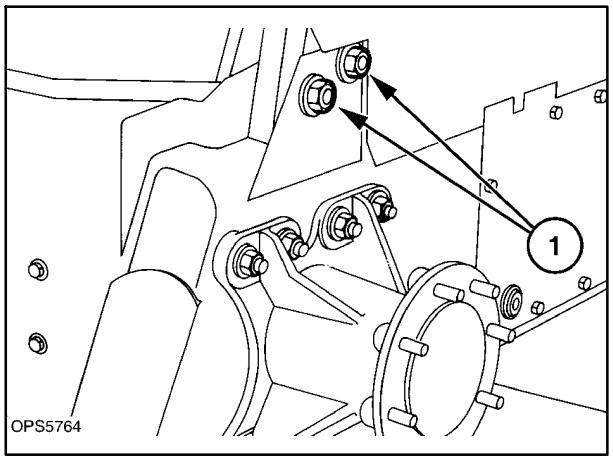

Figure 7-67

To remove the ROPS with the cab inner shell and boom attached:

1. Remove any attachment from the loader mounting plate, raise the boom and rest on the boom lock pins.

CAUTION: NEVER WORK UNDER A RAISED BOOM UNLESS IT IS PROPERLY SUPPORTED BY THE BOOM LOCK PINS.

CAUTION: NEVER WORK UNDER A RAISED BOOM WITH AN ATTACHMENT. ALWAYS REMOVE THE ATTACHMENT FROM THE LOADER.

2. Remove the front step shield, 1.
3. Remove the right and left fenders, 2.

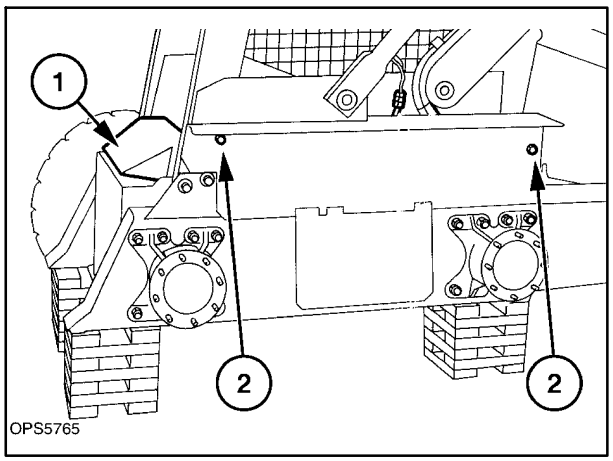

Figure 7-68

4. Lower the boom to the lowered position and turn the ignition (key) switch to the “OFF” position. Do not unbuckle the seat belt and exit the loader.
5. Relieve the hydraulic pressure from the boom and bucket circuits.
   a. Turn the ignition (key) switch to the “ON” position.
   b. Operate the boom and bucket controls relieving all pressure in the system.
   c. Turn the ignition switch “OFF” and exit the loader.

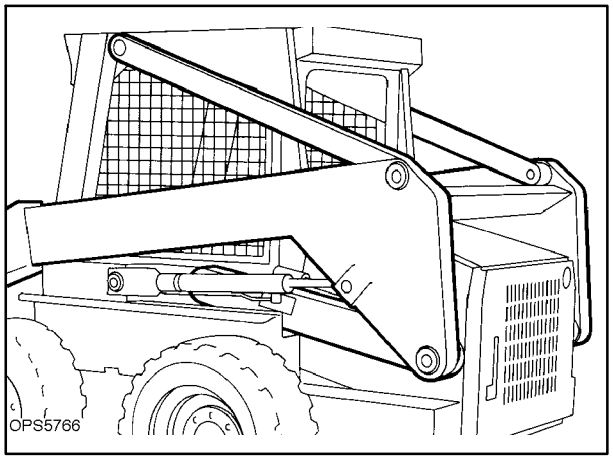

Figure 7-69

6. Raise the operator's seat/seat pan support to the raised latched position.

CAUTION: DO NOT WORK UNDER A RAISED SEAT UNLESS IT IS SECURELY LATCHED IN THE RAISED POSITION.

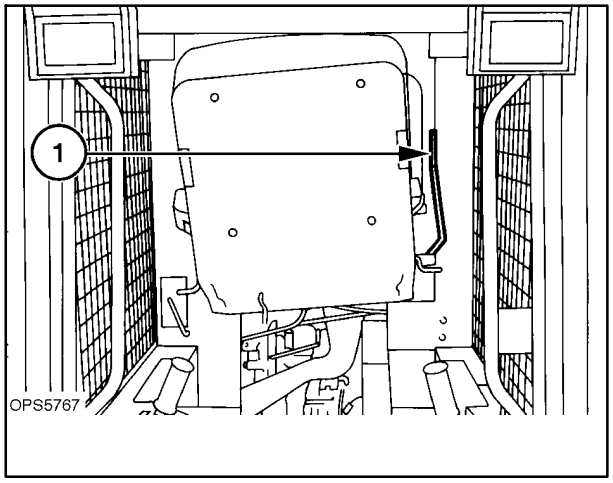

Figure 7-70

7. Disconnect the parking brake linkage at 1.
8. Raise the parking brake control lever to the raised engaged position.

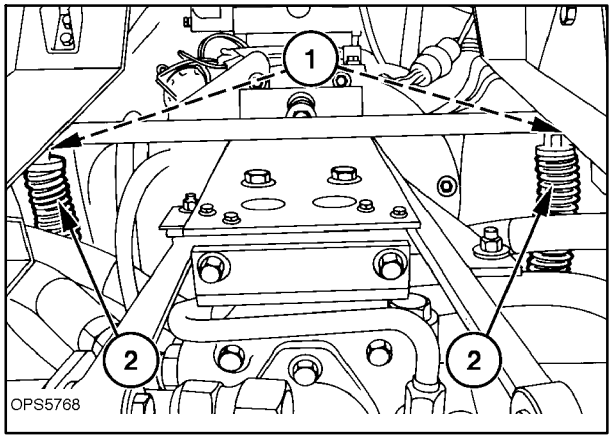

Figure 7-71

9. Remove the engine side panels, 1, and top engine screen, 2.
10. Disconnect the (-) negative ground battery cable.

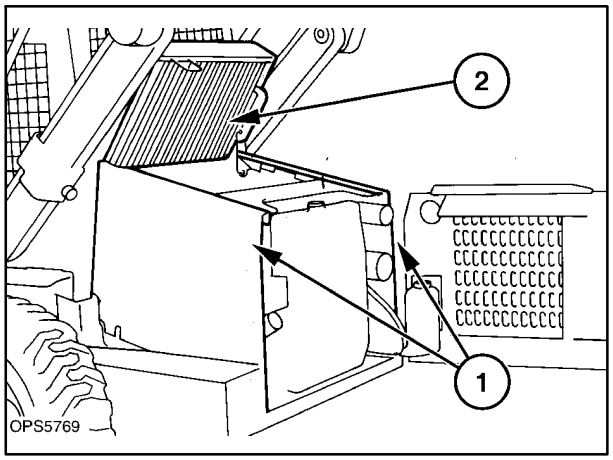

Figure 7-72

11. Unplug the engine wire harness from the main harness, 1.
12. Remove the ground wires from the engine bell housing, 2.
13. Remove the wires from the electric fuel pump and wire harness from along the fuel tank on the left side of the engine.
14. Remove the wires from the hydrostatic charge pressure sender, oil filter sensor, and remove the wire harness from the right side of the engine.

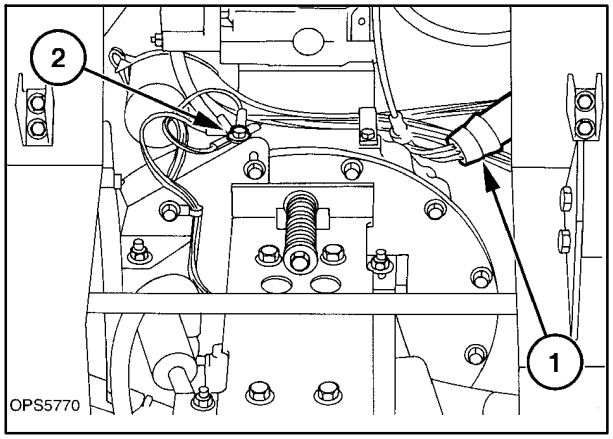

Figure 7-73

15. Remove the wire harness clamps and plastic ties along the left side of the lower frame at 1, 2, and 3.

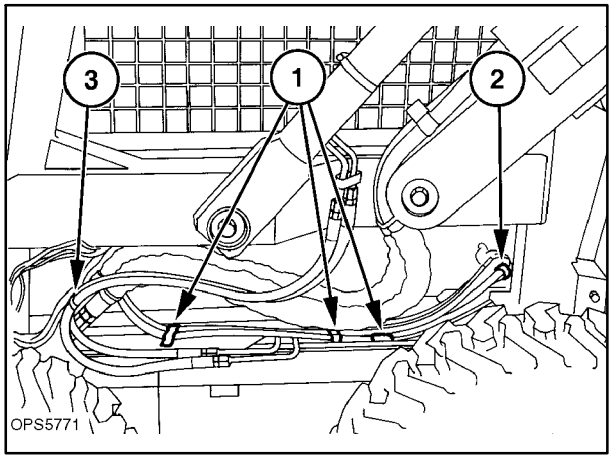

Figure 7-74

16. Remove the ground strap, 1, from the cab inner shell and lower main frame.

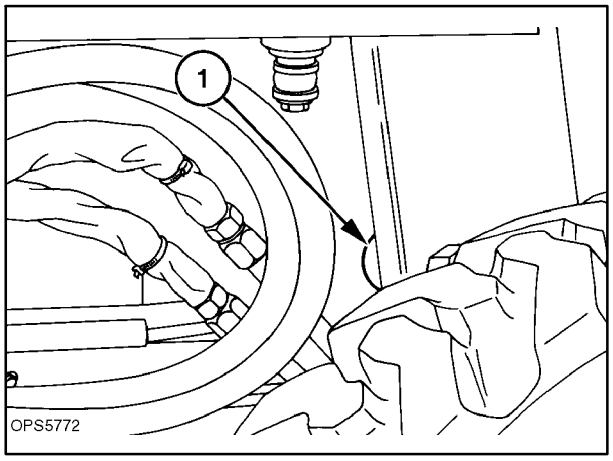

Figure 7-75

17. Remove the engine fuse/relay panel support hardware, 1, and raise and tie the panel assembly to the back of the cab assembly.

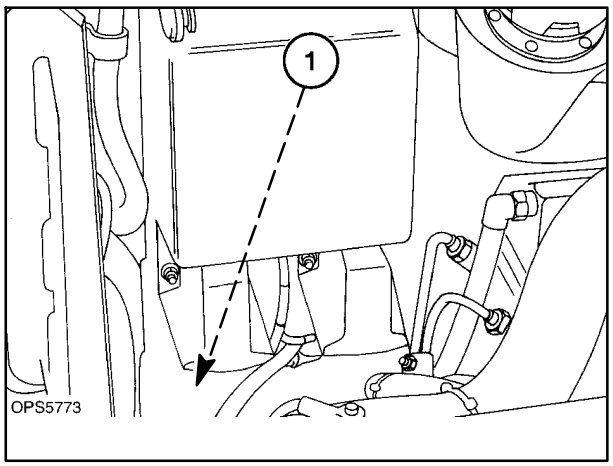

Figure 7-76

18. Remove the throttle control cable, 1, from the control lever at 2. Remove the cable retaining nut, 3, and slide the cable down through the right side shield at 4.

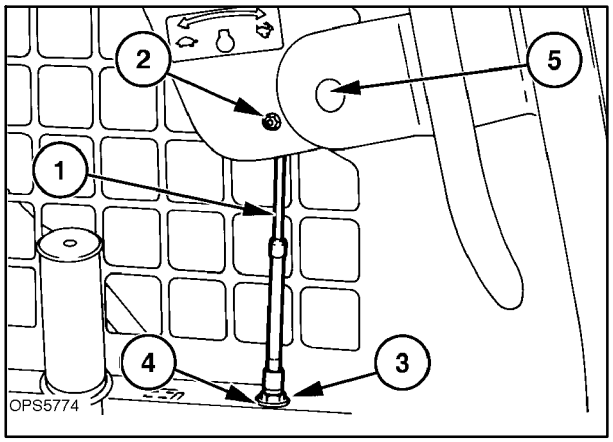

Figure 7-77

19. Remove the cotter pins from the parking brake control link spring at 1. Unhook the spring link from the control rod, 2.

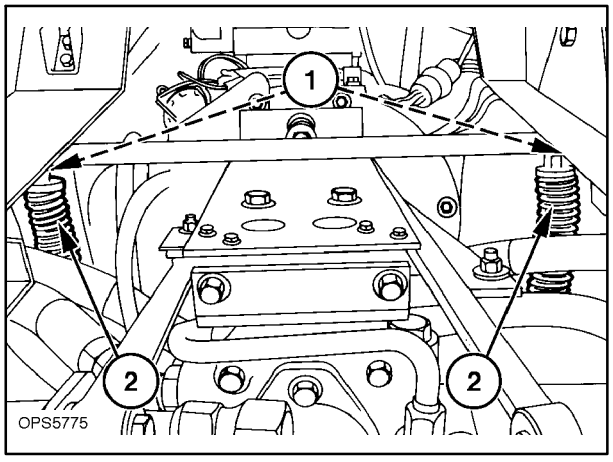

Figure 7-78

20. With the boom in the lowered position and the hydraulic pressure relieved in the boom and bucket circuits, disconnect the boom, bucket, and auxiliary boom hydraulics hose connections, 1, and cap all connections.

CAUTION: NEVER LOOSEN ANY HYDRAULIC LINES WITHOUT FIRST RELIEVING ALL PRESSURE IN THE SYSTEM.

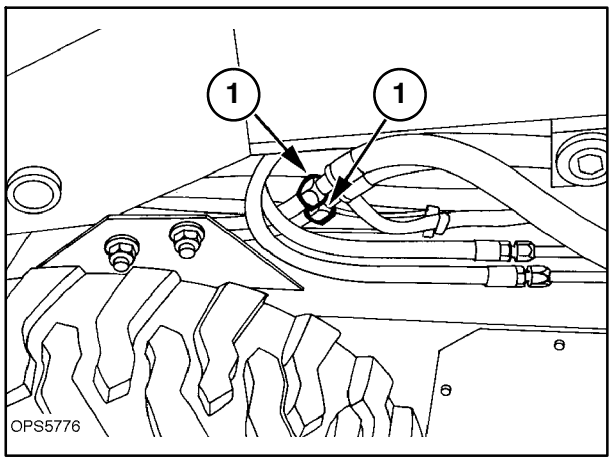

Figure 7-79

21. Rotate the boom lock pin control lever, 1, to extend (engage) the boom lock pins.

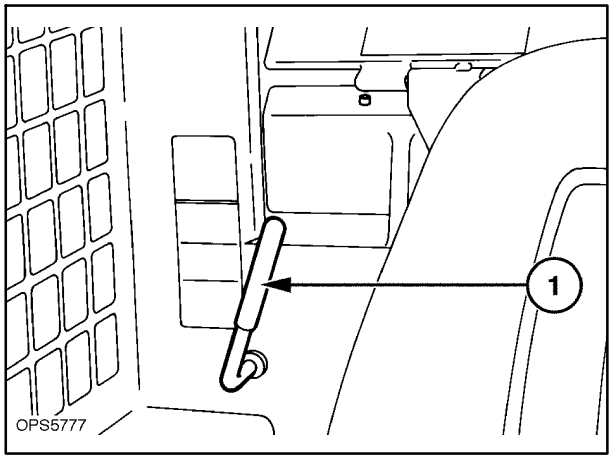

Figure 7-80

22. Remove the left and right rear attaching hardware, 1. If there are washer spacers under the bolt heads, make sure to replace them on installation for proper torquing.

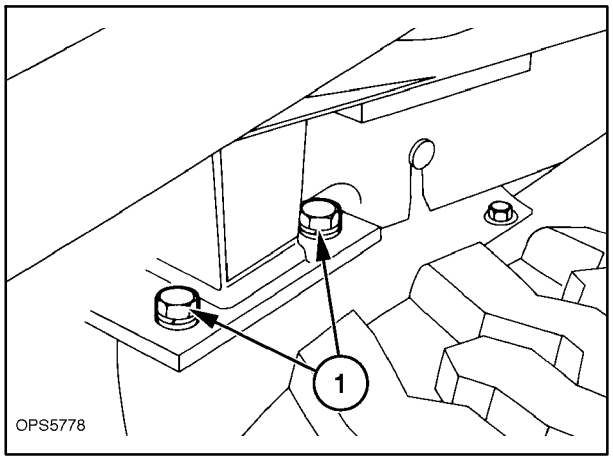

Figure 7-81

23. With a suitable lifting device support the boom at the rear.

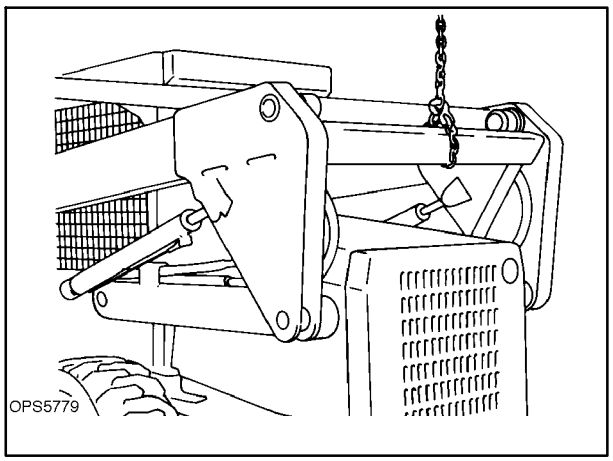

Figure 7-82

24. With a suitable lifting device support the boom at the front as shown, and raise the boom assembly up, from both front and rear, until it contacts the boom lock pins at 2.

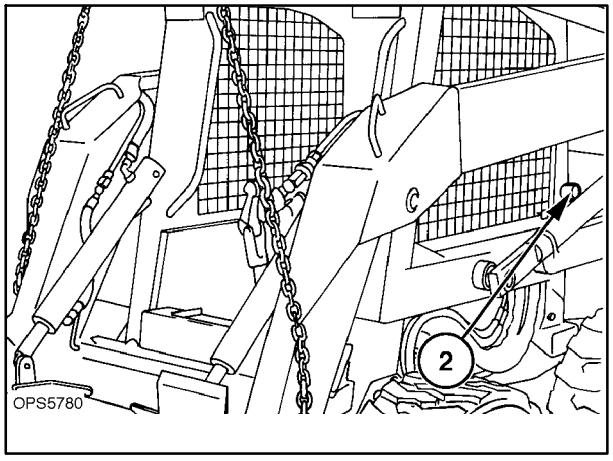

Figure 7-83

25. Remove the right and left front retaining bolts, 1.

26. Lift the ROPS and boom assembly from the lower main frame and move to a level area. Rest the assembly on the floor, lowering the boom to the floor.

ROPS INSPECTION

Refer to Service Bulletin 9/97-I5 for complete ROPS inspection procedures and reinforcement installation instructions.

Refer to Service Bulletin 12/97-I1 for complete Lower Main Frame inspection procedures and reinforcement kit instructions.

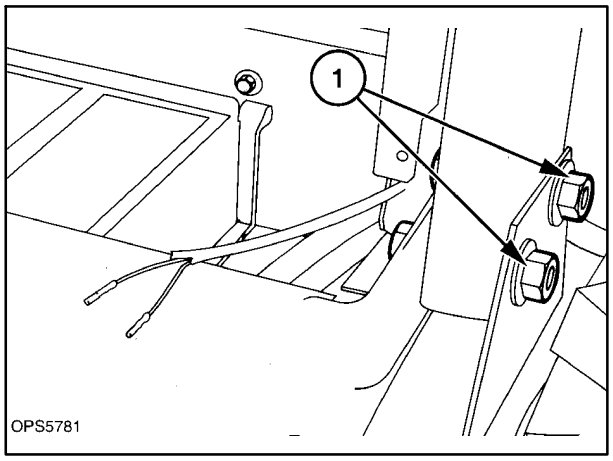

Figure 7-84

ROPS INSTALLATION

1. Lift the ROPS and boom assembly onto the lower frame, resting the rear ROPS post on the lower frame pads. Supporting the front of the ROPS install the front retaining hardware. With the front hardware installed, align the rear ROPS posts and install the rear hardware.
2. Torque the front hardware, 1, to 217 N·m (160 ft. lbs.).

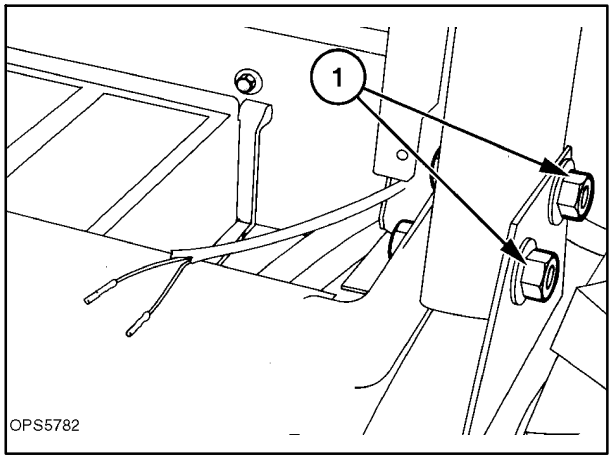

Figure 7-85

3. Torque the rear hardware, 1, to 108 N·m (80 ft. lbs.). Replace any washers used for proper spacing.
4. With the ROPS and boom securely attached to the lower frame and the boom in the lowered position, remove the lifting device from the ROPS.

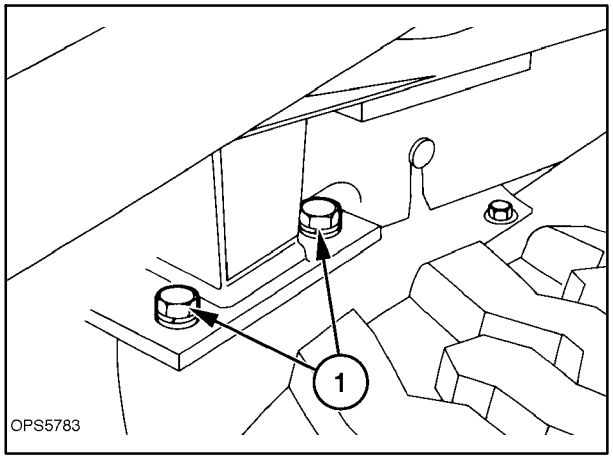

Figure 7-86

5. Reinstall the wire harness along the main frame and attach the engine fuse/relay panel.
6. Reconnect the main harness to the engine harness, re-route the wire harness along the fuel tank and the right side of the engine installing all clamps and ties previously removed at 1, 2, and 3.

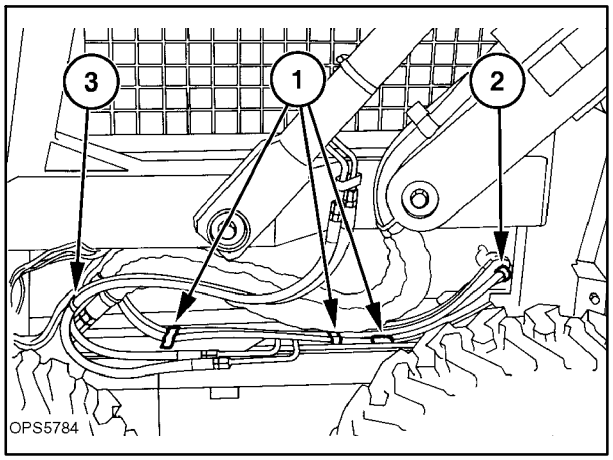

Figure 7-87

7. Reconnect the ground wires to the bell housing at 1. Place the largest wire next to the ground surface, stacking the remaining wire by size, largest to smallest, to ensure proper grounding. Reconnect the main wiring harness connector, 2.

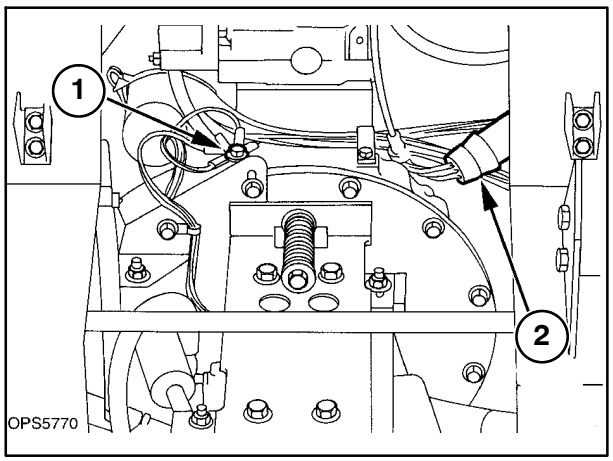

Figure 7-88

8. Reconnect all hydraulic lines, 1, and position for clearances between other components. Install any hose clamps removed.

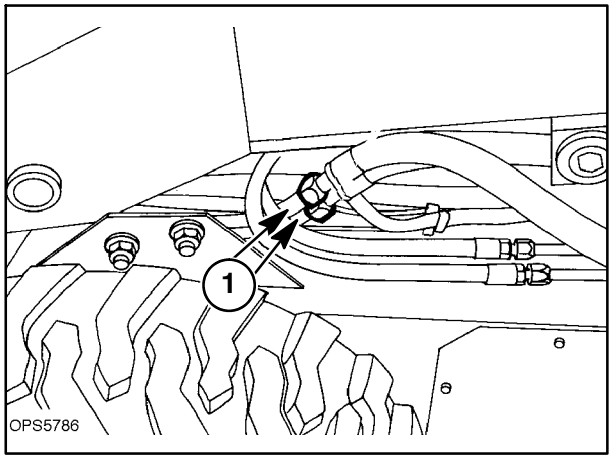

Figure 7-89

9. Slide the throttle cable up through the hole in the left cab panel and secure with retaining nut at 1. Attach the control lever, 2, to the cab panel at 3, with 3/8″ x 1-1/2″ cap screw; friction disc, 4; spring, 5; 3/8″ flat washer; and locknut. Tighten the pivot hardware to hold the control lever in set position. Over tightening will require more effort to set the throttle.

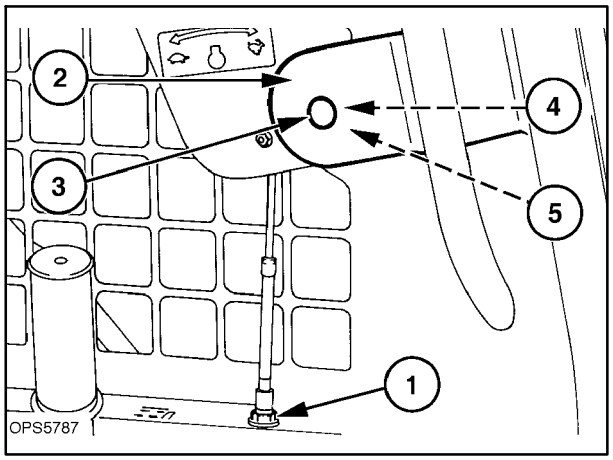

Figure 7-90

10. Reconnect the parking brake spring links, 1, to the control rod at 2, and install the cotter pins.

11. Reconnect the (-) negative ground battery cable.

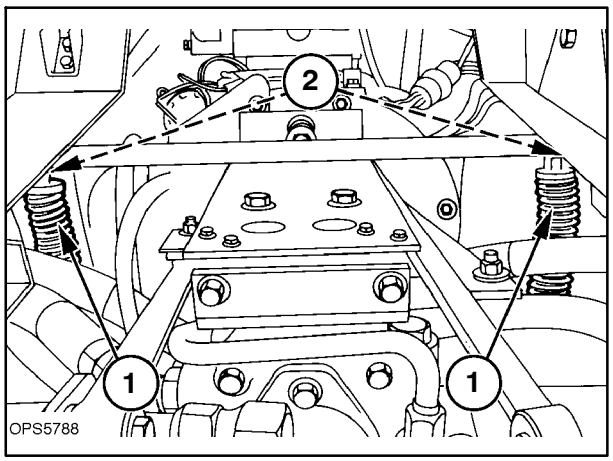

Figure 7-91

12. After all wires and hydraulic hoses are connected, start the unit, raising the boom checking for oil leaks.

    NOTE: The boom and bucket hydraulic circuits may require cycling several times to purge the air from the hydraulic system.

13. Reinstall all fenders, shields, etc., removed; including the front step shield, 1. Tighten the fender hardware, 2, securely.

14. After the fenders are reinstalled, raise and lower the boom and recheck the hoses and tubes for clearance at 3. Readjust the hoses and tubes if they contact the fenders.

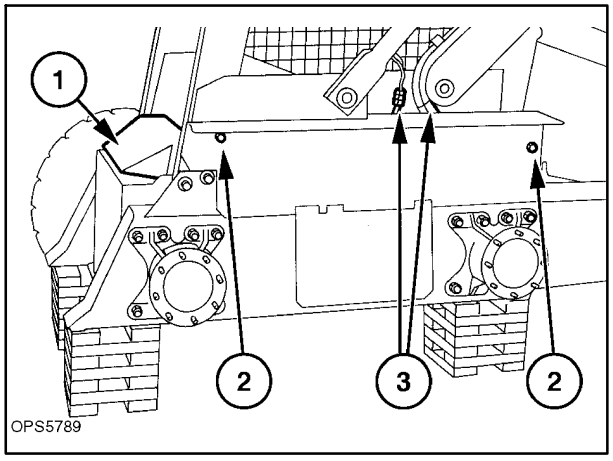

Figure 7-92

BOOM LOCK PIN LINKAGE

BOOM LOCK PIN/LINKAGE REMOVAL

1. Lower the boom to the lowered position.
2. Open the rear door, 1, and the top engine, 2, access cover.
3. Remove the right and left engine side covers, 3.

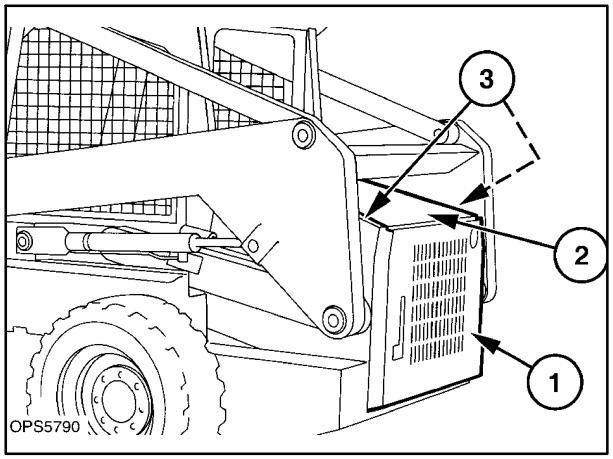

Figure 7-93

4. Unhook the spring, 1, from control rod by sliding spring to the side and removing spring at bottom hook, 2.
5. Remove the push nuts, 3, from the control rod, 4.
6. Remove the linkage to pin through bolt, 5.
7. Remove the linkage support retaining hardware, 6.

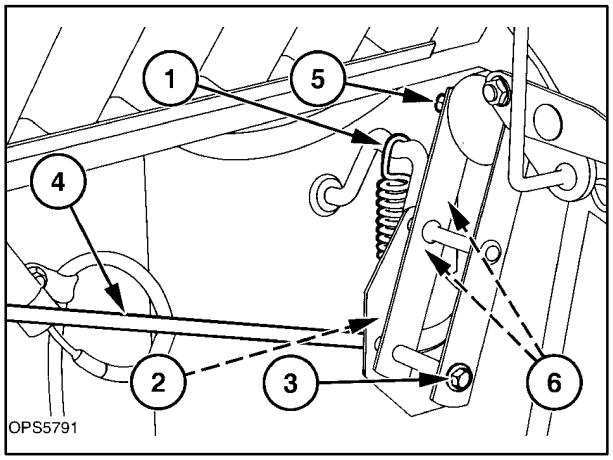

Figure 7-94

8. Remove the plastic handle grip, 1, from the control lever.

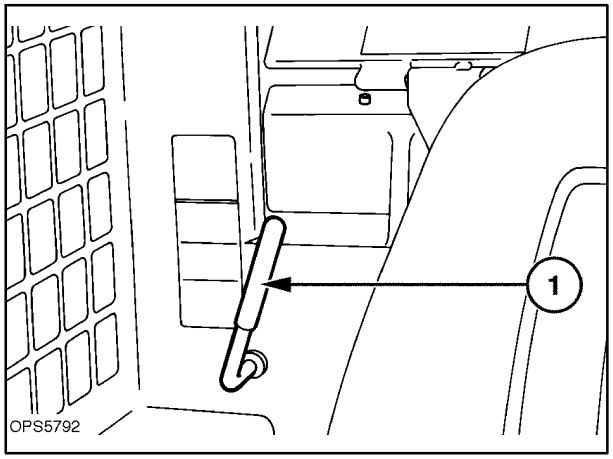

Figure 7-95

9. Remove the control rod, 2, from the lever at 5, and slide the handle from the rear of the cab.
10. Slide the boom pins, 1, right and left, from the loader ROPS post.
11. The boom lock pins and linkage include:
    1. Boom Lock Pins (2)
    2. Control Rod (1)
    3. Push Nuts (2)
    4. Support Angle (1)
    5. Control Lever Assembly (1)
    6. Plastic Handle Grip (1)
    7. Spring

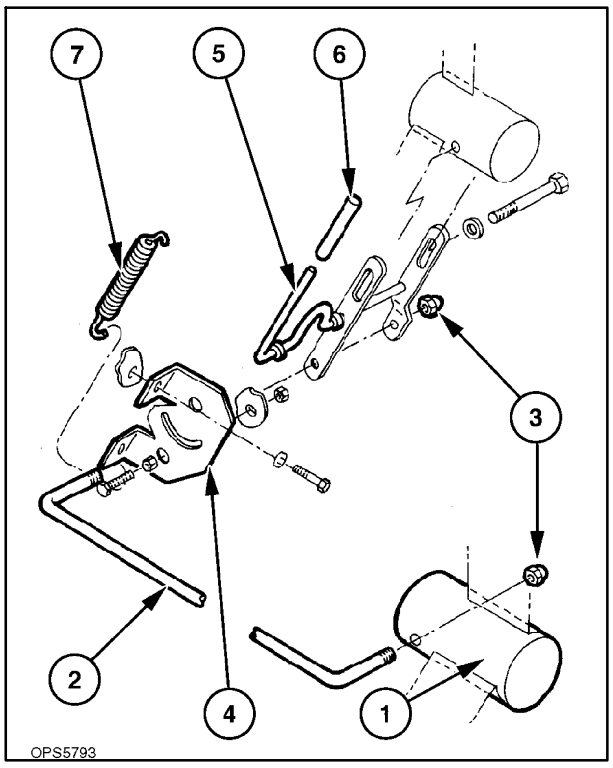

Figure 7-96

BOOM LOCK PIN/LINKAGE INSTALLATION

1. Install the boom lock pins, 1, right and left, into the ROPS posts at 2.
2. Install a rubber grommet at 3. Insert the control handle assembly, 4, through the right cab side shield at 5.

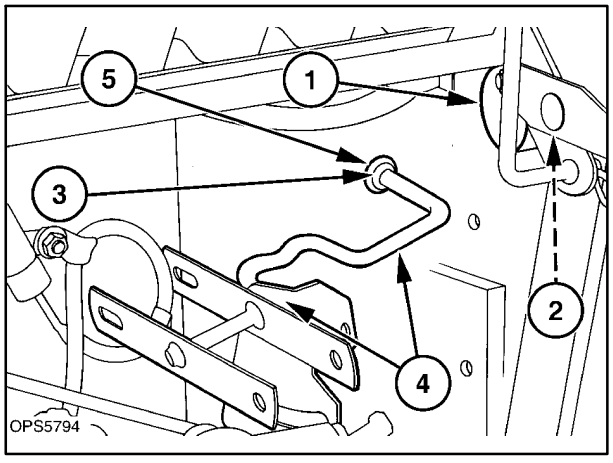

Figure 7-97

3. Position the control handle over the lock pin, 1, and install the support hardware at 2.
4. Install the handle and lock pin through bolt at 3.
5. With the handle properly positioned tighten the support hardware at 2, and the through bolt lock nut, 3.

   NOTE: Do not over-tighten the through bolt because the handle must pivot at the lock pin.

6. Install the control rod, 4, in the handle assembly, positioning the wire harness, 5, to the seat side of the control rod as shown.

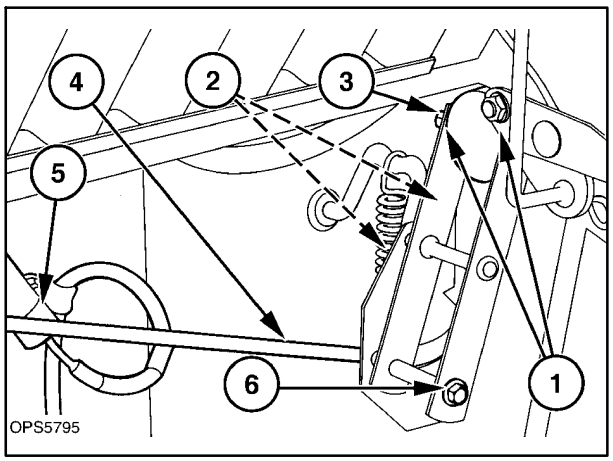

Figure 7-98

7. Install the control rod, 4, in the handle assembly and the left boom lock pin, 1. Slide new push retaining nuts onto rod at 6, Figures 7-98 and 7-99.

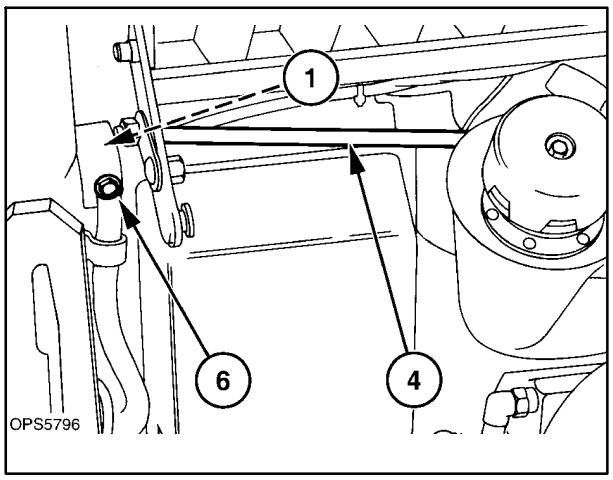

Figure 7-99

8. Slide the plastic handle grip, 1, onto the handle.
9. Operate the control handle to insure proper operation.
   a. Pivot the handle towards the outside of the operator's cab. The lock pins should extend from the cab post.
   b. Pivot the handle towards the inside of the operator's cab. The lock pins should retract into the cab post far enough to allow boom movement without contacting the lock pins.
10. Reinstall the engine side shields. Close the top engine cover and rear door.

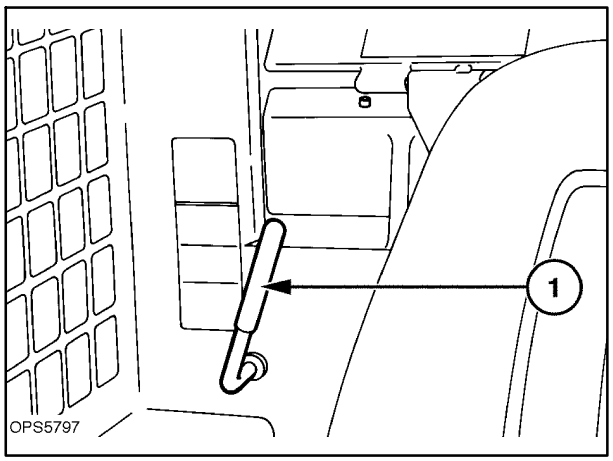

Figure 7-100

BOOM, UPPER AND LOWER LINK

BOOM, UPPER AND LOWER LINK REMOVAL

1. Remove any attachment (bucket, fork, etc.) from the boom mounting plate and lower the boom to the lowered position.

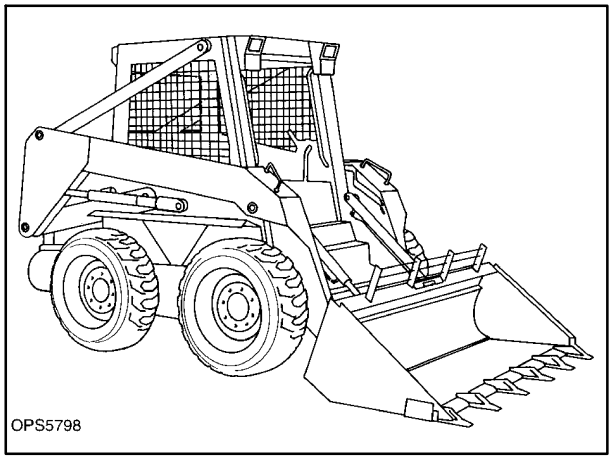

Figure 7-101

2. Attach a chain or strap suitable for handling the weight of the boom (approximately 800 lbs.) to the boom grab handles as shown at 1. Support the boom about level with the top of the loader ROPS.

CAUTION: ALWAYS USE A SUITABLE LIFTING DEVICE AND CHAINS OR STRAPS TO SUPPORT AND REMOVE THE BOOM.

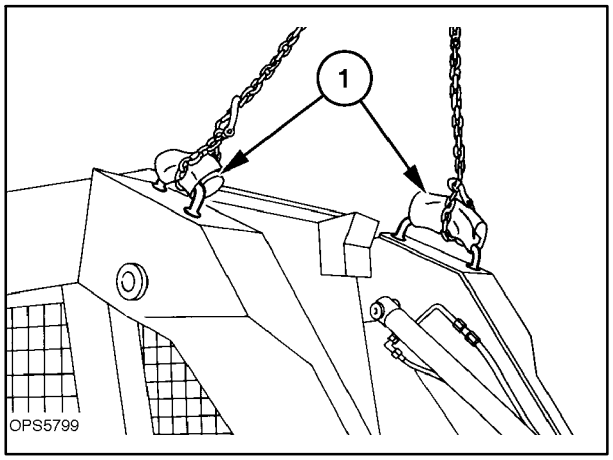

Figure 7-102

3. Support the rear of the boom with the rear lower link pivot above the top of the engine shielding as shown.

NOTE: This will enable the removal of the link pivot hardware.

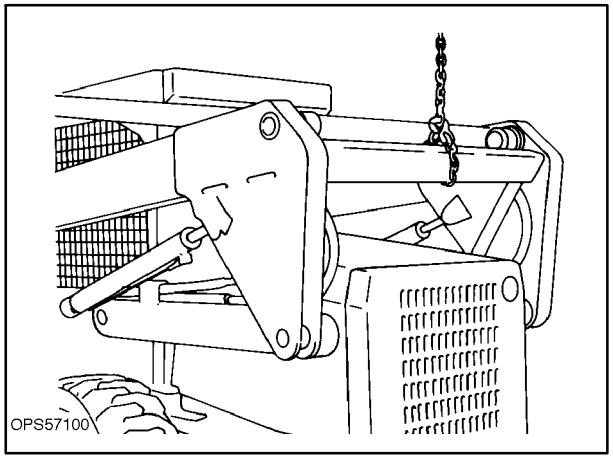

Figure 7-103

Lower Link Removal

1. Remove the plastic plugs, 1, from the cab inner shell to access the boom lower link and cylinder pivot hardware.
2. Remove the fenders to gain access to the boom and bucket hydraulic tube and hose connections.

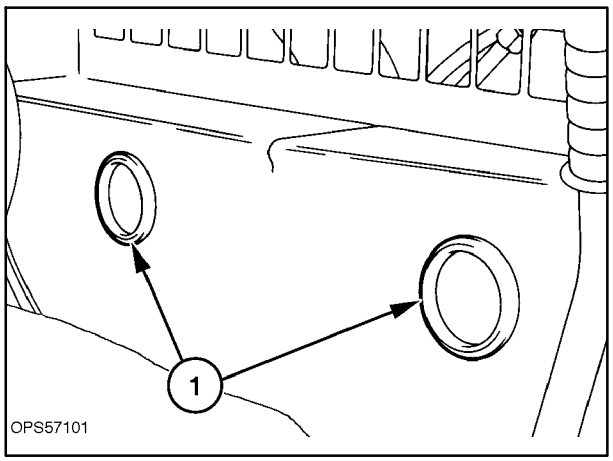

Figure 7-104

3. With the boom properly supported and all hydraulic oil pressure removed from the boom and bucket circuits, disconnect the hydraulic lines at 1. Cap open ends of lines and hoses. Remove the boom hose clamps, 2, retaining the hoses to the lower boom links. Remove the hoses from the lower hose retainer, 3.

CAUTION: ALWAYS USE A SUITABLE LIFTING DEVICE AND CHAINS OR STRAPS TO SUPPORT AND REMOVE THE BOOM.

CAUTION: DO NOT DISCONNECT ANY HYDRAULIC LINES UNTIL ALL HYDRAULIC PRESSURE IS REMOVED FROM THE BOOM AND BUCKET HYDRAULIC CIRCUITS.

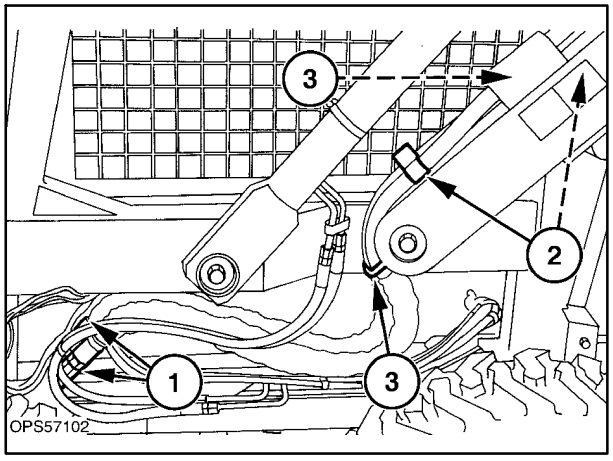

Figure 7-105

4. Loosen the lower link rear pivot pin retaining hardware.

CAUTION: DO NOT REMOVE THE PIN RETAINING HARDWARE UNTIL THE TAPERED PIVOT PIN IS BROKEN LOOSE AT THE TAPERED END OF PIN OR THE LINK AND PIN MAY FALL.

5. With a soft-faced sledge hammer, strike the lower link as shown to break the tapered pivot pin loose in the main boom link.

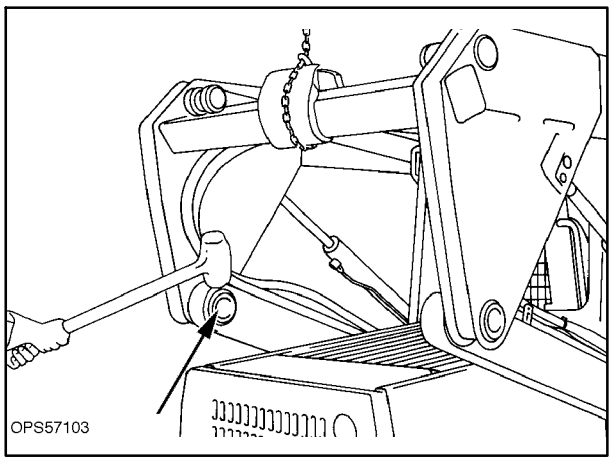

Figure 7-106

6. Loosen the front lower link pivot pin retaining hardware, 1, and strike the link at 2, to break the tapered pivot pin loose in the ROPS frame.

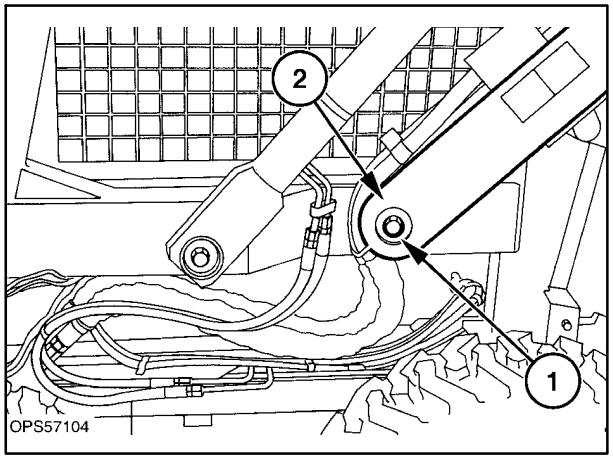

Figure 7-107

7. Remove the retaining pin hardware from the front and rear pins. Lift the lower link and pins from the loader.

NOTE: Both the right and left lower links can be removed as described.

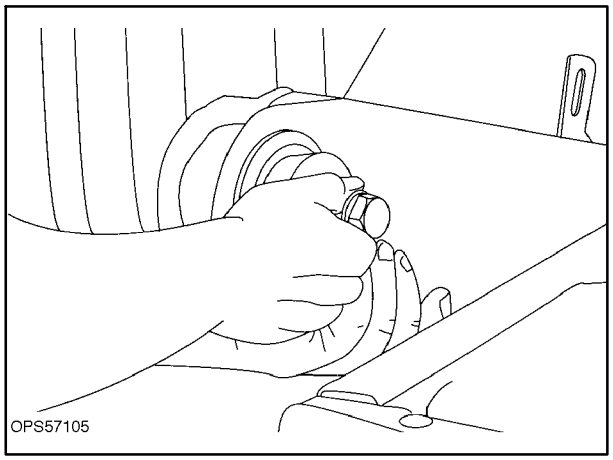

Figure 7-108

Upper Link Removal

1. The boom must be properly supported at the front and rear of the boom with the boom in the lowered position or the front of the boom above the front upper link pivot. Remove all hydraulic oil pressure from the boom and bucket hydraulic circuits.

   NOTE: Supporting of the boom will keep the boom in position during removal of the upper links.

   CAUTION: ALWAYS USE SUITABLE LIFTING DEVICE AND CHAINS OR STRAPS TO SUPPORT AND REMOVE THE BOOM.

2. Loosen the rear link retaining bolt, 1; do not remove. With a soft-faced sledge hammer, strike the link at 2, to break the tapered pivot pin loose in the main boom.

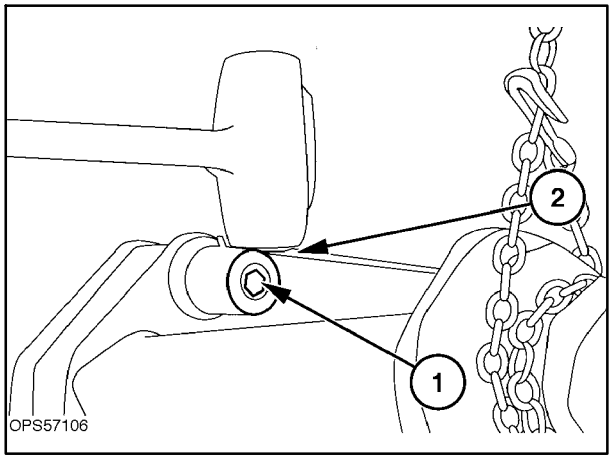

Figure 7-109

3. Loosen the front link pivot hardware, 1, and with a soft-faced sledge hammer, strike the link at 1, to loosen the tapered pin in the ROPS post.
4. Remove the front and rear pivot pin retaining bolts and tapered pins and lift the link from the loader.

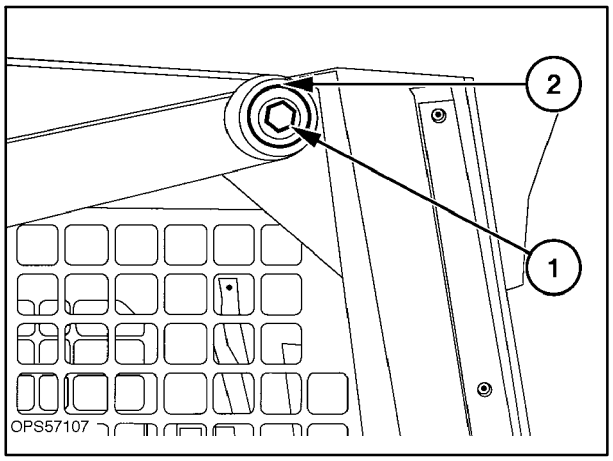

Figure 7-110

Main Boom Removal

1. Remove the plastic plugs, 1, from the cab inner shell to access the boom lower link and cylinder pivot hardware.
2. Remove the fenders to gain access to the boom and bucket hydraulic tube and hose connections.

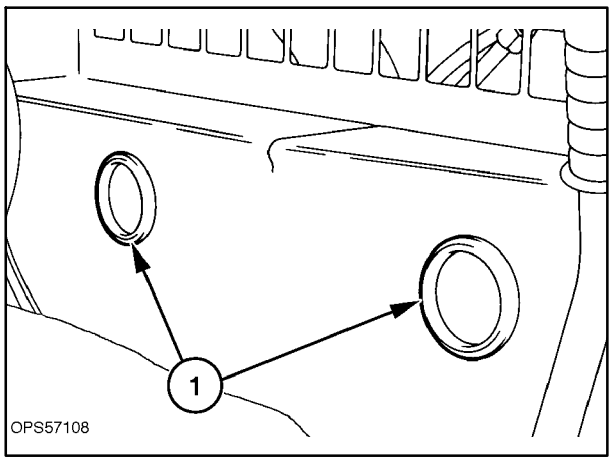

Figure 7-111

3. With the boom properly supported and all hydraulic oil pressure removed from the boom and bucket circuits, disconnect the hydraulic lines at 1. Cap open ends of lines and hoses. Remove the boom hose clamps, 2, retaining the hoses to the lower boom links. Remove the hoses from the lower hose retainer, 3.

CAUTION: ALWAYS USE A SUITABLE LIFTING DEVICE AND CHAINS OR STRAPS TO SUPPORT AND REMOVE THE BOOM.

CAUTION: DO NOT DISCONNECT ANY HYDRAULIC LINES UNTIL ALL HYDRAULIC PRESSURE IS REMOVED FROM THE BOOM AND BUCKET HYDRAULIC CIRCUITS.

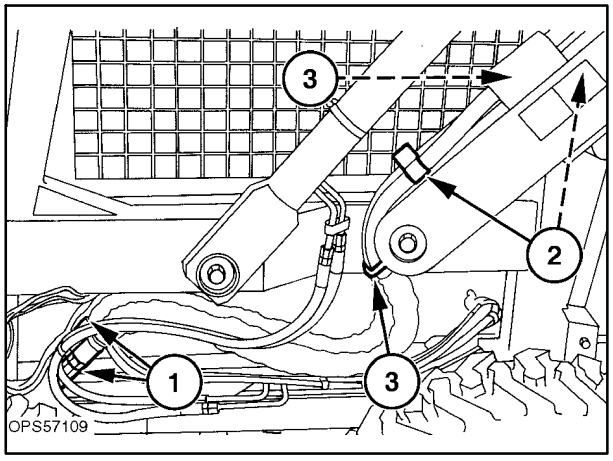

Figure 7-112

4. Remove the hoses from the rear hose support, 1, remove the tube clamps, 2, and disconnect the tubes at the Z-bracket and quick couplers, 3.

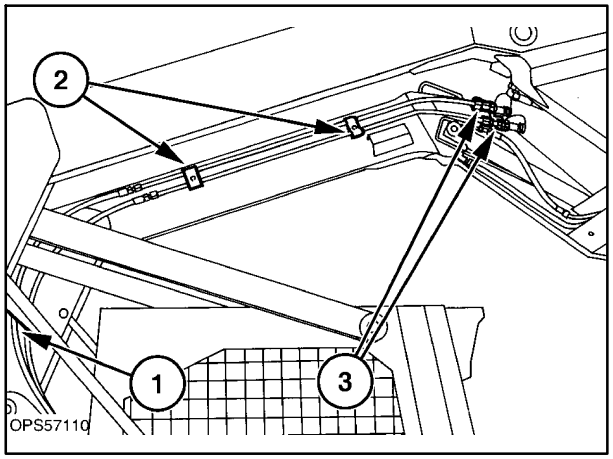

Figure 7-113

5. Remove the right and left upper boom cylinder pivot pin retaining hardware, 1, and pin, 2, from cylinders and boom.

   NOTE: If only the main boom is being removed, the cylinders can remain attached at the bottom pivot.

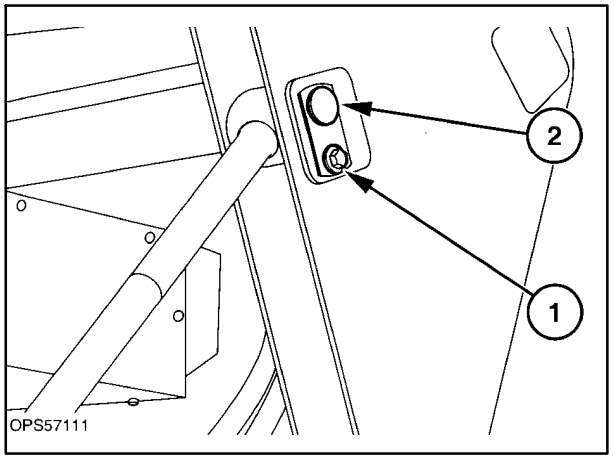

Figure 7-114

6. Loosen the right and left lower link rear pivot pin retaining hardware, 1.

   CAUTION: DO NOT REMOVE THE PIN RETAINING HARDWARE UNTIL THE TAPERED PIVOT PIN IS BROKEN LOOSE AT THE TAPERED END OF PIN OR THE LINK AND PIN MAY FALL.

7. With a soft-faced sledge hammer, strike the lower link as shown to brake the tapered pivot pin loose in the main boom link.

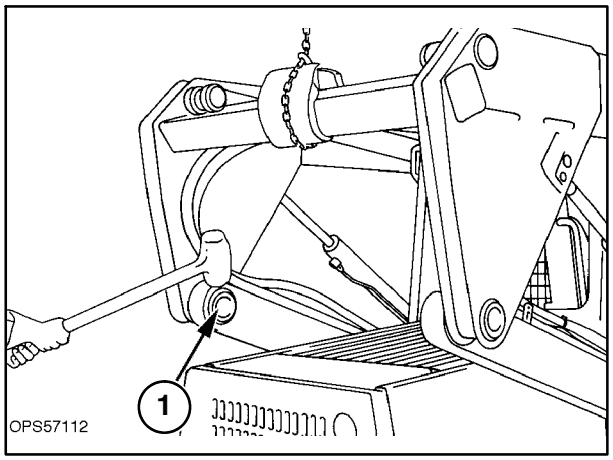

Figure 7-115

8. Remove the pin retaining hardware and pin from the link and main boom. Lower the link and rest it on the loader frame.

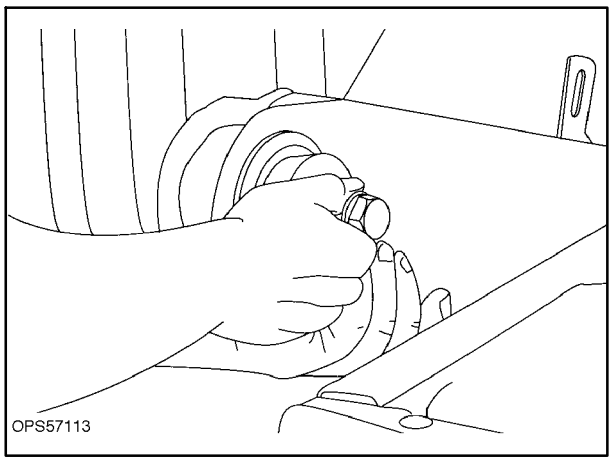

Figure 7-116

9. Loosen the right and left upper link rear retaining bolts, 1; do not remove. With a soft-faced sledge hammer, strike the link at 2, to break the tapered pivot pin loose in the main boom.
10. Remove the hardware and pins from the ROPS and link, resting the link on the lower link.
11. Lift the boom assembly from the loader.

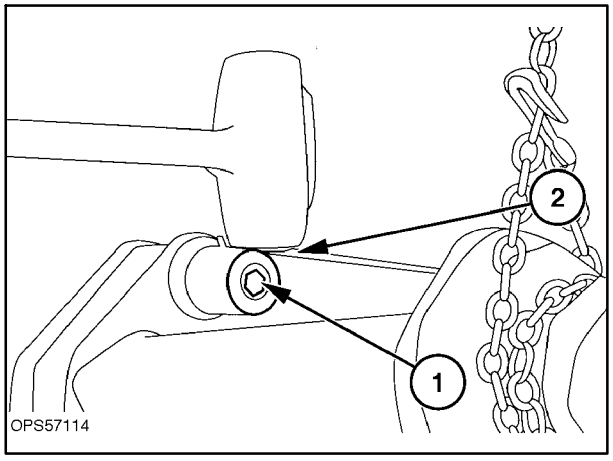

Figure 7-117

BOOM INSPECTION

1. Inspect the rear lower pivot area for cracking in the weld or main boom frame. Examine the inside area around the boom pivot at 1.

   The lower link may be removed at the rear pivot for better access. Only remove one lower link at a time and rest it on top of the final drive case. If cracks are found, examine the outside of the pivot area at 2.

   a. If cracks are found in the weld, grind to remove the old weld, reweld the hub to the main boom, and add the reinforcing gussets.

   b. If cracks are found around the weld and into the main boom frame at 3, across the top of the pivot (inside and outside), a new boom assembly is required.

2. Inspect the mounting plate pivot pin area at 1, for cracking in the weld around the hub or main boom frame. The mounting plate may be removed for better access and for inspection.

   a. If cracks are found in the weld, grind to remove the old weld, reweld the hub to the main boom, and add the reinforcing gussets.

   b. If cracks are found around the weld and into the main boom frame at 2, across the top of the pivot area around the pivot hub and boom, a new boom assembly is required.

   c. If the hub is cracked or worn severely in the tapered area of hub, 3, the hub assembly may be removed and replaced.

3. Inspect the upper boom cylinder pivot pin and hub area, 1. If this area is worn and needs repaired, refer to Service Bulletins 5/96-I6 and 7/96-I6 for parts requirements and repair procedures.

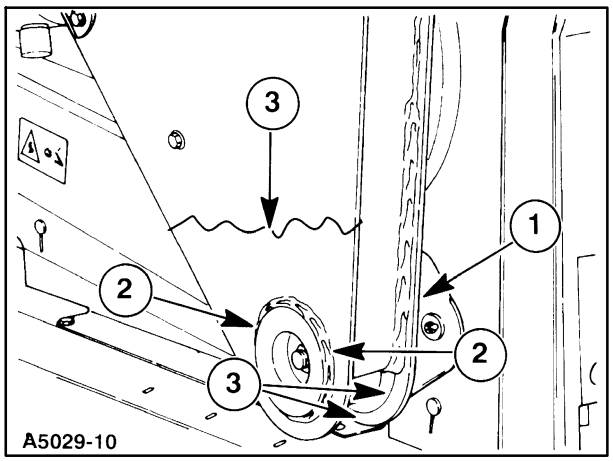

Figure 7-118

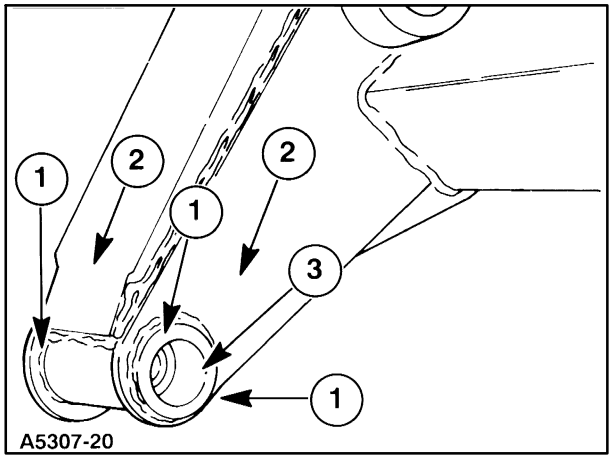

Figure 7-119

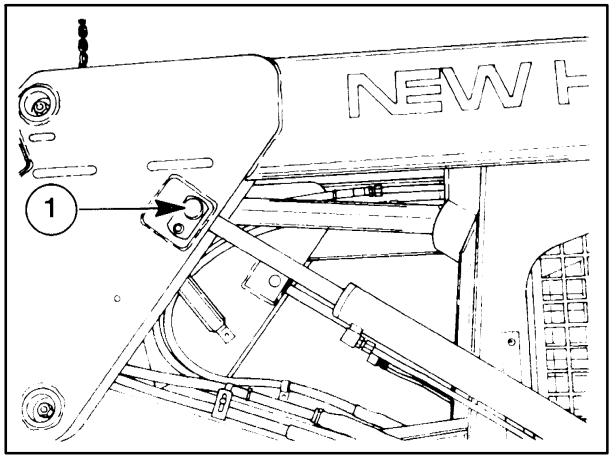

Figure 7-120

BOOM INSTALLATION WITH REINFORCEMENTS

Two front gussets, 1 (part #86543122), and two rear gussets, 2 (part #86538758), are required for each skid-steer loader being repaired.

If the mounting plate pivot hub requires replacement, order two hub assemblies (part #9829913) for the skid-steer loader being repaired.

IMPORTANT: Please read the complete installation section before installing the reinforcement gussets. Welding is required for gusset installation. Use welding rods marked 6011 or comparable.

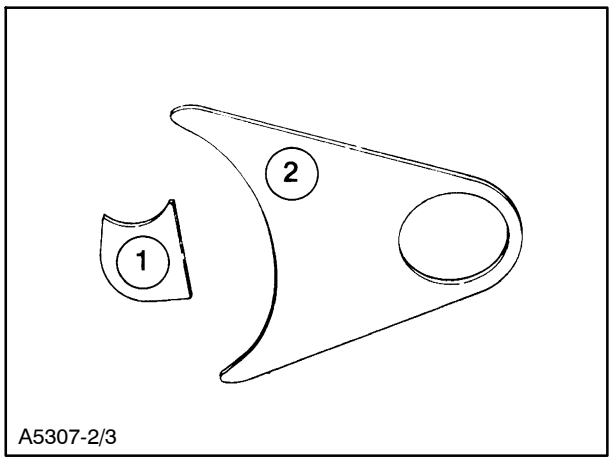

Figure 7-121

FRONT BOOM REINFORCEMENT GUSSETS #86543122

1. Remove any attachment, bucket, etc., from the boom mounting plate.
2. Grinding and welding is required to install the reinforcement gussets. The skid-steer loader must be thoroughly cleaned.

   CAUTION: THOROUGHLY CLEAN THE DEBRIS FROM THE SKID-STEER LOADER TO PREVENT A FIRE WHILE GRINDING OR WELDING.

3. Pivot the mounting plate out flat and remove all hydraulic pressure from the bucket circuit.
4. Remove the cylinder rod pivot pin retaining hardware and pin from the mounting plate and cylinder at 1.
5. Remove the mounting plate from the main boom.
   a. Loosen mounting plate pivot hardware, 2. DO NOT remove the hardware.
   b. With a sledge hammer (8 lbs) or larger, strike the mounting plate at 3, to loosen the tapered pivot pin.
   c. Remove the retaining hardware, pins, and mounting plate from the boom.

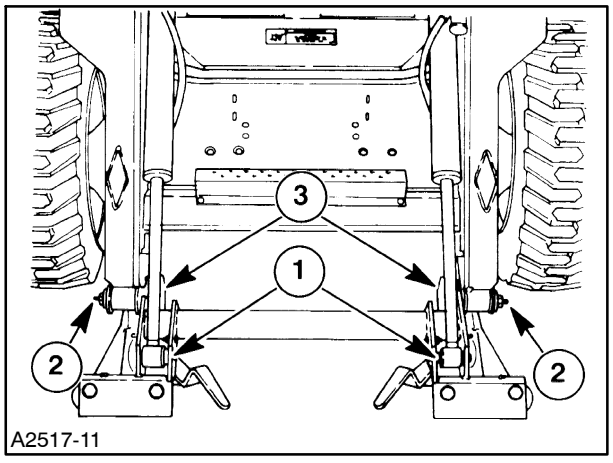

Figure 7-122

6. Raise the boom and support the boom 24″ off the ground on jack stands or suitable blocking at 1.
7. Remove the negative (-) battery cable.
8. Clean the pivot area and repair cracked welds if required.
9. Remove any paint from the area where the reinforcing gusset will be installed and welded to ensure good weld penetration.

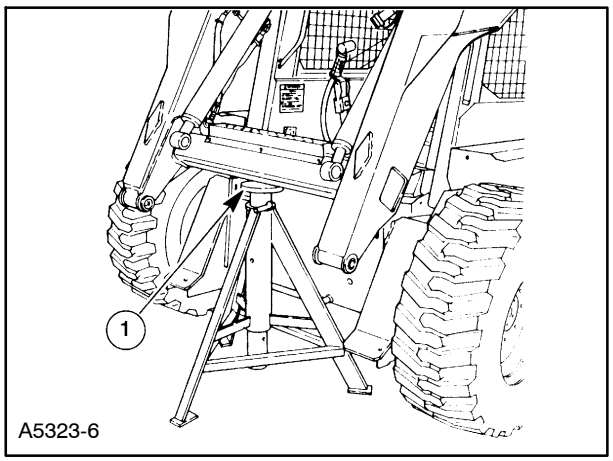

Figure 7-123

10. Position the gusset as shown at 1, with a maximum 6 mm (0.24″) between the hub and gusset at 2.

    NOTE: Grind any weld that interferes with the gusset to obtain the 6 mm (0.24″) clearance or prevents the gusset from setting flat against the boom.

11. Position the gusset from the bottom of the boom at 3, 9 mm (0.35″) from edge of boom.
12. Weld the gusset into position to the boom and hub with a 5 mm (0.20″) weld, as indicated by the X's. Weld past the end of the gusset as indicated at 4.
13. Clean the boom and gussets and paint the gusset and boom with New Holland semi-gloss black paint.
14. Reinstall the mounting plate pivot pins and retaining hardware. Torque the retaining hardware to 108 N·m (80 ft. lbs.).

    The tapered pin must be hammer-seated by striking on the retaining bolt and pin. Retorque the bolt until the torque is maintained.

15. Reinstall the cylinder rod pivot pins and retaining hardware. Torque the hardware to 38 N·m (28 ft. lbs.).

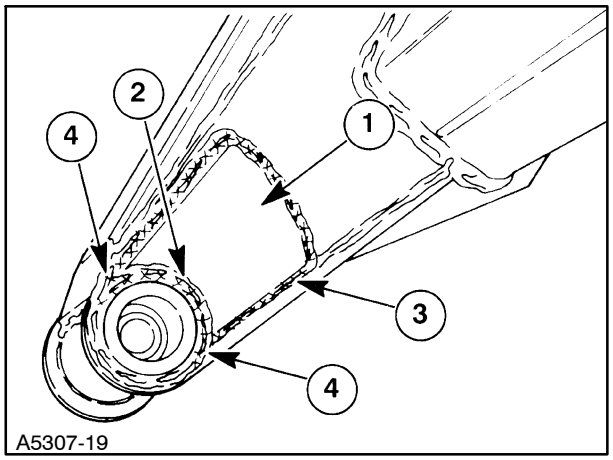

Figure 7-124

FRONT BOOM MOUNTING PLATE PIVOT HUB REPLACEMENT

1. Remove any attachment, bucket, etc., from the boom mounting plate.
2. Pivot the mounting plate out flat and remove all hydraulic pressure from the bucket circuit.
3. Remove the cylinder rod pivot pin retaining hardware and pin from the mounting plate and cylinder.
4. Remove the mounting plate from the main boom.
   a. Loosen the mounting plate pivot hardware. DO NOT remove the hardware.
   b. With a sledge hammer (8 lbs.) or larger, strike the mounting plate at 1, to loosen the tapered pivot pin.
   c. Remove the retaining hardware, pins, and mounting plate from the boom.
5. Raise the boom and support the boom 609.6 mm (24″) off the ground on jack stands or suitable blocking at 1.
6. Remove the negative (-) battery cable.

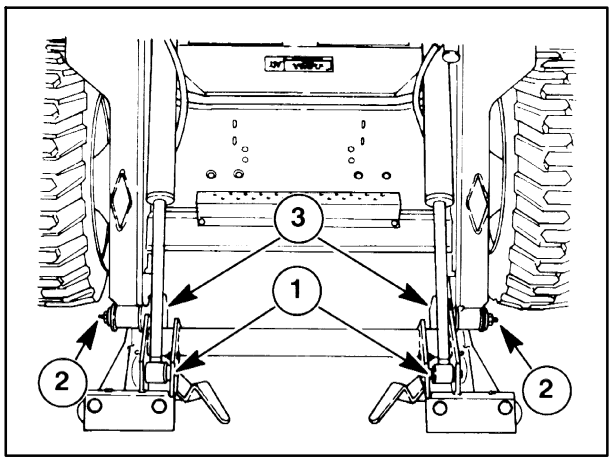

Figure 7-125

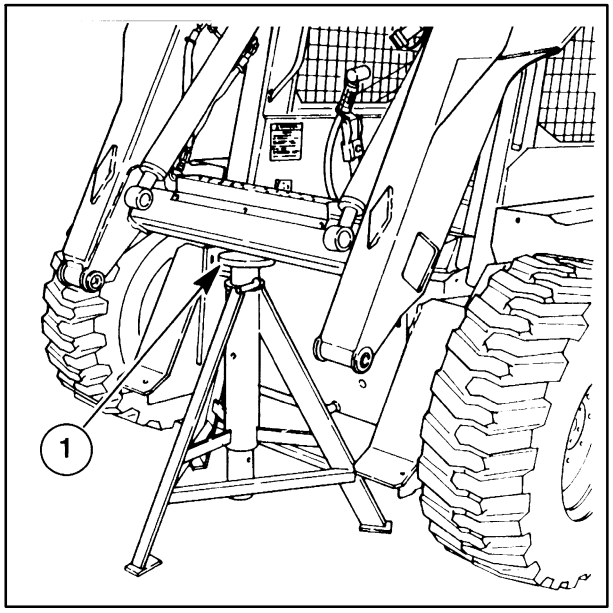

Figure 7-126

7. Using a cutting torch, cut the weld around the hub to separate the hub from the main boom. DO NOT cut any material from the main boom. Grind to remove any remaining weld and hub from the boom

8. Position the hubs on the boom straight, from side to side, with center spacing, 2, as follows, and tack weld the hubs to the boom.

   Hub Center Spacing - 822 mm (32.36″)

9. Reinstall the mounting plate and tapered pivot pins and hardware. Pivot the mounting plate up and down to ensure there is no binding between the mounting plate and pivot pins. Weld the hubs to the boom.

10. Install the hub reinforcement gussets described earlier in these instructions.

11. Lubricate the pivots and torque and hammer seat the tapered pins and hardware. Refer to “MOUNTING PLATE REPAIR,” in this section.

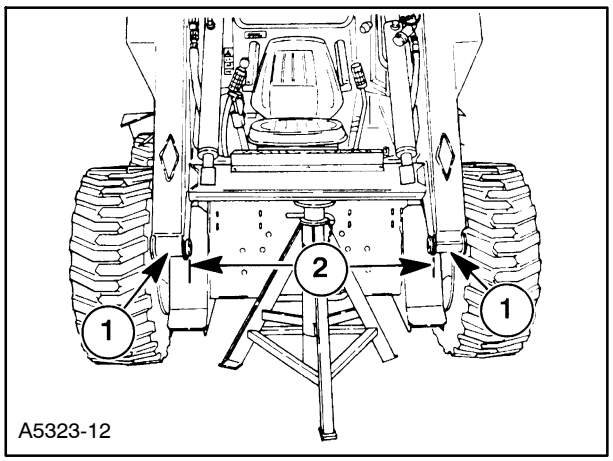

Figure 7-127

REAR BOOM REINFORCEMENT GUSSETS

1. Remove any attachments, bucket, etc., from the boom mounting plate.

2. Raise and lock the boom in the “UP” position, 1.

CAUTION: BEFORE INSTALLING THE REINFORCEMENT GUSSETS, THE BOOM MUST BE SUPPORTED AT THE FRONT ON JACK STANDS AND THE REAR SUPPORTED WITH A HOIST OR LIFTING DEVICE.

   a. RAISE THE BOOM, EXTEND THE BOOM LOCKPINS, AND LOWER THE BOOM ONTO THE BOOM LOCKPINS.

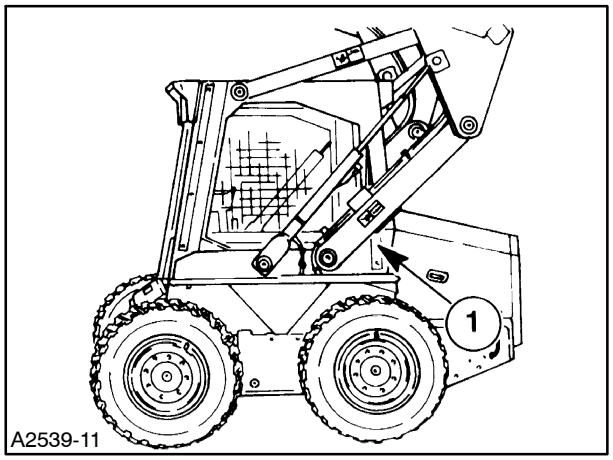

Figure 7-128

3. Position a jack stand or suitable support under the boom at the front, as shown at 1. The boom must be supported 1320.8 mm (52″) to 1371.6 mm (54″) off the ground at 1. Support the rear of the boom at 1, Figure 7-130, with a hoist or lifting device. This will position the boom for the rear lower link pivot pin removal and installation of the gussets.

   a. RAISE THE BOOM OFF THE STOPS, DISENGAGE THE BOOM STOPS, AND TURN THE IGNITION KEY TO THE “OFF” POSITION. AFTER STOPPING THE ENGINE, TURN THE IGNITION KEY SWITCH TO THE “ON” POSITION.

   b. PUSH THE BOOM PEDAL TO LOWER THE BOOM ONTO THE SUPPORT AND RELIEVE ALL HYDRAULIC PRESSURE IN THE BOOM CIRCUIT.

   c. TURN “OFF” THE IGNITION KEY SWITCH.

   d. ENGAGE THE PARKING BRAKE.

4. Remove the negative (-) battery cable.

5. Loosen the boom lower link (one side at a time) and rear pivot pin retaining hardware. DO NOT remove the hardware.

6. Remove hose support, 2, from the boom.

7. With a sledge hammer (8 lbs.) or larger, strike the link at 3, to loosen the tapered pivot pin (one side at at time). Remove the retaining bolt and pin, resting the link on the final drive case.

8. Clean the pivot area and remove the paint from the link in the area of the gusset to ensure good weld penetration.

9. Repair the pivot area if required (weld cracks etc.).

   IMPORTANT: During any grinding and welding, protect the painted surfaces with a non-flammable material to prevent damage to the painted surfaces.

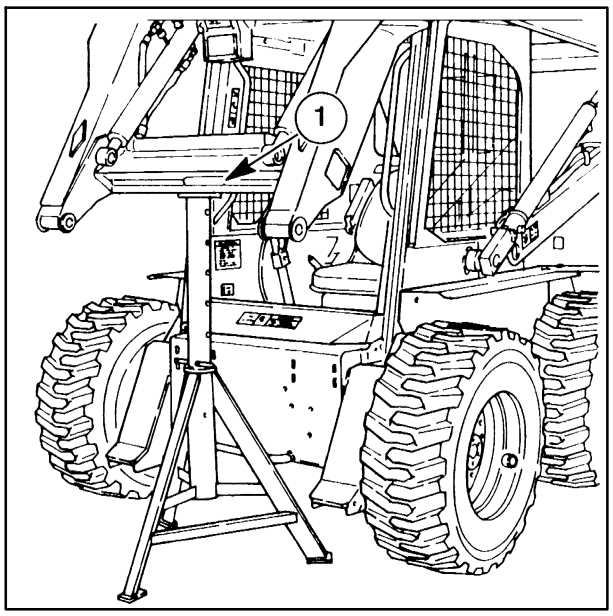

Figure 7-129

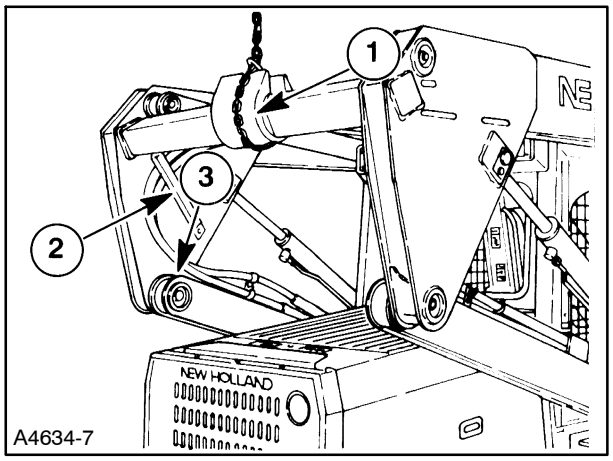

Figure 7-130

GUSSET POSITIONING

1. Position the gusset over the pivot bushing and set it flat against the boom side plate.

   NOTE: Grind any weld that interferes with the gusset, preventing it from setting flat.

2. Position the gusset to center from the rear edge to the front edge of the boom at 1.
3. Weld the gusset by starting midway of the plate at 2 and 3. With a continuous weld, weld around the top corners at 4 and 5. Weld the remaining areas around the outer edge of the plate.
4. With a continuous weld, weld the plate to the pivot bushing, by starting and stopping in the area at 6.
5. Grind to remove any sharp edges from the gussets or welds that could cut and damage the hydraulic hoses that run across them.
6. Clean the boom and gusset and paint the gusset and welded areas.
7. Reinstall the boom lower link.
8. Torque the pin retaining hardware to 228 N·m (250 ft. lbs.). The pivot pin and hardware must be hammer seated and retorqued until the torque is maintained.
9. Reinstall the hose supports.
10. Reconnect the negative (-) battery cable.
11. Reinstall any other shields removed for the repair.

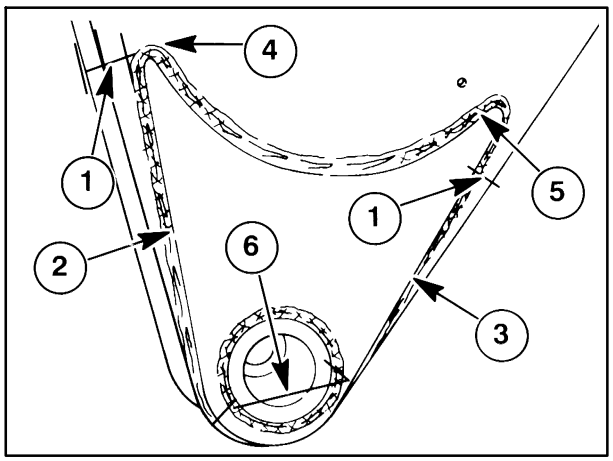

Figure 7-131

BOOM, UPPER AND LOWER LINK INSTALLATION

1. If the upper and lower boom links and boom cylinders were removed, attach the upper and lower links to the ROPS before installing the main boom assembly.
2. Install the lower link pivot pins, 1, through the links, 2, and insert the tapered end of the pin into the ROPS frame. Install the pin retaining hardware and tighten, making sure the tapered pin is inserted into the ROPS straight.

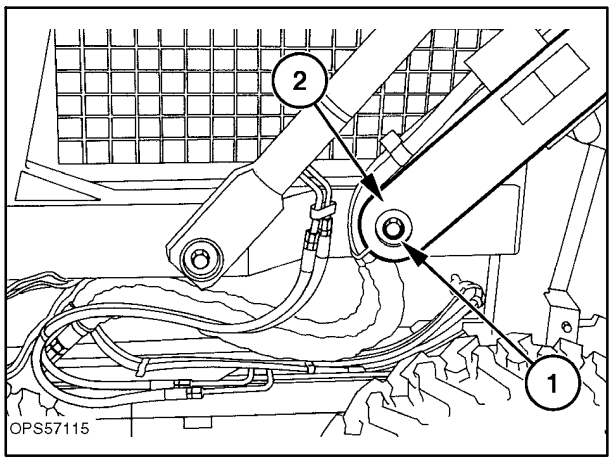

Figure 7-132

3. Install the upper link pivot pins through the links and insert the tapered end of the pin into the ROPS post. Install the pin retaining hardware and tighten, making sure the tapered pin is inserted into the ROPS post straight.
4. Position the main boom assembly over the loader positioning the boom against the boom stops (front of the final drive case).

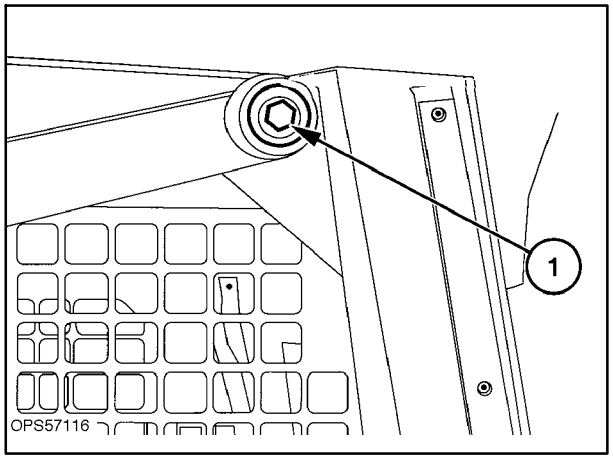

Figure 7-133

5. Attach the upper link rear with tapered pivot pins, 1, and retaining hardware. Tighten the hardware, making sure the pin is straight in the main boom.

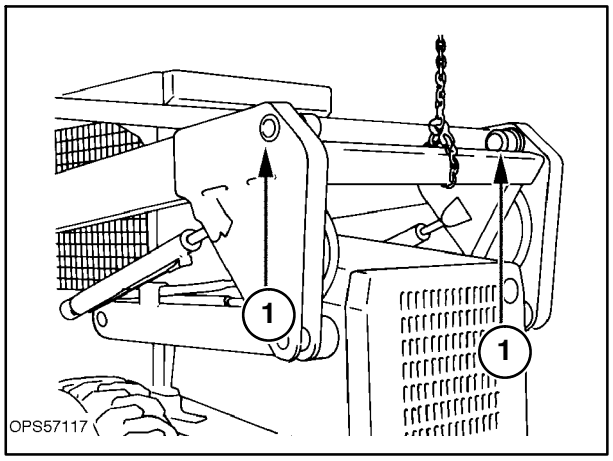

Figure 7-134

6. Attach the lower link rear with tapered pivot pins and retaining hardware. Tighten the hardware, making sure the pin is straight in the main boom.

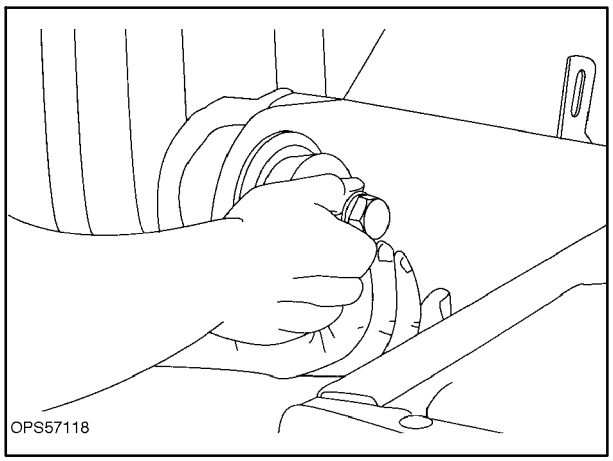

Figure 7-135

7. With the main boom, upper and lower links attached, the pivot pins and hardware must be properly seated.

   Torque the pin retaining hardware to the following torques:

   1 - Lower link - 338 N·m (250 ft. lbs.)

   2 - Upper link - 338 N·m (250 ft. lbs.)

   3 - Cylinder pivot (lower) - 338 N·m (250 ft. lbs.)

   4 - Cylinder pivot (upper) - 38 N·m (28 ft. lbs.)

8. After the pivot pin retaining hardware is torqued the pins must be properly seated. Using a hammer, strike the head of the bolt and pin several times to seat the tapered pin in the taper in the ROPS. Retorque the hardware to specified torque. Repeat this process until the torque is maintained.

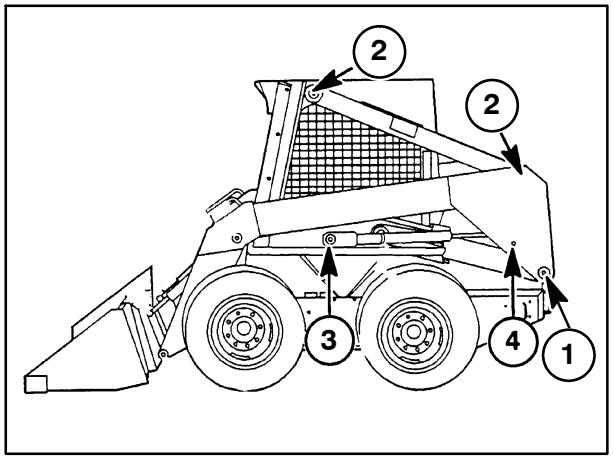

Figure 7-136

9. Reinstall the cylinders to the boom upper pivot.
10. Reinstall the boom hydraulic tubes and hoses if removed. Position the tube at 1, the front of the boom to maintain clearance between boom and tubes. The tubes must be properly positioned or the tubes will contact the corner of the ROPS (cab) when the boom is raised and lowered.
11. Reattach the tubes to the Z-bracket, 2, and install the quick couplers. Install the tube clamps, 3, front shown.

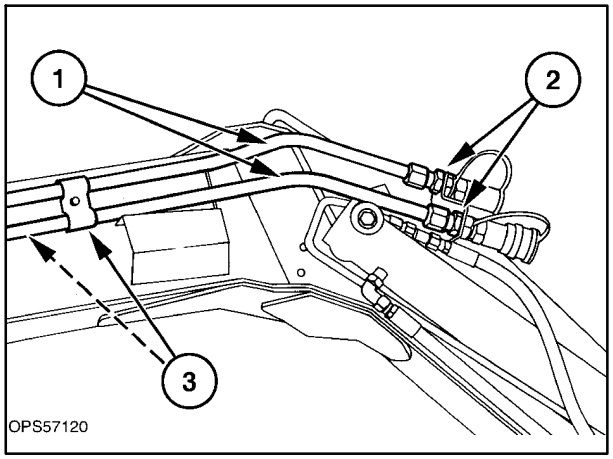

Figure 7-137

12. Route the tubes and hoses to the rear of the boom through the rear hose supports, 1, and on the top side of the lower link at 2.

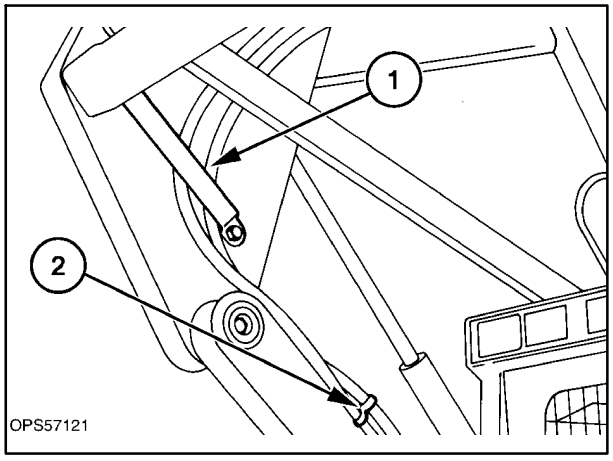

Figure 7-138

13. Position the hoses with one on each side of the lower link retaining clips, 1, and through the hose retainer at 2. Do not tighten clamps at this time; further adjustment will be required later.
14. Insert the hoses through the hose support on the end of link at 3.
15. Reconnect the hoses to the tubes at 4, positioning the hoses and tubes for clearance at the fender when the boom is raised and lowered.

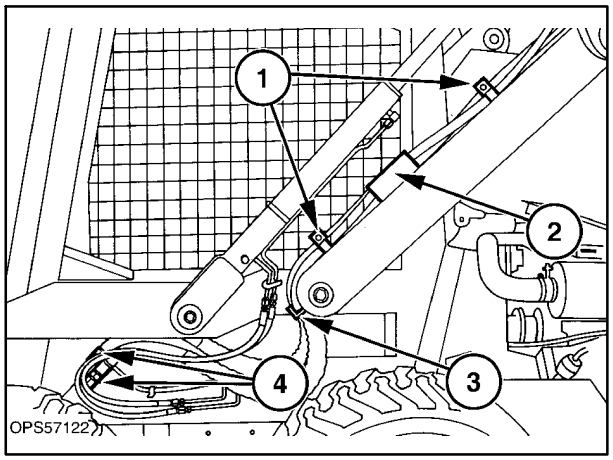

Figure 7-139

16. When all boom links and pivot pins are properly seated and torqued and all hydraulic connections are tightened, operate the boom up and down. Check the clearance between the tube and ROPS (cab) at 1.

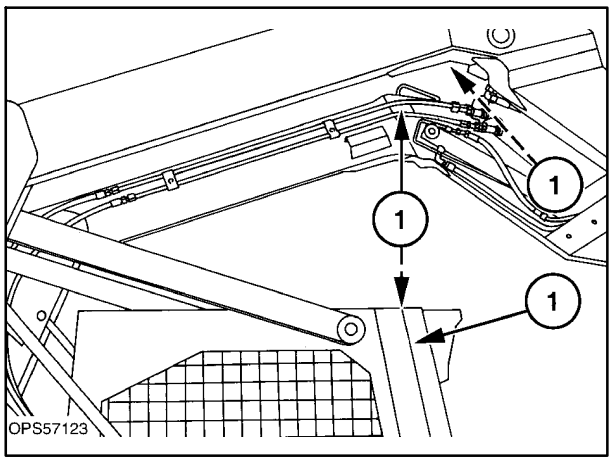

Figure 7-140

17. Check the hoses, 1, around the rear supports with the boom in the fully raised position. The hoses should be routed as shown. Remove any slack from the hoses to the boom tubes and tighten the hose clamp, 2.

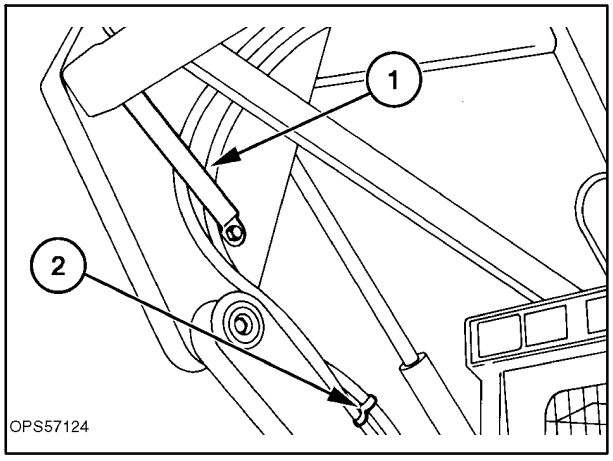

Figure 7-141

18. Remove any slack between the top clamp, 1, and second clamp, 2, and then tighten the second clamp.

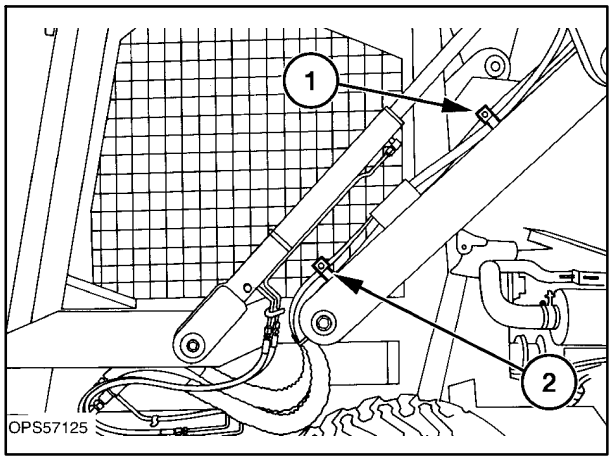

Figure 7-142

19. Install the front step shield, 1, the fenders, and fender hardware, 2. Raise and lower the boom checking the hose/tube clearance to fenders at 3, and readjust if required. Check for any oil leaks and repair if required.

    NOTE: The boom may require several cycles up and down to remove the air from the boom hydraulic circuit.

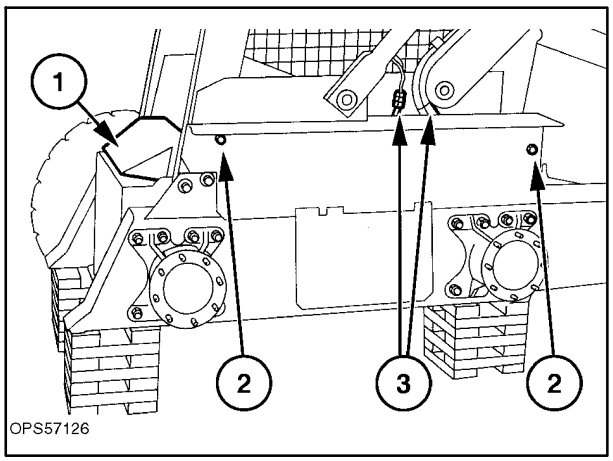

Figure 7-143

20. Reinstall the boom mounting plate if removed. Torque the pivot bolts, 1, to 108 N·m (80 ft. lbs.). The tapered pivot pins and retaining hardware must be hammer seated by striking the head of the bolt and pin and retorquing the bolt. This step must be repeated until the torque is maintained.

21. Reinstall any shields removed for the repair.

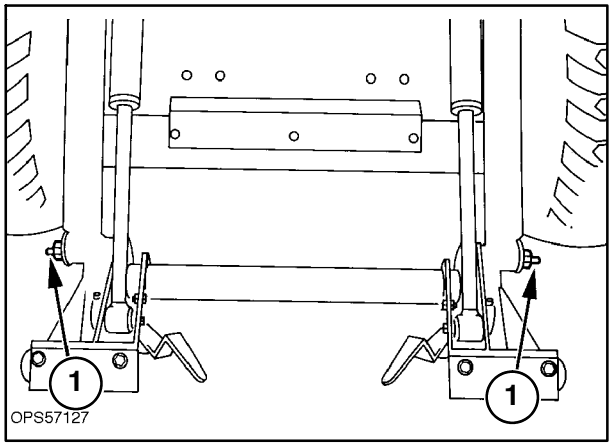

Figure 7-144

ATTACHMENT MOUNTING PLATES - ROUND-BAR AND SQUARE-BAR

There are two styles of attachment mounting plates in use on the L565, Lx565, and Lx665 model skid-steer loaders - the “Round-Bar” and “Square-Bar” mounting plates. The “bar”, or tube, refers to the main support that connects the two mounting plates. Early models used the Round-Bar version and later models use the Square-Bar version.

Determine the style of Attachment Mounting Plate and refer to the appropriate section for Removal, Repair/Rebuild, or Reassembly.

Round-Bar - 1
Early Model L565, Lx565, and Lx665 loaders between serial numbers:

L565 - 850751 to 999999 and 0001 to 31302
Lx565 - 847451 to 999999 and 0001 to 40917
Lx665 - 847851 to 999999 and 0001 to 68174

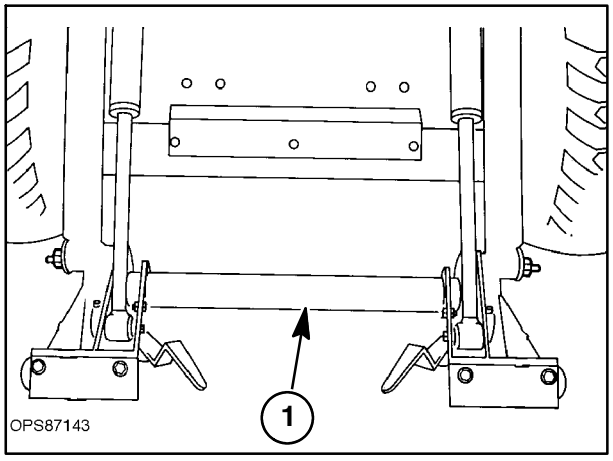

Figure 7-145

Square-Bar - 2
Later Model L565, Lx565, Lx685 loaders between serial numbers:

L565 - 31303 to 850750
Lx565 - 40918 to 847450
Lx665 - 68175 to 847850

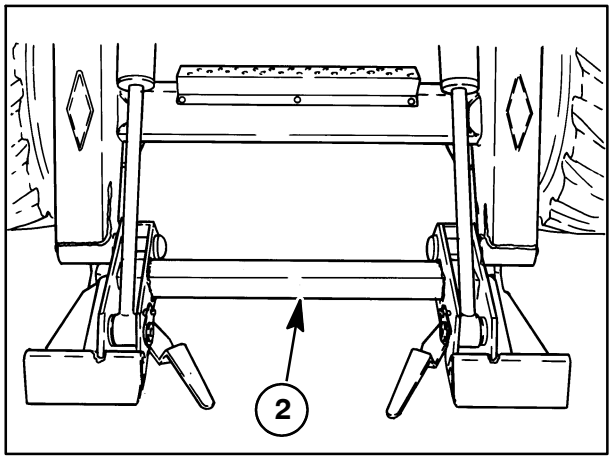

Figure 7-146

ROUND-BAR ATTACHMENT MOUNTING PLATE

REMOVAL

1. Remove any attachment from the loader mounting plate.
2. Lower the boom to the lowered position.
3. Tilt the mounting plate forward until the face is level with the ground.
4. Remove the cylinder mounting plate pivot pins. Remove the pin retaining bolts, 1, and slide the pins from the mounting plate and cylinders.
5. Loosen the mounting plate to boom pivot pin hardware, 2. Do Not remove bolts at this time.
6. With a soft-faced sledge hammer strike the mounting plate pivot area at 3. This will free up the tapered pivot pin in the boom link.
7. Remove the pivot pin retaining hardware and remove the tapered pin.

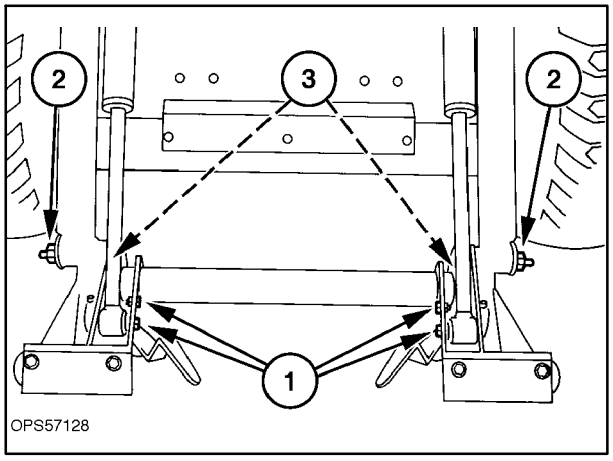

Figure 7-147

CAUTION: SUPPORT THE MOUNTING PLATE DURING REMOVAL TO PREVENT DROPPING OF PLATE WHEN PINS ARE REMOVED.

REPAIR/REBUILD MOUNTING PLATE

Latch Lever and Pin Removal/Repair

1. Remove any attachment (bucket, fork, etc.) from the loader mounting plate.
2. Tilt the mounting plate forward until the face is level with the ground.
3. With an allen wrench, remove the setscrew, 1, from the back side of the mounting plate.

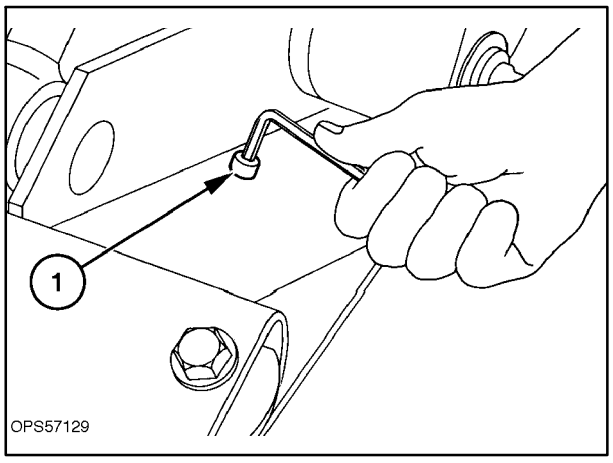

Figure 7-148

4. Moving the latch handle, 1, align the groove pin in the setscrew hole. Drive out the groove pin, 2, with a hammer and punch.
5. Remove the latch pin from the bottom of the mounting plate.

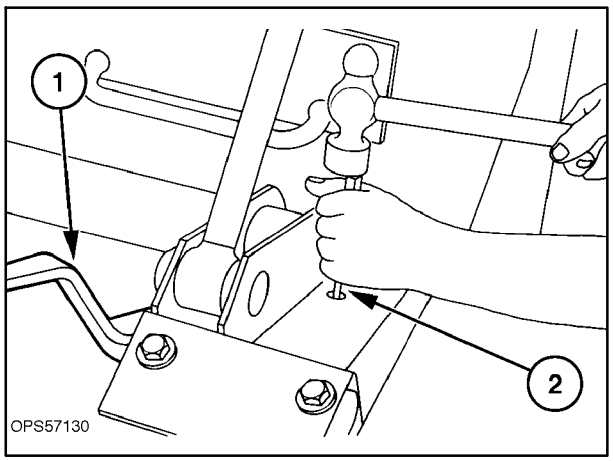

Figure 7-149

6. Enter the loader. Sitting in the seat with seat belt buckled, start the loader and roll the mounting plate back until the face is vertical with the ground.
7. Remove the latch handle pivot bolt and spacer, 1.

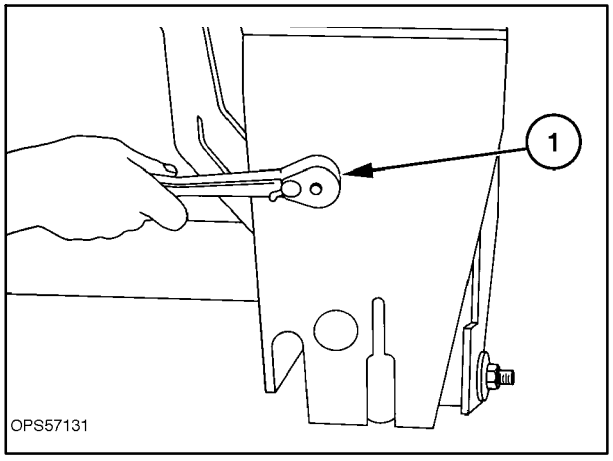

Figure 7-150

8. Remove the handle/spring assembly, 1, from the plate.
9. Repeat the procedure for both the right and left sides.

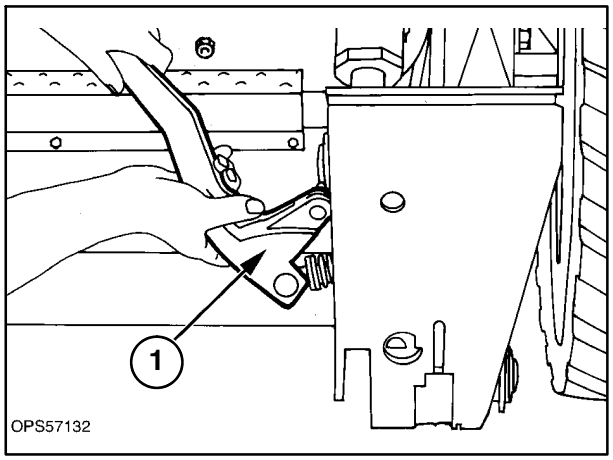

Figure 7-151

Parts Inspection

1 - Mounting Plate Assembly

1. Inspect the plate for straightness, if the mounting plate pods are not straight with each other it may be difficult to hook up to attachments. Refer to “Checking Procedure for Buckets and Attachments” in Section 8 (Optional Equipment) for more details. If plate is not within specifications replace assembly.
2. Excessive wear in pivot pin holes, can result in a sloppy fit. Replace the bushings in the plate.
3. Excessive wear in the latch pin area can result in loose attachments. If the pins do not slide freely, remove pin and clean and lubricate.

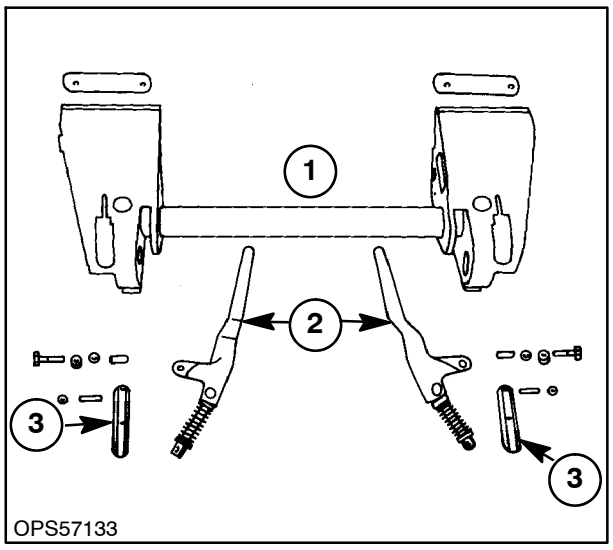

Figure 7-152

2 - Latch Handle/Spring Assemblies

1. Examine latch handle pivot hole for excessive wear.
2. Examine spring for looseness or broken coils.

3 - Latch Pins

1. Examine pins for excessive wear and binding in mounting plate.
2. Check the tapered area of the pin for wear or breakage.

Pivot Bushings Replacement

1. Use a suitable bushing driver and remove old bushings.
2. Clean the bushing area to remove any dirt/trash and burrs.
3. Using a bushing driver install the new pivot bushings from each end of hole, 1. Drive bushings flush with the outer edge of the hub.

   NOTE: There will be a space in the center between the two bushings.

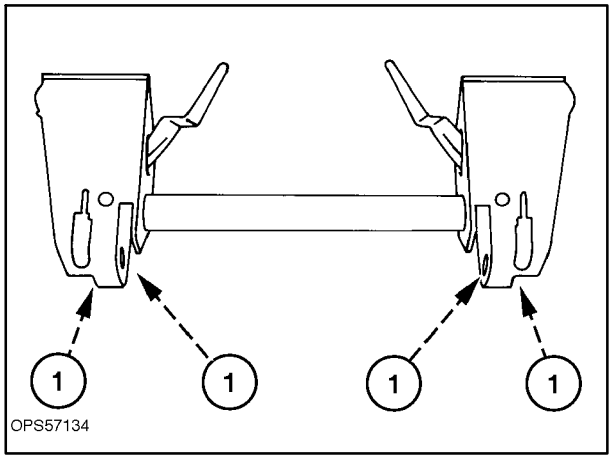

Figure 7-153

Latch Lever and Spring Repair/Rebuild

Serial Number Range:

L565	850751 to 853483
Lx565	847451 to 869753
Lx665	847851 to 869993

This lever/spring assembly may have shim washers at 1 and 2. Also the lever will be square in area, 3.

Within this serial number range, the assembly has a lighter spring, 5, Figure 7-155.

NOTE: DO NOT intermix parts between below and above serial number designs.

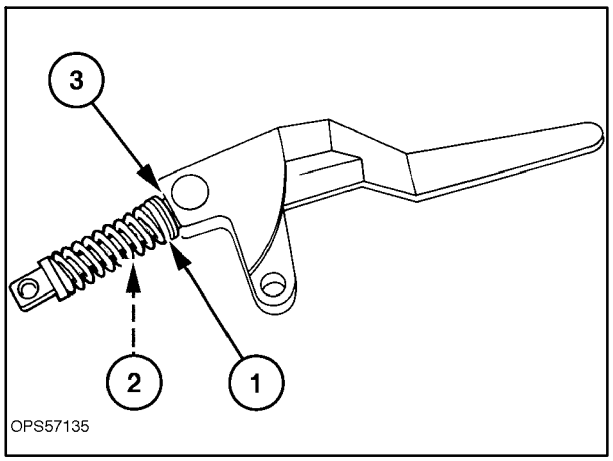

Figure 7-154

Serial Number Ranges:

L565	853484 to 999999 and 0001 to 31302
Lx565	869754 to 999999 and 0001 to 40917
Lx665	869994 to 999999 and 0001 to 68174

This lever/spring assembly will have a heavier coil spring, 1, and longer spring retainers, 2 and 3, than the old assembly. The lever will have a radius corner at 4.

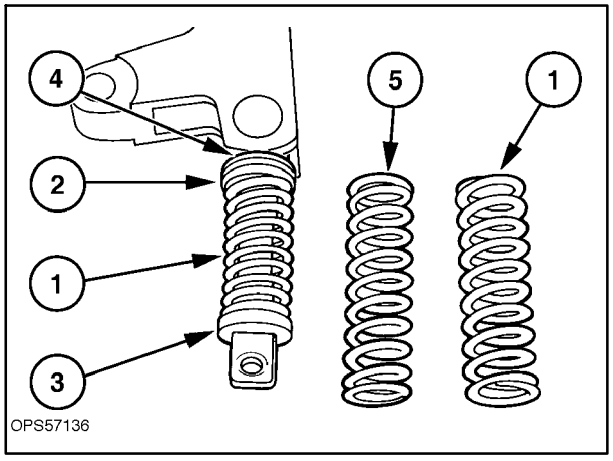

Figure 7-155

Disassembly of Lever/Spring Assembly

1. Clamp the lower spring guide, 1, in a vise. Turn the step bolt, 2, to remove the lower spring guide, 1, from the step bolt, and remove the spring, 3.

CAUTION: WHEN REMOVING THE STEP BOLT, THE SPRING WILL HAVE SOME COMPRESSION PRESSURE. REMOVE THE BOLT WHILE APPLYING DOWN PRESSURE ON THE BOLT.

2. Remove upper spring guide, 4, step bolt, 2, and pivot block, 5, from handle, 6.

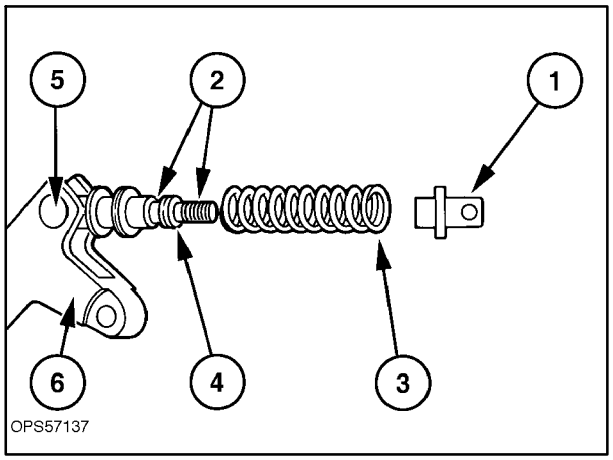

Figure 7-156

Reassembly of Latch Lever

Serial Number Range:

L565	850751 to 853483
Lx565	847451 to 869753
Lx665	847851 to 869993

1. Insert pivot block, 1, and step bolt, 2, into handle at 3.
2. Install the upper spring guide and two large washers #184353 at 4.
3. Install four small washers #00721 at 5.
4. Install spring, 6, over upper spring guide.
5. Install the lower spring guide, 7, onto step bolt.

   NOTE: Slight pressure will need to be applied to lower spring guide to compress spring slightly to start threading lower guide onto step bolt.

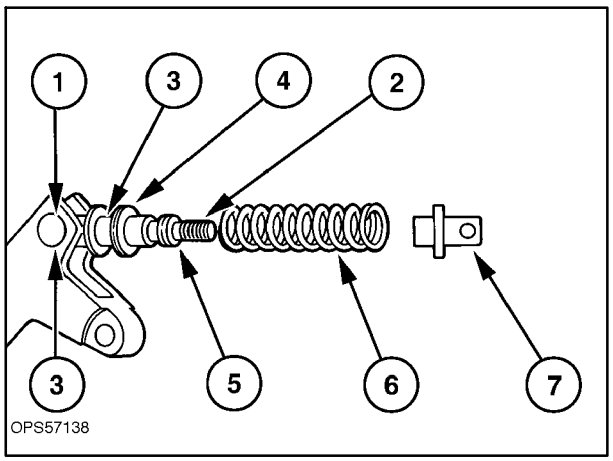

Figure 7-157

Serial Number Ranges:

L565	853484 to 999999 and 0001 to 31302
Lx565	869754 to 999999 and 0001 to 40917
Lx665	869994 to 999999 and 001 to 68174

1. Insert pivot block, 1, and step bolt, 2, into handle at 3.
2. Install the upper spring guide, 4.
3. Install spring, 5, over upper spring guide.
4. Install the lower spring guide, 6, onto step bolt.

   NOTE: Apply slight pressure to lower spring guide to compress spring slightly and start threading lower guide onto step bolt.

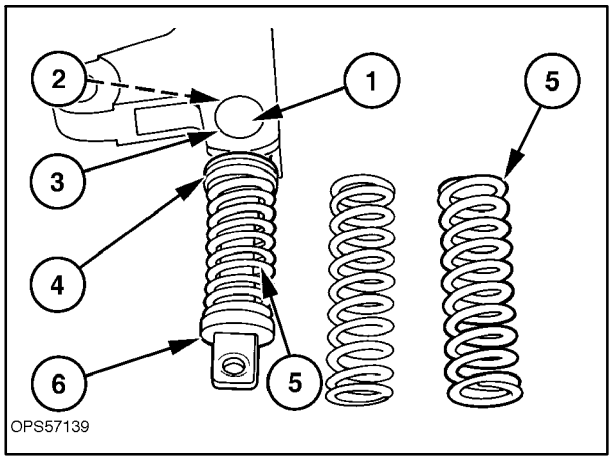

Figure 7-158

Reinstallation of Latch Lever into Mounting Plate

1. Slide the handle/spring assembly into the mounting plate at 1, pointing the spring down.
2. Install the handle pivot bolt and tighten securely.

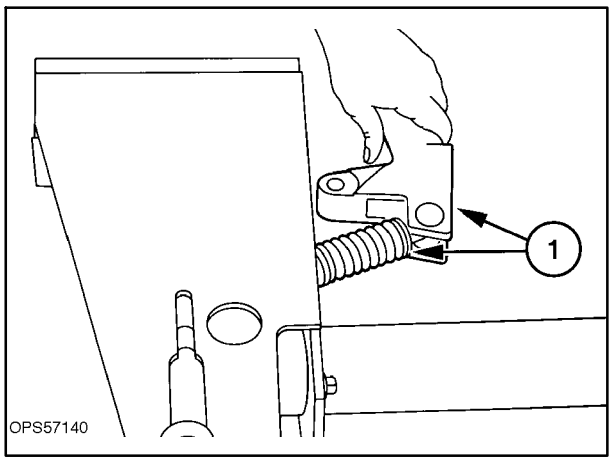

Figure 7-159

3. Insert the latch pin, 1, with the tapered side towards the loader boom, away from the attachment.
4. With a hammer and punch drive the grooved pin through the lower spring guide and latch pin.

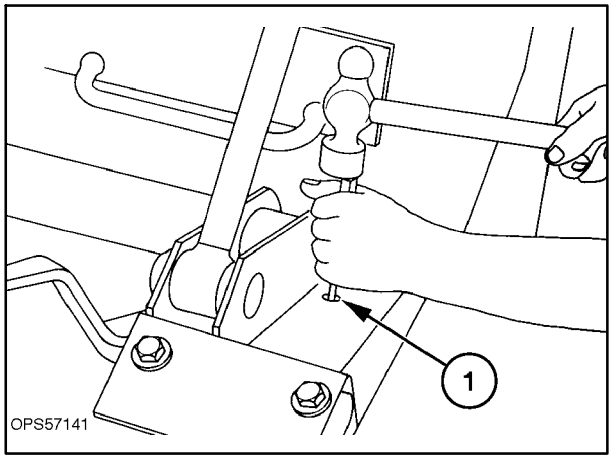

Figure 7-160

5. Reinstall the setscrew at 1.

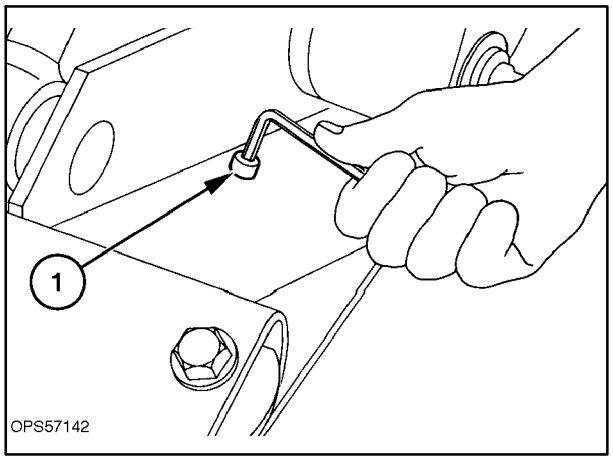

Figure 7-161

6. Reinstall the boom mounting plate if removed. Torque the pivot bolts to 108 N·m (80 ft. lbs.). The tapered pivot pins and retaining hardware must be hammer seated by striking the head of the bolt and pin and retorquing the bolt. This step must be repeated until the torque is maintained.

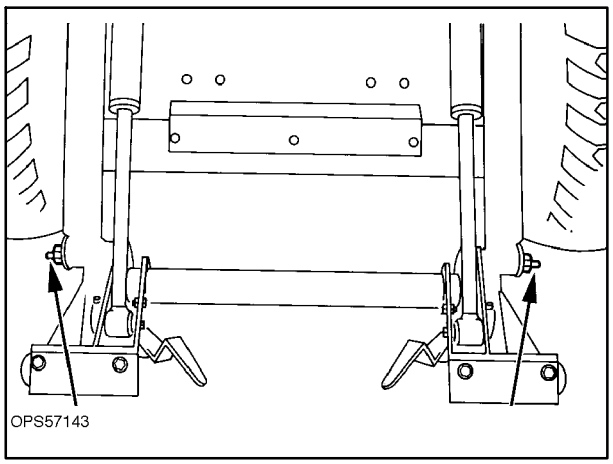

Figure 7-162

SQUARE-BAR ATTACHMENT MOUNTING PLATE

REMOVAL

1. Remove any attachment from the loader attachment mounting plate.
2. Lower the boom to the fully lowered position.
3. Tilt the attachment mounting plate forward until the face is level with the ground.
4. Remove the cylinder attachment mounting plate pivot pins by removing the pin retaining bolts, 1, and sliding the pins from the mounting plate and cylinders.

CAUTION: SUPPORT THE MOUNTING PLATE DURING REMOVAL TO PREVENT DROPPING THE PLATE WHEN PINS ARE REMOVED.

5. Remove hub caps, 2, from the pivots.
6. Loosen the attachment mounting plate to boom pivot pin hardware, 3. DO NOT remove the bolts at this time.
7. With a soft-faced sledgehammer, strike the mounting plate pivot area, 4. This will free the tapered pivot pin in the boom link.
8. Remove the pivot pin retaining hardware and remove the tapered pins.

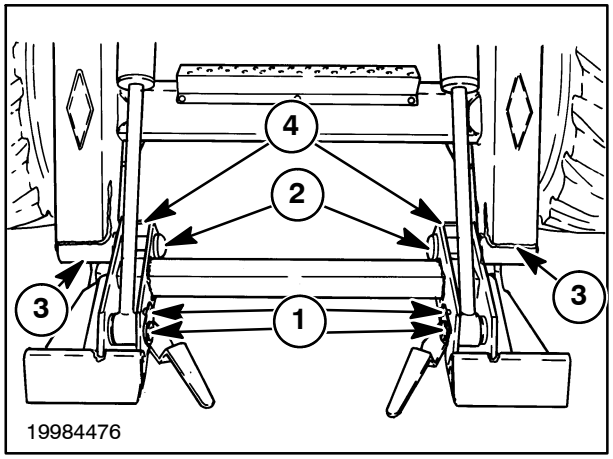

Figure 7-163

REPAIR/REBUILD MOUNTING PLATE

Latch Lever and Pin Removal/Repair

1. Remove any attachment from the loader attachment mounting plate.
2. Lower the boom to the lowered position.
3. Tilt the attachment mounting plate forward until the face is level with the ground.
4. With an allen wrench, remove the setscrew, 1, from the backside of the mounting plate for both the left and right sides.

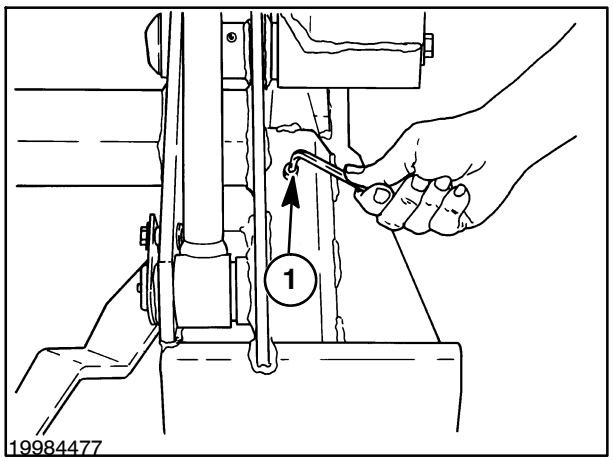

Figure 7-164

5. Move the latch handle, 1, to align the groove pin in the setscrew hole, 2. Drive out the groove pin with a hammer and punch. Repeat this procedure on other side.
6. Remove the latch pin from each side from the bottom of the mounting plate.

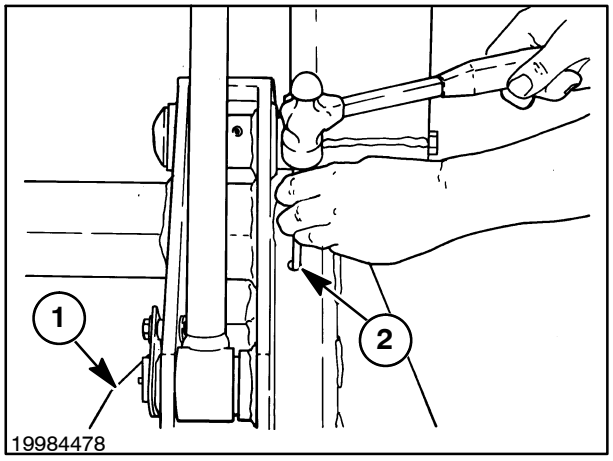

Figure 7-165

7. Remove the cylinder attachment mounting plate pivot pins to allow access to the latch handle pivot pin snap ring clips.

CAUTION: SUPPORT THE MOUNTING PLATE DURING REMOVAL OF THE MOUNTING PLATE PIVOT PINS TO PREVENT DROPPING THE PLATE DOWN WHEN PINS ARE REMOVED.

8. Remove the pin retaining bolts, 1, and slide the pins from the mounting plate and cylinders.

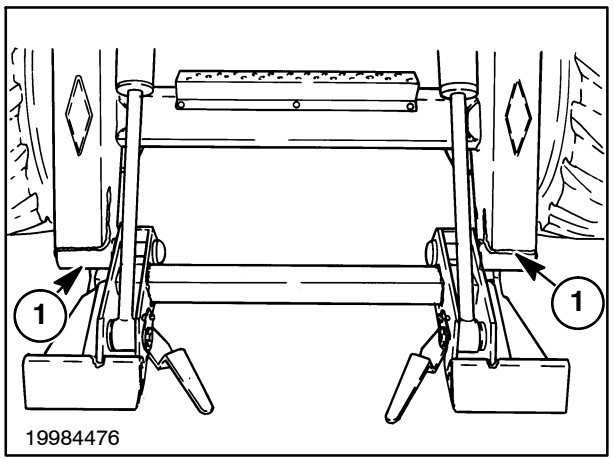

Figure 7-166

9. Enter the skid-steer loader. Sitting in the operator's seat with the seat belt buckled, start the loader and retract the attachment mounting plate actuating cylinders, 1, fully to clear the attachment mounting plate, 2.

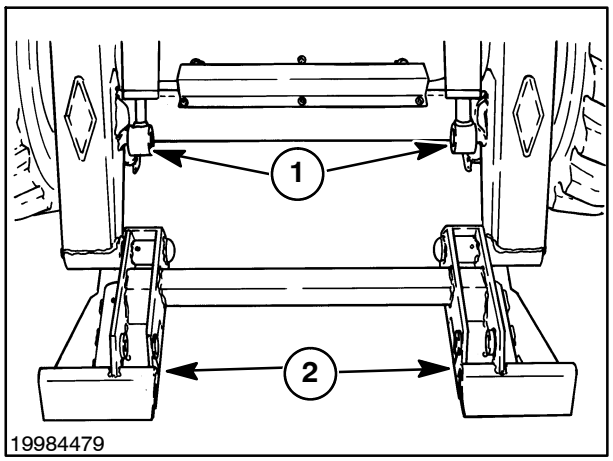

Figure 7-167

10. Remove the retaining ring, 1, from the latch handle pivot pin, 2, from the rear of the mounting plate on the LEFT and RIGHT sides.

11. Using a punch and hammer drive the latch handle retaining pin, 2, downward and out through the front of the attachment mounting plate on both sides. If there is insufficient ground clearance to fully remove the latch handle pivot pins, lift the attachment mounting plate up as necessary to clear the pins.

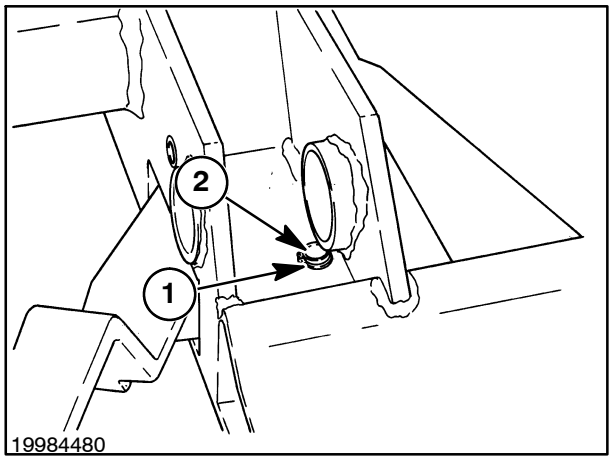

Figure 7-168

12. Remove the handle/spring assembly, 1, from the attachment mounting plate on the LEFT and RIGHT sides of the attachment mounting plate.

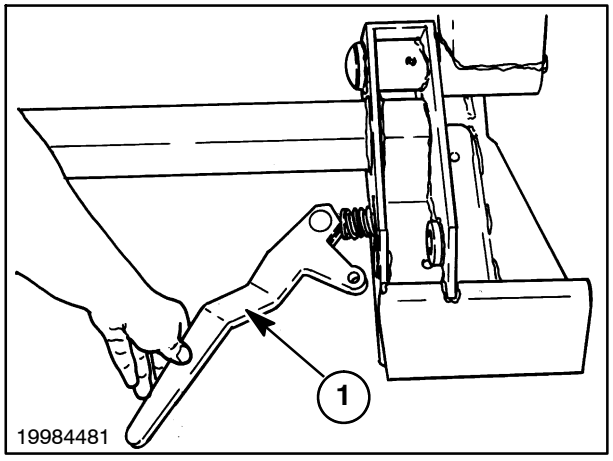

Figure 7-169

PARTS INSPECTION

Mounting Plate Assembly

1. Inspect the plate, 1, for straightness. If the mounting plate pods are not straight with each other it may be difficult to hook up to attachments. Refer to the “Checking Procedure for Buckets and Attachments” in Section 8 - Optional Equipment for further details. If the mounting plate is not within specifications, replace the assembly.
2. Inspect the latch pin area for excessive wear, which can result in loose attachments. If the pins, 2, do not slide freely, remove the pins, clean and lubricate.
3. Inspect the mounting plate pivot pins, 3, and bushings, 4, for wear, which can result in loose attachment to the mounting plate boom cylinders.
4. Inspect the cylinder pivot pins, 5, for wear. Inspect the pivot pin holes for wear that could cause a sloppy fit. Replace the bushings in the mounting plate or pivot pins, if necessary.

Latch Handle/Spring Assemblies

1. Inspect the latch handle pivot holes, 6, for excessive wear and binding in the mounting plate.
2. Check that the spring, 7, is not bent, damaged, or has broken coils. Replace if necessary.

Latch Pins

1. Examine the latch pins, 2, for excessive wear and binding in the mounting plate.
2. Check the tapered area of the pins for wear or chips. Replace if necessary.

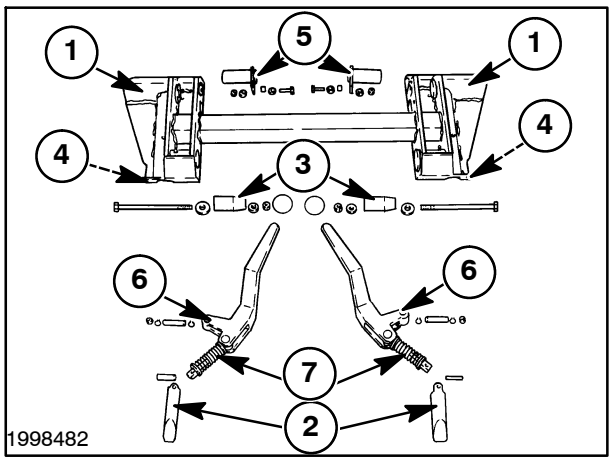

Figure 7-170

Pivot Bushing Replacement

1. Use a suitable bushing driver and remove the old bushings.
2. Clean the bushing area to remove any dirt, debris and burrs.
3. Using a bushing driver, install the new pivot bushings from each end of hole, 1. Drive bushings flush with the outer edge of the hub.

   NOTE: There will be a space in the center between the two bushings.

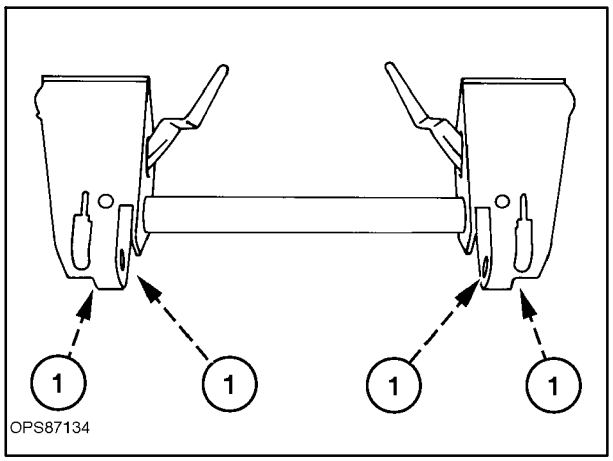

Figure 7-171

Latch Lever and Spring Repair/Rebuild

NOTE: DO NOT intermix latching lever assemblies or parts between the Round Bar attachment mounting plate and units with the Square Bar attachment mounting plates.

1. Clamp the lower spring guide, 1, in a vise. Turn the step bolt, 2, to remove the lower spring guide from the step bolt and remove spring, 3.

CAUTION: WHEN REMOVING THE STEP BOLT, THE SPRING WILL HAVE SOME COMPRESSION PRESSURE. REMOVE THE BOLT WHILE APPLYING DOWNWARD PRESSURE ON THE BOLT.

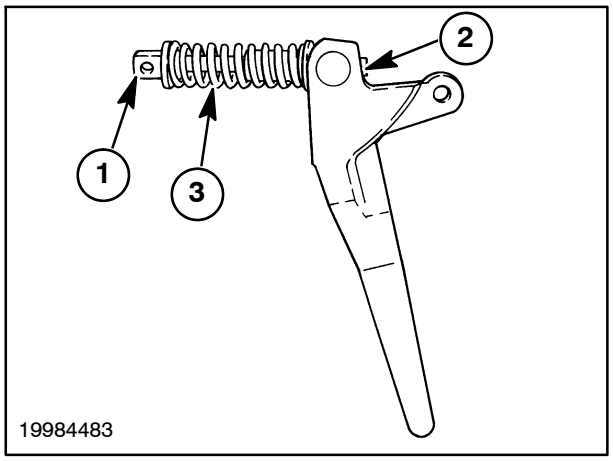

Figure 7-172

2. Remove the upper spring guide, 1, pivot block, 2, and step bolt, 3, from handle, 4.

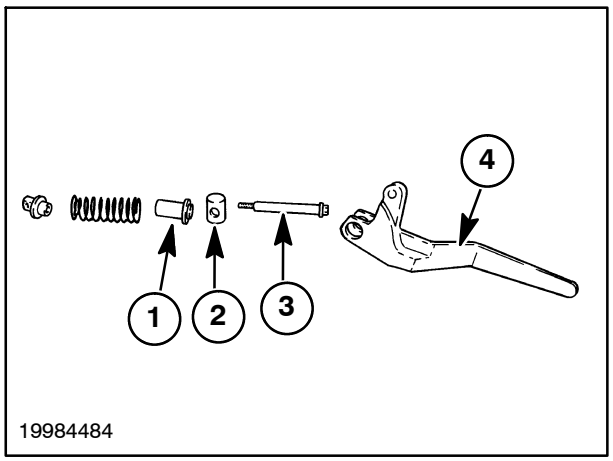

Figure 7-173

REASSEMBLY

1. Insert the pivot block, 1, and step bolt, 4, into the handle, 2. Install the upper spring guide, 3, onto step bolt, 4.
2. Install spring, 5, over the upper spring guide, 3. Install the lower spring guide, 6, onto step bolt, 4, and tighten.

   NOTE: Apply slight pressure to the lower spring guide to compress the spring slightly and start threading the lower guide onto the step bolt.

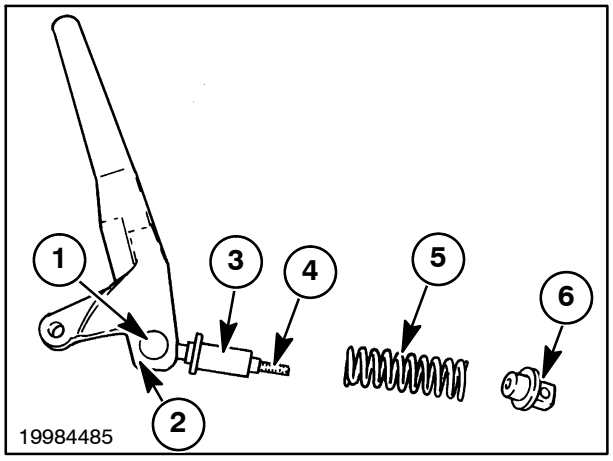

Figure 7-174

3. Slide the latch handle/spring assembly, 1, into the mounting plate, pointing the spring down.

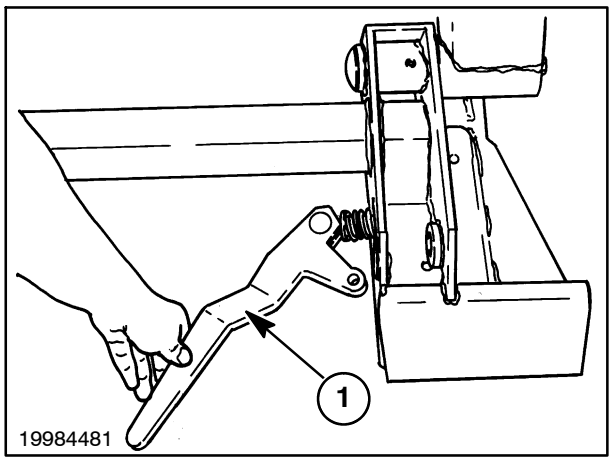

Figure 7-175

4. Install the handle pivot pin, 1, from the front of the plate and install the snap ring retaining clip, 2. The pivot pins will have a snap ring on both ends of the pins.

   NOTE: The handle pivot pin should have one snap ring retaining clip already installed prior to reinstallation in the attachment plate. If the snap ring retaining clip is not present, install the clip prior to pin installation.

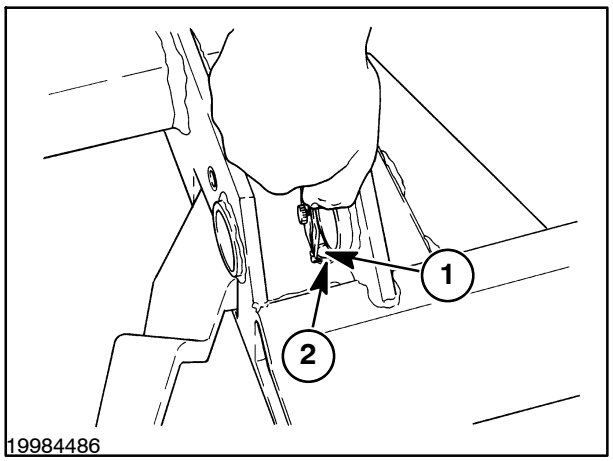

Figure 7-176

5. Move the latch handle, 1, to align hole with the groove and insert the latch pin with the tapered side towards the loader boom, away from the attachment.
6. With a hammer and punch, drive the grooved pin, 2, through the lower spring guide and latch pin.

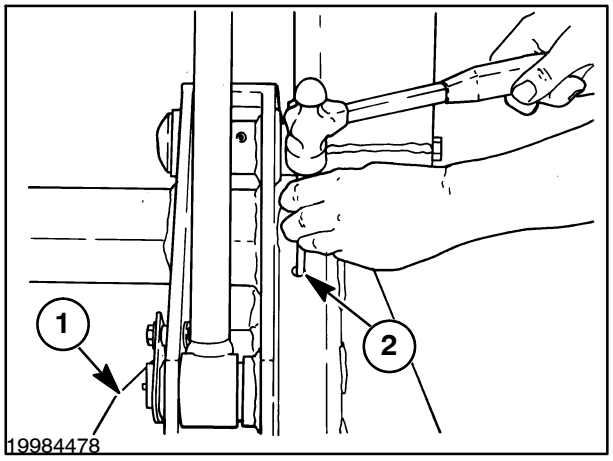

Figure 7-177

7. Reinstall the setscrew, 1.

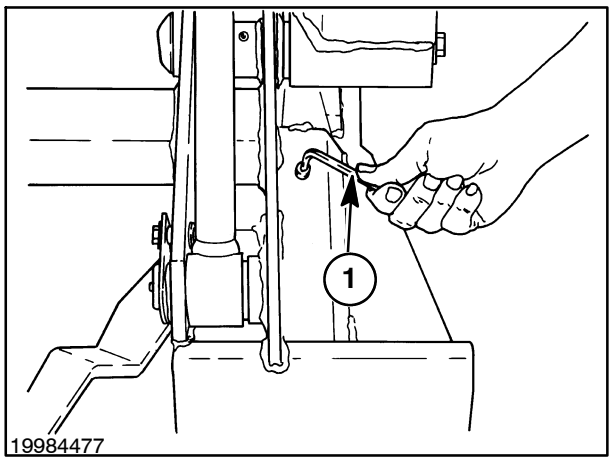

Figure 7-178

8. Reinstall the boom mounting plate, if removed, by installing the pivot taper pins and retaining hardware, 2.
9. Torque the pivot bolts, 2, to 108 N·m (80 ft. lbs.).

   NOTE: The tapered pivot pins and retaining hardware must be hammer seated by striking the head of the bolt and pin, and then re-tightening. This step must be repeated until the torque remains constant.

10. Reinstall hub caps, 3, into the plate pivots.
11. Extend the attachment mounting plate cylinders until they align with their mounting holes on the attachment mounting plate.
12. Install the cylinder attachment mounting plate pins through the mounting plate and into the cylinder rod ends. Install the pin retaining hardware, 1, and tighten.
13. Grease the two boom mounting plate pivot pins and the two cylinder mounting plate pivot pins prior to moving the attachment mounting plate to prevent any damage to the pivot points.

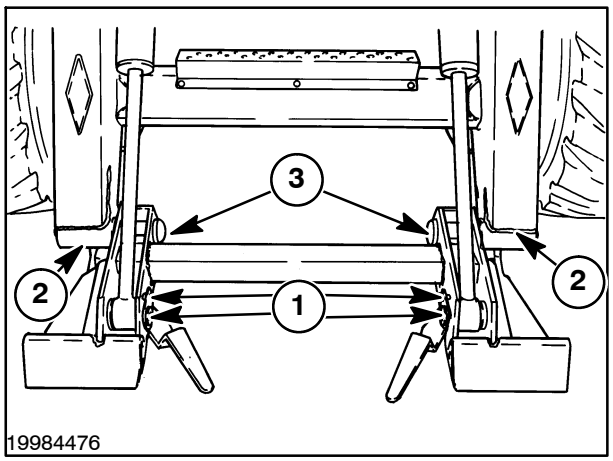

Figure 7-179

ADDITIONAL MOUNTING PLATE INFORMATION

Attachment Overcenter Handles

When the attachment plate overcenter handles are raised to the disengaged position, the handles may not remain raised high enough to enter the attachment requiring the operator to raise the handle a second time after engaging the attachment so the pins can be properly engaged in the attachment lower slots.

Reference Service Bulletin 9/95-I2, pages 22 and 23, “Attachment Mounting Plate Hardware Changes.”

Use the Parts list to be sure there are not intermixed parts, i.e., older light springs with newer handles.

If parts are intermixed with old, lighter springs and newer handles, the handles may not stay in the completely-raised, disengaged position.

The cast overcenter handles are identified with a rough casting number in the grip area, 1. See the chart below for handle identification.

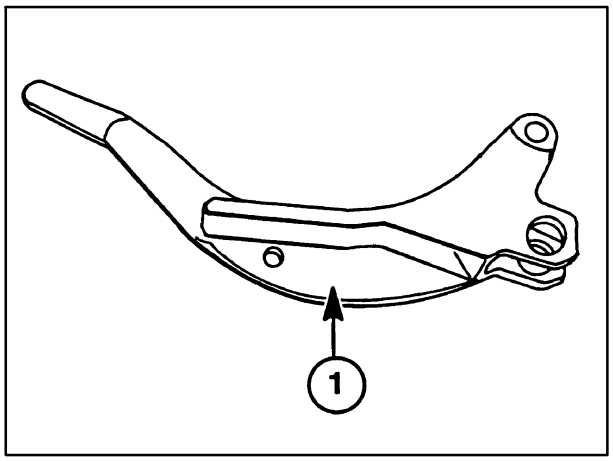

Figure 7-180

The cast overcenter handles have been improved further, with more radius material at 1, to increase overcenter action and keep handles in the disengaged position. The pivot area profile at 2, Figure 7-182 (new style), and Figure 7-183 (previous style), has also been modified.

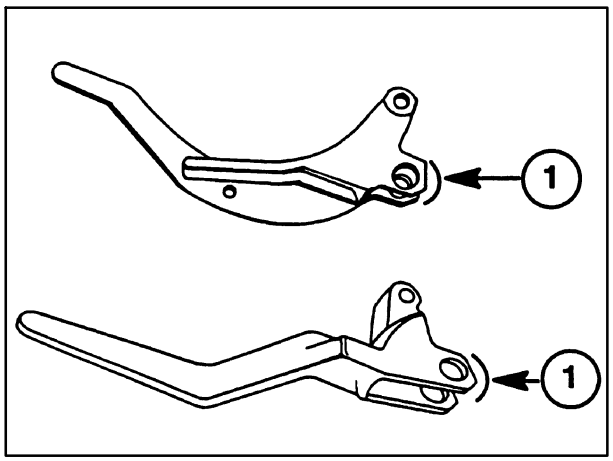

Figure 7-181

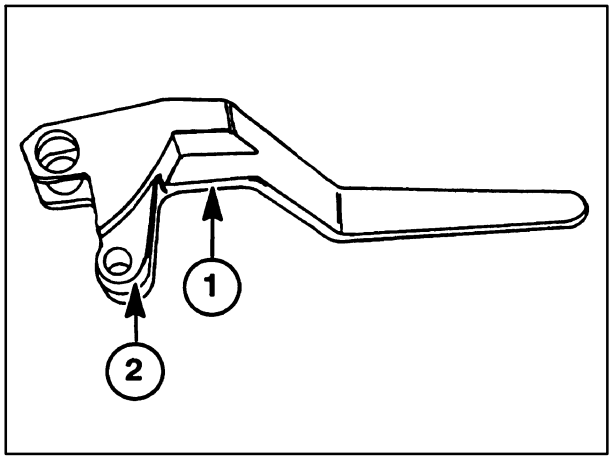

Figure 7-182

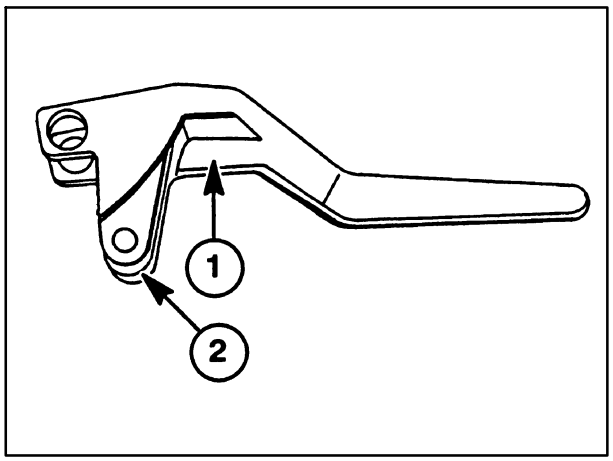

Figure 7-183

The following parts are now used in production and the Parts System:

	Previous Part	Current Part
LH handle	86510870	86526101
RH handle	86510872	86526103

ADDITIONAL INFORMATION

The newest-style handles are used within these serial number ranges:

L565 - 894091 to 999999 and 0001 to 850750
Lx565 - 894091 to 999999 and 0001 to 847450
Lx665 - 894722 to 999999 and 0001 to 847850

Each cast handle has a part number cast into the handle, Figure 7-180. However, the part number on the handle is not the service part order number, but a rough casting number.

Part numbers can be cross-referenced as follows:

Description	Service Part Number	Rough Casting Number Found on Handle
New handles (Style #3)	86526105 86526107	86526106-Figure 7-181 86526108
	86526101 86526103	86526102-Figure 7-182 86526104
Previous handles (Style #2)	86510876 86510878	86510877 86510879
	86510870 86510872	86510871 86510873
Previous handles (Style #1)	9860078 9860080	9860079 9860081
	9841196 9841199	9841197-Figure 7-183 9841198

MOUNTING PLATE PIVOT LUBRICATION KIT

The mounting plate pivot grease fittings may be difficult to lubricate. Some fittings have been broken off during operation.

Material can build up in the grease fitting recess area, resulting in the fittings breaking off. Material buildup also results in difficulty when lubricating the mounting plate pivot area.

A mounting plate pivot lubrication kit, part #86546105, is being provided in Service Parts, that may be welded onto the customers' skid-steer loaders, where they have experienced grease fitting breakage and lubrication problems.

KIT CONTENTS

Ref.	Description	Qty.
1	1/8″ pipe thread female fittings	2
2	1/8″ pipe nipples	2
3	1/2″ SAE plain flat washers	6
4	Angles	2

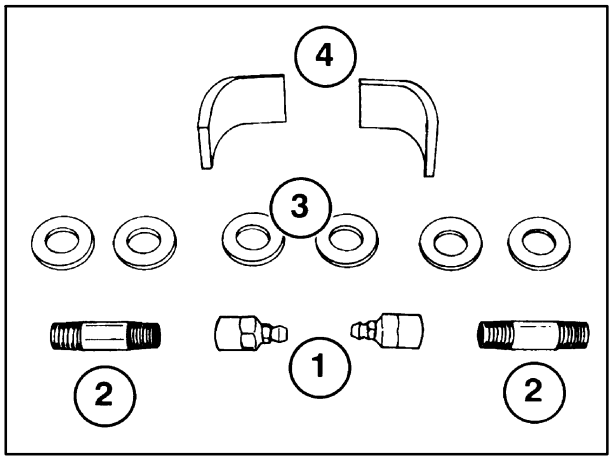

Figure 7-184

Remove the original grease fittings and install new fittings and nipple to extend the fitting from the recessed area at each pivot point. Weld on an angle to protect the new fitting assembly from being damaged, as shown at 1.

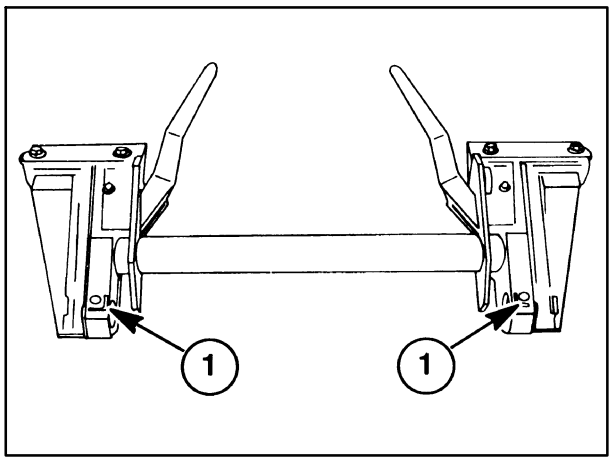

Figure 7-185

Attachment Plate Over-Center Latch Pins Wear/Bend

The loader attachment may become loose at the mounting plate. Inspection of the over-center latch pins part #9822358, shows the pin ends worn and bent, 1.

The over-center pins are NOT heat-treated. Thus, if an attachment does not fit correctly and hammers against the pins, the pins will wear and bend. New pins and ones used with properly fitted attachments should be straight, as shown at 2.

If worn pins are encountered, the pins must be replaced. Additionally, an inspection of all the customer's attachments must be made to determine the improperly fitted attachment which is causing the pin problem. Usually, an old attachment used on a previous loader can be worn and can be the problem.

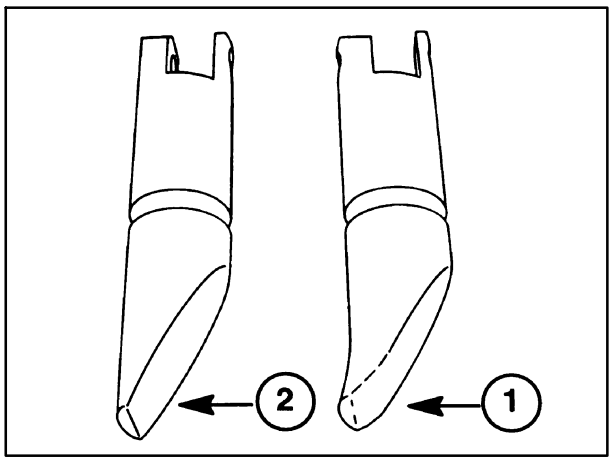

Figure 7-186

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job Description	Man-Hours
Remove and replace seat, seat support	1.5
Remove and replace switches (1)	0.5
Remove and replace seat support lock linkage	0.5
Remove and replace cab inner shell	6.5
Remove and replace ROPS frame (Includes seat, boom lock linkage, boom removal, inner shell)	18.5
Remove and replace boom lock pins and linkage	2.5
Remove and replace main boom	4.5
Removal and replace one upper link	1.0
Removal and replace one lower link	2.0
Remove and replace attachment mounting plate	1.0
Rebuild attachment mounting plate	1.5

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GENERAL INFORMATION

ADAPTING ATTACHMENTS REQUIRING 12V ELECTRICAL POWER

There are important rules that must be followed when adapting attachments that require 12 volt electrical power. Proper wiring of electrical devices and power and ground connections is very important to prevent other electrical component damage. Attaching electrical connections to locations other than recommended may allow electric current to feed back through the EIC board, creating false EIC board readings and warnings, or causing EIC board damage or failure.

1. ALWAYS FOLLOW the instructions for New Holland kit installation to ensure proper function and operation.
2. NEVER CONNECT an electrical device to any wires, fuses, switches or grounds inside the cab area. This includes any terminals of the ignition switch, fuse panel, or ground terminal.
3. NEVER INSTALL an electrical device, music radio, two-way radio, or unapproved New Holland attachment into the cab area.
4. ONLY USE the 12-volt accessory power outlet for attachments requiring less than 10 amps. The accessory outlet is connected to the engine fuse/relay panel and protected with a 15 amp fuse.

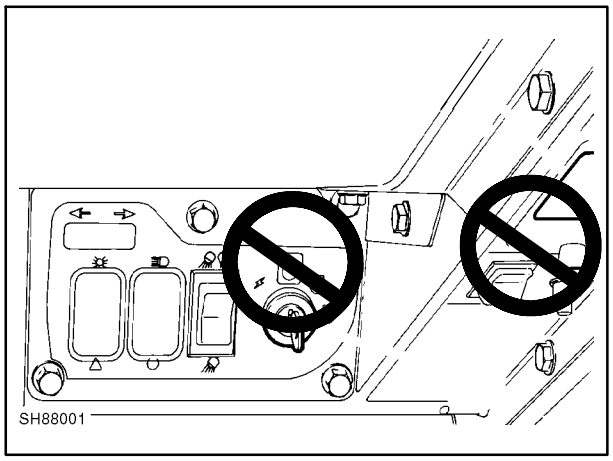


Figure 8-1

5. ALWAYS CONNECT new electrical attachments to the engine fuse/relay panel, 1, and connect the grounds to the engine bell housing. USE ONLY vacant connections and fuses not in use for specified attachments.
6. PLEASE REFER to Service Bulletin 11/95-I4 for more detailed information about higher amperage requirements and making electrical connections.

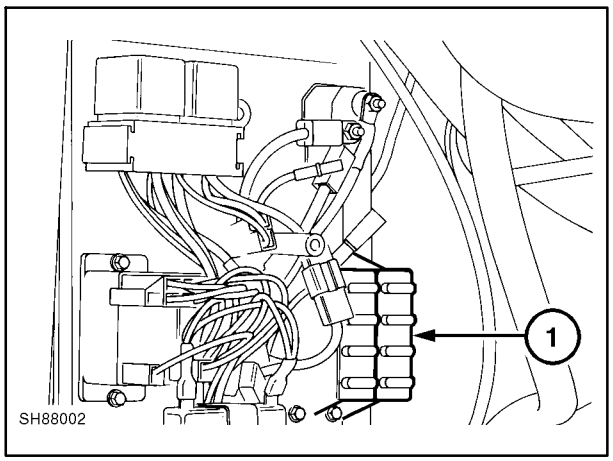


Figure 8-2

Wire connections available if electrical attachments were not previously installed.

Engine Fuse Panel

Ref.	Color	Destination	Fuse	Battery Voltage	Status
1	R/B	To turn signal relay	10-amp	All times	Available
2	R/GY	To accessory relay	25-amp	All times	Available
3	R/LTGN	To EIC board pin #14 P2 connector	5-amp	All times	Occupied
4	LTGN/R	To seat switch(es)	5-amp	All times	Occupied
5	R/W	To key switch (battery terminal)	15-amp	All times	Occupied
6	R	From preheat circuit breaker	20-amp	All times	Occupied
7	R	From start relay		All times	Occupied
8	R/O	To heater power relay	20-amp	All times	Available
9	R/T	Spare	7.5-amp	All times	Available
10	DKGN/R	To high flow, horn, power outlet	15-amp	Key “ON” position	Available
11	O/LTGN	From accessory relay		Key “ON” position	Occupied
12	O/W	To Back-up alarm switch	5-amp	Key “ON” position	Available
13	O/LTGN	From road/work light fuse (cab panel)		Key “ON” position	Occupied

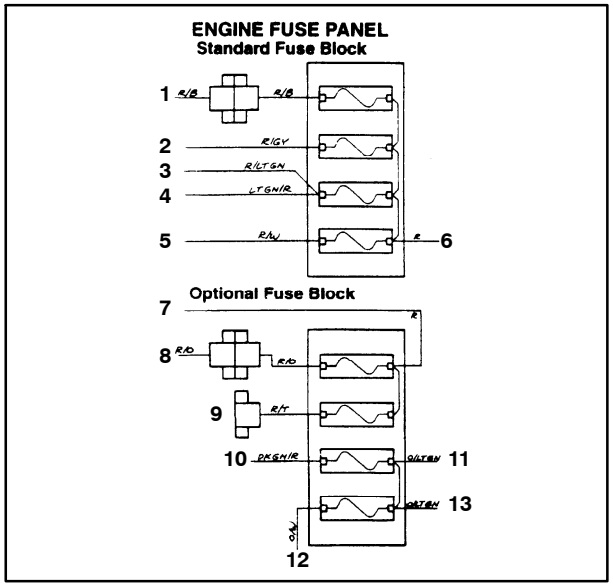


Figure 8-3

A completely new auxiliary wiring circuit can be installed as shown in Figures 8-4 and 8-5, depending on electrical requirements. Mounting holes for the added circuit breakers must be drilled in the panel. Disconnect the battery before drilling and installing new wiring. Protect the panel's electrical components from drilling shavings that could cause electrical shorting of components. Figure 8-4 shows circuits for intermittent high current loads up to 15 amps.

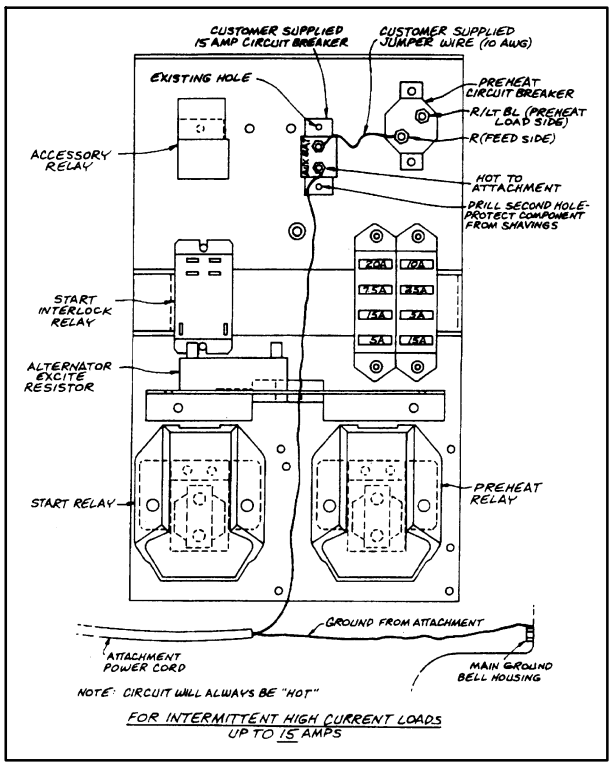


Figure 8-4

Figure 8-5 shows the circuit for intermittent high current loads up to 30 amps.

New Holland sealed circuit breakers that can be purchased from parts.

Part Number	Capacity
9827329	15 amp
9828493	20 amp
9840279	25 amp
9840280	30 amp

NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to size on top of the heaviest wire.

IMPORTANT: Additional electrical attachments must have circuits properly connected to prevent damage to the Advanced Warning System (EIC board) and other electrical components.

CAUTION: ALWAYS DISCONNECT THE BATTERY BEFORE INSTALLING ANY ELECTRICAL ATTACHMENT TO PREVENT ACCIDENTAL SHORTING OF SYSTEM.

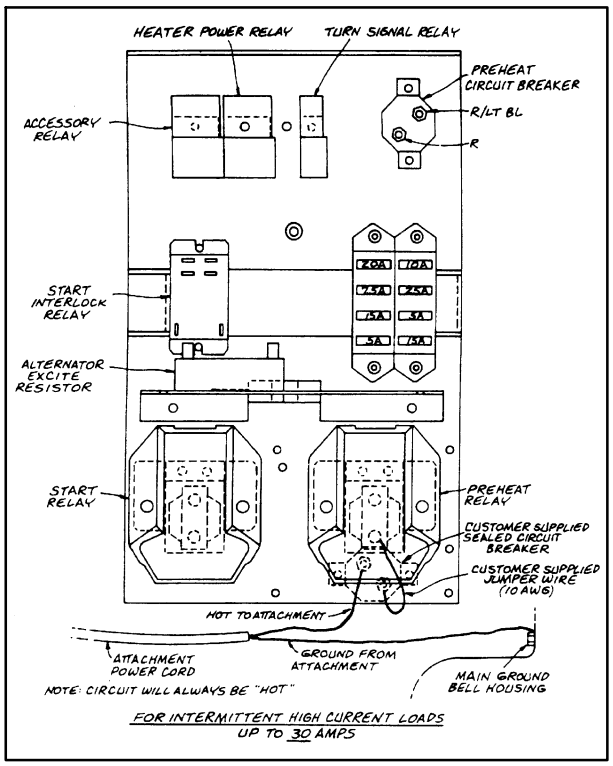


Figure 8-5

ACCESSORY RELAY AND FUSE BLOCK IN ENGINE FUSE PANEL

Later model loaders include an accessory relay, 1, and a second fuse block, 2, to the right of the standard fuse block, 3. The relay and fuse block are included in some accessory kits. The serial number breaks for the factory installed second fuse block are as follows.

EARLIER MODELS - without accessory relay and second fuse block

Model	Serial Number Range
L565	850751 to 999999 and 0001 to 31153
Lx565	847451 to 999999 and 0001 to 38841
Lx665	847851 to 999999 and 0001 to 64384

LATER MODELS - with accessory relay and second fuse block installed from factory

Model	Serial Number Range
L565	31154 to 850750
Lx565	38842 to 847450
Lx665	64385 to 847850

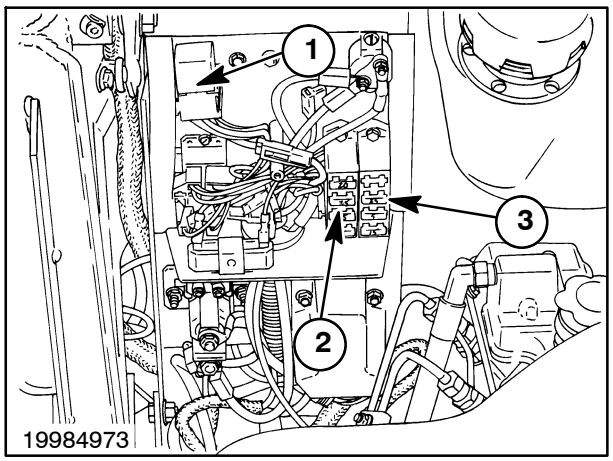


Figure 8-6

HYDRAULIC SYSTEM COMPATIBILITY

There are six questions that must be answered before adapting attachments that require hydraulic oil power.

1. **What is the hydraulic pressure requirement, minimum and maximum? Are they higher than the maximum pressure of the model?**

Model	Maximum Pressure
L565, Lx565, Lx665	170-176 bar (2500-2600 PSI)

2. **What is the hydraulic oil flow requirement? Is it more than the highest total flow rate of the skid-steer loader model?**

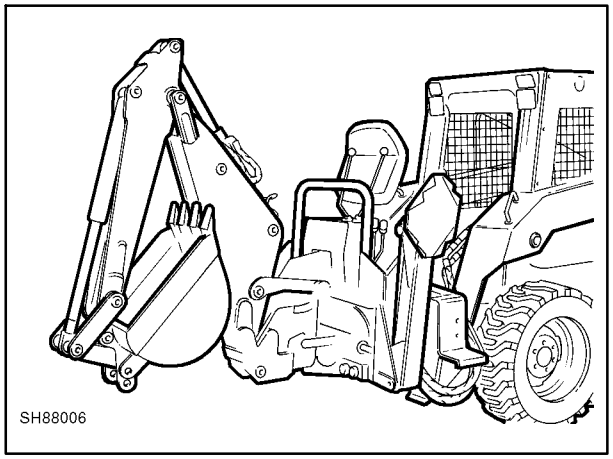


Figure 8-7

Model	Standard Hydraulics	High Flow Hydraulics
L565 Lx565	54.9 l/min. (14.5 GPM) @2900 RPM @68 bar (1000 PSI)	84.0 l/min. (22.2 GPM) @2900 RPM @156 bar (2300 PSI)
Lx665	64.9 l/min. (17.1 GPM) @2900 RPM @68 bar (1000 PSI)	91.6 l/min. (24.2 GPM) @2900 RPM @156 bar (2300 PSI)

NOTE: When using the High-Flow system, 3/4″ quick couplers must be used or high system backpressure may result.

3. **Will the attachment accept oil flow in both directions?**

   If “YES”, nothing is required.

   If “NO”, install a check valve or cross into the attachment return line to prevent reverse oil flow to the attachment.

   Examples: Backhoes and trees spades with a separate control valve do not accept oil flow in both directions.

4. **Must the attachment “Free Wheel” to a STOP?**

   a. If “YES”, a crossover relief connection must be installed on the attachment side to allow the attachment to free wheel to a stop after the skid-steer loader hydraulics is turned off.

   b. If “NO”, nothing is required.
   Example: Snow blowers must free wheel to a stop.

5. **Will the attachment accept hydraulic system backpressure?**

   If “YES”, nothing is required.

   If “NO”, the attachment will not function properly on a New Holland skid-steer loader. Normal backpressure for New Holland skid-steer loaders is between 14-17 bar (200-250 PSI).

   Examples: Post drivers, some breakers, and some hand held hydraulic tools do not accept system backpressure.

   NOTE: L565, Lx565, Lx665 model loaders must have a minimum of 22.7 l/min. (6 GPM) returning through the main hydraulic system at all times to charge the hydrostatic system.

If all the skid-steer loader oil flow is not required to operate an attachment (e.g., shaver post driver), a flow divider can be installed into the hydraulic oil circuit on the attachment. The flow divider sends the required oil flow to the attachment and the remainder back to the normal skid-steer loader hydraulic circuits.

6. Does the attachment have a separate case drain oil line?

If “NO”, nothing is required.

If “YES”, install a separate case drain line to return the attachment case drain oil directly to the hydraulic oil reservoir.

Example: Cold planners have a separate case drain oil line.

NOTE: Most attachment case drains will not accept backpressure and must drain directly into the reservoir.

NOTE: Skid-steer loaders equipped with High Flow Hydraulics have a separate case drain coupler and return line attached to the right boom arm.

7. Does the attachment require a circuit relief in the bucket circuit?

If “NO”, nothing is required.

If “YES”, install a bucket circuit relief valve on front of the control valve in the bucket circuit.

Example: Some mini-backhoes attach like a bucket, and require a bucket circuit relief.

ARM PADS FOR CAB SIDE PANELS

The cab arm pads provide additional operator comfort and may be used separately or in combination with the seat armrest.

The arm pads, 1, require gluing in place to the cab side panels with Loctite® 454 gel adhesive.

The area where the arm pads are to be located must be cleaned thoroughly to insure a secure bond to the cab side panel. If the area is not cleaned, the adhesive will not adhere to the metal side panels. Clean with methyl ethyl ketone, isopropyl alcohol, or equivalent cleaning solvent that will not leave a residue.

NOTE: Position arm pads quickly because the adhesive begins to bond in a few seconds.

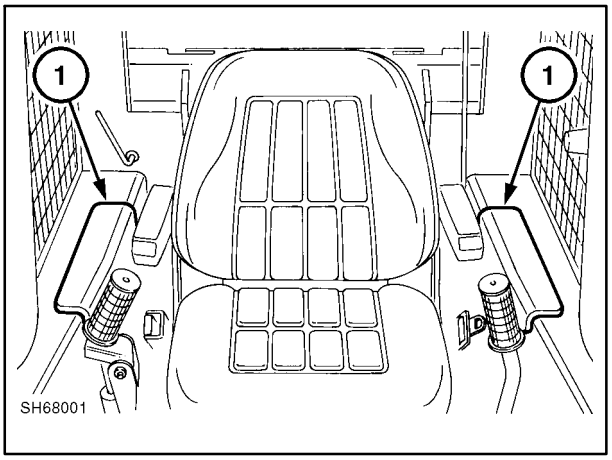


Figure 8-8

CAUTION: READ THE ADHESIVE LABEL WARNINGS. LOCTITE 454 GEL IS A SUPERGLUE-TYPE MATERIAL AND CAN BOND SKIN, EYES, ETC. USE WITH ADEQUATE VENTILATION.

ARMRESTS FOR DELUXE SEAT

Right and left side armrests can be installed to the back, 1, of the **deluxe seat only**, for operator comfort.

NOTE: The standard seat mounting holes are not provided to attach the armrests.

There are two styles of armrest:

- Bolts attach armrests to the back of the steel seat support.
- Bolts attach armrests to the sides of the plastic seat supports

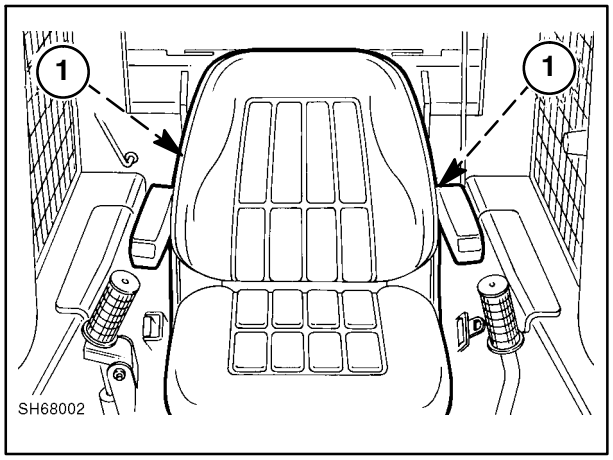


Figure 8-9

Armrest Adjustment

The armrest can be adjusted up or down for operator comfort by turning adjusting screws, 1.

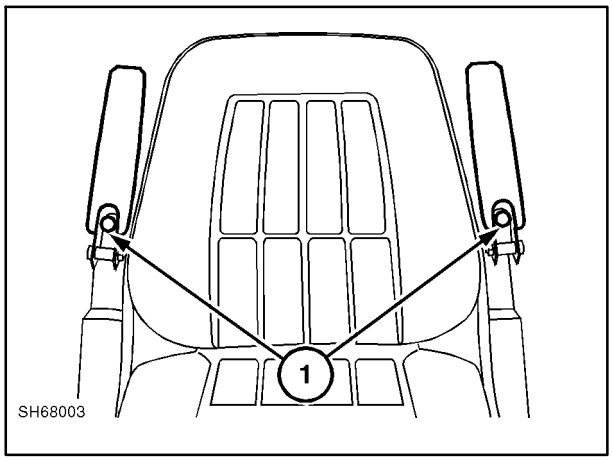


Figure 8-10

AUXILIARY BOOM HYDRAULICS

The boom hydraulic kit provides hydraulic flow at the front of the boom to operate boom-mounted or remote hydraulic drive attachments.

The boom hydraulic kit is standard equipment on the Lx565 and Lx665 model loaders.

NOTE: If the loader is equipped with the hydraulic high flow kit, 3/4″ quick couplers must be used when the high flow is utilized.

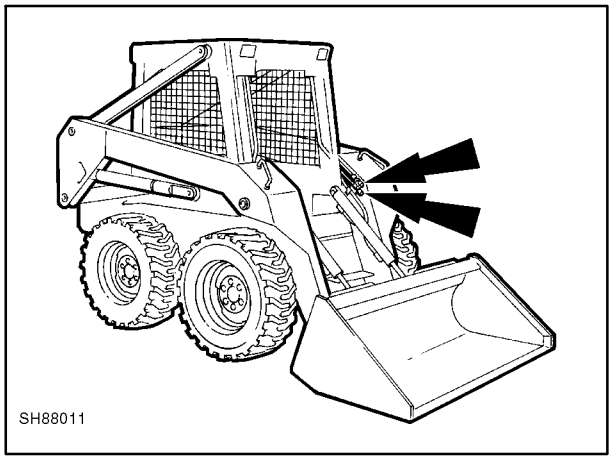


Figure 8-11

The loader may be equipped with either boom and bucket foot controls with auxiliary hand control, 1, or boom and bucket hand controls with auxiliary foot control (left pedal), 2.

When the auxiliary control handle, 1, is operated, full rated flow and pressure will be supplied to the boom quick couplers for use.

When the control handle is pushed all the way down, it will put the control valve spool in the detent position for continuous oil flow to the attachment.

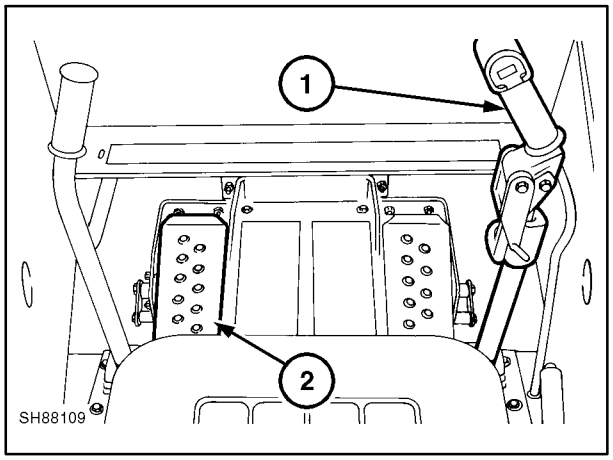


Figure 8-12

L565, Lx565

54.9 LPM (14.5 GPM) at 2900 RPM at 68 bar (1000 PSI)

Lx665

64.7 LPM (17.1 GPM) at 2900 RPM at 68 bar (1000 PSI)

Main system relief valve setting:
170-176 bar (2500-2600 PSI)

When the auxiliary hydraulics are not in use, always lock the control handle in the neutral position. This will prevent shifting of the control spool, deadheading the hydraulic oil and operating over relief at all times. The hand control is shown in the locked position, 1.

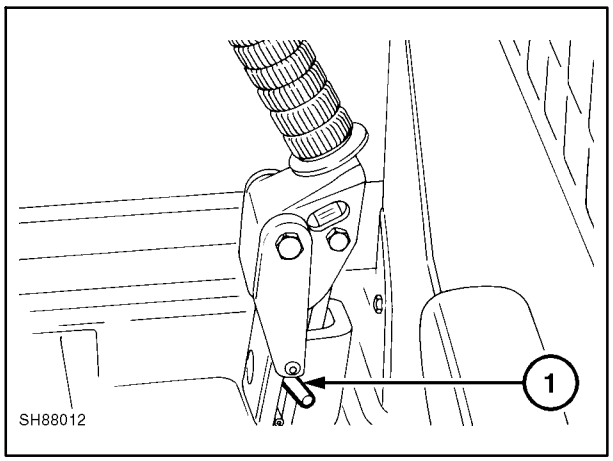


Figure 8-13

The foot control is shown in the unlocked position, 2. To lock the foot control linkage, push the locking knob and rod down.

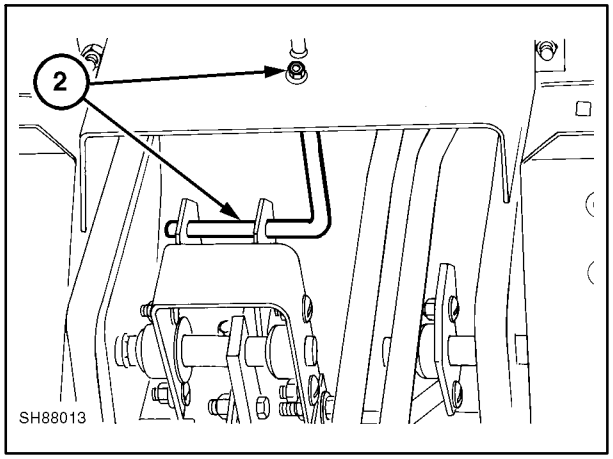


Figure 8-14

AUXILIARY BOOM HYDRAULICS TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTION
No oil flow to quick couplers	Broken control linkage	Check and repair linkage
	Inoperative quick coupler	Repair or replace
	Plugged supply line	Clean or replace
	Control valve plugs leaking oil to return	Check O ring and back-up washer on plugs
	Inoperative gear pump	Check and repair
Control will not hold in detent position	Loose linkage	Repair
	Misadjusted linkage	Repair
	Inoperative control valve spool (binding)	Check and repair
	Inoperative control valve detent cap	Check and repair
Hydraulic system overheats when auxiliary hydraulics is in use	Restriction in return line	Check and repair
	Inoperative quick coupler	Repair or replace
	Restriction in attachment	Check and repair
	Operating at, or close to, relief pressure	Operate at lesser loads
	Relief pressure to low	Check operating pressure
	Plugged oil cooler not allowing cooling air to pass through	Clean oil cooler
Hydraulic system overheats when auxiliary hydraulics is not in use	Control handle shifted slightly	Return control to neutral and lock
	Control linkage not adjusted properly	Adjust linkage
	Control valve spool binding	Check and repair

Adjustments Control Handle Locked, 1, In Neutral

Adjust the length of rod, 2, by threading the ball joints, 3, on or off, at both ends of the rod to set the link, 4, vertical. Check adjustment by shifting the hydrostatic control lever forward and reverse. If the rod length is set correctly, there should be no movement in the link, 4, as the rod, 5, moves.

With the control handle locked in neutral and the control valve spool centered in the neutral position, adjust the length of rod, 6, with yoke, 7, to allow the installation of the yoke pin.

When the loader is operated, there should be no noise in the hydraulic system when in neutral.

NOTE: When using a hydraulic attachment, all oil must be returned through the standard return system to provide charge oil to the hydrostatic system.

IMPORTANT: If sufficient oil is not provided for the hydrostatic system, severe damage to the hydrostatic system will occur.

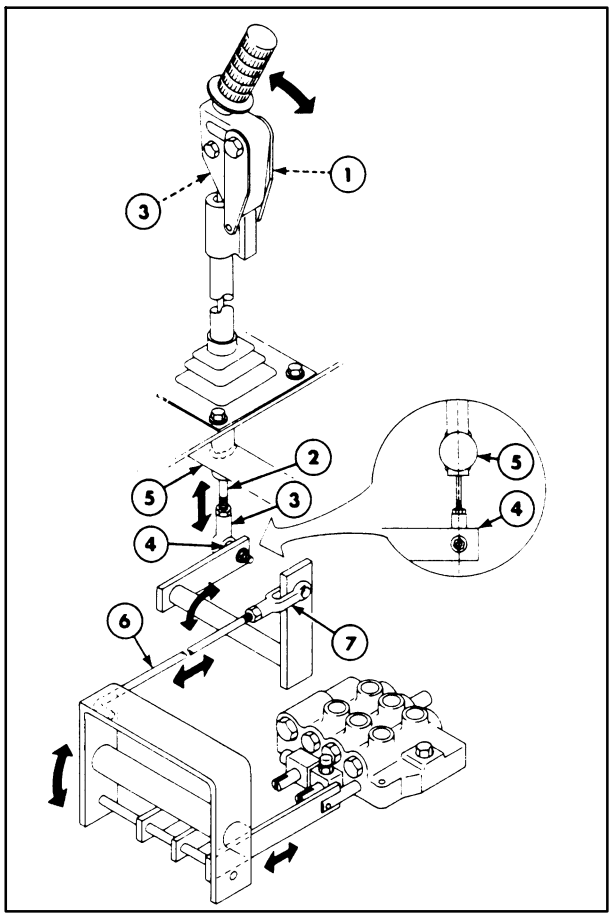


Figure 8-15

Always use the quick-coupler covers, 1, if equipped, when the auxiliary hydraulics is not in use.

Always clean the quick-coupler covers before installation.

Always clean the quick coupler when connecting to the attachment or contamination of the hydraulic system may occur.

ATTENTION: Keep the hydraulic system clean to prevent premature hydraulic component failure.

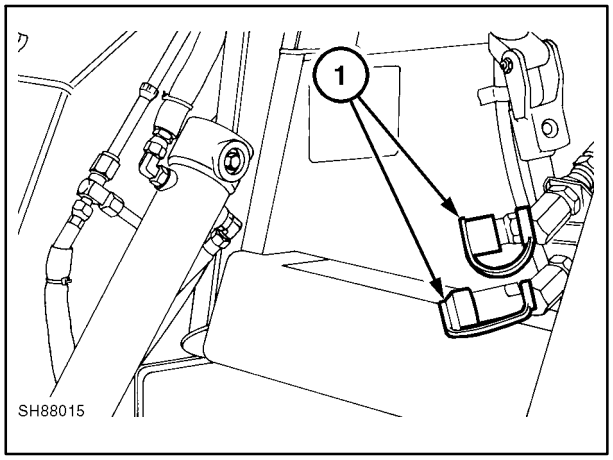


Figure 8-16

BACK-UP ALARM

The back-up alarm serves as an audible warning device to alert bystanders and other machine operators of machine movements. The alarm will only sound when both hydrostatic control levers are stroked into reverse. Refer to local codes for requirements.

ATTENTION: Before servicing any switches or alarm, disconnect the negative (-) battery ground cable to avoid accidental shorts in the wiring system when removing or installing components.

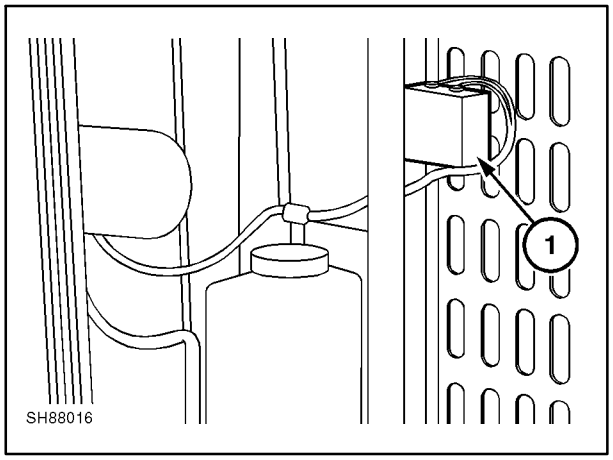


Figure 8-17

Alarm Location

The back-up alarm sound device should be located to the inside and in the upper right rear corner of the engine rear door at 1.

Adjustment

With the battery connected, and both hydrostatic control levers in the neutral position, loosen and slide both strikers, 1, rearward until the alarm sounds. Move the strikers forward until the alarm stops (approximately 1.5 mm [1/16″]) and tighten the hardware.

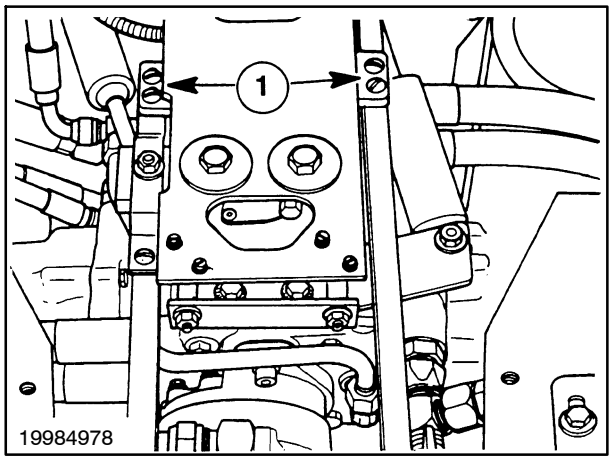


Figure 8-18

Back-up Alarm Wiring

The alarm is a negative (-) ground system.

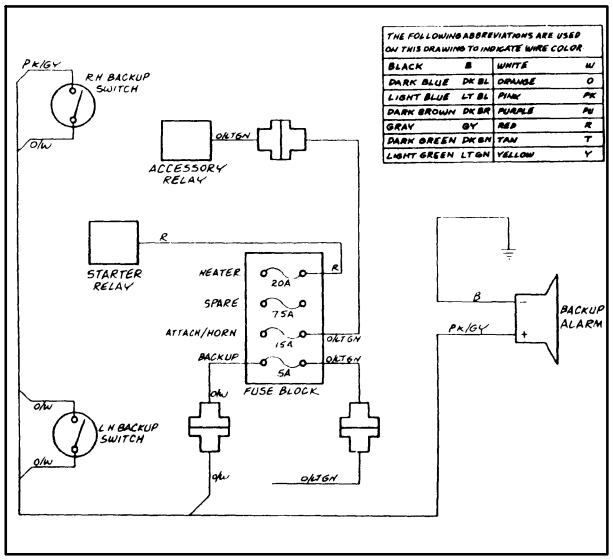


Figure 8-19

BLOCK HEATER (Engine)

The engine block heater, 1, may be required in colder climate areas to assist in starting of the diesel engine.

The block heater is a 115-volt, 400-watt immersion type.

WARNING: THE BLOCK HEATER MUST BE INSTALLED AND OPERATED PER THE INSTRUCTIONS PROVIDED WITH THE KIT OR DAMAGE TO THE ENGINE, HEATER ELEMENT, AND/OR PERSONAL INJURY COULD OCCUR.

Position the heater into the engine block so that the element is pointing to the 7 o'clock position for proper heater operation.

WARNING: BEFORE CONNECTING THE HEATER TO THE POWER SOURCE, BE SURE THAT THE ELEMENT IS IMMERSED IN COOLANT. NEVER ENERGIZE THE HEATER IN AIR. IF SO ENERGIZED, THE ELEMENT SHEATH COULD BURST AND CAUSE PERSONAL INJURY.

Do not operate the heater until the engine cooling system is filled with a 50/50 mixture of a permanent-type antifreeze and water.

Operate the engine and check for any coolant leaks and purge the air from the cooling system; repair accordingly.

IMPORTANT: Failure to fill the cooling system and purging the air will cause premature failure of the block heater.

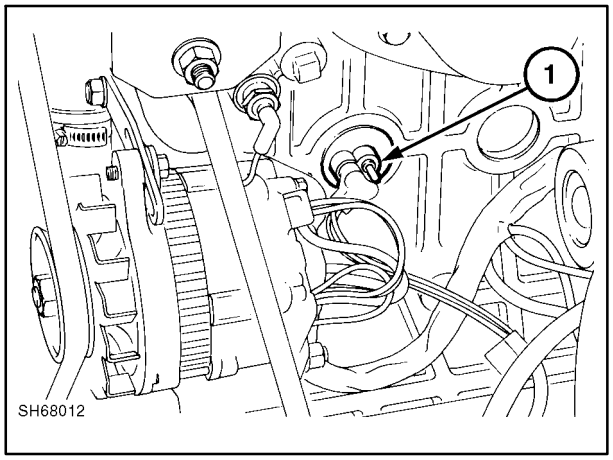


Figure 8-20

CAUTION: THIS IS A 115-VOLT HEATER. USE CAUTION WHEN INSTALLING AND USING THE HEATER. PROPERLY GROUNDED ELECTRICAL OUTLETS AND PROPERLY SIZED EXTENSION CORDS ARE ESSENTIAL FOR THE USE OF THE HEATER.

TO INSURE CONTINUED PROTECTION AGAINST SHOCK HAZARD, CONNECT TO PROPERLY GROUNDED ELECTRICAL OUTLETS ONLY.

First connect a grounded extension cord of the proper rating for the length used to the heater plug. Then connect the extension cord to the grounded electrical outlet.

CAUTION: DISCONNECT THE EXTENSION CORD FROM THE GROUNDED ELECTRICAL OUTLET FIRST AND THEN FROM THE HEATER BEFORE STARTING THE LOADER. INSPECT THE HEATER WIRES PERIODICALLY FOR BROKEN OR FRAYED WIRES AND/OR WIRE COVERINGS. IF WIRES AND/OR COVERINGS ARE BROKEN OR FRAYED, DO NOT USE THE HEATER.

BUCKETS

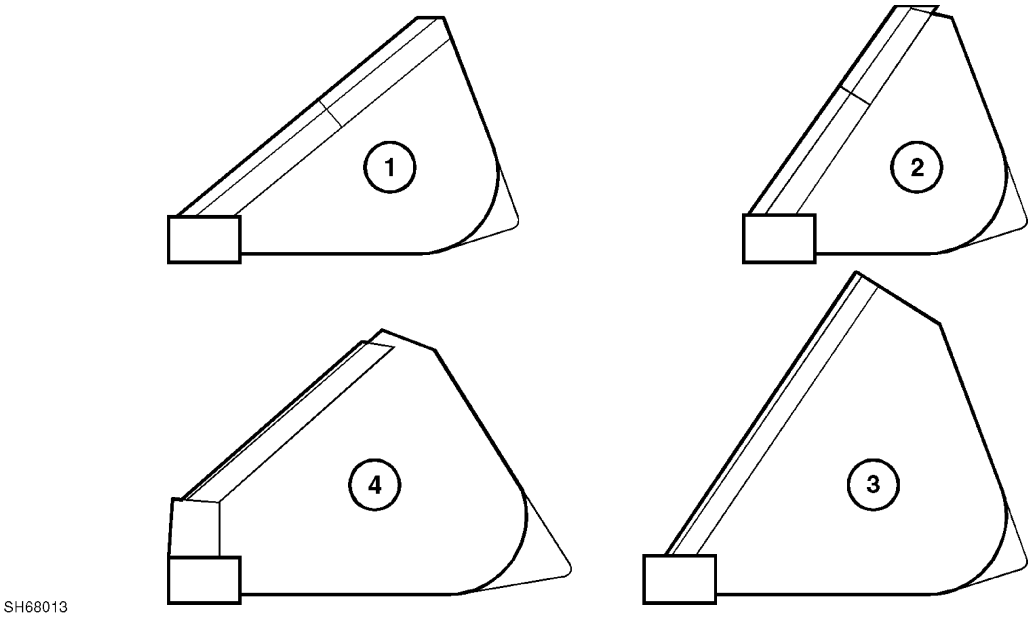


Figure 8-21

Bucket Types

1 - LP - Low profile

The low-profile bucket has a shorter back and is longer from bucket heel to cutting edge for optimum cutting edge visibility. This is important for finish grading and accurate cut and fill jobs.

2 - D & F - Dirt and foundry

The dirt and foundry bucket is shorter from bucket heel to cutting edge to provide maximum breakout force for tough digging conditions.

3 - M & F - Manure and fertilizer (slurry)

The manure and slurry bucket is for handling loose or fluid materials with more rollback to minimize spillage.

4 - LM - Light material

The light-material bucket is for light, high-volume materials for more productivity handling light material.

Select bucket styles and sizes to provide both adequate breakout force and reasonable carrying capacity. Handle dense materials with a relatively small bucket. Handle lighter materials with higher capacity buckets. Refer to the following bucket capacity chart and the material weight chart in the operator's manual when choosing the bucket for a job.

Bucket Capacity Cubic Feet

Width		Bucket Capacity Heaped (cu ft)	Bucket Capacity Struck (cu ft)
66″	Utility fork	N/A	N/A
60″	Low profile	11.5	8.9
60″	Dirt and foundry	11.5	8.7
66″	Low profile	13.2	9.7
66″	Dirt and foundry	15.2	11.6
72″	Low profile	14.5	10.6
72″	Dirt and foundry	16.7	12.7
72″	Manure and fertilizer	15.5	15.5
72″	Light material	23.7	19.0
84″	Light material	27.9	22.3

ADAPTING BUCKETS

NOTE: L553, L555, L781, L783, and L785 buckets can only be adapted for "Round-Bar" mounting plates, NOT the newer "Square-Bar" mounting plates.

There are two methods of adapting L553, L555, L781, L783, L785 buckets for use on the L565, Lx565, Lx665 loaders with "Round-Bar" attachment mounting plates.

To adapt L553, L555 skid-steer loader buckets to be used only on the L565, Lx565, Lx665 loaders, order #9862077 adapter kit, shown in Figure 8-23. When this kit is used, the buckets will not attach to the L553 and L555 loaders.

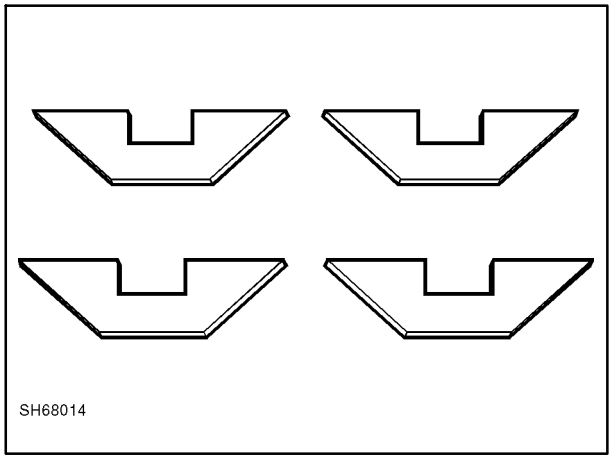


Figure 8-22

To adapt L553, L555 skid-steer loader buckets to be used on the L553, L555 or the L565, Lx565, Lx665 loaders, order #9805472 adapter kit, shown in Figure 8-24.

Both kits require welding and require tools for attaching the buckets to the L565, Lx565, Lx665 loaders.

Material to be welded is low carbon, grade 50 steel. Use welding rods marked 6011 or comparable.

CAUTION: GOOD QUALITY WELDS ARE NECESSARY WHEN WELDING NEW PLATES TO THE BUCKETS SO THE BUCKET CAN BE PROPERLY RETAINED TO THE LOADER MOUNTING PLATE. USE A PROFESSIONAL WELDER IF REQUIRED.

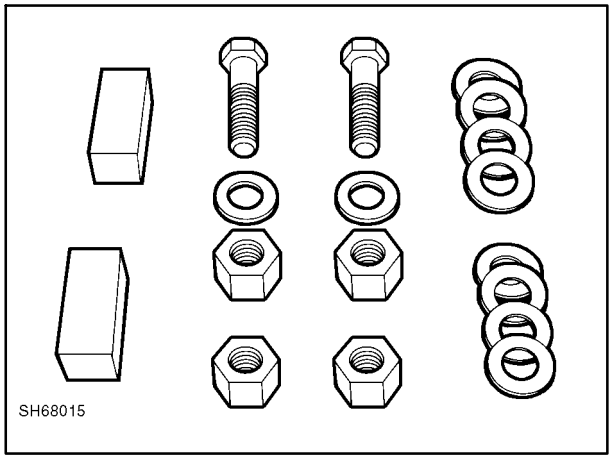


Figure 8-23

NOTE: These two bucket adapting kits only apply to loaders equipped with round-bar mounting plates. The round-bar showing at 4, Figure 8-25.

#9862077 bucket adapting kit is used to adapt buckets to the L565, Lx565, Lx665 boom mounting plate.

1. The spacer plates, 1, must be installed on the top of the attaching plate at 2.
2. Attach the bucket to the loader by engaging the top of the boom attaching plate, 3, under the lip of the bucket.

   NOTE: The spacer plates must be installed as shown to ensure proper seating of the attaching plate and bucket. Failure to obtain proper seating will result in a loose attachment.

3. When a production L565, Lx565, Lx665 attachment is used, the spacer plates must be reinstalled under the top of the mounting plate and in the extended position, 1. If the plates are not in this position, the bucket may not be centered on the mounting plate and may not latch properly at the bottom latch points.

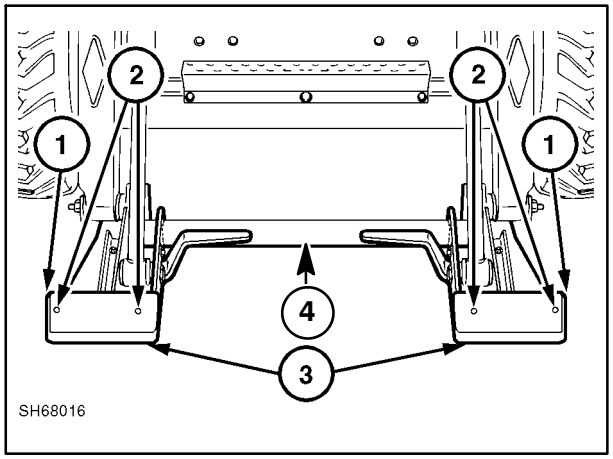


Figure 8-24

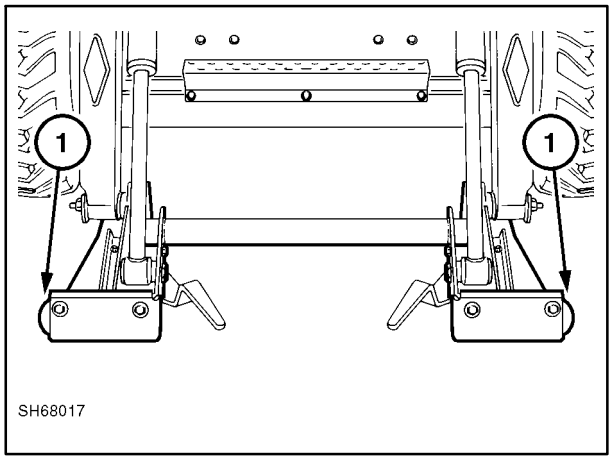


Figure 8-25

#9805472 bucket adapting kit is used to adapt buckets to the L565, Lx565, Lx665 boom mounting plate.

1. The spacer plates, 1, must be installed on the top of the attaching plate at 2.
2. Install the wedge blocks in the loader quick-attach plate, 3.
3. Attach the bucket to the loader by engaging the top of the boom attaching plate, 4, under the lip of the bucket.

   NOTE: The spacer plates must be installed as shown to insure proper seating of the attaching plate and bucket. Failure to obtain proper seating will result in a loose attachment.

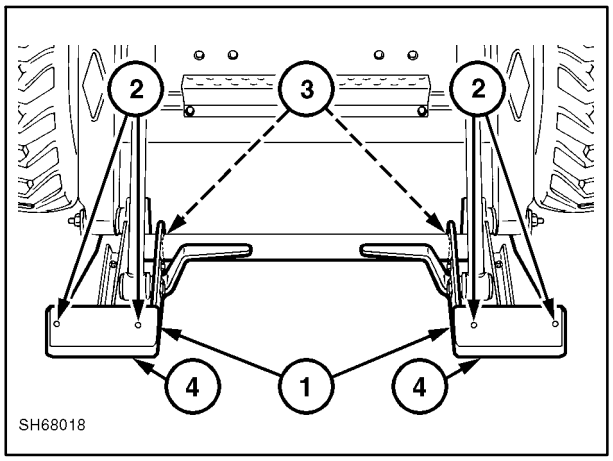


Figure 8-26

4. With the bucket tight against the loader mounting plate, slide the wedge blocks, 1, down securely, making sure the blocks are tight against the bucket hooks at 2. Tighten the bolts in each set of wedge blocks securely with a 15/16″ wrench.

CAUTION: THE BOLTS AND WEDGE BLOCKS MUST BE TIGHTENED SECURELY TO HOLD THE ATTACHMENT IN PLACE.

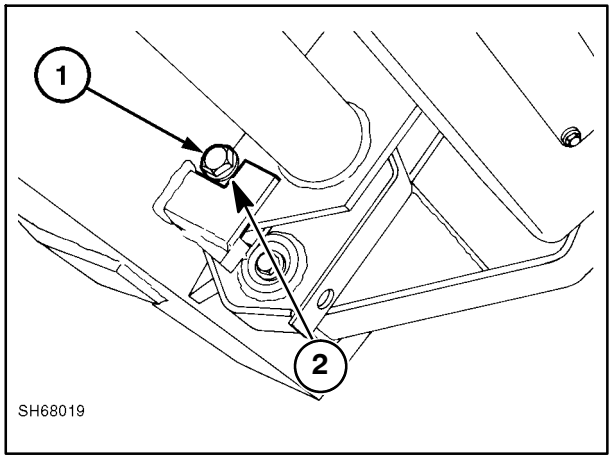


Figure 8-27

5. When a production L565, Lx565, Lx665 attachment is used, the spacer plates must be reinstalled under the top of the mounting plate and in the extended position, 1. If the plates are not in this position, the bucket may not be centered on the mounting plate and may not latch properly at the bottom latch points.

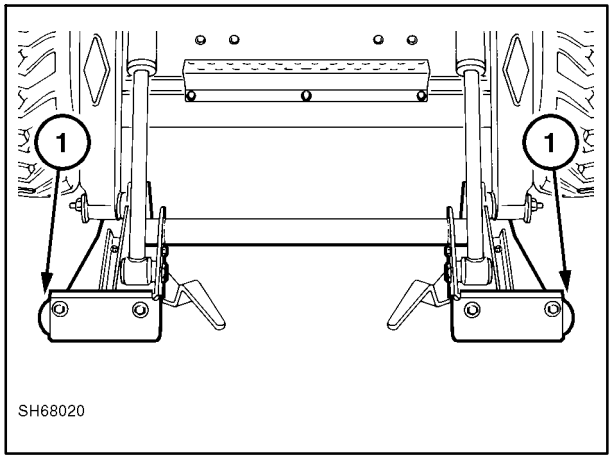


Figure 8-28

CUTTING EDGE (REPLACEMENT)

Cut or grind the old cutting edge from the bucket floor and sides. Remove all old weld and foreign material from the welding area.

1. Straighten the bucket floor and sides if required.
2. Thoroughly clean the area where the new cutting edge will be welded.
3. Use dry AWS-E7018 low hydrogen electrodes or either of the following equivalent low hydrogen wire feed electrodes: Gas metal arc welding (CO_2 or argon CO_2) AWS-E70S6 or flux cored arc welding AWS-E70T1.

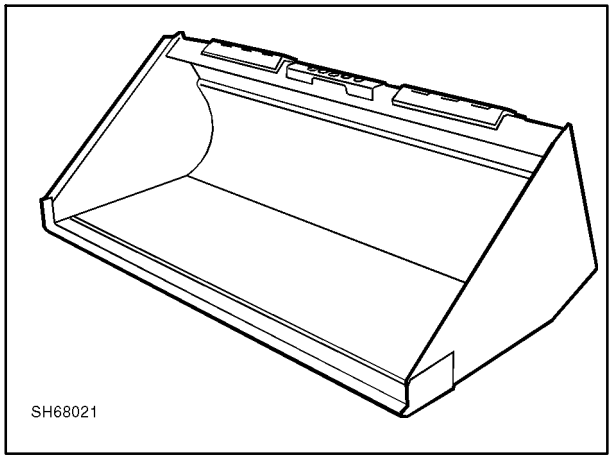


Figure 8-29

4. Preheat the parts to be welded (both tack and final welds) to a minimum of 204°C (400°F). **The preheat temperature must be throughout the entire thickness of the parts joined, and at least 51 mm (2″) back from the joint.** Maintain preheat throughout the entire welding operation.

   NOTE: This is a hardened steel edge. If not preheated, the cutting edge may later crack during use.

5. Tack weld the preheated parts starting at the center of the bucket and working toward the outside ends.
6. Finish welding the preheated parts starting at the center of the front edge of the bucket floor and working toward the outside ends. Repeat this operation at the back side of the cutting edge to bucket floor.
7. Do not remove the bucket from the welding environment until the weld and metal temperature drops to the ambient temperature. **Do not force the cooling rate of the welds and material.**

Follow the same welding procedure for welding the side cutting edges and bottom wear plates to the bucket.

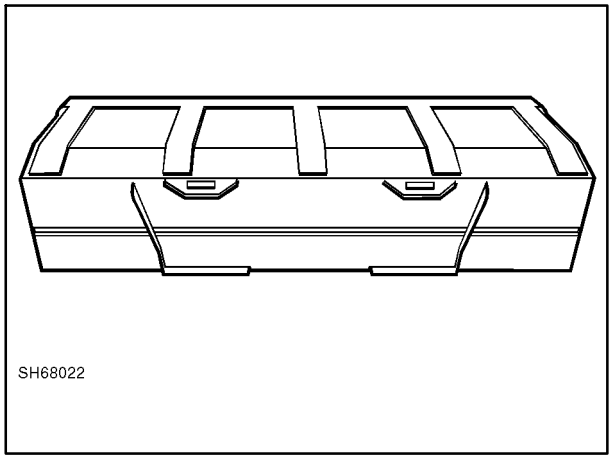


Figure 8-30

DIRT TOOTH KIT INSTALLATION

Bucket Dirt Tooth Kit

The dirt tooth kit consists of six teeth that are welded to the bucket cutting edge as indicated below. The teeth are used when rough digging conditions are anticipated to break up the material for easier bucket filling. The teeth are intended to be used only on dirt and foundry or low-profile buckets.

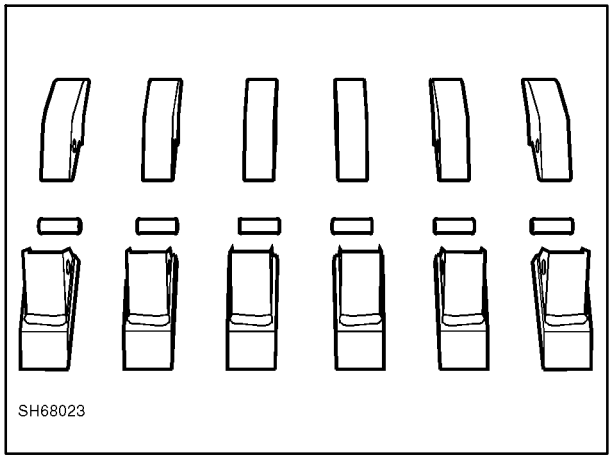


Figure 8-31

Tooth Point Replacement

The points of the teeth are a replaceable “pin-on” design and can be obtained from Parts.

To replace the “pin-on” points, use a punch that just fits into the pin hole, 1, and drive the old retaining pin from the shank.

Place the new point over the shank and insert the retaining pin into pin hole, 1. With a punch that contacts both sides of the metal part of the retaining pin, drive the pin until it is centered in the shank.

NOTE: If the punch or driver is too small and just contacts the rubber center of the retaining pin, the pin will be damaged and will not retain the point.

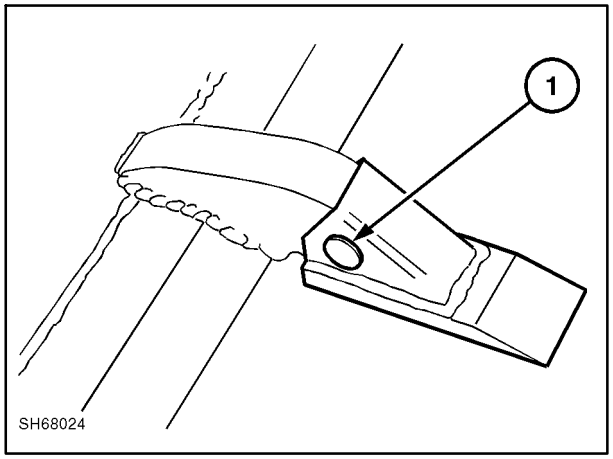


Figure 8-32

Tooth Location and Installation

1. The bucket should be flat on the floor when placing and welding the teeth.

   ATTENTION: Remove the bucket from the loader while welding teeth to prevent damage to the loader electrical system.

   Slide the replaceable points in place but do not attach with the steel/rubber pins as the rubber may be damaged during the welding process.

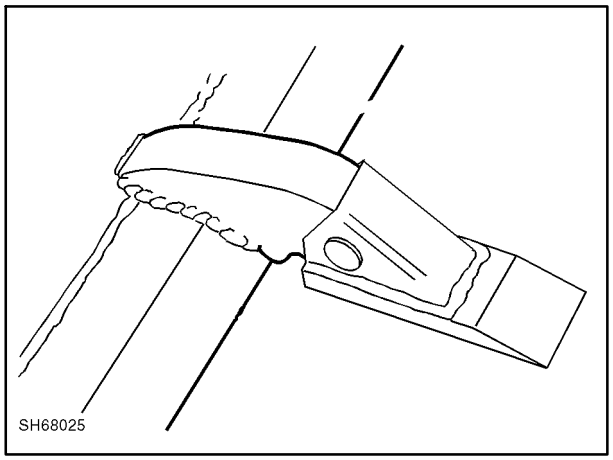


Figure 8-33

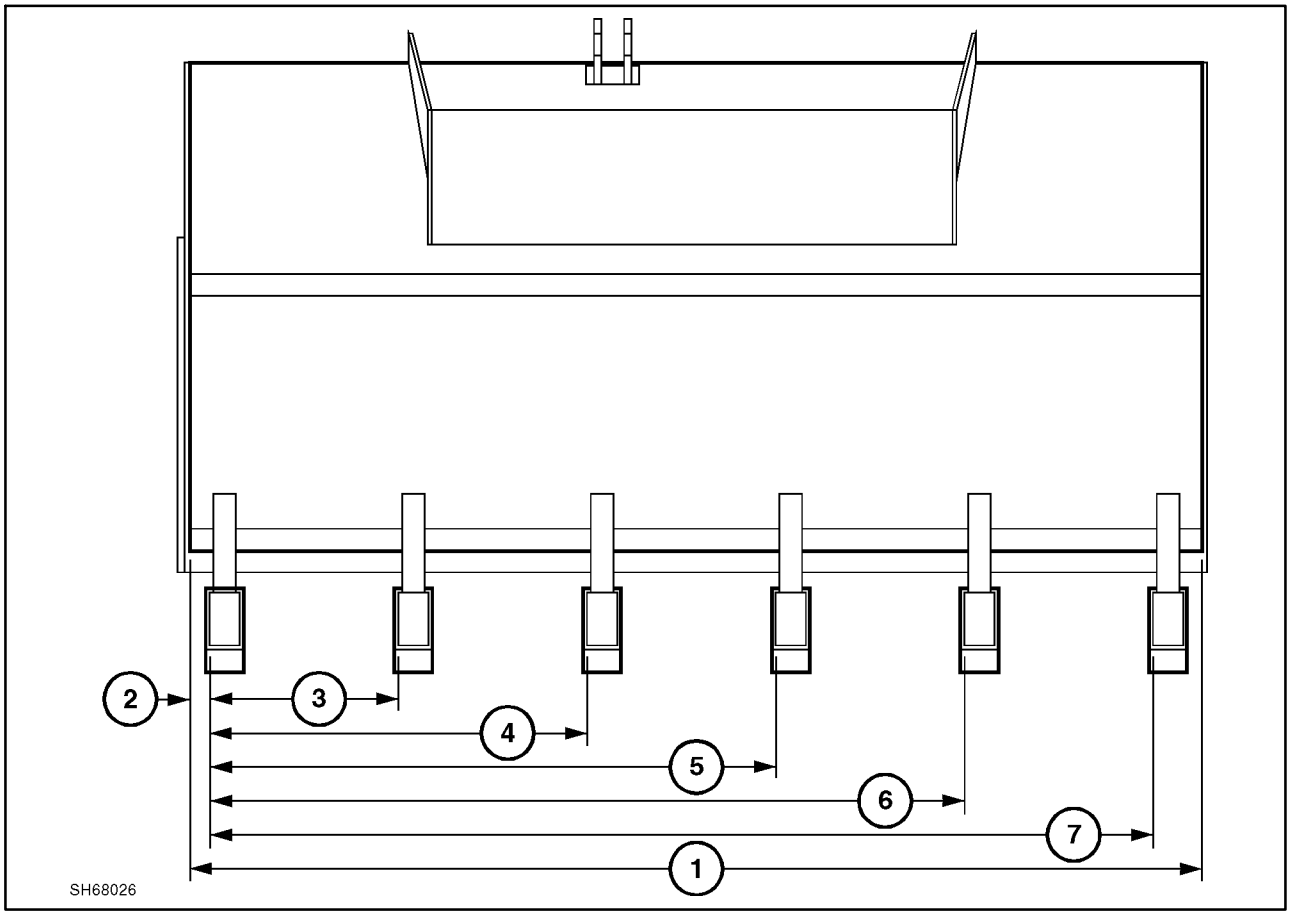


Figure 8-34

2. Locate the teeth on the bucket edge as indicated.

BUCKET TOOTH SPACING

Bucket Width	From End	2nd Tooth	3rd Tooth	4th Tooth	5th Tooth	6th Tooth
1	2	3	4	5	6	7
52″	1-13/16″	9-1/2″	18-15/16″	28-3/8″	37-13/16″	47-5/16″
54″	1-13/16″	9-3/4″	19-1/2″	29-3/16″	38-15/16″	48-5/8″
58″	1-13/16″	10-11/16″	21-5/16″	32″	42-5/8″	53-5/16″
60″	1-13/16″	10-15/16″	21-7/8″	32-3/4″	43-3/4″	54-5/8″
62″	1-13/16″	11-3/8″	22-3/4″	34-1/8″	45-1/2″	56-7/8″
66″	1-13/16″	12-3/16″	24-5/16″	36-1/2″	48-11/16″	60-7/8″
70″	1-13/16″	13″	26″	38-15/16″	51-7/8″	64-7/8″
76″	1-13/16″	14-3/16″	28-5/16″	42-1/2″	56-11/16″	70-7/8″
82″	1-13/16″	15-3/8″	30-3/4″	46-1/8″	61-1/2″	76-13/16″

NOTE: Position the teeth at these spacings, then re-center if necessary for equal spacing.

3. Weld, 1, is high carbon steel (tooth) to high carbon steel (bucket). Use welding rods marked 7018 or comparable rods. Weld on both sides of the tooth from the back of the tooth towards the replaceable point.

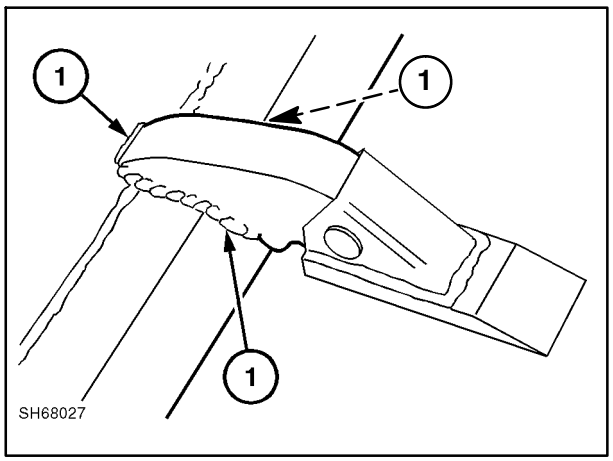


Figure 8-35

4. Stop welding 13 mm (1/2″) from the cutting edge as noted. A minimum 5 mm (3/16″) fillet weld is required for this application.
5. Weld in the direction shown at 1.
6. Weld a 5 mm (3/16″) bevel groove weld on both sides of the tooth, 2, high carbon steel to high carbon steel.

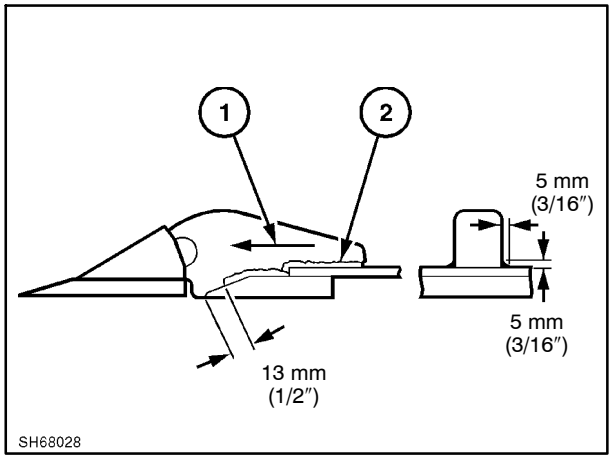


Figure 8-36

PALLET FORK

The pallet fork (shown) has a frame and guard assembly, with different length forks available. The fork pairs can be 36″, 42″, or 48″ long. Also available is a multi-fork block fork set for lifting cinder blocks.

To remove or replace the forks, the back guard must be removed from the top of the fork attachment plate by sliding it upwards out of the mounting tubes.

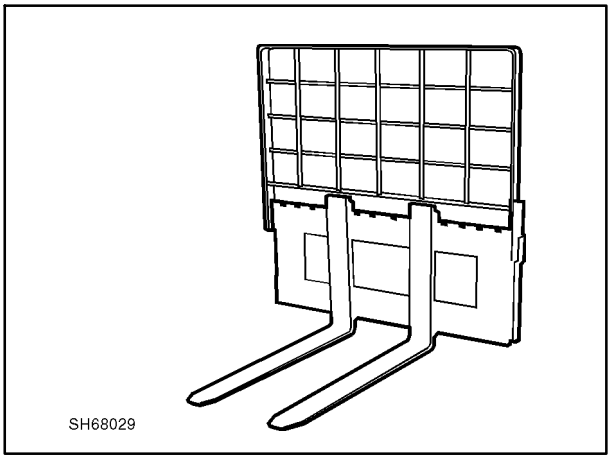


Figure 8-37

CAUTION: DO NOT USE A PALLET FORK ATTACHMENT UNLESS THE BACK GUARD IS IN GOOD CONDITION AND PROPERLY INSTALLED ON THE ATTACHMENT FRAME.

Pallet Fork Capacity

WITH WEIGHT KIT			
Max. Reach Height	**Tip Load**	**50%**	**SAE Rating**
2489 mm (98″)	1288 kg (2840 lbs.)	644 kg (1420 lbs.)	644 kg (1420 lbs.)
WITHOUT WEIGHT KIT			
Max. Reach Height	**Tip Load**	**50%**	**SAE Rating**
2489 mm (98″)	1138 kg (2510 lbs.)	569 kg (1255 lbs.)	569 kg (1255 lbs.)

Capacities listed are Lx665 numbers with 10 x 16.5 tires at 3.5 bar (50 PSI), full fluids, 79 kg (175 lb.) operator, 48″ pallet forks w/back guard, weight kit two 27 kg (60 lbs.) per side, per SAE rating specification J1197.

UTILITY FORK

The utility fork is for handling matted, stringy material which is difficult to load into a standard bucket.

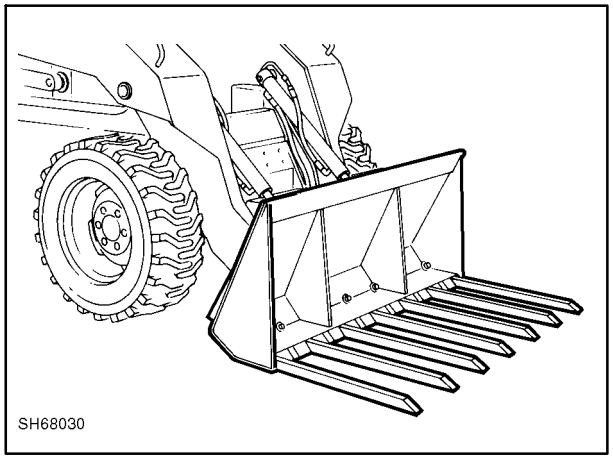


Figure 8-38

The standard tine spacing, center to center, is 21.8 cm (8-1/2″). The fork frame is equipped with additional holes for additional tines, reducing the tine spacing to 10.9 cm (4-1/4″).

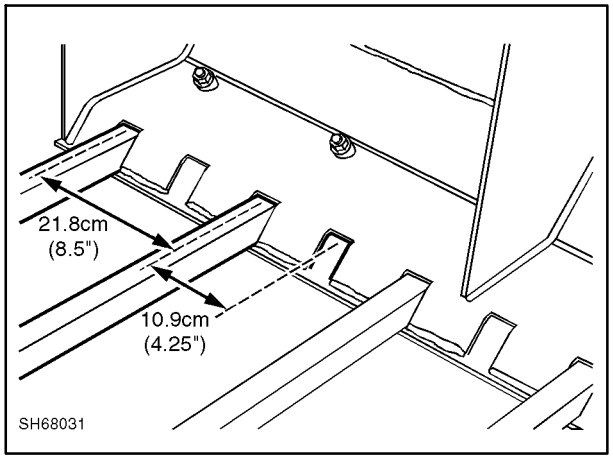


Figure 8-39

Tine Installation

1. Slide each tine, 1, into the fork backplate for the desired tine spacing, until the 1/2″ x 2-3/4″ bolt, 2, can be inserted through the fork backplate and tine with the nut to the inside of the fork backplate.
2. Position the spacer, 3, as shown with the angle end of the spacer next to the floor of the backplate. Secure the assembly with 1/2″ lock washer and nut. Tighten securely.

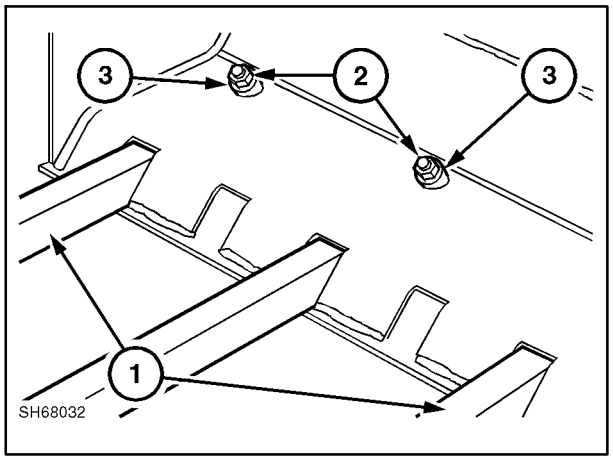


Figure 8-40

UTILITY GRAPPLE

A medium-duty grapple attachment is available to attach to the utility fork or to the pallet fork frames, as shown. The grapple is suited for light industrial or farm applications.

The boom hydraulic kit is required to power the grapple attachment.

The utility grapple is shown installed on a pallet fork assembly.

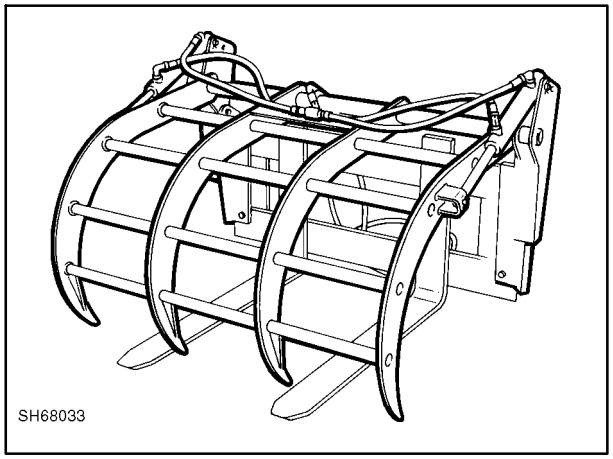


Figure 8-41

The utility grapple can be installed on either the 54″ or 66″ utility fork; it is shown installed on a 66″ utility fork.

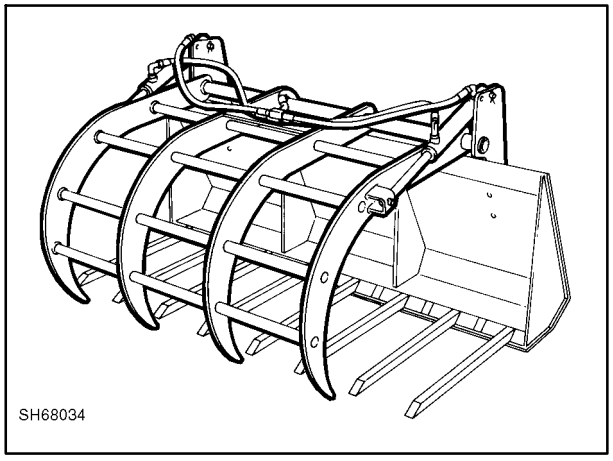


Figure 8-42

Hydraulic Cylinder Positioning

Attach the base end of the cylinders to the supports as follows.

Use rear holes, 1, for the utility fork mounting.

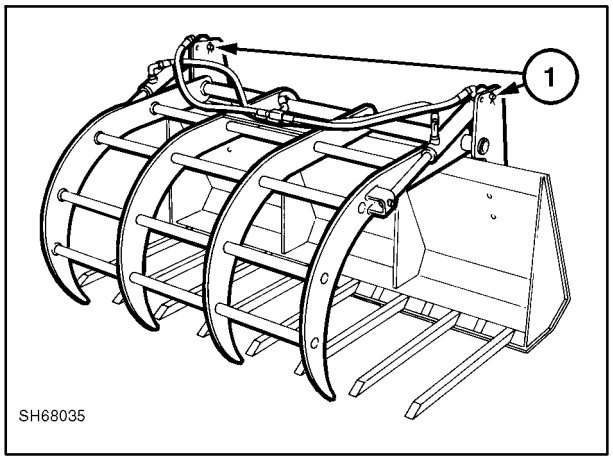


Figure 8-43

Use front holes, 1, for the pallet fork mounting.

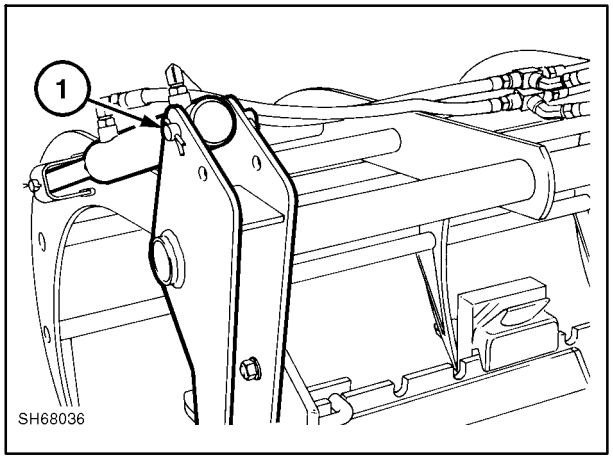


Figure 8-44

Grapple Cylinder Repair

Removal

1. Lower the grapple to the closed or lowered position.
2. Operate the auxiliary control, with the loader engine “OFF,” to relieve any hydraulic pressure in the grapple cylinders and lines.
3. Disconnect the hydraulic lines at the cylinder, 1, and cap to prevent loss of oil.
4. Remove the cylinder pins, 2 and 3. Note the position of cylinder pin, 2, for reinstallation.

   There are two positions for cylinder location; use rear holes, 2, with the utility fork mounting and front holes, 4, for the pallet fork mounting.

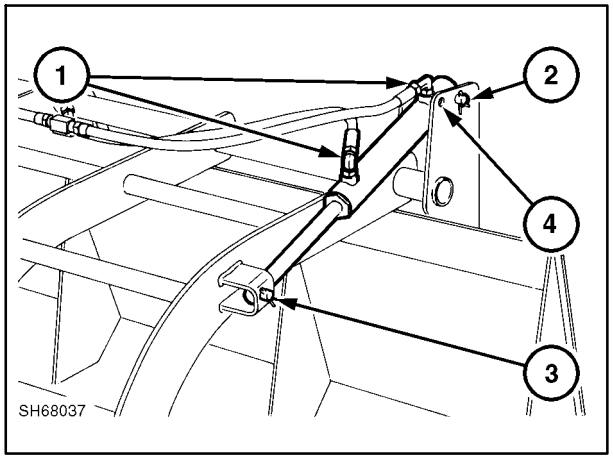


Figure 8-45

Disassembly

5. Thoroughly clean the cylinder. Clamp the cylinder in a vise at 1 to support the cylinder and squeeze the barrel to the gland. This will hold the gland from rotating when removing the retaining nut, 2. A small pin punch can be inserted into a hole in the barrel and gland at 3, to assist in holding the gland.
6. Remove the gland retaining nut, 2.
7. With a hammer and punch, drive the gland into the barrel at 4, far enough to remove the retaining ring, 5.
8. Slide the rod and piston assembly from the barrel.

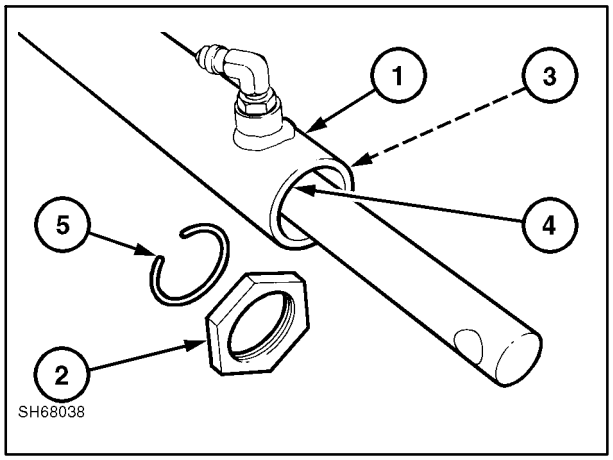


Figure 8-46

9. Remove the piston retaining nut, 1, from the rod, 2, and remove the piston, 3.
10. Remove the gland assembly, 4, from the rod.

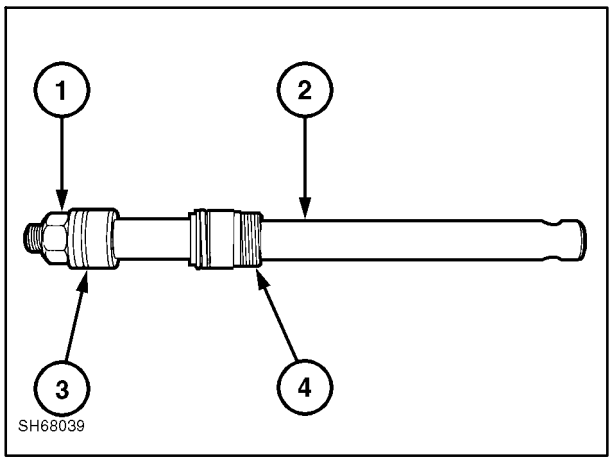


Figure 8-47

Inspection

11. Inspect the barrel for scoring inside, 1, and for flat areas on the outside of the barrel. Inspect the retaining ring groove for damage.
12. Inspect the rod for scoring, 2, and thread damage, 3.
13. Inspect the gland and seals, 4.
14. Inspect the piston and seals, 5.

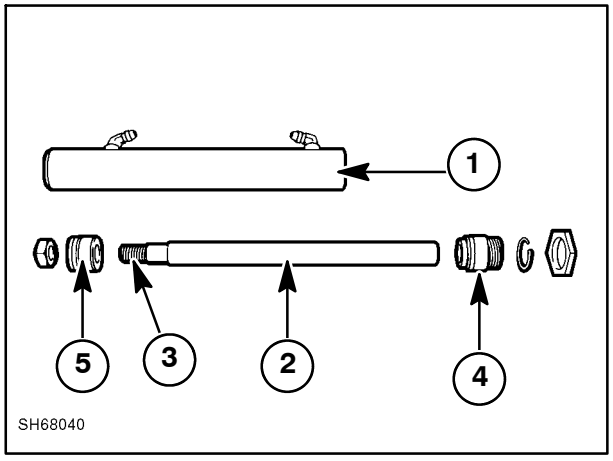


Figure 8-48

Reassembly

1. Install new seals on the gland and piston.
2. Install the gland, 1, onto the rod.
3. Install the piston and torque the retaining nut to 170 N·m (125 ft. lbs.).
4. Lubricate the piston and gland seals. Insert the rod and piston assembly into the barrel.

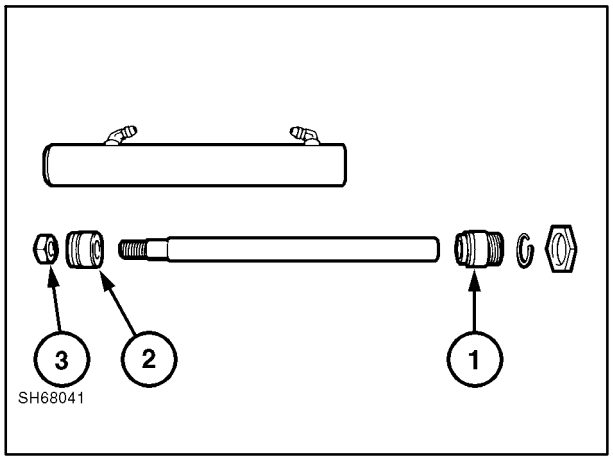


Figure 8-49

5. Slide the gland into the barrel and install the retaining ring in the groove in the barrel.

   Slide the gland out tight against the retaining ring.

6. Install the gland retaining nut and torque to 156 N·m (115 ft. lbs.).

7. Reinstall the cylinder on the grapple and connect the hoses to the cylinder.

   NOTE: There are two positions for cylinder location; use rear holes, 3, with the utility fork mounting and front holes, 4, for the pallet fork mounting.

8. Operate the grapple, fully extend and fully retract the grapple cylinders several times to purge the air from the cylinders and hoses.

9. When the repair is completed and the air is purged from the system and the grapple is in the lowered (closed) position, check the loader hydraulic reservoir oil level and add 10W30 engine oil to correct level.

WARNING: WHEN FINISHED OPERATING THE GRAPPLE, ALWAYS LOWER THE COMPLETE ATTACHMENT TO THE GROUND TO PREVENT POSSIBLE CONTACT WITH THE POINTED TINES.

LOWER THE GRAPPLE TO THE ATTACHMENT BEFORE EXITING THE LOADER.

STORE THE GRAPPLE IN THE COMPLETELY LOWERED POSITION WHEN REMOVING THE ATTACHMENT FROM THE SKID-STEER LOADER.

ATTENTION: The dust caps should be placed on the skid-steer couplers when the couplers are not in use to keep contaminants from collecting in the couplers. If the couplers have become contaminated, clean thoroughly before attaching hydraulic lines. Connect the grapple couplers together to keep them clean in storage.

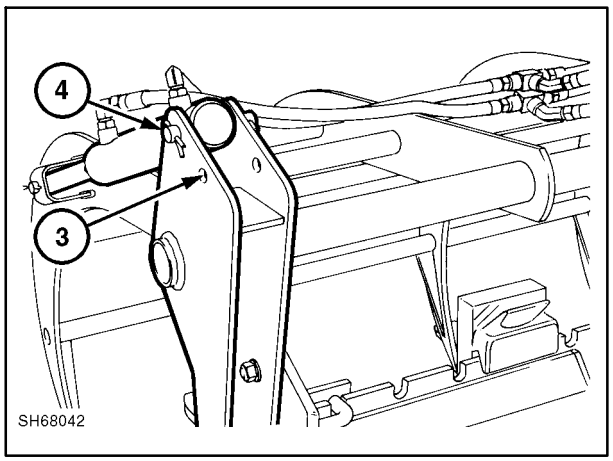


Figure 8-50

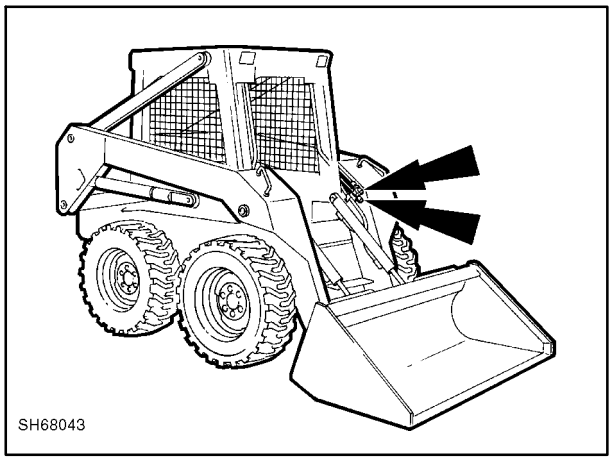


Figure 8-51

CHECKING PROCEDURE FOR BUCKETS AND ATTACHMENTS

The bucket/attachment does not fit or appears to come loose on the boom faceplate.

The loader boom faceplate is worn or out of height dimensions and/or the bucket latch points are worn or out of dimensions.

Inspection

The L565, Lx565, Lx665 loader latching system requires that the faceplate wedge into the attachment. The faceplate must contact the attachment at 1, 2, and 3, and must have clearance between the attachment and faceplate at 4, when the attachment is latched properly.

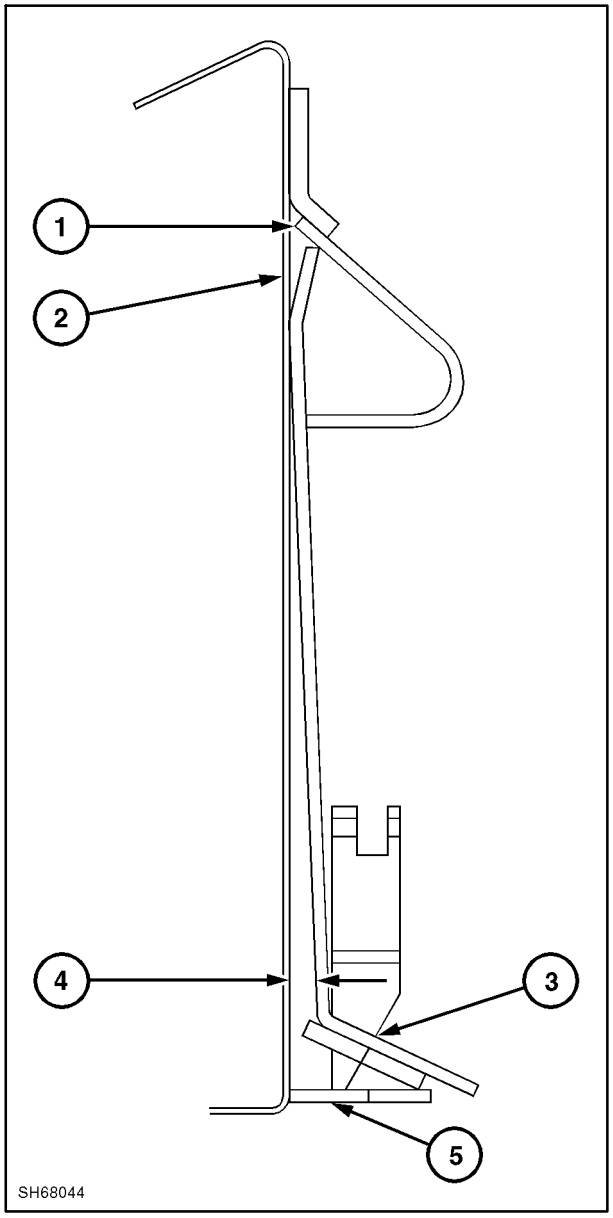


Figure 8-52

The following are some quick visual checks of the loader faceplate and attachment.

1. The attachment must have a 850.1 mm ± 0.8 mm (33-15/32″ ± 1/32″) center to center latch point, 1, to be compatible with the latch system.
2. Check the latch pins and levers for proper operation and lubrication. If the latch pins do not move freely, the system will not function properly.
   a. Control levers pivot over center into the lowered latched position.
   b. Latch pins fully extend from the faceplate.
   c. Control levers pivot over center into the raised unlatched position and hold in this position.

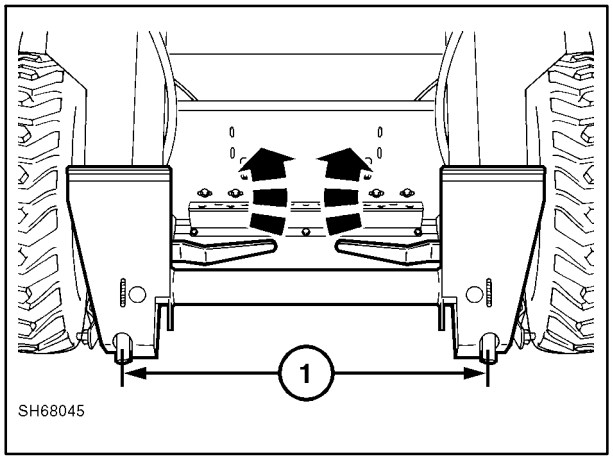


Figure 8-53

Loader faceplate, 5, and attachment, 6, engagement.

3. Check the saddle area of the attachment at 1, for interference, weld, debris, etc. to prevent the attaching plate and attachment from seating properly.
4. The loader latch pin should engage the lower latch plates as shown at 2.
5. Check for clearance between the faceplate and attachment at 3, minimum 0.8 mm (1/32″) and maximum 9.5 mm (3/8″), with the latch pins fully engaged.
   a. If there is no clearance at 3, the loader faceplate is too short or the distance between the top saddle area and lower latch plates is too great, 2, Figure 8-56.
   b. If the clearance is too great or the latch pins will not engage into the latch plates on the attachment, the loader faceplate is too long or the distance between the top saddle area and lower latch plates is too short, 2, Figure 8-56 or the latch plates are located incorrectly, 1, Figure 8-56.
6. When the latch pins are fully engaged, New Holland buckets only, the end of the pin should not extend beyond the lower plate at 4.
   a. If the latch handles do not fully engage, the dimension from the back of the attachment to the rear of the slot in the latch plates is too short at 1, Figure 8-56.
   b. If the latch pins extend below the lower plate at 4, the dimension from the back of the attachment to the rear of the slot in the latch plate is too long at 1, Figure 8-56.

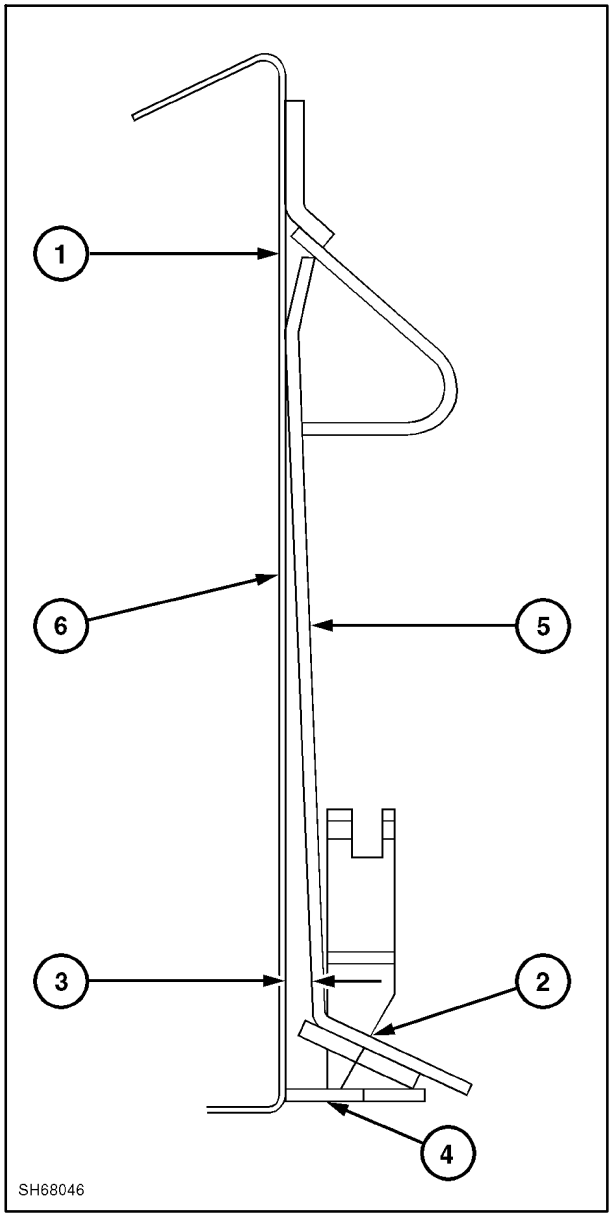


Figure 8-54

CHECKING PROCEDURE

The following are the procedures used to measure the skid-steer loader faceplate and how to measure the attachment.

Checking the Attachment

1. Check the placement of the lower latch plates at 1. Measure from the back surface of the attachment to the rear of the latch plate slot at 1: 235.8 mm ± 0.8 mm (1-9/32″ ± 1/32″).

   a. If this dimension is too short, the slot can be widened by grinding out the slot 1/16″ maximum or replace the latch plates.

      If grinding is required, the rear of the slot must be ground square with the top surface of the plate to ensure proper pin engagement, 2, Figure 8-55.

   b. If the dimension is too long, replace the latch plates.

2. Check the height of the attachment at 2. Insert a 1/2″ x 2″ with 1/2″ standard nut as shown at 3. Measure from the top of the bolt, 4, to the rear of the latch plate slot at 5: 403.2 mm ± 0.8 mm (15-7/8″ ± 1/32″).

   If this dimension is incorrect, the lower latch plates will require replacement.

   NOTE: If new latch plates are required, order four plates #86506587 (102 mm [4″] slot) through Parts and follow the latch plate installation procedure.

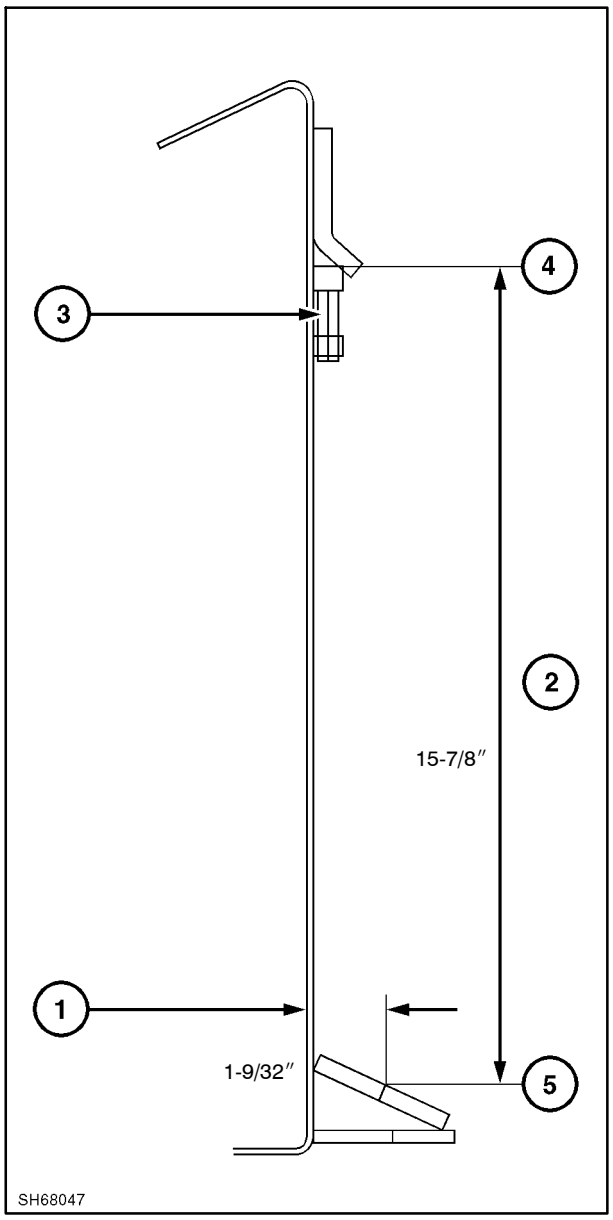


Figure 8-55

CHECKING THE LOADER FACEPLATE

1. Check the height of the loader faceplate from the top of the plate at 1, to the bottom of the plate at 2: 396.9 mm ± 0.8 mm (15-5/8″ ± 1/32″). To check the faceplate, place a 24″ square over the top of the plate as shown at 4, and a straightedge at 5.

   If the faceplate is not within specifications, the plate will require replacement.

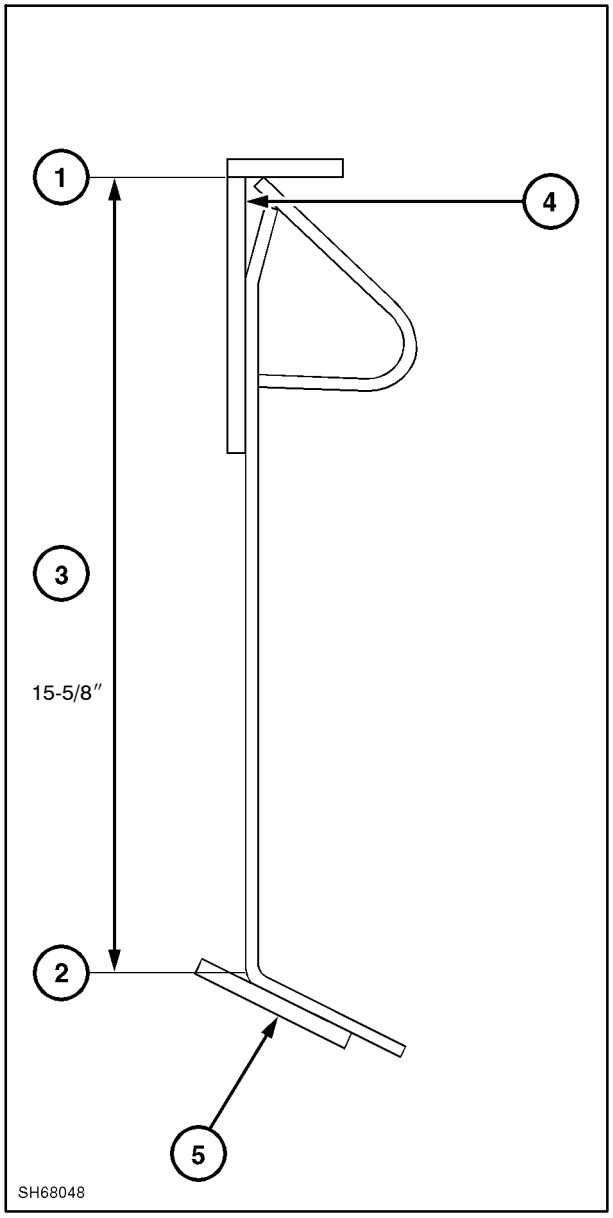


Figure 8-56

2. Check the faceplate pods to ensure they are straight with each other and not twisted. Place a straightedge across both pods as shown at 1, across the front flat surface and at 2, the top of the pods.

   If the pods are not straight, the faceplate will require straightening or replacement.

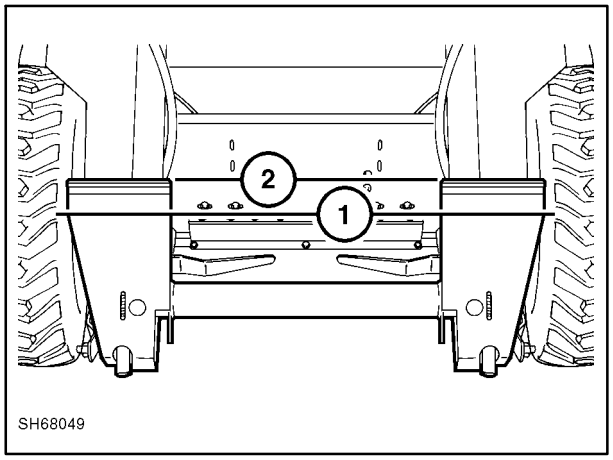


Figure 8-57

3. Check the center dimension between the faceplate pods and the overall outside dimension including the removable plates in the extended position for new buckets on the L565, Lx565, Lx665 faceplates.

   Inside Dimension 1: 647.7 mm (25-1/2″)

   Outside Dimension 2: 1122.4 mm (44-3/16″)

   Latch Pin Dimension 3: 850.1 mm ± 0.8 mm (33-15/32″ ± 1/32″) center

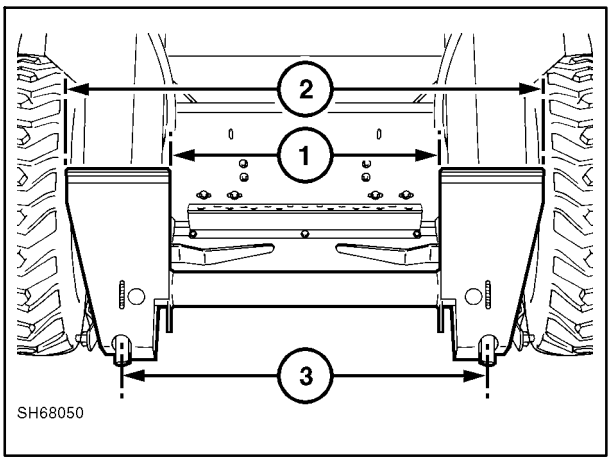


Figure 8-58

CAUTION: DO NOT CUT OR GRIND THE LOADER FACEPLATE TO ADAPT ANY BUCKETS OR OTHER ATTACHMENTS.

DO NOT CUT OR GRIND THE LOADER FACEPLATE LATCH PINS.

When **attaching unapproved attachments**, the latch points on the attachment must meet the correct dimensions and be strong enough to maintain the correct dimensions during operation.

BUCKET LATCH PLATE INSTALLATION PROCEDURE

1. Remove the bucket from the loader before welding to prevent damage to the loader electrical system.

   Material to be welded is low carbon, grade 50 steel; use welding rods marked 6011 or comparable.

   CAUTION: GOOD QUALITY WELDS ARE NECESSARY FOR NEW PLATES TO BE PROPERLY RETAINED. USE A PROFESSIONAL WELDER IF REQUIRED.

2. Turn the bucket over and support it about 305 mm (12″) off the floor.
3. Cut the old lower retaining plates, 1, off the bucket and grind the area flat.
4. For locating the new lower attaching plates, remove the quick-attach plate from the loader boom. To remove the plate from the boom, remove the cylinder pins, 1, and the pivot pins, 2.

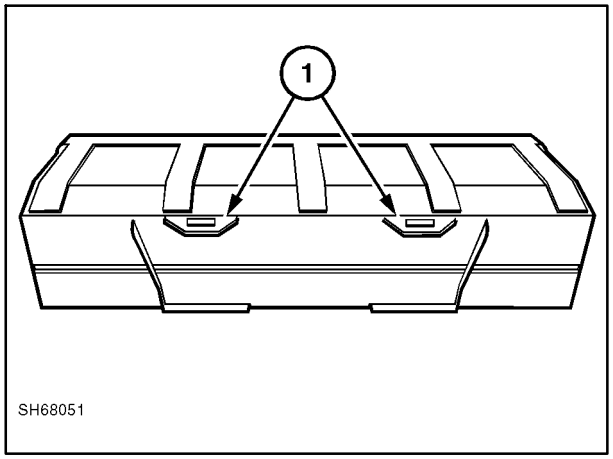


Figure 8-59

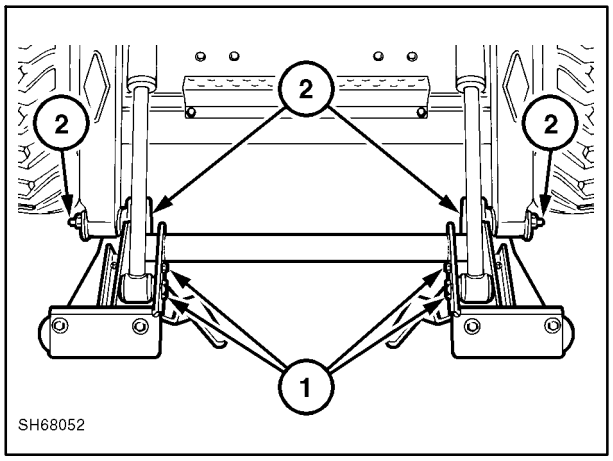


Figure 8-60

5. Rest the attaching plate in the saddle area, 1, of the bucket with the latch handles in the unlatched position as shown at 2. Put two 152 mm (6″) long pieces of 4.8 mm (3/16″) square key stock at 3, to position the attaching plate properly against the back of the bucket.

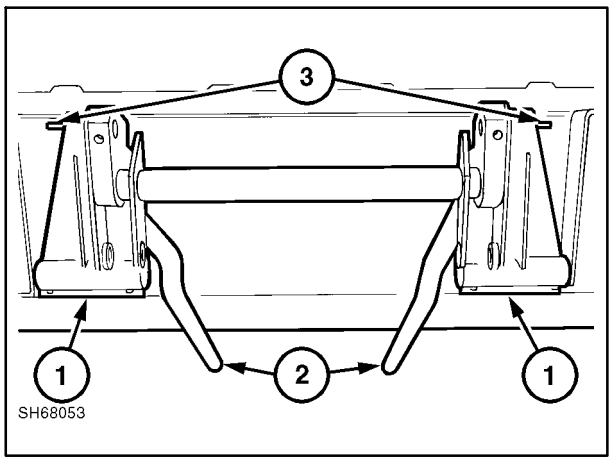


Figure 8-61

6. Position the first plates against the back of the bucket at 1, and rest on the quick-attach plate, 2. Locate the center of the latch plate notches, 4, and center the outer half of the notch over the latch pin, 3. Spot weld the plate to the bucket at 1 to hold the plate in position.

   NOTE: The material to be welded is low carbon, grade 50 steel; use welding rods marked 6011 or comparable.

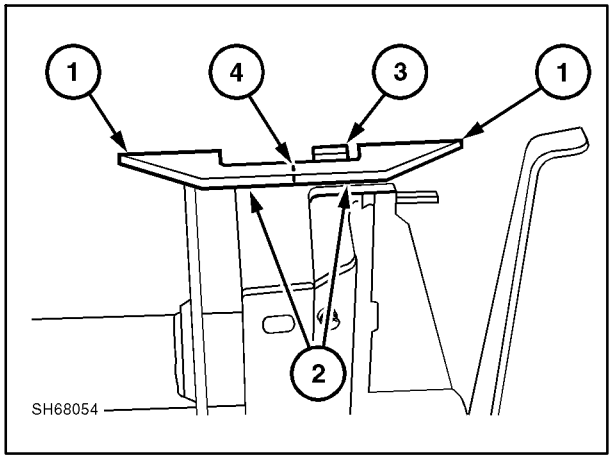


Figure 8-62

7. Position the second plates as shown at 1, with the plates contacting each other at 2, and about 28.6 mm (1-1/8″) spacing at 3. On low-profile buckets, the second plate will be at the rear corner of the bucket at 4. Spot weld the second plate to the bucket at 4 and the two plates together at 5.
8. Remove the 4.8 mm (3/16″) square key stock and push the latch handles to the latched position making sure the latch pins engage the bucket latch plates. The latch handles must fully latch. The latch pin will only contact the top latch plate, 6.

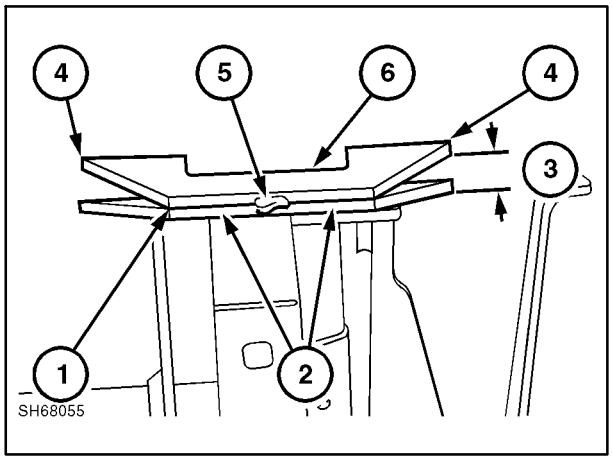


Figure 8-63

9. If the latch handles will not fully latch, the top plate may require some grinding in the pin area at 1, or the plates are not located properly.

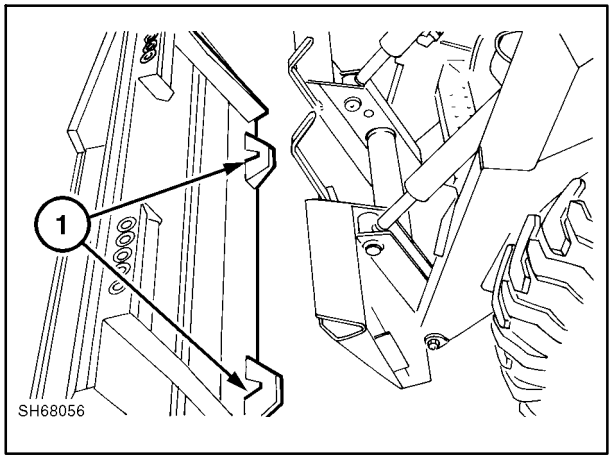


Figure 8-64

10. Weld the plates to the bucket at 2; also weld the two plates at 3.
11. Reinstall the bucket quick-attach plate to the loader boom with the pins previously removed.

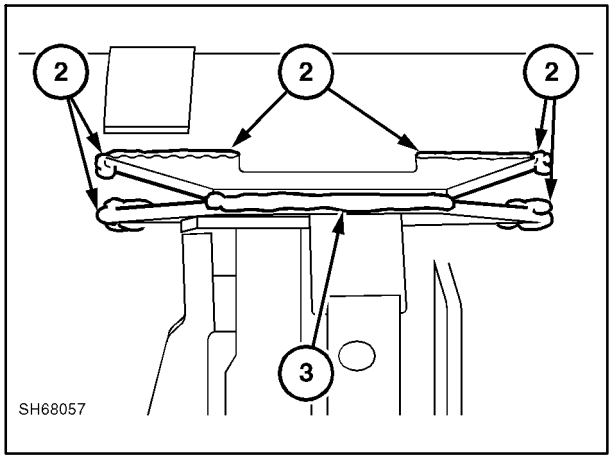


Figure 8-65

12. Attach the bucket to the loader by engaging the top of the plate, 1, under the lip of the bucket at 2. Curl the bucket back to allow the bucket to contact the loader quick-attach plate and engage the latch handles and pins, making sure the latch pins engage the bucket plates properly.

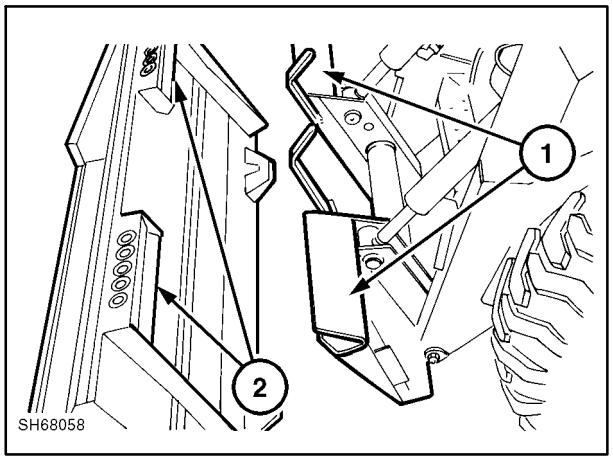


Figure 8-66

ELECTRIC POWER SUPPLY
(12 volt, 15 amp)

The electric power outlet can be installed on the loader to provide an auxiliary 12-volt power outlet rated at 15 amp.

If the horn kit is installed, the power kit wire harness is incorporated in the horn harness.

If the horn kit is not installed, the power kit receives its power from the 15-amp attachment/horn fuse in the engine fuse panel.

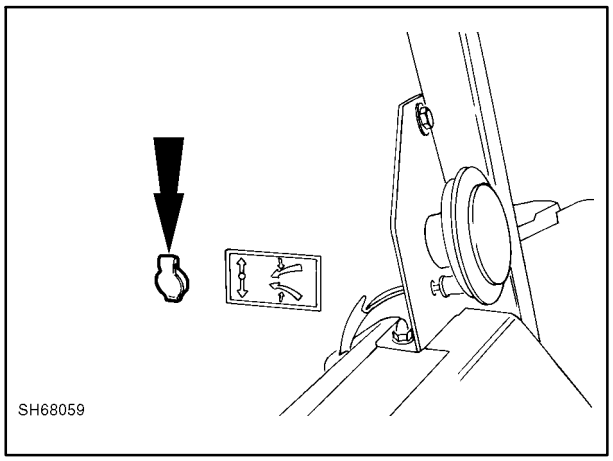


Figure 8-67

Electric Power Wiring

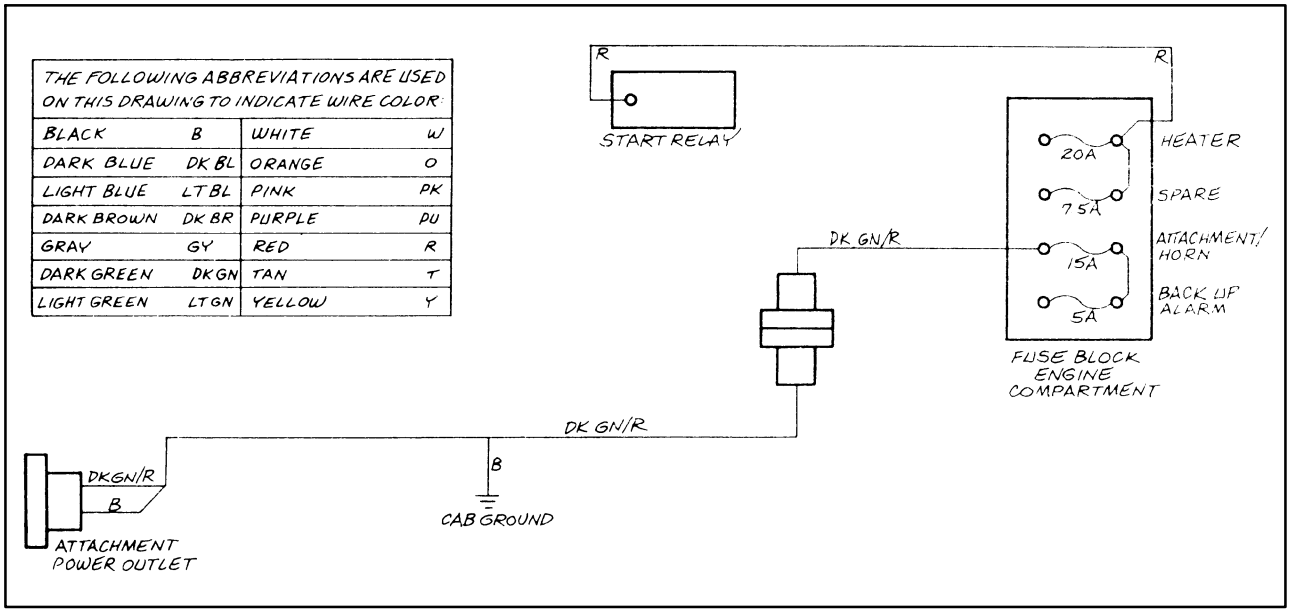


Figure 8-68

EXHAUST (Engine)

CATALYTIC MUFFLER

The catalytic muffler kit can be installed on diesel engines being operated in applications where cleaner exhaust emissions are required.

The catalytic muffler, 1, is a direct replacement for the standard muffler without adding other parts.

When operating a skid-steer loader equipped with the catalytic muffler, the unit must be operated at full engine speed.

The engine exhaust system must be operated at operating temperature for the catalytic purifier muffler to function properly.

If the temperature is not high enough, the catalytic purifier muffler will not function properly and not reduce the carbon monoxide level. The operating life of the purifier muffler will also be reduced.

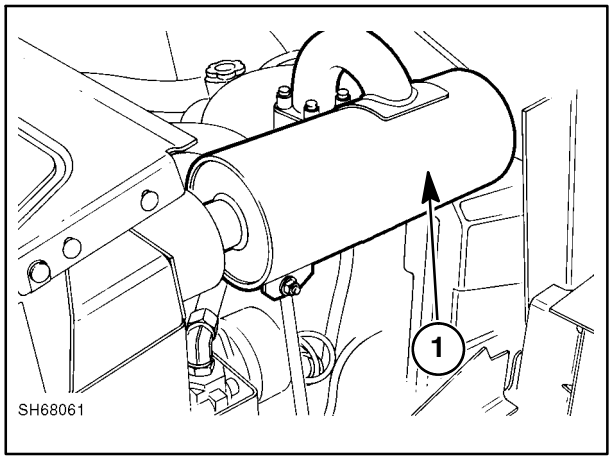


Figure 8-69

ASPIRATOR PRECLEANER MUFFLER

The precleaner aspirator muffler kit can be installed on diesel engines being operated in dusty applications to prolong air cleaner element life.

The aspirator muffler, 1, is a direct replacement for the standard muffler and standard air cleaner.

NOTE: When the aspirator muffler is installed, the engine must be operated at/or near full engine speed to reduce the recirculating of exhaust gases through the air cleaner. If an air cleaner element is sooted with diesel smoke, the engine is being operated at reduced speeds.

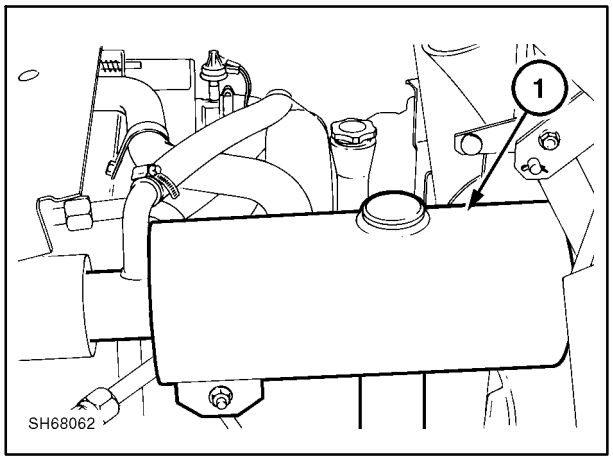


Figure 8-70

The aspirator muffler hose connects to the air cleaner at 1.

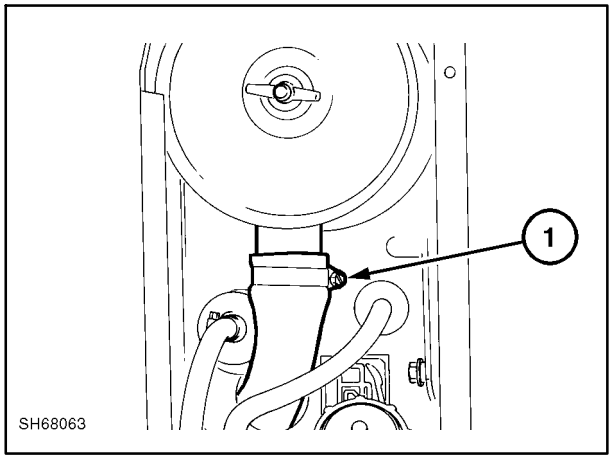


Figure 8-71

Aspirator or Spark Arrester Muffler Cleaning

Clean the muffler every 250 hours of use to ensure proper operation and prolong muffler life.

1. To clean the muffler, first move the loader to an area clear of any flammable material.
2. Allow the engine and muffler to cool before cleaning the muffler.
3. Remove the plug, 1, and allow the accumulated particles to drain from the muffler; a wire or stiff bottle brush might help to begin the particles to drain.
4. Start the engine and idle in neutral, alternate between low and high idle engine speeds for a couple of minutes to thoroughly clean the muffler.
5. Turn off the engine and allow the muffler to cool, then reinstall the drain plug.

CAUTION: CLEAN THE PRECLEANER OR SPARK ARRESTING MUFFLERS IN AN AREA CLEAR OF FLAMMABLE MATERIAL. ALLOW THE ENGINE AND MUFFLER TO COOL BEFORE REMOVING AND REINSTALLING THE DRAIN PLUG.

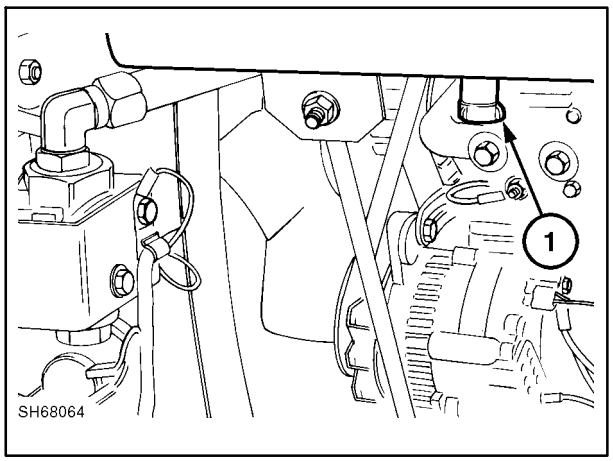


Figure 8-72

HAND CONTROLS (Right Hand Only)

Auxiliary Control Handle with Boom and Bucket Foot Controls

The control handle must be locked when the auxiliary hydraulics are not in use. If the control is partially stroked, the oil will be sent to the quick couplers and deadhead, causing the hydraulic system to operate over relief all the time. This will create excessive heat in the hydraulic system.

When the control handle is locked, 1, the linkage must be adjusted to position the control valve spool in the neutral position.

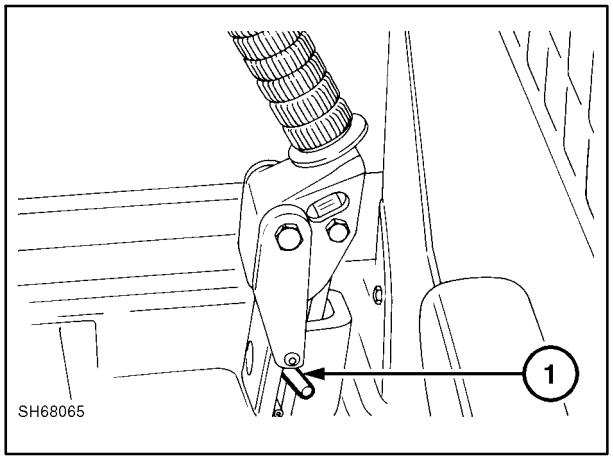


Figure 8-73

Auxiliary Boom Hydraulic Control or Bucket Hand Control Adjustment

Lock the control handle in neutral at 1. Adjust the length of rod, 2, by threading the ball joints, 3, on or off, at both ends of the rod to set the link, 4, vertical. Check adjustment by shifting the hydrostatic control lever forward and reverse. If the rod length is set correctly, there should be no movement in the link, 4, as the rod, 5, moves.

With the control handle locked in neutral (auxiliary hydraulic control only) and the control valve spool centered in the neutral position, adjust the length of rod, 6, with yoke, 7, to allow the installation of the yoke pin.

When the loader is operated, there should be no noise in the hydraulic system when in neutral.

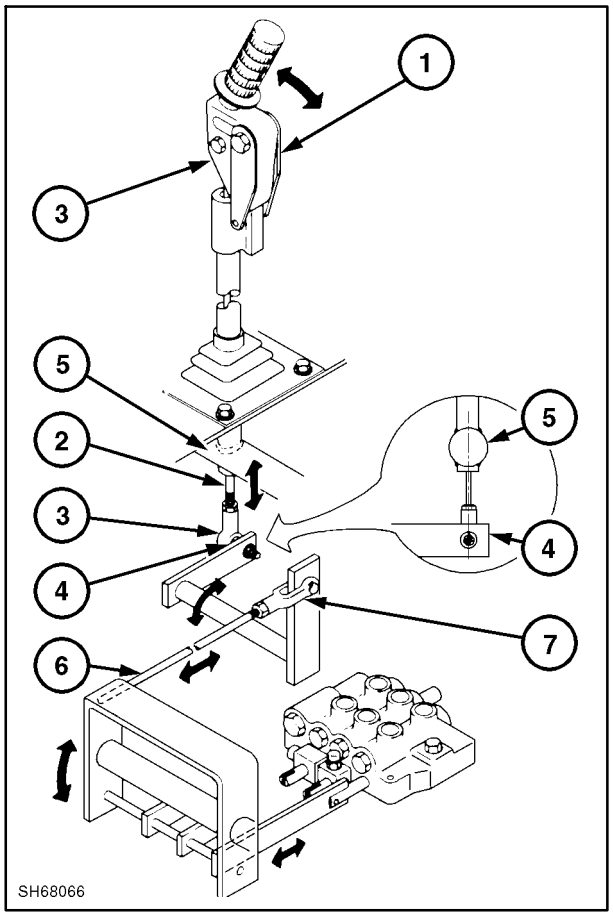


Figure 8-74

HAND CONTROLS (Left Hand and Valve Linkage)

Boom Hand Control Adjustment

1. Adjust the length of rod, 1, by threading the ball joints, 2, on or off, at both ends of the rod to set the link, 3, vertical. Check adjustment by shifting the hydrostatic control lever forward and reverse. If the rod length is set correctly, there should be no movement in the link, 3.
2. With the control handle and valve spool in the neutral position, adjust the length of rod, 4, with yoke, 5, to allow the installation of the yoke retaining bolt.
3. After the left boom linkage is connected, push the handle down to shift the valve spool into detent (float) position. If the valve spool will not go into detent and stay there, further adjustment of the control rod is required.

   NOTE: If the handle and linkage are not adjusted properly, the spool travel will be incorrect and oil flows will not be correct, resulting in incorrect boom and bucket speeds.

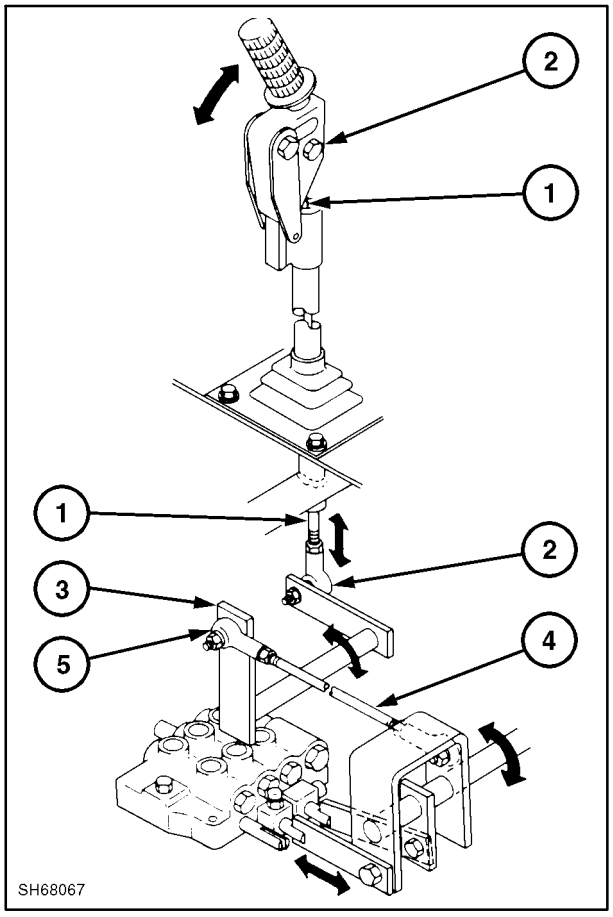


Figure 8-75

Auxiliary Pedal Control Lock

When the loader is equipped with boom and bucket hand controls, the auxiliary control is with the left foot control pedal.

The control must be locked when the auxiliary hydraulics are not in use. If the control is partially stroked, the oil will be sent to the quick couplers and deadhead causing the hydraulic system to operate over relief all the time. This will create excessive heat in the hydraulic system.

When the control handle is locked, 1, the linkage must be adjusted to position the control valve spool in the neutral position.

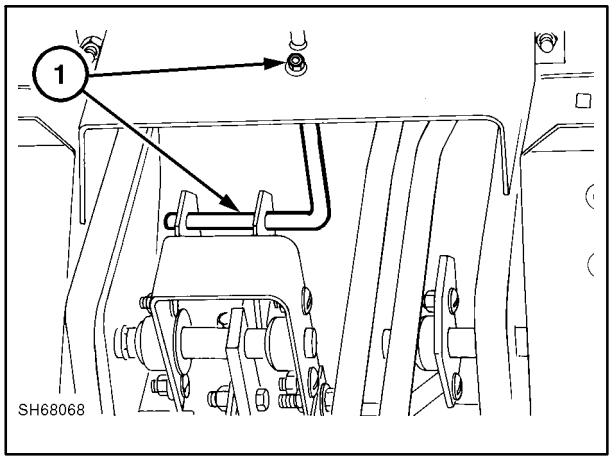


Figure 8-76

The support must be adjusted to allow link, 1, to set into the slot of link, 2, to prevent control valve spool movement. Loosen the support retaining hardware and slide the support to obtain proper alignment.

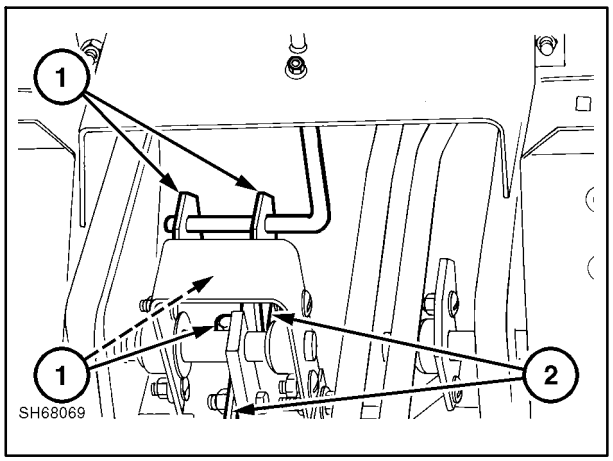


Figure 8-77

HEATER/DEFROSTER (Cab)

Switch and Control Panel

1. Disconnect the negative (-) battery cable to prevent possible shorting of the electrical system.
2. Remove the retaining hardware, 1, and pull the panel from the rear support, 2.
3. Disconnect the switch wires and control cable.

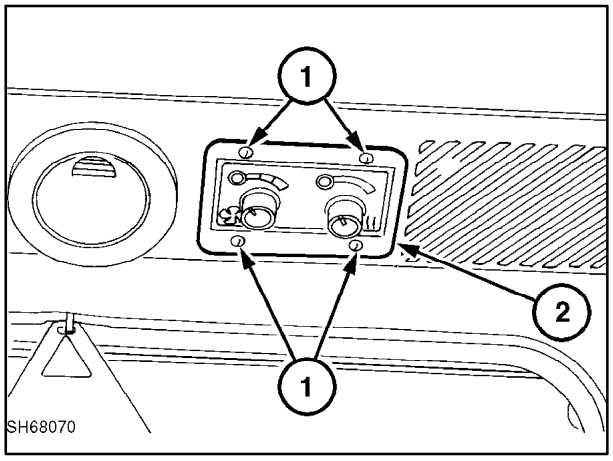


Figure 8-78

A new control panel assembly, part #86531994, with an improved temperature control mechanism, has been released. The new control panel is a direct replacement for the older control mechanism, part #86504804. The new complete panel will not accept the new converter control and cable.

The new control panel assembly is serviced with the following parts:

Item #	Description	Part #
1	Control Assembly - Complete	86531994
2	Knob - Switch	274481
3	Sign - Heater Control	86506429
4	Knob - Converter	86533841
5	Control Panel	86533232
6	Switch - Blower	271439
7	Converter Control (includes cable)	86531995
8	Cable - NSS	

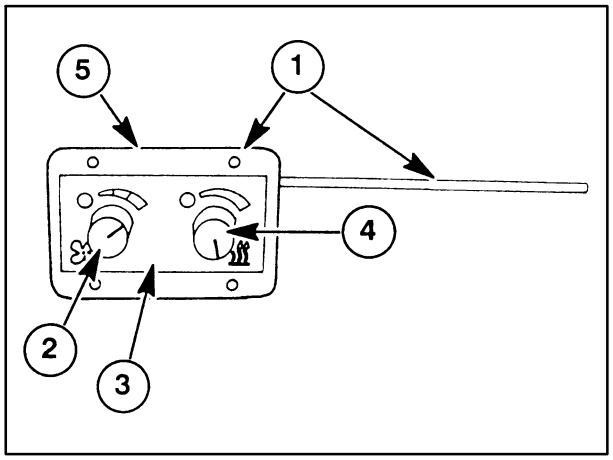


Figure 8-79

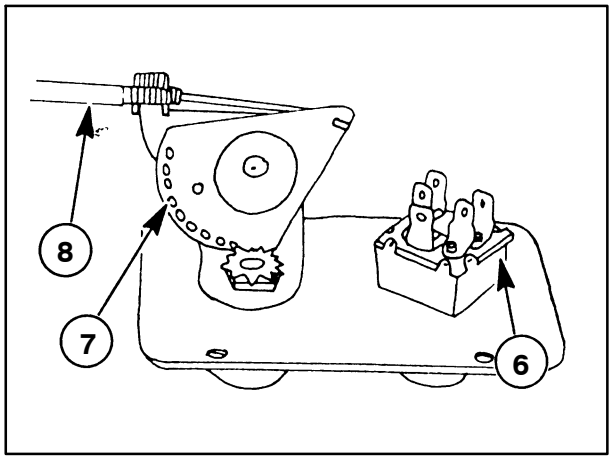


Figure 8-80

Switch Wiring

The heater switch, 1, has four terminals marked, L, M, H, and B, that the wire harness must be connected to.

Connect the wires as follows:

Terminal	Wire
L	R/W (Red/White)
M	Y (Yellow)
H	O (Orange)
B	O/DKBL (Orange/Dark Blue)

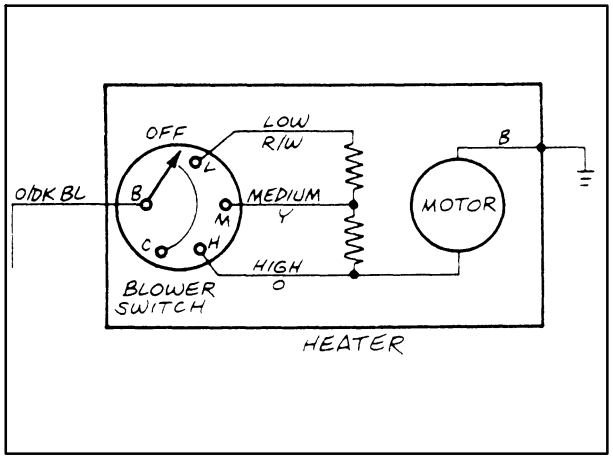


Figure 8-81

Relay and Fuse Block

1 - Fuse block - 20 amp

2 - Relay

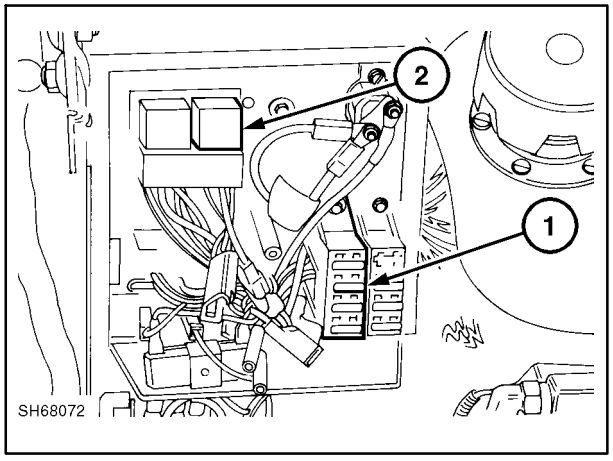
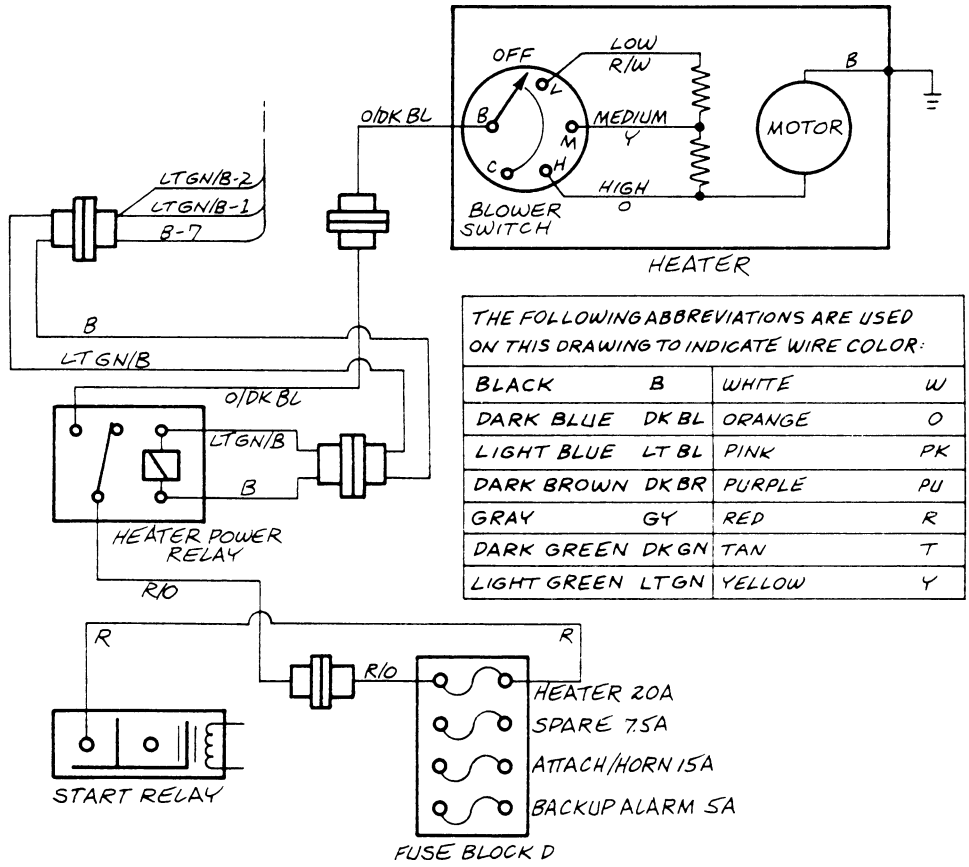


Figure 8-82



Heater Wiring Diagram

Figure 8-83

Louver Replacement

1. To remove the louver, use a small flat screwdriver and pry the louver from the support base at 1.
2. Remove the two #6 self-tapping screws from the base and remove the base from the headliner.

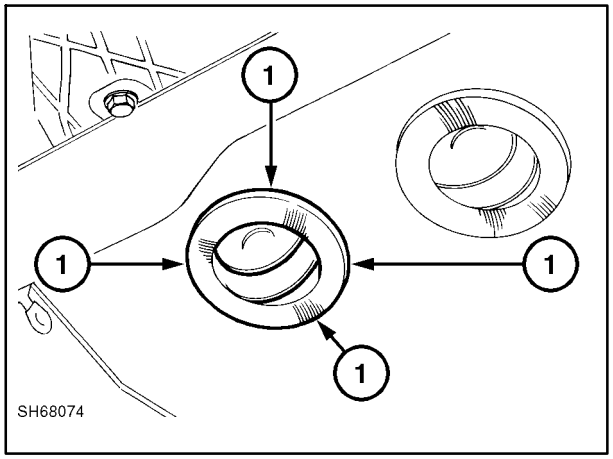


Figure 8-84

Heater Core, Shutoff Valve and Fan Assembly Access

To access the heater core and/or fan assembly, the rear light bar, 1, (if equipped with lights) and top heater cover, 2, must be removed. Remove the heater cover mounting screws, 3, to remove the cover and light bar together.

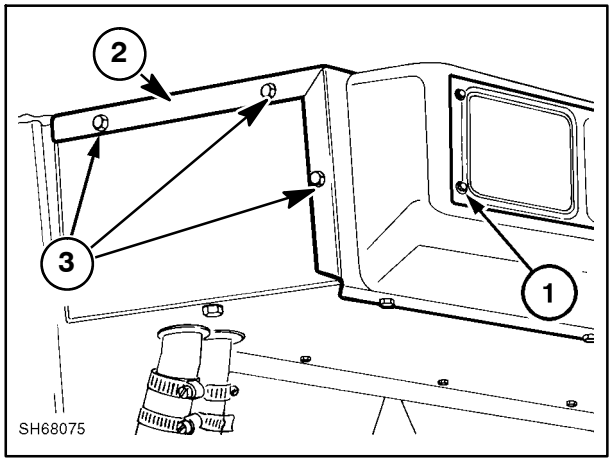


Figure 8-85

Heater Core Replacement

1. Drain the cooling system enough to drain the coolant from the core, about 2 liters (2 quarts).
2. Remove the heater hose clamps, 1, from the heater core and remove the hoses from the core and cap hoses.
3. Remove the heater core retaining hardware, 2, and remove the core from the heater support.

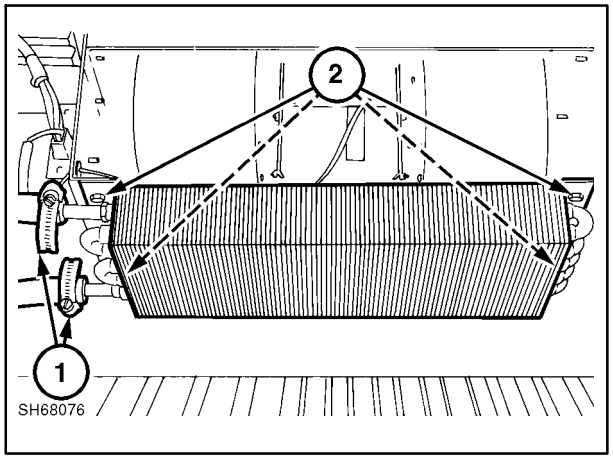


Figure 8-86

Heater Shutoff Valve Replacement

1. Drain the cooling system enough to drain the coolant from the core, about 2 liters (2 quarts).
2. Remove the control cable from the valve.
3. Remove the heater hose clamps, 1, from the heater shutoff valve and remove the hoses from the valve and cap hoses.
4. Remove the heater shutoff valve, 2.

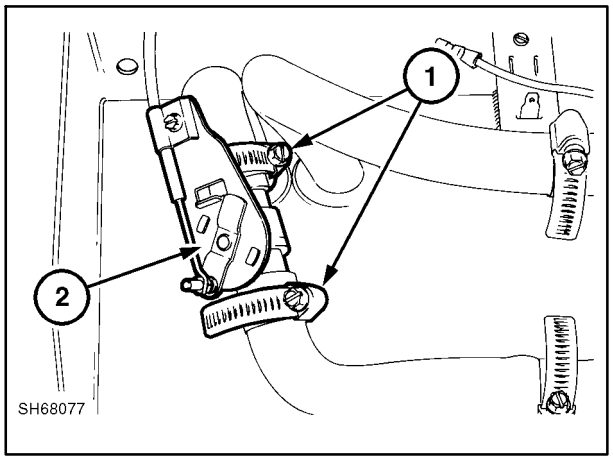


Figure 8-87

Heater Fan Assembly Replacement

1. Remove the heater core retaining hardware and pivot the core away from the fan support.
2. Disconnect the fan power wire, 1.
3. Remove the fan and motor assembly, 2, retaining hardware.

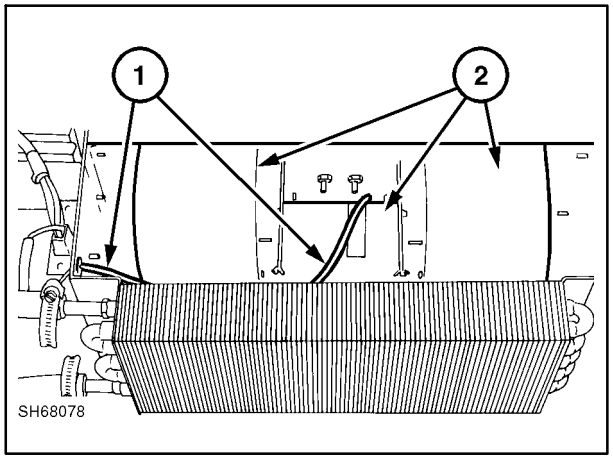


Figure 8-88

Heater Hose to Engine Connections

1. Heater hose from the heater core to the front plug, 1.

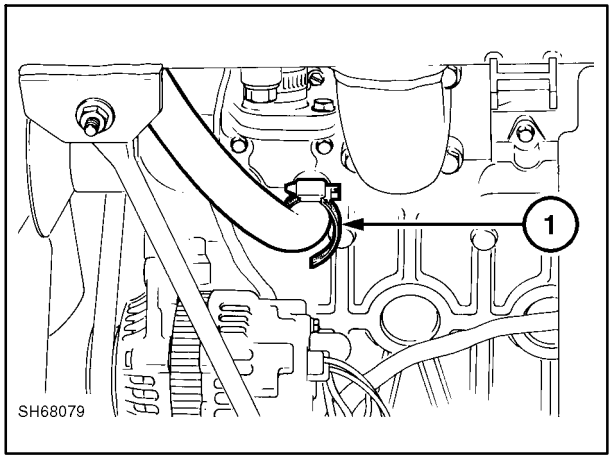


Figure 8-89

2. Heater hose from the heater shutoff valve to the plug in the top of the water pump at 1.

   NOTE: If the heater is installed on an Lx665 turbocharged loader, this hose will be at the tee at 2.

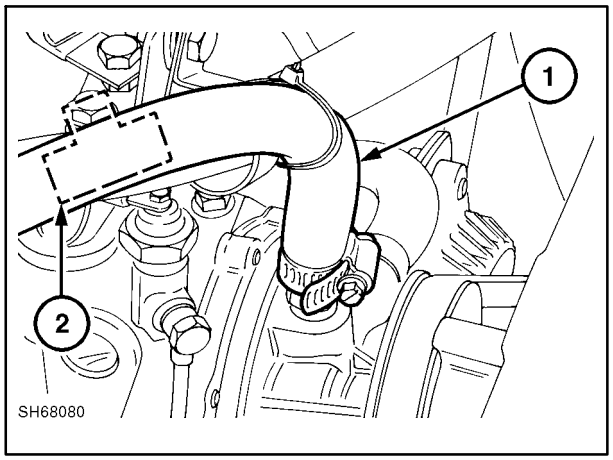


Figure 8-90

Heater Core Connections

Connect the pressure hose to the left side hose, 1, and the return hose, 2, to the right side. Secure with hose clamps. The hoses from the engine will have to be cut to length for proper fit.

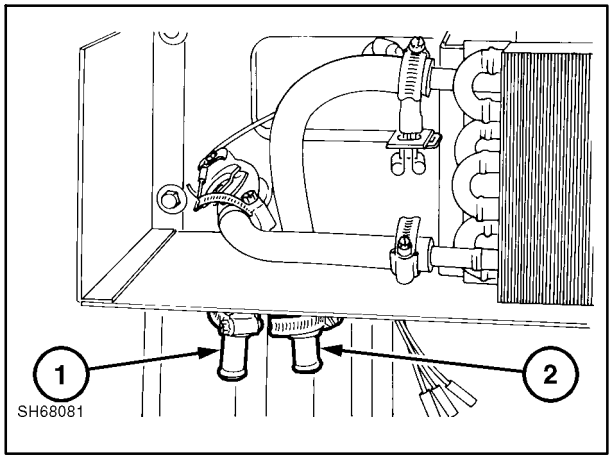


Figure 8-91

Filter

Replacement filter #86504784

The heater contains an air filter element in the rear right side at 1.

Remove cover plate, 2, by removing two self-tapping screws, 3.

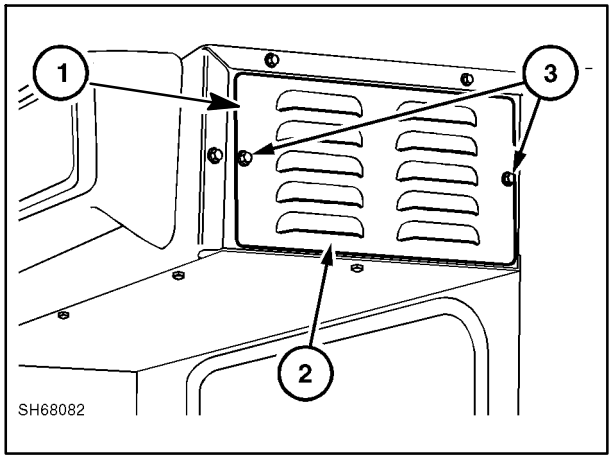


Figure 8-92

Check the filter element, 1, periodically, especially if running in dirty applications and using the fresh air ventilation. The element can be blown off with a **low-pressure** air gun and reused or replaced. The element must be placed with the rubber seal toward the heater core. Be sure the seal is behind the top clamp, 2, and lower screw, 3.

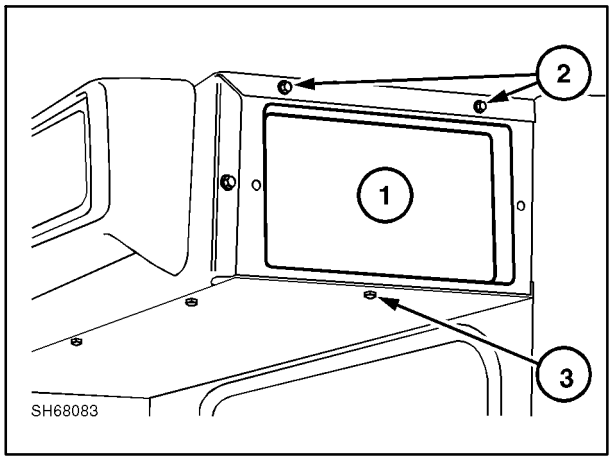


Figure 8-93

Bleeding Air from Heater (Lx665)

The Lx665 utilizes an engine crankcase oil cooler which is teed into the water pump supply side of the cab heater.

To completely bleed air from the heater lines and heater core:

1. After component installation is completed, refill the coolant system, per the installation instructions.
2. Leave the radiator cap off and run the loader engine, circulating coolant. Stop the engine and refill the radiator.
3. Temporarily “pinch off” the oil cooler supply hose at the new tee to force coolant through the heater hoses and heater core.

CAUTION: STOP THE ENGINE WHILE WORKING AROUND THESE HOSES.

4. Start and run the engine. When the system is completely bled, remove the “pinch off” device.
5. Finish system filling, per the installation instructions.

NOTE: Do not install a shut-off valve or orifice in the oil cooler supply hose. Restricting coolant flow to the engine oil cooler may result in overheating and engine failure. Should this type of overheating cause a failure, it is NOT covered by warranty.

HIGH FLOW HYDRAULICS

When the high flow hydraulics circuit is used, it will allow the operator to utilize more available engine horsepower through the auxiliary hydraulic circuit.

The high flow increases the hydraulic flow:

L565, Lx565

From 15.1 GPM, 1000 PSI at 2900 RPM to 27.2 GPM, 2300 PSI at 2900 RPM (= 37.4 HP).

Lx665

From 17.2 GPM, 1000 PSI at 2900 RPM to 29.8 GPM, 2300 PSI at 2900 RPM (= 40.3 HP).

During warm climate operation, be conscious of the EIC (Electronic Instrument Cluster) temperature monitoring system. Adjust the attachment load (rate of feed) and length of continuous operation (duty cycle times) accordingly.

This high flow is not intended to replace a fully dedicated, specialized machine.

When the attachment is not in use, be sure the high flow switch, 1, is in the “OFF” position to prevent overheating of the hydraulic oil.

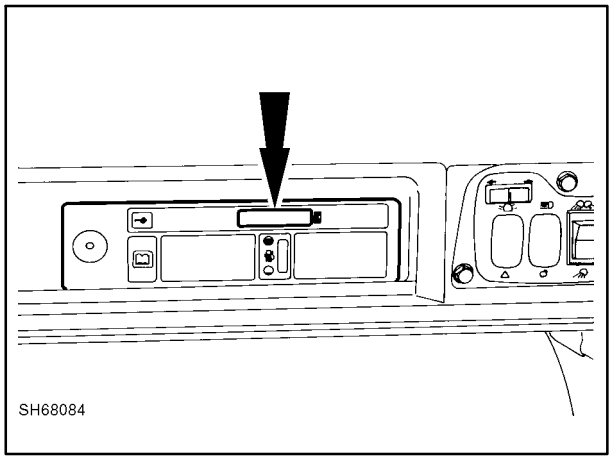


Figure 8-94

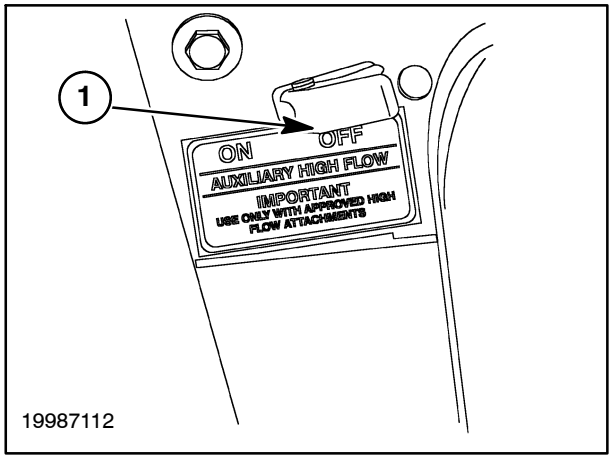


Figure 8-95

When the high-flow is being used, 3/4″ quick couplers, 1, must be used on the loader and attachment or overheating of the hydraulic oil may occur. The 1/2″ quick couplers, 2, can be used for other attachments that do not require the added oil flow.

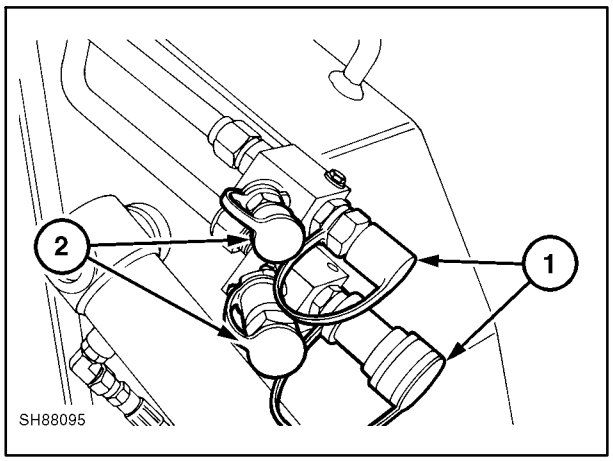


Figure 8-96

Attachment Case Drain

When the high flow kit is installed, there is a separate case drain return line, 1, for the attachment case (housing) to drain oil. The case drain line drains into the hydrostatic pump/motor case drain system with 0.0-1.7 bar (0-25 PSI) system back pressure. Most auxiliary hydraulic drive attachments equipped with a separate case drain line require no system back pressure for the drain line.

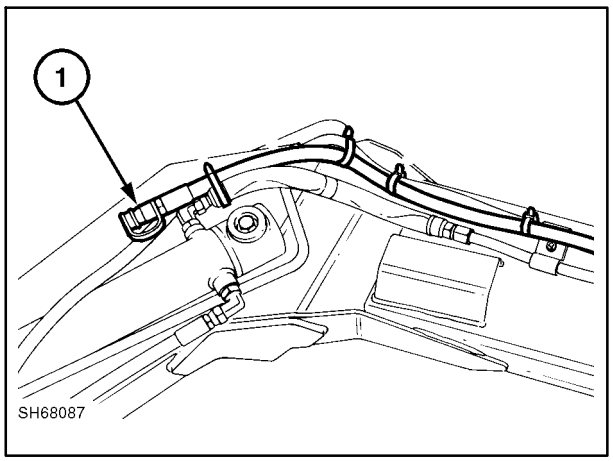


Figure 8-97

HIGH FLOW HYDRAULICS TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTION
No switch operation	No battery voltage to switch	Check power supply at 15-amp fuse (attachment) engine fuse panel
		Check DKGN/R (Dark Green/Red) wire from fuse to switch
	Inoperative switch	Replace switch
No selector valve operation	No battery voltage to selector valve	Check switch for proper operation
		Check W/T (White/Tan) wire from switch to selector valve
	No circuit ground	Check B (Black) ground wire for proper grounding
	No selector valve spool movement	Check valve spool for binding and sticking
Hydraulic oil overheats	Using 1/2″ quick couplers	Must use 3/4″ quick couplers
	Control valve and boom steel lines and hoses were not changed from 5/8″ to 3/4″	Change lines and hoses to 3/4″
	Operating high flow when not required	Turn high flow switch to the “OFF” position
	Operating high flow at relief pressure continuously	Operate attachment at lesser load
	Operating attachment when not applying a load to the attachment	Stop attachment when not loaded (moving from one work area to another)
	Operating attachment when high oil flows are not required	Turn high flow switch to the “OFF” position
	Restriction in pressure or return lines	Check and repair
	Oil cooler restricted not allowing cooling air to flow properly	Clean oil cooler and radiator

PROBLEM	POSSIBLE CAUSES	CORRECTION
No increase in hydraulic oil flow when switch is in the “ON” position	No switch operation	Check power supply circuit
	No selector valve operation	Check power supply from switch
	Selector valve spool binding	Check for spool binding and repair
	Drive belt slipping or broken	Check drive belt adjustment or replace
Low hydraulic power	Low high flow relief valve pressure setting	Check and replace relief valve
	Low main system relief valve setting	Check and replace relief valve
	Leaking control valve plugs, leaking oil to return	Check O ring and backup washer on plugs
	Inefficient gear pump (main)	Check pump efficiency, repair or replace
	Inefficient gear pump (high flow)	Check pump efficiency, repair or replace

HIGH FLOW HYDRAULICS COMPONENT REPLACEMENT

High Flow Selector Valve Replacement

To access the selector valve, 1, the seat must be raised and latched in the raised position.

The left hydrostatic control lever assembly must be removed.

The cab may be tilted forward for easier access.

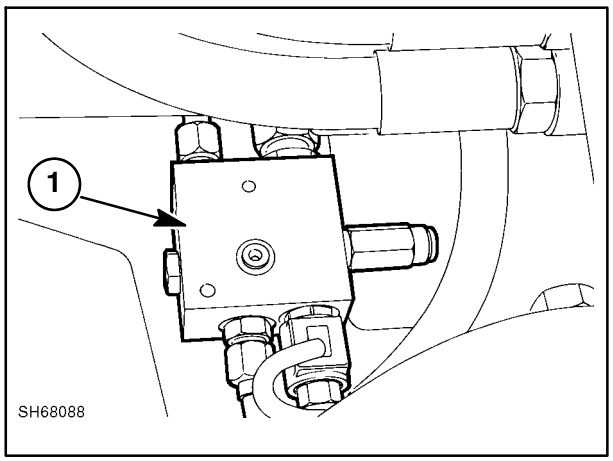


Figure 8-98

Rebuild the selector valve with new O rings on the spool and fittings at 1, and on both ends of the coil at 2.

To check the coil, use an ohmmeter and put one lead on one wire and the other on the other wire; the ohms reading should be between 7.5 and 11.5. If the coil is not within specification, replace it.

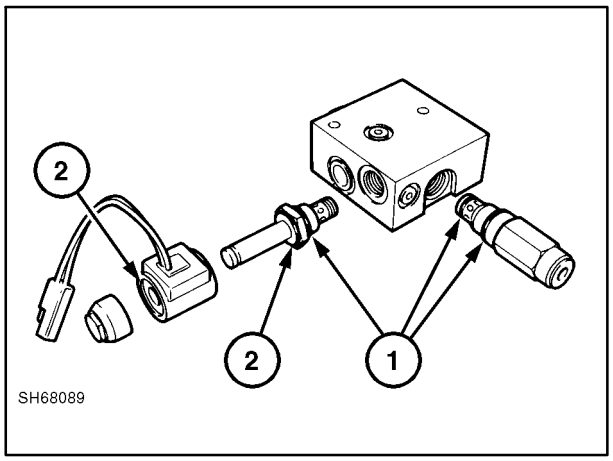


Figure 8-99

High Flow Gear Pump Removal

1. Boom in the raised position resting on the boom lock pins.
2. Remove the engine belly pan.
3. Loosen the gear pump mounting bolts and loosen the belt.
4. Remove suction line, 1, from the pump, and cap the line. If the lines are not capped, the hydraulic oil reservoir must be drained to prevent loss of oil.
5. Remove the pressure line, 2, from the pump, and cap the line.

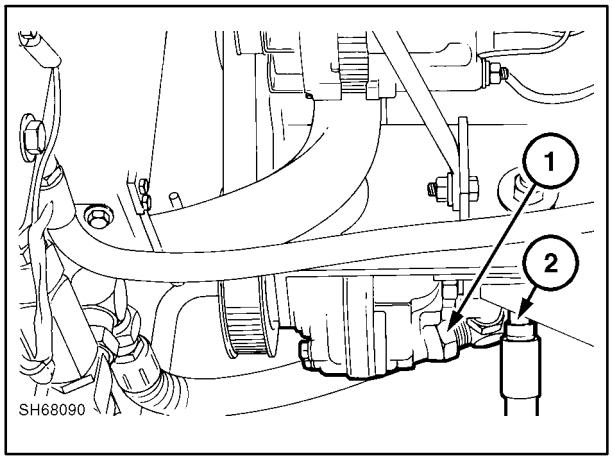


Figure 8-100

6. Remove the drive pulley, 1, from the pump shaft by removing the three center drive hub bolts, 2. Place the three center drive hub bolts into the opposite three holes, 3, and tighten the bolts; this will loosen the drive hub on the pump shaft.
7. Remove the pump mounting hardware.
8. Remove the gear pump from the right engine mount and pump mount.

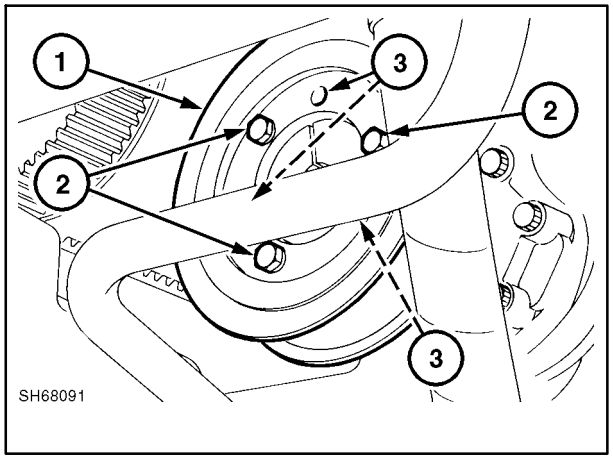


Figure 8-101

Gear Pump Repair

1. Remove the pump hardware, 1.
2. Using a soft hammer, tap the gear pump section to separate the pump sections.
3. Inspect the pump bearings, 2, for damage and wear.
4. Inspect the pump center section, 3, for scoring damage.
5. Inspect the pump end caps and bearing plate at 4 for scoring damage.
6. Inspect the drive shaft and gears, 5, for wear and scoring. Inspect the shaft in seal and bearing areas for scoring.

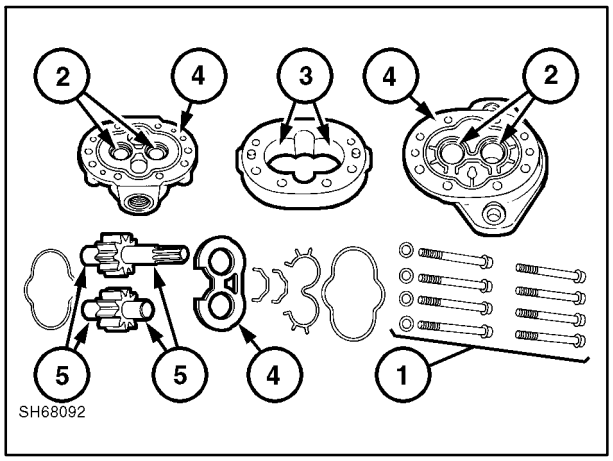


Figure 8-102

Gear Pump Installation and Belt Tension

1. Install the pump adapting plate, 1, to support at 2, with 3/8″ x 1″ cap screw and hardened flat washer. Align the adapting plate with support at 3.

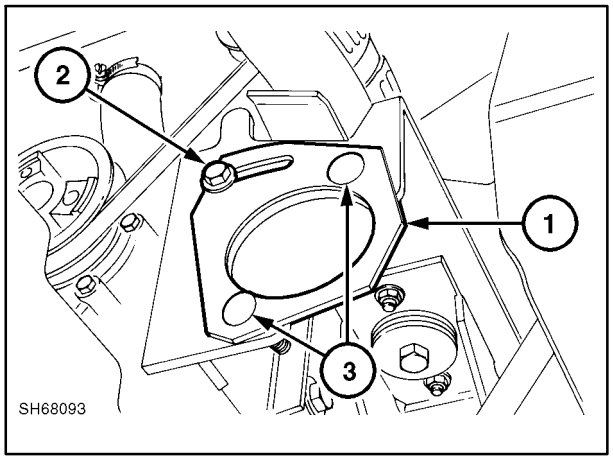


Figure 8-103

2. Mount the hydraulic pump to the support and adapting plate with two 3/8″ x 3/4″ carriage bolts, two hardened flat washers, two metric lock washers and nuts at 1. Install key, 2, in the slot in the pump shaft.

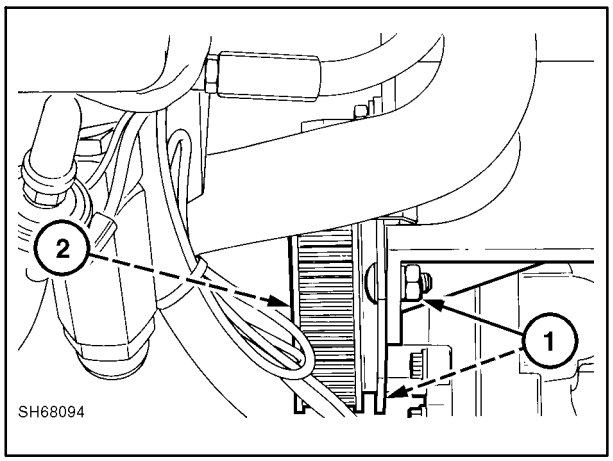


Figure 8-104

3. Figure 8-106 shows the proper assembly of the pump, 1; adapting plate, 2; and engine mount, 3.

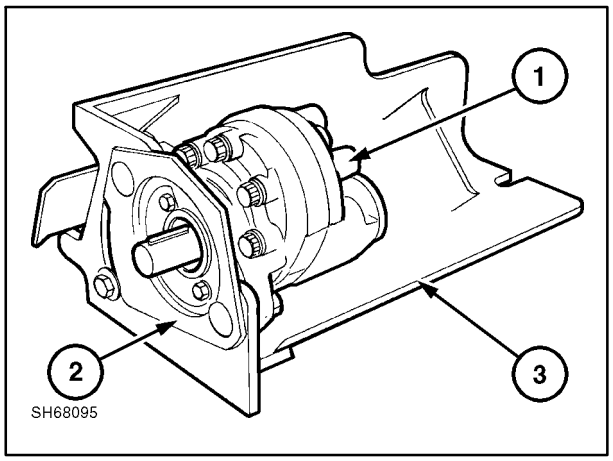


Figure 8-105

4. If the center drive bushing, 1, was removed from the drive pulley, place the center drive hub in the sprocket (pulley), 2, opposite the wording on sprocket, 3; remove the three cap screws from the hub and insert into the opposite holes. Tighten cap screws, 4, finger tight into the bushing flange.

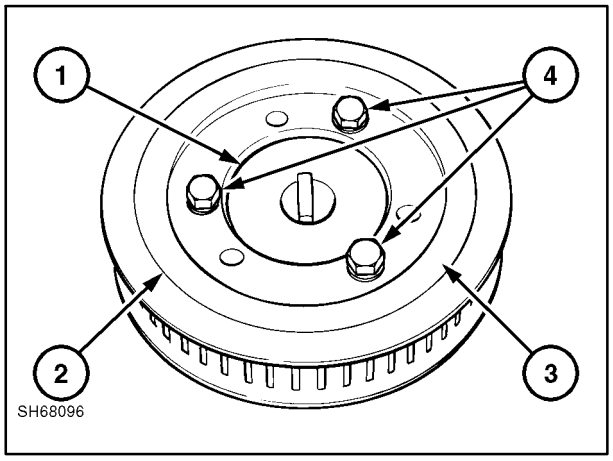


Figure 8-106

5. Slide the loosely assembled sprocket onto the pump shaft with hub, 1, towards the pump and wording and bolt heads, 2, towards the outside.

   Align crankshaft, 3, and pump sprockets, 4. Tighten cap screws, 2, alternately and evenly to 12 N·m (108 in. lbs.).

   NOTE: When tightened, there may be a 1/8″ to 1/4″ gap between the bushing flange and the sprocket hub.

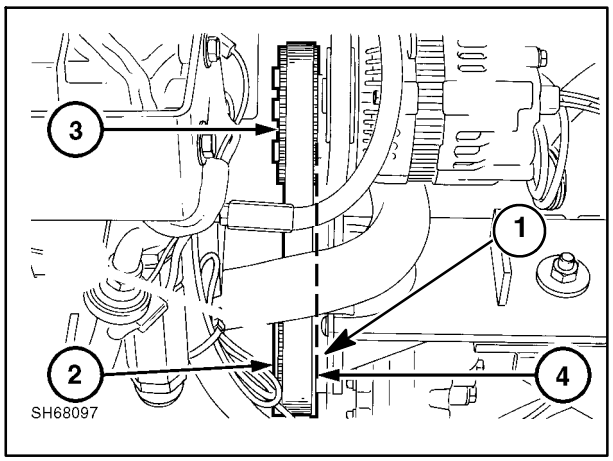


Figure 8-107

6. Install belt, 1, and tighten the belt by rotating the pump to obtain a 1/8″ deflection with a 9 kg (20-lb.) force in the center of the belt span. Tighten both pump mounting bolts, 2, securely to 49 N·m (36 ft. lbs.).

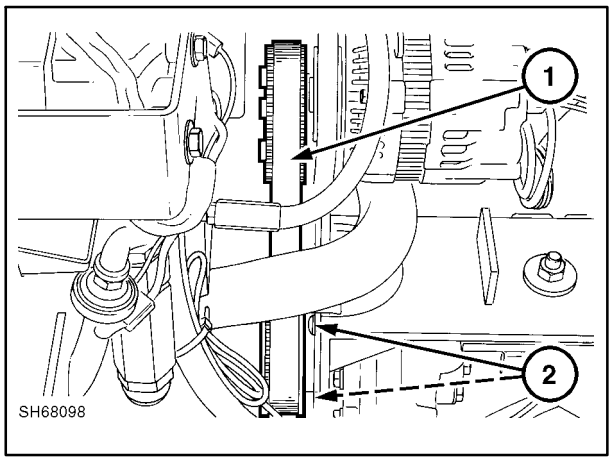


Figure 8-108

High Flow Electrical Wiring Diagram

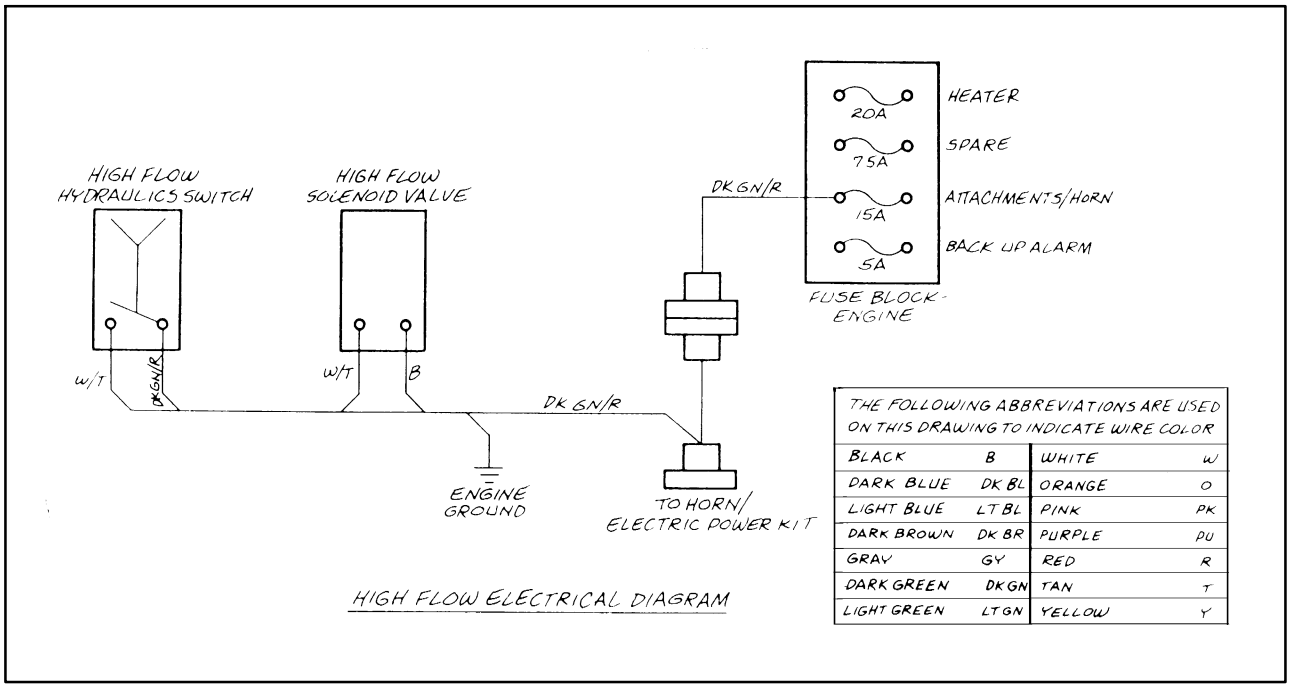


Figure 8-109

High Flow Hydraulic Oil Flow Diagram

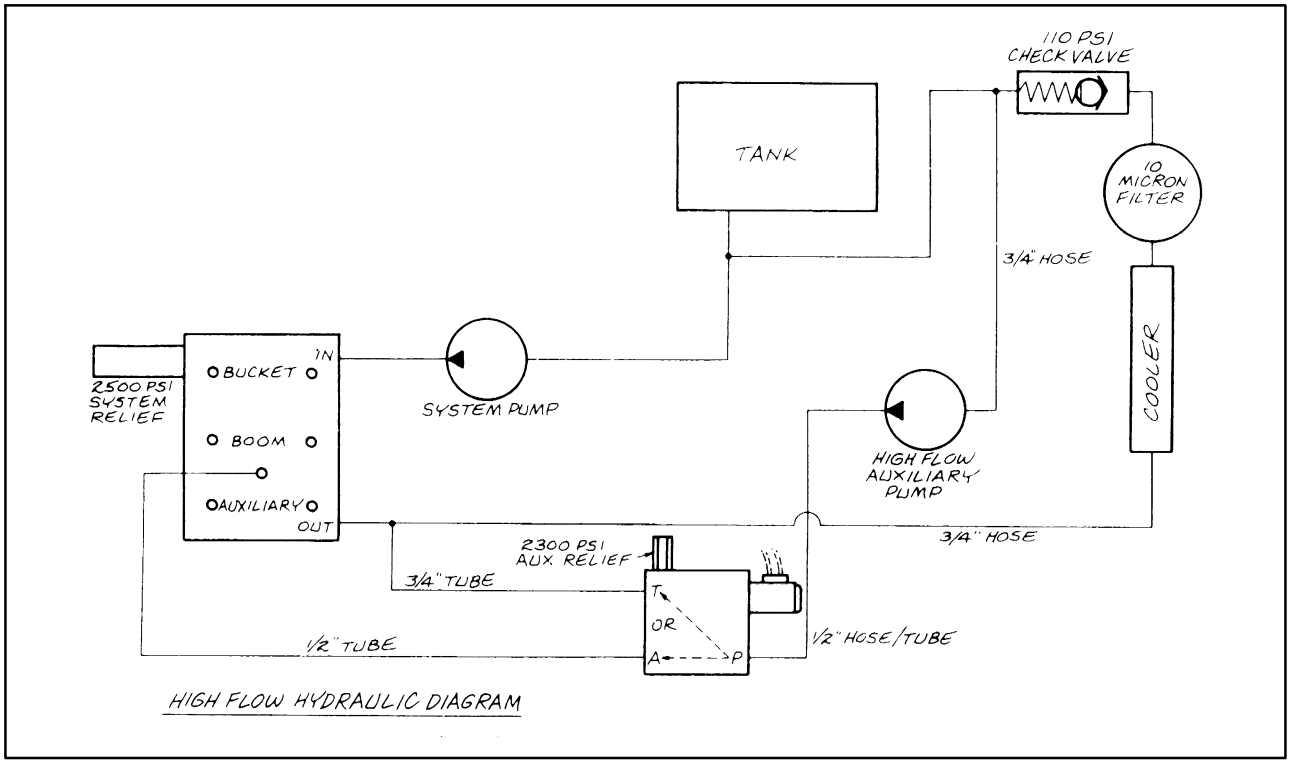


Figure 8-110

HORN

The horn kit provides an operator-controlled device to alert bystanders and other machine operators. The horn button, 1, is located in the top of the left hydrostatic control lever.

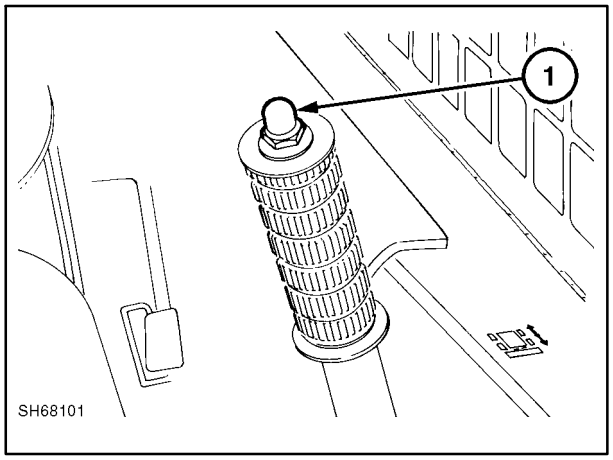


Figure 8-111

The horn button may be located to the front of the left hydrostatic control lever as shown at 1.

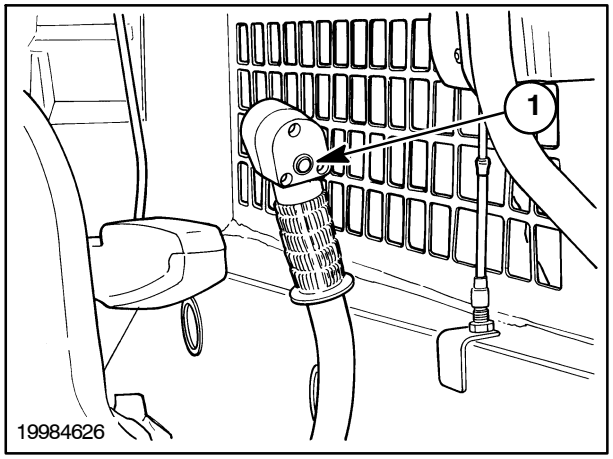


Figure 8-112

Horn Wiring Diagram

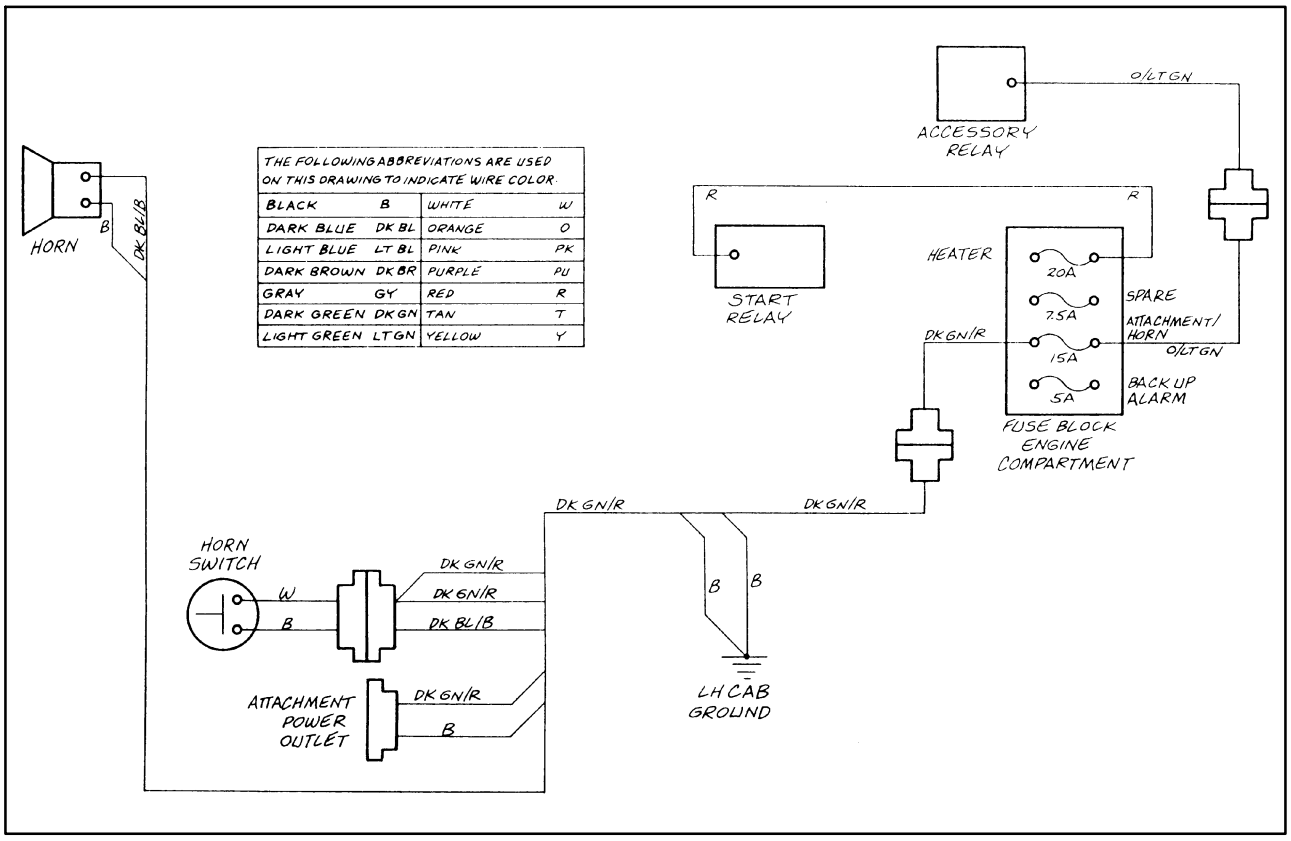


Figure 8-113

ROAD/WORK LIGHTS

The road and work lights are standard on the Lx_ _ _ models.

The road and work lights provide illumination for road travel and work operations. The rear work lights are not recommended for road travel.

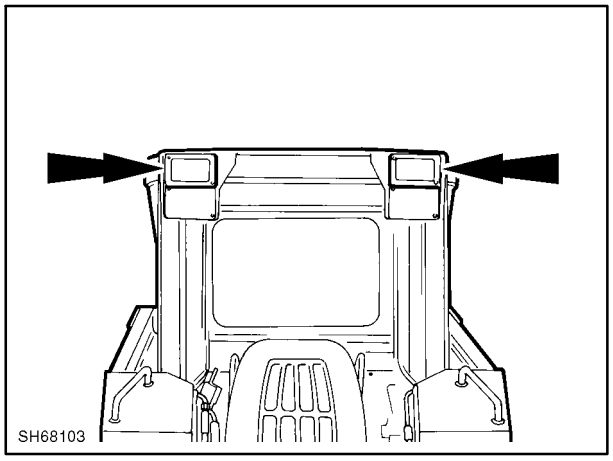


Figure 8-114

Road/work light switch, 1, is located in the ignition key switch panel in the upper right corner of the overhead dash. To remove the switch, disconnect the negative (-) ground battery cable. Remove the key switch panel hardware, 2, and tilt the panel down.

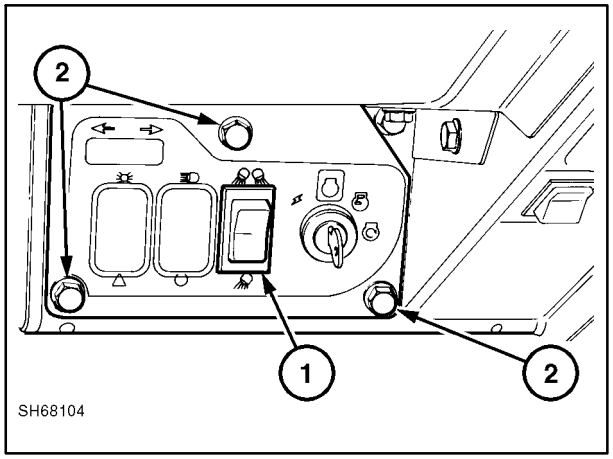


Figure 8-115

Disconnect wires from the switch, squeeze the switch retaining tabs in, and remove the switch from the panel.

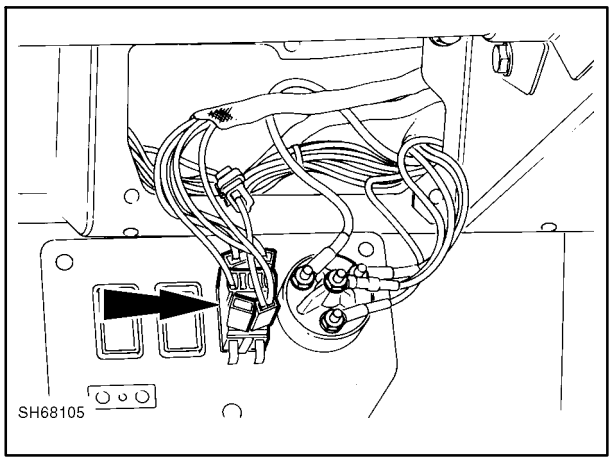


Figure 8-116

Road/Work Light Switch Wiring

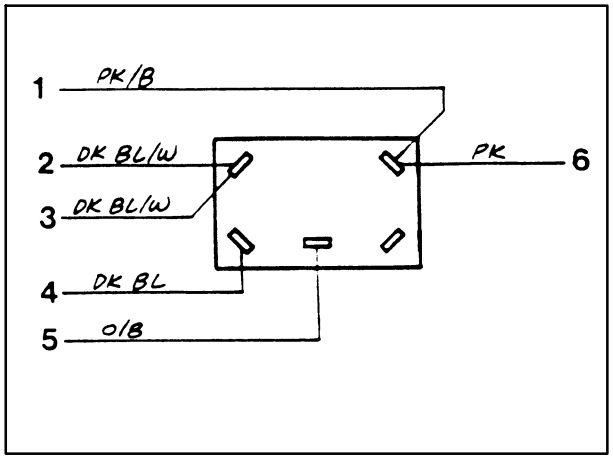


Figure 8-117

Road/Work Light Wiring Diagram

NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to size on top of the heaviest wire.

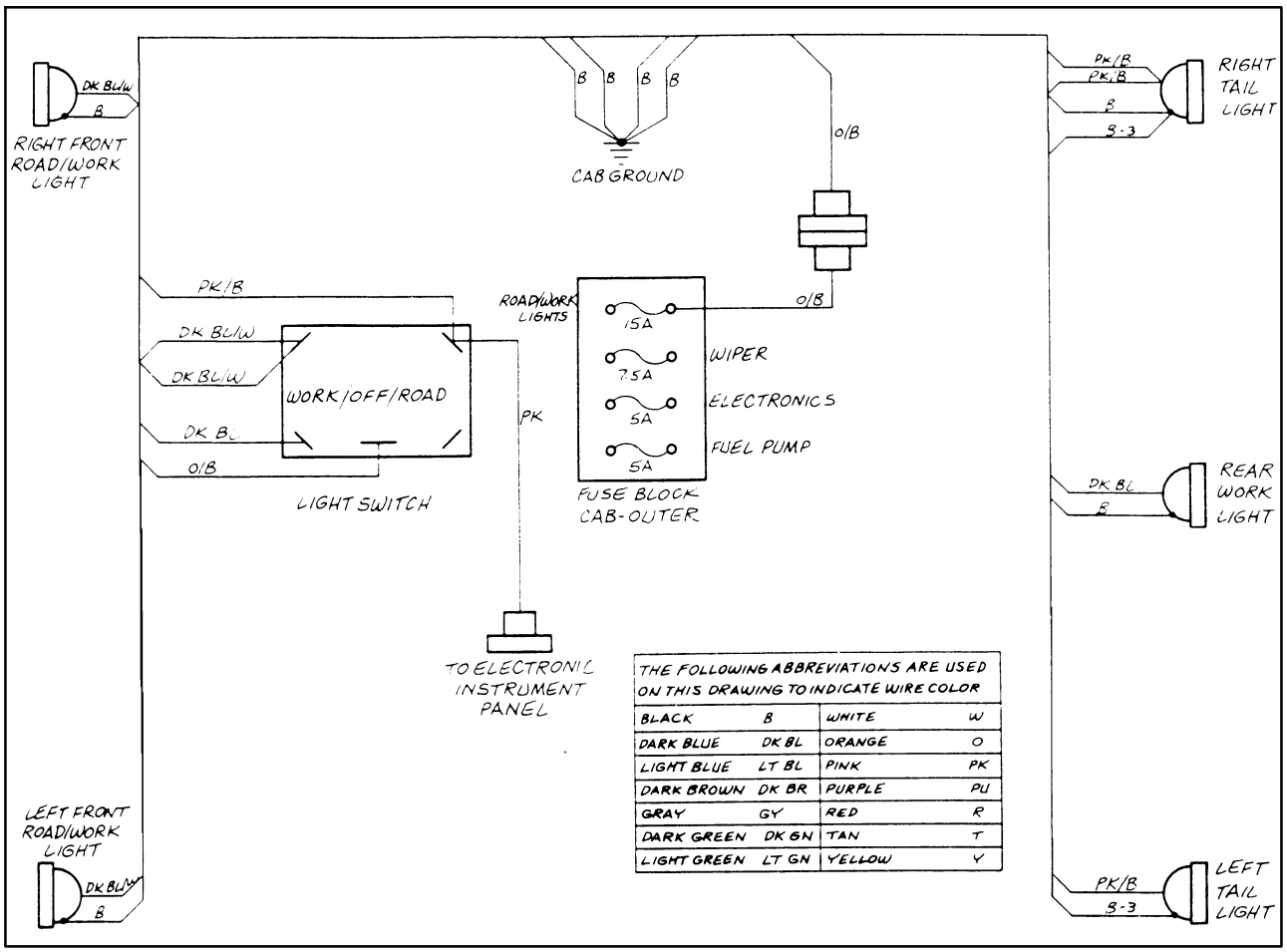


Figure 8-118

Bulb Replacement - Early Model

Clear lens with bulb #9829523
Bulb only (clear) #9847313
Red lens with bulb #9829515
Bulb only (red) #C6AB13465A

NOTE: Late model loaders feature supports and lenses that better isolate the bulbs from vibration. Refer to Service Bulletin 12/97-I8 for conversion instructions.

Front Road/Work Light - Early Model

1. Remove the bezel retaining screws, 1, and remove lens from support.
2. Disconnect the wire harness from the bulb holder.
3. Rotate the light bulb holder and element assembly from the lens and remove from the lens.
4. Insert the new bulb into the lens and rotate to lock into position, using caution not to touch the bulb element.

   IMPORTANT: Touching the light bulb element may damage the element and cause a premature failure.

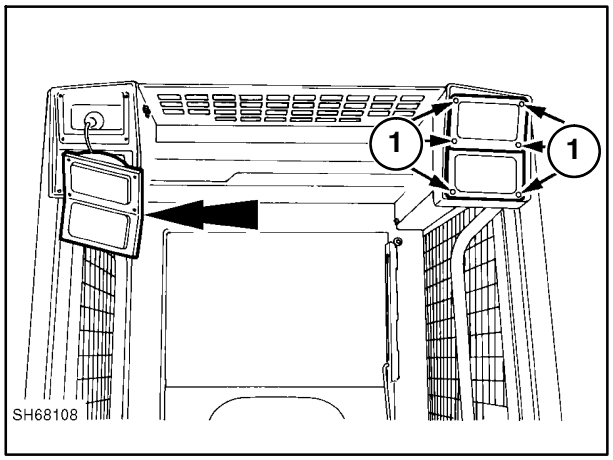


Figure 8-119

Rear Work or Taillight - Early Model

1. Remove the bezel retaining hardware, 1, and remove the lens from the light bar.

   NOTE: The remaining light lens will be loose in the light bar.
2. Disconnect the wire harness from the bulb holder.
3. Rotate the light bulb holder and element assembly from the lens and remove from the lens.
4. Insert the new bulb into the lens and rotate it to lock into position, using caution not to touch the bulb element.

   IMPORTANT: Touching the light bulb element may damage the element and cause a premature failure.

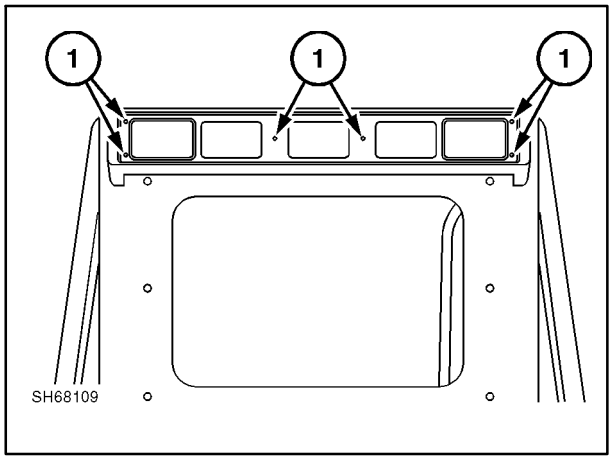


Figure 8-120

Bulb Replacement - Late Model

Clear lens with bulb #86533429

Bulb only (clear) #86533428

Red lens with bulb #9829515

Bulb only (red) #C6AB13465A

NOTE: Later model loaders feature supports and lenses that better isolate the bulbs from vibration. The new lenses are available in a kit and are standard equipment on the following model serial numbers:

L565	**31153 to 850750**
Lx565	**38841 to 847450**
Lx665	**64384 to 847850**
Lx665 w/high flow	**64521 to 847850**

Front Road/Work Light - Late Model

1. Facing the lens of the light assembly, push the lens assembly to the left and lift the right side of the assembly from the support.

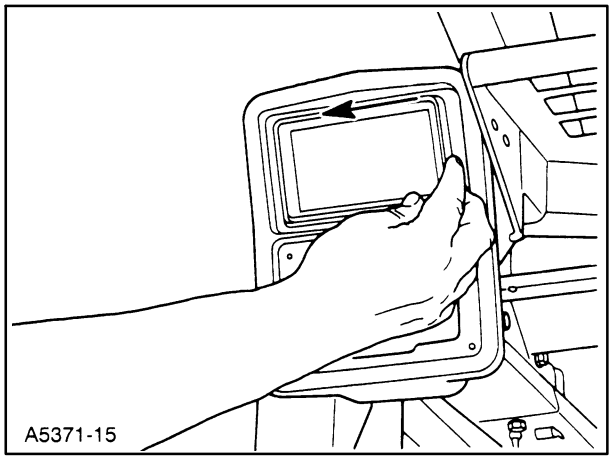


Figure 8-121

2. Unplug the wire harness from the bulb, unlatching the connector at 1, and sliding the harness from the bulb.

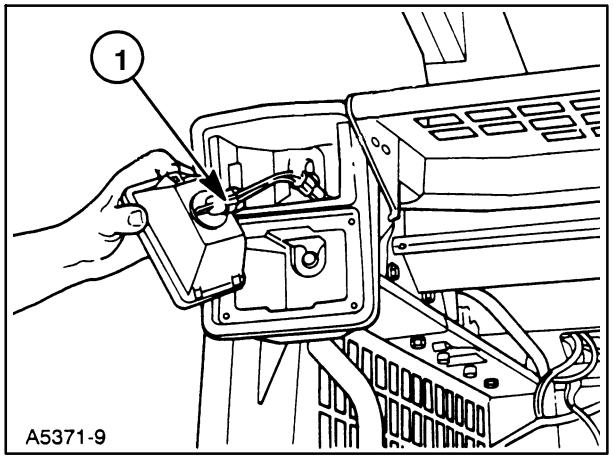


Figure 8-122

3. Facing the back of the assembly, rotate the bulb holder, 1, counterclockwise and remove the bulb from the support.
4. Position the bulb so when it is locked in position the connector, 2, is pointed down with the clip, 3, to the right.

   IMPORTANT: DO NOT touch the bulb during removal and installation. The bulb may become damaged or a premature failure may occur.

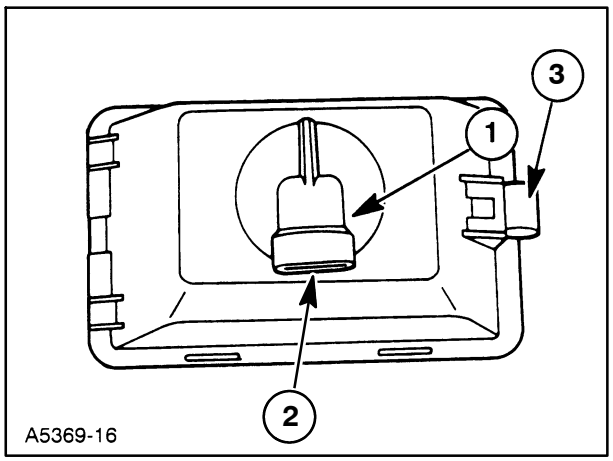


Figure 8-123

Rear Work and Taillight - Late Model

1. Remove the center work light, 1, by pushing the lens assembly to the left and lift the right side of the assembly from the support.
2. Remove the red taillight lamps, 2, by unscrewing the bezel self-tapping screws, and removing the bezels, 3.
3. Unplug the wire harness from the bulb, unlatching the connector, and sliding the harness from the bulb.

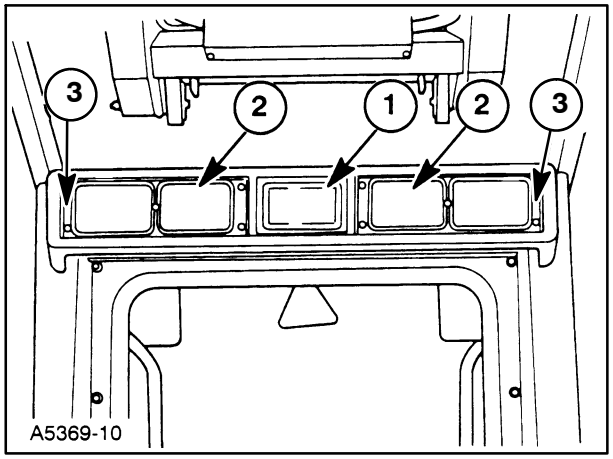


Figure 8-124

4. Facing the back of the assembly, rotate the bulb holder, 1, counterclockwise and remove the bulb from the support. Replace the bulb.
5. For the clear rear work lamp, position the bulb so when it is locked in position the connector, 2, is pointed down with the clip, 3, to the right.

   IMPORTANT: DO NOT touch the bulb during removal and installation. The bulb may become damaged or a premature failure may occur.

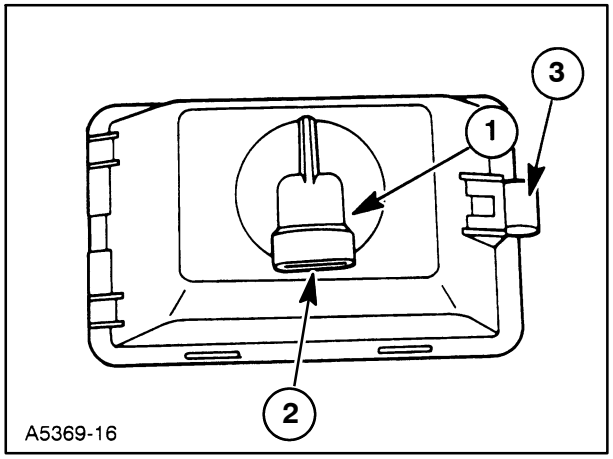


Figure 8-125

SHOULDER BELT (Seat)

The shoulder belt can be installed with the lap seat belt.

The shoulder belt is recommended anytime a front cab door is installed.

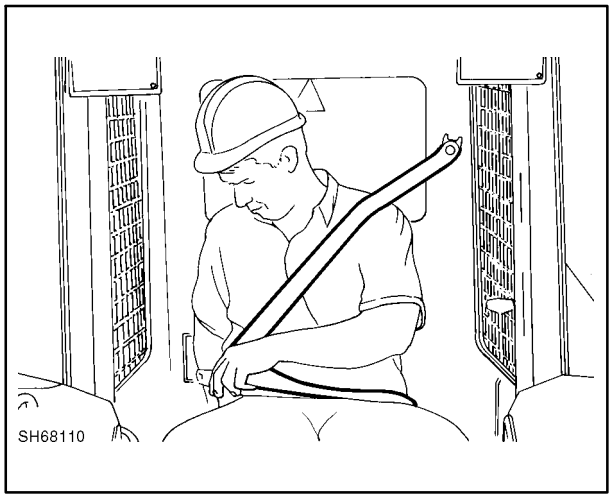


Figure 8-126

If the shoulder belt becomes completely retracted or the belt becomes locked, the web must move back into the retractor approximately 13 mm (1/2″) with the retractor in 90/90 degree or proper mounting position. When the belt is retracted 13 mm (1/2″), hold the belt straight up and pull the belt up slowly, 1. The belt will not unlock and pull out in any other position.

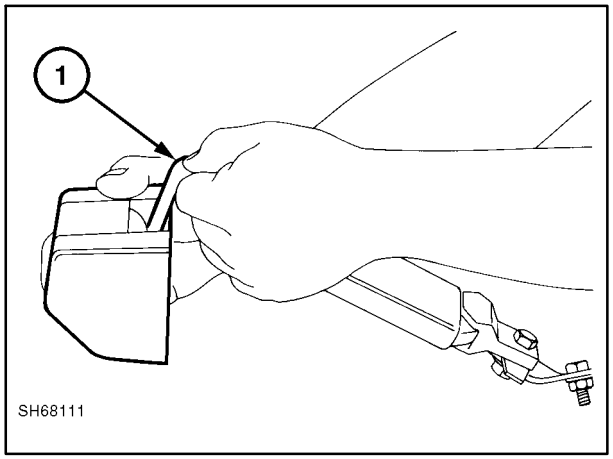


Figure 8-127

The shoulder belt support pivot bolt, 1, must be loose enough to allow the belt to pivot. If the belt will not pivot properly, it will not adjust to fit the operator.

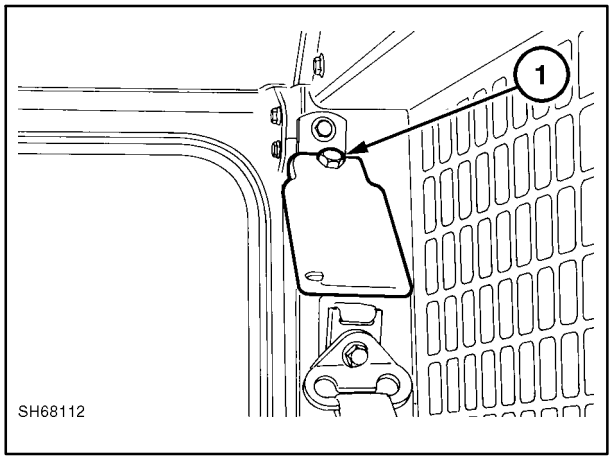


Figure 8-128

SLOW-MOVING VEHICLE (SMV) SIGN KIT

The Slow-Moving Vehicle (SMV) kit mounts to the rear door of the skid-steer loader when the loader is operated on roadways.

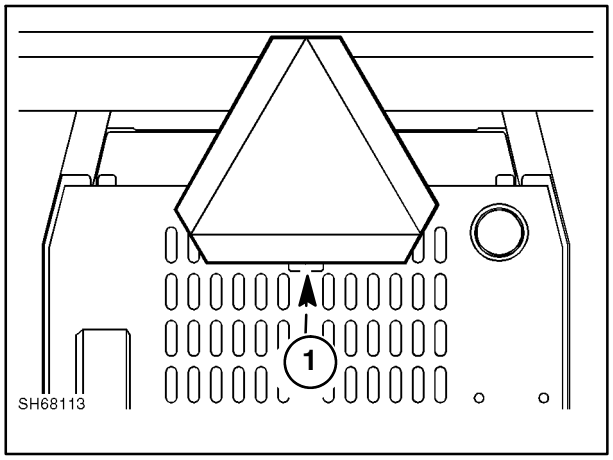


Figure 8-129

Installation - Slotted Rear Door

Open the rear door and locate the center slot in the top row of air slots in the door. Attach the door mount spade, 1, with two 5/16″ x 1″ carriage bolts, large flat washers, lock washers and nuts.

ATTENTION: Do not mount the SMV sign lower on the door as it may restrict air flow from the radiator area and possibly result in engine and hydraulic system overheating.

Installation - Louvered Rear Door

On louvered rear doors, a bracket, 1, must be installed to hold the SMV sign in place on top of the door.

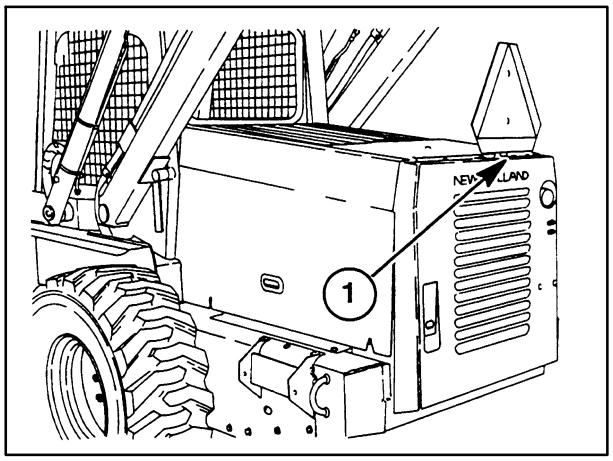


Figure 8-130

1. Attach the angle, 1, with one 5/16″ x 1-1/4″ carriage bolt from the kit and nut and M8 lock washer previously removed at 2.
2. Attach the spade socket to the angle at 3 using two 5/16″ x 1″ carriage bolts, M8 lock washers, and nuts.
3. Assemble the SMV sign, 4, to the support, 5, using two #10 x 1/2″ machine screws and flange nuts at 6.
4. Mount the SMV sign assembly in the spade socket as shown at 7.

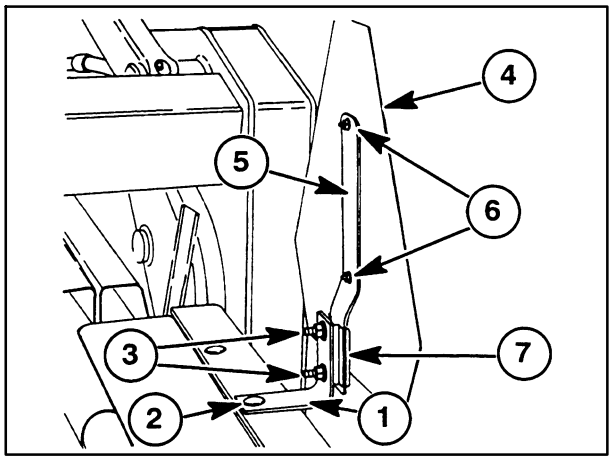


Figure 8-131

TIRES/WHEELS

TIRE OPTIONS

1 7.50 x 15 HST-Hollow segmented

2 10.00 x 16.5 HST-Hollow segmented

3 10.00 x 16.5 PHD- Premium heavy-duty

4 10.00 x 16.5 R4-Cleat tread

5 7.00 x 15 Chevron tread

6 31.0 x 15.5-15 G1 Cleat tread

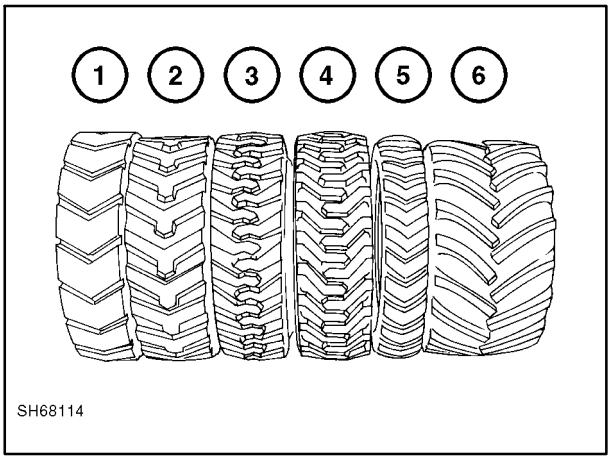


Figure 8-132

Tire Pressures

Tire	Pressure
7.00 x 15 Chevron tread	60 PSI (414 kPa)
7.50 x 15 HST-Hollow segmented	N/A
10.00 x 16.5 R4-Cleat tread	50 PSI (345 kPa)
10.00 x 16.5 PHD- Premium heavy-duty	50 PSI (345 kPa)
10.00 x 16.5 HST-Hollow segmented	N/A
31.0 x 15.5-15 G1 Flotation	40 PSI (276 kPa)

MAINTAIN PROPER TIRE INFLATION!

NOTE: Iatco “Air Boss” segmented tires are approved for all new generation New Holland loader models. These tires must be mounted with the wheel dish “in” to the frame (narrowest wheel tread position). Reversing the wheels with the dish “out” is not recommended, as increased axle and frame loading occurs, which may lead to eventual axle bearing and/or main frame failure.

BUCKET AND TIRE COMBINATION CHART

Tire Size	Description	Machine Width Including Tires	Recommended Bucket
7.00 x 15	Chevron Tread	60″	60 - 66-LP-D&F 72-LP-M&F 72-D&F-LM
7.50 x 15	HST Hollow Segmented Tire	59″	60 - 66-LP-D&F 72-LP-M&F 72-D&F-LM
10.00 x 16.5	R4 Cleat Tread	66″	66-LP-D&F 72-LP-M&F 72-D&F-LM 84-LM
10.00 x 16.5	PHD Premium Heavy-Duty	66″	66-LP-D&F 72-LP-M&F 72-D&F-LM 84-LM
10.00 x 16.5	HST Hollow Segmented Tires	63″	66-LP-D&F 72-LP-M&F 72-D&F-LM 84-LM
31.0 x 15.5-15	G1 Cleat Tread	75″	72-LP-M&F 72-D&F-LM 84-LM

TIRE AND TRACK INSTALLATION

Tire Installation on Loader

The 7.50 x 15 HST-Hollow segmented and the 10.00 x 16.5 HST-Hollow segmented tires must be mounted with the wheel dish “IN” to the frame (narrowest wheel tread position). Reversing the wheels with the dish “OUT” is not recommended, as increased axle and frame loading occurs. This may lead to eventual axle bearing and/or main frame failures.

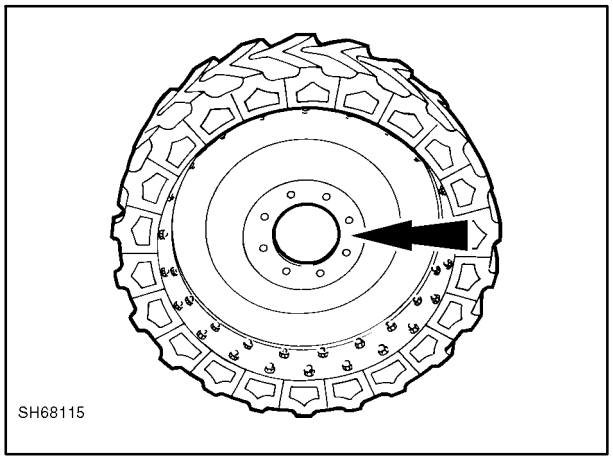


Figure 8-133

When replacing the sections of the hollow segmented tires, torque the section hardware to 13.6 N·m (10 ft. lbs.).

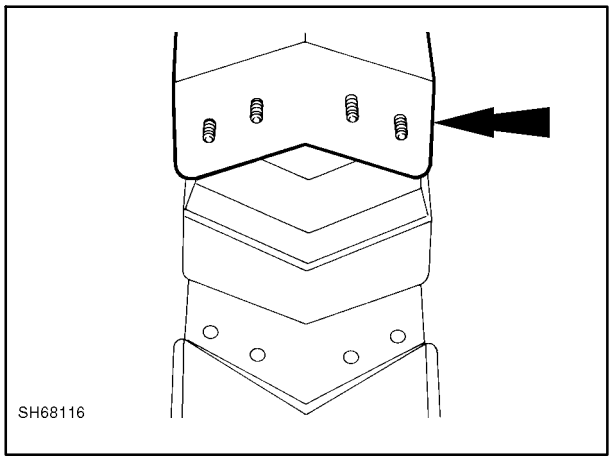


Figure 8-134

Track Installation on Loader

Correct tire/track combinations are important to prevent damage to the tracks, tires/wheels, and loader main frame.

Installing tracks on skid-steer loaders equipped with segmented tires, solid tires, foam-filled tires, or any hard-type non-pneumatic tires is not recommended. If these tire combinations are used with steel tracks, track or loader main frame damage may occur.

These tires **do not** provide a cushion when debris comes between the track and tire. A pneumatic tire will absorb this type of stress and, in severe cases, may deflate before damage to the loader or track occurs.

New Holland only recommends pneumatic tires be installed with tracks.

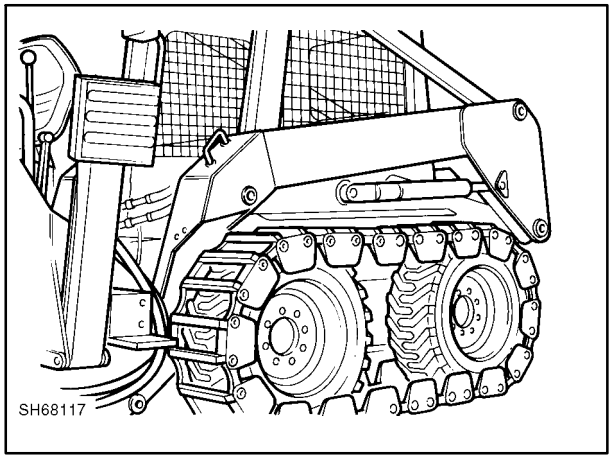


Figure 8-135

WARNING LIGHT (Rotary Beacon)

The beacon light is a visual alerting device for bystanders and other machine operators. The beacon light's magnetic base mounts the light securely to any part of the roof or frame.

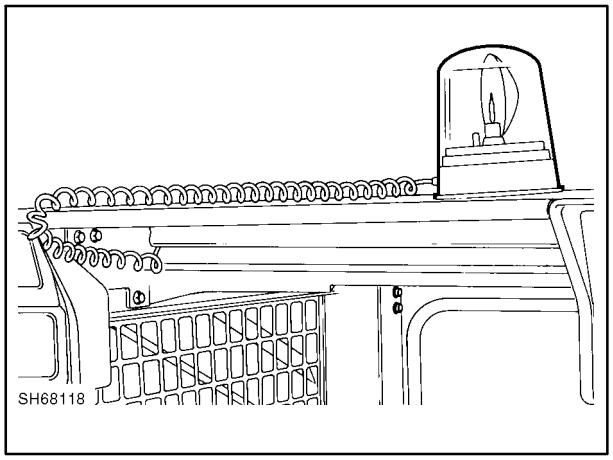


Figure 8-136

The beacon light switch, 1, is located in the ignition key switch panel in the upper right corner of the overhead dash.

To remove the switch, disconnect the negative (-) ground battery cable, remove the key switch panel hardware, 2, and tilt the panel down.

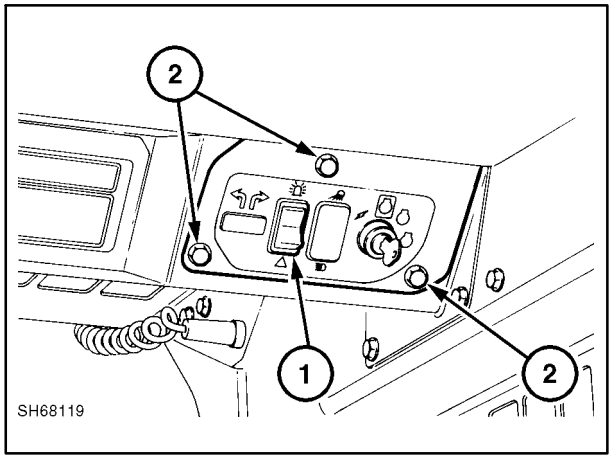


Figure 8-137

Disconnect wires from the switch, squeeze the switch retaining tabs in, and remove the switch from the panel.

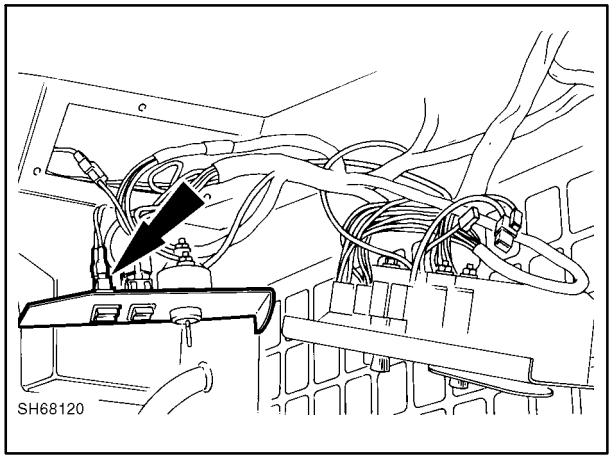


Figure 8-138

Beacon Switch Wiring

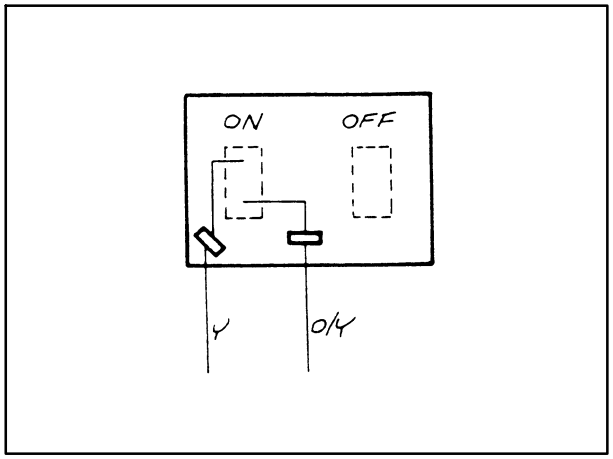


Figure 8-139

Beacon Wiring Diagram

NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to size on top of the heaviest wire.

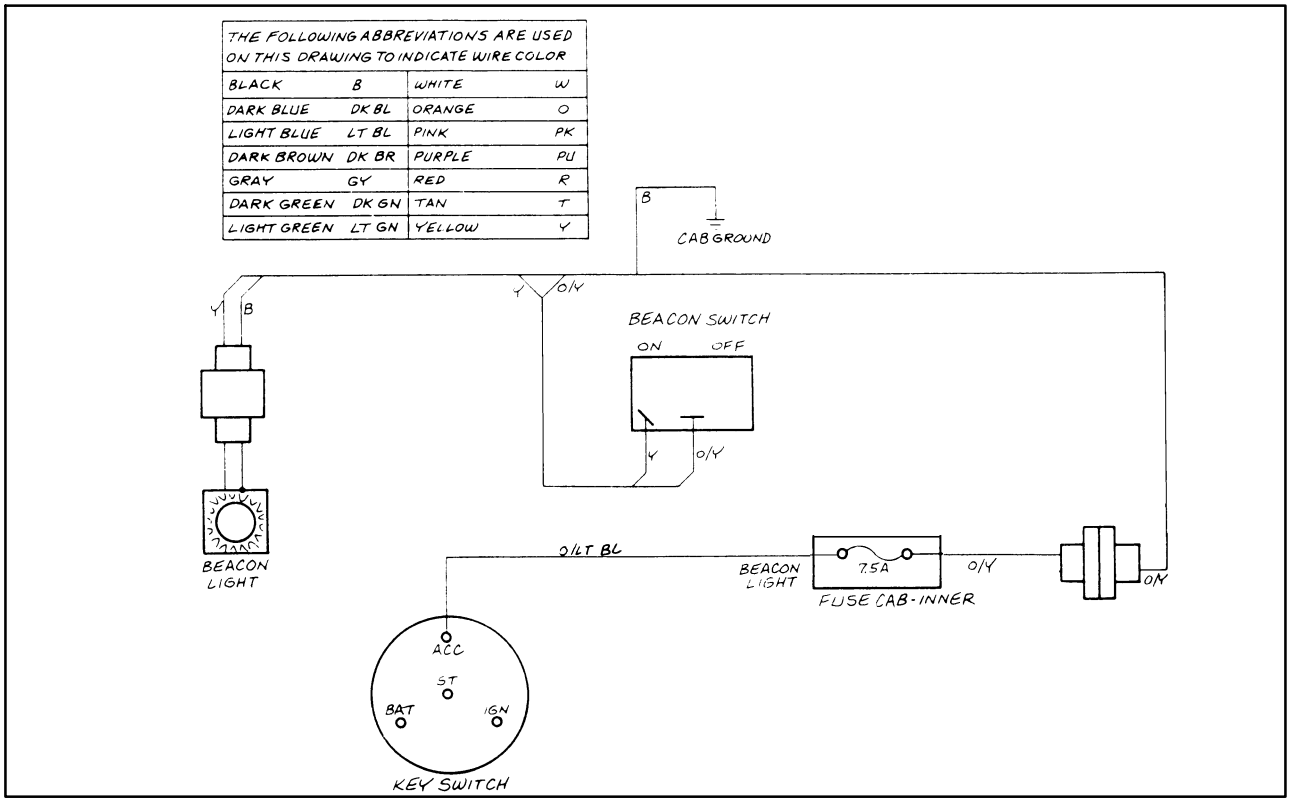


Figure 8-140

Beacon Bulb Replacement

Bulb only #69AG13009AA (H1 12V 55W)

To replace the bulb, remove the three screws attaching the lens to the base and lift the lens from the base.

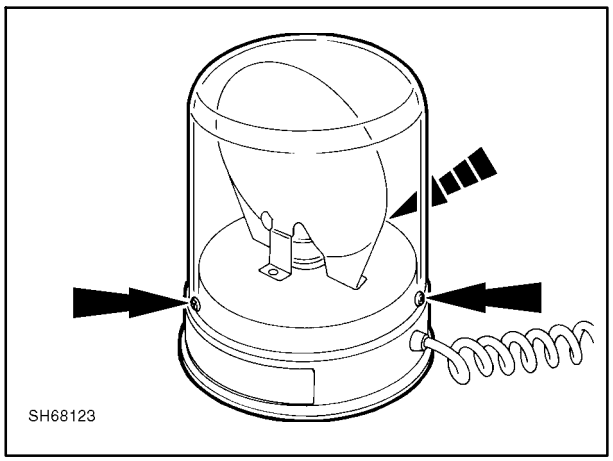


Figure 8-141

Squeeze the bulb retaining tabs to separate the bulb from the holder.

Remove the bulb assembly from the wire connector.

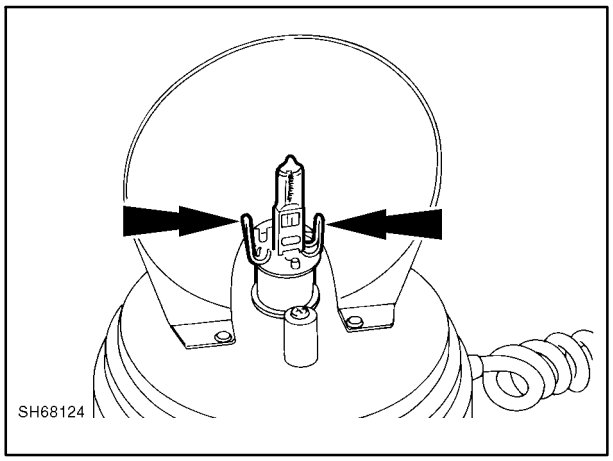


Figure 8-142

WARNING LIGHTS (Four-Way Flashers/Turn Signal/Horn)

The four-way flashing lights on the front and rear of the loader provide a visual alerting device to bystanders and other machine operators.

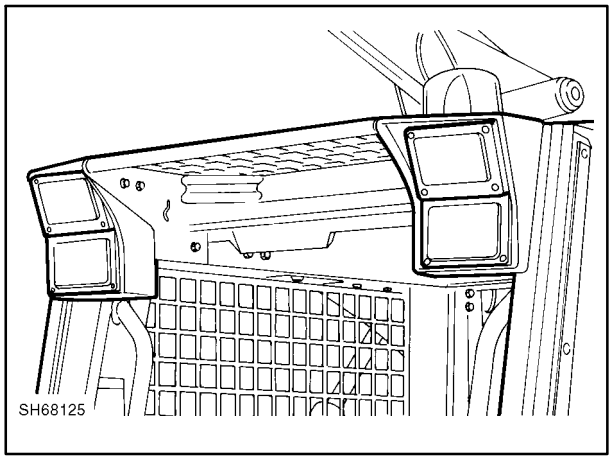


Figure 8-143

The warning light switch, 1, is located in the ignition key switch panel in the upper right corner of the overhead dash.

To remove the switch, disconnect the negative (-) ground battery cable, remove the key switch panel hardware, 2, and tilt the panel down.

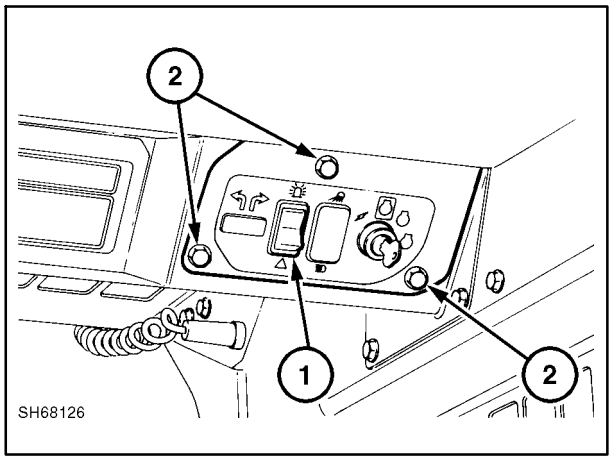


Figure 8-144

Disconnect the wires from the switch. Squeeze the switch retaining tabs in and remove the switch from the panel.

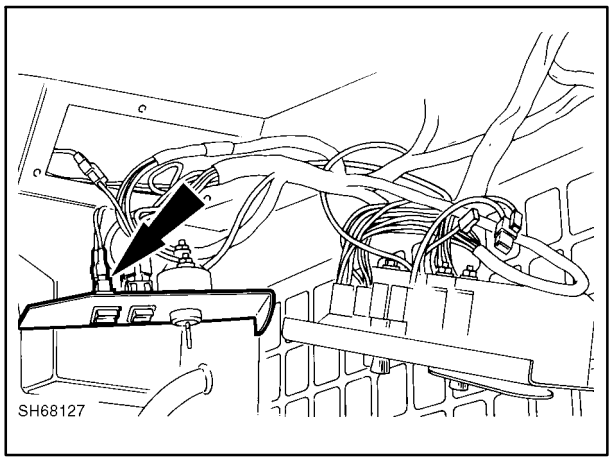


Figure 8-145

Warning Light Switch Wiring

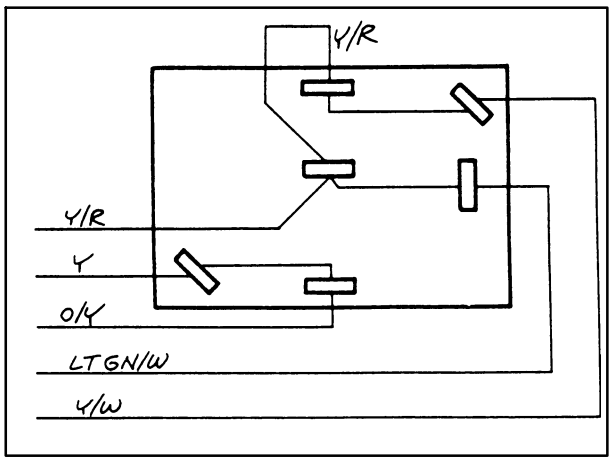


Figure 8-146

Warning Light (Four-way) Wiring Diagram

NOTE: When attaching ground wires, always place the heaviest ground wire next to the ground surface and then stack the remaining ground wires according to size on top of the heaviest wire.

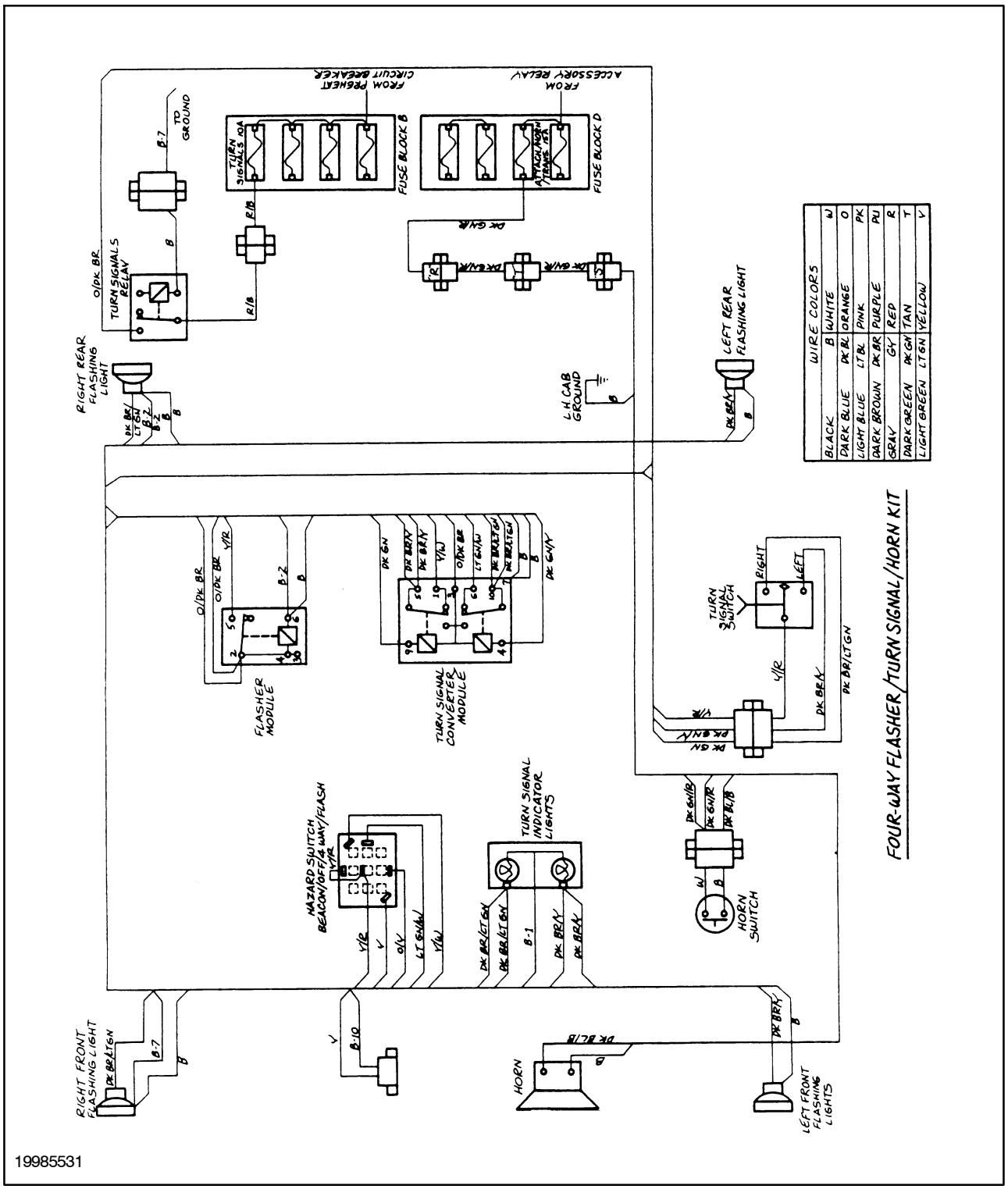


Figure 8-147

Warning Light Bulb Replacement

Amber lens with bulb #9841566
Bulb only #529068

Front Light

1. Remove the bezel, 1, retaining screws and remove lens from support.
2. Disconnect the wire harness from the bulb holder.
3. Rotate the light bulb holder and element assembly from the lens and remove from the lens.
4. Insert the new bulb into the lens and rotate to lock into position, using caution not to touch the bulb element.

   IMPORTANT: Touching the light bulb element may damage the element and cause a premature failure.

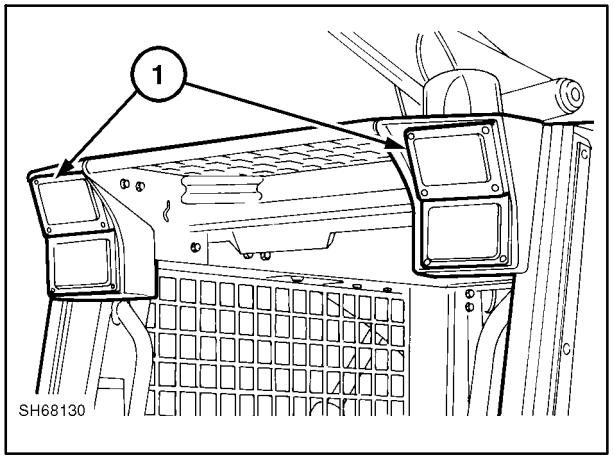


Figure 8-148

Rear Light

1. Remove the bezel, 1, retaining hardware and remove the lens from the light bar.

   NOTE: The remaining light lens will be loose in the light bar.
2. Disconnect the wire harness from the bulb holder.
3. Rotate the light bulb holder and element assembly from the lens and remove from the lens.
4. Insert the new bulb into the lens and rotate it to lock into position, using caution not to touch the bulb element.

   IMPORTANT: Touching the light bulb element may damage the element and cause a premature failure.

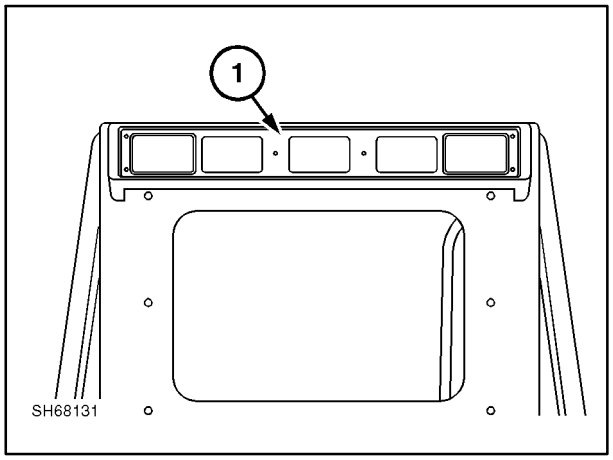


Figure 8-149

REAR COUNTERWEIGHTS

Counterweights can be installed to improve the stability of the loader when handling heavy loads or when operating the skid-steer loader with a heavy front mounted attachment.

Four 27.2 kg (60.0 lbs.) weights, 1, (two per side) may be added to the rear of the loader as shown.

The rear counterweights should be removed when not required. Operating the skid-steer loader with rear counterweights installed and with light front loads, may cause uneven tire wear.

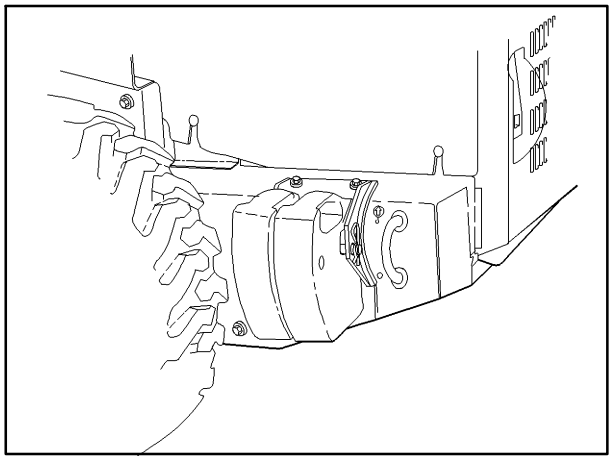


Figure 8-150

If the weight kit bracket installation is difficult, the top mount holes, 1, in the frame may not have 3/8″ weld nuts attached inside the frame.

Right side - To install 3/8″ weld nuts on the right side (battery area), remove the side shield, 2, and install the nuts on the inside of the frame at 1.

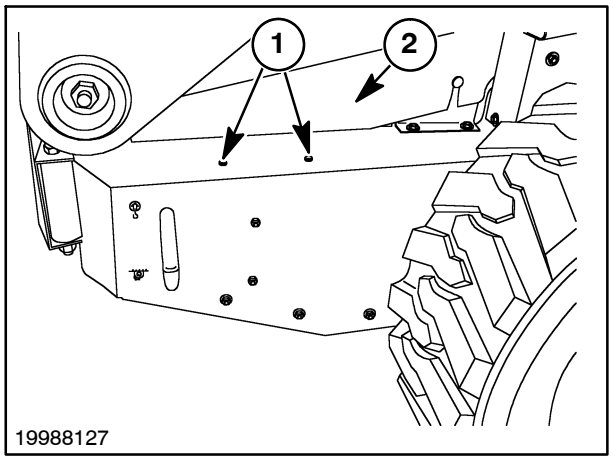


Figure 8-151

Left side - To install 3/8″ weld nuts on the left side, remove the engine mud guard, 1. Lower the fuel tank far enough to insert a 3/8″ flange but at each mounting hole. Install 1″ long 3/8″ bolts and follow the kit instructions.

NOTE: Do not use bolts longer than 1″ as they may contact the fuel tank and puncture the tank. Later production loaders have the weld nuts pre-installed.

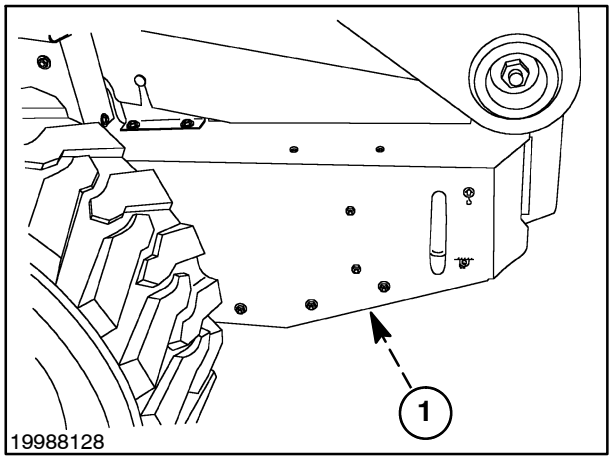


Figure 8-152

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job Description	Hours
Arm pads (cab)	
Remove and replace (2)	0.5
Armrest (seat)	
Remove and replace (1)	0.25
Attachment 12-Volt Electric Power Supply	
Remove and replace outlet	0.25
Remove and replace wire harness	0.5
Auxiliary Boom Hydraulics	
Remove and replace auxiliary boom hydraulic hoses (boom)	1.0
Remove and replace auxiliary boom hydraulics tubes (boom)	0.5
Remove and replace auxiliary boom hydraulic tubes (control valve) (includes tilting cab/boom forward)	2.0
Remove and replace auxiliary boom hydraulic quick couplers (1)	0.25
Back-Up Alarm	
Remove and replace back-up alarm	0.25
Remove and replace back-up alarm linkage and adjust	1.0
Remove and replace back-up alarm wire harness	0.5
Block Heater (engine)	
Remove and replace block heater (engine)	0.5
Bucket	
Remove and replace bucket cutting edge	3.5
Remove and replace bucket wear plate (1)	0.75
Remove and replace bucket tooth (1)	0.5
Heater/Defroster	
Remove and replace electrical switch	0.25
Remove and replace water shutoff valve	1.5
Remove and replace heater core	1.5
Remove and replace heater fan assembly	1.5
Remove and replace heater hoses (1)	0.5

High Flow Hydraulics	
Remove and replace drive belt and adjust	1.0
Remove and replace drive pulley (1)	1.5
Remove and replace gear pump	2.0
Remove and replace selector valve (includes tilting cab/boom forward)	2.5
Remove and replace wire harness	0.5
Horn	
Remove and replace horn button	0.5
Remove and replace horn	0.25
Remove and replace horn wire harness	0.5
Road/Work Lights	
Remove and replace switch	0.5
Remove and replace lamp bulb or lamp assembly (1)	0.25
Remove and replace front lamp bezel	0.5
Remove and replace rear lamp bezel	1.0
Remove and replace wire harness	2.0
Seat/Shoulder Belt	
Remove and replace belt (must replace complete assembly)	1.0
Warning Light (rotary beacon)	
Replace bulb	0.25
Warning Lights (four-way flashing lights)	
Remove and replace switch	0.05
Remove and replace lamp bulb or lamp assembly (1)	0.25
Remove and replace wire harness	2.0

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