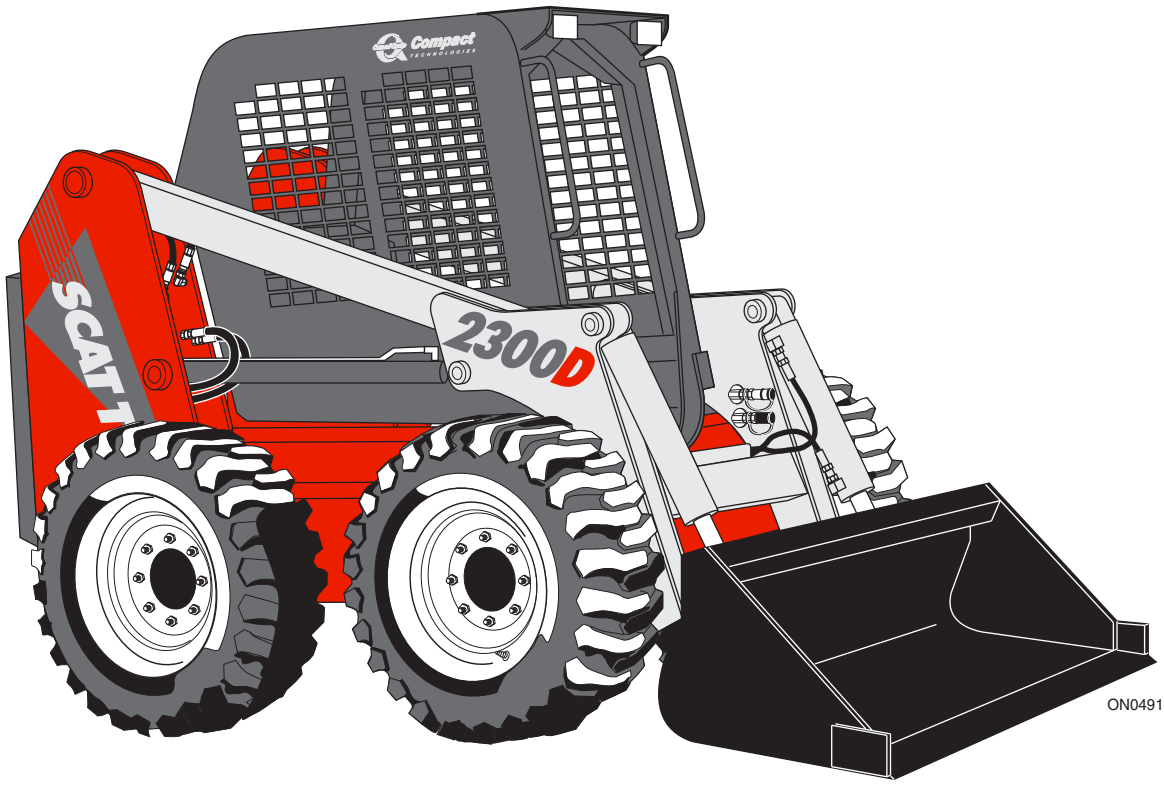
SCAT TRAK®

SKID STEER

Models 1750D
2000D/DX
2300D/DX

SERVICE MANUAL



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FOREWORD

SCAT TRAK Model 1750D, 2000D/DX, 2300D/DX
Service Manual

This manual is designed to provide the service technician with complete information on the maintenance and repair of the Compact Technologies SCAT TRAK Model 1750D, 2000D/DX, and 2300D/DX Skid Steer Loaders.

Particular effort has been made to produce a manual to serve as a reference handbook for the experienced service technician, but also provide essential step-by-step procedures for the professional development of the less experienced person. Remember that even the best manual in the world is no substitute for an appropriate education, skill development that comes through experience alone, safety, wise and judicious discernment, and, ultimately, proper performance of service procedures.

There are many variations in service environments and skill levels of repair technicians, as well as procedures, techniques, tools, and service parts. A service manual cannot possibly anticipate all such variations and provide advice or cautions for each one. Accordingly, any departure from the instructions in this manual must take into consideration both personal safety as well as vehicle integrity.

This service manual provides general directions for accomplishing service and repair procedures with tested, effective techniques. Following the procedures in this manual will help assure safety and equipment reliability.

Appropriate service methods and proper repair procedures are essential for the safety of the individual doing the work, for the safety of the operator, and for the safe, reliable operation of the vehicle.

The *Section Contents* allows the user to quickly locate any desired section. Each section begins with its own table of contents, and, where applicable, an exploded view illustration appears, to show the location of major section components.

Provision for supplementary information is made by Compact Technologies in the form of Service Bulletins, Service Campaigns, Service Training Schools, the OmniQuip web site, other literature, and through updates to the manual itself. Comments and suggestions for improvement are welcomed and encouraged.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication approval. Compact Technologies reserves the right to make changes and improvements to its products, and to discontinue the manufacture of any product, at its discretion at any time without public notice or obligation.

Section	Subject	Page

Section 1
Safety Practices

Contents

1.1 INTRODUCTION

Compact Technologies products meet all applicable industry safety standards. Compact Technologies actively promotes safe practices in the use a nd maintenance of its products through training programs, instructional manuals, and the pro-active efforts of all employees involved in the engineering, design, manufacture, marketing and service.

Many factors contribute to unsafe conditions: carelessness, fatigue, overload, inattentiveness, unfamiliarity, even drugs and alcohol, among others. Although equipment damage can usually be repaired in a brief period of time, death and irrepairable injury are permanent. For optimal safety, encourage everyone to think, and to act, safely.

Read, understand, and follow the information in this manual, and obey all locally-approved safety practices, procedures, rules, codes, regulations and laws. Prior to performing any maintenance on this vehicle, consider all factors, circumstances, and conditions which can have an effect upon the safety of personnel and equipment, and take appropriate action to ensure the safety of all involved.

These instructions cannot cover all details or variations in the equipment, procedures, or processes described, nor provide directions for meeting every possible contingency during operation, maintenance, testing or repair. When additional information is desired to satisfy a situation not covered sufficiently, consult the local Compact Technologies distributor, or the Compact Technologies Service Department at 1-800-716-3466 or (262) 268-3250.

1.2 OWNERS/OPERATORS MANUAL

The vehicle must be driven and operated as a consequence of, or when performing maintenance and test procedures. The service technician must, therefore, thoroughly read, understand, and follow the SCAT TRAK 1750D, 2000D/DX & 2300D/DX Owners/Operators Manual.

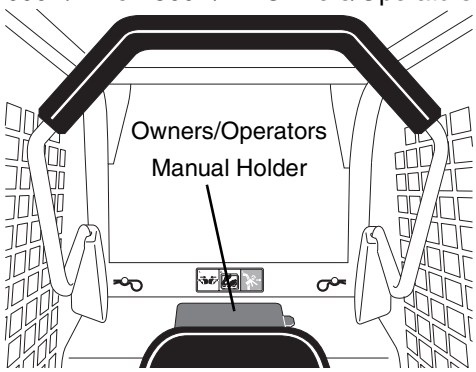

Figure 1-1 Owners/Operator Manual Holder

An Owners/Operators manual is supplied with each vehicle and must be kept in the holder or storage compartment located behind the operator's seat (Fig. 1-1). In the event that the Owners/Operators manual is missing, consult the Compact Technologies distributor or the Compact Technologies Service Department before proceeding.

1.3 SAFETY INFORMATION

The following information provides general safety instructions, including examples of hazard statements with signal words, notification of hazards, methods to help avoid hazards, and the consequences of failing to follow the safety information. To avoid possible death or injury, carefully read and follow all safety messages. Fully understand the potential causes of death and injury.

In the event of an accident, know where to obtain medical assistance, use a first-aid kit and fire extinguisher/fire suppression system. Keep emergency telephone numbers (fire department, ambulance, rescue squad/paramedics, police department, etc.) nearby. If working alone, check with another person routinely to help assure personal safety.

The information in this manual does not replace any other safety rules or proper judgement. Governmental authorities and employers also have their own sets of rules, codes, regulations and laws. Before starting work at a site, check with the supervisor or safety coordinator and ask about the safety policy. Learn the safety requirements in effect before operating, maintaining, testing or servicing the vehicle. Safety depends on following safety requirements.

1.3.1 Safety Alert Symbol

An exclamation mark within a triangle is the Safety Alert Symbol.

This symbol means "**Attention! Become Alert! Your Safety is Involved!**" The symbol is used to attract attention to safety hazards found on the vehicle safety decals and throughout this manual.

1.3.2 Hazard Statements

Signal words and messages are used in conjunction with the safety alert symbol to create hazard statements. These hazard statements convey important information about SAFETY.

Four types of hazard statements are used within this manual. Each statement indicates the existence of and degree of relative risk of the hazard described within the statement that follows a signal word.

Explanations of the types of hazard statements are as follows:

DANGER:

The signal word "**DANGER**" indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING:

The signal word "**WARNING**" indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION:

The signal word "**CAUTION**" indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION:

The signal word "**CAUTION**" used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, may result in property damage.

For safe maintenance of the vehicle, read, understand and follow all DANGER, WARNING and CAUTION information.

1.4 ACCIDENT PREVENTION TAG USAGE

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Figure 1-2 Accident Prevention Tag

Before beginning any maintenance or service, place an Accident Prevention Tag (Fig. 1-2) on both the starter key switch and the hand hold (Fig. 1-3) at the front of the operator's protective structure, stating that the vehicle should not be operated. Actual Accident Prevention Tags, that can be punched out and used, are included as the last page in this manual. Retain these Accident Prevention Tags for reuse at a later date.

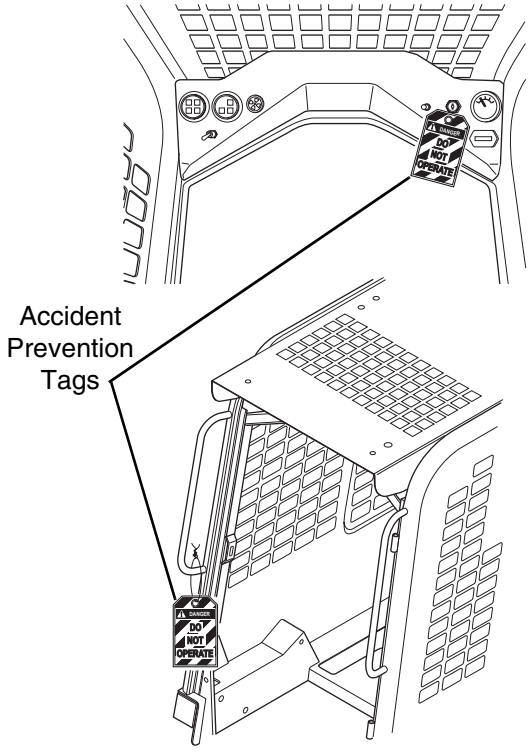

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Figure 1-3 Accident Prevention Tag Placement

1.5 SAFETY INSTRUCTIONS

Following are general safety statements to consider ***before*** performing maintenance procedures on a vehicle. Additional statements related to specific tasks and procedures are located throughout this manual and are listed prior to any work instructions to provide safety information before the potential of hazard occurs.

For all safety messages, carefully read, understand and follow the instructions ***before*** proceeding.

1.5.1 Personal Hazards

HAIR and CLOTHING: **DO NOT** wear loose clothing or jewelry. Tie up or restrain hair. Wear the correct safety equipment for the job (including, but not limited to: hard hat; safety shoes; safety glasses, goggles, or face shield; heavy gloves; hearing protection; reflective clothing; wet-weather gear; respirator or filter mask).

EYE PROTECTION: Always wear appropriate eye protection when chiseling, grinding, sanding, welding, painting, repairing hydraulic systems, or checking, testing or charging the battery.

BREATHING PROTECTION: Wear respiratory protection when grinding or painting.

HEARING PROTECTION: Always wear hearing protection in a high noise area.

FOOT PROTECTION: Wear protective footwear with reinforced toe caps and slip-resistant soles.

LIFTING: **NEVER** lift a heavy object without the help of at least one assistant or a suitable sling and hoist.

1.5.2 Equipment Hazards

OWNERS/OPERATORS MANUAL: Before operating the vehicle, carefully read, understand and follow the Owners/Operators manual

OPERATIONAL PROTECTION: Before operating the vehicle, or returning it for operational use, check that the cab and all roll-over protection systems and falling object protection systems (ROPS/FOPS) are intact, undamaged, unmodified and secure. Replace any component as required.

LIFTING OF EQUIPMENT: Before using any lifting equipment (chains, slings, brackets, hooks, etc.), verify that it is of the proper capacity, in good working order, and is properly attached.

NEVER stand or otherwise become positioned under a suspended load or under raised equipment. The load or equipment could fall or tip.

DO NOT use a hoist or jack to support raised equipment. A hoist or jack failure can allow the equipment to tip or fall. Always support equipment with proper capacity blocks or stands properly rated for the load.

COMPRESSED AIR: Before and during the use of compressed air, wear eye protection and advise all other personnel in the work area that compressed air is about to be used.

HAND TOOLS: Always use the proper tool for the job; keep tools clean and in good working order, and use special service tools only as recommended.

1.5.3 General Hazards

SOLVENTS: Only use approved solvents, and solvents that are know to be safe for use.

HOUSEKEEPING: Keep the work area and operator's cab clean, and remove all hazards (debris, oil, tools, etc.).

FIRST AID: Immediately clean, dress and report all injuries (cuts, abrasions, burns, etc.), no matter how minor the injury may seem. Know the location of a First Aid Kit, and know how to use it.

CLEANLINESS: Wear eye protection, and clean all components with a high-pressure or steam cleaner before attempting service.

When removing hydraulic components, plug hose ends and connections to prevent excess leakage and contamination. Place a suitable catch basin beneath the vehicle to capture fluid run-off.

1.5.4 Operational Hazards

OPERATIONAL CONSIDERATIONS: Before operating the vehicle, carefully read, understand and follow the Owners/Operators manual.

ENGINE: Stop the engine before performing any service.

DANGEROUS START: Place Accident Prevention Tags on the hand hold and starter key switch before attempting to perform any service or maintenance. Disconnect battery leads. Place a warning sign on vehicles that are dangerous to start, if leaving vehicle unattended.

VENTILATION: Avoid prolonged engine operation in enclosed areas without adequate ventilation.

RADIATOR CAP: Always wear steam-resistant, heat protective gloves when opening the radiator cap. Cover the cap with a clean, thick cloth and turn slowly to the first stop to relieve pressure.

SOFT SURFACES AND SLOPES: **NEVER** work on a vehicle that is parked on a soft surface or slope (inclined ground or hills). The vehicle must be on a hard level surface with the wheels blocked when performing any service. Obtain assistance, block all wheels, and add supports if necessary before beginning any work.

Operational Hazards (continued)

SUPPORTS AND STRAPS: Install safe, stable supports, slings or straps beneath or around a component or structural member before beginning any work.

FLUID PRESSURE: Before loosening any hydraulic or diesel fuel component, hose or tube, turn the engine OFF. Wear heavy, protective gloves and eye protection. NEVER check for leaks using any part of your body; use a piece of cardboard or wood instead. If injured, seek medical attention immediately. Diesel fluid leaking under pressure can explode. Hydraulic fluid and diesel fuel leaking under pressure can penetrate the skin, cause infection, gangrene, and other serious personal injury. Relieve all pressure before disconnecting any component, part, line or hose. Slowly loosen parts and allow release of residual pressure before removing any part or component. Before starting engine or applying pressure, use components, parts, hoses and pipes that are in good condition, connected properly, and are tightened to the proper torque. Capture fluid in an appropriate container and dispose of in accordance with prevailing environmental regulations.

PRESSURE TESTING: When conducting any test, only use test equipment that is correctly calibrated and in good condition. Use the correct equipment in the proper manner, and make changes or repairs as indicated by the test procedure to achieve the desired result.

LEAVING VEHICLE: Lower the loader arm to the ground before leaving the vehicle.

TIRE PRESSURE: Always keep tires inflated to the proper pressure to help prevent dangerous travel and load-handling situations. **DO NOT** over-inflate tires.

LOADER ARMS: Loader arm safety support must be down and pinned in position on the lift cylinder if the loader arm is raised and held for service.

1.6 EMERGENCY EXIT REAR WINDOW

The rear window can be used as an emergency exit by pulling the hairpins from the securing base of the window (Fig. 1-4). Pulling the hairpins will release the securing base which holds the window in place on the outside of the Operator's Protective Structure. Once the securing base is released, the window can be pushed out toward the rear of the Operator's Protective Structure by using your hand or foot.

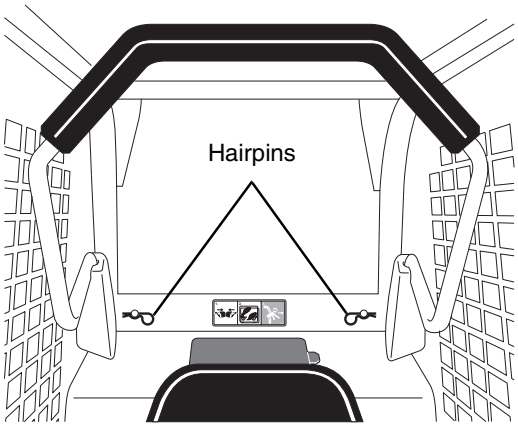

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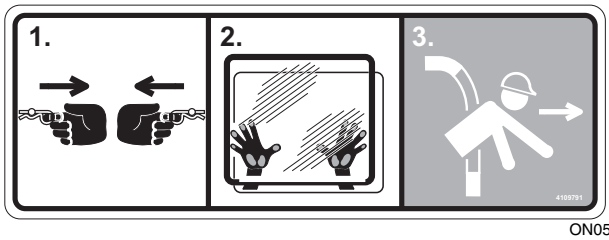
Figure 1-4 Emergency Exit Rear Window Hairpins

Some of the earlier units have orange tags hanging on the hairpins. These tags have been replaced by the instructional decal shown below. If your unit still has the orange hanging tags, replace them with the new decal.



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Refer to the Owners/Operators manual or parts manual for the latest part numbers and ordering information. Or, contact OmniQuip Parts Worldwide directly at:

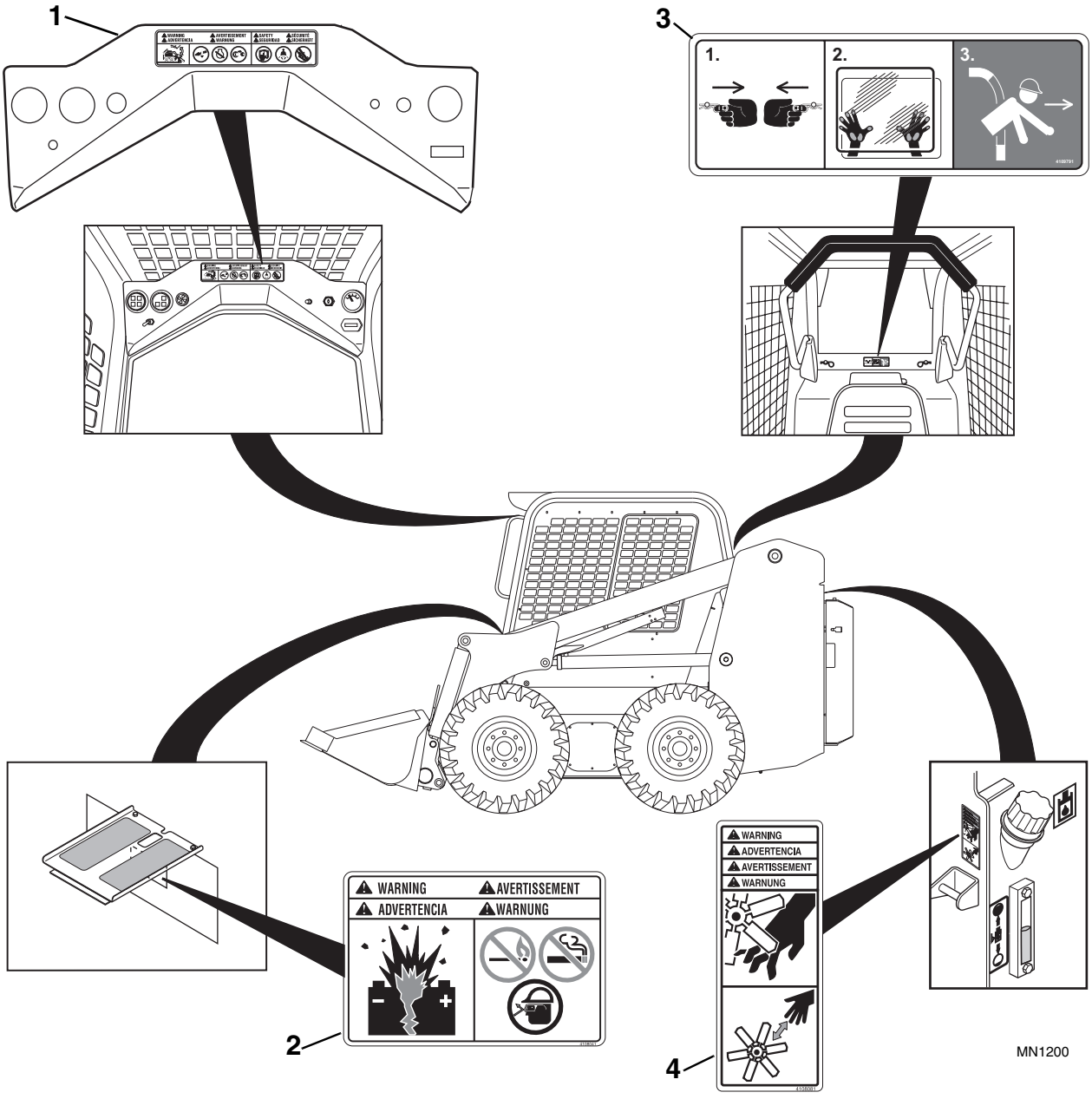
1-888-872-5123

1.7 HAZARD DECALS

Locations of vehicle hazard and other emergency information decals are shown below. As part of routine maintenance, check that ALL hazard and emergency information decals on the vehicle are present and readable. Keep the hazard decals clean.

If a replacement decal is needed, refer to the Owners/Operators manual or parts manual for the latest part numbers and ordering information. Or, contact OmniQuip Parts Worldwide directly at:

1-888-872-5123



1) Loader Arm Movement Warning
Note: *Must replace entire panel if screen printed warning is damaged or illegible.*

2) Explosive Gases Warning

3) Emergency Exit Instructions

4) Moving Parts Warning

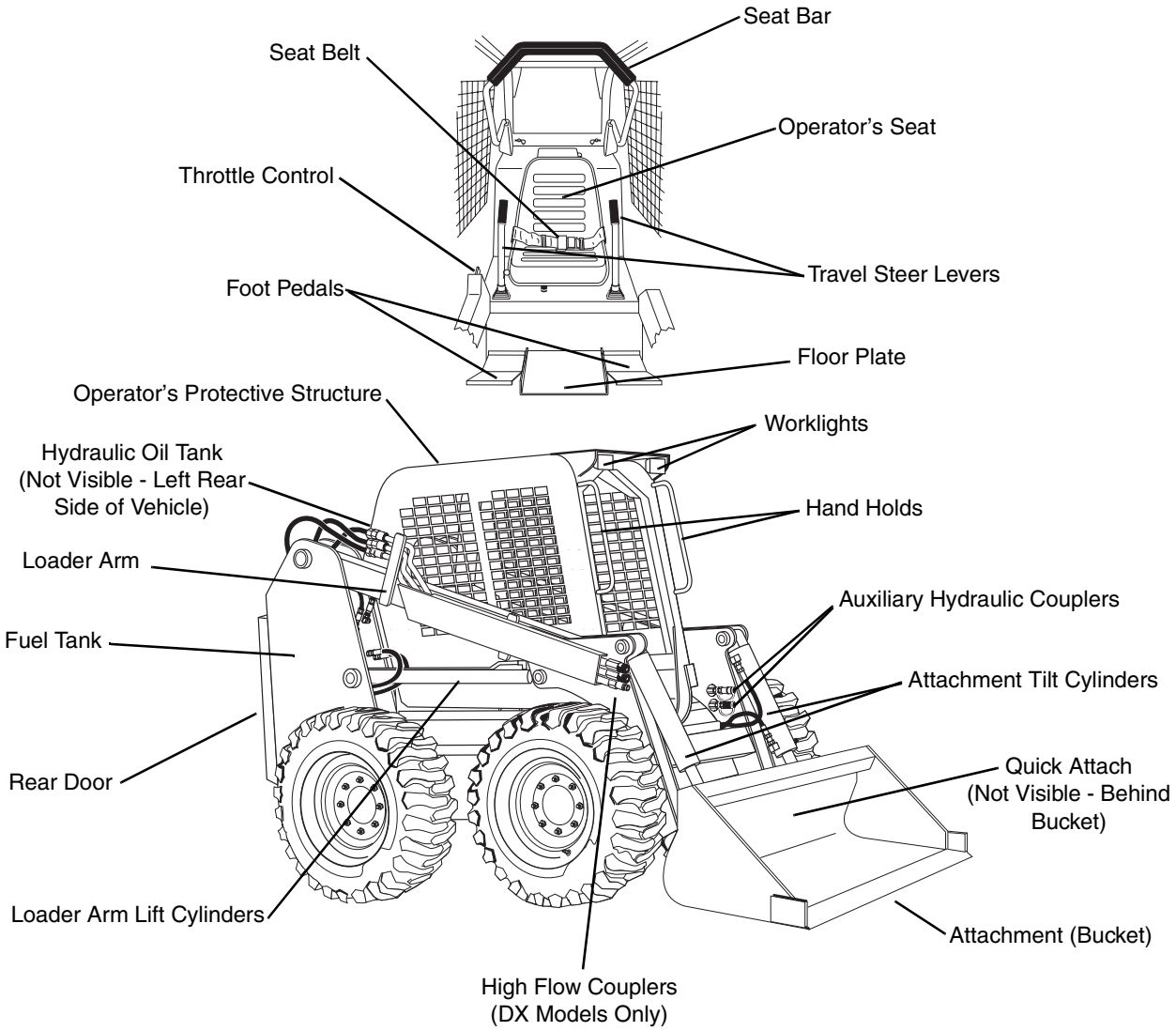
Figure 1-5 Hazard Decal Location

Section 2
General Instructions

Contents

2.1 SKID STEER LOADER TERMINOLOGY

To understand the safety, operation and maintenance information presented in this manual, it is necessary that the operator/mechanic be familiar with the name and location of the major assemblies on this vehicle. The following illustrations identify the components that are referred to throughout this manual.



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2.2 INTRODUCTION

2.2.1 Service Methods

Appropriate service methods and proper repair procedures are essential for safe, reliable operation of skid steer loaders and safety of the individual doing the work. This Service Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will assure reliability.

There are many variations in procedures, techniques, tools, and parts for servicing vehicles, as well as work skills. This Manual cannot possibly anticipate all such variations and provide advice or cautions for each one. Accordingly, anyone who intends to depart from the instructions in this Manual must first consider personal safety and then vehicle integrity.

IMPORTANT: ***Compact Technologies*** *recommends the use of environmentally sound waste storage and disposal practices. Never drain fluids on the ground or into a sewer or catch basin. Use suitable collection containers, then store and/or dispose of waste products in an approved and safe manner. Check and obey all Federal, State and or Local regulations regarding waste storage, disposal and recycling.*

2.2.2 The Owners/Operators Manual

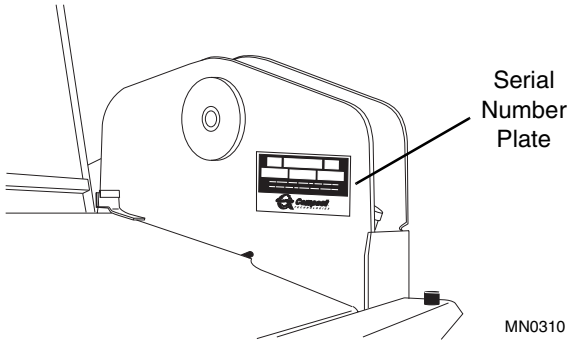
The Owners/Operators Manual provides information you need to properly operate and maintain this vehicle.

IMPORTANT: *Before you operate this vehicle, read that manual completely and carefully so you will understand the safety instructions and the operation of the controls and safety equipment. You must comply with all* ***Danger****,* ***Warning****, and* ***Caution*** *notices. They are for your benefit.*

All references to the right side, left side, front, or rear are given from the operator's seat looking in a forward direction.

2.2.3 Replacement Parts

For reference when ordering replacement parts or making service inquiries, record the model and serial numbers of your vehicle.



Serial Number: _____

Figure 2-1 Serial Number Plate Location

They are stamped on the serial number plate (Fig. 2-1), located on the upper inside of the right rear tower.

IMPORTANT: *The replacement of any part on this vehicle with anything other than an authorized replacement part may adversely affect the performance, durability, or safety of this vehicle and will void the warranty.* ***Compact Technologies*** *disclaims liability for any claims or damages, whether regarding property, personal injury or death arising out of the use of unauthorized replacement parts.*

2.2.4 Disclaimer

Compact Technologies reserves the right to make changes to and to add improvements upon its products at any time without public notice or obligation. **Compact Technologies** also reserves the right to discontinue manufacturing any product at its discretion at any time.

2.3 CLEANING PRIOR TO REPAIR

Clean the exterior of all parts before repairing. Dirt and abrasive dust reduce the efficient work life of the part and lead to costly replacement.

Use cleaning fluids and solvents which are suitable for cleaning parts and do not risk the safety of the user. Certain types of fluids damage rubber parts and/or cause skin irritation.

The following precautions must be observed to insure hydraulic cleanliness:

1. Flush hose and tube assemblies with a solvent compatible with hose assemblies. Blow out excess solvent with shop air.
2. Cap hydraulic fittings and protect threads until installation.
3. Cap hoses and tube assemblies until installation.
4. Flush hydraulic reservoir, fuel tank, and chain case housings with a suitable solvent to remove any foreign debris.
5. Protect system components from airborne contaminants. Plug all cylinder, valve, reservoir, tank, and pump openings until installation.
6. Use clean, filtered motor oil equal to 10W30 API, CC or CD specifications when filling the system.
7. System cleanliness level must be a minimum ISO code 18/15.

2.4 GENERAL PART REPLACEMENT

Replace O-rings, seals, and gaskets whenever they are disturbed. Never mix new and old seals or O-rings regardless of condition. Always lubricate new seals and O-rings with 10W30 oil before installation.

Replace all used elastic locknuts with new parts.

When replacing parts, use the correct tool.

2.5 HOSES AND TUBES

2.5.1 Inspection

1. If the hose end connections are damaged, always replace hoses and tubes. Damaged, dented, crushed, or leaking hose fittings restrict oil flow and the operation of the parts being served. Fittings showing signs of movement from their original position have failed and must be replaced.
2. Be sure hoses are in good condition. If in doubt, replace them.
3. Replace hoses if the following occur:
   - chafed outer cover.
   - concealed corrosion of wire reinforcement.
   - ballooning (**replace immediately!**).
   - kinked, crushed, stretched, or deformed.

2.5.2 Installation

1. When installing a new hose, loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.
2. If a hose is replaced on a moving part, be sure it does not foul by moving the part through its complete range of travel.
3. Be sure any hose which has been installed is not kinked, twisted, or exposed to any sharp edges.
4. Free moving, unsupported hoses must never touch each other or related work surfaces. This causes chafing, reducing hose life.

2.6 BEARINGS

2.6.1 Removal

1. Bearings should never be removed unless absolutely necessary. Always use the recommended puller to reduce the risk of bearing or related component damage.
2. When bearings or bushings are removed, check that the bearing is free from discoloration, nicks, scuffing, and signs of overheating. If in doubt, replace the bearing or bushing.

2.6.2 Cleaning

Bearings acceptable for service should be cleaned in a suitable solvent and immersed in clean lubricating oil until needed.

2.6.3 Installation

1. Be sure bearings are installed with care during servicing, maintenance, and repair.
2. All bearings on this loader are installed as a press fit.
3. When possible, always install the bearing into the rotating part first.
4. Use the proper tools or a press when installing a bearing or bushing.
5. In the absence of the proper tools or a press, heat the bearings and/or casing in hot oil to assist in the installation.

2.7 PRESSURE TESTING

1. Prior to pressure testing, be sure all hoses are in good condition and all fittings are tight.
2. Use a pressure gauge with a range that is high enough to measure the specified pressure.
3. Comply with the correct procedure to prevent damage to the system or the equipment and to eliminate the possibility of injury.

2.8 TORQUES

2.8.1 Fasteners

All fasteners are plated and equal to SAE grade 5 (PC8.8) unless otherwise specified.

2.8.2 Bolts and Nuts

Unless otherwise specified the following grade 5 (PC8.8) torque values (±10%) apply:

Size	Torque		Size	Torque	
Inch	lb/ft	Nm	mm	Nm	lb/ft
1/4	9	12	6.0	10	7
5/16	18	24	8.0	25	18
3/8	31	42	10.0	50	37
7/16	50	68	--	--	--
1/2	75	102	12.0	80	59
9/16	110	150	14.0	130	95
5/8	150	203	16.0	200	146
3/4	250	340	20.0	360	263
7/8	380	515	22.0	510	372
1	585	793	24.0	650	475
1-1/8	635	861	27.0	995	770
1-1/4	890	1207	30.0	1350	1044

2.8.3 Weld Studs

Unless otherwise specified, the following grade 2 torque values (±10%) apply:

Stud Size	Torque	
#10	20 lb/in	--
1/4"	4 lb/ft	5 Nm
5/16"-18	9 lb/ft	12 Nm
5/16"-24	10 lb/ft	14 Nm
3/8"	14 lb/ft	19 Nm
1/2"	35 lb/ft	47 Nm
5/8"	70 lb/ft	95 Nm

2.8.4 F.F.F.T. (Flats From Finger Tight) Method

Compact Technologies recommends that the F.F.F.T. tightening method described here be used when assembling all hydraulic fittings. This method will minimize the risk of fitting damage or failure due to under or over-tightening. It will also reduce the chance of a leaky connection which is caused normally by different plating combinations of fittings. This method is particularly useful when the plating type of a fitting is unknown and during maintenance or repair when a joint may be oily.

Follow these steps when tightening all fitting connections (Refer to Fig. 2-2):

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign particles.
2. Align tube or hose to the mating fitting and check to see that the flare seats properly on the nose of the fitting.
3. Finger tighten the nut onto the fitting. If necessary, a wrench should be used to seat the nut snugly against the fitting. This is considered the “finger tight” condition.

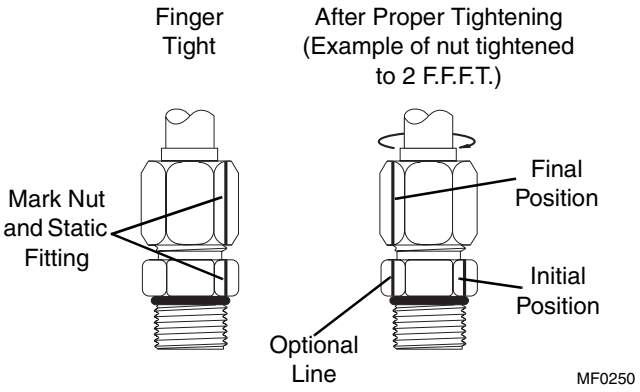


Figure 2-2 F.F.F.T. Tightening Method

4. Using a permanent type ink marker, make a mark (Fig. 2-2) on one of the flats of the nut and continue it onto the hex of the static fitting or port.
5. Tighten the joint by the number of flats (F.F.F.T.) specified for the size and type of fitting (Refer to Group 2.8.5, 2.8.6, and 2.8.7).
6. (Optional for future tightening of the same connection.) Extend the line from the nut at its new location onto the hex of the static fitting or port (Fig. 2-2).

2.8.5 37° Flared Fitting (Steel) (Tube or Hose to Fitting)

Follow F.F.F.T. method (Refer to Group 2.8.4) to tighten these types of fittings.

SAE Size	Tube Conn. (F.F.F.T.)	Swivel Nut/ Hose Conn. (F.F.F.T.)
2	-	-
3	-	-
4	2	2
5	2	2
6	1.5	1.25
8	1.5	1
10	1.25	1
12	1.25	1
14	1	1
16	1	1
20	1	1
24	1	1
32	1	1

2.8.6 Adjustable Straight Thread O-Ring Fitting (Fitting to Port)

Follow F.F.F.T. method to tighten these types of fittings.

1. Inspect both mating parts for burrs, nicks, scratches, or foreign particles.

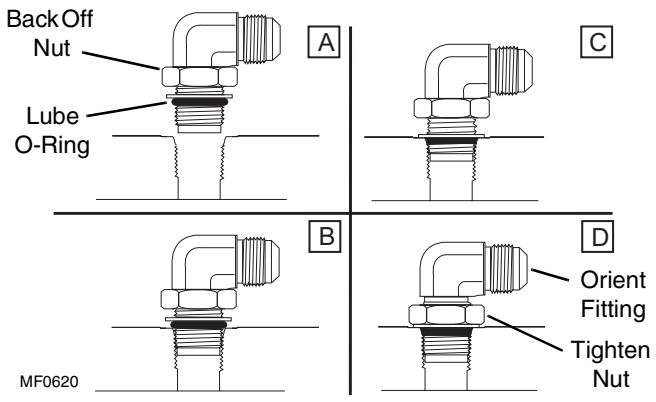


Figure 2-3 Adjustable Fitting to Port

2. Back off the nut, and lubricate the O-ring with a light coat of clean oil (Fig. 2-3, A).
3. Back off locknut as far as possible (Fig. 2-3, A).

4. Screw fitting into port by hand until the backup washer contacts face of port and is pushed all the way towards the locknut (Fig. 2-3, B & C).
5. To orient the fitting, unscrew the fitting the required amount, but not more than one full turn (Fig. 2-3, D).
6. Hold the fitting in the desired position and tighten nut (Fig. 2-3, D) following the F.F.F.T. method (Refer to Group 2.8.4).

Adjustable Steel Straight Thread O-Ring Fittings	
SAE Size	**(F.F.F.T.)**
2	1.0 ± 0.25
3	1.0 ± 0.25
4	1.0 ± 0.25
5	1.0 ± 0.25
6	1.5 ± 0.25
8	1.5 ± 0.25
10	1.5 ± 0.25
12	1.5 ± 0.25
14	1.5 ± 0.25
16	1.5 ± 0.25
20	2.0 ± 0.25
24	2.0 ± 0.25
32	2.0 ± 0.25

2.8.7 Non-Adjustable Straight Thread O-Ring Fitting (Fitting to Port)

Follow F.F.F.T. method (Refer to Group 2.8.4) to tighten these types of fittings.

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign particles.

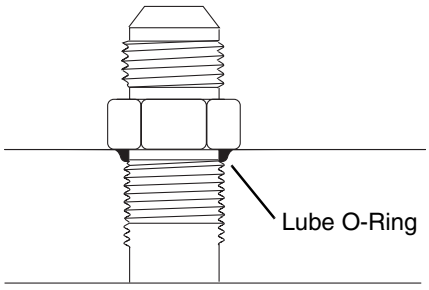


Figure 2-4 Non-Adjustable Fitting to Port

2. Lubricate O-ring (Fig. 2-4) with light coat of clean oil.
3. Turn fitting until finger tight.
4. Using the assembly torque method, tighten to given torque for the size from the following table.

Non-Adjustable Steel Straight Thread O-Ring Fittings		
SAE Sizes	**Torque**	
2	90 ±5 lb/in	10 ±0,7 Nm
3	170 ±10 lb/in	19 ±1,4 Nm
4	220 ±15 lb/in	24 ±1,4 Nm
5	260 ±15 lb/in	30 ±1,4 Nm
6	27 ±2 lb/ft	37 ±3,0 Nm
8	48 ±2 lb/ft	65 ±3,0 Nm
10	90 ±5 lb/ft	122 ±7,0 Nm
12	110 ±5 lb/ft	149 ±7,0 Nm
14	145 ±6 lb/ft	197 ±8,0 Nm
16	160 ±6 lb/ft	217 ±8,0 Nm
20	225 ±12 lb/ft	305 ±16,0 Nm
24	250 ±12 lb/ft	339 ±16,0 Nm
32	325 ±15 lb/ft	441 ±20,0 Nm

2.9 PAINTING

Unless otherwise specified, paint components as follows:

2.9.1 Orange Paint

- P/N 8528071 ..... 16 oz. Spray Can
- P/N 8528074 .....1 Gallon Can

2.9.2 Light Gray Paint

- P/N 8528109 .....16 oz. Spray Can
- P/N 8528108 .....1 Gallon Can

2.9.3 Dark Gray Paint

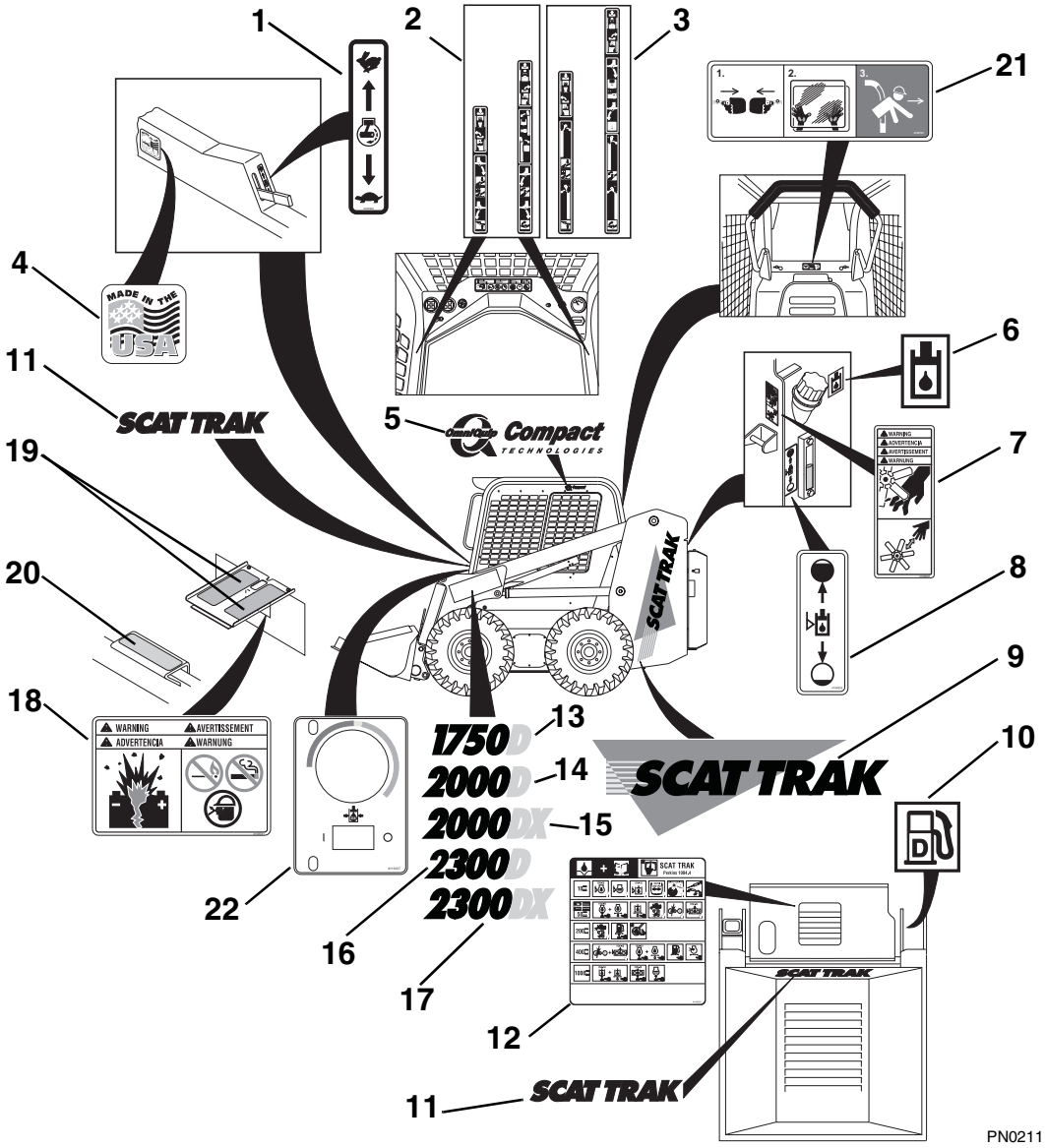
- P/N 8528106 .....16 oz. Spray Can
- P/N 8528105 .....1 Gallon Can

2.9.4 Gray Paint (Primer)

- P/N 8528054 .....16 oz. Spray Can
- P/N 8528075 .....1 Gallon Can

2.10 VEHICLE DECALS

Locations of all vehicle decals are shown below. If a replacement decal is needed, refer to the appropriate parts manual for the latest part numbers and ordering information.



1. Throttle
2. Lower Panels - Standard Foot Controls
3. Lower Panels - Optional Hand Controls
4. “Made in USA”
5. “OmniQuip - Compact Technologies”
6. Hydraulic Oil
7. Fan/Moving Parts Warning
8. Hydraulic Oil Level
9. “SCAT TRAK” Stripe
10. Diesel Fuel
11. “SCAT TRAK”
12. Lube and Maintenance
13. Model - “1750D”
14. Model - “2000D”
15. Model - “2000DX”
16. Model - “2300D”
17. Model - “2300DX”
18. Explosive Gases Warning
19. Safety Walk
20. Safety Walk
21. Emergency Exit Instructions
22. High Flow Pressure Gauge

Figure 2-5 Vehicle Decal Placement

2.11 OPERATOR'S PROTECTIVE STRUCTURE TILT SERVICE POSITION

IMPORTANT: *The recommended service position for the vehicle is to have the loader arm all the way up, the loader arm safety support down and locked in place, the engine OFF, starter key removed from the starter key switch and the seat bar in the raised position*

2.11.1 To Raise Operator's Protective Structure:

It is not necessary to raise the loader arm in order to tilt the Operator's Protective Structure forward. This feature was added to facilitate servicing the vehicle when there is a total loss of engine power or hydraulics with the loader arm in the lowered position. When servicing the vehicle in this condition, the engine should always be OFF, ignition key removed from the ignition switch and the seat bar in the raised position.

It is highly recommended that the loader arm always be located in the raised service position when servicing the vehicle. In the event that it is necessary to manually lift the loader arm to service the vehicle, follow the instructions in "Manual Lifting of Loader Arm" (Refer to Section 2.11.3).

Note: *You will require a 15/16" wrench or socket with ratchet when performing this procedure.*

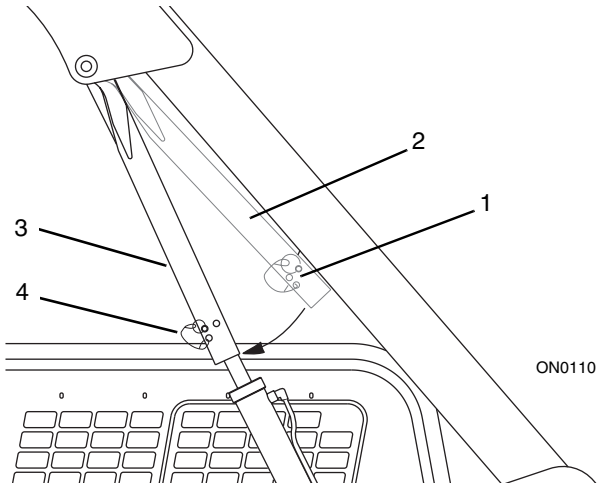


Figure 2-6 Loader Arm Safety Support

1. Remove the safety support pin (Fig. 2-6, 1) securing the safety support (2) to the left loader arm and swing the safety support down onto the lift cylinder (3).

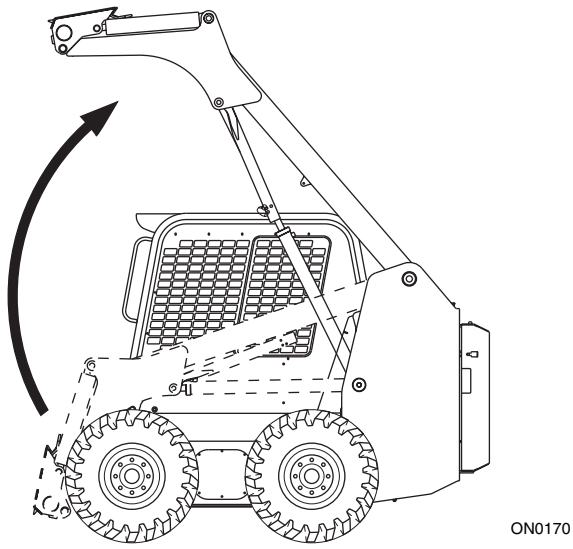


Figure 2-7 Raising Loader Arm

2. Remove any attachment from the quick attach and raise loader arm all the way up (Fig. 2-7). If the engine power will not lift the loader arm refer to the "Manual Lifting of Loader Arm" (Refer to Section 2.11.3).
3. Shut engine off and remove ignition key.
4. Unfasten seat belt, raise seat bar and exit the vehicle using the hand holds.
5. Insert the safety support pin (Fig. 2-6, 4) through the lower hole in the safety support to secure the safety support in place on the rod of the lift cylinder.

IMPORTANT: *The Loader Arm Safety Support must be in place whenever it is required that the loader arm be in a raised position for servicing.*

6. Unlock and open the rear door, and raise the engine cover.

WARNING: To avoid severe burns, **DO NOT** attempt the next procedure when the engine is HOT. Wait for the engine, muffler and tailpipe to cool before proceeding.

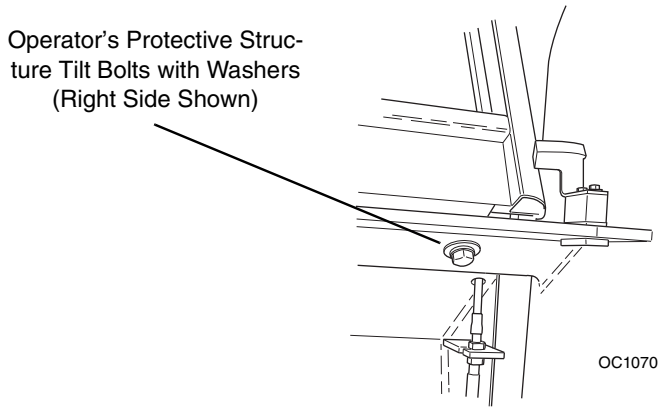


Figure 2-8 Operator's Protective Structure Retaining Bolts

7. At the rear corners of the Operator's Protective Structure loosen the two bolts and washers (Fig. 2-8) that secure it to the frame. The bolts are retained and will not come completely out of the frame.

Note: *If this vehicle is equipped with the optional enclosed cab kit, the door MUST be in the OPEN position before tilting the Operator's Protective Structure into the raised (service) position in the next step.*

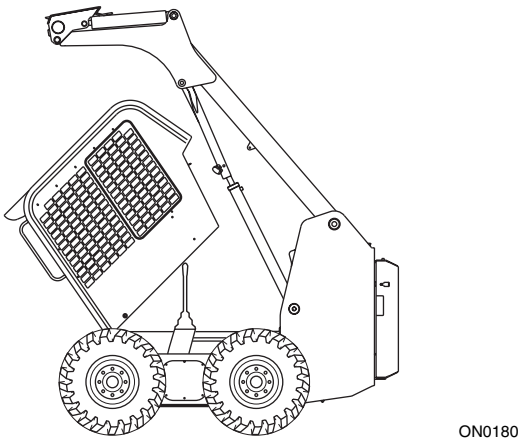


Figure 2-9 Vehicle in Service Position

8. At the front of the vehicle, grasp both front hand holds and tilt the Operator's Protective Structure forward until it locks securely in the raised position (Fig. 2-9).

IMPORTANT: *When the Operator's Protective Structure is tipped forward in the service position and the service being performed requires that the engine be running; keep hands, hair, feet and loose clothing away from the rotating universal joint.*

2.11.2 To Lower Operator's Protective Structure:

1. Remove tools, be sure all personnel are clear of the area.

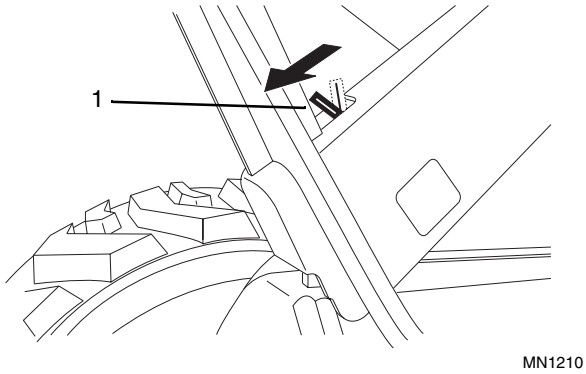


Figure 2-10 Operator's Protective Structure Lock Lever

2. At the front of the vehicle, grasp the front hand holds and tilt the Operator's Protective Structure forward slightly and release the lock lever (Fig. 2-10, 1) in the lower left hand corner as viewed from the front of the vehicle.
3. Using both hand holds, slowly lower the Operator's Protective Structure down to the lowered position.
4. At the rear corners of the Operator's Protective Structure, retighten the two bolts and washers (Fig. 2-8) through the access openings on each side of the vehicle, and torque to 150 lb/ft (203 Nm).
5. Lower the engine cover and close the rear door.
6. Check to see if the loader arm has come down against the safety support. If it has, the vehicle has to be started and the loader arm raised (See step 8).
7. Place the safety support in the normal operation position and pin in place on the support tab.
8. Using the hand holds enter the vehicle, fasten the seat belt, lower the restraint bar and start the engine.
9. Press the raise/lower reset button and lower the loader arm.

2.11.3 Manual Lifting Of Loader Arm

In the event of total loss of engine power with a lowered loader arm, the loader arm can be raised safely.

Before fully lifting the loader arm; remove the bucket or any other attachment from the quick attach by whatever means are necessary. For instance:

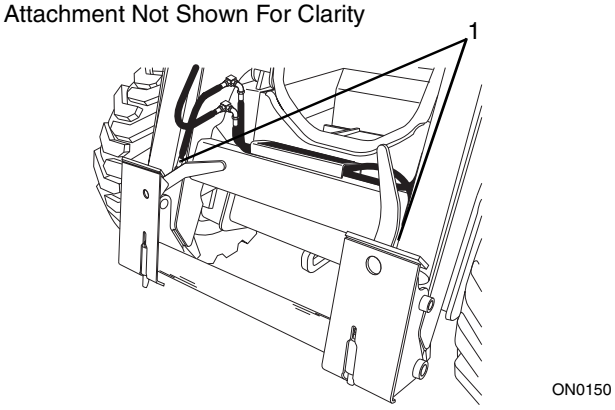


Figure 2-11 Attachment Removal from Quick Attach

1. Place a receptacle under both attachment tilt cylinders (Fig. 2-11, 1). Loosen the fittings on the rod end ports of both cylinders.
2. Have a second person assist you in the next steps.
3. Have one person sit in the operator's seat with the seat bar lowered and the starter key switch in the ON position, the loader arm in the float position, and depress the loader arm reset button.
   a. For standard foot controls, float position is accomplished by pressing down on the front of the left foot pedal, until it locks into the detent position.
   b. For optional wrist controls, float position is accomplished by moving the left wrist control lever to the right, until it locks into the detent position.

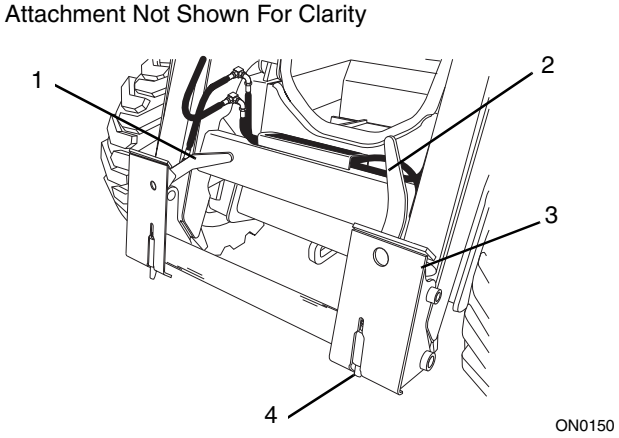


Figure 2-12 Attachment Release from Quick Attach

4. Rotate both locking levers from the engaged position (Fig. 2-12, 1) to the disengaged position (2) on the quick attach (3) until the locking pins are fully retracted (4).

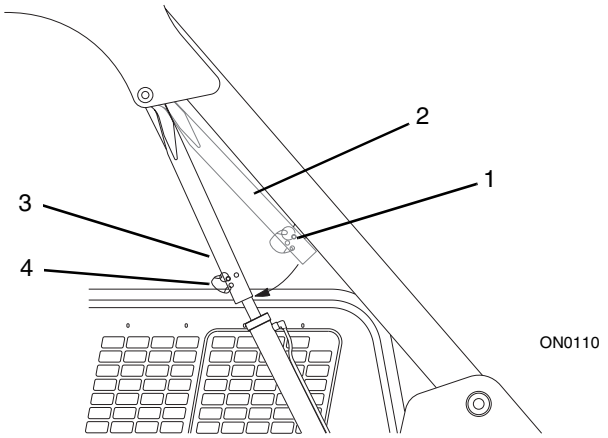


Figure 2-13 Loader Arm Safety Support

5. The second person should first release the safety support pin (Fig. 2-13, 1). Now, lift the loader arm from the area shown in Fig. 2-14 by some means (an overhead hoist or another piece of equipment). Lift the loader arm only far enough to permit the attachment to be safely removed from the quick attach.
6. Use a second piece of equipment or hoist and remove the attachment.
7. Tighten the fittings on the attachment tilt cylinders.
8. Remove the receptacle with the drained hydraulic oil. Dispose of the used oil at an approved recycling facility.
9. Be sure to recheck oil level in the hydraulic tank and replace the drained hydraulic oil with fresh hydraulic oil (Refer to Section 4.10.1, “Hydraulic Oil Level Check”).

Now the loader arm can be raised safely using the following procedures:

1. Have a second person assist you in the next steps.
2. Have one person sit in the operator’s seat with the seat bar lowered, the key in the ON position, the loader arm in float position and depress the loader arm reset button.
   a. For standard foot controls, float position is accomplished by pressing down on the front of the left foot pedal, until it locks into the detent position.
   b. For optional wrist controls, float position is accomplished by moving the left wrist control lever to the right, until it locks into the detent position.

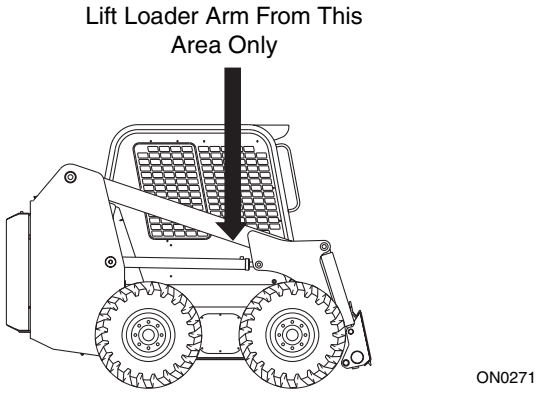


Figure 2-14 Lifting Loader Arm

3. The second person should first release the safety support pin (Fig. 2-13, 1). Now, lift the loader arm from the area shown in Fig. 2-14 by some means (an overhead hoist or another piece of equipment) all the way up to allow engagement of the loader arm safety support (Fig. 2-13, 3).
4. When the loader arm is all the way up the person in the operator’s seat should center the left foot pedal, turn the key to the OFF position, raise the seat bar and carefully exit the vehicle using the hand holds. This person should then secure the loader arm safety support with the safety support pin (Fig. 2-13, 4).
5. The loader arm is now secured in the service position and the Operator’s Protective Structure can be tilted into the service position.

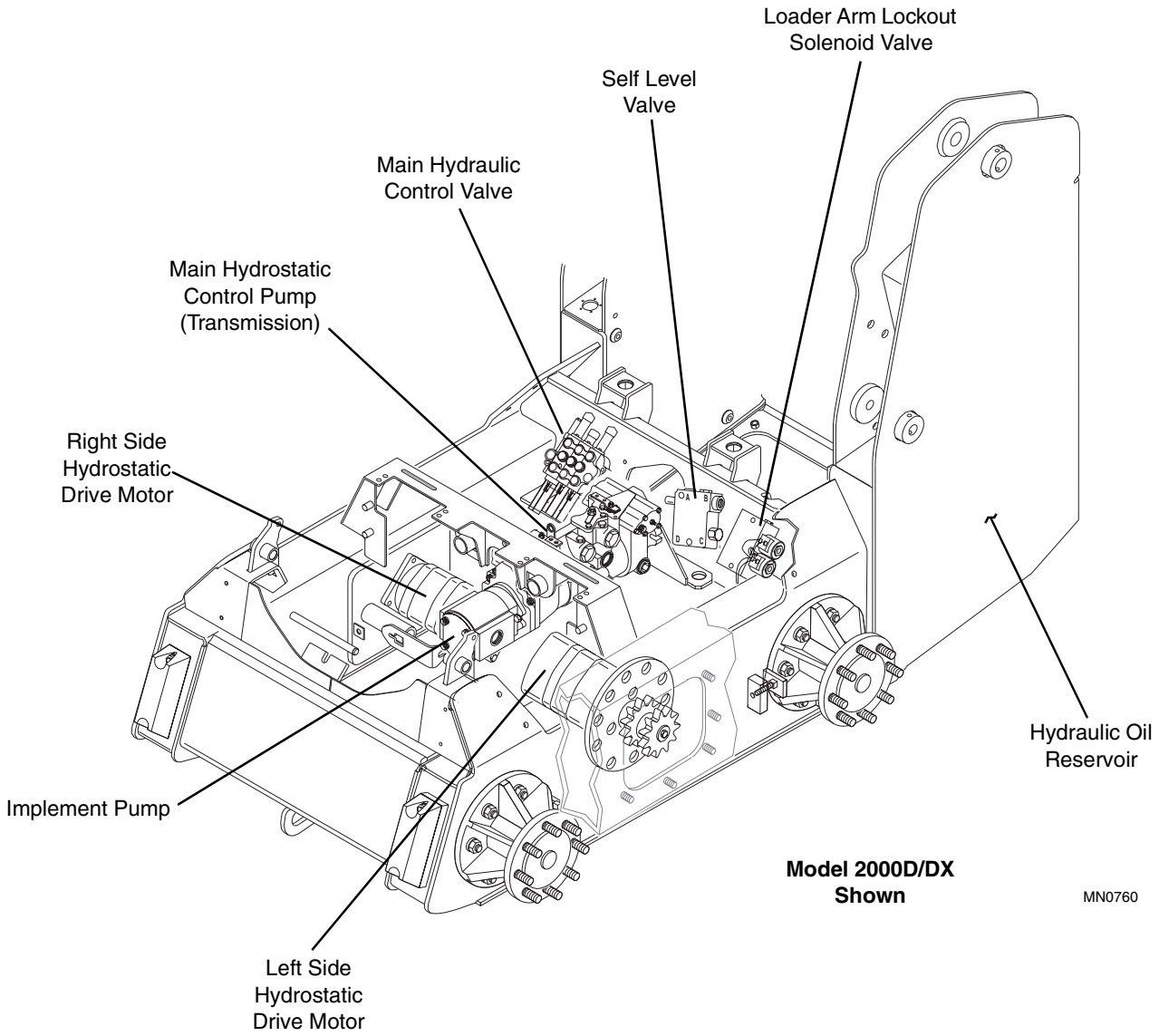
IMPORTANT: *When the Operator’s Protective Structure is tipped forward in the service position and the engine is running, keep hands, hair, feet and loose clothing away from the rotating universal joint.*

Section 3
Hydraulic Component Testing

Contents

3.1 HYDRAULIC COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the vehicle hydraulic components. The following illustration identifies the components that are referred to throughout this section.



3.2 HYDRAULIC COMPONENT TESTING INSTRUCTIONS

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic fluid under pressure can penetrate the skin causing serious injury.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic fluid can cause severe burns.

3.2.1 Gauges and Meters Required

A 10,000 psi (689 bar), a 4,000 psi (275,6 bar), a 1,000 psi (68,9 bar) and 300 psi (20,7 bar) hydraulic pressure gauges are required to perform the hydraulic pressure tests in this section.

A hydraulic flow meter (Fig. 3-1) capable of measuring up to 60 gallons per minute (gpm) (3,8 liters per second [liter/sec]) is required to perform the hydraulic flow tests.

A hydraulic load control valve, connected to or incorporated into a flow meter (Fig. 3-1) capable of 6,000 psi (413,4 bar) and 60 gpm (3,8 liter/sec) is required to load the hydraulic circuit when performing the hydraulic flow tests.

3.2.2 Hydraulic Pressure Diagnostic Test Kit

A combination Hydraulic Pressure Diagnostic Test Kit (Fig. 3-2) is available from Compact Technologies. This kit (part number 5755589) contains all the necessary fittings, couplers, hoses and gauges needed to properly pressure test the various hydraulic components in all families of SCAT TRAK Skid Steer Loaders, and includes durable, oil resistant Troubleshooting Guides (Fig. 3-3).

The kit comes in a rugged, easy-to-carry plastic case. The durable case is convenient for storage, and features an o-ring seal in the cover that keeps the gauges, fittings and hoses free from moisture, dust and dirt. The case protects the contents against breakage by use of a contoured pad with individual pockets for all major components.

Today, more than ever, proper maintenance is essential for obtaining maximum vehicle performance. We know that good maintenance contributes to the life of the vehicle. The Hydraulic Pressure Diagnostic Test Kit is a valuable tool for every SCAT TRAK trained service technician.

Order the Hydraulic Pressure Diagnostic Test Kit for your SCAT TRAK fleet today!

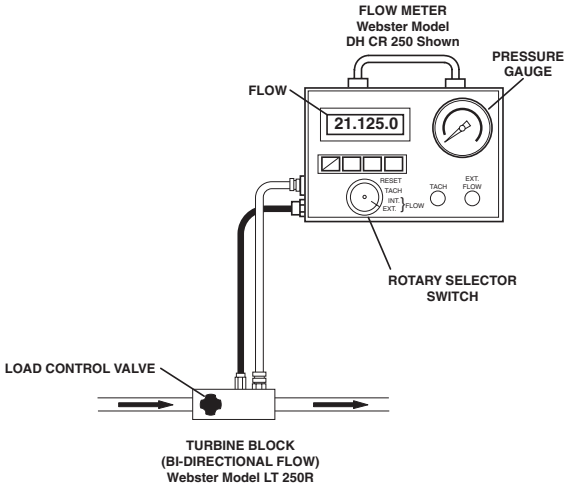


Figure 3-1 Typical Flow Meter Installation

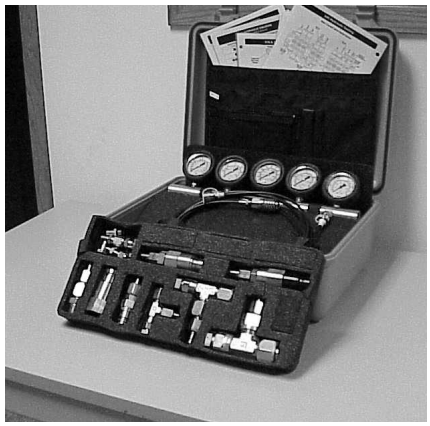


Figure 3-2 Hydraulic Pressure Diagnostic Test Kit

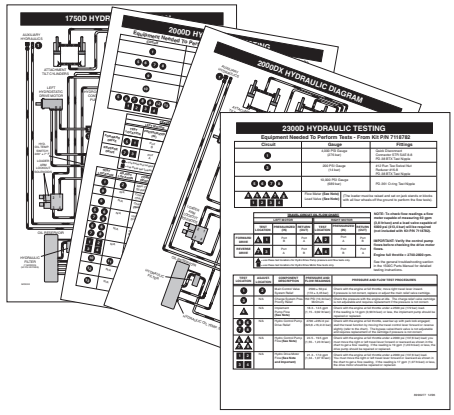


Figure 3-3 Hydraulic System Troubleshooting Guides

All of the test procedures in this section are to be performed with the Opreators Protective Structure in the service position (tilted up) (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

3.2.3 Hydraulic Testing Schedule

The following hydraulic components can be tested for either pressure or component flow displacement.

Pressure Testing

- Main Control Valve System Relief
- Charge System Pressure Priority Valve Relief (1750 Only)
- Charge System Pressure Relief (2000D/DX & 2300D/DX Only)
- Hydrostatic Control Pump Drive Reliefs
- High Flow Valve Relief

After pressure tests have been performed you will be instructed to either adjust or replace the relief cartridge.

Flow Displacement Testing

- Implement Pump
- Hydrostatic Control Pumps
- High Flow Pump

After the component flow displacement tests have been performed and if the components flow displacement is less than 80% of its theoretical displacement, the component is showing considerable wear and should be repaired or replaced.

Note: *Unless otherwise instructed, all hydraulic testing is performed with the engine in the full throttle position. Engine full throttle is 2600 ±50 rpm.*

IMPORTANT: *To properly identify a damaged or faulty hydraulic component, the tests should be performed in the following sequence.*

Model 1750D

1. Main Control Valve system relief test (Refer to Section 3.4.1, Fig. 3-9)
2. Charge System Pressure Priority Valve Relief test (Refer to Section 3.4.2, Fig. 3-11)
3. Implement Pump flow displacement test (Refer to Section 3.4.4, Fig. 3-13)
4. Hydrostatic Control Pump drive relief tests (Refer to Section 3.4.5, Fig. 3-15)
5. Hydrostatic Drive Motor test (Refer to Section 3.4.6, Fig. 3-17)
6. Hydrostatic Control Pump flow displacement tests (Refer to Section 3.4.7, Fig. 3-18)

Model 2000D & 2300D

1. Main Control Valve system relief test (Refer to Section 3.4.1, Fig. 3-10)
2. Charge System Pressure Relief Valve test (Refer to Section 3.4.3, Fig. 3-12)
3. Implement Pump flow displacement test (Refer to Section 3.4.4, Fig. 3-14)
4. Hydrostatic Control Pump drive relief tests (Refer to Section 3.4.5, Fig. 3-16)
5. Hydrostatic Drive Motor test (Refer to Section 3.4.6, Fig. 3-17)
6. Hydrostatic Control Pump flow displacement tests (Refer to Section 3.4.7, Fig. 3-19)

Model 2000DX & 2300DX

1. Main Control Valve system relief test (Refer to Section 3.4.1, Fig. 3-10)
2. Charge System Pressure Relief Valve test (Refer to Section 3.4.3, Fig. 3-12)
3. Implement Pump flow displacement test (Refer to Section 3.4.4, Fig. 3-14)
4. Hydrostatic Control Pump drive relief tests (Refer to Section 3.4.5, Fig. 3-16)
5. Hydrostatic Drive Motor test (Refer to Section 3.4.6, Fig. 3-17)
6. Hydrostatic Control Pump flow displacement tests (Refer to Section 3.4.7, Fig. 3-19)
7. High Flow Valve relief test (Refer to Section 3.4.8, Fig. 3-20)
8. High Flow Pump flow displacement test (Refer to Section 3.4.9, Fig. 3-21)

3.3 HYDRAULIC SYSTEM SCHEMATICS

3.3.1 Model 1750D Hydraulic Schematic

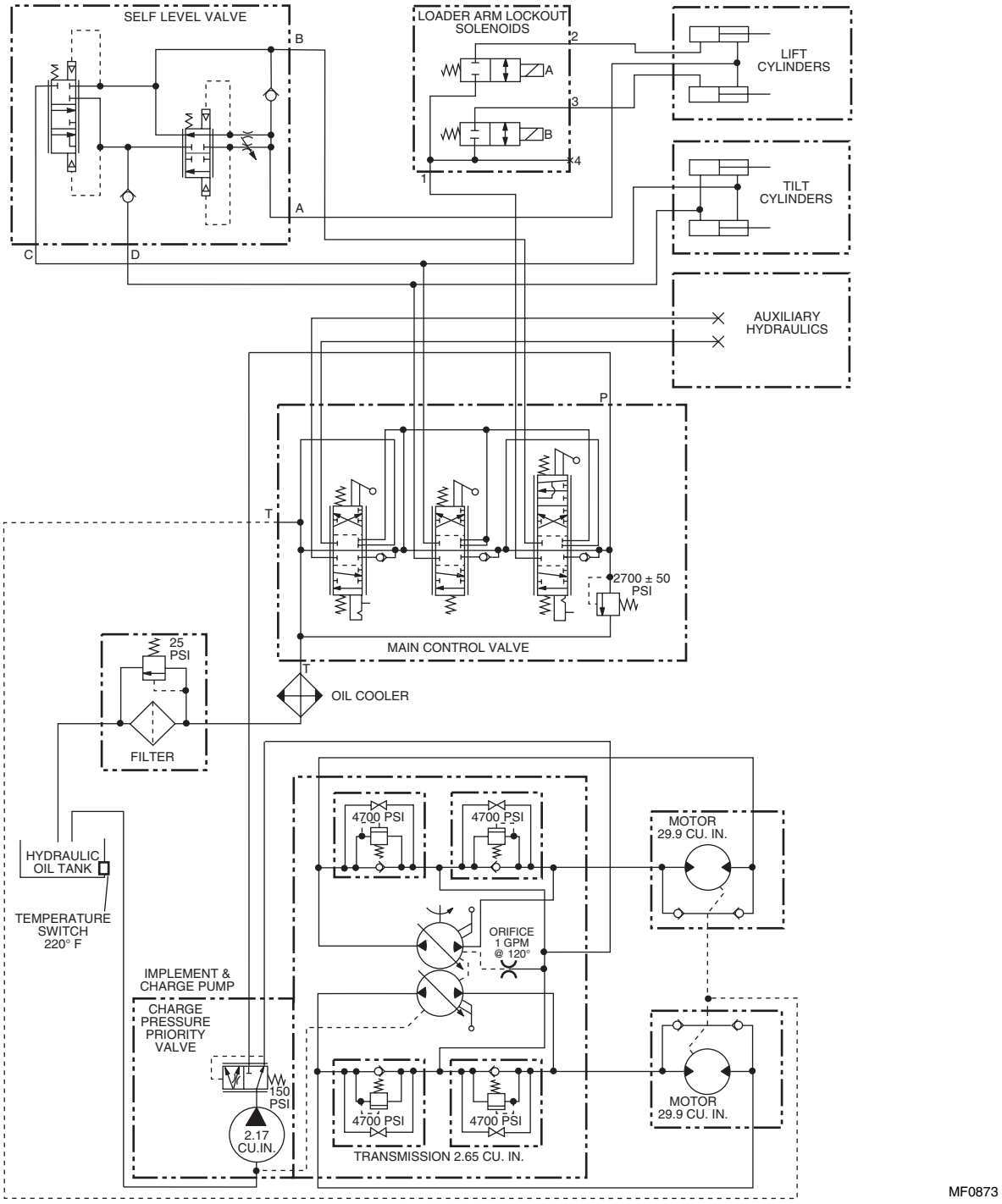


Figure 3-4 Model 1750D Hydraulic Schematic

3.3.2 Model 2000D Hydraulic Schematic

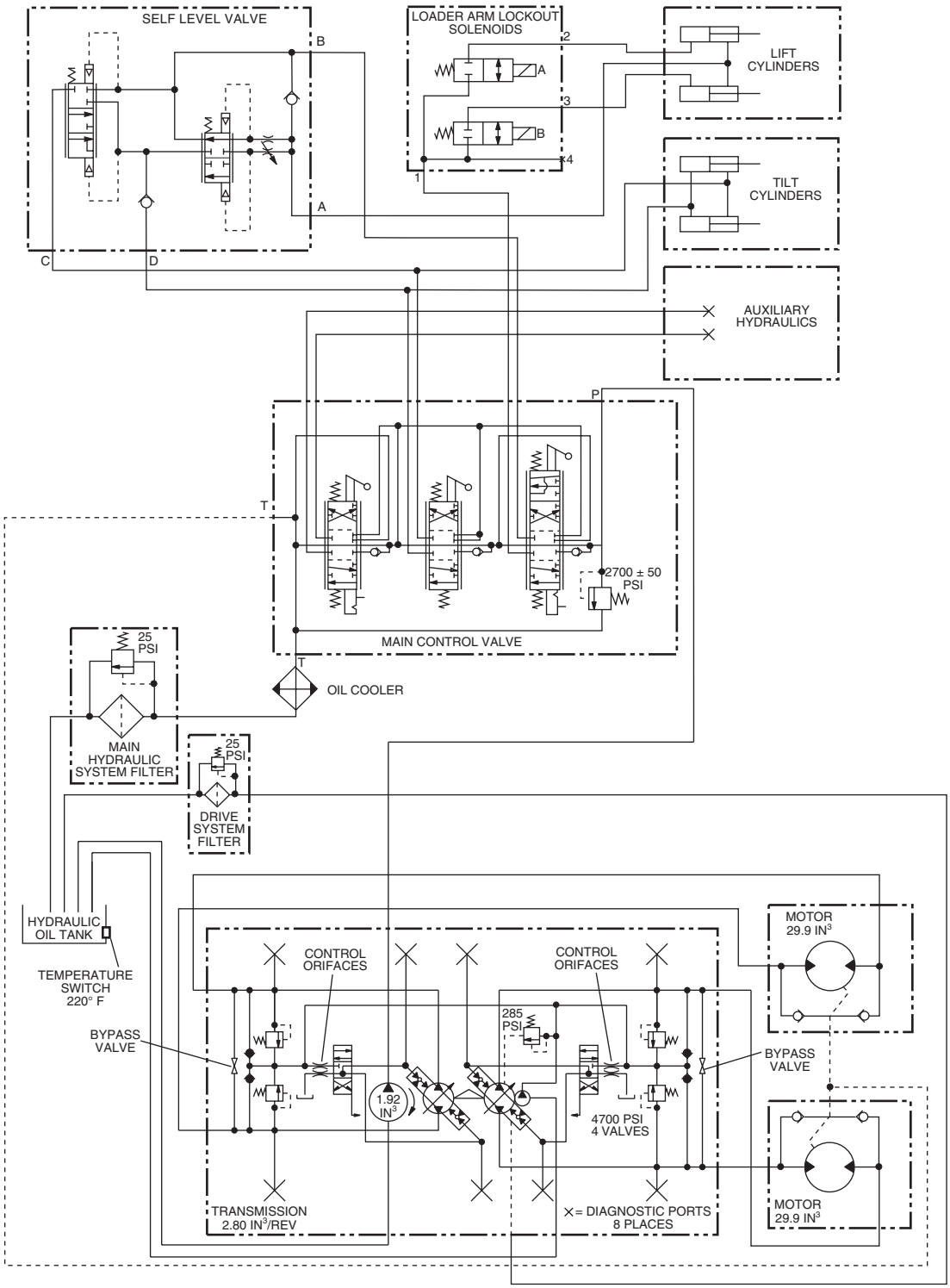


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Figure 3-5 Model 2000D Hydraulic Schematic

3.3.3 Model 2000DX Hydraulic Schematic

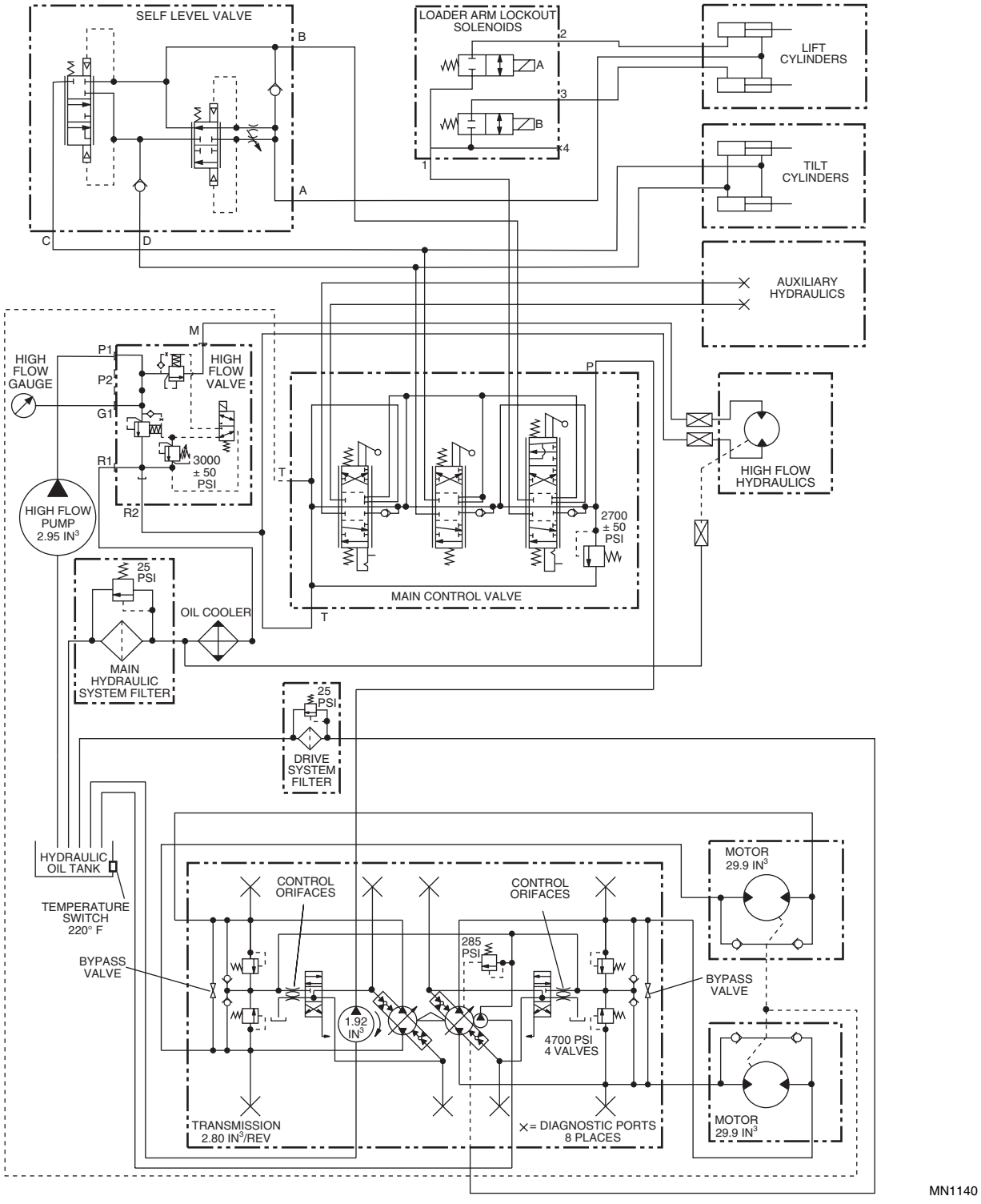

Figure 3-6 Model 2000DX Hydraulic Schematic

3.3.4 Model 2300D Hydraulic Schematic

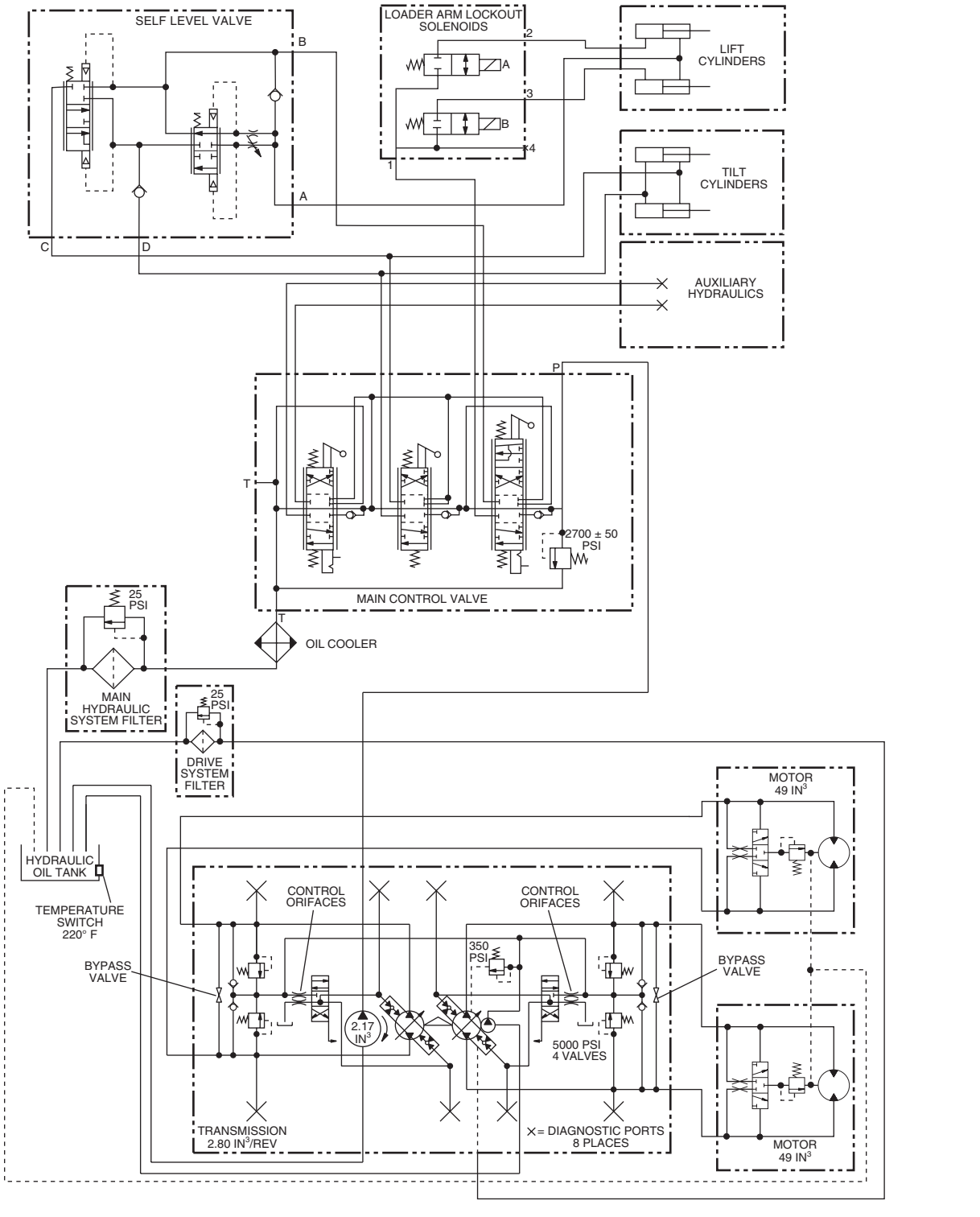

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Figure 3-7 Model 2300D Hydraulic Schematic

3.3.5 Model 2300DX Hydraulic Schematic

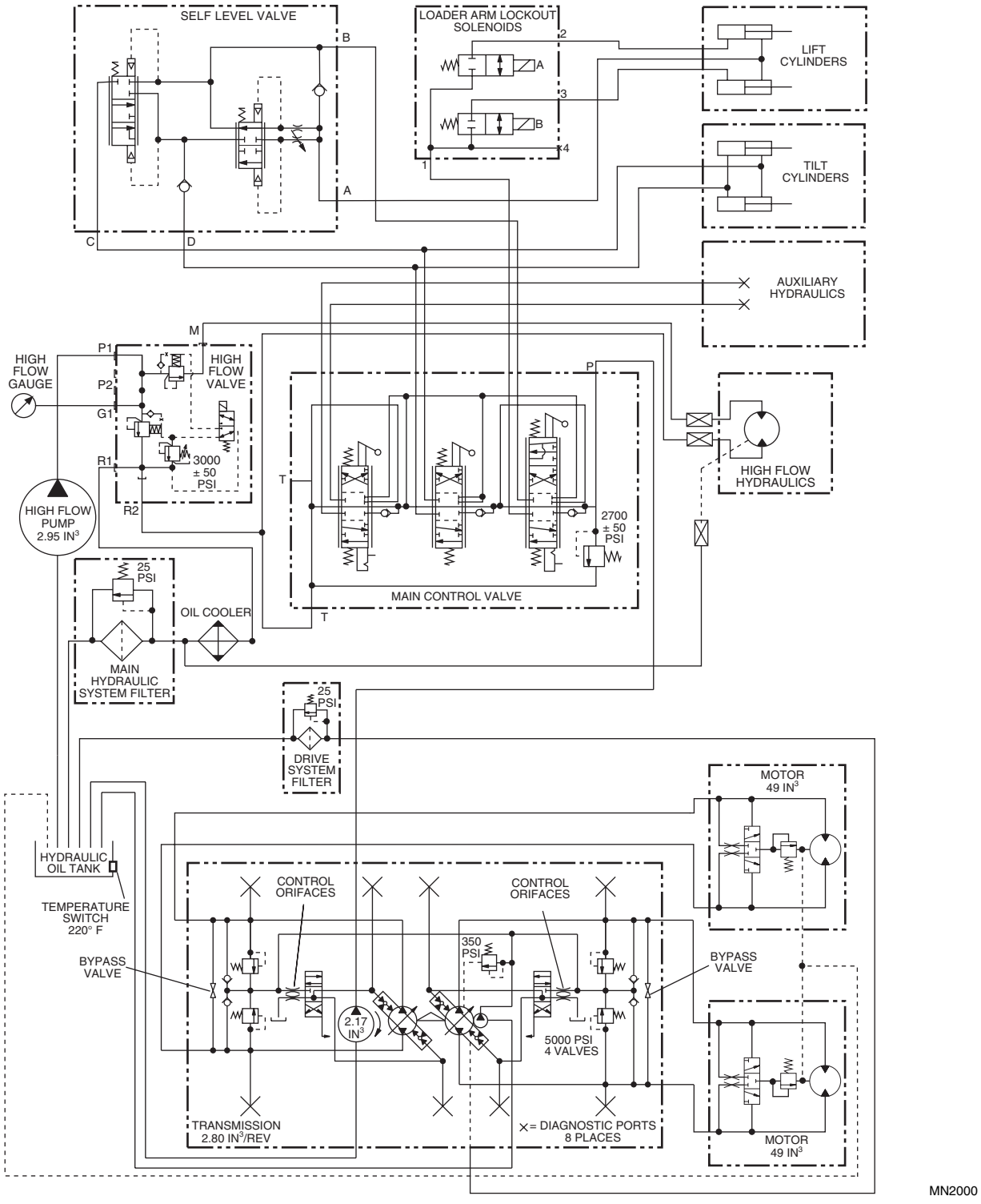


Figure 3-8 Model 2300DX Hydraulic Schematic

3.4 HYDRAULIC CIRCUIT TESTING

3.4.1 Main Control Valve System Relief Test

Model 1750D

With a 4000 psi (275,6 bar) pressure gauge installed at test location 1 and engine at full throttle (2600 ±50 rpm); unlock and move the right travel-steering/auxiliary hydraulic control lever to the left (inward), applying pressure to the auxiliary hydraulic female coupling. The pressure reading should be 2500 ±50 psi (172 ±3,45 bar). If pressure is not correct, replace or adjust the main relief valve cartridge at location 2.

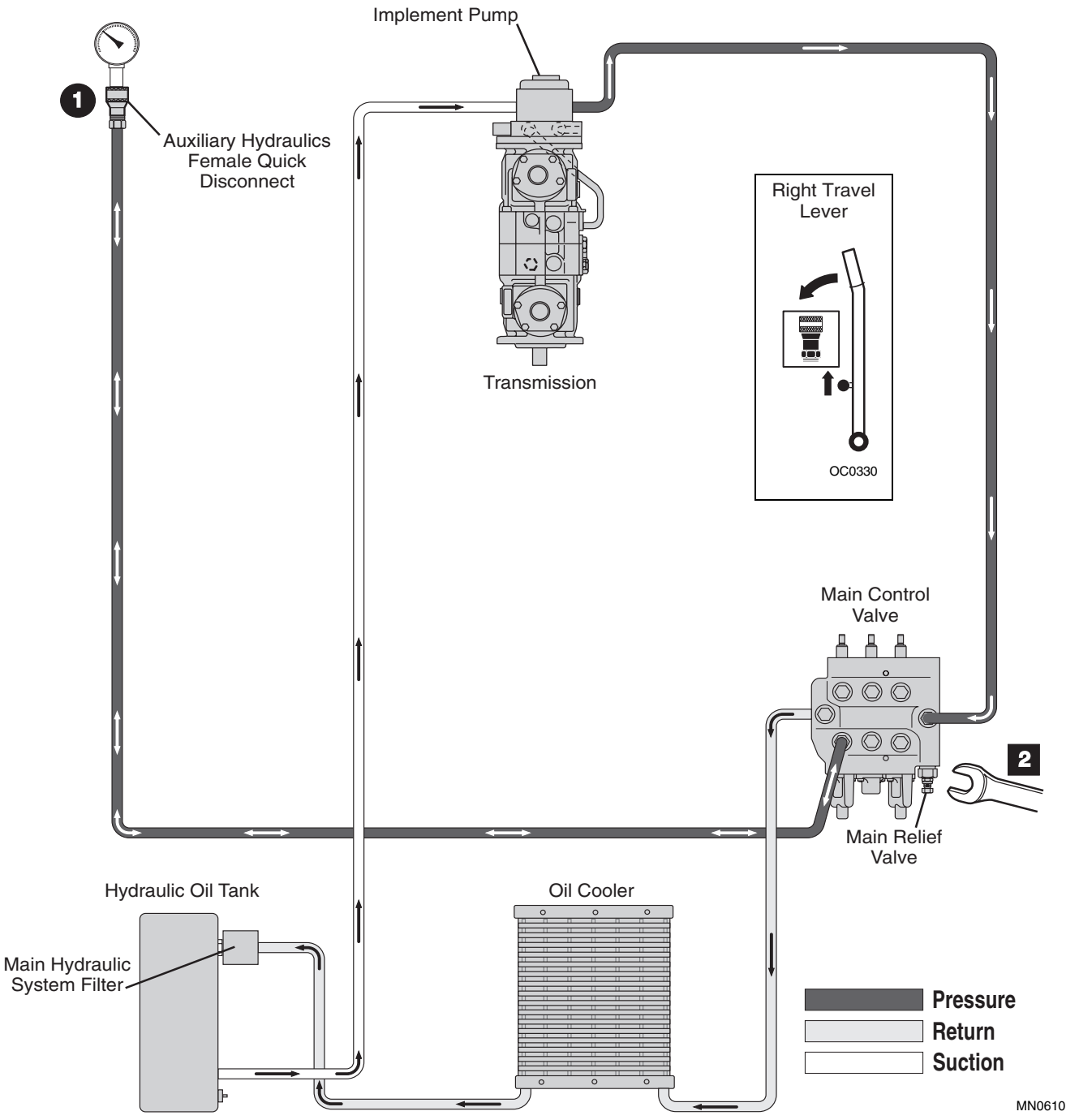


Figure 3-9 Model 1750D Main Control Valve System Relief Test

Models 2000D/DX & 2300D/DX

With a 4000 psi (275,6 bar) pressure gauge installed at test location 1 and engine at full throttle (2600 ±50 rpm); unlock and move the right travel-steering/auxiliary hydraulic control lever to the left (inward) until detent, applying pressure to the auxiliary hydraulic female coupling. The pressure reading for should be 2700 ±50 psi (186 ±3,45 bar) If pressure is not correct, replace or adjust the main relief valve cartridge at location 2.

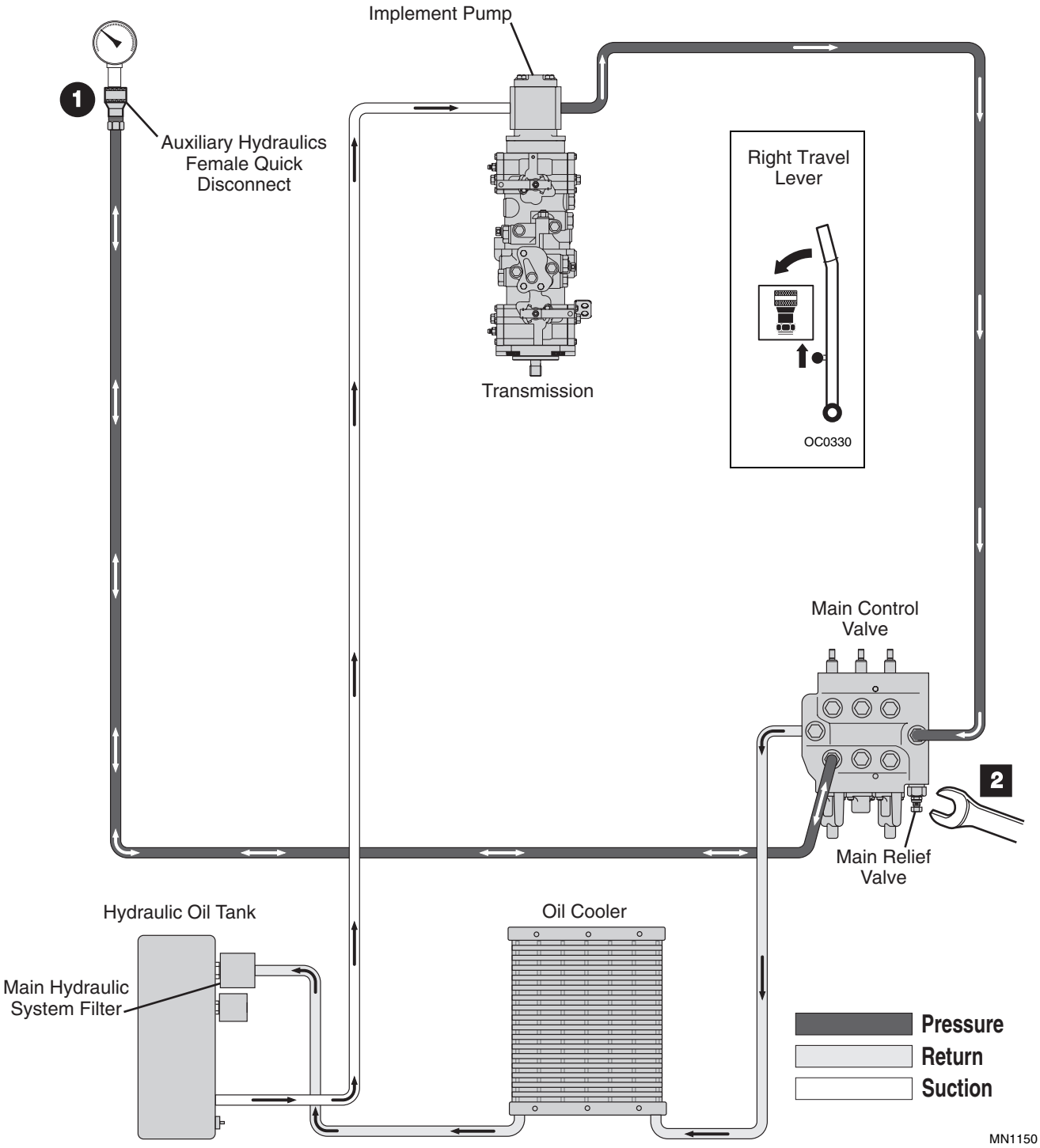


Figure 3-10 Model 2000D/DX & 2300D/DX Main Control Valve System Relief Test

3.4.2 Charge System Pressure Priority Valve Relief Test

Model 1750D

With a 300 psi (20,7 bar) pressure gauge installed with a Tee fitting at test location 1 and engine at idle; hydraulic oil temperature at 125° F (52° C) or above; the pressure reading should be at least 150 psi (10,34 bar) minimum.

If the reading is less than 150 psi (10,34 bar), remove the pressure priority valve, clean, install, and perform the test again. If the reading remains less than 150 psi (10,34 bar), perform the Implement Pump Flow Displacement Test (Refer to Section 3.4.4, Fig. 3-13).

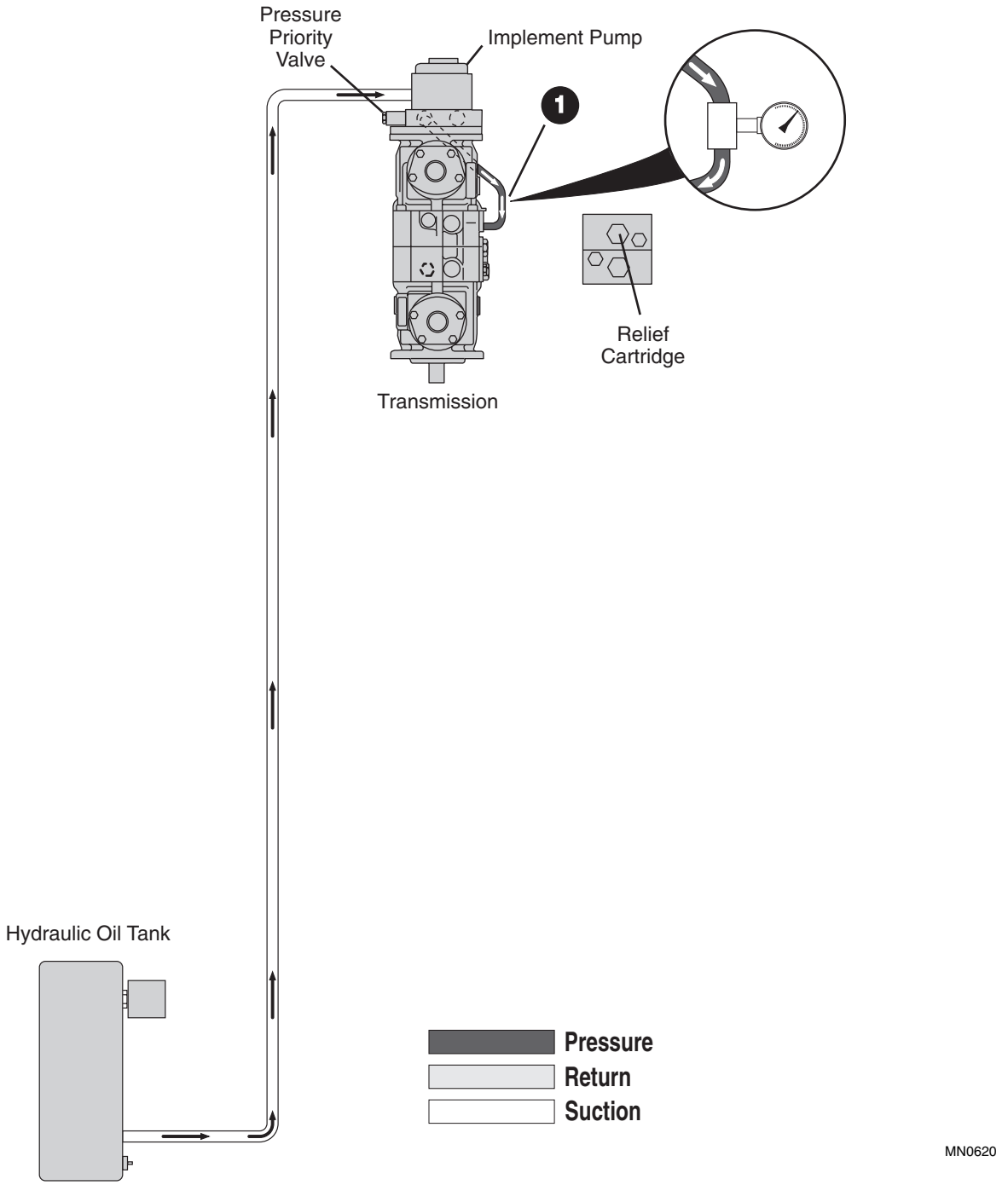


Figure 3-11 Model 1750D Charge System Pressure Priority Valve Relief Test

3.4.3 Charge System Pressure Relief Valve Test

Model 2000D/DX & 2300D/DX

With a 1000 psi (68,9 bar) pressure gauge installed at test location 1 and engine at 1800 ±20 rpm; hydraulic oil temperature at 125° F (52° C) or above; the pressure reading should be at least 285 psi (19,6 bar) minimum for Model 2000D/DX, and 350 psi (24,11 bar) minimum for Model 2300D/DX. If the reading is less than specification, remove the pressure relief valve, clean, install, and/or replace and perform the test again. If the reading remains below specification, adjust the pressure by adding shims as required under the hex cap retaining the relief valve. If the pressure cannot be adjusted to specification with shims, a charge pump failure is possible.

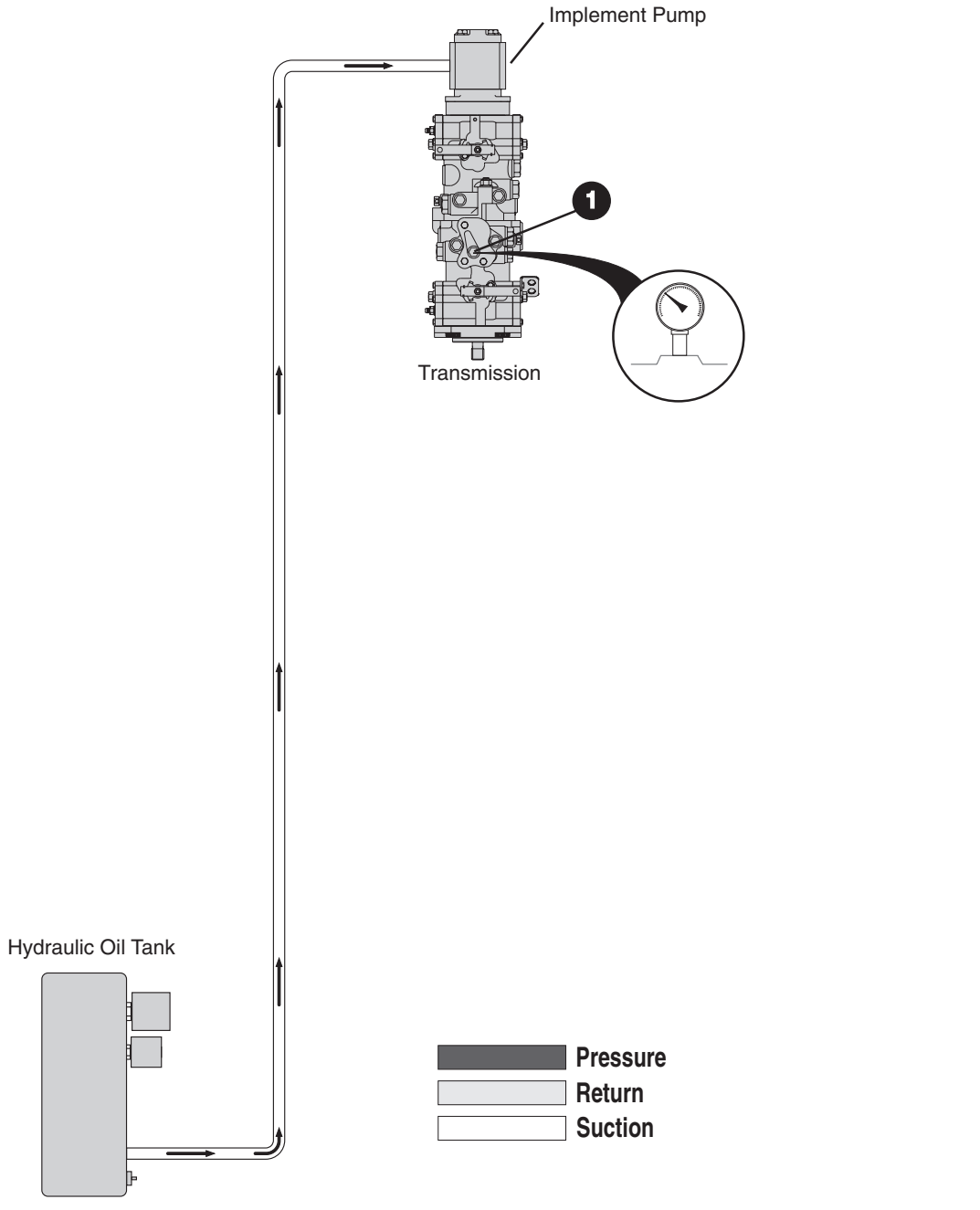


Figure 3-12 Model 2000D/DX & 2300D/DX Charge System Pressure Relief Valve Test

3.4.4 Implement Pump Flow Displacement Test

Model 1750D

With a flow meter and a load valve installed at location 4 and engine at full throttle (2600 ±50 rpm), under a 2500 psi (172 bar) load; the reading should be more than 18.5 gpm (1,16 liter/sec). If the reading is 18.5 gpm (1,16 liter/sec) or less, the implement pump is showing considerable wear and should be replaced.

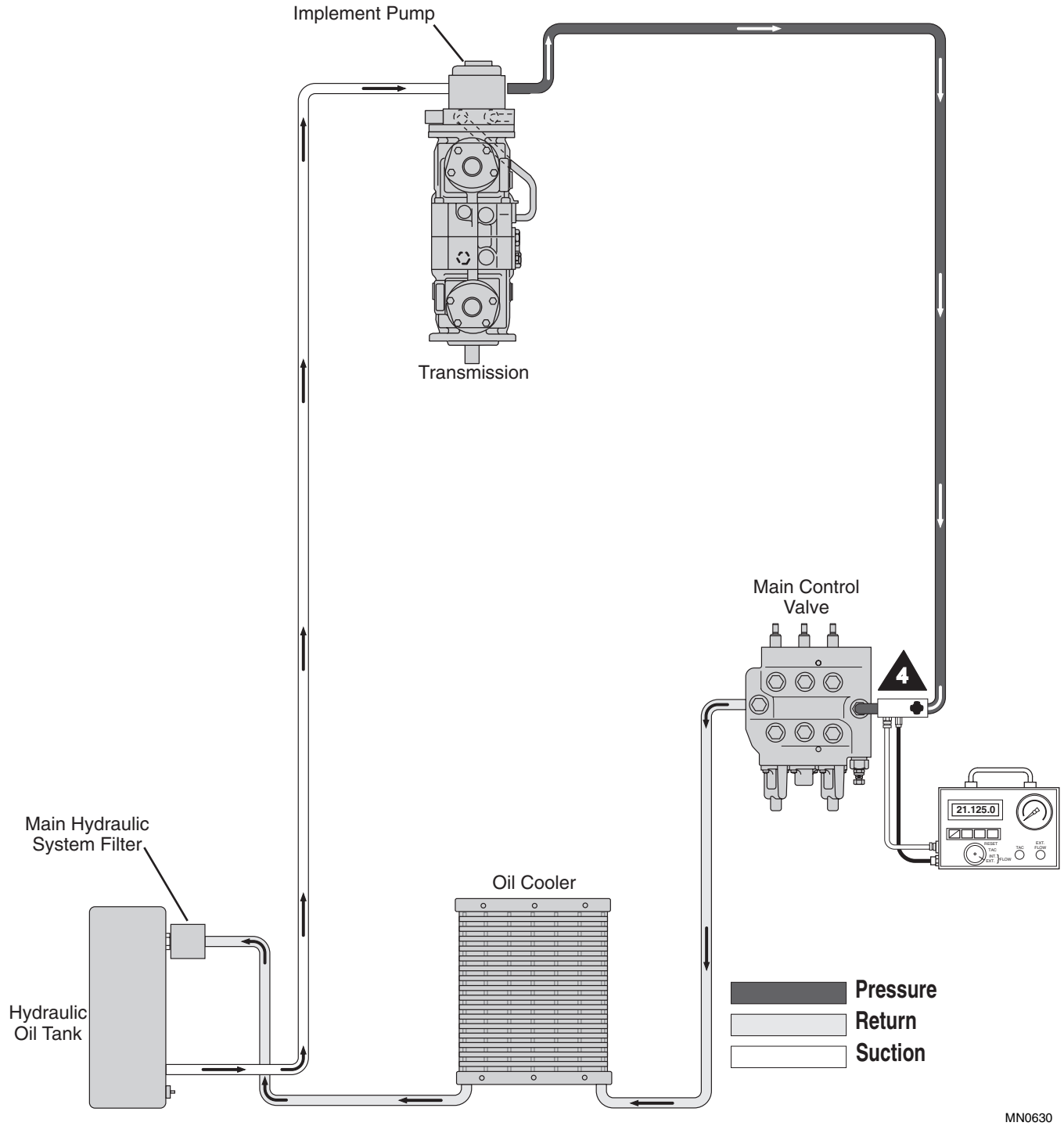


Figure 3-13 Model 1750D Implement Pump Flow Displacement Test

2000D/DX & 2300D/DX

With a flow meter and a load valve installed at location 4 and engine at full throttle (2600 ±50 rpm), under a 2500 psi (172 bar) load; the reading should be more than 18.5 gpm (1,16 liter/sec).

If the reading for Model 2000D/DX is less than 18.5 gpm (1,16 liter/sec), or the reading for Model 2300D/DX is less than 20 gpm (1,26 liter/sec), the implement pump is showing considerable wear and should be replaced.

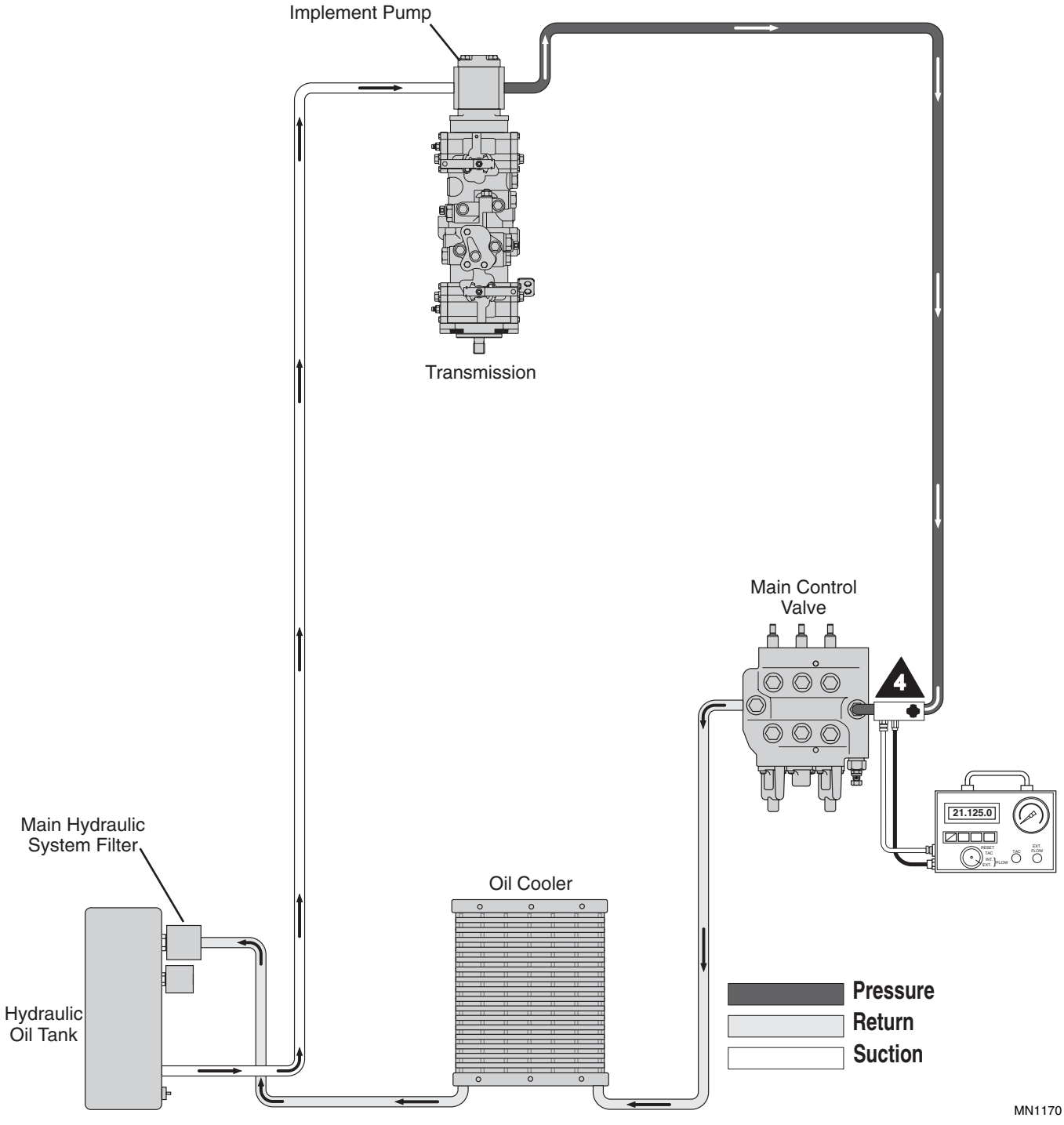


Figure 3-14 Model 2000D/DX & 2300D/DX Implement Pump Flow Displacement Test

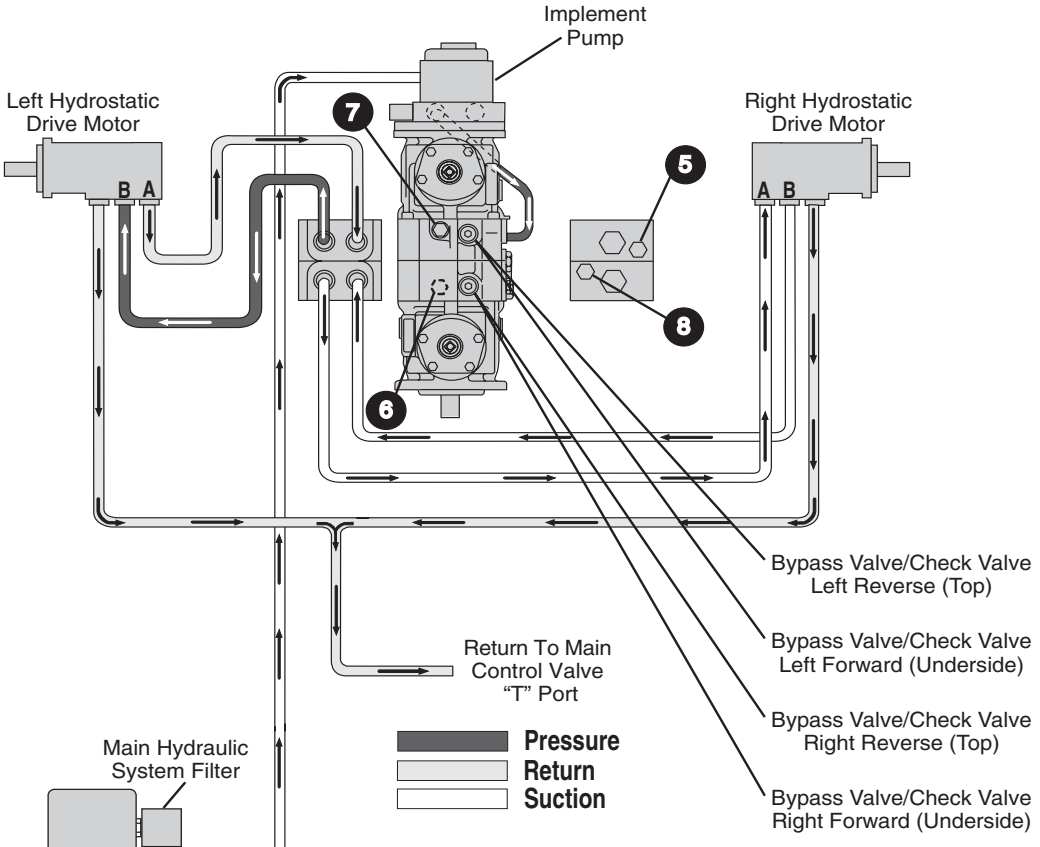
3.4.5 Hydrostatic Control Pump Drive Relief Tests

Model 1750D

There are four bypass valve/check valve cartridges to test in the transmission. Each cartridge is at the same relief pressure and is located as shown for testing.

Example: Oil flow shown is for testing the bypass valve/check valve cartridge for the left motor in forward drive as shown in the shaded area of the travel circuit oil flow chart below. With a 10,000 psi (689 bar) pressure gauge installed at test location 5 and engine at full throttle (2600 ±50 rpm), seat bar up with park lock engaged; stall the travel function by moving the right travel control lever forward until maximum pressure is achieved. The pressure reading should be 4700 +180/-0 psi (323,8 +12,4/-0 bar). The bypass valve/check valve cartridge is not adjustable. If the reading is not correct, replace the cartridge that corresponds to the port being tested.

Follow the travel circuit oil flow chart for testing the other three bypass valve/check valve cartridges with a pressure gauge installed at the other test locations 6, 7, 8. With engine at full throttle, seat bar up and park lock engaged; stall the travel function by moving the left or right travel control lever in the direction indicated in the chart below, until maximum pressure is achieved and the pressure is read.



	HYDROSTATIC CONTROL PUMP					
	LEFT DRIVE (LEFT TRAVEL CONTROL LEVER)			RIGHT DRIVE (RIGHT TRAVEL CONTROL LEVER)		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5	PORT B	PORT A	6	PORT A	PORT B
REVERSE DRIVE	7	PORT A	PORT B	8	PORT B	PORT A

MN0640

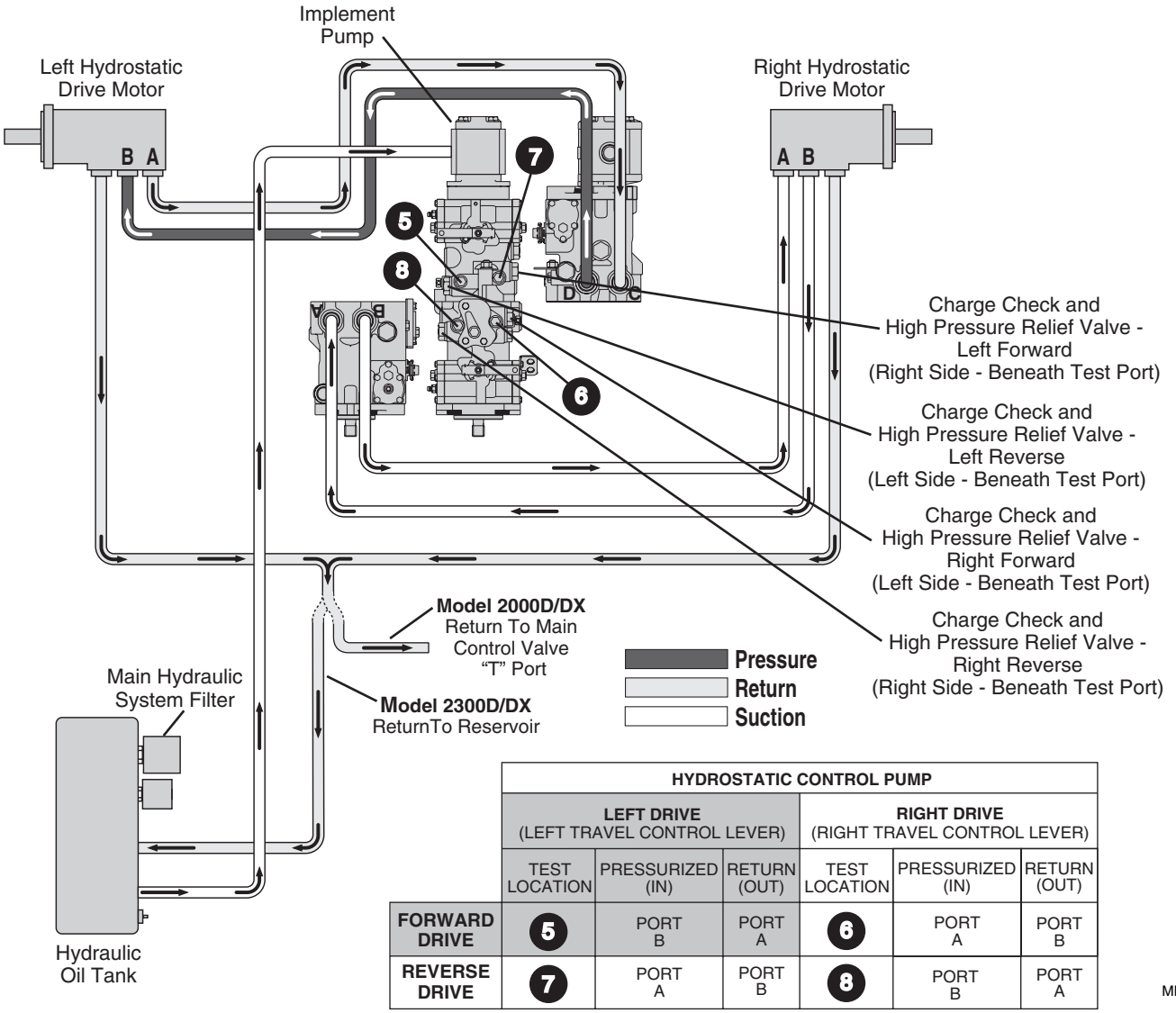
Figure 3-15 Model 1750D Hydrostatic Control Pump Drive Relief Tests

Models 2000D/DX & 2300D/DX

There are four bypass valve/check valve cartridges to test in the transmission. Each cartridge is at the same relief pressure and is located as shown for testing.

Example: Oil flow shown is for testing the bypass valve/check valve cartridge for the left motor in forward drive as shown in the shaded area of the travel circuit oil flow chart below. With a 10,000 psi (689 bar) pressure gauge installed at test location 5 and engine at full throttle (2600 ±50 rpm), seat bar up with park lock engaged; stall the travel function by moving the right travel control lever forward until maximum pressure is obtained. The pressure reading for model 2000D/DX should be 4700 +285/-0 psi (323,8 +19,6/-0 bar), and for model 2300D/DX should be 5000 +350/-0 psi (344,36 +24,11/-0 bar). The bypass valve/check valve cartridge is not adjustable. If the reading is not correct, replace the cartridge that corresponds to the port being tested.

Follow the travel circuit oil flow chart for testing the other three bypass valve/check valve cartridges with a pressure gauge installed at the other test locations 6, 7, 8. With engine at full throttle, seat bar up and park lock engaged; stall the travel function by moving the left or right travel control lever in the direction indicated in the chart below, until maximum pressure is achieved and the pressure is read.



	HYDROSTATIC CONTROL PUMP					
	LEFT DRIVE (LEFT TRAVEL CONTROL LEVER)			RIGHT DRIVE (RIGHT TRAVEL CONTROL LEVER)		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5	PORT B	PORT A	6	PORT A	PORT B
REVERSE DRIVE	7	PORT A	PORT B	8	PORT B	PORT A

MN1180

Figure 3-16 Model 2000D/DX & 2300D/DX Hydrostatic Control Pump Drive Relief Tests

3.4.6 Hydrostatic Drive Motor Test

All Models

Note: *An "Optical Tachometer" is recommended to perform the following test.*

To determine if pump flow tests are necessary, perform the following:

1. The loader must be raised and set on jack stands or blocks with all four wheels off the ground before continuing with this test.
2. Check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. The wheel revolutions from right side to left side of the vehicle must be within 2 rpm.
3. If wheel revolutions are not within the range, check the control linkage for proper adjustment. Adjust the control linkage as required, and repeat Step 2 above.
4. If the control linkage adjustment is correct, and wheel revolutions vary more than 2 rpm from side to side, then proceed with the hydro control pump flow test (Refer to Section 3.4.7, Fig. 3-18 or Fig. 3-19 as appropriate for the model being tested).

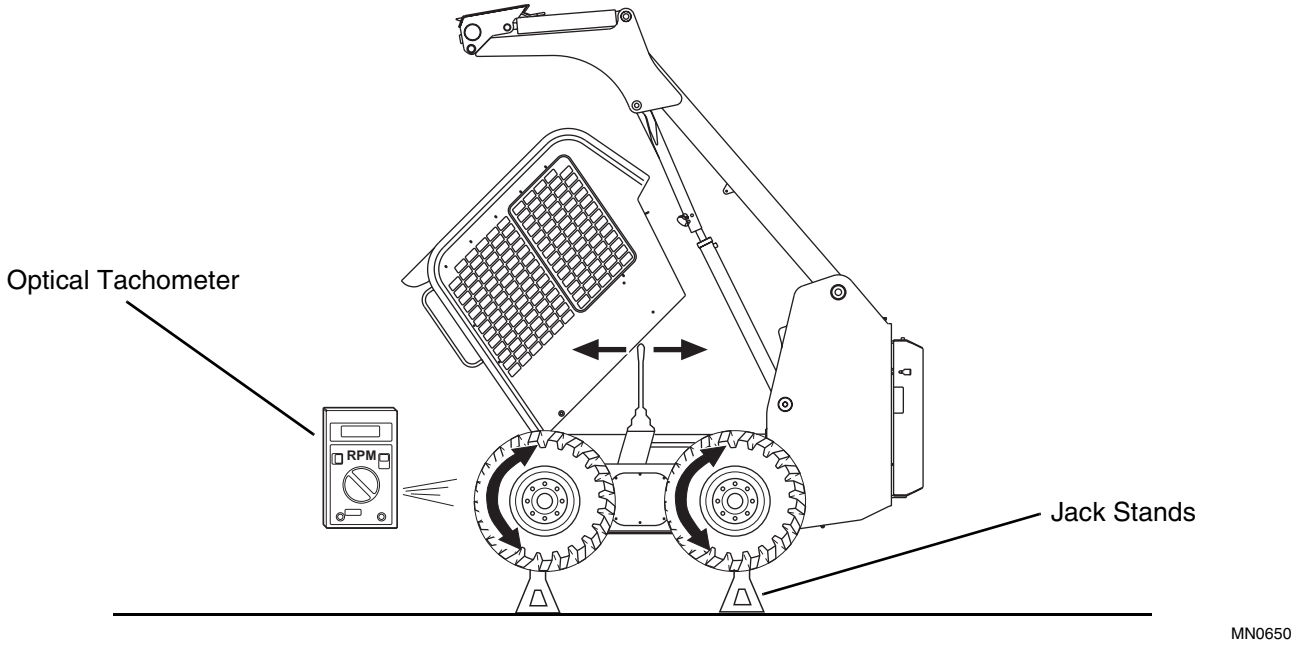


Figure 3-17 Hydrostatic Drive Motor Test

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3.4.7 Hydrostatic Control Pump Flow Displacement Tests

Model 1750D

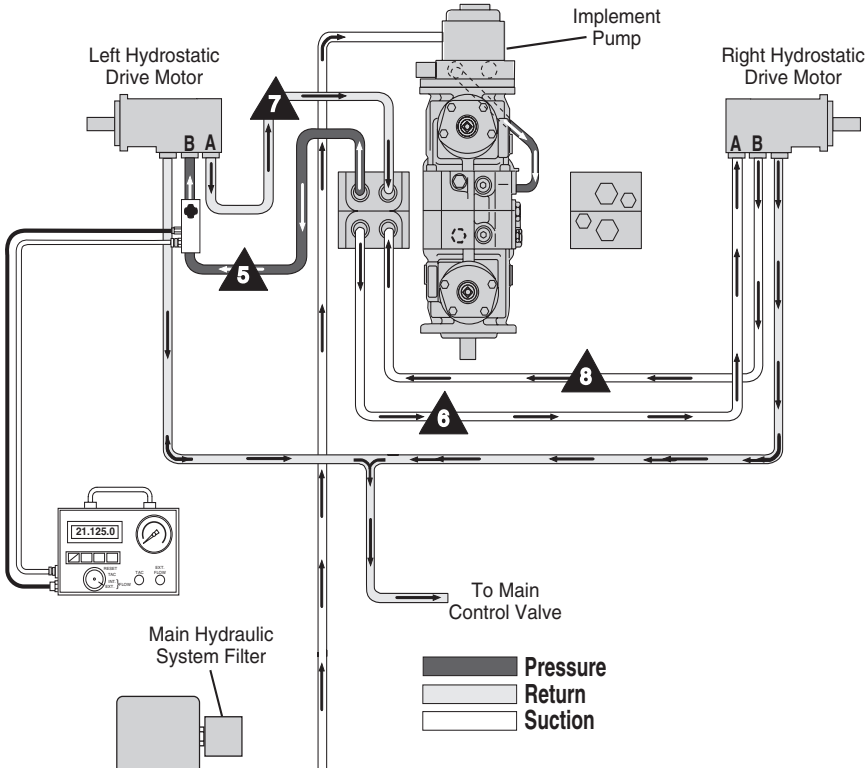
The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the following tests.

There are four hydrostatic flow displacement tests to check the displacement of oil from the right and left hydrostatic control pumps.

Example: Oil flow shown is for testing the oil flow displacement of the left control pump in forward drive as shown in the shaded area of the travel circuit oil flow chart below. With a flow meter and a load valve installed at test location 5 and engine at full throttle (2600 ±50 rpm), under a 2000 psi (137,8 bar) load; the flow meter reading should be higher than 19.5 gpm (1,23 liter/sec). You must move the right travel lever fully forward to get maximum flow reading.

Follow the travel circuit oil flow chart to test the oil flow displacement of the left control pump in reverse drive and the right control pump in forward and reverse drive by installing a flow meter at the other test locations 6, 7, 8. With engine at full throttle under a 2000 psi (137,8 bar) load; the flow meter reading should be higher than 19.5 gpm (1,23 liter/sec). You must move the right or left travel lever forward or rearward as shown in the chart to get flow reading.

If the flow meter reading is 19.5 gpm (1,23 liter/sec) or less in any of the tests, the drive pump is showing considerable wear and should be repaired or replaced.



	HYDROSTATIC CONTROL PUMP					
	LEFT DRIVE (LEFT TRAVEL CONTROL LEVER)			RIGHT DRIVE (RIGHT TRAVEL CONTROL LEVER)		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	
FORWARD DRIVE	5	PORT B	PORT A	6	PORT A	PORT B
REVERSE DRIVE	7	PORT A	PORT B	8	PORT B	PORT A

MN0660

Figure 3-18 Model 1750D Hydrostatic Control Pump Flow Displacement Tests

Models 2000D/DX & 2300D/DX

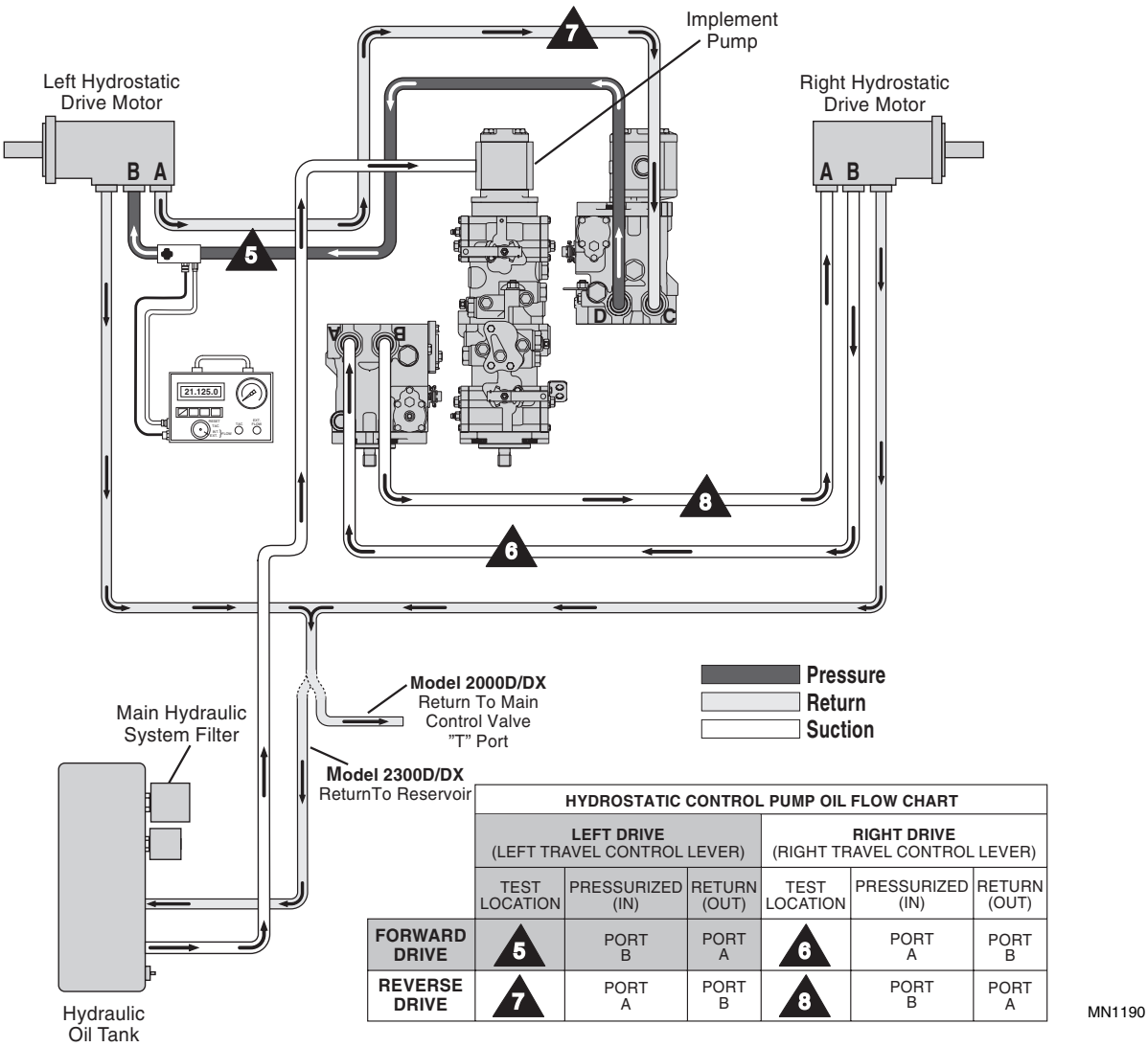
The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the following tests.

There are four hydrostatic flow displacement tests to check the displacement of oil from the right and left hydrostatic control pumps.

Example: Oil flow shown is for testing the oil flow displacement of the left control pump in forward drive as shown in the shaded area of the travel circuit oil flow chart below. With a flow meter and a load valve installed at test location 5 and engine at full throttle (2600 ±50 rpm), under a 2000 psi (137,8 bar) load; the flow meter reading should be higher than 26 gpm (1,79 liter/sec). You must move the right travel lever fully forward to get maximum flow reading.

Follow the travel circuit oil flow chart to test the oil flow displacement of the right control pump in reverse drive and the left control pump in forward and reverse drive by installing a flow meter at the other test locations 6, 7, 8. With engine at full throttle, the flow meter reading should higher than 26 gpm (1,79 liter/sec). You must move the right or left travel lever as shown in the chart below to get flow reading.

If the flow meter reading is 26 gpm (1,79 liter/sec) or less in any of the tests, the drive pump is showing considerable wear and should be repaired or replaced.



HYDROSTATIC CONTROL PUMP OIL FLOW CHART						
	LEFT DRIVE (LEFT TRAVEL CONTROL LEVER)			RIGHT DRIVE (RIGHT TRAVEL CONTROL LEVER)		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5	PORT B	PORT A	6	PORT A	PORT B
REVERSE DRIVE	7	PORT A	PORT B	8	PORT B	PORT A

MN1190

Figure 3-19 Model 2000D/DX & 2300D/DX Hydrostatic Control Pump Flow Displacement Tests

3.4.8 High Flow Valve Relief Test

Models 2000DX & 2300DX

With a 4000 psi (275,6 bar) pressure gauge installed at test location 10, engine at full throttle (2600 ±50 rpm) and the high flow switch ON; the pressure reading should be 3000 ± 50 psi (206,6 ± 3,4 bar). If the pressure reading is not correct, replace or adjust the relief valve cartridge at location 11.

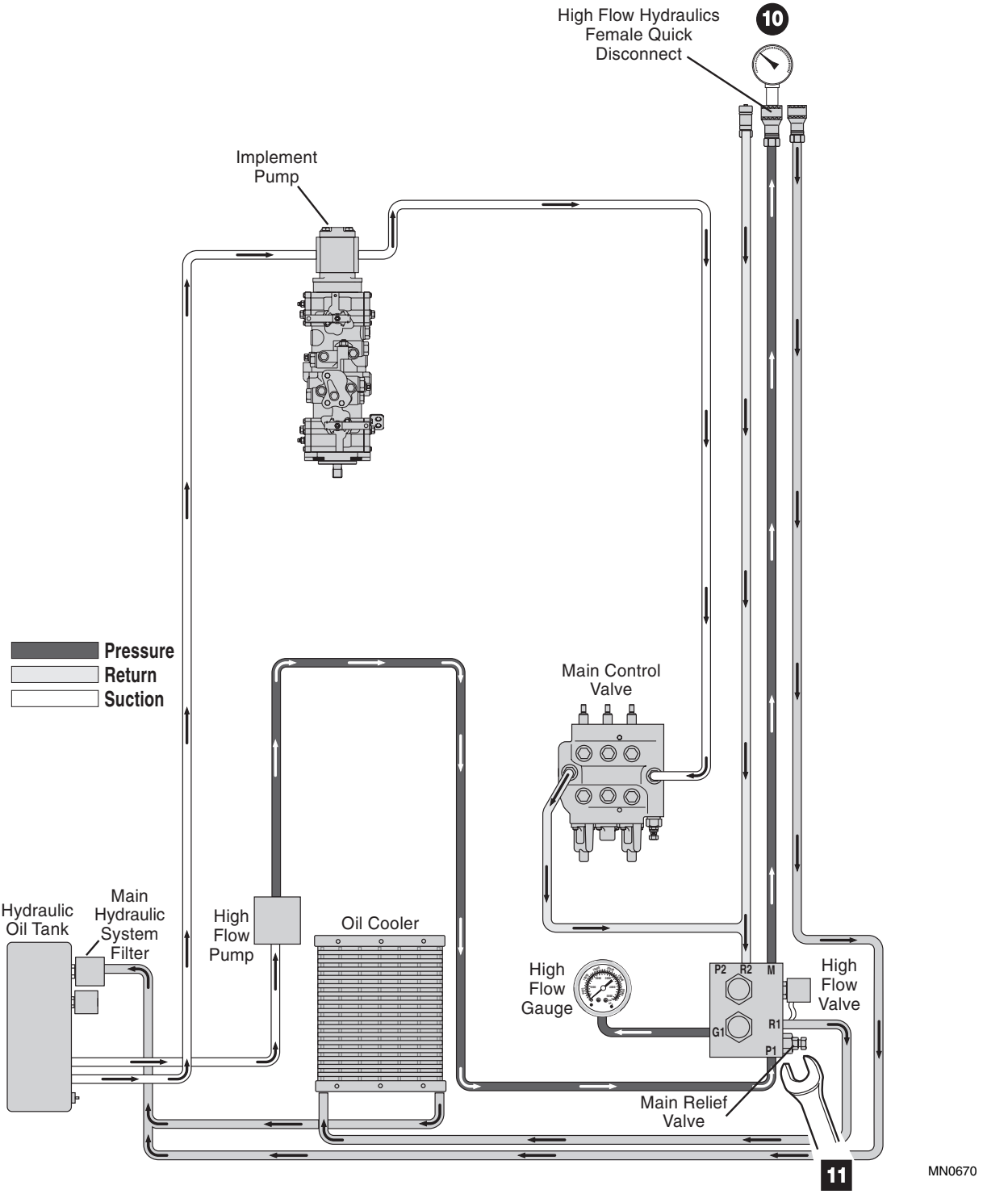


Figure 3-20 Model 2000D/DX & 2300D/DX High Flow Valve Relief Test

3.4.9 High Flow Pump Flow Displacement Test

Models 2000DX & 2300DX

With a flow meter and a load valve installed at location 12 and engine at full throttle (2600 ±50 rpm), under a 2500 psi (172 bar) load; the reading should be higher than 30 gpm (1,89 liter/sec). If the reading is 30 gpm (1,89 liter/sec) or less, the pump is showing considerable wear and should be replaced.

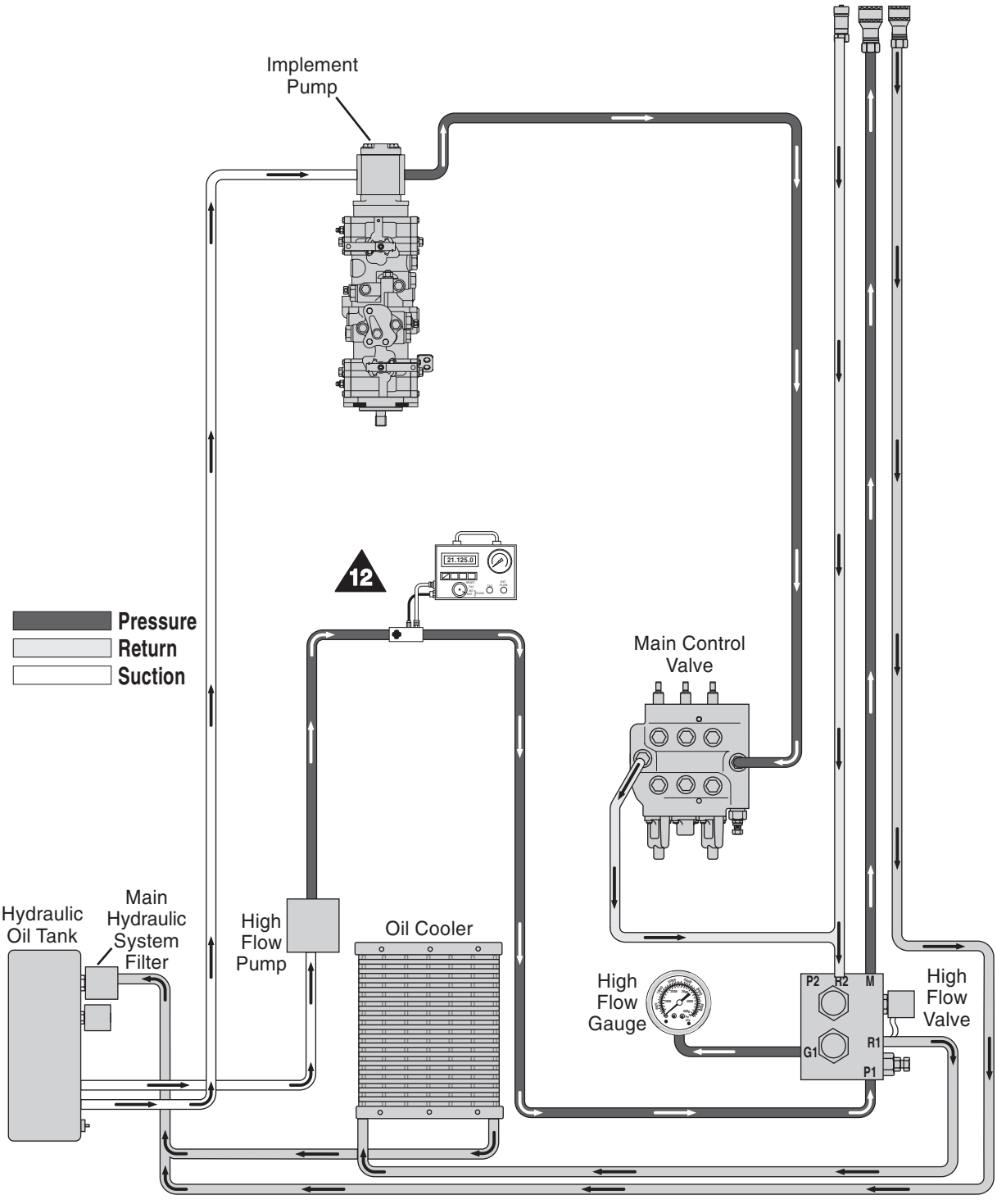


Figure 3-21 Model 2000D/DX & 2300D/DX High Flow Pump Flow Displacement Test

3.5 HYDRAULIC SYSTEM TESTING

3.5.1 Model 1750D Testing

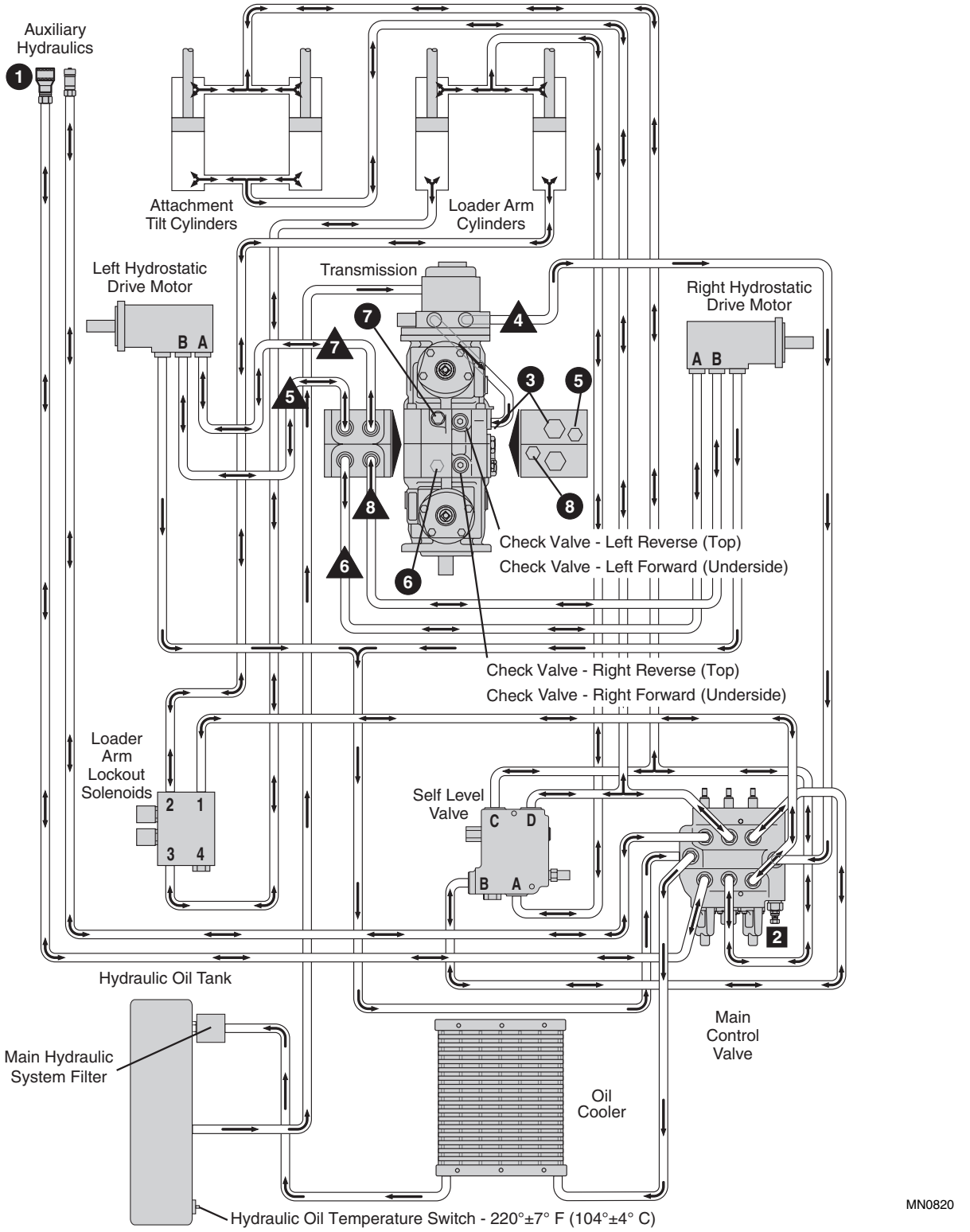


Figure 3-22 Models 1750D Hydraulic System Testing

Equipment Needed To Perform Tests - From Hydraulic Diagnostic Test Kit

Circuit	Gauge	Fittings
1	4,000 psi Gauge (275,6 bar)	Quick Disconnect - Flat Face Connector STR SAE 8-8 PD38TX Test Nipple
3	300 psi Gauge (20,7 bar)	#8 Run Tee Swivel Nut PD38TX Test Nipple
5 6 7 8	10,000 psi Gauge (689 bar)	PD-361 O-ring Test Nipple
5 6 7 8	Flow Meter **(See Note)** Load Valve **(See Note)**	**IMPORTANT:** The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the flow tests. To determine if pump flow tests are necessary, check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. If wheel revolutions are not within the range, verify the control linkage for proper adjustment. If correct then proceed with the control pump flow test.

HYDRO CONTROL PUMP OIL FLOW CHART

	LEFT DRIVE			RIGHT DRIVE		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5 5	Port B	Port A	6 6	Port A	Port B
REVERSE DRIVE	7 7	Port A	Port B	8 8	Port B	Port A

Note: To check flow readings a flow meter capable of measuring 60 gpm (3,8 liter/sec) and a load valve capable of 6000 psi (413,4 bar) will be required (not included with Hydraulic Diagnostic Test Kit).

Engine Full Throttle = 2600 ± 50 rpm

Hydraulic oil temperature for the following tests should be 125° F (52° C) or higher.

TEST LOCATION	ADJUST. LOCATION	COMPONENT DESCRIPTION	PRESSURE AND FLOW READINGS	PRESSURE AND FLOW TEST PROCEDURES
1	2	Main Control Valve System Relief	2700 ± 50 psi (186 ± 3,45 bar)	Check with the engine at full throttle (2600 ± 50 rpm); move right travel lever inward. If pressure is not correct, replace or adjust the main relief valve cartridge.
3	N/A	Charge System Pres. Priority Relief	150 psi (10,34 bar) Minimum	Check the pressure with the engine at idle. The charge relief valve cartridge is not adjustable and requires replacement if the pressure is not correct.
4	N/A	Implement Pump Flow **(See Note)**	21 - 18.5 gpm (1,32 - 1,16 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 18.5 gpm (1,16 liter/sec) or less, the implement pump should be repaired or replaced.
5 6 7 8	N/A	Hydro Control Pump Drive Relief	4700 + 180/-0 psi (323,8 + 12,4/-0 bar)	Check with the engine at full throttle (2600 ± 50 rpm), seat bar up with park lock engaged; stall the travel function by moving the travel control lever forward or reverse **(refer to Hydro Control Pump Flow chart).** The bypass valve/check valve is not adjustable and requires replacement of the cartridge if pressure is not correct. If this fails to correct the condition, it may be necessary to perform the hydro pump flow test.
5 6 7 8	N/A	Hydro Control Pump Flow **(See Note)**	24.5 - 19.5 gpm (1,55 - 1,23 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2000 psi (137,8 bar) load; you must move the right or left travel lever fully forward or rearward as shown in the **Hydro Control Pump Flow chart** to get a flow reading. If the reading is 19 gpm (1,23 liter/sec) or less, the drive pump should be repaired or replaced.

3.5.2 Model 2000D Testing

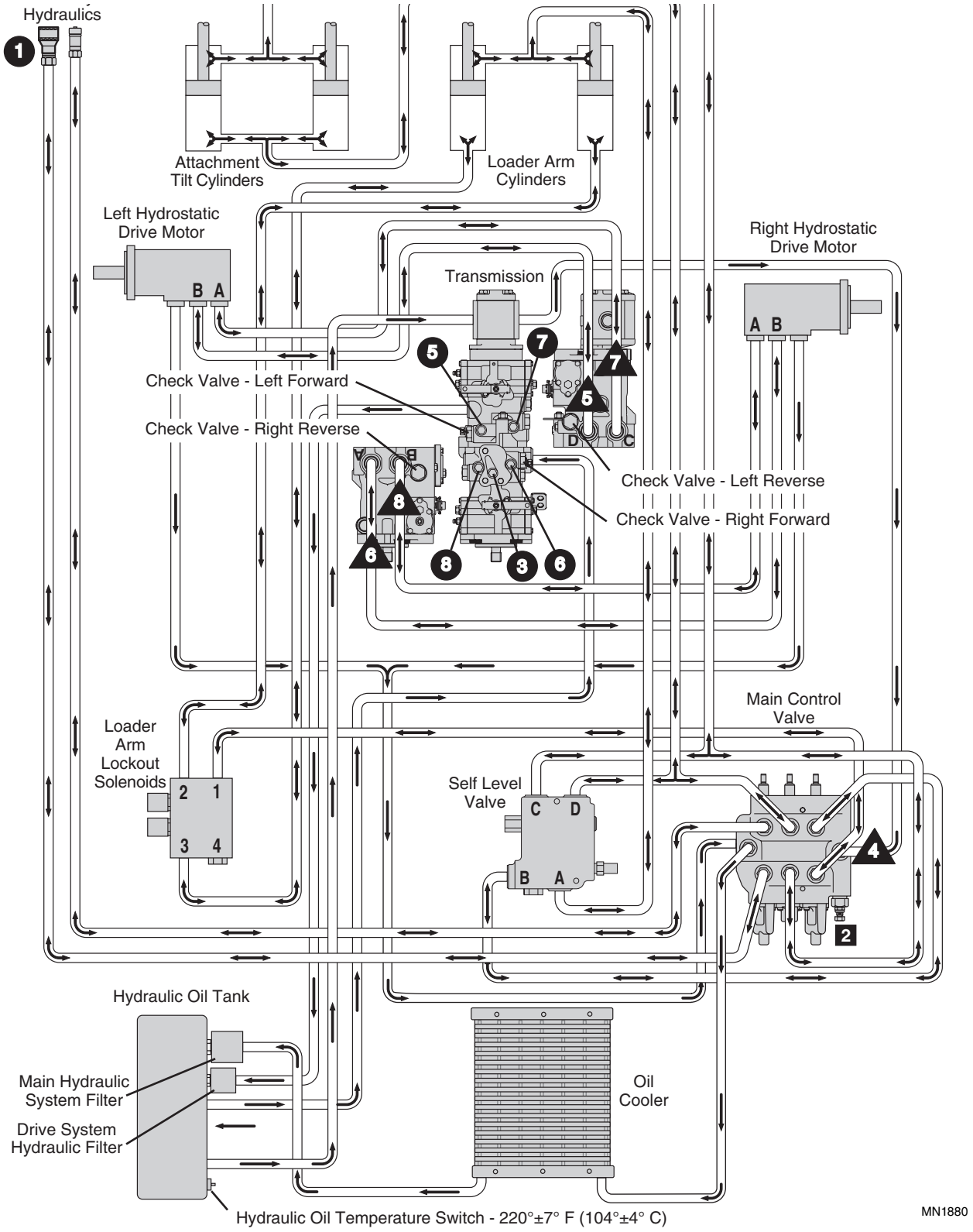


Figure 3-23 Model 2000D Hydraulic System Testing

Equipment Needed To Perform Tests - From Hydraulic Diagnostic Test Kit

Circuit	Gauge	Fittings
1	4,000 psi Gauge (275,6 bar)	Quick Disconnect - Flat Face Connector STR SAE 8-8 PD38TX Test Nipple
3	1,000 psi Gauge (68,9 bar)	#12 Run Tee Swivel Nut Reducer #16-8 PD38TX Test Nipple
5 6 7 8	10,000 psi Gauge (689 bar)	PD-361 O-ring Test Nipple
4 5 6 7 8	Flow Meter **(See Note)** Load Valve **(See Note)**	**IMPORTANT:** The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the flow tests. To determine if pump flow tests are necessary, check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. If wheel revolutions are not within the range, verify the control linkage for proper adjustment. If correct then proceed with the control pump flow test.

HYDRO CONTROL PUMP OIL FLOW CHART

	LEFT DRIVE			RIGHT DRIVE		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5 5	Port B	Port A	6 6	Port A	Port B
REVERSE DRIVE	7 7	Port A	Port B	8 8	Port B	Port A

Note: To check flow readings a flow meter capable of measuring 60 gpm (3,8 liter/sec) and a load valve capable of 6000 psi (413,4 bar) will be required (not included with Hydraulic Diagnostic Test Kit).

Engine Full Throttle = 2600 ± 50 rpm

Hydraulic oil temperature for the following tests should be 125° F (52° C) or higher.

TEST LOCATION	ADJUST. LOCATION	COMPONENT DESCRIPTION	PRESSURE AND FLOW READINGS	PRESSURE AND FLOW TEST PROCEDURES
1	2	Main Control Valve System Relief	2700 ± 50 psi (186 ± 3,45 bar)	Check with the engine at full throttle (2600 ± 50 rpm); move right travel lever inward. If pressure is not correct, replace or adjust the main relief valve cartridge.
3	N/A	Charge System Pres. Priority Relief	285 psi (19,63 bar) Minimum	Check the pressure with the engine at 1800 ± 20 rpm. The priority relief valve cartridge is adjustable. If the pressure is not correct, shim as required and/or replace cartridge.
4	N/A	Implement Pump Flow **(See Note)**	21.0 - 18.5 gpm (1,32 - 1,16 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 18.5 gpm (1,16 liter/sec) or less, the implement pump should be repaired or replaced.
5 6 7 8	N/A	Hydro Control Pump Drive Relief	4700 + 285/-0 psi (323,8 + 19,63/-0 bar)	Check with the engine at full throttle (2600 ± 50 rpm), seat bar up with park lock engaged; stall the travel function by moving the travel control lever forward or reverse **(refer to Hydro Control Pump Flow chart).** The bypass valve/check valve is not adjustable and requires replacement of the cartridge if pressure is not correct. If this fails to correct the condition, it may be necessary to perform the hydro pump flow test.
5 6 7 8	N/A	Hydro Control Pump Flow **(See Note)**	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2000 psi (137,8 bar) load; you must move the right or left travel lever fully forward or rearward as shown in the **Hydro Control Pump Flow chart** to get a flow reading. If the reading is 26.0 gpm (1,79 liter/sec) or less, the drive pump should be repaired or replaced.

3.5.3 Model 2000DX Testing

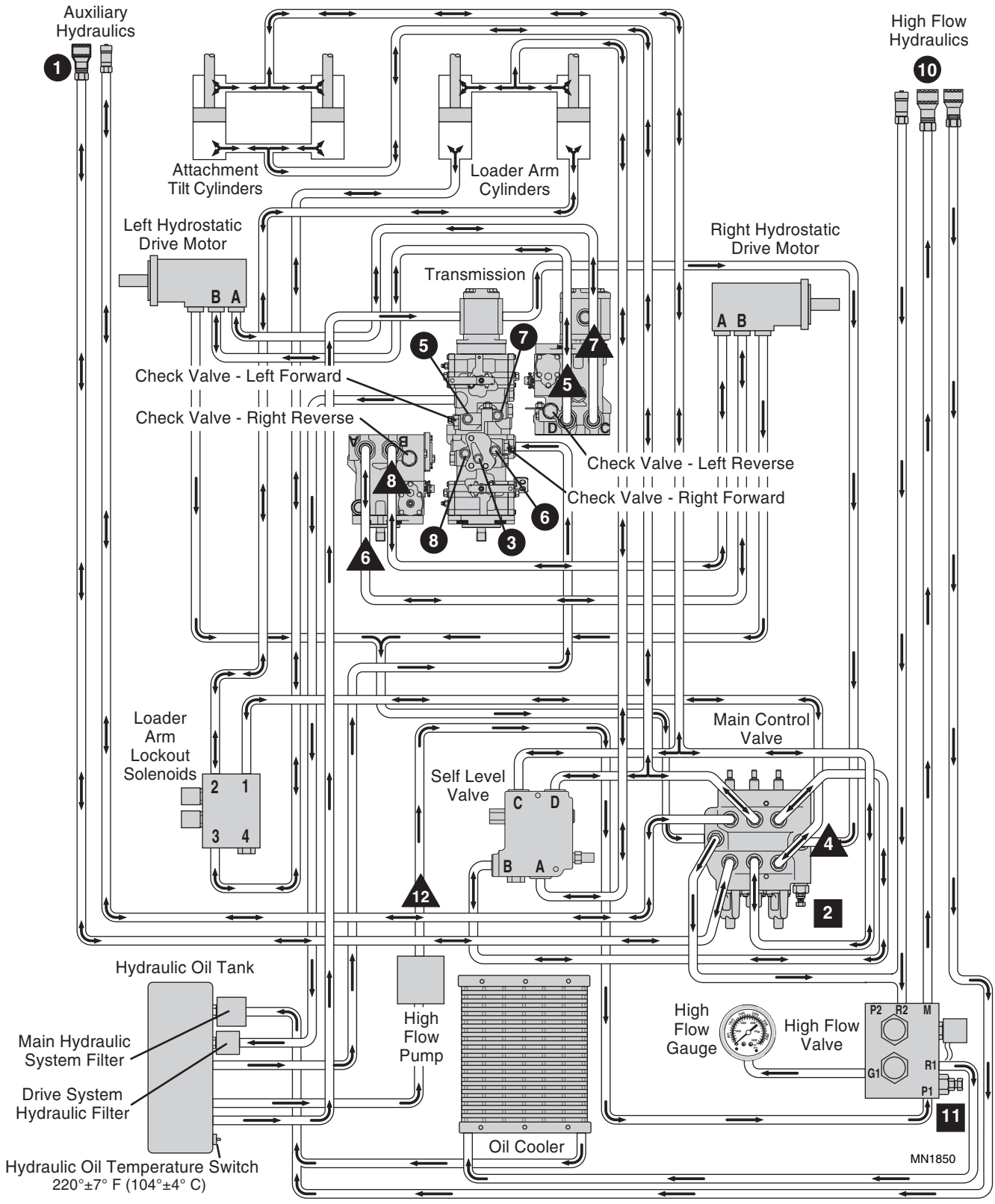


Figure 3-24 Model 2000DX Hydraulic System Testing

Equipment Needed To Perform Tests - From Hydraulic Diagnostic Test Kit

Circuit	Gauge	Fittings
1	4,000 psi Gauge (275,6 bar)	Quick Disconnect - Flat Face Connector STR SAE 8-8 PD38TX Test Nipple
3	1,000 psi Gauge (68,9 bar)	#12 Run Tee Swivel Nut Reducer #16-8 PD38TX Test Nipple
5 6 7 8	10,000 psi Gauge (689 bar)	PD-361 O-ring Test Nipple
10	4,000 psi Gauge (275,6 bar)	Quick Disconnect-male 12-12P Connector Str. SAE 12-12 Tube End Reducer #12-8 PD38TX Test Nipple
4 5 6 7 8	Flow Meter **(See Note)** Load Valve **(See Note)**	**IMPORTANT:** The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the flow tests. To determine if pump flow tests are necessary, check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. If wheel revolutions are not within the range, verify the control linkage for proper adjustment. If correct then proceed with the control pump flow test.

HYDRO CONTROL PUMP OIL FLOW CHART

	LEFT DRIVE			RIGHT DRIVE		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5 5	Port B	Port A	6 6	Port A	Port B
REVERSE DRIVE	7 7	Port A	Port B	8 8	Port B	Port A

Note: To check flow readings a flow meter capable of measuring 60 gpm (3,8 liter/sec) and a load valve capable of 6000 psi (413,4 bar) will be required (not included with Hydraulic Diagnostic Test Kit).

Engine Full Throttle = 2600 ± 50 rpm

Hydraulic oil temperature for the following tests should be 125° F (52° C) or higher.

TEST LOCATION	ADJUST. LOCATION	COMPONENT DESCRIPTION	PRESSURE AND FLOW READINGS	PRESSURE AND FLOW TEST PROCEDURES
1	2	Main Control Valve System Relief	2700 ± 50 psi (186 ± 3,45 bar)	Check with the engine at full throttle (2600 ± 50 rpm); move right travel lever inward. If pressure is not correct, replace or adjust the main relief valve cartridge.
3	N/A	Charge System Pres. Priority Relief	285 psi (19,63 bar) Minimum	Check the pressure with the engine at 1800 ± 20 rpm. The priority relief valve cartridge is adjustable. If the pressure is not correct, shim as required and/or replace cartridge.
4	N/A	Implement Pump Flow **(See Note)**	21.0 - 18.5 gpm (1,32 - 1,16 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 18.5 gpm (1,16 liter/sec) or less, the implement pump should be repaired or replaced.
5 6 7 8	N/A	Hydro Control Pump Drive Relief	4700 + 285/-0 psi (323,8 + 19,63/-0 bar)	Check with the engine at full throttle (2600 ± 50 rpm), seat bar up with park lock engaged; stall the travel function by moving the travel control lever forward or reverse **(refer to Hydro Control Pump Flow chart).** The bypass valve/check valve is not adjustable and requires replacement of the cartridge if pressure is not correct. If this fails to correct the condition, it may be necessary to perform the hydro pump flow test.
5 6 7 8	N/A	Hydro Control Pump Flow **(See Note)**	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2000 psi (137,8 bar) load; you must move the right or left travel lever fully forward or rearward as shown in the **Hydro Control Pump Flow chart** to get a flow reading. If the reading is 26.0 gpm (1,79 liter/sec) or less, the drive pump should be repaired or replaced.
10	11	High Flow Valve Relief	3000 ± 50 psi (206,6 ± 3,4 bar)	Check pressure with the high flow switch ON and engine at full throttle. If pressure is not correct, adjust or replace the relief valve cartridge.
12	N/A	High Flow Pump Flow **(See Note)**	31.0 - 30.0 gpm (1,96 - 1,89 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 30 gpm (1,89 liter/sec) or less, the high flow pump should be repaired or replaced.

3.5.4 Model 2300D Testing

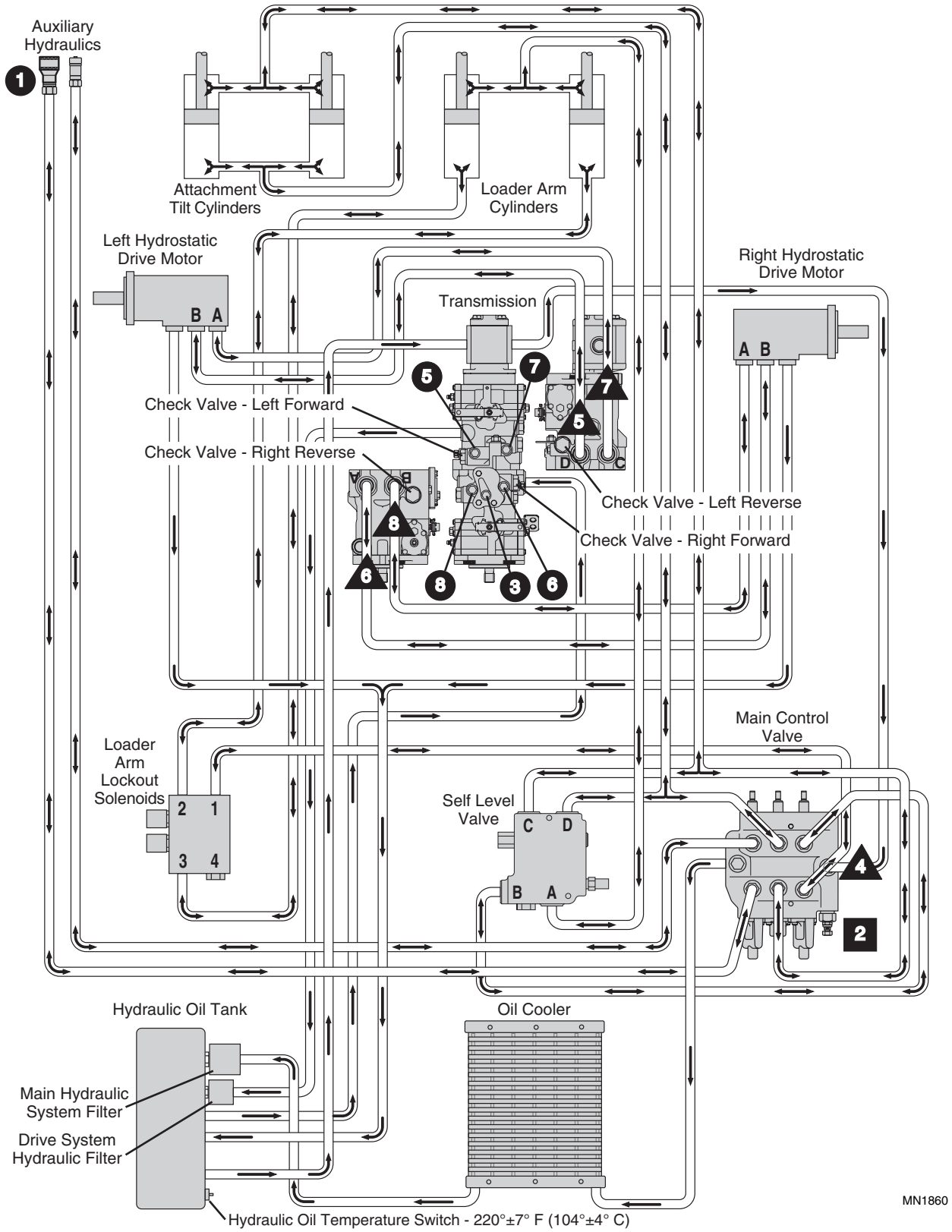


Figure 3-25 Models 2300D Hydraulic System Testing

Equipment Needed To Perform Tests - From Hydraulic Diagnostic Test Kit

Circuit	Gauge	Fittings
1	4,000 psi Gauge (275,6 bar)	Quick Disconnect - Flat Face Connector STR SAE 8-8 PD38TX Test Nipple
3	1,000 psi Gauge (68,9 bar)	#12 Run Tee Swivel Nut Reducer #16-8 PD38TX Test Nipple
5 6 7 8	10,000 psi Gauge (689 bar)	PD-361 O-ring Test Nipple
4 5 6 7 8	Flow Meter **(See Note)** Load Valve **(See Note)**	**IMPORTANT:** The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the flow tests. To determine if pump flow tests are necessary, check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. If wheel revolutions are not within the range, verify the control linkage for proper adjustment. If correct then proceed with the control pump flow test.

HYDRO CONTROL PUMP OIL FLOW CHART

	LEFT DRIVE			RIGHT DRIVE		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5 5	Port B	Port A	6 6	Port A	Port B
REVERSE DRIVE	7 7	Port A	Port B	8 8	Port B	Port A

Note: To check flow readings a flow meter capable of measuring 60 gpm (3,8 liter/sec) and a load valve capable of 6000 psi (413,4 bar) will be required (not included with Hydraulic Diagnostic Test Kit).

Engine Full Throttle = 2600 ± 50 rpm

Hydraulic oil temperature for the following tests should be 125° F (52° C) or higher.

TEST LOCATION	ADJUST. LOCATION	COMPONENT DESCRIPTION	PRESSURE AND FLOW READINGS	PRESSURE AND FLOW TEST PROCEDURES
1	2	Main Control Valve System Relief	2700 ± 50 psi (186 ± 3,45 bar)	Check with the engine at full throttle (2600 ± 50 rpm); move right travel lever inward. If pressure is not correct, replace or adjust the main relief valve cartridge.
3	N/A	Charge System Pres. Priority Relief	350 psi (24,11 bar) Minimum	Check the pressure with the engine at 1800 ± 20 rpm. The priority relief valve cartridge is adjustable. If pressure is not correct, shim as required and/or replace the cartridge.
4	N/A	Implement Pump Flow **(See Note)**	23.0 - 20.0 gpm (1,45 - 1,26 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 20 gpm (1,26 liter/sec) or less, the implement pump should be repaired or replaced.
5 6 7 8	N/A	Hydro Control Pump Drive Relief	5000 + 350/-0 psi (344,36 + 24,1/-0 bar)	Check with the engine at full throttle (2600 ± 50 rpm), seat bar up with park lock engaged; stall the travel function by moving the travel control lever forward or reverse **(refer to Hydro Control Pump Flow chart).** The bypass valve/check valve is not adjustable and requires replacement of the cartridge if pressure is not correct. If this fails to correct the condition, it may be necessary to perform the hydro pump flow test.
5 6 7 8	N/A	Hydro Control Pump Flow **(See Note)**	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2000 psi (137,8 bar) load; you must move the right or left travel lever fully forward or rearward as shown in the **Hydro Control Pump Flow chart** to get a flow reading. If the reading is 26.0 gpm (1,79 liter/sec) or less, the drive pump should be repaired or replaced.

3.5.5 Model 2300DX Testing

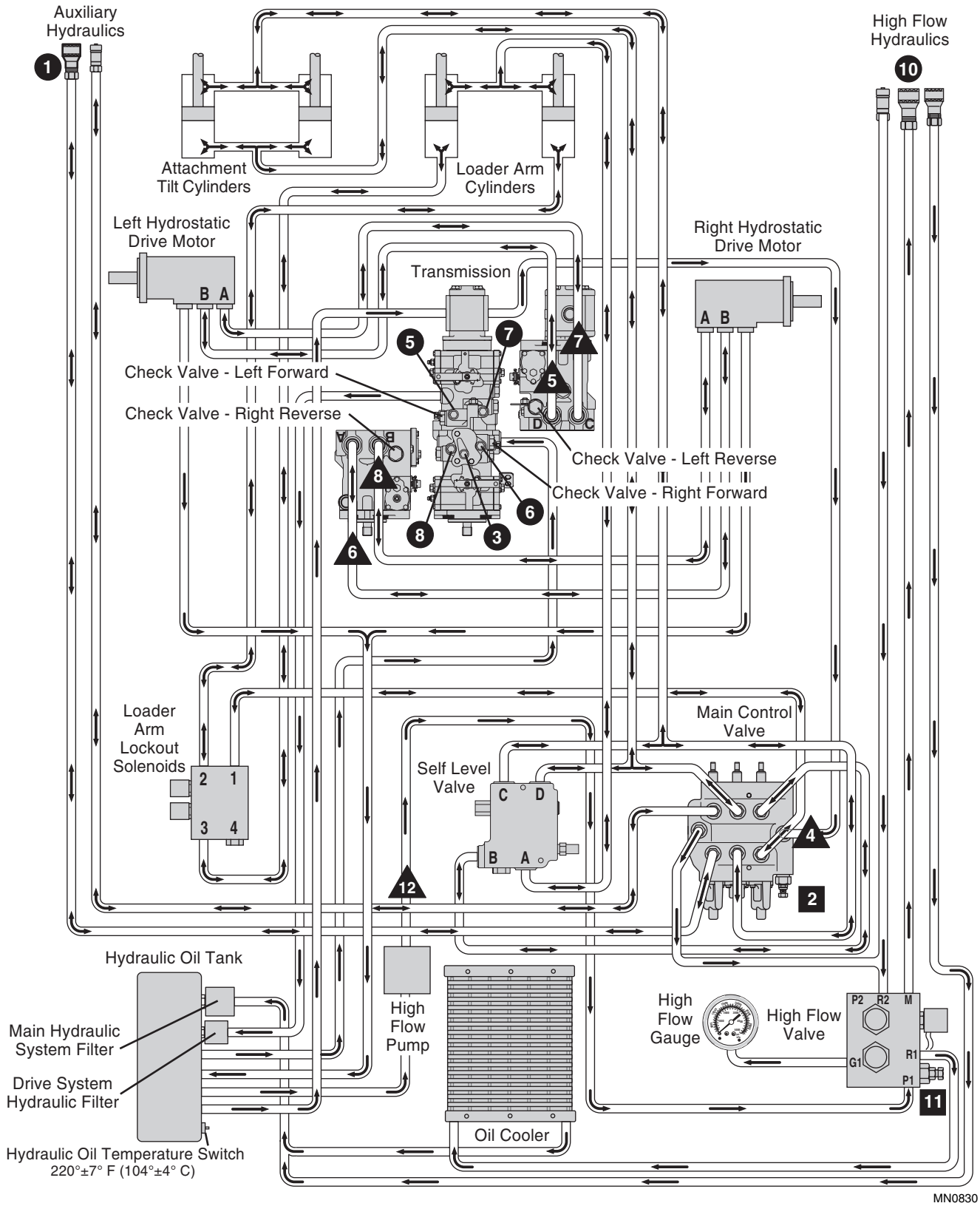


Figure 3-26 Models 2300DX Hydraulic System Testing

Equipment Needed To Perform Tests - From Hydraulic Diagnostic Test Kit

Circuit	Gauge	Fittings
1	4,000 psi Gauge (275,6 bar)	Quick Disconnect - Flat Face Connector STR SAE 8-8 PD38TX Test Nipple
3	1,000 psi Gauge (68,9 bar)	#12 Run Tee Swivel Nut Reducer #16-8 PD38TX Test Nipple
5 6 7 8	10,000 psi Gauge (689 bar)	PD-361 O-ring Test Nipple
10	4,000 psi Gauge (275,6 bar)	Quick Disconnect-male 12-12P Connector Str. SAE 12-12 Tube End Reducer #12-8 PD38TX Test Nipple
4 5 6 7 8	Flow Meter **(See Note)** Load Valve **(See Note)**	**IMPORTANT:** The loader must be raised and set on jack stands or blocks with all four wheels off the ground to perform the flow tests. To determine if pump flow tests are necessary, check the wheel revolutions at full throttle (2600 ±50 rpm). The wheels should turn at 68-70 rpm (dependent on engine full throttle) with the lever fully stroked in forward or reverse. If wheel revolutions are not within the range, verify the control linkage for proper adjustment. If correct then proceed with the control pump flow test.

HYDRO CONTROL PUMP OIL FLOW CHART

	LEFT DRIVE			RIGHT DRIVE		
	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)	TEST LOCATION	PRESSURIZED (IN)	RETURN (OUT)
FORWARD DRIVE	5 5	Port B	Port A	6 6	Port A	Port B
REVERSE DRIVE	7 7	Port A	Port B	8 8	Port B	Port A

Note: To check flow readings a flow meter capable of measuring 60 gpm (3,8 liter/sec) and a load valve capable of 6000 psi (413,4 bar) will be required (not included with Hydraulic Diagnostic Test Kit).

Engine Full Throttle = 2600 ± 50 rpm

Hydraulic oil temperature for the following tests should be 125° F (52° C) or higher.

TEST LOCATION	ADJUST. LOCATION	COMPONENT DESCRIPTION	PRESSURE AND FLOW READINGS	PRESSURE AND FLOW TEST PROCEDURES
1	2	Main Control Valve System Relief	2700 ± 50 psi (186 ± 3,45 bar)	Check with the engine at full throttle (2600 ± 50 rpm); move right travel lever inward. If pressure is not correct, replace or adjust the main relief valve cartridge.
3	N/A	Charge System Pres. Priority Relief	350 psi (24,11 bar) Minimum	Check the pressure with the engine at 1800 ± 20 rpm. The priority relief valve cartridge is adjustable. If the pressure is not correct, shim as required and/or replace cartridge.
4	N/A	Implement Pump Flow **(See Note)**	23.0 - 20.0 gpm (1,45 - 1,26 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 20 gpm (1,26 liter/sec) or less, the implement pump should be repaired or replaced.
5 6 7 8	N/A	Hydro Control Pump Drive Relief	5000 + 350/-0 psi (344,36 + 24,1/-0 bar)	Check with the engine at full throttle (2600 ± 50 rpm), seat bar up with park lock engaged; stall the travel function by moving the travel control lever forward or reverse **(refer to Hydro Control Pump Flow chart).** The bypass valve/check valve is not adjustable and requires replacement of the cartridge if pressure is not correct. If this fails to correct the condition, it may be necessary to perform the hydro pump flow test.
5 6 7 8	N/A	Hydro Control Pump Flow **(See Note)**	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2000 psi (137,8 bar) load; you must move the right or left travel lever fully forward or rearward as shown in the **Hydro Control Pump Flow chart** to get a flow reading. If the reading is 26.0 gpm (1,79 liter/sec) or less, the drive pump should be repaired or replaced.
10	11	High Flow Valve Relief	3000 ± 50 psi (206,6 ± 3,4 bar)	Check pressure with the high flow switch ON and engine at full throttle. If pressure is not correct, adjust or replace the relief valve cartridge.
12	N/A	High Flow Pump Flow **(See Note)**	31 - 30 gpm (1,96 - 1,89 liter/sec)	Check with the engine at full throttle (2600 ± 50 rpm) under a 2500 psi (172 bar) load. If the reading is 30 gpm (1,89 liter/sec) or less, the high flow pump should be repaired or replaced.

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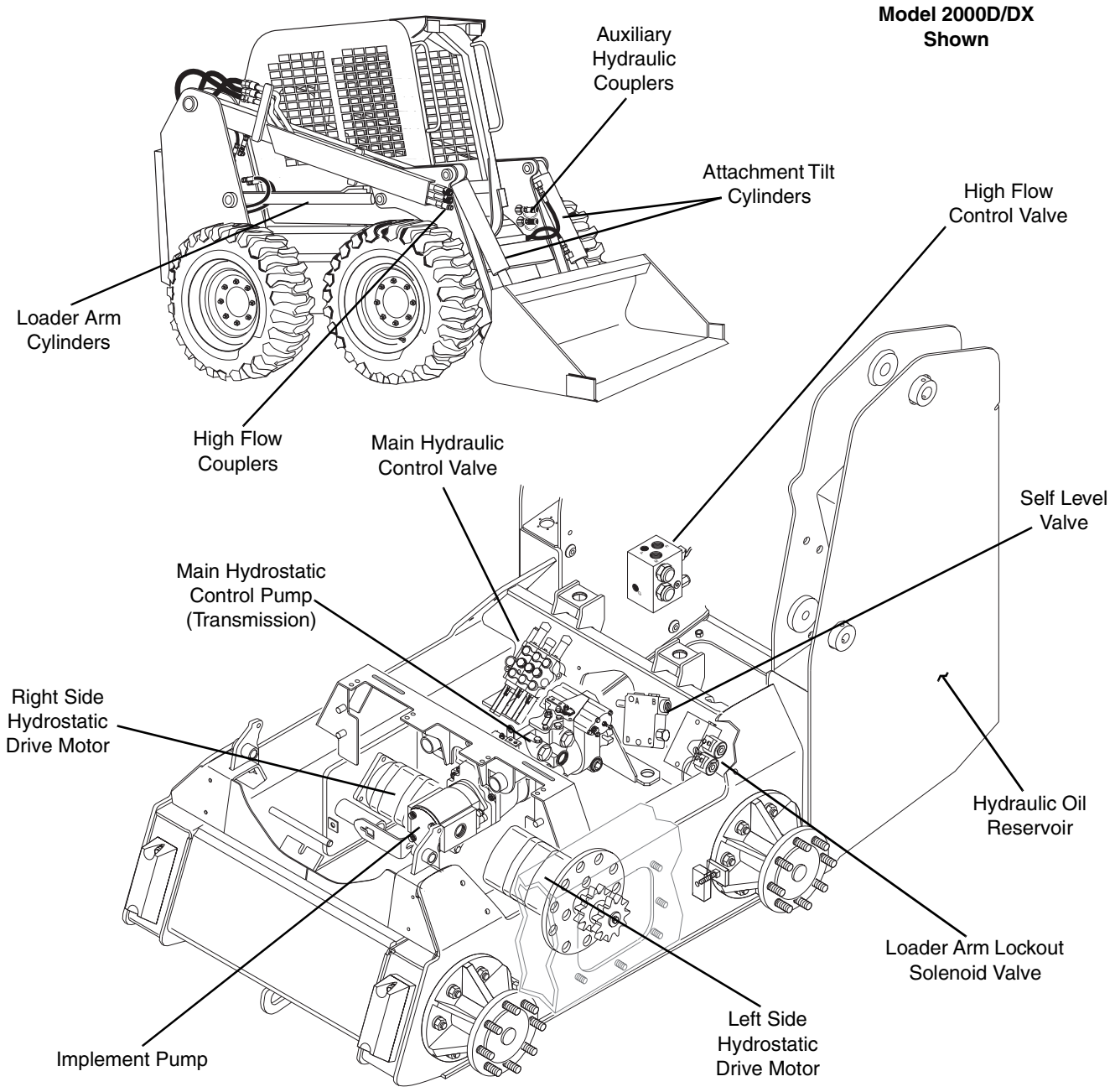
Section 4
Loader Arm, Attachment Tilt, Auxiliary & High Flow Hyd.

Contents

(Continued on next page)

4.1 HYDRAULIC COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the vehicle hydraulic components. The following illustration identifies the components that are referred to throughout this section.



WARNING: Do not service the loader without instruction or taking the necessary safety precautions outlined in the “Safety Practices” section of this manual.

4.2 VEHICLE HYDRAULIC CIRCUIT

The circuit (Fig. 4-1) contains an implement pump that draws system oil from the reservoir and delivers it to the three-spool main control valve assembly. The pump is driven at engine speed by the same shaft that passes through the hydrostatic drive pumps.

The main control valve assembly directs oil to the auxiliary attachments, self leveling valve and loader arm lockout solenoids. The oil from the main control valve flows through the self leveling valve to the base and rod end of the attachment tilt cylinders, and to the rod end of the loader arm cylinders.

The loader arm lockout solenoids open oil flow or block oil flow to and from the base end of the loader arm cylinders. Return oil from the cylinders passes through the self leveling valve, loader arm lockout solenoids and main control valve assembly and is directed to an oil cooler and a filter before completing the circuit at the reservoir.

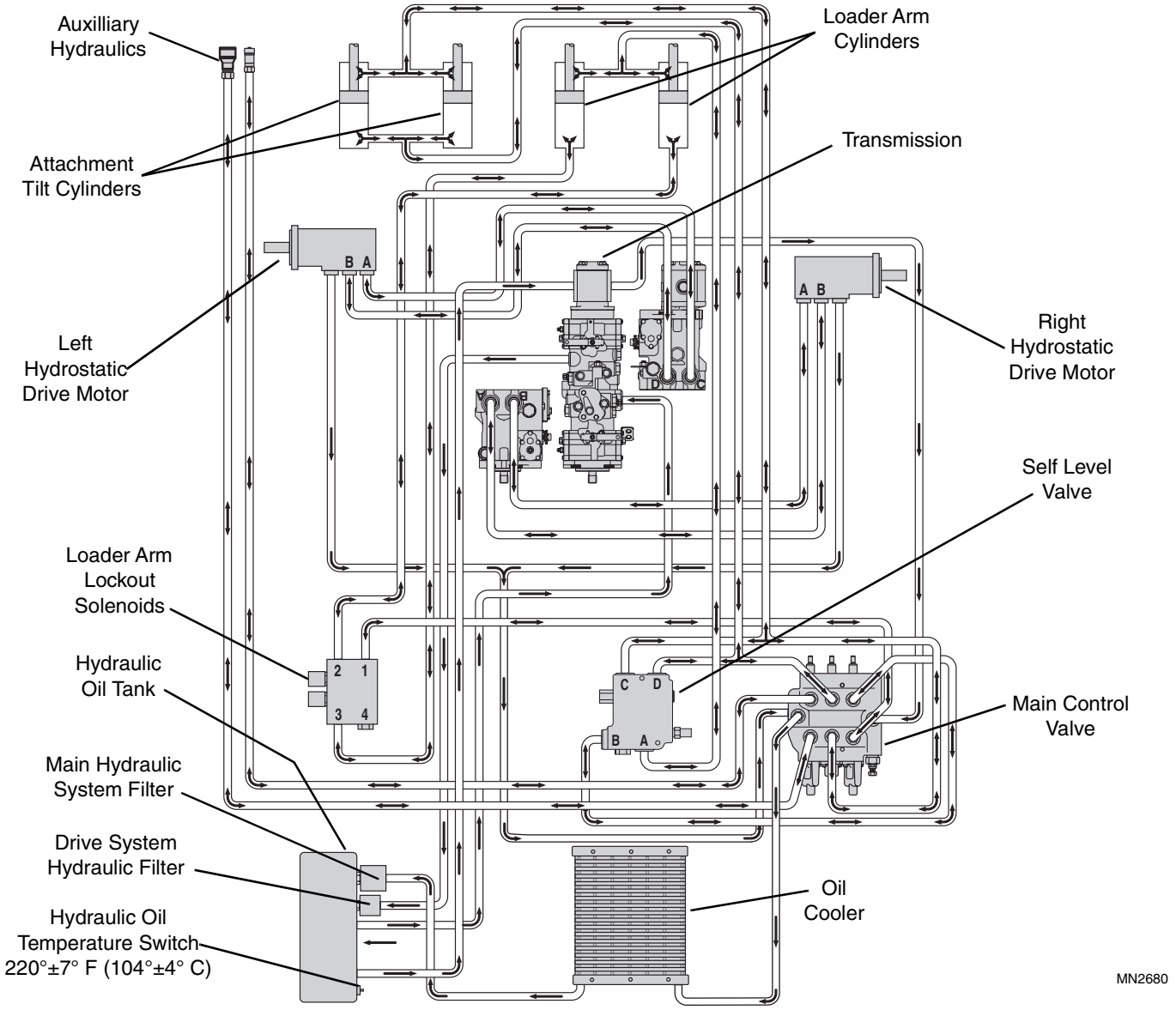


Figure 4-1 Loader Arm, Attachment Tilt and Auxiliary Hydraulic Circuit (Model 2000D Shown - Other Models Similar)

4.3 HYDRAULIC SYSTEM OIL SPECIFICATION

WARNING:

- If anyone is injured by or if any hydraulic system oil is injected into the skin, obtain medical attention immediately or gangrene may result.
- Wear appropriate eye protection. Hydraulic system oil can cause permanent eye injury. Do not wear loose fitting clothing when servicing the loader.

The 10W30 motor oil used in the hydraulic system should be changed at 1000 hour intervals or when contaminated. Refer to Section 4.10, “Hydraulic Oil Reservoir, Oil Filter, and Oil Cooler.”

4.4 HYDRAULIC SYSTEM OIL CONTAMINATION

4.4.1 Microscopic Contamination

Microscopic contamination occurs when excessive fine particles of foreign material are in the system oil. These particulates are too small to see or feel. The ISO (International Organization for Standardization) has developed a code for expressing the level of particulate contaminant in hydraulic fluid and for specifying acceptable levels of cleanliness. The ISO Solid Contaminant code for this vehicles hydraulic oil is ISO 18/15, and can only be properly determined by laboratory testing.

Examples of contamination problems caused by excessive particulates would include the following:

- cylinder rod seals leak,
- control valve spools do not return to neutral, and/or
- hydraulic circuit has a high operating temperature.

4.4.2 Sense Contamination

Sense contamination is foreign matter found by sight, touch, or smell. This type of contamination can cause a sudden failure of a hydraulic component. Examples of sense contamination are:

- particles of metal or dirt in the system oil,
- air in the system oil,
- system oil dark and thick,
- odor of burned system oil, and/or
- water in the system oil. Water will cause oil to become white in color.

4.5 STARTUP AFTER HYDRAULIC REPAIR

To prevent damage on startup after draining the hydraulic system oil reservoir or replacing hydraulic components, comply with the following procedure.

1. Remove reservoir fill cap and fill reservoir with motor oil equal to 10W30 API, CD or CE specifications, until the oil level is in the middle of the sight gauge. Wait a few minutes after adding oil before checking the level. Fill to proper level if necessary.
2. Install a pressure gauge to check the charge pressure of your specific model (Refer to Section 3.4.2 or 3.4.3).

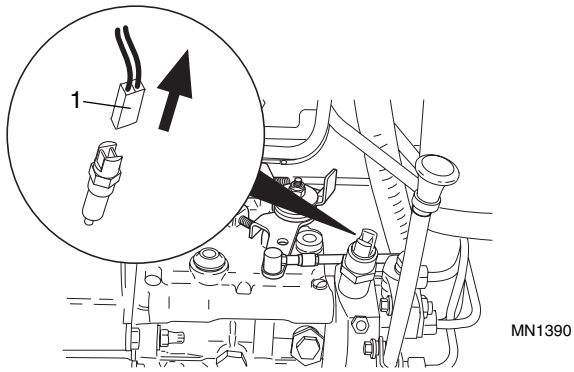


Figure 4-2 Fuel Run Solenoid Connector

3. Disconnect the Fuel Run solenoid connector (Fig. 4-2, 1) and turn the engine over with the starter at 15 second intervals until you get a pressure reading of at least 75 psi (5,18 bar), or a minimum of three 15 second intervals if not checking with a gauge. This permits the implement pump to draw oil from the reservoir, ensuring the system is full before starting engine and operating the hydraulic functions. Reconnect the wire.
4. Start the engine and run it at half throttle for several minutes with no hydraulics engaged.

WARNING: Do not start the engine unless you are in the seat with the seat belt fastened and the seat bar down. Serious injury could result if the belt is not securely fastened. Be sure the area is clear before starting the engine.

5. Momentarily press the loader arm raise/lower reset button to activate the loader arm raise/lower system.
6. To bleed air from the hydraulic system, operate all the hydraulic controls with engine at half throttle.
7. Shut the engine OFF and check for leaks. Recheck fluid level and add as necessary.

4.6 IMPLEMENT PUMP

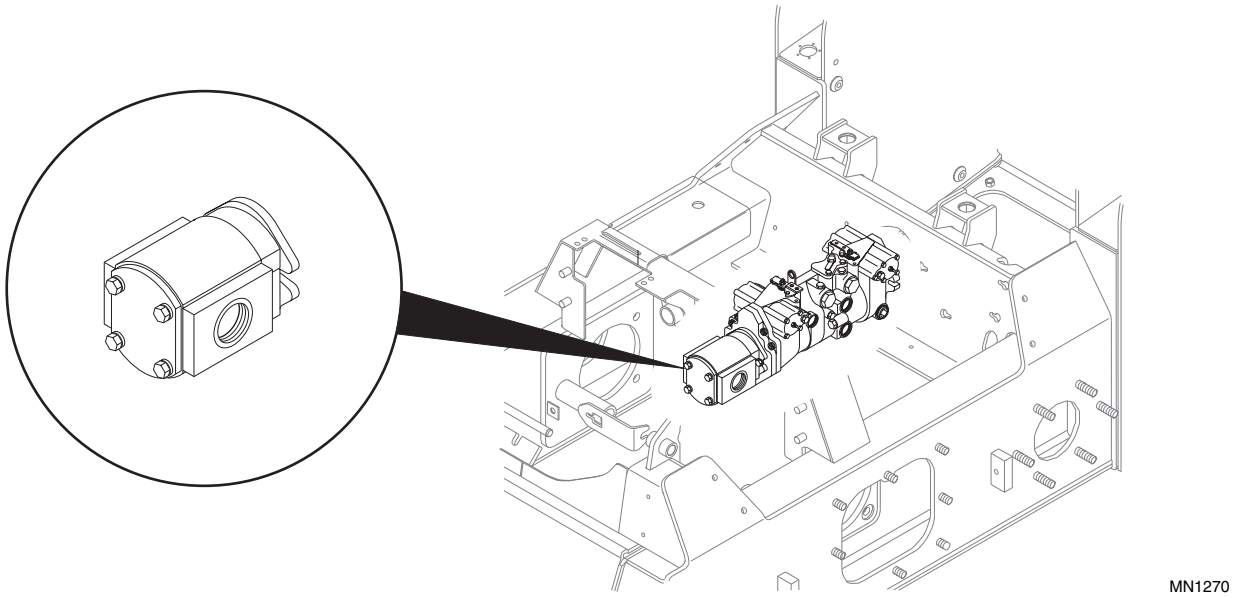


Figure 4-3 Implement Pump

4.6.1 Pump Description

The implement pump (Fig. 4-3) mounts at the end of two travel control pumps forming a transmission unit. The front travel control pump shaft drives the implement pump shaft at engine crankshaft speed. Engine speed determines the pump output; maximum output being at full rated engine speed.

Note: *The Model 1750D implement pump also serves as a charge pump for the main travel control pumps. Refer to Section 5.6, "Charge/Implement Pump" for additional information.*

4.6.2 Pump Operation

Oil entering the inlet is carried to the outlet in pumping chambers formed between the gear teeth and housing. The pump draws oil from the hydraulic system oil reservoir and pumps the oil to the main control valve. The main control valve directs oil to the auxiliary functions and to the self leveling valve; from the self leveling valve, oil is directed to the loader arm and attachment tilt cylinders.

4.6.3 Pump Maintenance

IMPORTANT: *When repairing the hydraulic system, keep parts and work area clean. Use caps and plugs on all lines.*

a. Testing

Refer to Section 4.12, "Troubleshooting" to find the trouble you are having with your loader and follow the chart to remedy the trouble.

If you are sure there is a problem in the implement pump, refer to Section 3.2, "Hydraulic Component Testing" and follow the instructions for testing the implement pump.

b. Removal

1. Park the vehicle on a level surface, raise the seat restraint bar to engage the park lock, and shut the engine OFF.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) or optional wrist controls (left and right) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

4. Refer to Section 4.10.3, “Hydraulic Oil and Filter Change,” and drain all the oil from the hydraulic reservoir.
5. Use an engine hoist, with a strap wrapped around the control pump assembly or position blocks under it to prevent it from falling, when it is unfastened from the chassis.

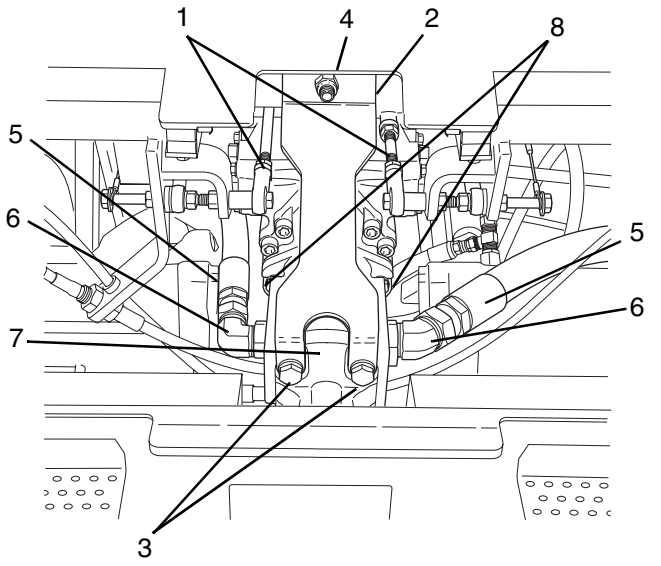


Figure 4-4 Implement Pump (2000 Series Model Shown - Other Models Similar)

6. Remove the travel-steering control rods at the ball joints (Fig. 4-4, 1).
7. Remove the bolts (Fig. 4-4, 3) securing the front transmission support (2) to the implement pump (7) and crossmember bolt (4), and remove the support.
8. Disconnect both hoses (Fig. 4-4, 5) and elbows (6) from the implement pump (7) and tag them with identification for proper re-installation.
9. Remove the two bolts (Fig. 4-4, 8) attaching the implement pump (7) to the transmission, and remove the pump.
10. Remove the o-ring (Model 1750D) or gasket (Models 2000D/DX & 2300D/DX) from the implement pump and discard (refer to Fig. 4-5).

c. Replacement

If the implement pump has been removed to stop a leak, plug all ports to the pump and clean the body with a suitable solvent.

Note: *The internal parts of the pump are not serviceable. If the pump is malfunctioning, replace the pump as a complete unit.*

d. Assembly and Installation

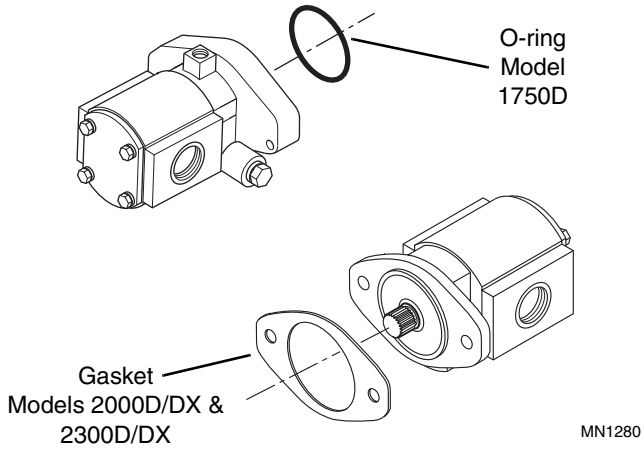


Figure 4-5 Implement Pump Installation

1. Lubricate a new o-ring (Fig. 4-5) with clean oil and install onto the implement pump (Model 1750D) or place a new gasket (Fig. 4-5) on the pump (Models 2000D/DX & 2300D/DX).
2. Install the implement pump (Fig. 4-4, 7) to the transmission and secure with the two capscrews (8), torquing them to 27-31 lb/ft (37-42 Nm).
3. Connect both elbow fittings (Fig. 4-4, 6) to the implement pump (7) and tighten to 1.5 ±0.25 F.F.F.T. (Refer to Section 2.8.4, “F.F.F.T. Method”).
4. Connect both hoses (Fig. 4-4, 5) to the fittings (7) and tighten to the appropriate F.F.F.T. value (Refer to Section 2.8.5, “F.F.F.T. Method”).
5. Install the front transmission support (Fig. 4-4, 2) to the implement pump (7). Torque the pump capscrews (3) to 45-50 lb/ft (61-68 Nm), and tighten the crossmember capscrew (4) securely.
6. Reinstall the travel-steering control rods (Fig. 4-4, 1). Refer to Section 7.2, “Travel-Steering Levers.”
7. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
8. Refer to Section 4.5, “Startup After Hydraulic Repair.”

4.7 MAIN CONTROL VALVE ASSEMBLY

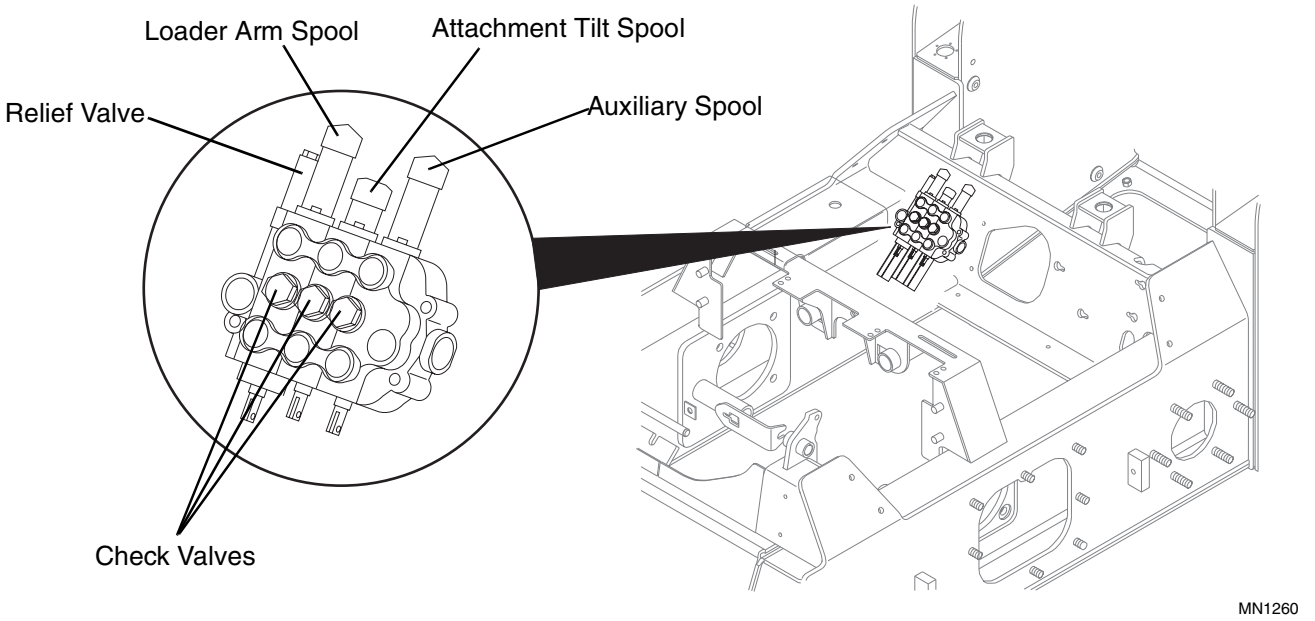


Figure 4-6 Main Hydraulic Control Valve

4.7.1 Valve Description

The main control valve assembly (Fig. 4-6) contains a relief valve assembly, loader arm spool assembly, attachment tilt spool assembly, auxiliary spool assembly, and three check valve assemblies. The loader arm raise/lower and auxiliary spool assemblies have detent mechanisms.

4.7.2 Valve Operation

The main control valve is a multiple directional valve. The valve controls the direction of hydraulic flow to and from the loader arm cylinders, attachment tilt cylinders and auxiliary attachments. The loader arm and attachment tilt spools in the valve are shifted by the foot pedals (or optionally by wrist controls on the travel-steer levers). The auxiliary spool is shifted by the right travel-steer lever (or with the optional wrist controls, by the right foot pedal).

In each position, the spool's are pushed against internal spring pressure, and valve body lands and grooves open, allowing oil to flow into one side of the circuit and returning oil from the other side of the circuit through the valve to the reservoir.

4.7.3 Loader Arm Spool Control

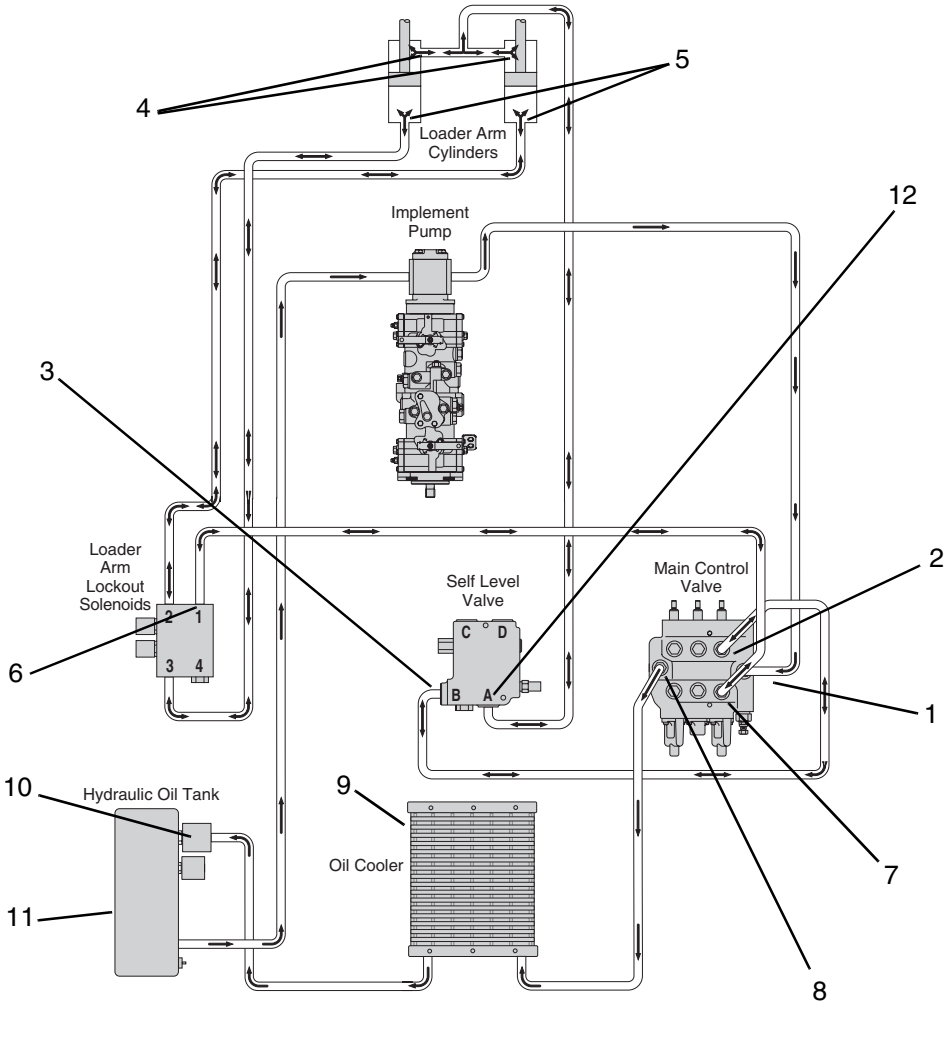


Figure 4-7 Loader Arm Hydraulic Circuits

a. Left Foot Pedal Forward (or optional Left wrist control moved right)

When the front of the left foot pedal is depressed or the optional left wrist control is moved right, the loader arm spool shifts, allowing oil to be pumped through the inlet port (Fig. 4-7, 1) of the main control valve into the loader arm spool lands and grooves. There it is held at the loader arm raise/lower check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the loader arm in position until the loader arm spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-7, 2) of the main control valve to port B (3) on the self leveling valve and to the rod end (4) of the loader arm cylinders. Oil from the base end (5) of the loader arm cylinders flows through the loader arm lockout solenoids (6) back to port (7) on the main control valve. The oil then flows out the outlet port (8) of the main control valve, through the oil cooler (9), and filter (10) before returning to the tank (11).

Note: *Depressing the front of the left foot pedal down, or moving the optional left wrist control to the right, until either control locks into a detent position allows the loader arm to float an implement with the contour of the ground. The detent mechanism is mechanical, and will hold the spool in the float position until it is released by opposite movement of the foot pedal or optional wrist control.*

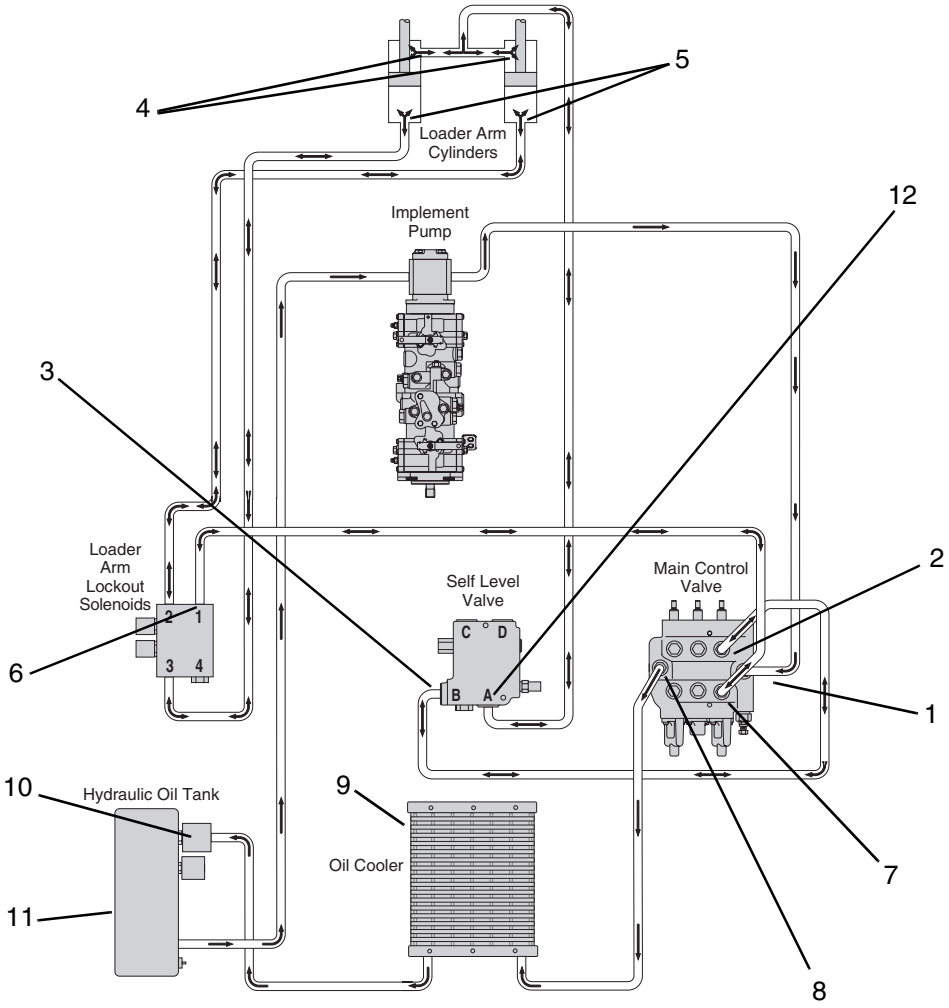


Figure 4-8 Loader Arm Hydraulic Circuits

b. Left Foot Pedal Rearward (or optional Left wrist control moved left)

When the rear of the left foot pedal is depressed or the optional left wrist control is moved to the left, the loader arm spool shifts and allows oil to be pumped through the inlet port (Fig. 4-8, 1) of the main control valve into the loader arm spool lands and grooves. There it is held at the loader arm raise/lower check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the loader arm in position until the loader arm spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-8, 7) of the main control valve, to port (6) on the loader arm lockout solenoids and to the base end (5) of the loader arm cylinders. Oil from the rod end (4) of the loader arm cylinders flows to port A (12) of the self leveling valve and out port B (3) of the self leveling valve back to port (2) on the main control valve. The oil then flows out the outlet port (8) of the main control valve, through the oil cooler (9), and filter (10) before returning to the tank (11).

4.7.4 Attachment Tilt Spool Control

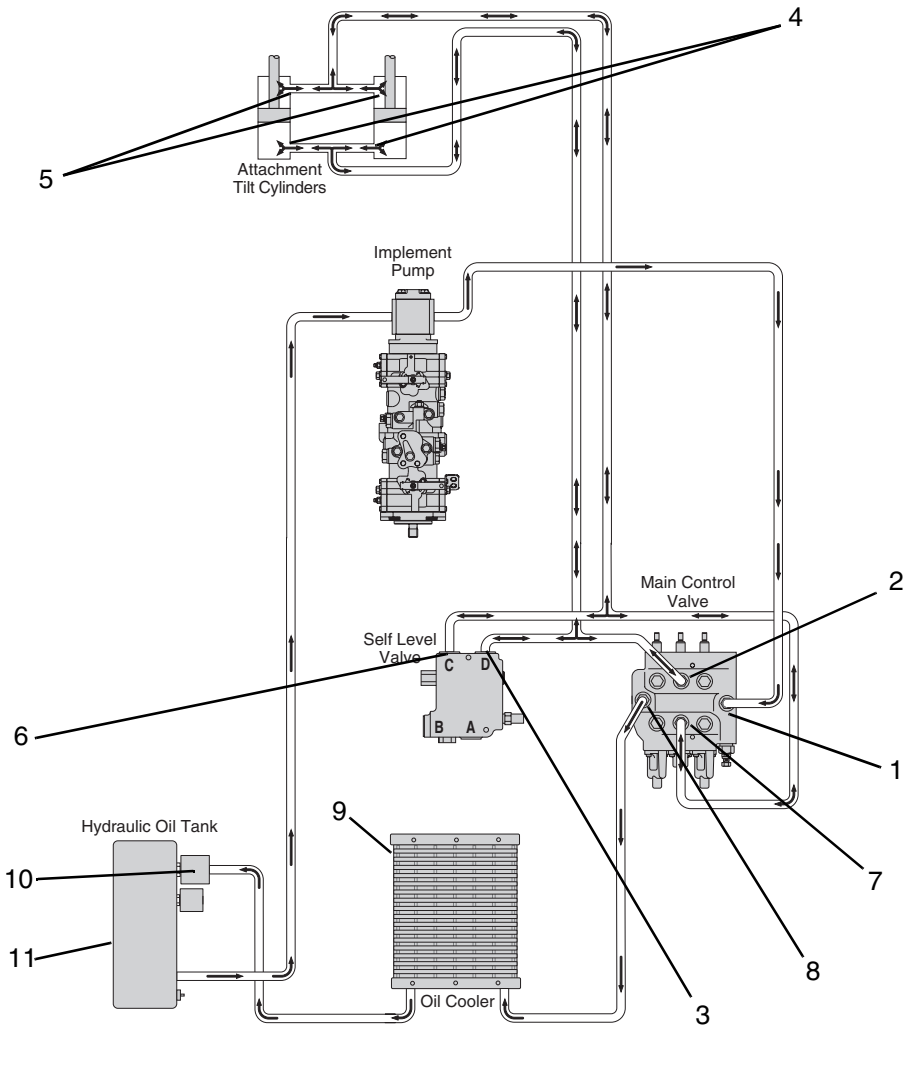
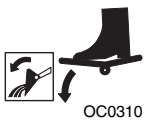


Figure 4-9 Attachment Tilt Hydraulic Circuits

a. Right Foot Pedal Forward (or optional right wrist control moved right)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When the front of the right foot pedal is depressed or the optional right wrist control is moved to the right, the attachment tilt spool shifts and allows oil to be pumped through the inlet port (Fig. 4-9, 1) of the main control valve into the attachment tilt spool lands and grooves. There it is held at the attachment tilt check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the quick attach in position until the attachment tilt spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-9, 2) of the main control valve to port D (3) of the self leveling valve and to the base end (4) of the attachment tilt cylinders. Oil from the rod end (5) of the attachment tilt cylinders flows to port C (6) of the self leveling valve and back to port (7) of the main control valve. The oil then flows out the outlet port (8) of the main control valve through the oil cooler (9), and filter (10) before returning to the tank (11).

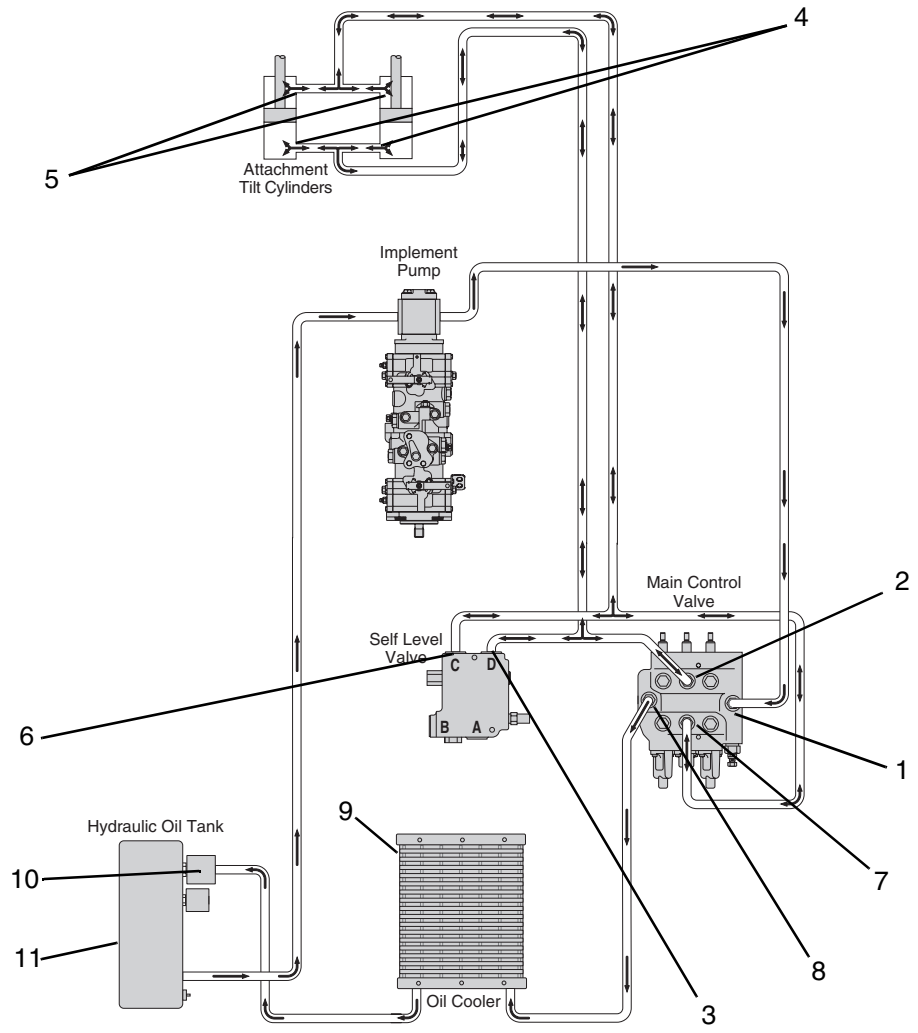


Figure 4-10 Attachment Tilt Hydraulic Circuits

b. Right Foot Pedal Rearward (or optional right wrist control moved left)

When the rear of the right foot pedal is depressed or the optional right wrist control is moved to the left, the attachment tilt spool shifts and allows oil to be pumped through the inlet port (Fig. 4-10, 1) of the main control valve into the attachment tilt spool lands and grooves. There it is held at the attachment tilt check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the quick attach in position until the attachment tilt spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-10, 7) of the main control valve to port C (6) of the self leveling valve and to the rod end (5) of the attachment tilt cylinders. Oil from the base end (4) of the attachment tilt cylinders flows to port D (3) of the self leveling valve and back to port (2) on the main control valve. The oil then flows out the outlet port (8) of the main control valve through the oil cooler (9), and filter (10) before returning to the tank (11).

4.7.5 Auxiliary Spool Control

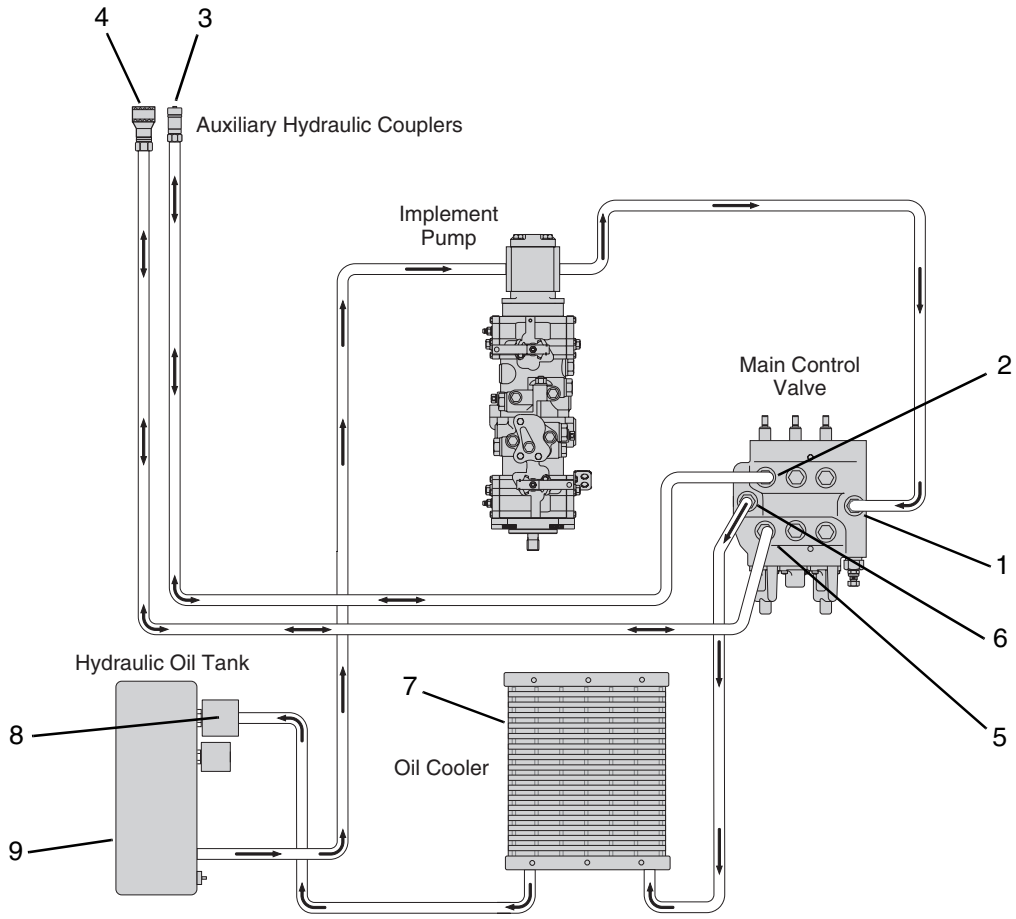
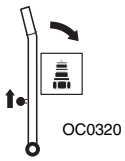


Figure 4-11 Auxiliary Hydraulic Circuits

a. Auxiliary/Travel-Steering Control Lever Moved to the Right (or with the optional wrist controls, the right foot pedal moved forward)



When the right travel-steer/auxiliary lever is moved to the right, or when the vehicle is equipped with the optional wrist controls, the front of the right foot pedal is depressed, the auxiliary spool shifts and allows oil to be pumped through the inlet port (Fig. 4-11, 1) of the main control valve into the auxiliary spool lands and grooves. There it is held at the auxiliary spool check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the auxiliary attachment in position until the auxiliary spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-11, 2) of the main control valve to the male disconnect coupling (3) to an auxiliary attachment. Oil returns from the auxiliary attachment, through the female disconnect coupling (4) back to port (5) on the main control valve. The oil then flows out the outlet port (6) of the main control valve through the oil cooler (7), and filter (8) before returning to the tank (9).

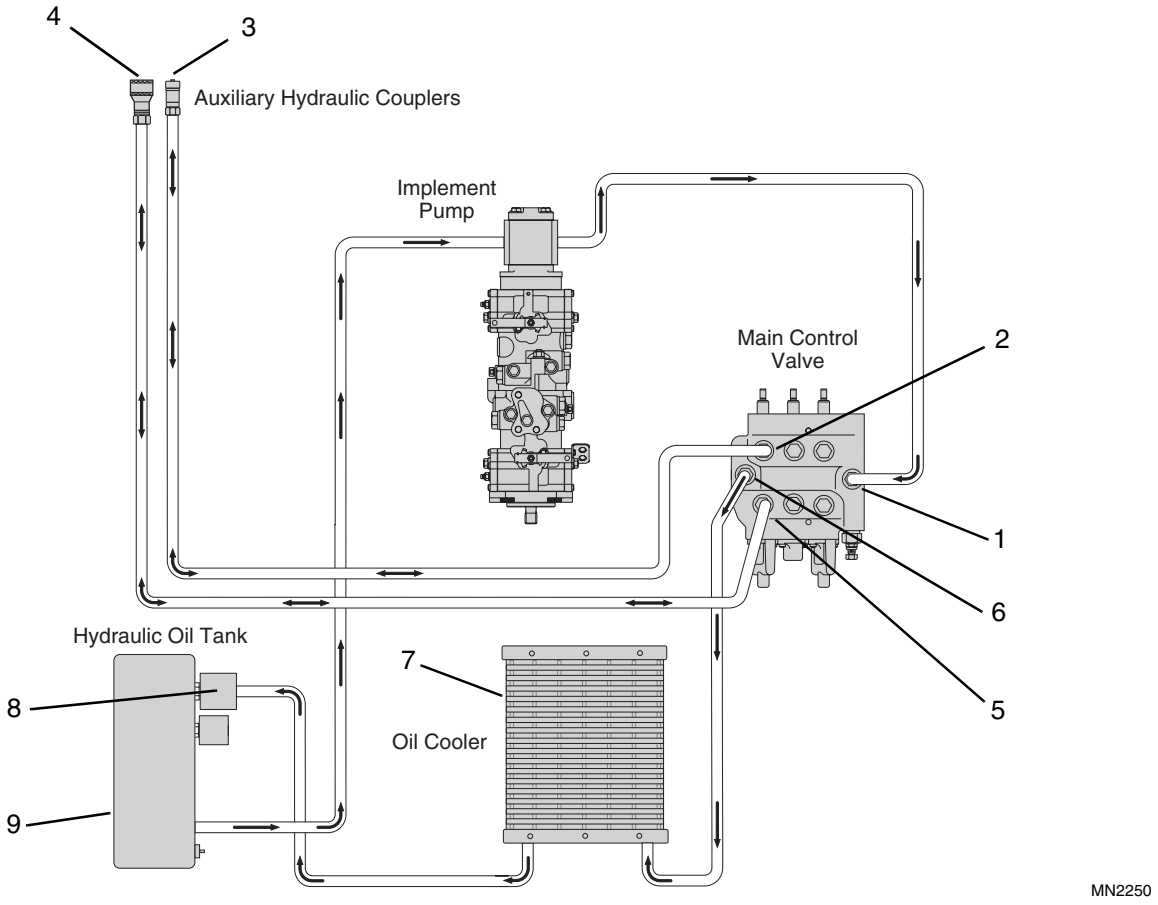
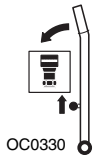


Figure 4-12 Auxiliary Hydraulic Circuits

b. Auxiliary/Travel-Steering Control Lever Moved to the Left (or with the optional wrist controls, the right foot pedal moved rearward)



When the right auxiliary/travel-steer lever is moved to the left, or when the vehicle is equipped with the optional wrist controls the rear of the right foot pedal is depressed, the auxiliary spool shifts and allow oil to be pumped through the inlet port (Fig. 4-12, 1) of the main control valve into the auxiliary spool lands and grooves. There it is held at the auxiliary spool check valve until the pumped oil overcomes the force holding the check valve on its seat.

Note: *The check valve holds the auxiliary attachment in position until the auxiliary spool is shifted forward or rearward.*

When the check valve unseats, it allows oil to flow out port (Fig. 4-12, 5) on the main control valve to the female disconnect coupling (4) to an auxiliary attachment. Oil returns from the auxiliary attachment through the male disconnect coupling (3) back to port (2) on the main control valve. The oil then flows out the outlet port (6) of the main control valve through the oil cooler (7), and filter (8) before returning to the tank (9).

Note: *Moving the right auxiliary/travel-steer lever fully to the left, or depressing the rear of the optional right foot pedal down completely, until either control locks into a detent position, allowing continuous hydraulic pressure to be directed to the female disconnect coupling. The detent mechanism is mechanical, and will hold the spool in position until it is released by opposite movement of the control lever or foot pedal.*

IMPORTANT: *DO NOT engage the auxiliary hydraulic circuit if an attachment is NOT connected to the vehicle. The hydraulic system will deadhead and cause rapid over-heating of the vehicles hydraulic oil, illuminating the High Oil Temperature warning light in the warning light cluster. A loss of engine horsepower and a reduction in the loader arm cycle time, caused by this unnecessary load, will be noted.*

4.7.6 Main Relief Valve Maintenance

a. Relief Valve Description

A hydraulic relief valve limits the maximum pressure available to components in the system. When a hydraulic circuit is energized, hydraulic pressure begins to rise. When this pressure reaches the setting of the relief valve, the valve opens, allowing a portion of oil to return to the reservoir, preventing pressure from building above the setting of the valve.

b. Testing

Refer to Section 4.12, “Troubleshooting,” to determine if the trouble you are having with your loader may be caused by the main relief valve.

The main relief valve can be tested for the pressure setting (Refer to Section 3.4.1, “Main Control Valve System Relief Test”).

c. Adjusting

If testing determines that a main relief valve adjustment is necessary, proceed as follows:

1. Shut the engine OFF.
2. Install a pressure gauge at the test location shown in Section 3.4.1, “Main Control Valve System Relief Test.”
3. Start the engine.
4. Move the right travel-steer/auxiliary lever to the right to activate the auxiliary hydraulic circuit. The pressure reading should be 2700 ±50 psi (186 ±3,45 bar).

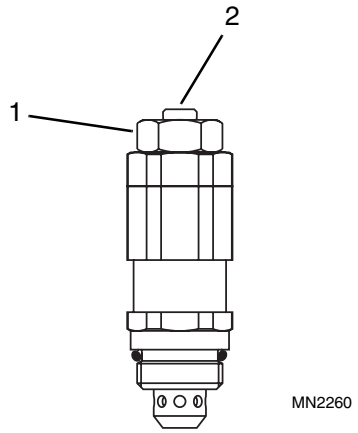


Figure 4-13 Main Relief Valve

WARNING: DO NOT exceed the specification listed in this manual when making adjustments to the main relief valve. Excessive pressure may cause component failure, and escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

5. If an adjustment is required, loosen the locknut (Fig. 4-13, 1) on the adjustment stud (2), and turn the stud no more than 1/4 turn at one time, clockwise to increase or counterclockwise to decrease the hydraulic system relief oil pressure.
6. When the correct pressure is obtained, tighten the locknut (Fig. 4-13, 1) to 10 lb/ft (13,6 Nm) while holding the adjustment stud stationary. Repeat Step 5 above to recheck the pressure relief setting after the nut is secure. Readjust if necessary.
7. Shut the engine OFF.
8. Remove the pressure gauge.

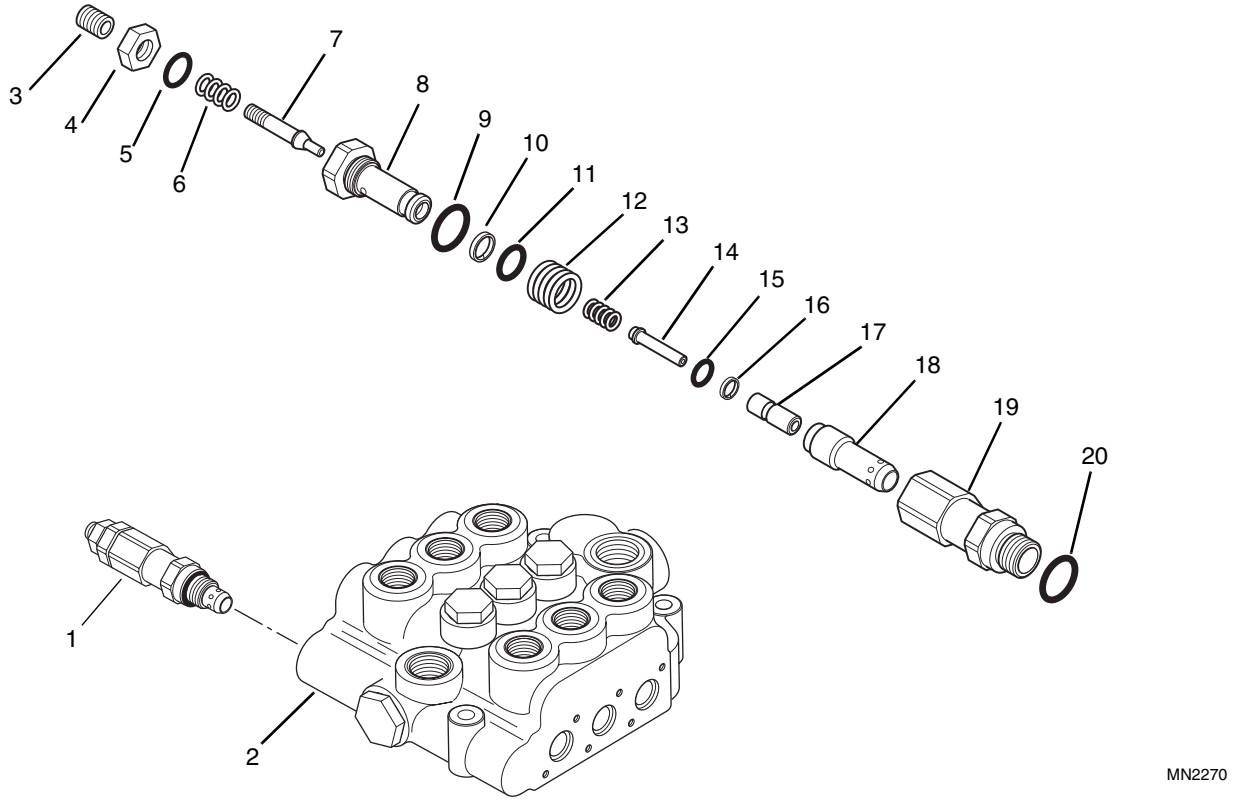


Figure 4-14 Main Relief Valve Disassembly

d. Removal

The main relief valve can be removed without removing the main control valve assembly from the loader. Remove the main relief valve as follows:

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate the right travel-steer/auxiliary lever (side to side) and foot pedals (forward and rearward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

4. Locate the main relief valve assembly (Fig. 4-14, 1) on the top of the main control valve assembly (2).
5. Clean any dirt and grease from the area and remove the main relief valve assembly from the control valve assembly by turning the body counterclockwise.
6. Plug the port in the control valve to prevent contamination of the hydraulic system while the pressure relief valve is removed.

e. Disassembly

1. Use care when disassembling the relief valve cartridge (Fig. 4-14, 1) to prevent scratching or nicking the inner components. Remove and discard o-ring (20) from the cartridge body (19).
2. Loosen locknut (Fig. 4-14, 4) and remove the adjustment screw (3), locknut (4), o-ring (5), spring (6), and poppet (7) from the cartridge. Discard the o-ring.
3. Remove plug (Fig. 4-14, 8) from the cartridge body (19). Remove spring (12), backup ring (10), o-ring (11), and o-ring (9) from plug (8). Discard the backup and o-rings.
4. Remove spring (Fig. 4-14, 13), piston (14), and poppet (17) from poppet (18).
5. Remove and discard o-ring (Fig. 4-14, 15) and backup ring (16) from poppet (17) to complete the disassembly.

f. Cleaning and Inspection

1. Clean the cartridge and its components with a suitable solvent.
2. Inspect all cartridge components for damage. The only serviceable parts in the cartridge are the spring (Fig. 4-14, 6), and all backup and o-rings. If any remaining component(s) are found to be damaged, the cartridge or must be replaced as an assembly.

IMPORTANT: *During any service or maintenance procedure, DO NOT reuse any o-ring removed from any component. ALWAYS use new o-rings for reassembly.*

g. Assembly and Installation

1. Lubricate new o-rings and backup rings with clean oil.
2. Assemble a new backup ring (Fig. 4-14, 16) and new o-ring (15) over poppet (17).
3. Assemble piston (Fig. 4-14, 14) into poppet (17), then install the poppet assembly into poppet (18).
4. Assemble a new o-ring (Fig. 4-14, 20) into the cartridge body (19).
5. Assemble poppet assembly (Fig. 4-14, 18) into the cartridge body (19).
6. Assemble a new o-ring (Fig. 4-14, 9), spring (12), new backup ring (10), and new o-ring (11) onto plug (8).
7. Assemble poppet (Fig. 4-14, 7), spring (6) into plug (8), and loose secure by threading adjustment stud (3) into plug (8) by several turns.
8. Assemble a new o-ring (Fig. 4-14, 5) and locknut (4) to the adjustment stud (3), and hand tighten against plug (8).
9. Assemble plug assembly (Fig. 4-14, 8), spring (13), and body assembly (14-19) together. Torque the plug/body assembly to 33 ±3 lb/ft (44,7 ±4 Nm)
10. Install the cartridge assembly (Fig. 4-14, 1) into the valve body (2) and torque to 33 ±3 lb/ft (44,7 ±4 Nm).
11. Test and adjust the pressure setting (Refer to Section 3.4.1, “Main Control Valve System Relief Test”).
12. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

4.7.7 Loader Arm Spool Maintenance

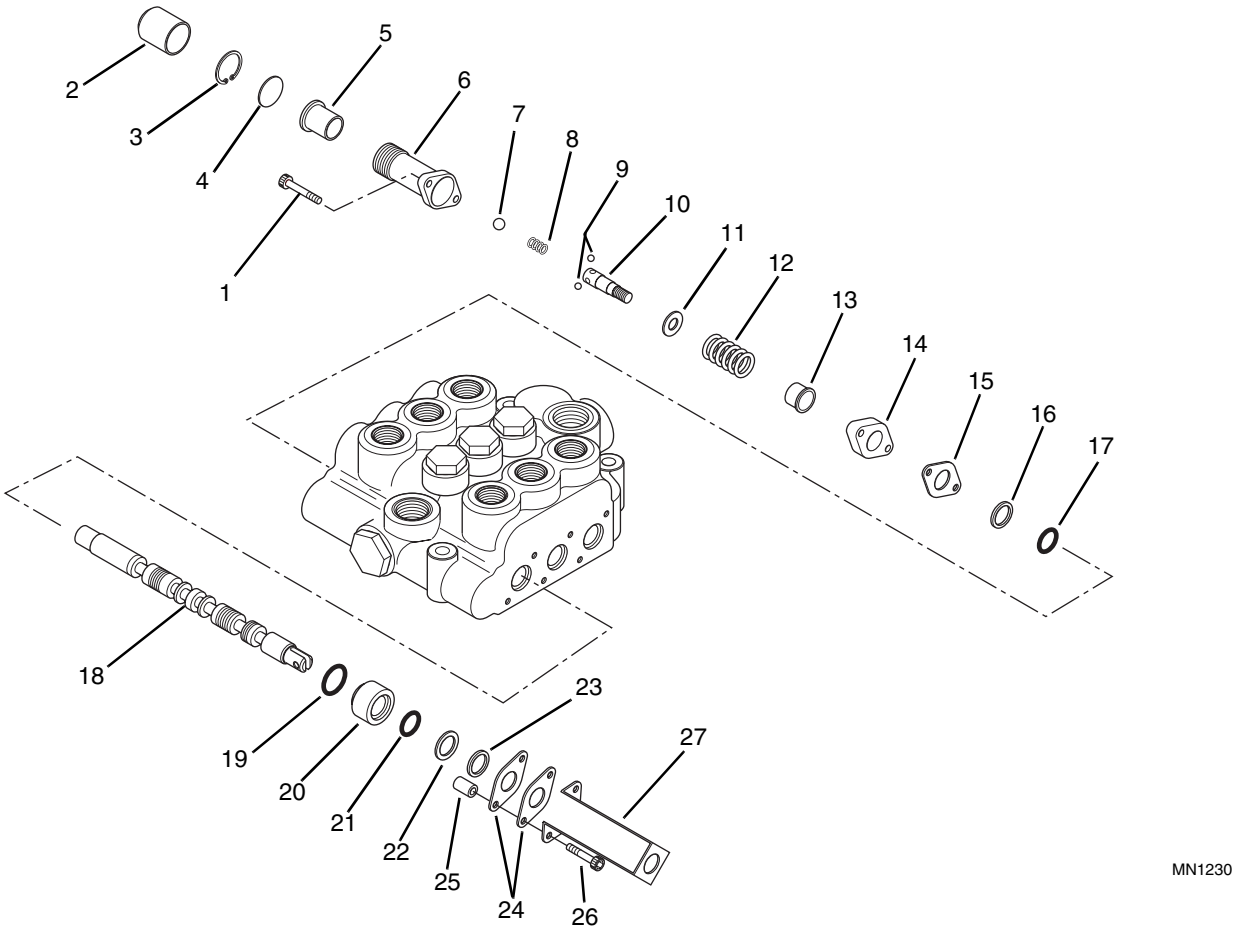


Figure 4-15 Loader Arm Spool Components

If you have not performed this procedure before, it is recommended to perform it with the control valve on a bench. Remove the control valve from the vehicle (Refer to Section 4.7.11, "Main Control Valve Removal and Replacement"). Then, remove the spool assembly from the control valve as follows:

IMPORTANT: *Spool is fit to valve housing at very close manufacturing tolerances. Care must be taken to avoid damage to spool while removed from housing.*

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove two capscrews (Fig. 4-15, 26), strap adapter (27), two seal plates (24), and two spacers (25)
3. Remove parts (Fig. 4-15, 20 through 23). Remove two capscrews (1). End mechanism assembly (2 through 15) and spool (18) can now be removed as a single unit from valve body for further disassembly.

Note: *Push spool into and through spool bore in housing.*

4. Remove o-rings (Fig. 4-15, 17 & 19) and wiper (16) from valve housing.
5. Pull detent cover (Fig. 4-15, 2) and end cap (6) off end mechanism assembly, being careful not to lose internal balls.

Note: *Once cap is removed do not try to force cap back into place (See reassembly procedure following).*

6. Remove retaining ring (Fig. 4-15, 3) by catching end and unwinding ring from groove. Remove plate (4) and detent sleeve (5) from cap (6). Inspect sleeve (5) for any sign of damage.

Note: *Minor amounts of birnelling (indentations in the metal) where detent balls ride over ramps is normal and not indicative of part failure.*

7. Remove balls [Fig. 4-15, 7 (qty. one), and 9 (qty. four)] and detent spring (8).

8. Using a protective cover or wooden blocks, put spool in vise. Remove spool end (Fig. 4-15, 10) using slot in end of spool. Remove parts (11 through 17).

b. Reassembly

1. Inspect parts for wear or damage. Replace all o-rings with new.
2. Put clean hydraulic oil on spool and re-install spool (Fig. 4-15, 18) into valve body.
3. Install o-ring (Fig. 4-15, 19) into spool cap spacer (20). Place o-ring end of assembly over tang end of spool, and insert into the valve housing. Install spool seal (21), ring seal (22), and spool wiper (23) over spool end and into spool cap spacer (20).
4. Install both plate seals (Fig. 4-15, 24) and strap adapter (27) using and 2 spacers (25) and two capscrews (26) until hand tight. Torque capscrews to 7 lb/ft (9 Nm).
5. Install spool seal (Fig. 4-15, 17) and spool wiper (16) over spool end and into seal gland on valve housing. Install seal plate (15) and spacer (14) over spool end.
6. Assemble spring collar (Fig. 4-15, 13), spring (12), and washer (11) onto spool end (18). Apply two drops of Loctite #271 or equivalent to the center of the spool end (10) threads. Compress spring and tighten spool end to spool. Torque spool end to 7 lb/ft (9 Nm).

Note: *This is most easily accomplished by placing a screwdriver or rod through the spool end clevis hole to keep spool from rotating. Care must be taken not to pinch the lip of the spring collar when installing the spool end.*

7. Install detent spring (Fig. 4-15, 8), one large ball (7), and four small balls (9) into spool end (10).

Note: *Hold balls in place by using any lithium grease (i.e.: wheel bearing grease).*

8. Install end cap (Fig. 4-15, 6) with two capscrews (1) through spacer (14) and seal plate (15).

Note: *Install capscrews hand tight. Do not torque yet.*

9. Slide detent sleeve (Fig. 4-15, 5) into place until it touches the four detent balls (9). Using a small, clean tool (i.e. rod, screwdriver, drift, etc.) inserted through the detent sleeve (5) and into the spool end (10), depress the large ball (7) against the detent spring (8). This will allow the 4 balls (9) to retract, and permit the detent sleeve (5) to be pushed fully into place in the end cap (6).

Note: *Do not force the detent sleeve (Fig. 4-15, 5) into the end cap. If difficulty is experienced pressing the detent sleeve into place, the large ball (7) is not fully depressed. Forcing the detent sleeve in this condition will result in damage to the sleeve.*

10. Install plate (Fig. 4-15, 4) and snap ring (3) into end cap (6).
11. Torque each capscrew (Fig. 4-15, 1) to 7 lb/ft (9 Nm).
12. Verify that spool assembly returns to neutral and strokes freely into both raise and lower positions. Verify that the detent functions.
13. Re-install detent cover (Fig. 4-15, 2) over end cap (6) to complete the reassembly.
14. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.7.8 Attachment Tilt Spool Maintenance

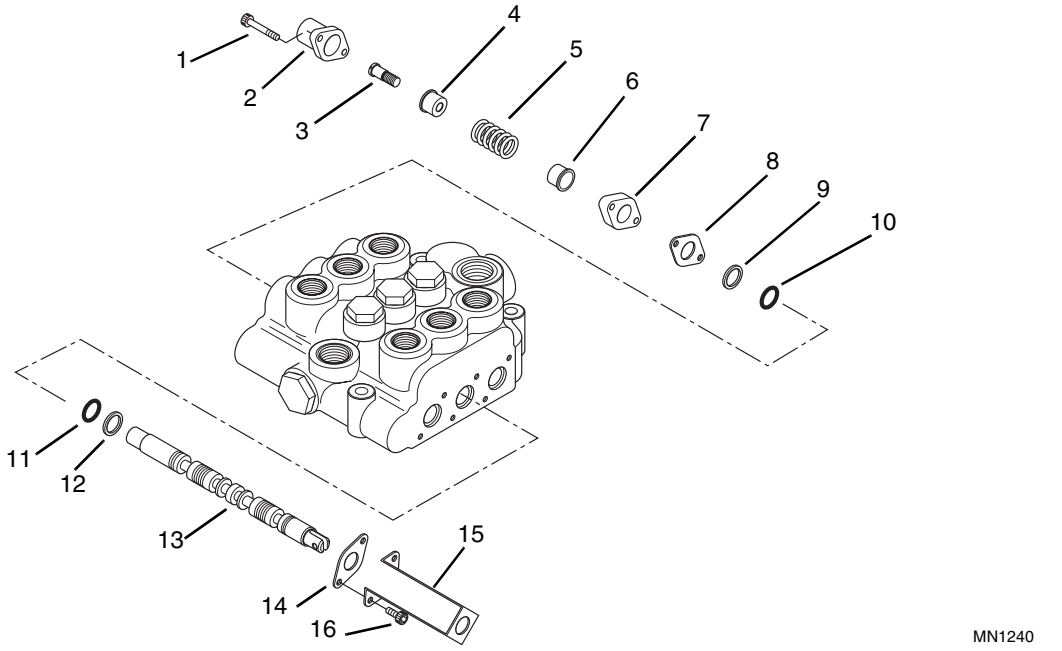


Figure 4-16 Attachment Tilt Spool Components

If you have not performed this procedure before, it may be easier to perform it with the control valve on a bench. Remove the control valve from the vehicle (Refer to Section 4.7.11, "Main Control Valve Removal and Replacement"). Then, remove the spool assembly from the control valve as follows:

IMPORTANT: *Spool is fit to valve housing at very close manufacturing tolerances. Care must be taken to avoid damage to spool while removed from valve housing.*

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove two capscrews (Fig. 4-16, 16), strap adapter (15), and seal plate (14).
3. Remove capscrews (Fig. 4-16, 1) and end cap (2). Spool (13) and end mechanism assembly (3 through 8) can now be removed as a single unit from housing for further disassembly.

Note: *Push spool into and through spool bore in housing.*

4. Remove o-rings (Fig. 4-16, 10 & 11) and wipers (9 & 12) from valve housing.
5. Using a protective cover or wooden blocks, put spool end (Fig. 4-16, 3) in vise. Remove spool end using slot in end of spool. Remove parts (4 through 8).

b. Reassembly

1. Inspect parts for wear or damage. Replace all o-rings with new. Put clean hydraulic oil on spool (Fig. 4-16, 13) and install spool into valve housing.
2. Install spool seal (Fig. 4-16, 11) and spool wiper (12) over spool end and into seal gland in valve housing.
3. Install plate seal (Fig. 4-16, 14) and strap adaptor (15) with two capscrews (16) hand tight. Torque capscrews to 7 lb/ft (9 Nm).
4. Install spool seal (Fig. 4-16, 10) and spool wiper (9) over spool end and into seal gland on valve housing. Install plate seal (8) and spacer (7) over spool end.
5. Assemble spring collar (Fig. 4-16, 6), spring (5), and spring collar (4) onto spool end (3). Apply two drops of Loctite #271 or equivalent to center of spool end threads. Compress spring and tighten spool end to spool. Torque spool end to 7 lb/ft (9 Nm).

Note: *This is most easily accomplished by placing a screwdriver or rod through the spool end clevis hole to keep spool from rotating. Care must be taken not to pinch the spring collar lip when installing the spool end.*

6. Install end cap (Fig. 4-16, 2) with two capscrews (1). Torque each capscrew to 7 lb/ft (9 Nm).
7. Verify that spool assembly returns to neutral and strokes freely into both curl and dump positions.
8. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.7.9 Auxiliary Spool Maintenance

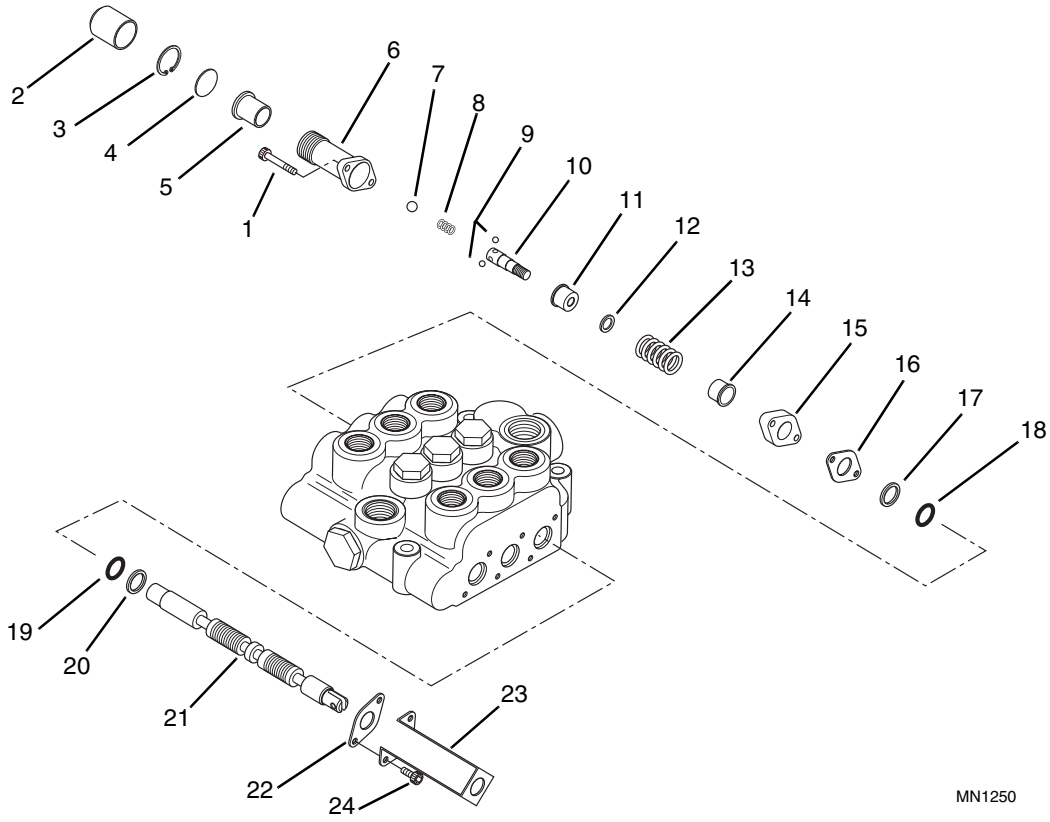


Figure 4-17 Auxiliary Spool Components

If you have not performed this procedure before, it may be easier to perform it with the control valve on a bench. Remove the control valve from the vehicle (Refer to Section 4.7.11, "Main Control Valve Removal and Replacement"). Then, remove the spool assembly from the control valve as follows:

IMPORTANT: *Spool is fit to valve housing at very close manufacturing tolerances. Care must be taken to avoid damage to spool while removed from housing.*

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove two capscrews (Fig. 4-17, 24), strap adapter (23) and seal plate (22).
3. Remove two capscrews (Fig. 4-17, 1). Spool (21) and end mechanism assembly (2 through 16) can now be removed as a single unit from valve housing for further disassembly.

Note: *Push spool into and through spool bore in housing.*

4. Remove o-rings (Fig. 4-17, 18 & 19) and wipers (17 & 20) from valve housing.
5. Pull detent cover (Fig. 4-17, 2) and end cap (6) off end mechanism assembly, being careful not to lose internal balls.

Note: *Once cap is removed do not try to force cap back into place. (See reassembly procedure following.)*

6. Remove retaining ring (Fig. 4-17, 3) by catching end and unwinding ring from groove. Remove plate (4) and detent sleeve (5) from cap (6). Inspect detent sleeve (5) for any sign of damage.

Note: *Minor amounts of birnelling (indentations in the metal) where detent balls ride over ramps is normal and not indicative of part failure.*

7. Remove balls [Fig. 4-17, 7 (qty. 1), and 9 (qty. 4)] and detent spring (8).
8. Using a protective cover or wooden blocks, put spool end (Fig. 4-17, 10) in vise. Remove spool end (10) using slot in end of spool. Remove parts (11 through 16).

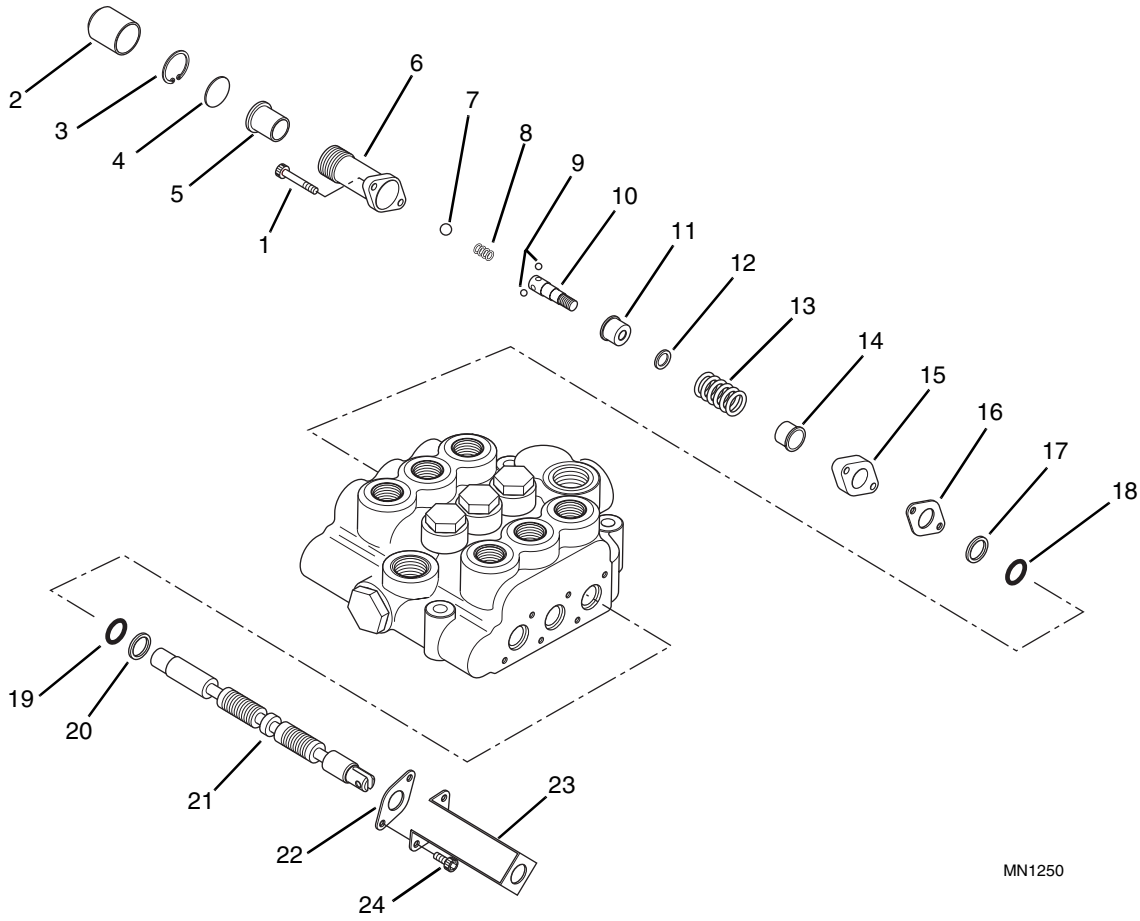


Figure 4-18 Auxiliary Spool Components

b. Reassembly

1. Inspect parts for wear or damage. Replace all o-rings with new. Put clean hydraulic oil on spool and re-install spool (Fig. 4-18, 21) into valve housing.
2. Install spool seal (Fig. 4-18, 19) and spool wiper (20) over spool end and into seal gland in valve housing.
3. Install plate seal (Fig. 4-18, 22) and strap adaptor (23) with two capscrews (24) hand tight. Torque capscrews to 7 lb/ft (9 Nm).
4. Install spool seal (Fig. 4-18, 18) and spool wiper (17) over spool end and into seal gland on valve housing. Install plate seal (16) and spacer (15) over spool end.
5. Assemble spring collar (Fig. 4-18, 14), spring (13), spacer (12), and spring collar (11) onto spool end (10). Apply two drops of Loctite #271 or equivalent to center of spool end threads. Compress spring and tighten spool end to spool. Torque spool end to 7 lb/ft (9 Nm).

Note: *This is most easily accomplished by placing a screwdriver or rod through the spool end clevis hole to keep spool from rotating. Care must be taken not to pinch the lip of the spring collar when installing the spool end.*

6. Install detent spring (Fig. 4-18, 8), one large ball (7), and four small balls (9) into spool end (10).

Note: *Hold balls in place by using any lithium grease (i.e.: wheel bearing grease).*

7. Install end cap (Fig. 4-18, 6) with two capscrews (1) through spacer (14) and seal plate (15).

Note: *Install capscrews hand tight. Do not torque yet.*

8. Slide detent sleeve (Fig. 4-18, 5) into place until it touches the 4 detent balls (9). Using a small, clean tool (i.e. rod, screwdriver, drift, etc.) inserted through the detent sleeve (5) and into the spool end (10), depress the large ball (7) against the detent spring (8). This will allow the 4 balls (9) to retract, and permit the detent sleeve (5) to be pushed fully into place in the end cap (6).

Note: *Do not force the detent sleeve (Fig. 4-18, 5) into the end cap. If difficulty is experienced pressing the detent sleeve into place, the large ball (7) is not fully depressed. Forcing the detent sleeve in this condition will result in damage to the sleeve.*

9. Install plate (Fig. 4-18, 4) and snap ring (3) into end cap (6).
10. Torque each capscrew (Fig. 4-18, 1) to 7 lb/ft (9 Nm).
11. Verify that spool assembly returns to neutral, strokes freely into both raise and lower positions, and that the detent functions.
12. Re-install detent cover (Fig. 4-18, 2) over end cap (6) to complete the reassembly.
13. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.7.10 Load Check Maintenance

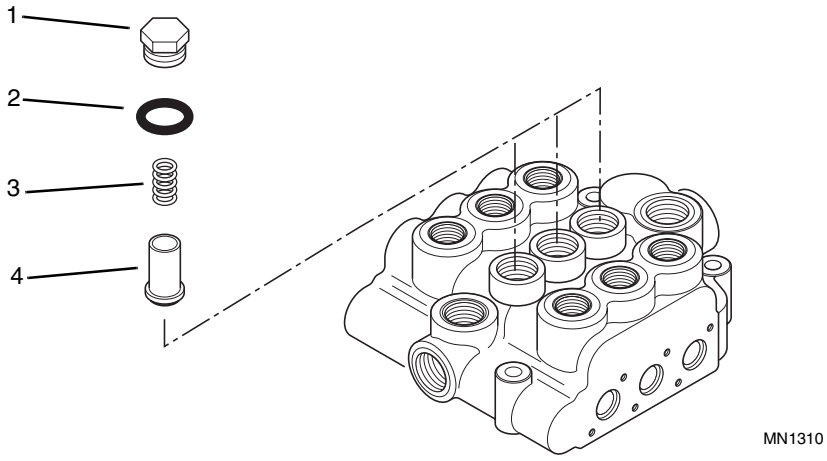


Figure 4-19 Load Check Components

All Functions

The load checks can be replaced without removing the main control valve assembly from the vehicle. Replace the load checks as follows:

a. Disassembly

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove plug (Fig. 4-19, 1), o-ring (2), spring (3) and poppet (4).
3. Inspect spring (Fig. 4-19, 3) and poppet (4) for wear or damage. Replace all o-rings with new.

Note: *Minor amounts of birnelling (indentations in the metal) on poppet seat is normal and is not indicative of part failure.*

b. Reassembly

1. Install poppet (Fig. 4-19, 4) and spring (3) into the valve housing.
2. Install a new o-ring (Fig. 4-19, 2) on the plug (1), and install the plug hand tight into the valve housing. Torque to 48 lb/ft (65 Nm).
3. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.7.11 Main Control Valve Removal and Replacement

The serviceable parts of the control valve assembly can be serviced without entirely removing the control valve assembly from the vehicle. If the spools and/or the valve housing bores are found to be damaged during disassembly, the entire control valve assembly should be replaced as follows:

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate the right travel-steer/auxiliary lever (side to side) and foot pedals (forward and rearward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

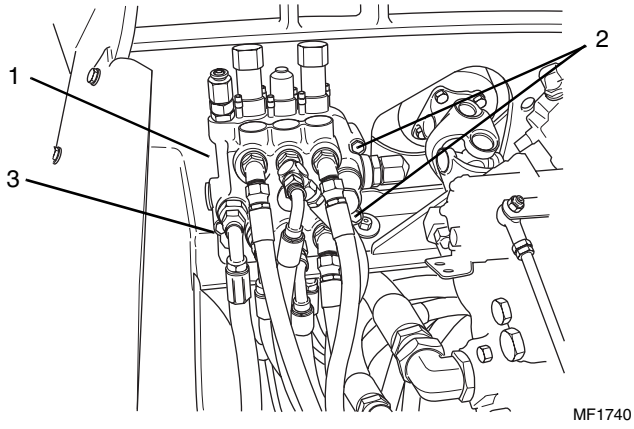


Figure 4-20 Main Control Valve

4. Remove any dirt and grease from the main control valve (Fig. 4-20, 1), hydraulic fittings and lines.
5. Tag and disconnect all hydraulic hoses from the main control valve (Fig. 4-20, 1). Plug or cap all hoses.
6. Disconnect the control cables from the auxiliary lever, loader arm pedal, and attachment tilt pedal. Refer to Section 7.3.2 a, "Auxiliary Hydraulic Cable Removal," and Section 7.3.2 b, "Foot Pedal Cable Removal" for procedures.
7. Remove the three screws (Fig. 4-20, 2 & 3) that fasten the main control valve to the frame crossmember.
8. Remove the main control valve (Fig. 4-20, 1) with the cables attached.

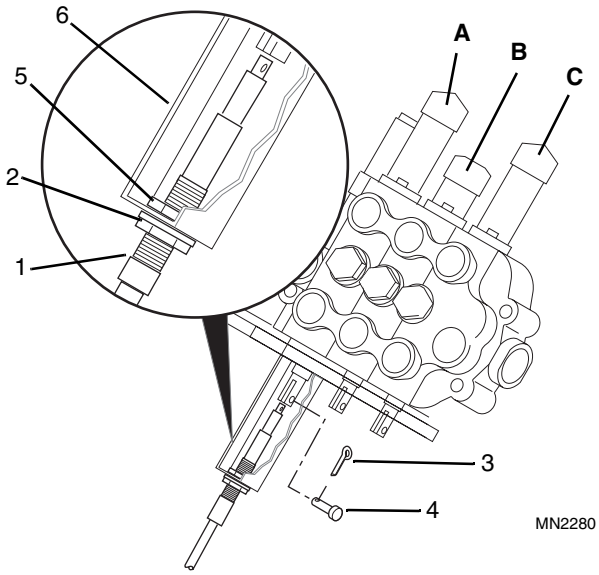


Figure 4-21 Control Cable Removal Loader Arm Spool Shown

9. Measure and record the visible thread length from the base of the cable end housing (Fig. 4-21, 1) to the bottom of jam nut (2). Tag each cable with this dimension and valve section position (A, B, or C).
10. Remove the hair cotter pin (Fig. 4-21, 3) and clevis pin (4) from each valve spool. Loosen and remove the inner jam nut (5) and remove each cable from the valve strap adapter (6).
11. Remove any remaining dirt and grease from the main control valve.

a. Disassembly

1. Tag and mark how the hydraulic fittings are oriented on the control valve. Remove all hydraulic fittings from the control valve body.

Note: *The main control valve fitting configuration varies among models. If the fitting location and orientation is not recorded during disassembly, it will be necessary to refer to Section 4.9.6, "Hydraulic Hose Routing Diagrams," Figure 4-53 through 4-56 for fitting location and orientation.*

2. Remove and discard all o-rings from the hydraulic fittings.

b. Cleaning and Inspection

1. Clean and dry all hydraulic fittings with a suitable solvent.
2. Inspect hydraulic fittings for damage.

c. Replacement

1. Replace main control valve assembly with a new assembly.
2. Replace hydraulic fittings that are damaged.
3. Lubricate new fitting o-rings with clean oil and install them on the hydraulic fittings.

d. Assembly and Installation

1. Install all hydraulic fittings into the new control valve body in the same ports and orient them the same as they were before removal. Refer to Section 2.8, "Torques," for torque specifications.
2. Install each control cable (Fig. 4-22, 1) into the valve strap adapter (6), and loosely secure with the inner jam nut (5).
3. Adjust the jam nuts (Fig. 4-22, 2 & 5) as required to obtain the same visual thread length (Dimension "X"), from the base of the cable end housing to the bottom of the jam nut, as was recorded during valve removal.

Note: *If the cable housing exposed thread length was not recorded, adjust to the following dimensions:*

- *Loader Arm Spool (Fig. 4-22, A): Dim. "X" = 9/16" (14 mm)*
- *Attachment Tilt Spool (Fig. 4-22, B): Dim. "X" = 7/16" (11 mm)*
- *Auxiliary Hydraulic Spool (Fig. 4-22, C): Dim. "X" = 7/16" (11 mm)*

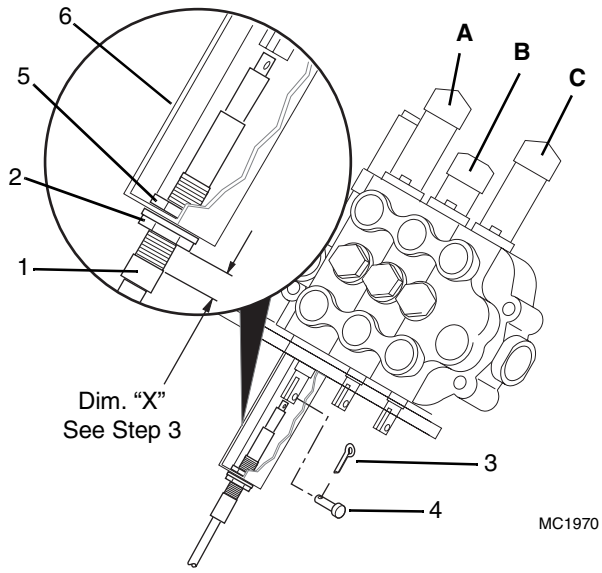


Figure 4-22 Control Cable Removal
Loader Arm Spool Shown

4. Tighten the jam nuts (Fig. 4-22, 2 & 5) securely.
5. Install the clevis pin (Fig. 4-22, 4) through each spool and cable end and secure with a cotter pin (3).
6. Install new control valve assembly into the vehicle, and secure with three capscrews. Do not exceed 15 lb/ft (20,3 Nm) torque.
7. Connect all hydraulic hoses to the control valve assembly. Refer to Section 2.8, "Torques" for torque specifications.
8. Connect the control cable ball joint to the control lever, and the control cable yokes to the control pedals. Refer to Section 7.3.2 c, "Auxiliary Hydraulic Cable Installation," and Section 7.4.2 c, "Foot Pedal Cable Removal" for installation and adjustment procedures.
9. Refer to Section 4.5, "Startup After Hydraulic Repair."
10. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.8 SELF LEVEL VALVE

4.8.1 Valve Description

The self level valve function is to keep the quick attach in the same position throughout the loader arm raise cycle. The self level valve contains two check valve assemblies, an adjustable orifice, a flow divider spool, and an unloading spool.

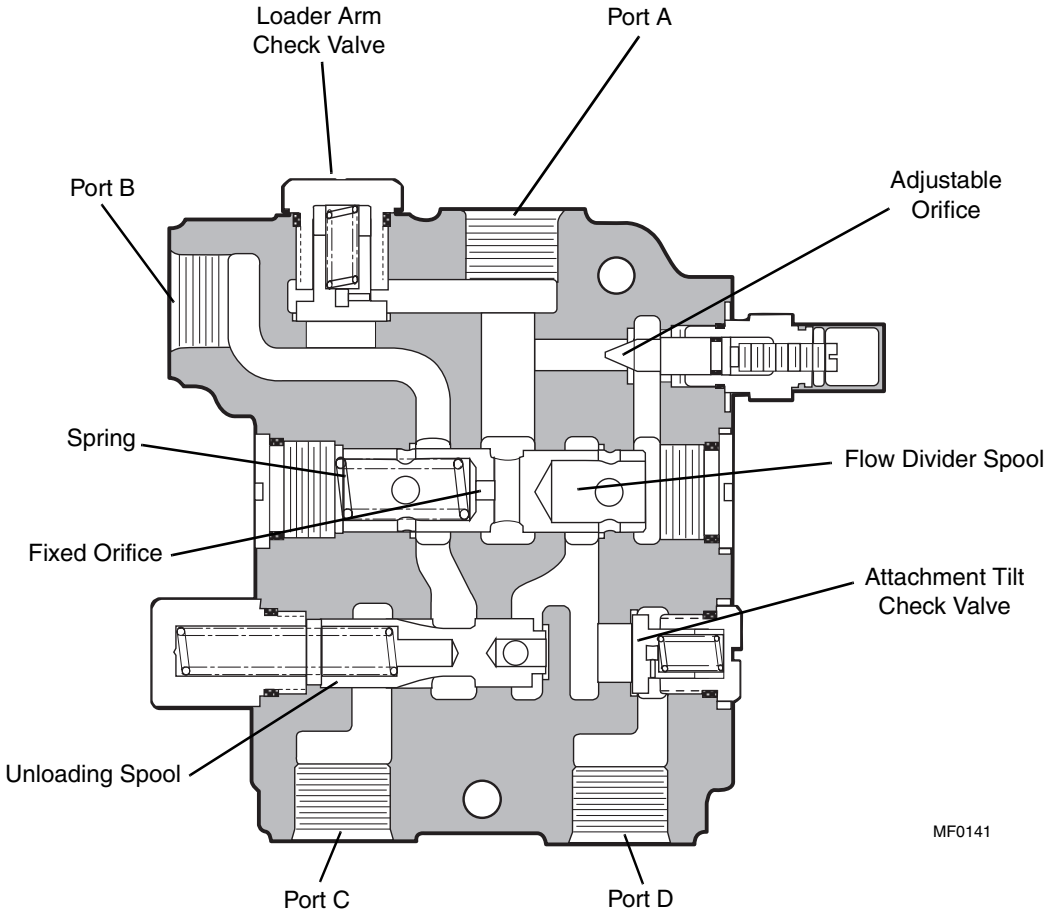


Figure 4-23 Self Level Valve

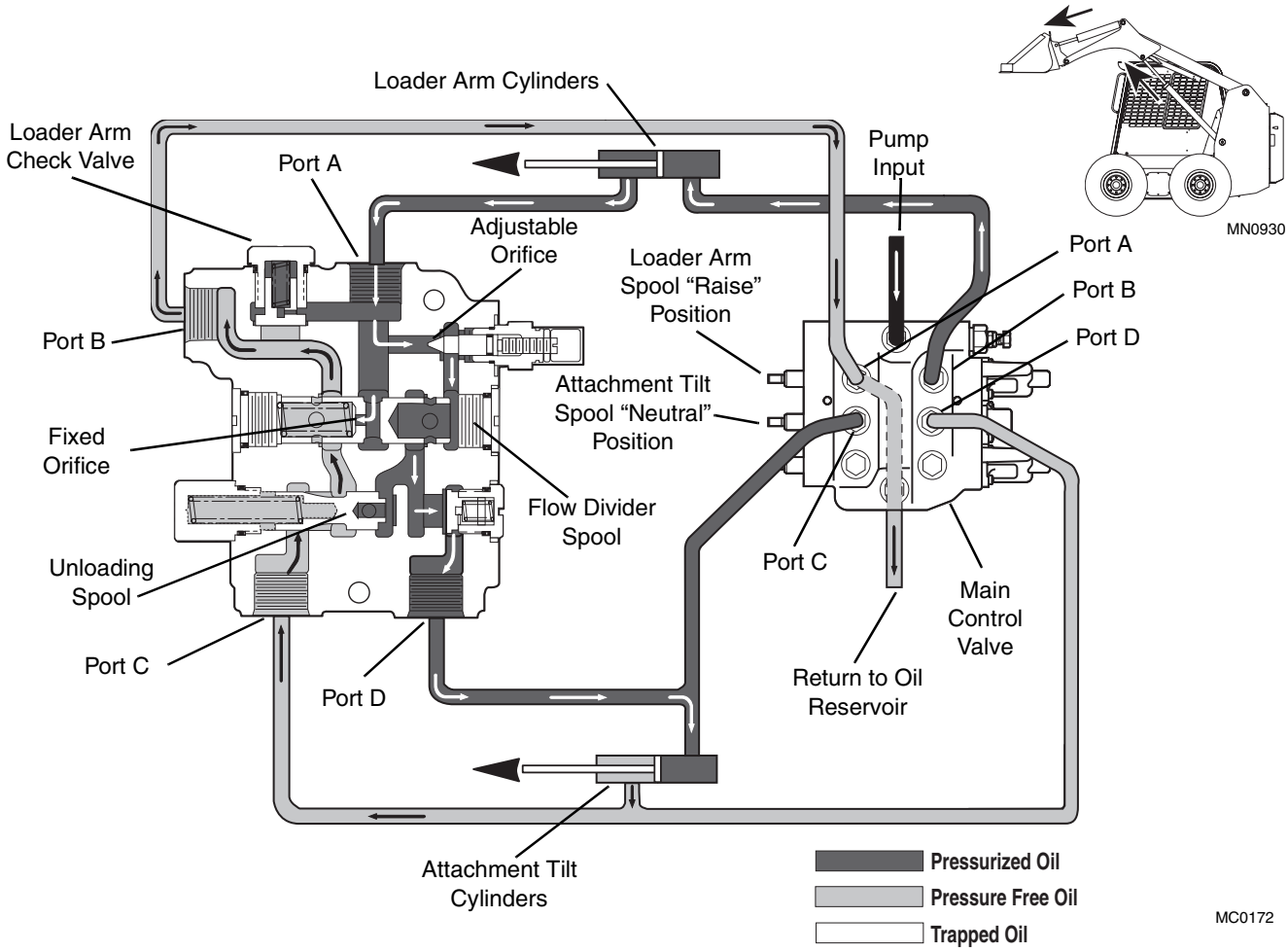


Figure 4-24 Self Leveling Circuit

4.8.2 Valve Operation

The self level valve directs oil flow from the main control valve to the loader arm cylinders and attachment tilt cylinders as follows:

a. Self Leveling Circuit

With the main control valve attachment tilt spool in "NEUTRAL" and the loader arm spool in the "RAISE" position, flow from the main control valve enters the base end of the loader arm cylinders.

As the loader arm cylinders extend, flow from the rod ports are directed to port A at the self level valve. Flow entering port A is able to pass through the adjustable orifice and through the fixed orifice in the flow divider spool.

The proportion of the flow split is determined by the size of the adjustable orifice. The remainder of the oil flows through the fixed orifice and out port B back to the main control valve and returns to the oil reservoir.

The oil that passes through the adjustable orifice opens the attachment tilt check valve and flows out port D to the base end of the attachment tilt cylinders. The resistance on the movement of the attachment tilt cylinders creates a pressure high enough to open the unloading spool in the self level valve.

As the attachment tilt cylinders extend, the oil flow from the rod ports of the cylinders enters port C past the open unloading spool, around the flow divider spool and out port B back to the main control valve and returns the oil to the reservoir.

Note: *The purpose of the unloading spool is to prevent the attachment tilt cylinders from dumping during the self leveling cycle.*

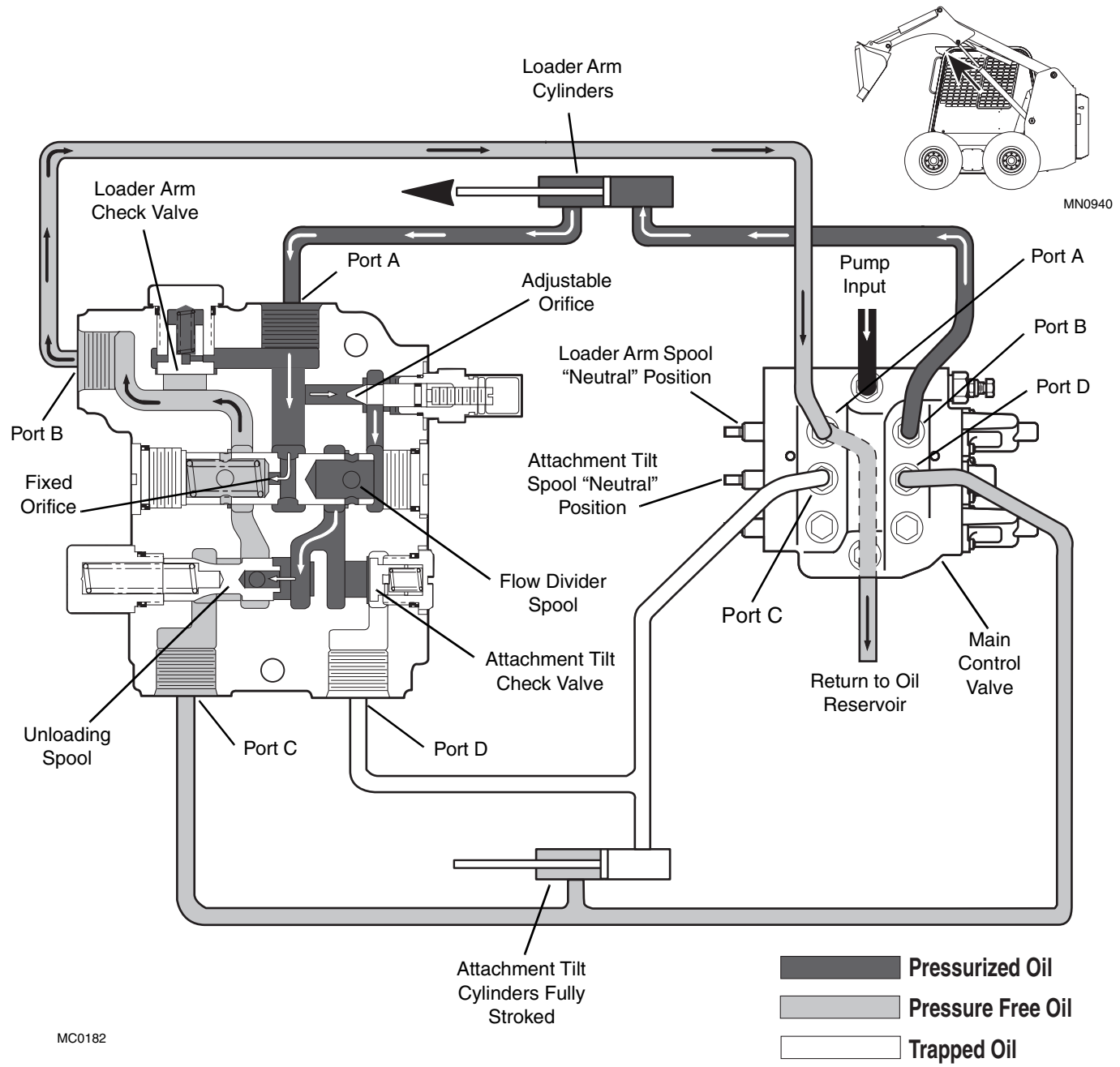


Figure 4-25 Self Leveling Circuit

In case the attachment tilt cylinders reach the fully extended state during the self leveling cycle, or the operator moves the attachment tilt pedal to the "forward" position, the loader arm cylinders will continue to raise. Because the attachment tilt cylinders are fully stroked, oil that would normally flow out port D to the base end of the attachment tilt cylinders is dead headed. Oil pressure in the self level valve will cause the unloading spool to shift to the left and unload the flow back to the oil reservoir. This prevents the loader arm cylinders from stopping during the raise function.

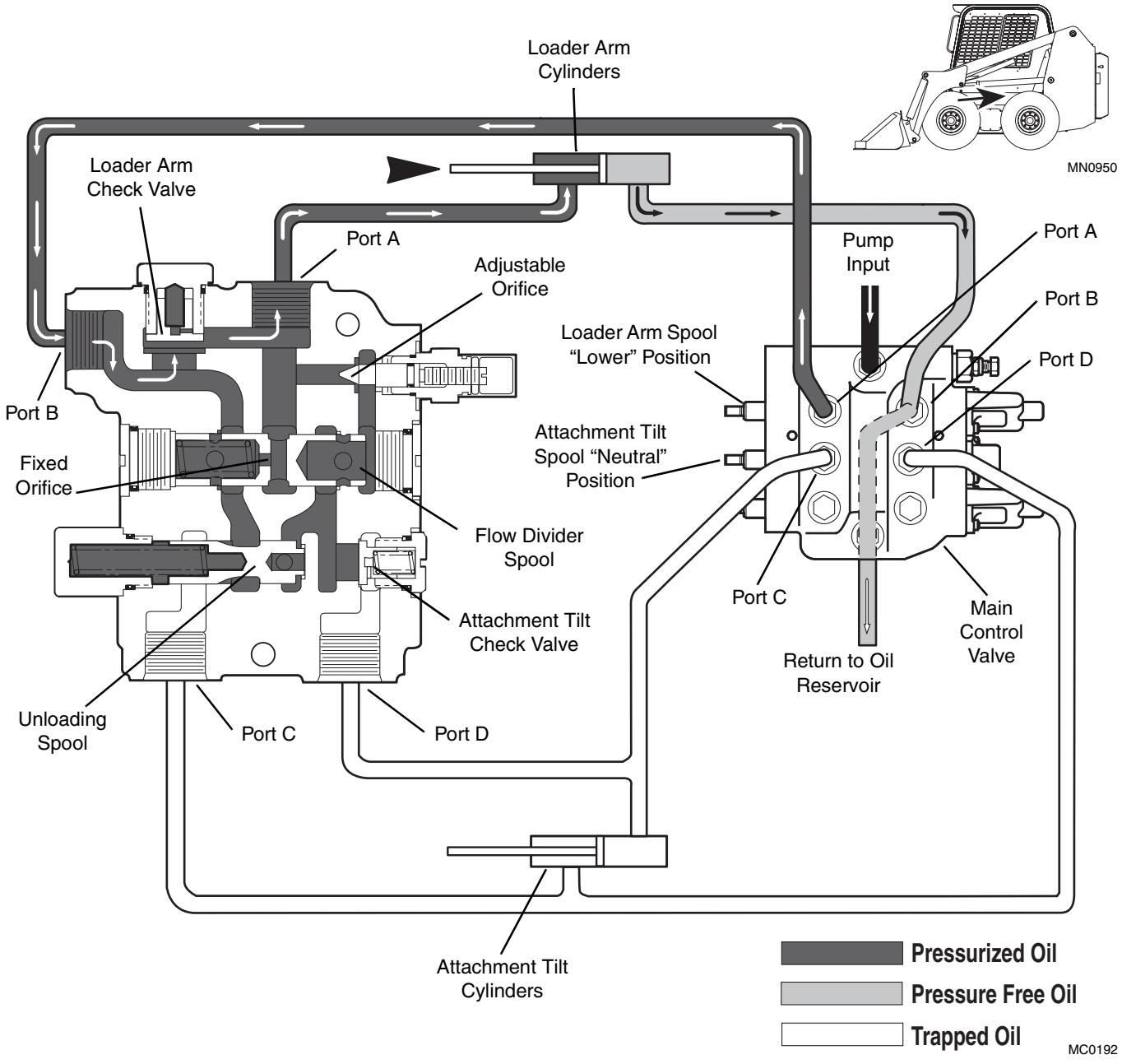


Figure 4-26 Loader Arm Cylinder Retracting Circuit

b. Loader Arm Cylinder Retracting Circuit

When the loader arm spool in the main control valve is shifted into the "lower" position, oil flow is directed to port B at the self level valve. Oil flow enters the self level valve, opens the loader arm check valve and flows out port A to the rod end of the loader arm cylinders.

Oil from the base end of the loader arm cylinders is directed back to the main control valve and returns to the oil reservoir.

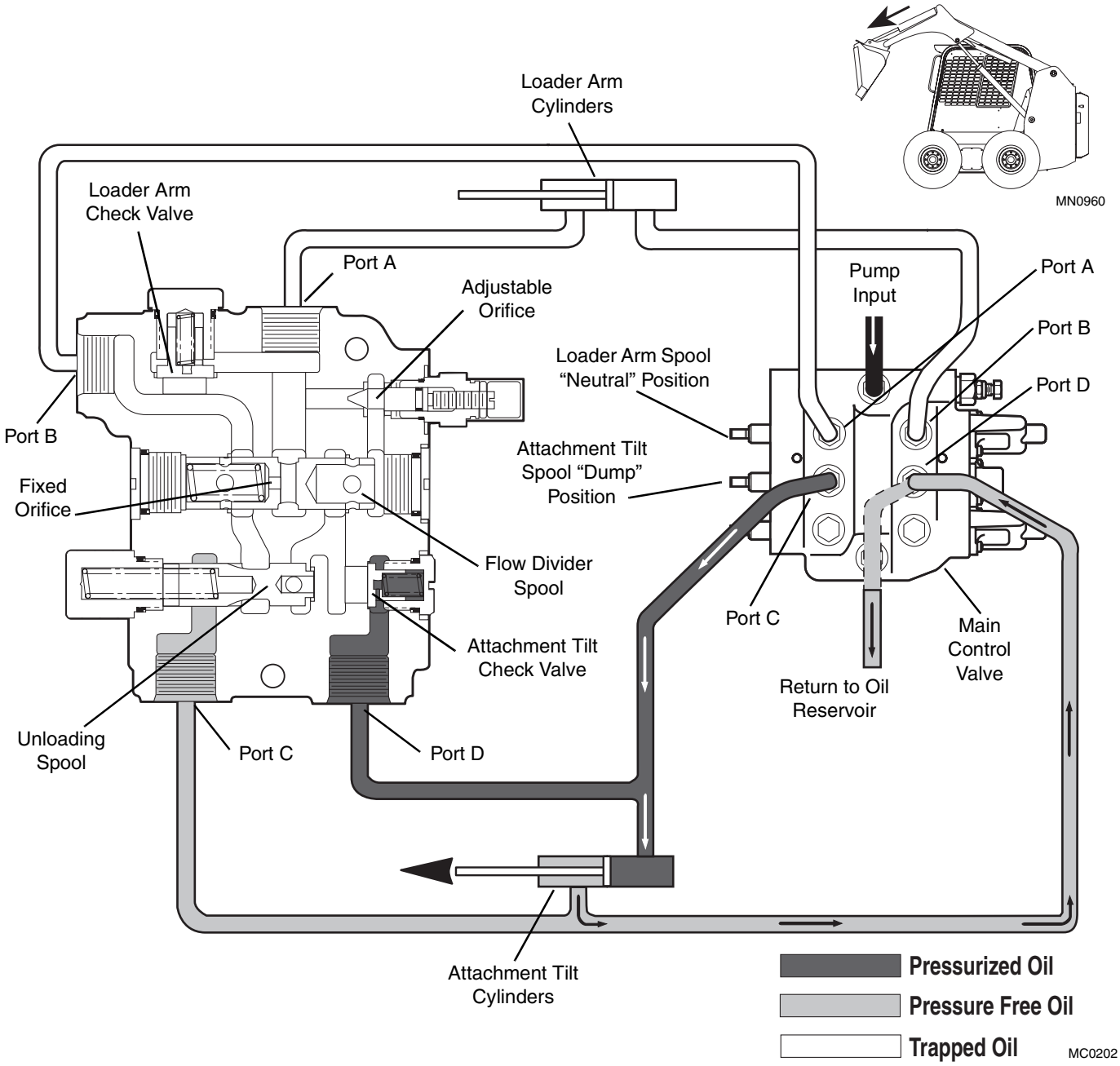


Figure 4-27 Extending Attachment Tilt Cylinder Circuit

c. Extending Attachment Tilt Cylinder Circuit

When the attachment tilt spool in the main control valve is shifted into the "dump" position, oil flow is directed from the main control valve to the base end of the attachment tilt cylinders. Oil flow also enters the self level valve at port D, but the oil is blocked by the attachment tilt check valve.

Return flow also enters port C in the self level valve, but is blocked by the unloading spool. Oil from the rod end of the attachment tilt cylinders is directed back to the main control valve and returns to the oil reservoir.

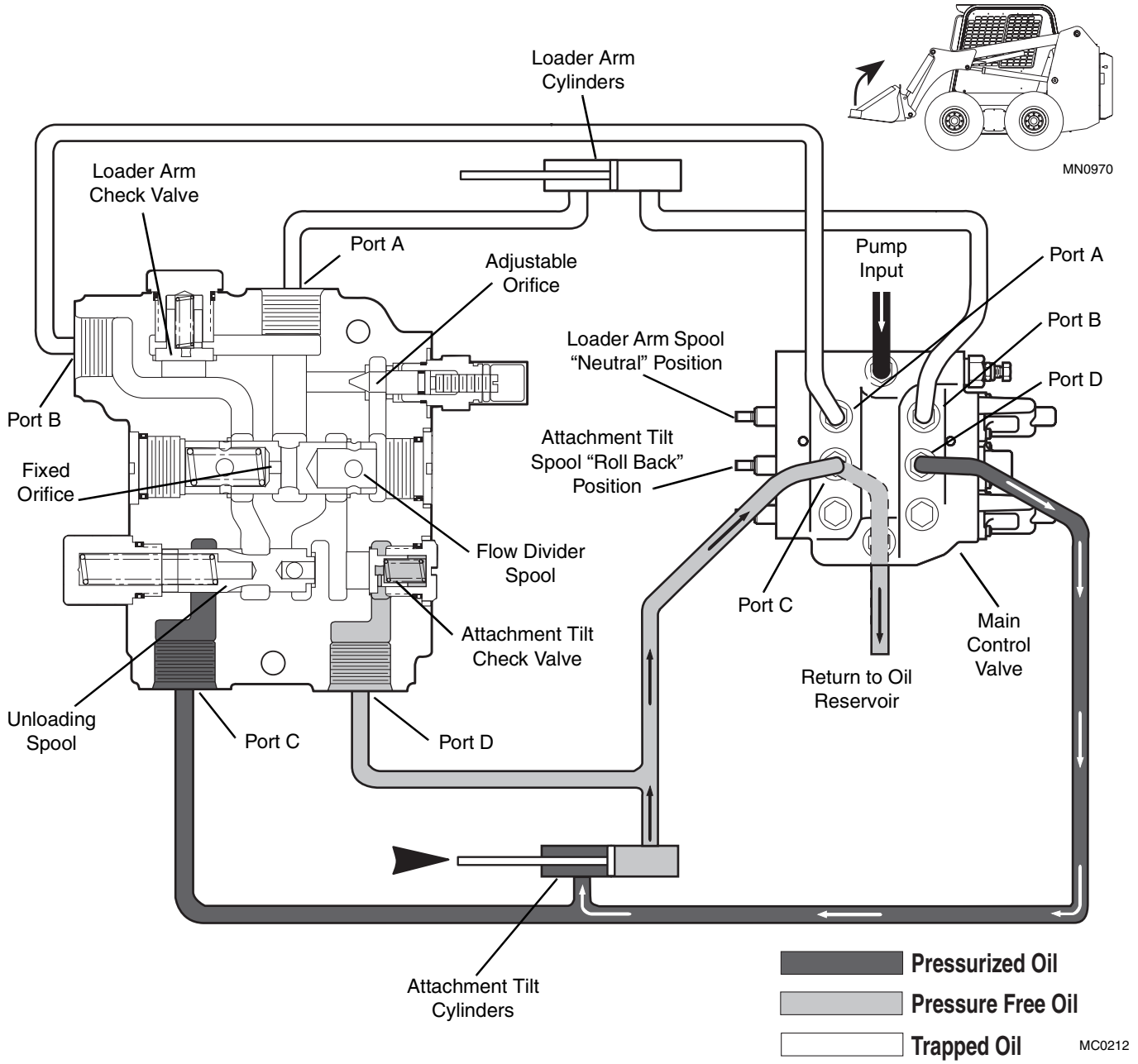


Figure 4-28 Retracting Attachment Tilt Cylinder Circuit

d. Retracting Attachment Tilt Cylinder Circuit

When the attachment tilt spool in the main control valve is shifted into the "roll back" position, oil flow is directed to the rod end of the attachment tilt cylinders. Oil flow also enters the self level valve at port C, but is blocked by the unloading spool.

Return oil flow enters port D in the self level valve, but is blocked by the attachment tilt check valve; so as a result, oil from the base end of the attachment tilt cylinders is directed back to the main control valve and returns to the oil reservoir.

4.8.3 Self Level Check Valve Maintenance

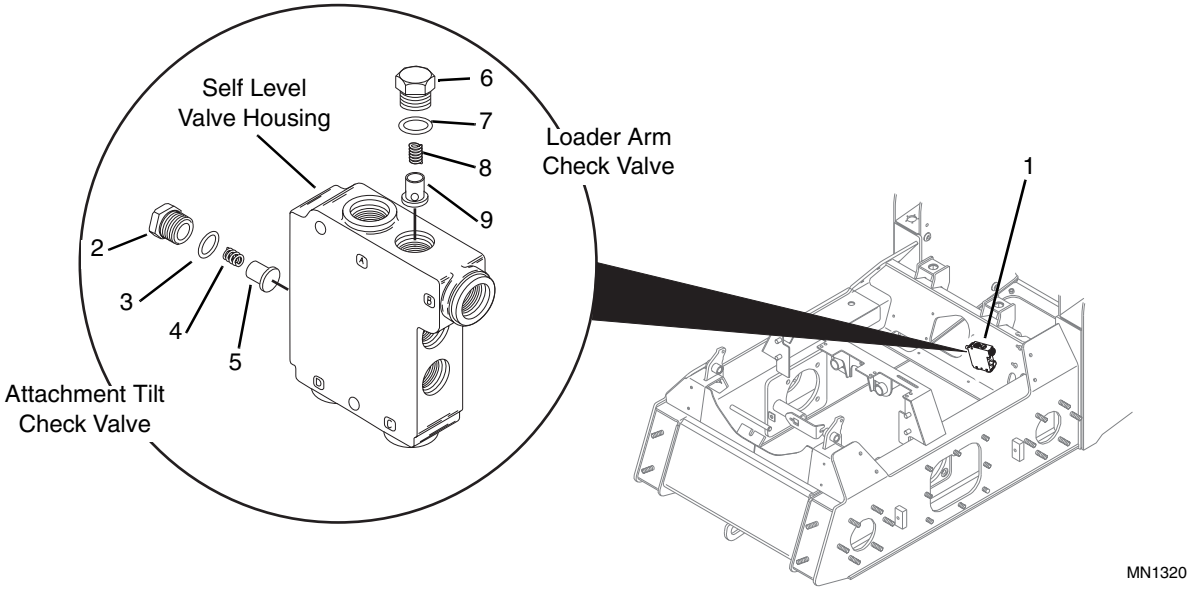


Figure 4-29 Self Level Check Valve Maintenance

There are two check valve assemblies in the self level valve. Each assembly consists of a plunger, spring, and plug assembly. The attachment tilt check valve is located in the lower rear of the valve housing and consists of items 2 through 5. The loader arm check valve is located in the top of the valve housing and consists of items 6 through 9. Remove each check valve assembly as follows:

a. Removal

IMPORTANT: *Do not mix parts from one check valve with another. Check valve parts are not interchangeable.*

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

4. Locate the self level valve (Fig. 4-29, 1) on the inside of the frame.
5. Clean the self level valve housing around the check valve to be removed.
6. Remove plug assembly (Fig. 4-29, 2 or 6) with o-ring (3 or 7) from the valve housing. Remove and discard the o-ring from both plugs.
7. Remove spring (Fig. 4-29, 4 or 8) and plunger (5 or 9) from the valve housing cavity.
8. Plug the open cavity in valve housing.

b. Cleaning and Inspection

1. Clean and dry all parts with a suitable solvent.
2. Inspect the plunger for scratches, nicks or scoring, and inspect the spring for cracks or breaks.

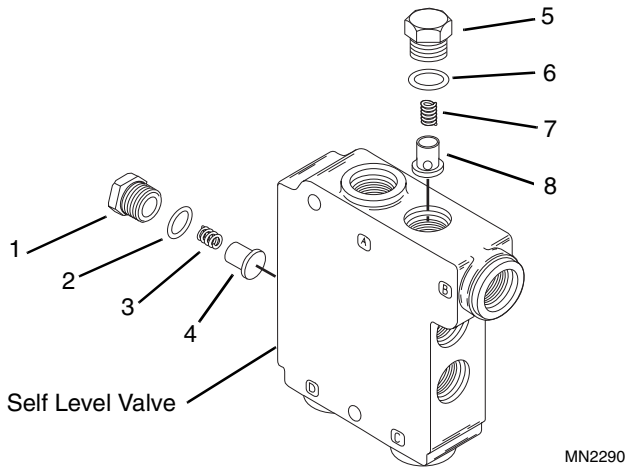


Figure 4-30 Self Level Valve

c. Replacement

1. Replace either plunger (Fig. 4-30, 4 or 8) if nicked, scored or scratched.
2. Replace either spring (Fig. 4-30, 3 or 7) if cracked, broken, or suspected to be weak.
3. Replace o-ring (Fig. 4-30, 2 or 6) with a new o-ring.

d. Reassembly and Installation

1. Center the plungers (Fig. 4-30, 4 or 8) in the valve body cavity.
2. Insert the springs (Fig. 4-30, 3 or 7) into the holes in the plunger (4 or 8).
3. Lubricate the new o-ring's (Fig. 4-30, 2 or 6) with clean oil and install on the plugs (1 or 5). Do not cut or over stretch o-ring.
4. Install the plug assemblies, with o-rings, into the respective bores in the valve body.
5. Torque plug assembly (Fig. 4-30, 1) to 27-30 lb/ft (37-41 Nm) and plug assembly (5) to 21-24 lb/ft (28-32 Nm).
6. Refer to "Startup After Hydraulic Repair," Section 4.5.
7. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

4.8.4 Self Level Valve Adjustable Orifice Assembly Maintenance

The adjustable orifice in the self level valve controls the response of the attachment tilt hydraulic circuit as the loader arm is being raised, by dividing the hydraulic flow between the base ports of the loader arm and attachment tilt cylinders. The flow division is controlled by the adjustable orifice.

a. Removal

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

4. Locate the self level valve on the inside of the frame (Refer to Fig. 4-29).
5. Clean area around the adjustable orifice assembly.

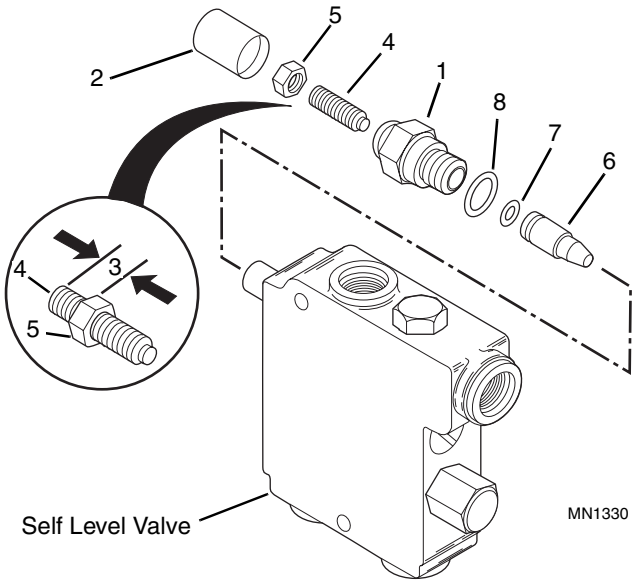


Figure 4-31 Self Level Valve Adjustable Orifice

6. Remove the adjustment cap assembly (Fig. 4-31, 1) from the self level valve.
7. Plug the orifice bore in the valve body cavity.

b. Disassembly

1. Remove the cover (Fig. 4-31, 2) from the orifice assembly. Measure and record the visible thread length (Dimension 3) from end of the setscrew (4) to the top of the jam nut (5).
2. Remove the nut (Fig. 4-31, 5) and setscrew (4) from the adjustment cap (1).
3. Slide pin (Fig. 4-31, 6) out of the adjustment cap (5). Remove and discard the o-ring (7) from the pin.
4. Remove and discard the o-ring (Fig. 4-31, 8) from the adjustment cap (1).

c. Cleaning and Inspection

1. Clean and dry all parts with a suitable solvent.
2. Check pin for scratches and nicks.

d. Replacement

1. Replace o-rings (Fig. 4-31, 7 & 8) with new o-rings.
2. Replace pin (Fig. 4-31, 6) if it is damaged.

e. Assembly and Installation

1. Lubricate new o-ring (Fig. 4-31, 8) with clean oil and install it on the adjustment cap (1). Do not cut or over stretch o-ring.
2. Lubricate new o-ring (Fig. 4-31, 7) with clean oil and install it on the pin (6). Do not cut or over stretch o-ring.
3. Lubricate pin (Fig. 4-31, 6) with clean oil and carefully slide it into the adjustment cap (1).
4. Install the nut (Fig. 4-31, 5) onto the setscrew (4), and screw the setscrew into the adjustment cap (1). Adjust the visible thread distance (3) to the dimension recorded in “Disassembly,” Step 1, and tighten the nut (5).
5. Install the cover (Fig. 4-31, 2) on the adjustment cap (1)
6. Remove the plug from the orifice bore in the self level valve housing and install the adjustable cap assembly. Torque the adjustment cap to 10-12 lb/ft (14-16 Nm).
7. Refer to Section 4.5, “Startup After Hydraulic Repair.”
8. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

f. Adjustment

With the vehicle hydraulic system warmed to normal operating temperature, and the attachment tilt cylinders positioned to ground the attachment, raise the loader arm. As the loader arm raises, the attachment tilt cylinders should extend, and keep the attachment level with the ground.

As the loader arm is being raised:

- If the attachment does not move, the setscrew (Fig. 4-31, 4) has bottomed out on the pin, and needs to be adjusted OUT.
- If the attachment curls, the setscrew (Fig. 4-31, 4) needs to be adjusted OUT.
- If the attachment dumps, the setscrew (Fig. 4-31, 4) needs to be adjusted IN.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

Remove the cover (Fig. 4-31, 2), loosen the nut (5), and adjust the setscrew (4) in small increments until the proper self level response is achieved. Tighten the nut (5) and replace the cover (2) to complete the adjustment.

4.8.5 Self Level Valve Removal and Replacement

a. Removal

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

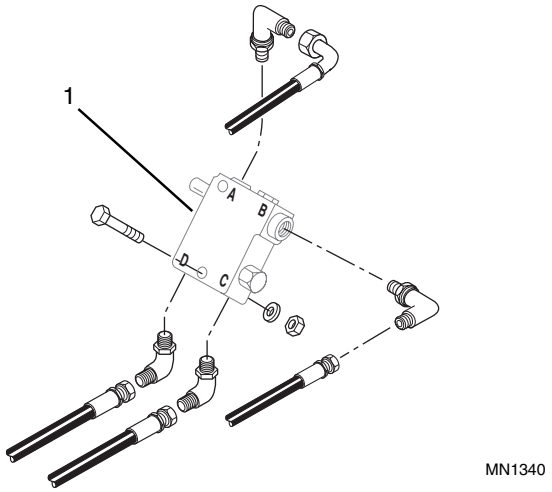


Figure 4-32 Self Level Valve Assembly Removal

4. Locate the self level valve (Fig. 4-32, 1) on the inside of the frame .
5. Clean area around the hydraulic fittings, tubes, and hoses where they attach to the self level valve assembly.
6. Tag and remove all hydraulic hoses from the hydraulic fittings on the self level valve assembly (Fig. 4-32). Cap or plug all hoses and ports in the valve housing.
7. Remove capscrews that fasten the valve assembly to the loader and remove valve assembly from the loader.

b. Disassembly

1. Tag and remove hydraulic fittings from the valve body.
2. Remove and discard o-rings from hydraulic fittings.

c. Cleaning and Inspection

1. Clean and dry hydraulic fittings with a suitable solvent.
2. Check hydraulic fittings for any damage.

d. Replacement

1. Replace hydraulic fittings that are damaged.
2. Replace all o-rings for the hydraulic fittings with new o-rings.
3. Replace self level valve assembly with a new assembly.

e. Reassembly and Installation

1. Lubricate new o-rings with clean oil and install them on the hydraulic fittings. Do not cut or over stretch the o-rings.
2. Install the hydraulic fittings into the new valve body in the same ports and orient them the same as they were before removal. Refer to Section 2.8, "Torques" for torque specifications.
3. Install new self level valve assembly. Secure with capscrews. Do not exceed 12 lb/ft (16 Nm) torque.
4. Install the hydraulic hoses removed earlier. Refer to Section 2.8, "Torques" for the torque specifications.
5. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
6. Refer to Section 4.5,"Startup After Hydraulic Repair."

4.8.6 Self Level Valve Bypass Procedure

If the loader arm or attachment tilt cylinders will not support a load and leak down, bypass the self level valve and recheck the operation of the cylinders.

a. Bypass the self level valve as follows:

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

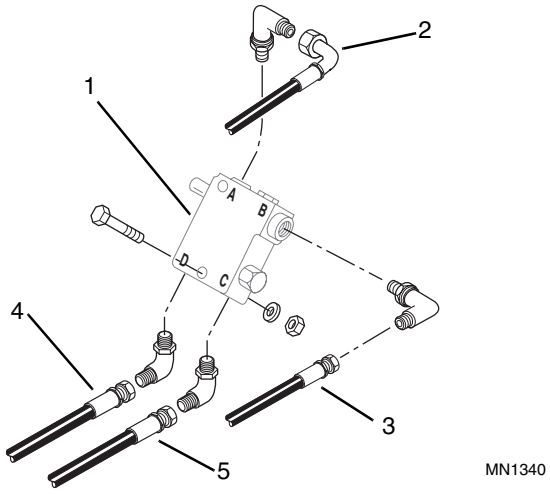


Figure 4-33 Self Level Valve Assembly

4. Locate the self level valve (Fig. 4-33, 1) on the inside of the frame.
5. Clean area around the hydraulic fittings and hoses where they attach to the self level valve assembly.
6. Disconnect hydraulic hose (Fig. 4-33, 2 & 3) from the fittings on the self level valve. Using a suitable hose coupler, connect hose (2 & 3) together, and tighten securely.
7. Disconnect hydraulic hose (Fig. 4-33, 4) from the fitting on the self level valve. Install a mating plug into the end of the hose and tighten securely.
8. Disconnect hydraulic hose (Fig. 4-33, 5) from the fitting on the self level valve. Install a mating plug into the end of the hose and tighten securely.
9. Cap all fittings on the self level valve.
10. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
11. Refer to Section 4.5, "Startup After Hydraulic Repair."

If the loader arm or attachment tilt cylinders DO NOT support the load and DO leak down, the self level valve is not defective. Refer to Paragraph "b" in this section to reconnect the self level valve.

If the loader arm or attachment tilt cylinders DO support the load and DO NOT leak down, the self level valve is at fault. Refer to Section 4.8.7, "Self Level Valve Troubleshooting" for further diagnostic procedures.

b. Reconnect the self level valve as follows:

1. If the Operator's Protective Structure is not already raised, perform the following two steps:
   a. Park the vehicle on a level surface.
   b. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

2. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

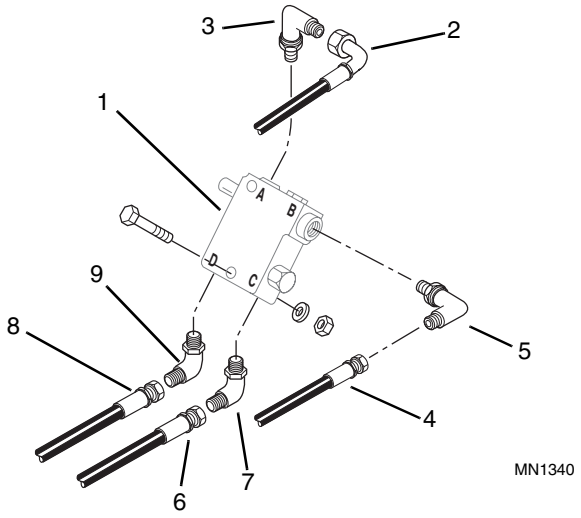


Figure 4-34 Self Level Valve Assembly

3. Locate the self level valve (Fig. 4-34, 1) on the inside of the frame.
4. Clean the hydraulic hose ends and the area around the hydraulic fittings on the self level valve assembly.
5. Remove the caps on the four fittings on the self level valve.
6. Remove the coupler connecting hydraulic hose (Fig. 4-34, 2 & 4). Install hose (2) to fitting (3) on the self level valve. Install hose (4) to fitting (5) on the self level valve.
7. Remove the plug from the end of hydraulic hose (Fig. 4-34, 6) and install the hose on the fitting (7).
8. Remove the plug from the end of hydraulic hose (Fig. 4-34, 8) and install the hose on the fitting (9).
9. Torque all four hydraulic hoses. Refer to Section 2.8, "Torques" for the torque specifications.
10. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
11. Refer to Section 4.5, "Startup After Hydraulic Repair."

4.8.7 Self Level Valve Troubleshooting

Trouble	Probable Cause	Remedy
1. Loader arm delay at start of self level or unstable self level.	Air in system.	Cycle loader arm and attachment slowly to rid system of air.
2. Loaded attachment dumps or uncurls when control valve is in NEUTRAL.	Unloading spool is leaking.	Remove and inspect unloading spool for damage.
3. Insufficient self level.	Pin is out of adjustment.	Adjust the pin outward to achieve proper flow split.
	Broken unloading spool spring.	Replace unloading spool spring.
	Flow divider spool stuck towards adjustment pin side.	Remove flow divider spool and check for damage.
4. Attachment dumps faster than loader arm raises. Too much self level.	Pin is out of adjustment.	Adjust the pin inward to achieve proper flow split.
	Flow divider spool is stuck towards port B.	Remove flow divider spool and inspect for damage.
	Flow divider spool installed wrong.	Remove spool and install with internal orifice towards port B.
5. With attachment dumped, loader arm is slow in starting to raise.	Dampening orifice in the unloading spool is plugged.	Remove unloading spool and clean dampening orifice.
6. Attachment does not move in self level.	Pin is screwed in all the way.	Adjust the pin outward to achieve proper flow split.
	Dampening orifice in the unloading spool is plugged.	Remove unloading spool and clean dampening orifice.
	Ports A and B plumbed backwards.	Reverse hoses to ports A and B.
7. Attachment curls in self level.	Ports C and D plumbed backwards.	Reverse hoses to ports C and D.
8. External leakage.	Damaged o-ring.	Replace o-ring.

4.9 HYDRAULIC CYLINDERS

4.9.1 Description

The loader contains two loader arm and two attachment tilt cylinders. Each cylinder is double-acting and consists of a rod inside of a barrel that is extended or retracted by hydraulic system oil pressure.

4.9.2 Operation

When the appropriate foot pedal (or optional wrist control) is activated, the main control valve directs hydraulic system oil to the rod or base end of the pistons in each cylinder pair, extending or retracting the rods.

4.9.3 General Maintenance Instructions

Rebuild cylinders only in a clean, well lighted area where you can carefully inspect all components. If a cylinder is to remain dismantled for any lengthy period, coat the metal parts that are to be reused with a good preservative and place in protective storage. Refer to specific instructions for removal, rebuilding and installation of each cylinder.

a. General Disassembly Instructions

1. All cylinder bushings are glued in place with Loctite, Black Max 380 Adhesive. If these bushings are removed, they will be damaged and can NOT be reused. Remove the bushings and seals as follows:
   a. Pull the bushing seals out of the counterbore and press the bushings out of the cylinder trunnions.
   b. The adhesive will leave a residue on the inside of the trunnion, which must be removed by brushing with a soft brass wire brush prior to reassembly.
2. The gland cap on each loader arm lift cylinder (Fig. 4-42, #7) is secured in place with a setscrew.
   a. Remove the gland cap from the barrel by loosening the setscrew in the gland cap and tap all the way around the gland cap with a hammer.
   b. Use a pipe wrench to loosen the gland cap 1/4 turn. Tap around the gland cap again, then the gland cap should unscrew from the barrel.
3. The gland head on each attachment tilt cylinder (Fig. 4-48, #9) screws on the end of the barrel. Use a pin spanner wrench to loosen and remove the gland head.
4. Do not attempt to salvage cylinder seals or sealing rings. Any hydraulic component must always be serviced with a complete seal kit during a component rebuild. Repair kits are available.

b. General Cleaning Instructions

1. Clean all reusable metal parts thoroughly with a suitable solvent after disassembly and prior to inspection.

IMPORTANT: *Before reassembly, clean and dry all parts a second time with a suitable solvent.*

2. Protect the finish on the rod at all times. Damage to the rod can cause premature seal failure.

c. General Assembly Instructions

1. Use proper tools for specific installation tasks. Clean tools are required for installation.
2. Do not over-stretch seals, wipers and o-rings. Make sure that seals, wipers and o-rings are not twisted or distorted in their grooves.
3. Lubricate piston seals and seal installation path with clean hydraulic oil from a filtered supply.
4. Use a suitable compression tool when installing glands and pistons into cylinders to prevent damage to the seals and o-rings. Place a little hydraulic oil on the seals and outside of glands and pistons to aid in installation.
5. Loctite Black Max 380, used to secure new cylinder bushings in place, is an adhesive which has special storage requirements. DO NOT keep this adhesive in stock. Only order enough of this adhesive from your local Loctite Distributor to make the required repair. For the name of your nearest Loctite Distributor, call Loctite at 1-800-323-5106.
6. When applying Loctite Black Max 380 Adhesive, follow the manufacturer's instructions. Make sure that the inside of the trunnion is free from adhesive residue before pressing the new bushings into the trunnion.
7. Cylinder bushings are impregnated with a special lubricant, and DO NOT require additional lubrication. DO NOT apply any type of lubricant to the cylinder pins during installation. This will shorten the normal life of the bushing.
8. Following cylinder reassembly:
   a. Initially bench test the cylinder at low operating pressure to be sure the piston and rod are moving freely in both directions, and that there is no external leakage.
   b. Install the cylinder on the vehicle, and with normal system operating pressure, check for unrestricted movement in both directions and for signs of external leakage.

4.9.4 Loader Arm Cylinder Maintenance

a. Vehicle Preparation

If your vehicle has an “open” cab proceed to Section 4.9.4 b, “Removal.” If your vehicle has an enclosed cab and/or front door assembly, proceed to the next step.

1. Remove the front door from the Operator's Protective Structure.

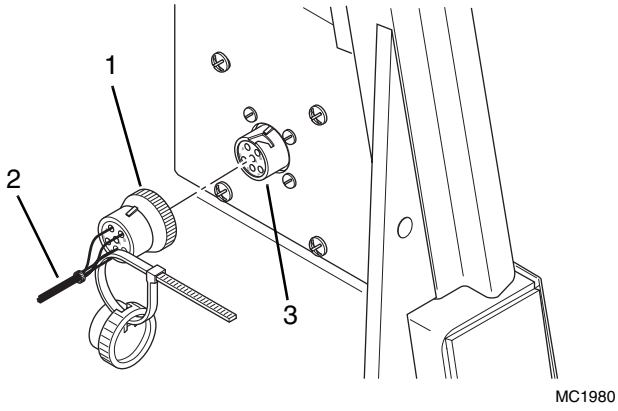


Figure 4-35 Door Harness Locking Collar

a. Rotate the locking collar (Fig. 4-35, 1) counter-clockwise to disconnect the door harness (2) from the fuse block (3).

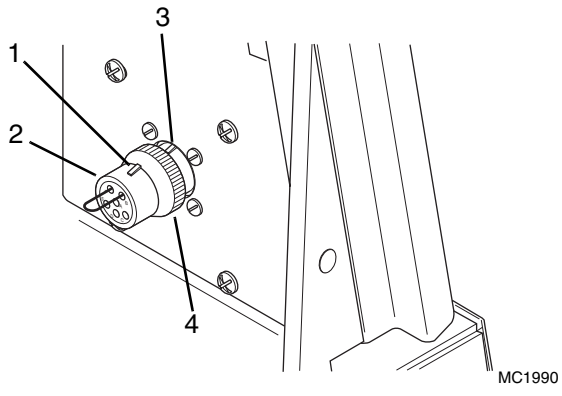


Figure 4-36 Jumper Harness

b. Line up the tab (Fig. 4-36, 1) on the jumper harness end (2) with the tab (3) on fuse block harness end. Rotate the locking collar (4) until you are able to slide the two pieces together. Rotate the locking collar (4) clockwise to lock in place.

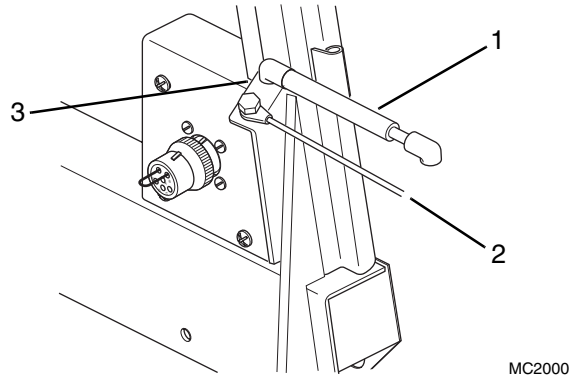


Figure 4-37 Gas Spring and Restraint Cable

c. Disconnect the gas spring (Fig. 4-37, 1) and restraint cable (2) from the gas spring mounting bracket (3) inside the Operator's Protective Structure.

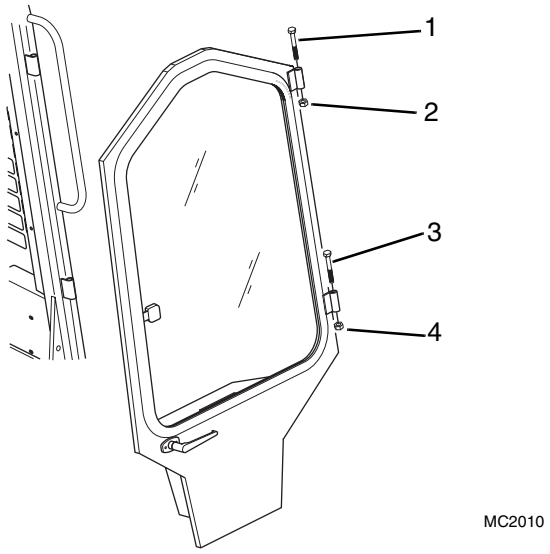


Figure 4-38 Door Hinge Hardware

d. Remove the lower door hinge nut (Fig. 4-38, 1) from the lower capscrew (2) and remove the capscrew. Remove the upper door hinge nut (3). Pull the upper capscrew (4) up far enough to clear the hinge on the Operator's Protective Structure and remove the door.

e. Proceed to Section 4.9.4 b, “Removal.”

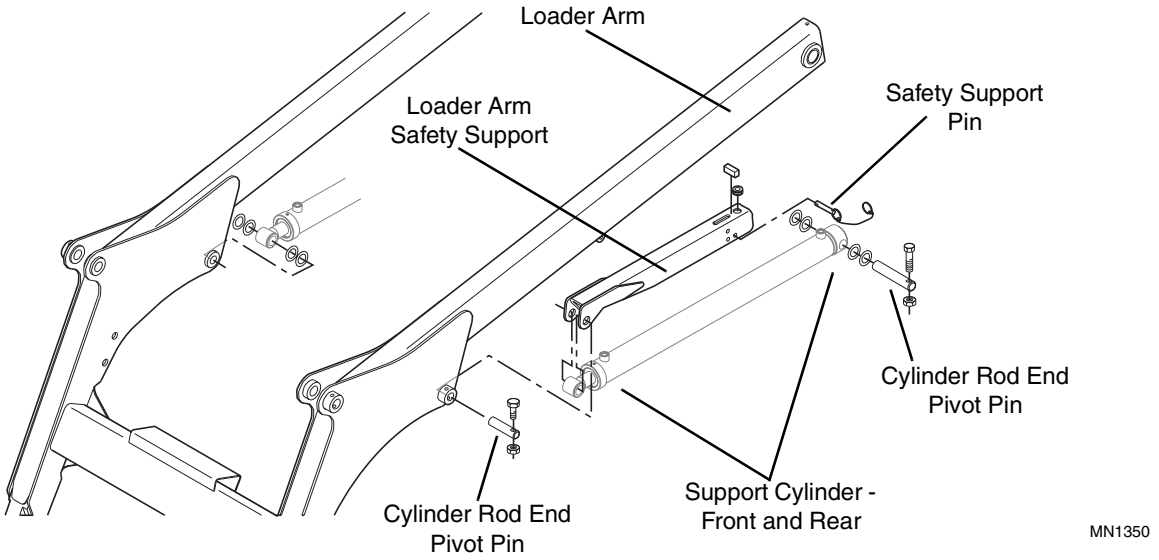


Figure 4-39 Loader Arm Cylinder and Related Components

b. Removal (Fig. 4-39)

1. Remove the attachment from the quick attach, and park the vehicle on a level surface.
2. Lower the loader arm against the front bumpers by using the "Float" control position. Shut the engine OFF, and raise the seat bar to engage the park lock.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate the foot pedals forward and backward (or optional wrist controls inward and outward) to relieve any trapped pressure in the hydraulic system, and exit the vehicle.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

IMPORTANT: *Be sure the hydraulic port areas are free from dirt and debris before disconnecting hydraulic fittings.*

4. Disconnect the hydraulic hoses from the rod and base end ports of the cylinder that is being serviced. Plug or cap the hoses and cylinder ports.
5. Place supports under the cylinder being removed to prevent the cylinder from falling while the pivot pins are removed.
6. Unlock and open the rear door, and raise the engine cover.

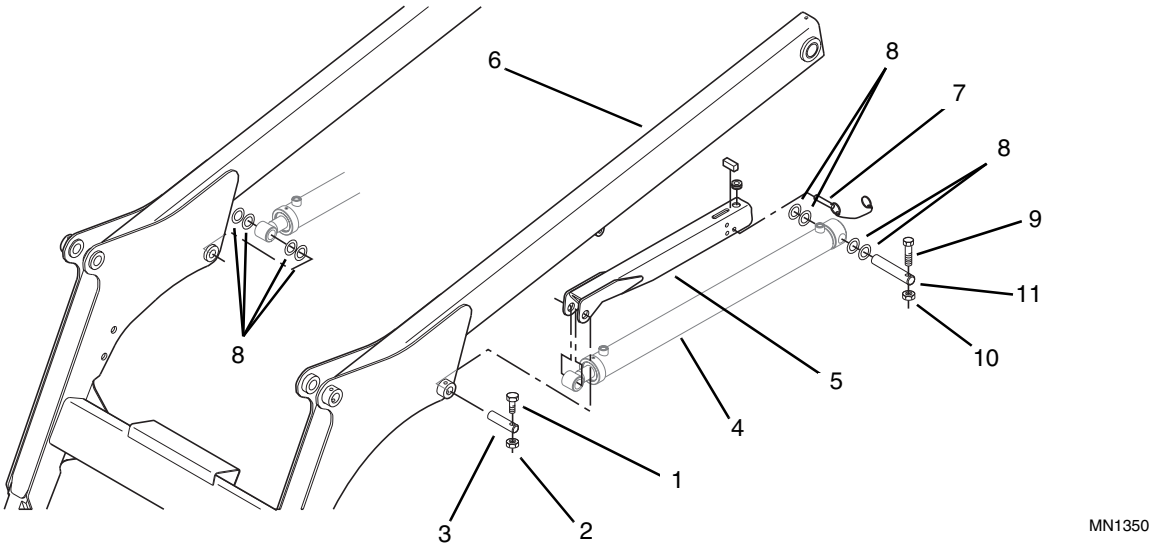


Figure 4-40 Loader Arm Cylinder Removal

WARNING: To avoid severe burns, **DO NOT** attempt the next procedure when the engine is HOT. Wait for the engine, muffler and tailpipe to cool before proceeding.

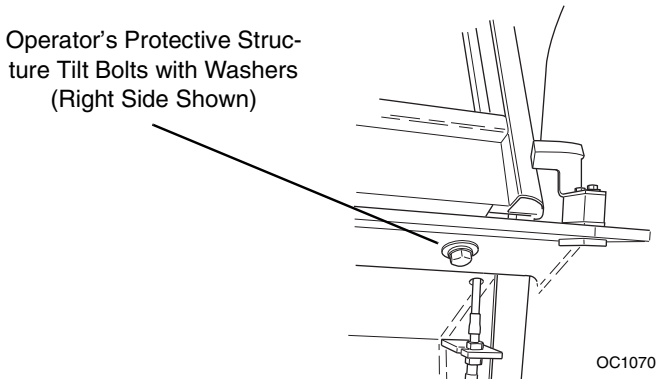


Figure 4-41 Operator's Protective Structure Retaining Bolts

7. At the rear corners of the Operator's Protective Structure loosen the two bolts and washers (Fig. 4-41) that secure it to the frame. The bolts are retained and will not come completely out of the frame.
8. At the front of the vehicle, grasp both front hand holds and tilt the Operator's Protective Structure forward until it locks securely in the raised position.
9. Remove the rod end pivot pin bolt (Fig. 4-40, 1) and locknut (2).

Note: *The rod end pivot pin (Fig. 4-40, 3) of the left cylinder (4) is the pivot point for the loader arm safety support (5). Before removing the left rod end pivot pin (3), ensure that the loader arm safety support (5) is secured in the normal operating position on the loader arm (6) by the safety support pin (7).*

Note: *As the pivot pins are removed in the following steps, note and record the location and quantity of shims (8) used at each pin location. It will be necessary to reinstall these shims in the same location and quantity during assembly later.*

10. Tap rod end pivot pin (Fig. 4-40, 3) from outside of vehicle and remove pivot pin and shims from vehicle.
11. Remove base end pivot pin bolt (Fig. 4-40, 9) and locknut (10).
12. Tap base end pivot pin (Fig. 4-40, 11) from the outside of vehicle to inside of engine compartment and remove pivot pin and shims from vehicle.
13. Remove loader arm cylinder (Fig. 4-40, 4) from vehicle.

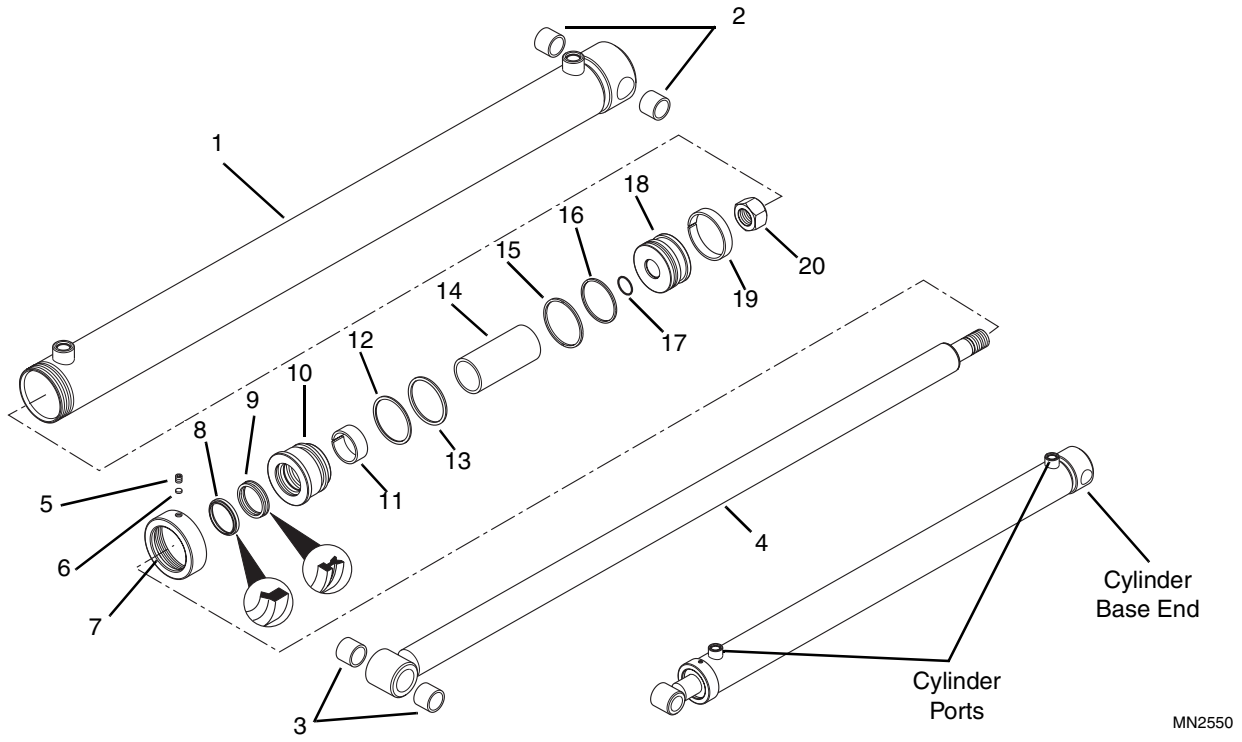


Figure 4-42 Loader Arm Cylinder Components

c. Disassembly

1. Use a suitable container to catch the oil from inside of the loader arm cylinder. Tip the cylinder over and drain the oil from the rod end port and the base end port.
2. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling center.
3. Secure the base end of cylinder in a vise and support rod end.
4. Remove hydraulic fittings from the cylinder ports and remove and discard o-rings from fittings.
5. Remove the gland cap setscrew (Fig. 4-42, 5) and locking insert (6). Tap all the way around the gland cap with a hammer, and loosen the gland cap 1/4 turn. Tap around the gland cap again, and unscrew from the barrel.
6. Slide rod assembly (Fig. 4-42, 4) from barrel assembly (1).
7. Secure trunnion end of the rod in a vise and support the piston end of the assembly.
8. Remove the locknut (Fig. 4-42, 20).
9. Slide piston (Fig. 4-42, 18) off rod.
10. Slide the spacer (Fig. 4-42, 14) off rod.
11. Slide gland head (Fig. 4-42, 10) and gland cap (7) off rod.
12. Remove square section seal (Fig. 4-42, 15), square ring (16), and small o-ring (17) from the piston and discard.
13. Remove o-ring (Fig. 4-42, 13), back-up ring (12), rod wiper (8), and deep Z seal (9) from the gland head (10) and discard.

d. Cleaning and Inspection

1. Thoroughly clean and dry all metal parts with a suitable solvent.
2. Clean and inspect bushings (Fig. 4-42, 2 & 3) in rod and barrel ends for wear.
3. Clean and inspect rod (Fig. 4-42, 4) for scratches, dents, flat spots, damaged threads, and other damage.
4. Clean and inspect gland cap (Fig. 4-42, 7) for nicks, burrs, or other damage.
5. Clean and inspect piston (Fig. 4-42, 18) and gland head (10) for damage.
6. Clean and inspect cylinder pivot pins for wear and rust.
7. Clean and inspect hydraulic fittings for damage.
8. Using a suitable light, inspect barrel bore and threads for scratches, dents, burrs, or other damage.

e. Repair

1. Repair minor rod (Fig. 4-42, 4), gland head (10), and piston (18) damage using a hard Arkansas stone or crocus cloth.
2. Smooth down any sharp edges on metal parts that could damage seals and cause leakage.

f. Replacement

1. Replace rod wiper (Fig. 4-42, 8), deep Z seal (9), back-up ring (12), o-ring (11), and square section seal (15). Lubricate new seals with clean hydraulic system oil before assembly.
2. Major scratches, dents, flat spots and rust or blemishes on the chrome rod are not repairable and the rod must be replaced.
3. Replace rod (Fig. 4-42, 4) and/or gland cap (7) if the threads are damaged.
4. If the barrel (Fig. 4-42, 1) is damaged, the entire cylinder assembly will need to be replaced.
5. Replace the pivot pins if rusted or nicked beyond repair. DO NOT reuse a rusted or nicked pivot pin.
6. Replace hydraulic fittings if damaged and install a new o-ring on each fitting.
7. Replace the bushings (Fig. 4-42, 2 & 3) if worn or damaged. The cylinder bushings are glued in place with Loctite, Black Max 380 Adhesive (Refer to Section 4.9.3 c, Step 5). Remove the bushings and seals as follows:
   a. Press the bushings out of the cylinder trunnions.
   b. The adhesive will leave a residue on the inside of the trunnion, which must be removed by brushing with a soft brass wire brush prior to reassembly
   c. Apply Loctite Black Max 380 Adhesive (Refer to Section 4.9.3 c, Step 6), following the manufacturer's instructions. Press the bushings into place in the cylinder trunnions.

g. Assembly

1. Coat gland head (Fig. 4-42, 10) with a light film of clean oil and install deep Z seal (9), and rod wiper (8) into gland head (10). Install back-up ring (12) and o-ring (13) onto the gland head (10).
2. Coat piston (Fig. 4-42, 18) with a light film of clean oil and install square section seal (15) and square ring (16) onto piston.
3. Coat rod (Fig. 4-42, 4) and o-ring (17) with a light film of clean oil, and install the o-ring on the rod.
4. Place gland cap (Fig. 4-42, 7) onto gland head (10) and coat gland head with a light film of clean oil.
5. Coat the wear band (Fig. 4-42, 11) with a light film of oil, and assemble into the gland head (10). Slide the gland head onto the rod.
6. Coat spacer (Fig. 4-42, 14) with a light film of clean oil and slide onto the rod.
7. Coat piston (Fig. 4-42, 18) with a light film of clean oil and carefully slide piston onto threaded part of rod. Be careful not to damage the o-ring (17) when sliding the piston over threads of the rod.
8. Install locknut (Fig. 4-42, 20) and torque to 185 to 215 lb/ft (251-291 Nm).
9. Apply a compression sleeve or other suitable tool to piston and gland in order to compress seals and o-rings while inserting assembled rod with gland head and piston into the barrel assembly (Fig. 4-42, 1).

IMPORTANT: *When sliding assembled rod with gland head and piston into barrel assembly, be careful so that gland threads in barrel do not damage gland head, piston seals, or o-rings. Keep rod in line with barrel to prevent binding.*

10. Secure barrel end of cylinder in a vise while supporting its rod end.
11. Install and tighten the gland cap (Fig. 4-42, 7) onto barrel. Torque to 250-300 lb/ft (339-407 Nm).
12. Tighten setscrew (Fig. 4-42, 5) with locking insert (6) to secure gland cap.

h. Installation

Note: *DO NOT apply any type of lubricant to the cylinder pins during installation procedures that follow. Cylinder bushings are impregnated with a special lubricant, and DO NOT require additional lubrication.*

1. Position the cylinder on the vehicle, and align the cylinder base end with pivot pin holes on loader arm and rear frame.
2. Install the pivot pin with shims removed earlier. Check for .07" (1,8 mm) maximum gap on each side of the cylinder base. Adjust the shims if required, and secure in place with a bolt and locknut.
3. Align the cylinder rod end with pivot pin holes on loader arm.

Note: *The loader arm safety support arm hinges on the left cylinder rod end pivot pin. Ensure that the hardware removed during "Cylinder Removal" is replaced, and that the safety support moves freely once the rod end pivot pin is installed and secured.*

4. Install the pivot pin with shims removed earlier. Check for .06" (1,5 mm) maximum gap on each side of the cylinder rod. Adjust the shims if required, and secure in place with a bolt and locknut. Remove caps or plugs from the cylinder ports, hydraulic hoses and fittings.
5. Install hydraulic fittings and hoses in cylinder ports.
6. At the front of the vehicle, grasp the front hand holds and tilt the Operator's Protective Structure forward slightly.
7. Release the lock lever (Fig. 4-43, 1) in the lower left hand corner by pulling toward the front of the vehicle, and using both hand holds, slowly lower the Operator's Protective Structure down to the lowered position.

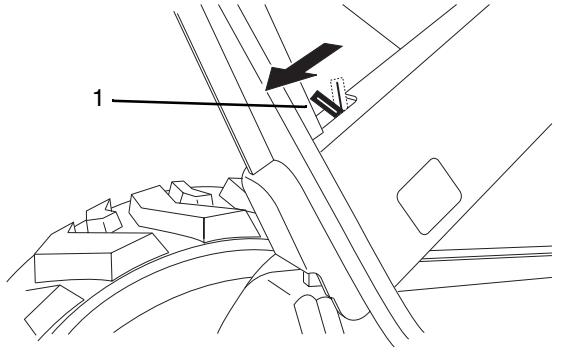


Figure 4-43 Operator's Protective Structure Lock Lever

8. At the rear corners of the Operator's Protective Structure, retighten the two bolts and washers through the access openings on each side of the vehicle. Torque to 150 lb/ft (203 Nm).
9. Refer to Section 4.5, "Startup After Hydraulic Repair."
10. Lower the engine cover and close and lock the engine compartment door.

i. Reassemble Front Door Assembly

1. If your vehicle is equipped with a front door assembly, reinstall the front door as follows:

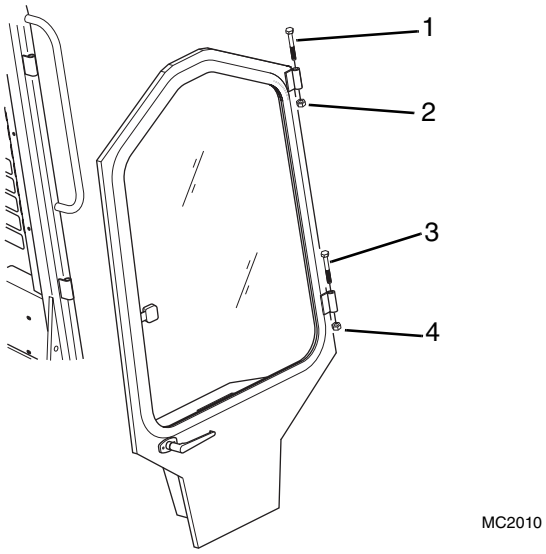


Figure 4-44 Door Hinge Hardware

a. Insert the upper door hinge capscrew (Fig. 4-44, 1) into the upper door hinge. Align the door hinges with the hinges on the Operator's Protective Structure and push the upper door hinge capscrew (1) through the upper hinge. Secure the upper capscrew in place with the upper door hinge nut (2). Tighten securely.

b. Insert the lower door hinge capscrew (Fig. 4-44, 3) through the lower hinges and secure in place with the lower door hinge nut (4). Tighten securely.

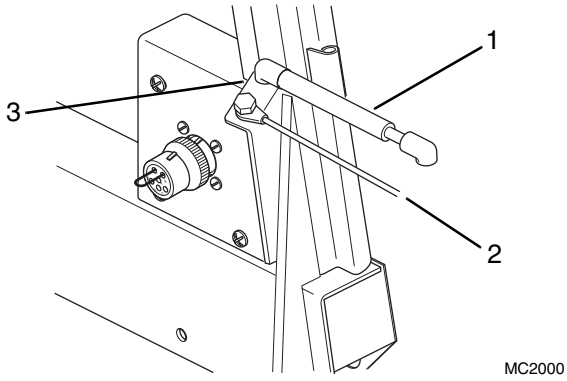


Figure 4-45 Gas Spring and Restraint Cable

c. Reassemble the gas spring (Fig. 4-45, 1) and the restraint cable (2) to the gas spring mounting bracket (3).

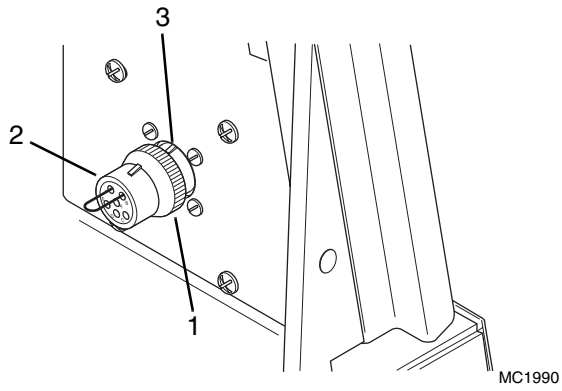


Figure 4-46 Jumper Harness

d. Rotate the locking collar (Fig. 4-46, 1) on the jumper harness (2) counterclockwise and remove from the fuse block harness (3). Store the jumper harness in a safe place. The jumper harness must be installed each time the door assembly is removed.

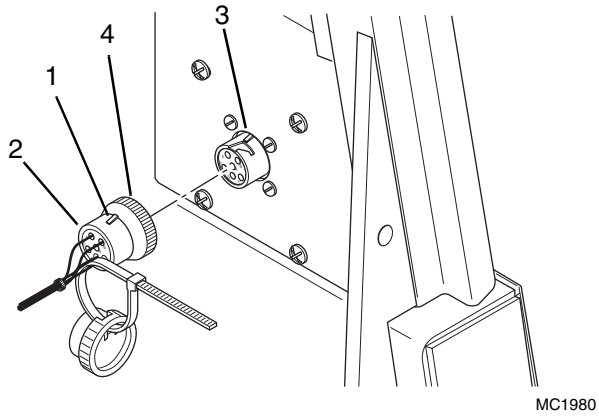


Figure 4-47 Door Harness Locking Collar

e. Line up the tab (Fig. 4-47, 1) on the door harness connector (2) with the tab (3) on the fuse block harness end. Rotate the locking collar (4) until you are able to slide the two pieces together. Rotate the locking collar (4) clockwise to lock in place.

4.9.5 Attachment Tilt Cylinder Maintenance

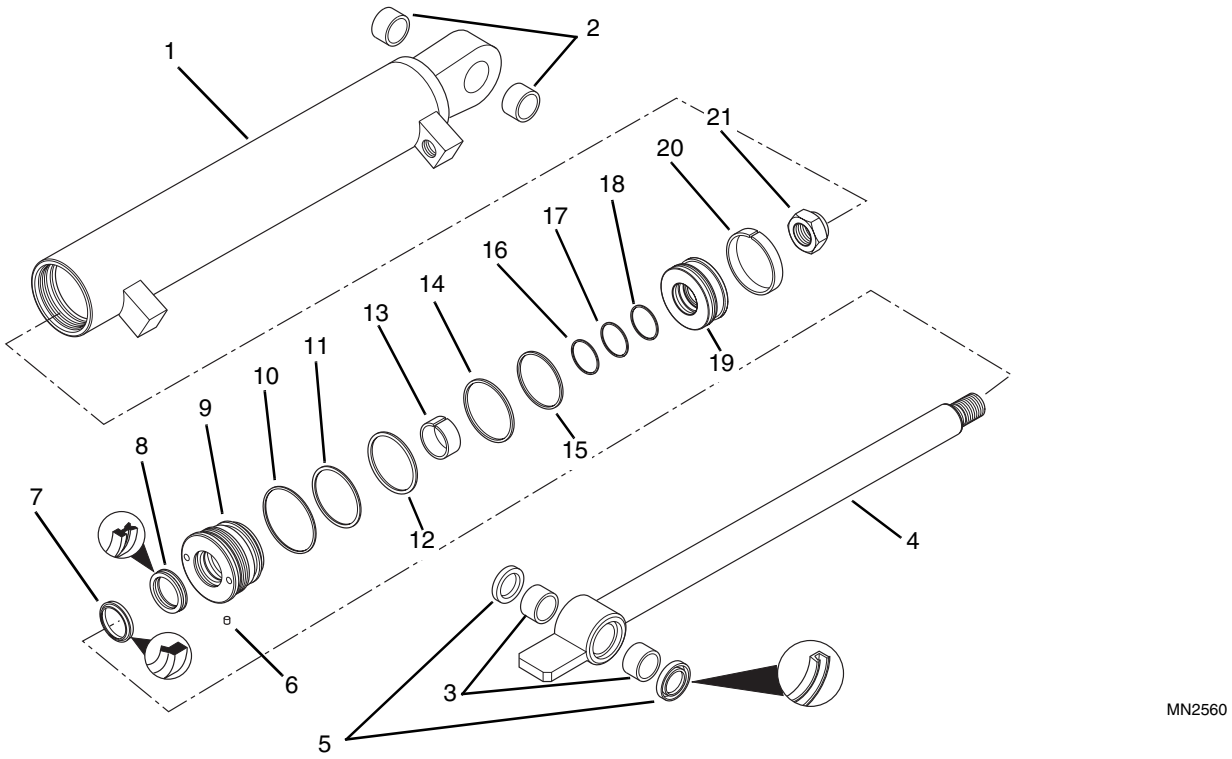


Figure 4-48 Attachment Tilt Cylinder Components

a. Removal

1. Remove the attachment from the quick attach.

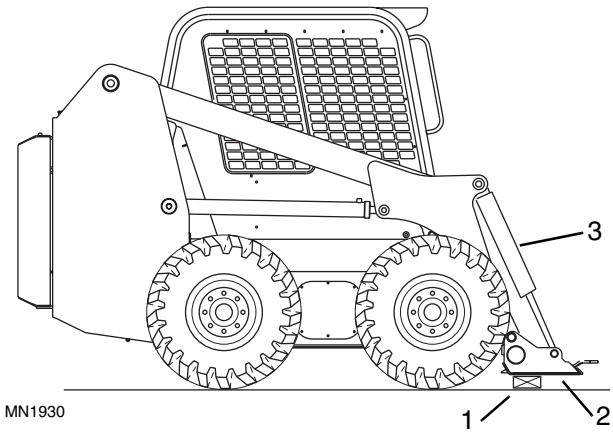


Figure 4-49 Quick Attach Support

2. Raise the loader arm slightly and place blocking (Fig. 4-49, 1) under the bottom of the quick attach frame.
3. Tilt the quick attach forward until the front face of the frame (Fig. 4-49, 2) rests level with the ground.
4. Lower the loader arms until the rear of the quick attach frame is supported by the blocking (Fig. 4-49, 1).
5. Shut the engine OFF, and remain in the operators seat.
6. Turn the ignition key to the RUN position. With the seat restraint bar LOWERED fully, PUSH the loader arm reset button on the instrument panel.
7. Depress the front and rear of both foot pedals to relieve any pressure in the loader arm hydraulic system.
8. Raise the seat bar to engage the park lock.

IMPORTANT: *Be sure the hydraulic port areas are free from dirt and debris before disconnecting hydraulic fittings.*

9. Disconnect the hydraulic hoses from the rod and base end ports of both cylinders (Fig. 4-49, 3). Plug or cap the hoses and cylinder ports.

Note: *As the pivot pins are removed in the following steps, note and record the location and quantity of shims used at each pin location. It will be necessary to reinstall these shims in the same location and quantity during assembly later.*

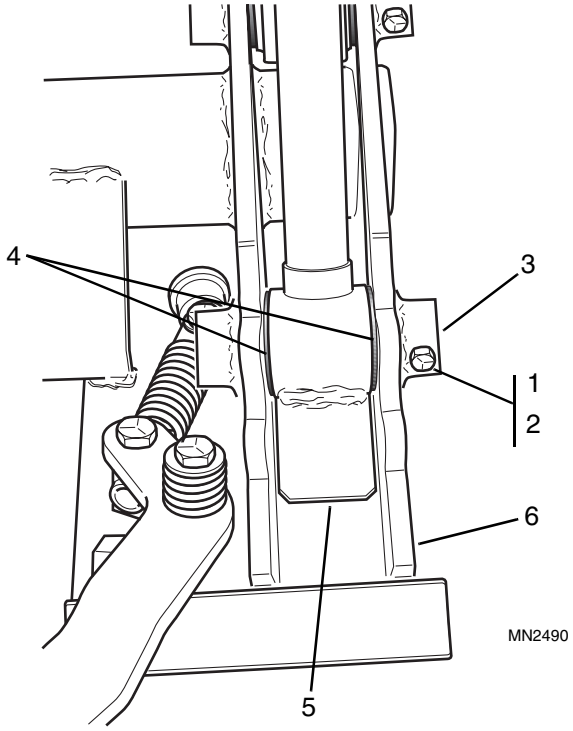


Figure 4-50 Attachment Tilt Cylinder Removal

10. Remove the capscrew (Fig. 4-50, 1), locknut (2), pin (3) and any shims (4) attaching the rod end (5) of the attachment tilt cylinder to the quick attach frame (6).
11. Drive rod end pivot pin (Fig. 4-50, 3) from the quick attach (6).
12. Remove base end pivot pin bolt and locknut.
13. Drive base end pivot pin from the loader arm.
14. Remove attachment tilt cylinder from loader arm.

b. Disassembly

1. Use a suitable container to catch the oil from inside of the loader arm cylinder. Tip the cylinder over and drain the oil from the rod end port and the base end port.
2. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling center.
3. Secure base end of cylinder in a vise and support rod end.
4. Remove hydraulic fittings from the cylinder ports. Remove and discard o-rings from fittings.
5. Remove the gland head (Fig. 4-48, 9) from the barrel (1), using an appropriate pin spanner wrench. Remove the locking insert (6) from the gland head (9).
6. Slide rod assembly (Fig. 4-48, 4) from barrel assembly.
7. Secure trunnion end of the rod in a vise and support the piston end of the assembly.
8. Remove the locknut (Fig. 4-48, 21).
9. Slide piston (Fig. 4-48, 19) off rod.
10. Slide gland head (Fig. 4-48, 9) off rod.
11. Remove wear band (Fig. 4-48, 20), backup rings (16 & 18), square piston seal (15), square ring (14) and o-ring (17) from the piston and discard.
12. Remove o-rings (Fig. 4-48, 10 & 12), back-up ring (11), rod wiper (7), and deep Z seal (8) from the gland head (9) and discard.

c. Cleaning and Inspection

1. Thoroughly clean and dry all metal parts with a suitable solvent. Inspect bushings (Fig. 4-48, 2 & 3) in rod and barrel ends for wear.
2. Inspect rod (Fig. 4-48, 4) for scratches, dents, flat spots, damaged threads, and other damage.
3. Inspect gland head (Fig. 4-48, 9) for nicks, burrs, or other damage.
4. Inspect piston (Fig. 4-48, 19) for damage.
5. Clean and inspect cylinder pivot pins for wear, rust, and nicks.
6. Clean and inspect the hydraulic fittings.
7. Using a suitable light, inspect barrel bore and threads for scratches, dents, burrs, or other damage.

d. Repair

1. Repair minor rod (Fig. 4-48, 4), gland head (9), and piston (19) damage using a hard Arkansas stone or crocus cloth.
2. Smooth down any sharp edges on metal parts that could damage seals and cause leakage.

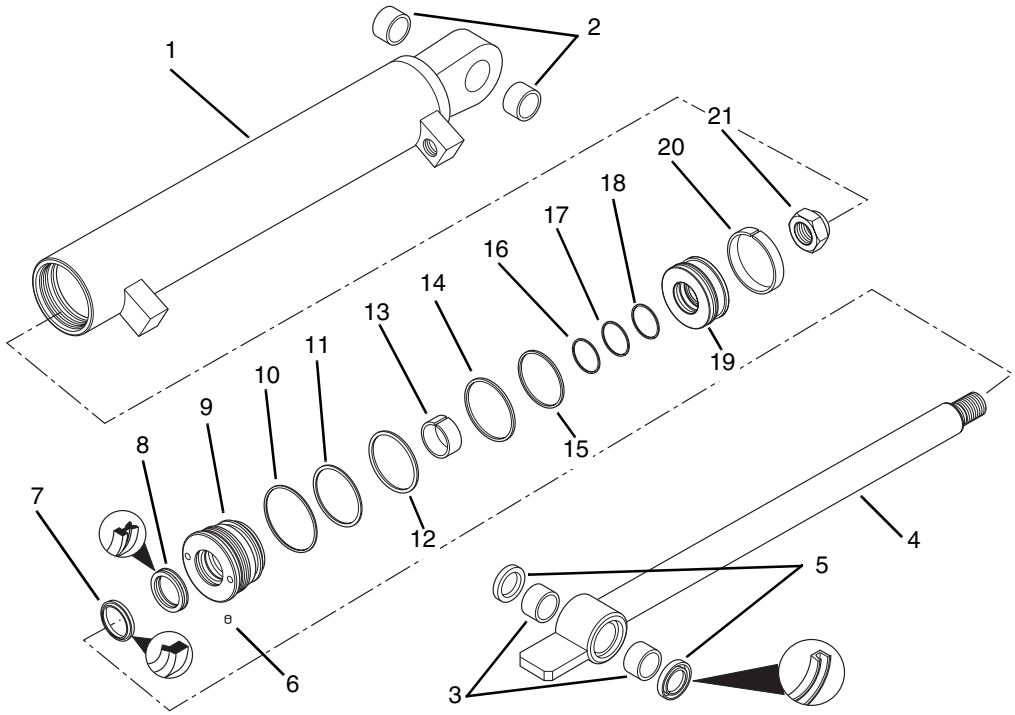


Figure 4-51 Attachment Tilt Cylinder Components

e. Replacement

1. Replace rod wiper (Fig. 4-51, 7), deep Z seal (8), back-up ring (11), o-ring (10), back-up rings (16 & 18), o-ring (17), and wear band (20) with new seals. Lubricate new seals with clean hydraulic system oil before assembly.
2. Major scratches, dents, flat spots and rust or blemishes on the chrome rod are not repairable and the rod must be replaced.
3. Replace rod and/or gland head if the threads are damaged.
4. If the barrel is damaged, the entire cylinder assembly will need to be replaced.
5. Replace gland head and/or piston if severely damaged.
6. Replace the pivot pin if rusted or nicked beyond repair. DO NOT reuse a rusted or nicked pivot pin.
7. Replace hydraulic fittings if damaged and install a new o-ring on each fitting.
8. Replace bushings (Fig. 4-51, 2 & 3) if they are worn or damaged. The cylinder bushings are glued in place with Loctite, Black Max 380 Adhesive (Refer to Section 4.9.3 c, Step 5). Remove the bushings and seals as follows:
   a. Press the bushings out of the cylinder trunnions.
   b. The adhesive will leave a residue on the inside of the trunnion, which must be removed by brushing with a soft brass wire brush prior to reassembly.
   c. Apply Loctite Black Max 380 Adhesive (Refer to Section 4.9.3 c, Step 6), following the manufacturer's instructions. Press the bushings into place in the cylinder trunnions.
   d. Install new bushing seals (Fig. 4-51, 5) in rod end trunnion as shown with the seal side out.

f. Assembly

1. Coat gland head (Fig. 4-51, 9) with a light film of clean oil and install deep Z seal (8), and rod wiper (7) and wear band (13) into gland head (9) as shown. Install o-ring (10), back-up ring (11), and o-ring (12) onto the gland head (9).

2. Coat piston (Fig. 4-51, 19) with a light film of clean oil and install back-up rings (16 & 18) and o-ring (17) into piston. Install square piston seal (15), square ring (14), and wear band (20) onto piston.
3. Coat rod (Fig. 4-51, 4) and gland head (9) with a light film of clean oil. Slide gland head (9) onto the rod.
4. Coat piston (Fig. 4-51, 19) with a light film of clean oil and carefully slide piston onto threaded part of rod. Be careful not to damage the back-up rings (16 & 18) and o-ring (17) when sliding the piston over threads of the rod.
5. Install locknut (Fig. 4-51, 21) and torque to 350-400 lb/ft (475-542 Nm).
6. Apply a compression sleeve or other suitable tool to piston and gland in order to compress seals and o-rings while inserting into the barrel assembly (Fig. 4-51, 1).

IMPORTANT: *When sliding assembled rod with gland head and piston into barrel assembly, be careful so that gland threads in barrel do not damage gland head and piston seals and o-rings. Keep rod in line with barrel to prevent binding.*

7. Secure barrel end of cylinder in a vice while supporting its rod end.
8. Using an appropriate pin spanner wrench, tighten the gland head (Fig. 4-51, 9) onto barrel, and install the locking insert (6). Torque the gland head to 250-300 lb/ft (339-407 Nm).

g. Installation

Note: *DO NOT apply any type of lubricant to the cylinder pins during installation procedures that follow. Cylinder bushings are impregnated with a special lubricant, and DO NOT require additional lubrication.*

1. Align cylinder ends with pivot pin holes on loader arm and rear frame. Install base end pivot pin and shims, and secure in place with a bolt and locknut.

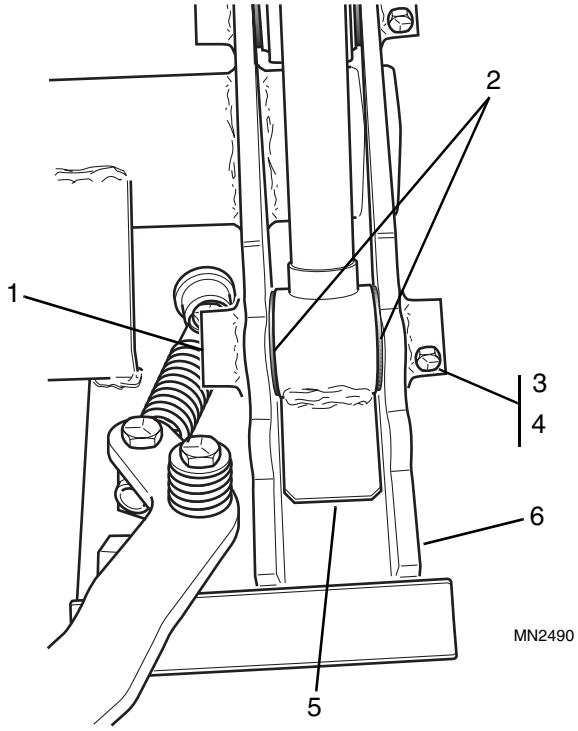


Figure 4-52 Attachment Tilt Cylinder Installation

2. Install the rod end pivot pin (Fig. 4-52, 1) from the inside of the quick attach. Carefully push the pin in [placing shims (2) as required] as far as possible with your hands and make sure pin is going in straight to avoid damage to bushing seals. Then tap the pin with a hammer until you can place the bolt (3) into the pin and install the locknut (4).
3. Remove caps or plugs from the cylinder ports, hydraulic hoses, and fittings.
4. Install hydraulic fittings and hoses in cylinder ports.
5. Refer to Section 4.5, “Startup After Hydraulic Repair.”

4.9.6 Hydraulic Hose Routing and Fitting Orientation Diagrams

a. Loader Arm Hydraulic Circuit

The illustrations in this section are provided as reference for the proper orientation of hydraulic fittings and the routing of hydraulic hoses in the vehicle.

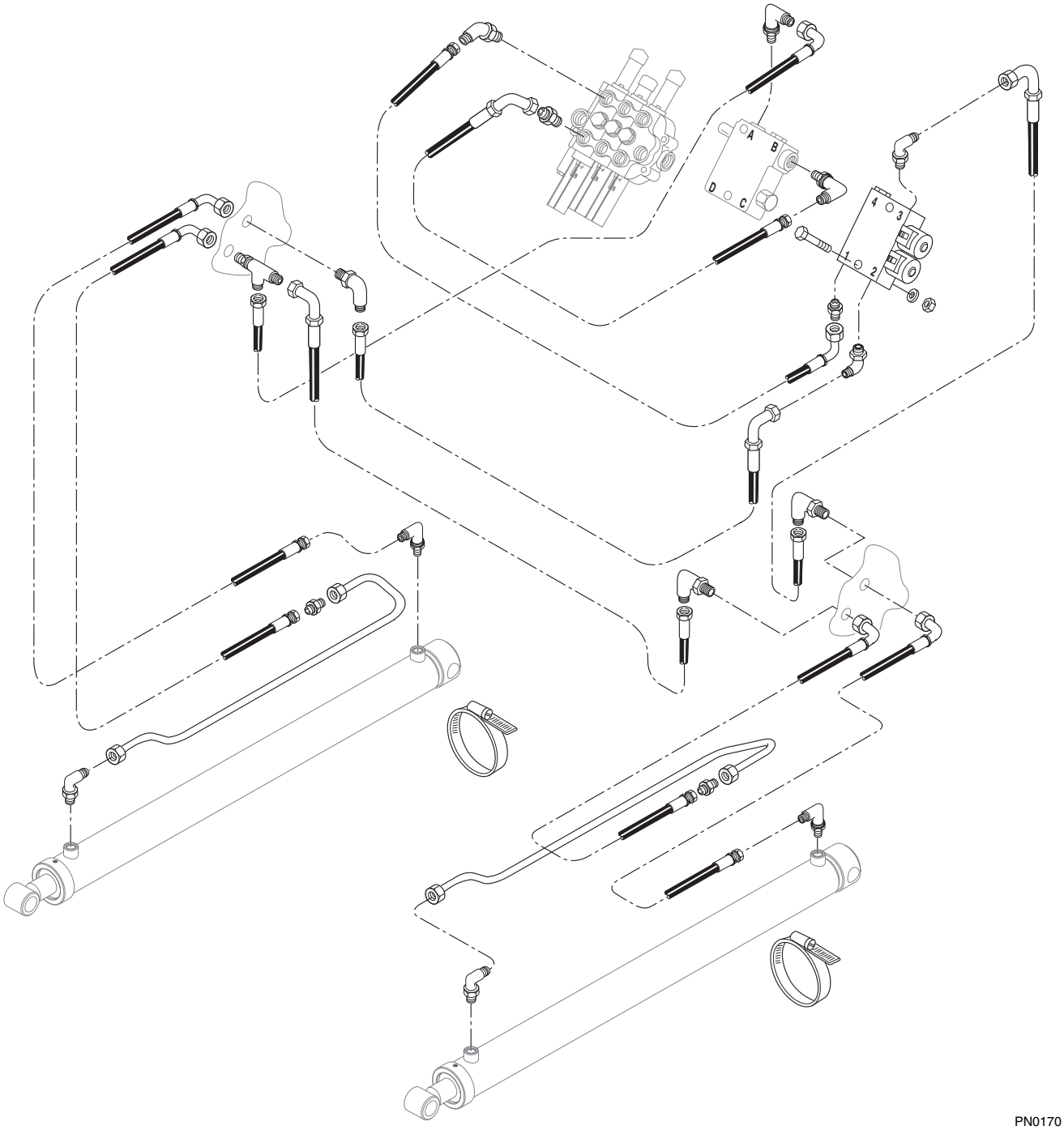


Figure 4-53 Loader Arm Hydraulic Hose Routing and Fitting Orientation

b. Attachment Tilt Hydraulic Circuit
Model 1750D, 2000D/DX

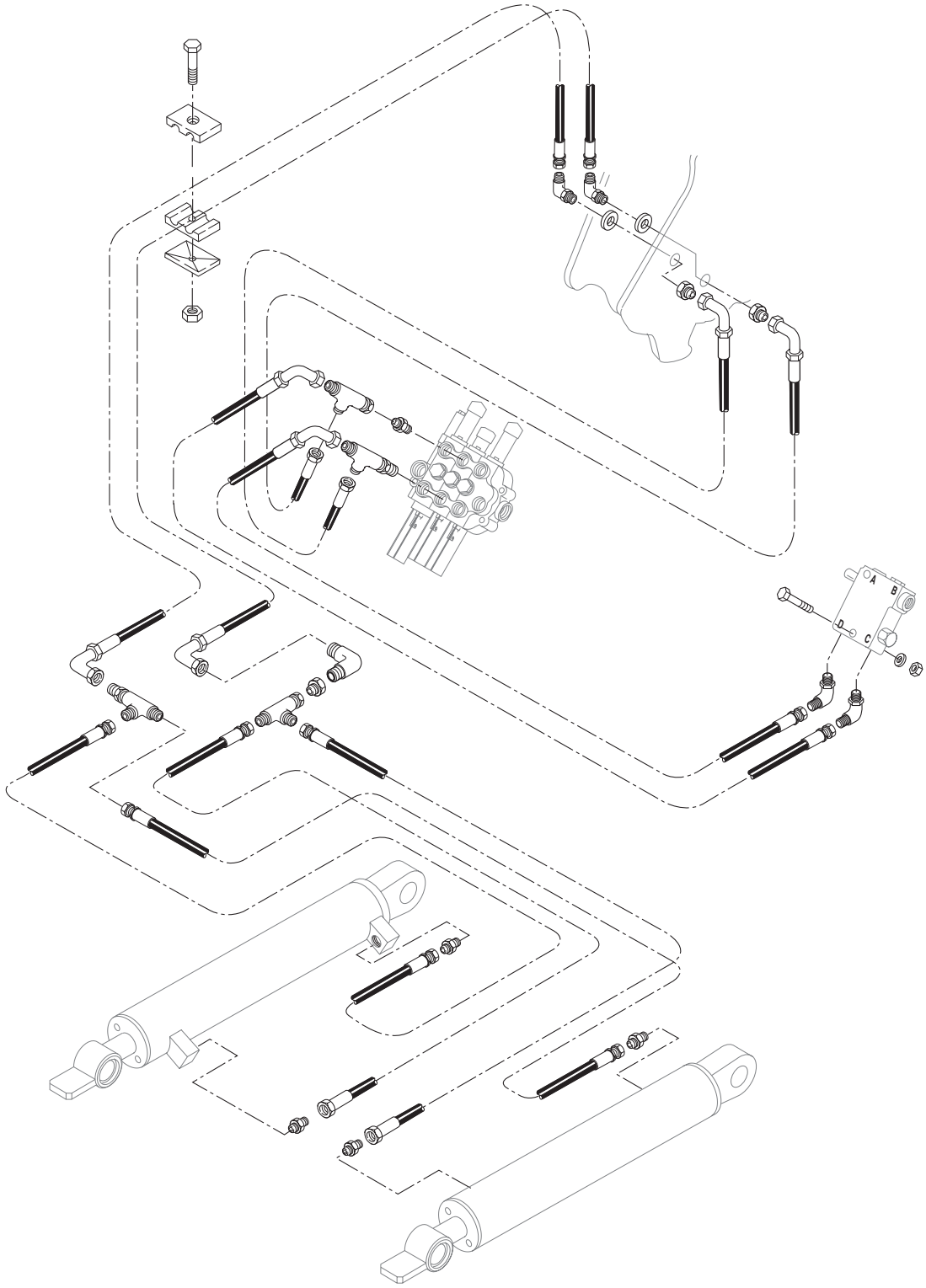


Figure 4-54 Attachment Tilt Hydraulic Hose Routing and Fitting Orientation - Model 1750D, 2000D/DX

c. Attachment Tilt Hydraulic Circuit
Model 2300D/DX

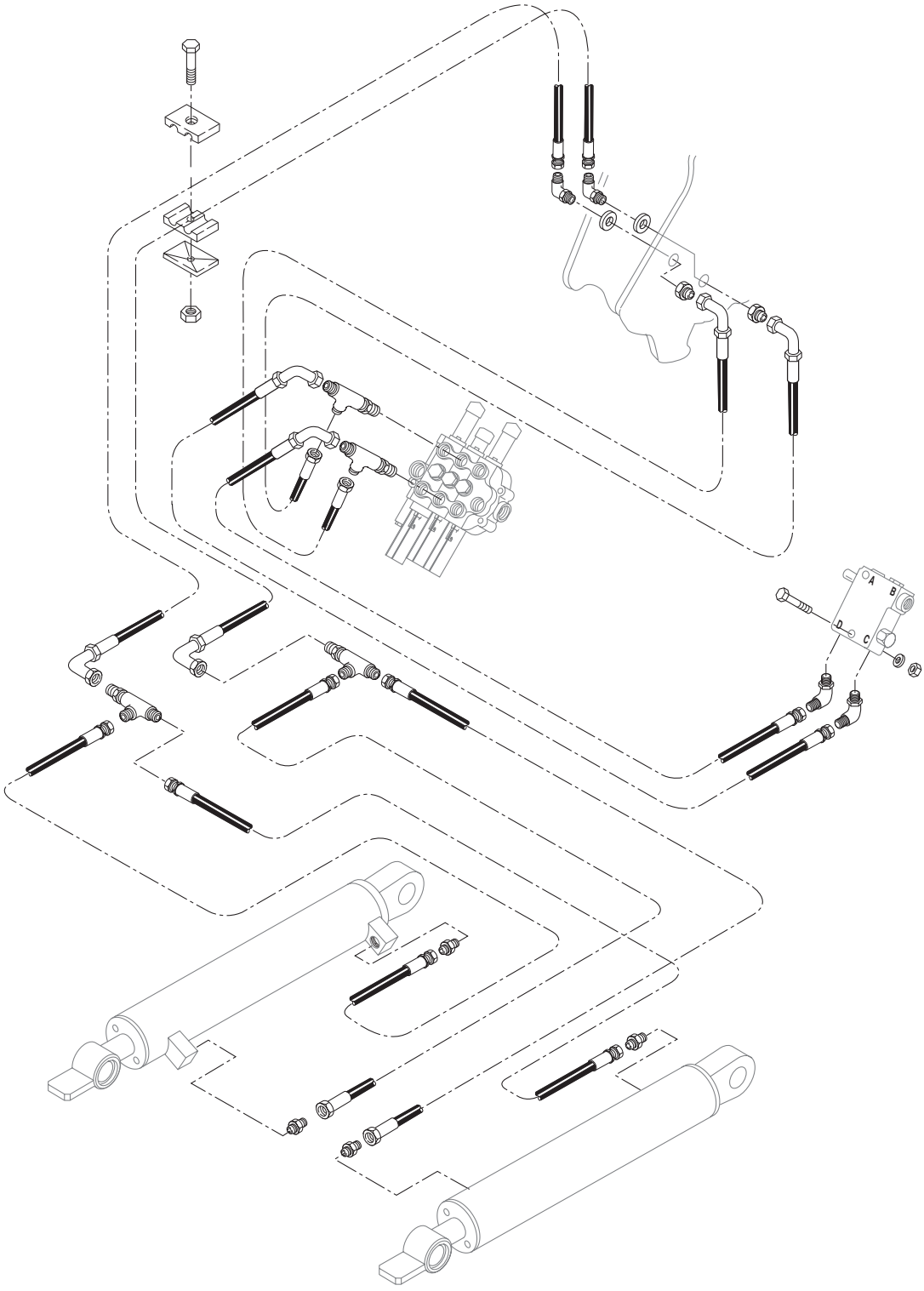


Figure 4-55 Attachment Tilt Hydraulic Hose Routing and Fitting Orientation - Model 2300D/DX

d. Auxiliary Hydraulic Circuit

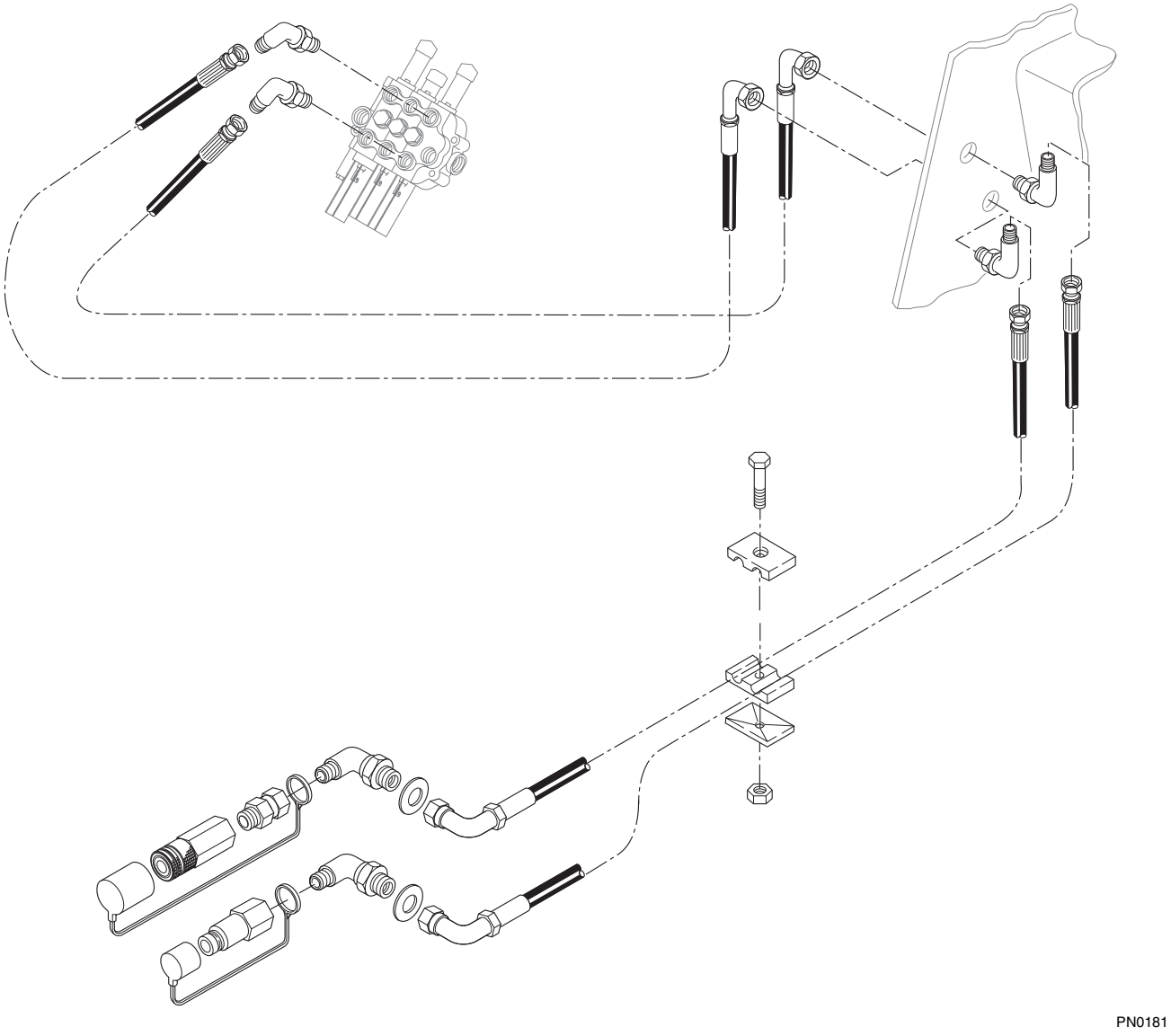
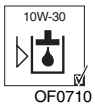


Figure 4-56 Auxiliary Hydraulic Hose Routing and Fitting Orientation

4.10 HYDRAULIC OIL RESERVOIR, OIL FILTER, AND OIL COOLER

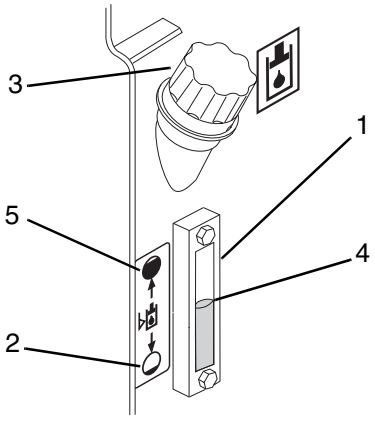
The oil reservoir is at the left rear of the loader. It stores 10W30 motor oil equal to API, CD or CE specifications for distribution to the charge, implement and high flow (DX models only) hydraulic pumps.

4.10.1 Hydraulic Oil Level Check Daily or Every 10 Hours



OF0710

1. Check hydraulic oil level with the vehicle parked on a level surface, with implement grounded, all cylinders fully retracted and engine shut off.
2. Unlock and open rear engine compartment door, lift engine cover and check oil level in sight gauge (Fig. 4-57, 1).



OC0734

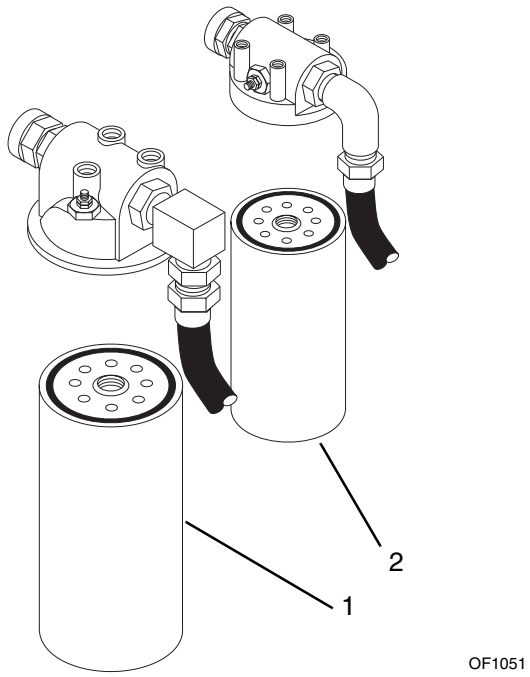
Figure 4-57 Hydraulic Reservoir Sight Gauge and Fill Cap

3. Check the oil level when oil is cold. If oil level is at or below the low level indicator (Fig. 4-57, 2), remove the fill cap (3) and add 10W30 motor oil equal to API, CD or CE specifications, until the oil level is in the middle (4) of the sight gauge. A level anywhere between the High (5) and Low (2) indicators is an acceptable operating level.
4. Install the fill cap (Fig. 4-57, 3).
5. The fins of the hydraulic oil cooler must be kept free of dirt and debris or the hydraulic system will overheat. Inspect the fins for damage and debris. Repair any damage and use compressed air to remove debris.
6. Lower engine cover, close and lock rear engine compartment door.

4.10.2 Hydraulic Oil Filter Change First 50 Hours - Every 1000 Hours


OF0770

1. Park the vehicle on a level surface, with the implement grounded and the engine shut off.
2. Unlock and open rear engine compartment door and raise engine cover.
3. Allow hydraulic oil to cool before changing the hydraulic oil filter.

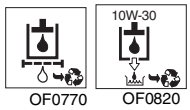


OF1051

Figure 4-58 Hydraulic Oil Filters

4. Remove the main filter element (Fig. 4-58, 1) and the drive system filter element [(2) Model 2000D/DX and 2300D/DX only]. A strap or chain filter wrench may be required. Properly discard the used elements.
5. Clean both filter sealing surfaces and apply a thin coat of clean engine oil to the seals on the new filters.
6. Install the new oil filter(s) (1 & 2) and hand tighten 1/2 turn after initial contact.
7. Start the vehicle as described in this manual. Check for leaks around the filter seals.
8. Recheck sight gauge fluid level, add oil if required.
9. Lower engine cover, close and lock rear engine compartment door.

4.10.3 Hydraulic Oil and Filter Change - Every 1000 Hours



Other than the 1000 hour interval, the hydraulic oil **must** be changed when a hydraulic component has contaminated the system. Change as follows:

1. With the loader on a level surface, implement grounded, park lock engaged, and the engine shut OFF, change the hydraulic filter(s). Refer to Section 4.10.2, “Hydraulic Oil Filter Change.”

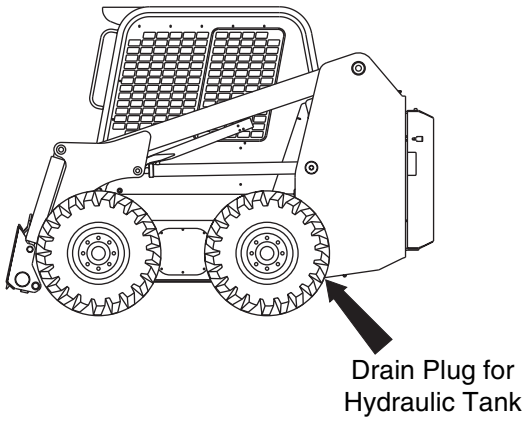


Figure 4-59 Hydraulic Reservoir Drain Plug

2. Place a receptacle under reservoir drain plug and remove drain plug. Clean loose particles from plug, allow oil to drain completely into the receptacle and dispose of properly.

Note: *Use a drain receptacle of adequate size to reduce the possibility of spillage. The reservoir capacity is 17.1 gallons (64,7 liters) for Model 1750D and 2000D/DX, and 17.3 gallons (65,5 liters) for 2300D/DX.*

3. Install drain plug in reservoir and torque it to 40 lb/ft (54 Nm).
4. Unlock and open rear engine compartment door and raise engine cover.
5. Remove reservoir fill cap and fill reservoir with motor oil equal to 10W30 API, CD or CE specifications, until the oil level is in the middle of the sight gauge. Wait a few minutes after adding oil before checking the level. The oil has to drain down to the reservoir. Fill to proper level if necessary. Capacity is dependant upon model, and will be found in the specifications section of this manual.
6. Refer to Section 4.5, “Startup After Hydraulic Repair.”

4.10.4 Hydraulic Oil Cooler Maintenance (D Models Only)

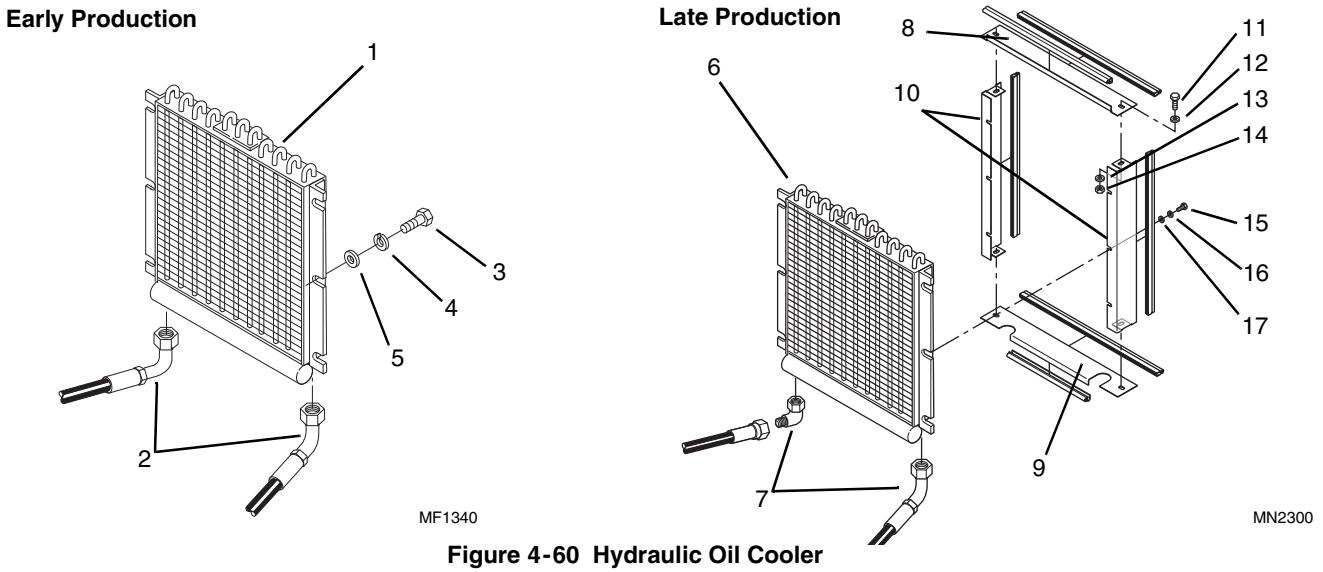


Figure 4-60 Hydraulic Oil Cooler (Model 1750D, 2000D & 2300D Only)

The hydraulic oil cooler (Fig. 4-60, 1 or 6) is mounted to the rear of the radiator. Return oil from the main control valve and hydrostatic travel motors is circulated through the oil cooler. Air pushed through the oil cooler fins by the engine fan cools the oil.

The oil cooler should be checked daily for dirt and debris buildup on the cooling fins. **If the air flow through the cooling fins is blocked or restricted, the hydraulic system will overheat.** Remove any buildup on the cooling fins with compressed air.

a. Removal

1. Be sure the loader is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

2. Operate travel-steer levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

3. Unlock and open the rear engine compartment door. Remove the two hydraulic hoses (Fig. 4-60, 2 or 7) attached to the bottom of the oil cooler (1 or 6). Cap or plug the hoses and fittings on the oil cooler immediately.
4. On early production units, remove the six capscrews (Fig. 4-60, 3), lockwashers (4), and washers (5) that fasten the oil cooler to the rear of the radiator, and remove the oil cooler.

5. On late production units, baffles (Fig. 4-60, 8-10) have been added to direct the air flow through the grille in the engine compartment door. Remove the capscrews (11), flat washers (12 & 13) and locknuts (14) from the top (8) and bottom (9) baffles, and remove the baffles.
6. Have an assistant support the oil cooler while you remove the six capscrews (Fig. 4-60, 15), lockwashers (16), and washers (17) that fasten the side baffles (10) and oil cooler (6) to the radiator. Remove the baffles and oil cooler.

b. Inspection

1. Clean the oil cooler (Fig. 4-60, 1 or 6) with compressed air and water.
2. Inspect the oil cooler (Fig. 4-60, 1 or 6) for any damage and repair or replace with a new oil cooler.

c. Installation

1. On early production units, install the oil cooler (Fig. 4-60, 1) to the radiator with six washers (5), lockwashers (4), and capscrews (3).
2. On late production units, have an assistant support the oil cooler (Fig. 4-60, 6) while you install the six capscrews (15), lockwashers (16), and washers (17) that fasten the side baffles (10) and oil cooler (6) to the radiator.
3. Install the top (Fig. 4-60, 8) and bottom (9) baffles, and secure with the capscrews (11), flat washers (12 & 13), and new locknuts (14).
4. Install the hydraulic hoses (Fig. 4-60, 2 or 7) to the bottom of oil cooler, and torque (Refer to Section 2.8, “Torques”).
5. Refer to Section 4.5, “Startup After Hydraulic Repair.”
6. Close and lock the engine compartment door.

4.10.5 Hydraulic Oil Cooler Maintenance (DX Models Only)

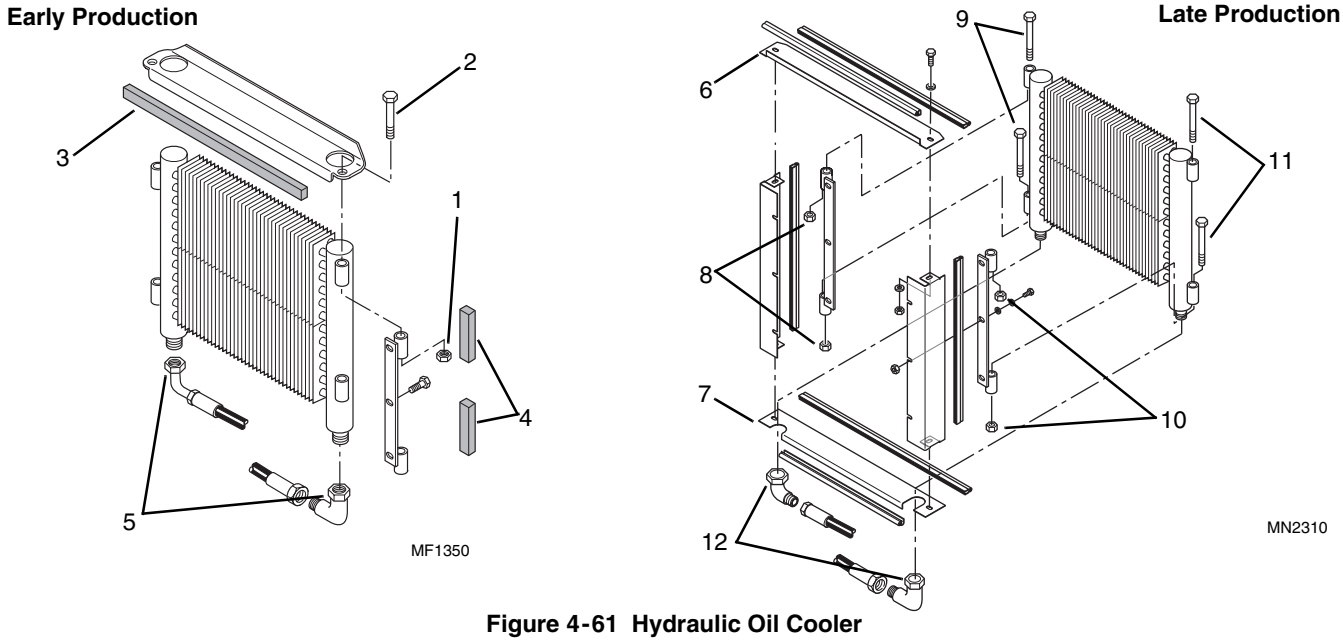


Figure 4-61 Hydraulic Oil Cooler (Model 2000DX & 2300DX Only)

The hydraulic oil cooler on DX model vehicles is mounted to the rear of the radiator. Return oil from the main control valve and hydrostatic travel motors is circulated through the oil cooler. Air pushed through the oil cooler fins by the engine fan cools the oil.

The oil cooler should be checked daily for dirt and debris buildup on the cooling fins. **If the air flow through the cooling fins is blocked or restricted, the hydraulic system will overheat.** Remove any buildup on the cooling fins with compressed air.

a. Routine Oil Cooler Cleaning

1. Early Production Models Only:
   a. Loosen the hydraulic fittings (Fig. 4-61, 5) on the bottom of the cooler only enough to allow the cooler to pivot.
   b. Loosen and remove both hex elastic locknuts (Fig. 4-61, 1) and capscrews (2) securing the oil cooler to the radiator on the left side.
   c. Loosen both hex elastic locknuts and capscrews securing the cooler to the radiator on the right side, and pivot the cooler out far enough to clean debris from between the cooler and radiator.

IMPORTANT: *Check for the presence of foam strips (Fig. 4-61, 3 & 4) between the cooler and radiator and on rear door. These strips are critical to the performance of the vehicle.*

   d. Swing the cooler back into place and reinstall and tighten all cooler mounting hardware (Fig. 4-61, 1 & 2).
   e. Torque the hydraulic fittings (Fig. 4-61, 5). Refer to Section 2.8, “Torques.”

2. Late Production Models Only:
   a. Remove the hardware securing the top baffle (Fig. 4-61, 6), and remove the baffle.
   b. Remove the hardware securing the bottom baffle (Fig. 4-61, 7), and remove the baffle.
   c. Loosen the hydraulic elbow fittings (Fig. 4-61, 12) on the bottom of the cooler only enough to allow the cooler to pivot.
   d. Remove both hex elastic locknuts (Fig. 4-61, 8) and capscrews (9) securing the oil cooler to the radiator on the right side.
   e. Loosen both hex elastic locknuts (Fig. 4-61, 10) and capscrews (11) securing the oil cooler to the radiator on the left side.
   f. Pivot the cooler out far enough to clean debris from between the cooler and radiator.
   g. Swing the cooler back into place and reinstall and tighten all cooler mounting hardware (Fig. 4-61, 8 through 11).

h. Torque the hydraulic fittings (Fig. 4-61, 12). Refer to Section 2.8, “Torques.”

i. Replace both baffles (Fig. 4-61, 6 & 7) and tighten the hardware securely.

b. Removal

1. Be sure the loader is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

2. Operate travel-steering levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

3. Unlock and open the rear engine compartment door. Remove the two hydraulic hoses (Fig. 4-61, 5 or 12) and elbows attached to the bottom of the oil cooler. Cap or plug the hoses and fittings on the oil cooler immediately.
4. Early production units only:
   Have an assistant support the oil cooler while you loosen and remove the hex elastic lock nuts (Fig. 4-61, 1) and capscrews (2) securing the oil cooler to both sides of the radiator. Remove the oil cooler from the vehicle.
5. Late production units only:
   a. Remove the hardware securing the top baffle (Fig. 4-61, 6), and remove the baffle.
   b. Remove the hardware securing the bottom baffle (Fig. 4-61, 7), and remove the baffle.
   c. Remove both hex elastic locknuts (Fig. 4-61, 8) and capscrews (9) securing the oil cooler to the radiator on the right side.
   d. Have an assistant support the oil cooler while you loosen and remove both hex elastic locknuts (Fig. 4-61, 10) and capscrews (11) securing the oil cooler to the radiator on the left side. Remove the oil cooler from the vehicle.

c. Inspection

1. Clean the oil cooler with compressed air and water, and inspect the oil cooler for any damage and repair or replace with a new oil cooler.

d. Installation

1. With an assistant, position the oil cooler in place on the vehicle.
2. Early production units only:
   Have the assistant support the oil cooler while you install and tighten the hex elastic locknuts (Fig. 4-61, 1) and capscrews (2) securing the oil cooler to both sides of the radiator.
3. Late production units only:
   a. Have the assistant support the oil cooler while you install and tighten the capscrews (Fig. 4-61, 9 &11) and new hex elastic locknuts (8 & 10) securing the oil cooler to both sides of the radiator.
   b. Install the top baffle (Fig. 4-61, 6) and hardware. Tighten securely.
   c. Install the bottom baffle (Fig. 4-61, 7) and hardware. Tighten securely.
4. Remove the fitting caps and hose plugs, and reconnect the two hydraulic elbows and hoses (Fig. 4-61, 5 or 12) attached to the bottom of the oil cooler.
5. Torque the hydraulic fittings and hoses (Fig. 4-61, 5 or 12). Refer to Section 2.8, “Torques.”
6. Refer to Section 4.5, “Startup After Hydraulic Repair.”
7. Close and lock the engine compartment door.

4.11 HIGH FLOW (DX) SYSTEM

4.11.1 Description

The High Flow System provides an increased hydraulic flow rate that is needed for certain types of auxiliary attachments. The system includes the following:

- A control switch and pressure gauge located on the left instrument panel post (Refer to Section 4.11.2 & 4.11.3);
- A set of three couplers located on the right loader arm (Refer to Section 4.11.4);
- A high flow pump located at the rear of the engine and driven by a flexible coupling connected to the engine crankshaft (Refer to Section 4.11.5);
- A solenoid operated high flow control valve, located in the engine compartment and mounted on the fuel tank (Refer to Section 4.11.6);
- An oil cooler, shared with the vehicle hydraulic system, that is mounted to the rear of the radiator (Refer to Section 4.10.5);
- Hydraulic lines, hoses, and fittings to interconnect all the components (Refer to Section 4.11.7 & 4.11.8).
- An electrical wiring harness connecting the switch/gauge panel in the operators protective structure to the high flow control valve in the engine compartment (Refer to Section 4.11.9).

4.11.2 High Flow Switch

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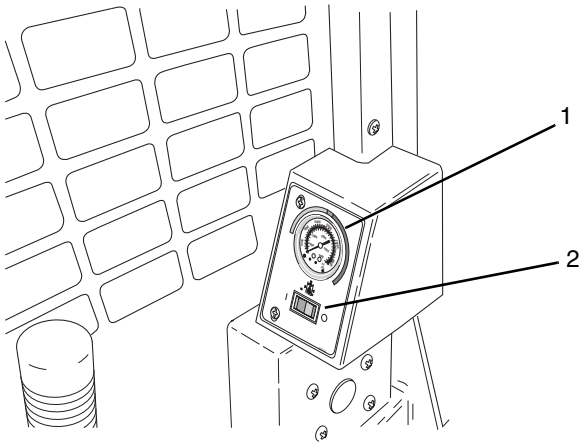


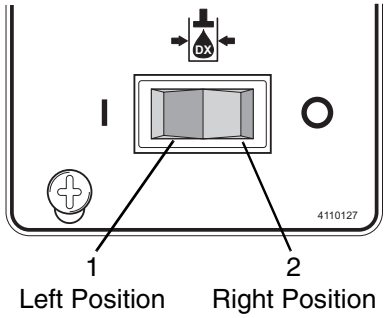
MN0980

Figure 4-62 High Flow Switch and Gauge

There is a high flow gauge (Fig. 4-62, 1) and switch (2) mounted on the left side instrument panel post.

The high flow switch will actuate any hydraulically controlled auxiliary attachment that is connected to the vehicles high flow hydraulic circuit.

The switch operates as follows:



MN2890

Figure 4-63 High Flow Switch Positions

IMPORTANT: *DO NOT turn the High Flow switch ON and energize the system if no hydraulic connections are made to the high flow hydraulic couplers. This will cause the hydraulic oil to overheat and produce a noticeable lugging of the engine. Return engine to idle before engaging or disengaging this switch to reduce pressure in the high flow hydraulic circuit.*

Depress and release the LEFT (I) side of the rocker switch (Fig. 4-63, 1) to apply power to the High Flow solenoid, and energize the High Flow hydraulic system. The Left switch position is momentary, allowing the switch to return to the center when released.

Depress and release the RIGHT (O) side of the rocker switch (Fig. 4-63, 2) to disconnect power to the High Flow solenoid, and disengage the High Flow hydraulic system.

Note: *Power to the High Flow hydraulics system will be disconnected whenever the starter key switch is turned to the OFF position.*

4.11.3 High Flow Gauge

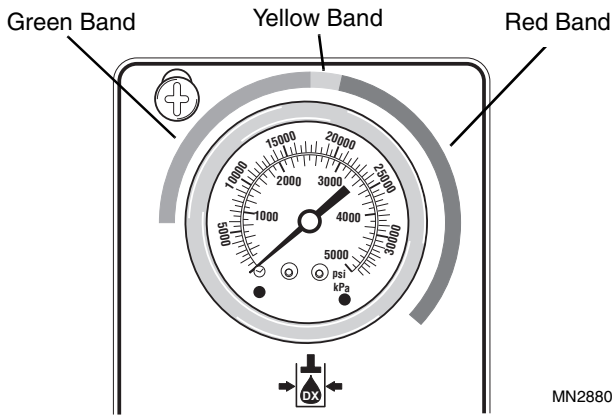


Figure 4-64 High Flow Gauge

The high flow gauge (Fig. 4-64) monitors the hydraulic operating range and pressure for the specific attachment being used on the vehicle.

The colored band around the High Flow gauge indicates the following:

GREEN Band
Preferred Optimum Operating Range.

YELLOW Band
Caution! Approaching Overload! Reduce load on attachment.

RED Band
Overload! Reduce load on attachment.

IMPORTANT: *If the attachment is operated in an overload condition the engine and hydraulic system will overheat and cause component failure.*

4.11.4 High Flow Couplers

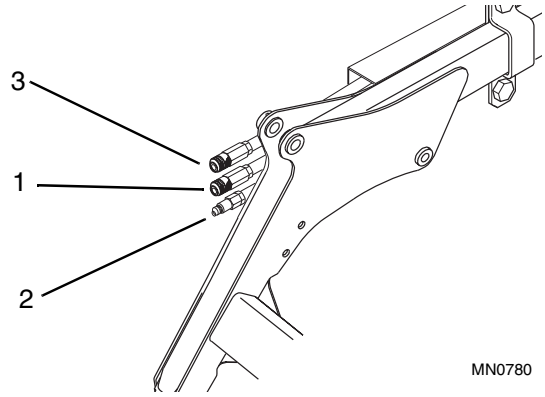


Figure 4-65 High Flow Couplers

1. The center female coupler (Fig. 4-65, 1) is used to connect the high flow system pressure to an attachment.
2. The lower male coupler (Fig. 4-65, 2) is the high flow system return from the attachment.
3. The top female coupler (Fig. 4-65, 3) is not required for all applications. When connecting certain hydraulic motors to the high flow system, a third line from the motor (the motor case drain) will be connected to the top coupler (3).

Note: *Always refer to the attachment operator's manual for specific instructions on attaching an optional attachment to the vehicle high flow quick couplers.*

4.11.5 High Flow Pump

a. Removal

1. Be sure the loader is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.

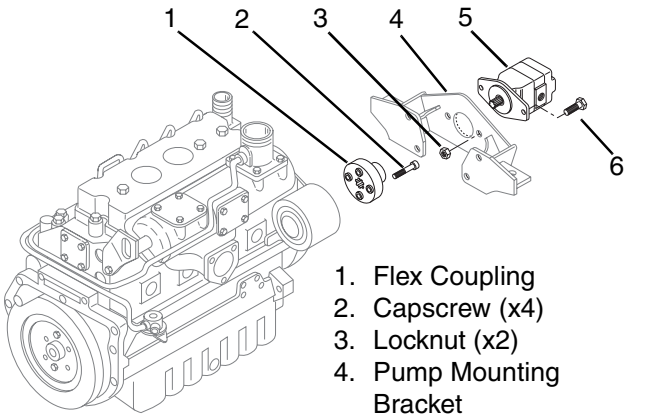
WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

2. Ensure that there is no pressure on the system. Check the high flow gauge to ensure that pressure has been released.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

3. Unlock and open the engine compartment door.
4. Remove and tag (for proper reassembly) both hoses connected to the high flow pump. Plug the hoses immediately to prevent fluid from siphoning out of the system.

Note: *If plugs are not available, it will be necessary to drain the hydraulic reservoir.*



1. Flex Coupling
2. Capscrew (x4)
3. Locknut (x2)
4. Pump Mounting Bracket
5. High Flow Pump
6. Capscrew (x2)

Figure 4-66 High Flow Pump Mounting

5. Remove the capscrews (Fig. 4-66, 6) and locknuts (3) that secure the pump (5) to the mounting bracket (4).
6. Remove the pump (Fig. 4-66, 5) by sliding the pump shaft out of the flexible coupler (1).
7. Remove the flexible coupler (Fig. 4-66, 1) from the crankshaft pulley by removing four capscrews (2).

b. Cleaning and Inspection

1. Clean the spline shaft on the pump and inside the flexible coupler with appropriate solvent.
2. Inspect the shaft splines and flexible coupler splines for indications of wear or damage. Replace the pump and coupler if any damage or wear is found.
3. Refer to Section 3.4.9, “High Flow Pump Flow Displacement Test” for testing procedures.

c. Repair

The high flow pump is not repairable. If the pump output is below rated specification or has otherwise failed, it must be replaced.

d. Installation

1. Install the flexible coupler (Fig. 4-66, 1) and secure with capscrews (2). Torque to 80 lb/ft (109 Nm).
2. Coat the pump shaft splines with molybdenum disulfide grease compound.
3. Slide the pump shaft into the flexible coupler (Fig. 4-66, 1).
4. Secure the pump (Fig. 4-66, 5) to the mounting bracket (4) with capscrews (6) and locknuts (3). Torque to 75 lb/ft (102 Nm).
5. Connect the hoses to the high flow pump.
6. Refer to Section 4.5, “Startup After Hydraulic Repair.”
7. Close and lock the engine compartment door.

4.11.6 High Flow Valve

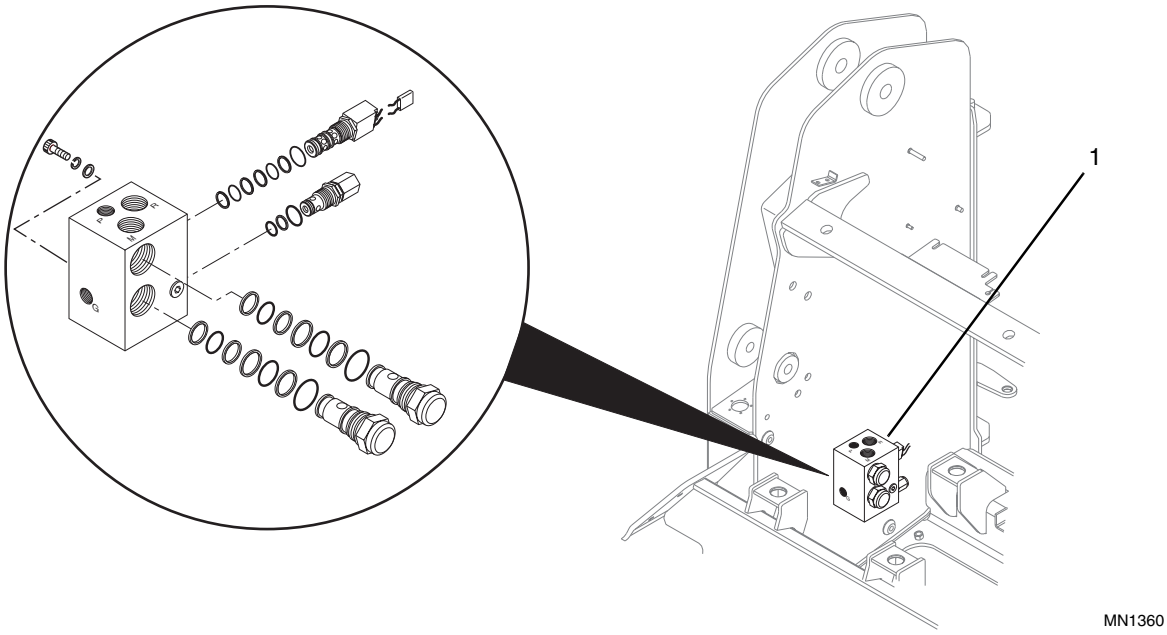


Figure 4-67 High Flow Valve

The high flow valve (Fig. 4-67, 1) controls the engagement of the high flow system by operation of a solenoid actuated cartridge valve, and regulates the maximum system pressure. The valve is located on the right side of the vehicle, inside the engine compartment.

a. Removal

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Ensure that there is no pressure on the system. Check the high flow gauge to ensure that pressure has been released.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

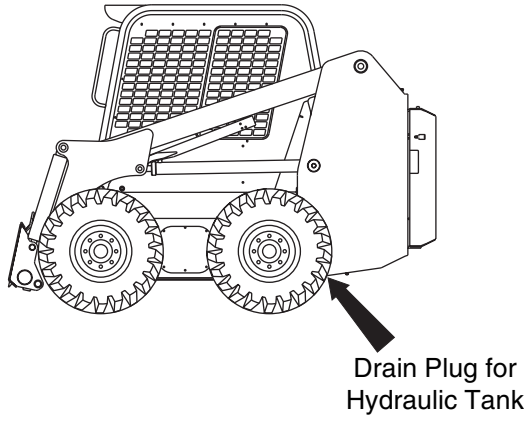


Figure 4-68 Hydraulic Reservoir Drain Plug

4. Place a receptacle under reservoir drain plug (Fig. 4-68) and remove drain plug. Clean loose particles from plug, allow oil to drain completely into the receptacle and dispose of properly.

Note: *Use a drain receptacle of adequate size to reduce the possibility of spillage. The reservoir capacity is 17.1 gallons (64,7 liters) for Model 1750D and 2000D/DX, and 17.3 gallons (65,5 liters) for 2300D/DX.*

5. Install drain plug in reservoir and torque it to 40 lb/ft (54 Nm).
6. Unlock and open rear engine compartment door and raise engine cover.

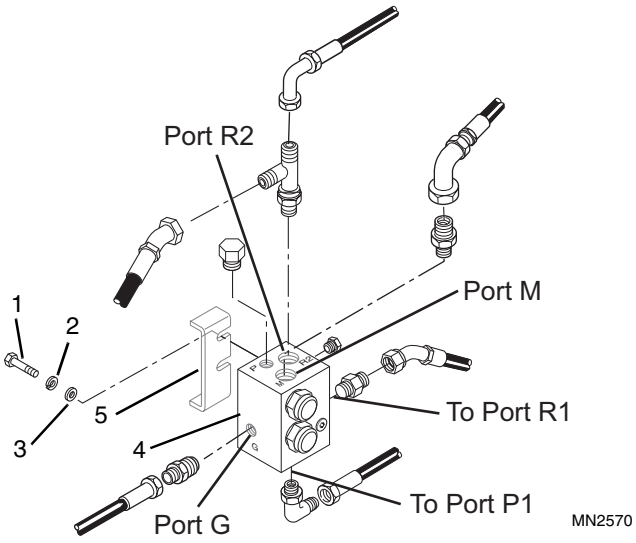


Figure 4-69 High Flow Valve

7. Disconnect and tag hoses (for proper reassembly) from the high flow valve (Fig. 4-69). Cap all hoses to prevent entry of dirt or other contamination into the hydraulic system.
8. Unplug the electrical connector (Fig. 4-70, 1) from the solenoid (2) on the valve.
9. Remove the socket head capscrews (Fig. 4-69, 1), lockwashers (2), and flat washers (3) that secure the valve (4) to the mounting bracket (5) on the frame. Place valve on a clean work bench.

b. Disassembly

1. Note the orientation of all the hydraulic fittings (Fig. 4-69) on the valve housing, and remove the fittings. Remove and discard the fitting o-rings.
2. Remove the solenoid/cartridge assembly (Fig. 4-70, 2) from the valve housing.
3. Remove the relief valve (Fig. 4-70, 3) from the valve housing.

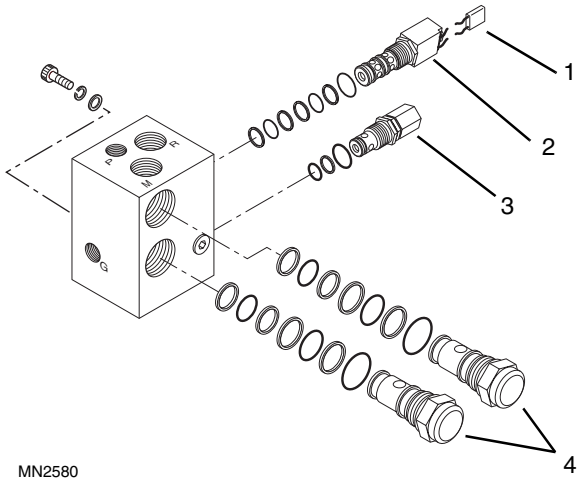


Figure 4-70 High Flow Valve Components

4. Remove both pressure sensing valves (Fig. 4-70, 4) from the valve housing.

Note: *Tag both pressure sensing valves as they are removed to ensure that they are installed into the original location in the high flow valve housing.*

c. Cleaning and Inspection

1. Clean all components with a suitable solvent. Avoid getting solvent on the electrical portion of the solenoid valve (Fig. 4-70, 2).
2. Inspect all components, including hydraulic hoses and fittings, for damage. Replace any component, hose,or fitting if damaged.
3. Refer to Section 3.4.8, “High Flow Valve Relief Test” and Section 3.4.9, High Flow Pump Flow Displacement Test” for complete high flow hydraulic system test procedures.

d. Assembly

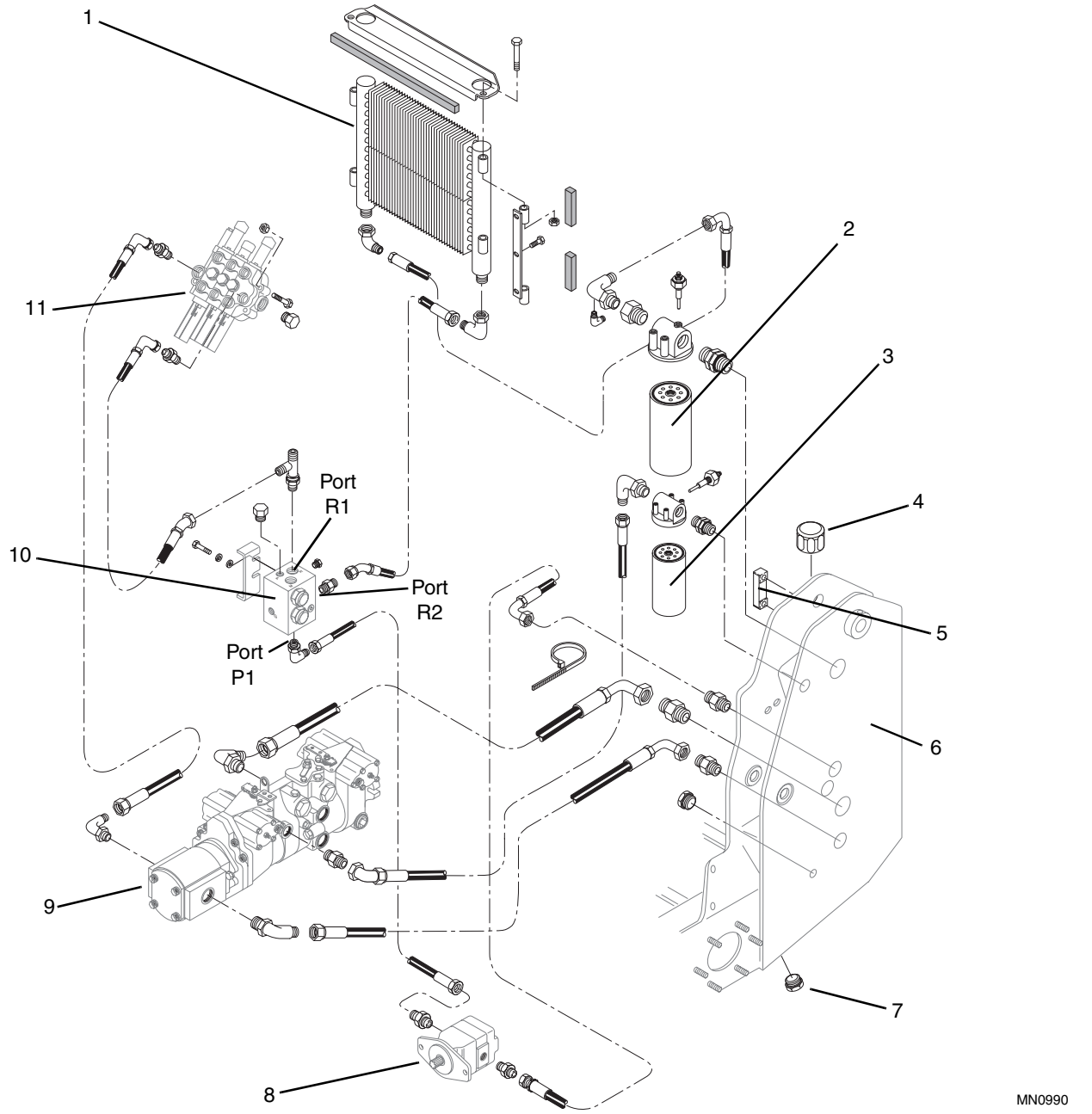
Note: *There are various seal kits available for all of the high flow valve components. Be sure to replace all o-rings and backup rings if a component has been removed from the high flow valve assembly for any reason.*

1. Install the solenoid/cartridge assembly (Fig. 4-70, 2). Torque to 4-6 lb/ft (5-8 Nm).
2. Install the relief valve (Fig. 4-70, 3). Torque to 35-40 lb/ft (47-54 Nm).
3. Install both pressure sensing valves (Fig. 4-70, 4). Torque to 95-115 lb/ft (129-156 Nm).
4. Install new o-rings on all hydraulic fittings, and install the fittings in the proper positions on the valve housing. Tighten and torque all fittings. Refer to Section 2.8, “Torques,” for torque specifications.

e. Installation

1. Install the valve (Fig. 4-69, 4) to the bracket (5) on the frame using the two socket head capscrews (1), lockwashers (2), and flat washers (3), and tighten securely.
2. Connect hoses to the high flow valve fittings (Fig. 4-69, Fig. 4-71, Fig. 4-72). Refer to Section 2.8, "Torques" for torque specifications.
3. Plug the electrical connector (Fig. 4-70, 1) from the solenoid (2) on the valve to the high flow harness.
4. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
5. Refer to Section 4.5, “Startup After Hydraulic Repair.”
6. Close and lock the engine compartment door.

4.11.7 High Flow Hydraulic Supply, Return and Cooling Circuits

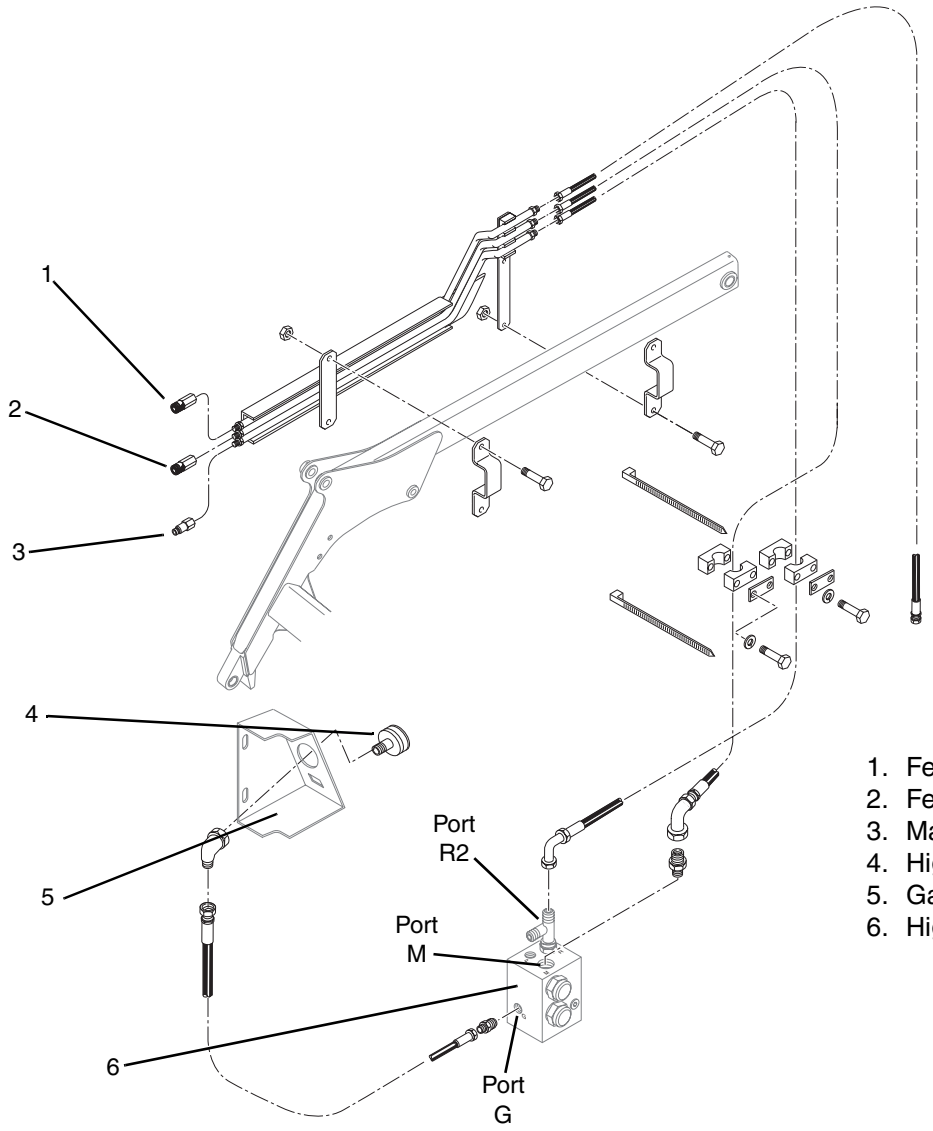


1. Hydraulic Oil Cooler
2. Main Hydraulic Filter
3. Drive System Filter
4. Reservoir Fill Cap
5. Oil Sight Gauge
6. Hydraulic Reservoir
7. Reservoir Drain Plug
8. High Flow Pump
9. Implement Pump/ Transmission
10. High Flow Valve
11. Main Control Valve

Figure 4-71 High Flow - Supply, Return and Cooling Circuits

4.11.8 High Flow System Hydraulic Circuit

Although there is no specific maintenance required on the gauge, tubes, or couplers that are associated with the high flow hydraulic circuit, it is recommended to inspect the systems components for damage or leakage at every scheduled maintenance interval.

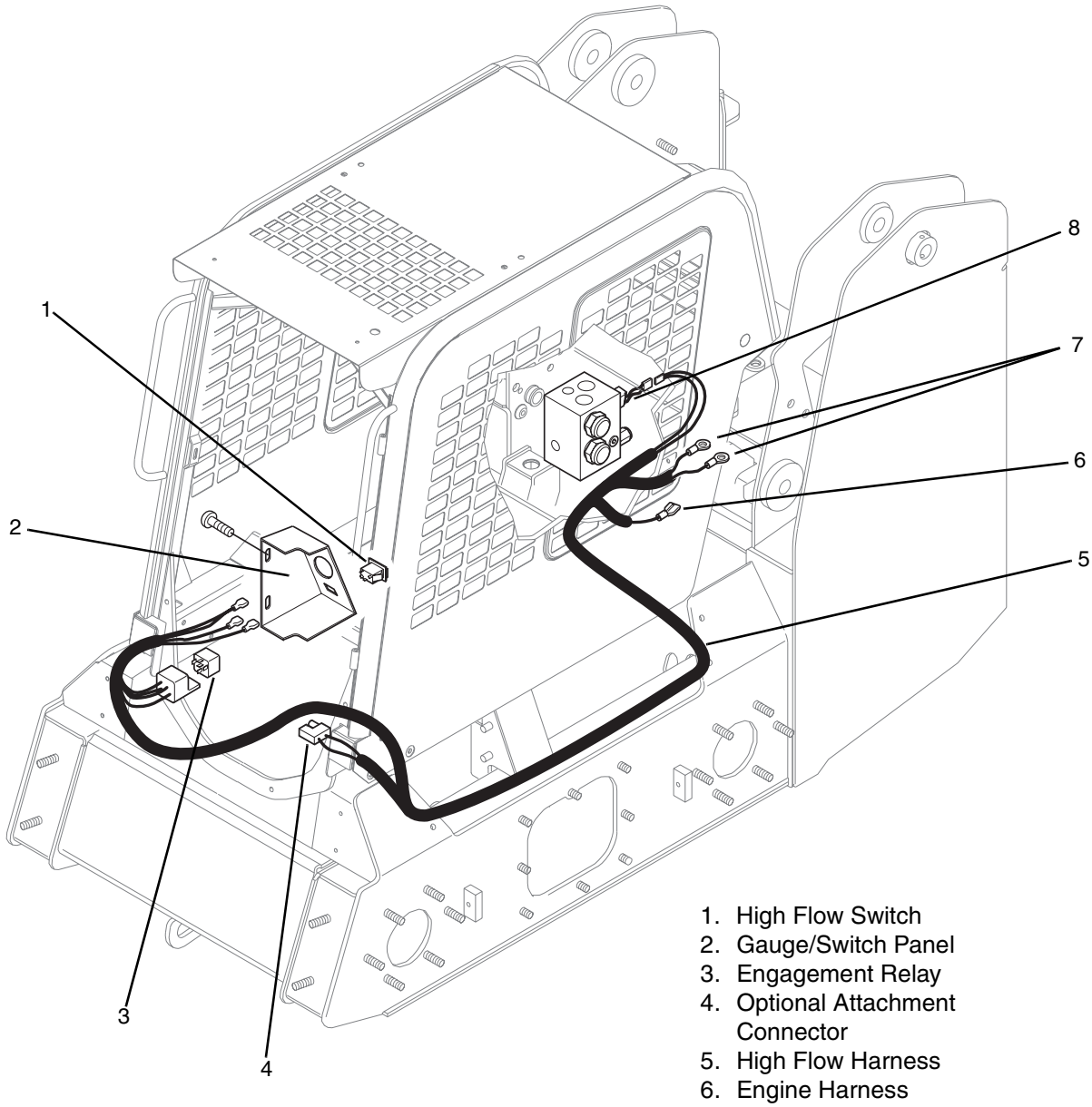


1. Female Coupler
2. Female Coupler
3. Male Coupler
4. High Flow Gauge
5. Gauge/Switch Panel
6. High Flow Valve

Figure 4-72 High Flow (DX) Hydraulic Circuit

4.11.9 High Flow System Wiring Harness

Refer to Section 8.10, “High Flow Electrical System” for the identification, inspection, testing, and replacement of all electrical components and wiring in the high flow system.



1. High Flow Switch
2. Gauge/Switch Panel
3. Engagement Relay
4. Optional Attachment Connector
5. High Flow Harness
6. Engine Harness Connection
7. Ground at Starter
8. Solenoid Cartridge Valve

PN0330

Figure 4-73 High Flow System Wiring Harness

4.12 TROUBLESHOOTING

Trouble	Probable Cause	Remedy	Ref. Par.
Loss of hydraulic power to loader arm, attachment tilt, or auxiliary hydraulics (no flow from charge and implement pump). Refer to Section 3.4.4 and perform an implement pump flow displacement test to be sure there is no flow from implement pump.	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Drive shaft universal joint between engine and pump failure.	Inspect and replace damaged parts. Check for misalignment.	5.7.5 and 10.17
	Implement pump cavitation.	Check supply hose to pump for leaks or bad connections.	4.6.3
	Implement pump failure.	Inspect and replace damaged parts.	4.6.3
	Control pump shaft failure.	Inspect and replace damaged parts.	5.7.3 and 5.7.4
	Spline coupling between front and rear travel control pump failure.	Inspect and replace damaged parts.	5.7.3 and 5.7.4
	Charge and implement pump shaft failure.	Inspect and replace damaged parts.	4.6.3
Loss of hydraulic power to loader arm, attachment tilt, or auxiliary hydraulics (full flow from charge and implement pump). Refer to Section 3.4.4 and perform an implement pump flow displacement test to be sure there is full flow from implement pump.	Right travel-steer auxiliary lever in auxiliary detent position without an auxiliary implement attached.	Move right travel-steer auxiliary lever out of detent position.	7.3.2 and 7.5.2
	Main relief valve failure or out of adjustment.	Check pressure setting and readjust or replace.	3.4.2 or 3.4.3 and 4.7.6
	Foot pedal or auxiliary hydraulics cable disconnected, binding or broken.	Inspect and replace or reconnect as required.	7.4.2 or 7.5.2
	Self level valve not functioning properly.	Remove and clean the internal spools, adjustable orifice, and check valves. Inspect and replace the damaged parts.	4.8

Trouble	Probable Cause	Remedy	Ref. Par.
Hydraulic action jerky.	Air in hydraulic system.	Check for leaks between oil reservoir and charge/implement pump. Bleed system by raising and lowering loader arm and fully tilting attachment forward and backward several times.	4.5 and 4.6.3 d
	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Restricted oil supply hose from reservoir to charge/implement pump.	Replace or repair damaged oil supply hose.	4.63 d
	Foot pedal or auxiliary hydraulic cable linkage worn, loose, or binding.	Inspect and tighten or replace as required.	7.3.2, 7.4.2 or 7.5.2
	Control valve spool spring return mechanism not functioning properly.	Remove, inspect and replace damaged parts.	4.7
	Load check valve in main control valve not functioning properly.	Remove, inspect and replace damaged parts.	4.7.10
	Cylinder base or rod trunnion end bushing failure, or loader arm bushing failure.	Replace bushings and/or bushing seals in applicable cylinder trunnion end.	4.9.4, 4.9.5 and 9.3
	Binding of cylinder rod or piston.	Remove, repair or replace cylinder.	4.9.4, 4.9.5 and 9.3
Loader arm will not raise or lower	Loader arm lockout solenoids engaged.	Push loader arm raise/lower reset button.	8.9 a
	Seat bar to loader arm lockout switch misadjusted or switch failure.	Check and adjust switch activation. Check switch function. Replace if necessary.	8.9 b
	Loader arm lockout solenoid wire connection loose, corroded, or broken.	Check and correct connection or wire.	8.11.9
	Loader arm lockout solenoid failure.	Test and replace if necessary.	8.9 g
	Loader arm raise/lower reset switch failure.	Test and replace if necessary.	8.9 e
	Foot pedal cable disconnected, rusted, or broken.	Inspect and repair or replace as necessary.	7.4.2
	Self level valve malfunction.	Inspect and repair self level valve.	4.8

Continued…

Trouble	Probable Cause	Remedy	Ref. Par.
Loader arm will not raise or lower (continued)	Cylinder rod bent.	Inspect and replace cylinder rod.	4.9.4
	Loader arm lockout relay malfunction.	Replace relay.	8.9 f
	Loose wires or corroded connection in loader arm lockout electrical circuit.	Inspect and test as required.	8.11.9
	Main relief valve failure.	Test and readjust or replace main relief valve.	3.4.2 or 3.4.3 and 4.7.6
	Broken hydraulic hose or tube.	Inspect hoses and tubes. Replace broken hose or tube.	4.9.6 a
	Spool not shifting in main control valve.	Check for damaged spring return mechanisms on spools.	4.7.3
Loader arm and/or quick attach function slowly.	Reservoir low in oil.	Check for leaks. Fill reservoir.	4.10.1
	Engine RPM too slow.	Check engine RPM and reset.	11.1
	Right travel-steer auxiliary lever in auxiliary detent position without an auxiliary implement attached.	Move right travel-steer auxiliary lever out of detent position.	7.3.2 or 7.5.2
	Foot pedal cable binding or pedal out of adjustment.	Inspect and adjust.	7.3.2 or 7.4.2
	Main relief valve failure or out of adjustment.	Check pressure and adjust or repair.	3.4.2 or 3.4.3 and 4.7.6
	Oil bypassing one or both loader arm or attachment tilt cylinder piston seals.	Check piston seal for leakage and repair.	4.9.4 or 4.9.5
	Internal leakage in implement pump.	Test implement pump flow and repair.	3.4.4
	Internal leakage in main control valve.	Inspect control valve and repair.	4.7
	Attempting to lift more than rated capacity.	Reduce load.	11.7

Trouble	Probable Cause	Remedy	Ref. Par.
Loader arm or attachment tilt cylinders will not support a load (leak down).	External leak between main control valve and cylinders.	Inspect and repair hoses and fittings between main control valve and cylinders.	4.9.6
	Control valve spool not centering.	Check foot pedals for binding or adjustment, and repair or adjust. Check for damaged spring return mechanism on main control valve spools.	7.4.2 and 4.7.7 or 7.5.2 and 4.7.8
	Oil bypassing one or both loader arm or attachment tilt cylinder piston seals.	Check piston seals for leakage and repair.	4.7.7 or 4.7.8
	Internal leakage in control valve.	Inspect main control valve and repair.	4.7
	Internal leakage in self level valve	Bypass self level valve, verify leakage.	4.8.7
Hydraulic Oil Temperature Light ON. Reservoir overheating.	Right travel-steer auxiliary lever in auxiliary detent position without an auxiliary implement attached.	Move right travel-steer auxiliary lever out of detent position.	7.3.2 or 7.5.2
	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Wrong type of hydraulic fluid.	Replace with 10W30 motor oil.	4..3
	Oil cooler plugged or dirty. Also check engine radiator.	Clean cooling fins.	4.10.4 and 10.6.3
	Engine RPM too slow.	Check engine RPM and reset.	11.1
	Engine cooling fan reversed or improper fan used.	Check fan and install correctly. Ensure the cupped side of blades face radiator.	10.11
	Main relief valve or high flow relief valve failure or out of adjustment.	Check pressure and adjust or replace.	3.4.1 and 4.7.6 or 3.4.8 and 4.11.6
	Hydraulic temperature sender switch defective.	Test and replace if necessary.	8.3.2 h
	Unapproved auxiliary implement being used. Implement operating pressures too high, causing hydraulic system to overheat.	DO NOT use implement.	11.7

Trouble	Probable Cause	Remedy	Ref. Par.
Quick attach will not function	Control cable disconnected, rusted, or broken.	Inspect and replace cable.	7.3.2 or 7.4.2
	Self level valve malfunction.	Inspect and repair self level valve.	4.8
	Cylinder rod bent.	Inspect and replace cylinder rod.	4.9.5
	Main relief valve failure.	Test and readjust or replace main relief valve.	4.6.3 or 4.7.3
	Control valve spool not centering.	Check for damaged spring return mechanisms on spools.	4.7.8
	Broken hydraulic hose.	Replace broken hose.	4.9.6 b, c
Auxiliary not functioning properly	Quick disconnect leaking and/or connectors are reversed.	Check quick disconnect. Reverse connectors from implement.	4.7.5
	Control cable disconnected, rusted, or broken.	Inspect and replace cable.	7.3.2 or 7.5.2
	Main relief valve failure.	Test and readjust or replace main relief valve.	3.4.1 or 4.7.6
	Broken hydraulic hose.	Inspect hoses. Replace broken hose.	4.9.6 d
	Spool not shifting in main control valve.	Check for damaged spring return mechanisms on spools.	4.7.9
High flow will not function	Electrical component of system inoperative.	Inspect and repair or replace high flow fuse, switch, relay or solenoid.	8.5, 8.11, 8.12
High flow not functioning properly	Quick disconnect couplers, hydraulic lines, tubes or fittings leaking or broken.	Inspect and repair or replace leaking or broken component.	4.11.7, 4.11.8
	Relief valve failure.	Test and readjust or replace relief valve.	3.4.8, 4.11.6
	High flow pump worn.	Test and replace pump.	3.4.9, 4.11.5 a

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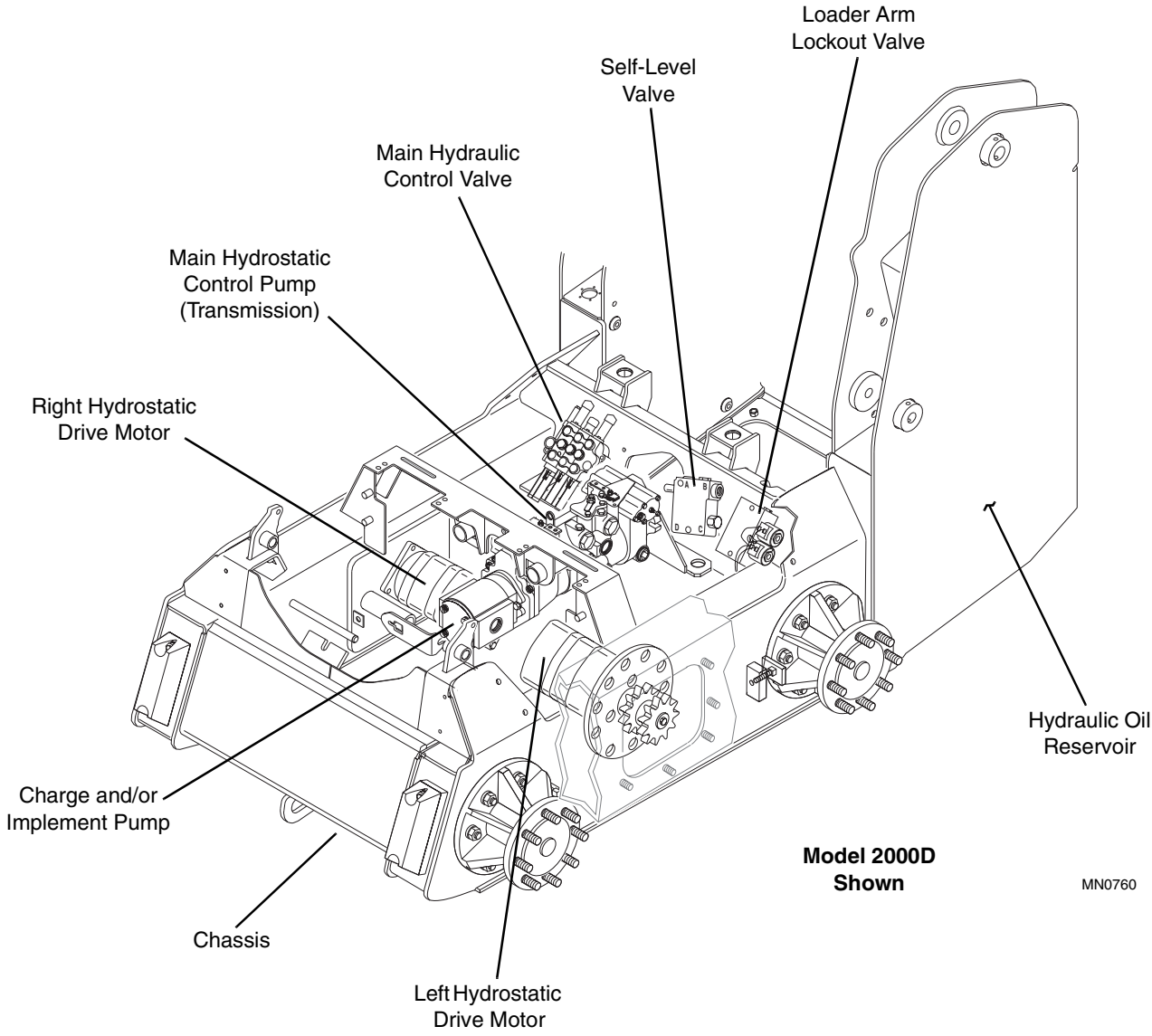
Section 5
Travel Hydraulics

Contents

5.1 COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the major assemblies of the hydraulic drive system. The following illustration identifies the components that are referred to throughout this section.



WARNING: Do not service the vehicle without instruction or taking the necessary safety precautions outlined in the “Safety Practices” section of this manual.

5.2 HYDRAULIC CIRCUIT

The travel hydraulic circuits below each contain an implement pump that draws system oil from the reservoir.

The implement pumps are driven at engine speed by a shaft that passes through from the hydrostatic pump to the implement pump and control pump assembly.

The hydrostatic travel control pumps direct oil to the left and right travel motors. Return oil from the travel motors is directed back to the control pump assembly.

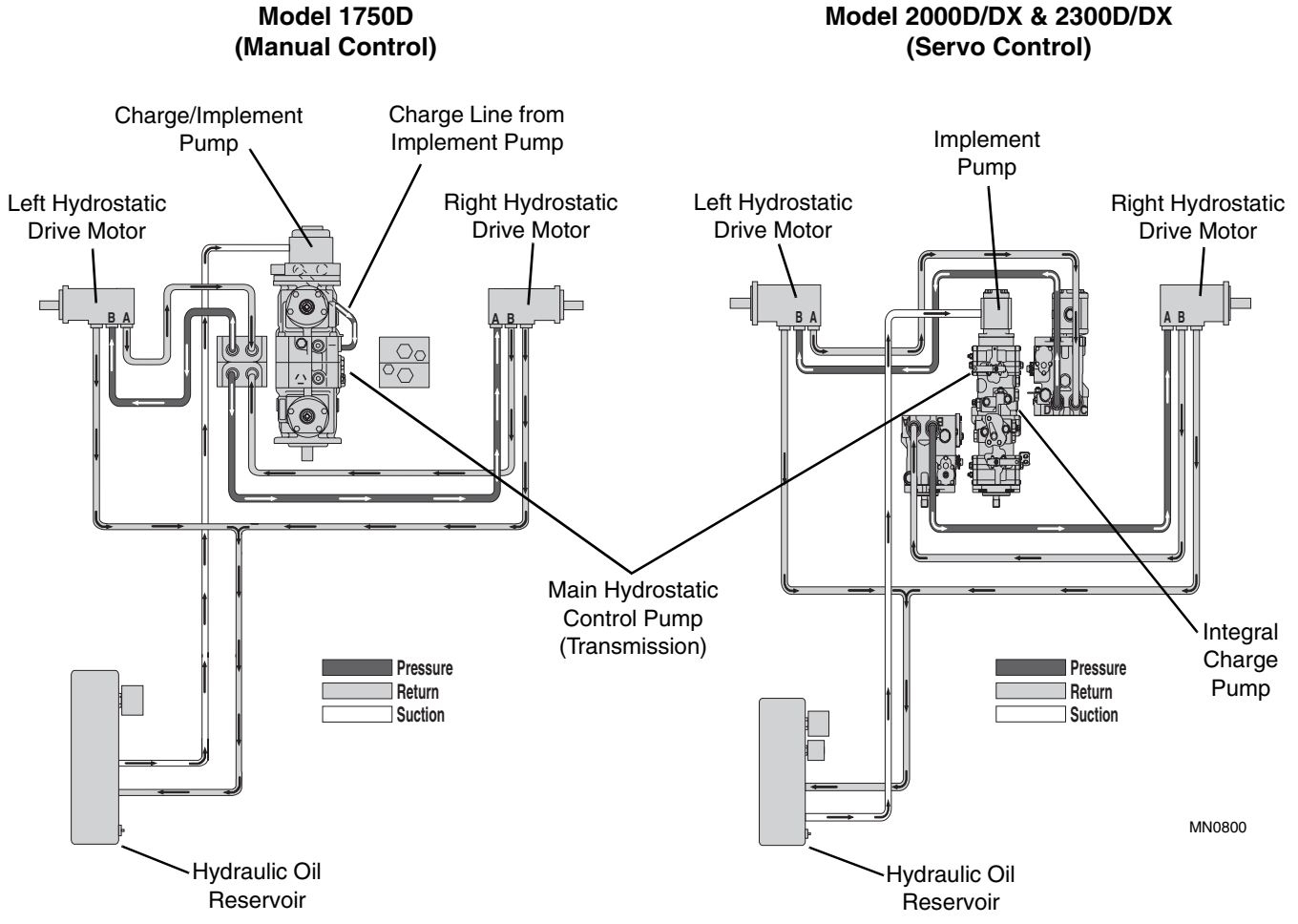


Figure 5-1 Travel Hydraulic Circuits

WARNING:

- If anyone is injured by, or if, any hydraulic system oil is injected into the skin, obtain medical attention immediately or gangrene may result.
- Wear appropriate eye protection. Hydraulic system oil can cause permanent eye injury. Do not wear loose fitting clothing when servicing the vehicle.

5.3 HYDRAULIC SYSTEM OIL SPECIFICATIONS

The 10W30 motor oil used in the hydraulic system should be changed at 1000 hour intervals or when contaminated. Refer to Section 4.10.3, “Hydraulic Oil Filter Change.”

5.4 HYDRAULIC SYSTEM OIL CONTAMINATION

5.4.1 Microscopic Contamination

Microscopic contamination occurs when fine particles of foreign material are in the system oil. These particles are too small to see or feel. The ISO (International Organization for Standardization) has developed a code for expressing the level of particulate contaminant in hydraulic fluid and for expressing acceptable levels of cleanliness. The ISO Solid Contaminant code for this vehicles hydraulic oil is ISO 18/15, and can only be properly determined by laboratory testing.

Examples of contamination problems caused by excessive particulates would include the following:

- cylinder rod seals leak,
- control valve spools do not return to neutral, and/or
- hydraulic circuit has a high operating temperature.

5.4.2 Sense Contamination

Sense contamination is foreign matter found by sight, touch, or smell. This type of contamination can cause a sudden failure of a hydraulic component. Examples of sense contamination are:

- particles of metal or dirt in the system oil,
- air in the system oil,
- system oil dark and thick,
- odor of burned system oil, and/or
- water in the system oil. Water will cause oil to become white in color.

5.5 STARTUP AFTER HYDRAULIC REPAIR

To prevent damage on startup after draining the hydraulic system oil reservoir or replacing hydraulic components, comply with the following procedure.

1. Remove reservoir fill cap and fill reservoir with motor oil equal to 10W30 API, CD or CE specifications, until the oil level is in the middle of the sight gauge. Wait a few minutes after adding oil before checking the level. Fill to proper level if necessary.
2. Install a pressure gauge to check the charge pressure of your specific model (Refer to Section 3.4.2 or 3.4.3).

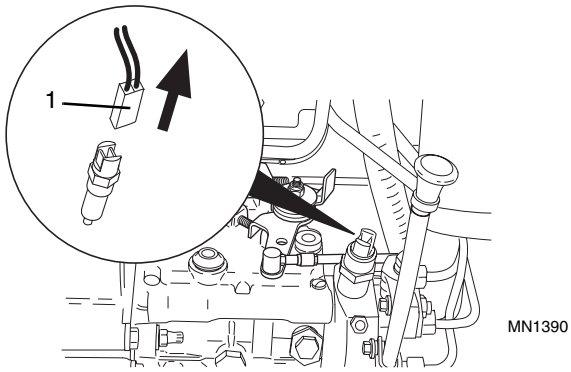


Figure 5-2 Fuel Run Solenoid Connector

3. Disconnect the Fuel Run solenoid connector (Fig. 5-2, 1) and turn the engine over with the starter at 15 second intervals until you get a pressure reading of at least 75 psi (5,18 bar), or a minimum of three 15 second intervals if not checking with a gauge. This permits the implement pump to draw oil from the reservoir, ensuring the system is full before starting engine and operating the hydraulic functions. Reconnect the wire.
4. Start the engine and run it at half throttle for several minutes with no hydraulics engaged.

WARNING: Do not start the engine unless you are in the seat with the seat belt fastened and the seat bar down. Serious injury could result if the belt is not securely fastened. Be sure the area is clear before starting the engine.

5. Momentarily press the loader arm raise/lower reset button to activate the loader arm raise/lower system.
6. To bleed air from the hydraulic system, operate all the hydraulic controls with engine at half throttle.
7. Shut the engine off and check for leaks. Recheck fluid level and add as necessary.

5.6 CHARGE/IMPLEMENT PUMP

5.6.1 Pump Description

The charge/implement pump on the Model 1750D mounts at the end of two travel control pumps forming a transmission unit. The transmission pump shaft drives the charge and implement pump shaft in all models at engine crankshaft speed. Engine speed determines the pump output; maximum output being at full rated engine speed.

Note: *Refer to Section 4.6, "Implement Pump" for additional information on the implement function of this pump.*

The Model 2000D/DX and 2300D/DX transmission has individual charge and implement pumps. The charge pump is incorporated into the control pump (transmission) assembly, and is located between the transmission halves.

The implement pump is mounted on the end of the control pumps, in the same location as on the 1750D model.

5.6.2 Pump Operation

The charge pumps develop flow by carrying oil between the teeth of two meshed gears. The pumps draw oil from the hydraulic system oil reservoir and pump the oil to the control pump (transmission) assembly as replenishment oil.

The Model 1750D charge/implement pump, using a pressure priority valve, also pumps cleaned and filtered oil to the main control valve.

5.6.3 Pump Maintenance

Refer to Section 4.6.3, "Pump Maintenance" for charge and implement pump maintenance.

Model 1750D (Manual Control)

Model 2000D/DX & 2300D/DX (Servo Control)

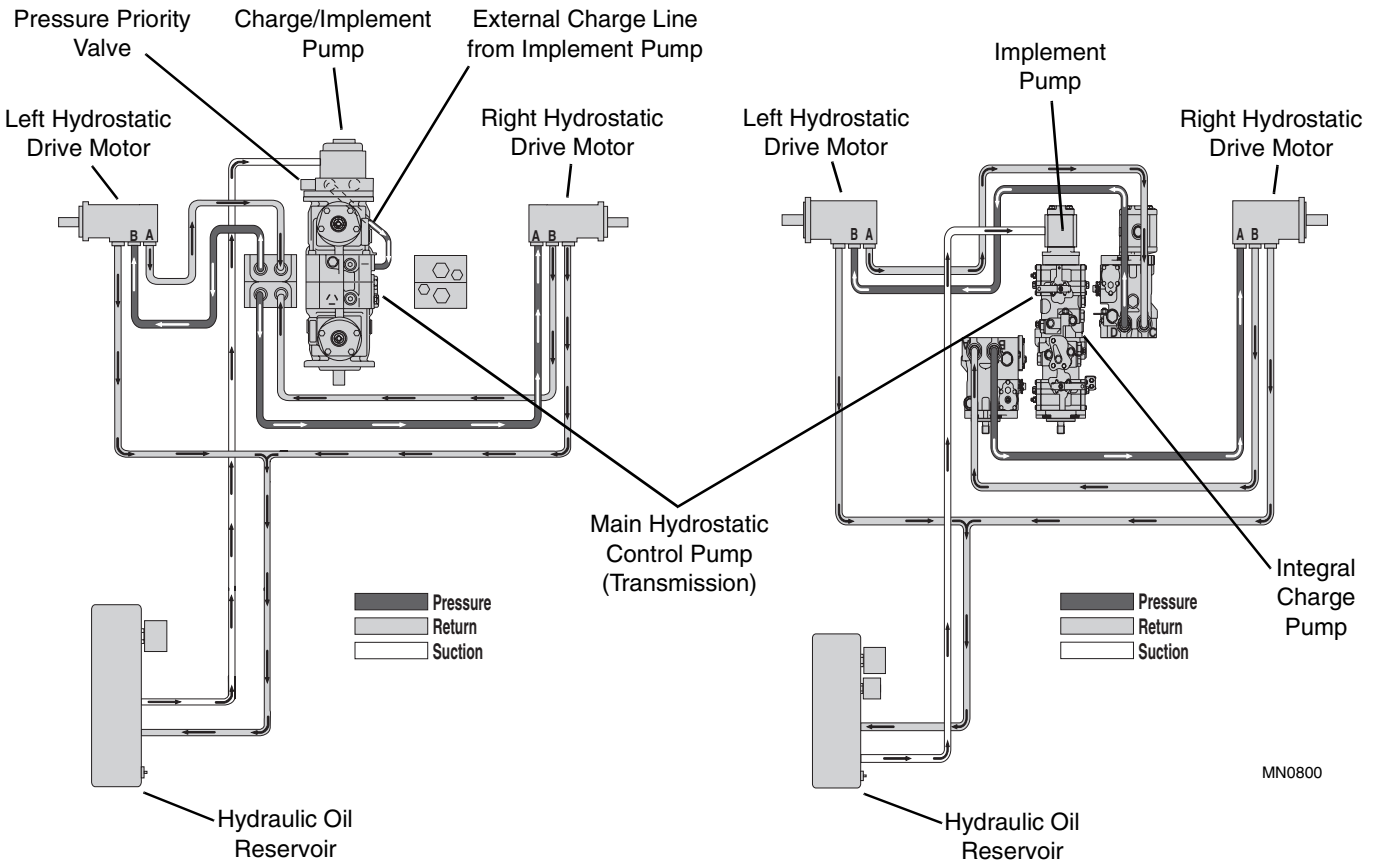


Figure 5-3 Charge/Implement Pump

5.6.4 Pressure Priority Valve Model 1750D Only

a. Valve Description

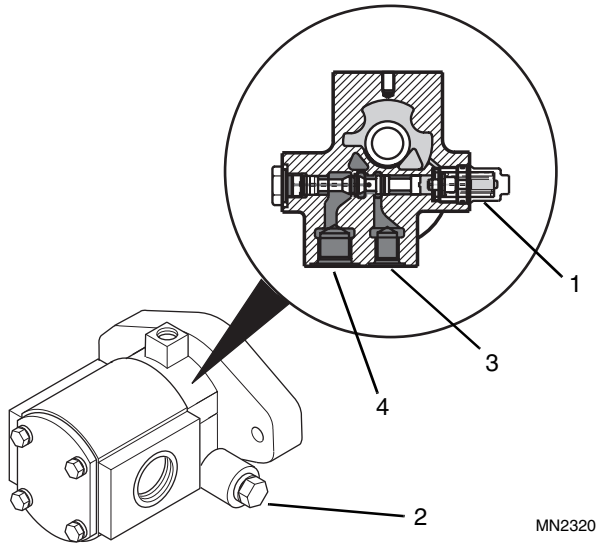


Figure 5-4 Pressure Priority Valve Assembly (Model 1750D Only)

The pressure priority valve assembly (Fig. 5-4, 1) is a flow divider that separates the oil flow into two individual circuits, and is incorporated in the charge/implement pump housing (2). The circuit given priority is the charge flow to the main travel control pumps, and is connected to port (3). The remaining flow, connected to port (4) is directed to the main hydraulic control valve.

b. Valve Operation

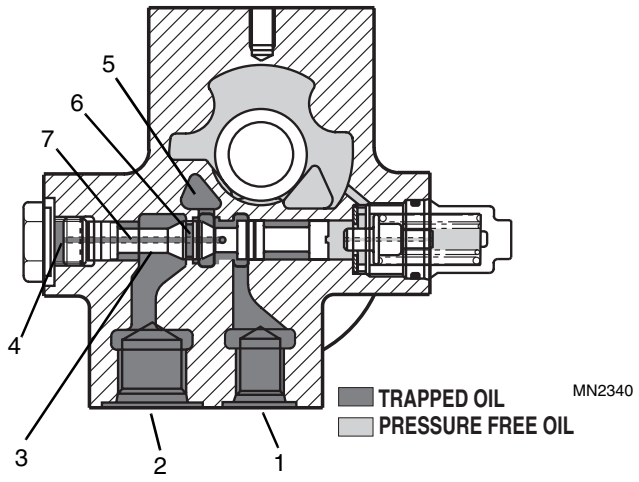


Figure 5-5 Pressure Priority Valve - Spool at Rest

With the engine STOPPED, oil in the charge (Fig. 5-5, 1) and implement port (2) is trapped, and the priority valve control spool (3) is at rest on the non-spring end (4) of the housing. When the engine is started, oil flow from the pump enters the housing at port (5), is fed to the control spool groove (6) and then to the charge port (1).

The charge circuit is ported to the non-spring end (Fig. 5-5, 4) of the valve housing by a small passage (7) in the control spool.

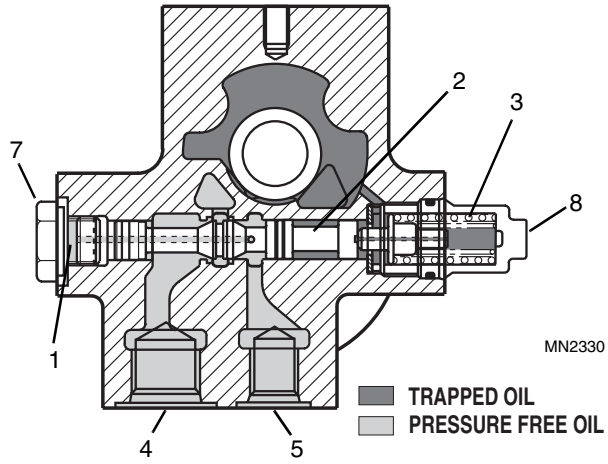


Figure 5-6 Pressure Priority Valve - Spool In Control

Pump pressure acting, on the non-spring side (Fig. 5-6, 1) of the control spool (2), will move the spool toward the opposite side of the housing, and up against the load spring (3). The spool moves across until it reaches a point where the flow to the charge port is controlled to maintain the required pressure. Excess flow is diverted to the main control valve through port (4). As pressure varies in this line, the spool moves to throttle the flow into the charge port line through port (5) to maintain the required charge pressure.

c. Valve Testing

The priority valve relief pressure is checked as part of the complete hydraulic system test procedure (Refer to Section 3.4.2, “Charge System Pressure Priority Valve Relief Test”).

If the charge system pressure is less than 150 psi (10 bar) at engine idle, the priority valve assembly components should be disassembled, cleaned, and reinstalled.

d. Valve Maintenance

The pressure priority valve contains no serviceable components. However, it can be disassembled for cleaning as follows:

1. Park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator's Protective Structure to the service position. Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position."

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers and foot pedals (or optional wrist controls) in all positions after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

4. Remove the plug (Fig. 5-6, 7) on the non-spring end of the housing and the load spring cap (8) on the opposite end of the housing. Remove and discard the o-rings from the plug and cap.
5. Noting the location and orientation, remove all internal components from the priority valve assembly.
6. Clean all parts in a suitable solvent, and dry thoroughly.
7. Lightly oil all components with clean oil, and reassemble in the reverse order of removal.
8. Install new o-rings on plug (Fig. 5-6, 7) and cap (8), and install on the valve housing. Tighten securely.
9. Refer to Section 5.5, "Startup After Hydraulic Repair."
10. Return to Section 3.4.2, "Charge System Pressure Priority Valve Relief Test," for additional test instructions.

5.7 MAIN HYDROSTATIC TRAVEL CONTROL PUMP ASSEMBLY

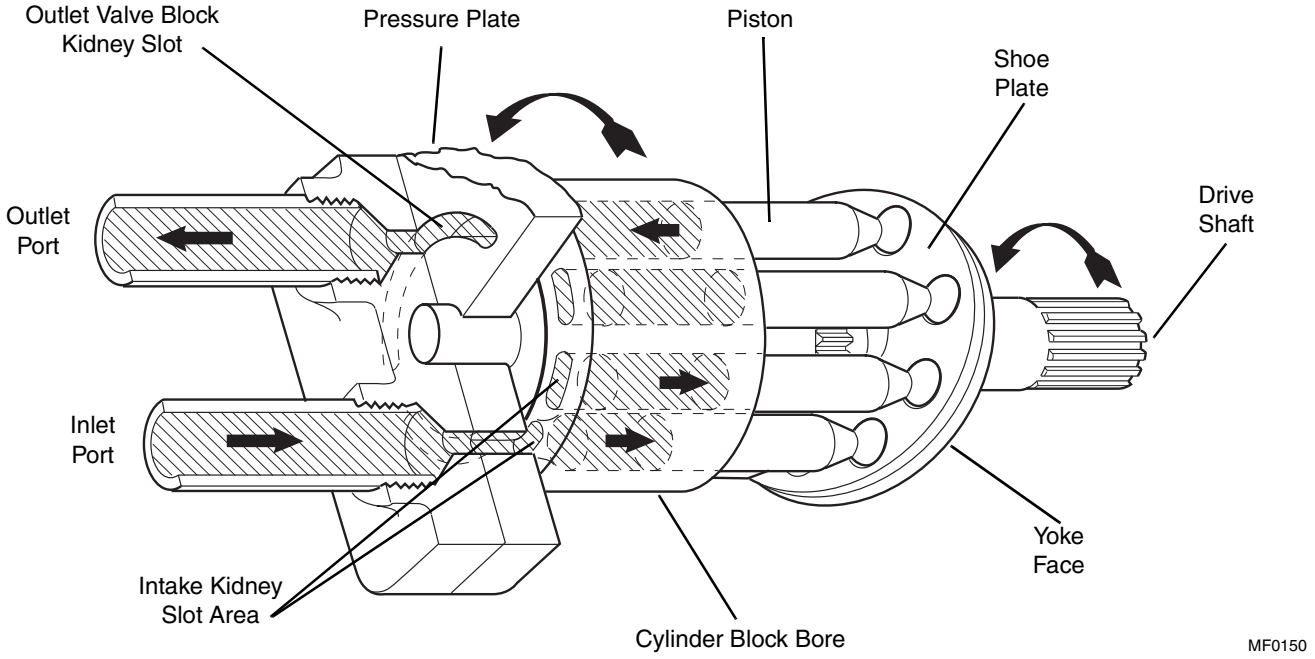


Figure 5-7 Typical Inline Travel Control Pump

5.7.1 Travel Control Pump Description

The travel control pump assembly is a typical hydrostatic variable displacement double transmission pump package. The valve block contains four drive circuit relief valves and one charge circuit relief valve. The control pumps deliver oil through the valve block to the left and right travel motors. Engine speed and movement of the travel-steering levers determine left and right control pump output.

5.7.2 Travel Control Pump Operation

Rotation of the control pump input drive shaft causes the cylinder block, shoe plate and pistons to move against the yoke face, creating a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney shape slotted wafer plate. As the pistons move out of the cylinder block a vacuum is created and oil is forced into the void by replenishing pressure. The oil moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and oil is pushed out of the cylinder block into the outlet port.

The angle of the yoke face/shoe plate determines the pump displacement from full displacement in one direction to full displacement in the opposite direction. Model 1750D travel control pumps utilize a direct mechanical lever for pump displacement/direction control. Model 2000D/DX and 2300D/DX travel control pumps utilize a mechanical input hydraulic servo for pump displacement/direction control. The servo control automatically corrects pump displacement fluctuations caused by load variations on the hydrostatic travel system.

5.7.3 Main Travel Control Pump Maintenance

Note: *The maintenance procedures are for an out-of-warranty main control pump. If the main control pump is still under warranty, it must be replaced as a complete assembly.*

Refer to Sunstrand-Sauer Repair Information Manuals for maintenance instructions on all out of warranty transmissions. Order the required manual as follows:

Model 1750D..... Publication number BLN 9992

Model 2000D/DX..... Publication number BLN 9987

Model 2300D/DX..... Publication number BLN 9987

For ordering information, contact:

Sunstrand-Sauer Company
2800 East 13th Street
Ames, IA 50010 USA
Phone: (515) 239-6000
Fax: (515) 239-6618

5.7.4 Main Travel Control Pump Testing

Refer to Section 5.11, “Troubleshooting” at the end of this section to find the trouble you are having with your vehicle and follow the chart to remedy the trouble.

If you are sure there is a problem in the control pump assembly, refer to Section 3.2, “Hydraulic Component Testing” and follow the instructions for testing the travel control pump assembly components.

5.7.5 Main Travel Control Pump Replacement - Model 1750D

a. Control Pump Removal

1. Park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator’s Protective Structure to the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers and foot pedals (or optional wrist controls) in all positions after the engine has stopped to relieve any trapped hydraulic pressure.

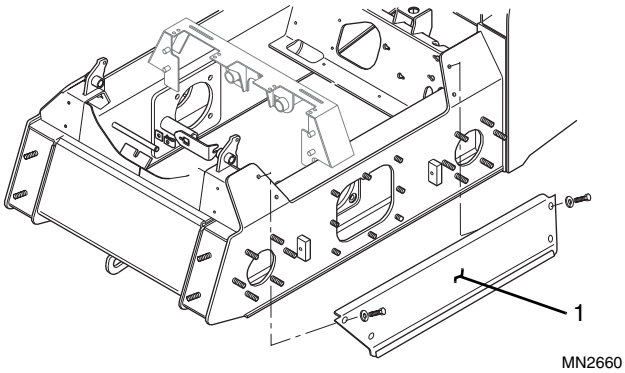


Figure 5-8 Frame Side Cover Removal

4. Remove the left (Fig. 5-8, 1) and right (not shown) side covers from the vehicle to access the control pump assembly.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

5. Drain all the oil from the hydraulic reservoir (Refer to Section 4.10.3, “Hydraulic Oil and Filter Change”).
6. Use an engine hoist with a strap wrapped around the control pump assembly or position blocks under it to prevent it from falling when it is unfastened from the chassis.
7. Remove the Travel-Steering Lever Assembly (Refer to Section 7.2.2, “Travel-Steering Lever Maintenance.”

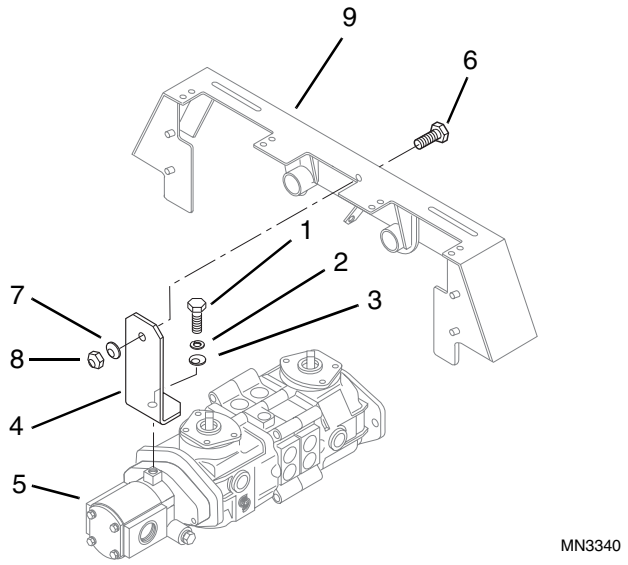


Figure 5-9 Support Bracket Removal

8. Remove the capscrew (Fig. 5-9, 1) lockwasher (2), and flat washer (3) attaching the front support bracket (4) to the implement pump (5). Remove one capscrew (6), flat washer (7), and elastic hex locknut (8) attaching the front support bracket (4) to the frame crossmember (9), and remove the support.

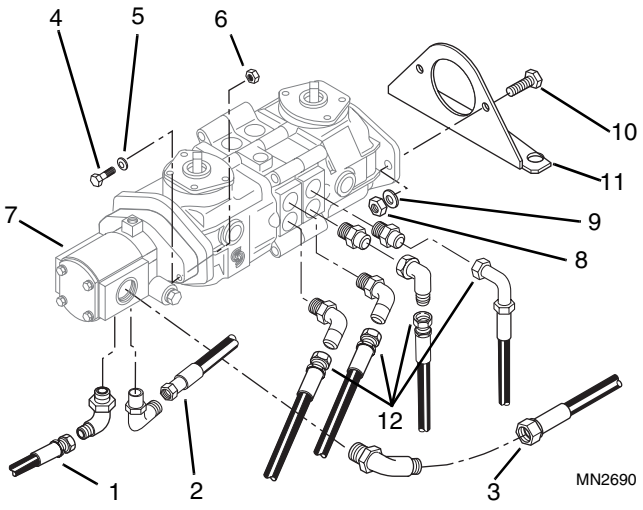


Figure 5-10 Control Pump Disassembly

9. Disconnect three hoses (Fig. 5-10, 1-3) from the implement pump and tag them with identification for proper re-installation. Cap or plug all hydraulic hoses and fittings.
10. Remove the two capscrews (Fig. 5-10, 4), washers (5), and nuts (6) attaching the implement pump (7) to the main travel control pump, and remove the implement pump.

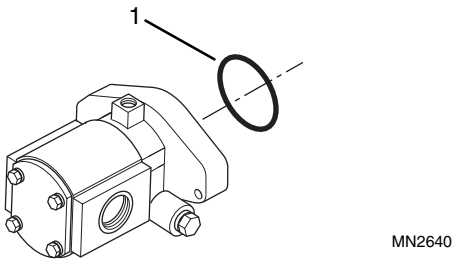


Figure 5-11 Implement Pump O-ring Removal

11. Remove the o-ring (Fig. 5-11, 1) from the implement pump and discard.

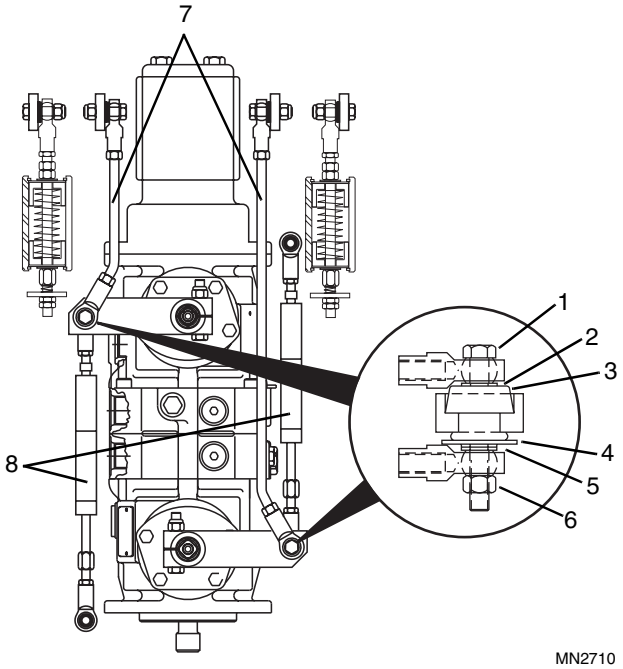


Figure 5-12 Control Pump Linkage Disassembly

12. Remove the capscrews (Fig. 5-12, 1), flat washers (2), rubber isolators (3), rebound washers (4), flat washers (5), and hex locknuts (6) that fasten the transmission control linkage (7) and shock absorbers (8) to the transmission levers on both sides of the control pump assembly.
13. Tag and remove all of the hydraulic hoses (Fig. 5-10, 12) that attach to the main travel control pump assembly. Cap or plug all hydraulic hoses and fittings.

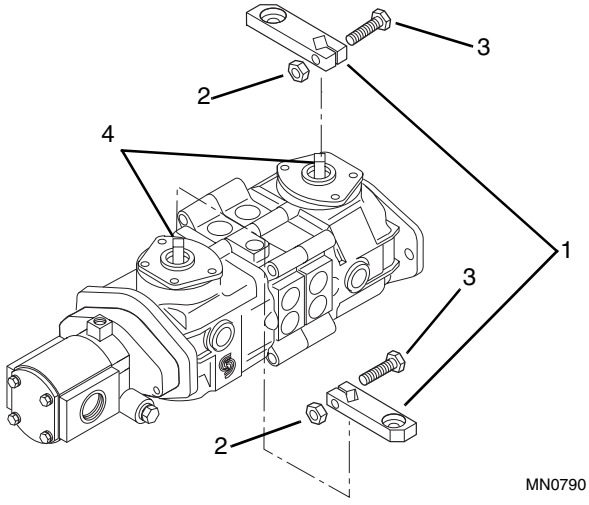


Figure 5-13 Pump Control Levers

14. Remove the transmission levers (Fig. 5-13, 1) from both control pumps by removing the locknuts (2) and capscrews (3). Slide the levers off the pump shafts (4).
15. Note how the hydraulic fittings are oriented (Fig. 5-10) and remove the fittings from the pump assembly.
16. Remove the o-rings from the hydraulic fittings and discard.
17. Clean the hydraulic fittings with a suitable solvent.
18. Remove the two locknuts (Fig. 5-10, 8), washers (9), and capscrews (10) that fasten the rear of the main travel control pump assembly to the pump mount (11).
19. Lift the control pump assembly out of the vehicle with the engine hoist. If an engine hoist is not available, have a second person assist with the pump removal.

Note: *The rear spline shaft connecting to the control pump drive shaft universal joint will slide out when the pump assembly is lifted out of the vehicle.*

20. Place the control pump assembly on a clean bench.

b. Control Pump Installation

1. Coat the input spline shaft of the control pump and the ID of the universal joint with molybdenum disulfide anti-seize compound. Lower the control pump assembly into the vehicle with an engine hoist or with assistance, place the pump assembly onto the supporting blocks used during removal.

Note: *Slide the spline shaft into the control pump drive shaft universal joint while lowering the control pump assembly into the vehicle.*

2. Fasten the rear of the control pump assembly to the pump mount (Fig. 5-10, 11) with two capscrews (10), washers (9), and new locknuts (8).
3. Lubricate new o-rings with clean oil and install o-rings on the fittings. Replace any damaged hydraulic fittings.

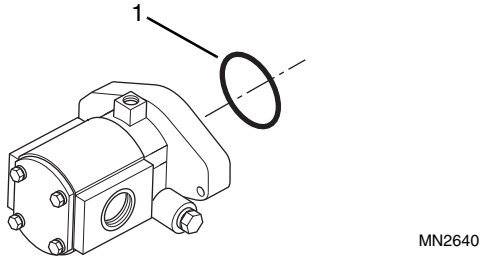


Figure 5-14 Implement Pump Installation

4. Lubricate a new o-ring with clean oil and install onto the charge/implement pump (Fig. 5-14, 1).
5. Install the implement/charge pump to the front drive pump, and secure with capscrews (Fig. 5-10, 4), washers (5) and nuts (6), and torque to 27-31 lb/ft (37-42 Nm).

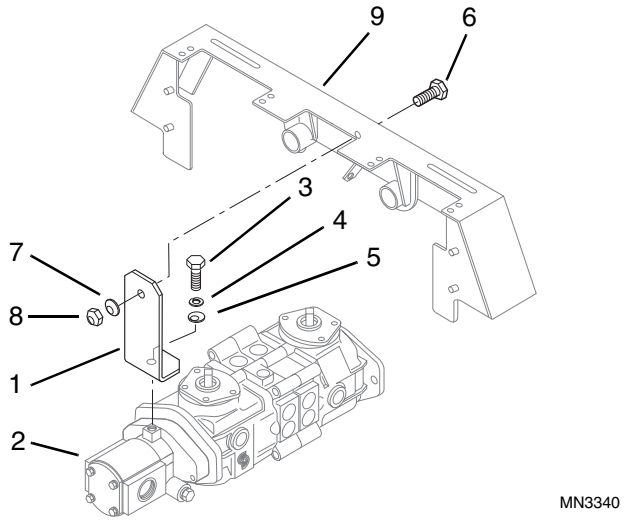


Figure 5-15 Support Installation

6. Install the front transmission support (Fig. 5-15, 1) to the implement pump (2), and secure with capscrew (3), lockwasher (4), and flat washer (5). Install capscrew (6), flat washer (7), and new elastic hex locknut (8) to secure the front support bracket (1) to the frame crossmember (9).
7. Install each transmission lever (Fig. 5-13, 1) onto the control pump shafts (4) and fasten with the capscrews (3) and new locknuts (2). Secure tightly.

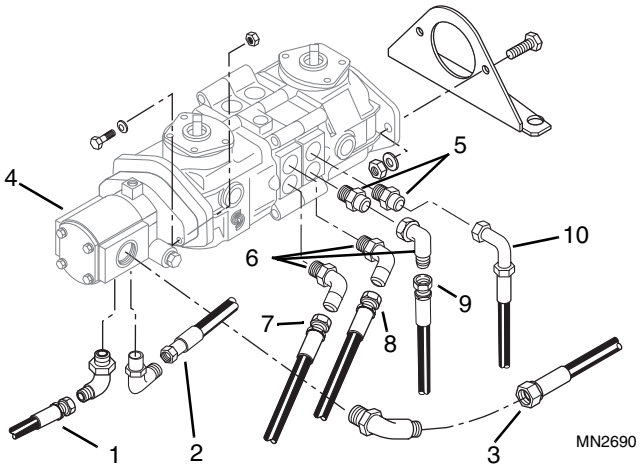


Figure 5-16 Control Pump Disassembly

8. Connect three hydraulic hoses (Fig. 5-16, 1-3) to the implement pump (4), and torque (Refer to Section 2.8, “Torques”).
9. Install two straight fittings (Fig. 5-16, 5) and three elbow fittings (6) into the ports of the new control pump assembly and orient them the same as they were before removal. Torque all fittings (Refer to Section 2.8, “Torques”).
10. Connect the remaining hydraulic hoses (Fig. 5-16) to the proper fittings.
    - Connect the hydraulic hose (Fig. 5-16, 7) from the left travel motor “B” port to the elbow in the left travel pump “B” port.
    - Connect the hydraulic hose (Fig. 5-16, 8) from the left travel motor “A” port to the elbow in the left travel pump “A” port.
    - Connect the hydraulic hose (Fig. 5-16, 9) from the right travel motor “A” port to the elbow and straight fitting in the right travel pump “A” port.
    - Connect the hydraulic hose (Fig. 5-16, 10) from the right travel motor “B” port to the straight fitting in the right travel pump “B” port.

    Refer to Section 5.9.1, “Hydraulic Components, Model 1750D,” if additional connection information is required.
11. Torque all hoses installed in Step 10 (Refer to Section 2.8, “Torques”).

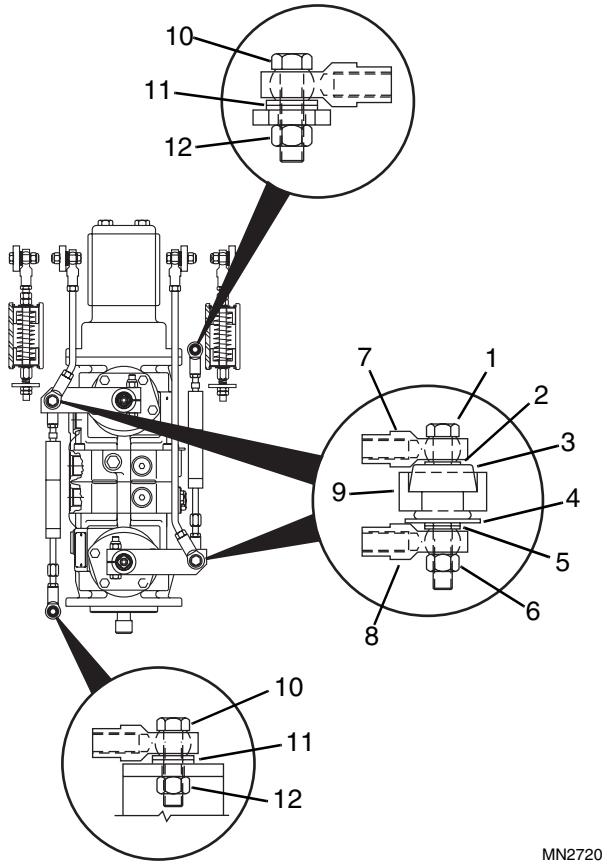


Figure 5-17 Linkage Installation

12. Install the capscrews (Fig. 5-17, 1), flat washers (2), rubber isolators (3), rebound washers (4), two flat washers (5), and new hex locknuts (6) that fasten the transmission control linkage (7) and shock absorbers (8) to the transmission levers (9) on both sides of the control pump assembly.
13. Install the capscrews (Fig. 5-17, 10), two flat washers (11), and new hex locknuts (12) that fasten the free end of each shock absorber to the vehicle on both sides of the control pump assembly.
14. Install the Travel-Steering Lever Assembly (Refer to Section 7.2.2, “Travel-Steering Lever Maintenance Checks.”
15. Refer to Section 5.5, “Startup After Hydraulic Repair.”
16. Check the neutral centering and travel/steering lever adjustment (Refer to Section 7.2.3, “Neutral Centering & Travel/Steering Lever Adjustment”).

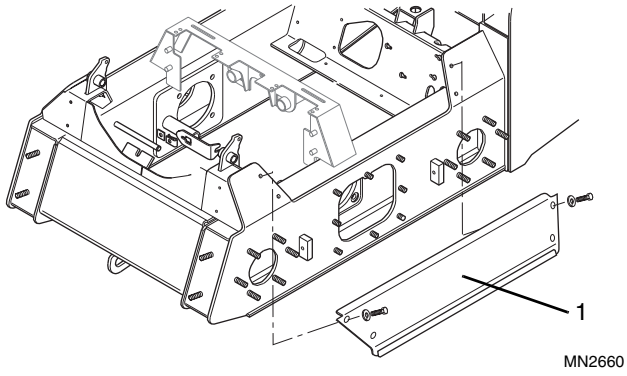


Figure 5-18 Frame Side Cover

17. Install the left (Fig. 5-18, 1) and right (not shown) side covers.
18. Lower the Operator's Protective Structure from the service position. Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position."

5.7.6 Main Travel Control Pump Replacement - Model 2000D/DX, 2300D/DX

a. Control Pump Removal

1. Park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator's Protective Structure to the service position. Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position."

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers and foot pedals (or optional wrist controls) in all positions after the engine has stopped to relieve any trapped hydraulic pressure.
4. Remove the left (Fig. 5-18, 1) and right (not shown) side covers from the vehicle to access the control pump assembly.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

5. Drain all the oil from the hydraulic reservoir (Refer to Section 4.10.3, "Hydraulic Oil and Filter Change").
6. Use an engine hoist with a strap wrapped around the control pump assembly or position blocks under it to prevent it from falling when it is unfastened from the chassis.
7. Remove the Travel-Steering Lever Assembly (Refer to Section 7.2.2, "Travel-Steering Lever Maintenance."

8. Disconnect both hoses (Fig. 5-19, 1 & 2) from the implement pump and tag them with identification for proper re-installation. Cap or plug all hydraulic hoses and fittings.
9. Remove two bolts (Fig. 5-19, 3) attaching the front support bracket (4) to the implement pump (5). Remove one bolt (6) attaching the front support bracket (4) to the frame crossmember, and remove the support.

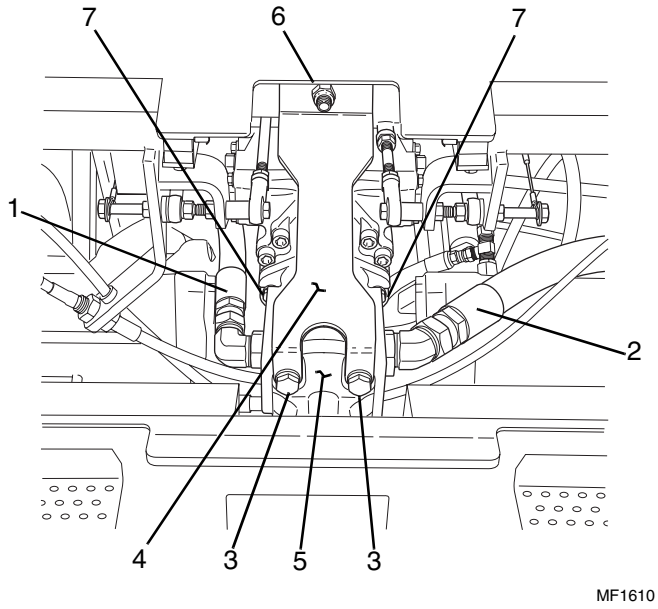


Figure 5-19 Implement Pump

10. Remove the two bolts (Fig. 5-19, 7) attaching the implement pump (5) to the front travel control pump, and remove the implement pump.

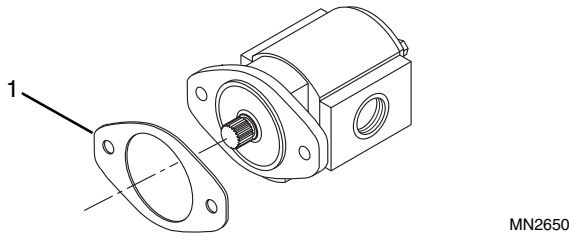


Figure 5-20 Implement Pump Removal

11. Remove the gasket (Fig. 5-20, 1) from the implement pump and discard.

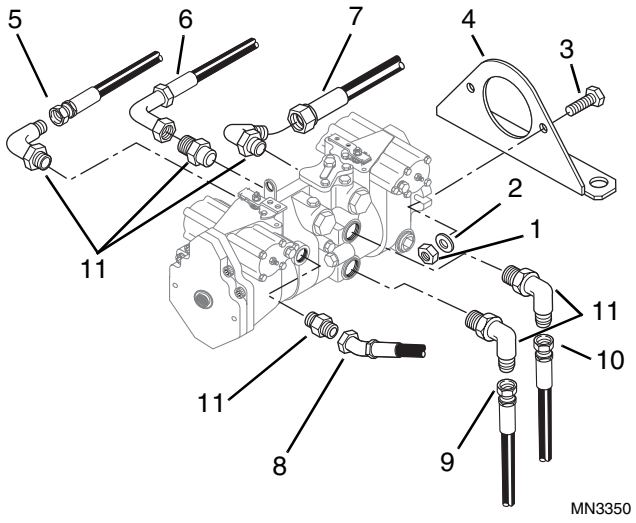


Figure 5-21 Control Pump Disassembly

12. Tag and remove all of the hydraulic hoses (Fig. 5-21, 5 - 10) that attach to the control pump assembly. Cap or plug all hydraulic hoses and fittings.

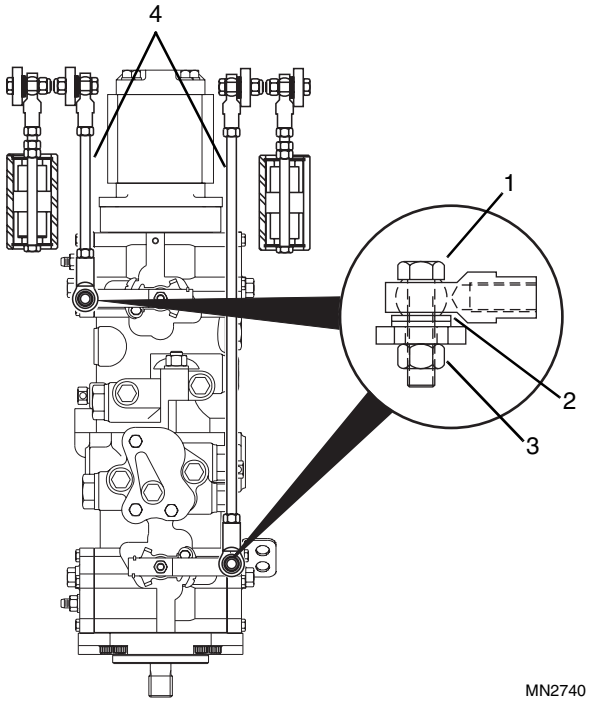


Figure 5-22 Control Pump Disassembly

13. Remove the capscrews (Fig. 5-22, 1), flat washers (2), and hex locknuts (3) that fasten the transmission control linkage (4) to the transmission levers on both sides of the control pump assembly.

14. Note how the hydraulic fittings are oriented (Fig. 5-21, 11) and remove the fittings from the pump assembly (Refer to Section 5.9.2, “Hydraulic Components, Model 2000D/DX,” or 5.9.3, “Hydraulic Components, Model 2300D/DX” for fitting identification).
15. Remove the o-rings from the hydraulic fittings and discard.
16. Clean the hydraulic fittings with a suitable solvent.
17. Remove two locknuts (Fig. 5-21, 1), washers (2), and capscrews (3) that fasten the rear of the control pump assembly to the pump mount (4).
18. Lift the control pump assembly out of the vehicle with the engine hoist. If an engine hoist is not available, have a second person assist with the pump removal.

Note: *The rear spline shaft connecting to the control pump drive shaft universal joint will slide out when the pump assembly is lifted out of the vehicle.*

19. Place the control pump assembly on a clean bench.

b. Control Pump Installation

1. Coat the input spline shaft of the control pump and the ID of the universal joint with molybdenum disulfide anti-seize compound. Lower the control pump assembly into the vehicle with an engine hoist or with assistance, place the pump assembly onto the supporting blocks used during removal.

Note: *Slide the spline shaft into the control pump drive shaft universal joint while lowering the control pump assembly into the vehicle.*

2. Fasten the rear of the control pump assembly to the pump mount (Fig. 5-21, 4) with two capscrews (3), washers (2), and new locknuts (1).
3. Lubricate new o-rings with clean oil and install o-rings on the fittings. Replace any damaged hydraulic fittings.
4. Install the fittings into the ports of the new control pump assembly (Fig. 5-21, 11) and orient them the same as they were before removal. Refer to Section 5.9.2, “Hydraulic Components, Model 2000D/DX,” or 5.9.3, “Hydraulic Components, Model 2300D/DX” if the fitting orientation was NOT noted during disassembly. Torque all fittings (Refer to Section 2.8, “Torques”).
5. Connect all the hydraulic hoses (Fig. 5-21) to the proper fittings.
   - Connect the hydraulic hose (Fig. 5-21, 5) from the left travel motor “B” port to the elbow in the left travel pump “C” port.
   - Connect the hydraulic hose (Fig. 5-21, 6) from the left travel motor “A” port to the straight fitting in the left travel pump “D” port.
   - Connect the hydraulic hose (Fig. 5-21, 7) from the hydraulic reservoir to the elbow in the rear port on the right side of the control pump assembly.
   - Connect the hydraulic hose (Fig. 5-21, 8) from the hydraulic drive oil filter to the straight fitting in the front port on the left side of the control pump assembly.
   - Connect the hydraulic hose (Fig. 5-21, 9) from the right travel motor “A” port to the elbow in the right travel pump “A” port.
   - Connect the hydraulic hose (Fig. 5-21, 10) from the right travel motor “B” port to the elbow in the right travel pump “B” port.

   Refer to Section 5.9.2, “Hydraulic Components, Model 2000D/DX,” or 5.9.3, “Hydraulic Components, Model 2300D/DX” if additional connection information is required.
6. Torque all hoses installed in Step 5 (Refer to Section 2.8, “Torques”).

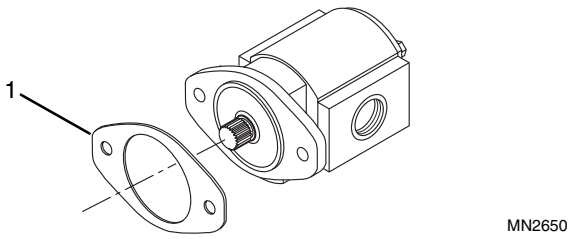


Figure 5-23 Implement Pump Installation

7. Place a new gasket on the implement pump (Fig. 5-23, 1).

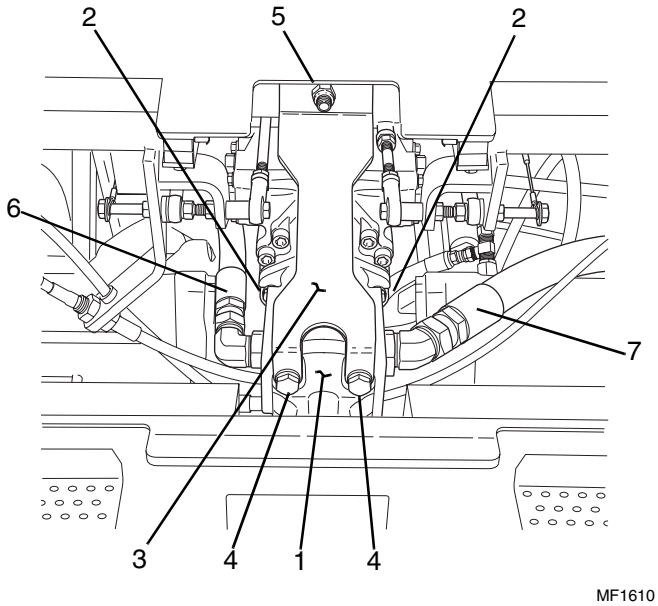


Figure 5-24 Implement Pump

8. Install the implement pump to the front drive pump. Secure the implement pump (Fig. 5-24, 1) to the front drive pump with the two capscrews (2), and torque to 27-31 lb/ft (37-42 Nm).
9. Install the front transmission support (Fig. 5-24, 3) to the implement pump (1). Torque the pump capscrews (4) to 45-50 lb/ft (61-68 Nm), and tighten the crossmember capscrew (5) securely.
10. Connect both hydraulic hoses (Fig. 5-24, 6 & 7) and torque (Refer to Section 2.8, “Torques”).

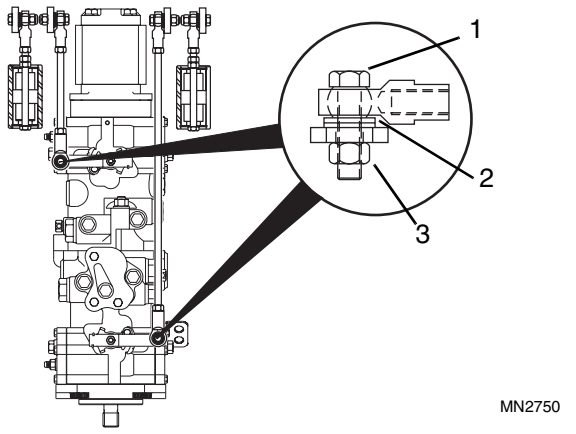


Figure 5-25 Linkage Installation

11. Install the capscrews (Fig. 5-25, 1), two flat washers (2), and new hex locknuts (3) that fasten the transmission control linkage to the transmission levers on both sides of the control pump assembly.
12. Install the Travel-Steering Lever Assembly (Refer to Section 7.2.2, “Travel-Steering Lever Maintenance Checks.”
13. Refer to Section 5.5, “Startup After Hydraulic Repair.”
14. Check the neutral centering and travel/steering lever adjustment (Refer to Section 7.2.4, “Neutral Centering & Travel/Steering Lever Adjustment”).

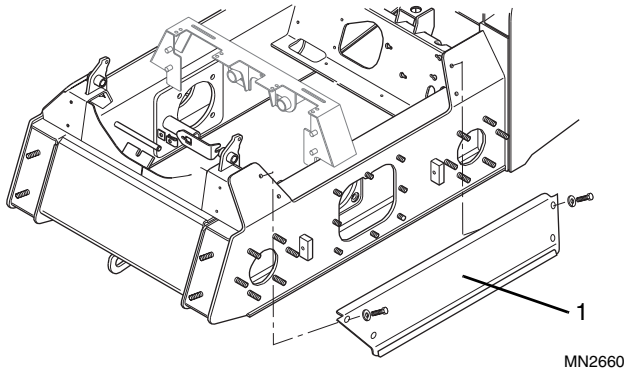


Figure 5-26 Frame Side Cover Installation

15. Install the left (Fig. 5-26, 1) and right (not shown) side covers.
16. Lower the Operator’s Protective Structure from the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

5.7.7 Transmission Drive Assembly

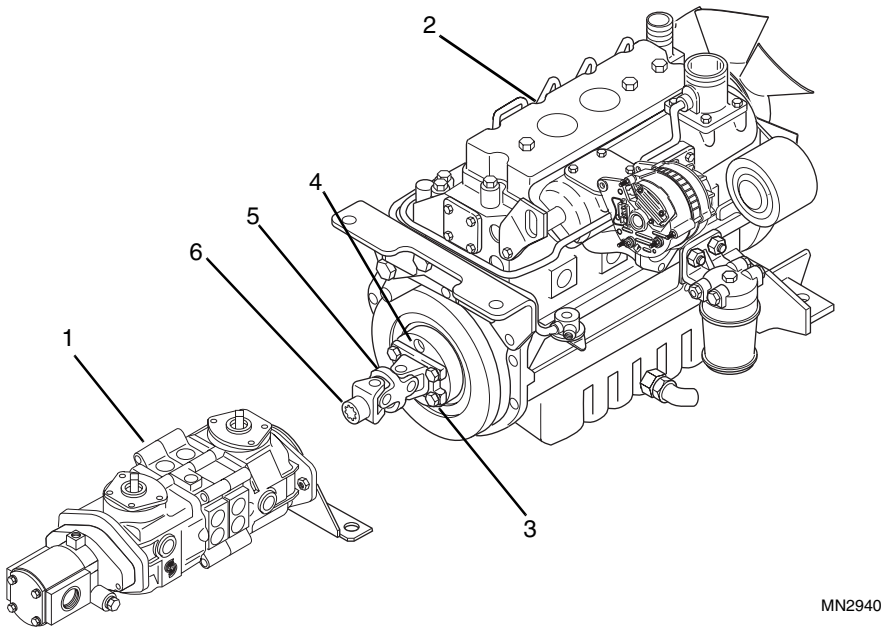


Figure 5-27 Transmission Drive Assembly

a. Description

The main travel control pump (Fig. 5-27, 1) is driven from the engine (2) by a transmission drive assembly, consisting of a flanged housing (3) that bolts to a flywheel adapter housing (4), two universal joints (5) in an intermediate housing, and a splined coupling (6) that mates with the input shaft on the travel control pump (1).

The universal joints are permanently lubricated, and are not individually serviceable.

Note: *If either universal joint in the transmission drive assembly is excessively worn, or has failed completely, and the engine continues to be run, damage to the travel control pump has most likely occurred. In these cases, it is recommended to remove the travel control pump (Refer to Section 5.7.5, "Main Travel Control Pump Replacement - Model 1750D" or Section 5.7.6, "Main Travel Control Pump Replacement - Model 2000D/DX, Model 2300D/DX"), and internally inspect it for damage (Refer to Section 5.7.3, "Main Travel Control Pump Maintenance").*

b. Removal

1. Park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator's Protective Structure to the service position. Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position."

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers and foot pedals (or optional wrist controls) in all positions after the engine has stopped to relieve any trapped hydraulic pressure.

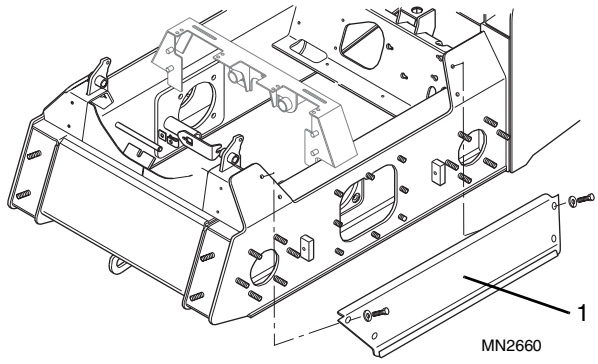


Figure 5-28 Frame Side Cover Removal

4. Remove the left (Fig. 5-28, 1) and right (not shown) side covers from the vehicle to access the control pump assembly.

5. Remove the hardware securing the travel control linkages to the travel control pumps as follows:

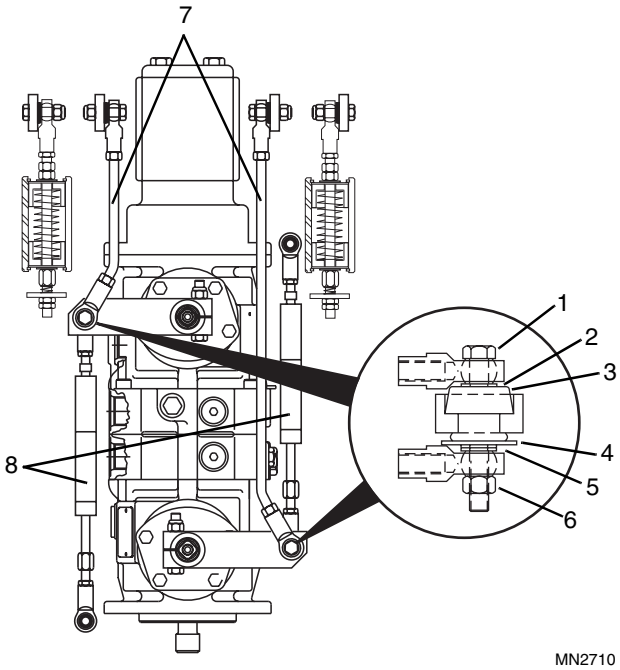


Figure 5-29 Control Pump Linkage Disassembly

Model 1750D Only - Remove the capscrews (Fig. 5-29, 1), flat washers (2), rubber isolators (3), rebound washers (4), flat washers (5), and hex locknuts (6) that fasten the transmission control linkage (7) and shock absorbers (8) to the transmission levers on both sides of the control pump assembly.

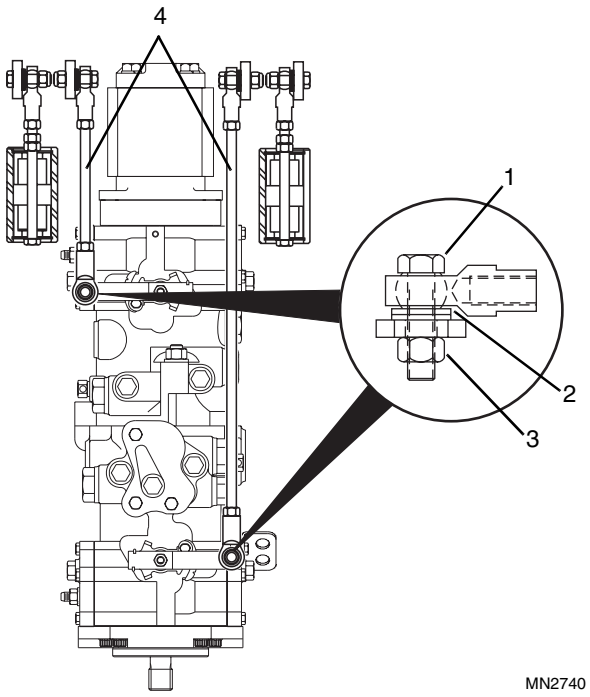


Figure 5-30 Pump Linkage Disassembly

Model 2000D/DX and 2300D/DX Only - Remove the capscrews (Fig. 5-30, 1), flat washers (2), and hex locknuts (3) that fasten the transmission control linkage (4) to the transmission levers on both sides of the control pump assembly.

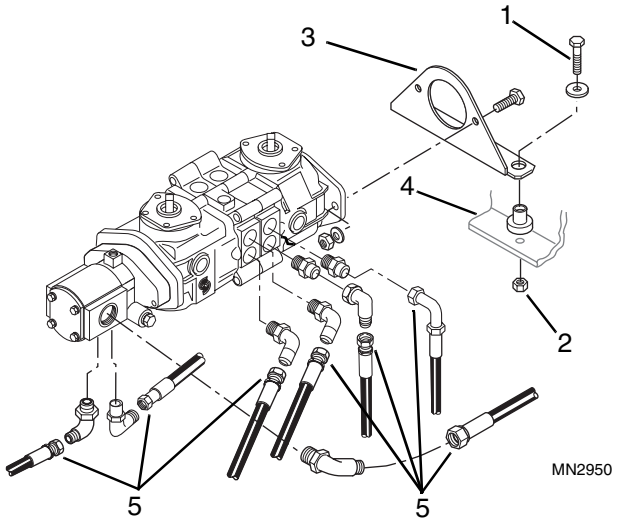


Figure 5-31 Transmission
Model 1750D Shown - Others Are Similar

6. Remove two capscrews (Fig. 5-31, 1) and locknuts (2) that secure the rear transmission mount (3) to the frame crossmember (4).

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

7. Loosen hydraulic hoses (Fig. 5-31, 5) on the main travel control pump assembly only enough to permit turning the hose on the fitting, NOT enough to allow excessive leakage.

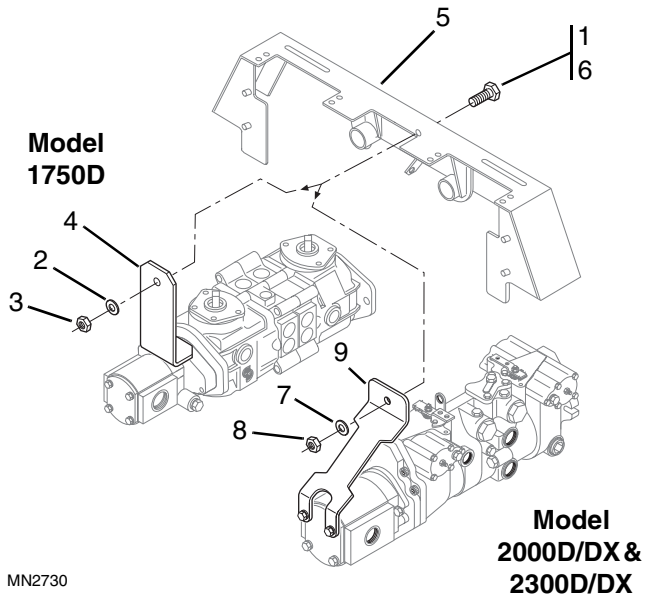


Figure 5-32 Transmission Front Support

8. Support the front of the travel control pump, and disconnect the front support as follows:

   Model 1750D Only - Remove the capscrew (Fig. 5-32, 1), flat washer (2), and locknut (3) that secures the top of the front support bracket (4) to the travel/steer lever crossmember (5).

   Model 2000D/DX and 2300D/DX Only - Remove the capscrew (Fig. 5-32, 6), flat washer (7), and locknut (8) that secures the front support bracket (9) to the travel/steer lever crossmember (5).

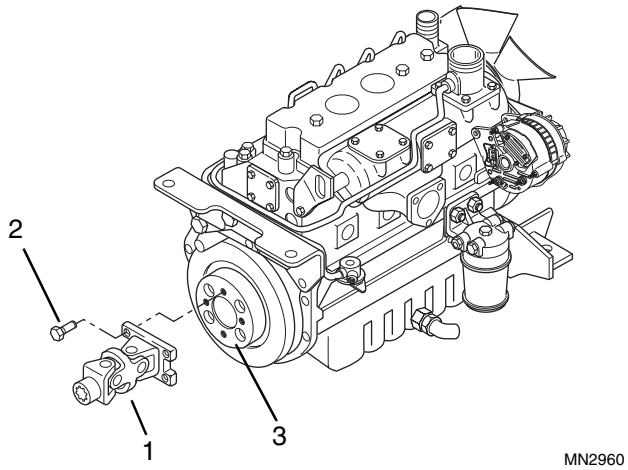


Figure 5-33 Transmission Drive Assembly

9. Pull pump toward the front of the vehicle, far enough to allow the pump input shaft to pull free from the transmission drive assembly (Fig. 5-33, 1) splined coupler.
10. Remove four capscrews (Fig. 5-33, 2) that secure the transmission drive assembly (1) to the flywheel drive adapter (3), and remove the drive assembly (1) from the vehicle.

c. Inspection

Clean the transmission drive assembly with a suitable solvent, and inspect the assembly for wear or damage.

Note: *If any free play is evident between either universal joint and its respective housing, the assembly is defective and must be replaced.*

d. Replacement

1. Apply Loctite Threadlocker to four capscrews (Fig. 5-33, 2). Position the transmission drive assembly (1) to the flywheel drive adapter (3), and install the four capscrews (2). Torque the capscrews (2) to 59 lb/ft (80 Nm).

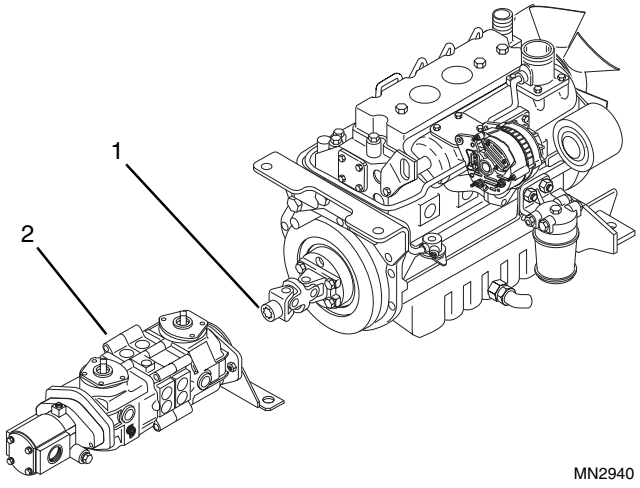


Figure 5-34 Transmission Drive Assembly

2. Coat the inside of the spline coupling (Fig. 5-34, 1) on the drive assembly and the transmission input shaft with a molybdenum disulfide anti-seize compound.
3. Align the drive assembly spline coupling (Fig. 5-34, 1) with the input shaft, and push the control pump assembly (2) to the rear, engaging the drive shaft spline coupling (1).

Note: *It may be necessary to turn the pump input shaft slightly to engage the splined coupling. Use care to prevent damage to the splines on the input shaft.*

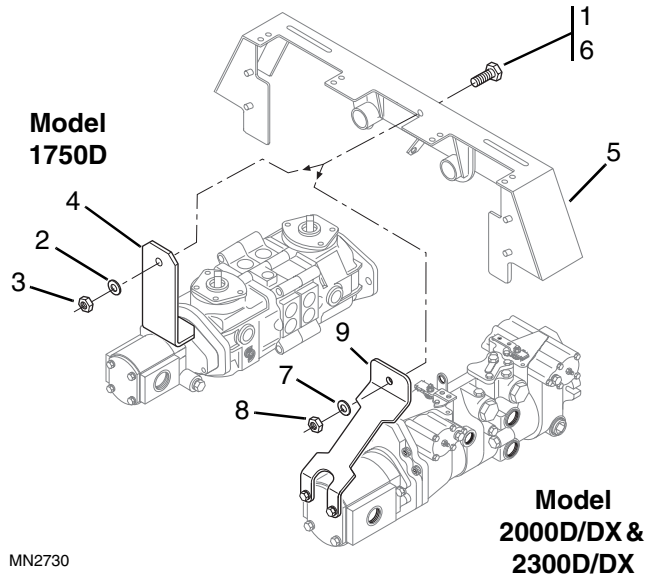


Figure 5-35 Transmission Front Support

4. Secure the front support bracket as follows:

   Model 1750D Only - Align the front support bracket (Fig. 5-35, 4) with the travel/steer lever crossmember (5), and install the top capscrew (1), flat washer (2), and new locknut (3), and tighten securely. Remove the support placed under the front of the transmission.

   Model 2000D/DX and 2300D/DX Only - Align the front support bracket (Fig. 5-35, 9) with the travel/steer lever crossmember (5), and install the top capscrew (6), flat washer (7), and new locknut (8), and tighten securely. Remove the support placed under the front of the transmission.

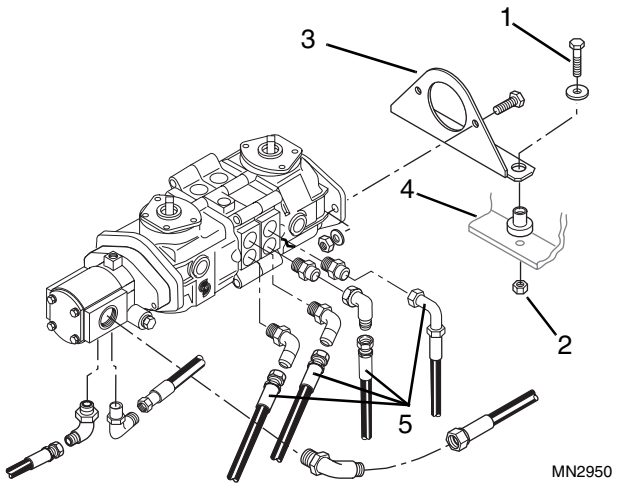


Figure 5-36 Transmission
Model 1750D Shown - Others Are Similar

5. Install and tighten the two capscrews (Fig. 5-36, 1) and new locknuts (2) that secure the rear transmission mount (3) to the frame crossmember (4).
6. Tighten and torque the hydraulic hoses (Fig. 5-36, 5) on the main travel control pump assembly (Refer to Section 2.8, “Torques”).

7. Install the hardware securing the travel control linkages to the travel control pumps as follows:

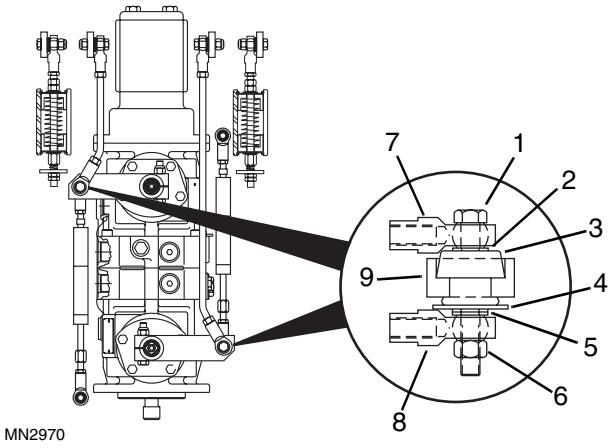


Figure 5-37 Linkage Installation

Model 1750D Only - Install the capscrews (Fig. 5-37, 1), flat washers (2), rubber isolators (3), rebound washers (4), two flat washers (5), and new hex locknuts (6) that fasten the transmission control linkage (7) and shock absorbers (8) to the transmission levers (9) on both sides of the control pump assembly.

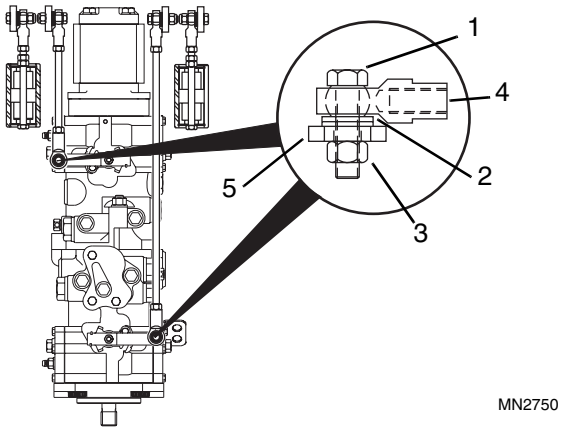


Figure 5-38 Linkage Installation

Model 2000D/DX and Model 2300D/DX Only - Install the capscrews (Fig. 5-38, 1), two flat washers (2), and new hex locknuts (3) that fasten the transmission control linkage (4) to the transmission levers (5) on both sides of the control pump assembly.

8. Check the neutral centering and travel/steering lever adjustment (Refer to Section 7.2.4, “Neutral Centering & Travel/Steering Lever Adjustment”).

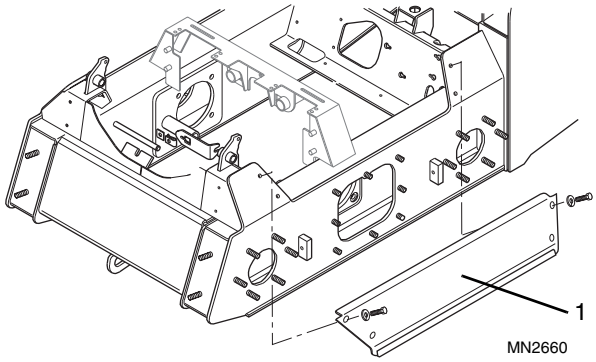
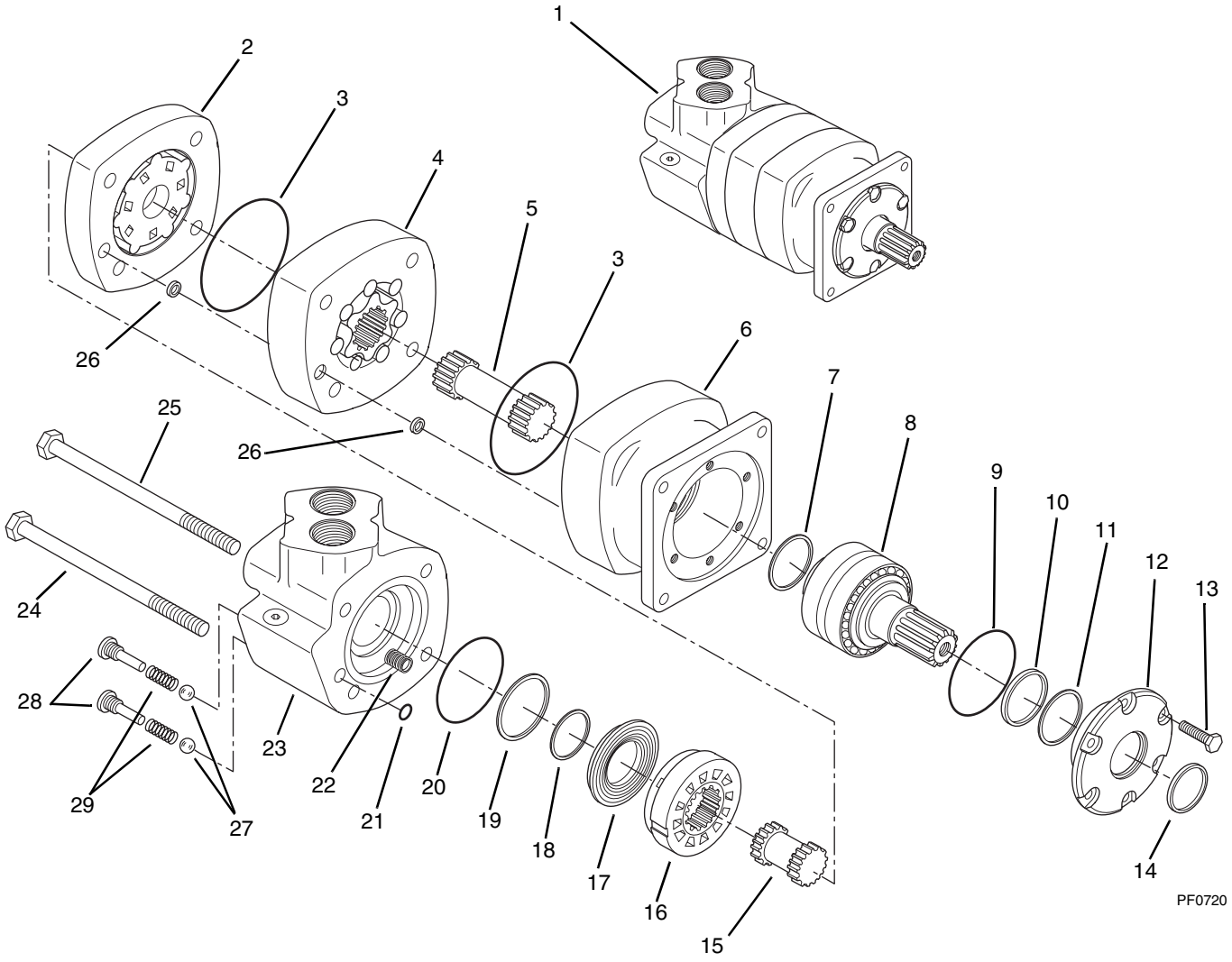


Figure 5-39 Frame Side Cover Installation

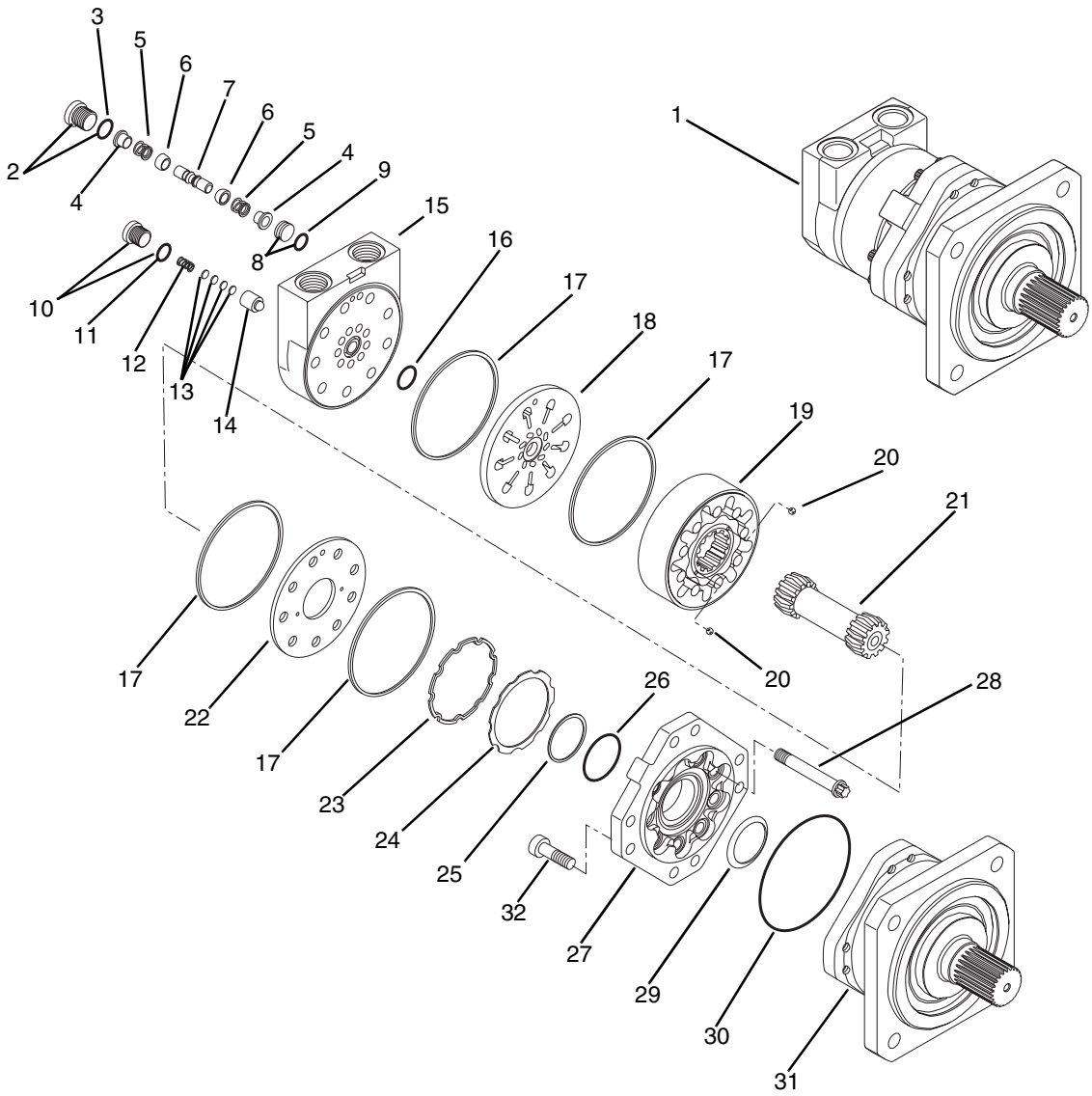
9. Install the left (Fig. 5-39, 1) and right (not shown) side covers.
10. Lower the Operator’s Protective Structure from the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

5.8 HYDROSTATIC TRAVEL MOTORS



1. Travel Motor Assembly (2)
2. Plate, Valve (1)
3. Seal (2)
4. Geroler Sub-Assembly (1)
5. Drive, Main (1)
6. Housing, Bearing (1)
7. Seal, Shaft Face (1)
8. Shaft, Sub-Assembly (1)
9. Seal (1)
10. Seal (1)
11. Ring, Back-up (1)
12. Retainer, Front (1)
13. Bolt (6)
14. Seal, Dust (1)
15. Drive, Valve (1)
16. Valve (1)
17. Balancing Ring Sub-Assembly (1)
18. Seal, Inner (1)
19. Seal, Outer (1)
20. Seal (1)
21. Seal (1)
22. Spring, Compression (3)
23. Valve Housing Sub-Assembly (1)
24. Screw, Cap (2)
25. Screw, Cap (2)
26. Seal (2)
27. Ball, Steel (2)
28. Plug, Sub-Assembly (2)
29. Spring, Compression (2)

Figure 5-40 Travel Motor Exploded View
Model 1750D and 2000D/DX



1. Travel Motor Assembly (2)
2. Plug, Sub Assembly (1)
3. O-ring (1)
4. Sleeve, Dash Pot (2)
5. Spring (2)
6. Poppet (2)
7. Piston, Shuttle (1)
8. Plug, Sub-Assembly (1)
9. O-ring (1)
10. Plug, Sub-Assembly (1)
11. O-ring (1)
12. Spring (1)
13. Shim (AR)
14. Poppet (1)
15. End Cap Sub Assembly (1)
16. O-ring (1)
17. Seal, Square Cut (4)
18. Valve, Plate (1)
19. Geroler Sub Assembly (1)
20. Ball (2)
21. Drive (1)
22. Plate, Balance (1)
23. Ring, Backup (1)
24. Seal (1)
25. Ring, Backup (1)
26. O-ring (1)
27. Flange, Mounting (1)
28. Screw, 12 Pt (9)
29. Seal, Face (1)
30. O-ring (1)
31. Bearing Housing Sub Assembly (2)
32. Screw, Socket Head (8)

Figure 5-41 Travel Motor Exploded View
Model 2300D/DX

5.8.1 Travel Motor Description

The hydrostatic travel motors are fixed displacement motors.

5.8.2 Travel Motor Operation

	Model 1750D Model 2000D/DX	Model 2300D/DX
Motor Type	Gerotor	Gerotor
Displacement	29.9 cu. in./rev (489,9 cm³/rev)	49 cu. in./rev (802,9 cm³/rev)
Rotation	Dual	Dual
Section Bolt Torque	62.5 lb/ft (84,7 Nm)	50 lb/ft (67,8 Nm)

The basic geroter design uses a combination of mechanical and hydraulic principles that are utilized in the high torque, low speed motors.

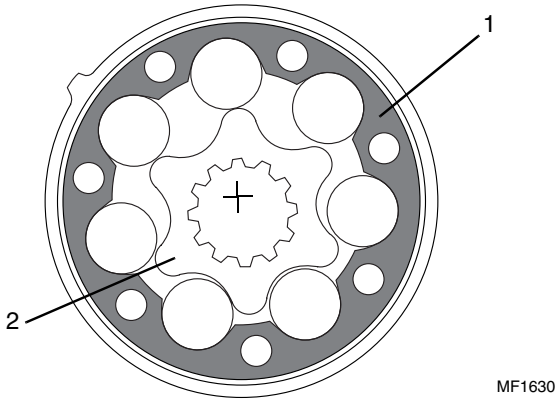


Figure 5-42 Geroler Assembly

The outer ring of the geroler assembly (Fig. 5-42, 1) is similar to an internal gear that is held in a fixed position by securing it to the motor housing. The rotating inner gear, called a star (2), orbits inside the secured outer ring.

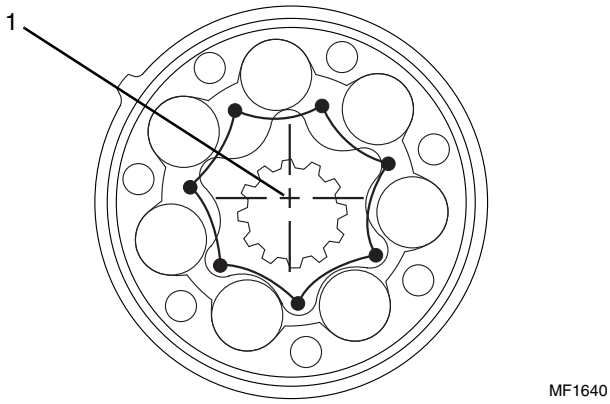


Figure 5-43 Geroler Assembly

Because of the different number of teeth on the star and outer ring, the star rotates in an eccentric circular orbiting motion from the housing center line (Fig. 5-43, 1).

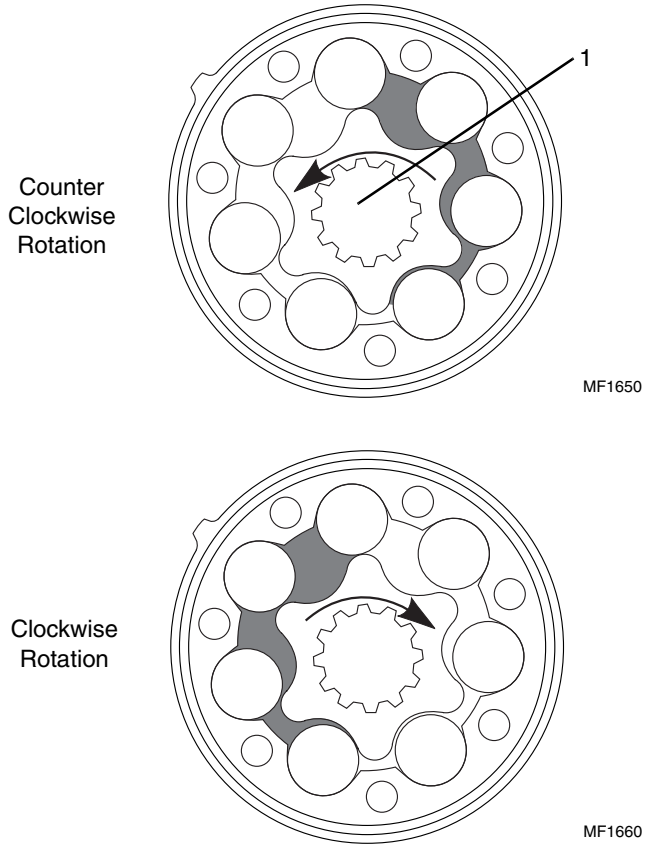


Figure 5-44 Fluid Pockets

A drive shaft (Fig. 5-44, 1) is used to transmit the rotation of the star to the output shaft. The drive shaft has crowned external splines to match the internal splines in the star and output shaft. This type of drive is used because the star center line continuously changes during rotation.

As the star orbits it, it causes a continuous opening and closing of the outer ring fluid pockets. Half of these fluid pockets are subject to fluid pressure, causing star rotation, and the opposing half are connected to a return line.

When pressure is introduced into the fluid pockets on the right side of the star the output rotation will be counterclockwise. When the fluid pockets on the left side of the star are pressurized the output rotation will be clockwise.

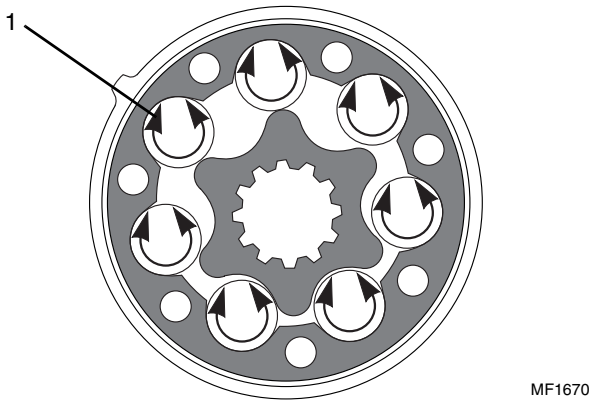


Figure 5-45 Roller Seal

To seal the fluid pockets the torque motor incorporates a rotating roller type seal (Fig. 5-45, 1). This type of rolling seal reduces friction at the star points, and provides increased efficiency and reduced component wear.

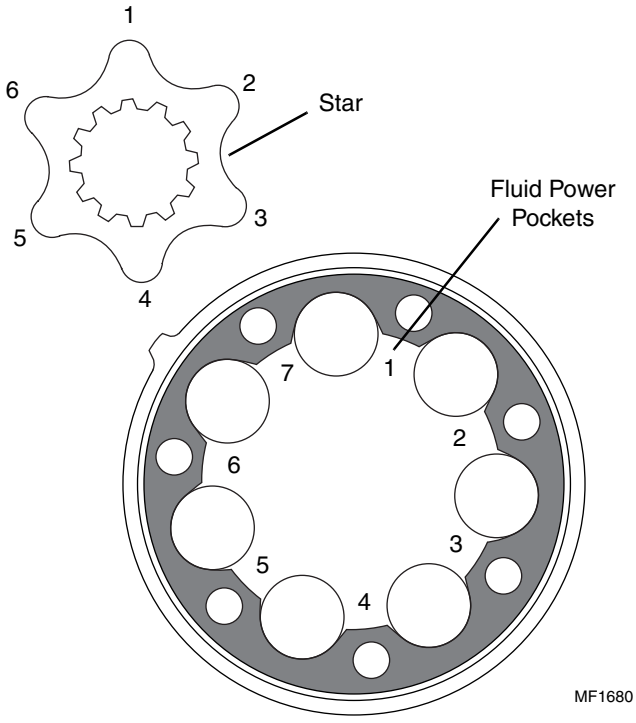


Figure 5-46 Geroler Principles

The geroler is both a fluid displacement motor and a gear reducer. It produces six times [the number of star points (Fig. 5-46)] greater power per revolution than a gear, vane or piston type motor. This means that six times greater torque can be developed at one-sixth the speed without further gear reduction.

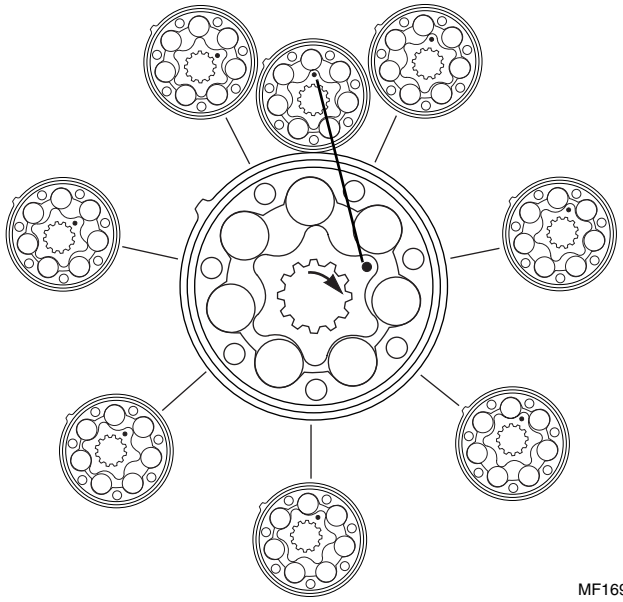
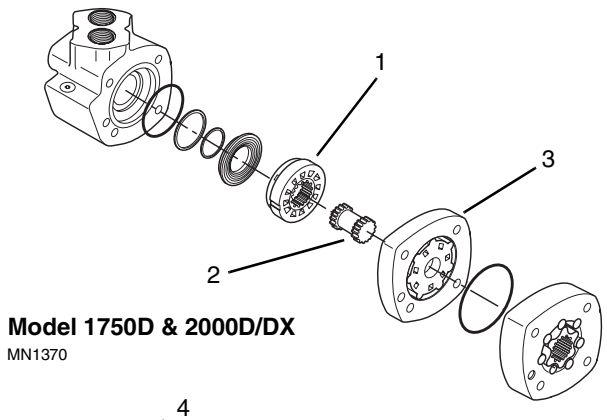
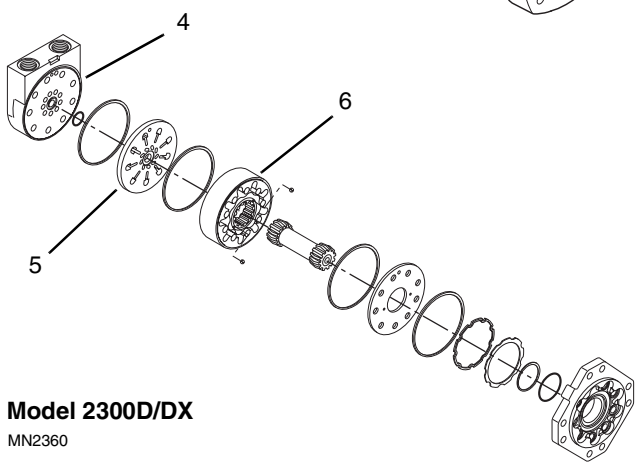


Figure 5-47 Complete Star Orbit

One complete star orbit, or one-sixth of the output shaft rotation is shown above (Fig. 5-47). The star must travel through six complete orbits for each single rotation of the output shaft creating a speed reduction of six to one. The use of seven fluid power pockets (Fig. 5-46) with the six to one ratio provides forty-two fluid power cycles per each complete shaft rotation.



Model 1750D & 2000D/DX
MN1370



Model 2300D/DX
MN2360

Figure 5-48 Disc Valve Arrangement

For smooth and continuous motor output rotation, the torque motor utilizes a disc valve which operates in synchronization with the geroler star. The model 1750D and 2000D/DX disc valve arrangement consists of a rotating disc valve (Fig. 5-48, 1), valve drive (2), and a stationary valve plate (3). The model 2300D/DX disc valve arrangement consists of an end cap assembly (4), plate valve (5), and geroler assembly (6).

The disc and plate valves (Fig. 5-48, 1 & 5) contain an inlet fluid passage port for each star valley area and a return fluid passage port.

The model 1750D and 2000D/DX motors use a separate crowned drive shaft (Fig. 5-48, 2) to synchronize the disc valve and geroler star so that they turn as one. To accept fluid from the disc valve, the valve plate (3) also contains internal porting passages to each outer ring pocket area.

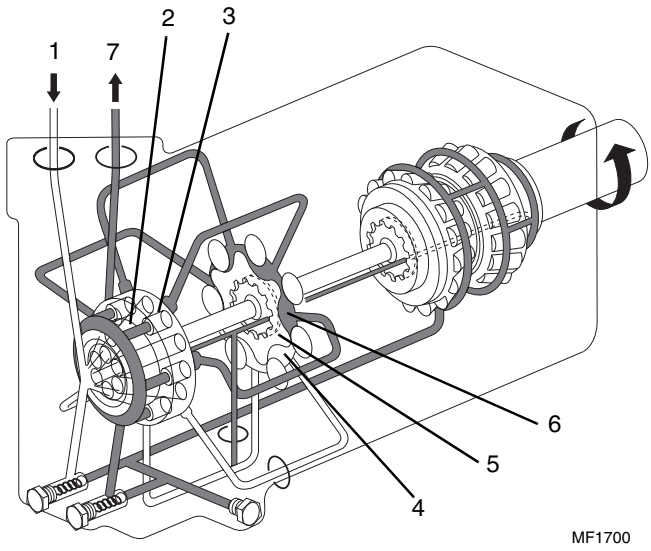


Figure 5-49 Motor Fluid Flow

Fluid flow through the torque motor for clockwise rotation is shown in Fig. 5-49. Fluid enters the housing through the inlet port (1) and is directed to the balance plate (2). The balance plate contains an inner and outer seal to separate the high and low pressure fluid passages.

Fluid passes through the stationary balance plate to the rotating disc valve (Fig. 5-49, 3). The rotating disc valve ports the fluid to the stationary valve plate and proper side of the geroler pockets (4) causing the rotor star (5) to turn.

As the rotor star (Fig. 5-49, 5) rotates, and each fluid pocket reaches its full open position, the return porting (6) in the rotating disc valve opens to allow the fluid in the pocket area to pass back through the valve plate, disc valve, balance plate and out through the housing return port (7), as the pocket closes.

The disc valve (Fig. 5-49, 3) is timed to the geroler rotor star (5) to govern the inlet fluid flow to output shaft rotation. If the timing of the disc valve to geroler star is off one tooth, the relationship of input fluid flow to output motor shaft rotation will be reversed.

5.8.3 Travel Motor Maintenance

Note: *Travel motors within the warranty coverage period must be replaced as a complete assembly. Maintenance and repair information, for travel motors out of warranty, is available from the motor manufacturer. Refer to Eaton Repair Information Manuals for maintenance and repair instructions on all out of warranty travel motors. Order the required manual as follows:*

Model 1750D ..... Publication number 7-119

Model 2000D/DX ..... Publication number 7-119

Model 2300D/DX ..... Publication number 7-151

For manual ordering information, contact your local authorized Eaton Distributor and Service Center, or contact:

Eaton Corporation Hydraulics
14615 Lone Oak Road
Eden Prairie, MN 55344-2079
Phone: (952) 937-7254
Fax: (952) 937-7130

a. Travel Motor Testing

Refer to Section 5.11, “Troubleshooting” to find the trouble you are having with your vehicle and follow the chart to remedy the trouble.

Note: *If you are sure there is a problem in the left or right travel motor, refer to Section 3, “Hydraulic Component Testing” and follow the instructions for testing the travel motors.*

5.8.4 Travel Motor Replacement

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

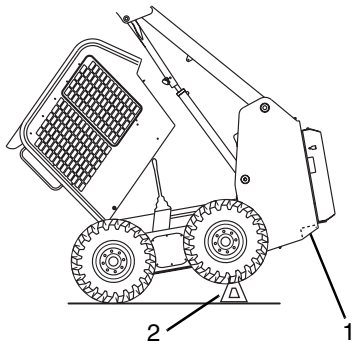
a. Vehicle Preparation (All Models)

1. Remove the bucket or implement from the quick attach, park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator’s Protective Structure to the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

3. Operate the right travel-steer/auxiliary lever (side to side) and foot pedals (forward and rearward) after the engine has stopped to relieve any trapped hydraulic pressure.

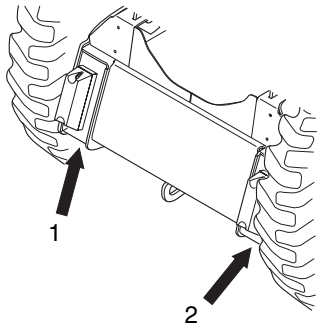
IMPORTANT: *To prevent personal injury, be certain that the floor jack and jack stands or support blocks used are stable and strong enough to support the weight of the vehicle.*



MN2920

Figure 5-50 Jack Stand Placement

4. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear crossmember (Fig. 5-50, 1) or chaincase.
5. Place jack stands under the rear left and right frame of the vehicle (Fig. 5-50, 2). If jack stands are not available, support blocks may be used.
6. Lower the rear of the vehicle down onto the jack stands or support blocks.



ON0390

Figure 5-51 Chain Case Oil Drain

7. Place a suitable receptacle under either chain case drain plug (Fig. 5-51, 1 or 2). Remove the plug and drain the oil into the receptacle. Clean and reinstall the drain plug, and torque to 40 lb/ft (54 Nm).
8. Reposition the drain oil receptacle under the other chain case and repeat Step 7. Transfer the drained oil into a suitable storage container and label as “Used Oil.” Dispose of the used oil at an approved recycling facility.

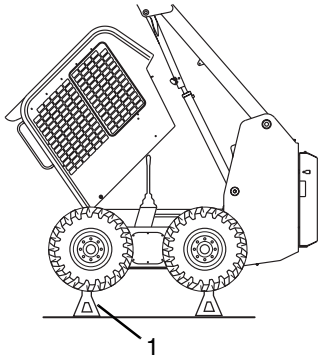


Figure 5-52 Jack Stand Placement

9. Raise the front of the vehicle with a floor jack and place jack stands under the front of each chain case (Fig. 5-52, 1). If jack stands are not available, support blocks may be used under the chain cases.
10. Lower the front of the vehicle onto the jack stands (1) or support blocks.
11. Remove the lug nuts from all wheel rims and remove the wheels from the vehicle. Save all hardware for reassembly.

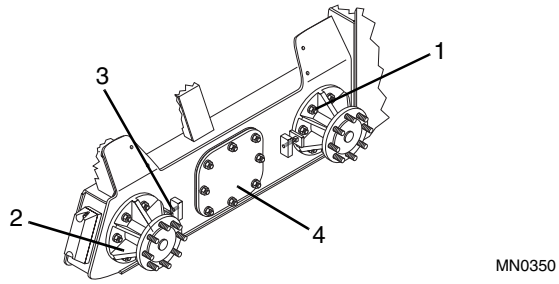


Figure 5-53 Vehicle Side Frame

12. Loosen, but DO NOT remove the six nuts (Fig. 5-53, 1) holding each axle housing (2) to the frame of the vehicle.
13. Loosen the chain adjusting screws (Fig. 5-53, 3) to remove all tension on the drive chains.
14. Remove eight nuts and washers that secure each side cover plate (Fig. 5-53, 4) to the sides of the frame. Remove the cover plates and gaskets.
15. To continue with the replacement procedure, refer to Section 5.8.4b for Model 1750D and 2000D/DX, and Section 5.8.4c for Model 2300D/DX.

b. Model 1750D & 2000D/DX Travel Motor Replacement (continued)

Travel Motor Removal

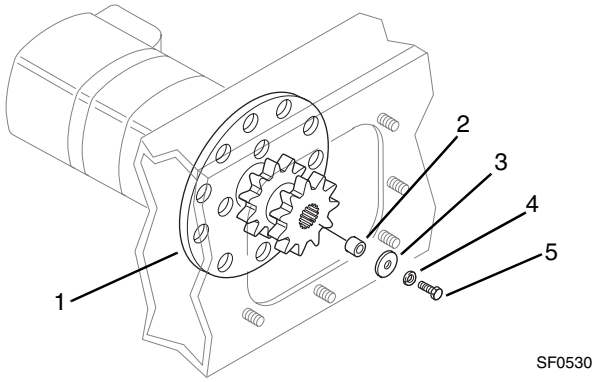


Figure 5-54 Drive Motor Sprocket Hardware

1. Loosen the drive sprocket (Fig. 5-54, 1) by removing capscrew (5), lockwasher (4), flat washer (3), and spacer (2).
2. Tag and remove the hydraulic hoses from the fittings on the travel motor. Plug the hose ends and fittings to prevent contamination from entering the hydraulic system.
3. Note and mark the orientation of the fittings on the travel motor. Remove and save the fittings for reassembly onto the replacement travel motor.
4. Lower the seat bar down to the operating position. This releases the left and right travel lock and allows the individual drive sprockets to be rotated manually.

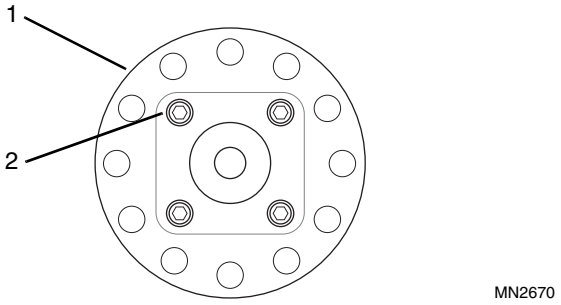


Figure 5-55 Drive Motor Mounting

5. Rotate the drive sprocket (Fig. 5-55, 1) as required to access the travel motor mounting capscrews through the access hole (2) in the sprocket. Rotate the drive sprocket by inserting a bar between the studs on one of the wheel hubs, and turn the wheel hub to position the sprocket as required.

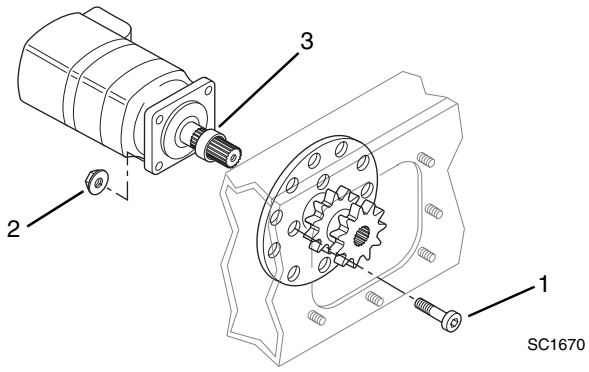


Figure 5-56 Drive Motor Removal

6. Remove and discard the socket head capscrews (Fig. 5-56, 1) and nuts (2). Remove the travel motor from inside the frame of the vehicle by pulling the splined shaft of the motor out of the drive sprocket. Retain the spacer (3) located between the travel motor and drive sprocket for later reassembly.

Travel Motor Installation

IMPORTANT: *When installing the travel motors, be sure that the ports are positioned in the same direction as they were prior to removal. Always use new mounting hardware and torque to specification to prevent motor from loosening.*

1. Clean any sealer residue from the motor flange mating area on the inside surface of the vehicle frame.

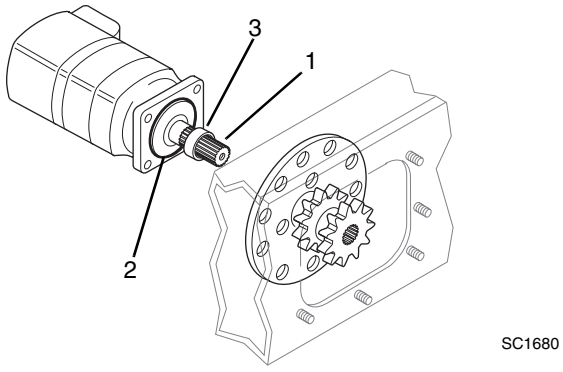


Figure 5-57 Drive Motor Installation

2. Coat the spline shaft (Fig. 5-57, 1) of the new travel motor with molybdenum disulfide anti-seize compound.
3. Follow manufacturer's instructions, apply a 1/8" bead of Loctite® Gasket Eliminator 518 Sealant around the mounting hub (Fig. 5-57, 2) on the flange of the replacement drive motor.
4. Place spacer (Fig. 5-57, 3) saved from Step 6 of travel motor removal onto the motor spline shaft.

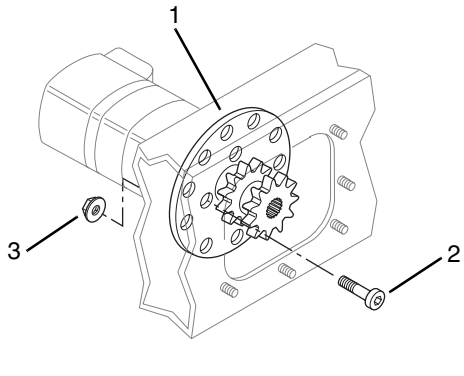


Figure 5-58 Drive Motor Hardware

5. Insert the drive motor into the mounting pilot on the inside wall of the chain case. Lift the drive sprocket (Fig. 5-58, 1) up, and line up its splines with the splined shaft of the drive motor. Insert the motor spline shaft through the drive sprocket and push the motor in, until the motor flange is fully seated against the chain case wall.
6. Place new motor mounting capscrews (Fig. 5-58, 2) through the frame and motor by way of the access hole in the drive sprocket. Secure the capscrews (2) with new nuts (3) and torque to 135-150 lb/ft (183-203 Nm).
7. Clean the hydraulic fittings removed from the original motor. Inspect the fittings, and replace any found damaged.
8. Install the fittings into the proper ports of the motor, and position them as they were in before removal.
9. Connect all of the hydraulic hoses to the proper hydraulic fittings and torque (Refer to Section 2.8, "Torques").

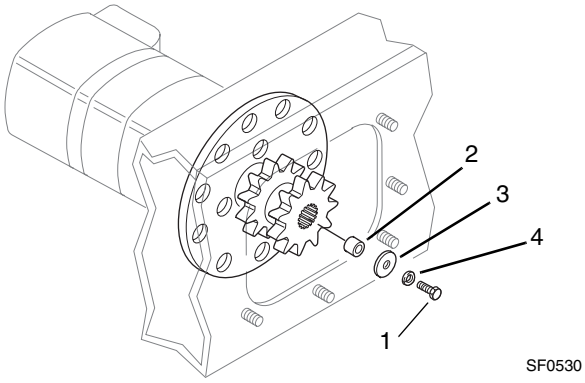


Figure 5-59 Drive Sprocket Installation

10. Apply Loctite threadlocker to the drive sprocket mounting screw (Fig. 5-59, 1), and secure the drive sprocket to the spline shaft using the spacer (2), washer (3), lockwasher (4) and screw (1). Tighten securely.

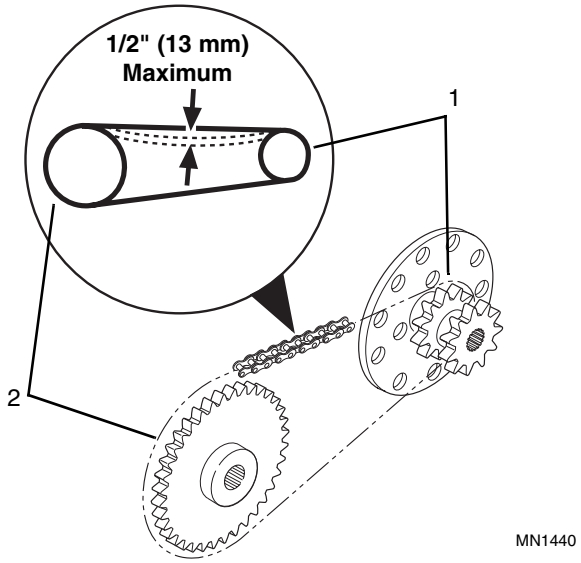


Figure 5-60 Drive Chain Tension

11. To adjust the tension of the front and rear drive chains, turn the chain adjusting screws to push the the axle housings away from the drive sprocket. Tension is checked by noting the chain vertical deflection (up and down movement) at a point midway between the drive sprocket (Fig. 5-60, 1) and axle sprocket (2). This movement should not exceed 1/2" (13 mm). DO NOT overtighten.
12. Once the correct chain tension is reached, tighten and torque the six axle housing nuts to 100-110 lb/ft (136-149 Nm).
13. Remove the chain case level/drain plug. With the vehicle still in a level position, fill the chain case to the proper level with 10W30 motor oil rated to API, CD or CE specifications. Fill the chain case through the side cover opening until oil flows from the level/drain plug hole at the front of the chain case. Each chain case will hold 6 qts (5,7 liters) of oil.
14. Reinstall the level/drain plug and torque to 40 lb/ft (54 Nm).

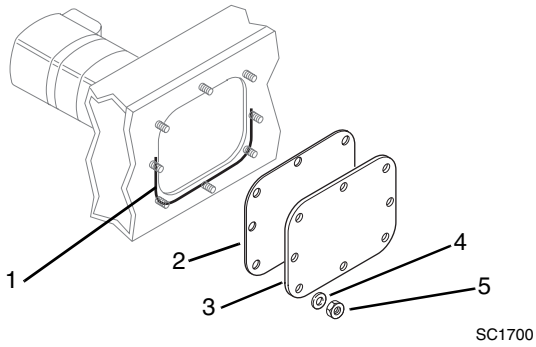


Figure 5-61 Cover Installation

15. Clean any sealer residue from the lower part of the side cover opening (Fig. 5-61, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening (1).
16. Reassemble the cover gasket (2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).

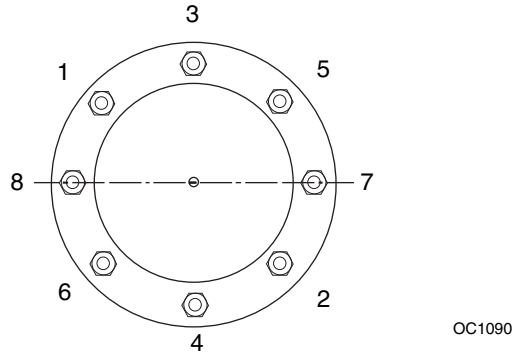


Figure 5-62 Lug Nut Torque Pattern

17. Reassemble the wheels to the axles. Torque all lug nuts in the sequence shown in Fig. 5-62 to 100-110 lb/ft (136-149 Nm).
18. Raise the front of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the front of the vehicle to the ground.
19. Raise the rear of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the rear of the vehicle to the ground.
20. Refer to Section 5.5, “Startup After Hydraulic Repair.”
21. Lower the Operator’s Protective Structure from the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

c. Model 2300D/DX Travel Motor Replacement (continued)

Travel Motor Removal

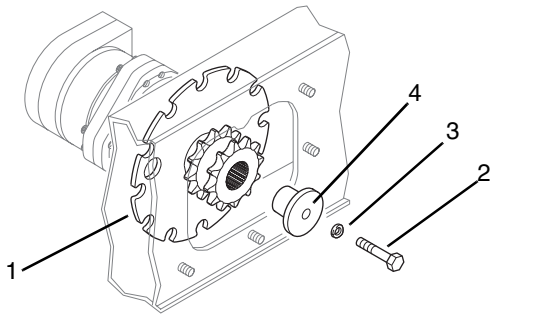


Figure 5-63 Drive Motor Sprocket Hardware

1. Loosen the drive sprocket (Fig. 5-63, 1) by removing capscrew (2), lockwasher (3), and drive sprocket stop (4).
2. Tag and remove the hydraulic hoses from the fittings on the travel motor. Plug the hose ends and fittings to prevent contamination from entering the hydraulic system.
3. Note and mark the orientation of the fittings on the travel motor. Remove and save the fittings for reassembly onto the replacement travel motor.
4. Lower the seat bar down to the operating position. This releases the left and right travel lock and allows the individual drive sprockets to be rotated manually.

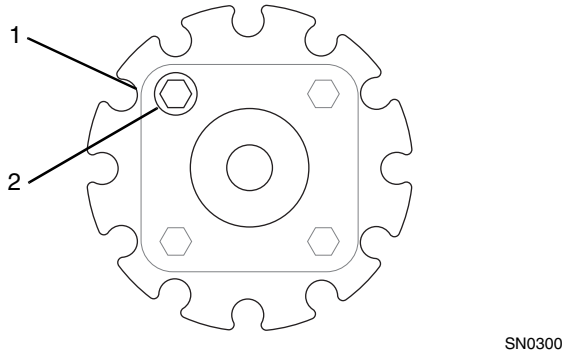


Figure 5-64 Drive Motor Mounting

5. Rotate the drive sprocket (Fig. 5-64, 1) as required to access the travel motor mounting capscrews through the access hole (2) in the sprocket. Rotate the drive sprocket by inserting a bar between the studs on one of the wheel hubs, and turn the wheel hub to position the sprocket as required.

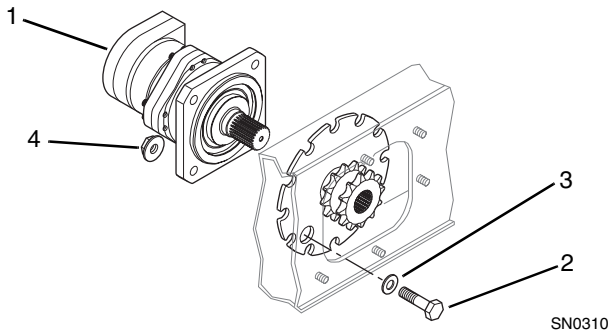


Figure 5-65 Drive Motor Removal

Note: *The drive motor (Fig. 5-65, 1) is a heavy component, and may be difficult to support during its removal from the vehicle. The use of a support sling around the motor housing and hoist is recommended during the removal procedure.*

6. Remove and discard the hex head capscrews (Fig. 5-65, 2), flat washers (3) and nuts (4).
7. Remove the travel motor from inside the frame of the vehicle by pulling the splined shaft of the motor out of the drive sprocket.

Travel Motor Installation

IMPORTANT: *When installing the travel motors, be sure that the ports are positioned in the same direction as they were prior to removal. On the left motor, the ports should be indexed toward the rear of the vehicle. On the right motor, the ports should be indexed toward the front of the vehicle. Always use new mounting hardware and torque to specification to prevent motor from loosening.*

1. Clean any sealer residue from the motor flange mating area on the inside surface of the vehicle frame.

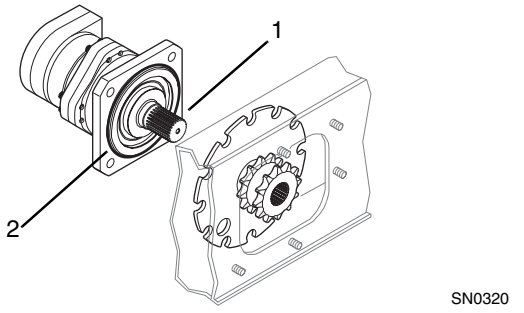


Figure 5-66 Drive Motor Installation

2. Coat the spline shaft (Fig. 5-66, 1) of the new travel motor with molybdenum disulfide anti-seize compound.
3. Follow manufacturer's instructions, apply a 1/8" bead of Loctite® Gasket Eliminator 518 Sealant around the mounting hub (Fig. 5-66, 2) on the flange of the replacement drive motor.

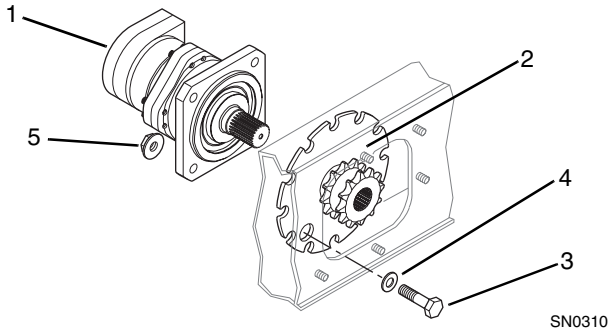


Figure 5-67 Drive Motor Hardware

Note: *The drive motor (Fig. 5-67, 1) is a heavy component, and may be difficult to support during its installation in the vehicle. The use of a support sling around the motor housing and hoist is recommended during the installation procedure.*

4. Insert the drive motor into the mounting pilot on the inside wall of the chain case. Lift the drive sprocket (Fig. 5-67, 2) up, and line up its splines with the splined shaft of the drive motor. Insert the motor spline shaft through the drive sprocket and push the motor in, until the motor flange is fully seated against the chain case wall.
5. Place new motor mounting hex head capscrews (Fig. 5-67, 3) and flat washers (4) through the frame and motor by way of the access hole in the drive sprocket. Secure the capscrews (3) with new flange locknuts (5) and torque to 165 lb/ft (223 Nm).
6. Clean the hydraulic fittings removed from the original motor. Inspect the fittings, and replace any found damaged.
7. Install the fittings into the proper ports of the motor, and position them as they were in before removal.
8. Connect all of the hydraulic hoses to the correct hydraulic fittings and torque (Refer to Section 2.8, "Torques").

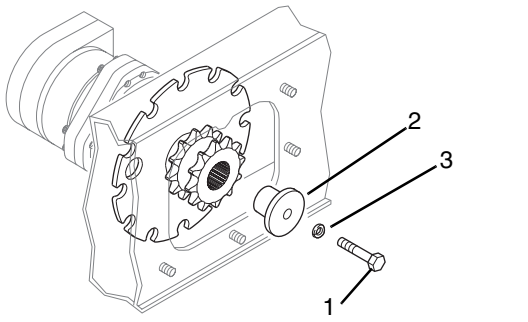


Figure 5-68 Drive Sprocket Installation

9. Apply Loctite threadlocker to the drive sprocket mounting capscrew (Fig. 5-68, 1). Insert the drive sprocket stop (2) into the center of the sprocket. Place a lockwasher (3) on the capscrew (1), and secure the drive sprocket and sprocket stop to the spline shaft on the motor. Tighten securely.

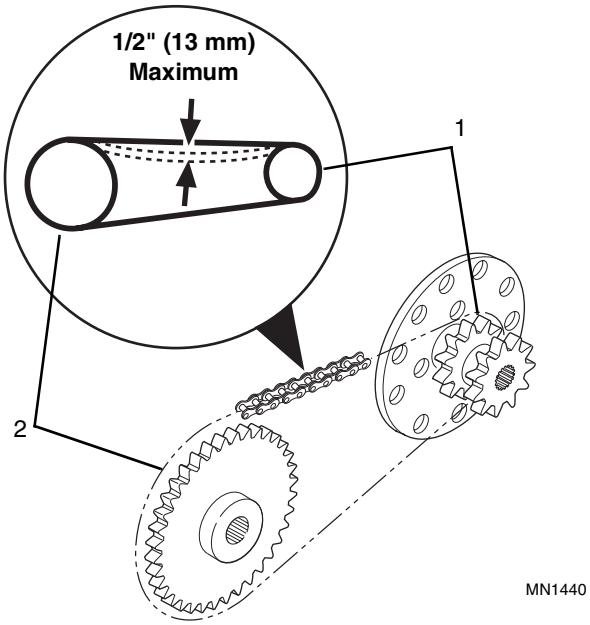


Figure 5-69 Drive Chain Tension

10. To adjust the tension of the front and rear drive chains, turn the chain adjusting screws to push the the axle housings away from the drive sprocket.
11. Tension is checked by noting the chain vertical deflection (up and down movement) at a point midway between the drive sprocket (Fig. 5-69, 1) and axle sprocket (2). This movement should not exceed 1/2" (13 mm). DO NOT overtighten.
12. Once the correct chain tension is reached, tighten and torque the six axle housing nuts to 100-110 lb/ft (136-149 Nm).
13. Remove the chain case level/drain plug. With the vehicle still in a level position, fill the chain case to the proper level with 10W30 motor oil rated to API, CD or CE specifications. Fill the chain case through the side cover opening until oil flows from the level/drain plug hole at the front of the chain case. Each chain case will hold 9 qts (8,5 liters) of oil.
14. Reinstall the level/drain plug and torque to 40 lb/ft (54 Nm).

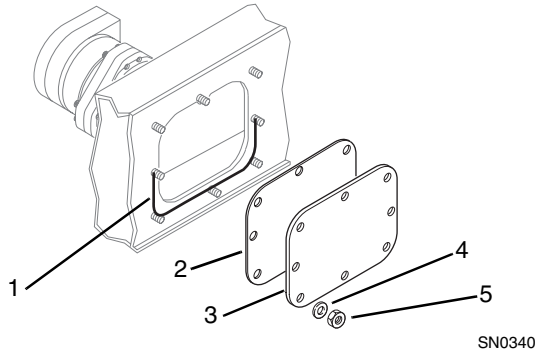


Figure 5-70 Cover Installation

15. Clean any sealer residue from the lower part of the side cover opening (Fig. 5-70, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
16. Reassemble the cover gasket (2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).

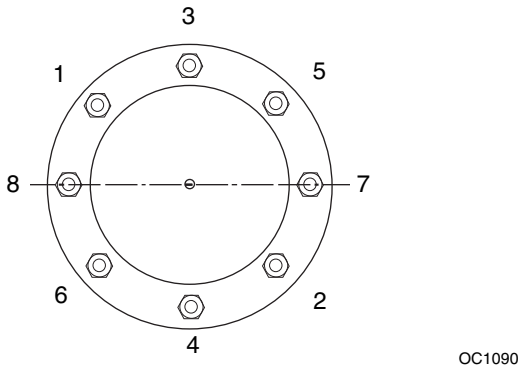
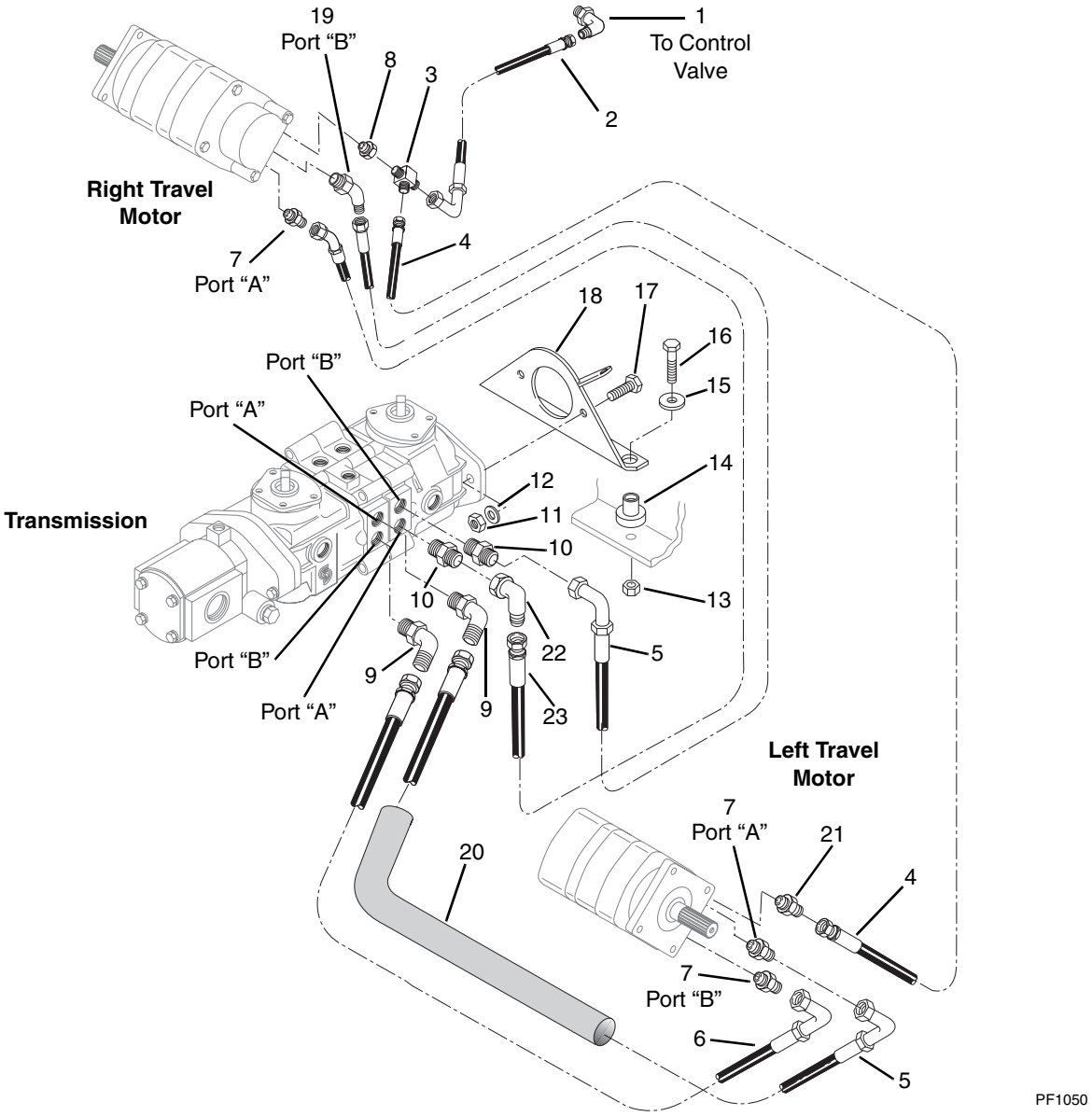


Figure 5-71 Lug Nut Torque Pattern

17. Reassemble the wheels to the axles. Torque all lug nuts in the sequence shown in Fig. 5-71 to 100-110 lb/ft (136-149 Nm).
18. Raise the front of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the front of the vehicle to the ground.
19. Raise the rear of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the rear of the vehicle to the ground.
20. Refer to Section 5.5, “Startup After Hydraulic Repair.”
21. Lower the Operator’s Protective Structure from the service position. Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position.”

5.9 TRAVEL SYSTEM

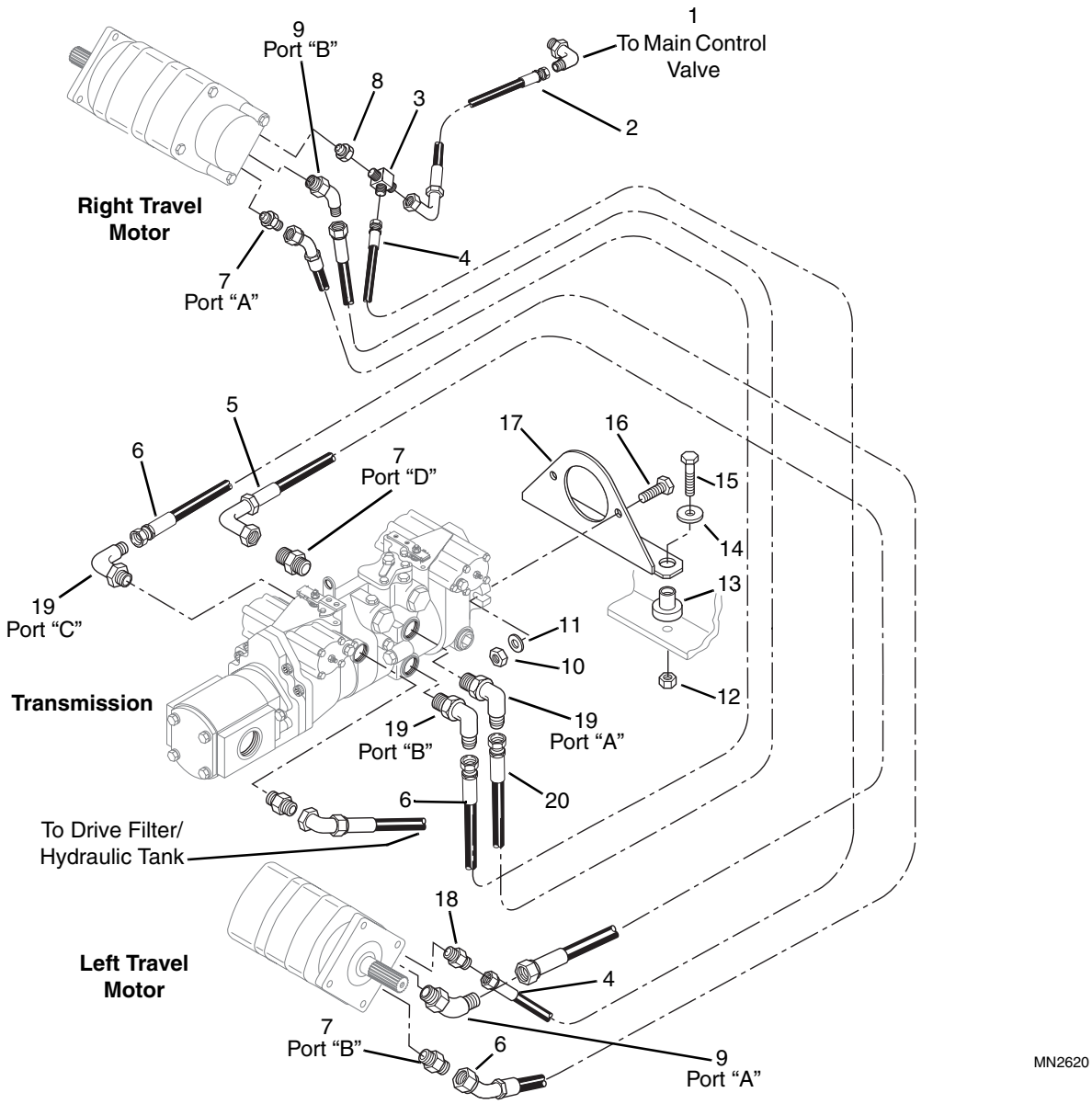
5.9.1 Hydraulic Components Model 1750D



1. Elbow, 90°, SAE 12-16 (1)
2. Hose Assembly, Right Motor Tee to Control Valve (1)
3. Tee, Male Run, SAE 6 (1)
4. Hose Assembly, Left Motor to Right Motor (1)
5. Hose Assembly (2)
6. Hose Assembly (1)
7. Connector, Straight, SAE 4-6 (3)
8. Reducer, SAE 4-6 (1)
9. Elbow, 90°, SAE 16-12 (2)
10. Connector, Straight, SAE 16-12 (2)
11. Nut, Hex Lock, 1/2-13 (2)
12. Washer, Flat, 1/2" (2)
13. Nut, Hex Lock, 3/8-16 (2)
14. Isolator, Rear Mount (2)
15. Washer, Rebound (2)
16. HHCS, 3/8-16 x 2-1/4" (2)
17. HHCS, 1/2-13 x 2" (2)
18. Mount, Rear Transmission (1)
19. Elbow, 45° SAE 16 (1)
20. Guard, Hose, 28" Lg. (1)
21. Connector, Straight, SAE 6-4 (1)
22. Elbow, 90°, SAE 16 (1)
23. Hose Assembly (1)

Figure 5-72 Hydraulic Travel Components (Model 1750D)

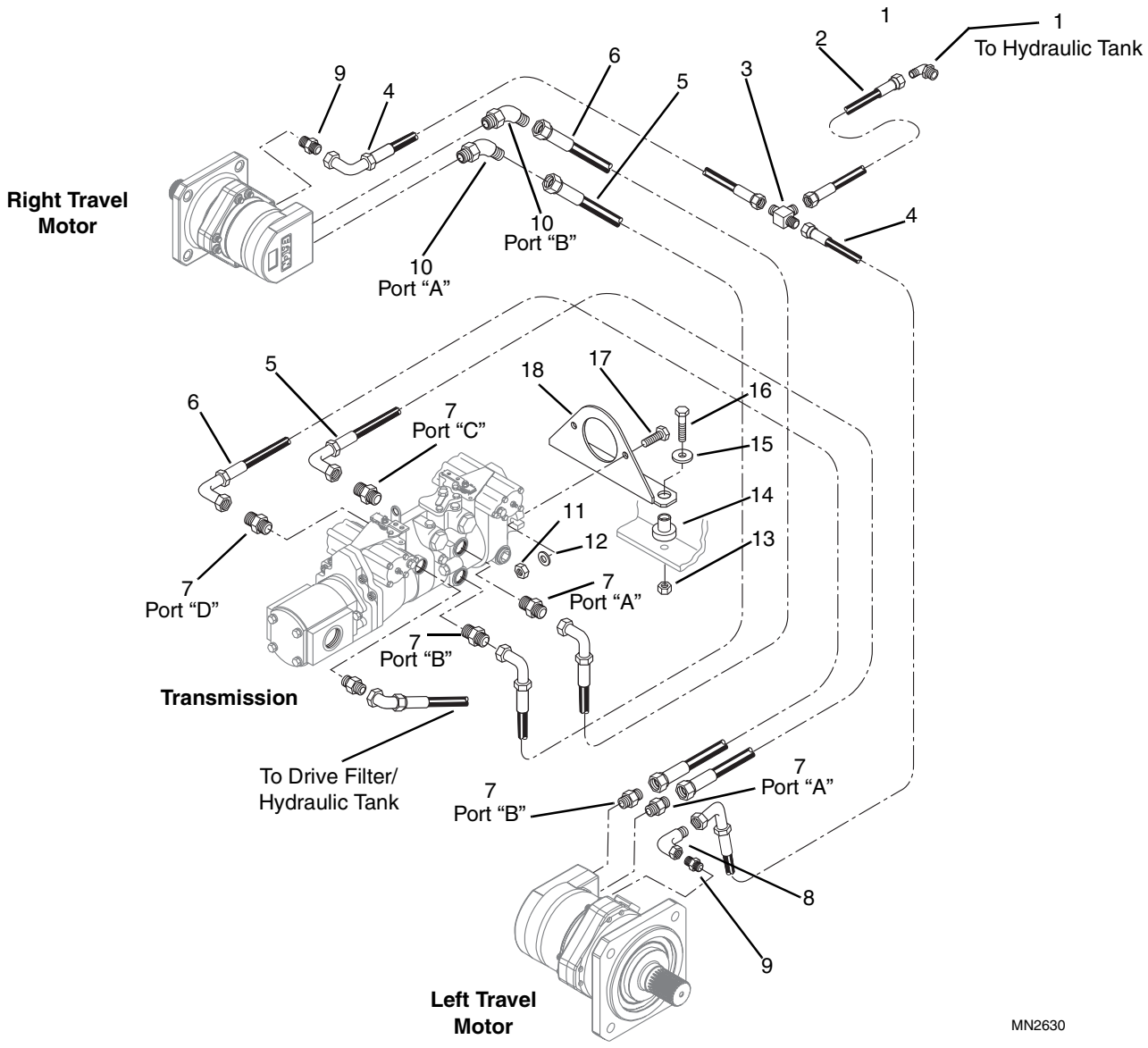
5.9.2 Hydraulic Components Model 2000D/DX



1. Elbow, 90°, SAE 16 (1)
2. Hose Assembly, Tee to Control Valve (1)
3. Tee, Male Run, SAE 6-6 (1)
4. Hose Assembly, Left Motor to Tee (1)
5. Hose Assembly (1)
6. Hose Assembly (2)
7. Connector, Straight, SAE 16 (3)
8. Reducer, SAE 4-6 (1)
9. Elbow, 45°, SAE 16 (2)
10. Nut, Hex Lock, 1/2-13 (2)
11. Washer, Flat, 1/2" (2)
12. Nut, Hex Lock, 3/8-16 (2)
13. Isolator, Rear Mount (2)
14. Washer, Rebound (2)
15. HHCS, 3/8-16 x 2-1/4" (2)
16. HHCS, 1/2-13 x 2-1/4" (2)
17. Mount, Rear Transmission (1)
18. Connector, SAE 4 - JIC 6 (1)
19. Elbow, 90°, SAE 16 (3)
20. Hose Assembly (1)

Figure 5-73 Hydraulic Travel Components (Model 2000D/DX)

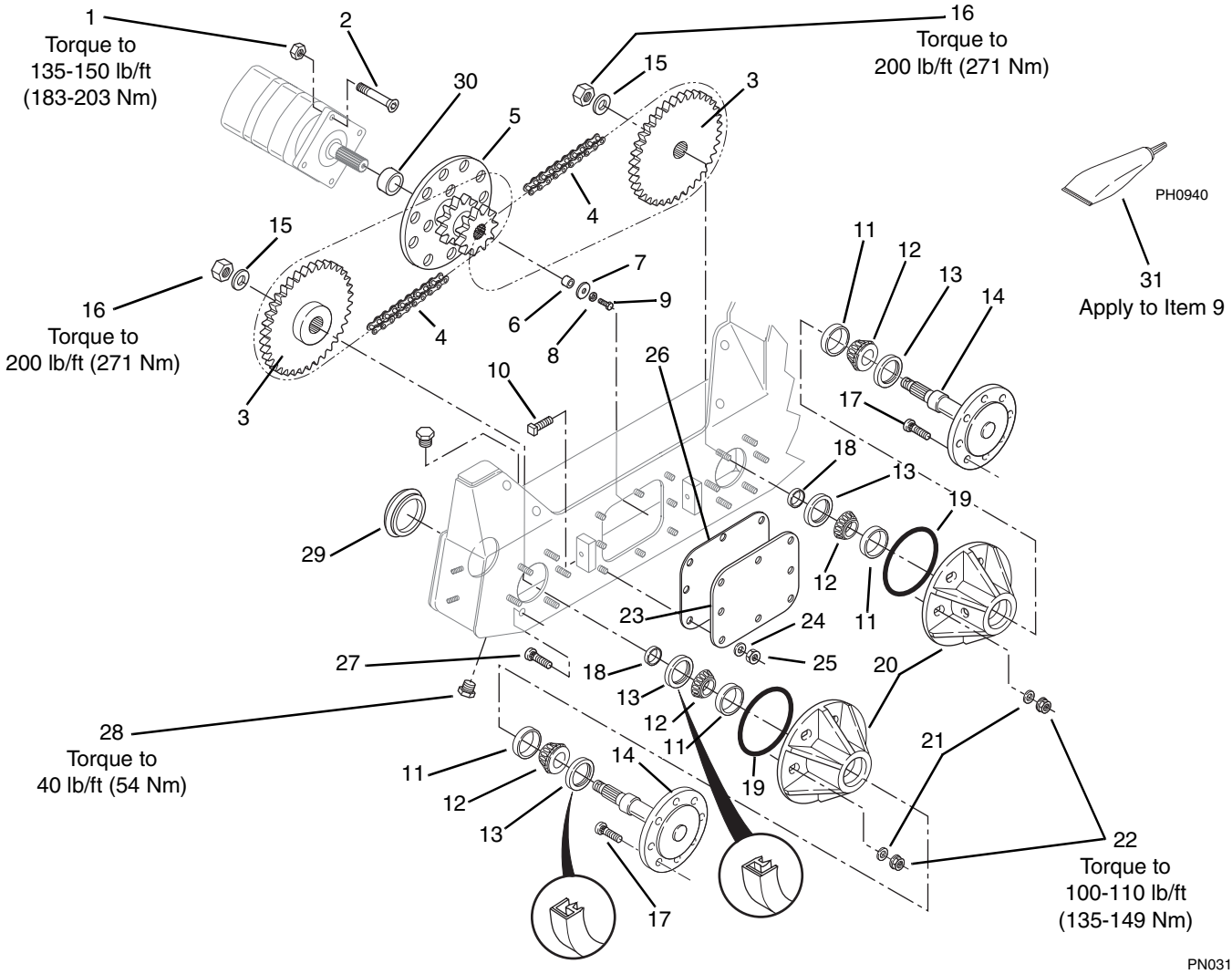
5.9.3 Hydraulic Components Model 2300D/DX



1. Elbow, 90°, SAE 8 (1)
2. Hose Assembly, Tee to Reservoir (1)
3. Tee, Union, SAE 8 (1)
4. Hose Assembly, Right/Left Motor to Tee (2)
5. Hose Assembly (2)
6. Hose Assembly (2)
7. Connector, Straight, SAE 16 (6)
8. Elbow, 90°, SAE 6 (1)
9. Connector, Straight, SAE 6 (2)
10. Elbow, 45°, SAE 16 (2)
11. Nut, Hex Lock, 1/2-13 (2)
12. Washer, Flat 1/2" (2)
13. Nut, Hex Lock, 3/8-16 (2)
14. Isolator, Rear Mount (2)
15. Washer, Rebound (2)
16. HHCS, 3/8-16 x 2-1/4" (2)
17. HHCS, 1/2-13 x 2-1/4" (2)
18. Mount, Rear Transmission (1)

Figure 5-74 Hydraulic Travel Components (Model 2300D/DX)

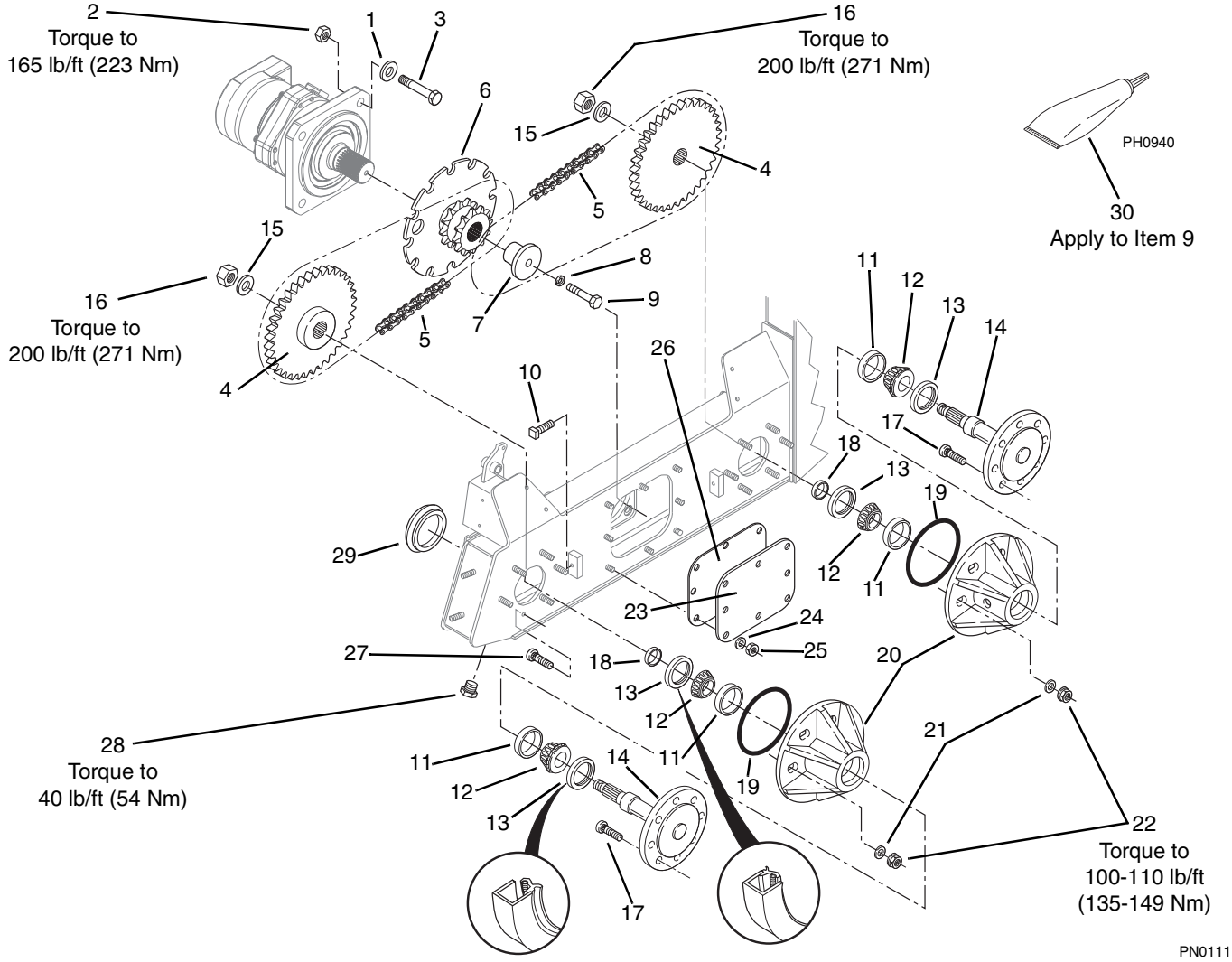
5.9.4 Mechanical Drive Components Model 1750D and 2000D/DX



1. Nut, Hex Flange Lock, 1/2-13 Gr. 8 (8)
2. SHCS, 1/2-13 x 2" (8)
3. Sprocket, Axle (4)
4. Chain, Drive (4)
5. Sprocket, Drive (2)
6. Spacer (2)
7. Washer (2)
8. Washer, Lock, 3/8" (2)
9. HHCS, 3/8-16 x 1-1/2" (2)
10. SQHD Setscrew, 1/2-13 x 2" (4)
11. Cup, Bearing (8)
12. Bearing, Tapered Roller, 2" Dia. (8)
13. Seal, Axle Shaft (8)
14. Shaft, Axle (4)
15. Washer, Flat Hardened (4)
16. Nut, Hex Lock, Thin Elastic, 1-1/2-12 (4)
17. Bolt, Wheel, 9/16-18 x 2-1/4" (32)
18. Spacer, Axle (4)
19. O-ring, 7-1/4 x 7-1/2 x 1/8" (4)
20. Housing, Axle (4)
21. Washer, Flat 1/2", Hardened (24)
22. Nut, Hex, 9/16-18 Gr. 8 (24)
23. Plate, Cover (2)
24. Washer, Flat, 3/8" (16)
25. Nut, Hex Lock Elastic, 3/8-16 (16)
26. Gasket, Cover Plate (2)
27. Stud, Axle Housing, 9/16-18 x 2-1/4" (24)
28. Plug, Hex HD, SAE 8 (2)
29. Plug (4)
30. Spacer, Sprocket (2)
31. Loctite, Threadlocker (As Required)

Figure 5-75 Mechanical Drivetrain Components (Model 1750D & 2000D/DX)

5.9.5 Mechanical Drive Components Model 2300D/DX



1. Washer, Flat Hardened, 3/4" (8)
2. Nut, Hex Flange Lock, 3/4-10 Gr. 8 (8)
3. HHCS, 3/4-10 x 2-1/2" Gr. 8 (8)
4. Sprocket, Axle (4)
5. Chain, Drive (4)
6. Sprocket, Drive (2)
7. Stop, Drive Sprocket (2)
8. Washer, Lock 1/2" (2)
9. HHCS, 1/2-20 x 2-1/4" Gr. 5 (2)
10. SQHD Setscrew, 1/2-13 x 2" (4)
11. Cup, Bearing (8)
12. Bearing, Tapered Roller, 2" Dia. (8)
13. Seal, Axle Shaft (8)
14. Shaft, Axle (4)
15. Washer, Flat Hardened (4)
16. Nut, Hex Lock, Thin Elastic, 1-1/2-12 (4)
17. Bolt, Wheel, 9/16-18 x 2-1/4" (32)
18. Spacer, Axle (4)
19. O-ring, 7-1/4 x 7-1/2 x 1/8" (4)
20. Housing, Axle (4)
21. Washer, Flat Hardened, 1/2" (24)
22. Nut, Hex, 9/16-18 Gr. 8 (24)
23. Plate, Cover (2)
24. Washer, Flat, 3/8" (16)
25. Nut, Hex Lock Elastic, 3/8-16 (16)
26. Gasket, Cover Plate (2)
27. Stud, Axle Housing, 9/16-18 x 2-1/4" (24)
28. Plug, Hex HD, SAE 8 (2)
29. Plug (4)
30. Loctite, Threadlocker (As Required)

Figure 5-76 Mechanical Drivetrain Components (Model 2300D/DX)

5.10 TOWING A DISABLED VEHICLE

Towing a disabled vehicle should only be attempted after exhausting all other repair options. Every effort should be made to repair the vehicle, and move it under it's own power before using the following emergency towing procedures.

To prepare this vehicle for towing, the braking action supplied by the hydrostatic travel drive system must be disabled.

IMPORTANT: *Review the procedures that follow. If these procedures are NOT clearly understood, DO NOT attempt to perform them. Contact your Compact Technologies Distributor for assistance. When these procedures have been completed, and the vehicle has been towed to a new location, it is mandatory that braking action*
supplied by the hydrostatic drive system be restored.

WARNING: The procedure that follows will disable a braking system on the vehicle, and may allow the vehicle to move unrestricted. Death or serious injury could result from contact with this vehicle if it begins to roll away. Before beginning this procedure, ensure that the vehicle seat restraint bar is fully raised and has engaged the park lock brake system.

IMPORTANT: *DO NOT attach a tow cable or chain to this vehicles Operator Protective Structure, loader arm, bucket or any other mounted attachment or accessory.*

In the event of total loss of power to the transmission the vehicle can be moved on level surfaces for short distances at a slow speed either forward or backward using the following procedure:

1. Connect a suitable tow cable or chain to the front or rear vehicle tie downs.
2. The gross vehicle weight (GVW) of the towing vehicle MUST be greater than the operating weight of this vehicle. Connect the free end of the tow cable or chain to the towing vehicle, and remove any slack.
3. **Model 1750D:**
   Locate the four charge/check high pressure relief valves (Fig. 5-77, 1) on the top and bottom of the transmission. Loosen each of them a maximum of four complete turns. All four valves must be loosened for the vehicle to be moved in either direction.

Note: *To prevent external leakage of hydraulic oil, the Model 1750D charge/check high pressure relief valves should never be loosened more than four complete turns.*

   Model 2000D/DX & 2300D/DX:
   Locate the two bypass valves (Fig. 5-77, 2-3) on either side of the transmission and loosen both of them a maximum of two complete turns. Both valves must be loosened for the vehicle to be moved in either direction.

Note: *To prevent external leakage of hydraulic oil the Model 2000D/DX & 2300D/DX bypass valves should never be loosened more than two complete turns.*

4. Lower the seat restraint bar and tow the vehicle.
5. After movement is complete, lift the seat restraint bar. Before normal operation can be resumed, all valves must be closed and torqued as follows:
   - **Model 1750D** charge/check high pressure relief valve torque is 30-50 lb/ft (41-68 Nm).
   - **Model 2000D/DX & 2300D/DX** bypass valve torque is 7-10 lb/ft (9,5-14 Nm).

Note: *Damage to units may result from over-torquing the bypass valves.*

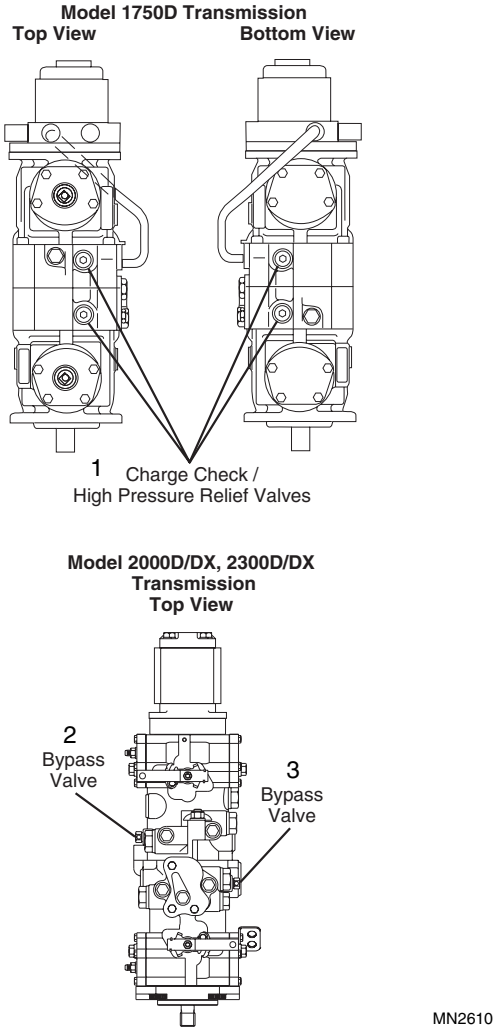


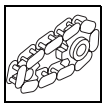
Figure 5-77 Transmission Bypass Valve Locations

5.11 TROUBLESHOOTING

Trouble	Probable Cause	Remedy	Ref. Par.
Loss of drive power on one side (both directions	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Disconnected or broken steering control linkage.	Reconnect and adjust steering control linkage.	7.2.2
	Lever loose on pump shaft.	Check transmission lever for loose bolt or excessive wear.	7.2.2
	High pressure line failure.	Replace line. Check travel motor and control pump mounting bolts.	5.2, 5.6, 5.7, 5.8
	Drive chain failure.	Inspect and repair drive chains. Check drive chain tension adjustment.	6.3.2, 6.3.3
	Travel motor shaft failure.	Inspect and repair defective parts. Check motor mounting bolts.	5.8.3, 5.8.4
	Charge pump failure.	Inspect and replace defective parts.	3.4.2, 3.4.3, 5.6.3, 5.6.4
	Excessive internal leakage or damage in control pump and/or travel motor.	Test, inspect, and repair defective control pump and/or travel motor. Replace hydraulic oil and oil filter. Check on type of oil used and engine RPM.	3.4.1 - 3.4.7, 5.7.3, 5.8.3
	Drive motor failure.	Remove, inspect and replace damaged parts.	5.8.3
	Wheel axle failure.	Inspect and replace axle.	6.4.2 - 6.4.4
	Travel pump failure.	Test pump flow and replace pump if necessary.	3.4.5, 3.4.6, and 3.4.7, 5.8.3
Loss of drive power on one side (one direction only)	Defective drive bypass/check valves.	Test and replace if necessary.	3.4.5 and 5.7.3

Trouble	Probable Cause	Remedy	Ref. Par.
Loss of drive power on both sides (no flow from charge and implement pump). Refer to Section 3.4.4 and perform a charge pump flow displacement test to be sure there is no flow from charge pump.	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Drive shaft universal joint between engine and pump failure.	Inspect and replace damaged parts. Check for misalignment.	5.7.3, 5.7.5 or 5.7.6, 5.7.7
	Charge pump cavitation.	Check supply hose to charge and implement pump for leaks or bad connections.	4.6.3
	Charge pump failure.	Test and replace if necessary.	4.6.3, 5.6.3, 5.6.4
	Control pump shaft failure.	Inspect and replace damaged parts.	5.7.3 and 5.7.5 or 5.7.6
	Charge and implement pump shaft failure.	Inspect and replace damaged parts.	4.6.3, 5.6.3
Loss of drive power on both sides (full flow from charge and implement pump). Refer to Section 3.4.4 and perform a charge pump flow displacement test to be sure there is full flow from charge pump.	Charge pump not functioning.	Inspect and replace as necessary.	4.6.3, 5.6.3
	Charge relief valve failure.	Test, and replace as necessary.	3.4.2 or 3.4.3, 5.6.4, and 5.7.3
	Excessive internal leakage or damage in control pump and/or travel motor.	Test, inspect, and repair defective control pumps and/or travel motors.	3.4.5, 3.4.6, 3.4.7, 5.7.3 or 5.8.3, 5.8.4
	Both drive motors failed.	Remove and inspect, replace damaged parts.	5.8.3, 5.8.4
	Park lock pins engaged.	Inspect operation and adjust.	7.7.2
Vehicle will not travel in a straight line.	Control levers binding.	Check interference of dirt and debris. Check adjustment and for loose or damaged parts.	7.2.2 and 7.2.3 or 7.2.4
	Control pump and/or travel motor failure on one side.	Test, inspect, and repair defective control pumps and/or travel motors.	3.4.2 - 3.4.9, 5.7.3 or 5.8.3
	Failure in one or more drive bypass/check valves.	Test and replace as necessary.	3.4.5 and 5.7.3
	One park lock pin engaging.	Inspect operation and adjust.	7.7.2

Trouble	Probable Cause	Remedy	Ref. Par.
Hydraulic Oil Temperature Light On. Reservoir overheating	Right travel-steer auxiliary lever in auxiliary detent position without an auxiliary implement attached.	Move right travel-steer auxiliary lever out of detent position.	7.3.2
	Reservoir low on oil.	Check for leaks. Fill reservoir.	4.10.1
	Hydraulic filter clogged and oil is by-passing filter.	Replace filter.	4.10.2
	Wrong type of hydraulic fluid.	Replace with 10W30 motor oil.	4.10.3
	Oil cooler plugged or dirty. Also check engine radiator.	Clean cooling fins.	4.10.4 or 4.10.5
	Engine RPM too slow.	Check engine RPM and reset.	11.1
	Engine cooling fan reversed or improper fan used.	Check fan and install correctly. Use pusher type fan.	10.15
	Main relief valve failure or out of adjustment.	Check pressure and adjust or replace.	3.4.1 and 4.7.6
	Hydraulic temperature sender switch defective.	Test and replace if necessary.	8.3.2
	Excessive damage or internal leakage in any system component (motors, control pumps, or charge/implement pump.	Test, inspect and replace as necessary.	4.6.3, 5.7 or 5.8
	Drive motor failure.	Check and replace damaged parts.	5.8.3
	Restriction in a hydraulic hose or tube.	Inspect hydraulic hoses and tubes. Replace damaged hoses and tubes.	4.9.6, 4.11.7 and 4.11.8
	Unapproved auxiliary implement being used. Implement operating pressures too high, causing hydraulic system to overheat.	DO NOT use implement.	11.7

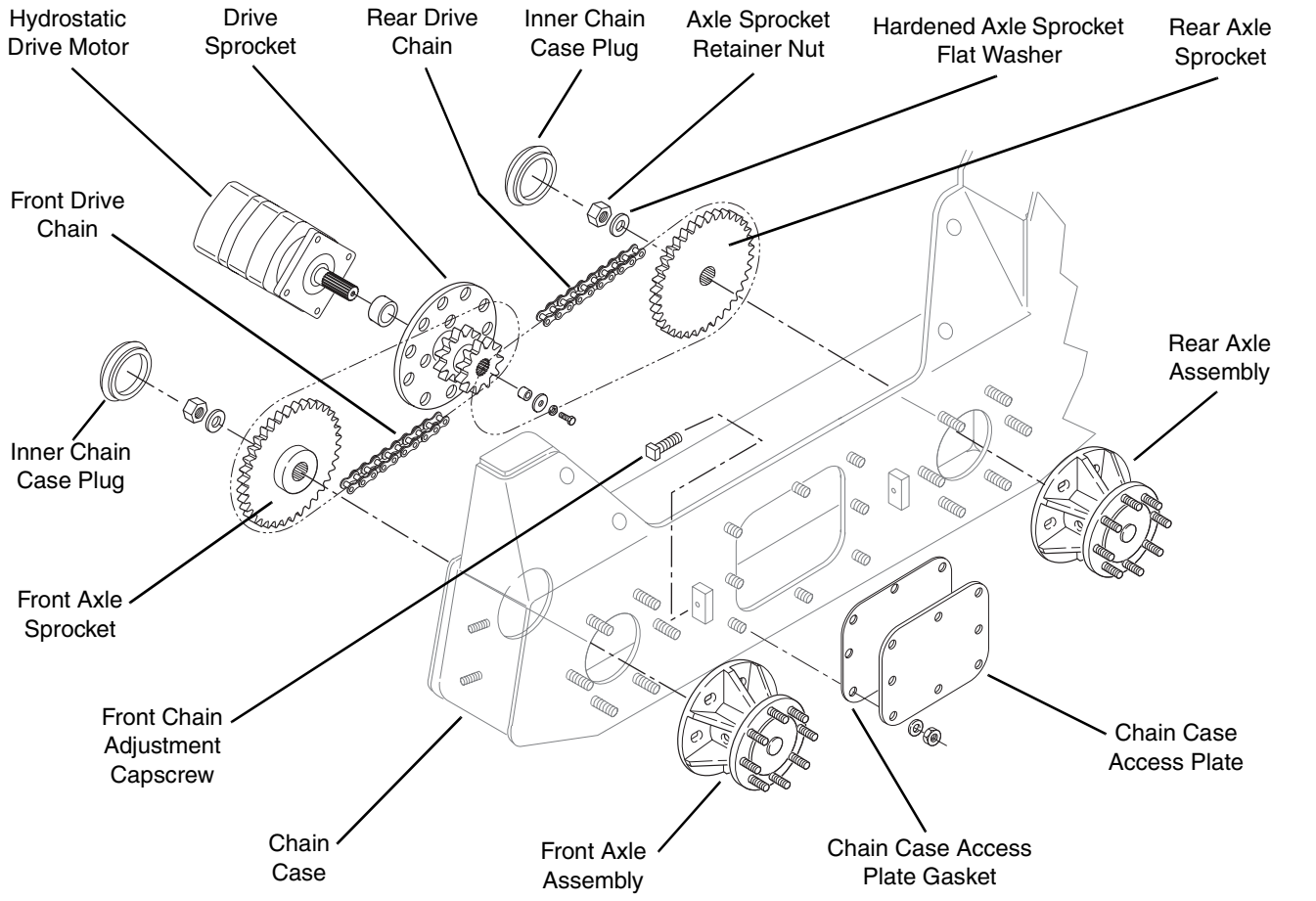


Section 6
Final Drives

Contents

6.1 DRIVETRAIN COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the major assemblies of the vehicle drivetrain. The following illustration identifies the components that are referred to throughout this section.



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WARNING: Do not service the vehicle without instruction or taking the necessary safety precautions outlined in the “Safety Practices” section of this manual.

6.2 DRIVETRAIN

6.2.1 Drivetrain Description

The vehicle has two identical independent drivetrains, one for rotating the wheels on the left side and one for rotating the wheels on the right side. Each drivetrain contains:

- one double drive sprocket driven by a hydrostatic motor,
- one front and one rear drive chain,
- one front and one rear axle sprocket,
- one front and one rear axle assembly,
- one front and one rear chain adjustment square head setscrew, and
- one chain case.

6.2.2 Drivetrain Operation

The hydrostatic drive motor rotates the double drive sprocket that is connected to the front and rear axle sprockets with the front and rear drive chains. The drive sprocket, drive chains, and axle sprockets are lubricated with oil that is contained in the chain case. The drive chains are adjusted for tension by square head setscrews that tighten against the front and rear axle housings.

6.2.3 Drivetrain Maintenance Intervals

Check at first 50 hours:

- drive chain tension in both drive chain cases, and
- oil level in both drive chain cases.

Check at 500 hour intervals:

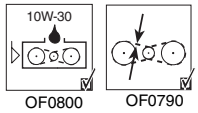
- drive chain tension in both drive chain cases, and
- oil level in both drive chain cases.

Change every 1000 hours:

- oil in both drive chain cases.

6.3 DRIVE CHAINS

6.3.1 Drive Chain Oil Level and Tension Check



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a. Check Oil Level and Drive Chain Tension (First 50 Hours and 500 Hour Intervals Thereafter)

1. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

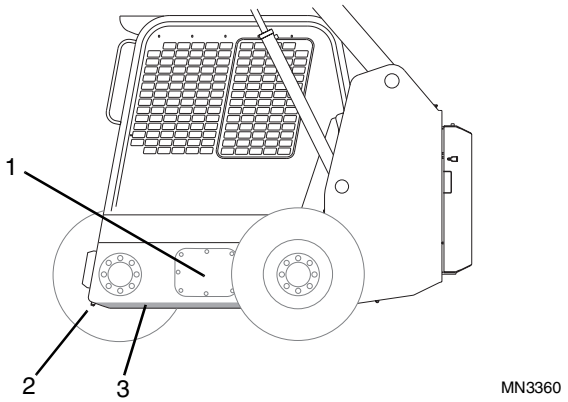


Figure 6-1 Chain Case Oil Level

2. Clean the area around the access plate (Fig. 6-1, 1) between the wheels on each side of the vehicle. Remove both chain case access plates.
3. Clean the area around the oil level/drain plugs (Fig. 6-1, 2) on each chain case. Place a suitable receptacle under either plug and remove the plug.
   - **If oil flows from the opening**, the oil level is adequate (Fig. 6-1, 3). Reinstall the drain plug, and torque to 40 lb/ft (54 Nm).
   - **If oil doesn’t flow from the opening**, the level is low. Add 10W30 motor oil that meets or exceeds API CD or CE specifications through the access cover opening until it flows from the level/drain plug hole. Reinstall the drain plug, and torque to 40 lb/ft (54 Nm).
4. Reposition the drain oil receptacle under the other chain case and repeat Step 3.
5. Transfer any oil drained during Step 3 above into a suitable storage container with a cover and label as “Used Oil.” Dispose of the used oil at an approved recycling facility.
6. DO NOT reinstall the access covers (Fig. 6-1, 1) at this time.

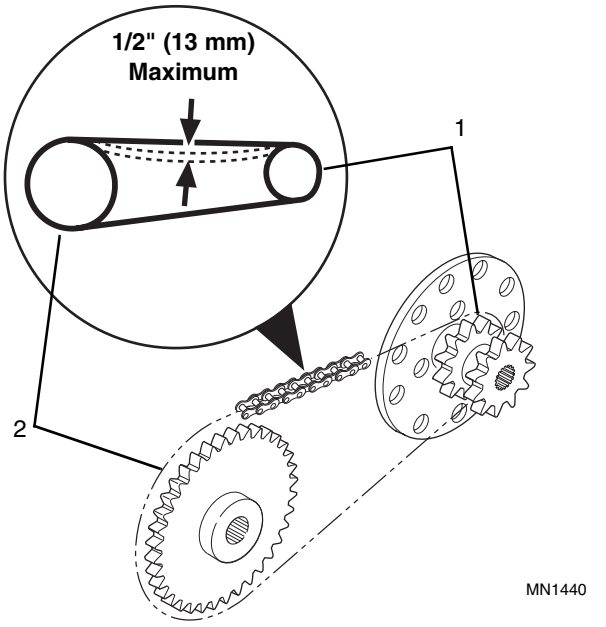


Figure 6-2 Drive Chain Tension

7. Chain tension is checked by measuring the deflection (total up and down movement) of an individual chain, at a point midway between the drive sprocket (Fig. 6-2, 1) and axle sprocket (2). Check the deflection of all four drive chains. Chain deflection must not exceed 1/2" (13 mm). If adjustment is required, refer to Section 6.3.2, “Drive Chain Tension Adjustment.”

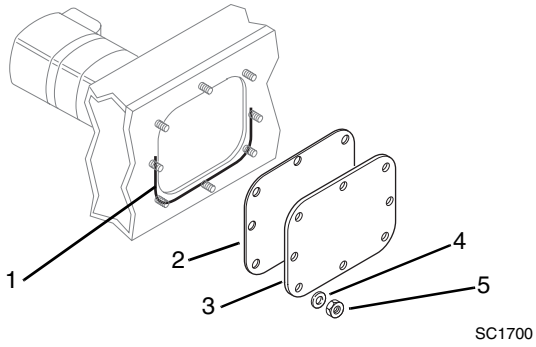


Figure 6-3 Cover Installation

8. Clean any sealer residue (Fig. 6-3, 1) from the lower part of the access cover opening. Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
9. Reassemble the cover gasket (Fig. 6-3, 2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).

b. Drive Chain Case Oil Change (1000 Hour Intervals)

1. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

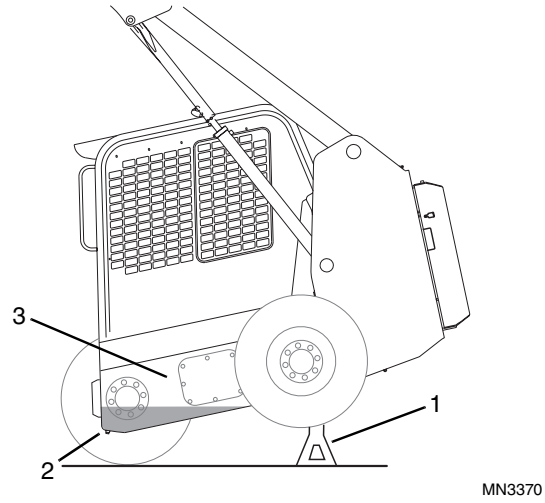


Figure 6-4 Chain Case Oil Removal

2. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the cross frame member.

IMPORTANT: *To prevent personal injury, be certain that the floor jack, jack stands or support blocks used are stable and strong enough to support the weight of the vehicle.*

3. Place jack stands (Fig. 6-4, 1) under the rear left and right frame of the vehicle. If jack stands are not available, support blocks may be used. Lower the rear of the vehicle down onto the jack stands or support blocks.
4. Place a receptacle under each level/drain plug (Fig. 6-4, 2), remove the plugs and allow all oil to drain into the receptacles. Transfer the oil drained into a suitable storage container with a cover and label as “Used Oil.” Dispose of the used oil at an approved recycling facility.
5. Raise the rear of the vehicle with a floor jack, and remove the jack stands or support blocks from under the vehicle. Lower the vehicle to the ground.
6. Clean the area around the access plate (Fig. 6-4, 3) between the wheels on each side of the vehicle. Remove both chain case access plates.
7. Add 10W30 motor oil, that meets or exceeds API CD or CE specifications, until it flows from the level/drain plug hole (Fig. 6-4, 2).

Note: *Model 1750D and 2000D/DX chain cases each hold 6 quarts (5,7 liter) of oil. Model 2300D/DX chain cases each hold 9 quarts (8,5 liter) of oil.*

8. Reinstall the level/drain plugs and torque to 40 lb/ft (54,2 Nm).

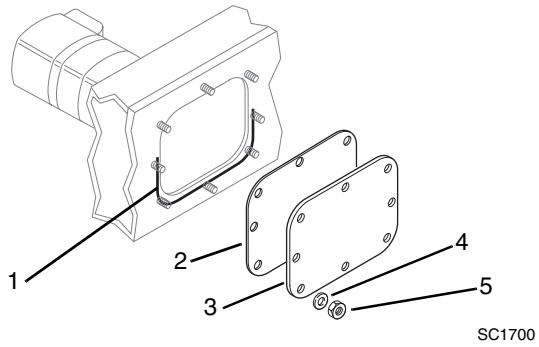


Figure 6-5 Access Cover Installation

9. Clean any sealer residue from the lower part of the access cover opening (Fig. 6-5, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
10. Reassemble the cover gasket (Fig. 6-5, 2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).
11. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

6.3.2 Drive Chain Tension Adjustment

WARNING: This procedure requires that the vehicle be raised off the ground. To prevent personal injury, be certain that jack stands or blocks being used are stable and strong enough to support the weight of the vehicle.

To adjust the drive chain tension of each of the four drive chains:

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

IMPORTANT: *Without an implement or bucket attached to the loader arm quick attach, the vehicle is rear end heavy. When raising the vehicle, raise the rear first and place support blocks under the rear of drive chain cases; not under the slanted part of the fuel and hydraulic oil reservoirs.*

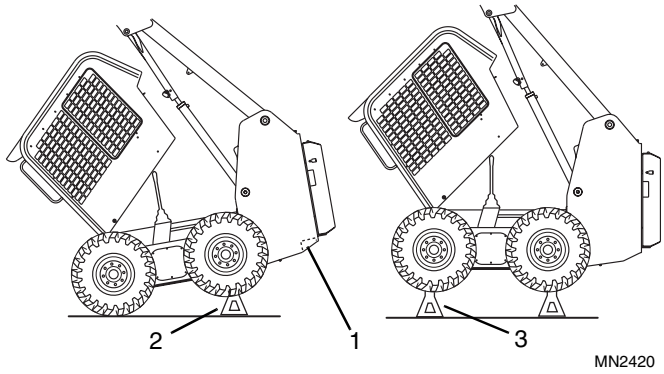


Figure 6-6 Jack Stand Placement

2. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear crossmember (Fig. 6-6, 1).

IMPORTANT: *To prevent personal injury, be certain that the floor jack, jack stands (Fig. 6-6, 2 & 3) or support blocks used are stable and strong enough to support the weight of the vehicle.*

3. Place jack stands (Fig. 6-6, 2) under the rear left and right frame of the vehicle. If jack stands are not available, support blocks may be used.
4. Lower the rear of the vehicle down onto the jack stands (Fig. 6-6, 2) or support blocks.
5. Raise the front of the vehicle with a floor jack and place jack stands (Fig. 6-6, 3) under the front of each chain case. If jack stands are not available, support blocks may be used under the chain cases.
6. Lower the front of the vehicle onto the jack stands (Fig. 6-6, 3) or support blocks.

7. Remove the lug nuts on all four wheels and remove all four wheels.

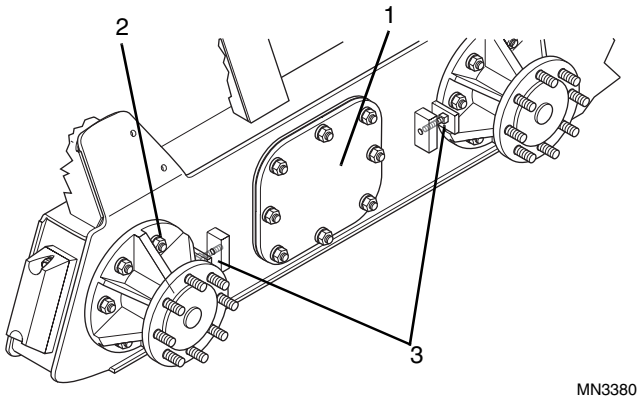


Figure 6-7 Drive Chain Tension Access

8. Clean the area around the access plates (Fig. 6-7, 1) and axle housings on each chain case, and remove the access plates and gaskets from both sides of the vehicle.
9. Loosen, but DO NOT not remove, all six nuts (Fig. 6-7, 2) on each axle housing.

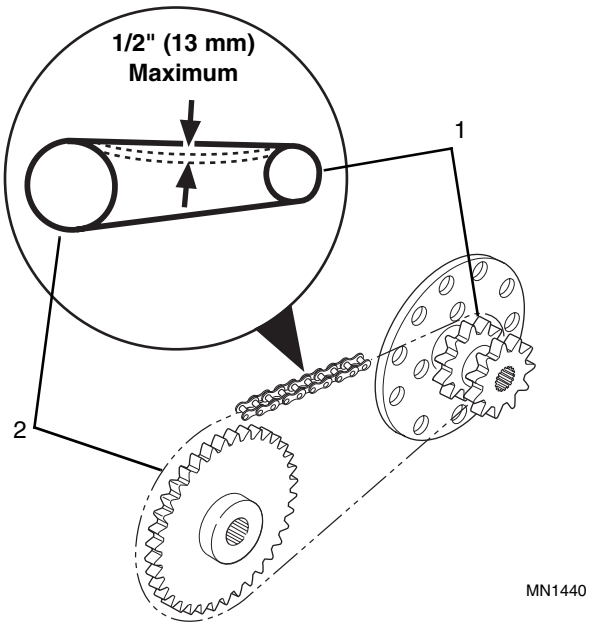


Figure 6-8 Drive Chain Tension

10. Chain tension is checked by measuring the deflection (total up and down movement) of an individual chain, at a point midway between the drive sprocket (Fig. 6-8, 1) and axle sprocket (2). Check the deflection of all four drive chains. Chain deflection must not exceed 1/2" (13 mm).
11. Adjust each chain as required by turning the adjusting bolts (Fig. 6-7, 3) against the axle housing.
12. When the proper chain deflection is obtained, tighten the six nuts (Fig. 6-7, 2) for each axle housing to 100-110 lb/ft (136-149 Nm).

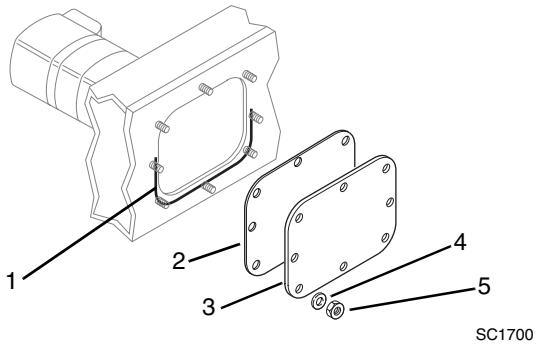


Figure 6-9 Access Cover Installation

13. Clean any sealer residue (Fig. 6-9, 1) from the lower part of the access cover opening. Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
14. Reassemble the cover gasket (Fig. 6-9, 2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).

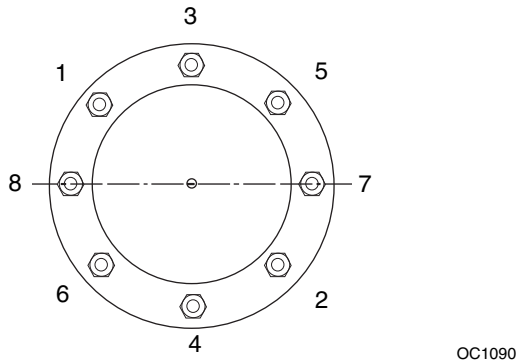


Figure 6-10 Lug Nut Torque Pattern

15. Reassemble the wheels to the axles. Torque all lug nuts in the sequence shown in Fig. 6-10 to 100-110 lb/ft (136-149 Nm).

IMPORTANT: *Without an implement or bucket attached to the loader arm quick attach, the vehicle is rear end heavy. When lowering vehicle, lower the front of vehicle to the ground first. DO NOT lower the rear of vehicle until the front of vehicle is on the ground.*

16. Raise the front of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the front of the vehicle to the ground.
17. Raise the rear of the vehicle with a floor jack, remove the jack stands or support blocks, and lower the rear of the vehicle to the ground.
18. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

6.3.3 Drive Chain Removal and Installation

a. Drive Chain Removal

IMPORTANT: *The axle assemblies must be removed from the vehicle to replace the drive chains. This vehicle has been manufactured using "Endless" drive chains. The chains should not be removed and replaced using a connector link, which would weaken the chain and reduce its useful service life.*

1. Refer to Section 6.4.2, "Axle Assembly and Axle Sprocket Removal," and remove the axle assemblies (Fig. 6-11, 1).

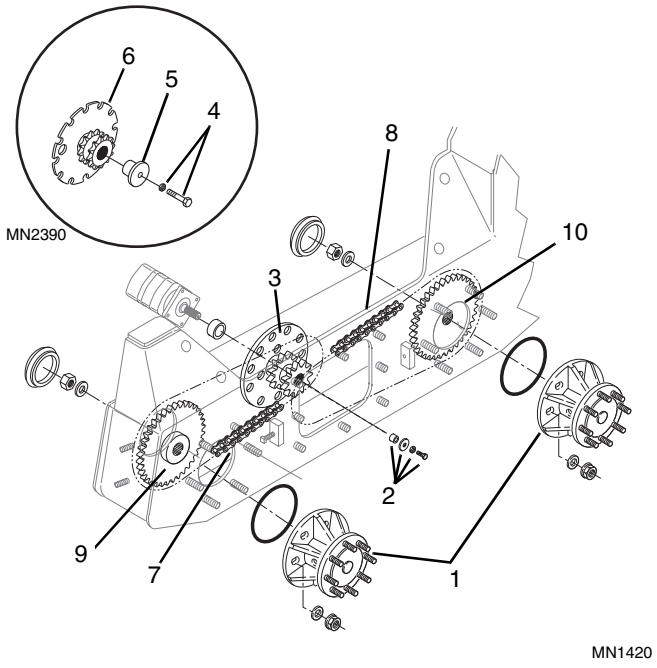


Figure 6-11 Vehicle Sprockets and Axles

2. **On Model 1750D, 2000D/DX Only**, remove the hardware (Fig. 6-11, 2) that holds the drive sprocket (3) on the drive motor shaft.

   On Model 2300D/DX Only, remove the hardware (Fig. 6-11, 4) and drive sprocket stop (5) that holds the drive sprocket (6) on the drive motor shaft.
3. Remove the drive chains (Fig. 6-11, 7 and 8) from the drive sprockets (3 or 6).
4. Remove the drive sprocket (Fig. 6-11, 3 or 6) from the travel motor output shaft and remove the drive sprocket from the chain case.
5. Move the axle sprockets (Fig. 6-11, 9 and 10) toward the access opening, and remove the chains (7 and 8) from the axle sprockets.
6. Remove the chains and axle sprockets from the chain case.

b. Cleaning and Inspection

1. Thoroughly clean and dry drive chains with a suitable solvent and inspect for wear and damage.

c. Replacement

1. If worn or damaged, replace the entire drive chain.

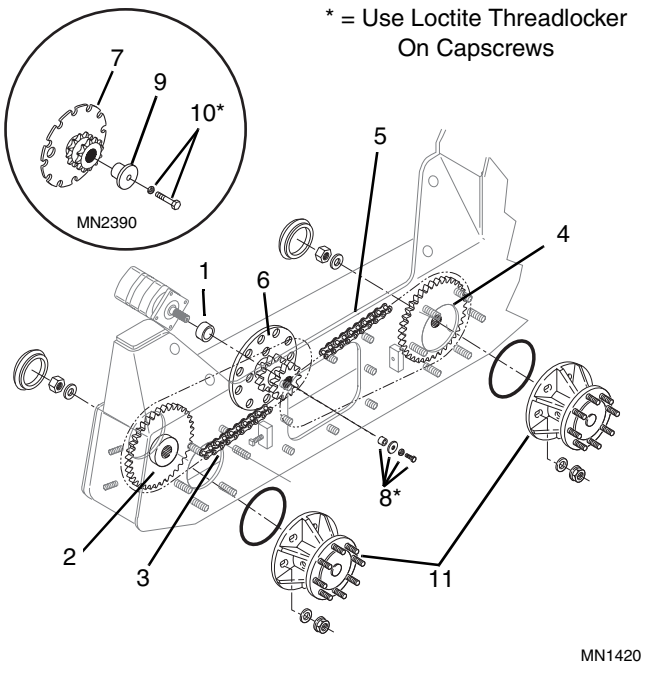


Figure 6-12 Vehicle Sprockets and Axles

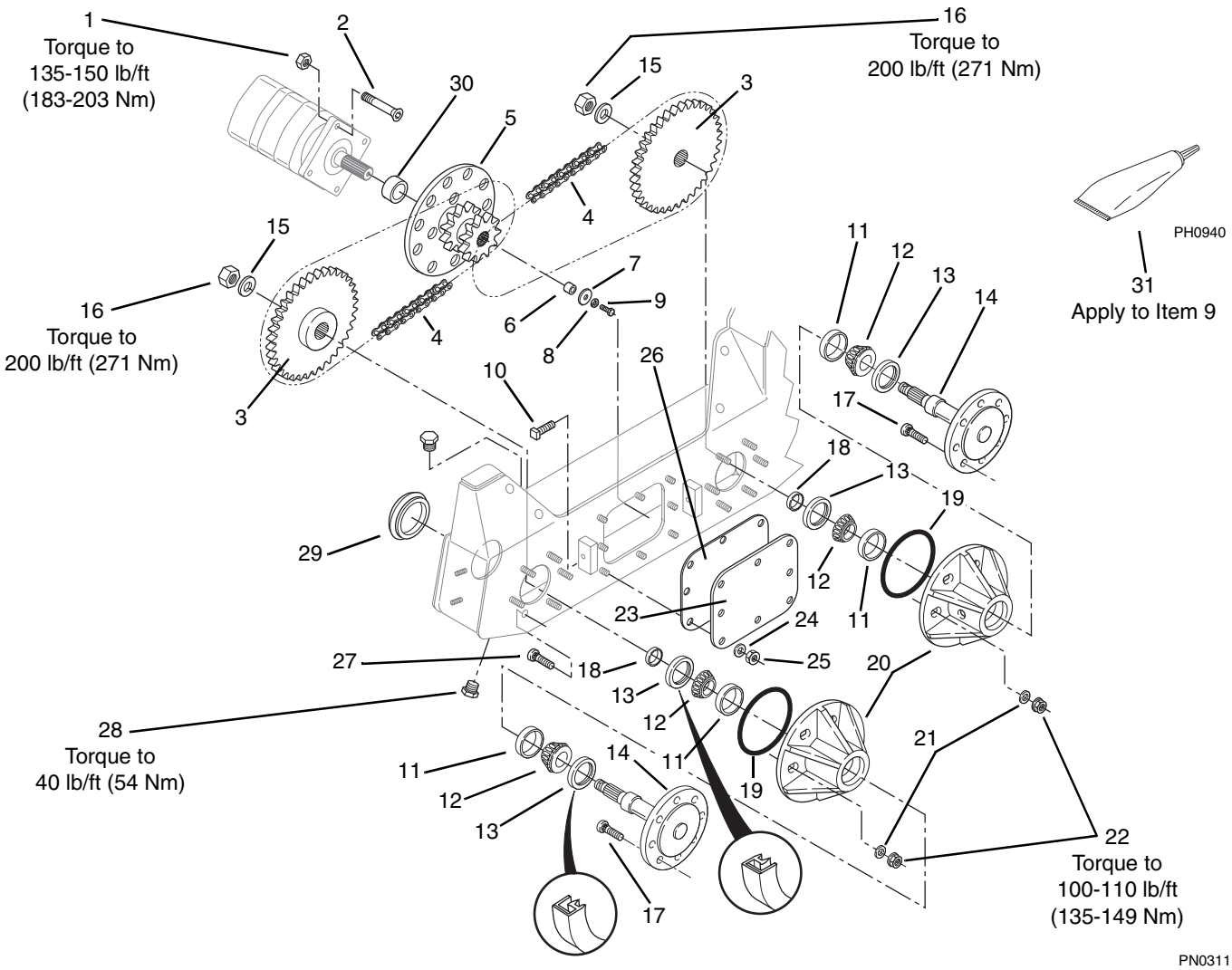
d. Installation

1. **On Model 1750D and 2000D/DX Only**, ensure that spacer (Fig. 6-12, 1) is in place on drive motor output shaft.
2. Install the drive chain (Fig. 6-12, 3) around the axle sprocket (2).
3. Place the front axle sprocket (Fig. 6-12, 2) with its hub facing the OUTSIDE of the chain case, and drive chain (3) into the chain case. Move the axle sprocket (2) toward the front axle opening.
4. Install the drive chain (Fig. 6-12, 5) around the axle sprocket (4).
5. Place the rear axle sprocket (Fig. 6-12, 4) with its hub facing the INSIDE of the chain case, and drive chain (5) into the chain case. Move the axle sprocket (4) toward the rear axle opening.
6. **On Model 1750D and 2000D/DX Only**, place the double drive sprocket (Fig. 6-12, 6) into the chain case and onto the travel motor output shaft.

   On Model 2300D/DX Only, place the double drive sprocket (Fig. 6-12, 7) into the chain case and onto the travel motor output shaft.
7. Install the front drive chain (Fig. 6-12, 3) first onto the inner sprocket of the drive sprocket (6 or 7) and then install the rear drive chain (5) on the outer sprocket.
8. **On Model 1750D and 2000D/DX Only**, install the hardware holding the drive sprocket (Fig. 6-12, 8) onto the travel motor output shaft, and secure. NOTE: Apply Loctite threadlocker to capscrew.

   On Model 2300D/DX Only, install the drive sprocket stop (Fig. 6-12, 9) and hardware (10) holding the drive sprocket (7) onto the travel motor output shaft, and secure. NOTE: Apply Loctite threadlocker to capscrew.
9. Refer to Section 6.4.4, “Axle Assembly and Axle Sprocket Installation,” and install the axle assemblies (Fig. 6-12, 11).

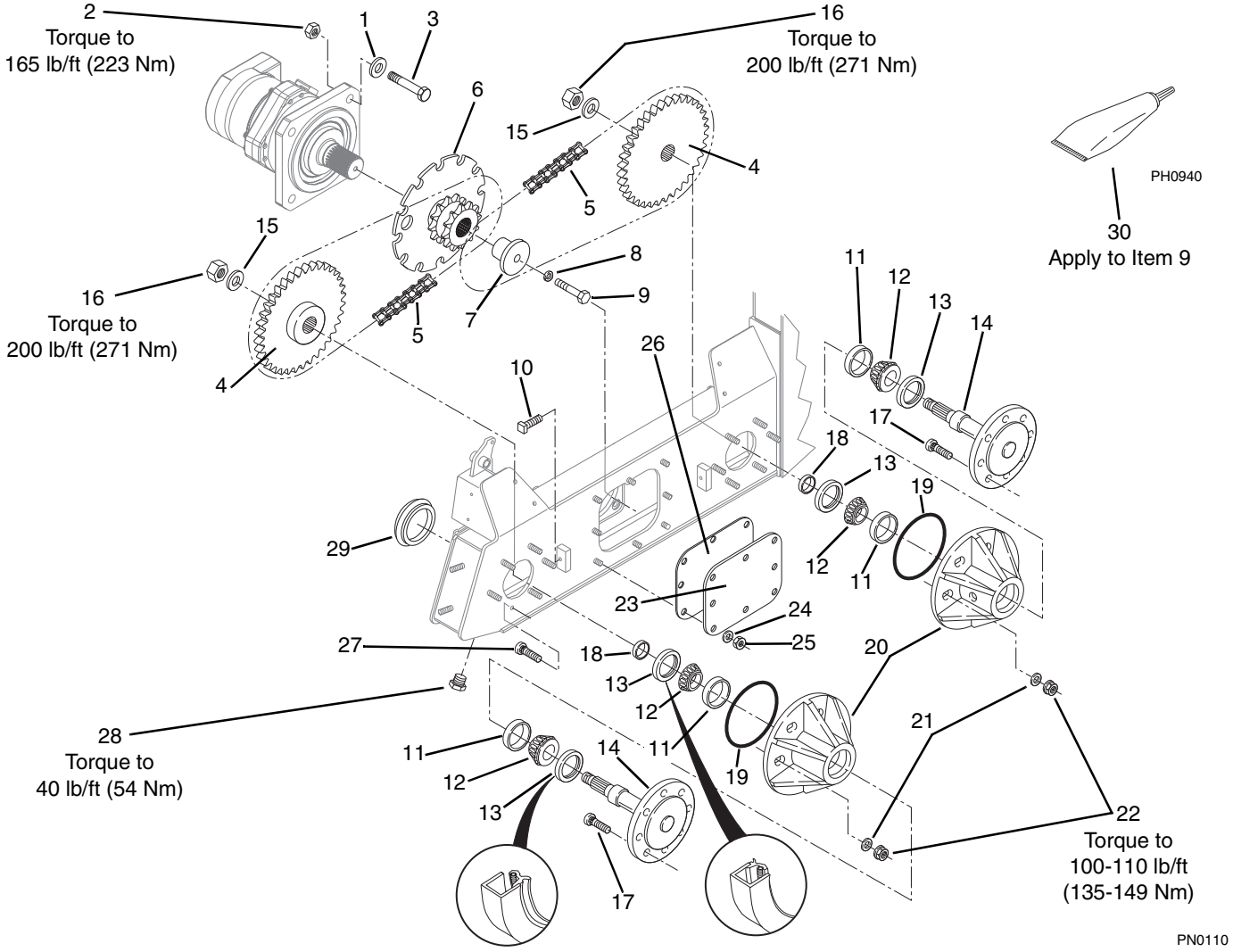
6.3.4 Final Drive Components Model 1750D and 2000D/DX



1. Nut, Hex Flange Lock, 1/2-13 Gr. 8 (8)
2. SHCS, 1/2-13 x 2" (8)
3. Sprocket, Axle (4)
4. Chain, Drive (4)
5. Sprocket, Drive (2)
6. Spacer (2)
7. Washer (2)
8. Washer, Lock, 3/8" (2)
9. HHCS, 3/8-16 x 1-1/2" (2)
10. SQHD Setscrew, 1/2-13 x 2" (4)
11. Cup, Bearing (8)
12. Bearing, Tapered Roller, 2" Dia. (8)
13. Seal, Axle Shaft (8)
14. Shaft, Axle (4)
15. Washer, Flat Hardened (4)
16. Nut, Hex Lock, Thin Elastic, 1-1/2-12 (4)
17. Bolt, Wheel, 9/16-18 x 2-1/4" (32)
18. Spacer, Axle (4)
19. O-ring, 7-1/4 x 7-1/2 x 1/8" (4)
20. Housing, Axle (4)
21. Washer, Flat 1/2", Hardened (24)
22. Nut, Hex, 9/16-18 Gr. 8 (24)
23. Plate, Cover (2)
24. Washer, Flat, 3/8" (16)
25. Nut, Hex Lock Elastic, 3/8-16 (16)
26. Gasket, Cover Plate (2)
27. Stud, Axle Housing, 9/16-18 x 2-1/4" (24)
28. Plug, Hex Hd, SAE 8 (2)
29. Plug (4)
30. Spacer, Sprocket (2)
31. Loctite, Threadlocker (As Required)

Figure 6-13 Left Side Drivetrain - Model 1750D & 2000D/DX (Exploded View)

6.3.5 Final Drive Components Model 2300D/DX



1. Washer, Flat Hardened, 3/4" (8)
2. Nut, Hex Flange Lock, 3/4-10 Gr. 8 (8)
3. HHCS, 3/4-10 x 2-1/2" Gr. 8 (8)
4. Sprocket, Axle (4)
5. Chain, Drive (4)
6. Sprocket, Drive (2)
7. Stop, Drive Sprocket (2)
8. Washer, Lock 1/2" (2)
9. HHCS, 1/2-20 x 2-1/4" Gr. 5 (2)
10. SQHD Setscrew, 1/2-13 x 2" (4)
11. Cup, Bearing (8)
12. Bearing, Tapered Roller, 2" Dia. (8)
13. Seal, Axle Shaft (8)
14. Shaft, Axle (4)
15. Washer, Flat Hardened (4)
16. Nut, Hex Lock, Thin Elastic, 1-1/2-12 (4)
17. Bolt, Wheel, 9/16-18 x 2-1/4" (32)
18. Spacer, Axle (4)
19. O-ring, 7-1/4 x 7-1/2 x 1/8" (4)
20. Housing, Axle (4)
21. Washer, Flat Hardened, 1/2" (24)
22. Nut, Hex, 9/16-18 Gr. 8 (24)
23. Plate, Cover (2)
24. Washer, Flat, 3/8" (16)
25. Nut, Hex Lock Elastic, 3/8-16 (16)
26. Gasket, Cover Plate (2)
27. Stud, Axle Housing, 9/16-18 x 2-1/4" (24)
28. Plug, Hex Hd, SAE 8 (2)
29. Plug (4)
30. Loctite, Threadlocker (As Required)

Figure 6-14 Left Side Drivetrain - Model 2300D/DX (Exploded View)

6.4 AXLE ASSEMBLY, AXLE SPROCKET AND DRIVE SPROCKET

6.4.1 Axle Assembly, Axle Sprocket and Drive Sprocket Description

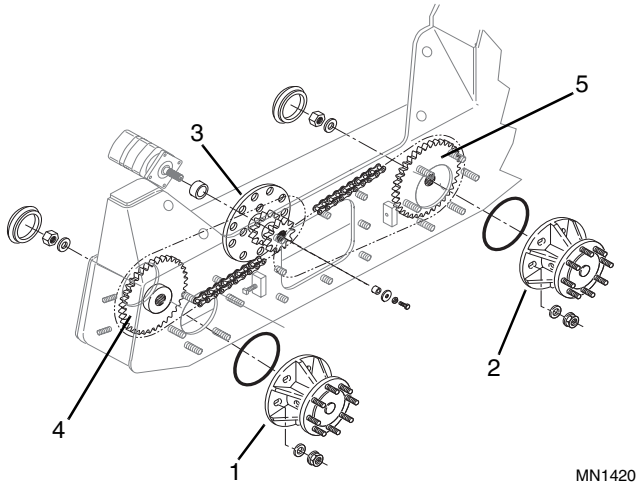


Figure 6-15 Vehicle Sprockets and Axles

The vehicle has two axle assemblies (Fig. 6-15, 1 & 2) and one drive sprocket (3) on each side. The axle assemblies are identical except for the orientation of the front (4) and rear (5) axle sprockets hubs. The drive sprocket (3) is driven by a hydrostatic drive motor and each axle assembly is chain driven by the drive sprocket.

6.4.2 Axle Assembly Removal

WARNING: This procedure requires that the vehicle be raised off the ground. To prevent personal injury, be certain that jack stands or blocks being used are stable and strong enough to support the weight of the vehicle.

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

IMPORTANT: *Without an implement or bucket attached to the loader arm quick attach, the vehicle is rear end heavy. When raising the vehicle, raise the rear first and place support blocks under the rear of drive chain cases; not under the slanted part of the fuel and hydraulic oil reservoirs.*

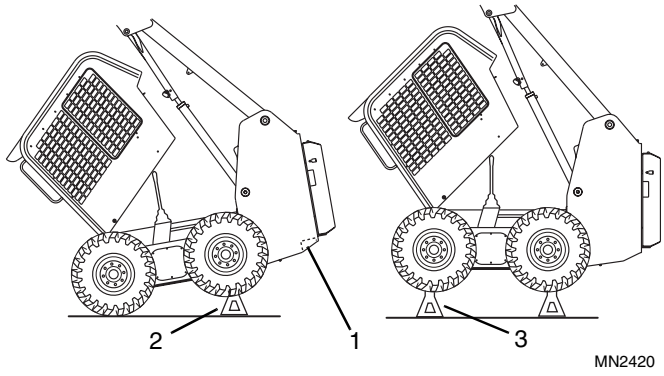


Figure 6-16 Jack Stand Placement

2. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear crossmember (Fig. 6-16, 1).

IMPORTANT: *To prevent personal injury, be certain that the floor jack, jack stands (Fig. 6-16, 2 & 3) or support blocks used are stable and strong enough to support the weight of the vehicle.*

3. Place jack stands (Fig. 6-16, 2) under the rear left and right frame of the vehicle. If jack stands are not available, support blocks may be used.
4. Lower the rear of the vehicle down onto the jack stands (Fig. 6-16, 2) or support blocks.
5. Raise the front of the vehicle with a floor jack and place jack stands (Fig. 6-16, 3) under the front of each chain case. If jack stands are not available, support blocks may be used under the chain cases.
6. Lower the front of the vehicle onto the jack stands (Fig. 6-16, 3) or support blocks.
7. Remove the lug nuts on all four wheels and remove all four wheels.

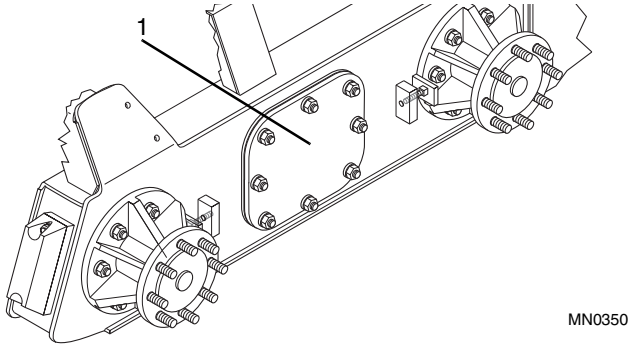


Figure 6-17 Drive Chain Tension Access

8. Clean the area around the access plate (Fig. 6-17, 1) and axle housings, and remove the access plates and gaskets from both sides of the vehicle.

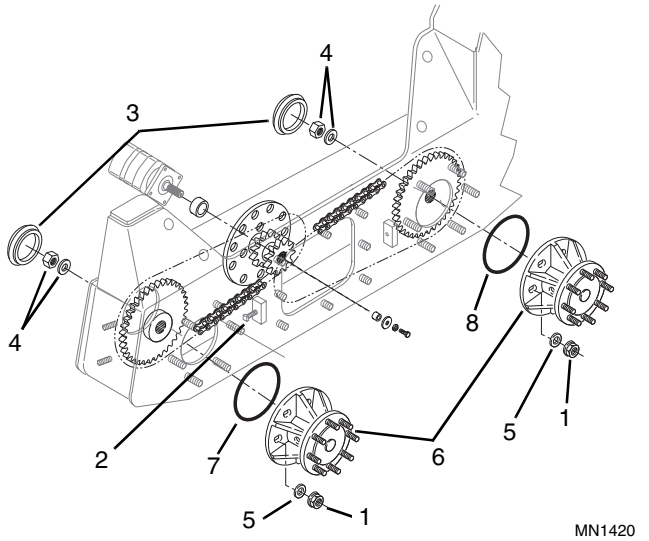


Figure 6-18 Vehicle Sprockets and Axles

9. Loosen, but DO NOT not remove, all six nuts (Fig. 6-18, 1) on each axle housing.
10. Back off the chain tension screws (Fig. 6-18, 2) from against each axle housing.
11. Remove floor plate from between pedals, and remove both batteries.
12. Remove the rubber plugs (Fig. 6-18, 3) from the inside walls of the chain case.
13. From the access hole in the inside wall of each chain case, remove the 1-1/2-12 hex locknut (using a 2-1/2" deep well socket) and the hardened washer (Fig. 6-18, 4) from the axle. Discard the hex locknuts. The hardened washers can be reused during reassembly of the axle assembly.
14. Remove all of the nuts (Fig. 6-18, 1) and washers (5) that fasten the axle housing assemblies (6) to the vehicle.
15. Remove the axle housing (Fig. 6-18, 6), and remove and discard the o-ring (7 & 8).

6.4.3 Axle Disassembly and Assembly

a. Axle Disassembly

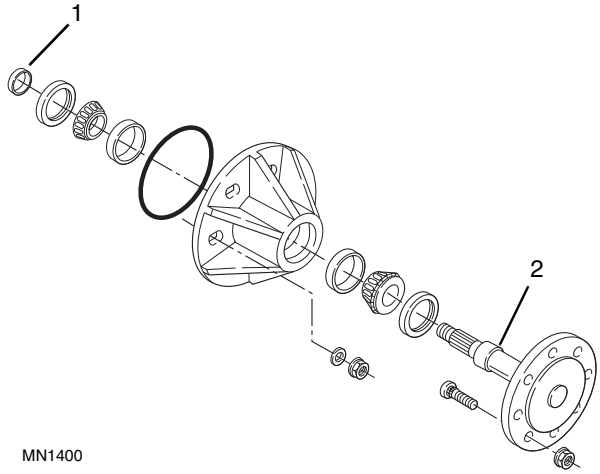


Figure 6-19 Axle Assembly - Exploded View

1. Pull the spacer (Fig. 6-19, 1) off the end of the axle (2) and save the spacer.

Note: *A hydraulic press, capable of applying at least 4,000 pounds of force, is required to press the axle out of inner bearing cone.*

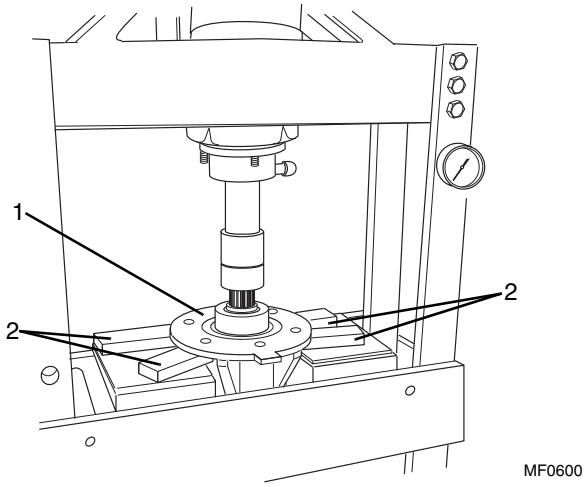


Figure 6-20 Hydraulic Press

2. Place the axle assembly (Fig. 6-20, 1) in a hydraulic press as shown. Use four steel plates (2) placed under the axle housing flange and into the center of housing as far as possible between the triangular fins of housing to support the housing.

IMPORTANT: *If the axle housing is not supported this way, damage to the axle housing flange will result.*

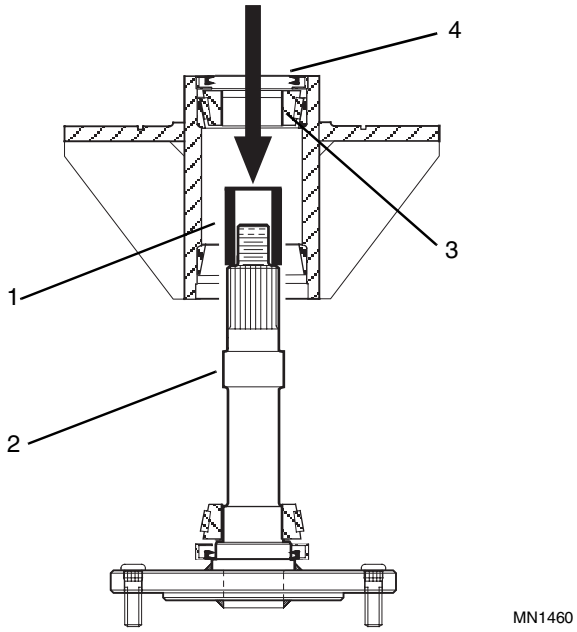


Figure 6-21 Axle Removal

3. To protect the threads on the end of the axle, use a steel spacer (Fig. 6-21, 1) that has a inside diameter slightly larger than the threaded part of axle. Place the spacer over the threads so it will set on the end of the axle splines.
4. Press the axle (Fig. 6-21, 2) out of the inner bearing cone (3) with the hydraulic press.

IMPORTANT: *DO NOT damage the inside of the axle housing when removing the inner and outer seals and bearing cups.*

5. Remove the inner seal (Fig. 6-21, 4) and inner bearing cone (3) from the inner end of the axle housing and discard the seal.

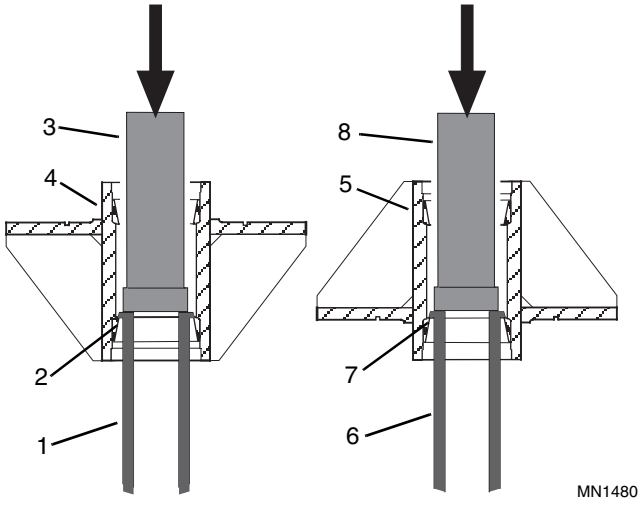


Figure 6-22 Bearing Cup Removal

6. Install an acceptable internal puller (Fig. 6-22, 1) on the outer bearing cup (2). Place a suitable driver (3) on top of the puller flanges, and press the outer bearing cup out of the housing (4).
7. Turn the axle housing over (Fig. 6-22, 5), and reinstall the internal puller (6) to engage the inner bearing cup (7). Place a driver (8) on top of the puller flanges, and press the inner bearing cup out of the housing (5).

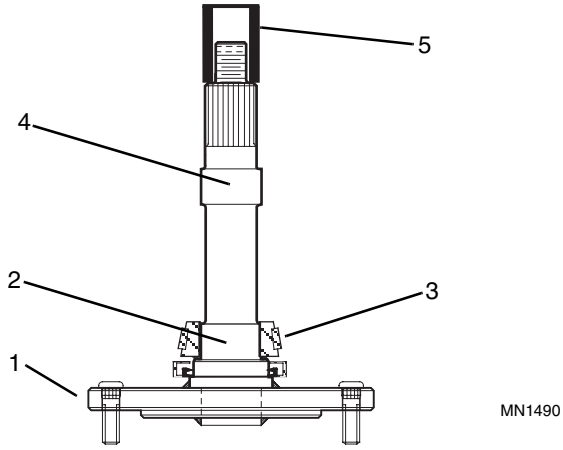


Figure 6-23 Axle Outer Bearing Removal

8. The axle (Fig. 6-23, 1) has two bearing journals machined on its shaft. The outer journal (2) supports the outer bearing cone (3), while the inner journal (4) supports the inner bearing cone. The outer bearing cone (3) must be pulled twice to remove it completely from the axle.
9. To protect the threads on the end of the axle, place a steel spacer (Fig. 6-23, 5) over the threaded end of the axle, so it will set on the end of the axle splines.

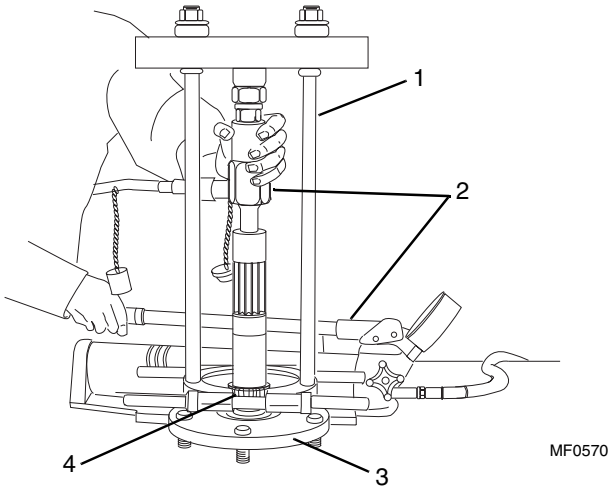


Figure 6-24 Outer Bearing Cone Removal

10. Install a suitable puller (Fig. 6-24, 1) and portable hydraulic hand pump (2) on the axle (3) and outer bearing cone (4).
11. The first pull will remove the outer bearing cone (Fig. 6-24, 4) from the outer journal. Lift the outer bearing cone up until it contacts the inner axle journal. Reset the puller and hydraulic hand pump, and pull the outer bearing from the inner axle journal.

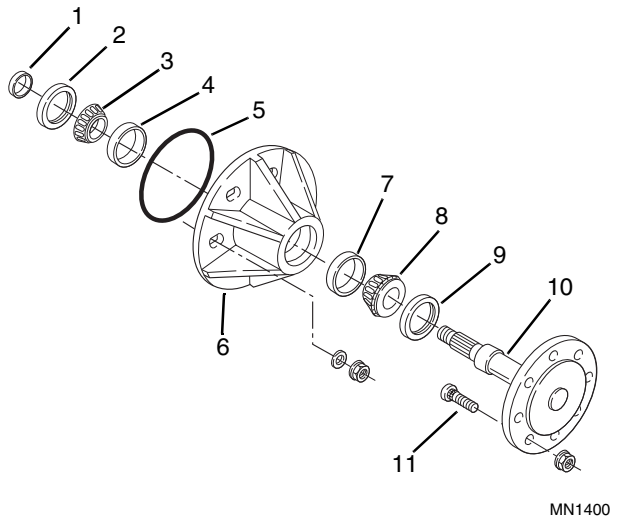


Figure 6-25 Axle Assembly Components

b. Cleaning and Inspection

1. Remove the outer seal (Fig. 6-25, 9) and discard.
2. Thoroughly clean and dry all metal components of axle assembly (Fig. 6-25) with a suitable solvent.
3. Inspect the spacer (Fig. 6-25, 1) for pitting, scoring, and other damage.
4. Inspect the bearing cones (Fig. 6-25, 3 & 8) and cups (4 & 7) for wear, flat areas, pitting, scoring, and other damage.
5. Inspect the axle housing (Fig. 6-25, 6) for cracks, and the internal housing surfaces for pitting, scoring, and other damage that may have been caused during removal of the bearing cups.
6. Inspect the axle (Fig. 6-25, 10) for wear, flat areas, pitting, scoring, and other damage.
7. Inspect the wheel studs (Fig. 6-25, 11) in the axle flange for damage.
8. Inspect the axle housing studs in the chain case for damage.

c. Repair or Replacement

1. Replace the inner and outer seals (Fig. 6-25, 2 & 9) with new seals.
2. Replace the bearing cones (Fig. 6-25, 3 & 8) and cups (4 & 7) if necessary with a new cup and cone. Replace the cone and cup as a set; DO NOT replace the cup or cone individually.
3. Replace the spacer (Fig. 6-25, 1) if necessary.
4. Repair the axle (Fig. 6-25, 10) journals with emery cloth if not severely damaged.
5. Repair the axle splines, axle sprocket splines, and sprocket teeth with a file if not severely damaged.
6. Repair nicks or pits in the axle housing (Fig. 6-25, 6) internal bores with emery cloth if not severely damaged.
7. Replace the wheel studs (Fig. 6-25, 11) with new studs if damaged.
8. Replace the axle housing studs with new studs if damaged.
9. Replace the o-ring (Fig. 6-25, 5) with a new o-ring.
10. Always replace any part that is found to be severely damaged with a new part or assembly.

d. Axle Assembly

Note: *Use NGLI grade 2 multi purpose lithium grease for packing the bearing cones and assembly of bearing cups.*

1. Apply multi purpose lithium grease on the inside of the axle housing bore.
2. Position the axle housing, with the inner side facing up, in a manual press.

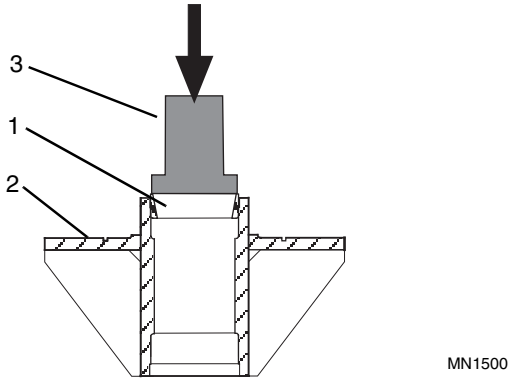


Figure 6-26 Inner Bearing Cup Installation

3. Hand place the inner bearing cup (Fig. 6-26, 1) squarely into the axle housing (2) bore.
4. Put an acceptable driver (Fig. 6-26, 3) on the inner bearing cup and position the axle housing in a manual press.
5. Using a manual press, similar to the one shown in Fig. 6-30, press the inner bearing cup all the way into the axle housing bore.

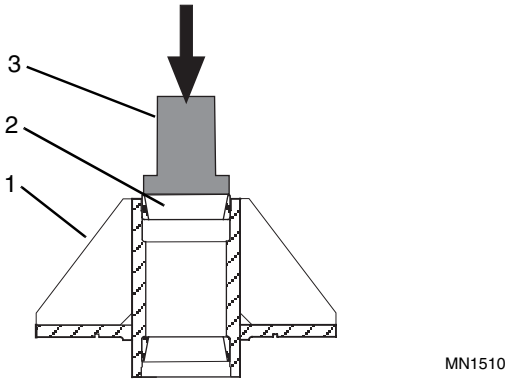


Figure 6-27 Outer Bearing Cup Installation

6. Turn the axle housing (Fig. 6-27, 1) over, with the outer side facing up, and repeat Steps 3 through 5 to install the outer bearing cup (2).

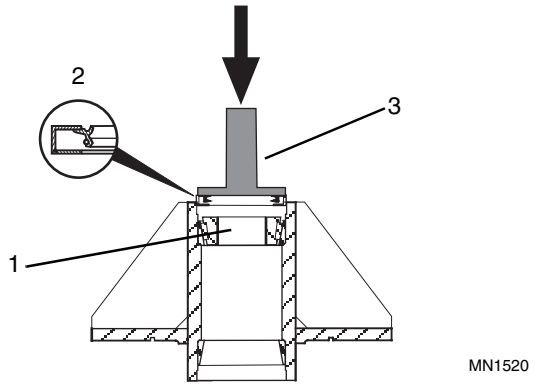


Figure 6-28 Outer Bearing and Seal Installation

7. Hand or pressure pack the bearing cones (Fig. 6-28, 1) with multi purpose lithium grease, and place the outer bearing cone in the outer bearing cup.
8. Place a new outer seal (Fig. 6-28, 2) squarely into the axle housing bore, positioned as shown.
9. Using an acceptable seal installation driver (Fig. 6-28, 3), carefully press the outer seal (2) into the axle housing until it is flush with the outer end of housing.

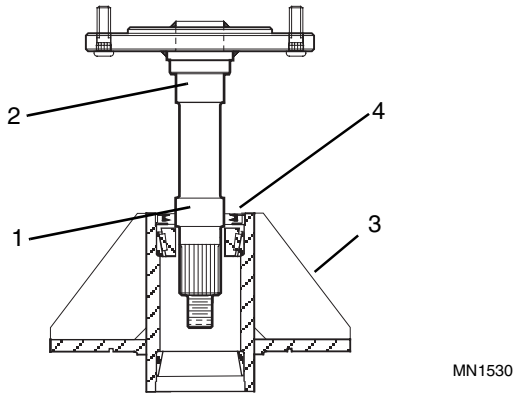


Figure 6-29 Axle Installation

10. Coat both axle bearing journals (Fig. 6-29, 1 & 2) with molybdenum disulfide anti-seize compound.
11. Place the axle housing (Fig. 6-29, 3) in a manual press, with the inner side facing down, and insert the axle into the outer bearing cone, using care to prevent damaging the outer seal (4).

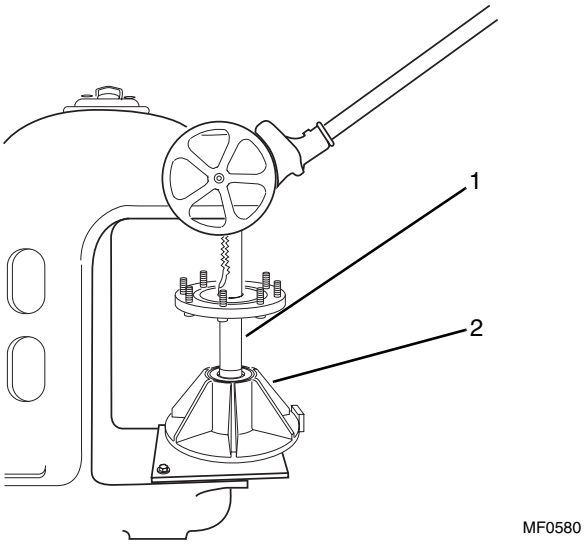


Figure 6-30 Pressing Axle Into Housing

12. Hold the axle (Fig. 6-30, 1) in a straight up, vertical position, and manually press the axle into the axle housing (2), until the outer bearing is fully seated on the axle.
13. Turn the axle housing over and put the axle housing back in the manual press. Use a support under the axle flange to prevent the wheel bolts from contacting the press.

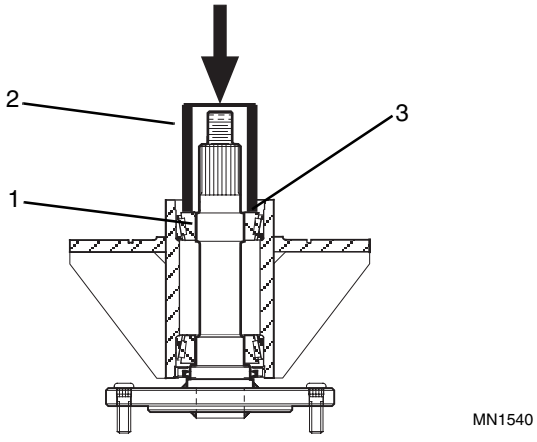


Figure 6-31 Inner Axle Bearing Installation

14. Place the inner bearing cone (Fig. 6-31, 1) on the axle.
15. Put an acceptable driver (Fig. 6-31, 2) on the hub of the inner bearing cone (3).
16. Using a manual press, install the inner bearing cone (Fig. 6-31, 1) onto the axle by pressing the driver until the bearing cone (1) makes contact with the bearing cup.

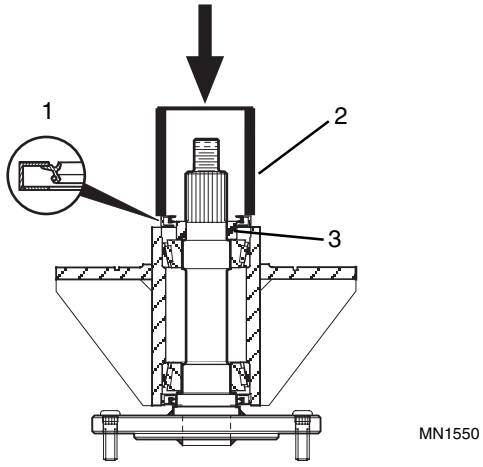


Figure 6-32 Inner Axle Seal Installation

17. Place a new outer seal (Fig. 6-32, 1) squarely into the axle housing bore, positioned as shown.
18. Using an acceptable seal installation driver (Fig. 6-32, 2), carefully press the outer seal (1) into the axle housing until it is flush with the outer end of housing.
19. Install the spacer (Fig. 6-32, 3) onto the axle, through the seal (1) until it is seated against the inner bearing cone.

6.4.4 Axle Assembly Installation

Note: *The installation of the axle assemblies into the axle sprockets will require the assistance of a second person.*

1. Coat the axle splines with a anti-seize molybdenum disulfide compound.

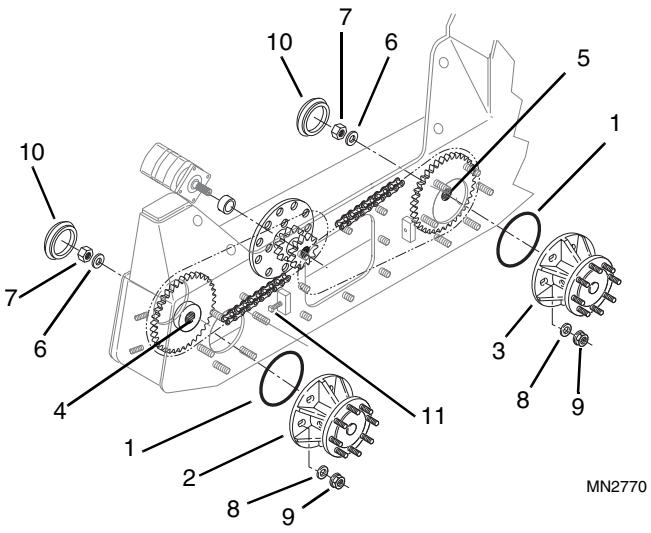


Figure 6-33 Axle Assembly Installation

2. Be sure the mating surfaces for the axle housing o-rings (Fig. 6-33, 1) are free of grease and install a new o-ring into the groove in each axle housing (2 and 3). Apply grease to the o-ring to hold it in the groove.
3. Slide the axle assembly (Fig. 6-33, 2 and 3) axle spline into the axle sprocket (4 and 5).

Note: *To engage the axle splines with the sprocket, the second person must lift and turn the sprocket from the inside of the frame, while the axle is being inserted.*

4. Install the hardened washer (Fig. 6-33, 6) and a new 1-1/2-12 hex locknut (7) onto each axle shaft and using a 2-1/2" deep well socket, tighten and torque the nut to 200 lb/ft (271 Nm).
5. Push the axle housing onto the axle housing studs and install the washers (Fig. 6-33, 8) and nuts (9) onto the axle housing studs and tighten finger tight.
6. Clean the rubber chain case plugs (Fig. 6-33, 10) and openings in chain case with a suitable solvent. Install the rubber chain case plugs.

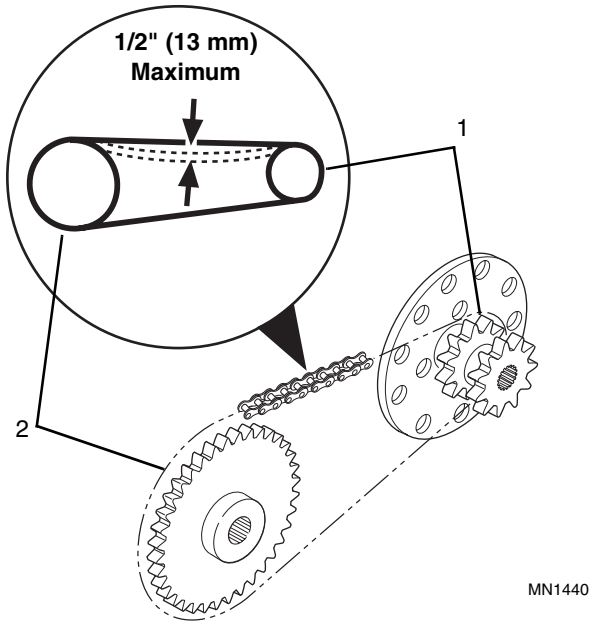


Figure 6-34 Drive Chain Tension

7. Chain tension is checked by measuring the deflection (total up and down movement) of an individual chain, at a point midway between the drive sprocket (Fig. 6-34, 1) and axle sprocket (2). Check the chain deflection of all drive chains. Chain deflection must not exceed 1/2" (13 mm).
8. Adjust each chain as required by turning the adjusting bolts (Fig. 6-33, 11) against the axle housing.
9. When the proper chain deflection is obtained, tighten the six nuts for each axle housing (Fig. 6-33, 9) to 100-110 lb/ft (136-149 Nm).
10. Clean the area around the oil level/drain plugs on each chain case. Place a suitable receptacle under either plug and remove the plug.
    - **If oil flows from the opening**, the oil level is adequate. Reinstall the drain plug, and torque to 40 lb/ft (54 Nm).
    - **If oil doesn't flow from the opening**, the level is low. Add 10W30 motor oil that meets or exceeds API CD or CE specifications through the access cover opening until it flows from the level/drain plug hole. Reinstall the drain plug, and torque to 40 lb/ft (54 Nm).
11. Reposition the drain oil receptacle under the other chain case if required and repeat Step 10.

12. Transfer any oil drained during Step 10 above into a suitable storage container with a cover and label as “Used Oil.” Dispose of the used oil at an approved recycling facility.

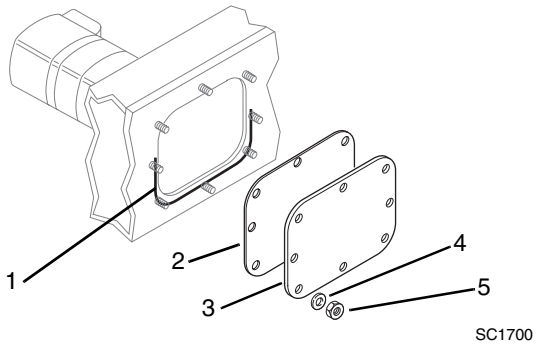


Figure 6-35 Access Cover Installation

13. Clean any sealer residue from the lower part of the access cover opening (Fig. 6-35, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
14. Reassemble the cover gasket (Fig. 6-35, 2) and cover (3) to the side of the chain case using the original washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).
15. Install the wheels and torque the wheel nuts to 100-110 lb/ft (136-149 Nm).

IMPORTANT: *Without an implement or bucket attached to the loader arm, the vehicle is rear end heavy. When lowering vehicle, lower the front of vehicle to the ground first. DO NOT lower the rear of vehicle until the front of vehicle is on the ground.*

16. Raise the front of vehicle first, and remove the jack stands or support blocks. Lower the front to the ground.
17. Raise the rear of vehicle, and remove the jack stands or support blocks. Lower the rear to the ground.
18. Reinstall both batteries, and the floor plate between the foot pedals.
19. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

6.4.5 Drive and Axle Sprocket Removal and Installation

a. Removal

1. Remove both axle assemblies before removing the drive sprocket. Refer to Section 6.4.2, “Axle Assembly Removal.”

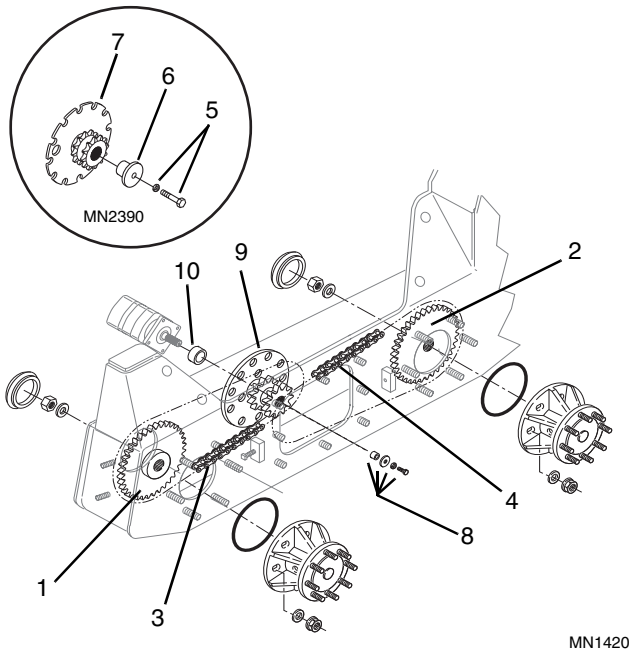


Figure 6-36 Sprocket Removal

2. Move the axle sprockets (Fig. 6-36, 1 and 2) toward the access opening, and remove the chains (3 and 4) from the axle sprocket.
3. **On Model 2300D/DX Only**, remove the hardware (Fig. 6-36, 5) and drive sprocket stop (6) that holds the drive sprocket (7) on the drive motor shaft.

   On Model 1750D, 2000D/DX Only, remove the hardware (Fig. 6-36, 8) that holds the drive sprocket (9) on the drive motor shaft.
4. Remove the drive chains (Fig. 6-36, 3 and 4) from the drive sprocket (7 or 9).
5. Remove the drive sprocket (Fig. 6-36, 7 or 9) from the travel motor output shaft and remove the drive sprocket (7 or 9) from the chain case.
6. **On Model 1750D, 2000D/DX Only**, ensure that spacer (Fig. 6-36, 10) remains on the motor output shaft.
7. Remove the chains (Fig. 6-36, 3 and 4) and axle sprockets (1 and 2) from the chain case.

b. Cleaning and Inspection

1. Thoroughly clean and dry drive and axle sprockets with a suitable solvent.
2. Inspect the sprockets for wear and damage to the spline and sprocket teeth.

c. Repair and Replacement

1. Repair minor nicks in the spline and sprocket teeth with a file.
2. Replace any sprocket with a new sprocket if severely damaged.

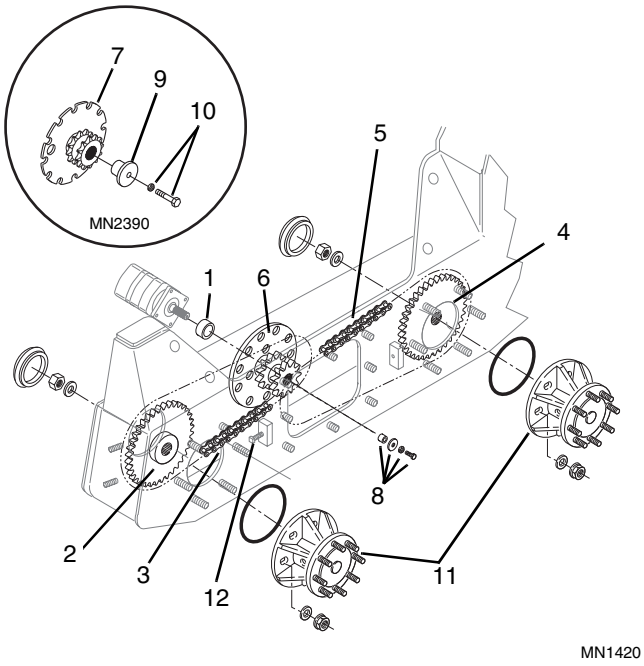


Figure 6-37 Sprocket Installation

d. Installation

1. **On Model 1750D and 2000D/DX Only**, ensure that spacer (Fig. 6-37, 1) is in place on drive motor output shaft.
2. Coat the drive motor output spline shaft with a anti-seize molybdenum disulfide compound.
3. Place the front axle sprocket (Fig. 6-37, 2) with its hub facing the OUTSIDE of the chain case, and a drive chain (3) into the chain case.
4. Install the drive chain (Fig. 6-37, 3) around the front axle sprocket (2). Move the sprocket toward the front axle opening.
5. Place the rear axle sprocket (Fig. 6-37, 4) with its hub facing the INSIDE of the chain case, and a drive chain (5) into the chain case.
6. Install the drive chain (Fig. 6-37, 5) around the rear axle sprocket (4). Move the sprocket toward the rear axle opening.
7. **On Model 1750D and 2000D/DX Only**, place the drive sprocket (Fig. 6-37, 6) into the chain case and onto the travel motor output shaft.

   On Model 2300D/DX Only, place the drive sprocket (Fig. 6-37, 7) into the chain case and onto the travel motor output shaft.
8. Install the front drive chain (Fig. 6-37, 3) first onto the inner sprocket of the drive sprocket (6 or 7) and then install the rear drive chain (5) on the outer sprocket.
9. **On Model 1750D and 2000D/DX Only**, install the hardware holding the drive sprocket (Fig. 6-37, 8) onto the travel motor output shaft, and secure.

   On Model 2300D/DX Only, install the drive sprocket stop (Fig. 6-37, 9) and hardware (10) holding the drive sprocket (7) onto the travel motor output shaft, and secure.
10. Refer to Section 6.4.4, “Axle Assembly and Axle Sprocket Installation,” and install the axle assemblies.

6.5 TROUBLESHOOTING

Refer to Section 5.11, “Troubleshooting” for troubleshooting the final drive of the vehicle.

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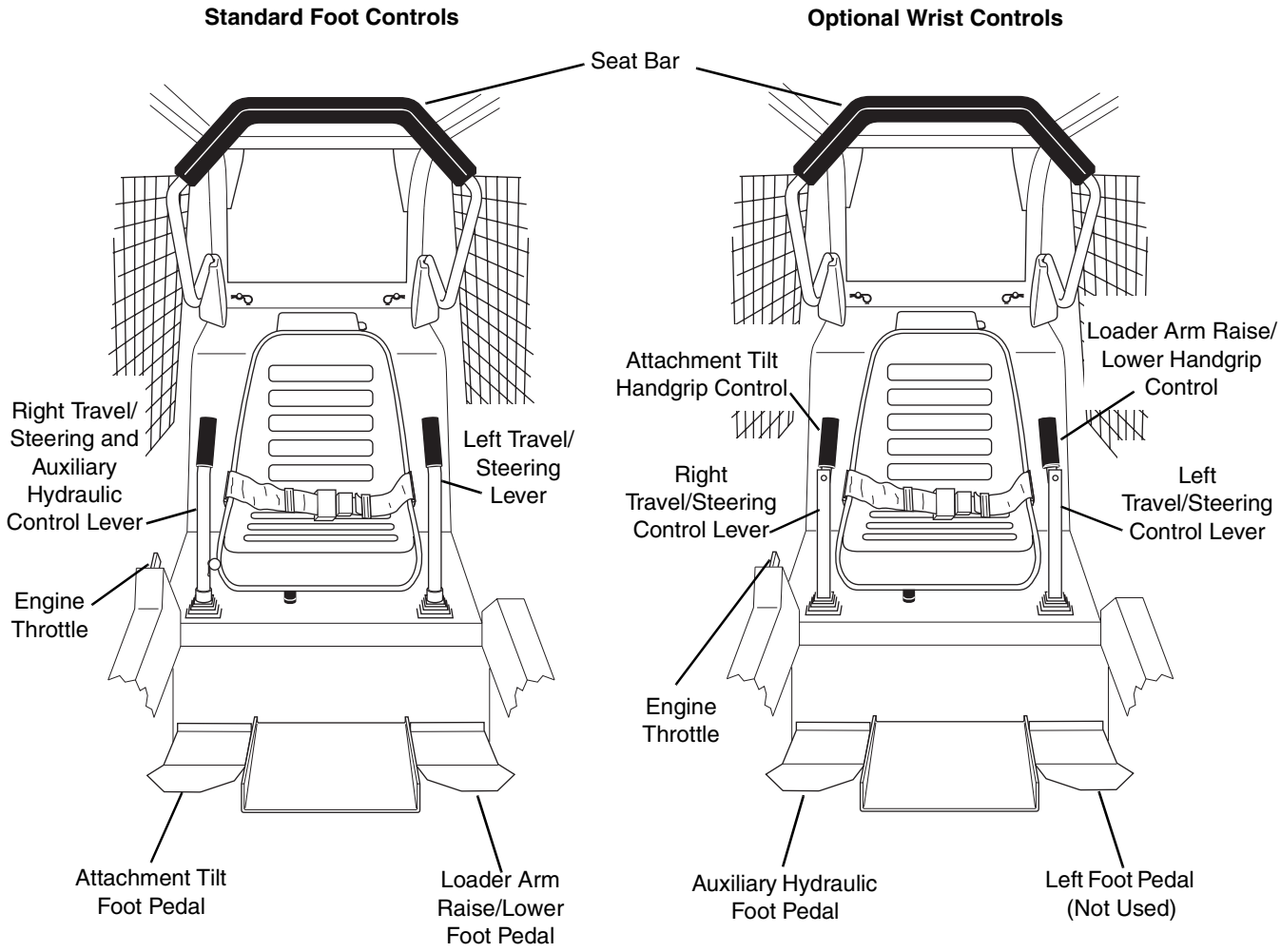
Section 7
Controls

Contents

7.1 CONTROL TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the vehicle controls. The following illustration identifies the components that are referred to throughout this section.



7.2 TRAVEL/STEERING LEVERS

7.2.1 Travel/Steering Lever Operation

Two travel/steering levers control speed, steering and stopping.

The right lever controls the wheels on the right side of the vehicle and the auxiliary hydraulic control (side to side movement). The left lever controls the wheels on the left side of the vehicle.

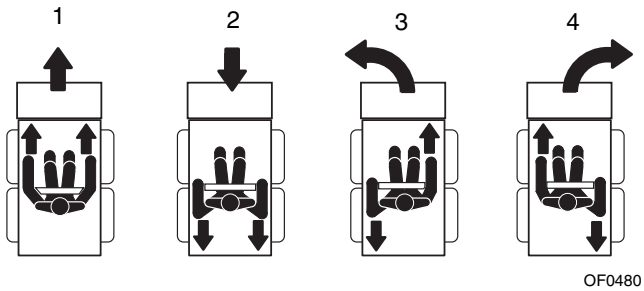


Figure 7-1 Travel Controls

To travel forward (Fig. 7-1, 1), both levers must move forward. To travel in reverse (2), both levers must move backward.

To turn left (Fig. 7-1, 3), the left lever goes back while the right lever goes forward. To turn right (4), the right lever goes back while the left lever goes forward.

To stop travel, return both levers to the center (NEUTRAL) position. Refer to the Owners/Operators Manual for more detailed operational instructions.

7.2.2 Travel/Steering Lever Maintenance Checks

a. Travel/Steering Control Assembly Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

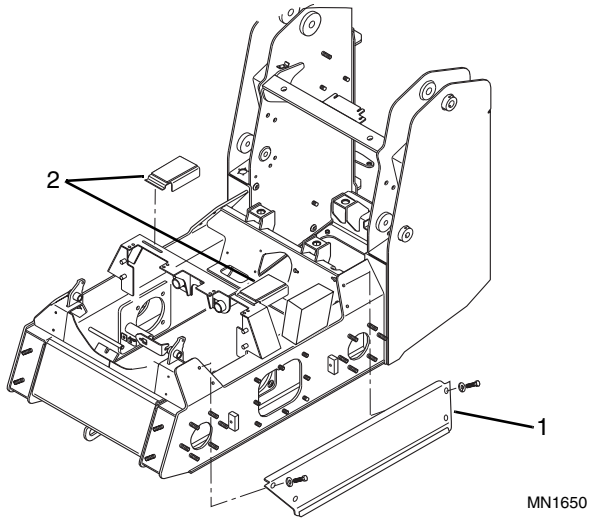


Figure 7-2 Chassis Panel Removal

2. Remove the left (Fig. 7-2, 1) and right (not shown) side panels from the chassis, and both seal covers (2) from the travel/steering lever crossmember.

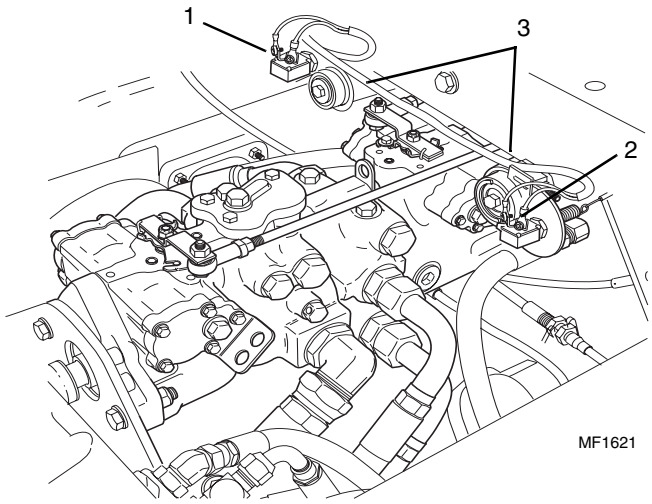


Figure 7-3 Back-up Alarm Switch Connections Model 2000D Shown - Others Similar

3. Disconnect wires from both back-up alarm switches (Fig. 7-3, 1 & 2), and move the switch wire harness (3) to the left side of the vehicle.

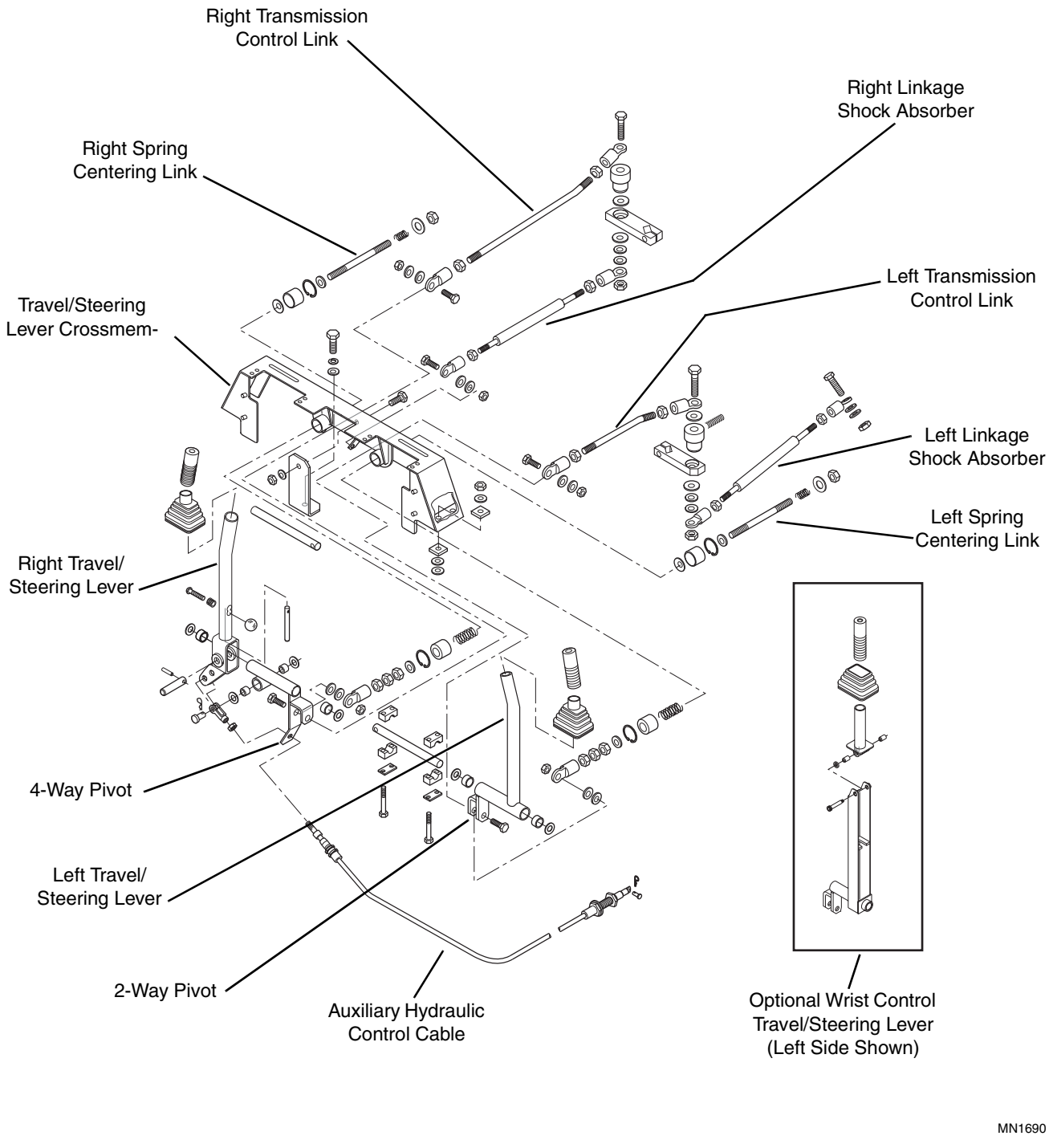


Figure 7-4 Model 1750D Travel Lever Linkage Components

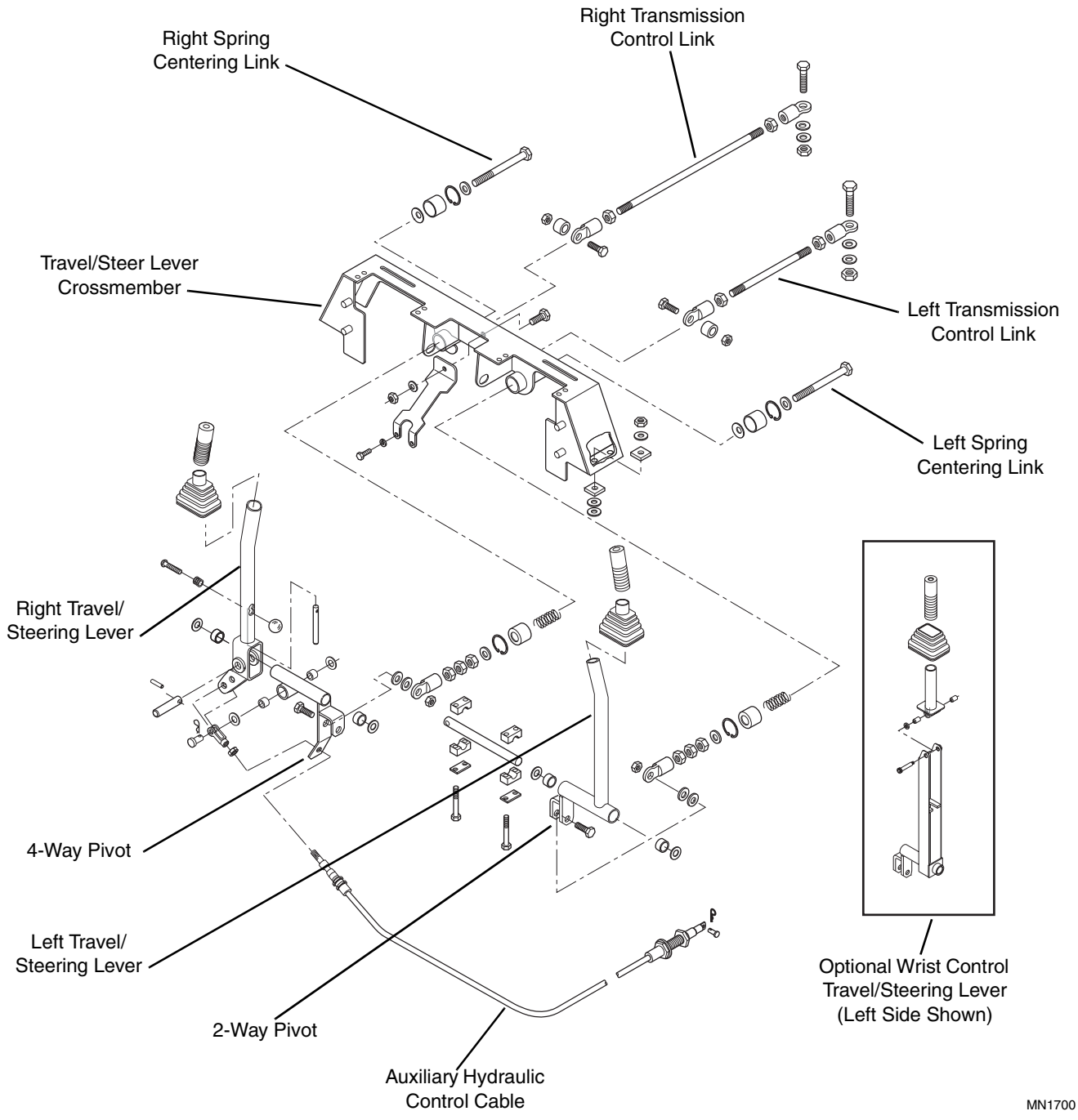


Figure 7-5 Model 2000D/DX and 2300D/DX Travel Lever Linkage Components

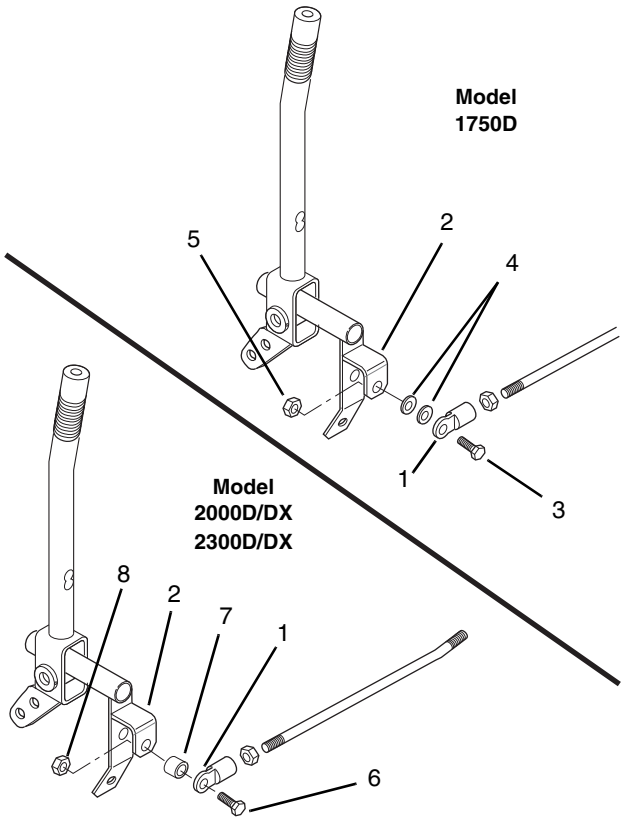


Figure 7-6 Right Side Link Removal

4. Disconnect right side link rod ball joint (Fig. 7-6, 1) from the right travel/steering lever 4-way pivot (2) by removing the following:

   Model 1750D Only - Capscrew (Fig. 7-6, 3), two flat washers (4), and locknut (5).

   Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-6, 6), spacer (7), and locknut (8).

5. Mark the ball joint position on the link rod threads for later use if the ball joint will be removed from the link rod.

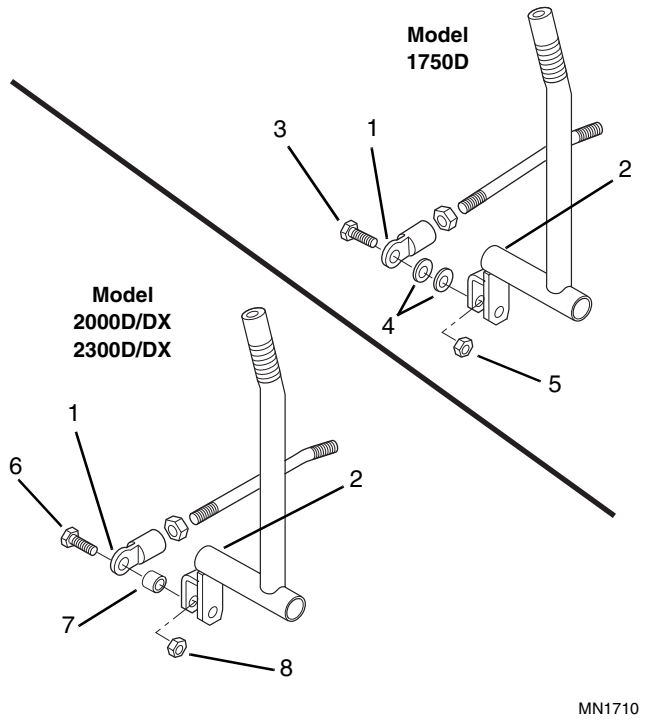


Figure 7-7 Left Side Link Removal

6. Disconnect the left side link rod ball joint (Fig. 7-7, 1) from the left travel/steering lever 2-way pivot (2) by removing the following:

   Model 1750D Only - Capscrew (Fig. 7-7, 3), two flat washers (4), and locknut (5).

   Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-7, 6), spacer (7), and locknut (8).

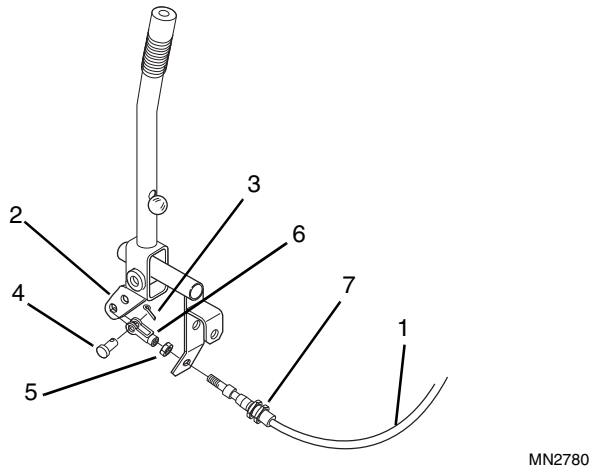


Figure 7-8 Auxiliary Hydraulic Control Cable Removal

7. Disconnect the auxiliary hydraulic control cable (Fig. 7-8, 1) from the 4-way pivot (2) by removing the spring clip (3) and clevis pin (4).
8. Loosen the hex jam nut (Fig. 7-8, 5) against the clevis (6), and remove the clevis and hex jam nut from the end of the cable.
9. Remove the bulkhead nut (Fig. 7-8, 7) from the cable housing (1), and pull the cable out of the 4-way pivot (2).
10. Place a support under the implement pump at the front of the hydrostatic transmission.

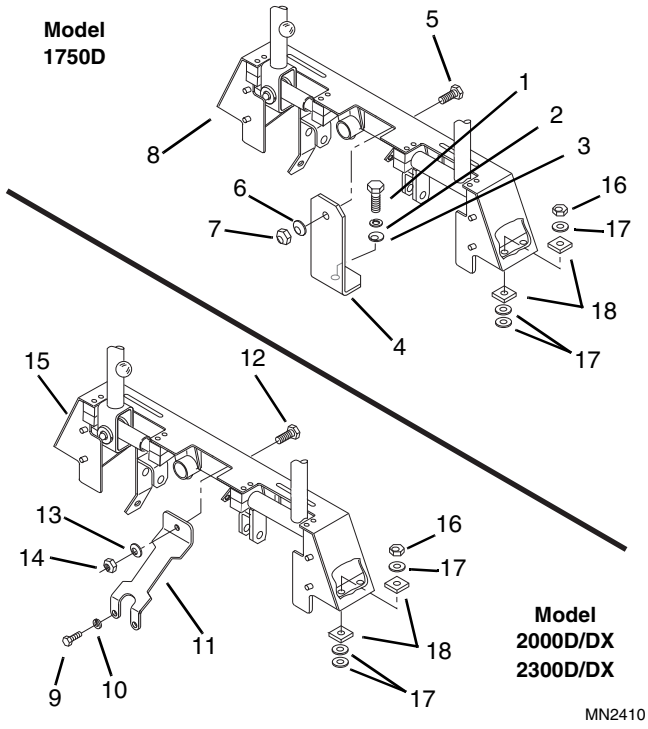


Figure 7-9 Lever Crossmember Removal

11. Remove the front support bracket as follows:

    Model 1750D - Remove the capscrew (Fig. 7-9, 1) lockwasher (2), and flat washer (3) attaching the front support bracket (4) to the implement pump. Remove the capscrew (5), flat washer (6), and elastic hex locknut (7) attaching the front support bracket (4) to the lever crossmember (8), and remove the support.

    Model 2000D/DX and 2300D/DX - Remove two capscrews (Fig. 7-9, 9) and lockwasher (10) attaching the front support bracket (11) to the implement pump. Remove the capscrew (12), flat washer (13), and elastic hex locknut (14) attaching the front support bracket (11) to the lever crossmember (15), and remove the support.
12. Remove locknuts (Fig. 7-9, 16), washers (17), and isolator pads (18) from both sides.
13. Lift the travel/steering lever crossmember out of the vehicle as an assembly. This will allow for further disassembly on a workbench.

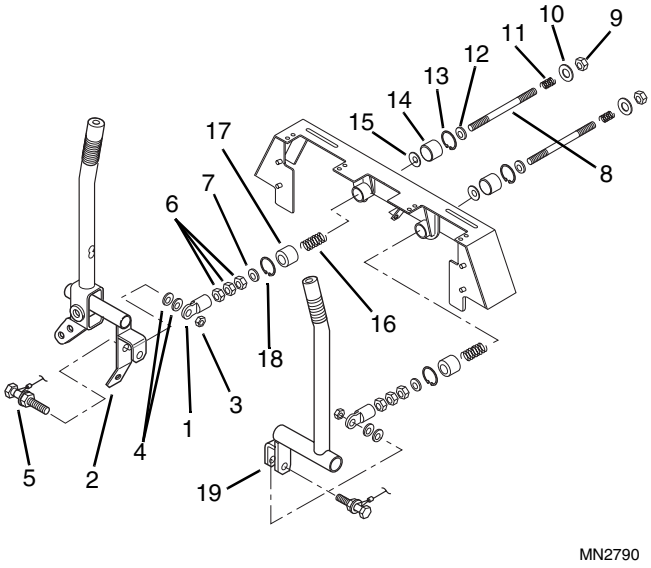


Figure 7-10 Spring Centering Link Disassembly Model 1750D Only

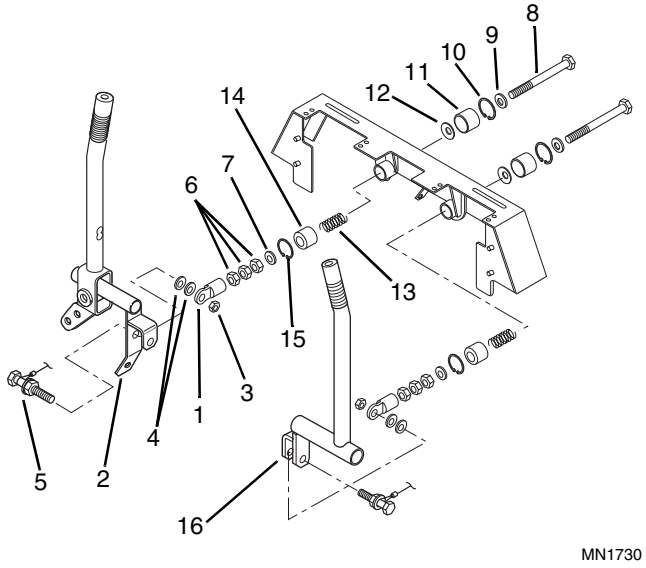


Figure 7-11 Spring Centering Link Disassembly Model 2000D/DX, 2300D/DX Only

b. Travel/Steering Lever Spring Centering Link Disassembly

Model 1750D:

1. Disconnect the spring assembly link rod ball joint (Fig. 7-10, 1) from the right travel/steering lever 4-way pivot (2) by removing locknut (3), washers (4), and capscrew (5). Loose assemble the washers and locknut to the capscrew, and let it hang by the back-up alarm tether.
2. Remove ball joint (Fig. 7-10, 1), hex jam nuts (6) and washer (7) from linkage rod (8).
3. Remove linkage rod (Fig. 7-10, 8), nut (9), washer (10), spring (11) and washer (12) from the spring assembly by pulling it out from the back side.
4. Remove rear retaining ring (Fig. 7-10, 13), rear spring guide (14), spring washer (15), spring (16), front spring guide (17) and front retaining ring (18) from the crossmember bore.
5. Repeat Steps 1 - 4 above for disassembly of the spring assembly on the left travel/steering lever 2-way pivot (Fig. 7-10, 19).

Model 2000D/DX and 2300D/DX:

1. Disconnect the spring assembly link rod ball joint (Fig. 7-11, 1) from the right travel/steering lever 4-way pivot (2) by removing locknut (3), washers (4), and capscrew (5). Loose assemble the washers and locknut to the capscrew, and let it hang by the back-up alarm tether.
2. Remove ball joint (Fig. 7-11, 1), hex jam nuts (6) and washer (7) from capscrew (8). Remove capscrew (8) and washer (9) from the spring assembly by pulling it out from the back side.
3. Remove rear retaining ring (Fig. 7-11, 10), rear spring guide (11), spring washer (12), spring (13), front spring guide (14) and front retaining ring (15) from the crossmember bore.
4. Repeat Steps 1 - 4 above for disassembly of the spring assembly on the left travel/steering lever 2-way pivot (Fig. 7-11, 16).

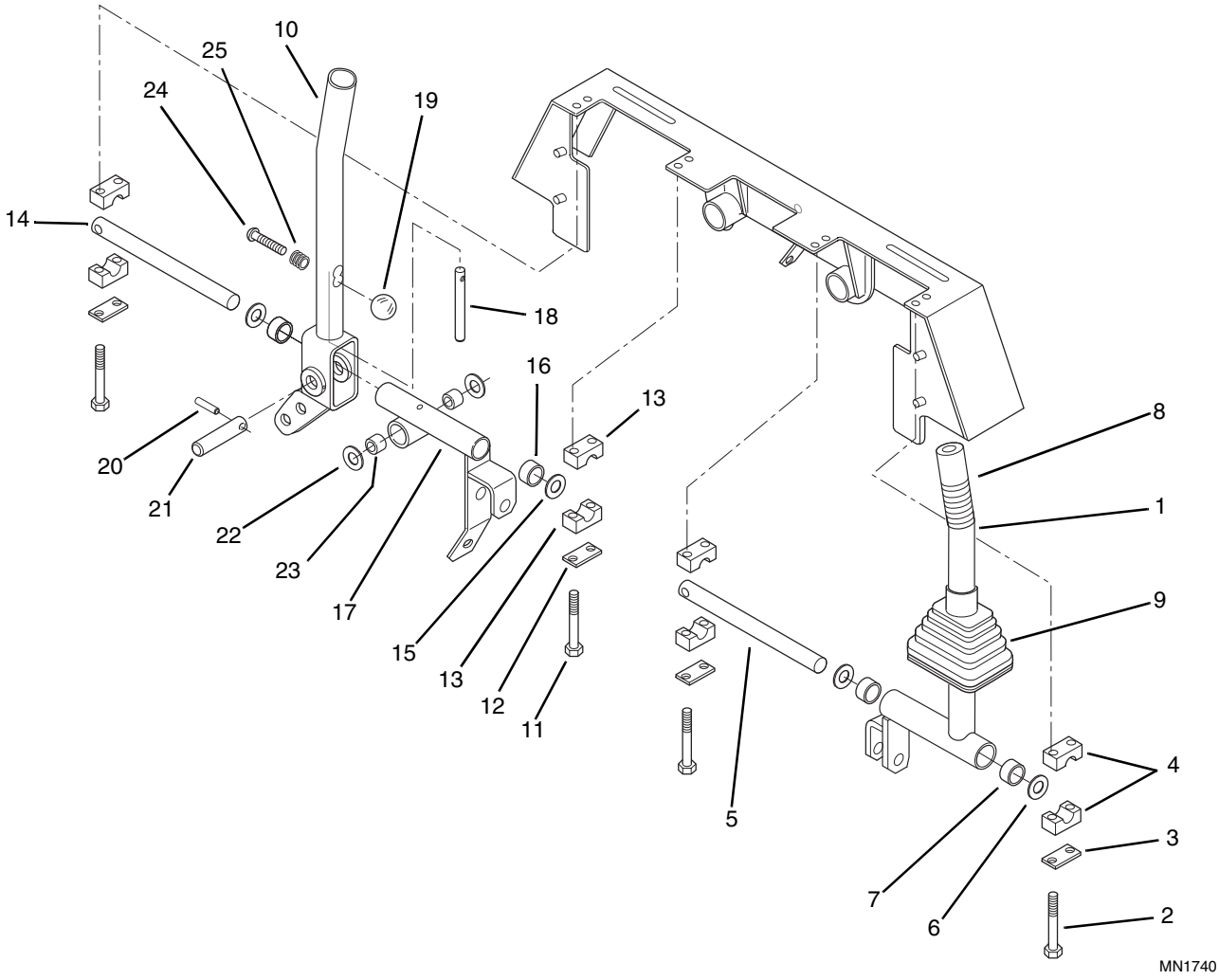


Figure 7-12 Travel/Steering Lever Disassembly

c. Travel/Steering Lever Disassembly

1. Remove the left travel/steering lever (Fig. 7-12, 1) from the crossmember by removing capscrews (2), clamp covers (3), and half clamps (4) from both sides of the lever. Remove the lever. Remove pivot pin (5), shims (6), plastic bushings (7), hand grip (8) and boot (9).
2. Remove the right travel/steering lever (Fig. 7-12, 10) from the crossmember by removing capscrews (11), clamp covers (12), and half clamps (13). Remove the lever. Remove pin (14), shims (15), and plastic bushings (16).
3. Remove 4-way pivot (Fig. 7-12, 17) from lever (10) by first lifting up on the lever locking pin (18) using the knob (19). Remove the roll pin (20) and tap out the pivot pin (21). Remove shims (22) and bushings (23) from 4-way pivot lever.
4. Remove the lever locking pin (Fig. 7-12, 18) from the lever (10) by removing slotted capscrew (24), spring (25), and knob (19). The locking pin (18) will drop out of the bottom of the travel/steering lever. Remove the hand grip and boot from the lever.

d. Inspection

1. Clean all parts with a suitable solvent.
2. Check that boot is not cracked.
3. Check that rods and levers are not bent.
4. Check bushings (Fig. 7-12, 7, 16 & 23) and shims (6, 15 & 22) in lever pivots for excessive wear. Replace as necessary.
5. Inspect all pins and ball joints for wear.
6. Check springs for damage or weakness.

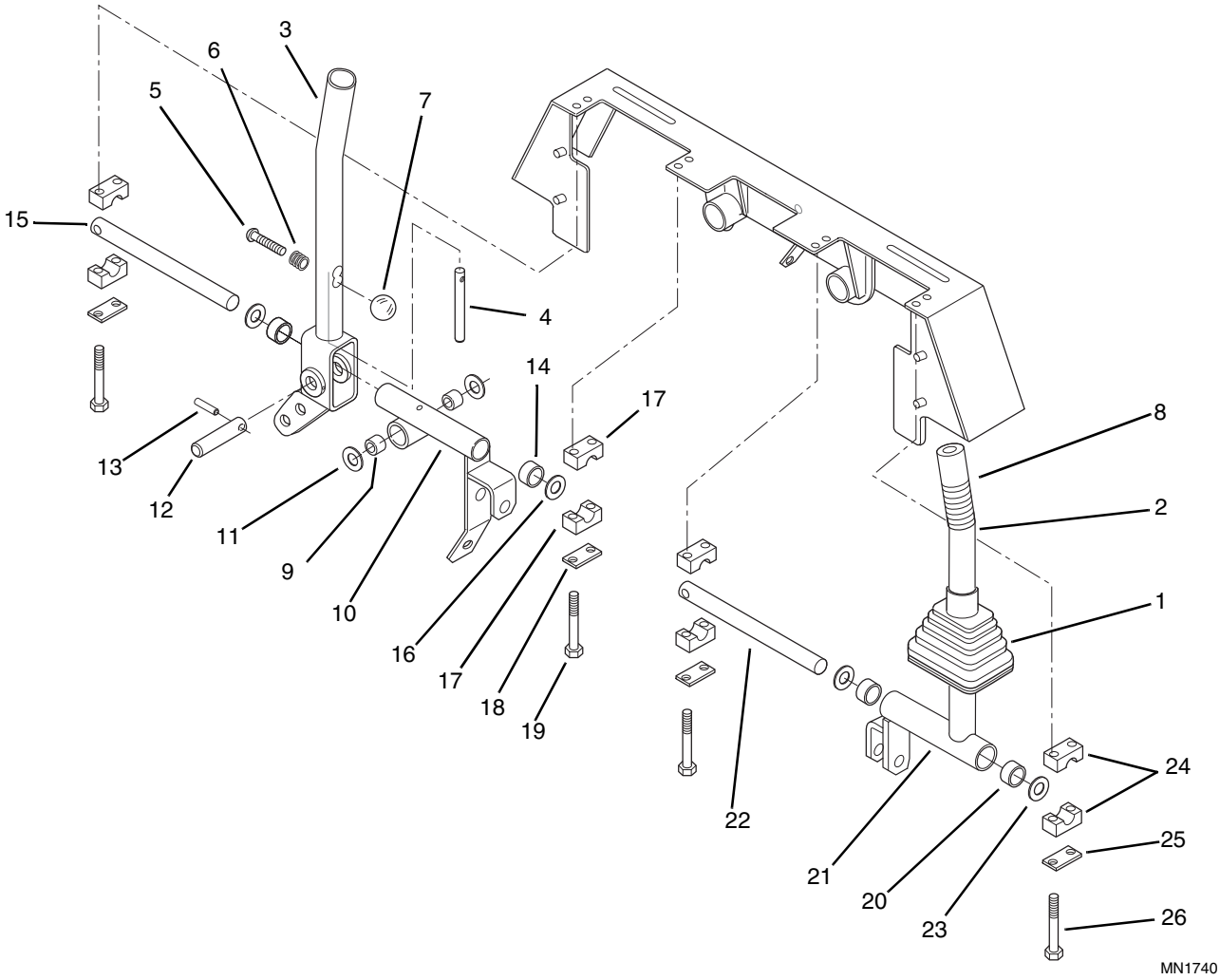


Figure 7-13 Travel/Steering Lever Assembly

e. Travel/Steering Lever Assembly

1. Install the boots (Fig. 7-13, 1) on both travel/steering levers (2 & 3).
2. Install the lever lock pin (Fig. 7-13, 4) into the bottom of the right travel/steering lever (3), and secure by installing the slotted capscrew (5) and spring (6) through lock pin (4), threading fully into knob (7) and tighten.

Note: *Apply Loctite Threadlocker to capscrew (5) before installing.*

3. Install the hand grips (Fig. 7-13, 8) on both travel/steering levers.
4. Install bushings (Fig. 7-13, 9) into each side of the right travel/steering lever 4-way pivot (10). Position the 4-way lever into the travel/steering lever, and secure with shims (as required) (11), pivot pin (12) and roll pin (13).
5. Insert plastic bushings (Fig. 7-13, 14) into each end of the 4-way pivot (10), install pin (15) and shims (as required) (16) on each end of the pin, and secure the assembly into the crossmember using half clamps (17), clamp covers (18), and capscrews (19) on both ends of pin (15).
6. Insert plastic bushings (Fig. 7-13, 20) into each end of the left travel/steering lever 2-way pivot (21), install pin (22) and shims (as required) (23) on each end of the pin, and secure the assembly into the crossmember using half clamps (24), clamp covers (25), and capscrews (26) on both ends of pin (22).

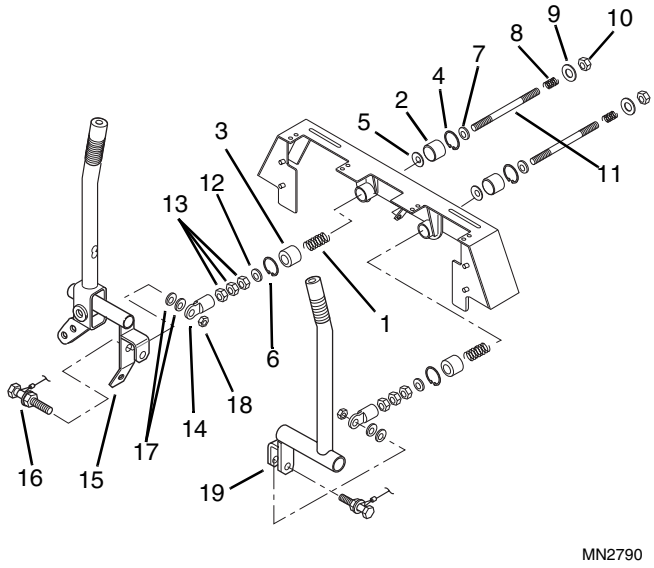


Figure 7-14 Spring Centering Link Assembly Model 1750D Only

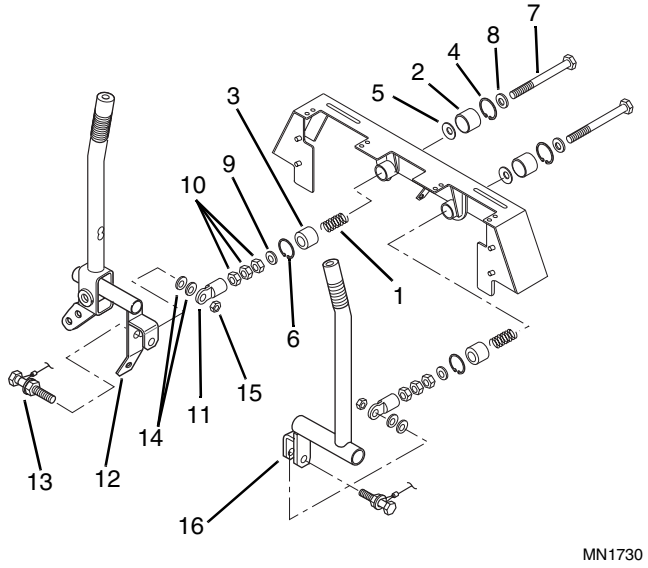


Figure 7-15 Spring Centering Link Assembly Model 2000D/DX, 2300D/DX Only

f. Travel/Steering Lever Spring Centering Link Assembly

Model 1750D:

1. Lubricate the centering spring (Fig. 7-14, 1), spring guides (2 & 3), and the spring housing bore in the crossmember with a molybdenum (moly) disulfide anti-seize compound.
2. Install the rear retaining ring (Fig. 7-14, 4), rear spring guide (2), spring washer (5), spring (1), front spring guide (3), and front retaining ring (6) into the crossmember bore.
3. Install the washer (Fig. 7-14, 7), spring (8), washer (9) and nut (10) onto linkage rod (11), and install into the spring assembly in the crossmember bore by pushing it in from the rear. Install the washer (12), hex jam nuts (13) and ball joint (14) to the front of the linkage rod (11).
4. Connect and secure the spring assembly link rod ball joint (Fig. 7-14, 14) to the right travel/steering lever 4-way pivot (15) using a capscrew (16), washers (17) and locknut (18).
5. Repeat Steps 1 through 4 above for reassembly of the spring assembly on the left travel/steer lever 2-way pivot (Fig. 7-14, 19).

Model 2000D/DX and 2300D/DX:

1. Lubricate the centering spring (Fig. 7-15, 1), spring guides (2 & 3), and the spring housing bores in the crossmember with a molybdenum (moly) disulfide anti-seize compound.
2. Install the rear retaining ring (Fig. 7-15, 4), rear spring guide (2), spring washer (5), spring (1), front spring guide (3), and front retaining ring (6) into the crossmember bore.
3. Install the capscrew (Fig. 7-15, 7) and washer (8) into the back of the spring assembly. Install the washer (9), hex jam nuts (10) and ball joint (11) to the front of the capscrew (7).
4. Connect and secure the spring assembly link ball joint (Fig. 7-15, 11) to the right travel/steering lever 4-way pivot (12) using a capscrew (13), washers (14) and locknut (15).
5. Repeat Steps 1 through 4 above for reassembly of the spring assembly on the left travel/steering lever 2-way pivot (Fig. 7-15, 16).

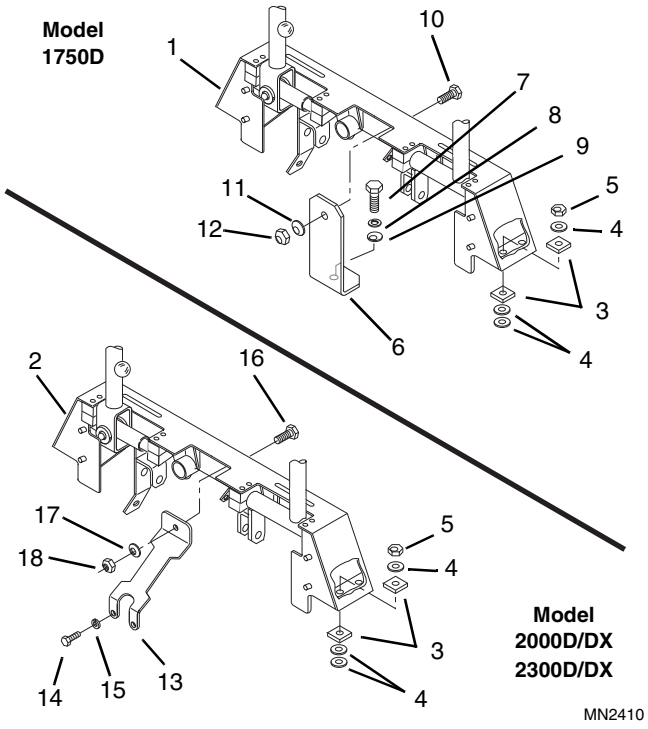


Figure 7-16 Lever Crossmember Installation

g. Travel/Steering Control Assembly Installation

1. Lift the travel/steering lever crossmember (Fig. 7-16, 1 or 2) into the vehicle as an assembly.
2. Install the isolator pads (Fig. 7-16, 3), washers (4) and new locknuts (5) to each side of the crossmember. Snug nuts to slightly pre-load the rubber isolator pads (3). Do not overtighten.
3. Install the front support bracket as follows:

   Model 1750D - Install the front support bracket (Fig. 7-16, 6) to the charge/implement pump using capscrew (7), lockwasher (8), and flat washer (9). Install the capscrew (10), flat washer (11), and elastic hex locknut (12) attaching the front support bracket (6) to the lever crossmember (1), and tighten.

   Model 2000D/DX and 2300D/DX - Install the front support bracket (Fig. 7-16, 13) to the implement pump using two capscrews (14) and lockwashers (15). Torque both capscrews (14) to 27-31 lb/ft (37-42 Nm). Install the capscrew (16), flat washer (17), and elastic hex locknut (18) attaching the front support bracket (13) to the lever crossmember (2), and tighten.
4. Remove the support placed under the implement pump at the front of hydrostatic transmission.

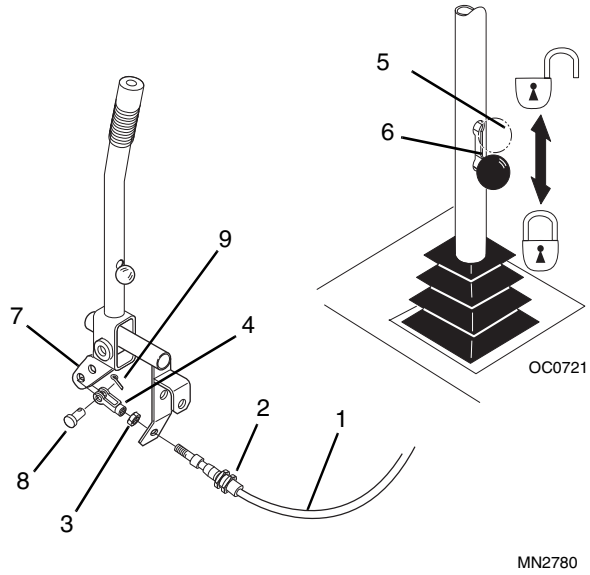


Figure 7-17 Auxiliary Hydraulic Control Cable Installation

5. Install the control cable (Fig. 7-17, 1) into the right travel/steering lever 4-way pivot, and secure with the bulkhead nut (2).
6. Install the hex nut (Fig. 7-17, 3) and clevis (4) loosely onto the threaded end of the control cable (1).
7. Center the right travel/steering lever by engaging the control lever lockout. Pulling the lockout knob (Fig. 7-17, 5) out slightly, push the knob down to the bottom of the slot (6), and release.
8. Turn the cable yoke (Fig. 7-17, 4) as required to align it with the lower hole in the control lever (7). Insert the clevis pin (8), secure with a new spring clip (9), and tighten the hex nut (3) against the yoke (4).
9. Release the control lever lockout. Pull the lockout knob (Fig. 7-17, 6) out slightly, pull the knob up to the top of the slot (5), and release.
10. Operate the control lever to ensure that the control valve spool moves fully into all of its operating positions. Readjust if required.

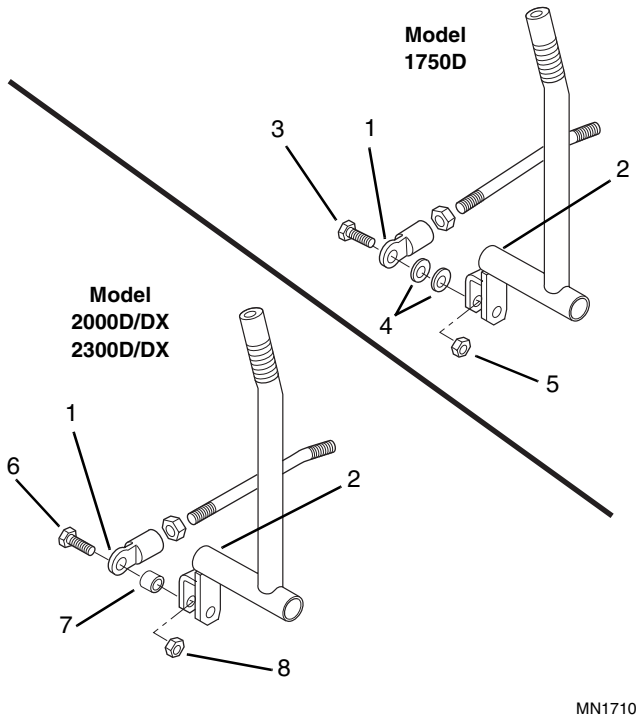


Figure 7-18 Left Side Link Installation

11. Connect the left side link rod ball joint (Fig. 7-18, 1) to the left travel/steering lever 2-way pivot (2) by installing and securing the following:

    Model 1750D Only - Capscrew (Fig. 7-18, 3), two flat washers (4), and locknut (5).

    Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-18, 6), spacer (7), and locknut (8).

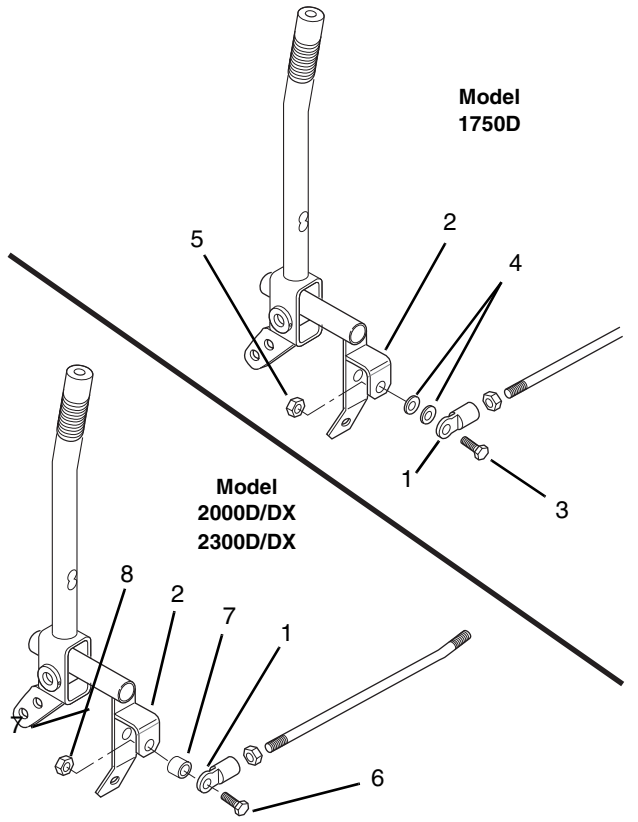


Figure 7-19 Right Side Link Installation

12. Connect right side link rod ball joint (Fig. 7-19, 1) to the right travel/steering lever 4-way pivot (2) by installing and securing the following:

    Model 1750D Only - Capscrew (Fig. 7-19, 3), two flat washers (4), and locknut (5).

    Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-19, 6), spacer (7), and locknut (8).

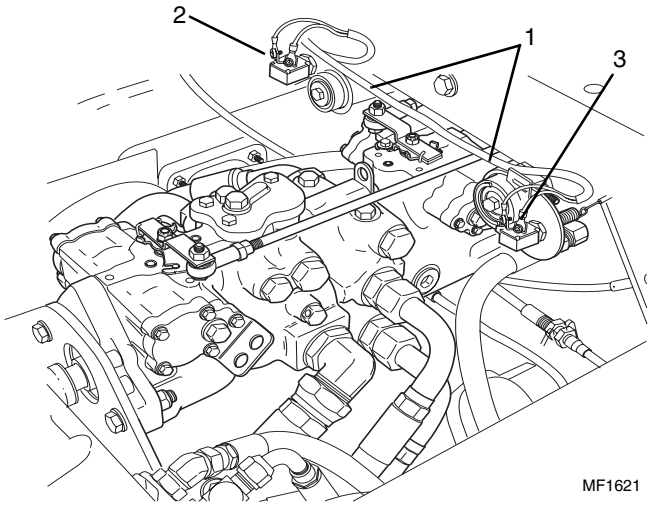


Figure 7-20 Back-up Alarm Switch Connections Model 2000D Shown - Others Similar

13. Route the back-up alarm switch wiring harness (Fig. 7-20, 1) along the rear edge of the crossmember, and secure with tie wraps. Connect the harness leads to both back-up alarm switches (2 & 3).

Note: *The back-up alarm switch harness leads are NOT polarity sensitive, so they can be individually connected to the switch terminals as desired.*

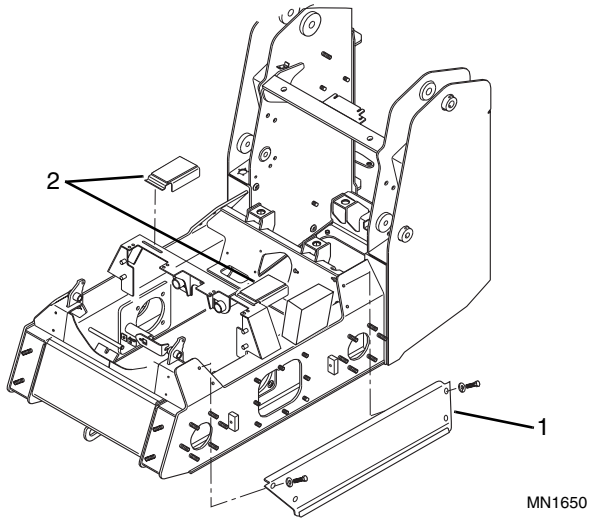


Figure 7-21 Chassis Panel Installation

14. Install the left (Fig. 7-21, 1) and right (not shown) side panels to the chassis, and both seal covers (2) to the travel/steering lever crossmember.
15. Adjust travel/steering levers (Refer to Section 7.2.3, “Neutral Centering & Travel/Steering Lever Adjustment - Model 1750D” or Section 7.2.4, “Neutral Centering & Travel/Steering Lever Adjustment - Model 2000D/DX & 2300D/DX”).
16. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

7.2.3 Neutral Centering & Travel/Steering Lever Adjustment - Model 1750D

a. Neutral Centering Adjustment

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: This procedure requires that the vehicle be raised off the ground. To prevent personal injury, be certain that jack stands or support blocks being used are stable and strong enough to support the weight of the vehicle.

IMPORTANT: *Without an implement or bucket attached to the loader arm quick attach, the vehicle is rear end heavy. When raising the vehicle, raise the rear first and place support blocks under the rear of drive chain cases, not under the slanted part of the fuel and hydraulic oil reservoirs.*

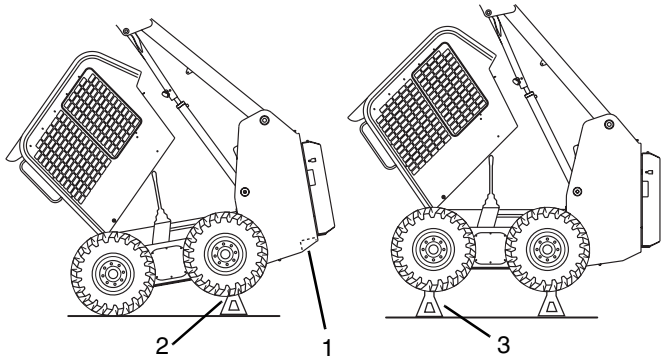


Figure 7-22 Jack Stand Placement

2. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear frame crossmember (Fig. 7-22, 1).
3. Place jack stands (Fig. 7-22, 2) under the rear left and right frame of the vehicle. If jack stands are not available, support blocks may be used. Lower the rear of the vehicle down onto the jack stands or support blocks.
4. Raise the front of the vehicle with a floor jack and place jack stands (Fig. 7-22, 3) under the front of each chain case. If jack stands are not available, support blocks may be used under the chain cases. Lower the front of the vehicle onto the jack stands or support blocks.
5. With the vehicle supported and all tires off the ground, start the engine and set the throttle at "low idle." Allow the vehicle hydraulic oil to warm up to normal operating temperature [110°F (43°C)], and shut the engine OFF.

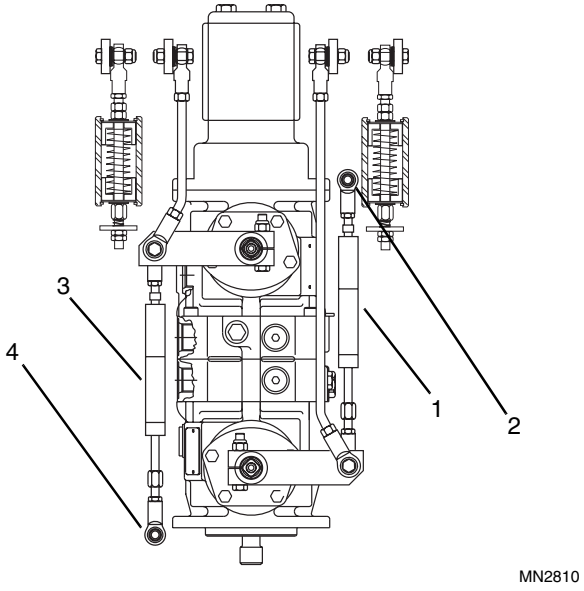


Figure 7-23 Travel/Steering Linkage Shock Absorbers Model 1750D

6. Disconnect the right control linkage shock absorber (1) by removing the hex locknut, flat washers and capscrew (Fig. 7-23, 2) securing it to the hand control crossmember, and allow the shock to hang free.
7. Disconnect the left control linkage shock absorber (Fig. 7-23, 3) by removing the hex locknut, flat washers and capscrew (4) securing it to the rear transmission mount, and allow the shock to hang free.

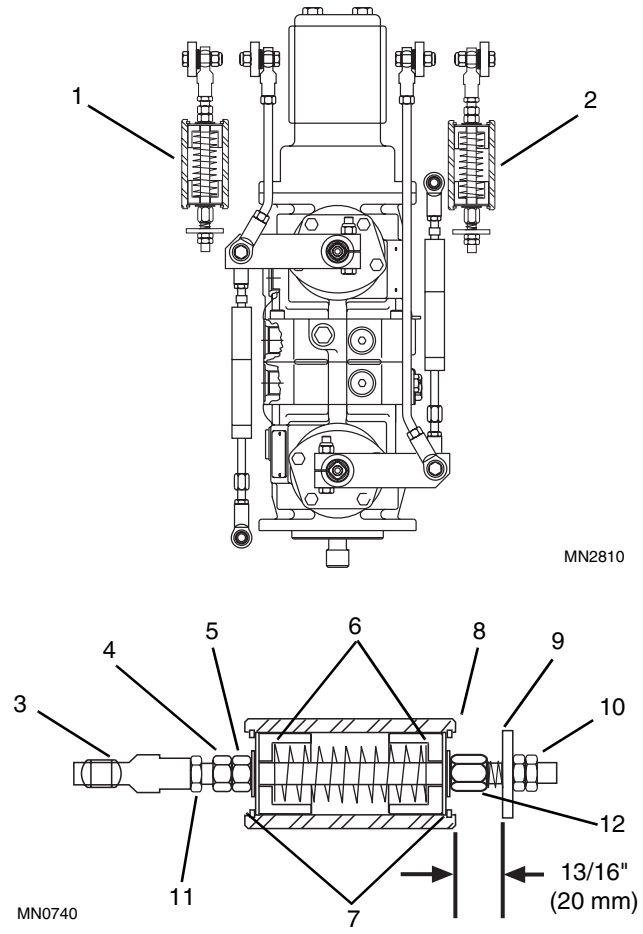


Figure 7-24 Centering Spring Assembly Model 1750D

Note: *The centering spring assemblies (Fig. 7-24, 1 & 2) return the travel/steering levers to the NEUTRAL (center) position when it is released during operation. Perform the following procedure for each lever:*

8. There cannot be any end-play in the centering spring assembly. Check for end-play by lightly pushing and pulling on the spring housing assembly ball joint (Fig. 7-24, 3).

   If end-play is detected, loosen the hex jam nut (Fig. 7-24, 4), and adjust nut (5) to position the spring guides (6) against the retaining rings (7) with minimal force. Once end-play has been eliminated, retighten the hex jam nut (4).

9. Measure the distance between the rear of the spring centering assembly bore (Fig. 7-24, 8) on the hand control crossmember and the front face of washer (9). Adjust nut (10) if required to 13/16" (20 mm).

   Repeat on other spring centering assembly.

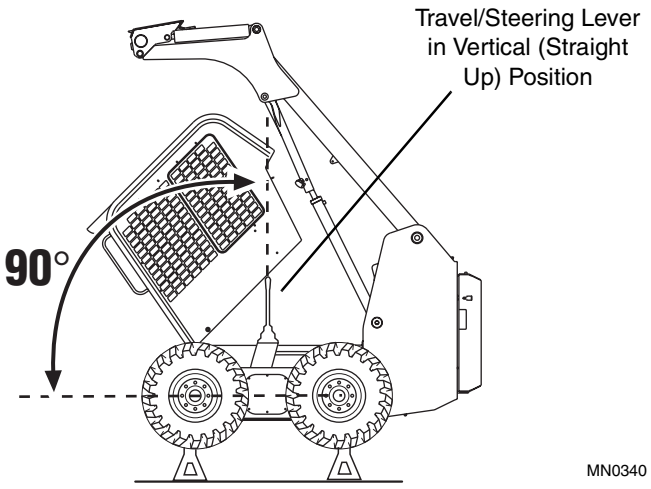


Figure 7-25 Travel/Steering Lever Position

10. If both (left and right) travel/steering levers are not in a vertical (straight up) position (Fig. 7-25), perform Steps 11 through 13. If both levers are in a vertical position, proceed to Step 14.

Note: *Vehicles equipped with an Enclosed Cab kit have the travel/steering levers positioned slightly toward the front, at an angle of 85°.*

11. Loosen the hex jam nut (Fig. 7-24, 11) on the centering spring assembly ball joints (3).
12. Turn the hex nut (Fig. 7-24, 12) on the opposite side of the spring assembly to adjust the vertical (NEUTRAL) position of the travel/steering lever.
13. Tighten the ball joint hex jam nut (Fig. 7-24, 11) against the ball joint once the travel/steering lever(s) has been adjusted to the vertical (straight up) position (Fig. 7-25).

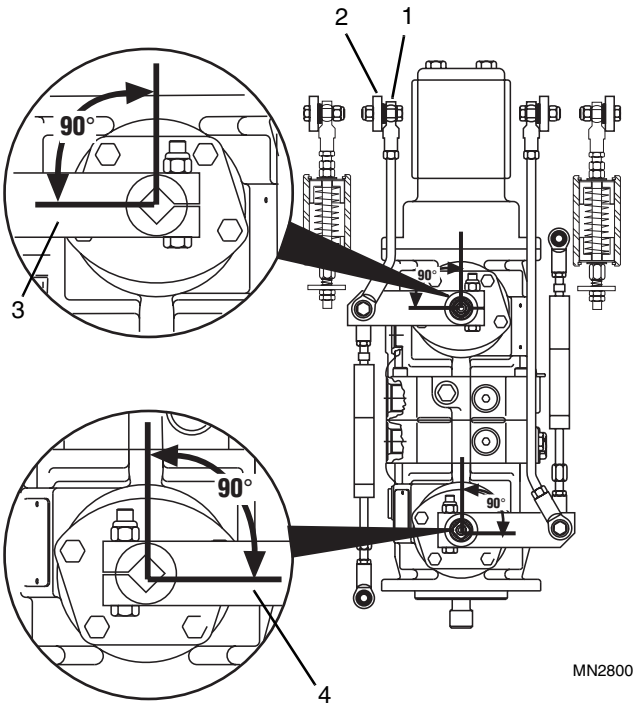


Figure 7-26 Transmission Lever Neutral Position Model 1750D

14. Disconnect the left transmission control rod ball joint (Fig. 7-26, 1) from the travel/steering lever (2). Place the corresponding transmission lever (3) in a position that is 90 degrees to the centerline of the transmission housing (4). This will be the approximate location of NEUTRAL.

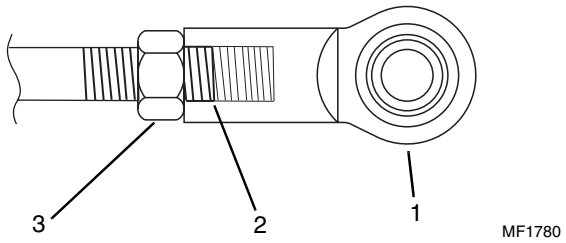


Figure 7-27 Ball Joint Thread Engagement

15. Adjust the transmission control rod ball joints (Fig. 7-27, 1), ensuring adequate thread engagement (2) on both ends, so that the control rod lines up with the attaching points on the travel/steering lever in its center position. Connect and tighten the ball joint hex jam nut (3) against the ball joint.
16. Perform Steps 14 and 15 for the right travel/steering lever (Fig. 7-26, 4) before starting the vehicle in the next step.
17. Start the vehicle and observe the wheels for rotation. They should not be moving in either direction. If the wheels are moving, make note of the direction of rotation.

    If the wheels are rotating in a reverse direction, the overall length of the rod (Fig. 7-28, 1 or 4) will need to be shortened by adjusting the ball joints (2 & 3 or 5 & 6) closer together. If the wheels are rotating in a forward direction, the overall length of the rod (1 or 4) will need to be lengthened by adjusting the ball joints (2 & 3 or 5 & 6) further apart.

    In either case, disconnect the ball joint (Fig. 7-28, 2 or 5) at the travel/steering lever. Adjust the ball joints in the appropriate direction, and ensure adequate thread engagement (Fig. 7-27, 2) on both ends.

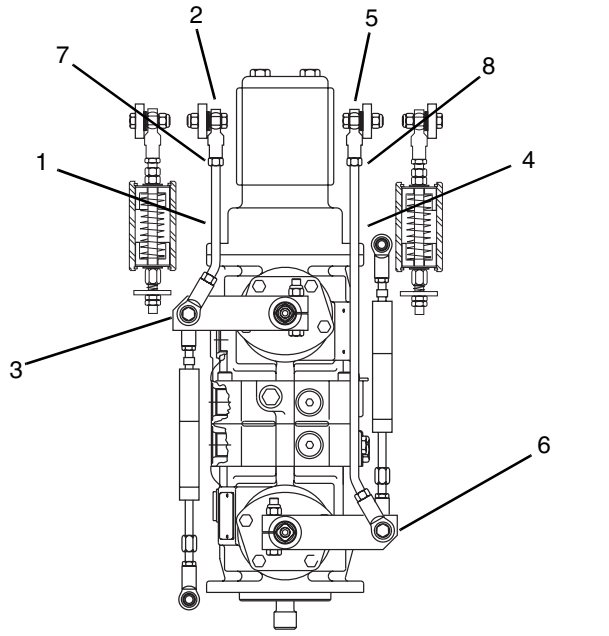


Figure 7-28 Control Rods Model 1750D

18. Reconnect and tighten the transmission control rod ball joints (Fig. 7-28, 2 & 5) and hex jam nuts (7 and 8).

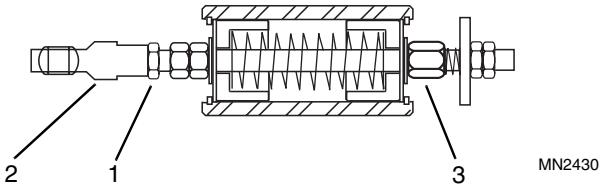


Figure 7-29 Centering Spring Fine Adjustment Model 1750D

19. Start the engine. If the wheels still rotate once the transmission control rod has been secured, and only a fine adjustment is necessary, loosen the hex jam nut (Fig. 7-29, 1) on the spring housing assembly ball joint (2). Turn the nut (3) on centering spring assembly until the wheels stop rotating.
20. Tighten the hex jam nut (Fig. 7-29, 1) once the final adjustment has been made.
21. Repeat Steps 17 through 20 for the other travel/ steering lever.
22. Adjust the exposed length of the right shock absorber rod (Fig. 7-30, 1), from the shock absorber body to the inside face of the hex nut on the rod, to 1-7/16" (36 mm), with the front ball joint aligned with its mounting hole in the hand control crossmember bracket (2).
23. Connect the right control linkage shock absorber by installing the capscrew (Fig. 7-30, 3), flat washers (4), and hex locknut (5) securing the shock ball joint (6) to the hand control crossmember bracket (2).
24. Adjust the exposed length of the left shock absorber rod (Fig. 7-30, 7), from the shock absorber body to the inside face of the hex nut on the rod, to 1-7/16" (36 mm), with the rear ball joint aligned with its mounting hole in the rear transmission mount bracket (8).

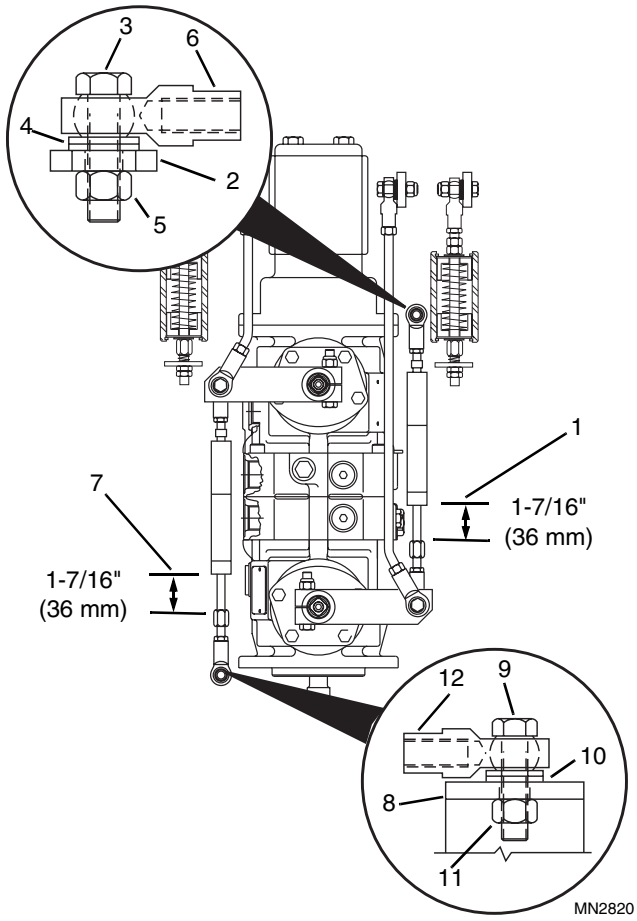


Figure 7-30 Travel/Steering Linkage Shock Absorbers Model 1750D

25. Connect the left control linkage shock absorber by installing the capscrew (Fig. 7-30, 9), flat washers (10), and hex locknut (Fig. 7-30, 11) securing the shock ball joint (12) to the rear transmission mount bracket (8).
26. Proceed to “Neutral Centering Test” (on the next page) to ensure that both of the transmission control rods are positioning the transmissions in the exact NEUTRAL position.

b. Neutral Centering Test

1. Lower the Operator's Protective Structure and start engine. With engine speed at low idle, stroke levers fully forward and release.
2. Stroke levers fully backward and release.
3. Stroke levers halfway forward and release.
4. Stroke levers halfway backward and release.
5. With engine speed at high idle, stroke levers fully forward and release.
6. Stroke levers fully backward and release.
7. Stroke levers halfway forward and release.
8. Stroke levers halfway backward and release.
9. With engine OFF, randomly stroke levers forward and backward. Start engine and check for wheel rotation. If wheels rotate, repeat the adjustment procedure (Refer to Section 7.2.3 a, "Neutral Centering Adjustment."
10. The shock absorber slows the travel/steering control levers return to the NEUTRAL position. The additional friction of the shock absorber may result in a slight tire rotation. If this rotation CANNOT be stopped by a very slight "jiggle" of the travel/steering control lever, the shock absorber is most likely defective and should be replaced.

IMPORTANT: *Without an implement or bucket attached to the loader arm, the vehicle is rear end heavy. When lowering vehicle, lower the front of vehicle to the ground first. DO NOT lower the rear of vehicle until the front of vehicle is on the ground.*

11. Raise the front of vehicle first, and remove the jack stands or support blocks. Lower the front to the ground.
12. Raise the rear of vehicle, and remove the jack stands or support blocks. Lower the rear to the ground.

7.2.4 Neutral Centering & Travel/Steering Lever Adjustment - Model 2000D/DX & 2300D/DX

a. Neutral Centering Adjustment

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

WARNING: This procedure requires that the vehicle be raised off the ground. To prevent personal injury, be certain that jack stands or support blocks being used are stable and strong enough to support the weight of the vehicle.

WARNING:
Models 2000D/DX & 2300D/DX: During cold weather conditions, it is not unusual for the travel hydraulic circuit to function very slowly or even become completely inoperative. Before moving the vehicle, make sure that the hydraulic oil is warmed up.

With seat bar in the up position (park lock engaged), hold the attachment tilt control in the tilt back position. This forces oil over relief, creating heat, which quickly elevates the hydraulic oil temperature.

After a short period of time (usually 1 to 3 minutes), the hydraulic oil should be at normal operating temperature. Move the vehicle at no load for one minute or until the transmission runs normally.

IMPORTANT: *Without an implement or bucket attached to the loader arm quick attach, the vehicle is rear end heavy. When raising the vehicle, raise the rear first and place support blocks under the rear of drive chain cases; not under the slanted part of the fuel and hydraulic oil reservoirs.*

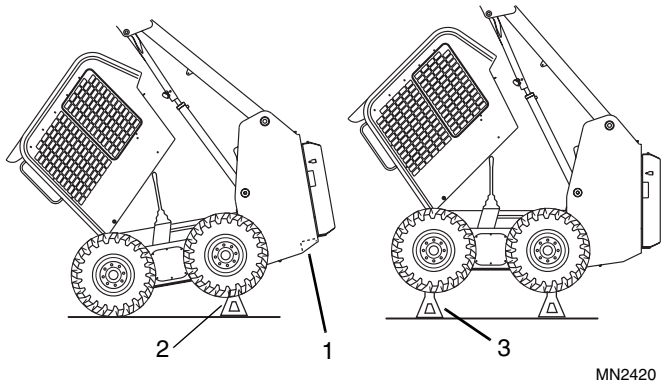


Figure 7-31 Jack Stand Placement

2. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear frame crossmember (Fig. 7-31, 1).
3. Place jack stands (Fig. 7-31, 2) under the rear left and right frame of the vehicle. If jack stands are not available, support blocks may be used. Lower the rear of the vehicle down onto the jack stands or support blocks.
4. Raise the front of the vehicle with a floor jack and place jack stands (Fig. 7-31, 3) under the front of each chain case. If jack stands are not available, support blocks may be used under the chain cases. Lower the front of the vehicle onto the jack stands or support blocks.
5. With the vehicle supported and all tires off the ground, start the engine and set the throttle at "low idle." Allow the vehicle hydraulic oil to warm up to normal operating temperature, and shut the engine OFF.

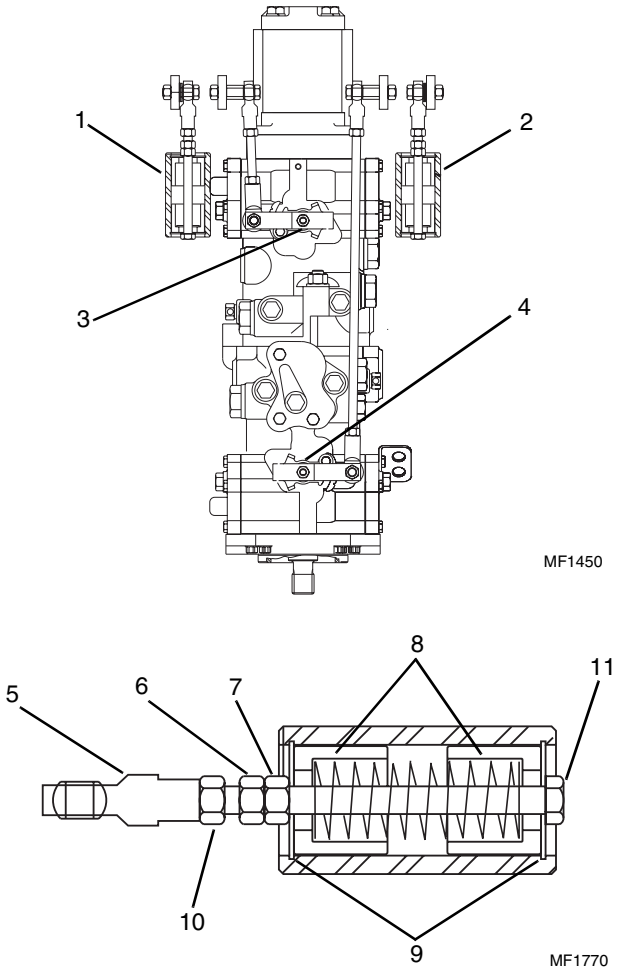


Figure 7-32 Centering Spring Assembly Model 2000D/DX & 2300D/DX

Note: *The centering spring assembly (Fig. 7-32, 1 & 2) returns the travel/steering lever to the NEUTRAL (center) position when it is released during operation. There are also centering springs (3 & 4) on the transmission levers that help bring the lever back to its center position. These two sets of centering springs must act together. Perform the following procedure for each lever:*

6. There cannot be any end-play in the spring housing assembly. Check for end-play by lightly pushing and pulling on the spring housing assembly ball joint (Fig. 7-32, 5).

   If end-play is detected, loosen the hex jam nut (Fig. 7-32, 6), and adjust the nut (7) to position the spring guides (8) against the retaining rings (9) with minimal force. Once end-play has been eliminated, retighten the hex jam nut (6).

   Repeat on other spring centering assembly.

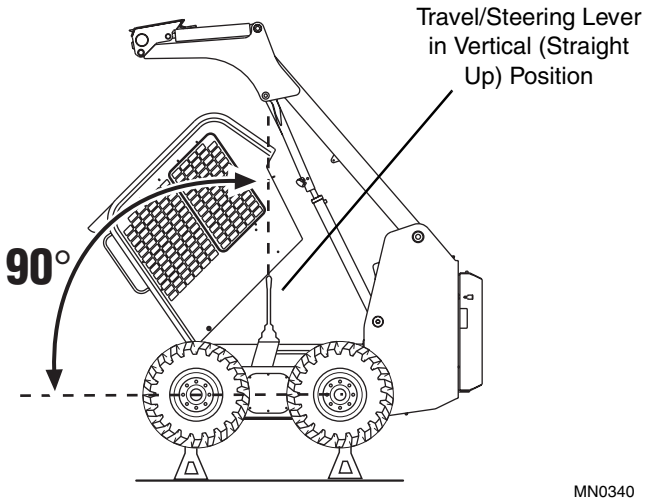


Figure 7-33 Travel/Steering Levers in Vertical (Straight Up) Position

7. If both (left and right) travel/steering levers are not in a vertical (straight up) position (Fig. 7-33), perform Steps 8 through 10. If they are, proceed to Step 11.

Note: *Vehicles equipped with an Enclosed Cab kit have the travel/steering levers positioned slightly toward the front, at an angle of 85°.*

8. Loosen the hex jam nut (Fig. 7-32, 10) on the centering spring assembly ball joints (5).
9. Turn the capscrew (Fig. 7-32, 11) on the opposite side of the centering spring assembly to adjust the vertical (NEUTRAL) position of the travel/steering lever.
10. Tighten the ball joint hex jam nut (Fig. 7-32, 10) against the ball joint once the travel/steering lever(s) has been adjusted to the vertical (straight up) position.

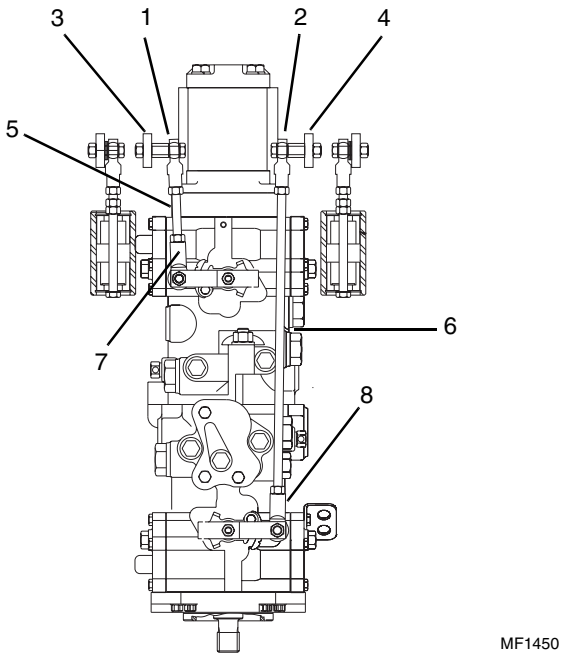


Figure 7-34 Control Rods - Model 2000D/DX & 2300D/DX

11. Disconnect the transmission control rod ball joints (Fig. 7-34, 1 & 2) from the travel/steering levers (3 & 4).
12. Start the engine.
13. The wheels should not turn in either direction with the control rod ball joints disconnected. The transmission levers are spring-loaded to the NEUTRAL position.

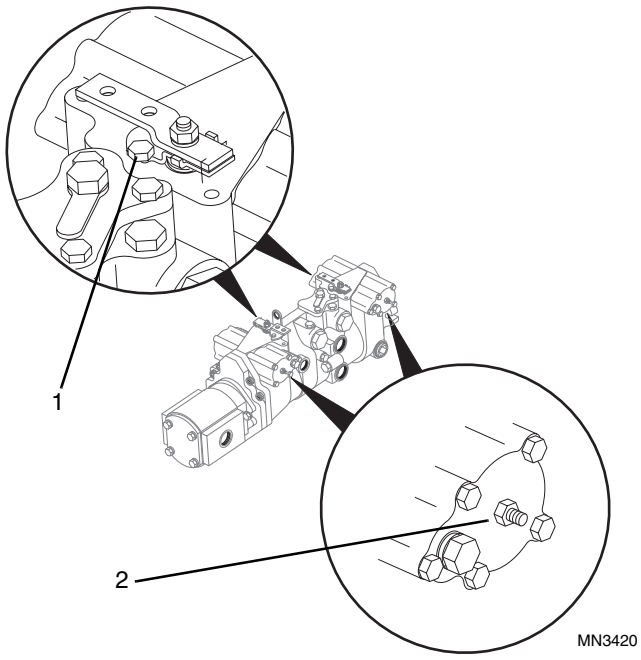


Figure 7-35 Transmission Neutral Adjustments

If the wheels rotate, one of two transmission neutral adjustments (Fig. 7-35, 1 & 2), originally set by the transmission manufacturer, may have been tampered with. If the wheels rotate while in this position, these transmission neutral adjustments must be checked and readjusted if required. Refer to Section 7.2.4 c, “Main Travel Control Pump Neutral Centering” for the procedure.

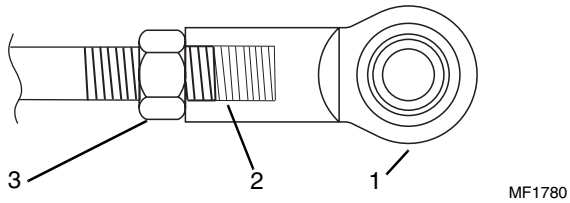


Figure 7-36 Ball Joint Thread Engagement

14. Shut the engine OFF.
15. If the wheels did not rotate when the control rods were disconnected, adjust the ball joint (Fig. 7-36, 1) ensuring adequate thread engagement (2) on both ends of the transmission control rod.

    Do this by removing the capscrews that go through the travel/steering lever control rod ball joints (Fig. 7-34, 1 & 7). Loosen the ball joints hex jam nut and turn the ball joints onto the control rod. The ball joint (7) must line up with the attaching point on the travel/steering lever in its center position. Connect and tighten the ball joints (1 & 7) and hex jam nuts.
16. Repeat Step 15 for the other travel/steering lever control rod (Fig. 7-34, 6) and ball joints (2 & 8).
17. Start the engine and observe the wheels for rotation. They should not be moving in either direction. If they do rotate, make note of the direction of rotation and shut the engine OFF.

    If the wheels are rotating in a reverse direction, the overall length of the rod (Fig. 7-34, 5) will need to be shortened by adjusting the ball joints (1 or 7) closer together. If the wheels are rotating in a forward direction, the overall length of the rod (5) will need to be lengthened by adjusting the ball joints (1 or 7) further apart.

    In either case, disconnect the ball joint (Fig. 7-34, 1) at the travel/steering lever (3). Adjust the ball joint in the appropriate direction, and ensure adequate thread engagement on both ends. Connect and tighten the ball joint (Fig. 7-36, 1) and hex jam nut (3).
18. Repeat Step 17 for the other travel/steering lever control rod (Fig. 7-34, 6) and ball joints (2 & 8).

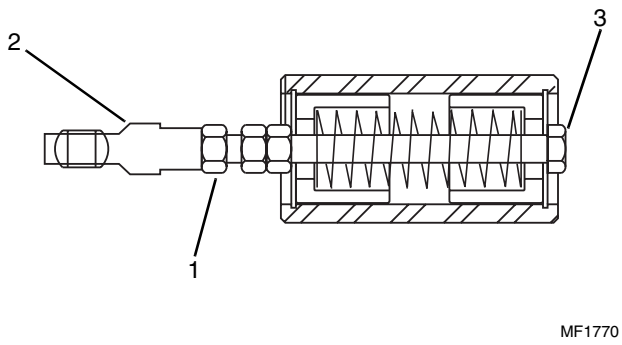


Figure 7-37 Centering Spring Fine Adjustment Model 2000D/DX & 2300D/DX

19. Start the engine. If the wheels still rotate once the transmission control rod has been secured, and only a fine adjustment is necessary, loosen the hex jam nut (Fig. 7-37, 1) on the spring housing assembly ball joint (2).

    Turn the capscrew (Fig. 7-37, 3) on the opposite side of the spring assembly until the wheels stop rotating. When adjustment is complete, tighten the hex jam nut (1).

20. Proceed to “Neutral Centering Test” to ensure that both of the transmission control rods are positioned in the exact NEUTRAL position.

b. Neutral Centering Test

1. Lower the Operator’s Protective Structure and start engine. With engine speed at low idle, stroke levers fully forward and release.
2. Stroke levers fully backward and release.
3. Stroke levers halfway forward and release.
4. Stroke levers halfway backward and release.
5. With engine speed at high idle, stroke levers fully forward and release.
6. Stroke levers fully backward and release.
7. Stroke levers halfway forward and release.
8. Stroke levers halfway backward and release.

IMPORTANT: *With engine OFF, randomly stroke levers forward and backward. Start engine and check for wheel rotation. If wheels rotate, repeat adjustment procedure (7.2.4 a).*

IMPORTANT: *Without an implement or bucket attached to the loader arm, the vehicle is rear end heavy. When lowering vehicle, lower the front of vehicle to the ground first. DO NOT lower the rear of vehicle until the front of vehicle is on the ground.*

9. Raise the front of vehicle first, and remove the jack stands or support blocks. Lower the front to the ground.
10. Raise the rear of vehicle, and remove the jack stands or support blocks. Lower the rear to the ground.

c. Main Travel Control Pump Neutral Centering

The main travel control pump utilizes two servos that control the direction and flow of fluid to the travel motors. Although the servo control automatically corrects pump displacement fluctuations caused by load variations, it is NOT possible for the servo to respond to fluctuation caused by normal wear on hydrostatic system components, and may eventually require adjustment for neutral centering.

Two adjustments may be required to each travel control pump. The first adjustment centers the transmission lever in a mechanical, spring loaded neutral bracket. The second adjustment, if required, centers the servos inside the travel control pump.

The adjustments are performed as follows:

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position. Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position."

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

3. Operate travel-steer levers and foot pedals (or optional wrist controls) in all positions after the engine has stopped to relieve any trapped hydraulic pressure.

IMPORTANT: *To prevent personal injury, be certain that the floor jack and jack stands or support blocks used are stable and strong enough to support the weight of the vehicle.*

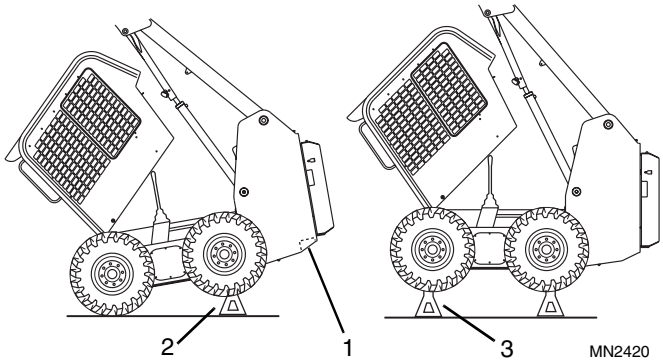


Figure 7-38 Jack Stand Placement

4. Raise the rear of the vehicle with a floor jack. DO NOT place the jack under the hydraulic reservoir or the fuel tank. Place the jack only under the rear crossmember (Fig. 7-38, 1) or chaincase.
5. Place jack stands under the rear left and right frame of the vehicle (Fig. 7-38, 2). If jack stands are not available, support blocks may be used.
6. Lower the rear of the vehicle down onto the jack stands (Fig. 7-38, 2) or support blocks.
7. Raise the front of the vehicle with a floor jack and place jack stands under the front of each chain case (Fig. 7-38, 3). If jack stands are not available, support blocks may be used under the chain cases.
8. Lower the front of the vehicle onto the jack stands (Fig. 7-38, 3) or support blocks.

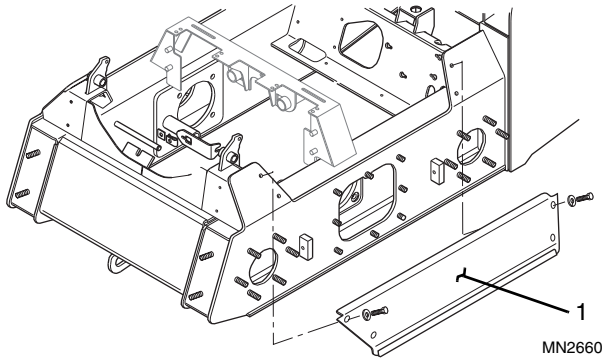


Figure 7-39 Frame Side Cover Removal

9. Remove the left (Fig. 7-39, 1) and right (not shown) side covers from the vehicle to access the control pump assembly.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

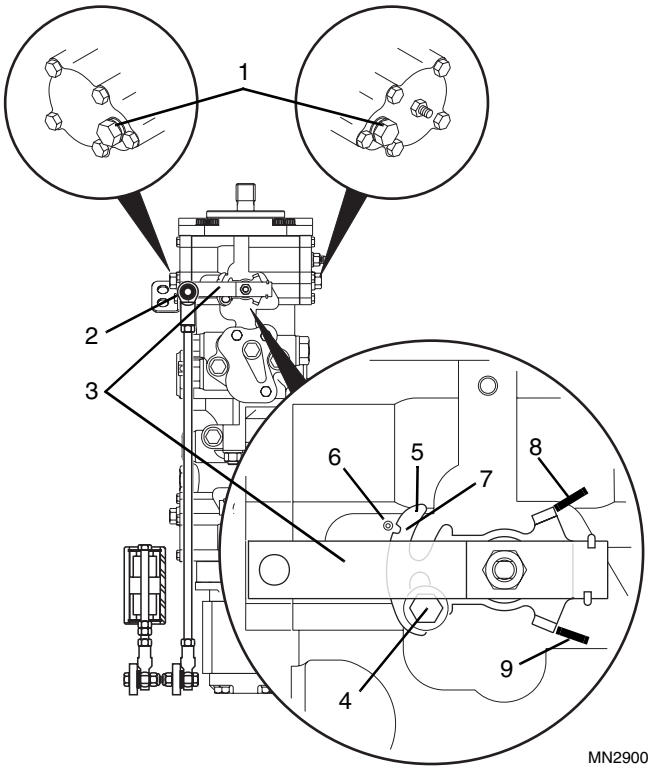


Figure 7-40 Neutral Centering Bracket Adjustment

10. Remove the port plugs (Fig. 7-40, 1) from both sides of the servo housing and install a 0-300 psi (0-21 bar) gauge into each servo port .
11. Remove the control rod ball joint (Fig. 7-40, 2) from the transmission lever (3).
12. Loosen the washer head capscrew (Fig. 7-40, 4) slightly, to allow the neutral bracket (5) to move, but not move freely.
13. Start the engine, and slowly accelerate the vehicle to full throttle.
14. Insert a small phillips head screwdriver into the centering hole (Fig. 7-40, 6) in the transmission housing, and engage the screwdriver shaft in the slot (7) on the neutral adjust bracket (5). Slowly pivot the neutral adjust bracket until the pressure is equal on both gauges.
15. Continue to slowly pivot the bracket (Fig. 7-40, 5) until one of the gauges begins to show an increase in pressure, and stop. Mark the position of the neutral adjust bracket (8).
16. Pivot the bracket (Fig. 7-40, 5) slowly in the opposite direction until the other gauge begins to show an increase in pressure, and stop. Mark the position of the neutral adjust bracket (9).
17. Pivot the neutral adjust bracket (Fig. 7-40, 5) to a final position midway between both marks made in Steps 15 and 16, and tighten the washer head capscrew (4). Torque the capscrew to 95-100 in/lbs (11-15 Nm).
18. Shut the engine OFF. Remove the gauges from both ports (Fig. 7-40, 1), and reinstall both port plugs.
19. Install the control rod (Fig. 7-40, 2) to the transmission lever (3).
20. Repeat Steps 10 through 19 on the second travel pump circuit.
21. Start engine, and check for wheel rotation.

    If wheels DO NOT rotate, proceed to Step 22.

    If wheels DO rotate, proceed to Step 24 to adjust servo centering.

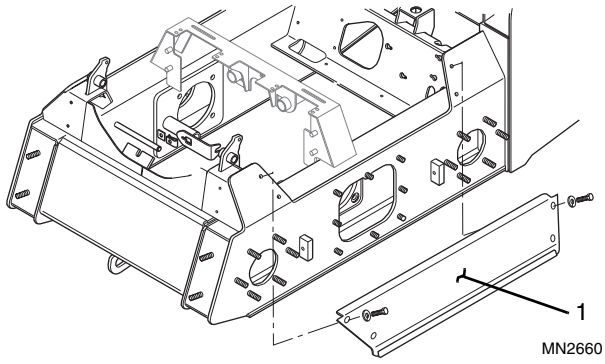


Figure 7-41 Frame Side Cover Removal

22. Install the left (Fig. 7-41, 1) and right (not shown) side covers to the vehicle.
23. Return to Section 7.2.4 a, Step 15, “Neutral Centering & Travel/Steering Lever Adjustment - Model 2000D/DX & 2300D/DX,” to complete the adjustment procedure.
24. Remove the control rod ball joint (Fig. 7-40, 2) from the transmission lever (3).

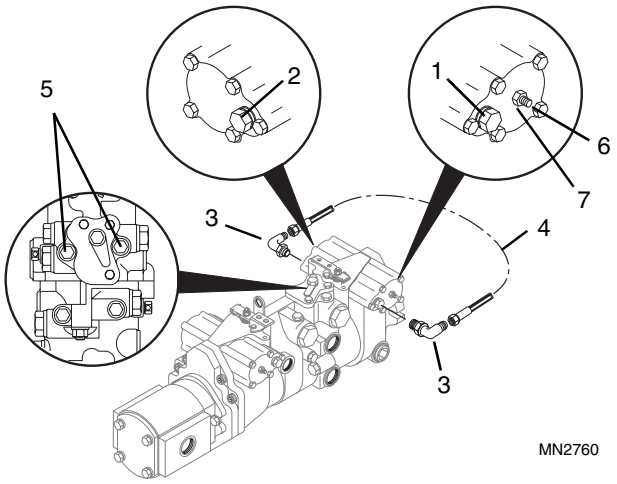


Figure 7-42 Neutral Centering Adjustment Connections

25. Remove the port plugs (Fig. 7-42, 1 & 2) from both sides of the servo housing and install two 9/16-18, 90° elbow o-ring fittings (3) into the left (1) and right (2) servo housing ports. Install a hose (4) rated at 1000 psi (69 bar) to both fittings to cross-connect both sides of the servo piston. This removes the effect of any control pressure on the servo piston.
26. Remove the port plugs (Fig. 7-42, 5) that correspond to the individual control pump being inspected and adjusted, and install two 10,000 psi (69 bar) pressure gauges in the ports (5) on the main control pump.
27. Start the engine, and slowly accelerate the vehicle to full throttle.
28. Hold the servo adjustment screw (Fig. 7-42, 6) in place, and loosen the locknut (7).
29. Turn the servo adjustment screw (Fig. 7-42, 6) until both pressure gauge readings are equal.
30. Turn the servo adjustment screw (Fig. 7-42, 6) clockwise until one gauge begins to show an increase in pressure, and stop.
31. Noting the revolutions required, turn the servo adjustment screw (Fig. 7-42, 6) counterclockwise, until the second gauge just begins to show an increase in pressure, and stop.
32. Divide the total quantity of revolutions counted in Step 31 in half, and turn the servo adjustment screw (Fig. 7-42, 6) clockwise this amount.
33. Holding the servo adjustment screw (Fig. 7-42, 6) in this position, tighten the adjustment screw locknut (7), and torque to 13-18 lb/ft (17-24 Nm).
34. Remove both pressure gauges from the gauge ports (Fig. 7-42, 5) on the main control pump, replace both gauge port plugs, and tighten securely.
35. Remove the cross-connect hose (Fig. 7-42, 4) and two fittings (3) from the left and right servo housing, and replace the port plugs (1 & 2).
36. Repeat Steps 24 through 35 for the second travel pump circuit.

Note: *Whenever a servo centering adjustment is made, it is necessary to repeat the mechanical adjustment (Steps 10 through 20) to both travel control pumps and repeat the wheel rotation test (Step 21). If the wheels continue to rotate during Step 21, the transmission has an internal failure (Refer to Section 5.7.3, "Main Travel Control Pump Maintenance").*

7.3 AUXILIARY HYDRAULIC SYSTEM CONTROL

7.3.1 Auxiliary Hydraulic Description

The auxiliary hydraulic system provides hydraulic flow to a pair of quick disconnect couplings mounted on the inside of the left loader arm. The system is operated by the right travel/steering control lever, which is connected by a control cable to the main control valve in the vehicle.

Note: *This vehicle may be equipped with optional wrist operated controls. In this configuration, the auxiliary hydraulic system is operated by the right foot pedal.*

Refer to the Owners/Operators Manual for detailed operational instructions.

7.3.2 Auxiliary Hydraulic Maintenance

Note: *For maintenance procedures for the pedal controlled, cable operated auxiliary hydraulic option, refer to Section 7.5.2, paragraph e, f & g.*

a. Auxiliary Hydraulic Cable Removal (Standard)

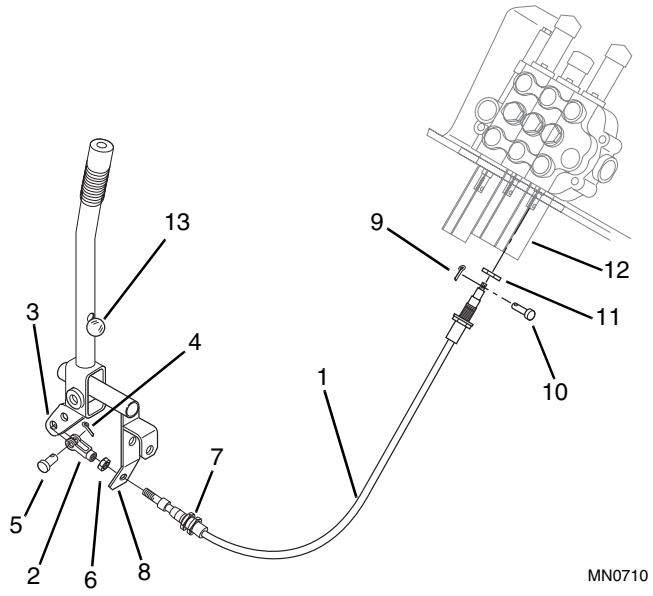


Figure 7-43 Auxiliary Hydraulics Cable

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. To remove the auxiliary hydraulic control cable (Fig. 7-43, 1) from the vehicle, disconnect the cable yoke end (2) from right control lever (3) by removing the cotter pin (4) and clevis pin (5) from the yoke and control lever.
3. Disassemble yoke (Fig. 7-43, 2) and hex nut (6) from the end of the cable.
4. Remove outer hex jam nut (Fig. 7-43, 7) from lever end of cable, and pull the cable out of the hole in 4-way pivot (8).

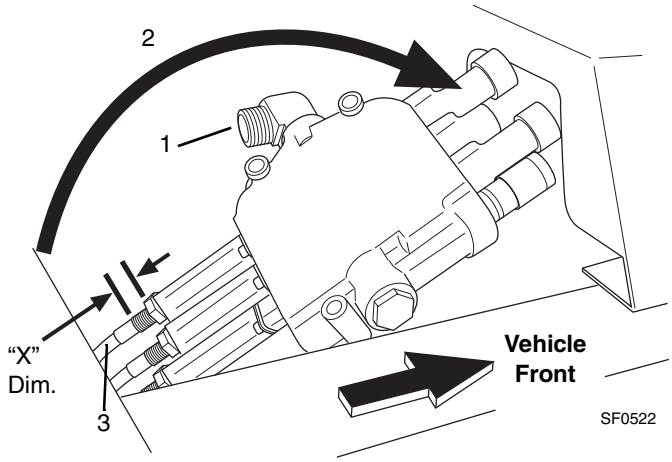


Figure 7-44 Main Control Valve Removal

5. Remove the hose from the elbow fitting (Fig. 7-44, 1) on the left side of the main control valve. Cap the fitting and plug the hose end to prevent contamination from entering the valve and/or hydraulic system.
6. Remove the three capscrews holding the valve to the crossmember, saving the hardware for reassembly. Carefully pull the valve toward the front of the vehicle, with the control cables attached, up and away from the crossmember and lay forward (Fig. 7-44, 2).
7. Before disconnecting the inside cable (Fig. 7-44, 3), measure the length of the exposed threads ("X" Dimension) on the cable housing to the first jam nut. Record this measurement for reference during cable installation.
8. Disconnect the opposite end of the control cable by removing the cotter pin (Fig. 7-43, 9) and clevis pin (10) from the cable end and valve spool.
9. Loosen and remove nut (Fig. 7-43, 11) and remove the cable from control valve strap adapter (12).
10. Remove the cable (Fig. 7-43, 1) from the vehicle.

b. Cable Inspection

Inspect cable for wear or damage. Replace if necessary. When reinstalling cable, check for kinks and for smooth operation.

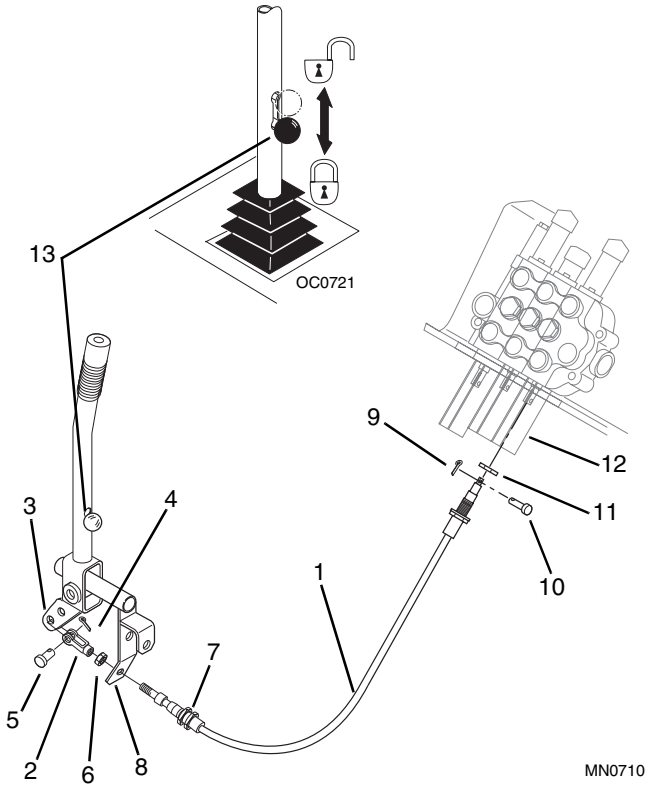


Figure 7-45 Auxiliary Hydraulics Cable

c. Auxiliary Hydraulic Cable Installation

1. Insert the valve end of the control cable (Fig. 7-45, 1) into the control valve strap adapter (12), and loose install the jam nut (11).
2. Adjust the length of the exposed threads (Fig. 7-46, “X” Dimension) on the cable housing to the measurement recorded during Step 7 of the removal procedure. If this dimension was not recorded, adjust the length of the exposed threads to 7/16" (11 mm). Tighten the jam nut (Fig. 7-45, 11).
3. Align the control cable (Fig. 7-45, 1) to the valve spool, and secure with a clevis pin (10) and cotter pin (9).

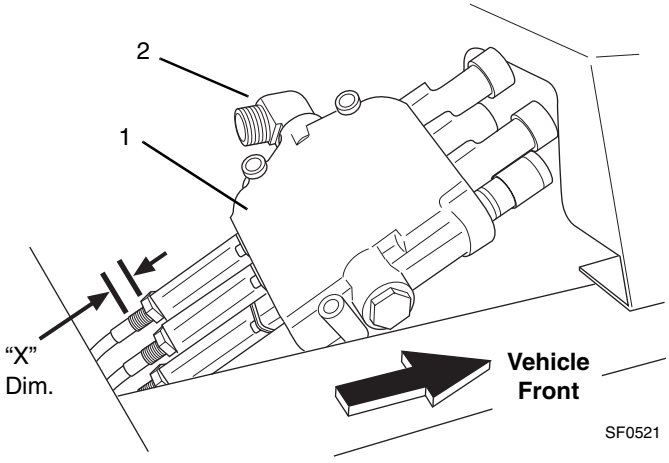


Figure 7-46 Main Control Valve Installation

4. Reassemble the main control valve (Fig. 7-46, 1) to the crossmember with the original three capscrews, and tighten securely.
5. Remove the hose fitting cap and hose plug, and reassemble the hose to the fitting (Fig. 7-46, 2) on the left side of the valve. Torque the hose (Refer to Section 2.8, “Torques”).
6. Insert the opposite end of the control cable housing (Fig. 7-45, 1) through the hole in the 4-way pivot (8), and secure with hex jam nut (7).
7. Loose install the hex nut (Fig. 7-45, 6) and yoke (2) to the threaded end of the control cable.
8. Center the control lever by engaging the control lever lockout (Fig. 7-45, 13). Pull out the lockout knob slightly, push the knob down to the bottom of the slot, and release.
9. Turn the cable yoke (Fig. 7-45, 2) as required to align it with the lower hole in the control lever (3). Insert the clevis pin (5), secure with a new cotter pin (4), and tighten the hex nut (6) against the yoke (2).
10. Release the control lever lockout (Fig. 7-45, 13). Pull the lockout knob out slightly, pull the knob up to the top of the slot, and release.
11. Operate the control lever to ensure that the control valve spool moves fully into all four operating positions: pressure to male coupler, neutral, pressure to female coupler and detented pressure to female coupler. Readjust if required.
12. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

d. Auxiliary Hydraulic Lock Pin Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

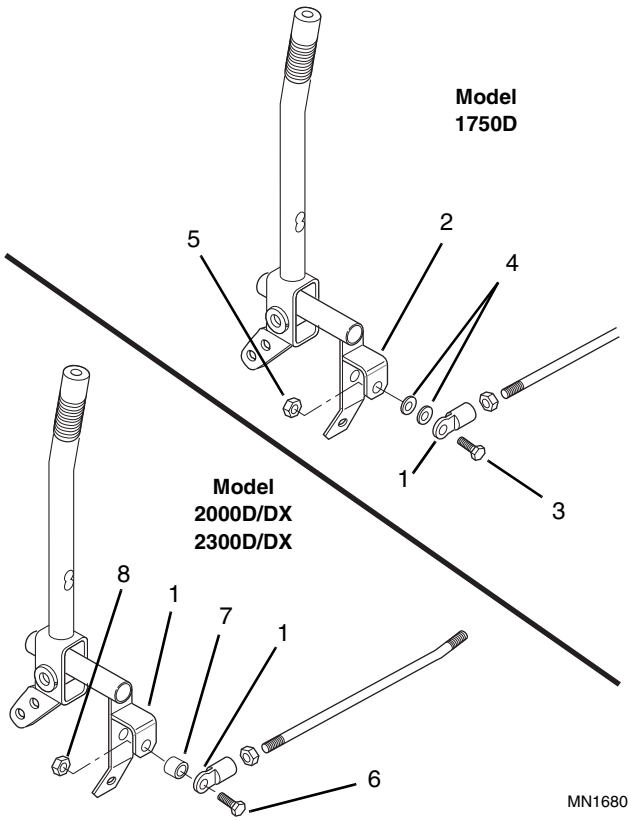


Figure 7-47 Right Side Link Removal

2. Disconnect right side link rod ball joint (Fig. 7-47, 1) from the right travel/steering lever 4-way pivot (2) by removing the following:

   Model 1750D Only - Capscrew (Fig. 7-47, 3), two flat washers (4), and locknut (5).

   Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-47, 6), spacer (7), and locknut (8).

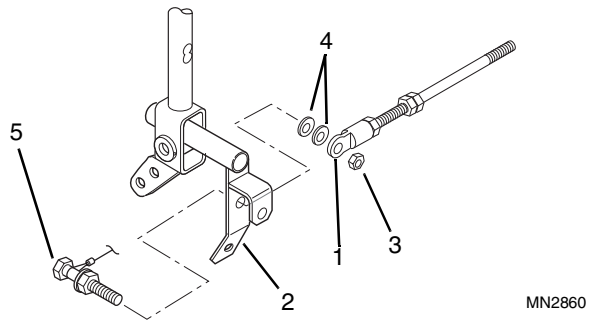


Figure 7-48 Spring Centering Link Removal

3. Disconnect the spring assembly link rod ball joint (Fig. 7-48, 1) from the right travel/steering lever 4-way pivot (2) by removing locknut (3), washers (4), and capscrew (5). Loose assemble the washers and locknut to the capscrew, and let it hang by the back-up alarm tether.

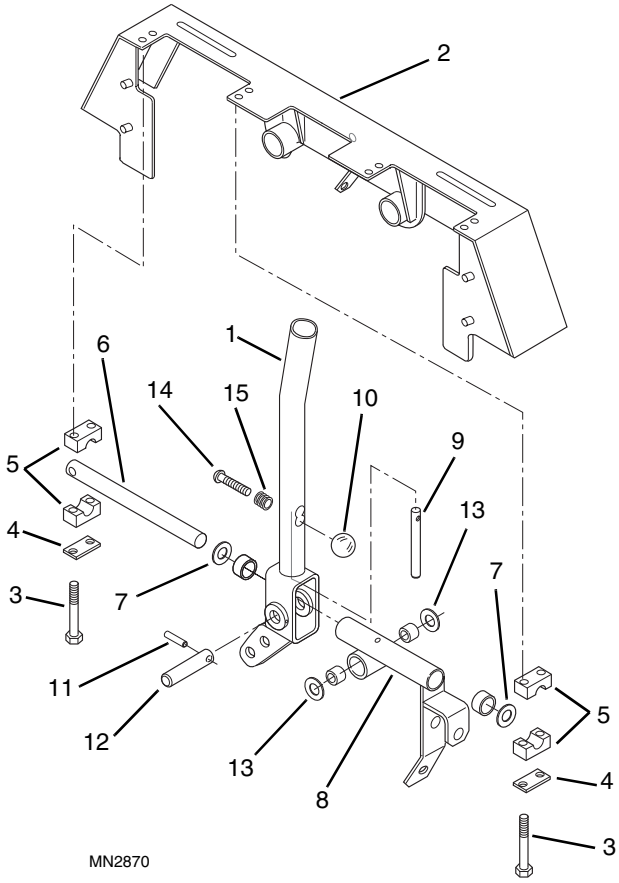


Figure 7-49 Travel/Steering Lever Disassembly

4. Remove the right travel/steering lever (Fig. 7-49, 1) from the crossmember (2) by removing capscrews (3), clamp covers (4), and half clamps (5). Remove the lever. Remove pin (6) and shims (7).
5. Remove 4-way pivot (Fig. 7-49, 8) from lever (1) by first lifting up on the lever locking pin (9) using the knob (10). Remove the roll pin (11) and tap out the pivot pin (12). Remove shims (13) from the 4-way pivot lever (8).
6. Remove the lever locking pin (Fig. 7-49, 9) from the lever (1) by removing slotted capscrew (14), spring (15), and knob (10). The locking pin (9) will drop out of the bottom of the travel/steering lever.

e. Inspection

1. Clean all parts with a suitable solvent.
2. Inspect the lockpin and all bushings for wear, replace as required.
3. Check spring for damage or weakness, replace as required.

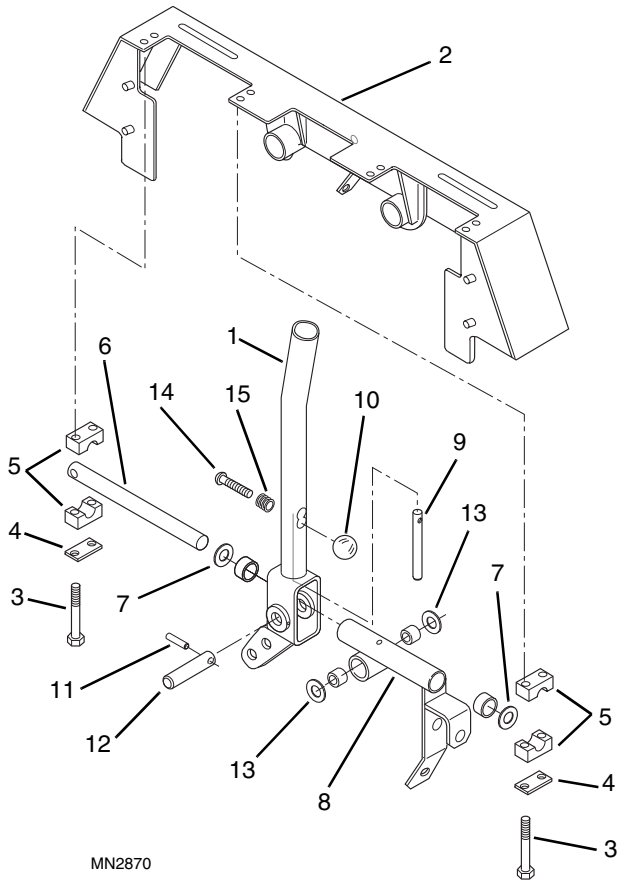


Figure 7-50 Travel/Steering Lever Disassembly

f. Auxiliary Hydraulic Lock Pin Assembly

1. Install the lever lock pin (Fig. 7-50, 9) into the bottom of the right travel/steering lever (1), and secure by installing the slotted capscrew (14) and spring (15) through lock pin (9), threading fully into knob (10) and tighten.

Note: *Apply Loctite Threadlocker to capscrew (14) before installing.*

2. Position the 4-way lever (Fig. 7-50, 8) into the travel/steering lever (1), and secure with pivot pin (12), shims (as required) (13), and roll pin (11).
3. Install pin (Fig. 7-50, 6) into the 4-way pivot (8) and add shims (as required) (7) on each end of the pin. Secure the assembly into the crossmember using half clamps (5), clamp covers (4), and capscrews (3) on both ends of pin (6).

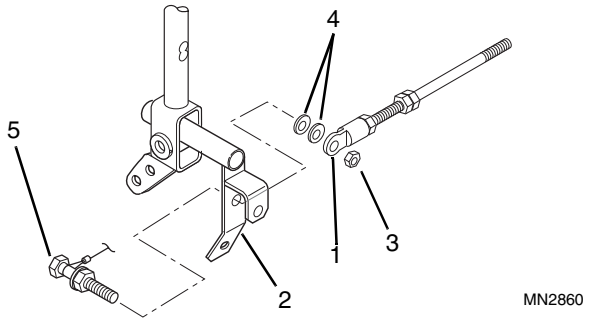


Figure 7-51 Spring Centering Link Installation

4. Connect the spring assembly link rod ball joint (Fig. 7-51, 1) to the right travel/steering lever 4-way pivot (2) by installing capscrew (5), washers (4), and locknut (3), and tighten securely.

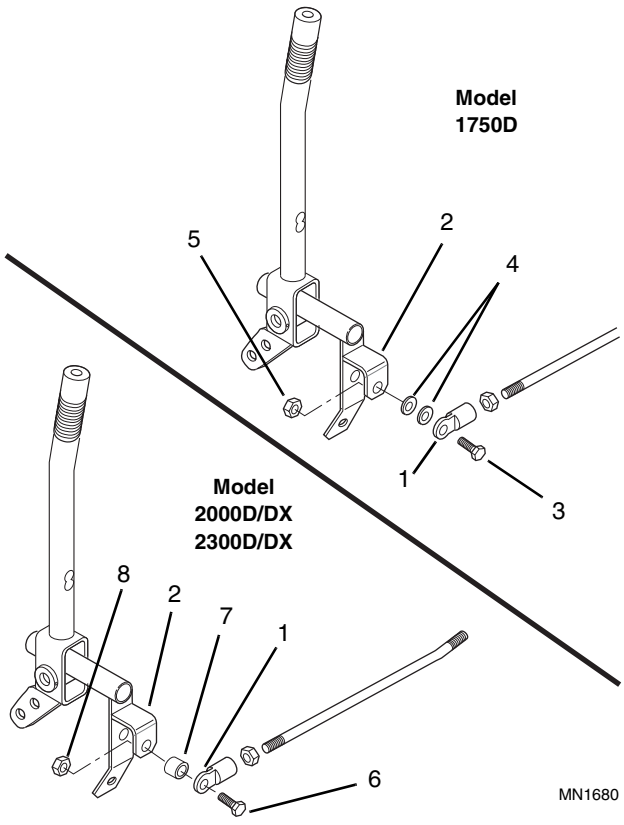


Figure 7-52 Right Side Link Installation

5. Connect right side link rod ball joint (Fig. 7-52, 1) to the right travel/steering lever 4-way pivot (2) by installing and securing the following:

   Model 1750D Only - Capscrew (Fig. 7-52, 3), two flat washers (4), and locknut (5).

   Model 2000D/DX and 2300D/DX Only - Capscrew (Fig. 7-52, 6), spacer (7), and locknut (8).
6. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

7.4 FOOT PEDAL HYDRAULIC CONTROLS

7.4.1 Foot Pedal Description

The left foot pedal controls the loader arm lift cylinders. The right foot pedal controls the attachment tilt (Quick Attach) functions.

Note: *This vehicle may be equipped with optional wrist operated controls. In this configuration, the right foot pedal controls the auxiliary hydraulic system, and the left foot pedal has no function. Refer to Section 7.5.2, paragraph e, f & g for cable maintenance procedures.*

Refer to the Owners/Operators Manual for detailed operational instructions.

7.4.2 Foot Pedal Maintenance

Note: *The steps in paragraph a, b & c that follow refer to cable removal from either foot pedal.*

a. Cable Removal

1. Park the vehicle on a level surface.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
3. Remove the floor plate between the pedals.

Note: ***DO NOT*** *reuse any elastic locknuts. Discard any elastic locknut(s) removed and replace with new.*

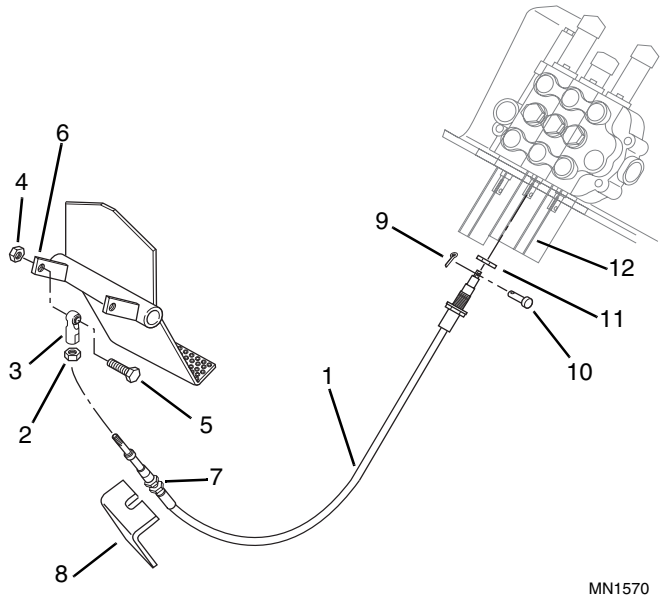


Figure 7-53 Foot Pedal Cable (Right Side Shown)

4. To remove the foot pedal control cable (Fig. 7-53, 1) from the vehicle, loosen the hex jam nut (2) below the ball joint (3), and remove the elastic locknut (4) and capscrew (5) connecting the ball joint (3) to the foot pedal (6). Remove the ball joint (3) and hex jam nut (2) from the cable.
5. Loosen the hex jam nut (Fig. 7-53, 7) and remove the cable (1) from its anchor bracket (8).

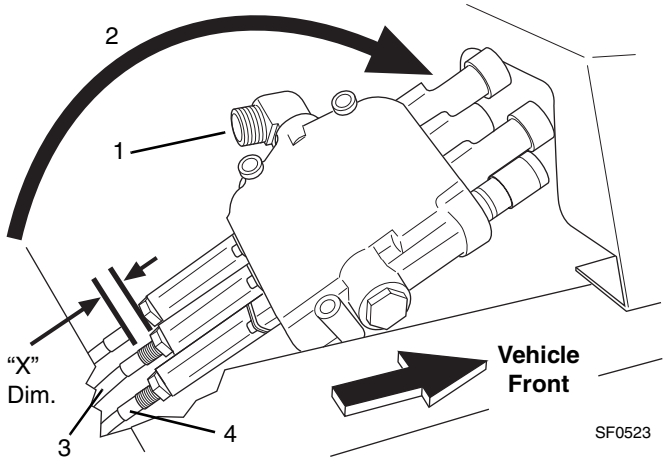


Figure 7-54 Main Control Valve Removal

6. Remove the hose from the elbow fitting (Fig. 7-54, 1) on the left side of the main control valve. Cap the fitting and plug the hose end to prevent contamination from entering the valve and/or hydraulic system.
7. Remove the three capscrews holding the valve to the crossmember, saving the hardware for reassembly. Carefully pull the valve, with the control cables attached, up and away from the crossmember and lay forward (Fig. 7-54, 2).
8. Before disconnecting the cable (Fig. 7-54, 3 or 4), measure the length of the exposed threads ("X" Dimension) on the cable housing to the first jam nut. Record this measurement for reference during cable installation.
9. Disconnect the opposite end of the control cable by removing the cotter pin (Fig. 7-53, 9) and clevis pin (10) from the cable end and valve spool.
10. Loosen and remove nut (Fig. 7-53, 11) and remove the cable from control valve strap adapter (12).
11. Remove the cable (Fig. 7-53, 1) from the vehicle.

b. Cable Inspection

Inspect cable for wear or damage. Replace if necessary. When reinstalling cable, check for kinks and for smooth operation.

c. Cable Installation

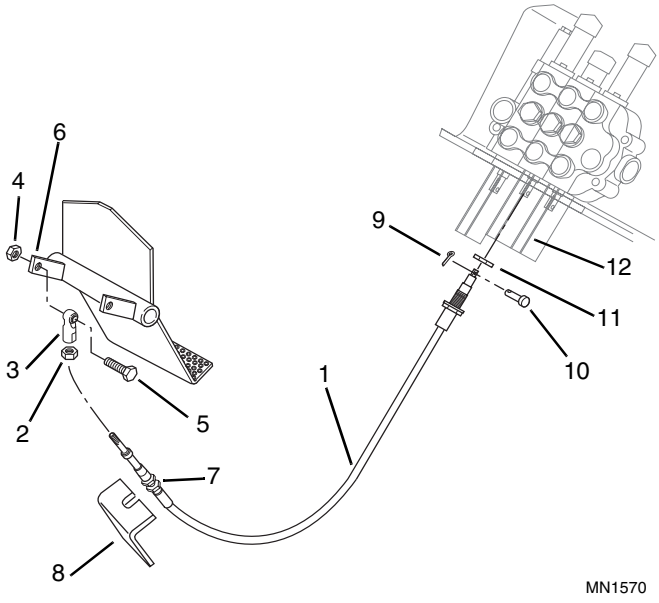


Figure 7-55 Foot Pedal Cable (Right Side Shown)

1. Insert the valve end of the control cable (Fig. 7-55, 1) into the control valve strap adapter (12), and loose install the jam nut (11).

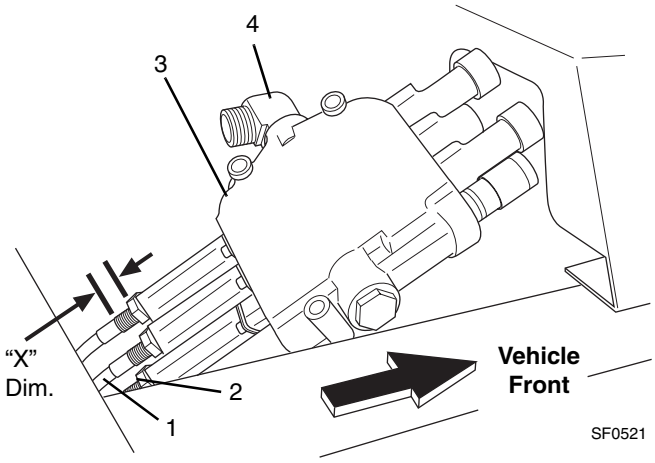


Figure 7-56 Main Control Valve Installation

2. Adjust the length of the exposed threads (Fig. 7-56, "X" Dimension) on the cable housing to the measurement recorded during the removal procedure. If this dimension was not recorded, adjust the length of the exposed threads on cable (2) to 7/16" (11 mm), and on cable (3) to 9/16" (14 mm). Tighten the jam nut (Fig. 7-55, 11).
3. Align the control cable (Fig. 7-55, 1) to the valve spool, and secure with a clevis pin (10) and cotter pin (9).
4. Reassemble the main control valve (Fig. 7-56, 4) to the crossmember with the original three capscrews, and tighten securely.
5. Remove the hose fitting cap and hose plug, and reassemble the hose to the fitting (Fig. 7-56, 5) on the left side of the valve. Torque the hose (Refer to Section 2.8, "Torques").
6. Insert the opposite end of the control cable (Fig. 7-55, 1) into the cable anchor (8), and secure with hex jam nut (7).
7. Install the hex jam nut (Fig. 7-55, 2) and ball joint (3) loosely onto the threaded end of the control cable (1).

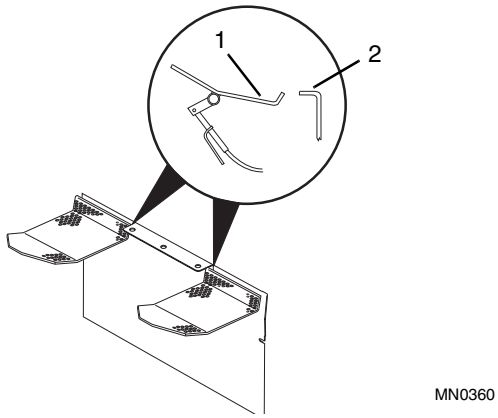


Figure 7-57 Foot Pedal Adjustment

8. Position the foot pedal to align its upper rear edge (Fig. 7-57, 1) with the lip on the panel (2). Adjust the ball joint (Fig. 7-55, 3) on the cable to align with the hole in the foot pedal. Insert the capscrew (5), and secure with a new elastic locknut (4).
9. Tighten the hex jam nut (Fig. 7-55, 2) to the ball joint (3).
10. Operate the foot pedal to ensure that the control valve spool moves fully into all of its operating positions. Readjust if required.
11. Replace floor plate between foot pedals.
12. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

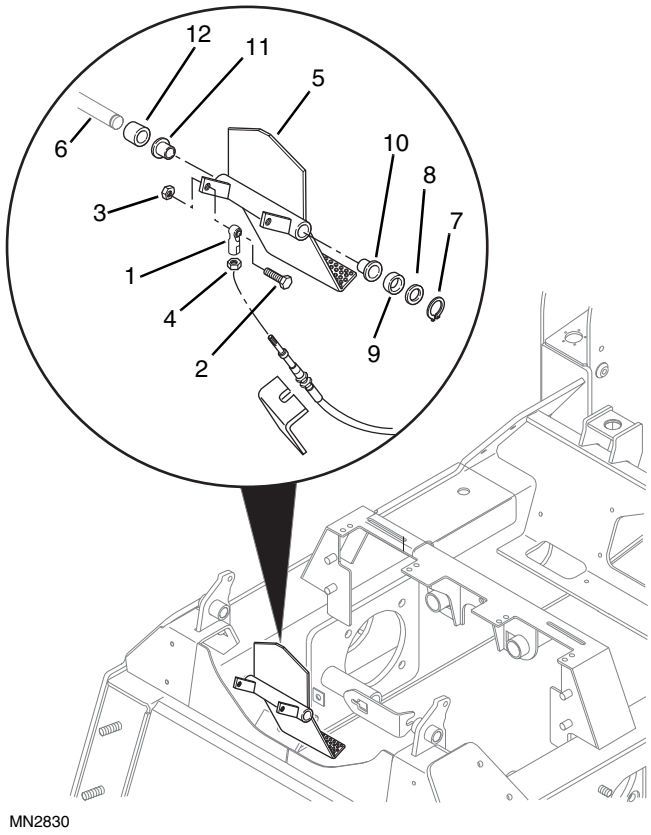


Figure 7-58 Foot Pedal Mounting
(Model 2000 right side shown - other models similar)

d. Foot Pedal Removal

1. Remove floor plate between pedals.
2. Remove the cable end ball joint (Fig. 7-58, 1) from the foot pedal by loosening and removing the elastic locknut (3) and capscrew (2).

***Note: DO NOT** reuse any elastic locknuts. Discard any elastic locknut(s) removed and replace with new.*

3. Remove the foot pedal (Fig. 7-58, 5) from its mounting pin (6) by removing retaining ring (7), shim washer (8), spacer bushing (9 - see note below) and flange bushing (10).

***Note:** On Model 1750D and 2000D/DX, spacer bushing (*Fig. 7-58, *9) is only used on S/N 1750/2000 -101314 & after.*

4. The pedal (Fig. 7-58, 5) can then be slid off the mounting pin (6). Remove the remaining flange bushing (11) and spacer bushing (12).
5. Repeat Steps 2 through 4 for the other foot pedal assembly, if necessary.

e. Pedal Cleaning and Inspection

1. Clean all individual parts in a suitable solvent before inspection.
2. Inspect pedals for cracks or damage.
3. Inspect flange bushings (Fig. 7-58, 10 & 11) for wear or damage.
4. Replace any worn or damaged parts.
5. Replace all elastic locknuts with new.
6. Touch-up any paint chips before reassembly.

f. Foot Pedal Installation

1. Install the spacer bushing (Fig. 7-58, 12) on the pedal mounting pin. Insert a flange bushing (10 & 11) into each side of the foot pedal.

***Note: DO NOT** lubricate foot pedal pivot pins. The bushings used are self-lubricating.*

2. Slide the foot pedal (Fig. 7-58, 5) onto its mounting pin (6).
3. On Model 1750D and 2000D/DX; S/N 1750/2000 - 101314 & after only: slide the spacer bushing (Fig. 7-58, 9) onto the mounting pin (6).
4. Slide the shim washer (Fig. 7-58, 8) onto the pin (6), and secure by installing the retaining ring (7) into the groove on the end of the pin.
5. Rotate the pedal to ensure that it can turn freely.

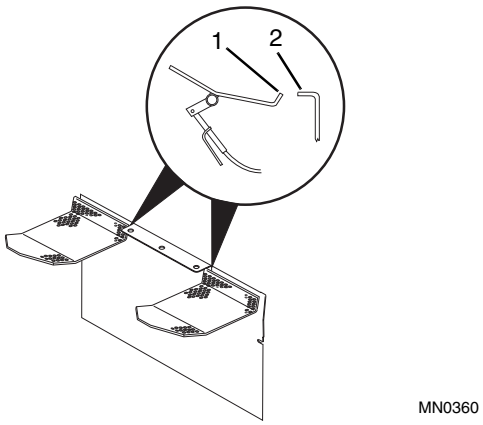


Figure 7-59 Foot Pedal Adjustment

g. Foot Pedal Cable Installation and Adjustment

1. Position the foot pedal to align its upper rear edge (Fig. 7-59, 1) with the lip on the panel (2).

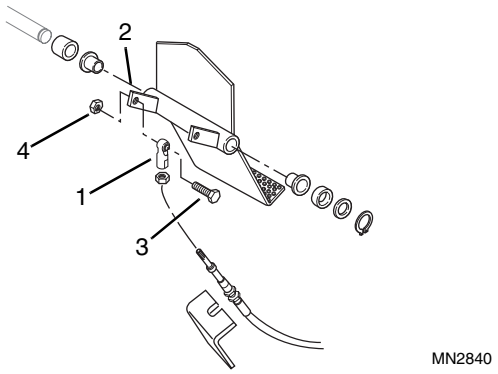


Figure 7-60 Foot Pedal Cable Attachment

2. Adjust the ball joint (Fig. 7-60, 1) on the cable if required to align with the hole (2) in the foot pedal. Insert the capscrew (3), and secure with a new elastic locknut (4).
3. Operate the foot pedal to ensure that the control valve spool moves fully into all of its operating positions. Readjust if required.
4. Repeat Section 7.4.2 f, “Foot Pedal Installation,” Steps 1 through 5, and “Foot Cable Installation and Adjustment,” Steps 1 through 3, for the other foot pedal if required.
5. Reinstall floor plate between foot pedals.

7.5 WRIST HYDRAULIC CONTROLS (OPTIONAL)

7.5.1 Wrist Hydraulic Control Description

With the optional wrist hydraulic controls, function of the loader arm and attachment tilt is controlled by left or right movement of the travel/steering lever handgrips, instead of being controlled by the foot pedals.

The left handgrip controls the loader arm hoist cylinders, and the right handgrip controls the attachment tilt cylinders.

When the vehicle is equipped with this control option, operation of the auxiliary hydraulic circuit is moved from the right control lever to the right foot pedal. The left foot pedal is rigidly mounted, and serves only as a foot rest.

Refer to the Owners/Operators Manual for detailed operating instructions.

7.5.2 Wrist Hydraulic Control Maintenance

a. Wrist Control Cable Removal

Note: *The following procedure can be used for maintenance on either wrist control assembly.*

1. Park the vehicle on a level surface.
2. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

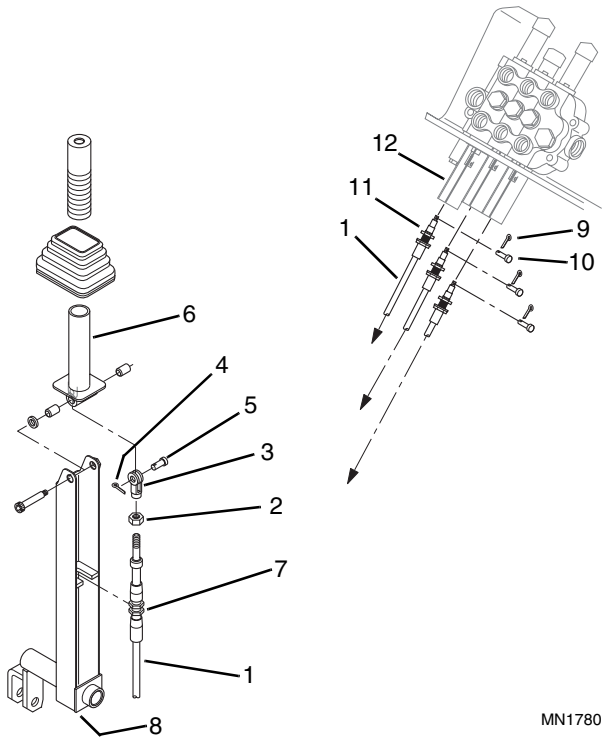


Figure 7-61 Wrist Control Cable Disassembly

3. To remove the hydraulic control cable (Fig. 7-61, 1) from the vehicle, loosen the hex jam nut (2) below the clevis (3) on the cable end. Remove the spring clip (4) and clevis pin (5) securing the clevis to the hand control lever (6).
4. Loosen the upper bulkhead nut (Fig. 7-61, 7) on the cable housing, pull the cable from its anchor bracket, and pull in out from the bottom of the pivot lever (8).

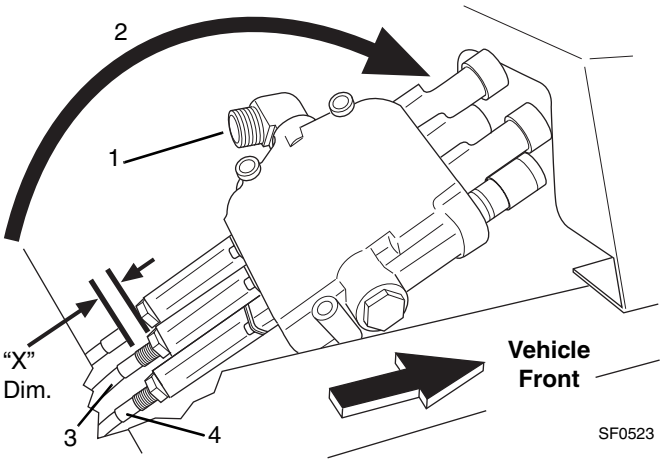


Figure 7-62 Main Control Valve Removal

5. Remove the hose from the elbow fitting (Fig. 7-62, 1) on the left side of the main control valve. Cap the fitting and plug the hose end to prevent contamination from entering the valve and/or hydraulic system.
6. Remove the three capscrews holding the valve to the crossmember, saving the hardware for reassembly. Carefully pull the valve, with the control cables attached, up and away from the crossmember and lay forward (Fig. 7-62, 2).
7. Before disconnecting either cable (Fig. 7-62, 3 or 4), measure the length of the exposed threads ("X" Dimension) on the cable housing to the first jam nut. Record this measurement for reference during cable installation.
8. Disconnect the opposite end of the control cable by removing the cotter pin (Fig. 7-61, 9) and clevis pin (10) from the cable end and valve spool.
9. Loosen and remove nut (Fig. 7-61, 11) and remove the cable from control valve strap adapter (12).
10. Remove the cable (Fig. 7-61, 1) from the vehicle.

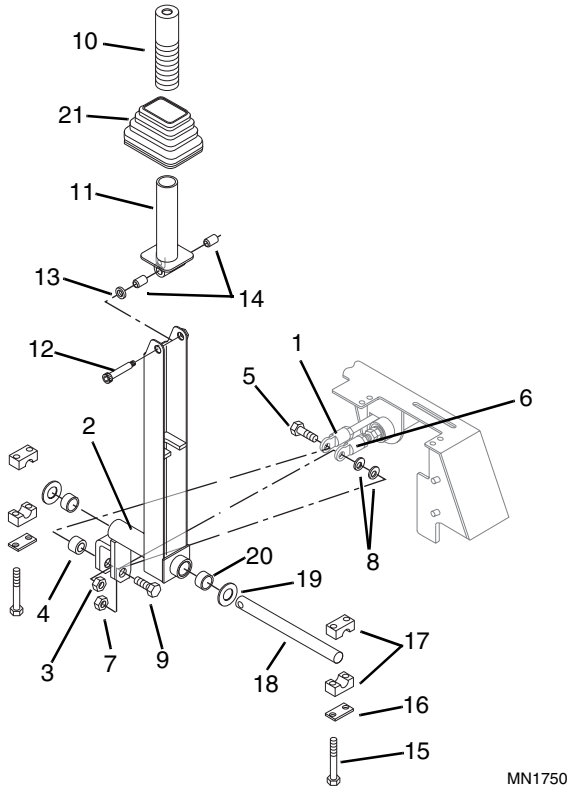


Figure 7-63 Wrist Control Lever Disassembly

11. Disconnect the left side link rod ball joint (Fig. 7-63, 1) from the 2-way pivot lever (2) by removing the hex locknut (3), spacer (4), and capscrew (5). Mark the ball joint position on the link rod threads for later use if the ball joint is to be removed from the link rod.
12. Disconnect the spring assembly link rod ball joint (Fig. 7-63, 6) from the 2-way pivot (2) by removing hex locknut (7), two flat washers (8), and capscrew (9).
13. Remove the handgrip (10) from the hand control lever (11).
14. Remove the socket head shoulder screw (Fig. 7-63, 12), flat washer (13), and bushings (14) used to secure the hand control lever (11) to the 2-way pivot lever (2).
15. Remove the pivot lever (Fig. 7-63, 2) from the crossmember by removing capscrews (15), clamp covers (16), and half clamps (17) from both sides of the pivot lever. Remove the lever from the crossmember.
16. Remove pivot pin (Fig. 7-63, 18), shims (19), plastic bushings (20) and boot (21) from the pivot lever.

b. Cleaning and Inspection

1. Clean all individual parts in a suitable solvent before inspection.
2. Inspect all metal components for cracks or damage.
3. Inspect all bushings for wear or damage.
4. Replace any worn or damaged parts.
5. Touch-up any paint chips before reassembly.

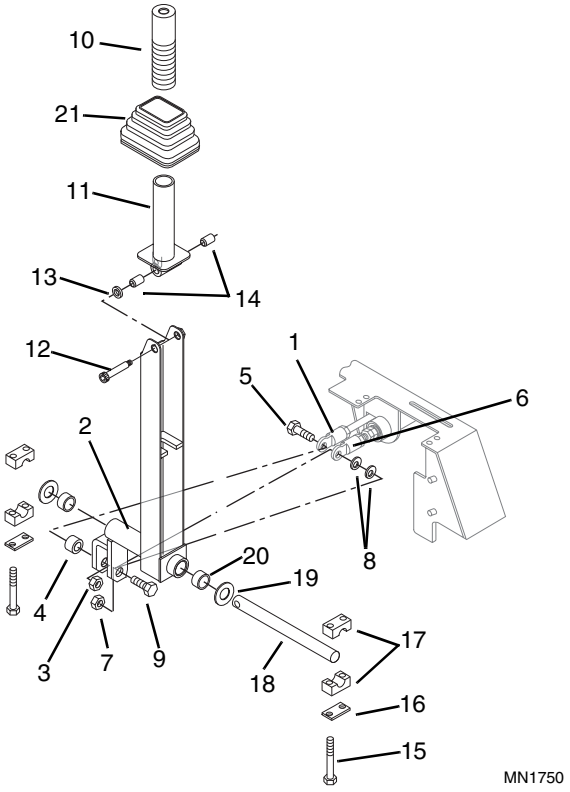


Figure 7-64 Wrist Control Lever Assembly

c. Assembly

***Note: DO NOT** lubricate any pivot pins. The bushings used are self-lubricating.*

1. Install the lever boot (Fig. 7-64, 21) and plastic bushings (20) on the pivot lever (2). Install the pivot pin (18) into the lever, and add a shim (19) to each side.
2. Install the pivot lever (Fig. 7-64, 2) to the crossmember. Secure the pivot pin (18) by installing the half clamps (17), clamp cover (16) and two capscrews (15) to each side of the pin.
3. Install new bushings (Fig. 7-64, 14) if required into the hand control lever (11). Install the hand control lever to the 2-way pivot (2) using the socket head shoulder screw (12) and flat washer (13). Tighten securely.
4. Install the handgrip (Fig. 7-64, 10) onto the hand control lever (11).
5. Connect the left side link rod ball joint (Fig. 7-64, 1) to the 2-way pivot lever (2) by installing the capscrew (5), spacer (4) and hex locknut (3).
6. Connect the spring assembly link rod ball joint (Fig. 7-64, 6) to the 2-way pivot (2) by installing capscrew (9), two flat washers (8) and hex locknut (7).

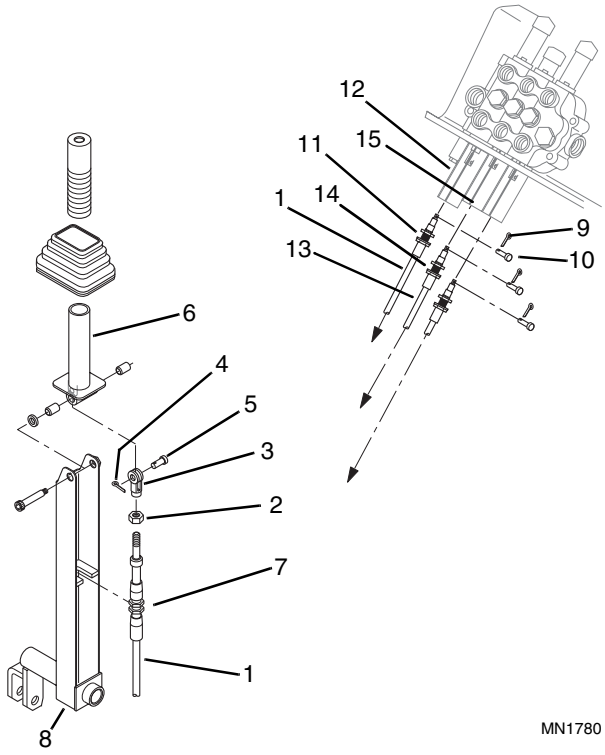


Figure 7-65 Wrist Control Cable Assembly

d. Cable Installation and Adjustment

1. Insert the valve end of the control cable (Fig. 7-65, 1 or 13) into the control valve strap adapter (12 or 15), and loose install the jam nut (11 or 14).

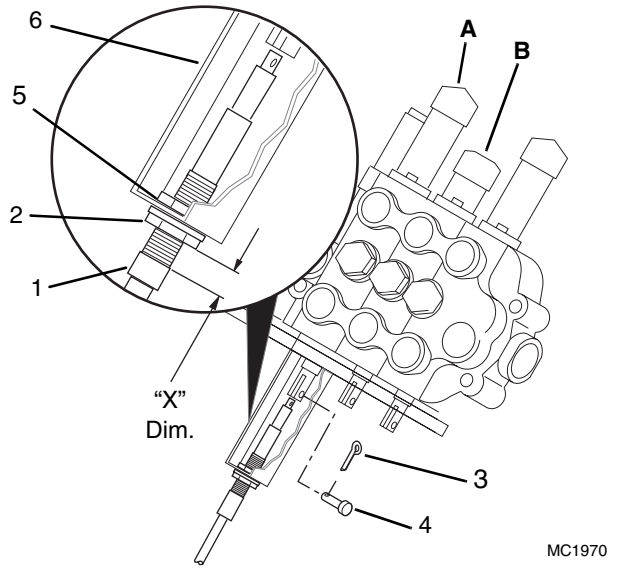


Figure 7-66 Control Cable Installation
Loader Arm Spool Shown

2. Adjust the jam nuts (Fig. 7-66, 2 & 5) as required to obtain the same visual thread length ("X" Dimension), from the base of the cable end housing (1) to the bottom of the jam nut (2), as was recorded during valve removal.

Note: *If the cable housing exposed thread length was not recorded, adjust to the following dimensions:*

- *Loader Arm Spool Cable (Fig. 7-66, A): Dimension "X" = 9/16" (14 mm)*
- *Attachment Tilt Spool Cable (Fig. 7-66, B): Dimension "X" = 7/16" (11 mm)*

3. Tighten the jam nuts (Fig. 7-66, 2 & 5) securely.
4. Install the clevis pin (Fig. 7-66, 4) through each spool and cable end and secure with a cotter pin (3).

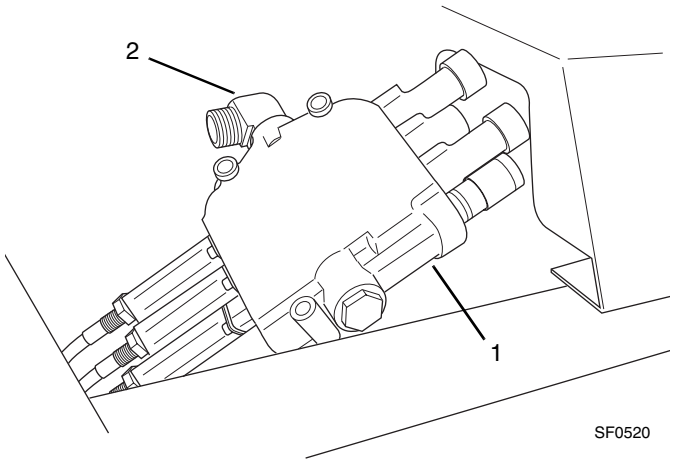


Figure 7-67 Main Control Valve Installation

5. Reassemble the main control valve (Fig. 7-67, 1) to the crossmember with the original three capscrews, and tighten securely.
6. Remove the hose fitting cap and hose plug, and reassemble the hose to the fitting (Fig. 7-67, 2) on the left side of the valve. Torque the hose (Refer to Section 2.8, "Torques").
7. Route the free end of the control cable into the bottom of the pivot lever (Fig. 7-65, 8), and push the cable into the slotted anchor bracket. Install and tighten the upper bulkhead nut (7) on the cable housing.
8. Secure the clevis (Fig. 7-65, 3) to the hand control lever (6) with the clevis pin (5) and spring clip (4).
9. Operate the wrist control from side to side and ensure that the corresponding main control valve spool moves fully into all operating positions.
10. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

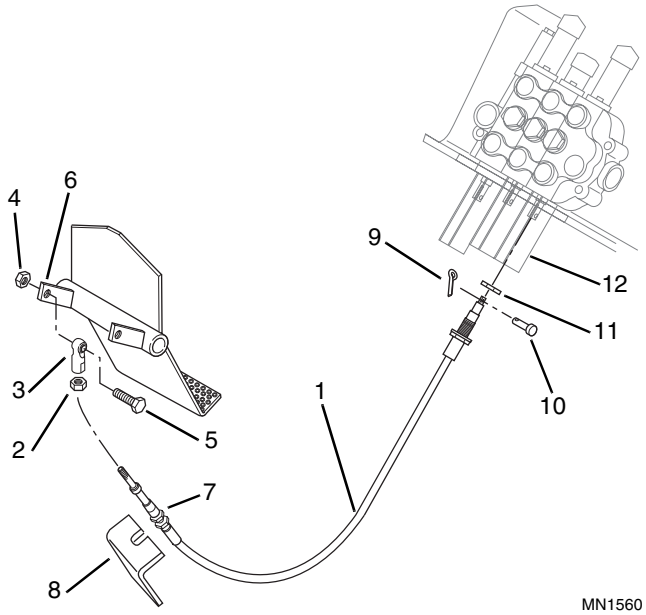


Figure 7-68 Optional Auxiliary Hydraulics Cable

e. Optional Auxiliary Hydraulic Cable Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove the floor plate between the foot pedals.
3. To remove the auxiliary hydraulic control cable (Fig. 7-68, 1) from the vehicle, loosen the hex jam nut (2) below the ball joint (3), and remove the hex nut (4) and capscrew (5) connecting the ball joint (3) to the foot pedal (6). Remove the ball joint (3) and hex jam nut (2) from the cable.
4. Loosen the hex jam nut (Fig. 7-68, 7) and remove the cable (1) from its anchor bracket (8).

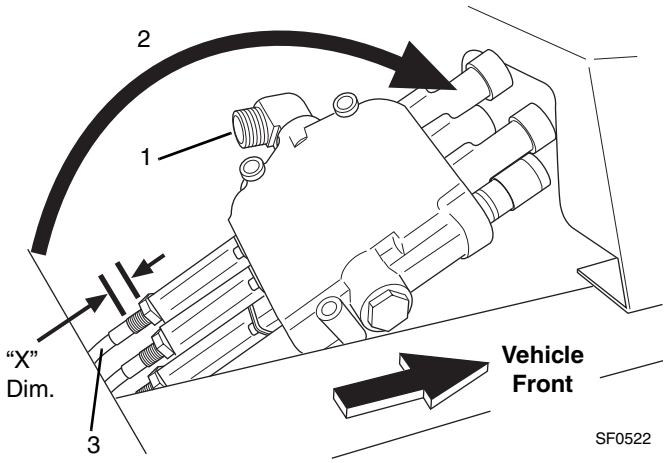


Figure 7-69 Main Control Valve Removal

5. Remove the hose from the elbow fitting (Fig. 7-69, 1) on the left side of the main control valve. Cap the fitting and plug the hose end to prevent contamination from entering the valve and/or hydraulic system.
6. Remove the three capscrews holding the valve to the crossmember, saving the hardware for reassembly. Carefully pull the valve, with the control cables attached, up and away from the crossmember and lay forward (Fig. 7-69, 2).
7. Before disconnecting the inner cable (Fig. 7-69, 3), measure the length of the exposed threads ("X" Dimension) on the cable housing to the first jam nut. Record this measurement for reference during cable installation.
8. Disconnect the end of the control cable by removing the cotter pin (Fig. 7-68, 9) and clevis pin (10) from the cable end and valve spool.
9. Loosen and remove nut (Fig. 7-68, 11) and remove the cable from control valve strap adapter (12).
10. Remove the cable (Fig. 7-68, 1) from the vehicle.

f. Cable Inspection

Inspect cable for wear or damage. Replace if necessary. When reinstalling cable, check for kinks and for smooth operation.

g. Optional Auxiliary Hydraulic Cable Installation

1. Insert the valve end of the control cable (Fig. 7-68, 1) into the control valve strap adapter (12), and loose install the jam nut (11).
2. Adjust the length of the exposed threads (Fig. 7-70, “X” Dimension) on the cable housing to the measurement recorded during the removal procedure. If this dimension was not recorded, adjust the length of the exposed threads to 7/16" (11 mm). Tighten the jam nut (Fig. 7-68, 11).

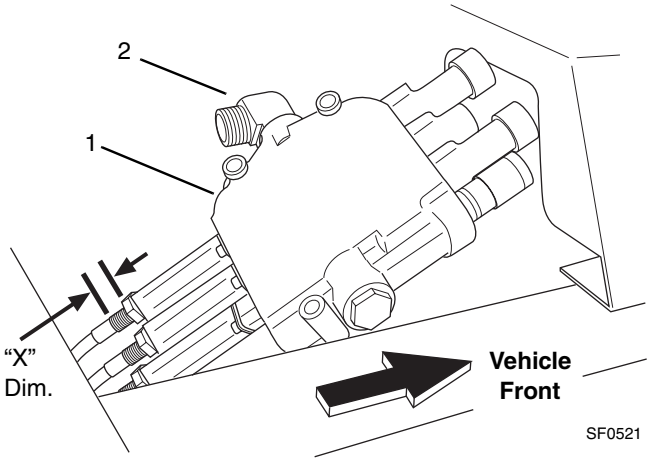


Figure 7-70 Main Control Valve Installation.

3. Align the control cable (Fig. 7-68, 1) to the valve spool, and secure with a clevis pin (10) and cotter pin (9).
4. Reassemble the main control valve (Fig. 7-70, 1) to the crossmember with the original three capscrews, and tighten securely.
5. Remove the hose fitting cap and hose plug, and reassemble the hose to the fitting (Fig. 7-70, 3) on the left side of the valve. Torque the hose (Refer to Section 2.8, “Torques”).
6. Insert the opposite end of the control cable (Fig. 7-68, 1) into the cable anchor (8), and secure with hex jam nut (7).
7. Loose install the hex nut (Fig. 7-68, 2) and ball joint (3) to the threaded end of the control cable.

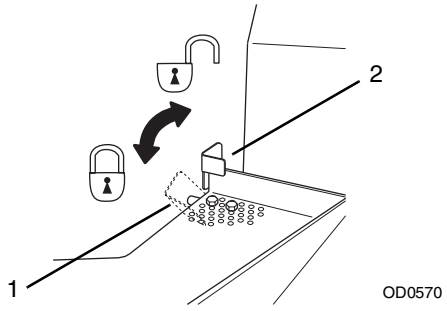


Figure 7-71 Optional Auxiliary Hydraulic Lockout Latch

8. Center the foot pedal by engaging the pedal lockout latch (Fig. 7-71, 1). Push the lockout latch forward until it hooks over the peg on the pedal.
9. Turn the ball joint (Fig. 7-68, 3) as required to align it with the hole in the foot pedal (6). Insert the capscrew (5), and secure with a hex nut (4). Tighten the hex jam nut (2) against the ball joint (3).
10. Release the foot pedal lockout by pulling the lockout latch backward fully (Fig. 7-71, 2).
11. Operate the foot pedal to ensure that the control valve spool moves fully into all of its operating positions. Readjust if required.
12. Reinstall the floor plate.
13. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

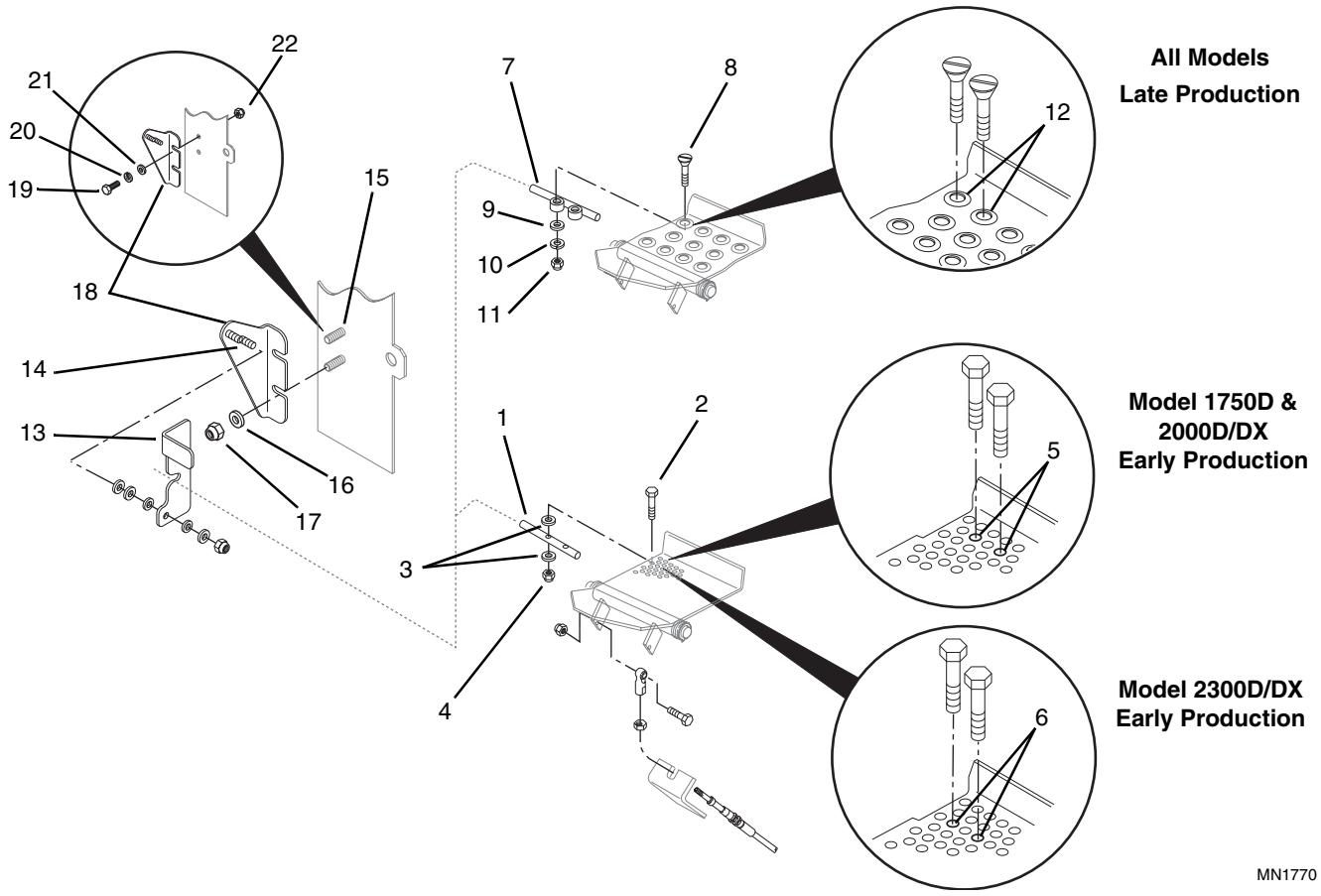


Figure 7-72 Auxiliary Hydraulic Right Foot Pedal Lock

h. Optional Auxiliary Hydraulic Pedal Lock Control

The auxiliary hydraulic system, on vehicles equipped with the optional wrist controls, is controlled by the right foot pedal. This foot pedal is equipped with a mechanical lock that prevents unintended engagement of the circuit. Maintenance of this lock should not be required under normal circumstances.

If this lock is found to be not functioning properly, inspect all components for damage, and replace as required.

1. On early production models, a latch pin (Fig. 7-72, 1) is mounted on the right foot pedal, and is secured by two capscrews (2), flat washers (3), and elastic hex locknuts (4) as follows:
   - **Model 1750D and 2000D/DX Only** - Insert the capscrews through the pedal holes (Fig. 7-72, 5) shown.
   - **Model 2300D/DX Only** - Insert the capscrews through the pedal holes (Fig. 7-72, 6) shown.

   On all late production models, the latch pin (Fig. 7-72, 7) is mounted on the right foot pedal, and is secured by two flathead capscrews (8), flat washers (9), lockwasher (10) and elastic hex locknuts (11). Insert the capscrews through the pedal holes as shown (Fig. 7-72, 12).
2. The pedal latch (Fig. 7-72, 13), is mounted to a stud (14) on the latch bracket (18). The bracket is installed to weld studs on the Operator's Protective Structure cover (15), and is secured by two flat washers (16) and elastic hex locknuts (17).

Note: *The latch bracket (Fig. 7-72, 18) on early units may be secured to the cover by two capscrews (19), lockwashers (20) flat washers (21), and hex locknuts (22).*

If the latch does not engage properly, inspect all components for damage, or an excessive accumulation of dirt of other debris. Clean the components as required, or replace any component found to be damaged.

7.6 THROTTLE CONTROL

7.6.1 Throttle Control Description

The throttle lever controls the engine speed. It is located on the right side of the operator in the Operator's Protective Structure, next to the travel/steering and auxiliary hydraulic control lever.

7.6.2 Throttle Control Operation

Push the throttle lever (Fig. 7-73, 1) up for full engine speed. Push the lever down for engine idle.

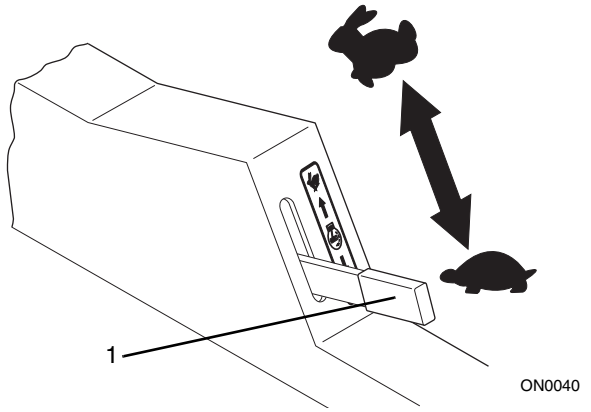


Figure 7-73 Throttle Lever

7.6.3 Throttle Control Maintenance

a. Removal and Inspection

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Open rear door and lift engine compartment cover.
3. Disconnect throttle cable (Fig. 7-74, 1) from fuel injection pump by removing the cotter pin (2) and washer (3), and lift the rod end (4) from the injection pump lever.
4. Remove cable from notch in bracket (Fig. 7-74, 5).
5. Disconnect the right side shock from the Operator's Protective Structure (Refer to Section 9.4.1 a or 9.4.2 a).
6. Disconnect the clevis (Fig. 7-74, 9) from the throttle lever (16) by removing the cotter pin (7) and clevis pin (8).
7. Remove the screws (Fig. 7-74, 11) and cable clamp (12). The cable is now free to be removed.

***Note: DO NOT** reuse any elastic locknut(s). Discard any elastic locknut(s) removed and replace with new.*

8. Remove the throttle control lever (Fig. 7-74, 16) from the mount by removing elastic locknut (14), belleville washer (15), friction pad (13), flat washer (17), and capscrew (18).

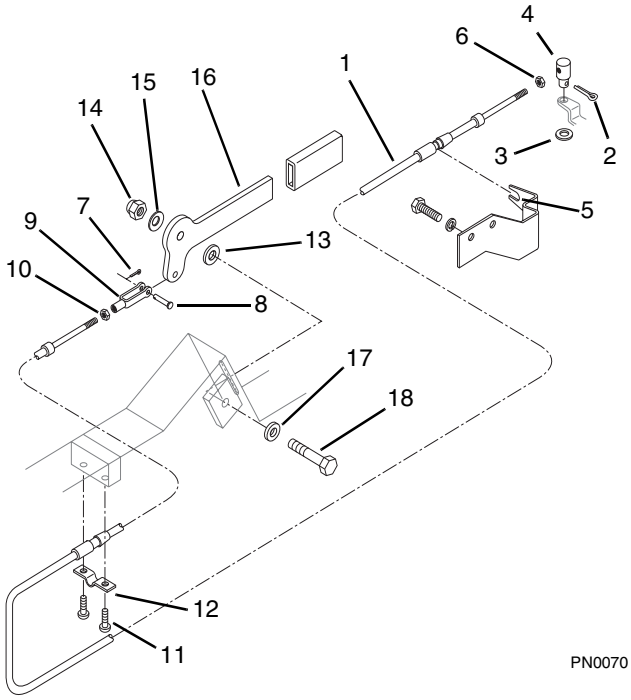


Figure 7-74 Throttle Cable

9. Inspect lever (Fig. 7-74, 16) for damage or distortion.
10. Inspect cable (Fig. 7-74, 1) for kinks or other damage that prevents smooth operation.
11. Replace used elastic locknut (Fig. 7-74, 14) with new.
12. Replace any other worn or damaged parts.

b. Installation and Adjustment

1. Reinstall the throttle control lever (Fig. 7-74, 16), capscrew (18), washer (17), friction pad (13), belleville washer (15), and new elastic locknut (14).
2. Adjust initial lever friction by tightening the capscrew (Fig. 7-74, 18) and elastic locknut (14) until a slight drag is felt on the lever as it is moved throughout its entire range of travel.
3. Place the throttle control lever in the full throttle position.

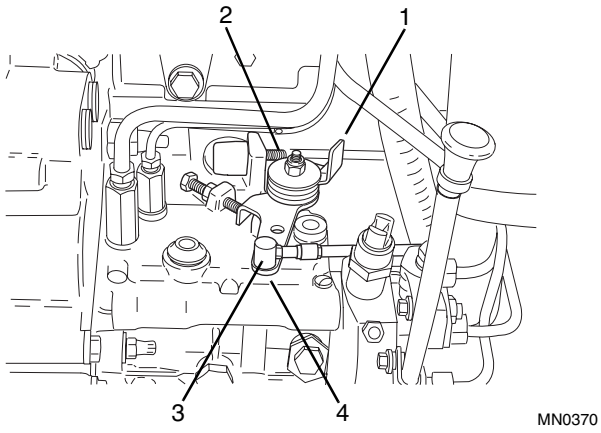


Figure 7-75 Injection Pump Lever

4. Move the injection pump throttle lever (Fig. 7-75, 1) so it contacts the high-speed stop screw (2).

IMPORTANT: *The high-speed stop setting has been set by the engine manufacturer and is capped and sealed.* ***DO NOT*** *tamper with the stop setting in any way. If this setting is altered, and allows the engine to operate at a speed higher than specified, severe damage to the engine may result. Tampering with this setting will also void the engine manufacturer's warranty.*

5. Adjust the cable if necessary, by turning the cable rod end (Fig. 7-75, 3) in the appropriate direction to align it with the hole in the injection pump throttle lever (4).

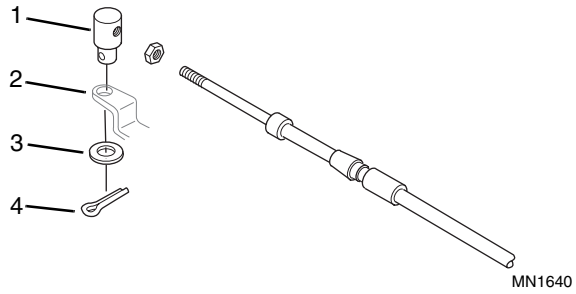


Figure 7-76 Throttle Cable Installation to Injection Pump

6. Once adjustment is correct, secure the cable rod end (Fig. 7-76, 1) to the injection pump throttle lever (2) using the flat washer (3) and cotter pin (4).
7. Reconnect the right side shock to the Operator's Protective Structure (Refer to Section 9.4.1 c or 9.4.2 d).
8. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
9. Start the engine, and operate the throttle lever through its entire range. Check the friction tension on the lever to ensure that the lever will not creep down during operation. If adjustment is necessary, tighten or loosen the elastic locknut at the throttle lever pivot point as required to make the necessary correction.

7.7 PARK LOCK SYSTEM

7.7.1 Park Lock Operation

The park lock prevents wheel movement whenever the seat bar is raised, by extending a lock pin into a hole in each drive sprocket, and preventing the sprockets from turning. When the seat bar is lowered, the park lock pins retract and allow the drive sprockets to rotate.

7.7.2 Park Lock Maintenance

a. Removal

IMPORTANT: *The following steps involve disassembly of the vehicles park lock system. Park the vehicle on a level surface, and block both sides of each wheel before beginning this procedure.*

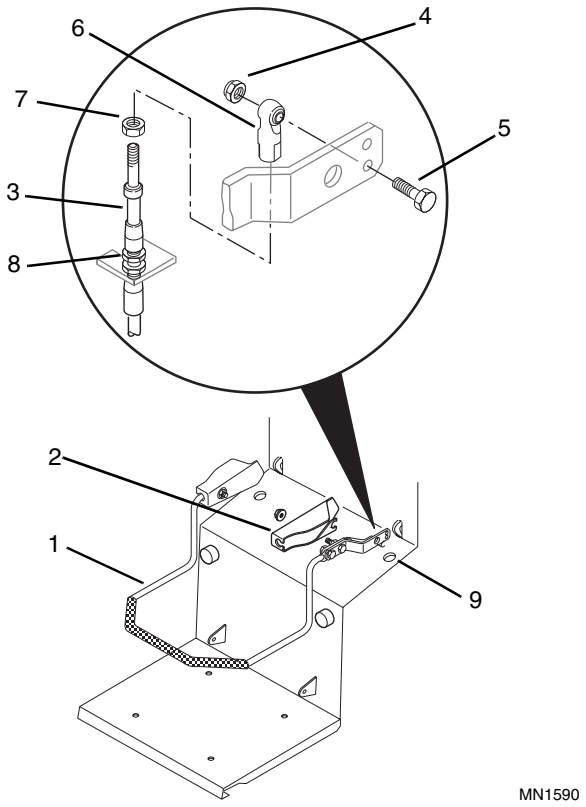


Figure 7-77 Park Lock Cable Removal Seat Bar Attachment

1. Lower seat bar (Fig. 7-77 ,1) and remove seat bar spring covers (2).
2. Disconnect cable (Fig. 7-77, 3) from seat bar by removing elastic locknut (4) and capscrew (5).

Note: ***DO NOT*** *reuse any elastic locknut(s). Discard any elastic locknut(s) removed and replace with new.*

3. Remove ball joint (Fig. 7-77, 6) and hex jam nut (7) from cable (3).
4. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
5. Loosen upper bulkhead nut (Fig. 7-77, 8) and remove it from the end of the cable.
6. Remove cable ties and clamps that secure cable to Operator's Protective Structure, and pull cable through hole in bulkhead (Fig. 7-77, 9).

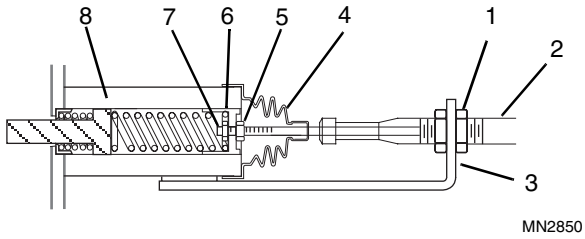


Figure 7-78 Park Lock Disassembly

7. Loosen the outer bulkhead nut (Fig. 7-78, 1) on the cable (2). Pull the cable from its mount (3), sliding the piston sub-assembly [consisting of boot (4), hex nut (5), piston (6), and hex nut (7)] intact from the bore (8).

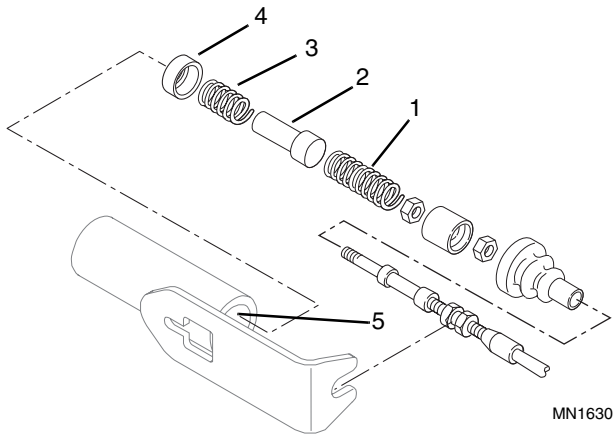


Figure 7-79 Park Lock Pin Disassembly

8. Remove the compression spring (Fig. 7-79, 1), park lock pin (2), compression spring (3), and the spring guide (4) from the bore (5).

Note: *Compression springs (1 & 3) are of different lengths and must be reassembled in the order removed.*

9. Repeat Steps 1 through 8 for the other cable and pin assembly.

b. Inspection

1. Examine all parts for damage and replace as required.
2. Check park lock pin and drive sprocket for wear or rust and replace if worn.

Note: *Drive sprockets cannot be properly examined unless they are removed. Refer to Section 6.4.5, "Drive and Axle Sprocket Removal and Installation."*

c. Installation

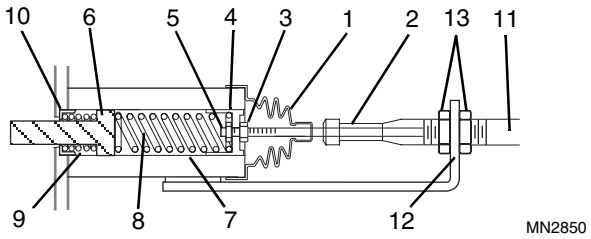


Figure 7-80 Park Lock Assembly

1. Slide boot (Fig. 7-80, 1) onto cable (2).
2. Thread hex jam nut (Fig. 7-80, 3) onto cable (2).
3. Slip piston (Fig. 7-80, 4) onto cable end and secure with a new elastic locknut (5).
4. Coat the piston (Fig. 7-80, 4), pin (6) and inside of housing bore (7) with an anti-seize compound having a molybdenum disulfide base.
5. Be sure to install the compression springs (Fig. 7-80, 8 & 9) in the order in which they were removed.
6. Insert the pin lock spring guide (Fig. 7-80, 10), compression spring (9), park lock pin (6), compression spring (8), and piston sub-assembly into the housing bore (7).
7. Insert the cable housing (Fig. 7-80, 11) into its mount (12), and adjust the bulkhead nuts (13) so an equal amount of threads are exposed on each side of the nuts. Tighten the bulkhead nuts securely. Slide boot (1) in place over the end of the housing (7).

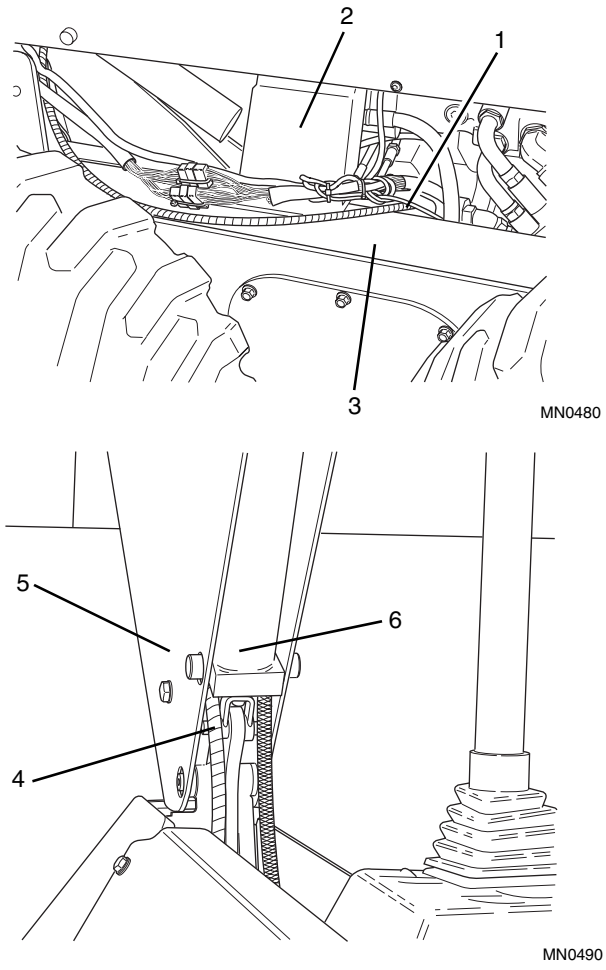


Figure 7-81 Park Lock Cable Routing (Left Side Shown - Right Side Similar)

8. Route the right park lock cable (Fig. 7-81, 1) from the right chaincase, behind the control lever crossmember (2), and over the top of the left chain case (3).
9. Feed the cable (Fig. 7-81, 4) into the Operator's Protective Structure left side (5), routing it in front of and over the top of the shock absorber (6).

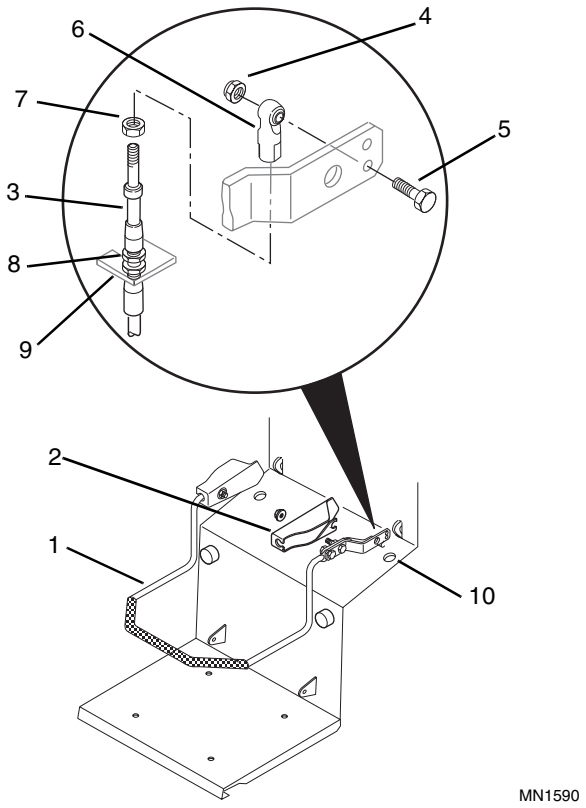


Figure 7-82 Park Lock Cable Installation

10. Insert cable (Fig. 7-82, 3) through hole in bulkhead (10), insert the cable body (3) into its mount (9), and tighten bulkhead nut (8) to secure the cable in place.
11. Install cable ties and clamps to cable that were removed during disassembly.
12. Reconnect the hex jam nut (Fig. 7-82, 7) and ball joint (6) to the cable (3).
13. Secure the cable (Fig. 7-82, 3) to the seat bar with a new elastic locknut (4) and capscrew (5).

Note: *Right park lock pin cable connects to left seat bar pivot. Left park lock pin cable connects to right seat bar pivot.*

14. Repeat Steps 1 through 13 for the other cable and pin assembly.
15. Proceed to Section 7.7.2 d, “Pin Operation - Inspection and Adjustment” to inspect pin operation and to adjust pin engagement, if required.
16. Replace both seat bar spring covers (Fig. 7-82, 2).

d. Pin Operation - Inspection

If the park lock pins are not properly engaging into the drive sprockets, the vehicle will either free-wheel when the seat bar is raised or the wheels will remain locked when the seat bar is lowered.

To correct either condition the park lock pin assembly(s) will require adjustment. Follow these procedures to inspect pin operation.

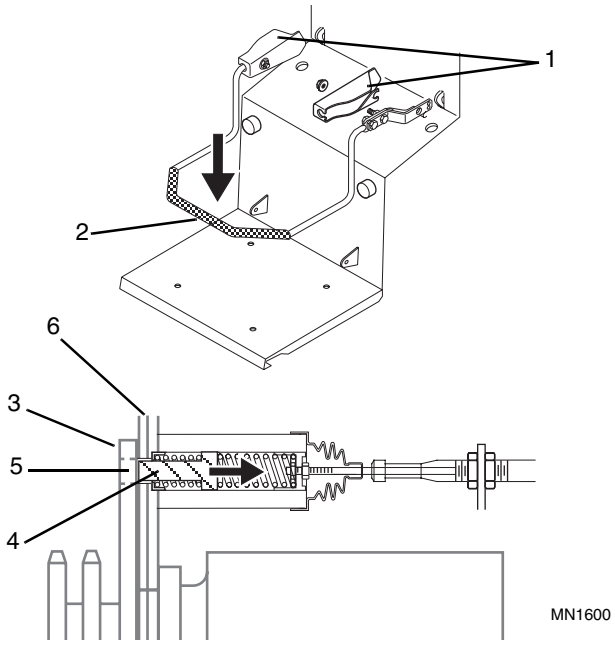


Figure 7-83 Park Lock - Disengaged

1. Remove seat bar spring covers (Fig. 7-83, 1).
2. Lower the seat bar (Fig. 7-83, 2).
3. Remove both side chain case access covers to gain access to the drive sprocket (Fig. 7-83, 3) and the end of the park lock pin (4).
4. Inspect to see that both pins (Fig. 7-83, 4) have fully retracted from the hole (5) in drive sprocket (3) and should be flush with the edge of the chaincase wall (6).

5. Raise seat bar (Fig. 7-84, 1).
6. Inspect to see that both pins (Fig. 7-84, 2) have fully extended through the hole (3) in its respective drive sprocket (4).

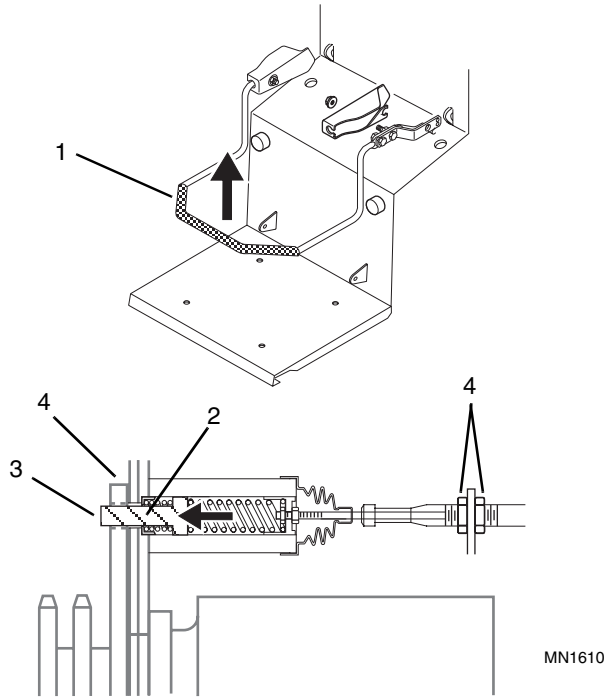


Figure 7-84 Park Lock - Engaged

7. If the pin operation is NOT CORRECT, proceed to 7.7.2 e “Park Lock Pin Adjustment.”
8. If pin operation IS CORRECT, replace seat bar spring covers. Complete the inspection and adjustment by following Steps 9 and 10.

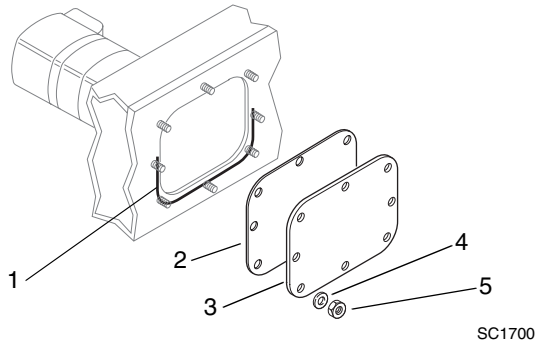


Figure 7-85 Access Cover Installation

9. Clean any sealer residue from the lower part of the access cover opening (Fig. 7-85, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
10. Reassemble the cover gasket (Fig. 7-85, 2) and cover (3) to the side of the chain case using the original washers (4) and hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm) to complete the inspection procedure.

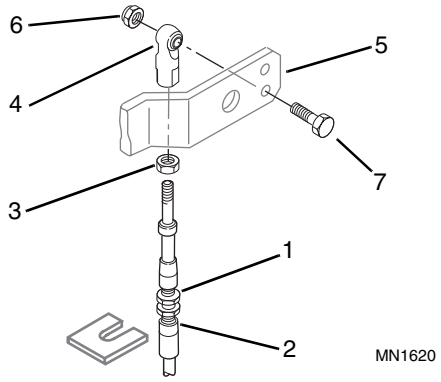


Figure 7-86 Park Lock Cable Operator’s Protective Structure Mount

e. Park Lock Pin Adjustment

1. Inspect both park lock cables where they mount to the rear of the Operator’s Protective Structure. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 7-86, 1 & 2) on each cable. If not, readjust as required until they are equal.
2. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

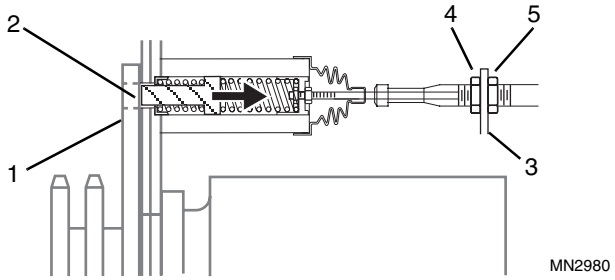


Figure 7-87 Park Lock Cable Chassis Mount

3. Remove both side chain case access covers, if not already removed, to gain access to the drive sprocket (Fig. 7-87, 1) and the end of the park lock pin (2).
4. Inspect both park lock cables where they mount to the chassis (Fig. 7-87, 3). An equal number of threads should be visible on each side of the bulkhead nuts (4 & 5) on each cable. If not, readjust the bulkhead nuts as required until they are equal.

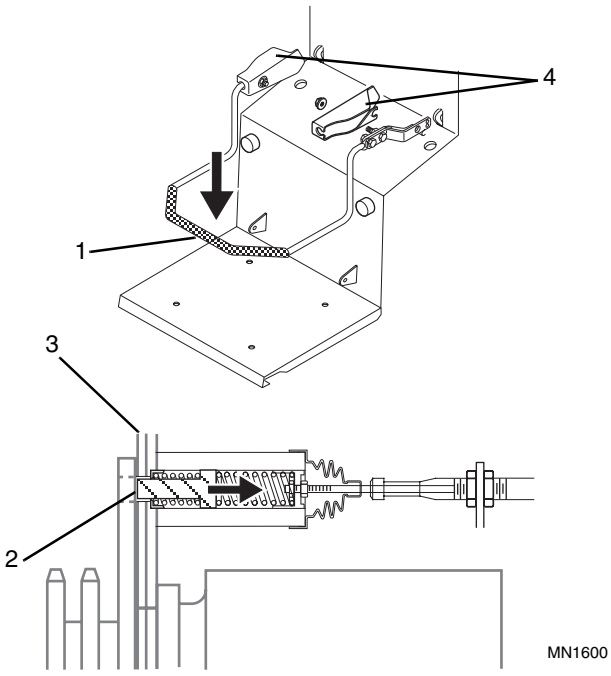


Figure 7-88 Park Lock - Disengaged

5. Lower the seat bar (Fig. 7-88, 1) to retract both lock pins. The face of each lock pin (2) must be flush with the inner wall of each respective chain case (3) with the seat bar lowered. The lock pin position is adjusted by moving the ball joint on the cable end at the seat bar.
6. At the rear of the seat bar, loosen the hex jam nut (Fig. 7-86, 3) against the ball joint (4).
7. Detach ball joint (Fig. 7-86, 4) from seat bar (5) by removing the elastic locknut (6) and capscrew (7). Discard locknut.

Note: *The left cable connection at the rear of the seat bar will adjust the right park lock spring assembly. The right cable connection at the rear of the seat bar will adjust the left park lock assembly.*

8. Turn the ball joint (Fig. 7-86, 4) onto the cable to retract either pin (Fig. 7-88, 2) away from the drive sprocket. Turn the ball joint toward the end of the cable to extend either pin closer to the drive sprocket.
9. With the seat bar still lowered, temporarily attach both ball joints (Fig. 7-86, 4) to the seat bar and inspect each pin position again. Repeat Step 8 as required until the face of the each lock pin (Fig. 7-88, 2) is flush with the inner wall of the respective chain case (3).
10. If either pin cannot be adjusted using Steps 5 through 9, loosen the cable housing bulkhead nuts (Fig. 7-87, 4 & 5), reposition the cable slightly and tighten the bulkhead nuts (4 & 5). Repeat Steps 5 through 9.

Note: DO NOT *reuse any elastic locknut(s). Discard any elastic locknut(s) removed and replace with new.*

11. Secure each cable ball joint (Fig. 7-86, 4) to the seat bar (5) with capscrew (7) and a new elastic locknut (6). Tighten the hex jam nut (3) on each cable to the ball joint (4).
12. Replace both seat bar spring covers (Fig. 7-88, 4).

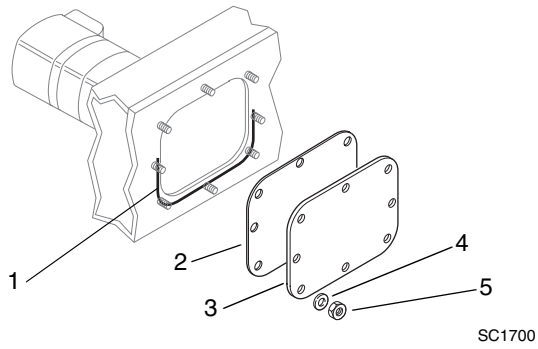


Figure 7-89 Access Cover Installation

13. Clean any sealer residue from the lower part of the access cover opening (Fig. 7-89, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
14. Reassemble the cover gasket (Fig. 7-89, 2) and cover (3) to the side of the chain case using the original washers (4) and hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm) to complete the adjustment procedure.
15. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

7.8 TROUBLESHOOTING

Trouble	Probable Cause	Remedy	Par. Ref.
Travel/steering lever will not self center.	Linkage out of adjustment.	Adjust. Check ball joints for wear and replace as necessary.	7.2.3 or 7.2.4
	Linkage disconnected.	Reconnect. Check for wear at rod ends or loose hex jam nuts.	7.2.2
	Centering spring broken.	Replace.	7.2.2
	Control lever binding. Shock binding/defective.	Check pistons for rust or bushings for deterioration and replace as required.	7.2.2
	Hydrostatic transmission neutral adjustment tampered with.	Adjust.	7.2.4 c
Vehicle operates erratically.	Steering linkage loose.	Replace and tighten locknuts.	7.2.2
	Steering linkage parts worn excessively.	Inspect linkage for wear at ball joints.	7.2.2
	Travel/steering lever out of adjustment.	Adjust.	7.2.3 or 7.2.4
	Hydrostatic transmission leakage.	Check all ports for loose connections, bad seals, etc. Replace damaged/defective unit if required.	5.7
Attachments will not operate.	Auxiliary hydraulic cable not properly connected.	Reconnect.	7.3.2 c
	Auxiliary hydraulic cable is worn or broken.	Replace.	7.3.2
	Low control valve main relief pressure.	Test and adjust, clean, or replace.	3.4.1 and 4.7.6
	Auxiliary main control valve spool binding.	Inspect and clean or replace valve.	4.7.5
Foot pedals do not return to neutral	Foot pedal bushings binding due to contamination.	Remove and replace bushings.	7.4.2
	Cable disconnected or broken.	Inspect and replace or reconnect as required.	7.4.2
	Low control valve main relief pressure.	Test and adjust, clean, or replace.	3.4.1 and 4.7.6
	Main control valve spool binding.	Inspect and clean or replace valve.	4.7.3 or 4.7.4

Trouble	Probable Cause	Remedy	Par. Ref.
Throttle control lever sticks or is loose.	Lever pivot bolt is too tight or too loose.	Adjust.	7.6.3
	Cable may be broken or seized.	Inspect and replace as required.	7.6.3
Engine stalls	Throttle idle setting too low.	Adjust.	7.6.3
	Other engine problems.	See engine section.	10.15
Engine does not reach full throttle (full speed) when throttle lever is moved up.	Cable is broken or disconnected.	Check and replace or reconnect as required.	7.6.3
	High speed stop screw has been altered.	Consult engine manufacturer.	7.6.3
Wheels do not lock with the seat bar raised.	Wheel pin locking assembly (Park Lock) not adjusted correctly.	Inspect and adjust.	7.7.2
or	Cable is disconnected, broken, rusted, etc.	Check and replaced or reconnect as required.	7.7.2
Wheels do not unlock when seat bar is lowered.	Boot is cracked, permitting moisture in pin/piston causing rust.	Replace boot and pin/piston as required.	7.7.2
	Spring(s) are weak or broken.	Check and replace as required.	7.7.2

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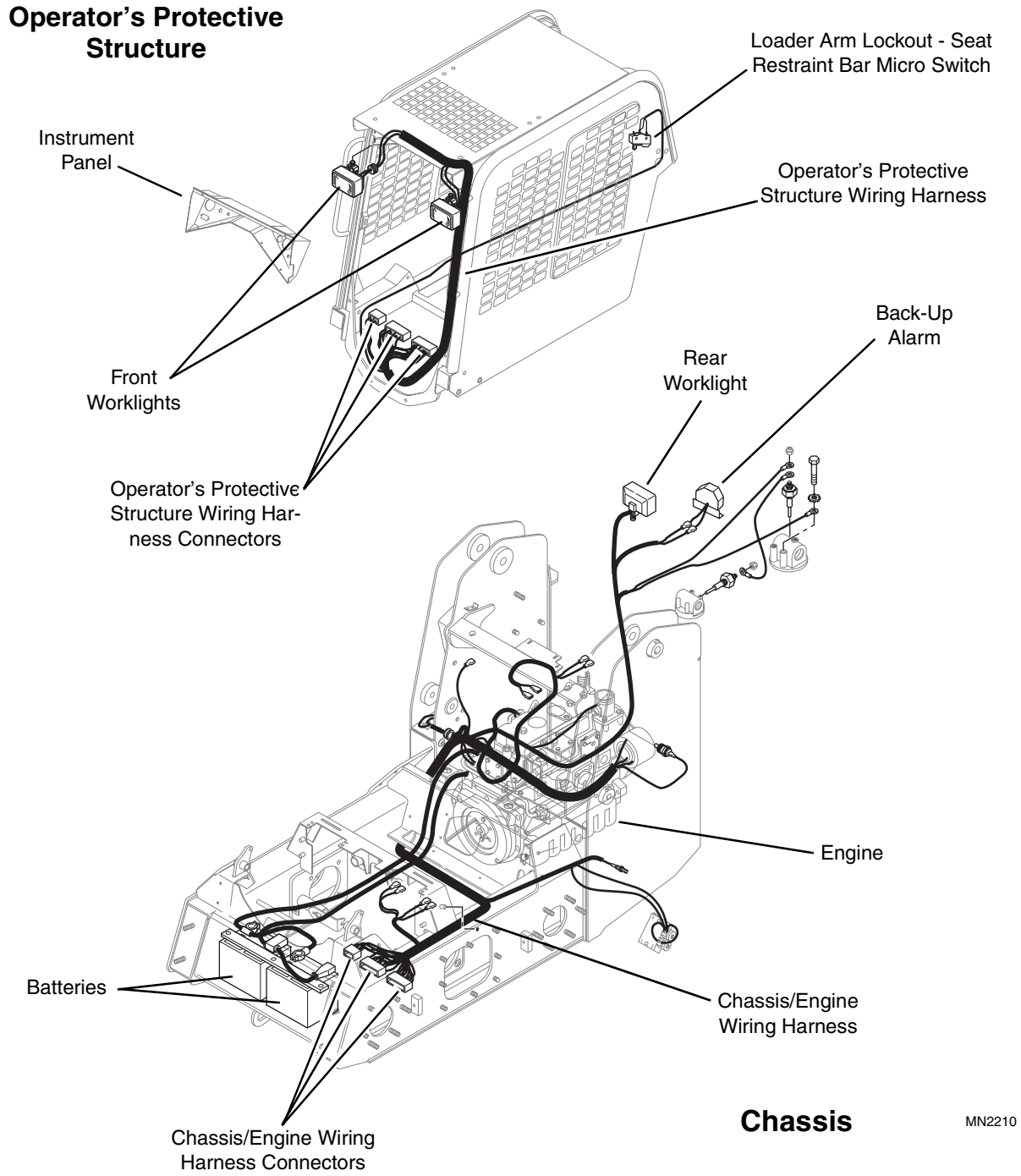
Section 8
Electrical System

Contents

8.1 ELECTRICAL SYSTEM TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the vehicle electrical components. The following illustration identifies the components that are referred to throughout this section.



8.2 SERVICE WARNINGS AND RECOMMENDATIONS

WARNING:

- **DO NOT** disconnect the batteries while the engine is running. This will cause a voltage surge in the alternator charging system that will immediately ruin the diodes or transistors.
- **DO NOT** disconnect any wiring without first stopping the engine, turning all electrical switches to the OFF position and disconnecting the battery ground cable from the batteries.
- **DO NOT** cause a short circuit by connecting leads to incorrect terminals. Always identify a lead to its correct terminal. A short circuit or wrong connection giving reverse polarity will immediately and permanently ruin transistors and diodes.
- **DO NOT** connect a battery into the system without checking for correct polarity and voltage.
- **DO NOT** "flash" connections to check for current flow. No matter how brief the contact, the alternator transistors may be ruined.
- **DO NOT** use torches, tools which spark, smoking materials or open flames when working near batteries. Lead-acid batteries generate hydrogen gas which is highlyflammable. If ignited, the gas may explode violently causing spraying of acid, fragmentation of the battery and possible severe personal injury.

WARNING: There are several test procedures in this section that involve the use of intense heat. Failure to follow appropriate procedures or warnings can cause burns, which can result in serious personal injury. While performing these tests, observe these general precautions:

- Wear personal protective clothing such as heat resistant gloves, a non-flammable apron, and eye protection - preferably full-face shield or safety glasses.
- Because the components will reach high temperatures, **DO NOT** handle materials until COMPLETELY cooled.

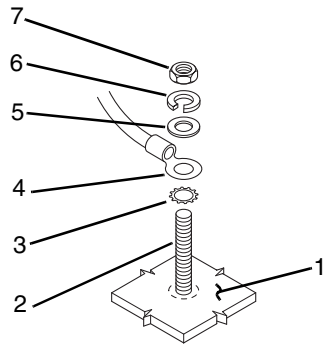


Figure 8-1 Recommended Sequence of Parts for Electrical Wire Grounding

IMPORTANT: *Effective ground connections are essential to the efficient operation of electrical components.*

The recommended sequence for installing parts to achieve a good electrical ground is shown above (Fig. 8-1).

The surface (Fig. 8-1, 1) surrounding the stud or bolt (2) should be free of paint and corrosion. Install an external or internal tooth lockwasher (3), followed by the terminal connection (4), flat washer (5), lockwasher (6) and hex nut (7).

8.3 INSTRUMENTATION

8.3.1 Instrument Panel Removal and Installation

a. Removal

1. Be sure the vehicle is on a level surface, the implement grounded, seat bar raised, and engine shut OFF.
2. Remove the floor plate between the foot pedals.
3. Disconnect the black negative battery cable from both batteries.

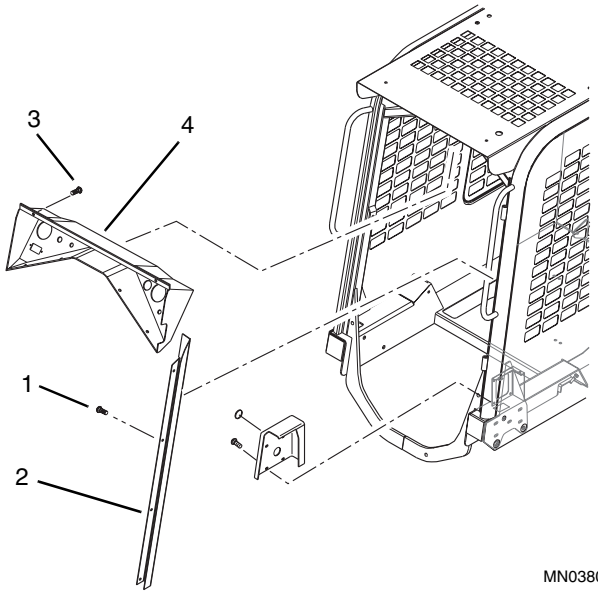


Figure 8-2 Instrument Panel, Cab Harness and Fuse Panel Cover

4. Remove three allen drive screws (Fig. 8-2, 1) that secure the left panel (2) to the Operator's Protective Structure.
5. Remove six allen drive screws (Fig. 8-2, 3) that secure the instrument panel (4) to the Operator's Protective Structure.
6. Pull the instrument panel (Fig. 8-2, 4) from the structure, guiding the wiring harness out of the left channel of the structure as the instrument panel is lowered.

b. Installation

1. Lift the instrument panel (Fig. 8-2, 4) into place in the Operator's Protective Structure, and install six allen drive screws to secure the panel in place.
2. Place the left panel (Fig. 8-2, 2) into position in the structure, and secure with three allen drive screws (1).
3. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

8.3.2 Warning Lights, Warning Light Alarm and Switches

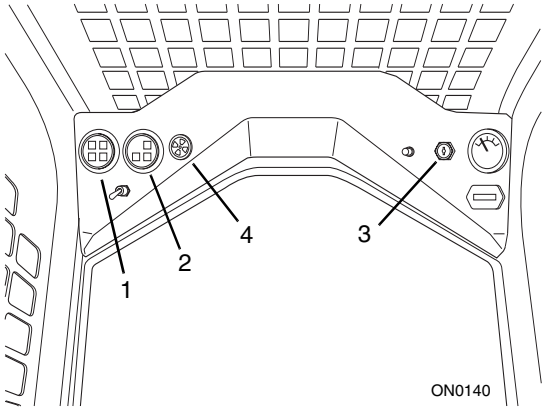


Figure 8-3 Instrument Panel Warning Lights

There are four warning lights in the left cluster (Fig. 8-3, 1), and three lights in the right cluster (2). When the ignition switch (3) is turned to the RUN position, the warning light alarm (4) will sound and the alternator charge and engine oil pressure lights will illuminate. This is a normal condition.

While the engine is running, all seven lights (Fig. 8-3, 1 & 2) and the alarm (4) should be OFF. However, if any of the lights illuminate, an abnormal condition exists and you should STOP the vehicle immediately.

The alarm (Fig. 8-3, 4) will only sound when the engine water temperature, engine oil pressure or hydraulic/transmission oil temperature lights come on, indicating that an abnormal condition exists that requires the vehicle engine to be STOPPED immediately.

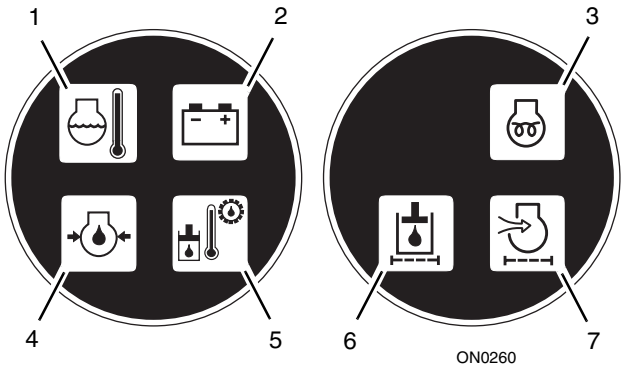


Figure 8-4 Warning Light Clusters

The individual warning lights (Fig. 8-4) indicate the following conditions:

1. **Engine Water Temperature Light** (Fig. 8-4, 1)
   Indicates high engine coolant temperature and the warning alarm will sound.
2. **Alternator Charging Light** (Fig. 8-4, 2)
   Indicates alternator is not charging.
3. **Thermo Start Light** (Fig. 8-4, 3)
   Will come on when ignition switch is turned to the thermo start position and will go off when engine is ready to start. This light will not come on with the test switch.
4. **Engine Oil Pressure Light** (Fig. 8-4, 4)
   Indicates low engine oil pressure and the warning alarm will sound.
5. **Hydraulic/Transmission Oil Temperature Light** (Fig. 8-4, 5)
   Indicates high hydraulic oil temperature and the warning alarm will sound.
6. **Hydraulic Oil Filter Restriction Light** (Fig. 8-4, 6)
   Indicates when hydraulic oil filter requires service.
7. **Air Cleaner Restriction Light** (Fig. 8-4, 7)
   Indicates when air cleaner requires service.

a. Warning Lights Test/Worklight Switch

A three position toggle switch is mounted on the left side of the instrument panel that tests the lights in the warning light clusters and also controls the vehicles worklights.

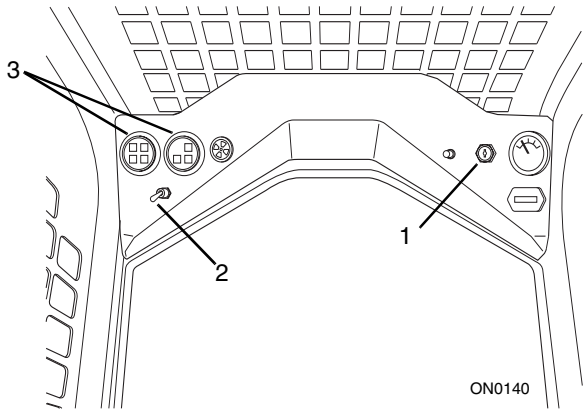


Figure 8-5 Instrument Panel Light Switch

With the ignition switch (Fig. 8-5, 1) in the RUN position and the engine is OFF, momentarily move the switch toggle (2) to the right to test the bulbs in both warning light clusters. It will be necessary to replace any bulbs that DO NOT illuminate.

IMPORTANT: *Test these lights daily, to be warned of serious potential damage to engine and hydrostatic drive.*

Move the switch toggle (Fig. 8-5, 2) to the left to turn ON the front and rear worklights.

Testing Warning Lights Test/Worklight Switch

1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”), and tag and disconnect the switch wiring.

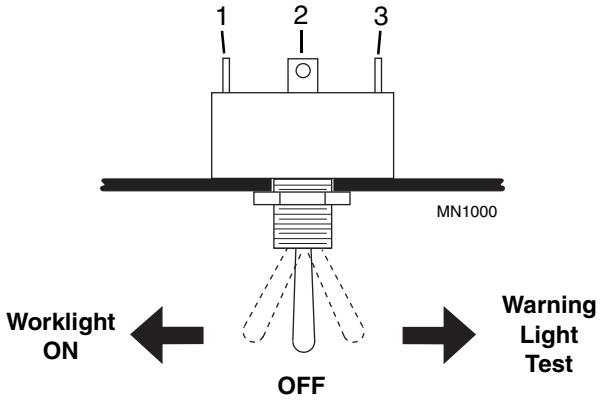


Figure 8-6 Warning LIght Test/Headlight Switch Test

3. Use an ohmmeter or a continuity tester to test all positions of the switch (Fig. 8-6) for continuity as follows:

CENTER "OFF" POSITION	**FUNCTIONS**
Terminals 1 to 2	No Continuity
Terminals 2 to 3	No Continuity
WORKLIGHT "ON" POSITION	
Terminals 1 to 2	No Continuity
Terminals 2 to 3	Continuity Exists
WARNING LIGHTS "TEST" POSITION (Momentary)	
Terminals 1 to 2	Continuity Exists
Terminals 2 to 3	No Continuity

4. If the switch fails any of the tests performed above, the switch is defective.
5. Replace the switch if defective, and install a new switch in the instrument panel. Connect the wiring removed in Step 2.
6. Install the instrument panel (Refer to Section 8.3.1, "Instrument Panel Removal and Installation").
7. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

b. Warning Light Cluster Bulb Replacement

1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, "Instrument Panel Removal and Installation"), and locate the defective warning light socket.
3. Grasp and turn the appropriate bulb socket counterclockwise and remove socket with bulb from gauge.
4. Pull bulb out of socket. Inspect socket contact areas on back of cluster for corrosion and clean and brighten any corroded areas. Replace bulb (GE 161 bulb) and/or socket as required.
5. Install the instrument panel (Refer to Section 8.3.1, "Instrument Panel Removal and Installation."
6. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

c. Hydraulic Oil Temperature Light

The hydraulic oil temperature light comes ON when the temperature of the oil in the hydraulic reservoir exceeds normal operating limits, 220° F (104° C).

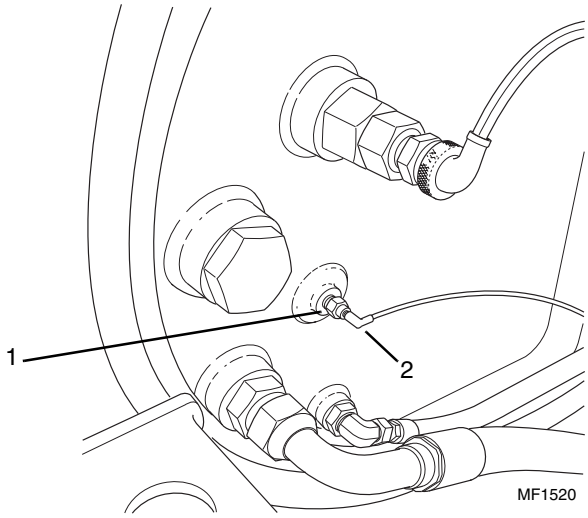


Figure 8-7 Hydraulic Oil Temperature Switch

The hydraulic oil temperature switch is located near the bottom of the hydraulic oil reservoir (Fig. 8-7, 1), inside the engine compartment. The switch measures the temperature of the hydraulic system oil.

If the hydraulic oil temperature light comes on during operation, shut engine off and determine the cause of overheating. Check the radiator and hydraulic oil cooler for any air flow restriction first before checking for a malfunction of the oil temperature switch.

Testing Hydraulic Oil Temperature Switch

1. Be sure the ignition switch is OFF.
2. Open the engine compartment door, reach in and pull the wire connector (Fig. 8-7, 2) off the switch terminal.
3. Drain the hydraulic reservoir as required to allow removal of the switch without excessive leakage from the reservoir. Remove the oil temperature switch from the reservoir.

WARNING: This test procedure involves the use of intense heat. Failure to follow appropriate procedures or warnings can cause burns, which can result in serious personal injury. While performing these tests, observe these general precautions:

- Wear personal protective clothing such as heat resistant gloves, a non-flammable apron, and eye protection - preferably full-face shield or safety glasses.
- Because the components will reach high temperatures, **DO NOT** handle materials until COMPLETELY cooled.

4. Test the switch using an ohmmeter or continuity tester connected to the switch terminal and body as follows:
   a. With the switch element at ambient air temperature, continuity should NOT exist. If continuity is present, the switch is defective.
   b. Pour enough 10W30 oil in a suitable container to submerge the element on the bottom of the switch. Heat the oil in container to a minimum of 220° F (104° C).
   c. Place the switch element in the oil, and allow several moments for the switch temperature to stabilize.
   d. With the switch element heated to a minimum of 220° F (104° C), continuity SHOULD exist. If continuity is NOT present, the switch is defective.
5. Replace the switch if defective, and install in the hydraulic reservoir.
6. Connect the wiring removed in Step 2.
7. Refill the hydraulic reservoir (Refer to Section 4.5, “Startup After Hydraulic Repair”).
8. Close and lock the engine compartment door.

d. Engine Oil Pressure Light


MF1820

The engine oil pressure light comes ON when engine oil pressure exceeds normal operating limits. The light illuminates during engine startup, not during running. If it lights during operation, shut engine OFF immediately and determine cause.

The engine oil pressure switch is located on the right side of the engine (Fig. 8.5), and is mounted on the oil filter base. It closes at low oil pressure, and illuminates the warning light.

Testing Engine Oil Pressure Switch

1. Unlock and open rear engine access door and lift engine cover.
2. Check engine oil level and add 10W30 oil if needed.

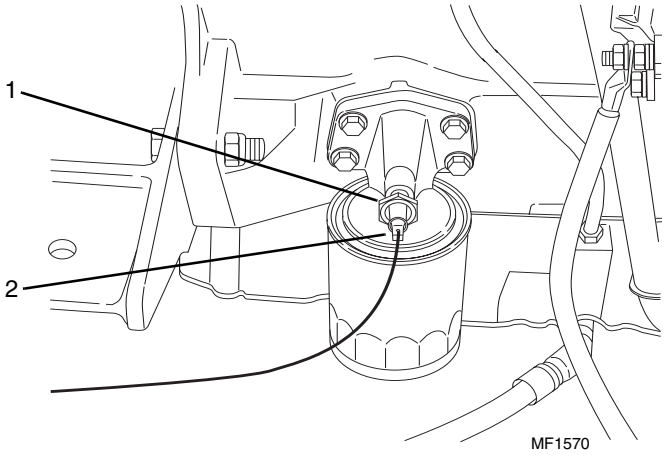


Figure 8-8 Engine Oil Pressure Switch

3. Locate the engine oil pressure switch (Fig. 8-8, 1) on right side of engine. Disconnect the wire (2) from the switch.
4. The oil pressure switch (Fig. 8-8, 1) can be tested while installed on the engine. Connect an ohmmeter or continuity tester between the switch terminal and any ground point on the engine.
   a. Continuity should exist. If continuity is NOT present, the switch is defective.
   b. Start the vehicle. Continuity should NOT exist once oil pressure has built up in the engine. If continuity is present, the switch is defective.
5. Replace the switch if defective, and reconnect the wire to the switch.
6. Close and lock the engine compartment door.

e. Engine Water Temperature Light


MF1830

The engine water temperature light comes ON when the engine coolant temperature exceeds normal operating limits. This light should not go on during normal start up. If it lights during start up or operation, shut the engine off immediately and determine the cause.

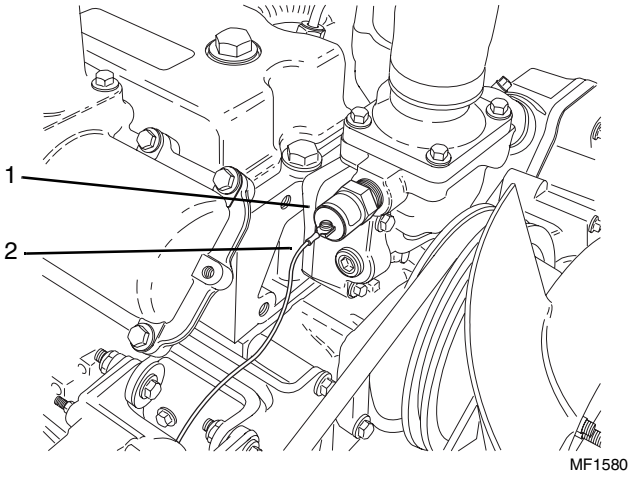


Figure 8-9 Engine Water Temperature Switch

The water temperature switch (Fig. 8-9, 1) is located on the left side of the thermostat housing on the engine. It senses coolant overheating which closes the switch and illuminates the warning light.

Testing the Engine Water Temperature Switch

WARNING: This test procedure involves the use of intense heat. Failure to follow appropriate procedures or warnings can cause burns, which can result in serious personal injury. While performing these tests, observe these general precautions:

- Wear personal protective clothing such as heat resistant gloves, a non-flammable apron, and eye protection - preferably full-face shield or safety glasses.
- Because the components will reach high temperatures, **DO NOT** handle materials until COMPLETELY cooled.

1. Unlock and open rear engine access door and lift engine cover.

2. Locate the engine water temperature switch (Fig. 8-9, 1) on the thermostat housing on the engine.
3. Disconnect the wire (Fig. 8-9, 2) from the switch terminal. Drain sufficient coolant from the radiator to allow removal of the switch (1) from engine without excessive coolant loss.
4. Test the switch (Fig. 8-9, 1) using an ohmmeter or continuity tester connected to the switch terminal and body as follows:
   a. With the switch element at ambient air temperature, continuity should NOT exist. If continuity is present, the switch is defective.
   b. Pour enough engine coolant in a suitable container to submerge the element on the bottom of the switch. Heat the coolant in the container to a minimum of 210° F (99° C).
   c. Place the switch element in the coolant, and allow several moments for the switch temperature to stabilize.
   d. With the switch element heated to a minimum of 210° F (99° C), continuity SHOULD exist. If continuity is NOT present, the switch is defective.
5. Replace the switch if defective. Install the switch in the engine thermostat housing.
6. Reconnect the wire (Fig. 8-9, 2) to the switch (1) terminal.
7. Refill the radiator to the proper level.
8. Lower engine cover, close and lock engine compartment door.

f. Alternator Light

The alternator light illuminates when the alternator is not producing sufficient current to charge the batteries. The light illuminates during the initial engine startup, but turns OFF shortly thereafter.

If the alternator warning light illuminates during operation, shut the engine off immediately and determine the cause.

Testing Alternator

For testing procedures, refer to Section 8.7.2, “Alternator Testing.”

g. Air Cleaner Restriction Light

The air cleaner restriction light illuminates when the air cleaner requires service. This light should NOT illuminate during normal engine start up. If it lights during start up or operation, shut the engine off and determine the cause.

The normal cause of the air restriction light illuminating is a clogged air cleaner. If this is suspected, change the air cleaner and/or safety element. Start the engine and check to ensure that the light is no longer illuminated. If the light remains ON, the switch or circuit may be at fault. Perform the following test procedure.

Testing Air Cleaner Restriction Switch

1. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
2. Open the engine compartment door and raise the engine cover.
3. Ensure key switch is in the OFF position.

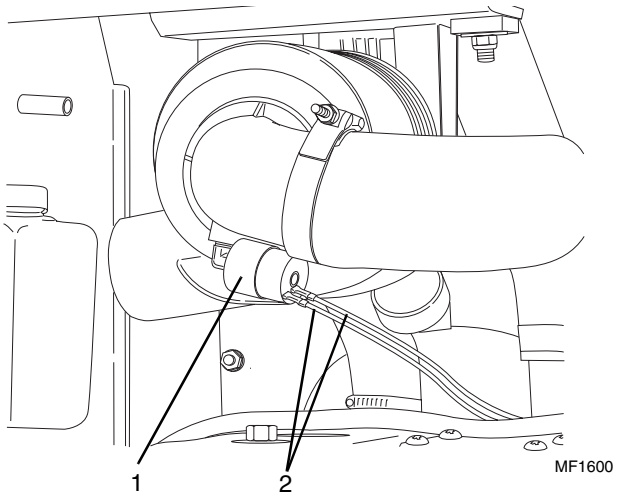


Figure 8-10 Air Restriction Indicator Switch

4. Disconnect the two wires (Fig. 8-10, 2) from the air cleaner restriction switch (1).

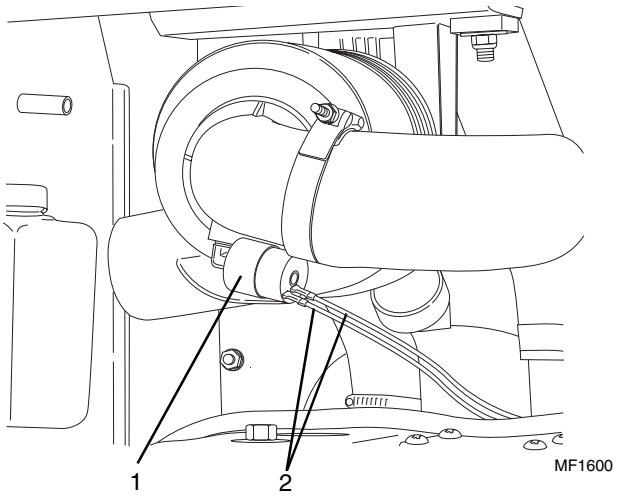


Figure 8-11 Air Restriction Indicator Switch

5. Test the air cleaner restriction switch (Fig. 8-11, 1) using an ohmmeter or continuity tester connected to the two switch terminals as follows:
   a. With the engine NOT running, NO continuity should exist. If continuity is present, the switch is defective.

WARNING: Contact with any rotating or moving part of the vehicle could cause severe injury or death. **NEVER** place any limb or other body areas near any rotating or moving part of the vehicle while the engine is run for testing purposes.

   b. With the engine running, NO continuity should exist. If continuity is present, the switch is defective.
   c. With the engine running at low idle, have an assistant restrict the air entering the air cleaner. Continuity should exist when the air flow is restricted. If there is no continuity, the switch is defective.
6. Replace the switch if defective.
7. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
8. Lower the engine cover and close and lock the engine compartment door.

h. Hydraulic Oil Filter Restriction Light

The hydraulic oil filter restriction light illuminates when the hydraulic oil filter (or filters) require service. This light should NOT illuminate during normal start up. If it lights during start up or operation, shut the engine off and determine the cause.

The normal cause is a clogged hydraulic filter. If this is the suspected cause, change the filter(s). Start the engine and check to ensure that the light is no longer illuminated.

If the light remains illuminated, the switch or circuitry may be at fault. Perform the following test procedure.

Testing Hydraulic Oil Filter Restriction Switch(es)

Note: *Models 2000D/DX and 2300D/DX have two hydraulic oil filters, with an individual switch on each filter. Both switches are individually tested in the same manner. Make sure that the wires are disconnected from both switches on these models when performing the following test.*

1. Open the engine compartment door and raise engine cover.
2. Ensure key switch is in the OFF position.

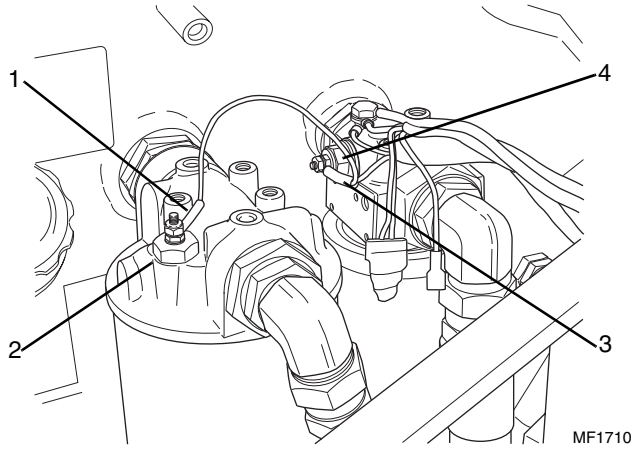


Figure 8-12 Hydraulic Oil Filter Restriction Switches-Model 2000D/DX and 2300D/DX Shown

3. Disconnect wire (Fig. 8-12, 1) from the switch (2). **On Model 2000D/DX & 2300D/DX vehicles**, also disconnect wire (3) from switch (4).
4. Test each switch individually using an ohmmeter or continuity tester connected between the switch terminal and a ground on the vehicle.
5. Continuity should NOT exist in either switch. If continuity is present, the individual switch is defective and requires replacement.
6. The restriction switch on one or both filters can also fail in the OPEN position. If this were the case, the light would NOT illuminate when there was a decrease in hydraulic oil flow (clogged filter). If you suspect this type of problem, you can verify proper switch operation by installing an old filter that is known to be clogged. When you do this, the light should come ON. If it does not, the restriction switch is faulty and should be disassembled and cleaned or be replaced.

8.3.3 Hourmeter

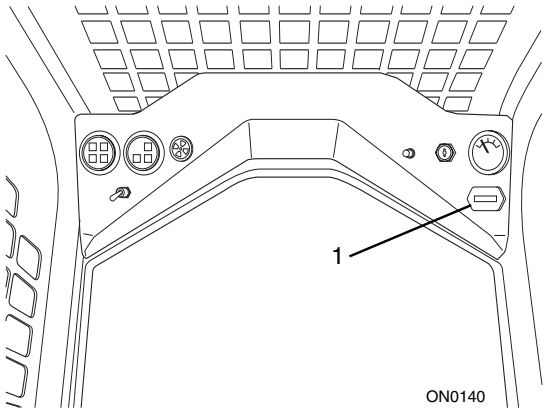


Figure 8-13 Instrument Panel Hourmeter

The hourmeter (Fig. 8-13, 1) is a solid state electronic unit, and records the number of engine operating hours. It is accurate to ±1% at 75° F (24° C), and has a total read-out of 99999.9 hours. The meter charges approximately once every 12 seconds, and will run a short time after the ignition has been shut off. To check its accuracy, observe the running indicator flag wheel.

The hourmeter is polarity insensitive, and designed to operate on a wide input voltage range. In this application, the proper voltage for the hourmeter to operate is 10-15.5 VDC. If the hourmeter is intermittent or fails to operate, check for proper voltage and faulty wiring or connections.

The hourmeter is not serviceable. If found to be defective, it must be replaced.

a. Hourmeter Replacement

1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).
3. Tag and disconnect the hourmeter wiring, and remove hourmeter.
4. Install new hourmeter, and reconnect the wiring.
5. Install the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).
6. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

8.3.4 Fuel Gauge and Level Sender

a. Operation

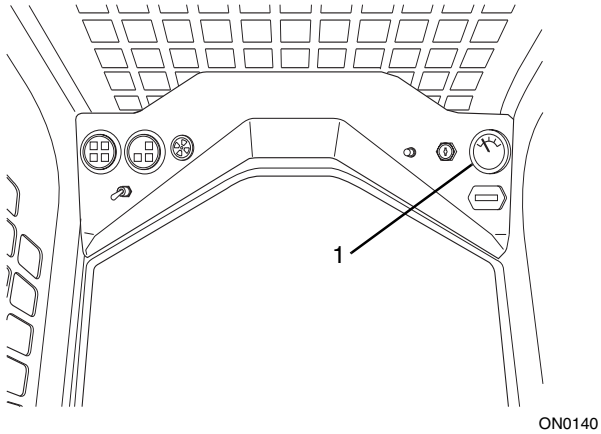


Figure 8-14 Instrument Panel Fuel Gauge

The fuel gauge (Fig. 8-14, 1) indicates the approximate level of fuel remaining in the fuel tank.

Note: *The vehicle should be refueled at the end of each workday. This will reduce the formation of moisture condensation in the fuel tank, which is harmful to the fuel injection system.*

During vehicle operation, if the fuel tank is allowed to run dry, air will enter the fuel system and make engine restart difficult. It will be necessary to remove this air from the fuel system after the tank is refilled (Refer to Section 10.9.3, “Bleeding Fuel System”).

b. Fuel Gauge Testing

1. Connect an ohmmeter to the “S” (1) and “I” (3) terminals of the fuel gauge.
   a. If an ohmmeter reading of 89 to 101 ohms is obtained, the fuel gauge is NOT defective.
   b. If the ohmmeter reading is outside of this range, the gauge is defective and must be replaced.

c. Fuel Gauge Removal

1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).

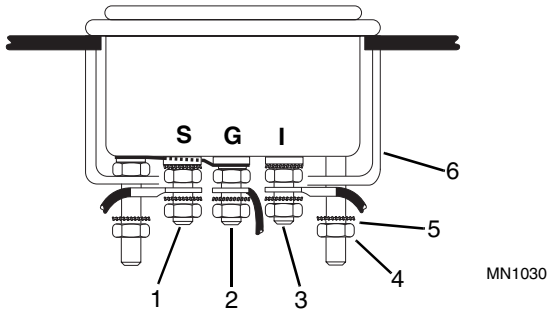


Figure 8-15 Fuel Gauge Wire Connections
(Bottom View)

3. Tag and remove the wires from the three terminals (Fig. 8-15, 1-3) on the rear of the gauge.
4. Remove two nuts (Fig. 8-15, 4) and external tooth lockwashers (5) that secure the gauge mounting clip (6) to the instrument panel. Remove the fuel gauge.

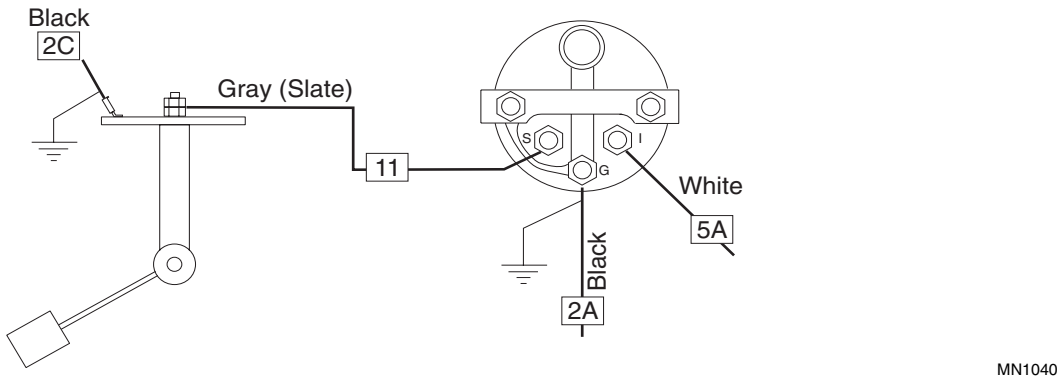


Figure 8-16 Fuel Gauge and Level Sender Electrical Schematic

d. Fuel Gauge Installation

1. Position the gauge in the instrument panel, and install the mounting clip (Fig. 8-15, 6) on the rear of the gauge. Secure the gauge by installing an external tooth lockwasher (5) and hex nut (4) on each mounting stud.
2. Replace the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).

e. Fuel Level Sender Removal

1. Be sure the ignition switch is OFF.

Note: *The fuel level sender (Fig. 8-17, 1) is mounted in an opening on the fuel tank (6) that is LOWER than the fuel tank filler neck. Before removing the fuel level sender (1), ensure that the fuel level in the tank is BELOW the level of the sender mounting hole (6).*

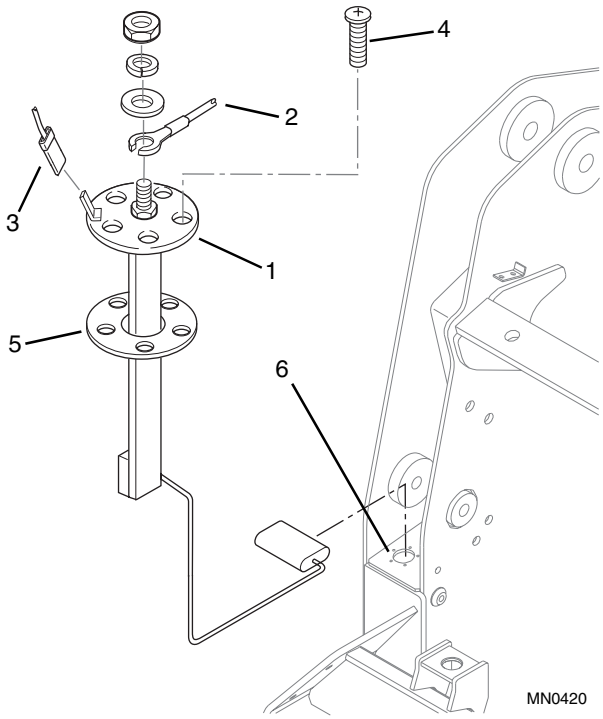


Figure 8-17 Fuel Level Sender

2. Locate the fuel level sender (Fig. 8-17, 1) below the right loader arm cylinder base end.
3. Remove the wire (Fig. 8-17, 2) connected to the sender center terminal, and remove the wire (3) connected to the ground lug on the sender flange.
4. Clean the area around the fuel level sender flange. Remove and discard the screws (Fig. 8-17, 4) securing the fuel level sender to the tank.
5. Carefully remove the fuel sender (Fig. 8-17, 1) and gasket (5) from the fuel tank.

f. Fuel Level Sender Testing

1. Connect an ohmmeter to the fuel sender center terminal and the ground tab on the flange.
   a. With the sender arm fully lowered, an ohmmeter reading of 250 to 270 ohms should be obtained. If the ohmmeter reading is higher than this range, the sender is defective and must be replaced.
   b. With the sender arm fully raised, an ohmmeter reading of 25 to 30 ohms should be obtained. If the ohmmeter reading is lower than this range, the sender is defective and must be replaced

g. Fuel Level Sender Installation

1. Clean the area on fuel tank (Fig. 8-17, 6) where sender (1) and gasket (5) are installed, using care to prevent any debris from entering the tank through the opening.
2. Carefully install the gasket (Fig. 8-17, 5) and fuel sender (1) into the tank.
3. Install new screws to secure the fuel level sender to the tank. New screws have a special sealant applied to the threads that minimize the possibility of fuel leaking past the screw threads.
4. Connect wire (Fig. 8-17, 2) to the sender center terminal, and connect wire (3) to the lug on the sender flange.
5. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

8.3.5 Back-up Alarm

a. Operation

The back-up alarm sounds whenever the ignition key is turned to the RUN position, and both travel/steering control levers are moved toward the rear, causing the vehicle to travel in a rearward direction.

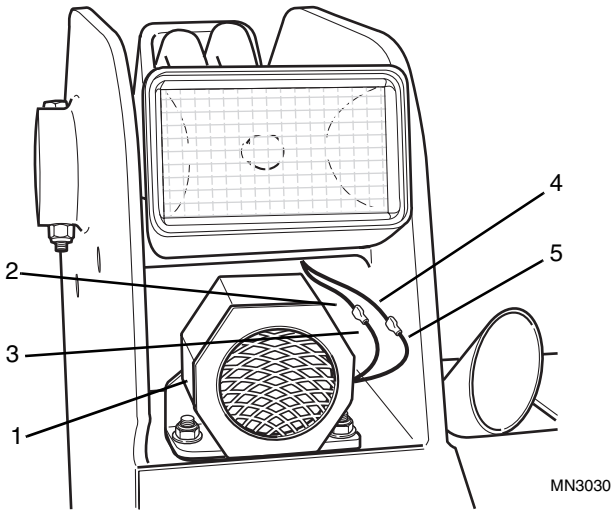


Figure 8-18 Back-up Alarm Unit

The back-up alarm consists of an electronic alarm unit (Fig. 8-18, 1) mounted above the hydraulic reservoir on the left side of the vehicle frame, and two switches (Fig. 8-19, 1 & 2) that are connected to the travel/steering control linkage.

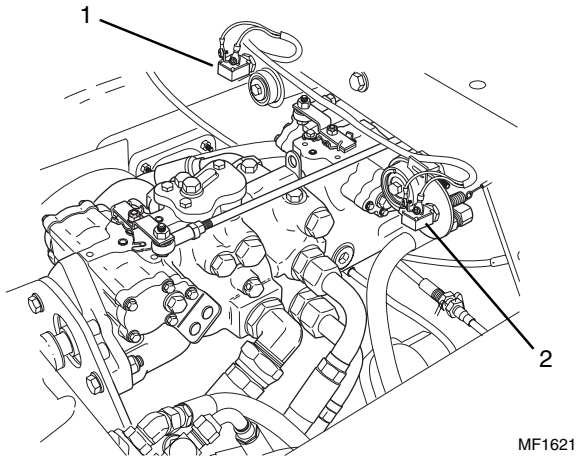


Figure 8-19 Back-up Alarm Switches

The electronic alarm unit (Fig. 8-18, 1) receives +12 VDC from a 15 AMP fuse in the fuse block. The alarm unit -12 VDC lead is routed to two switches (Fig. 8-19, 1 & 2), mounted below the travel/steering lever crossmember. Each switch is connected to a travel/steering lever. The switches are connected in series, so both must be activated to complete the alarm unit circuit to ground, causing the alarm unit to sound an audible warning.

b. Testing

1. The back-up alarm (Fig. 8-18, 1) should sound whenever both travel/steering controls are moved to the rear. If the alarm (1) sounds after the vehicle has begun moving, refer to Section c, “Adjustment,” and adjust both switches (Fig. 8-19, 1 & 2) for proper operation. If the alarm DOES NOT sound, proceed to the next step.
2. Raise the Operator’s Protective Structure into the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
3. Disconnect pink chassis wire #23 (Fig. 8-18, 2) from the alarm red lead (3), and black chassis harness #2L (4) from the alarm black lead (5).
4. With the ignition switch in the RUN position, check pink chassis wire #23 (Fig. 8-18, 2) for 12VDC power. If power is NOT present, a 15 amp fuse in the fuse block is most likely defective. Check and replace the fuse.
5. If 12 VDC power is present at pink chassis wire #23 (Fig. 8-18, 2), reconnect the wire to the alarm unit red lead (3). Using a suitable jumper wire, connect the alarm unit black lead (5) to a vehicle ground. If the alarm DOES NOT sound, the alarm unit is defective, and must be replaced. If the alarm DOES sound, reconnect black chassis wire #2L (4) to the alarm unit black lead (5), and proceed to the next step.

Note: *The wires (Fig. 8-20, 1 & 3, 4 & 6) connected to each back-up light switch (2 & 5) are not polarity sensitive. To ensure accurate test results with the procedure that follows, check the individual wires at each switch for the wire identification number hot stamped into the insulation near the wire terminal end before making any test connections.*

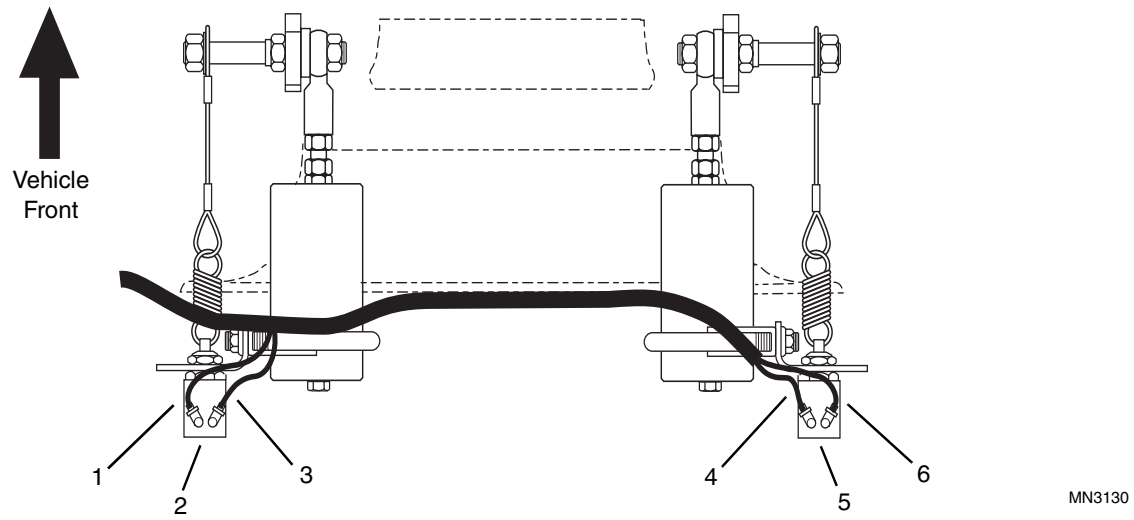


Figure 8-20 Back-up Alarm Switch Wiring Connections

6. Black wire #2L (Fig. 8-20, 1) connects the alarm unit to the left back-up switch (2). With the ignition switch in the RUN position, connect a jumper wire from black wire #2L (1) at the switch (2) to a vehicle ground. If the alarm DOES NOT sound, the black wire #2L (1) is defective and must be repaired. If the alarm DOES sound, continue to the next step.
7. Connect the jumper wire to the black wire #2J (Fig. 8-20, 3) on the left back-up switch (2) and a vehicle ground. Move the left travel/steering control lever to the rear. If the alarm DOES NOT sound, the left switch (2) is defective, and must be replaced. If the alarm DOES sound, continue to the next step.
8. Connect the jumper wire to the black wire #2J (Fig. 8-20, 4) on the right back-up switch (5) and a vehicle ground. Move the left travel/steering control lever to the rear. If the alarm DOES NOT sound, black wire #2J is defective, and must be repaired. If the alarm DOES sound, continue to the next step.
9. Connect the jumper wire to the black wire #2F (Fig. 8-20, 6) on the right back-up switch (5) and a vehicle ground. Move both travel/steering control levers to the rear. If the alarm DOES NOT sound, the right switch (5) is defective, and must be replaced. If the alarm DOES sound, black wire #2F (4) connection to ground is defective, and must be repaired.
10. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

c. Adjustment

1. Raise the Operator's Protective Structure into the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

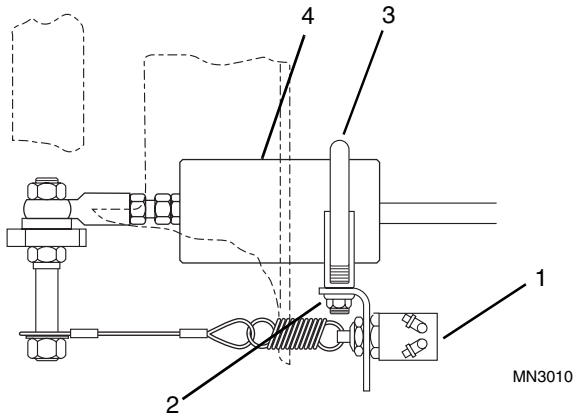


Figure 8-21 Back-up Alarm Switch Adjustment

2. Each back-up switch (Fig. 8-21, 1) is adjusted by loosening both nuts (2) on the u-bolt (3), and sliding the u-bolt (3) with bracket and switch on the spring centering guide housing (4) either forward or backward until the alarm sounds as both travel/steering control levers are moved to the rear. Tighten the u-bolt nuts (2), and repeat the adjustment procedure on the other back-up switch.
3. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

8.4 STARTING SYSTEM

8.4.1 Ignition Switch

a. Operation

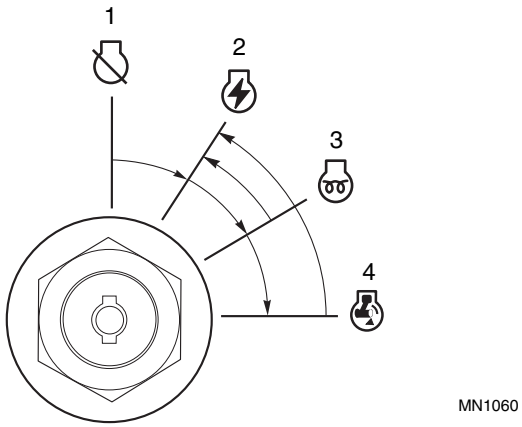


Figure 8-22 Ignition Switch Positions

With a key, the ignition switch rotates to either OFF (Fig. 8-22, 1), RUN (2), THERMO START/PREHEAT (3) or START (4) positions. The preheat (3) and start (4) positions are spring-loaded and must be manually held in place to function.

b. Ignition Switch Testing

1. Remove the floor plate between the foot pedals and disconnect the black negative battery cable at both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).

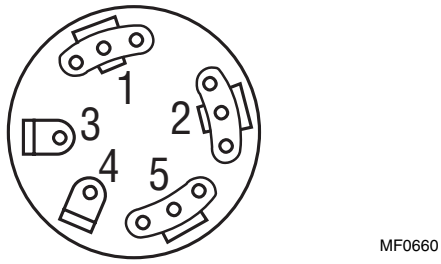


Figure 8-23 Ignition Switch - Rear View

3. Tag and remove the wires from ignition switch terminals (Fig. 8-23, 1-5).
4. Use an ohmmeter or a continuity tester to test all positions of the ignition switch for continuity at the switch terminals (Fig. 8-23). Turn the key to each of four switch positions shown below. Continuity should exist between the switch terminals marked with an “X” for each switch position. If no continuity exists, the switch is defective and must be replaced.

		SWITCH POSITION			
		OFF	RUN	THERMO START	START
Switch Terminals	1 - BAT		X	X	X
	2 - IGN		X	X	X
	3 - START				X
	4 - ACC		X		
	5 - HEAT			X	X

5. Replace the switch if defective. Reconnect the wiring removed in Step 3, and reinstall the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).
6. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

8.4.2 Fuel Shutoff Solenoid

The fuel shutoff solenoid valve lets fuel enter the injection pump when the ignition key is turned to the RUN or START positions.

a. Removal

1. With the vehicle on a level surface, ground the implement and the shut the engine OFF.

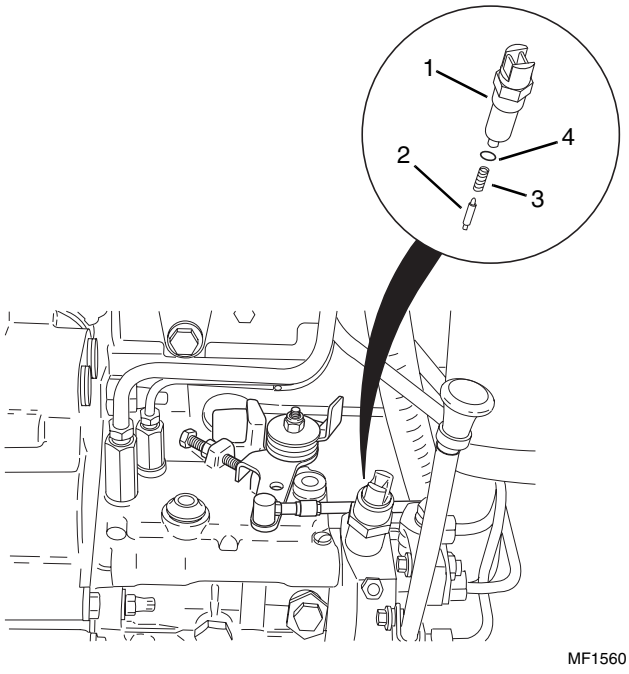


Figure 8-24 Fuel Shutoff Solenoid

2. Unlock and open rear engine compartment door and lift engine cover to access the fuel shutoff solenoid (Fig. 8-24, 1) on the fuel injection pump.
3. Tag and remove wiring from fuel shutoff solenoid.

Note: *Plunger (Fig. 8-24, 2) and spring (3) are not secured in the base of the solenoid (1), and may fall out when it is removed from the fuel injection pump.*

4. Remove the solenoid by turning counterclockwise (be prepared to catch the plunger and spring as the solenoid is removed).
5. Remove and discard the solenoid o-ring (Fig. 8-24, 4).

b. Disassembly

Note: *DO NOT disassemble the fuel shutoff solenoid.*

c. Cleaning and Drying

Without submerging the electrical components, clean the fuel shutoff solenoid using an approved solvent and dry using a clean lint-free cloth.

d. Inspection and Testing

1. Inspect the rubber tip on the plunger (Fig. 8-24, 2) for wear or damage. Replace if required.
2. Lubricate the plunger (Fig. 8-24, 2) and plunger bore in the solenoid body using clean fuel.
3. Place the spring (Fig. 8-24, 3) and plunger (2) in the solenoid body.
4. Holding the spring and plunger in place, momentarily connect the solenoid electrical terminals to a 12 VDC source. The plunger (Fig. 8-24, 2) should be felt retracting into the solenoid body (1). If the plunger does not retract, the fuel shutoff solenoid is defective, and must be replaced.

e. Replacement

1. Install a new o-ring (Fig. 8-24, 4) on the solenoid body, and install the plunger (2), spring (3) and solenoid body (1) into the fuel injection pump and secure.
2. Lower the engine cover. Close and lock the rear engine compartment door.

8.4.3 Starter

a. General Starting System Inspection and Tests

If the vehicle starter fails to start the engine when the ignition key is turned to the START position, the following items should be checked before assuming the starter or starter solenoid are at fault.

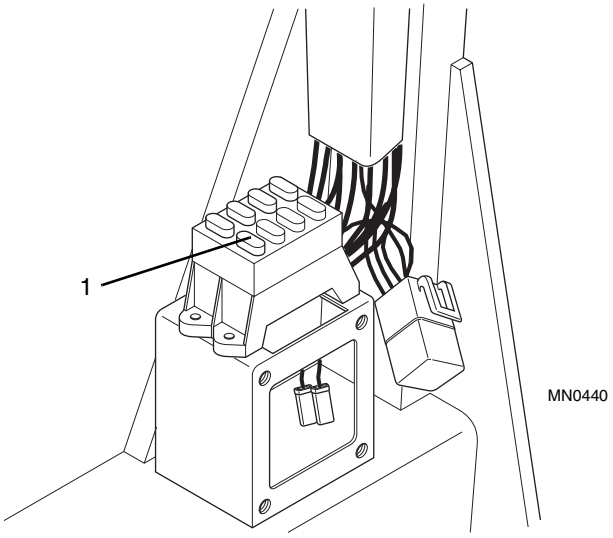


Figure 8-25 Fuse Block

1. Check the 40 amp fuse (Fig. 8-25, 1) in the fuse block. It may be open and require replacement.
2. Check the condition of the batteries.

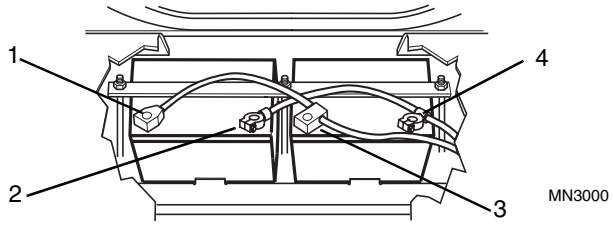


Figure 8-26 Battery Cable Connections

3. Clean all battery posts and cable connectors (Fig. 8-26, 1-4) on each battery cable.
4. Check all connections at the starter solenoid, key switch and wiring harness plugs. Disconnect the black negative battery cable from both batteries, clean and tighten all connections, and reconnect the black negative battery cable to both batteries.
5. Check the ignition switch for proper function (Refer to Section 8.4.1 b, “Ignition Switch Testing”).
6. If the starter fails to operate properly after these checks, refer to “Starter Inspection and Tests” in the next section.
7. Check for broken wires and damaged insulation on the Operator Protective Structure and engine/chassis wiring harnesses. Repair any broken or damaged wire noted, or replace the harness(es) if required.

b. Starter Inspection and Tests

1. Park the vehicle on a level surface, and shut the engine OFF.
2. Raise the Operator’s Protective Structure to the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
3. Remove the floor plate between the foot pedals and disconnect the black negative battery cable at both batteries.
4. Tag and disconnect all wires and cables at the starter solenoid.
5. Remove the starter from the vehicle for bench testing. Ground the starter housing to a bench power supply, and apply positive (+) 12 V power to the small blade terminal on the solenoid. Using an ohmmeter, check for continuity across the large stud terminals.
   a. Continuity should exist across the terminals, proceed to Step 6.
   b. If continuity is NOT present, the starter solenoid is defective and must be replaced.
6. Connect the bench power supply positive (+) cable to the top stud on the starter solenoid. Briefly connect a jumper from the top solenoid stud to the small blade terminal.

   If the starter motor turns, but the starter drive gear does not extend, the solenoid is defective and must be replaced.
7. If the tests in Steps 5 and 6 above do not indicate a failure related to the starter solenoid, the starter is most likely defective and should be replaced.
8. Install the replacement starter in the vehicle and secure.
9. Connect wires and cable removed in Step 4 to the starter solenoid.
10. Connect the black negative battery cable at both batteries and replace the floor plate between the foot pedals.
11. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

8.4.4 Thermo Start Plug (cold starting aid)

a. Operation

The Thermo Start cold starting system eases engine start when the ambient air temperature is 32° F (0° C) or below.

When the ignition switch is turned to the THERMO START position, a coil in the thermo start plug heats in the induction manifold. When the ignition switch is turned to the start position, a controlled amount of diesel fuel is sprayed onto the heated coil and ignites, heating the air drawn into the induction manifold and facilitating cold weather starting.

WARNING: **DO NOT** use ether or starting fluid with the THERMO START cold starting aid. The thermo start system electrically heats a coil in the induction manifold. If ether or starting fluid is injected into the engine while the ignition key is turned to the THERMO START or START position, an explosion could result and cause serious injury or engine damage.

1. Position the throttle lever to 1/3 to 1/2 throttle. Turn and hold the ignition key in the THERMO START position until the indicator light in the warning cluster on the instrument panel goes off (about 15 to 20 seconds).
2. Turn key to START to engage starting motor. If engine starts at this point, let key return to the RUN position.

IMPORTANT: *Do not crank starting motor for more than 5 seconds to avoid draining the batteries. Wait 30 seconds before cranking again.*

3. If engine does not start in 5 seconds, return the key to the THERMO START position until the indicator light goes off (about 15 to 20 seconds) and then turn it to the START position for no more than 5 seconds.

b. Inspection and Testing

1. Check the white/brown thermo start wire #4 (Fig. 8-27, 1) for power with the ignition switch in the THERMO START position.
2. Using an ohmmeter or a continuity tester, test the electrical coil of the thermo start plug (Fig. 8-27, 2). Connect the leads to the electrical terminal (3) on the plug and the plug housing (2).
   a. Continuity should exist at these test points.
   b. If continuity is NOT found, the thermo start plug is defective and must be replaced.

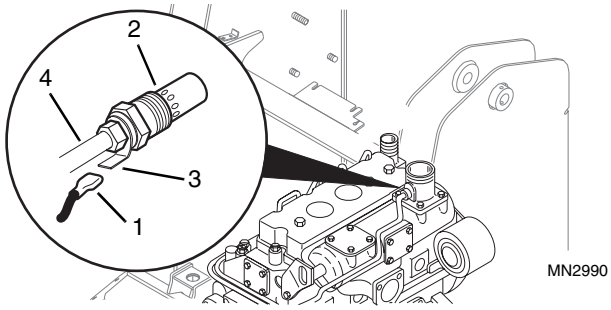


Figure 8-27 Thermo Start Plug

WARNING: Contact with any rotating or moving part of the vehicle could cause severe injury or death. **NEVER** place any limb or other body areas near any rotating or moving part of the vehicle while the engine is run for testing purposes.

3. Have an assistant crank the engine, or start and run at low idle. Slowly loosen, but DO NOT remove the fuel line (Fig. 8-27, 4) at the thermostart plug (2). Ensure that fuel, free of air comes from the fitting. Shut the engine OFF, and tighten the fitting.

a. Removal

1. With the vehicle on a level surface, ground the implement and the shut the engine OFF.
2. Unlock and open rear engine compartment door and lift engine cover to access the thermo start plug (Fig. 8-27, 2) on the induction manifold.
3. Disconnect wire (Fig. 8-27, 1) at electrical terminal (3) of thermo start housing and disconnect fuel line (4).
4. Remove thermo start plug (Fig. 8-27, 2) from induction manifold.

Note: *DO NOT disassemble the thermo start plug.*

b. Cleaning and Drying

Without submerging the electrical components, clean the exterior of the thermo start plug using an approved solvent and dry using a clean lint-free cloth.

c. Replacement

1. Install the thermo start plug (Fig. 8-27, 2) into the induction manifold and torque to 23 lb/ft (31 Nm).
2. Reconnect the harness electrical wire (Fig. 8-27, 1) to the terminal (3) on the thermo start housing.
3. Reconnect and bleed air from the fuel line (Fig. 8-27, 4). Refer to Section 10.9.3, “Bleeding Fuel System.”
4. Lower the engine cover. Close and lock the rear engine compartment door.

8.5 FUSES

a. Description

The fuses in this vehicle protect the entire electrical system. An individual fuse will blow whenever current drawn beyond the fuse exceeds the fuse rating. If a fuse continues to blow after replacement, the electrical system must be checked for shorted or grounded circuits, or defective components.

Never replace a blown fuse with a fuse of a higher rating. The resulting overload could cause wires to overheat and burn or damage other components elsewhere in the electrical system.

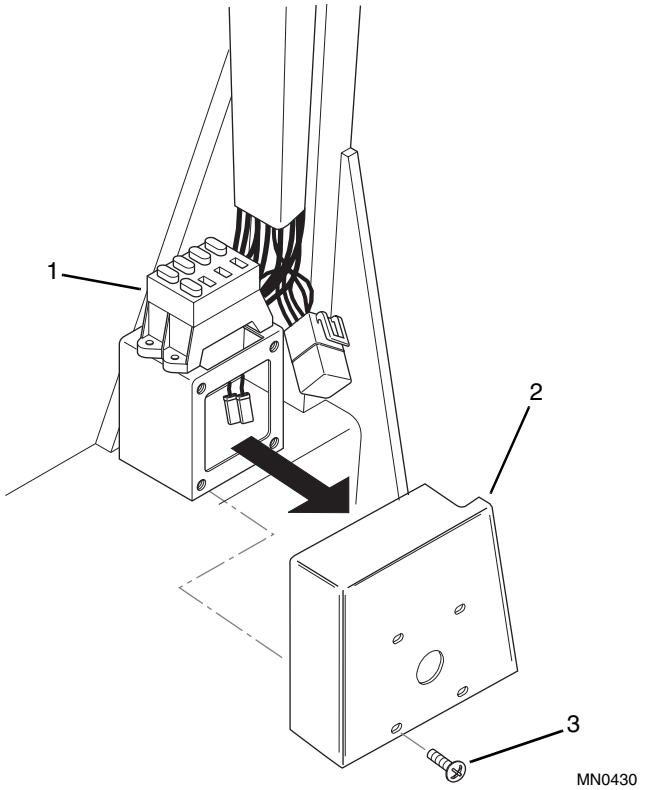


Figure 8-28 Fuse Box Access

The fuse block (Fig. 8-28, 1) for this vehicle is located behind a panel (2) on the left side of the Operator's Protective Structure.

Access the fuse block (Fig. 8-28, 1) by removing four phillips drive screws (3) and remove the panel (2).

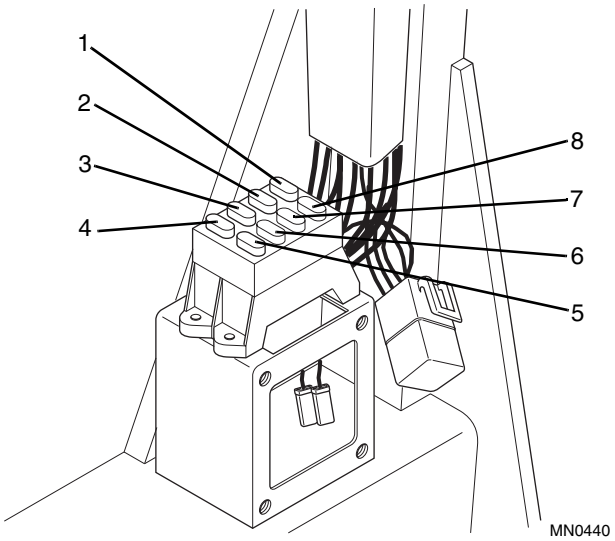


Figure 8-29 Fuse Block

The fuses (Fig. 8-29) used are as listed below:

#	Size	Circuit Protected
1	15 AMP	Back-up Alarm
2	15 AMP	Gauges, Worklights
3	7.5 AMP	Loader Arm Lock Solenoid Valve
4	7.5 AMP	Fuel Solenoid
5	40 AMP	Ignition Switch Feed for Entire Electrical System
6	7.5 AMP	High Flow Solenoid - 2000DX & 2300DX Only
7	25 AMP	Strobe Option; Defroster and Windshield Wiper (Front Door) Option
8	25 AMP	Heater (Enclosed Cab) Option

8.6 BATTERY

8.6.1 Battery Safety

The following WARNING is intended to supplement and does not replace the warnings and information provided on the battery by the battery manufacturer.

Figure 8-30 Explosive Gases Warning Decal

WARNING: To avoid personal injury when checking, testing, or servicing a battery, keep sparks, flames, and all smoking material away from the battery. A lead acid battery generates an explosive gas when charging and when the engine is running. Always wear safety glasses and chemical resistant gloves when working on or near a battery.

WARNING: Fluid in electric storage batteries contains sulfuric acid which is POISON and can cause SEVERE CHEMICAL BURNS. Avoid all contact of fluid with eyes, skin, and clothing. Use proper protective gear when handling all batteries. **DO NOT** tip any battery beyond a 45° angle in any direction. If contact with battery electrolyte does occur, follow the first aid suggestions below.

Battery Electrolyte First Aid

- **External Contact** - Flush with water.
- **Eyes** - Flush with water for at least 15 minutes and get medical attention immediately!
- **Internal Contact** - Drink large quantities of water. Follow with Milk of Magnesia, beaten egg or vegetable oil. Get medical attention immediately!

IMPORTANT: *In case of internal contact,* ***DO NOT*** *give fluids that would induce vomiting!*

8.6.2 Maintenance

a. Removal

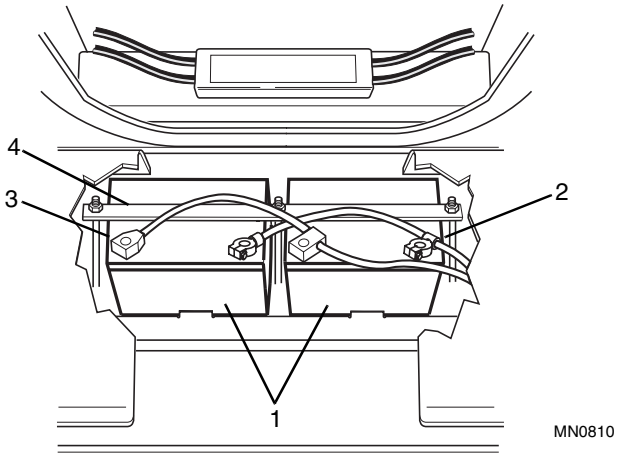


Figure 8-31 Battery Compartment

1. With the vehicle on a level surface, implement grounded and the engine shut off, lift and remove the floor plate between the foot pedals to gain access to the batteries (Fig. 8-31, 1).
2. Disconnect the black negative cable from both batteries (Fig. 8-31, 2).
3. Disconnect the red positive cable from both batteries (Fig. 8-31, 3).
4. Remove the battery holddown (Fig. 8-31, 4) and both batteries (1) from the vehicle.

b. Cleaning and Inspection

1. Clean the exterior of the batteries and cable terminals using a nonmetallic brush which has been dipped in a solution of one part baking soda and four parts water.
2. Rinse all parts and painted surfaces thoroughly with clear water, and dry with a clean cloth.
3. Inspect batteries for any accumulation of dirt or corrosion on top of the batteries, corroded terminals and cables, broken or loose terminal posts, or cracked covers. If obvious physical damage is noted, replace battery and/or cables.
4. Check the alternator voltage regulator output at every periodic maintenance inspection. Overcharging is a common cause of battery failure. The voltage output should NEVER exceed 15.5 VDC (Refer to Section 8.7.2, “Alternator Testing”).

c. Installation

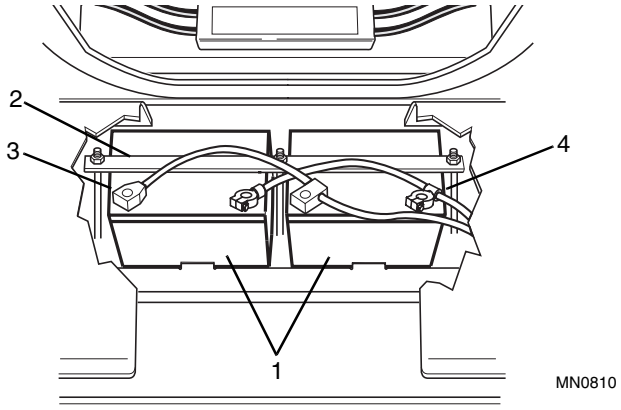


Figure 8-32 Battery Installation

1. Carefully install the batteries (Fig. 8-32, 1) and secure with holddown (2). Make sure holddown strap is properly attached to keep batteries from bouncing. Vibration is very harmful to a battery.
2. Connect red positive cable (Fig. 8-32, 3) to the batteries, and position both protective covers over cable ends.
3. Connect black negative cable (Fig. 8-32, 4) to the batteries.
4. Before operating the vehicle, replace floor plate.

d. Battery Load Test

1. Disconnect the black negative battery cable (Fig. 8-32, 4) from both batteries (1).
2. Disconnect the red positive battery cable (Fig. 8-32, 3) from both batteries (1).
3. Be sure the battery posts are clean for a good connection. Attach voltmeter and battery load tester clamps to posts.

***IMPORTANT: DO NOT** remove surface charge from batteries that have been in storage. Skip Step 4 and proceed with Step 5 if battery has been in storage.*

4. Remove surface charge from any battery that has been on charge by either vehicle alternator or charger. To remove surface charge, apply a 300 ampere load across the terminals for 15 seconds. Then, turn off load and wait for 15 seconds to allow battery to recover.
5. Estimate battery temperature by determining air temperature battery was exposed to in the few hours preceding test. Select the nearest estimated temperature in the table that follows and determine the corresponding minimum voltage which must be maintained during load test.

Temperature	Minimum Voltage
70° F (21° C)	9.6 VDC
50° F (10° C)	9.4 VDC
30° F (-1° C)	9.1 VDC
15° F (-10° C)	8.8 VDC
0° F (-18° C)	8.5 VDC
Below 0° F (-18° C)	8.0 VDC

6. Apply a 260 ampere load across the terminals for 15 seconds. Turn off load.
   a. If voltage is below value determined in Step 5, replace battery.
   b. If voltage is at or above the value determined in Step 5, the battery is acceptable and may be returned to service.

e. Charging

***IMPORTANT:** Before charging, be sure the battery in the vehicle to be jumped is not frozen. If the electrolyte inside either battery is frozen, remove the battery from the vehicle and allow it to thaw before charging is begun.*

1. Disconnect the black negative battery cable (Fig. 8-32, 4) from both batteries (1).
2. Disconnect the red positive battery cable (Fig. 8-32, 3) from both batteries (1).

WARNING: **DO NOT** charge a frozen battery, as it may explode and cause injury. Let the battery warm before charging.

3. Connect a battery charger to one battery at a time, and charge at rate that does NOT exceed 50 amperes. During charging, if electrolyte boil-over (spewing) occurs or the battery temperature exceeds 125° F (52° C), reduce the charging rate or temporarily halt the charging to permit the battery to cool.

f. Jump Starting

WARNING: Never jump start the vehicle directly to the starter or starter solenoid. Serious injury or death could result from the vehicle moving forward or backward, running over the person jump starting the vehicle.

WARNING: To avoid personal injury when jump starting, be sure both vehicles are not touching. Keep sparks, flames and all smoking materials away from the battery. Lead acid batteries generate explosive gases when charging, and when the engine is running. Wear safety glasses when you work on or near a battery.

IMPORTANT: *Before jump starting, be sure the battery in the vehicle to be jumped is not frozen. If the electrolyte inside either battery is frozen, remove the battery from the vehicle and allow it to thaw before jump starting is begun.*

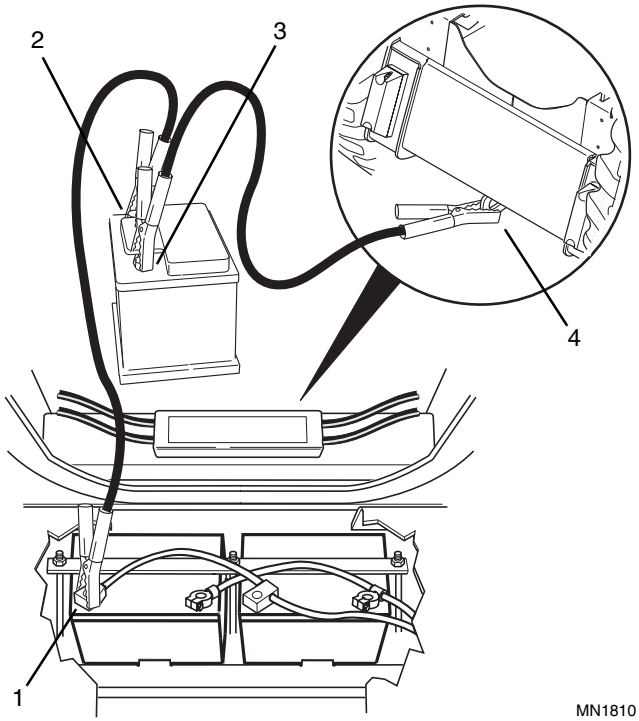


Figure 8-33 Jumper Cable Connections

WARNING: Follow exactly the Jump Starting procedure below. Any deviation from this procedure could result in:

- Personal injury caused by electrolyte spraying.
- Personal injury or property damage due to battery explosion.
- Damage of the charging system of the booster vehicle or the immobilized vehicle.

The following procedure should be used to jump start the vehicle:

- The vehicle used for jump starting should have a 12-volt, negative ground electrical system and a battery with a minimum rating of 500 CCA (cold cranking amperes).
- Be sure the seat bar is up and turn ignition key to the “OFF” position.

1. Connect one end of the red positive (+) jumper cable to the positive (+) terminal (Fig. 8-33, 1) of the discharged battery in the vehicle.
2. Connect the other end of the red positive (+) jumper cable to the positive (+) terminal (Fig. 8-33, 2) of the booster battery.
3. Connect one end of the black negative (-) jumper cable to the negative terminal (Fig. 8-33, 3) of the booster battery.
4. Connect the remaining end of the negative (-) jumper cable to the furthest ground point (Fig. 8-33, 4) away from the discharged battery in the vehicle.
5. Start the engine in the vehicle with the discharged battery.
6. When the engine has been started, remove the jumper cables in the reverse order of their connections above, following Steps 4, 3, 2, and 1.

8.7 ALTERNATOR

8.7.1 Alternator Description

The alternator has a rotating field system inside a stationary generating winding. When the rotor rotates inside the stator, the output produced is alternating current (AC).

This is unsuitable for charging the batteries, so it is rectified by means of diodes which convert the alternating current to direct current (DC).

The alternator has a solid state voltage regulator that is mounted inside the alternator slip ring end frame. The regulator voltage setting has no provision for adjustment.

The alternator rotor bearings contain sufficient lubricant to eliminate the need for periodic lubrication. No periodic adjustments or maintenance of any kind are required on the entire alternator assembly.

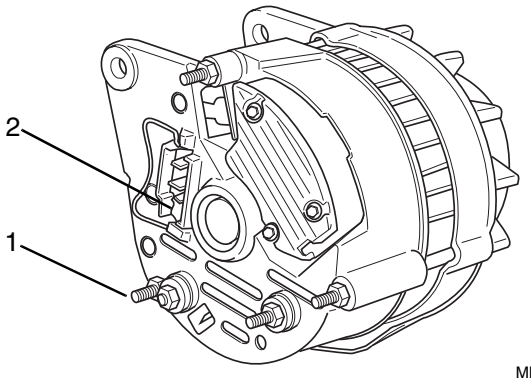


Figure 8-34 Alternator

8.7.2 Alternator Testing

Wire Harness Test

The following test must be performed with alternator installed, all wiring harness leads connected and the ignition switch “ON.”

1. Connect a voltmeter red positive probe to the alternator “BAT” terminal (Fig. 8-34, 1), and the voltmeter black negative probe to a vehicle ground.

   A zero volt reading indicates an open circuit in the red/gray wire #19 between the alternator terminal and the red positive battery cable mounted to the starter solenoid. Repair the wire lead or replace the wiring harness as required.

2. Connect a voltmeter red positive probe to the alternator “NO. 1” terminal (Fig. 8-34, 2) and the voltmeter black negative probe to a vehicle ground.

   A zero volt reading indicates an open circuit in the yellow wire #7 or #7A between the alternator terminal and the left warning light cluster in the instrument panel. Repair the wire leads or replace the wiring harness(es) as required.

Output Voltage Test

The following test must be performed with all accessories turned “OFF.”

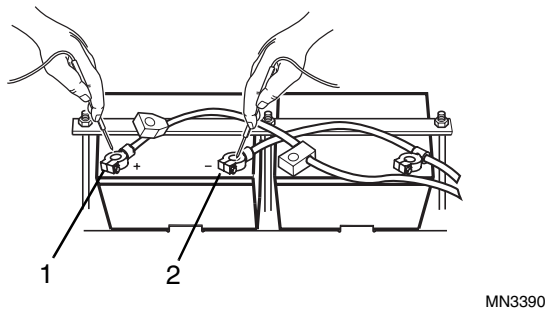


Figure 8-35 Voltmeter Connection To Battery

1. Connect a voltmeter red positive probe (Fig. 8-35, 1) to a positive (+) battery terminal and the voltmeter black negative probe (2) to a negative (-) battery terminal.
2. Operate the engine at a moderate speed.
3. If the voltage is 15.5 V or more, the internal voltage regulator in the alternator is defective.

Remove the alternator for repair by an alternator repair center.

Output Amperage Test

If previous tests check satisfactory, check alternator as follows:

1. Disconnect the black battery ground cable from both batteries.
2. Connect an ammeter between the red/gray wire #19 and the “BAT” terminal (Fig. 8-34, 1) on the alternator.
3. Connect the black battery ground cable to both batteries.
4. Connect a carbon pile battery tester across the batteries.

5. Turn on all electric equipment and operate the engine at a moderate speed and adjust the carbon pile battery tester as required to obtain maximum current output.
   a. If ampere output is within 10 amperes of rated output as stamped on the alternator frame, the alternator is not defective.
   b. If ampere output is not within 10 amperes of rated output, the alternator is probably defective and additional alternator diagnosis is required. Consult the alternator manufacturer's repair manual or an alternator repair center for additional troubleshooting guidelines.
6. Disconnect the black battery ground cable from both batteries.
7. Disconnect an ammeter between red/gray wire #19 and the "BAT" terminal (Fig. 8-34, 1) of the alternator, and reconnect the red/gray wire to the "BAT" terminal.
8. Connect the black battery ground cable to both batteries.

8.8 WIRING HARNESSES

The vehicle has two main wiring harnesses. One harness supplies connections in the Operator's Protective Structure (Refer to Section 8.11.2, "Operator's Protective Structure Electrical Diagram"). The second harness connects the chassis and engine (Refer to Section 8.11.3, "Engine/Chassis Electrical Diagram").

WARNING: To avoid personal injury or damage to the electrical system, **DO NOT** disconnect any wiring without first stopping the engine, turning off all electrical switches and disconnecting the black battery ground cable from both batteries.

Wire harnesses on this vehicle contain internal spliced connections between individual circuits. If a wire is found to be damaged or defective in a harness, it is recommended to replace the entire harness instead of making a repair.

a. Removal/Disassembly

To prevent the possibility of improper connections when replacing a harness, install the replacement harness step by step as the original harness is being removed. If this is not possible, tag the terminal locations of all wires and cable clips/ties as the old harness is removed to permit identical installation of the new harness (Refer to Section 8.11.2, "Operator's Protective Structure Electrical Diagram," and Section 8.11.3, "Engine/Chassis Electrical Diagram").

b. Inspection

Clean the wiring harness using a natural bristle brush and the same detergents used to clean the vehicle.

Inspection the harness cover, individual wire leads, and wire terminal ends for cuts, corrosion, or other damage.

c. Repair

1. If a single wire lead or wire terminal is damaged, it can be repaired as follows:
   a. Always use the same gauge of wire being replaced. NEVER replace a section of wire with one of a higher gauge size.
   b. If a wire is spliced into a circuit, use rosin core solder to bond the splice. Use insulating tape to cover all splices or otherwise bare wires.
   c. Replacement crimp type wire terminals must be of the correct size for the wire gauge used, and must be installed will the proper crimping tool.
   d. After the wiring is routed and connected, secure the wire(s) to the harness as required to prevent contact with sharp edges, rotating or moving components, and any part that generates heat during vehicle operation.

d. Replacement

Wire harnesses are held securely in place by clips or other devices that prevent chafing or wearing of the insulation due to vibration, contact with sharp edges, rotating or moving components, and any part that generates heat during vehicle operation. Be careful to install all harness clips and tie wraps in the locations tagged on the vehicle as the old harness was removed.

8.9 LOADER ARM LOCKOUT SYSTEM

a. Operation

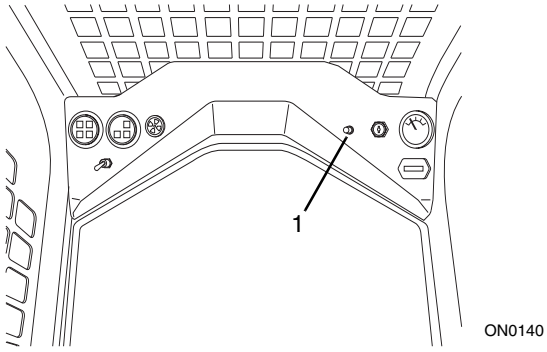


Figure 8-36 Loader Arm Lock Reset Switch

The loader arm lockout is a safety feature which prevents loader arm movement until the operator lowers the seat restraint bar, starts the engine, and presses a reset switch (Fig. 8-36, 1).

When the ignition switch is in the RUN position, the seat restraint bar lowered and micro switch actuated, the reset switch momentarily depressed; a relay is activated which in turn opens the loader arm lockout solenoid valves. The open solenoid valve allows hydraulic system oil to flow in the loader arm raise/lower circuit.

If the vehicle is equipped with the optional enclosed cab, with front door, an additional provision is added to the loader arm lockout system that prevents loader arm operation until the front door is fully closed. When the front door from these models is removed and stored, the loader arm lockout function must be restored to its original configuration and operation.

b. Loader Arm Lockout System Test

Open Cab Models

1. Enter the Operator's Protective Structure and sit in the operator's seat. Buckle the seat belt, lower the seat restraint bar, and start the engine. The loader arm hydraulic circuit SHOULD NOT be operational.
2. Momentarily depress the loader arm reset switch, and the loader arm hydraulic circuit SHOULD become operational.
3. Raise the seat restraint bar a minimum of 3" (76 mm) and the loader arm hydraulic circuit SHOULD STOP functioning. Fully lower the seat restraint bar and the circuits should remain non-functional.
4. Momentarily depress the loader arm reset switch, and the loader arm circuit SHOULD become operational.

IMPORTANT: *If the loader arm lockout system DOES NOT operate exactly as described in Step 1 through 4, a component of the lockout system requires adjustment or replacement. Proceed to Section 8.9 c through i, and Figures 8-57 & 8-58 to identify and service the affected component.*

Enclosed Cab Models

1. Enter the Operator's Protective Structure, close and latch the front door, and sit in the operator's seat. Buckle the seat belt, lower the seat restraint bar, and start the engine. The loader arm hydraulic circuit SHOULD NOT be operational.
2. Momentarily depress the loader arm reset switch, and the loader arm hydraulic circuit SHOULD become operational.
3. Raise the seat restraint bar a minimum of 3" (76 mm) and the loader arm hydraulic circuit SHOULD STOP functioning. Fully lower the seat restraint bar and the circuit should remain non-functional.
4. Momentarily depress the loader arm reset switch, and loader arm circuit SHOULD become operational.
5. Raise the loader arm and tilt any bucket or attachment to clear the top of the front door. Open the front door fully. Attempt to RAISE the loader arm. The loader arm hydraulic circuit SHOULD NOT function.
6. Close and latch the front door, and attempt to RAISE the loader arm. The loader arm hydraulic circuit SHOULD NOT function.
7. Momentarily depress the loader arm reset switch, and the loader arm circuit SHOULD become operational.
8. Disconnect the front door wire harness from the connector on the left panel, and attempt to move the loader arm. The loader arm hydraulic circuit SHOULD STOP functioning.
9. Reconnect the front door harness, and attempt to move the loader arm. The loader arm hydraulic circuit SHOULD NOT function.

10. Momentarily depress the loader arm reset switch, and the loader arm circuit SHOULD become operational.
11. Disconnect the front door wire harness from the connector on the left panel, and connect the harness jumper plug in its place. Attempt to move the loader arm. The loader arm hydraulic circuit SHOULD NOT function.
12. Momentarily depress the loader arm reset switch, and the loader arm circuit SHOULD become operational.

IMPORTANT: *If the loader arm lockout system DOES NOT operate exactly as described in Step 1 through 12, a component of the lockout system requires adjustment or replacement. Proceed to Section 8.9 c through i, and Figures 8-57 & 8-58 to identify and service the affected component.*

c. Loader Arm Lockout Fuse Testing

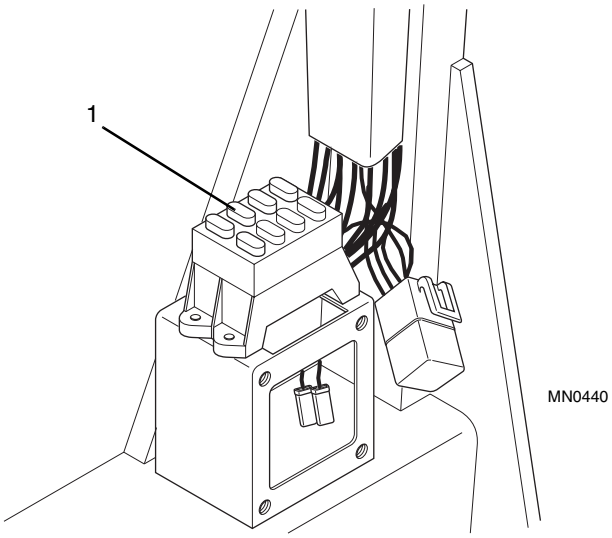


Figure 8-37 Fuse Block

1. Check the 7.5 amp fuse (Fig. 8-37, 1) in the fuse block. It may be OPEN and require replacement (Refer to Section 8.5, “Fuses”).

d. Loader Arm Lockout Micro Switch Testing

1. Be sure the vehicle is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.
2. Remove the flange locknut from the left plastic cover at the rear of the seat bar and remove the cover.

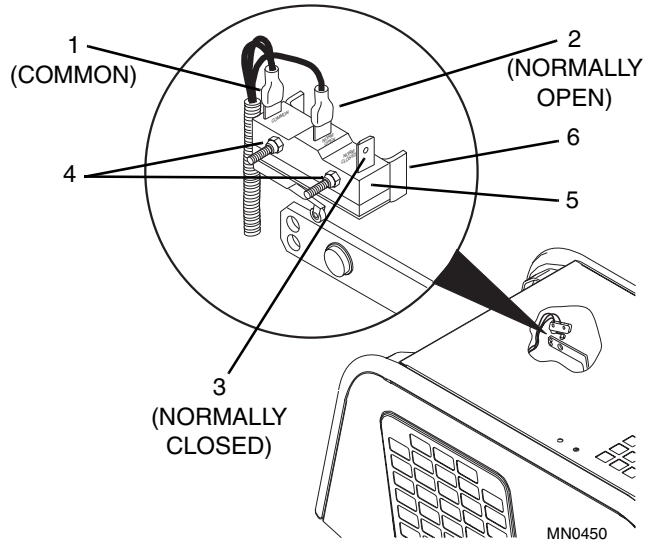


Figure 8-38 Seat Restraint Bar Micro Switch

IMPORTANT: *The micro switch used has three terminals on its top surface. The rear terminal (Fig. 8-38, 1) is labeled “COMMON,” the center terminal (2) is labeled “NORMALLY OPEN,” and the front terminal (3), which is NOT used, is labeled “NORMALLY CLOSED.” Ensure that the wires are properly connected to the rear (1) and center (2) terminals on the micro switch (5).*

3. Tag and disconnect red/white wire #18 and red/black wires #30/30A (Fig. 8-38, 1 & 2) from the micro switch (5) terminals.
4. Use an ohmmeter or a continuity tester to test the micro switch (Fig. 8-38, 5) for continuity at the switch terminals (1 & 2) as follows:

SWITCH ARM NOT ACTIVATED	**FUNCTIONS**
Terminals NORM/OPEN to COMM	No Continuity
SWITCH ARM DEPRESSED	
Terminals NORM/OPEN to COMM	Continuity Exists

5. If the micro switch tests defective, remove two plastic plugs on the left side of the cab exterior, the two locknuts and machine screws (Fig. 8-38, 4) holding the micro switch (5) to the mount (6), and remove the micro switch (5).

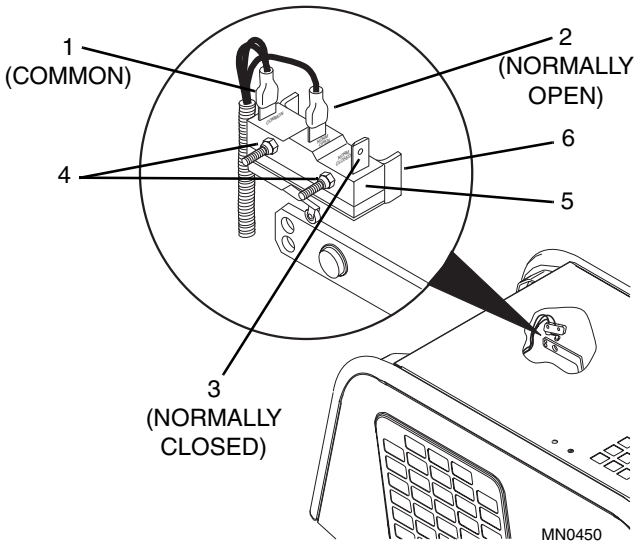


Figure 8-39 Seat Restraint Bar Micro Switch

6. Place the new micro switch (Fig. 8-39, 5) on the mount (6) and reassemble the two machine screws and locknuts (4). Snug up the hardware but DO NOT tighten.
7. Adjust the micro switch (Refer to Section 8.9 c, “Loader Arm Lockout Micro Switch Adjustment”).
8. Reconnect red/white wire #18 and red/black wires #30/30A (Fig. 8-39, 1 & 2), removed in Step 3, to the micro switch (5).
9. Reinstall the two plastic plugs into the holes in the left side of the cab exterior.
10. Install the spring cover and fasten with the flange head nut.

e. Loader Arm Lockout Micro Switch Adjustment

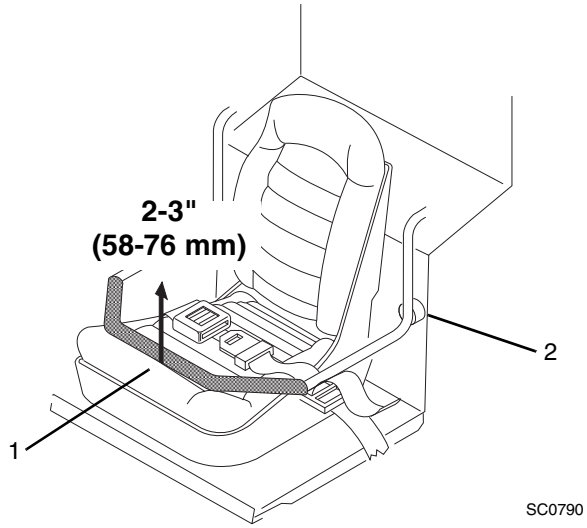


Figure 8-40 Loader Arm Lockout Micro Switch Adjustment

Check the loader arm lockout micro switch for proper adjustment. The seat bar (Fig. 8-40, 1) should be able to be raised 2-3" (58-76 mm) from the fully lowered position, with the bar resting against the rubber stops (2), before activating the loader arm lockout system.

As the seat bar (Fig. 8-40, 1) is raised, an audible click will be made by the loader arm lockout micro switch as it closes, engaging the loader arm lockout.

If an adjustment is required, proceed as follows:

1. Be sure the vehicle is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.
2. Remove the flange locknut from the left plastic cover at the rear of the seat bar and remove the cover.
3. Remove two plastic plugs on the left side of the cab to access the capscrews that secure the micro switch to its mounting bracket. Loosen both locknuts (Fig. 8-39, 4) on the inside of the cab, until the micro switch can be repositioned using a slight hand force.
4. Reposition the switch in small increments, rechecking the seat bar travel required to activate the switch with every move. When the seat bar travel (Fig. 8-40, 1) is within 2-3" (58-76 mm), tighten the two locknuts securely.
5. Replace the plastic hole plugs on the left side of the cab.
6. Reassemble the plastic cover to the rear of the seat bar and tighten the flange nut securely.

f. Loader Arm Lockout Reset Switch Testing and Replacement

1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).

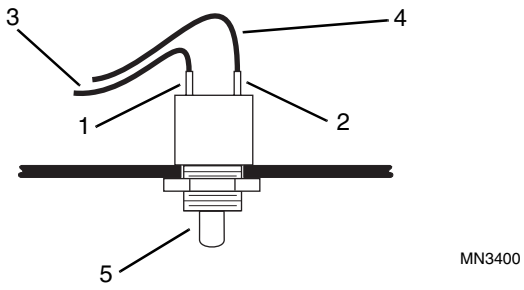


Figure 8-41 Loader Arm Reset Switch Testing

3. Tag and disconnect dark blue wire #86A (Fig. 8-41, 3) and red/black wire #30A (4) from reset switch (5) terminals.
4. Use an ohmmeter or a continuity tester to test the reset switch for continuity at the switch terminals (Fig. 8-41, 1 & 2) as follows:

SWITCH BUTTON RELEASED	FUNCTIONS
Terminals 1 to 2	No Continuity
SWITCH BUTTON DEPRESSED	
Terminals 1 to 2	Continuity Exists

5. Replace the reset switch (Fig. 8-41, 5) if it fails either test in the table above.
6. Install the instrument panel (Refer to Section 8.3.1, “Instrument Panel Removal and Installation”).
7. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

g. Loader Arm Lockout Relay Testing and Replacement

1. Be sure the vehicle is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.

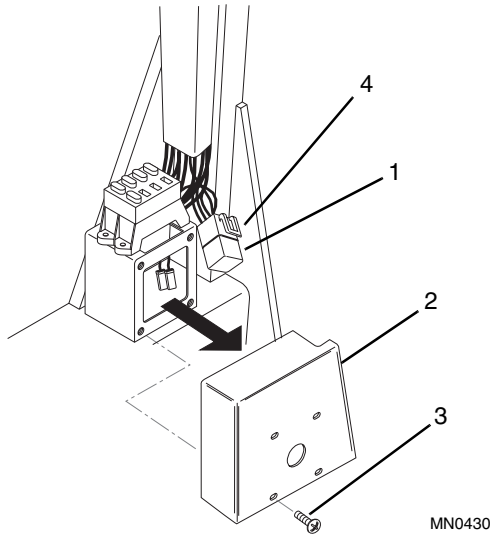


Figure 8-42 Loader Arm Lockout Relay Location

The loader arm lockout relay (Fig. 8-42, 1) is located behind a panel (2) on the left side of the Operator’s Protective Structure.

2. Access the relay (Fig. 8-42, 1) by removing four phillips drive screws (3) and remove the panel (2).
3. Remove the relay (Fig. 8-42, 1) from the harness socket (4).

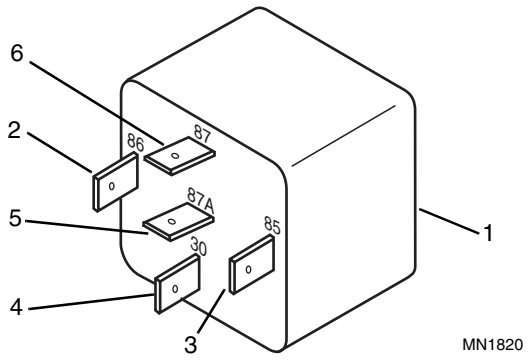


Figure 8-43 Loader Arm Lockout Relay

4. Use an ohmmeter or a continuity tester to test the relay (Fig. 8-43, 1) for continuity as follows:
   a. Continuity should exist between terminals (Fig. 8-43, 2 & 3). If continuity is NOT present, the relay is defective.
   b. Continuity should exist between terminals (Fig. 8-43, 4 & 5). If continuity is NOT present, the relay is defective.
   c. Continuity should NOT exist between terminals (Fig. 8-43, 4 & 6). If continuity IS present, the relay is defective.
5. Apply 12 VDC to relay terminals (Fig. 8-43, 2 & 3).
   a. An audible “click” should be heard when power is applied. If a click is NOT heard, the relay is defective.
   b. With power applied to terminals (Fig. 8-43, 2 & 3), continuity should exist between terminals (5 & 6). If continuity is NOT present, the relay is defective.
   c. With power applied to terminals (Fig. 8-43, 2 & 3), continuity should NOT exist between terminals (4 & 5). If continuity IS present, the relay is defective.
6. Replace the relay (Fig. 8-43, 1) if it fails any tests in Steps 4 and 5.
7. Reinstall the left panel in the Operator’s Protective Structure (Fig. 8-42, 2).

h. Loader Arm Lockout Front Door Switch (Enclosed Cab Only)

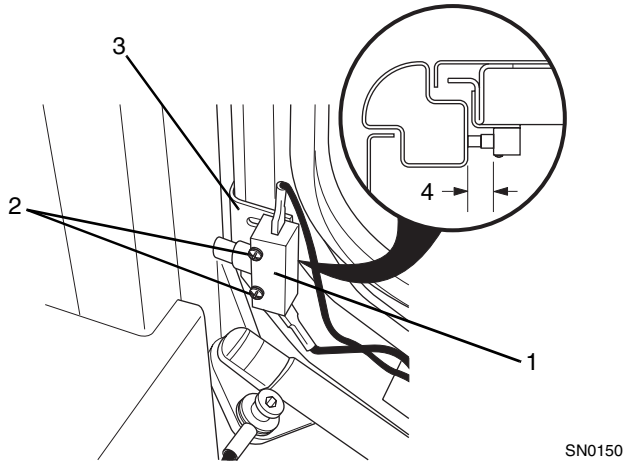


Figure 8-44 Loader Arm Lockout Front Door Switch

The loader arm lockout front door switch (Fig. 8-44, 1) is located on the left side of the front door frame. When the front door is open, the loader arm lockout circuit is engaged, preventing loader arm movement. Adjust the loader arm lockout switch as follows:

1. With the cab door closed and latched, loosen the two switch mounting screws (Fig. 8-44, 2).
2. Slide the switch (Fig. 8-44, 1) fully to the right side of its mounting bracket (3), then slide the switch (1) to the left until an audible “click” is heard from the switch (the distance (4) from the switch body to the door frame should be approximately 5/8" (16 mm).
3. Tighten both mounting screws (Fig. 8-44, 2), and check the lockout switch (1) operation.

i. Loader Arm Lockout Solenoid Testing

If all of the other components of the loader arm lockout circuit are functioning properly, there should be an audible click when the loader arm lockout solenoids are actuated.

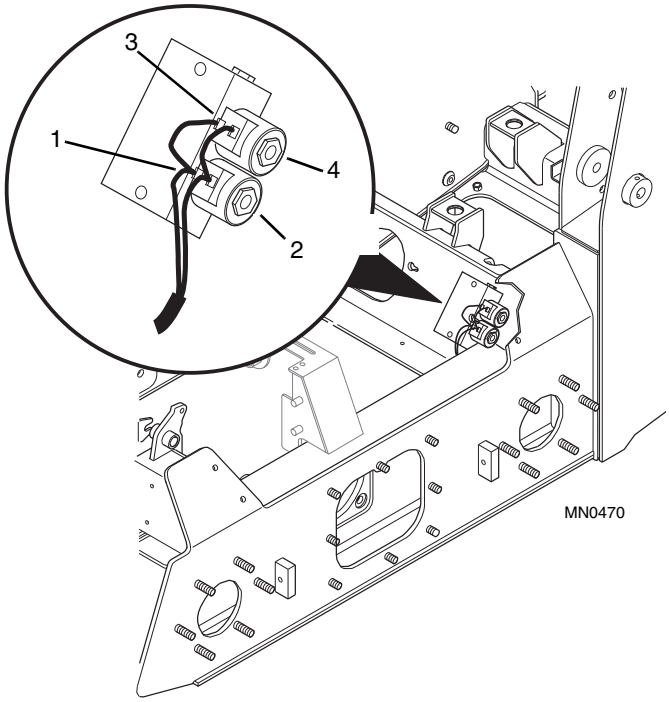


Figure 8-45 Loader Arm Lockout Solenoids

Test each solenoid as follows:

1. Disconnect the blue wire #86 (Fig. 8-45, 1) from solenoid valve (2).
2. Lower the seat bar fully, turn the ignition switch to the RUN position, and press the loader arm reset button on the instrument panel.
   a. If a click is heard from solenoid valve (Fig. 8-45, 4), the solenoid is functioning properly.
   b. If no click is heard, connect a voltmeter across both terminals of the solenoid (Fig. 8-45, 4). If there is voltage, the solenoid valve is defective. If there is no voltage at the terminal, there is a short or break in the wiring harness.
3. Reconnect the blue wire #86 (Fig. 8-45, 1) to solenoid valve (2).
4. Disconnect the blue wire #86A (Fig. 8-45, 3) from solenoid valve (4).
5. Lower the seat bar fully, turn the ignition switch to the RUN position, and press the loader arm reset button on the instrument panel.
   a. If a click is heard from solenoid valve (Fig. 8-45, 2), the solenoid is functioning properly.
   b. If no click is heard, connect a voltmeter across both terminals of the solenoid (Fig. 8-45, 2). If there is voltage, the solenoid valve is defective. If there is no voltage at the terminal, there is a short or break in the wiring harness.
6. Replace either solenoid valve (Fig. 8-45, 2 or 4) if required.

8.10 HIGH FLOW ELECTRICAL SYSTEM

a. Description and Operation

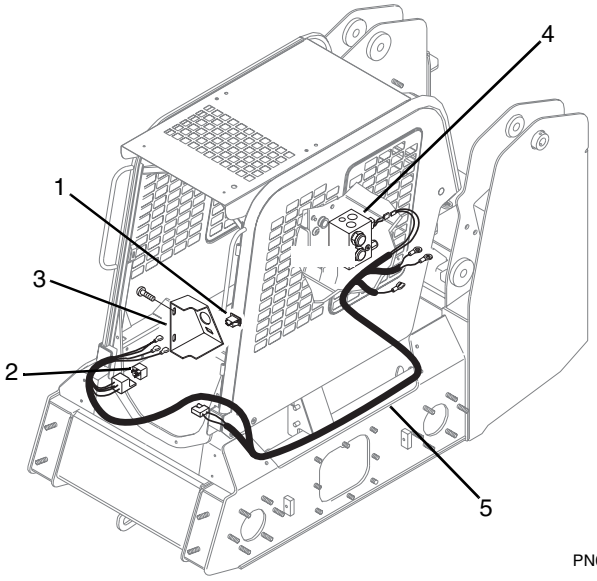


Figure 8-46 High Flow Electrical System

The high flow electrical system (Fig. 8-46) consists of a switch (1) and relay (2) that are mounted in a panel (3) on the left side of the Operator's Protective Structure, an electric solenoid mounted in the high flow valve (4) and associated wiring (5) to complete the circuits.

For the following circuit description, refer to Fig. 8-47. When the ignition key switch is placed in the ON position, power is applied through a 7.5 amp fuse in the fuse block to terminal "5" on the high flow switch.

When the high flow switch is placed in the ON position, power is directed to terminals "3" & "6" of the high flow switch. From there, power is sent to terminals "86" & "87" of the relay. Terminal "85" of the relay is connected to ground. With the circuit between terminals "86" & "87" completed, the relay closes terminals "87" & "30" which completes the circuit to the solenoid valves. This in turn allows the high flow valve to send fluid to the high flow couplers.

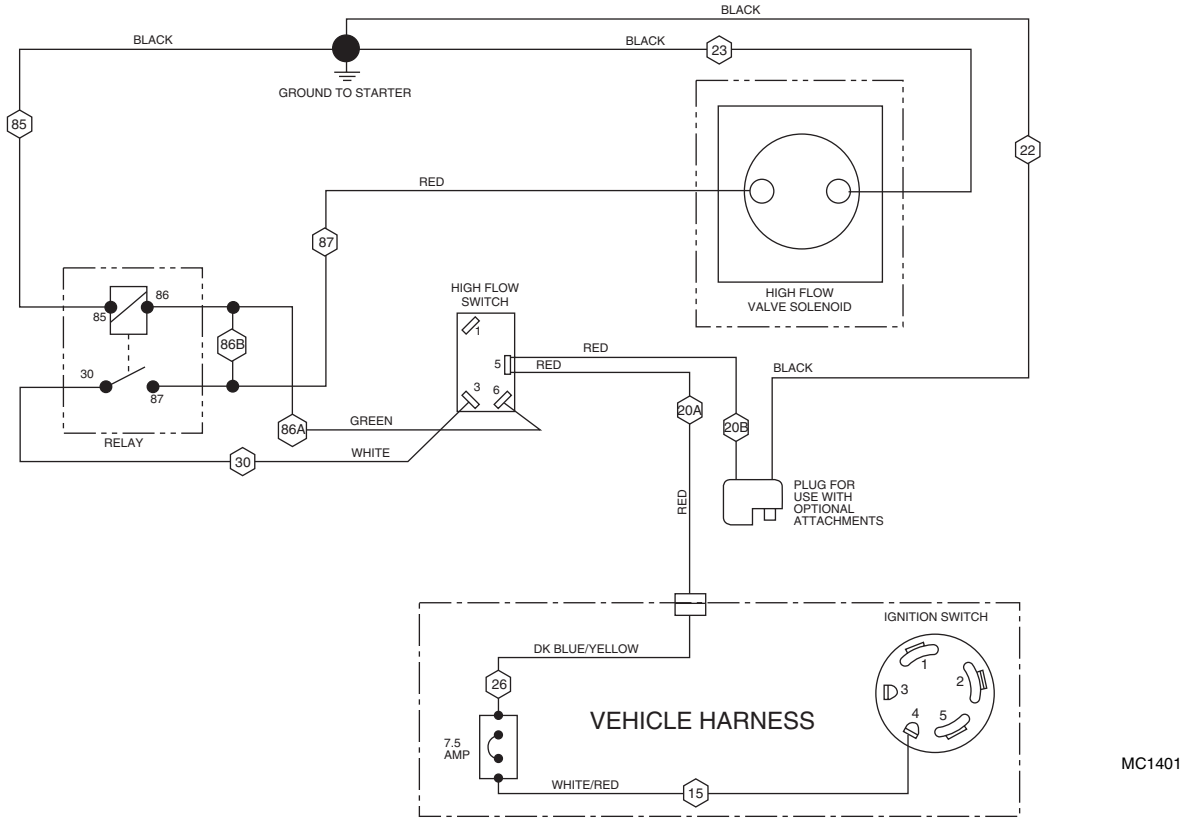


Figure 8-47 High Flow Electrical Circuit

b. Switch and Relay Testing

1. Be sure the vehicle is on a level surface, the implement grounded, park lock engaged, and engine shut OFF.
1. Remove the floor plate between the foot pedals, and disconnect the black negative battery cable from both batteries.
2. Remove the high flow panel (Fig. 8-46, 3) from the left side of the Operator's Protective Structure.
3. Tag and disconnect the three wires from the high flow switch.
4. Use an ohmmeter or continuity tester to test the switch for continuity.
   a. With the high flow switch in the OFF position, continuity should NOT exist between terminals "5" & "3" or between terminals "5" & "6." If continuity is present, the switch is defective.
   b. With the high flow switch in the ON position, continuity should exist between terminals "3," "5," & "6." If continuity is NOT present, the switch is defective.
5. If the switch failed either test in Step 4, replace the switch.
6. Reconnect the wires removed in Step 3.
7. Remove the relay (Fig. 8-46, 2) from the harness socket.

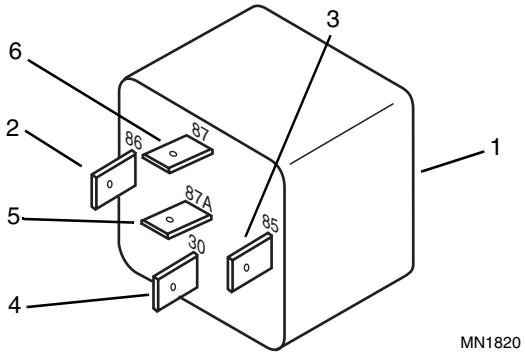


Figure 8-48 High Flow Relay

8. Use an ohmmeter or a continuity tester to test the high flow relay (Fig. 8-48, 1) for continuity as follows:
   a. Continuity should exist between terminals (Fig. 8-48, 2 & 3). If continuity is NOT present, the relay is defective.
   b. Continuity should exist between terminals (Fig. 8-48, 4 & 5). If continuity is NOT present, the relay is defective.
   c. Continuity should NOT exist between terminals (Fig. 8-48, 4 & 6). If continuity IS present, the relay is defective.
9. Apply 12 VDC to relay terminals (Fig. 8-48, 2 & 3).
   a. An audible "click" should be heard when power is applied. If a click is NOT heard, the relay is defective.
   b. With power applied to terminals (Fig. 8-48, 2 & 3), continuity should exist between terminals (5 & 6). If continuity is NOT present, the relay is defective.
   c. With power applied to terminals (Fig. 8-48, 2 & 3), continuity should NOT exist between terminals (4 & 5). If continuity IS present, the relay is defective.
10. Replace the high flow panel (Fig. 8-46, 3) on the left side of the Operator's Protective Structure.
11. Connect the black negative battery cable to both batteries, and replace the floor plate between the foot pedals.

c. Solenoid Valve Testing

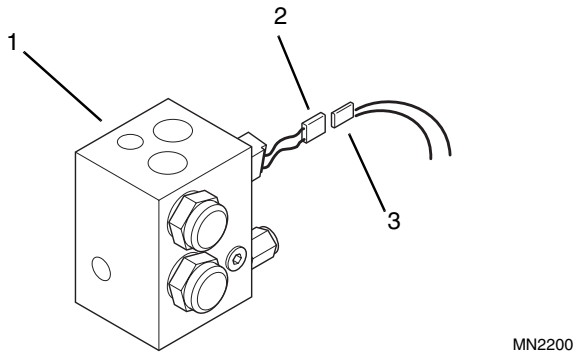


Figure 8-49 High Flow Valve

If all other components of the high flow circuit are functioning properly, there should be an audible click at the high flow valve (Fig. 8-49, 1) when the solenoid (2) activates. Test the solenoids as follows:

1. Disconnect black wire #23 and red wire #87 (Fig. 8-49, 3) from the solenoid connector (2).
2. Check for continuity between the two terminals on the solenoid. If continuity is NOT present, the solenoid is defective.
3. Reconnect the wires to the solenoid valves.
4. Turn the ignition key switch in the RUN position, but do not start the vehicle. Turn the high flow switch to the ON position.
5. Use a voltmeter or test light, test for voltage between the negative terminal (black wire) side of the solenoid and ground. Voltage should be present. If no voltage is present, replace the solenoid valve (Refer to Section 4.11.6, "High Flow Valve").

8.11 ELECTRICAL SCHEMATICS AND CIRCUIT DIAGRAMS

The following circuit diagrams will assist the technician in troubleshooting wiring problems. The wire colors used in the vehicle and referred to in these diagrams are the same.

Reference numbers appearing on individual wires in these diagrams are listed in the chart below, and are printed on the actual wires in the vehicle.

8.11.1 Electrical Wire Color Codes, Wire Gauge, And Function Chart

CIRCUIT	WIRE COLOR	WIRE GAUGE	FUNCTION
1	White/Blue	12	Ignition Switch “3” to Starter Solenoid
2	Black	14	Main Ground Circuit from Operator Protective Structure Harness through Engine/Chassis Harness to Starter Mounting Bolt/Battery Ground Cable
2A	Black	20	Fuel Gauge “G” spliced to Wire #2
2B	Black	16	1) Light Switch Center Terminal Spliced to Wire #2 2) Light Switch Center Terminal and Alternator Ground Spliced to Wire #2
2C	Black	14	1) Loader Arm Lock Relay Spliced to Wire #2 2) Fuel Gauge Sender Spliced to Wire #2
2D	Black	16	Loader Arm Lockout Solenoid Spliced to Wire #2
2E	Black	14	Engine Fuel Solenoid Spliced to Wire #2
2F	Black	14	1) Two Ground Connectors at Loader Arm Lock Relay Spliced to Wire #2 2) One Terminal on Right Backup Alarm Switch Spliced to Wire #2
2G	Black	20	Hydraulic Oil Filter Base Housing Spliced to Wire #2
2H	Black	20	One Terminal on Air Cleaner Switch Spliced to Wire #2
2J	Black	16	1) Lamp Timer (Black Pigtail Connector) Spliced to Wire #2 2) Jumper Between Left and Right Backup Alarm Switches
2L	Black	16	1) Left Backup Alarm Switch to Alarm Assembly 2) Jumper Between Loader Arm Lock Solenoids
3	Red	10	Power (12 VDC) from Starter Solenoid/Positive Battery Cable Spliced to #3A and #3B
3A	Red	10	Splice from Wire #3 to 40 amp Fuse in Fuse Panel
3B	Red	10	Splice from Wire # 3 and #3A to Auxiliary Power (12 VDC) Connector
4	White/Brown	12	Ignition Switch Terminal #4 to Thermostart Assembly
5	White	20	15 amp Fuse (12 VDC) Spliced to #5A, #5B, #5C, #5D, & #5E
5A	White	20	Splice from Wire #5 (12 VDC) to Fuel Gauge Terminal “L”
5B	White	20	Splice from Wire #5 (12 VDC) to Hourmeter (Not Polarity Sensitive)
5C	White	20	Splice from Wire #5 (12 VDC) to Left Warning Light Cluster “3”
5D	White	20	Splice from Wire #5 (12 VDC) to Warning Light Alarm “+”
5E	White	20	Splice from Wire #5 (12 VDC) to Right Warning Light Cluster “3”
6	Green	20	Hydraulic Oil Temperature Signal from Sending Unit to Connector (with Wire #6A) at Warning Light Alarm Harness
6A	Green	20	Hydraulic Oil Temperature Signal from Warning Alarm Harness Connector (with Wire #6) to Left Warning Light Cluster “2”
7	Yellow	20	Alternator Warning Light Signal from Alternator through Diode to Connector Located Near Fuse Panel
7A	Yellow	20	Alternator Warning Light Signal from Connector with Wire #7 to Left Warning Light Cluster “1”
8	Light Blue	20	Engine Temperature Signal from Sending Unit to Connector (with Wire #8A) at Warning Light Alarm Harness
8A	Light Blue	20	Engine Temperature Signal from Warning Alarm Harness Connector (with Wire #8) to Left Warning Light Cluster “6”

9	Brown	20	Oil Pressure Light Signal from Sending Unit to Connector (with Wire #9A) at Warning Light Alarm Harness
9A	Brown	20	Oil Pressure Buzzer Signal from Warning Alarm Harness Connector (with Wire #9) to Left Warning Light Cluster “5”
10	Orange	20	Hourmeter (Not Polarity Sensitive) Spliced to Wire #2
11	Gray (Slate)	20	Fuel Level Sender to Fuel Gauge “S”
12	Violet (Purple)	10	Ignition Switch “2” to Main Harness Connector
12A	Violet (Purple)	10	Ignition Switch “2” to Fuse Panel
13	Red/Blue	10	40 amp Fuse (12 VDC) to Ignition Switch “1”
14	White/Black	16	Light Switch to Rear Worklight (Negative)
14A	White/Black	16	Splice from #14B to Left Front Worklight (Negative)
14B	White/Black	16	Light Switch Spliced to #14A/#14C Front Worklights (Negative)
14C	White/Black	16	Splice from #14B to Right Front Worklight (Negative)
15	White/Red	10	Ignition Switch “4” to Fuse Panel
15A	White/Red	14	25 amp Fuse (12 VDC) to Connector for Optional Wiper and Fan
16	White/Green	20	Light Switch to “4” of Left and Right Warning Light Clusters
17	White/Yellow	16	Splice at 17B to Rear Worklight Connector
17A	White/Yellow	16	Splice at 17B to Left Front Worklight Connector
17B	White/Yellow	16	15 amp Fuse (12 VDC) Spliced to 17, 17A, and 17C (Worklights)
17C	White/Yellow	16	Splice at 17B to Right Front Worklight Connector
18	Red/White	16	Power (12 VDC) from #18A Connector to Loader Arm Lock Micro Switch “Normally Open” Terminal
18A	Red/White	16	7.5 amp Fuse (12 VDC) to #18 Connector
19	Red/Gray	10	Alternator (12 VDC Charge) to Starter Solenoid (Positive Battery Cable)
20	Green/White	14	Power (12 VDC) from #20A Connector to Engine Shutdown Solenoid
20A	Green/White	14	7.5 amp Fuse (12 VDC) to #20 Connector
20B	Green/White	14	Power (12 VDC) from Engine Shutdown Solenoid to Cold Start Timing Advance Switch
20C	Orange	16	Cold Start Timing Advance Switch to Cold Start Timing Advance Solenoid
21	White/Green	18	Lamp Timer (White Pigtail Connector) to Right Warning Light Cluster “1”
22	Red/Green	18	Ignition Switch “5” to Lamp Timer (Red Pigtail Connector)
23	Pink	16	15 amp Fuse (12 VDC) to Backup Alarm Assembly
26	Dark Blue/ Yellow	16	7.5 amp Fuse (12 VDC) to Optional High Flow Connector
27	Red/Yellow	20	Hydraulic Oil Filter Restriction Signal from Switch to Right Warning Light Cluster “5”
28	Red/Blue	20	Air Cleaner Restriction Signal from Switch to Right Warning Light Cluster “2”
30	Red/Black	16	Loader Arm Lockout Micro Switch “Common” to Relay
30A	Red/Black	16	Loader Arm Lockout Micro Switch “Common” to Reset Pushbutton
31A	Yellow/Blue	14	25 amp Fuse (12 VDC) to Optional Heater Connector
31B	Yellow/Blue	14	25 amp Fuse (12 VDC) to Optional Strobe Connector in Instrument Panel
86	Dark Blue	18	Splice from #86A, #86B, & #86C to Loader Arm Lockout Solenoid
86A	Dark Blue	18	1) Loader Arm Lockout Pushbutton Switch Spliced to #86 Wire 2) Loader Arm Lockout Solenoid to Solenoid
86B	Dark Blue	16	Loader Arm Lockout Relay Spliced to #86 Wire
86C	Dark Blue	16	Loader Arm Lockout Relay Spliced to #86 Wire

8.11.2 Operator's Protective Structure Electrical Diagram

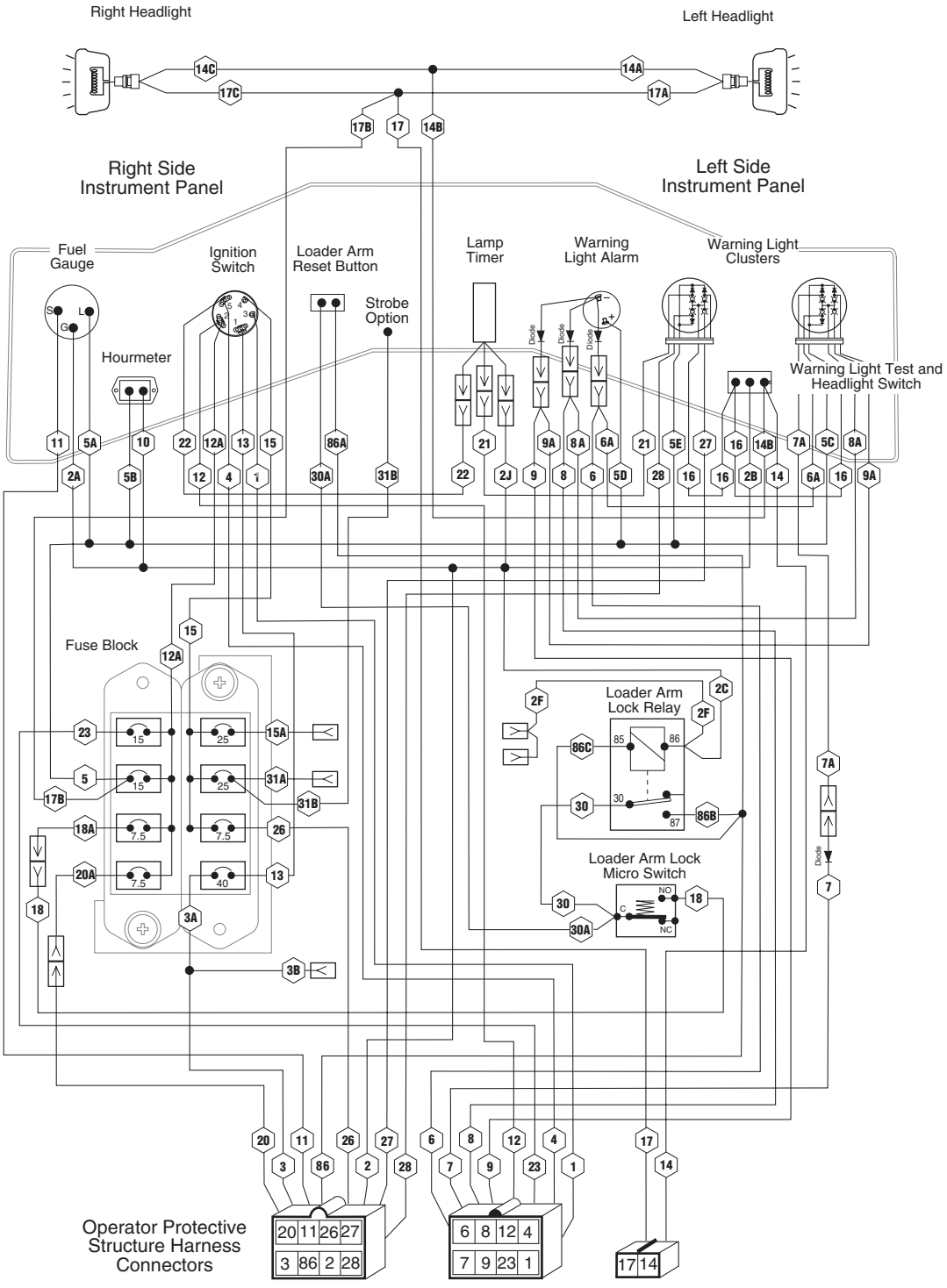


Figure 8-50 Operator Protective Structure Electrical Diagram

8.11.3 Engine/Chassis Electrical Diagram

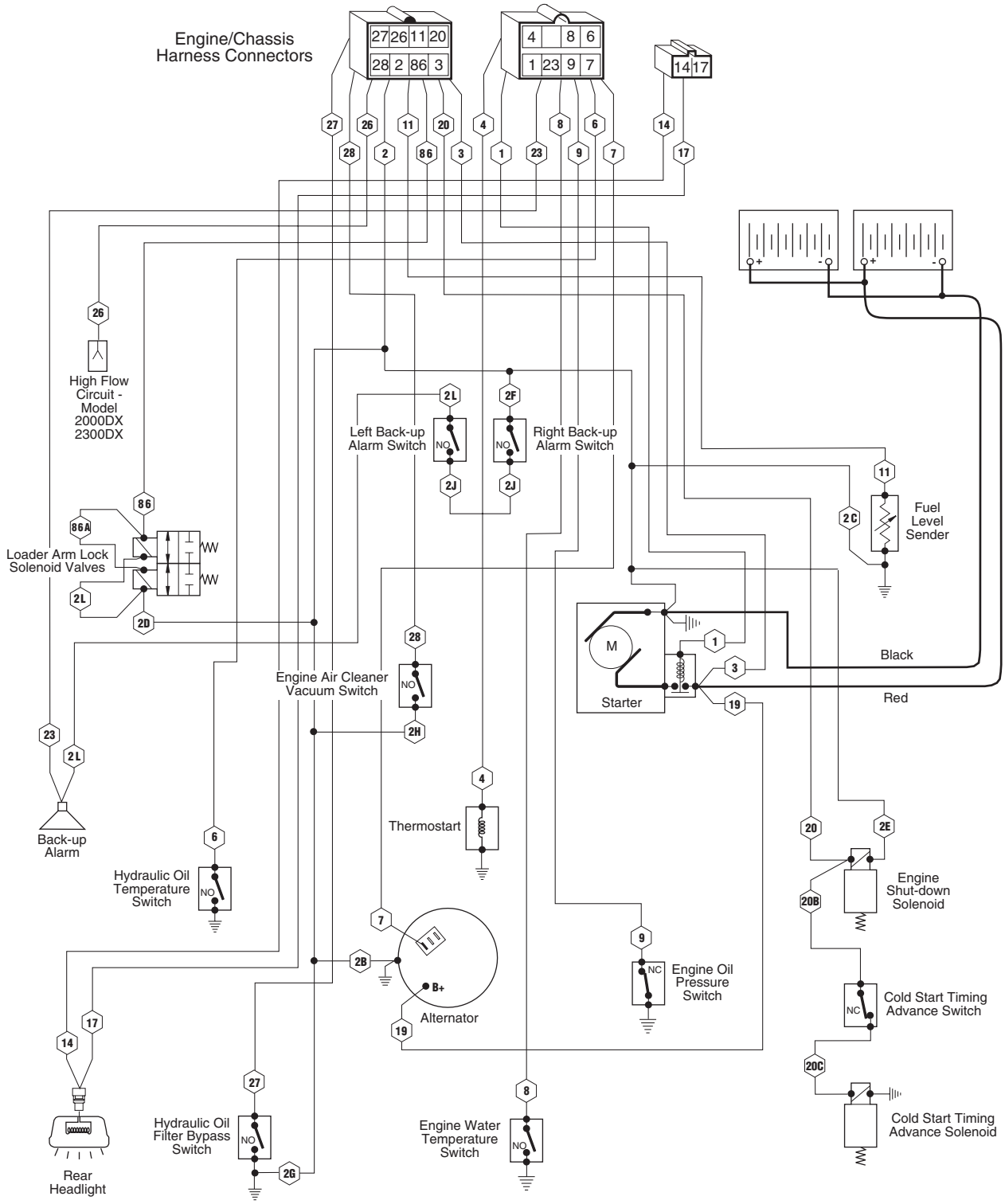


Figure 8-51 Engine/Chassis Electrical Diagram

8.11.4 Vehicle Electrical Schematic

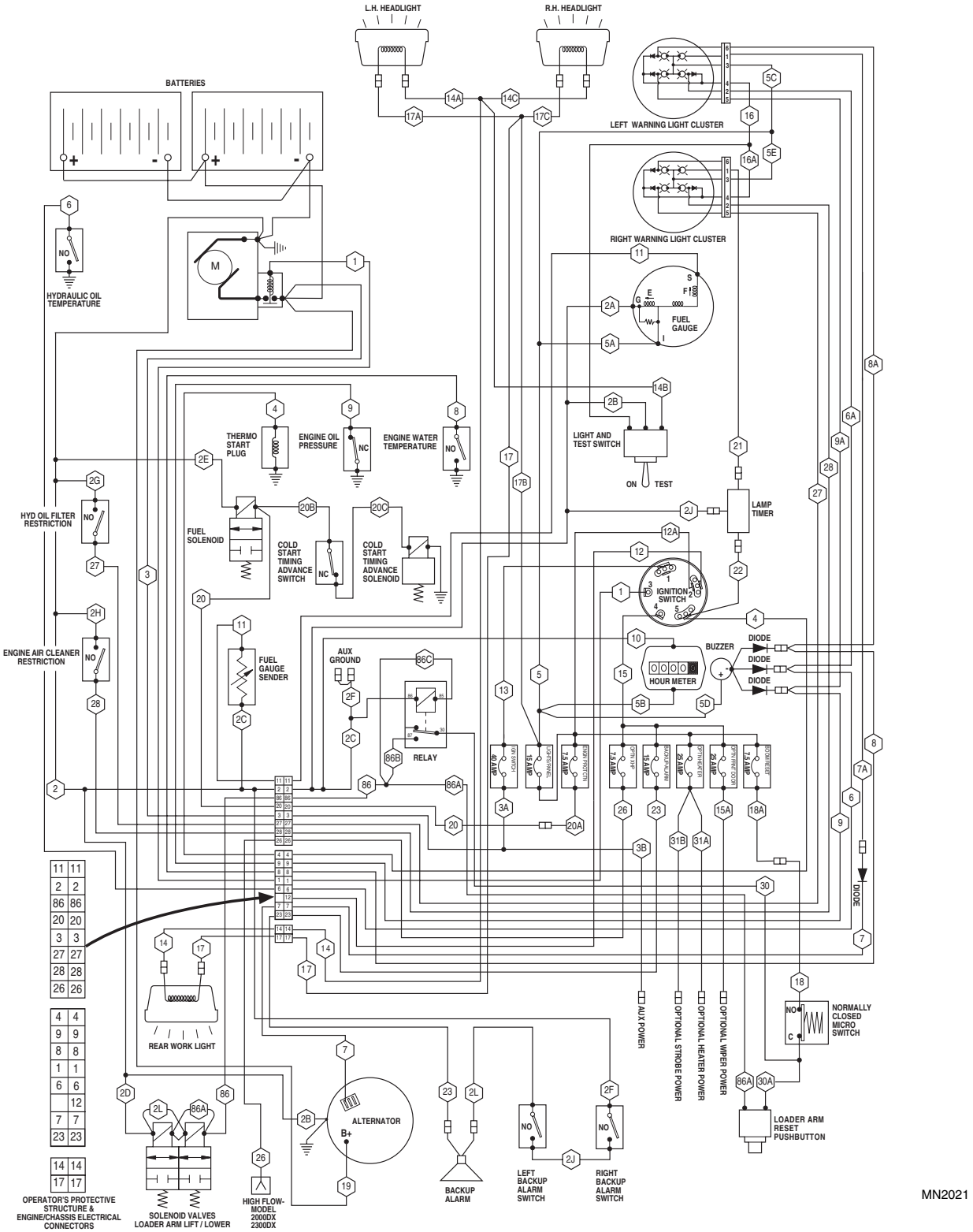


Figure 8-52 Model 1750D, 2000D/DX, 2300D/DX Electrical Schematic

8.11.5 Cranking Circuit Electrical Schematic

SWITCH TERMINAL	SWITCH POSITION			
	OFF	RUN	PREHEAT	START
1 - BAT		X	X	X
2 - IGN		X	X	X
3 - START				X
4 - ACC		X		
5 - HEAT			X	X

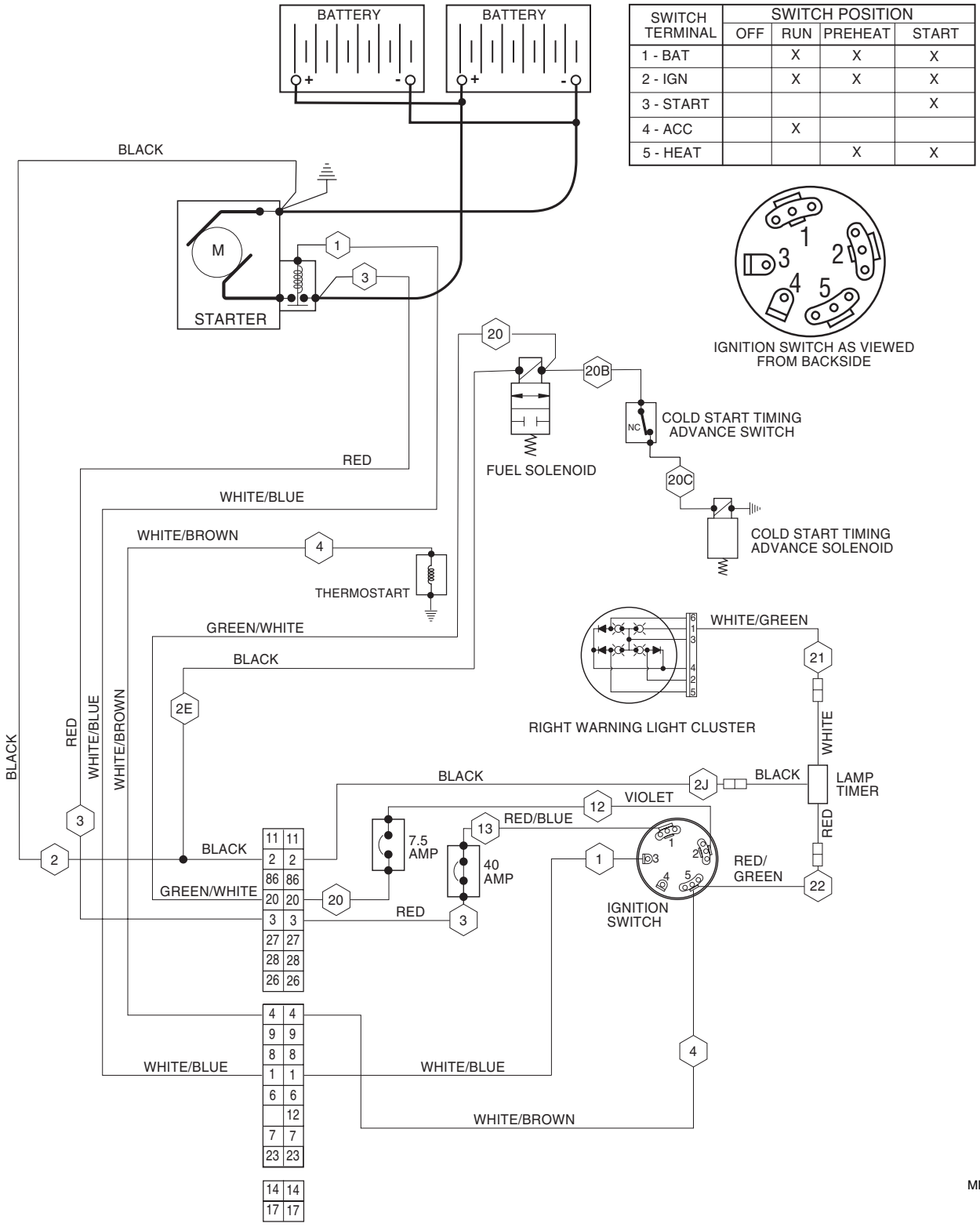


Figure 8-53 Model 1750D, 2000D/DX, 2300D/DX Cranking Circuit

8.11.6 Charging Circuit Electrical Schematic

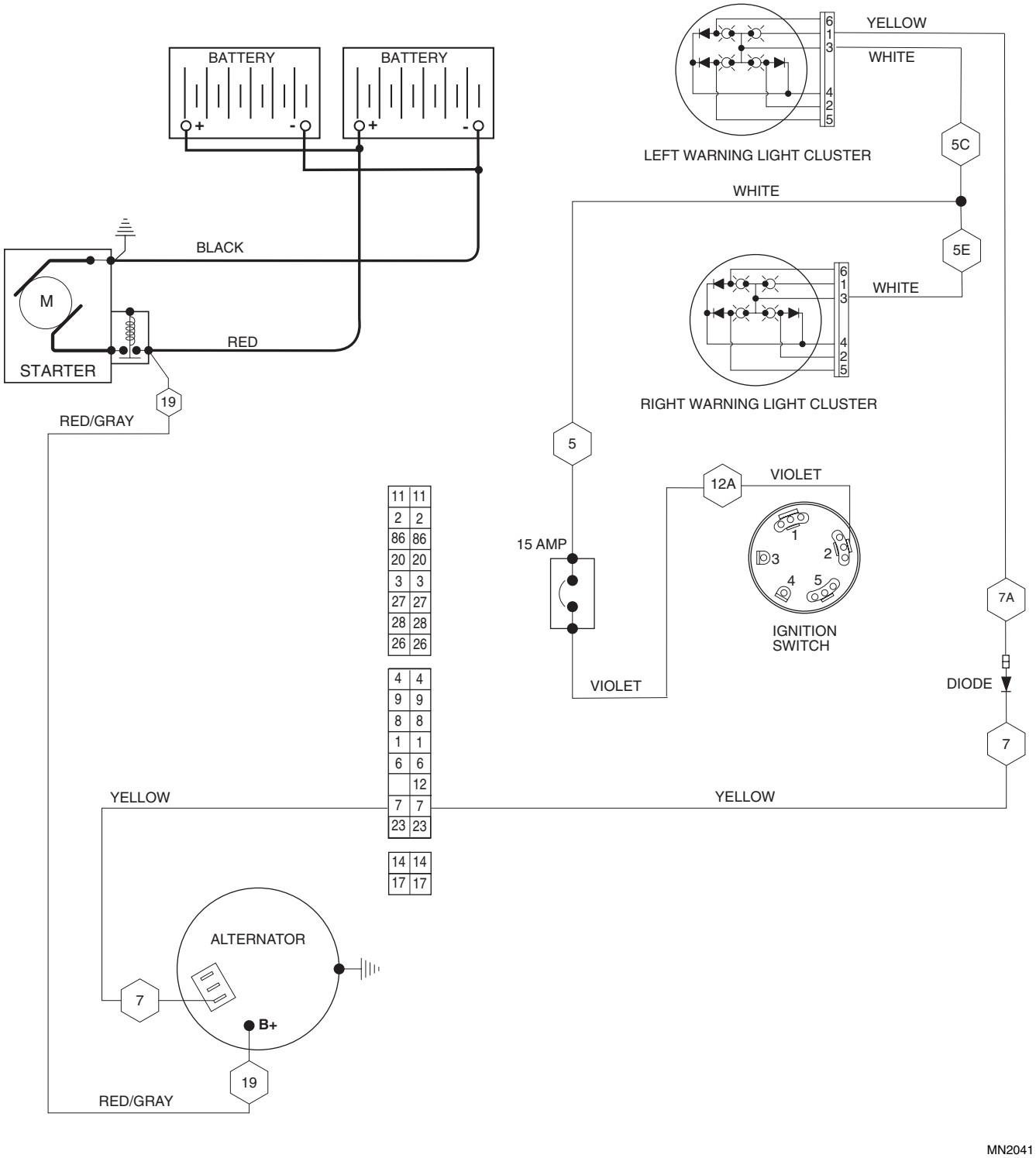


Figure 8-54 Model 1750D, 2000D/DX, 2300D/DX Charging Circuit

8.11.7 Worklights/Gauge Circuit Electrical Schematic

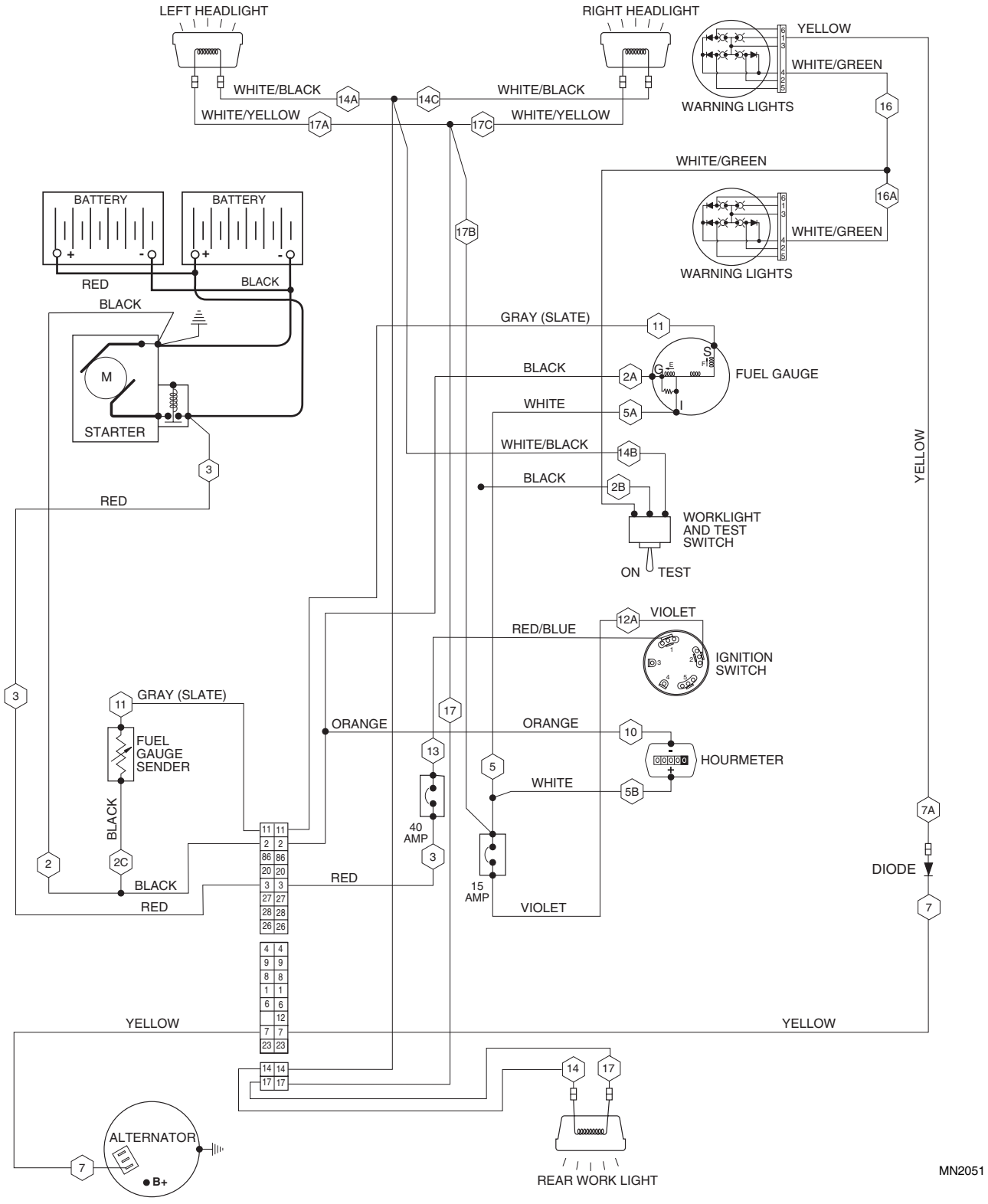


Figure 8-55 Model 1750D, 2000D/DX, 2300D/DX Worklights/Gauge Circuit

8.11.8 Warning Lights Circuit Electrical Schematic

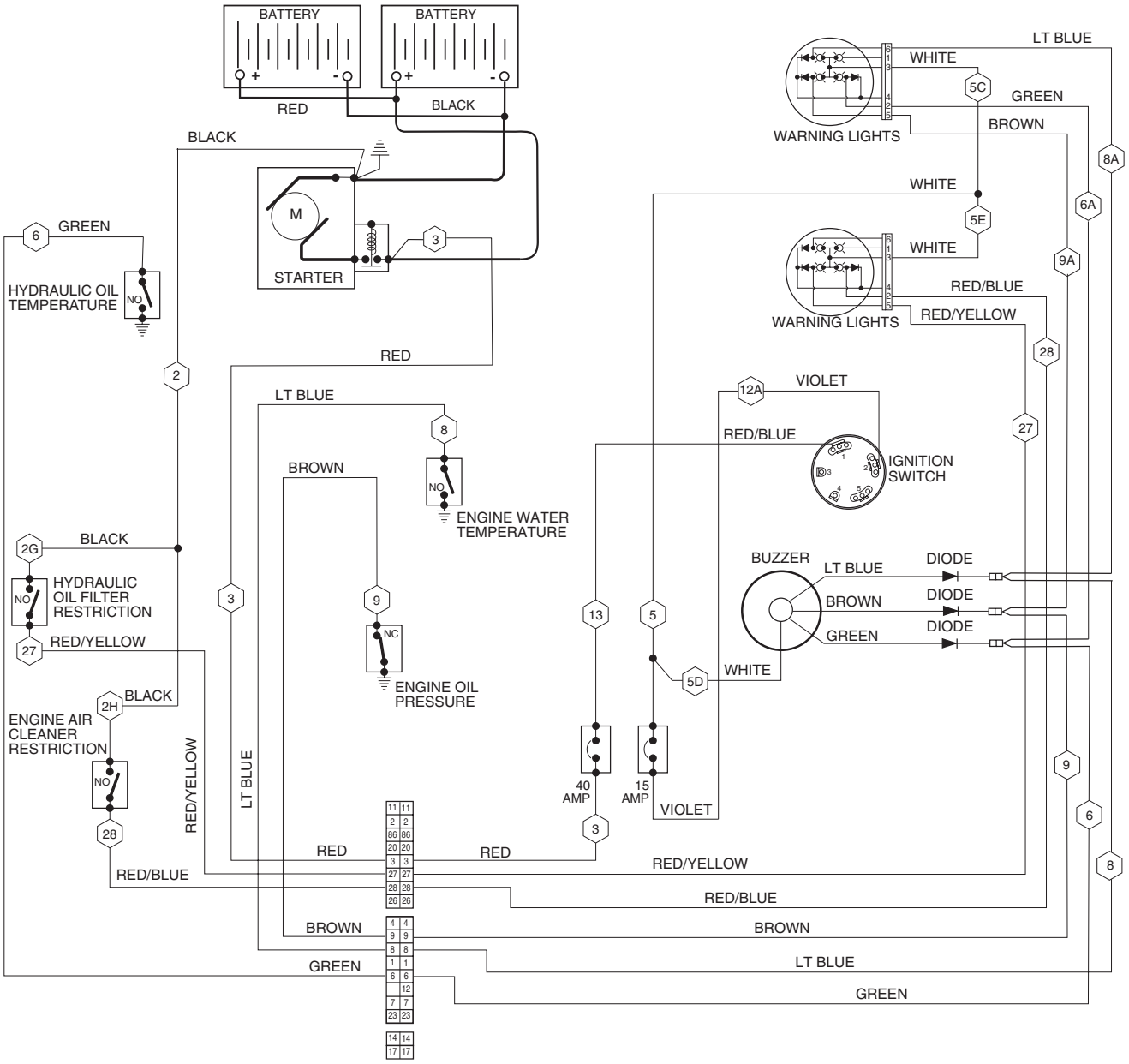


Figure 8-56 Model 1750D, 2000D/DX, 2300D/DX Warning Lights Circuit

8.11.9 Loader Arm Lockout Circuit Electrical Schematic - Open Cab Models

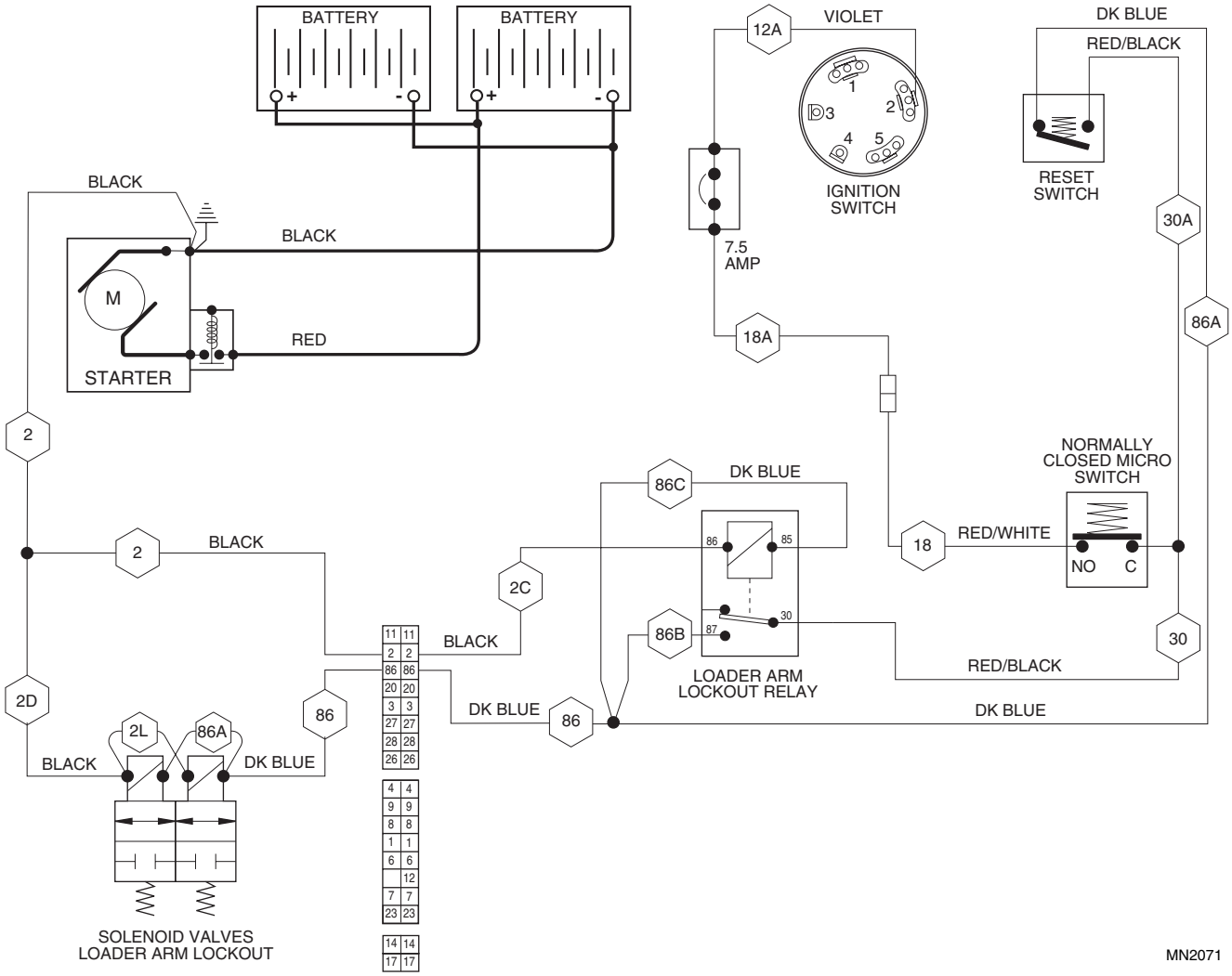


Figure 8-57 Model 1750D, 2000D/DX, 2300D/DX Loader Arm Lockout Circuit Open Cab Models Only

8.11.10 Loader Arm Lockout Circuit Electrical Schematic - Enclosed Cab Models

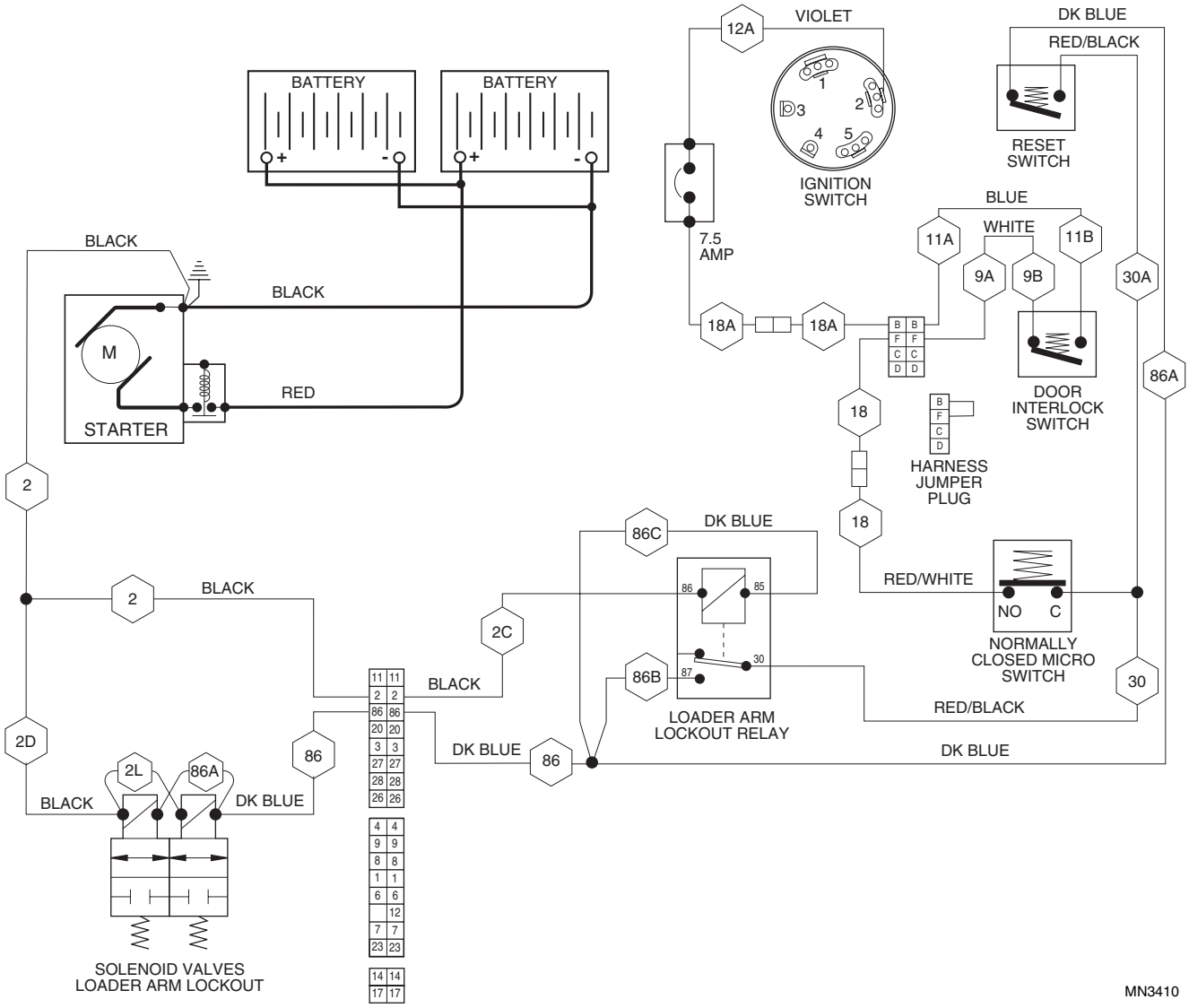


Figure 8-58 Model 1750D, 2000D/DX, 2300D/DX Loader Arm Lockout Circuit Enclosed Cab Models With Front Door Only

8.11.11 Enclosed Cab Door, Wiper and Defroster Circuit Harness Diagram

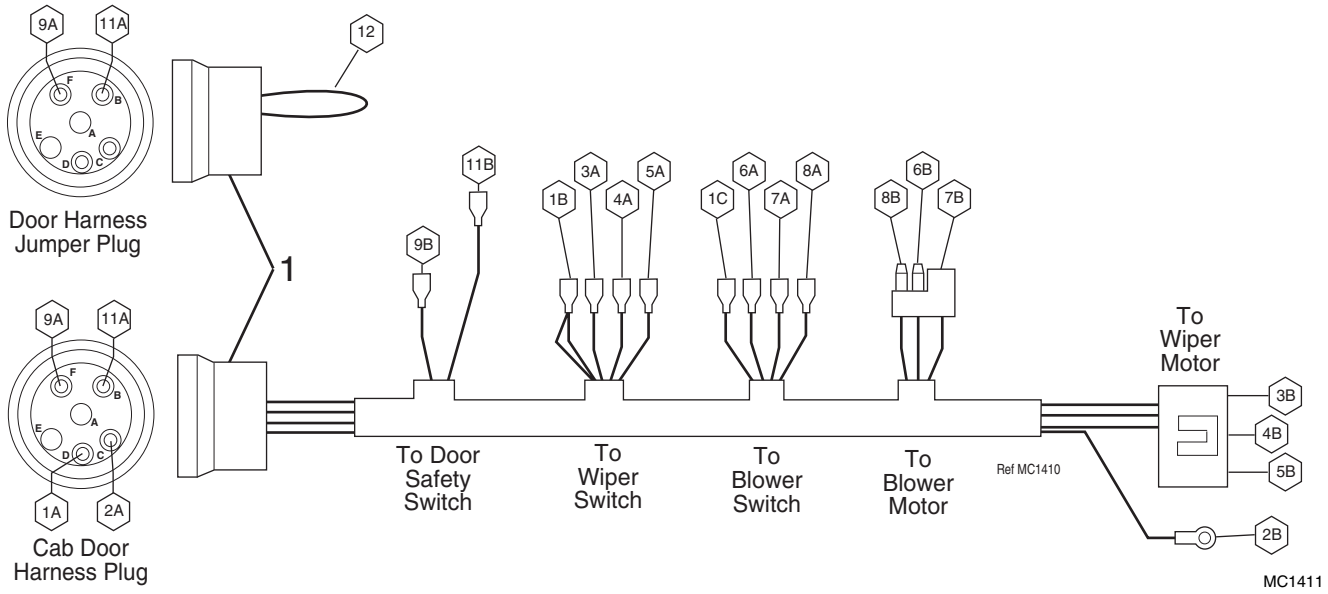


Figure 8-59 Model 1750D, 2000D/DX, 2300D/DX Cab Door, Wiper and Defroster Circuit Harness Diagram

CIRCUIT	WIRE COLOR	WIRE GAUGE	FUNCTION
1A	Red/White	14	Power On Vehicle Fuse Block; Harness Connector Position D (Connects To Vehicle Circuit #31A, Refer To Figure 8-60)
1B	Red/White	14	Wiper Switch Terminal “B”
1C	Red/White	16	Blower Switch Terminal “B”
2A	Black	14	Ground On Vehicle; Harness Connector Position C (Connects To Vehicle Circuit #2F, Refer To Figure 8-60)
2B	Black	14	Ground On Wiper Motor
3A	Green	16	Wiper Switch Terminal “L”
3B	Green	16	Wiper Connector (To “L” on Wiper)
4A	Red	16	Wiper Switch Terminal “H”
4B	Red	16	Wiper Connector (To “H” on Wiper)
5A	Purple	16	Wiper Switch Terminal “P”
5B	Purple	16	Wiper Connector (To “P” on Wiper)
6A	Red	14	Blower Switch Terminal “M”
6B	Red	14	Blower Connector (Red Wire)
7A	Orange	14	Blower Switch Terminal “H”
7B	Orange	14	Blower Connector (Orange Wire)
8A	Yellow	14	Blower Switch Terminal “L”
8B	Yellow	14	Blower Connector (Yellow Wire)
9A	White	16	Terminal On Item #1; Harness Connector Position F (Connects To Vehicle Circuit #18, Refer To Figure 8-60)
9B	White	16	“Normally Open” On Safety Switch
11A	Blue	16	Terminal On Item #1; Harness Connector Position B (Connects To Vehicle Circuit #18A, Refer To Figure 8-60)
11B	Blue	16	“Common” On Safety Switch
12		16	Jumper Between Harness Connector (1) Terminal B and F

8.11.12 Enclosed Cab Heater & Door Harness Electrical Diagram

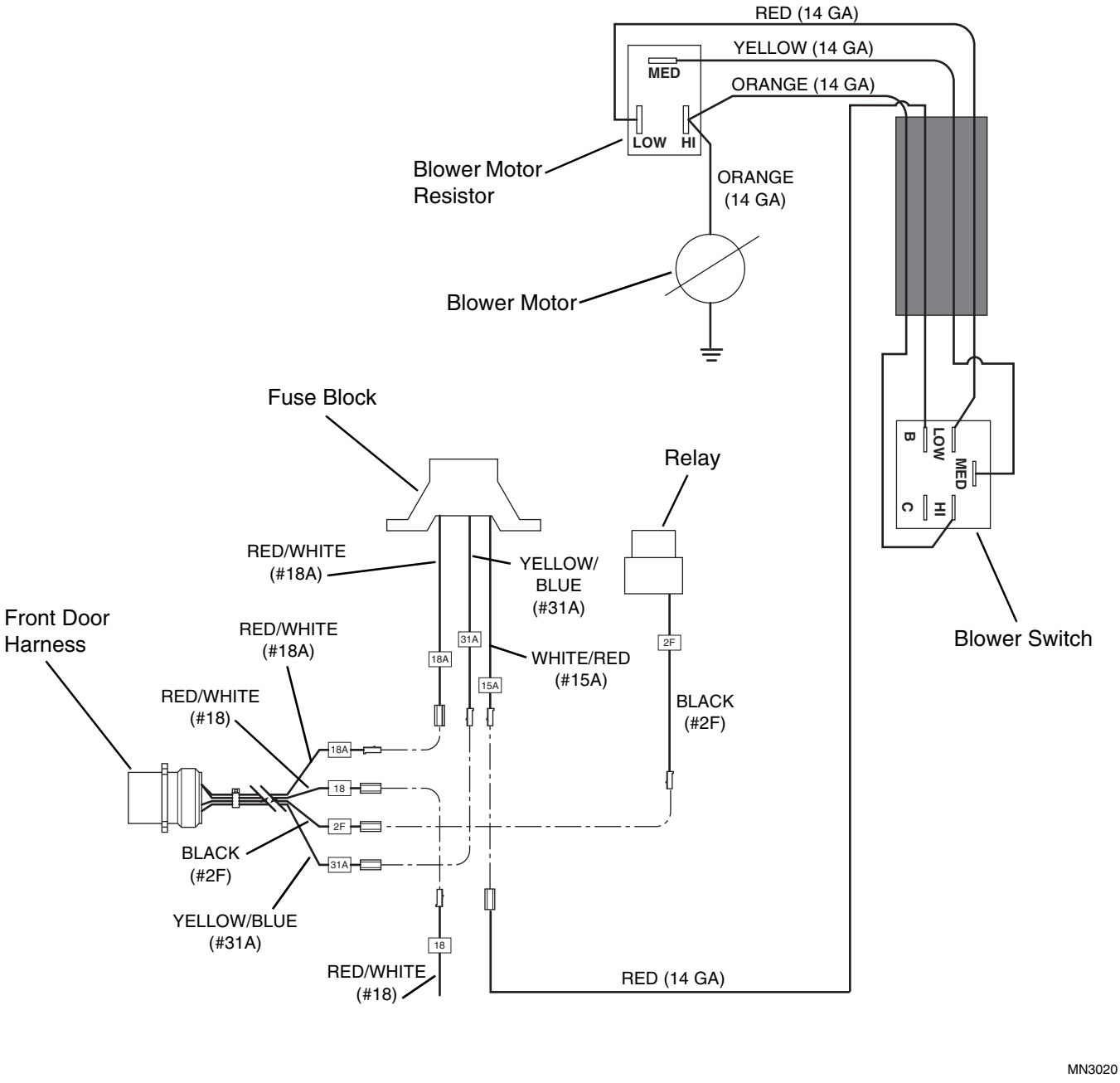


Figure 8-60 Model 1750D, 2000D/DX, 2300D/DX Enclosed Cab Heater & Door Harness Circuit Electrical Diagram

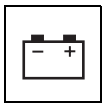
8.12 ELECTRICAL TROUBLESHOOTING

Trouble	Probable Cause	Remedy	Par. Ref.
Starter will not engage.	One or both batteries discharged.	Check and charge batteries. Replace if necessary.	8.6.1
	Corroded battery terminal posts and cable connectors.	Remove battery cables and clean battery terminal posts and cable connectors.	8.6.1 b
	Loose or disconnected battery cables or wiring.	Clean and check connections, cables, and wiring.	8.6.1, 8.8, 8.11.5
	Defective starter solenoid.	Check and replace if required.	8.4.3
	Defective starter.	Check and replace if required.	8.4.3
	Defective ignition switch.	Check and replace if required.	8.4.1
	Blown fuse.	Check and replace.	8.5
Starter drive gear engages, but starter motor does not turn over.	Defective starter.	Check and replace if required.	8.4.3
	Defective starter solenoid.	Check and replace if required.	8.4.3
Starter rotates at full speed before drive gear engages.	Defective starter drive gear spring.	Check and replace if required.	8.4.3
Starter does not disengage after engine starts.	Faulty ignition switch.	Check and replace if required.	8.4.1
	Defective starter solenoid.	Check and replace if required.	8.4.3
One or both batteries low in charge or discharged.	Fan belt is loose and slipping.	Adjust or replace.	10.8.1
	Corroded battery terminal posts and cable connectors.	Remove battery cables and clean battery terminal posts and cable connectors.	8.6.1 b
	Defective battery.	Check and replace if required.	8.6.1
	Loose or disconnected battery cables or wiring.	Clean and check connections, cables, and wiring.	8.6.1, 8.8, 8.11.6
	Defective regulator in alternator or defective alternator.	Check and replace if required.	8.7.2
	Electrical overload.	Disconnect any electrical equipment not supplied with vehicle (such as radio), and check alternator output.	8.7.2

Trouble	Probable Cause	Remedy	Par. Ref.
Batteries overheat, alternator overcharging.	Defective battery.	Check and replace if necessary.	8.6.1
	Defective voltage regulator in alternator or defective alternator.	Check and replace if necessary.	8.7.2
Alternator warning light goes on when engine is running.	Fan belt is loose and slipping.	Adjust or replace.	10.8.1
	Faulty wiring or connections.	Check and repair.	8.8, 8.11.6
	Defective voltage regulator in alternator or defective alternator.	Check and replace if necessary.	8.7.2
Alternator warning light flickers on and off.	Faulty wiring or connections.	Check and repair.	8.8, 8.11.6
	Dirty or worn slip rings or brushes in alternator.	Check and repair.	8.7.2
Alternator warning light does not go on when alternator is not producing voltage.	Alternator is not producing voltage or warning light bulb is burned out.	Replace warning light bulb.	8.7.2, 8.3.2 b
	Battery is discharged.	Charge battery.	8.6.1
	Defective alternator.	Check and replace if necessary.	8.7.2
One or more warning light bulbs do not go on when testing with the warning light test/ worklight switch.	Warning light bulb is burned out or bulb socket connections are bad.	Replace warning light bulb. Check bulb socket connection.	8.3.2 b
	Faulty wiring or connections.	Check and repair.	8.8, 8.11.8
	Faulty warning lights test/ worklight switch.	Check and replace if necessary.	8.3.2 a
Warning light bulbs go on continuously when ignition switch is in “RUN” position.	Defective test switch.	Test switch for continuity and replace if necessary.	8.3.2 a
	Short circuit in wiring.	Determine and repair the cause of the short circuit.	8.8, 8.11.8
	Defective sender switches.	Test switches for continuity and replace if necessary.	8.3.2 c, d, e, g, or h
One headlight or rear worklight is inoperative or intermittent.	Loose connection.	Secure all connections to lights, including the ground wire.	8.8, 8.11.7
	Defective sealed beam worklight.	Replace sealed beam worklight.	8.1
One or both headlights are dim.	Faulty ground connection.	Secure all connections to lights, including the ground wire.	8.8, 8.11.7

Trouble	Probable Cause	Remedy	Par. Ref.
One or more headlights have a short life.	Charge circuit problem.	Check and repair wiring.	8.7.2, 8.8, 8.11.7
Hourmeter does not operate or is inaccurate.	Defective wiring and ground.	Check and repair or replace as necessary.	8.8, 8.11.2
	Incorrect voltage at hourmeter terminals.	Check alternator output voltage.	8.3.3, 8.7.2
	Check running indicator flag wheel.	Replace hourmeter if defective.	8.3.3
Fuel gauge does not function.	Loose connections or faulty wiring.	Check and repair connections and wiring.	8.8, 8.11.7
	Blown fuse.	Check and replace.	8.5
	Defective fuel gauge or sender.	Test and replace as required.	8.3.4
Key binds in ignition switch lock.	Sticky, painted or bent key.	Clean, remove paint and straighten, remove any burrs from surface of key and sprinkle powered graphite on working surfaces of key. *IMPORTANT: Use only graphite or a liquid lock deicer within the lock. Severe lock malfunctions may require the services of a locksmith.*	8.4.1
Key cannot enter ignition switch or cannot be turned inside lock.	Moisture within ignition switch is frozen.	Warm the ignition switch using a hair dryer or use a liquid lock deicer to lower the freezing point and evaporate the moisture within the lock.	8.4.1
Ignition switch fails to function in one or more positions.	Loose or broken wiring.	Check and repair or replace as required.	8.11.4
	Trouble in starting circuit.	Check and repair or replace as required.	8.8, 8.11.5
	Trouble in the THERMO START circuit.	Check and repair or replace as required.	8.4.4, 8.8, 8.11.5
	Defective ignition switch.	Check and repair or replace as required.	8.4.1

Trouble	Probable Cause	Remedy	Par. Ref.
Ignition switch causes starter to crank engine, but engine will not operate in "RUN" position.	Fuel shutoff solenoid fails to admit fuel to fuel injection pump, due to loose connections or broken wires.	Check connections and wiring to fuel shutoff solenoid. Repair or replace as required.	8.8, 8.11.5
	Fuel shutoff solenoid is stuck in open position.	Replace fuel shutoff solenoid.	8.4.2
	Fuel tank is empty.	Fill fuel tank.	10.6.4
Loader Arm will not RAISE or LOWER after pressing the loader arm reset button.	Ignition switch is not in the "RUN" position	Turn ignition switch to the "RUN" position.	8.4.1 a
	Seat restraint bar is not lowered.	Lower seat restraint bar.	8.9 a
	Defective loader arm reset switch.	Test and replace if necessary.	8.9 fc
	Defective ignition switch.	Test and replace if necessary.	8.4.1 b
	Defective micro switch.	Test and replace if necessary.	8.9 dc
	Defective loader arm lockout relay.	Test and replace if necessary.	8.9 gc
	Defective loader arm lockout solenoid(s).	Test and replace if necessary.	8.9 ic
	Defective front door switch.	Test and replace if necessary.	8.9 c
	Faulty wiring in loader arm lockout circuit.	Check and repair.	8.11.9, 8.11.10
	Blown fuse.	Test and replace if necessary.	8.9 c

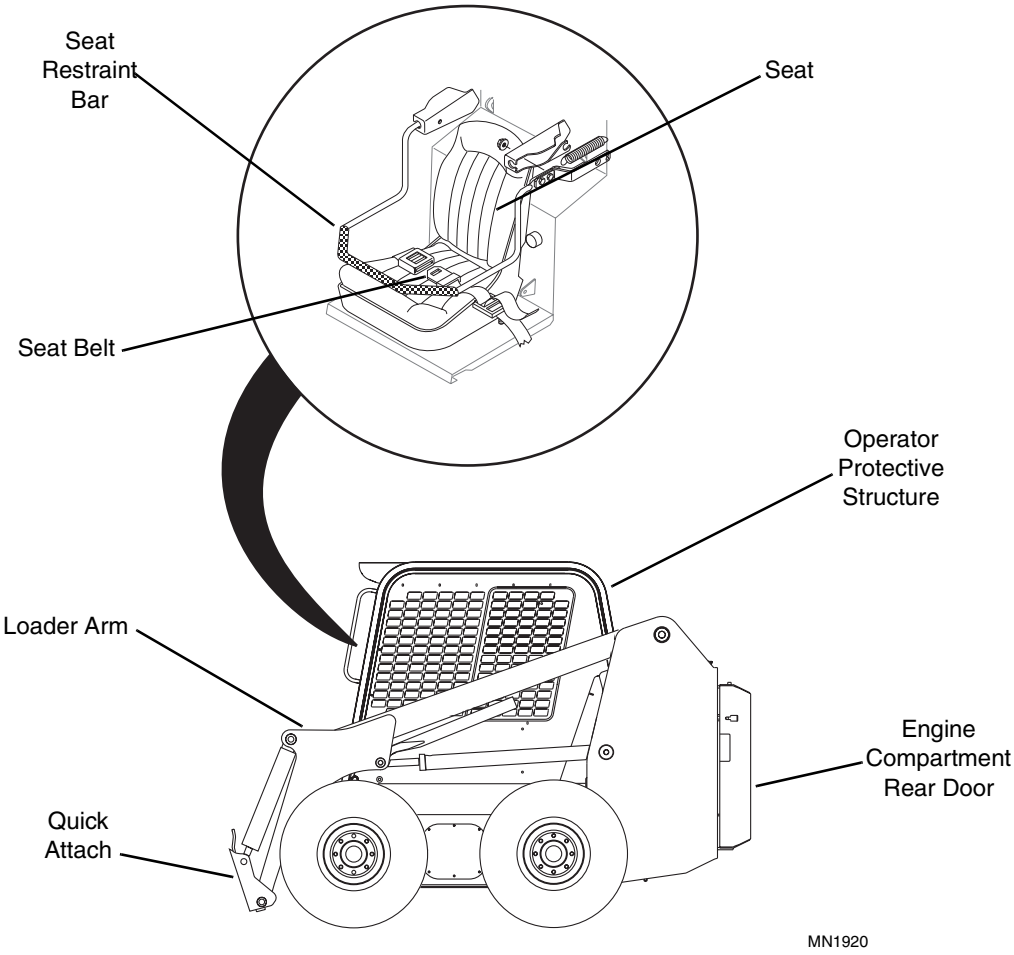


Section 9
Main Frame

Contents

9.1 MAIN FRAME TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the main frame components. The following illustration identifies the components that are referred to throughout this section.



9.2 QUICK ATTACH

9.2.1 Quick Attach Description

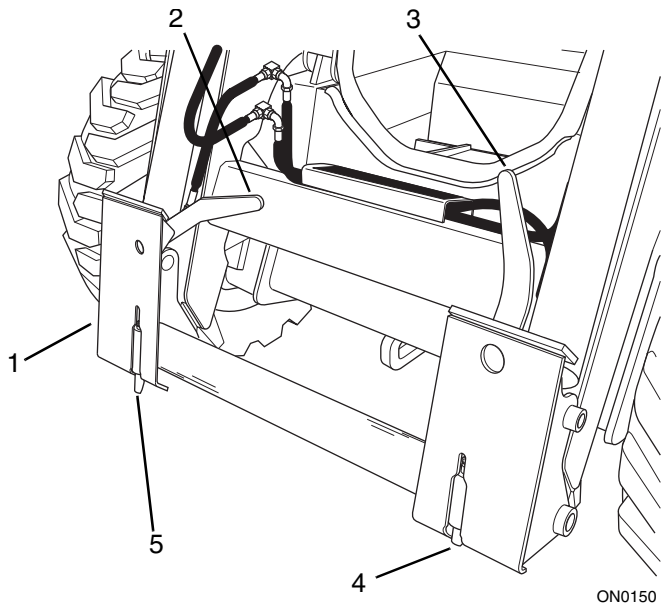


Figure 9-1 Quick Attach

The quick attach unit (Fig. 9-1, 1) provides a rigid frame to which an attachment is connected to the vehicle. The quick attach unit (1) is secured to the loader arms and attachment tilt cylinders with pins, capscrews, and locknuts. Locking levers (2 & 3) and pins (4 & 5) on the quick attach unit (1) are used to secure the attachment to the vehicle.

9.2.2 Quick Attach Operation

Attachment Installation

1. If attaching a bucket or other attachment, follow these instructions. If the attachment requires attaching additional linkage beyond quick attach or controls beyond auxiliary couplers refer to that attachment operator's manual.
2. The bucket or attachment should be on firm level ground.
3. Fully raise both locking levers (Fig. 9-1, 3) until the locking pins are retracted (4) into the quick attach (disengaged position).
4. Carefully enter vehicle using the hand holds, fasten seat belt, lower seat bar. Start and position the vehicle directly behind the bucket or attachment. Increase engine speed to full throttle, momentarily press loader arm raise/lower reset button.

IMPORTANT: *To prevent personal injury, do not use the cross bar on the quick attach as a step.*

5. Raise the loader arm slightly and tilt the quick attach forward.
6. Slowly drive forward until the top of the quick attach slips under the top lip of the bucket or the attachment mounting plate.
7. Raise the loader arm slightly and slowly tilt the quick attach back against the loader arm.
8. Move engine throttle control fully to the idle position and remove your feet from the pedals.
9. Raise the seat bar and unfasten the seat belt.
10. Carefully exit the vehicle using the hand holds.

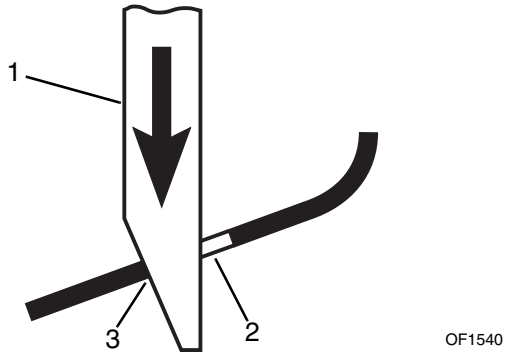


Figure 9-2 Quick Attach Lock Pin Engagement

11. Fully lower both locking levers (Fig. 9-1, 2) down. This pushes the locking pins (Fig. 9-2, 1) down (engaged position) through the slots (2) at the base of the bucket or attachment mounting plate, locking the bucket or attachment to the quick attach.

WARNING: Locking pins must be in full contact with the lower edge of the slot in the attachment (Fig. 9-2, 3). Locking levers must be fully lowered. The attachment could come loose from the quick attach if the slot on the attachment is excessively worn or the attachment mount is not properly aligned. Failure to secure locking pins in the attachment slots could allow the attachment to come off and cause death or serious injury.

12. Check to be sure the lock pins are protruding through the slots in the bottom of the bucket.
13. Remove the bucket or attachment as instructed in "Attachment Removal" (Page 9.4) if the lock pins are not protruding through the slots. Repeat "Attachment Installation" (Page 9.3) after removing any dirt and debris from the quick attach, locking levers and lock pins and make sure that the locking levers operate.

Attachment of Auxiliary or High Flow Hydraulics

If the attachment requires a hydraulic connection, the auxiliary couplers (Fig. 9-3, 1) are on the left side of the vehicle and the high flow couplers are on the right side (2).

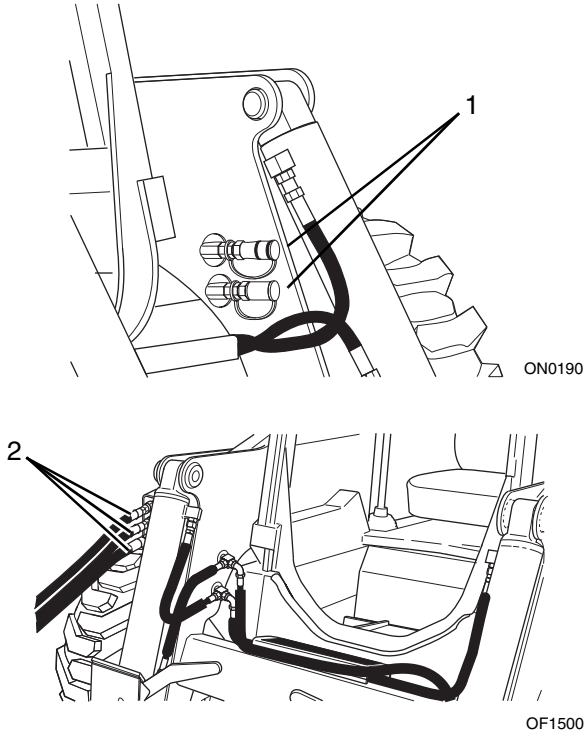


Figure 9-3 Hydraulic Couplers

Attachment Removal

1. If removing a bucket or other attachment, follow these removal instructions. If the attachment requires removal of additional linkage beyond quick attach or controls beyond auxiliary couplers refer to that attachment operator's manual.
2. Disconnect the attachment hydraulic couplers from the vehicles hydraulic system (Fig. 9-3, 1 and/or 2) if necessary. Reinstall the protective caps onto all couplers to prevent dirt and debris from entering the hydraulic system of the vehicle and attachment.
3. Position the vehicle on firm level ground.
4. Lower the bucket or attachment to the ground. Be sure the bucket or attachment is stabile and will not tip once the quick attach is disconnected from the mounting plate.

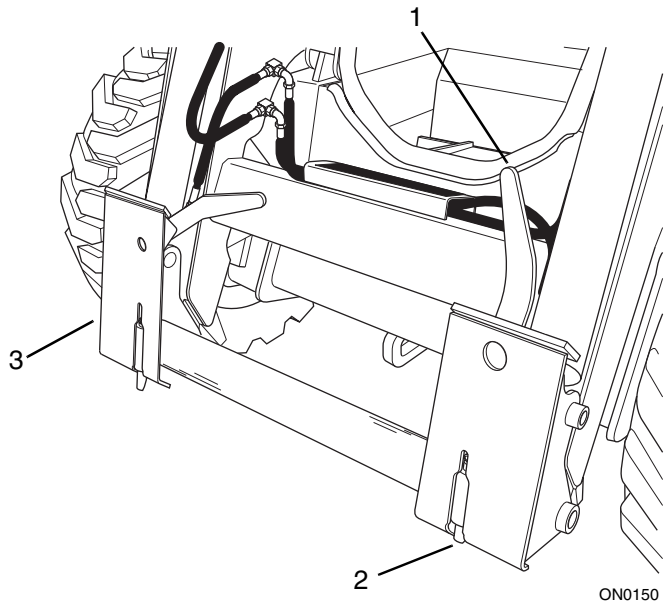


Figure 9-4 Quick Attach

5. Lower engine throttle control to idle. Remove your feet from the control pedals, raise the seat bar and unfasten seat belt.
6. Carefully exit the vehicle using the hand holds.
7. Fully raise both locking levers (Fig. 9-4, 1) until the locking pins are retracted (Fig. 9-4, 2) into the quick attach (disengaged position).
8. Carefully enter vehicle using the hand holds, fasten seat belt, lower the seat bar and increase engine speed to full throttle.
9. Press the loader arm raise/lower reset button.
10. Tilt the quick attach (Fig. 9-4, 3) forward.
11. Drive backward slowly until the top of the quick attach slips out from under the top lip of the bucket or the attachment mounting plate.

Clean entire quick attach (Fig. 9-4, 3) of all dirt and debris. ***DO NOT*** *allow dirt and debris to build up in the locking mechanisms or the locking pins of the quick attach.*

9.2.3 Quick Attach Maintenance

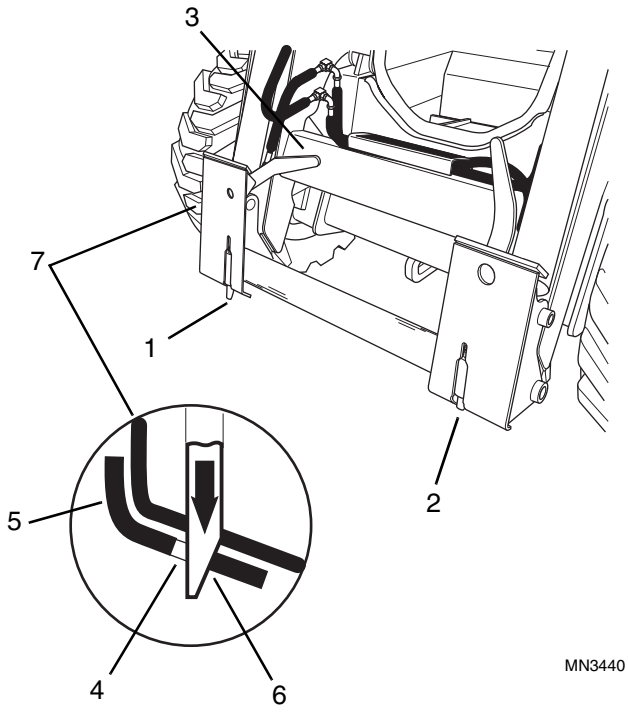


Figure 9-5 Quick Attach Lock Pin Engagement

An accumulation of dirt and/or debris may prevent proper engagement of the locking pins (Fig. 9-5, 1 & 2) when the locking levers are fully lowered (3).

WARNING: Locking pins must be in full contact with the lower edge of the slot in the attachment (Fig. 9-5, 6). Locking levers must be fully lowered. The attachment could come loose from the quick attach if the slot on the attachment is excessively worn or the attachment mount is not properly aligned. Failure to secure locking pins in the attachment slots could allow the attachment to come off and cause death or serious injury.

If either lock pin (Fig. 9-5, 1 or 2) does NOT protrude through the slot (4) in the attachment (5), or the angled edge (6) of either lock pin (1 or 2) is NOT in full contact with the rear of the slot (4) in the attachment (5), remove the attachment and clean the dirt and/or debris from locking lever/pin assemblies, quick attach frame (7), and attachment (5).

If, after cleaning, either locking pin (Fig. 9-5, 1 or 2) still does NOT properly engage the attachment slot (4); inspect the locking lever/pin assemblies, quick attach frame (7), and attachment (5) for wear or damage, and repair as required.

The quick attach unit (Fig. 9-5, 7) may be removed as an assembly or the locking lever/pin assemblies may be removed separately.

a. Quick Attach Removal

1. Remove any attachment from the quick attach.

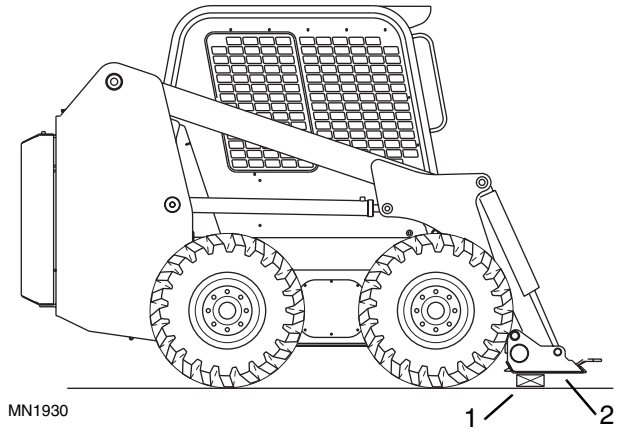


Figure 9-6 Quick Attach Support

2. Raise the loader arm slightly and place blocking (Fig. 9-6, 1) under the bottom of the quick attach frame.
3. Tilt the quick attach forward until the front face of the frame (Fig. 9-6, 2) rests level with the ground.
4. Lower the loader arm until the rear of the quick attach frame is supported by the blocking.
5. Shut the engine OFF, and remain in the operators seat.
6. Turn the ignition key to the RUN position. With the seat restraint bar LOWERED fully, PUSH the loader arm reset button on the instrument panel.

7. Depress the front and rear of both foot pedals to relieve any pressure in the loader arm hydraulic system.

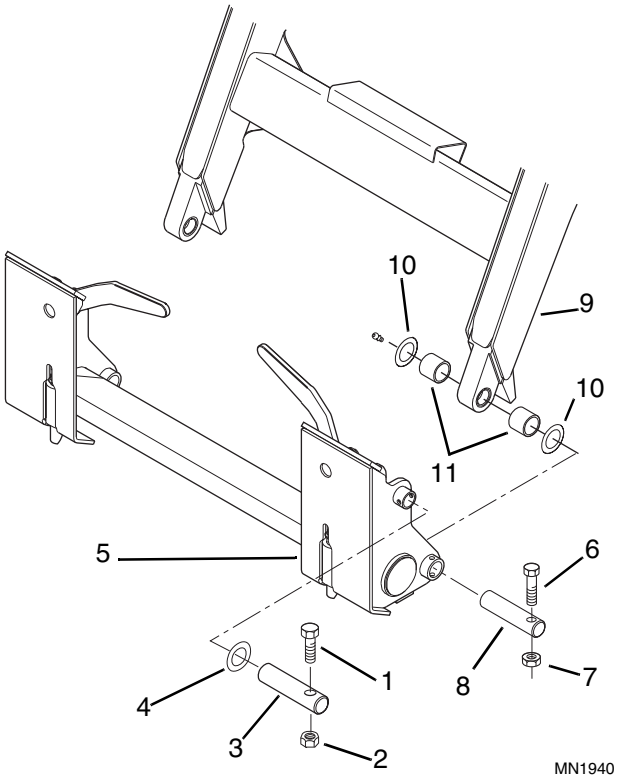


Figure 9-7 Quick Attach Removal

8. Remove the capscrew (Fig. 9-7, 1), locknut (2), pin (3) and any shims (4) attaching the rod end of the attachment tilt cylinder to the quick attach frame (5).

Note: *Tag the location and quantity of shims used on all pins removed. If the quick attach is not being replaced, it will be necessary to reinstall the exact quantity of shims in the same location from which they were removed.*

9. Remove the capscrew (Fig. 9-7, 6), locknut (7), pin (8), and any shims (10) attaching the loader arm (9) to the quick attach frame (5).
10. Repeat Steps 8 and 9 for the other attachment tilt cylinder and loader arm pins to complete the quick attach removal.

b. Locking Lever and Pin Disassembly

Note: *The quick attach assembly DOES NOT have to be removed from the vehicle for maintenance.*

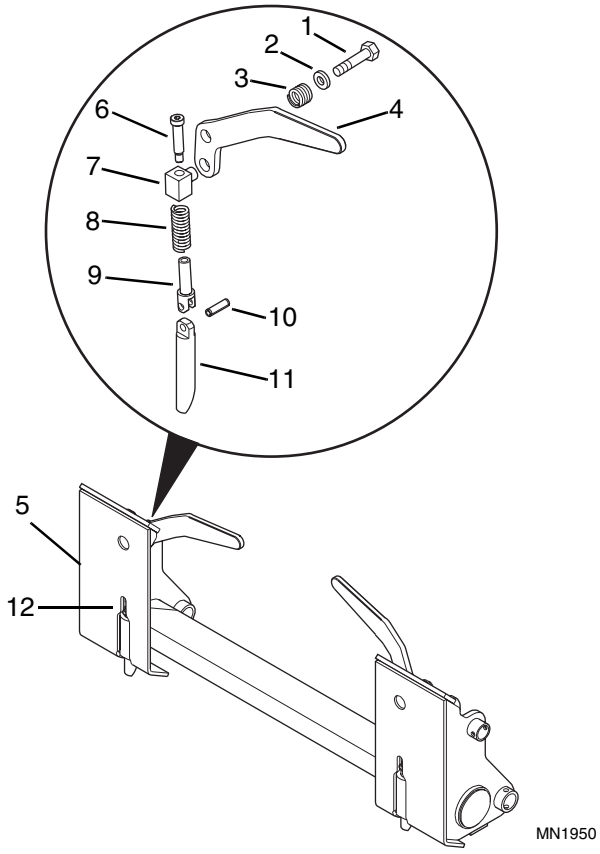


Figure 9-8 Quick Attach Lock Disassembly

1. Remove the hex drive shoulder bolt (Fig. 9-8, 1), flat washer (2), spring (3), and lever handle (4) from the quick attach frame (5).
2. Remove the hex socket head shoulder screw (Fig. 9-8, 6) that secures the guide (7) and spring (8) to the link (9).
3. Drive the spring pin (Fig. 9-8, 10) out of the link (9) and pin (11) from the front (12).
4. Remove the pin (Fig. 9-8, 11) from the frame (5).

c. Cleaning and Inspection

1. Clean all parts in a suitable solvent before inspection. Remove any paint chips from mating surfaces.
2. Inspect all parts for wear or damage.
3. Inspect all welds.
4. Replace broken compression springs (Fig. 9-8, 8).
5. Inspect condition of bushings (Fig. 9-7, 11) in loader arm pivots. Replace if worn or damaged.
6. Inspect condition of bushings in rod end of attachment tilt cylinder. Replace if worn or damaged (Refer to Section 4.9.5, “Attachment Tilt Cylinder Maintenance”).

d. Locking Lever and Pin Assembly

1. Insert the pin (Fig. 9-8, 11) into its bore in the quick attach frame, aligning the tapered face toward the rear of the frame.
2. Install the link (Fig. 9-8, 9) onto the pin (11), and secure by driving the spring pin (10) from the rear of the frame (5) through both pin holes. Continue driving the pin, until it engages the slot in the face of the quick attach frame.
3. Insert the hex socket head shoulder screw (Fig. 9-8, 6) through the guide (7) and spring (8), and into the link (9). Align the lever pivot boss on the guide (7) toward the rear of the frame (5).
4. Position the lever (Fig. 9-8, 4) on the pivot boss on the frame, and engage the guide (7) boss to the lever (4).
5. Install the hex drive shoulder bolt (Fig. 9-8, 1), flat washer (2), spring (3) through the lever handle (4) into frame and tighten securely
6. Using multi-purpose lithium based grease; grease both quick attach lock pin grease fittings.

e. Quick Attach Installation

Note: ***DO NOT*** *reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

1. Position the quick attach frame (Fig. 9-9, 1) on blocking (2) in front of the loader, and align both loader arm pivot pin holes with the corresponding holes (3) in the frame.

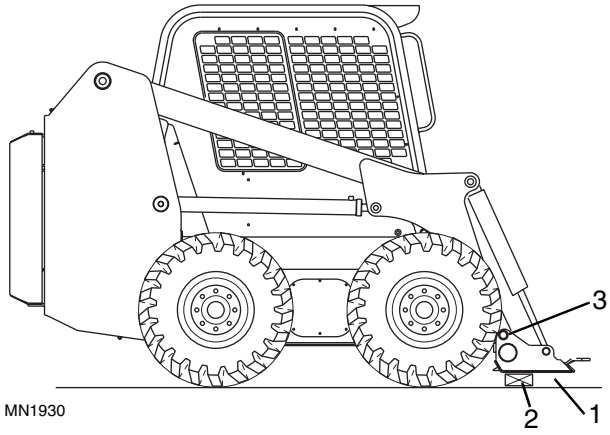


Figure 9-9 Quick Attach Frame Installation

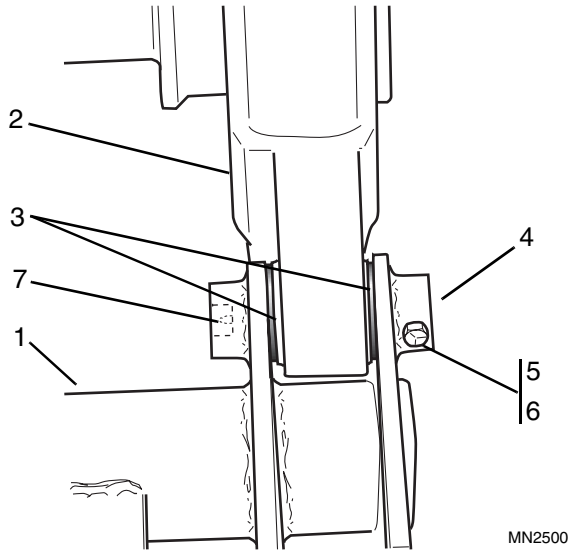


Figure 9-10 Quick Attach Frame Shimming

Note: *If the quick attach frame (Fig. 9-10, 1) and loader arm (2) have not been replaced, install the pivot pin shims (3) in the following steps in the same quantity and location as they were removed. If the quick attach frame or loader arm has been replaced or has worn, it will be necessary to install shims (3) between the loader arm frame and quick attach on both sides of the loader arm frame. Place the shims as required to center the frame (1) to the loader arm (2), and maintain a maximum clearance of 0.06" (1,5 mm) between the components*.

2. Install the shims (Fig. 9-10, 3) as required and pins (4) that attach the quick attach frame (1) to the loader arm (2), and secure each pin with a capscrew (5) and new hex elastic locknut (6).
3. Using multi-purpose lithium based grease, grease both attachment tilt pivot pin grease fittings (7).

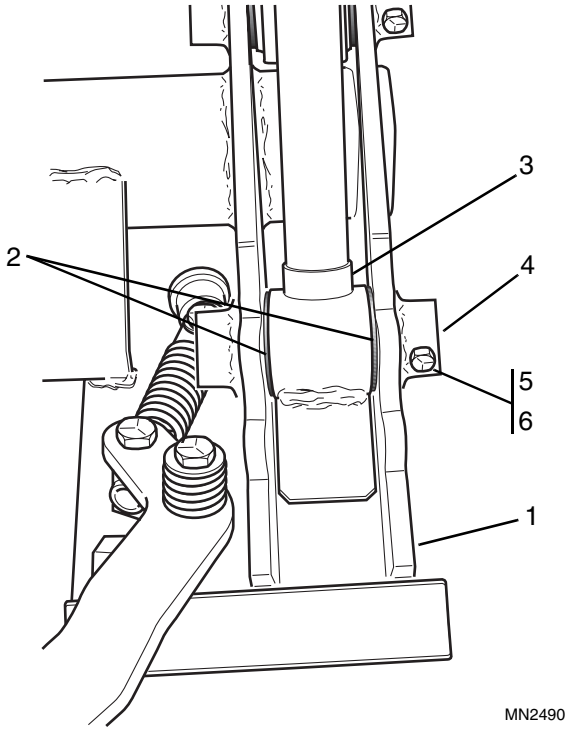


Figure 9-11 Attachment Tilt Cylinder (Rod End) Shimming

Note: *If the quick attach frame (Fig. 9-11, 1) and loader arm have not been replaced, install the pivot pin shims (2) in the following step in the same quantity and location as they were removed. If the quick attach frame or loader arm has been replaced or has worn, it will be necessary to install shims (2) between the quick attach attachment tilt cylinders (3) on both sides of the quick attach frame (1). Place the shims as required to center the attachment tilt cylinders to the quick attach frame (1), and maintain a maximum clearance of 0.06" (1,5 mm) between the components.*

4. Install the shims (Fig. 9-11, 2) as required and pins (4) that attach the rod end of the attachment tilt cylinder to the quick attach frame, and secure each pin with a capscrew (5) and new hex elastic locknut (6).

9.3 LOADER ARM

a. Removal

1. Remove the quick attach from the loader arm (Refer to Section 9.2.3 a, “Quick Attach Removal”).
2. If this vehicle has been equipped with the optional enclosed cab kit, remove the front door assembly from the Operator’s Protective Structure.

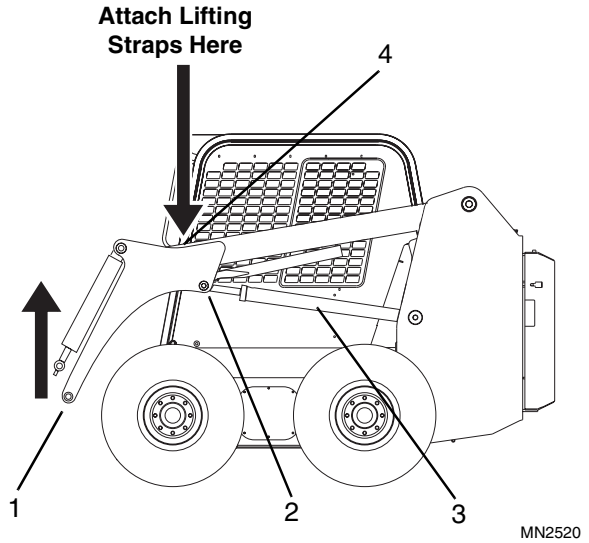


Figure 9-12 Loader Arm Cylinder Pin Removal

3. Start engine and raise the loader arm (Fig. 9-12, 1) until the pivot pins (2) in the rod ends of the loader arm cylinders (3) can be accessed through the holes in the side windows of the Operator’s Protective Structure. Shut the engine OFF.
4. Position a suitable lifting device above the loader arm. Attach suitable lift straps to the each side of the loader arm (Fig. 9-12, 4). Connect the free end of the lift straps to the lifting device and remove all slack from the lift straps.

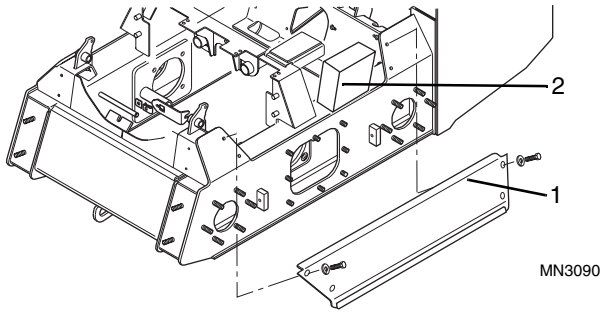


Figure 9-13 Chassis Panel Removal

5. Remove the left (Fig. 9-13, 1) and right (not shown) side panels from the chassis.

6. Place a blocking support (Fig. 9-13, 2), using care not to pinch wires, cables or hoses, between each loader arm lift cylinder and the chassis to prevent the cylinder from falling when the rod end pivot pin is removed.

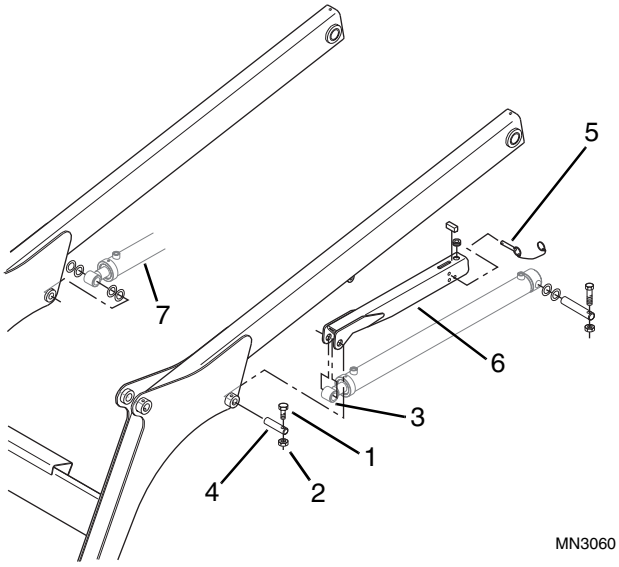


Figure 9-14 Loader Arm Cylinder Pivot Pin

7. Remove the capscrew (Fig. 9-14, 1) and hex elastic locknut (2) securing the left cylinder rod end pivot pin (4) to the loader arm.
8. Drive the rod end pivot pin (Fig. 9-14, 4) from the outside of the loader through the Operator's Protective Structure.

Note: *Ensure that the pin clears the hole in the structure side window as the pin is driven out.*

9. Remove the safety support pin (Fig. 9-14, 5) from the rear of the safety support (6), and remove the safety support from the loader arm.
10. Repeat Step 6, 7, & 8 to disconnect the right loader arm cylinder (Fig. 9-14, 7). Tag the shims removed, noting quantity and location for reinstallation later.
11. Adjust the blocking support (Fig. 9-13, 2) under the loader arm cylinders to allow full lowering of the loader arm.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

12. Operate both foot pedals (forward and backward) or optional wrist controls (left and right) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

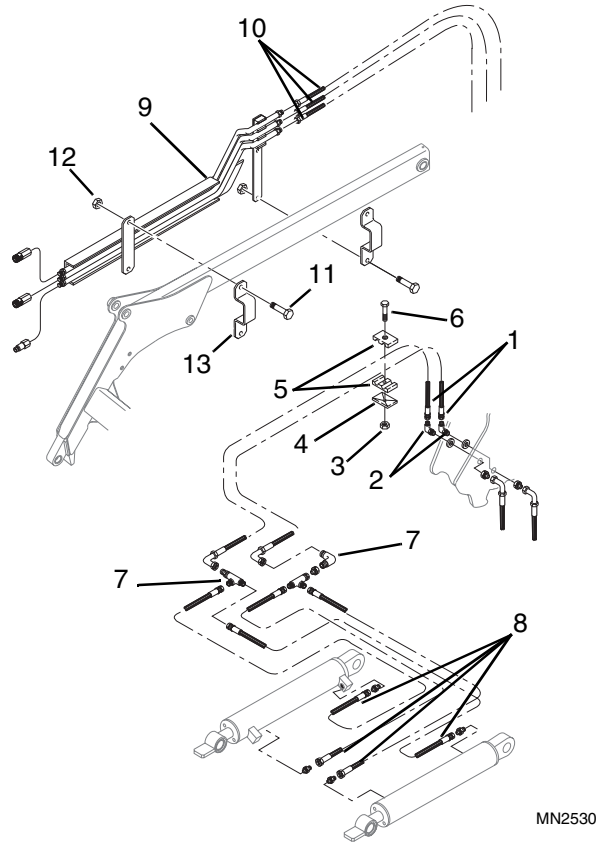


Figure 9-15 Hydraulic Hose Removal (Right Loader Arm)

13. Disconnect the attachment tilt cylinder hydraulic hoses (Fig. 9-15, 1) at the bulkhead fittings (2) on the rear frame of the vehicle. Cap both bulkhead fittings.
14. Remove the hex elastic locknut (Fig. 9-15, 3), cover plate (4), half clamps (5) and capscrew (6) securing the hoses (1) to the rear of the loader arm. Disconnect both hoses from the front bulkhead fittings (7), and remove the hoses.
15. Tag and remove the remaining hoses (Fig. 9-15, 8) and fittings routed to the attachment tilt cylinders.
16. **Next two steps for DX Models only:** The high flow tube assembly (Fig. 9-15, 9) is clamped to the right loader arm. Remove and plug three hydraulic hoses (10) from the tube assembly, and cap the lines.
17. Remove capscrew (Fig. 9-15, 11), hex elastic locknut (12), and strap (13), and remove the tube assembly (9) from the loader arm.

18. Remove both attachment tilt cylinders (Refer to Section 4.9.5 a, “Attachment Tilt Cylinder Maintenance”).

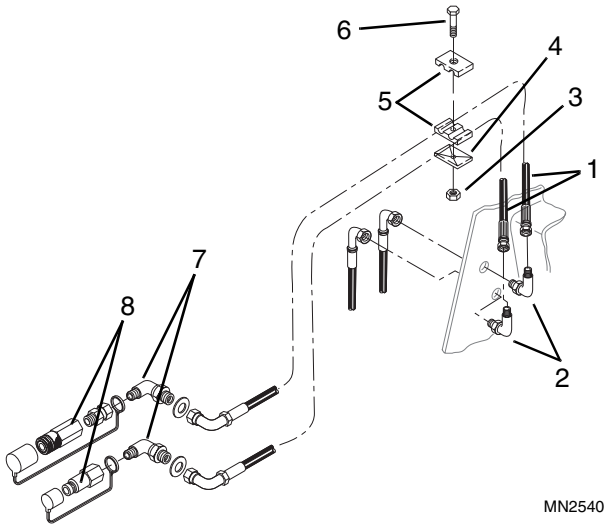


Figure 9-16 Auxiliary Couplers And Hydraulic Hose Removal (Left Loader Arm

19. Disconnect the auxiliary coupler hydraulic hoses (Fig. 9-16, 1) at the bulkhead fittings (2) on the rear frame of the vehicle. Cap both bulkhead fittings.
20. Remove the hex elastic locknut (Fig. 9-16, 3), cover plate (4), half clamps (5) and capscrew (6) securing the hoses (1) to the rear of the loader arm. Disconnect both hoses from the front bulkhead fittings (7), and remove the hoses.
21. Remove the auxiliary couplers (Fig. 9-16, 8), and remove both bulkhead fittings (7).

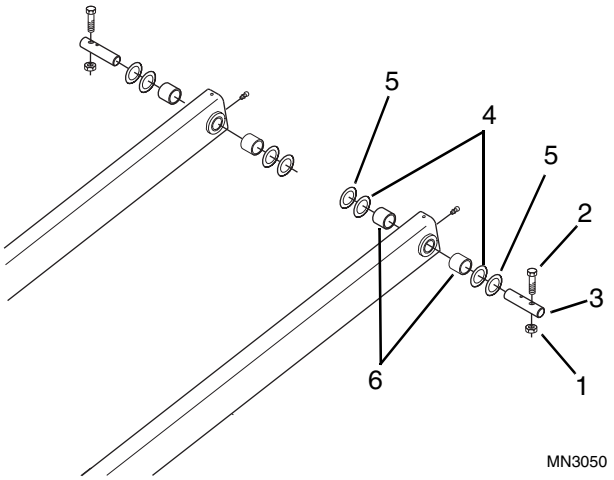


Figure 9-17 Loader Arm Pivot Pin

22. Remove the hex elastic locknut (Fig. 9-17, 1) and capscrew (2) securing the left rear loader arm pivot pin (3).
23. Remove any slack in the lift straps. Tap out the rear loader arm pivot pin (Fig. 9-17, 3), noting the location and quantity of shims (4) and washers (5) used.
24. Repeat Step 22 & 23 to remove the right pivot pin.

WARNING: **DO NOT** stand or place any appendages under the loader arm as it is being lifted. Failure of the lifting equipment would allow the structure to fall, and result in personal injury or death.

25. Raise the loader arm with the lifting device and remove it from the loader.

b. Inspection

1. Clean the loader arm with a suitable solvent before inspection.
2. Inspect the loader arm for damage. Inspect all welds. If minor fatigue cracks are noted, they can be repaired by a certified welder only with prior written permission from Compact Technologies. If major structural damage or weld failures are noted, the loader arm should be replaced.
3. Inspect loader arm pivot bushings (Fig. 9-17, 6) and quick attach pivot bushings (not shown) for wear, cracks, or other damage. Replace if necessary.
4. Clean and inspect bushings in the detached ends of the loader arm and attachment tilt cylinders. Replace if necessary (Refer to Section 4.9.4 e, “Loader Arm Cylinder Maintenance” and Section 4.9.5 e, “Attachment Tilt Cylinder Maintenance”).
5. Inspect all hydraulic hoses and fittings for damage or breakage. Replace if necessary.

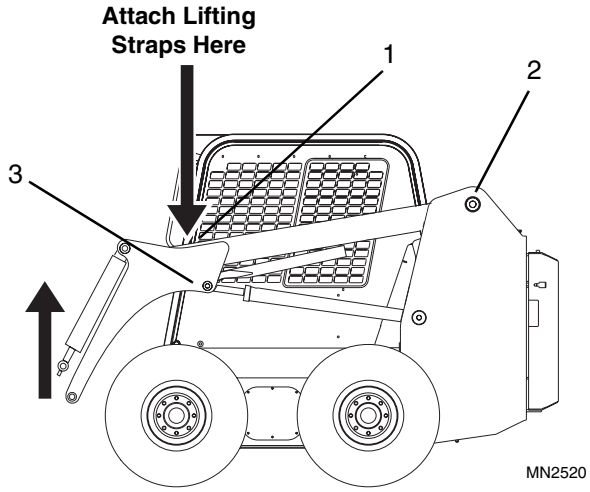


Figure 9-18 Loader Arm Cylinder Pin Installation

c. Installation

***Note: DO NOT** reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

1. Attach suitable lift straps to the each side of the loader arm (Fig. 9-18, 1).
2. Raise the loader arm with the lifting device and position it on the loader, aligning both loader arm rear pivot bushings with the mating holes (Fig. 9-18, 2) in the frame.

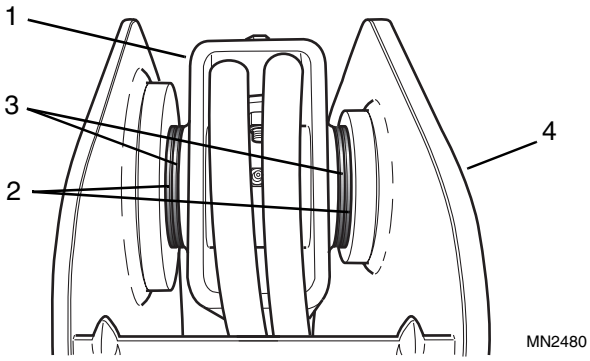


Figure 9-19 Loader Arm Shimming

***Note:** If the loader arm (Fig. 9-19, 1) has not been replaced, install the pivot pin washers (2) and shims (3) in the following steps in the same quantity and location as they were removed. If the loader arm (1) has been replaced or is worn, it will be necessary to place the shims (3) as required to center the loader arm (1) to the frame, and maintain a maximum clearance of 0.06" (1,5 mm) between each side of the loader arm and the vehicle frame.*

3. Install the shims (Fig. 9-19, 3) and washers (2) as required, insert the pins that attach the loader arm on each side to the frame, and secure each pin with a capscrew and new hex elastic locknut.
4. Using multi-purpose lithium based grease, grease both rear loader arm pivot pins at the grease fittings.
5. Raise the loader arm with the lifting device to align the loader arm pin bores with both loader arm cylinder rod end bores (Fig. 9-18, 3).

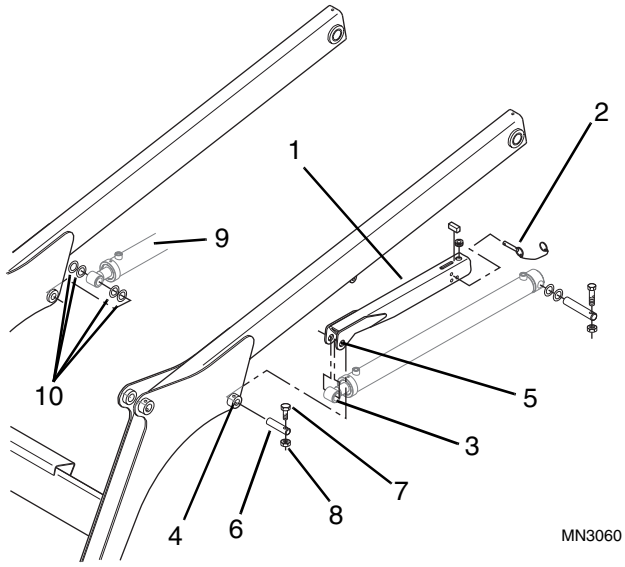


Figure 9-20 Loader Arm Safety Support

6. Position the safety support (Fig. 9-20, 1) under the left loader arm, and install the safety support pin (2) in the rear to keep the safety support loosely in position.
7. Lift the free end of the left loader arm cylinder (Fig. 9-20, 3), and align the loader arm pin hole (4), safety support pin hole (5), and cylinder rod end bore (3). Insert the pivot pin (6) from the outside, ensuring alignment of the holes for capscrew (7).

***IMPORTANT: DO NOT** lubricate the loader arm cylinder pins (Fig. 9-20, 6). The bushings that these pins ride against are self lubricating.*

8. Install the capscrew (Fig. 9-20, 7) and new hex elastic locknut (8). Tighten securely.
9. Lift the free end of the right loader arm cylinder (Fig. 9-20, 9), and align the pivot pin holes in the loader arm and cylinder rod end.

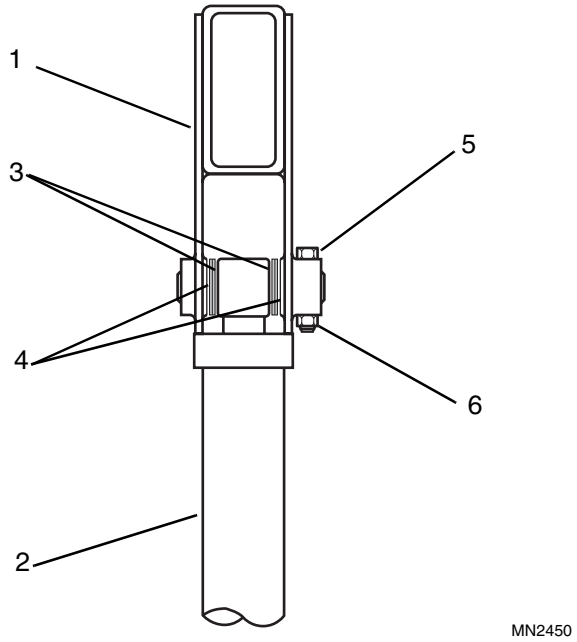


Figure 9-21 Right Loader Arm Cylinder Shimming

Note: *If the loader arm (Fig. 9-21, 1) has not been replaced, install the loader arm cylinder (2) pivot pin washers (3) and shims (4) in the following step in the same quantity and location as they were removed. If the loader arm has been replaced, it will be necessary to place the shims (4) as required to center the right cylinder (2) rod end in the loader arm (1), and maintain a maximum clearance of 0.06" (1,5 mm) between each side of the cylinder rod end and the loader arm.*

10. Install the washers (Fig. 9-21, 3) and shims (4) as required between the right loader arm (1) and cylinder (2) rod end as the pivot pin is being inserted from the outside.
11. Align the loader arm (Fig. 9-21, 1) and pivot pin to install the capscrew (5) and new hex elastic locknut (6). Tighten securely.
12. Remove the lifting straps from both sides of the loader arm, and remove the blocking supports from under the cylinders.
13. Seated in the operators seat and without starting the engine, turn the ignition key to the RUN position. Lower the seat restraint bar, and momentarily press the loader arm reset button on the instrument panel. Press the front of the left foot pedal fully into the FLOAT position, and allow the loader arm to fully lower. Turn the ignition key to the OFF position, raise the restraint bar, and exit the vehicle using the hand holds.

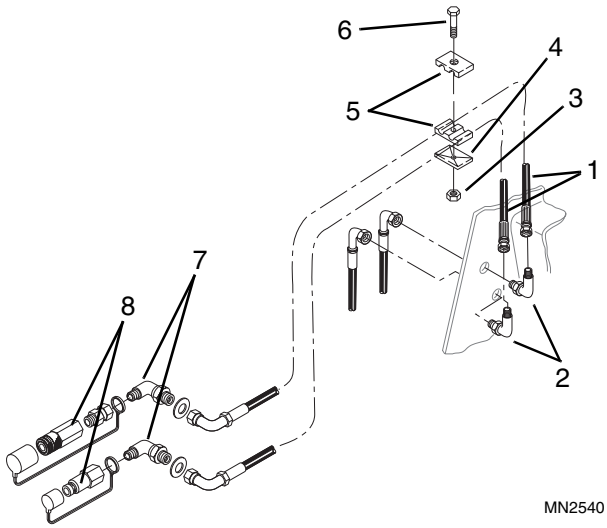


Figure 9-22 Auxiliary Couplers And Hydraulic Hose Installation (Left Loader Arm)

14. Install both attachment tilt cylinders (Refer to Section 4.9.5 e, “Attachment Tilt Cylinder Maintenance”).

Note: *Torque the all hydraulic hoses and fittings connected in the remainder of this section (Refer to Section 2.8, “Torque”).*

15. Install both bulkhead fittings (Fig. 9-22, 7).
16. Install the auxiliary couplers (Fig. 9-22, 8).
17. Route two hydraulic hoses (Fig. 9-22, 1) down the interior of the left loader arm. Install the new hex elastic locknut (Fig. 9-22, 3), cover plate (4), half clamps (5) and capscrew (6) securing the hoses (1) to the rear of the loader arm.
18. Uncap and install both hoses (Fig. 9-22, 1) to the front bulkhead fittings (7), and torque.
19. Uncap and install both hoses (Fig. 9-22, 1) to the rear bulkhead fittings (2), and torque.

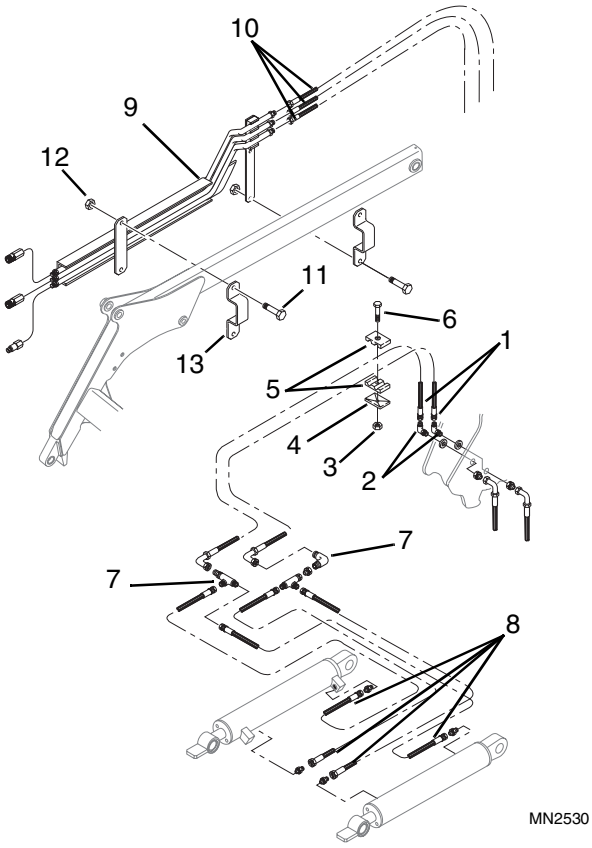


Figure 9-23 Hydraulic Hose Installation (Right Loader Arm)

20. Uncap and connect both attachment tilt cylinder hydraulic hoses (Fig. 9-23, 1) to the bulkhead fittings (2) on the rear frame of the vehicle.
21. Install two hydraulic hoses (Fig. 9-23, 1) down the interior of the right loader arm. Install the new hex elastic locknut (3), cover plate (4), half clamps (5) and capscrew (6) securing the hoses (1) to the rear of the loader arm.
22. Connect both hoses (Fig. 9-23, 1) to the front bulkhead fittings (7).
23. Install the remaining hoses (Fig. 9-23, 8) and fittings routed from the front bulkhead fittings to the attachment tilt cylinders.
24. If this vehicle is equipped with the optional enclosed cab kit, reinstall the front door assembly on the Operator's Protective Structure (Refer to Section 9.4.2 c, "Preparation for Installation," Step 9).
25. **Next two steps for DX Models only**, install the high flow tube assembly (Fig. 9-23, 9) to the loader arm and secure with straps (13), capscrews (11), and new hex elastic locknuts (12).
26. Remove the plugs from three high flow hydraulic hoses (Fig. 9-23, 10), and install the hoses to the tube assembly (9).
27. Before starting the engine, refer to Section 4.5, "Startup After Hydraulic Repair."
28. Install the quick attach to the loader arm (Refer to Section 9.2.3, "Quick Attach Maintenance").

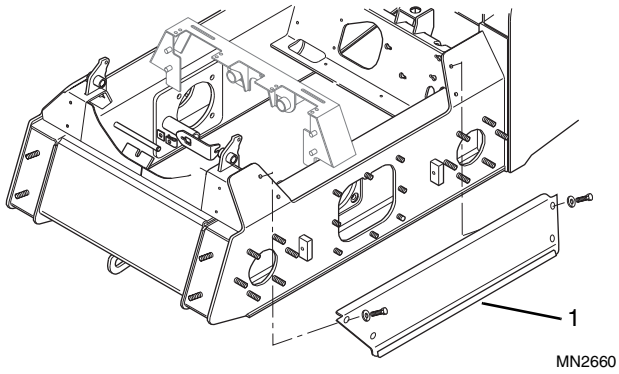


Figure 9-24 Chassis Panel Installation

29. Replace the left (Fig. 9-24, 1) and right (not shown) side panels on the chassis.

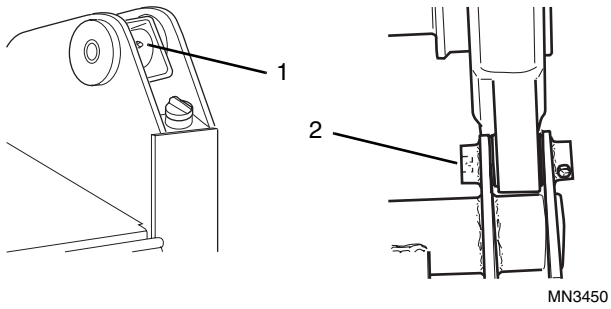


Figure 9-25 Loader Arm Lubrication

d. Lubrication

Using the grease fittings at the loader arm (Fig. 9-25, 1) and quick attach pivot points (2), lubricate the pivot pins with a quality multi-purpose lithium based grease. Apply the grease until excess shows on both sides of the pin.

9.4 OPERATOR'S PROTECTIVE STRUCTURE

9.4.1 Open Cab Maintenance

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove the plate between the foot pedals, and disconnect the negative battery cable from both batteries.

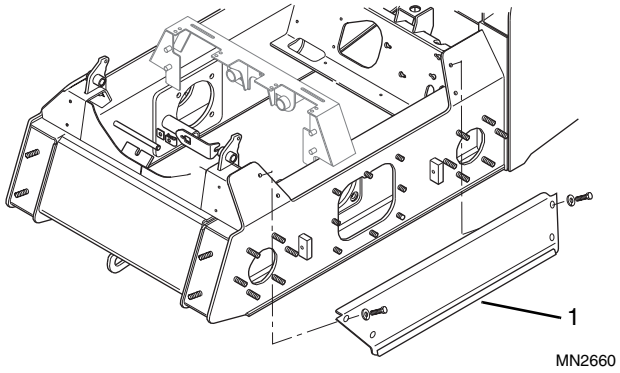


Figure 9-26 Chassis Panel Removal

3. Remove the left (Fig. 9-26, 1) and right (not shown) side panels from the chassis.

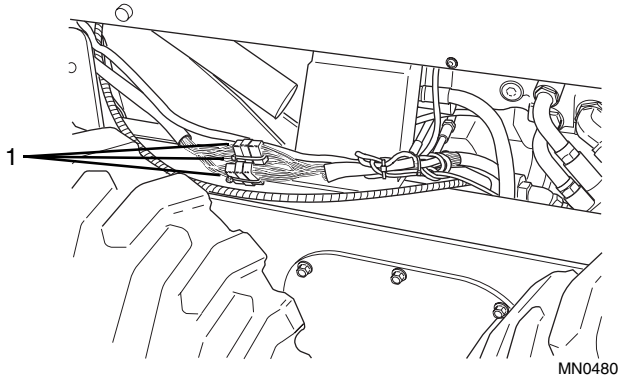


Figure 9-27 Wiring Harness Connectors

4. Disconnect three electrical harness connectors (Fig. 9-27, 1).
5. Disconnect both park lock cables from park lock mechanisms (Refer to Section 7.7.2, "Park Lock Maintenance").
6. Disconnect throttle cable from injection pump (Refer to Section 7.6.3, "Throttle Control Maintenance").

Note: *If your vehicle is a "D" Series, skip to Step 8. If your vehicle is a "DX" Series, proceed to Step 7.*

7. **DX Models Only:** Remove the high flow control panel, and disconnect and cap the hydraulic hose at the high flow gauge [Refer to Section 4.11, "High Flow (DX) System"].

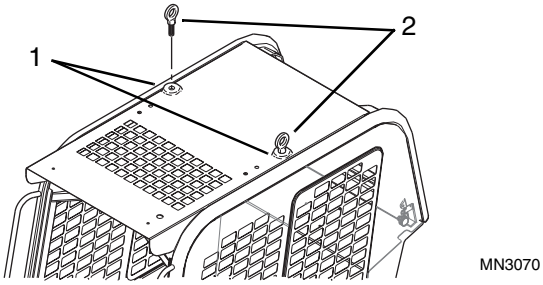


Figure 9-28 Operator Protective Structure Lift Points

8. Two threaded holes (Fig. 9-28, 1) are located in the top of the Operator's Protective Structure. Remove the plastic plugs and install a 3/8-16 forged steel hoist eye (2 [must obtain locally]) into each hole.
9. Attach a suitable lifting device to both hoist eyes (Fig. 9-28, 2), and remove any slack from the lifting equipment to ensure the Operator's Protective Structure remains in the raised position while disconnecting the shocks in the following step.

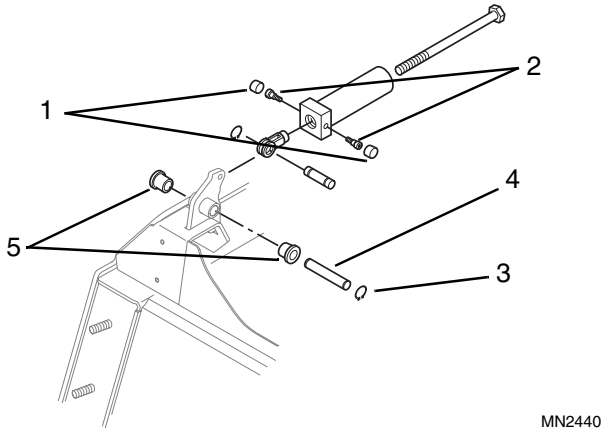


Figure 9-29 Operator Protective Structure Shock Absorber

10. Disconnect shock assemblies by removing the caps (Fig. 9-29, 1) and shoulder screws (2) from both shock assemblies.

WARNING: To prevent personal injury, use a suitable lift device to lower the Operator's Protective Structure when the shock assemblies have been disconnected. The spring assist that the shocks provide is not available when the shocks are disconnected. Lowering the Operator's Protective Structure manually will be difficult to control.

11. Release the tilt lock lever in the lower right corner of the Operator's Protective Structure, slowly lower the protective structure from the service position using the lift device.
12. Remove two retaining rings (Fig. 9-29, 3) from both pivot pins (4) and remove the pins. The plastic bushings (5) can be removed, inspected, and replaced if required once the structure has been removed.

WARNING: **DO NOT** stand under the Operator's Protective Structure as it is being lifted. Failure of the lifting equipment would allow the structure to fall, and result in personal injury or death.

13. Using the lifting equipment attached in Step 9, remove the Operator's Protective Structure from the vehicle. While lifting the structure, have an assistant guide the cables out of the frame bulkheads.
14. If replacing the Operator's Protective Structure, the following items must be removed:
    - Seat with seat belt and seat restraint bar (Refer to Section 9.5, "Seat Assembly and Seat Restraint Bar").
    - Loader arm lockout switch assembly (Refer to Section 8.9, "Loader Arm Lockout").
    - Throttle control and cable (Refer to Section 7.6.3, "Throttle Control Maintenance").
    - Instrument panel, front worklights, fuse panel and wiring harness (Refer to Section 8.3, "Instrumentation").
    - Manual holder box and sound control panels (as equipped).

b. Inspection

1. Inspect the Operator's Protective Structure for damage and inspect the condition of all welds. If structural damage or weld failures are noted, the Operator's Protective Structure MUST be replaced.

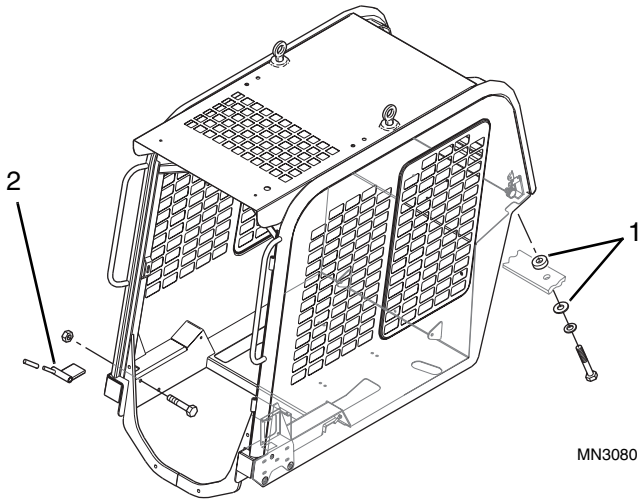


Figure 9-30 Operator Protective Structure

2. Check the condition of all neoprene isolator washers (Fig. 9-30, 1) and tilt lock latch (2). Replace if damaged.

c. Installation

***Note: DO NOT** reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

1. If replacing the Operator's Protective Structure, the following items must be installed on the replacement structure:
   - All emergency information decals and operational decals (Refer to the parts manual for this vehicle for the complete list of decals currently used).
   - Seat with seat belt (Refer to Section 9.5, "Seat Assembly and Seat Restraint Bar").
   - Throttle control and cable (Refer to Section 7.6.3, "Throttle Control Maintenance").
   - Instrument panel, front worklights, fuse panel and wiring harness (Refer to Section 8.3, "Instrumentation").
   - Manual holder box and sound control panels (as originally equipped).

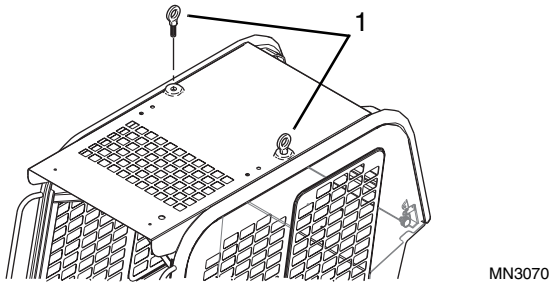


Figure 9-31 Operator Protective Structure

2. Attach a suitable lifting device to both forged steel hoist eyes (Fig. 9-31, 1).

WARNING: **DO NOT** stand under the Operator's Protective Structure as it is being lifted. Failure of the lifting equipment would allow the structure to fall, and result in personal injury or death.

3. Lift the Operator's Protective Structure into position over the frame. Have an assistant guide the park lock cables, throttle cable, and wiring harness down through the frame bulkheads while slowly lowering the Operator's Protective Structure.

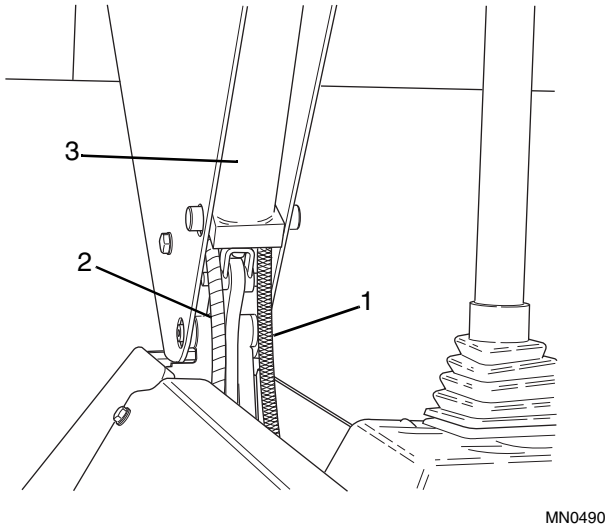


Figure 9-32 Left Harness and Cable Routing

4. Ensure that the wiring harness (Fig. 9-32, 1) and park lock cable (2) are positioned over the top of the left shock (3).

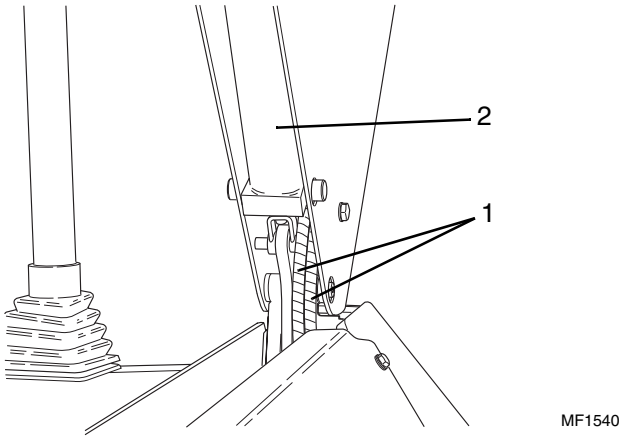


Figure 9-33 Right Cable Routing

5. Ensure that the throttle and park lock cables (Fig. 9-33, 1) are positioned over the top of the right shock (2).

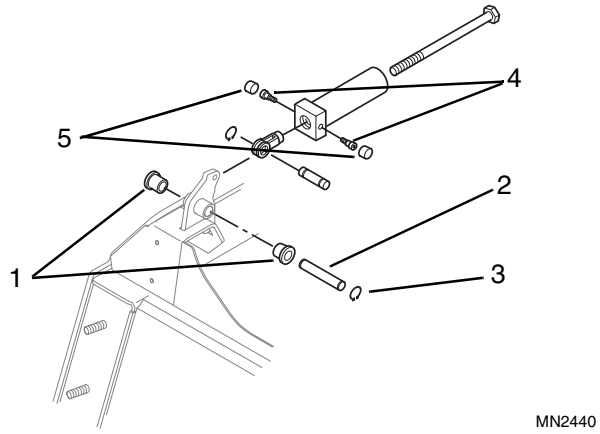


Figure 9-34 Operator Protective Structure Shock Absorber

6. Place new plastic bushings (Fig. 9-34, 1) into the pivot holes in the frame, if removed earlier.
7. Lower the Operator's Protective Structure onto the frame.
8. Secure the front of both sides of the Operator's Protective Structure to the frame using pins (Fig. 9-34, 2) and retaining rings (3).
9. Raise the Operator's Protective Structure into the service position, and ensure that the tilt lock lever has been engaged.
10. Reconnect the left and right shock assemblies to the Operator's Protective Structure using shoulder screws (Fig. 9-34, 4). Tighten securely. Once screws have been tightened, reinstall the plastic caps (5).
11. Remove the lifting equipment and the hoist eyes (Fig. 9-31, 1) from the top of the Operator's Protective Structure, and replace the plastic plugs in each hole.

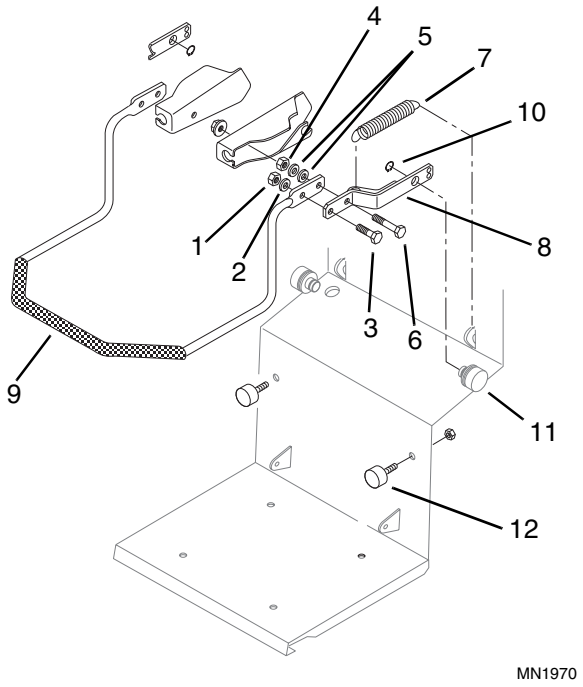


Figure 9-35 Seat Restraint Bar

12. Position both restraint bar pivot arms (Fig. 9-35, 8) on the pivot mounts (11), and secure with retaining rings (10).
13. Install the restraint bar (Fig. 9-35, 9) on both restraint bar pivot arms (8) using capscrew (6), flat washers (5) and new hex elastic locknut (4) inserted into the rear holes, but NOT tightened.
14. Connect spring (Fig. 9-35, 7) on each side between the restraint bar pivot arm (8) and seat platform.
15. Install a capscrew (Fig. 9-35, 3), flat washer (2) and new hex elastic locknut (1) in the front of each restraint bar pivot arm and tighten.
16. Tighten the capscrew (Fig. 9-35, 6), flat washers (5) and hex elastic locknut (4) left loose in Step 13.

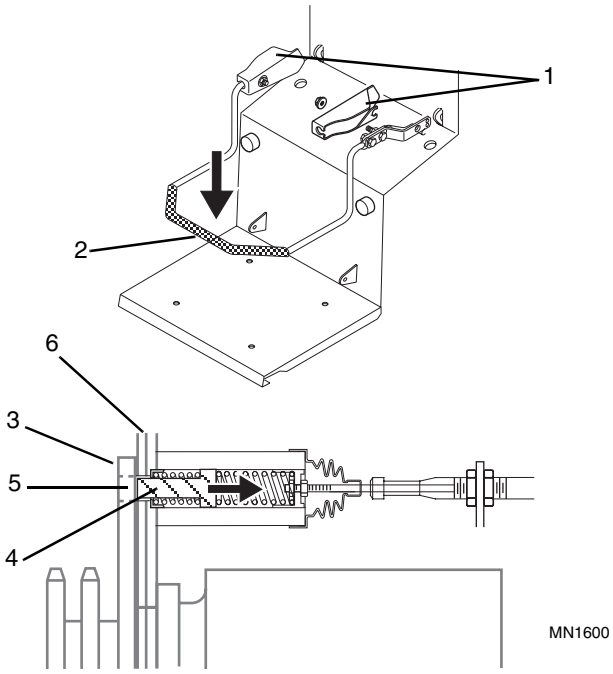


Figure 9-36 Park Lock - Disengaged

17. Reconnect both park lock cables and check the adjustment of both park lock pins. With the seat restraint covers (Fig. 9-36, 1) still removed, lower the seat bar (2).

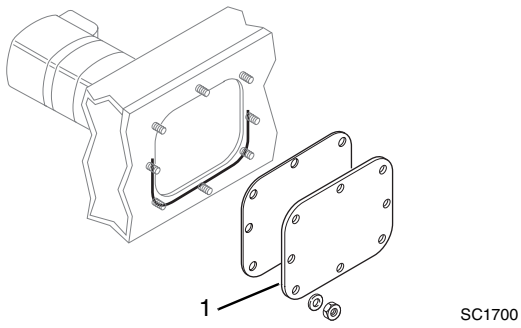


Figure 9-37 Access Cover Installation

18. Remove both side chain case access covers (Fig. 9-37, 1) to gain access to the drive sprocket (Fig. 9-36, 3) and the end of the park lock pin (4).
19. Inspect to see that both pins (Fig. 9-36, 4) have fully retracted from the hole (5) in drive sprocket (3) and should be flush with the edge of the chaincase wall (6).

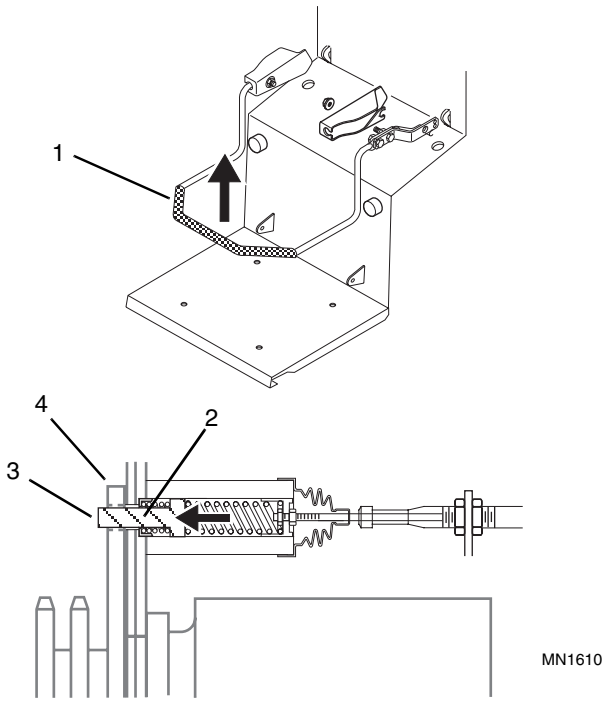


Figure 9-38 Park Lock - Engaged

20. Raise seat bar (Fig. 9-38, 1).
21. Inspect to see that both pins (Fig. 9-38, 2) have fully extended through the hole (3) in its respective drive sprocket (4).
22. If the pin operation is NOT CORRECT, skip to Step 24.
23. If pin operation IS CORRECT, skip to Step 33.

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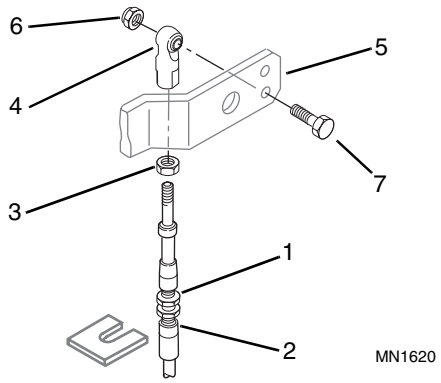

Figure 9-39 Park Lock Cable Operator Protective Structure Mount

24. Inspect both park lock cables where they mount to the rear of the Operator's Protective Structure. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-39, 1 & 2) on each cable. If not, readjust as required until they are equal.

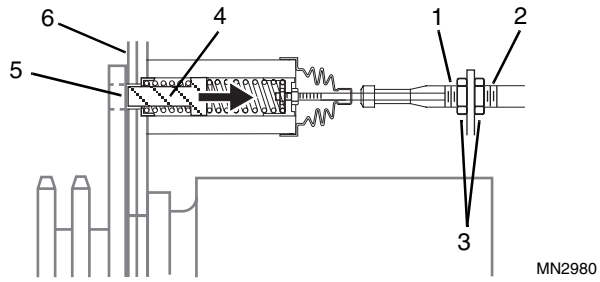

Figure 9-40 Park Lock Cable Chassis Mount

25. Inspect both park lock cables where they mount to the chassis. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-40, 1 & 2) on each cable. If not, readjust the bulkhead nuts (3) as required until the visible threads are equal.
26. Lower the seat bar to retract both lock pins (Fig. 9-40, 4). The face of each lock pin (5) must be flush with the inner wall of each respective chain case (6) with the seat bar lowered. The lock pin position is adjusted by moving the ball joint (Fig. 9-39, 4) on the cable end at the seat restraint bar pivot arm (5).
27. At the rear of the seat bar, loosen the hex jam nut (Fig. 9-39, 3) against the ball joint (4).
28. Detach ball joint from seat restraint bar pivot arm (Fig. 9-39, 5) by removing the elastic locknut (6) and capscrew (7). Discard locknut.

Note: *The left cable connection at the rear of the seat bar will adjust the right park lock assembly. The right cable connection at the rear of the seat bar will adjust the left park lock assembly.*

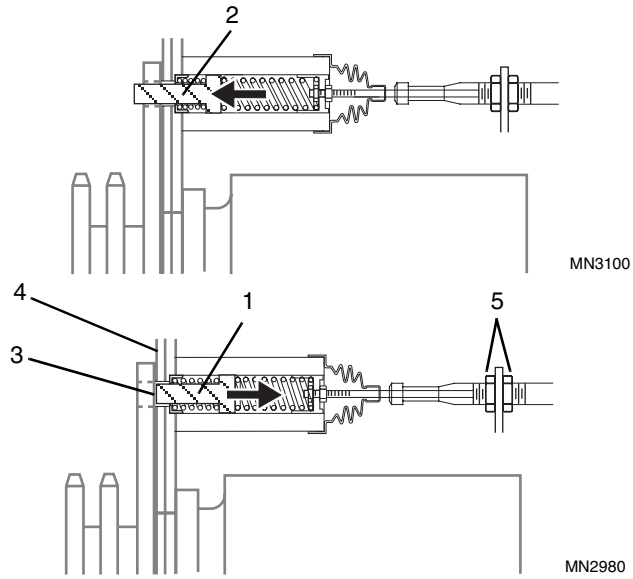

Figure 9-41 Park Lock Cable Chassis Mount

29. Turn the ball joint (Fig. 9-39, 4) onto the cable to retract either pin (Fig. 9-41, 1) away from the drive sprocket. Turn the ball joint toward the end of the cable to extend either pin (2) closer to the drive sprocket.
30. With the seat bar still lowered, temporarily attach both ball joints (Fig. 9-39, 4) to the seat restraint bar pivot arm (5) and inspect each pin position again. Repeat Step 29 as required until the face of the each lock pin (Fig. 9-41, 3) is flush with the inner wall of the respective chain case (4).
31. If either pin cannot be adjusted using Steps 27 through 30, loosen the cable housing bulkhead nuts (Fig. 9-41, 5), reposition the cable slightly and tighten the bulkhead nuts (5). Repeat Steps 27 through 30.
32. Secure each cables ball joint (Fig. 9-39, 4) to the seat restraint bar pivot arm (5) with capscrew (7) and a new elastic locknut (6). Tighten the hex jam nut (3) on each cable to the ball joint (4).

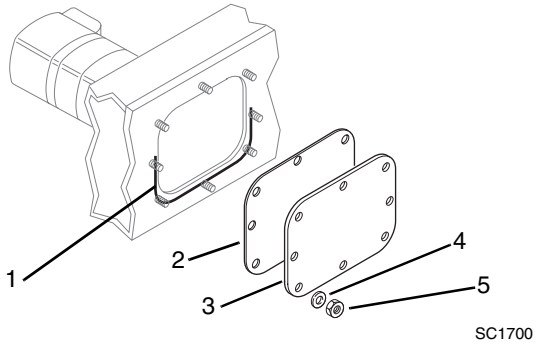

Figure 9-42 Access Cover Installation

33. Clean any sealer residue from the lower part of the access cover opening (Fig. 9-42, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
34. Reassemble the cover gasket (Fig. 9-42, 2) and cover (3) to the side of the chain case using the lock washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm) to complete the inspection procedure.

Note: *If your vehicle is a "D" Series, skip to Step 36. If your vehicle is a "DX" Series, proceed to Step 35.*

35. **DX Models Only:** Route the high flow gauge hydraulic line to the gauge. Uncap the line and connect to the gauge. Install the high flow panel to the Operator's Protective Structure [Refer to Section 4.11, "High Flow (DX) System"].
36. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

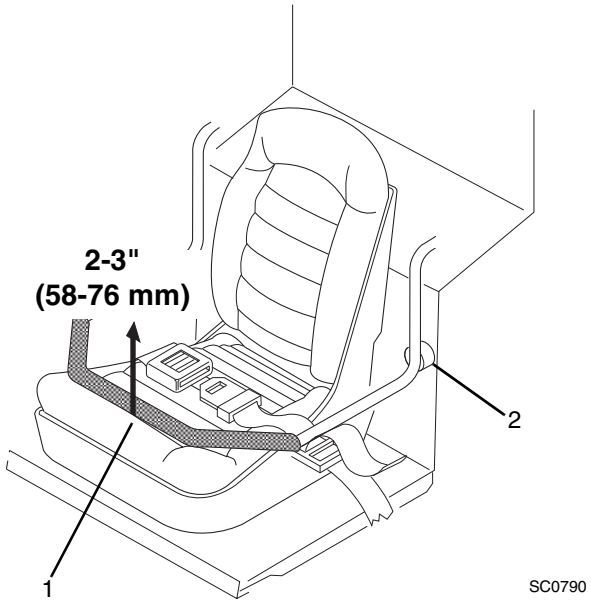

Figure 9-43 Loader Arm Lockout Micro Switch Adjustment

37. Install the loader arm lockout micro switch assembly (Refer to Section 8.9, "Loader Arm Lockout").
38. Check the loader arm lockout micro switch (Fig. 9-44, 1) for proper adjustment. The seat bar (Fig. 9-43, 1) should be able to be raised 2-3" (58-76 mm) from the fully lowered position, with the bar resting against the rubber stops (2), before activating the loader arm lockout switch.

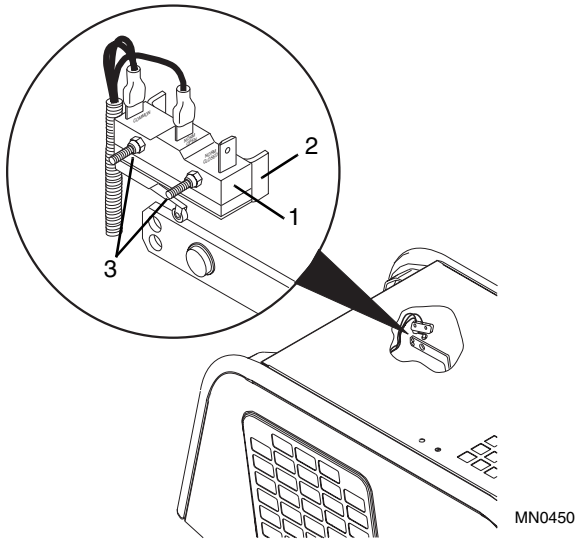

Figure 9-44 Seat Bar Micro Switch

If an adjustment is required, proceed as follows:

a. Remove two plastic plugs on the left side of the cab to access the capscrews that secure the micro switch (Fig. 9-44, 1) to its mounting bracket (2). Loosen both locknuts (3) on the inside of the cab, until the micro switch (1) can be repositioned using a slight hand force.

b. Reposition the micro switch (Fig. 9-44, 1) in small increments, rechecking the seat bar travel required to activate the switch with every move. When the seat bar travel (Fig. 9-43, 1) is within 2-3" (58-76 mm), tighten the two locknuts (Fig. 9-44, 3) securely.

c. Replace the plastic hole plugs on the left side of the cab.

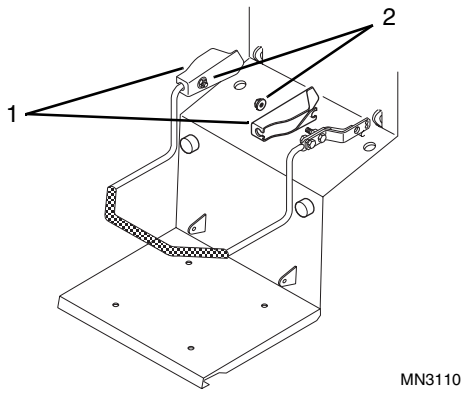

Figure 9-45 Restraint Bar Spring Cover Installation

39. Install the left (Fig. 9-45, 1) and right restraint bar covers, and secure with a hex flange nut (2) on each side.

40. Connect and adjust the throttle (Refer to Section 7.6.3, “Throttle Control Maintenance”).

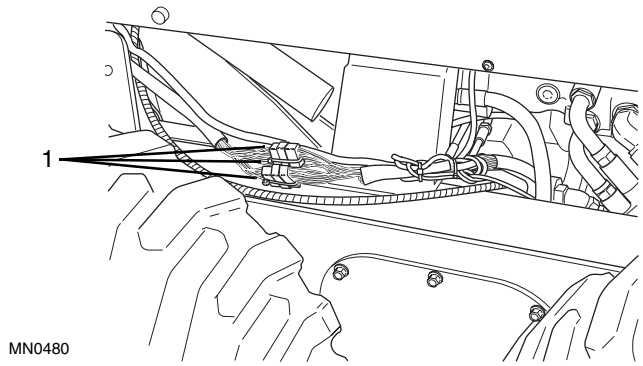

Figure 9-46 Wiring Harness Connectors

41. Connect the Operator’s Protective Structure harness and chassis/engine harness electrical connectors (Fig. 9-46, 1), and secure with cable ties.

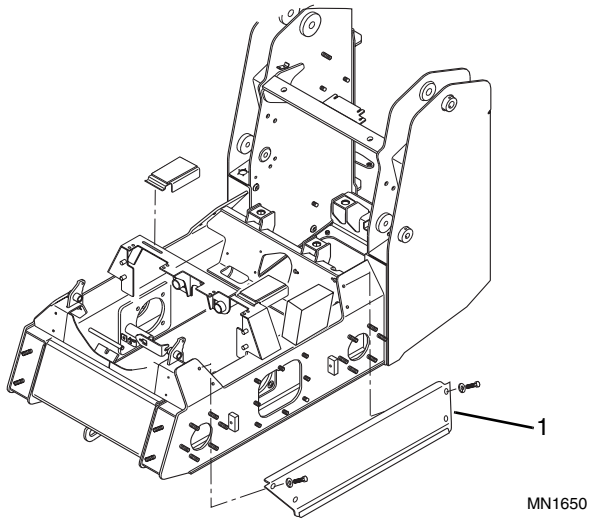

Figure 9-47 Chassis Panel Installation

42. Replace the left (Fig. 9-47, 1) and right (not shown) side panels on the chassis.

43. Connect the negative battery cable to both batteries, and reinstall the plate between the foot pedals, if not already done.

44. Lower the Operator’s Protective Structure from the service position, if not already done (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).

45. Perform “Loader Arm Lockout System Test - Open Cab Models” (Refer to Section 8.9 b).

9.4.2 Enclosed Cab Maintenance

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
2. Remove the plate between the foot pedals, and disconnect the negative battery cable from both batteries.

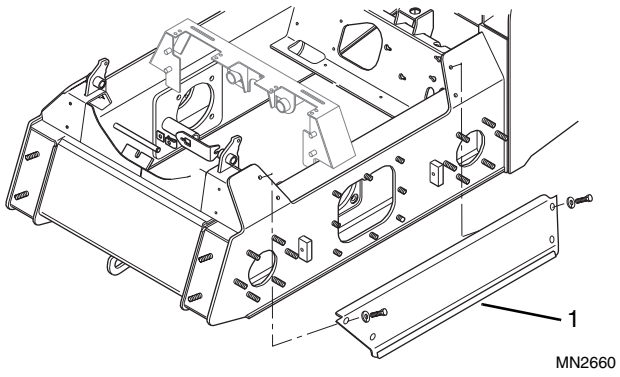

Figure 9-48 Chassis Panel Removal

3. Remove the left (Fig. 9-48, 1) and right (not shown) side panels from the chassis.

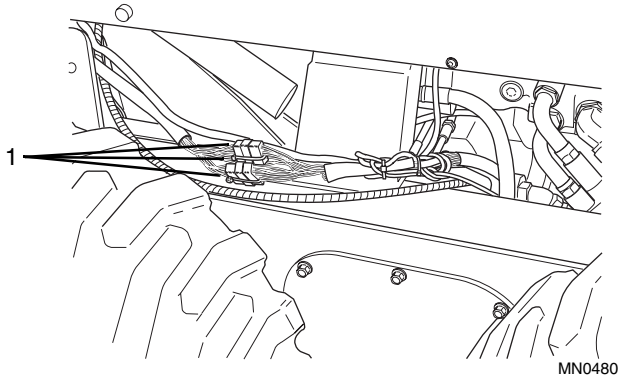

Figure 9-49 Wiring Harness Connectors

4. Disconnect three electrical harness connectors (Fig. 9-49, 1).
5. Disconnect both park lock cables from park lock mechanisms (Refer to Section 7.7.2, "Park Lock Maintenance").
6. Disconnect throttle cable from injection pump (Refer to Section 7.6.3, "Throttle Control Maintenance").

Note: *If your vehicle is a "D" Series, skip to Step 8. If your vehicle is a "DX" Series, proceed to Step 7.*

7. **DX Models Only:** Remove the high flow control panel, and disconnect and cap the hydraulic hose at the high flow gauge [Refer to Section 4.11, "High Flow (DX) System"].
8. With the vehicle on a level surface and engine shut OFF, unlock and open rear engine compartment door and lift the engine cover.

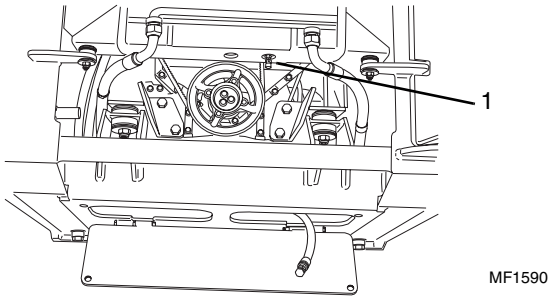

Figure 9-50 Radiator Petcock

9. Place a container under the radiator drain valve (Fig. 9-50, 1).
10. With the engine cool, slowly loosen the radiator cap and turn it to the first stop. Allow any pressure to escape and then remove the cap.
11. Open the drain valve (Fig. 9-50, 1) and allow approximately 1 gal (3,8 liters) of coolant to drain into the container. Close the drain valve (1).
12. Transfer the coolant to a container with a cover and label the container as "Used Antifreeze." Dispose of the coolant at an approved recycling facility.

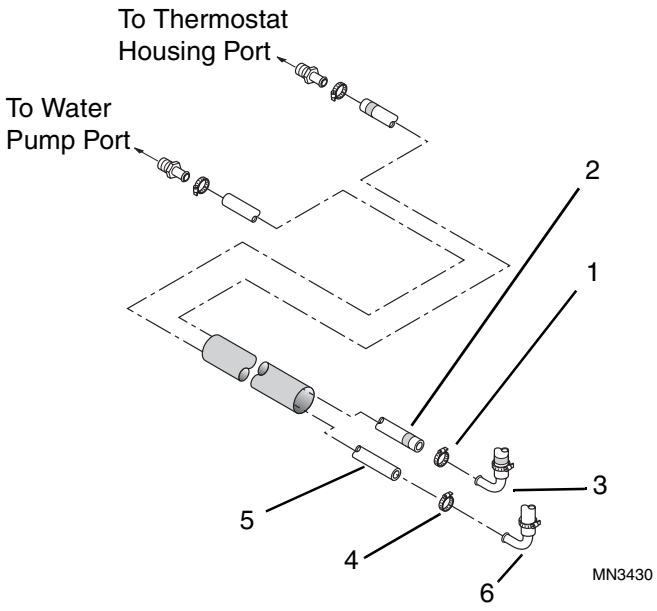

Figure 9-51 Heater Hose Connections

13. Loosen hose clamp (Fig. 9-51, 1), and slide the end of the hose (2) from the 90° hose fitting (3).
14. Loosen hose clamp (Fig. 9-51, 4), and slide the end of the hose (5) from the 90° hose fitting (6).

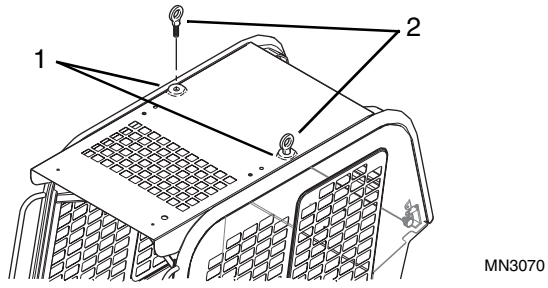

Figure 9-52 Operator Protective Structure Lift Points

15. Two threaded holes (Fig. 9-52, 1) are located in the top of the Operator's Protective Structure. Remove the plastic plugs and install a 3/8-16 forged steel hoist eye (2 [must obtain locally]) into each hole.
16. Attach a suitable lifting device to both hoist eyes (Fig. 9-52, 2), and remove any slack from the lifting equipment to ensure the Operator's Protective Structure remains in the raised position while disconnecting the shocks in the following step.

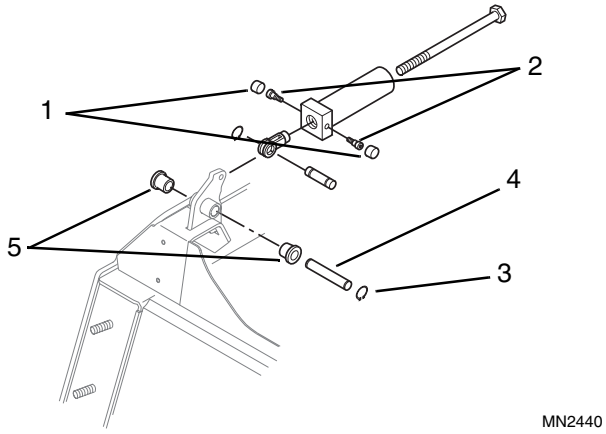

Figure 9-53 Operator Protective Structure Shock Absorber

17. Disconnect shock assemblies by removing the caps (Fig. 9-53, 1) and shoulder screws (2) from both shock assemblies.

WARNING: To prevent personal injury, use a suitable lift device to lower the Operator's Protective Structure when the shock assemblies have been disconnected. The spring assist that the shocks provide is not available when the shocks are disconnected. Lowering the Operator's Protective Structure manually will be difficult to control.

18. Release the tilt lock lever in the lower right corner of the Operator's Protective Structure, slowly lower the protective structure from the service position using the lift device.
19. Remove two retaining rings (Fig. 9-53, 3) from both pivot pins (4) and remove the pins. The plastic bushings (5) can be removed, inspected, and replaced, if required, once the structure has been removed.

WARNING: **DO NOT** stand under the Operator's Protective Structure as it is being lifted. Failure of the lifting equipment would allow the structure to fall, and result in personal injury or death.

20. Using the lifting equipment attached in Step 16, remove the Operator's Protective Structure from the vehicle. While lifting the structure, have an assistant guide the cables out of the frame bulkheads.

b. Inspection

1. Inspect the Operator's Protective Structure for damage and inspect the condition of all welds. If structural damage or weld failures are noted, the Operator's Protective Structure MUST be replaced.

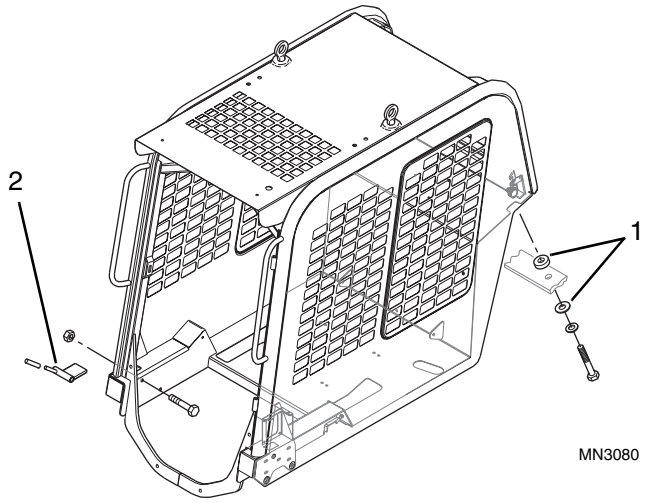

Figure 9-54 Operator Protective Structure

2. Check the condition of all neoprene isolator washers (Fig. 9-54, 1) and tilt lock latch (2). Replace if damaged.

c. Preparation For Installation

***Note: DO NOT** reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

If replacement of the Operator's Protective Structure is required, the following items must be removed from the original structure, and transferred to the replacement:

1. Seat with seat belt and seat restraint bar (Refer to Section 9.5, "Seat Assembly and Seat Restraint Bar").
2. Loader arm lockout switch assembly (Refer to Section 8.9, "Loader Arm Lockout").
3. Throttle control and cable (Refer to Section 7.6.3, "Throttle Control Maintenance").
4. Instrument panel, front worklights, fuse panel and wiring harness (Refer to Section 8.3, "Instrumentation").
5. Manual holder box and sound control panels (as equipped).

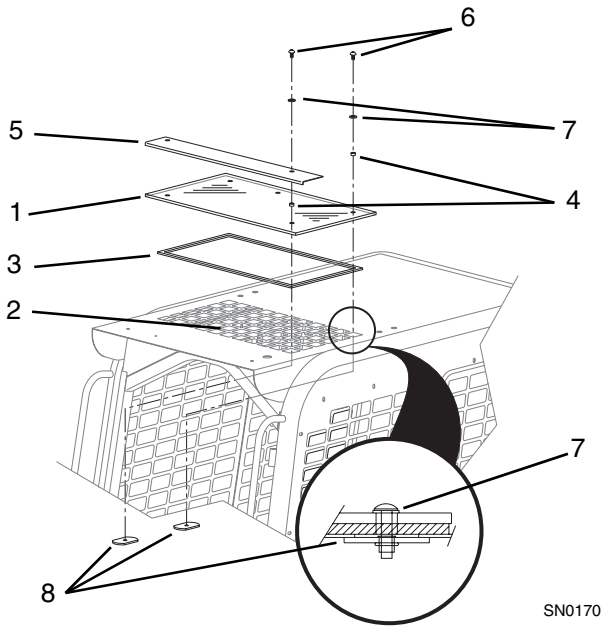

Figure 9-55 Top Window

6. **Top Window Removal/Installation:**
   a. Remove five 1/4-20 x 7/8" truss head capscrews (Fig. 9-55, 6), 1/4" weathertight washers (7), Lexan retainer assemblies (8), and skylight stiffener (5) from the top window (1) on the original Operator's Protective Structure.
   b. Remove the top window (Fig. 9-55, 1) from the structure, cutting the butyl tape (3) as required. Remove any butyl tape (3) remaining on the window (1).

c. Use a suitable cleaner (DO NOT use ammonia based window cleaner) to clean the underside of the glass and the roof surface (Fig. 9-56, 1) of the replacement Operator's Protective Structure, approximately 1" around outside of cut-outs (2). Be sure all grease or oil is removed from the structure and glass.

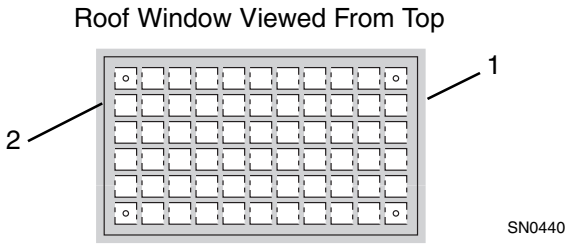

Figure 9-56 Top Window Positioning

d. Position the roof window (Fig. 9-56, 1) on top of the replacement Operator's Protective Structure, centered over cut-outs (2) and mark its location around the entire glass.

e. This mark will be used as a guide when placing the top window on the surface of Operator's Protective Structure roof.

f. Apply new butyl tape (Fig. 9-55, 3) to the underside of the top window. Keep tape between the edge of the window and the mounting holes on the window.

g. Ensure that spacers (Fig. 9-55, 4) are in all five mounting holes on the window.

h. Place roof window (Fig. 9-55, 1), with spacers (4) and butyl tape (3), already installed, onto Operator's Protective Structure roof. Use the marks made in Step d to center the glass over the cut-outs (2).

i. Place skylight stiffener (Fig. 9-55, 5) along front edge of the roof window (1), lining up the mounting holes in the stiffener with the mounting holes in the window.

j. Secure in place using five 1/4-20 x 7/8" truss head capscrews (Fig. 9-55, 6), 1/4" weathertight washers (7) and Lexan retainer assemblies (8).

Note: *Weathertight washers (Fig. 9-55, 7) should be placed on the roof window with rubber side down and the Lexan retainer (8) should be placed perpendicular to the cutouts.*

k. Tighten all screws (Fig. 9-55, 6) evenly until window is secure.

IMPORTANT: *DO NOT overtighten! Glass may crack!*

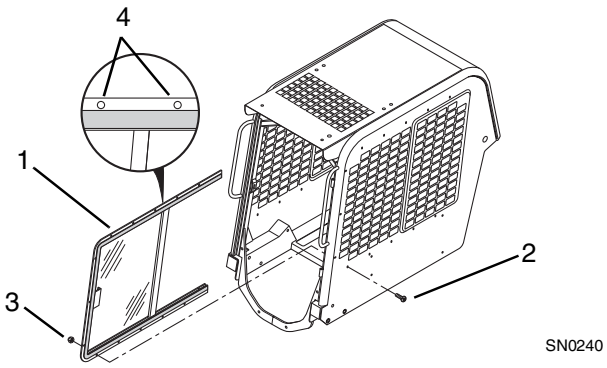

Figure 9-57 Sliding Side Window

7. **Side Window Removal/Installation:**

a. Remove the 1/4-20 x 5/8" truss head screws (Fig. 9-57, 2) and 1/4-20 acorn nuts (3), inserted into holes (4) in the sliding window frames (1), and remove both frames from the original Operator's Protective Structure.

Note: *The three mounting holes on the front, vertical piece of the window frame are threaded and DO NOT require nuts.*

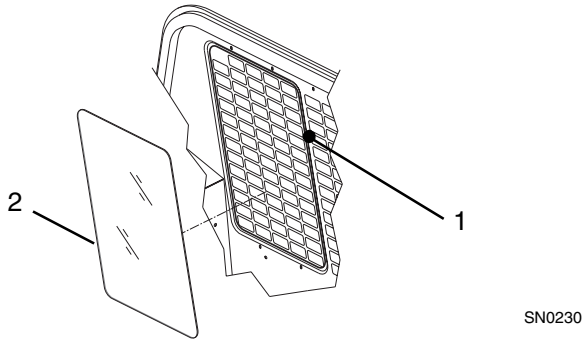

Figure 9-58 Fixed Side Window

b. While supporting each side window (Fig. 9-58, 2), cut the urethane (1) securing each window to the inside of the original Operator's Protective Structure, and remove the windows.

c. Remove any urethane remaining on each window (Fig. 9-58, 1). Use a suitable cleaner (DO NOT use ammonia based window cleaner) to clean the outside of both fixed side windows (2) and the inside surfaces on the Operator's Protective Structure where side windows (2) will be installed. Be sure all grease or oil is removed from the structure and glass.

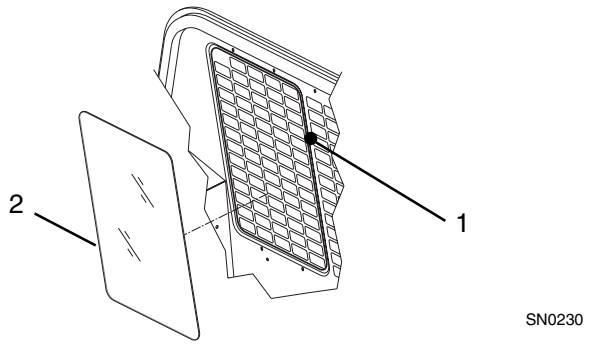

Figure 9-59 Fixed Side Window Installation

d. Using high viscosity urethane, place a 3/8" (10 mm) diameter bead of urethane (Fig. 9-59, 1) around the rear section of cut-outs.

e. Press fixed side window (Fig. 9-59, 2) firmly against the bead of urethane (1).

Note: *Use some means to brace both side windows in place for 24 hours. Normal cure time for urethane is 24 hours at 70° F (21° C) and 50% humidity. Lower temperatures or humidity will cause the cure time to be longer.*

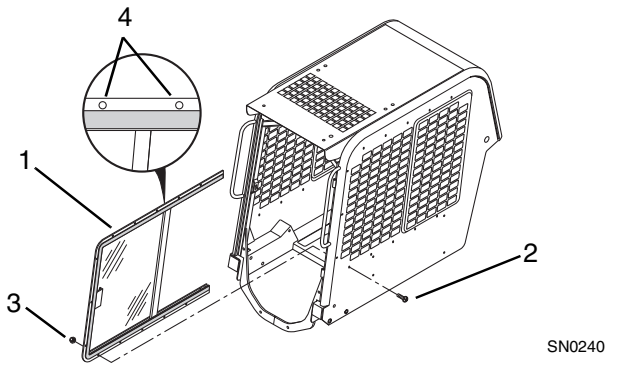

Figure 9-60 Sliding Side Window

f. Install the sliding window frames (Fig. 9-60, 1) into the Operator's Protective Structure, and secure using the 1/4-20 x 5/8" truss head screws (2) and 1/4-20 acorn nuts (3), inserted into holes (4) in the sliding window frames (1).

Note: *The three mounting holes on the front, vertical piece of the window frame are threaded and will not require nuts.*

8. **Heater Removal/Installation:**

a. Remove screw (Fig. 9-61, 4) from the top of the water valve (5).

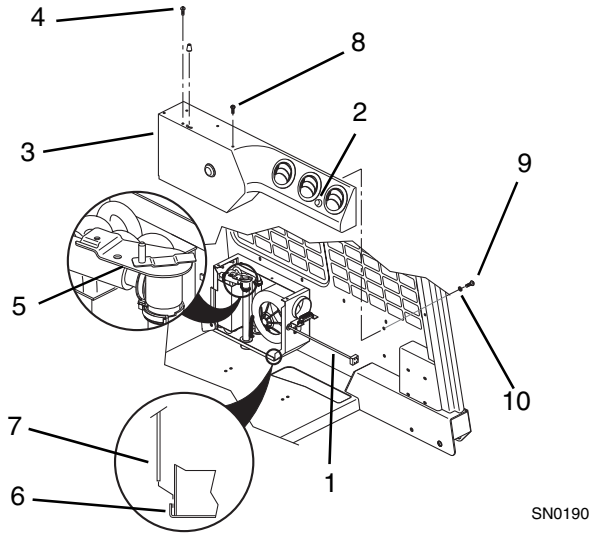

Figure 9-61 Heater Unit Removal

b. Remove four #10-24 x 1/2" phil pan head screws (Fig. 9-61, 8), 1/4-20 x 3/4" truss head screws (9) and lockwashers (10) that secure the heater cover assembly (3) in place. Lift the lower edge (7) of the heater cover assembly (3) from the lower lip of heater assembly (6).

c. Disconnect the blower switch wire (Fig. 9-61, 1), coming from the front of the heater assembly, from the blower switch (2) installed in the heater cover assembly (3).

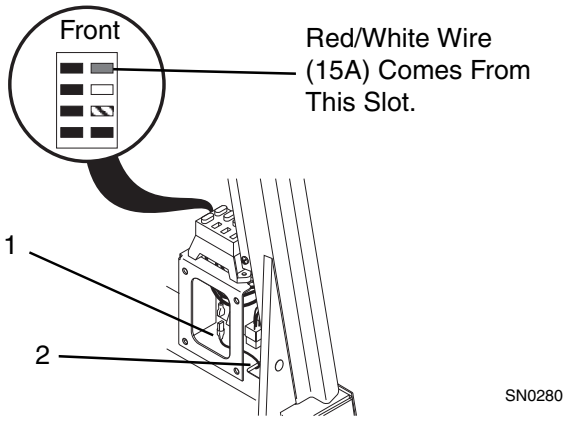

Figure 9-62 Wire Routing

d. Disconnect the red power wire (Fig. 9-62, 1) from the red/white wire #15A coming from the bottom of the fuse block.

e. Remove the heater power wire (Fig. 9-62, 1) from the area (2) below the fuse box, and remove any wire ties securing the wire to the wire harness under the original Operator's Protective Structure.

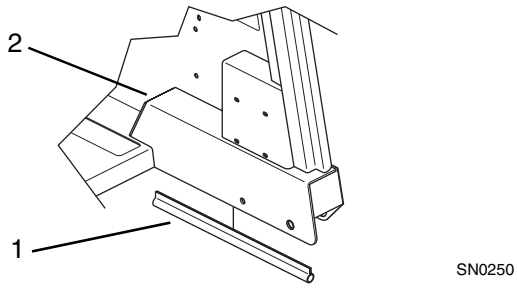

Figure 9-63 Seal Removal/Installation

f. Remove the bulb seals (Fig. 9-63, 1) from the lower front channel (2) on both sides of the original Operator's Protective Structure, and install both seals in the same location on the replacement structure.

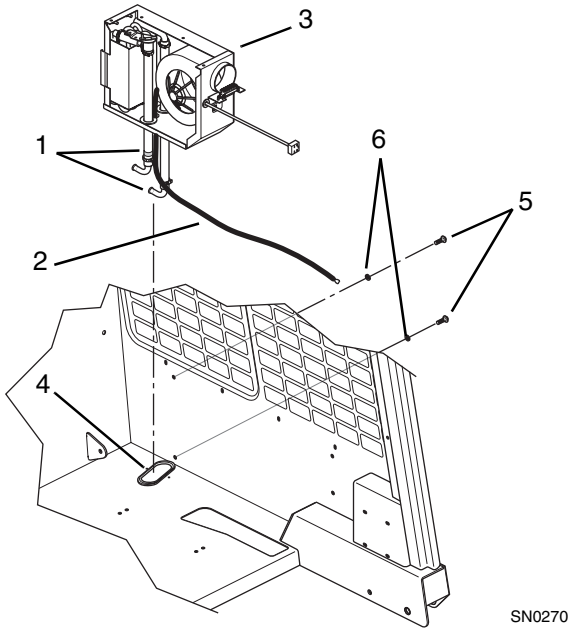

Figure 9-64 Heater Unit Removal/Installation

g. Remove two 1/4-20 x 3/4" truss head screws (Fig. 9-64, 5) and 1/4" internal tooth lockwashers (6) that secure the heater unit (3) to the original Operator's Protective Structure. Lift the heater unit from the structure while guiding the heater hoses (1) and power wire (2) from the oval shaped hole (4) in the floor.

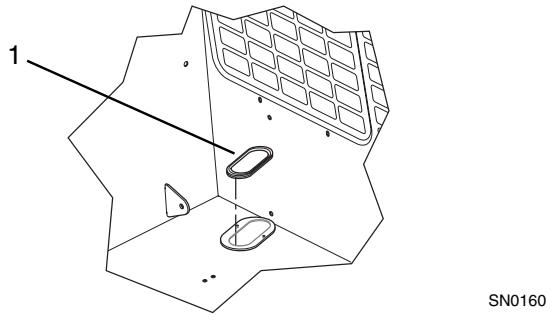

Figure 9-65 Enclosed Cab Hole Moulding

h. Remove the bulb seal (Fig. 9-65, 1) from the heater hose hole in the floor of the original Operator's Protective Structure, and install in the replacement structure.

i. Route the heaters hoses (Fig. 9-64, 1) and power wire (2) from the heater unit (3) through the oval shaped hole (4). Use wedges or a second person to line up the mounting holes and hold it in place until the heater is secured to the Operator's Protective Structure using two 1/4-20 x 3/4" truss head screws (5) and 1/4" internal tooth lockwashers (6).

j. Route the heater power wire (Fig. 9-64, 2), coming from bottom of heater, along the bottom of the Operator's Protective Structure wire harness, and into the area (Fig. 9-62, 2) below the fuse block. Wire tie in place.

k. Connect the red power wire (Fig. 9-62, 1) to the red/white wire #15A coming from the bottom of the fuse block.

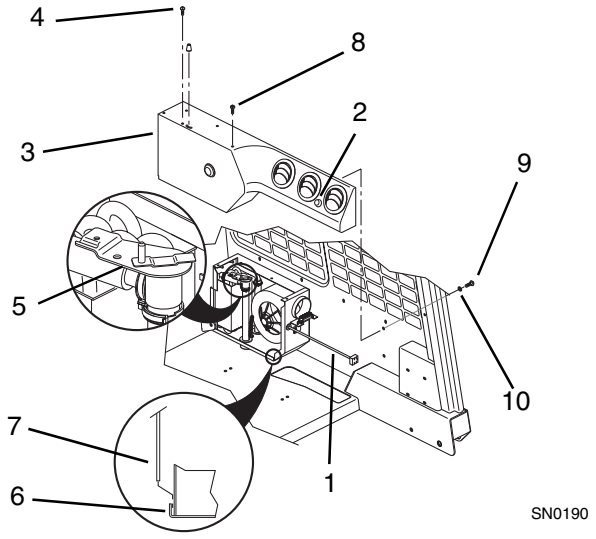

Figure 9-66 Heater Unit Installation

l. Connect the blower switch wire (Fig. 9-66, 1), coming from the front of the heater assembly, to the blower switch (2) already installed in the heater cover assembly (3).

m. Insert the lower edge (Fig. 9-66, 7) of heater cover assembly (3) into lower lip of heater assembly (6). Secure heater cover assembly in place with the four #10-24 x 1/2" phil pan head screws (8), 1/4-20 x 3/4" truss head screws (9), lockwashers (10), and the screw (4) removed from the water valve in Step a.

9. **Front Door Removal/Installation:**

a. Rotate the front door harness locking collar (Fig. 9-67, 3) counterclockwise, and remove the harness end (1) from the connector (2).

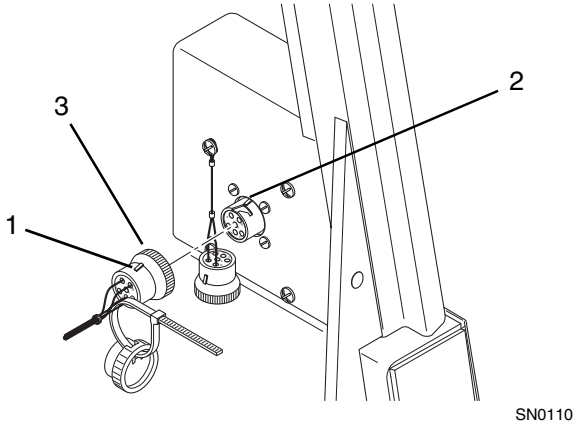

Figure 9-67 Front Door Harness Connector

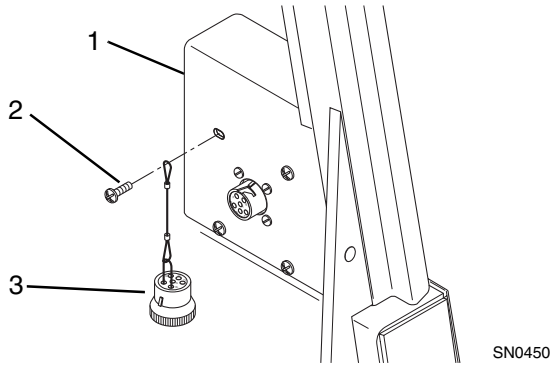

Figure 9-68 Fuse Block Cover

b. Remove four screws (Fig. 9-68, 2) securing the tethered jumper harness connector (3) and fuse block cover (1) to the original Operator's Protective Structure.

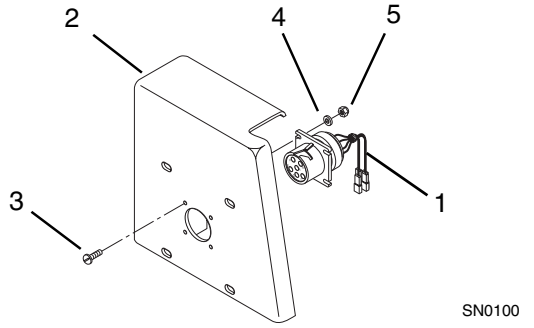

Figure 9-69 Front Door Harness Connector

c. Disconnect the four wires (2F, 18, 18A and 31A) coming from the front door harness (Fig. 9-69, 1) from the wires on the Operator's Protective Structure wire harness.

d. Remove four #4-40 x 1/2" slotted pan head screws (Fig. 9-69, 3), washers (4) and #4-40 hex lock elastic nuts (5) that secures the front door harness connector (1) to the inside of the original fuse block cover (2).

e. Remove the 5/16-18 x 3/4" shoulder screw (Fig. 9-70, 17) and 5/16" flat washer (18) that secures the restraint cable (16) on the door to the gas spring mounting bracket (2).

f. Remove the gas spring (Fig. 9-70, 14) from the ball stud (15) on the gas spring mounting bracket (2) and the ball stud on the door (8) on the original Operator's Protective Structure.

g. Remove the hex locknut (Fig. 9-70, 13), door striker (1), and striker bolt guard (12) from the original Operator's Protective Structure, and install on the replacement with a new hex locknut (13), but DO NOT tighten.

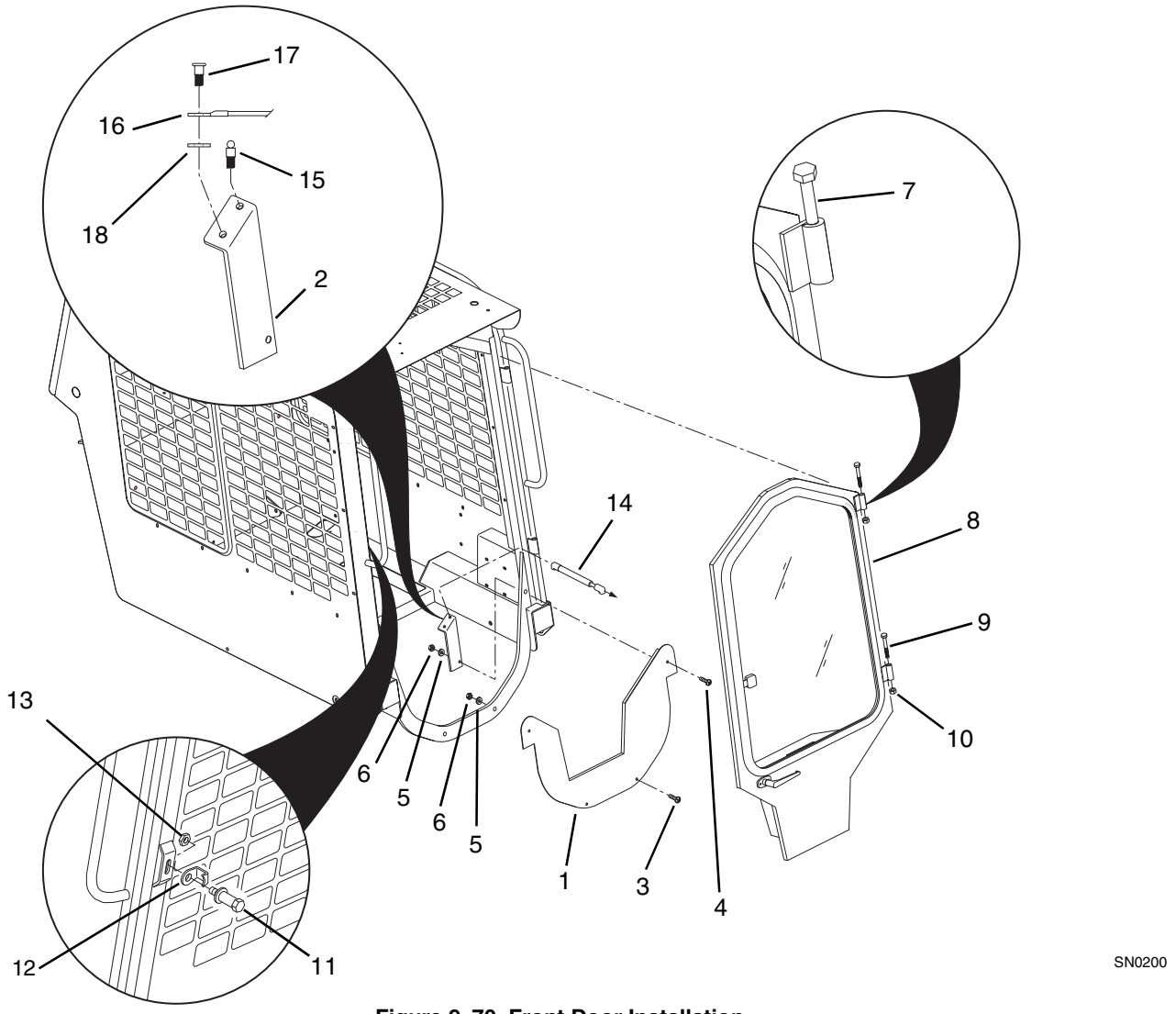

Figure 9-70 Front Door Installation

h. Remove three 1/4-20 x 1" screws (Fig. 9-70, 3), one 1/4-20 x 1-1/4" screw (4), four 5/16" flat washers (5), and four 1/4-20 hex nuts (6) that secure the lower door filler panel (1) and gas spring mounting bracket (2) to the original Operator's Protective Structure, and remove the panel (1) and bracket (2).

i. Install the lower door filler panel (Fig. 9-70, 1) and gas spring mounting bracket (2) to the replacement Operator's Protective Structure using three 1/4-20 x 1" screws (3), one 1/4-20 x 1-1/4" screw (4), four 5/16" flat washers (5), and four 1/4-20 hex nuts (6).

Note: *Use the longer screw (Fig. 9-70, 4) to install both the lower door filler panel (1) and the gas spring mounting bracket (2). Only hand tighten these screws at this time.*

j. Remove the 3/8-16 hex nuts (Fig. 9-70, 10) from the 3/8-16 x 4" capscrews (7 & 9) that secure the door (8) to the original Operator's Protective Structure. Remove the lower capscrew (9) from the hinge.

k. Slide the top capscrew (Fig. 9-70, 7) part way through the top hinge on the door (to avoid interference with the roof) and remove the door (8).

l. Install the door (Fig. 9-70, 8) on the replacement Operator's Protective Structure.

Note: *Place the door hinges above the hinges on the Operator's Protective Structure.*

m. Secure the door using the remaining 3/8-16 x 4" capscrew (Fig. 9-70, 9) and two 3/8-16 hex nuts (10). Tighten both hex nuts (10) securely.

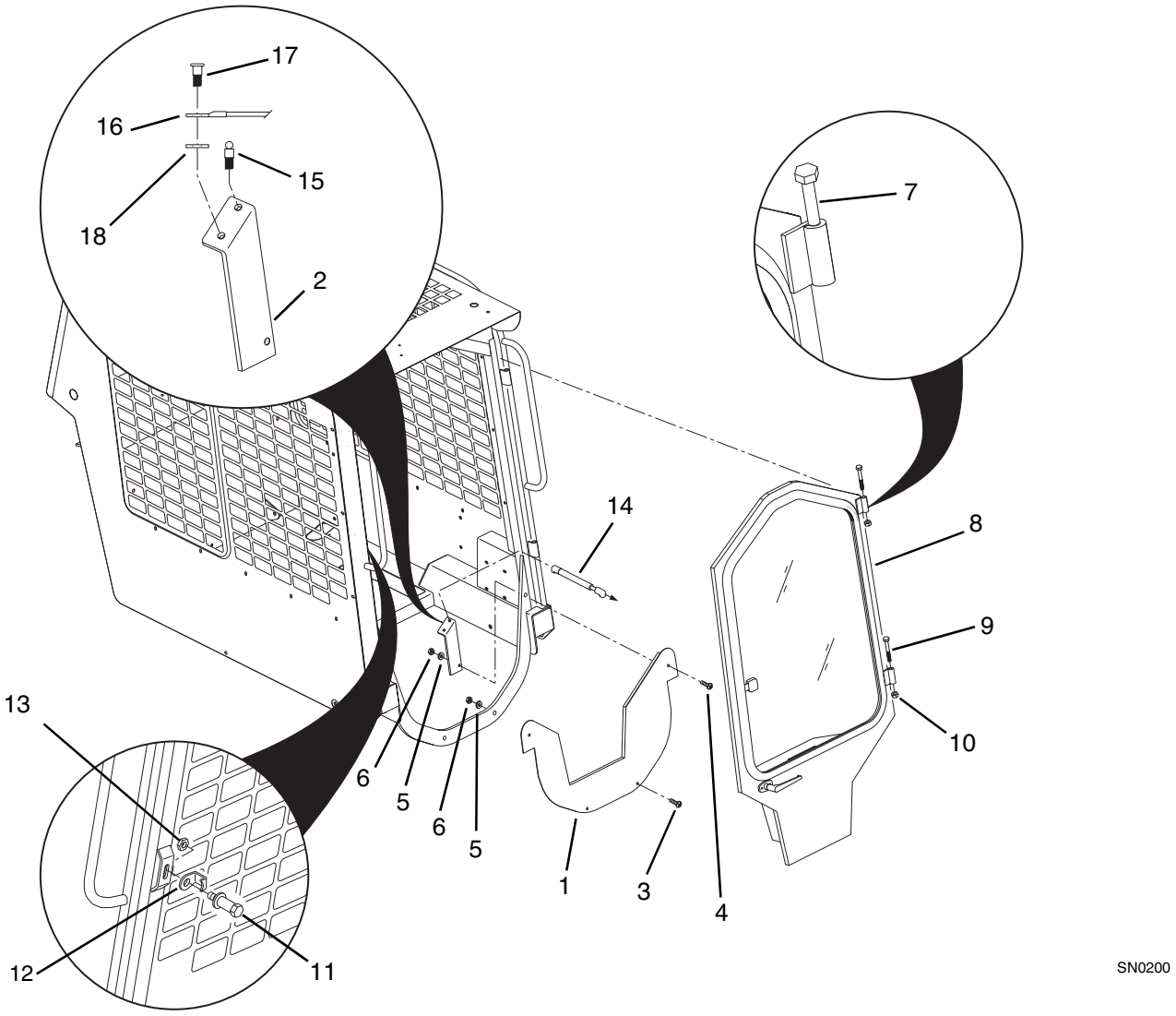

Figure 9-71 Front Door Installation

n. Adjust the door striker (Fig. 9-71, 1) up or down as required, so the door (8) closes and latches properly. Tighten the hex lock nut (13) securely.

o. Install gas spring (Fig. 9-71, 14). Snap the gas spring end over the ball studs already mounted on the door and the gas spring mounting bracket.

p. Install the free end of the restraint cable (Fig. 9-71, 16) on the door to the gas spring mounting bracket (2), using a 5/16-18 x 3/4" shoulder screw (17) and 5/16" flat washer (18).

q. Fully tighten three 1/4-20 x 1" screws (Fig. 9-70, 3), one 1/4-20 x 1-1/4" screw (4), four 5/16" flat washers (5), and four 1/4-20 hex nuts (6) mounting the gas spring mounting bracket (2) and the lower door filler panel (1) at this time.

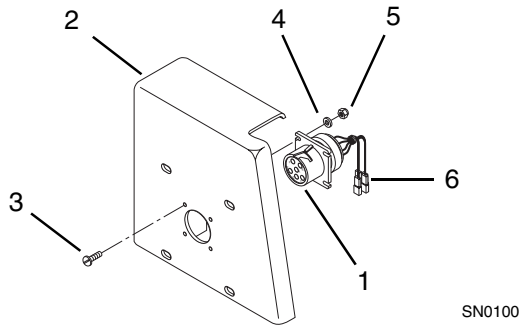

Figure 9-72 Front Door Harness Connector

r. Mount the front door harness connector (Fig. 9-72, 1) to the inside of the new fuse block cover (2), using four #4-40 x 1/2" slotted pan head screws (3), washers (4) and #4-40 hex lock elastic nuts (5).

s. Connect the four wires (2F, 18, 18A and 31A) coming from the front door harness (Fig. 9-72, 6) to the appropriate wires on the replacement Operator's Protective Structure wire harness (Refer to Section 8.11.12, “Enclosed Cab Heater & Door Harness Electrical Diagram”).

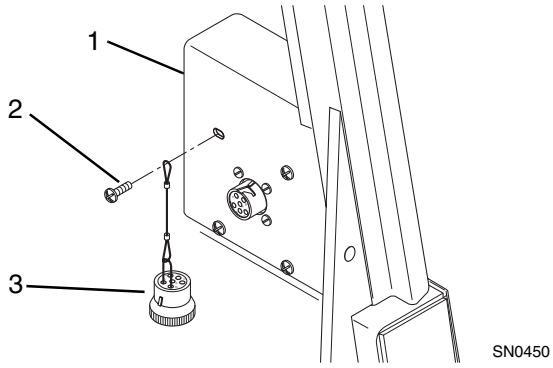

Figure 9-73 Fuse Block Cover

t. Install the fuse block cover (Fig. 9-73, 1) using the original hardware (2). Use one of the top mounting screws (2) for installing the tethered jumper harness connector (3).

u. Line up tab on front door wire harness end (Fig. 9-74, 1) with the tab on the fuse block harness end (2). Rotate locking collar (3) until you are able to slide the two pieces together. Rotate locking collar (3) clockwise to lock in place.

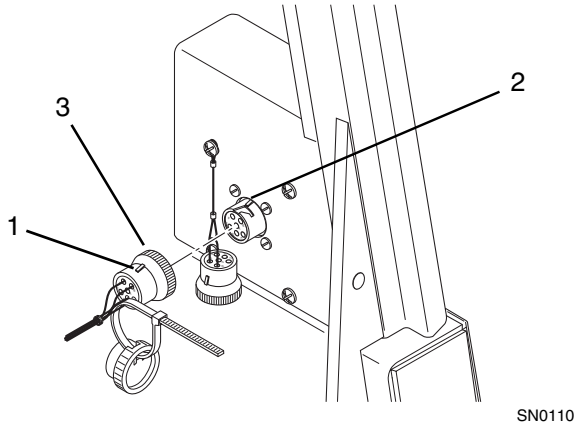

Figure 9-74 Front Door Harness Connector

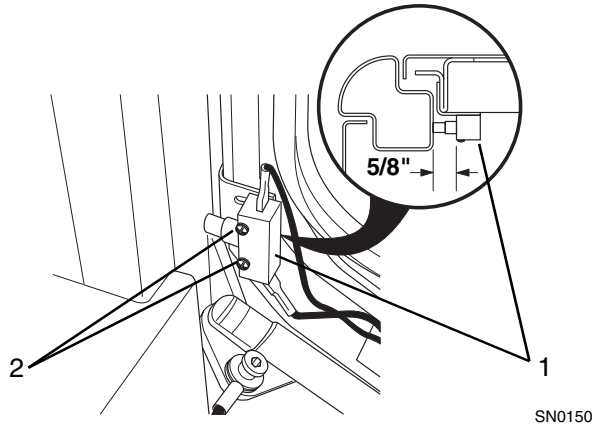

Figure 9-75 Front Door Loader Lockout Switch

v. Adjust the loader arm lockout door switch (Fig. 9-75, 1). With the cab door closed and latched, loosen the two mounting screws (2). The switch (1) makes an audible clicking sound when it is engaged and the lockout circuit is closed. With the mounting screws loosened, slide the switch on the mounting bracket until you hear the switch engage. There should be approximately 5/8" (16 mm) distance between the Operator’s Protective Structure and the left side of the switch (1).

d. Installation:

***Note: DO NOT** reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

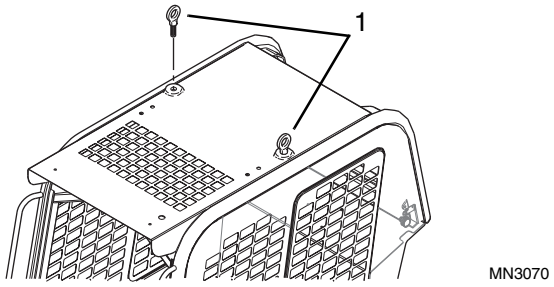

Figure 9-76 Operator Protective Structure

1. Attach a suitable lifting device to both forged steel hoist eyes (Fig. 9-76, 1).

WARNING: DO NOT stand under the Operator's Protective Structure as it is being lifted. Failure of the lifting equipment would allow the structure to fall, and result in personal injury or death.

2. Lift the Operator's Protective Structure into position over the frame. Have an assistant guide the park lock cables, throttle cable, and wiring harness down through the frame bulkheads while slowly lowering the Operator's Protective Structure.

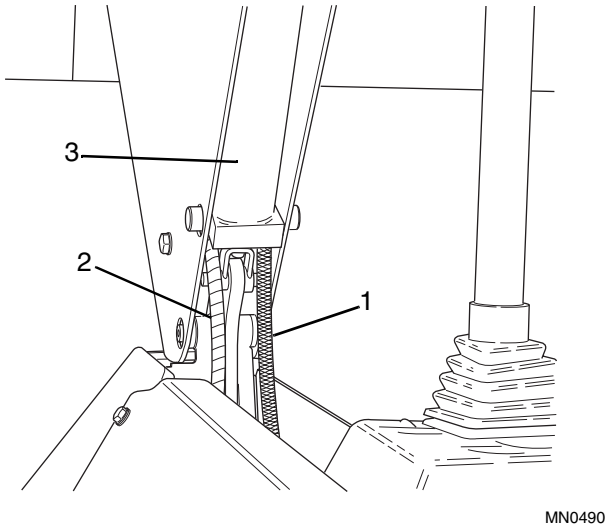

Figure 9-77 Left Harness and Cable Routing

3. Ensure that the wiring harness (Fig. 9-77, 1) and park lock cable (2) are positioned over the top of the left shock (3).

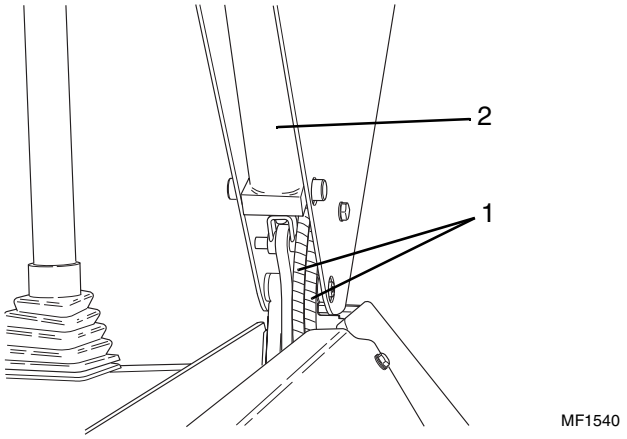

Figure 9-78 Right Cable Routing

4. Ensure that the throttle and park lock cables (Fig. 9-78, 1) are positioned over the top of the right shock (2).

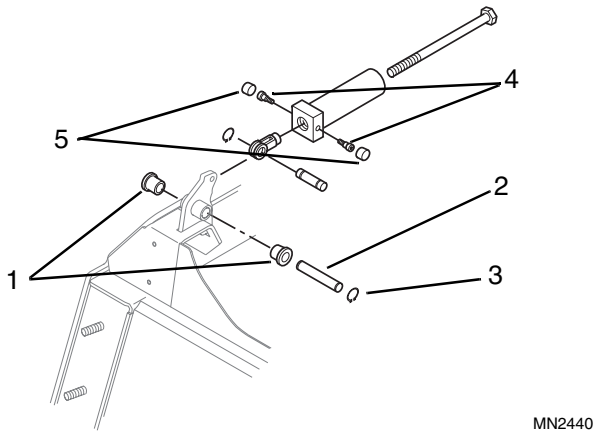

Figure 9-79 Operator Protective Structure Shock Absorber

5. Place new plastic bushings (Fig. 9-79, 1) into the pivot holes in the frame, if removed earlier.
6. Lower the Operator's Protective Structure onto the frame.
7. Secure the front of both sides of the Operator's Protective Structure to the frame using pins (Fig. 9-79, 2) and retaining rings (3).
8. Raise the Operator's Protective Structure into the service position, and ensure that the tilt lock lever has been engaged.
9. Reconnect the left and right shock assemblies to the Operator's Protective Structure using shoulder screws (Fig. 9-79, 4). Tighten securely. Once screws have been tightened, reinstall the plastic caps (5).

10. Remove the lifting equipment and the hoist eyes (Fig. 9-76, 1) from the top of the Operator's Protective Structure, and replace the plastic plugs in each hole.

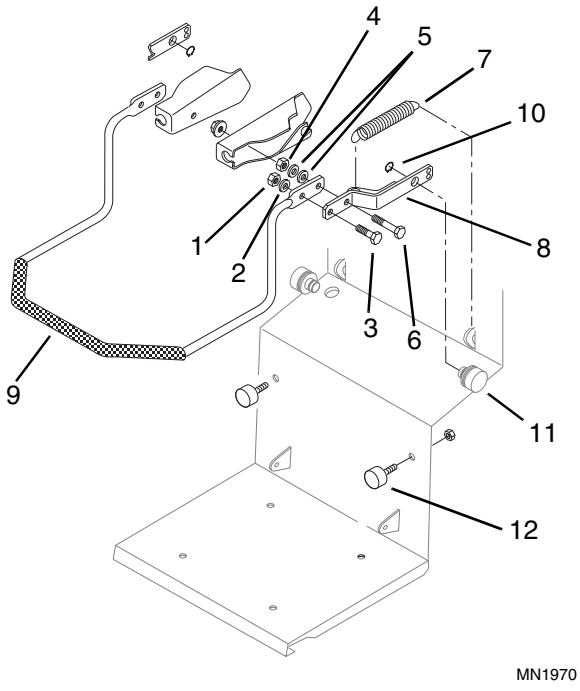

Figure 9-80 Seat Restraint Bar

11. Position both restraint bar pivot arms (Fig. 9-80, 8) on the pivot mounts (11), and secure with retaining rings (10).
12. Install the restraint bar (Fig. 9-80, 9) on both restraint bar pivot arms (8) using capscrew (6), flat washers (5) and new hex elastic locknut (4) inserted into the rear holes, but NOT tightened.
13. Connect spring (Fig. 9-80, 7) on each side between the restraint bar pivot arm (8) and seat platform.
14. Install a capscrew (Fig. 9-80, 3), flat washer (2) and new hex elastic locknut (1) in the front of each restraint bar pivot arm and tighten.
15. Tighten the capscrew (Fig. 9-80, 6), flat washers (5) and hex elastic locknut (4) left loose in Step 12.

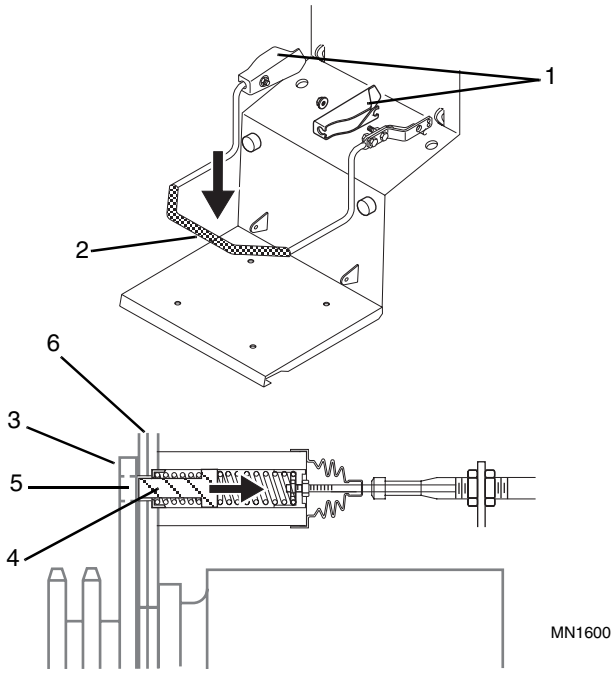

Figure 9-81 Park Lock - Disengaged

16. Reconnect both park lock cables and check the adjustment of both park lock pins. With the seat restraint covers (Fig. 9-81, 1) still removed, lower the seat bar (2).

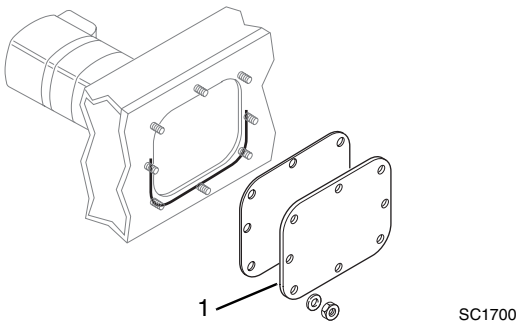

Figure 9-82 Access Cover Installation

17. Remove both side chain case access covers (Fig. 9-82, 1) to gain access to the drive sprocket (Fig. 9-81, 3) and the end of the park lock pin (4).
18. Inspect to see that both pins (Fig. 9-81, 4) have fully retracted from the hole (5) in drive sprocket (3) and should be flush with the edge of the chaincase wall (6).

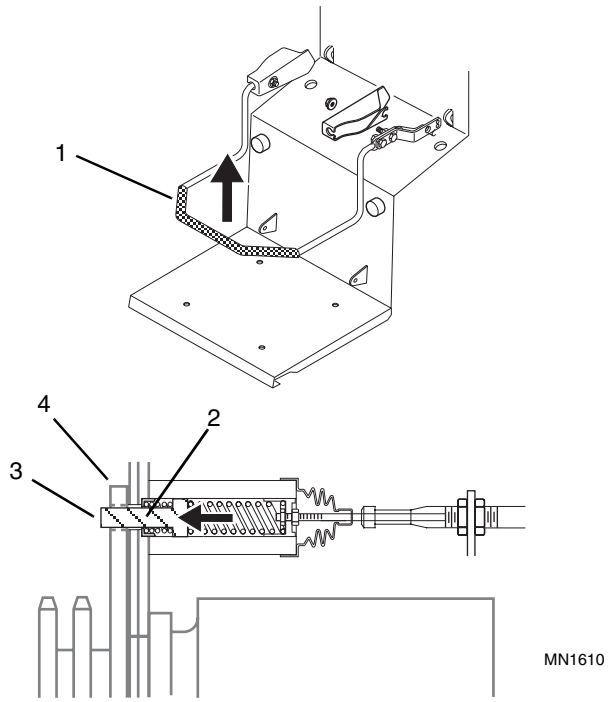

Figure 9-83 Park Lock - Engaged

19. Raise seat bar (Fig. 9-83, 1).
20. Inspect to see that both pins (Fig. 9-83, 2) have fully extended through the hole (3) in its respective drive sprocket (4).
21. If the pin operation is NOT CORRECT, skip to Step 23.
22. If pin operation IS CORRECT, skip to Step 32.

.

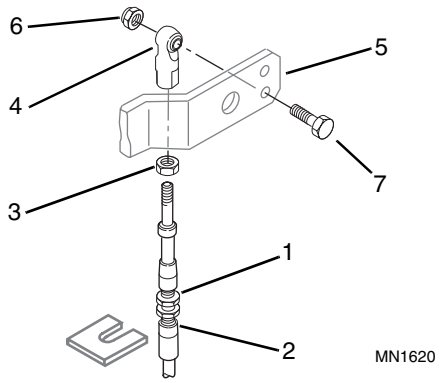

Figure 9-84 Park Lock Cable Operator Protective Structure Mount

23. Inspect both park lock cables where they mount to the rear of the Operator's Protective Structure. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-84, 1 & 2) on each cable. If not, readjust as required until they are equal.

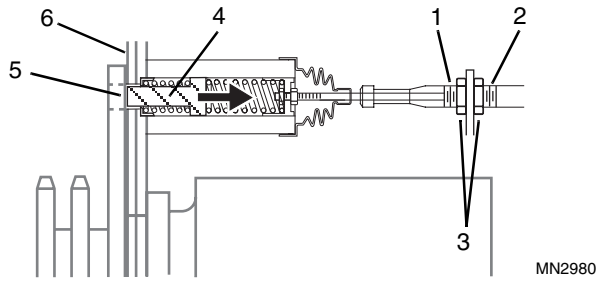

Figure 9-85 Park Lock Cable Chassis Mount

24. Inspect both park lock cables where they mount to the chassis. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-85, 1 & 2) on each cable. If not, readjust the bulkhead nuts (3) as required until the visible threads are equal.
25. Lower the seat bar to retract both lock pins (Fig. 9-85, 4). The face of each lock pin (5) must be flush with the inner wall of each respective chain case (6) with the seat bar lowered. The lock pin position is adjusted by moving the ball joint (Fig. 9-84, 4) on the cable end at the seat restraint bar pivot arm (5).
26. At the rear of the seat bar, loosen the hex jam nut (Fig. 9-84, 3) against the ball joint (4).
27. Detach ball joint from seat restraint bar pivot arm (Fig. 9-84, 5) by removing the elastic locknut (6) and capscrew (7). Discard locknut.

Note: *The left cable connection at the rear of the seat bar will adjust the right park lock assembly. The right cable connection at the rear of the seat bar will adjust the left park lock assembly.*

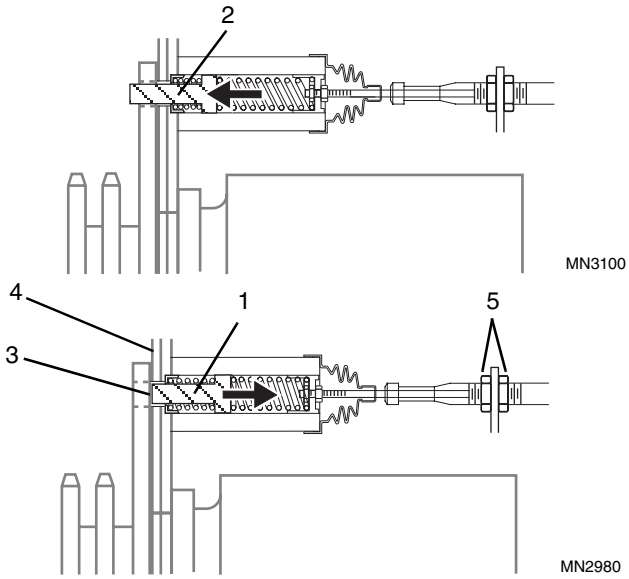

Figure 9-86 Park Lock Cable Chassis Mount

28. Turn the ball joint (Fig. 9-84, 4) onto the cable to retract either pin (Fig. 9-86, 1) away from the drive sprocket. Turn the ball joint toward the end of the cable to extend either pin (2) closer to the drive sprocket.
29. With the seat bar still lowered, temporarily attach both ball joints (Fig. 9-84, 4) to the seat restraint bar pivot arm (5) and inspect each pin position again. Repeat Step 29 as required until the face of the each lock pin (Fig. 9-86, 3) is flush with the inner wall of the respective chain case (4).
30. If either pin cannot be adjusted using Steps 26 through 29, loosen the cable housing bulkhead nuts (Fig. 9-86, 5), reposition the cable slightly and tighten the bulkhead nuts (5). Repeat Steps 26 through 29.
31. Secure each cables ball joint (Fig. 9-84, 4) to the seat restraint bar pivot arm (5) with capscrew (7) and a new elastic locknut (6). Tighten the hex jam nut (3) on each cable to the ball joint (4).

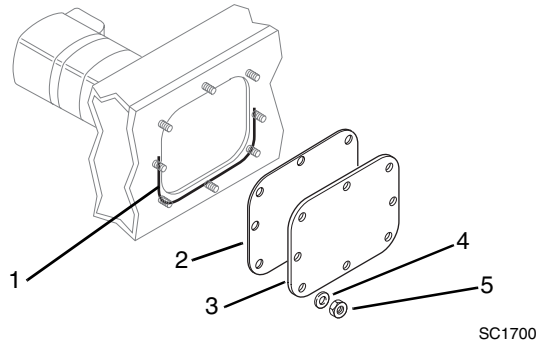

Figure 9-87 Access Cover Installation

32. Clean any sealer residue from the lower part of the access cover opening (Fig. 9-87, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
33. Reassemble the cover gasket (Fig. 9-87, 2) and cover (3) to the side of the chain case using the lock washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm) to complete the inspection procedure.

Note: *If your vehicle is a "D" Series, skip to Step 35. If your vehicle is a "DX" Series, proceed to Step 34.*

34. **DX Models Only:** Route the high flow gauge hydraulic line to the gauge. Uncap the line and connect to the gauge. Install the high flow panel to the Operator's Protective Structure [Refer to Section 4.11, "High Flow (DX) System"].

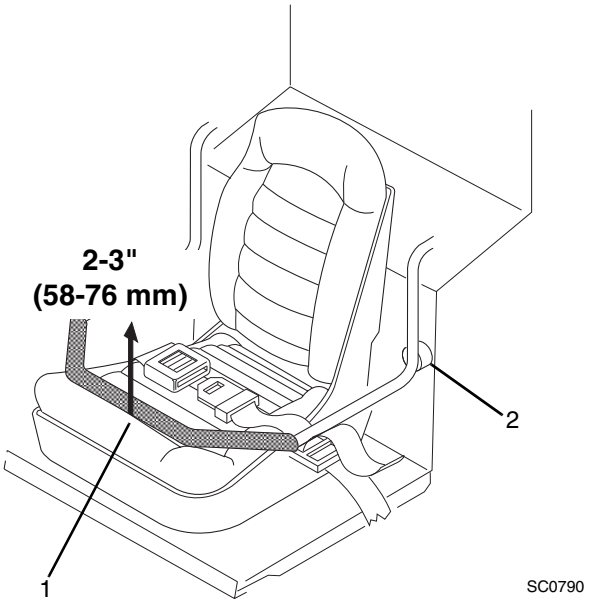

Figure 9-88 Loader Arm Lockout Micro Switch Adjustment

35. Install the loader arm lockout micro switch assembly (Refer to Section 8.9, “Loader Arm Lockout”).
36. Check the loader arm lockout micro switch (Fig. 9-89, 1) for proper adjustment. The seat bar (Fig. 9-88, 1) should be able to be raised 2-3" (58-76 mm) from the fully lowered position, with the bar resting against the rubber stops (2), before activating the loader arm lockout switch.

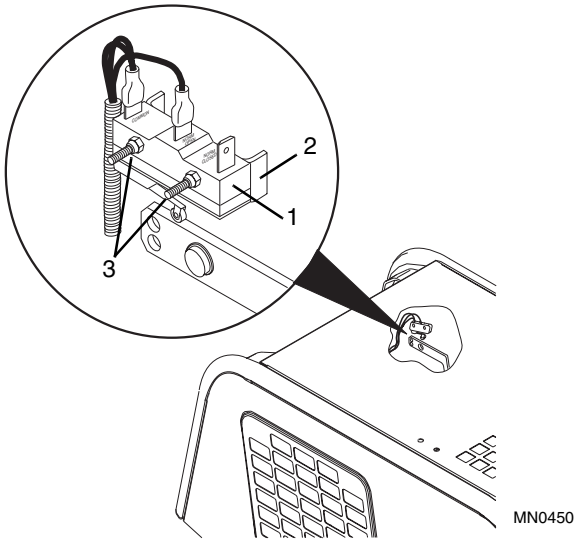

Figure 9-89 Seat Bar Micro Switch

If an adjustment is required, proceed as follows:

a. Remove two plastic plugs on the left side of the cab to access the capscrews that secure the micro switch (Fig. 9-89, 1) to its mounting bracket (2). Loosen both locknuts (3) on the inside of the cab, until the micro switch (1) can be repositioned using a slight hand force.
b. Reposition the micro switch (Fig. 9-89, 1) in small increments, rechecking the seat bar travel required to activate the switch with every move. When the seat bar travel (Fig. 9-88, 1) is within 2-3" (58-76 mm), tighten the two locknuts (Fig. 9-89, 3) securely.
c. Replace the plastic hole plugs on the left side of the cab.

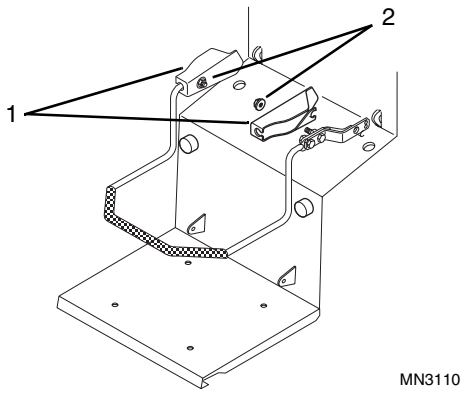

Figure 9-90 Restraint Bar Spring Cover Installation

37. Install the left (Fig. 9-90, 1) and right restraint bar covers, and secure with a hex flange nut (2) on each side.
38. Connect and adjust the throttle (Refer to Section 7.6.3, “Throttle Control Maintenance”).

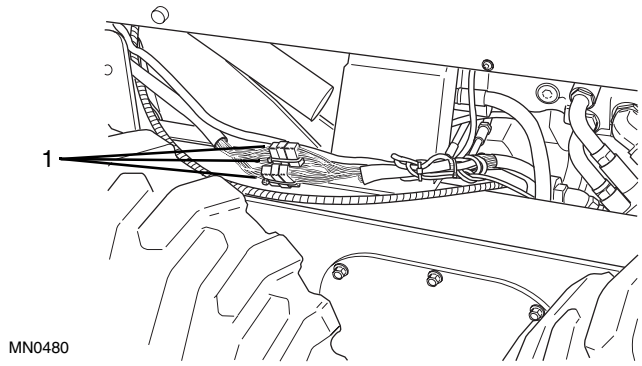

Figure 9-91 Wiring Harness Connectors

39. Connect the Operator's Protective Structure harness and chassis/engine harness electrical connectors (Fig. 9-91, 1), and secure with cable ties.

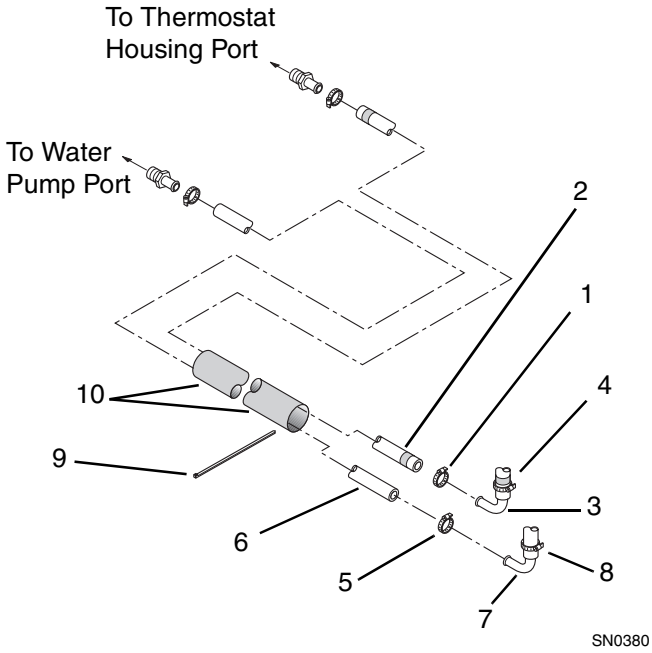

Figure 9-92 Heater Hose Connections

40. Position a hose clamp (Fig. 9-92, 1) over the end of the heater hose (2) with the red tape, and slide the end of the hose onto the 90° hose fitting (3) connected to the heater supply hose (4) also marked with red tape. Tighten the hose clamp (1).
41. Position a hose clamp (Fig. 9-92, 5) over the end of the heater hose (6) without the red tape, and slide the end of the hose onto the 90° hose fitting (7) connected to the heater supply hose (8) NOT marked with red tape. Tighten the hose clamp (5).
42. Use plastic ties (Fig. 9-92, 9) where necessary, to secure the nylon sleeve (10) in place and to prevent hoses from making contact with hot or moving engine parts.
43. Fill radiator completely with a 50/50 mixture of ethylene glycol and water, allowing time for the coolant to fill the engine block. Replace radiator cap. Add coolant to overflow bottle until it is 1/2 full.
44. Replace the negative battery cable onto the batteries and tighten securely. Replace the floor plate between the foot pedals.
45. Start engine and allow it to warm to operating temperature. Shut off engine and allow engine coolant to cool.
46. Overflow bottle should be 1/4 to 1/2 full; add coolant if required.

Note: *After running the heater for a period of time, it will be necessary to add engine coolant. Check coolant level daily or at 10 hour intervals until level stabilizes.*

47. Close the engine cover, and close and lock the rear engine compartment door.

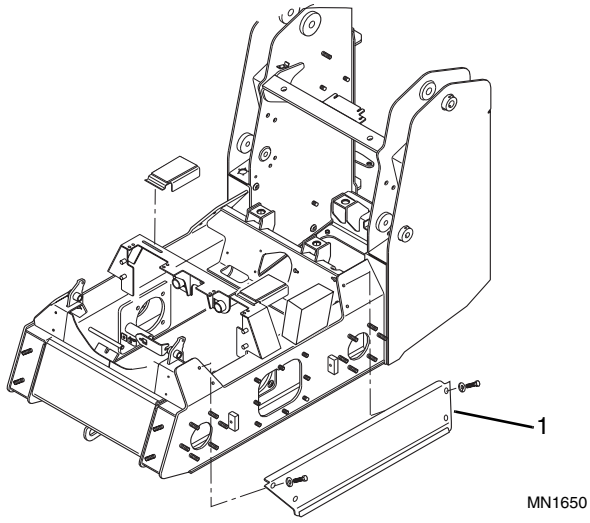

Figure 9-93 Chassis Panel Installation

48. Replace the left (Fig. 9-93, 1) and right (not shown) side panels on the chassis.
49. Lower the Operator's Protective Structure from the service position, if not already done (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
50. Perform "Loader Arm Lockout System Test - Enclosed Cab Models" (Refer to Section 8.9 b).

9.5 SEAT ASSEMBLY AND SEAT RESTRAINT BAR

9.5.1 Seat Maintenance

a. Removal

1. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

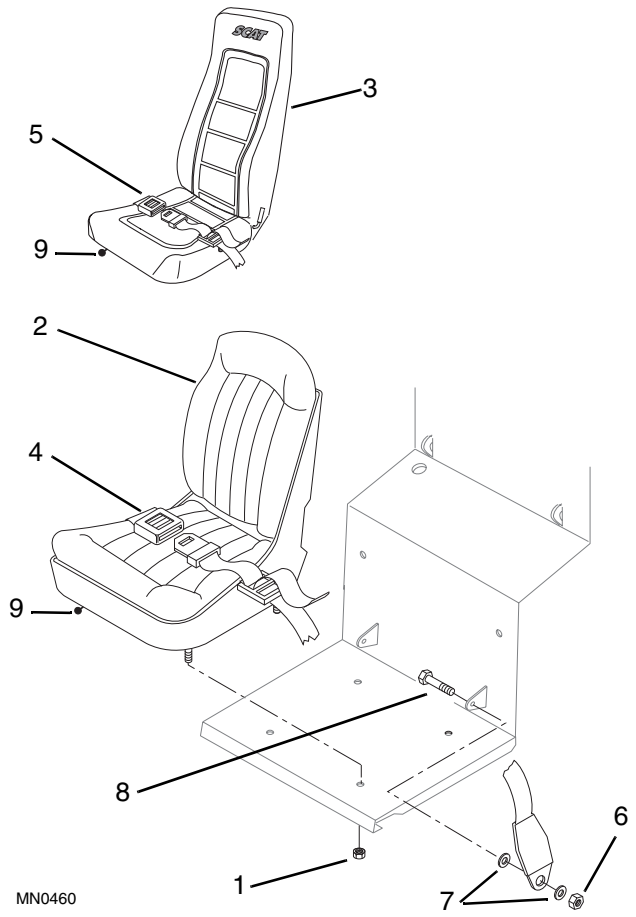

Figure 9-94 Seat Mounting

2. Remove and discard four hex elastic locknuts (Fig. 9-94, 1).
3. Remove the standard seat assembly (Fig. 9-94, 2), or optional deluxe seat assembly (3).
4. Remove seat belt (Fig. 9-94, 4 or 5) by removing hex elastic locknuts (6), two washers (7), and capscrews (8) from the belt mount on each side. Discard the capscrews (8) and hex elastic locknuts (6).

b. Inspection

1. Inspect seat belts (Fig. 9-94, 4 or 5) for rips and frayed ends. Check that the seat belt latch works properly.

IMPORTANT: *<u>NEVER</u> repair a seat belt. If any damage is noted during the seat belt inspection, replace the seat belt assembly.*

2. Inspect the seat adjuster (Fig. 9-94, 9) for proper operation.

c. Assembly

IMPORTANT: *DO NOT reuse the original seat belt mounting capscrews or any hex elastic locknut for any reason. Order the exact replacements from the parts manual for this vehicle. Contact your OmniQuip Parts Worldwide or Compact Technologies Distributor for assistance.*

1. Replace the seat belt (Fig. 9-94, 4 or 5) by installing a new capscrew (8) through each tab on the seat platform, followed by a washer (7), seat belt (4 or 5), washer (7) and new hex elastic locknut (6).
2. Install the seat assembly (Fig. 9-94, 2 or 3), and secure with four new hex elastic locknuts (1).
3. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

9.5.2 Restraint Bar Maintenance

a. Removal

IMPORTANT: *The following steps involve disassembly of the vehicles park lock system. Park the vehicle on a level surface, and block both sides of each wheel before beginning this procedure.*

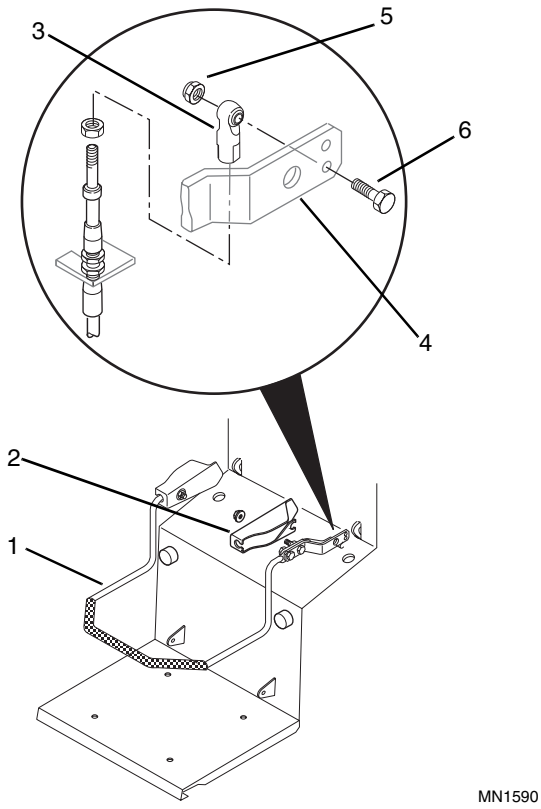

Figure 9-95 Park Lock Cable Removal Seat Bar Attachment

1. Lower seat bar (Fig. 9-95 ,1) and remove seat bar spring covers (2).
2. Disconnect the cable ball joint (Fig. 9-95, 3) from each seat bar pivot arms (4) by removing elastic locknut (5) and capscrew (6).

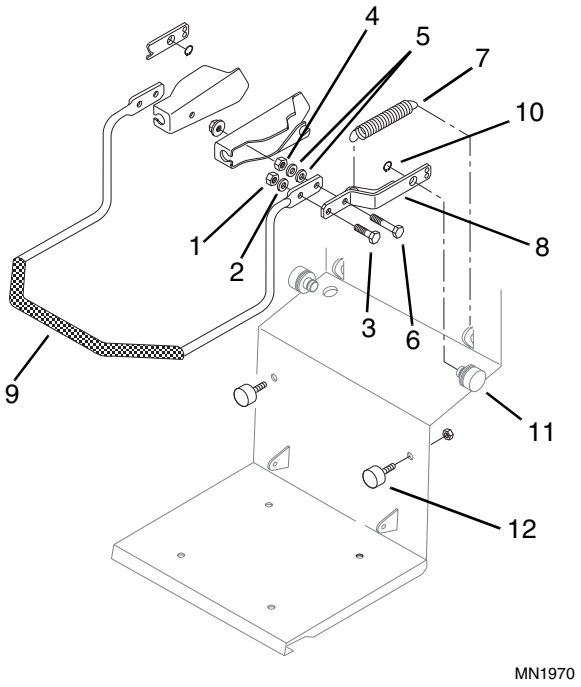

Figure 9-96 Seat Restraint Bar

3. Remove the hex elastic locknuts (Fig. 9-96, 1) flat washers (2), and capscrew (3) from the front of each restraint bar mount
4. Loosen, but DO NOT remove, the hex elastic locknuts (Fig. 9-96, 4) on rear capscrews (6). This will help remove some of the spring tension.
5. Disconnect springs (Fig. 9-96, 7) from the restraint bar pivot arms (8) and the seat platform.
6. Remove the hex elastic locknuts (Fig. 9-96, 4) flat washers (5), and capscrew (6) from the rear of each restraint bar mount, and remove the restraint bar (9).
7. Remove retaining rings (Fig. 9-96, 10) from both restraint bar pivot mounts (11), and remove both restraint bar pivot arms (8) from the vehicle.

b. Inspection

1. Inspect both restraint bar pivot arms (Fig. 9-96, 8) for wear or damage. Replace restraint bar pivot arm if necessary.
2. Inspect spring for indications of stretching and replace if necessary.
3. Inspect restraint bar for cracks or bending. Replace if necessary.
4. Inspect bumpers (Fig. 9-96, 12) for wear and replace if necessary.

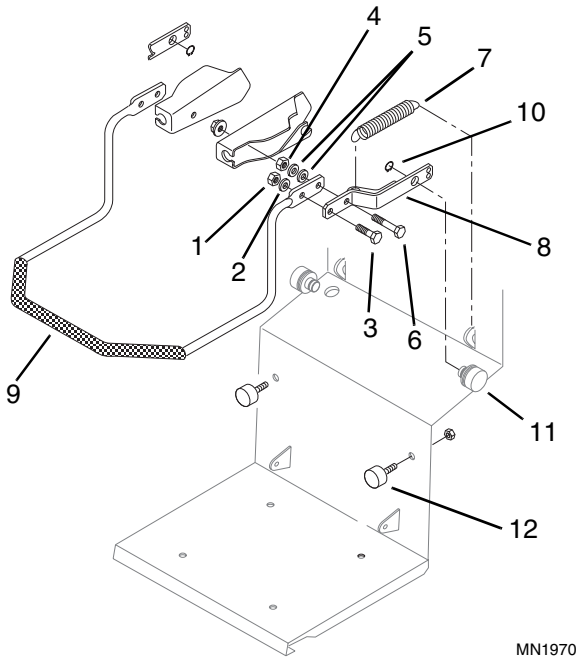

Figure 9-97 Seat Restraint Bar

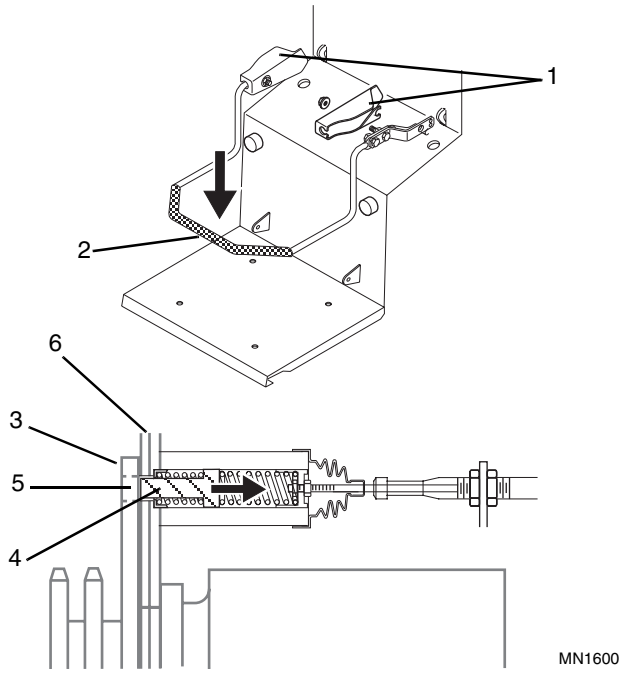

Figure 9-98 Park Lock - Disengaged

c. Assembly

***Note: DO NOT** reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

1. Position both restraint bar pivot arms (Fig. 9-97, 8) on the pivot mounts (11), and secure with retaining rings (10).
2. Install the restraint bar (Fig. 9-97, 9) on both restraint bar pivot arms (8) using capscrew (6), flat washers (5) and new hex elastic locknut (4) inserted into the rear holes, but NOT tightened.
3. Connect spring (Fig. 9-97, 7) on each side between the restraint bar pivot arm (8) and seat platform.
4. Install a capscrew (Fig. 9-97, 3), flat washer (2) and new hex elastic locknut (1) in the front of each restraint bar pivot arm and tighten.
5. Tighten the capscrew (Fig. 9-97, 6), flat washers (5) and hex elastic locknut (4) left loose in Step 2.
6. Reconnect both park lock cables and check the adjustment of both park lock pins. With the seat restraint covers (Fig. 9-98, 1) still removed, lower the seat bar (2).

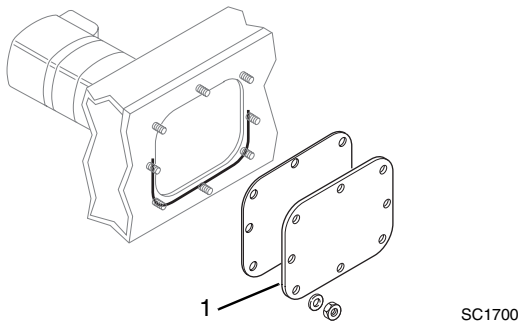

Figure 9-99 Access Cover Installation

7. Remove both side chain case access covers (Fig. 9-99, 1) to gain access to the drive sprocket (Fig. 9-98, 3) and the end of the park lock pin (4).
8. Inspect to see that both pins (Fig. 9-98, 4) have fully retracted from the hole (5) in drive sprocket (3) and should be flush with the edge of the chaincase wall (6).

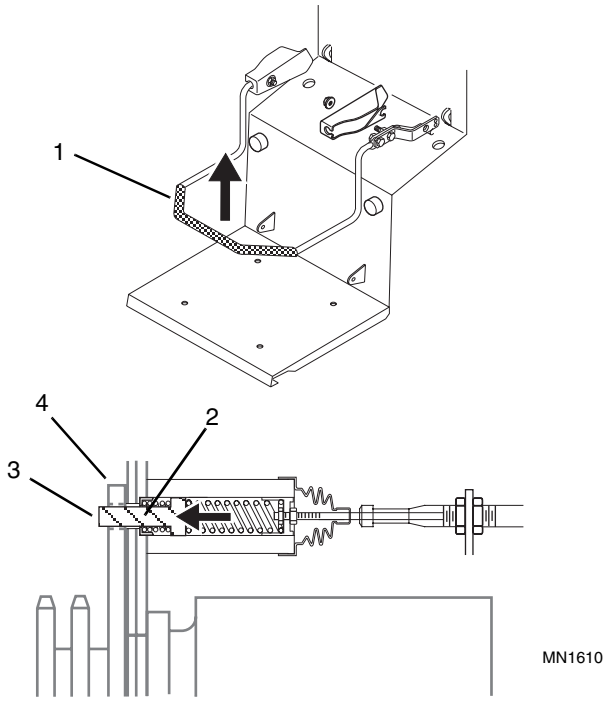

Figure 9-100 Park Lock - Engaged

9. Raise seat bar (Fig. 9-100, 1).
10. Inspect to see that both pins (Fig. 9-100, 2) have fully extended through the hole (3) in its respective drive sprocket (4).
11. If the pin operation is NOT CORRECT, skip to Step 13.
12. If pin operation IS CORRECT, skip to Step 23.

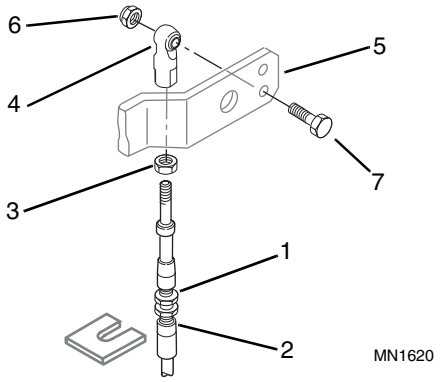

Figure 9-101 Park Lock Cable Operator Protective Structure Mount

13. Inspect both park lock cables where they mount to the rear of the Operator's Protective Structure. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-101, 1 & 2) on each cable. If not, readjust as required until they are equal.
14. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

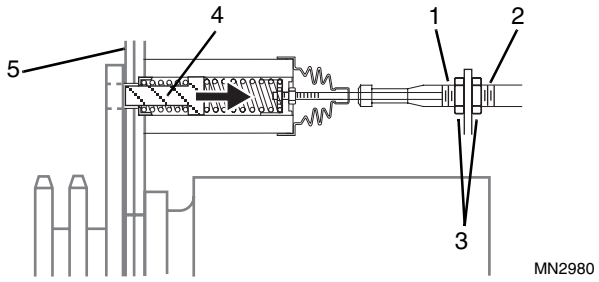

Figure 9-102 Park Lock Cable Chassis Mount

15. Inspect both park lock cables where they mount to the chassis. An equal number of threads should be visible on each side of the bulkhead nuts (Fig. 9-102, 1 & 2) on each cable. If not, readjust the bulkhead nuts (3) as required until the visible threads are equal.
16. Lower the seat bar to retract both lock pins (Fig. 9-102, 4). The face of each lock pin (4) must be flush with the inner wall of each respective chain case (5) with the seat bar lowered. The lock pin position is adjusted by moving the ball joint (Fig. 9-101, 4) on the cable end at the seat restraint bar pivot arm.

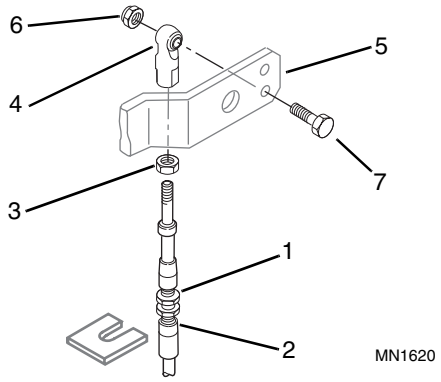

Figure 9-103 Park Lock Cable Operator Protective Structure Mount

17. At the rear of the seat bar, loosen the hex jam nut (Fig. 9-103, 3) against the ball joint (4).
18. Detach ball joint from seat restraint bar pivot arm (Fig. 9-103, 5) by removing the elastic locknut (6) and capscrew (7). Discard locknut.

Note: *The left cable connection at the rear of the seat bar will adjust the right park lock assembly. The right cable connection at the rear of the seat bar will adjust the left park lock assembly.*

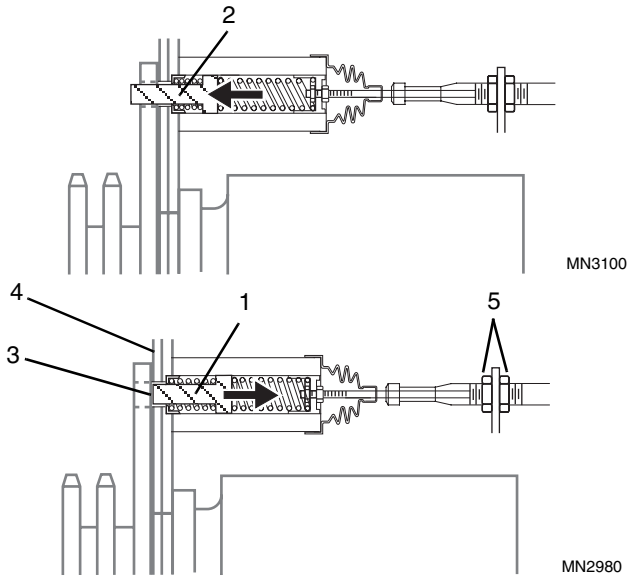

Figure 9-104 Park Lock Cable Chassis Mount

19. Turn the ball joint (Fig. 9-103, 4) onto the cable to retract either pin (Fig. 9-104, 1) away from the drive sprocket. Turn the ball joint toward the end of the cable to extend either pin (2) closer to the drive sprocket.
20. With the seat bar still lowered, temporarily attach both ball joints (Fig. 9-103, 4) to the seat restraint bar pivot arm (5) and inspect each pin position again. Repeat Step 19 as required until the face of the each lock pin (Fig. 9-104, 3) is flush with the inner wall of the respective chain case (4).
21. If either pin cannot be adjusted using Steps 17 through 20, loosen the cable housing bulkhead nuts (Fig. 9-104, 5), reposition the cable slightly and tighten the bulkhead nuts (5). Repeat Steps 17 through 20.

Note: DO NOT *reuse any elastic locknuts. Discard any elastic locknut(s) removed and replace with new.*

22. Secure each cables ball joint (Fig. 9-103, 4) to the seat restraint bar pivot arm (5) with capscrew (7) and a new elastic locknut (6). Tighten the hex jam nut (3) on each cable to the ball joint (4)

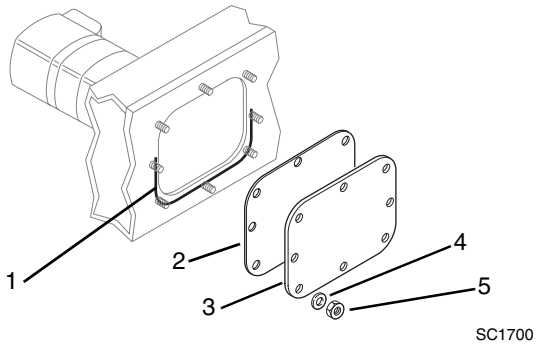

Figure 9-105 Access Cover Installation

23. Clean any sealer residue from the lower part of the access cover opening (Fig. 9-105, 1). Apply a new 1/8" bead of sealant (1) such as Permatex 2 RTV around the lower half of the opening.
24. Reassemble the cover gasket (Fig. 9-105, 2) and cover (3) to the side of the chain case using the lock washers (4) and new hex locknuts (5). Torque the eight locknuts to 14 lb/ft (19 Nm).
25. Lower the Operator's Protective Structure from the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").

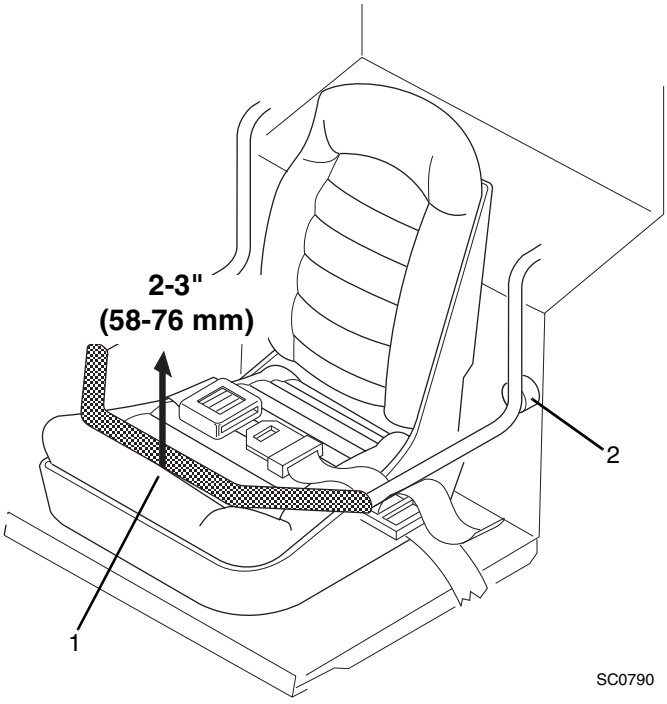

Figure 9-106 Loader Arm Lockout Micro Switch Adjustment

26. Check the loader arm lockout micro switch for proper adjustment. The seat bar (Fig. 9-106, 1) should be able to be raised 2-3" (58-76 mm) from the fully lowered position, with the bar resting against the rubber stops (2), before activating the loader arm lockout system.

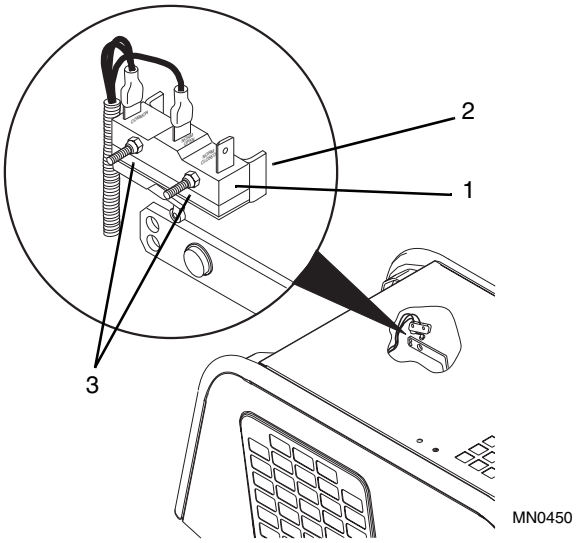

Figure 9-107 Seat Bar Micro Switch

If an adjustment is required, proceed as follows:

a. Remove two plastic plugs on the left side of the cab to access the capscrews that secure the micro switch (Fig. 9-107, 1) to its mounting bracket (2). Loosen both locknuts (3) on the inside of the cab, until the micro switch can be repositioned using a slight hand force.

b. Reposition the micro switch (Fig. 9-107, 1) in small increments, rechecking the seat bar travel required to activate the switch (1) with every move. When the seat bar travel (Fig. 9-106, 1) is within 2-3" (58-76 mm), tighten the two locknuts (3) securely.

c. Replace the plastic hole plugs on the left side of the cab.

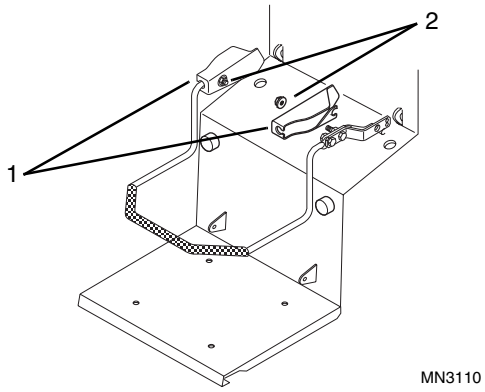

Figure 9-108 Restraint Bar Spring Cover Installation

27. Install the left (Fig. 9-108, 1) and right restraint bar covers, and secure with a hex flange nut (2) on each side.

9.6 REAR DOOR AND ENGINE COVER

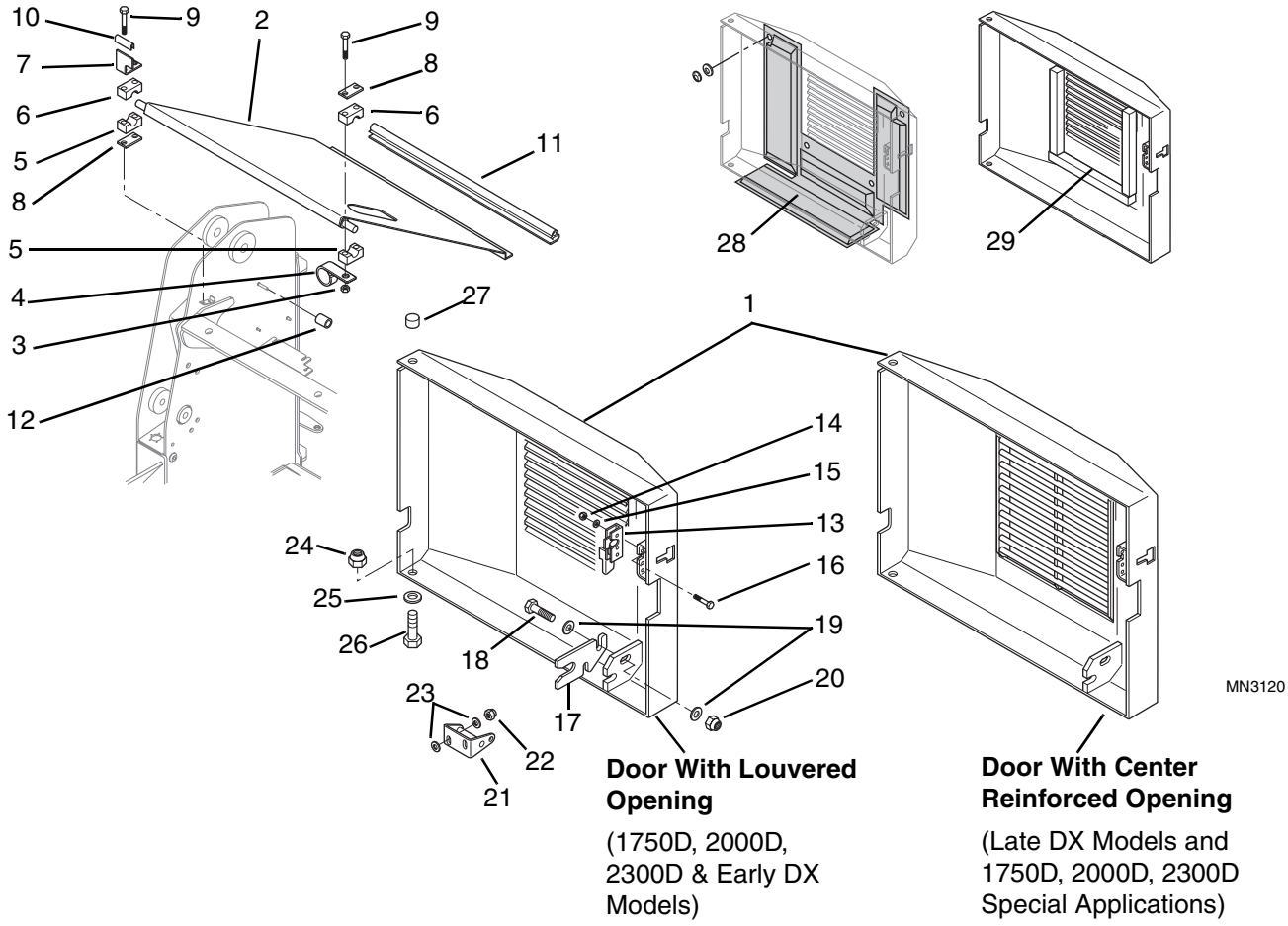

Figure 9-109 Rear Door and Engine Cover

9.6.1 Rear Door and Engine Cover Maintenance

a. Removal

1. Unlock and open the rear door (Fig. 9-109, 1), and raise the engine cover (2).
2. If necessary to remove the engine cover (Fig. 9-109, 2), remove the hex elastic locknuts (3), J-clamp (4) on left side and clamp cover plate (8) on right side, lower half clamps (5), upper half clamps (6), stop plate (7) on right side and clamp cover plate (8) on left side, and capscrews (9). Remove the engine cover.
3. To remove the door latch (Fig. 9-109, 13), remove the hex elastic locknuts (14), flat washers (15), and capscrews (16).
4. To remove the door stop (Fig. 9-109, 17), remove the hex elastic locknuts (20), flat washers (19), and capscrews (18).
5. To remove the door striker (Fig. 9-109, 21), remove the hex elastic locknuts (22), and flat washers (23).
6. If necessary to remove door (Fig. 9-109, 1), use suitable lifting equipment. Position two slings or straps of adequate capacity through each end of the top louver on either door style. Raise the lifting equipment to remove any slack in the slings or straps.
7. Remove the hex elastic locknut (Fig. 9-109, 24), flat washer (25), capscrew (26), and plastic cap (27).
8. Lift the door (Fig. 9-109, 1) up and off of the upper pivot pin (part of vehicle frame).

b. Inspection

1. Inspect all parts for damage or wear. Repair or replace as required.
2. Inspect the moulding (Fig. 9-109, 10), seal bulb (11), rubber hose bumper (12), sound panels (28) or door gaskets (29) where applicable, for wear. Replace if necessary.

Note: *If the door is to be replaced, removal of the door gasket strips (Fig. 9-109, 29) or sound panels (28) without damage, is unlikely. Therefore, it will be necessary to install new door gasket strips or sound panels on the replacement door if either were originally used.*

c. Installation

Note: ***DO NOT*** *reuse any elastic locknuts. Replace all hex elastic locknuts removed with new parts.*

1. Position two slings or straps of adequate capacity through each end of the top louver on either door style. Using suitable lifting equipment, raise the door up and onto the upper pivot pin.

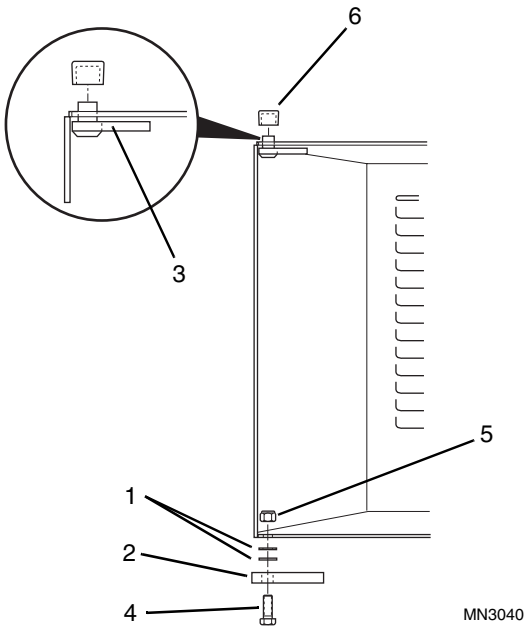

Figure 9-110 Rear Door Shimming

2. Using flat washers (Fig. 9-110, 1) as required, shim the door above the lower mount (2), to raise the top of the door off of the upper deck support (3). Install the capscrew (4), flat washers (1) as required, and new hex elastic locknut (5) and tighten securely. Install the plastic cap (6) on the upper pivot pin.
3. To replace the door stop (Fig. 9-109, 17), install capscrews (18), flat washers (19), and stop (17) on the door mount. Add other flat washers (19) and new hex elastic locknuts (20) to secure door stop in place.
4. Adjust the door stop (Fig. 9-109, 17) as required for smooth door operation and tighten securely.
5. To replace the door latch (Fig. 9-109, 13), install the capscrews (16), latch (13), flat washers (15), and new hex elastic locknuts (14). DO NOT tighten.
6. To replace the door striker (Fig. 9-109, 21), install flat washers (23), striker (21), flat washers (23), and new hex elastic locknuts (22). DO NOT tighten.
7. Adjust the door latch (Fig. 9-109, 13) and striker (21) as required for smooth latch operation and tighten securely.
8. If the engine cover (Fig. 9-109, 2) was removed, replace by installing the capscrews (9), clamp cover plate (8) on left side and stop plate (7) on right side , upper half clamps (6), the cover (2), lower half clamps (5), J-clamp (4) on left side and clamp cover plate (8) on right side, and new elastic locknuts (3).

Note: *Check the holding tension of the half clamps by lifting the cover (Fig. 9-109, 2) up to a vertical position. The clamps should be tight enough to hold the cover in this position. The clamps should NOT be tight to the point that the cover requires excessive force to move. Adjust as required for proper operation.*

9. Lower the engine cover (Fig. 9-109, 2). Close and lock the rear door (1).

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Section 10
Engine

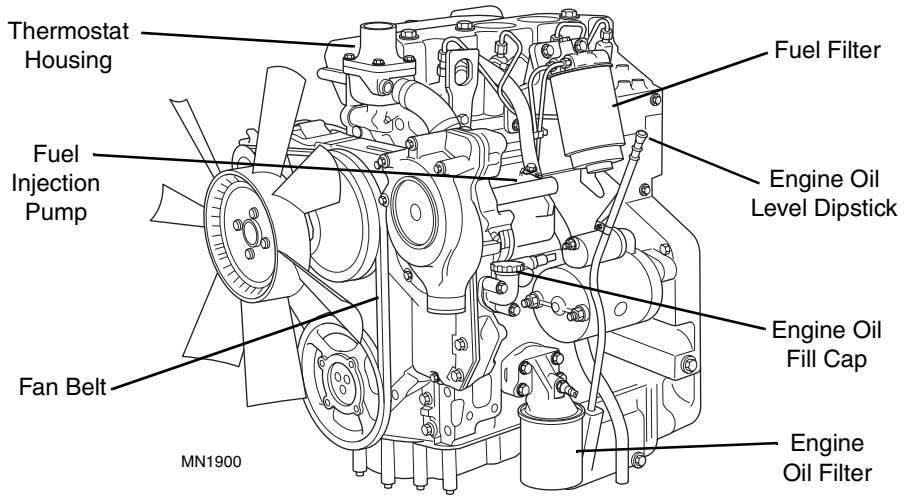
Contents

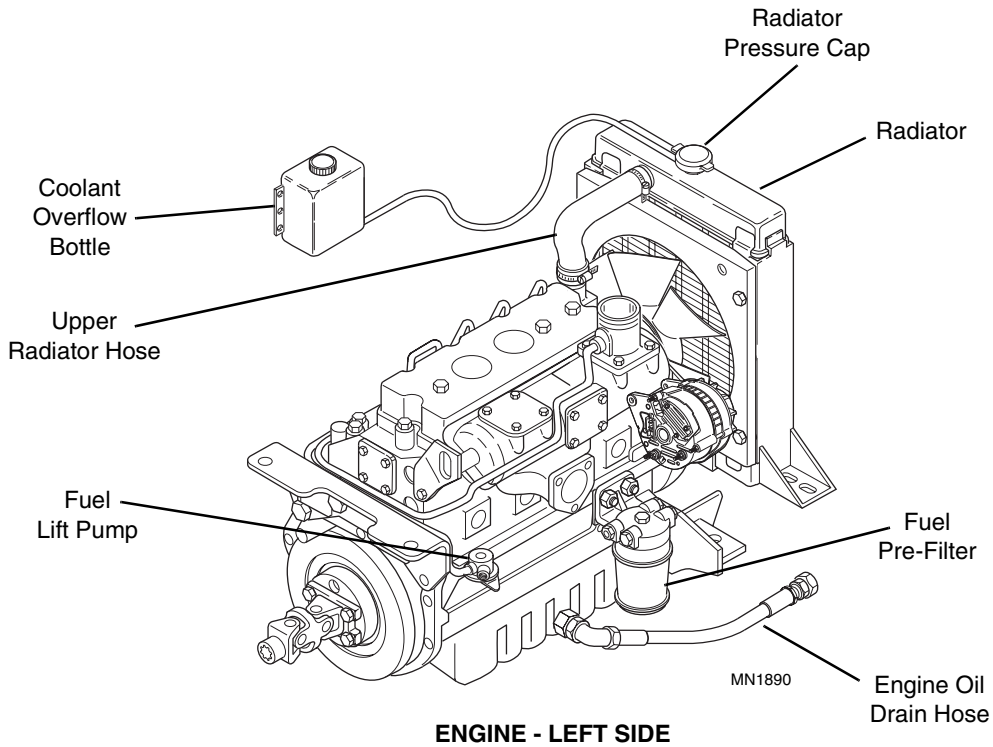
(Continued on next page)

10.1 ENGINE TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the engine components. The following illustration identifies the components that are referred to throughout this section.

ENGINE - RIGHT SIDE





ENGINE - LEFT SIDE

10.2 SAFETY CONSIDERATIONS

WARNING:

To protect yourself and others:

- **DO NOT** smoke or operate engine during refueling.
- **DO NOT** operate engine in the presence of a fuel spill or gas leak. Such combustible vapors when drawn into the engine can cause engine overspeeding, an explosion, fire and extensive personal injury and property damage. Before you operate in any hazardous environment consult a recognized authority in this field such as your engine distributor.
- **DO NOT** remove radiator cap while engine and coolant are hot; coolant under pressure is dangerous and can injure the eyes and cause severe burns.
- **DO NOT** use salt water or other corrosive liquid in the cooling system.
- **DO NOT** pull or pry on the fan blades. This practice will damage the fan blades and cause fan failure. Use only approved methods and tools for manually rotating the engine.
- **DO NOT** operate, clean, lubricate or adjust engine without correct training.
- **DO NOT** permit loose clothing, long hair, etc., near moving parts.
- Keep away from parts which rotate; fan blades can appear invisible when fan is rotating.
- At any time only one person must be in control of engine.
- Clear all persons from the immediate area during engine and loader operation.
- Be sure engine operation will not produce a concentration of toxic emissions.
- Operate well within the stability limits of the equipment.
- Work area must support the weight of the equipment plus the weight of the load.
- Wear protective glasses and protective shoes.
- **DO NOT** work on engine or equipment that is supported ONLY by lift jacks or a hoist; use blocks or special stands.
- To avoid burns, be alert for components which remain hot after power is turned off or disconnected.
- Corrosion inhibitor contains alkali. **DO NOT** get the substance in your eyes. Avoid prolonged or repeated contact with skin. **DO NOT** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Get medical assistance immediately. Keep out of the reach of children.
- Make only adjustments and repairs you understand.
- Before beginning any adjustments or repairs, place a "**DO NOT OPERATE**" tag in the operator's compartment and on the controls, disconnect negative cable from batteries.
- Relieve pressure in fuel, oil, cooling and hydraulic lines before servicing; get medical assistance immediately if a high pressure jet of fuel, oil, antifreeze or hydraulic system oil strikes your skin.
- Keep sparks and fire away from batteries; batteries produce hydrogen gas which can explode and cause severe personal injury and property damage.
- Battery fluid can burn the skin and injure the eyes. If you come in contact with battery acid, flush skin with large amounts of water and get medical assistance immediately.
- Always use the same fastener part number (or equivalent) when replacing fasteners. **DO NOT** use a fastener of lesser quality if replacement is necessary.
- Never use gasoline or other flammable materials when cleaning parts; use an approved cleaning solvent.
- Diesel fuel can irritate the skin; use gloves or a protective hand lotion.
- Avoid prolonged and repeated skin contact with new and used engine oil. This contact may cause skin disorders and bodily injury. Wash thoroughly after contact and keep out of the reach of children.

10.3 DISCLAIMER AND SCOPE

These instructions are written for world wide use. In territories where legal requirements govern engine smoke emission, noise, safety factors etc., then all instructions, data and dimensions given must be applied in such a way that, after servicing (preventive maintenance) or repairing the engine, it does not contravene the local regulations when in use.

IMPORTANT: *These instructions cover only the routine maintenance of the engine. Refer to your Perkins Engine Distributor for engine diagnosis, repair and component replacement.*

A gradual running in of a new engine is not necessary. Full load can be applied to a new engine as soon as the engine is put into service and the coolant temperature is at least 140° F (60° C). Extended light load operation during the early life of the engine is not recommended. **DO NOT** run engine at high no load speeds. **DO NOT** apply an overload to the engine.

10.4 STANDARD PRACTICES

Cleanliness is very important during the repair of a diesel engine. Contamination of the engine during repair will reduce the life of an engine.

Gaskets should be replaced and gasket faces should be cleaned, where applicable.

In reassembly and inspection, all parts are to be thoroughly cleaned, and where present, burrs and scale are to be removed.

Any open ports of high precision components such as fuel system equipment, exposed by removal or disassembly, should be covered until reassembled to prevent the entry of foreign material.

Use a suitable sealant such as Loctite when installing screws into “through” holes in the interior of the engine. Refer to Perkins Engine Workshop Manual for specific type.

Note: *Screw threads which have been sealant coated can be identified by their red, blue, etc. color.*

There are a variety of thread types used on the Perkins engine. Refer to the Perkins Workshop Manual for specific requirements regarding fastener and pipe/plug threads and torques.

10.5 ENGINE MAINTENANCE

10.5.1 Left and Right Sides of Engine

Throughout this section, the left or right side of the engine are identified by the operator facing forward while seated in the operators seat (normal operating position).

10.5.2 Maintenance Intervals

The engine will require maintenance:

- Daily or 10 Hours
- At First 50 Hours
- 250 Hours
- 500 Hours
- 1000 Hours

Use shorter intervals if ambient temperature is consistently below 0° F (-18° C), above 100° F (38° C), if frequent stops are made or if you are operating in a dusty environment. Consult your engine distributor for recommended intervals.

10.6 ENGINE MAINTENANCE - DAILY BEFORE OPERATING OR EVERY 10 HOURS

10.6.1 Inspect the Engine

1. With vehicle on a level surface, implement grounded, and engine shut OFF, unlock and open rear engine compartment door and lift engine cover.
2. Look for any change in engine appearance such as leaks, loose or damaged parts, and worn or damaged belts.
3. Check the fan for cracks, nicked or bent blades. Make sure it is securely mounted and capscrews are tightened. Replace fan if damaged.
4. Inspect the air intake piping for cracked hoses, loose clamps, and punctures. Tighten or replace parts as necessary to make sure the air intake system does not leak.

10.6.2 Check Engine Oil Level

OF0690

1. With the vehicle on a level surface, implement grounded, and engine shut off, unlock and open rear engine compartment door and lift engine cover.

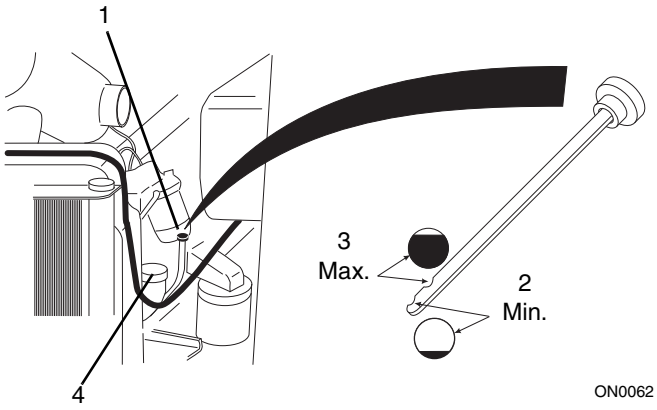


Figure 10-1 Engine Oil Level Dipstick

2. Remove dipstick (Fig. 10-1, 1) and check oil level on dipstick. Oil should be between the minimum (2) and maximum (3) oil level marks on the dipstick.
3. If oil is below the minimum mark (Fig. 10-1, 2), remove the crankcase oil filler cap (4), and add 10W30 motor oil that is equal to API, CD or CE specifications. Recheck the dipstick oil level, and add additional oil until the proper level is achieved. Replace the dipstick, lower the engine cover, and close and lock engine compartment door.

10.6.3 Check Engine Coolant Level

OF0700

1. With the vehicle on a level surface, the implement grounded, and engine shut OFF, unlock and open rear engine compartment door and lift the engine cover.

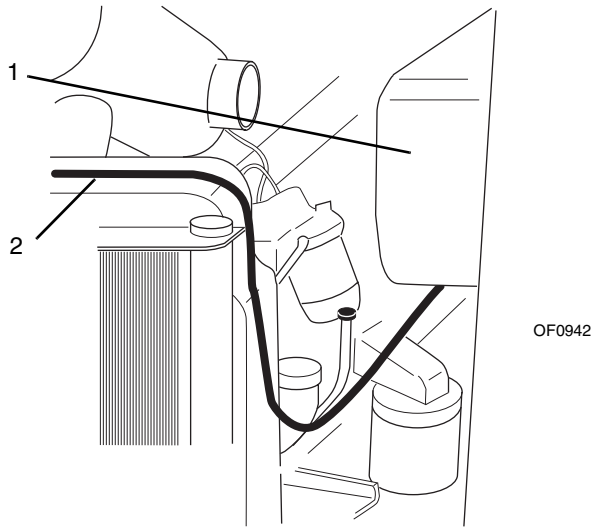


Figure 10-2 Check Coolant Overflow Bottle Level

2. Check level of coolant in overflow bottle (Fig. 10-2, 1) on the right side of the engine compartment. When the coolant is hot, the bottle should be 1/2 to 3/4 full. When cool, the bottle should be 1/4 to 1/2 full. Remove cap from bottle and pour a 50/50 mixture of ethylene glycol and water as required into the bottle and replace the cap.

WARNING: To prevent personal injury, never remove radiator cap while the cooling system is hot. The system is under pressure and escaping coolant can cause severe burns and eye injury. Wear Safety Glasses. Turn cap slowly to the first stop and allow pressure to escape before removing cap completely.

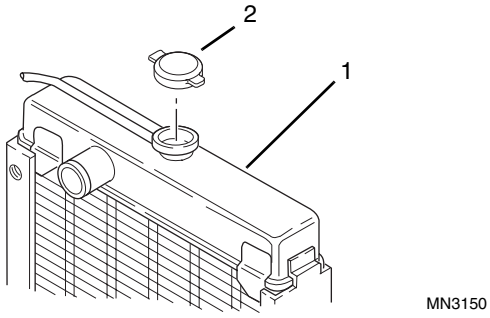


Figure 10-3 Check Engine Radiator Coolant Level

3. Periodically check the level of coolant in the radiator (when the system is cool) by slowly turning the radiator cap to the first stop to release any pressure in the system. Remove the cap completely and fill the radiator (Fig. 10-3, 1) with coolant if necessary and replace the cap.

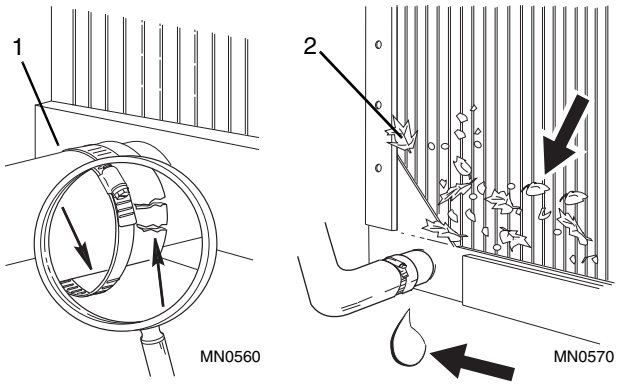


Figure 10-4 Check Radiator Cooling Fins and Hoses

If the coolant level in the radiator was low and the overflow bottle still contained coolant you will need to check the radiator hoses (Fig. 10-4, 1) for loose clamps, cracking, or other signs of damage. Check the hose (Fig. 10-2, 2) between the radiator and the overflow bottle also for loose clamps, cracking, or other signs of damage. Replace any hose or clamp found to be damaged, so coolant can properly siphon to and from the overflow bottle.

4. Inspect the radiator cooling fins for damage and debris (Fig. 10-4, 2). Repair any damage and, if necessary, remove debris between the fins by using compressed air.

IMPORTANT: *DX MODELS ONLY require pivoting the engine oil cooler to access the rear of the radiator for inspection and cleaning. Proceed to Step 5 or Step 6 to access the radiator.*

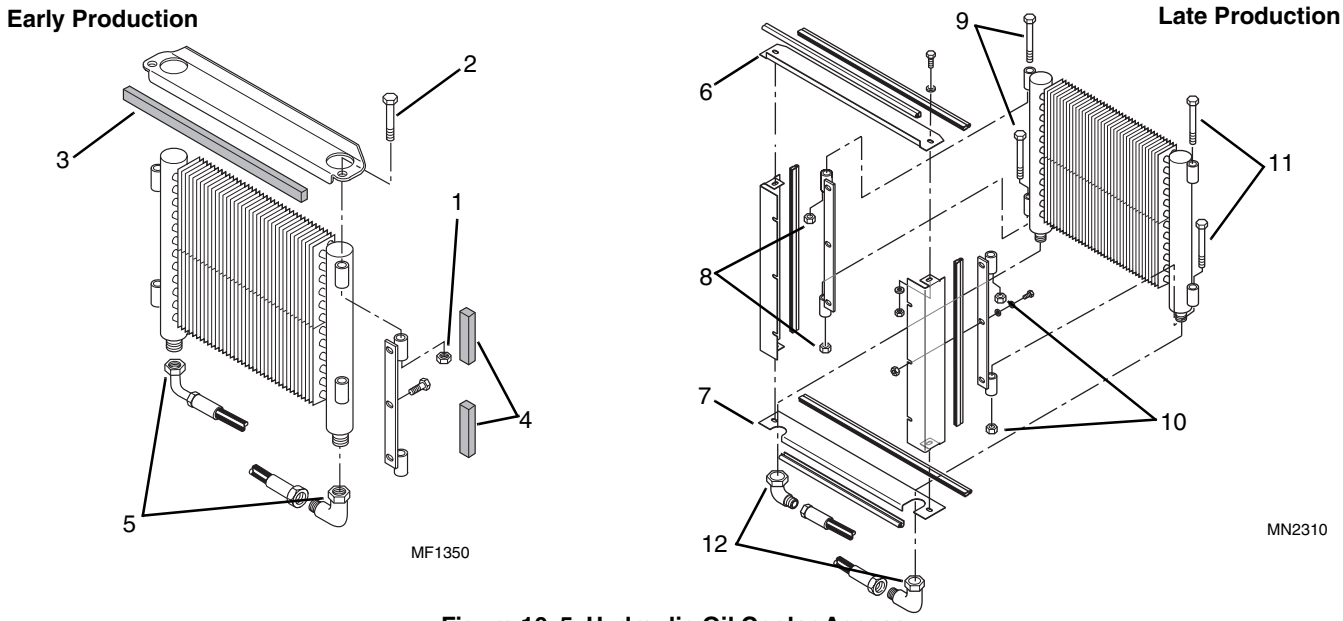


Figure 10-5 Hydraulic Oil Cooler Access (Model 2000DX & 2300DX Only)

5. Early Production DX MODELS ONLY:
   a. Loosen the hydraulic fittings (Fig. 10-5, 5) on the bottom of the cooler only enough to allow the cooler to pivot.
   b. Loosen and remove both hex elastic locknuts (Fig. 10-5, 1) and capscrews (2) securing the oil cooler to the radiator on the left side.
   c. Loosen both hex elastic locknuts and capscrews securing the cooler to the radiator on the right side, and pivot the cooler out far enough to clean debris from between the cooler and radiator.

IMPORTANT: *Check for the presence of foam strips (Fig. 10-5, 3 & 4) between the cooler and radiator and on rear door. These strips are critical to the performance of the vehicle.*

   d. Inspect and clean debris from between the cooler and radiator.
   e. Swing the cooler back into place and reinstall and tighten all cooler mounting hardware (Fig. 10-5, 1 & 2).
   f. Torque the hydraulic fittings (Fig. 10-5, 5). Refer to Section 2.8, “Torques.”

6. Late Production DX MODELS ONLY:
   a. Remove the hardware securing the top baffle (Fig. 10-5, 6), and remove the baffle.
   b. Remove the hardware securing the bottom baffle (Fig. 10-5, 7), and remove the baffle.
   c. Loosen the hydraulic elbow fittings (Fig. 10-5, 12) on the bottom of the cooler only enough to allow the cooler to pivot.
   d. Remove both hex elastic locknuts (Fig. 10-5, 8) and capscrews (9) securing the oil cooler to the radiator on the right side.
   e. Loosen both hex elastic locknuts (Fig. 10-5, 10) and capscrews (11) securing the oil cooler to the radiator on the left side.
   f. Pivot the cooler out far enough to inspect and clean debris from between the cooler and radiator.
   g. Swing the cooler back into place and reinstall and tighten all cooler mounting hardware (Fig. 10-5, 8 through 11).
   h. Torque the hydraulic fittings (Fig. 10-5, 12). Refer to Section 2.8, “Torques.”
   i. Replace both baffles (Fig. 10-5, 6 & 7) and tighten the hardware securely.
7. Lower the engine cover, and close and lock the door.

10.6.4 Fill Fuel Tank

WARNING: Engine fuel is ***flammable*** and can cause a fire or an explosion. To prevent personal injury or death, keep sparks, open flames and smoking materials away from the vehicle during refueling or servicing of the fuel system.

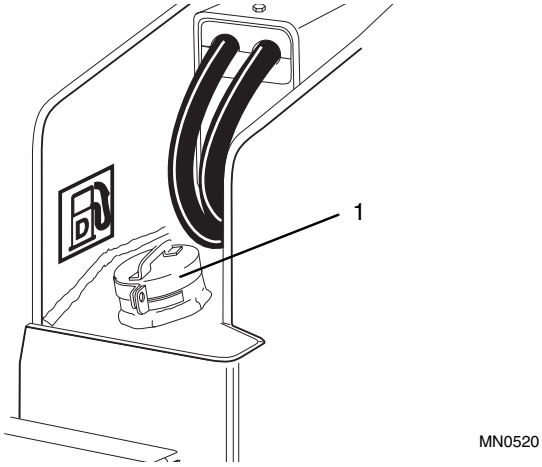


Figure 10-6 Fuel Fill Cap

1. Unlock and remove the fill cap (Fig. 10-6, 1) and fill the fuel tank with Diesel Fuel that meets or exceeds the following requirements:
   - When operating at temperatures above 32° F (0° C) use standard No. 2 diesel fuel.
   - When operating at temperatures below 32° F (0° C), use a blend of No. 1 and No. 2 diesel fuels, most commonly known as “winterized” No. 2 diesel fuel.

Note: *Use ASTM No. 2 diesel fuel with a minimum Cetane number of 45. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 45 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.*

2. Tank capacity for your specific model can be found in Section 11, “Specifications.”
3. Install and lock fill cap (Fig. 10-6, 1).

10.6.5 Check Air Cleaner Restriction Warning Light

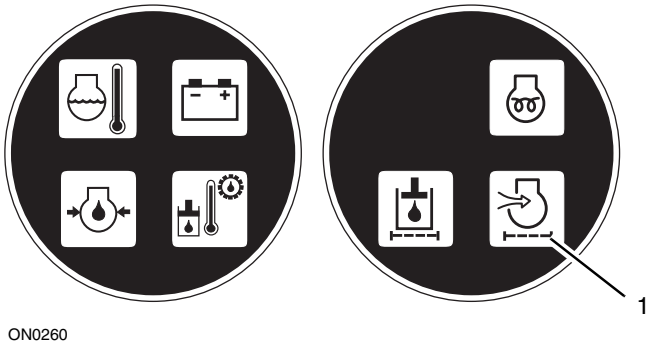


Figure 10-7 Air Restriction Indicator Light

Start the engine and check the air cleaner restriction light (Fig. 10-7, 1) in the warning light cluster. If light is ON and the filters are known to be clean, the switch may be faulty. For testing the air cleaner restriction light, refer to Section 8.3.2, “Warning Lights, Warning Light Alarm and Switches”).

10.6.6 Check Air Cleaner Vacuator Valve

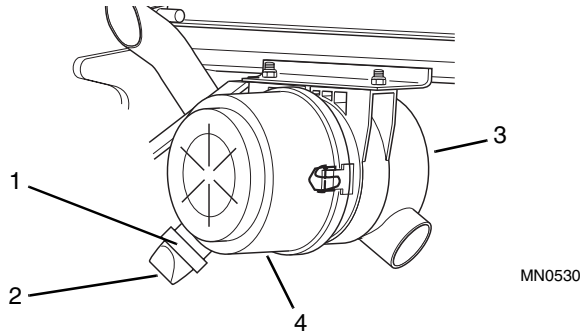


Figure 10-8 Air Cleaner Vacuator Valve and Housing

Remove dust and dirt from the vacuator valve (Fig. 10-8, 1). The lips (2) of the automatic dust ejector must close but not adhere or stick together.

10.6.7 Filter and Air Intake Check

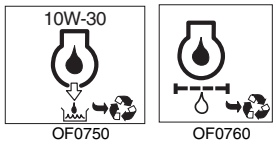
1. Start the engine and check the air cleaner restriction light (Fig. 10-7, 1) in the warning light cluster. If light is ON, filter must be replaced.

IMPORTANT: *Only remove canister cover to service the elements as restriction indicator indicates or during scheduled maintenance intervals. Excessive access to check an element can lead to premature element failure and increase the possibility of dirt entering the engine.*

2. Ground implement and shut off engine.
3. Remove dust from vacuator valve (Fig. 10-8, 1) by squeezing bottom of vacuator (2) to allow loose particles to fall out. Replace elements, if required (Refer to Section Fig. 10.9.4, “Change Air Filter Elements”).
4. Inspect the engine air cleaner canister (Fig. 10-8, 3), canister cover (4), and all intake piping for cracked hoses, loose clamps, or punctures which can damage the engine. If necessary, tighten or replace parts to prevent air intake system leakage.

10.7 ENGINE MAINTENANCE FIRST 50 HOURS

10.7.1 Engine Oil and Filter Change



1. Operate engine until warm (approximately 5 minutes).
2. Park the vehicle on a level surface, ground implement, shut off engine, unfasten seat belt, raise the seat bar, and exit the vehicle using the hand-holds.

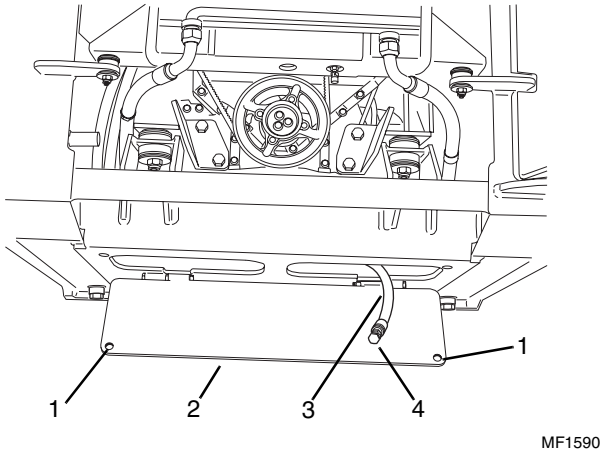


Figure 10-9 Engine Oil Drain

3. Remove two capscrews (Fig. 10-9, 1) holding the access plate (2) to the underside of the vehicle frame and swing the plate down.
4. Locate the drain hose (Fig. 10-9, 3) above the access plate. Place a suitable receptacle under the end of the drain hose, remove the drain hose plug (4) and allow the oil to drain into the receptacle.
5. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling facility.
6. Clean and re-install drain hose plug (Fig. 10-9, 4) onto the drain hose (3).

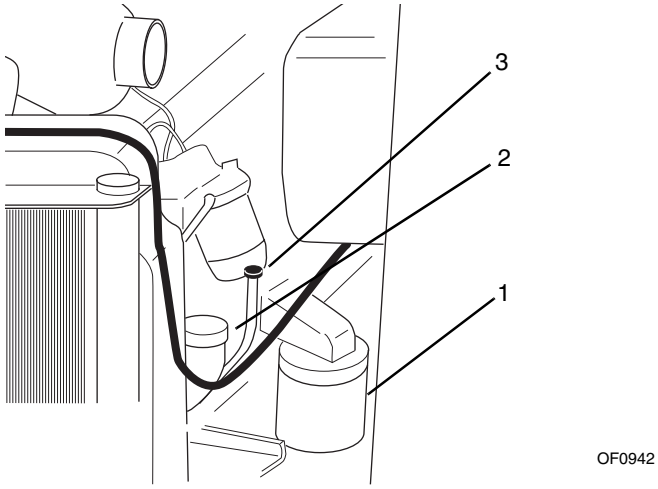


Figure 10-10 Engine OIl Filter

7. Remove oil filter element (Fig. 10-10, 1) by accessing the filter through the access plate opening. A strap or chain filter wrench may be required. Dispose of the used filter at an approved recycling facility.
8. Clean filter sealing surface.
9. Apply a thin coat of clean engine oil to seal on new filter.
10. Install the new oil filter and tighten 1/2 turn after initial contact.
11. Remove oil fill cap (Fig. 10-10, 2) and add 10W30 motor oil that is equal to API, CD or CE specifications. **DO NOT** over-fill. Engine oil capacity for your specific model can be found in Section 11, “Specifications.”
12. Start engine and run for several minutes.
13. Shut off engine. Let the oil drain back for a few minutes. Check oil level on dipstick (Fig. 10-10, 3) and check for leaks at filter (1) and drain hose plug. Re-tighten filter and drain cap if necessary.
14. Swing the access plate (Fig. 10-9, 2) up and secure with capscrews removed earlier, lower the engine cover, and close and lock engine compartment door.

10.7.2 Inspect Fan Belt and Check Fan Belt Tension

1. With vehicle on a level surface, implement grounded and the engine shut off, unlock and open the rear engine compartment door and lift the engine cover.

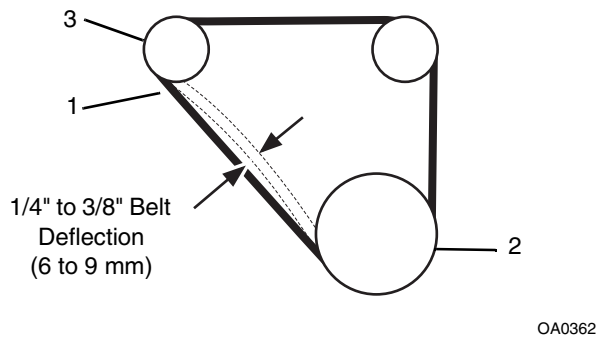


Figure 10-11 Engine Fan Belt

2. Inspect the fan belt (Fig. 10-11, 1) for cracking or fraying. Replace the belt if any damage is noted.
3. Check the belt tension midway between the crankshaft (Fig. 10-11, 2) and alternator pulleys (3). Deflection should be 1/4" to 3/8" (6 to 9 mm) with an applied force of 13 to 15 lb (6 to 7 kg).
4. Lower the engine cover, and close and lock engine compartment door.

10.8 ENGINE MAINTENANCE EVERY 250 HOURS

All checks or inspection listed under daily (or 10 Hour) maintenance intervals must also be performed at this time in addition to those listed under this maintenance interval.

10.8.1 Inspect Fan Belt and Check Fan Belt Tension

1. With vehicle on a level surface, implement grounded and the engine shut off, unlock and open the rear engine compartment door and lift the engine cover.

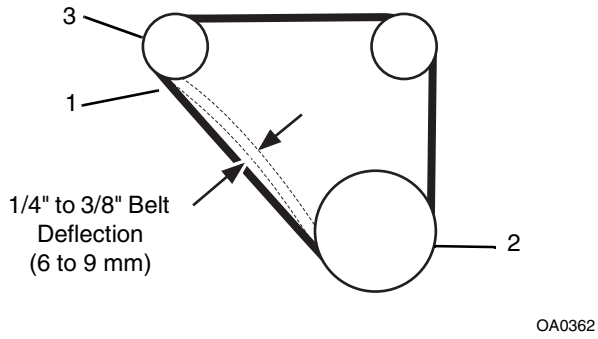


Figure 10-12 Engine Fan Belt

2. Inspect the fan belt (Fig. 10-12, 1) for cracking or fraying. Replace the belt if any damage is noted.
3. Check the belt tension midway between the crankshaft (Fig. 10-12, 2) and alternator pulleys (3). Deflection should be 1/4" to 3/8" (6 to 9 mm) with an applied force of 13 to 15 lb (6 to 7 kg).
4. Lower engine cover, and close and lock engine compartment door.

10.8.2 Drain Fuel From Water Separator

1. Unlock and open engine compartment door and raise engine cover.

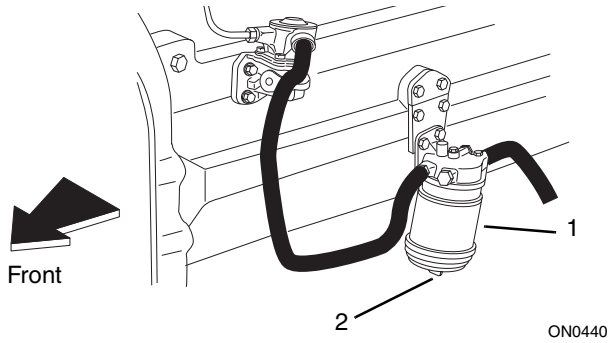


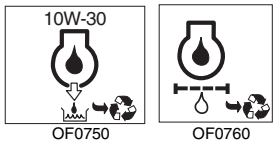
Figure 10-13 Drain Fuel Pre-Filter

2. The fuel pre-filter/water separator (Fig. 10-13, 1) is located on the left side toward rear of engine.
3. Open the drain valve (Fig. 10-13, 2) on the underside of the water separator.
4. Drain into a suitable container any collected water from the valve, until only clean fuel comes from the drain.
5. Close the drain valve (Fig. 10-13, 2).
6. Transfer the fuel/water collected to a container with a cover and label the container as “Diesel Fuel.” Dispose of the fuel at an approved recycling facility.
7. Lower the engine cover and close and lock the engine compartment door.

10.9 ENGINE MAINTENANCE EVERY 500 HOURS

All checks or inspections listed under previous maintenance intervals must also be performed at this time in addition to those listed under this maintenance interval.

10.9.1 Engine Oil and Filter Change



1. Operate engine until warm (approximately 5 minutes).
2. Park the vehicle on a level surface, ground implement, shut off engine, unfasten seat belt, raise the seat bar, and exit the vehicle using the hand-holds.

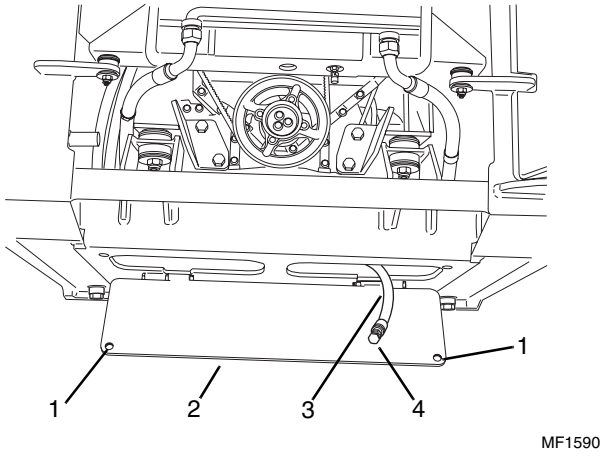


Figure 10-14 Engine Oil Drain

3. Remove two capscrews (Fig. 10-14, 1) holding the access plate (2) to the underside of the vehicle frame and swing the plate down.
4. Locate the drain hose (Fig. 10-14, 3) above the access plate. Place a suitable receptacle under the end of the drain hose, remove the drain hose plug (4) and allow the oil to drain into the receptacle.
5. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling facility.
6. Clean and re-install drain hose plug (Fig. 10-14, 4) onto the drain hose (3).

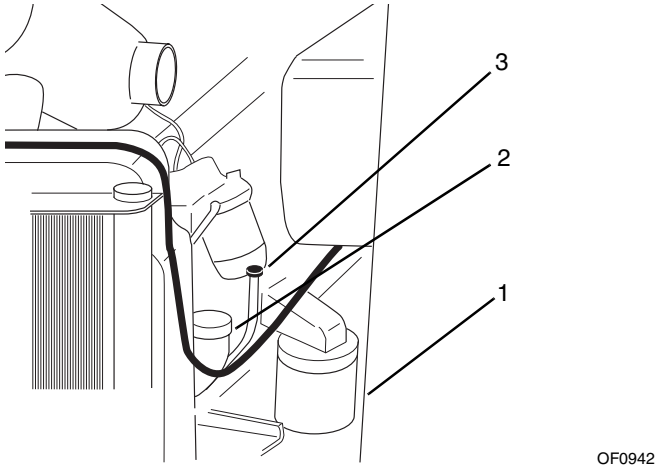


Figure 10-15 Engine Oil Filter

7. Remove oil filter element (Fig. 10-15, 1) by accessing the filter through the access plate opening. A strap or chain filter wrench may be required. Dispose of the used filter at an approved recycling facility.
8. Clean filter sealing surface.
9. Apply a thin coat of clean engine oil to seal on new filter.
10. Install the new oil filter and tighten 1/2 turn after initial contact.
11. Remove oil fill cap (Fig. 10-15, 2) and add 10W30 motor oil that is equal to API, CD or CE specifications. **DO NOT** over-fill. Engine oil capacity for your specific model can be found in Section 11, “Specifications.”
12. Start engine and run for several minutes.
13. Shut off engine. Let the oil drain back for a few minutes. Check oil level on dipstick (Fig. 10-15, 3) and check for leaks at filter (1) and drain hose plug. Re-tighten filter and drain cap if necessary.
14. Swing the access plate (Fig. 10-14, 2) up and secure with capscrews removed earlier, lower the engine cover, and close and lock engine compartment door.

10.9.2 Replace Fuel Filter Element

WARNING: Engine fuel is ***flammable*** and can cause a fire or an explosion. To prevent personal injury or death, keep sparks, open flames and smoking materials away from the vehicle during refueling or servicing of the fuel system.

1. Unlock and open engine compartment door and raise engine cover.

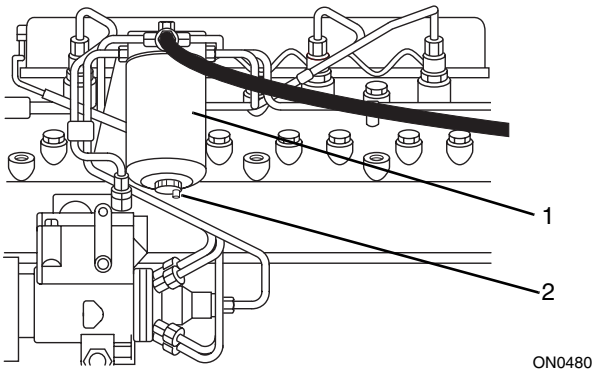


Figure 10-16 Fuel Filter

2. Clean outside surfaces of the filter assembly (Fig. 10-16, 1).
3. Open the drain valve (Fig. 10-16, 2) on underside of filter, and drain all fuel in the filter into a suitable container.
4. Close the drain valve and remove the filter.
5. Transfer the fuel/water collected to a container with a cover and label the container as “Water Contaminated Diesel Fuel.” Dispose of the filter and fuel at an approved recycling facility.
6. Lightly lubricate the gasket with clean diesel fuel. Fit the new filter to the filter head and hand tighten only. **DO NOT** over tighten.
7. Bleed air from the fuel system (Refer to Section 10.9.3, “How to Bleed the Fuel System”).

Note: *Marginal fuel cleanliness conditions will require fuel system service more frequently. Loss of engine power is often caused by dirty fuel filters.*

10.9.3 How to Bleed the Fuel System

Air must be vented from the fuel system whenever any part of the system between the fuel tank and injection pump has been disconnected for any reason, or when the system has been emptied of fuel.

IMPORTANT: DO NOT *start the engine until the injection pump has been filled and primed as the pump can be severely damaged due to lack of lubrication.*

Remove air from the fuel system as follows:

If bleeding the system after a fuel filter element change only:

1. Turn the ignition key to the RUN position.

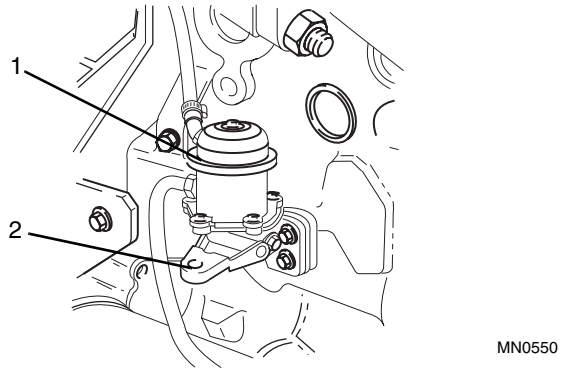


Figure 10-17 Fuel Lift Pump

WARNING: To avoid severe burns, **DO NOT** attempt the following procedures when engine is hot. Wait for engine and muffler to cool before proceeding.

2. Locate the fuel lift pump (Fig. 10-17, 1) on the left side toward the front of the engine. Pump the priming lever (2) on the fuel lift pump slowly for approximately two minutes, or until a moderate resistance is felt.

Note: *If the fuel lift pump cam is on or near maximum lift, it may not be possible to operate the priming lever. The engine should be momentarily turned over, without attempting to start, to reposition the lift pump cam, and repeat Step 2.*

3. Turn the ignition key to the START position to start the engine. Operate the engine at a moderate speed until any remaining air is gone and the engine runs smoothly.
4. Lower engine cover, close and lock engine compartment door.

If the system or a component in the system has been drained, or run out of fuel:

1. Turn the ignition key to the RUN position.

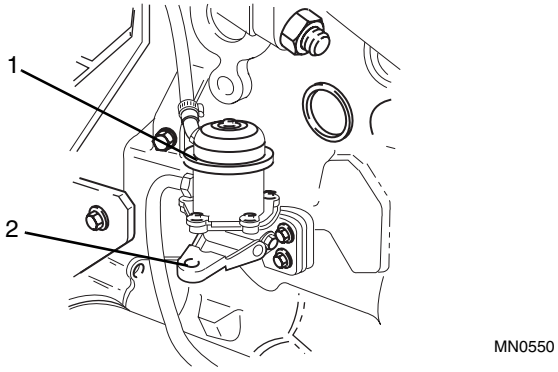


Figure 10-18 Fuel Lift Pump

WARNING: To avoid severe burns, **DO NOT** attempt the following procedures when engine is hot. Wait for engine and muffler to cool before proceeding.

2. Locate the fuel lift pump (Fig. 10-18, 1) on the left side toward the front of the engine. Pump the priming lever (2) on the fuel lift pump slowly for approximately two minutes, or until a moderate resistance is felt.

Note: *If the fuel lift pump cam is on or near maximum lift, it may not be possible to operate the priming lever. The engine should be momentarily turned over, without attempting to start, to reposition the lift pump cam, and repeat Step 2.*

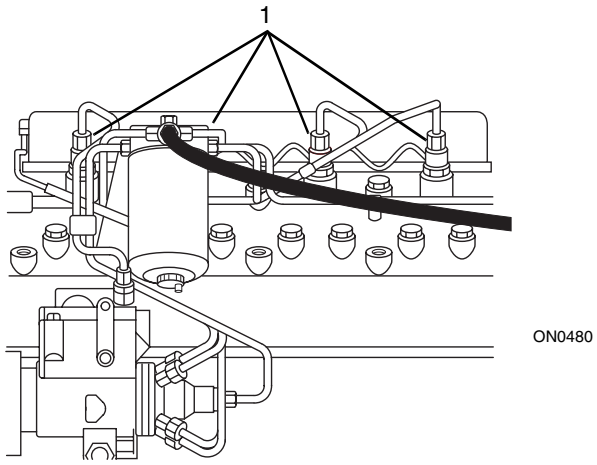


Figure 10-19 Fuel Injector High Pressure Piping

WARNING: Diesel fuel under pressure can penetrate the skin, and cause serious personal injury. Slowly loosen fittings and allow release of residual pressure before removing any fuel line.

3. Slightly loosen the high pressure connection on all four fuel injectors (Fig. 10-19, 1).
4. Operate the starter motor until fuel, free of air, comes out of the pipe connections. Tighten connections to 16 lb/ft (22 Nm).

IMPORTANT: ***DO NOT*** *crank starting motor for more than 15 seconds to avoid overheating the motor. Wait 30 seconds before cranking again.*

5. Turn the ignition key to the START position to start the engine. Operate the engine at a moderate speed until any remaining air is gone and the engine runs smoothly.
6. Lower engine cover, and close and lock engine compartment door.

10.9.4 Change Air Filter Element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All air cleaner manufacturers agree that attempting to clean or wash an air filter element increases the chance for element damage. It is highly recommended that you consider the value of cleaning an element against the risks which could lead to engine damage. Adopt the policy that all elements should be replaced with new and not cleaned. Cleaning the element will void the manufacturers warranty.

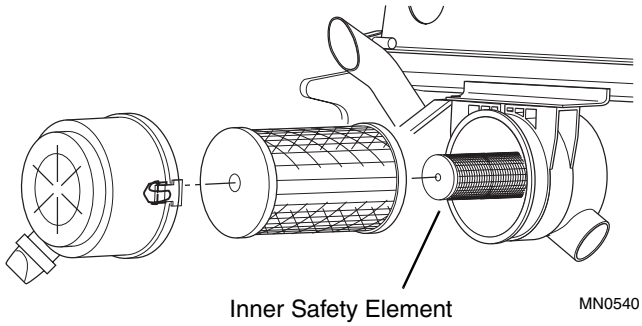

Figure 10-20 Air Cleaner Safety Element

IMPORTANT: *The air cleaner in this vehicle uses an inner safety element (Fig. 10-20). This safety element should never be reused. Always install a new element. Replace safety elements after every third primary element change. NEVER remove a safety element until you have thoroughly cleaned the inside of the air cleaner canister. This will prevent dirt, which could damage the engine, from entering the induction manifold.*

To change air filter elements:

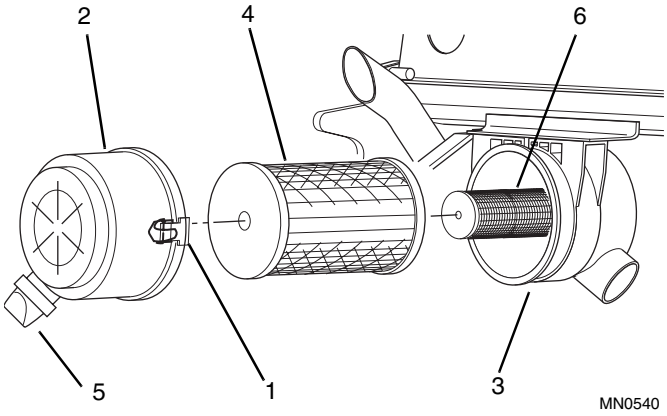

Figure 10-21 Air Cleaner Elements

1. Open the three retaining clips (Fig. 10-21, 1) and remove cover (2) from air cleaner canister (3).
2. The outer primary element (Fig. 10-21, 4) fits tightly over the outlet tube, creating a critical seal on the inside diameter of the element endcap. There will be some initial resistance, but gently release the seal on the primary element by moving the end of the element up and down and side to side or twist to break the seal.
3. Avoid dislodging dust from the primary element. Gently pull the element off the outlet tube and out of the housing. Avoid knocking the element against the housing. Inspect element for damage. Damaged elements should not be reused.
4. Thoroughly clean the interior of the air filter canister (Fig. 10-21, 3), canister cover (2) and vacuator valve (5).
5. Always clean the sealing surface of the outlet tube. Dust on the outside diameter of the outlet tube could hinder an effective seal and cause leakage. The old element can help detect foreign material on the sealing surface. A streak of dust on the clean side of the element is a telltale sign. Make sure that all contaminant is removed before the new element is inserted.
6. If replacing the inner safety element (Fig. 10-21, 6) at this time, follow the same removal procedure as when removing the primary element and carefully slide safety element out. ALWAYS discard this element and replace with a new element.
7. Always clean the inside of the outlet tube carefully. Dirt accidently transferred to the inside of the outlet tube will reach the engine and cause wear. This is the sealing surface for the safety element. Be careful not to damage the sealing areas on the inside or outside of the outlet tube.
8. Inspect all new elements for shipping damage. Pay attention to the inside of the open end on the primary element and the outside of the open end on the safety element (sealing areas). **DO NOT** install a damaged element.
9. Install the new element(s). To ensure a tight seal, apply pressure at the outer rim of the closed end of the each element as it is installed, not the flexible center.

Note: DO NOT *apply any type of petroleum product to the sealing surface of the filter in an attempt to get a more positive seal. This will cause sealing surface damage and allow dirt to by-pass the filter. Use a light film of liquid dish washing soap (Ivory, Dawn, etc.) on the sealing surface only.*

10. Position canister cover (Fig. 10-21, 2) in place and secure the retaining clips (1).

10.10 ENGINE MAINTENANCE EVERY 1,000 HOURS

All checks or inspections listed under previous maintenance intervals must also be performed at this time in addition to those listed under this maintenance interval.

10.10.1 Drain and Flush Radiator

OF0840

WARNING: To avoid severe burns, **DO NOT** attempt this procedure when the engine is hot. Wait for engine and muffler to cool before proceeding.

WARNING: To prevent personal injury, never remove radiator cap while the cooling system is hot. The system is under pressure and escaping coolant can cause severe burns and eye injury. Wear Safety Glasses. Turn cap slowly to the first stop and allow pressure to escape before removing cap completely.

1. With the vehicle on a level surface and engine shut OFF, unlock and open rear engine compartment door and lift the engine cover.

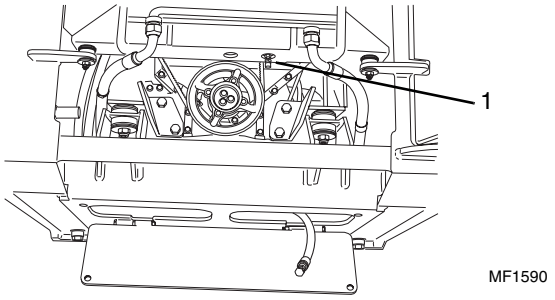

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Figure 10-22 Radiator Petcock

2. Place a container under the radiator drain valve (Fig. 10-22, 1).
3. With the engine cool, slowly loosen the radiator cap and turn it to the first stop. Allow any pressure to escape and then remove the cap.
4. Open the drain valve (Fig. 10-22, 1) and allow coolant to drain into the container.
5. Detach the hose from overflow connection at radiator fill spout and drain the coolant from the overflow bottle into the container. Reconnect the hose to the radiator fill spout.
6. Close the drain valve (Fig. 10-22, 1).

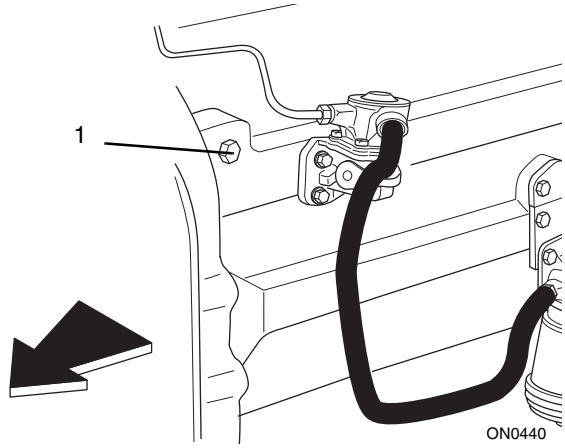

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Figure 10-23 Cylinder Block Drain Plug

7. Place another suitable container under the engine coolant drain plug (Fig. 10-23, 1) on the left side of the cylinder block. Remove the plug (1) and drain the block completely.
8. Install the plug, but do not tighten.
9. Flush the system by filling the cooling system with clean water, and repeat Steps 3, 4, and 5. Install and tighten the cylinder block drain plug.
10. Transfer all coolant collected to a container with a cover and label the container as “Used Antifreeze.” Dispose of the coolant at an approved recycling facility.
11. Fill radiator completely with a 50/50 mixture of ethylene glycol and water, allowing time for the coolant to fill the engine block. Engine coolant capacity for your specific model can be found in Section 11, “Specifications.” Replace radiator cap. Add coolant to overflow bottle until it is 1/2 full [approximately 1.5 quarts (1,4 liters)].
12. Start engine and allow it to warm to operating temperature. Shut off engine and allow engine coolant to cool.
13. Overflow bottle should be 1/4 to 1/2 full; add coolant if required.
14. Lower the engine cover, and close and lock the rear lock door.

10.11 ENGINE COOLING SYSTEM

The engine cooling system consists of coolant passages in the engine, a thermostat, pump, hoses, a radiator and a radiator overflow bottle.

The engine is cooled by the circulation of coolant through passages in the cylinder block and head. Circulation is by thermo-syphon action assisted by an impeller type water pump driven by a V-belt from the crankshaft pulley.

The water pump bearings are prepacked with a special grease during assembly and do not require attention in service.

10.11.1 Coolant Requirements

The quality of coolant will determine the efficiency and life of the cooling system.

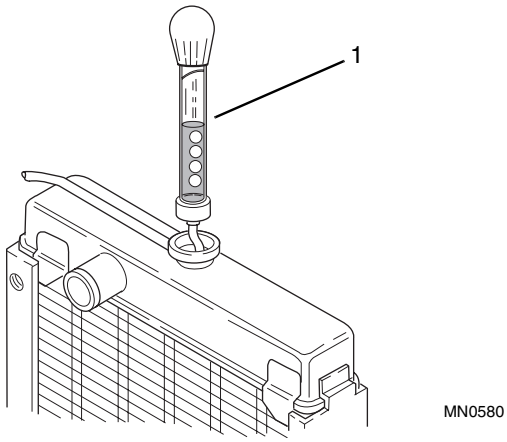


Figure 10-24 Testing Antifreeze Concentration

1. Check antifreeze concentration (Fig. 10-24, 1) several weeks before the beginning of the cold season. Use any suitable tester capable of measuring the lowest expected temperatures in your region, and follow the instructions provided with the tester.
2. The antifreeze must have an ethylene glycol (ethanediol) base. Use a low silicate antifreeze which contains no more than 0.1 percent anhydrous alkali metasilicate.
3. There is an advantage to using antifreeze even when frost protection is not necessary. Antifreeze protects against corrosion and also raises the boiling point of the coolant. A 50 percent concentration of antifreeze is preferred, but if this much protection is not required, a 33 percent concentration can be used. Never use more than a 65 percent concentration under any condition.
4. Where frost protection will never be required, use an approved corrosion inhibitor and clean soft water. Change the water/corrosion inhibitor every six months or according to the manufacturer's recommendations.
   - **DO NOT** USE HARD WATER in the cooling system. Hard water, or water with high levels of calcium and magnesium ions, encourages the formation of silica gel formations, especially after a number of heating and cooling cycles. These gel formations can result in loss of cooling or heating in radiators and cab heater cores by coating and plugging the tubes. The formations usually deposit in the cooler section of the cooling system, such as the radiator bottom tank.
   - USE SOFT WATER, DISTILLED WATER OR DEIONIZED WATER to reduce the potential and the severity of silicate dropouts.

IMPORTANT: *If you use water without a corrosion inhibitor, rust will form and plug the small holes in the head gasket. These holes are orifices and their size is critical. Do not enlarge the size of the orifices. To do so will disturb the coolant flow and will not solve an overheating problem. If you use water without a corrosion inhibitor for even a relatively short period, the cup plugs will rust through, allowing coolant to leak. An incorrect or malfunctioning radiator cap can result in the loss of coolant and the engine running hot. Any sudden loss of coolant from a heavily loaded engine can result in severe damage to the pistons and cylinder bore.*

Note: *Some corrosion inhibitor mixtures contain soluble oil which can have an adverse effect on some types of water hose.*

10.11.2 Radiator Pressure Cap

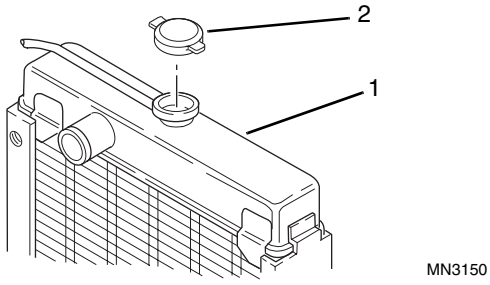


Figure 10-25 Radiator Pressure Cap

The radiator (Fig. 10-25, 1) is designed to use a pressure cap (2) to prevent the boiling of the coolant. For a 210° F (99° C) system use a 14 lb/in² (96 kPa) radiator cap. An incorrect or malfunctioning cap can result in the loss of coolant and the engine running hot.

10.11.3 Engine Thermostat Replacement

WARNING: To avoid severe burns, **DO NOT** attempt this procedure when the engine is hot. Wait for engine and muffler to cool before proceeding.

WARNING: To prevent personal injury, never remove radiator cap while the cooling system is hot. The system is under pressure and escaping coolant can cause severe burns and eye injury. Wear Safety Glasses. Turn cap slowly to the first stop and allow pressure to escape before removing cap completely.

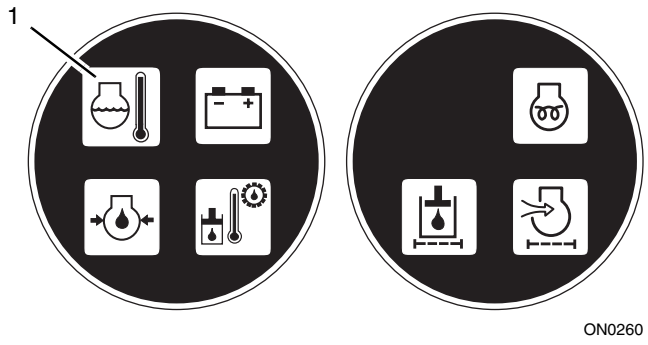


Figure 10-26 Engine Water Temperature Warning Light

Engine overheating may be caused by a malfunctioning engine thermostat. If the engine water temperature warning light (Fig. 10-26, 1) illuminates, and the warning alarm sounds during normal operation, STOP the engine, allow it to cool completely, and determine the cause of overheating. If the engine coolant level in the overflow bottle and radiator is acceptable, and the cooling fins are not plugged with dirt and debris, the engine water temperature switch or warning lamp cluster may be at fault. To test the switch or indicator, refer to Section 8.3.2, “Warning Lights, Warning Light Alarm, and Switches.”

If the engine water temperature switch and warning light are not at fault, it will be necessary to replace the engine thermostat.

To change the engine thermostat, proceed as follows:

1. With the vehicle on a level surface and engine shut OFF, unlock and open rear engine compartment door and lift the engine cover.

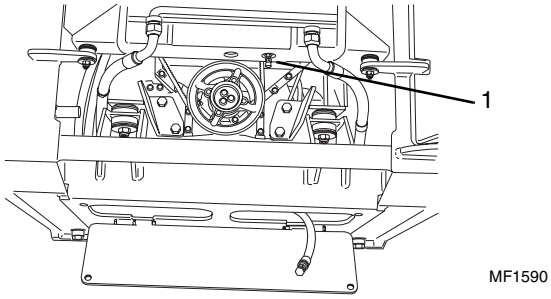


Figure 10-27 Radiator Petcock

2. Open the rear access door and lift the engine cover. Place a container under the radiator drain valve (Fig. 10-27, 1).
3. With the engine cool, slowly loosen the radiator cap and turn it to the first stop. Allow any pressure to escape and then remove the cap.
4. Open the drain valve (Fig. 10-27, 1) and allow approximately 1 gal (3,8 liters) of coolant to drain into the container. Close the drain valve.
5. Transfer the coolant to a container with a cover and label the container as “Used Antifreeze.” Dispose of the coolant at an approved recycling facility.

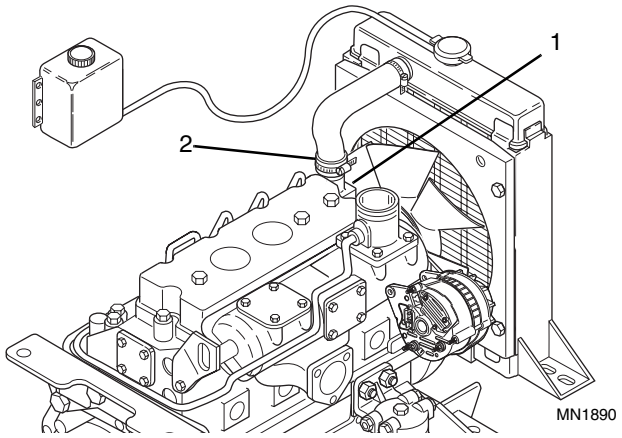


Figure 10-28 Thermostat Location

6. The thermostat is located in a housing (Fig. 10-28, 1) at the front of the engine. Loosen the upper radiator hose clamp (2) on the thermostat outlet, and remove the end of the hose from the housing.

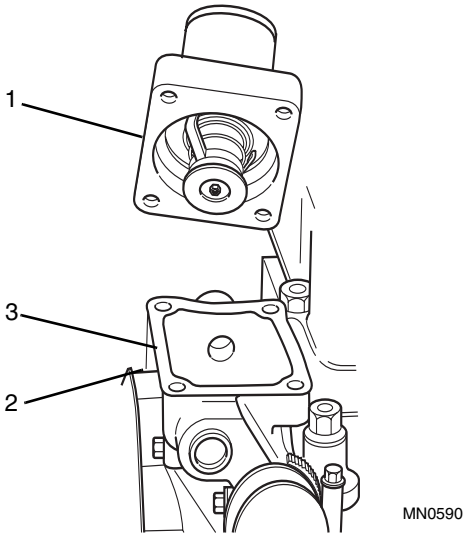


Figure 10-29 Thermostat Housing

7. Loosen and remove the capscrews securing the thermostat outlet (Fig. 10-29, 1) to it's base (2), and remove the outlet.
8. Remove and discard the gasket (Fig. 10-29, 3).

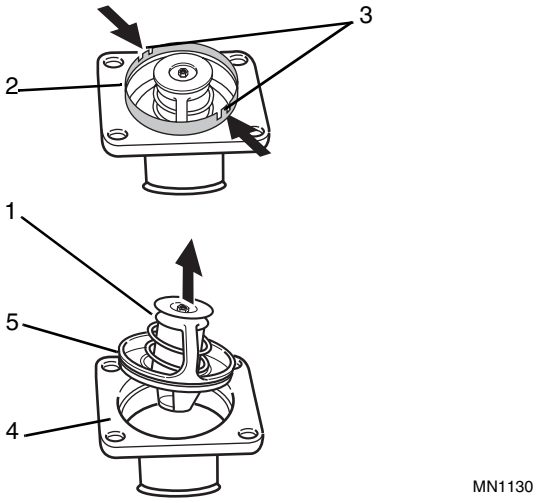


Figure 10-30 Thermostat Removal

9. The thermostat (Fig. 10-30, 1) is secured into the outlet housing by a retaining ring (2). Press the retaining ring tabs (3) inward slightly, and lift the retainer from the housing.
10. Remove the thermostat (Fig. 10-30, 1), and clean any residual gasket material from the face of the housing.

Note: *If the thermostat is to be reused, replace the o-ring (Fig. 10-30, 5) around the thermostat before installation into the housing.*

11. Firmly seat the new thermostat (Fig. 10-30, 1) in the outlet housing. Press the retainer (2) into the housing, until the retainer tabs lock into place.
12. Place a new gasket (Fig. 10-29, 3) on the outlet housing base (2), and install the outlet housing with thermostat on the base using the original capscrews. Torque the capscrews to 18 lb/ft (24 Nm).
13. Install the upper radiator hose on the thermostat housing, and secure with a hose clamp.
14. Fill radiator completely with a 50/50 mixture of ethylene glycol and water, allowing time for the coolant to fill the engine block. Engine coolant capacity for your specific model can be found in Section 11, "Specifications." Replace radiator cap. Add coolant to overflow bottle until it is 1/2 full.
15. Start engine and allow it to warm to operating temperature. Shut off engine and allow engine coolant to cool.
16. Overflow bottle should be 1/4 to 1/2 full; add coolant if required.
17. Lower engine cover and close and lock the rear lock door.

10.11.4 Radiator Replacement

If radiator leakage is noticed, or the radiator becomes physically damaged, or its internal passages become restricted or clogged, remove the radiator for service or replacement as follows:

a. Removal

WARNING: To avoid severe burns, **DO NOT** attempt this procedure when the engine, cooling, exhaust, and hydraulic systems are hot. Wait until they have cooled before proceeding.

1. With the vehicle on a level surface, implement grounded, and engine shut OFF, unlock and open rear engine compartment door and lift the engine compartment cover.
2. Remove the floor plate between the foot pedals and disconnect the negative (-) battery cable from both batteries.

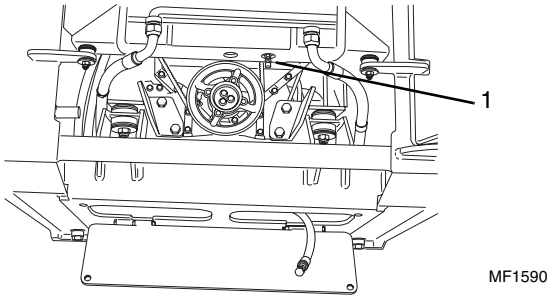


Figure 10-31 Radiator Petcock

3. Place a container under the radiator drain valve (Fig. 10-31, 1).
4. Slowly loosen the radiator cap and turn it to the first stop. Allow any pressure to escape and then remove the cap.
5. Open the drain valve (Fig. 10-31, 1) and allow all coolant to drain into the container. Close the drain valve.

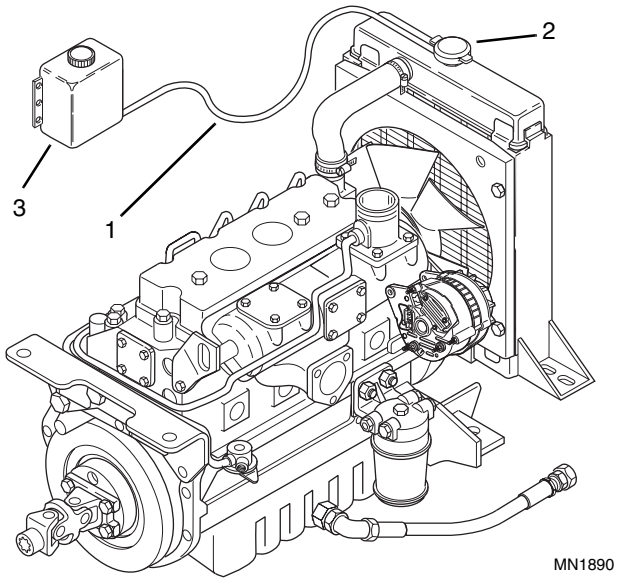


Figure 10-32 Radiator Overflow Bottle

6. Disconnect the radiator overflow hose (Fig. 10-32, 1) from radiator filler neck fitting (2) and drain the overflow bottle (3) into the container.
7. Transfer the coolant to a container with a cover and label the container as “Used Antifreeze.” Dispose of the coolant at an approved recycling facility.

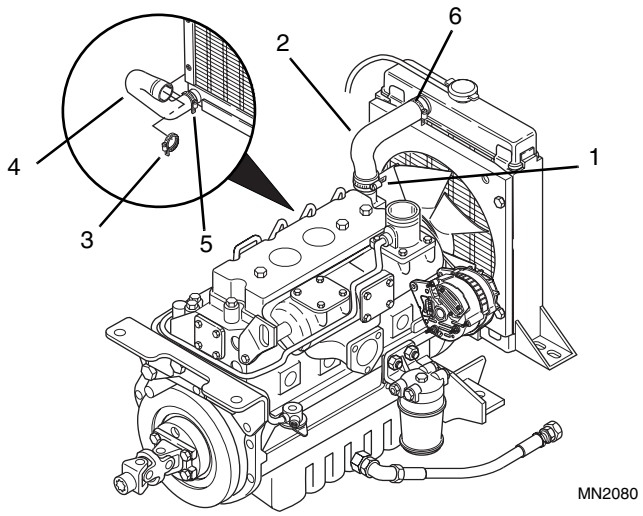


Figure 10-33 Radiator Hose Removal

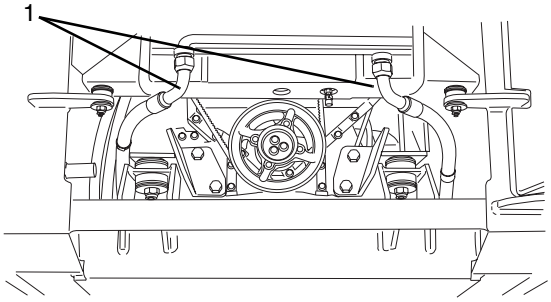
8. Loosen the upper engine side radiator hose clamp (Fig. 10-33, 1) and remove the hose end (2) from the thermostat housing outlet. Loosen the lower engine radiator hose clamp (3) and remove the hose end (4) from the water pump inlet.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

9. Operate travel-steering levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

Model 1750D, 2000D, 2300D



Model 2000DX, 2300DX

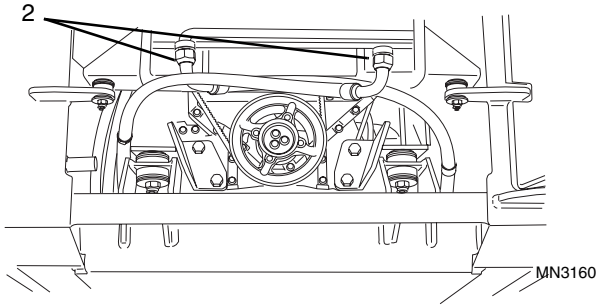


Figure 10-34 Hydraulic Oil Cooler Connections

10. Place a drain pan under the hydraulic oil cooler lines (Fig. 10-34, 1 or 2) to catch any oil that comes out of the oil cooler or lines as they are removed. Loosen and remove one line at a time from the bottom of the cooler, plugging the hose end and capping the cooler fitting immediately. Loosen and remove the remaining cooler line, also plugging the hose end and cap the line.
11. Transfer the oil to a container with a cover and label the container as “Used Oil.” Dispose of the oil at an approved recycling facility.
12. Remove the hydraulic oil cooler, and baffles if equipped, from the vehicle as follows:
    - **For Model 1750D, 2000D and 2300D**, refer to Section 4.10.4, “Hydraulic Oil Cooler Maintenance (D Models Only).”
    - **For Model 2000DX and 2300DX**, refer to Section 4.10.5, “Hydraulic Oil Cooler Maintenance (DX Models Only).”

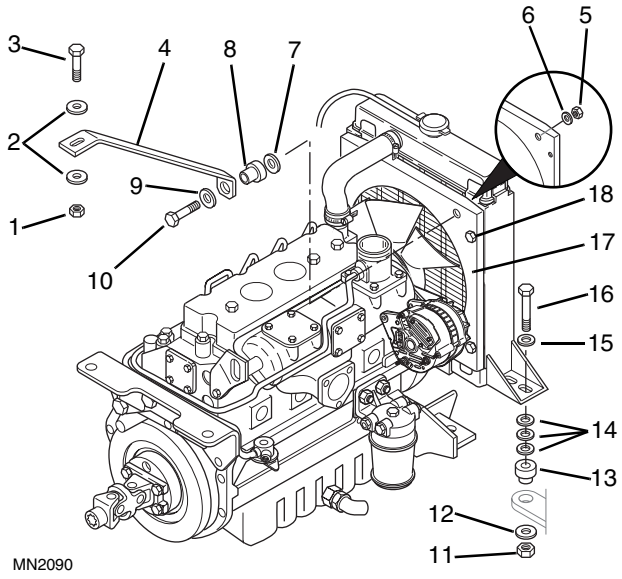


Figure 10-35 Radiator Removal

13. Remove the hex elastic locknut (Fig. 10-35, 1), flat washers (2) and capscrew (3) from the top of the upper radiator support (4).
14. Remove the hex elastic locknut (Fig. 10-35, 5), flat washer (6), rebound washer (7), isolator (8), rebound washer (9) and capscrew (10) from the bottom of the upper radiator support (4), and remove the radiator support.
15. Remove the hex elastic locknut (Fig. 10-35, 11), rebound washer (12), isolator (13), fender washers (14) flat washer (15) and capscrew (16) from the left and right side of the bottom of the radiator.
16. Remove the radiator, with shroud (Fig. 10-35, 17) and upper and lower radiator hoses from the vehicle.

Note: *Use care when handling the radiator assembly. To prevent damage to the radiator drain valve,* ***DO NOT*** *place the radiator on its bottom surface without support blocks used on each side.*

17. Remove the hardware (Fig. 10-35, 18) securing the shroud (17) to the radiator, and remove the shroud.
18. Loosen the clamps (Fig. 10-33, 5 & 6) securing the upper (2) and lower (4) radiator hoses to the radiator, and remove the hoses.

b. Installation

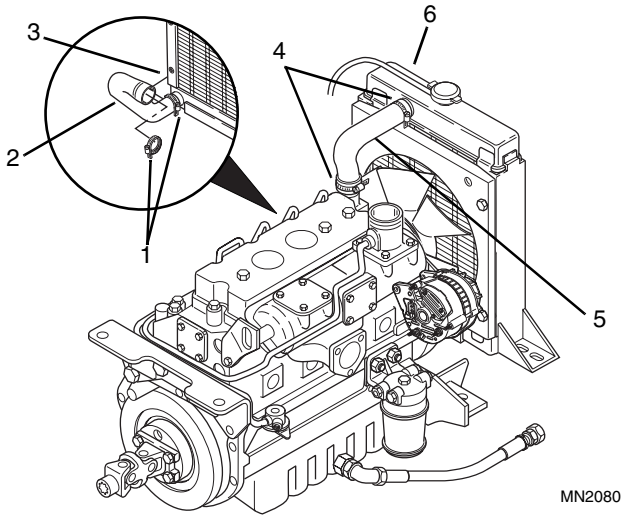


Figure 10-36 Radiator Hose Installation

1. Place two hose clamps (Fig. 10-36, 1) on the lower radiator hose (2), and loose fit the hose to the radiator (3).
2. Place two hose clamps (Fig. 10-36, 4) on the upper radiator hose (5), and loose fit the hose to the radiator (6).

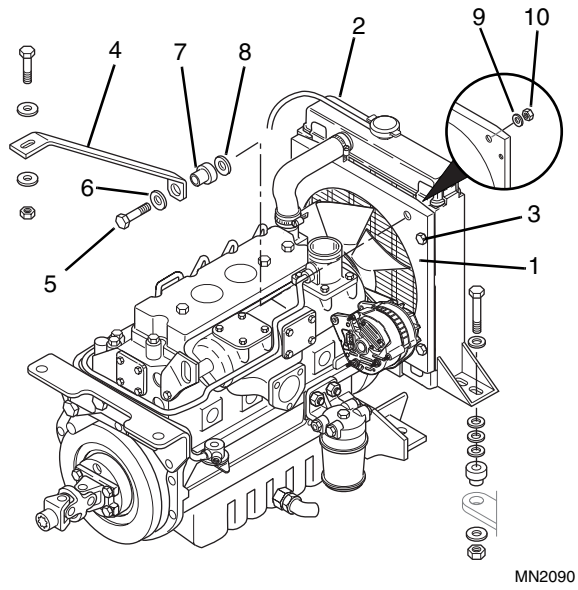


Figure 10-37 Radiator Installation

3. Install the shroud (Fig. 10-37, 1) to the radiator (2), and secure using the original hardware (3).
4. Position the radiator assembly (Fig. 10-37, 2) on the vehicle.

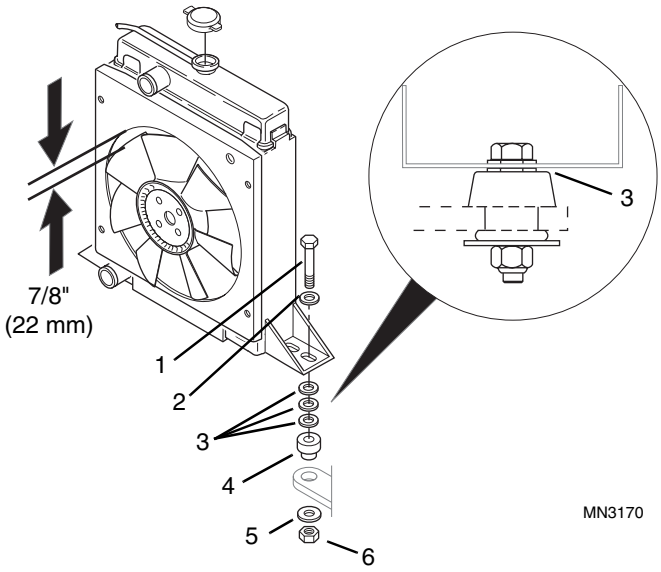


Figure 10-38 Radiator Installation

5. Loose install the capscrew (Fig. 10-38, 1), flat washer (2), fender washers (3), isolator (4), rebound washer (5), and new hex elastic locknut (6) to the left and right side of the bottom of the radiator.
6. By adjusting the quantity of flat washers (Fig. 10-38, 3), adjust the radiator assembly position to achieve a clearance of 7/8" (22 mm) between the shroud and fan blade tips (See Fig. 10-38). When the clearance is adjusted as required, tighten all capscrews (1) and hex elastic locknuts (6) securely.
7. Loose install the upper radiator support (Fig. 10-37, 4) to the radiator shroud (1), using a capscrew (5), rebound washer (6), isolator (7), rebound washer (8), flat washer (9), and a new hex elastic locknut (10).

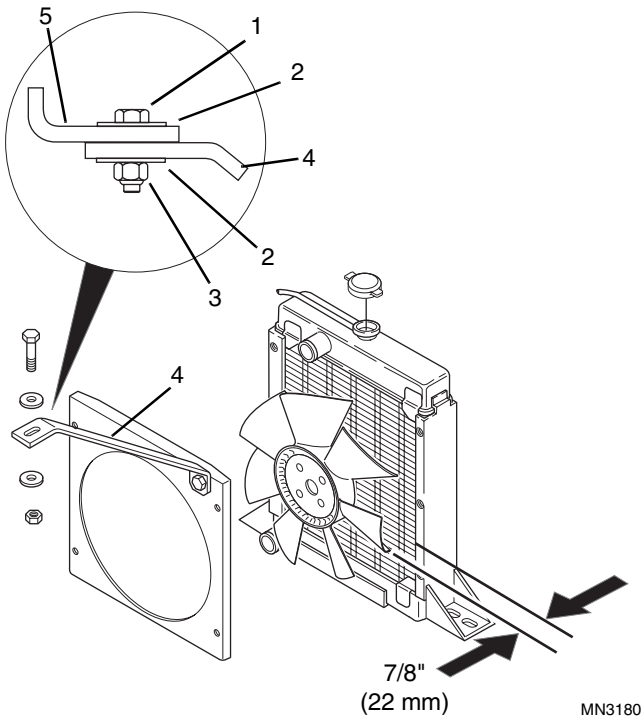


Figure 10-39 Radiator Installation

8. Loose install the capscrew (Fig. 10-39, 1), flat washers (2), and new hex elastic locknut (3) that secures the top of the upper radiator support (4) to the frame crossmember (5).
9. The top hole of the radiator support (Fig. 10-39, 4) is slotted, to allow adjustment of the radiator assembly for front-to-back fan clearance with the radiator core. Adjust this clearance to 7/8" (22 mm) (See Fig. 10-39), and tighten capscrew (1) and hex elastic locknut (3) securely.
10. Install the hydraulic oil cooler, and baffles if equipped, to the vehicle as follows:
    - **For Model 1750D, 2000D and 2300D**, refer to Section 4.10.4, “Hydraulic Oil Cooler Maintenance (D Models Only).”
    - **For Model 2000DX and 2300DX**, refer to Section 4.10.5, “Hydraulic Oil Cooler Maintenance (DX Models Only).”

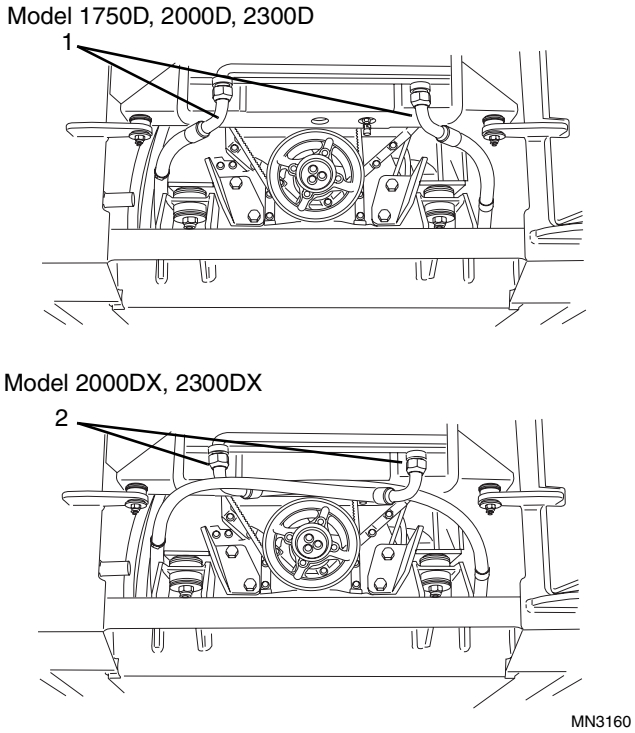


Figure 10-40 Hydraulic Oil Cooler Connections

11. Place a drain pan under the hydraulic oil cooler lines (Fig. 10-40, 1 or 2) to catch any oil that comes out of the oil cooler or lines as they are connected.
    a. Remove a plug from one cooler hose and the cap from the corresponding oil cooler fitting, and install the hydraulic hose to the fitting. Torque the hose (Refer to Section 2.8, “Torque”).
    b. Remove the plug from the second oil cooler hose and the cap from the corresponding oil cooler fitting, and install the second hydraulic hose to the fitting. Torque the hose (Refer to Section 2.8, “Torque”).
    c. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling facility.

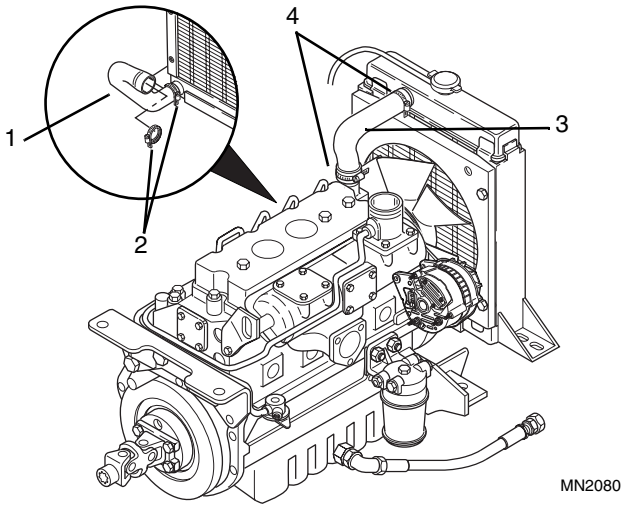


Figure 10-41 Radiator Hose Removal

12. Connect the lower radiator hose (Fig. 10-41, 1) to the engine, and tighten both clamps (2). Connect the upper radiator hose (3) to the engine, and tighten both clamps (4).

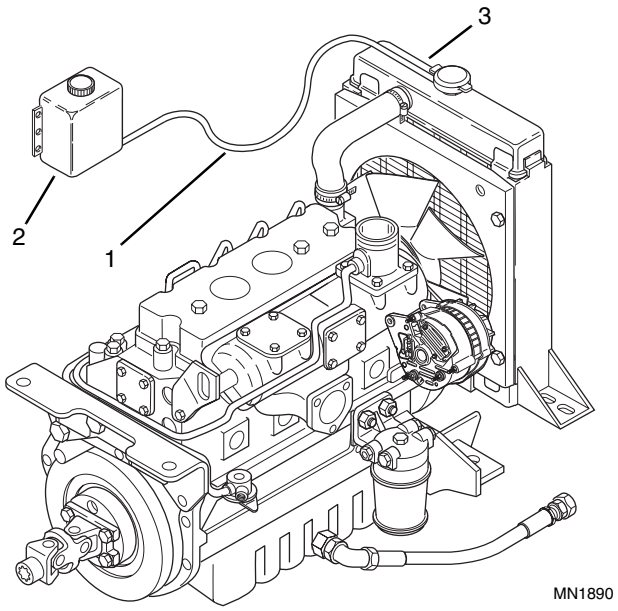


Figure 10-42 Radiator Overflow Bottle

13. Connect the radiator overflow hose (Fig. 10-42, 1) from the overflow bottle (2) to the radiator filler neck fitting (3).

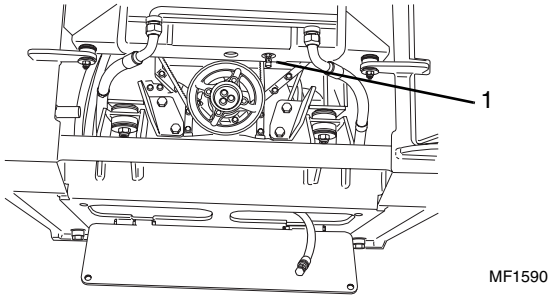


Figure 10-43 Radiator Drain Valve

14. Ensure the radiator drain valve (Fig. 10-43, 1) is securely closed.
15. Fill the radiator completely with 50/50 mixture of ethylene glycol and water. The cooling system capacity is listed in “Specifications,” Section 11.
16. Replace radiator cap.
17. Add coolant to the overflow bottle until it is about 1/4 to 1/2 full - approximately 1 quart (0,9 liter).
18. Connect the negative (-) battery cable to both batteries, and replace the floor plate between both foot pedals.
19. Refer to Section 4.5, “Startup After Hydraulic System Repairs,” for instructions on checking the level of the hydraulic system oil before initial engine startup.

IMPORTANT: *When the engine is initially started, run it briefly at low idle, and check the vehicle for any visual sign of fluid leakage.* ***STOP*** *the engine immediately if any leakage is noted, and make any necessary repairs before continuing.*

20. Lower the engine cover, and close and lock the rear engine compartment door.

10.12 ENGINE ELECTRICAL SYSTEM

The engine electrical system is described in Section 8, Electrical System. These instructions describe warning devices, wiring harnesses, fuses, the starting and charging circuits, switches and solenoids, gauges and indicator lights, and electrical troubleshooting.

10.13 ENGINE FUEL SYSTEM

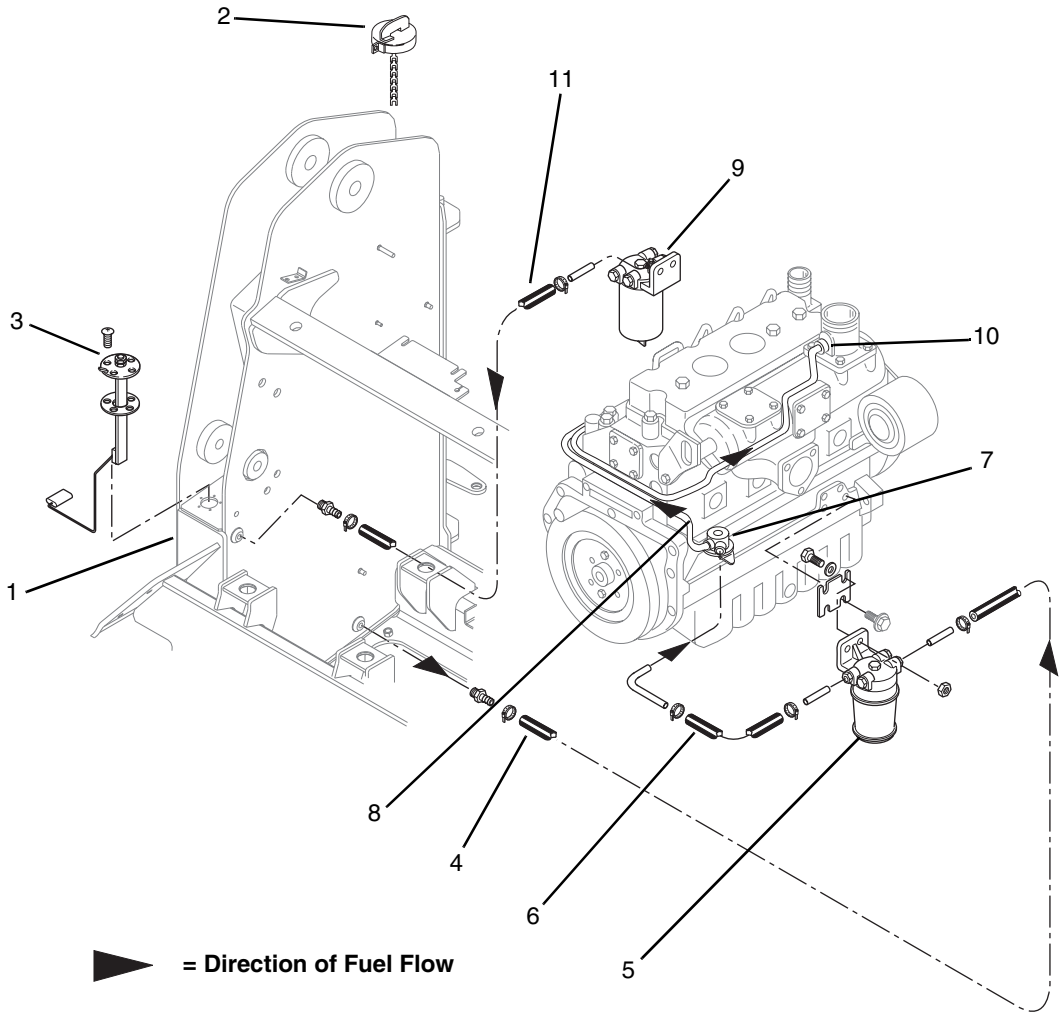


Figure 10-44 Fuel System Components

The engine fuel system includes a fuel tank in the right rear tower (Fig. 10-44, 1) of the frame. The threaded fuel fill opening in the top of the fuel tank has a filler cap (2) with a tether. The tank is equipped with a fuel level sender (3) that mounts in the tank, and is read from a gauge on the instrument panel (the fuel level sender and gauge are described in Section 8, Electrical System.).

A fuel supply hose (Fig. 10-44, 4) carries fuel from the bottom of the tank to the fuel pre-filter (5). The fuel then flows through a hose (6) to the lift pump (7) which is located on the left side of the engine.

A tube (Fig. 10-44, 8) carries fuel under pressure from the fuel lift pump to fuel filter (9) on the right side of the engine. Fuel which has been filtered by the fuel filter is directed through tubes to the fuel injection pump and to the Thermo Start plug (10) in the intake manifold.

A tube from the fuel injectors returns surplus fuel from the injectors to the fuel filter (Fig. 10-44, 9) and into a line and hose (11) which returns it to the fuel tank.

10.13.1 Fuel Types

When operating at temperatures above 32° F (0° C) use standard No. 2 diesel fuel.

When operating at temperatures below 32° F (0° C), use a blend of No. 1 and No. 2 diesel fuels, most commonly known as “winterized” No. 2 diesel fuel.

IMPORTANT: *Use ASTM No. 2 diesel fuel with a minimum Cetane number of 45. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 45 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.*

WARNING: Engine fuel is ***flammable*** and can cause a fire or an explosion. To prevent personal injury or death, keep sparks, open flames and smoking materials away from the vehicle during refueling or servicing of the fuel system.

10.13.2 Fuel Tank

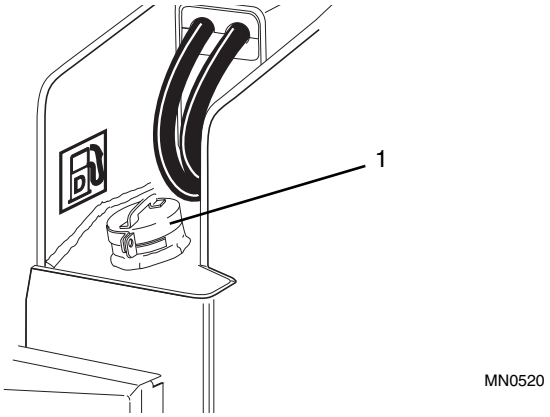


Figure 10-45 Fuel Tank Filler Cap

Check fuel supply daily before operation. Unlock and remove fuel fill cap (Fig. 10-45, 1) and add fuel as required. Replace and lock fuel fill cap.

Fuel capacity for your specific model, in US gallons and liters, can be found in Section 11, “Specifications.”

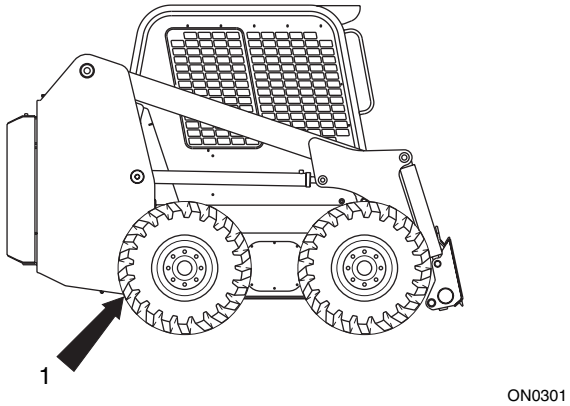


Figure 10-46 Fuel Tank Drain Plug

Use fuel tank drain plug (Fig. 10-46, 1) if you must drain old or contaminated fuel. Dispose of the fuel at an approved recycling facility.

10.13.3 Fuel Level Sender and Gauge

The fuel level sender and gauge assembly is described in Section 8, Electrical System.

10.14 ENGINE EXHAUST SYSTEM

- Exhaust fumes contain carbon monoxide, a colorless, odorless gas, which is fatal when inhaled in a confined area. Avoid breathing exhaust fumes and be sure engine operation will not cause a concentration of toxic emissions.
- Exhaust system components get very hot and can cause severe burns.

Periodic maintenance of the exhaust system is not required; however, it is advisable to check the condition of the system when performing other maintenance on the vehicle.

Check the complete exhaust system for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections, and other deterioration which could permit exhaust fumes to seep into the operators cab. Any damaged areas must be corrected immediately.

IMPORTANT: *Exhaust system components will expand slightly as the system is brought up to normal operating temperature. When replacing exhaust parts, make sure there is sufficient clearance between all exhaust system components and pipes, hoses, and wiring that would be adversely affected by excessive heat.*

The exhaust system is constructed to minimize the transfer of noise and vibration into the operators area. Rattles and vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all bolts or nuts loose until all parts are properly aligned. Tighten the exhaust manifold elbow (Fig. 10-47, 1) to the manifold (2), the flex exhaust tube (3) to the elbow (1), The muffler (4) to the flex exhaust tube (3), the muffler T-bolt clamp (5) to the chassis, and finally the tailpipe (6) to the muffler (4).

Note: *Whenever you replace a muffler you should also replace the tail pipe.*

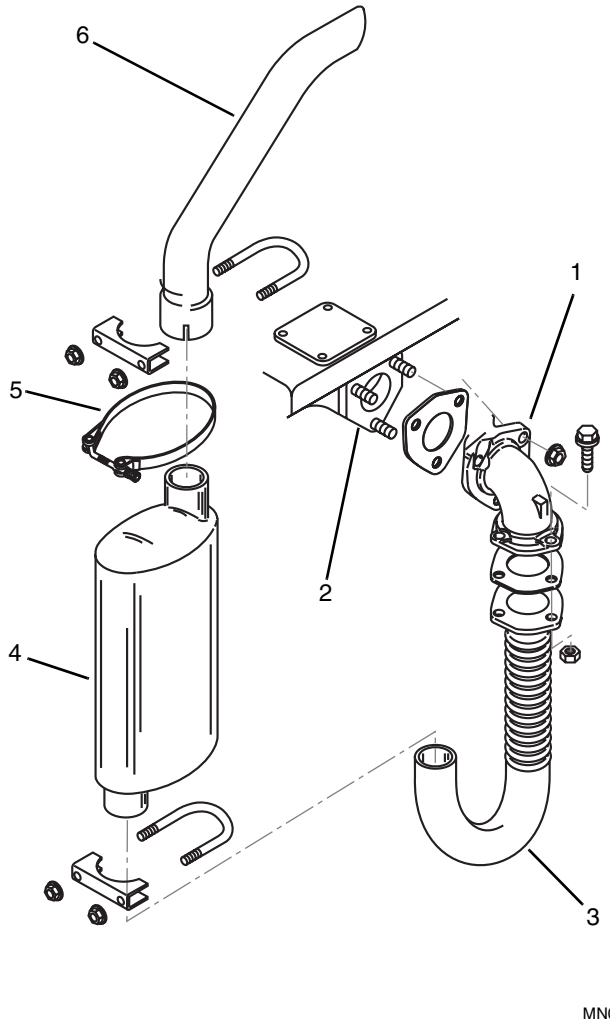


Figure 10-47 Exhaust System

10.15 ENGINE MANUFACTURER MANUALS

There are other engine-related maintenance procedures that must be performed on the Perkins engines that are not covered in this Service Manual. Refer to the appropriate Perkins User Handbook and/or Workshop Manual for detailed procedures, specifications and intervals for those procedures:

User Handbook - Engine Model 1004.42
Publication # TPD 1349E

Workshop Manual - Engine Model 1004.42
Publication # TPD 1350E

Note: *These publication numbers and contact locations were current at the time this manual was published. Contact your local Perkins Engine Distributor to obtain additional or updated copies of these publications.*

For the distributor nearest you, contact one of the following:

United States of America

Perkins International - North America
12025 Tech Center Drive
Livonia, Michigan 48150
Phone Number (313) 266-5427

International

Perkins International Ltd,
Eastfield, Peterborough PE1 5NA,
England
Phone Number 0044 (0) 1733 583000

10.16 ENGINE REMOVAL

WARNING: To avoid severe burns, **DO NOT** attempt this procedure when the engine, cooling, exhaust, and hydraulic systems are hot. Wait until they have cooled before proceeding.

1. Park the vehicle on a level surface and shut the engine OFF. Unlock and open rear engine compartment door and lift the engine compartment cover.
2. Raise the Operator's Protective Structure to the service position (Refer to Section 2.11, "Operator's Protective Structure Tilt Service Position").
3. Remove the floor plate between the foot pedals and disconnect the negative (-) battery cable from both batteries.

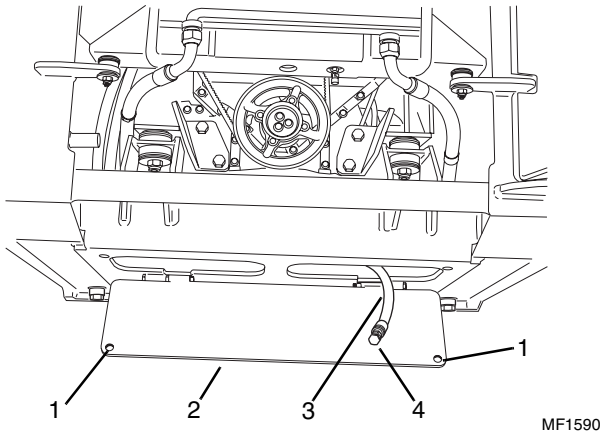


Figure 10-48 Engine Oil Drain

4. Remove two capscrews (Fig. 10-48, 1) holding the access plate (2) to the underside of the vehicle frame and swing the plate down.
5. Locate the drain hose (Fig. 10-48, 3) above the access plate. Place a suitable receptacle under the end of the drain hose, remove the drain hose plug (4) and allow the oil to drain into the receptacle.
6. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling facility.
7. Remove the drain hose (Fig. 10-48, 3) from the engine oil pan.

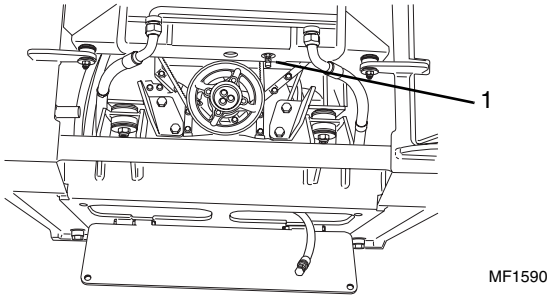


Figure 10-49 Radiator Petcock

8. Place a container under the radiator drain valve (Fig. 10-49, 1).
9. Slowly loosen the radiator cap and turn it to the first stop. Allow any pressure to escape and then remove the cap.
10. Open the drain valve (Fig. 10-49, 1) and allow all coolant to drain into the container. Close the drain valve.

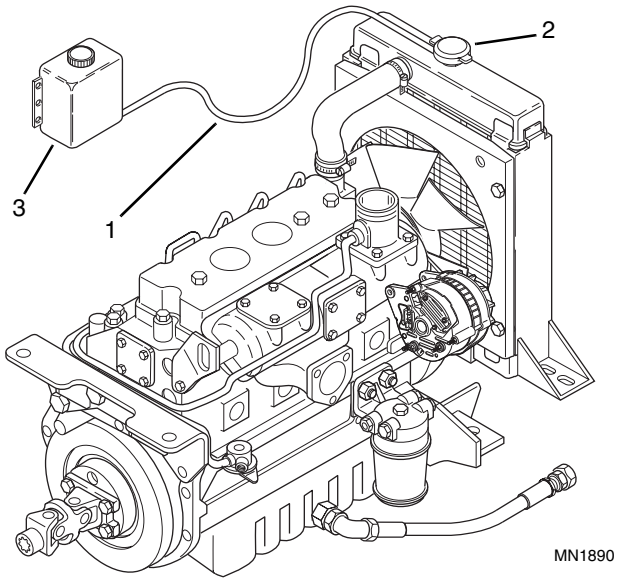


Figure 10-50 Radiator Overflow Bottle

11. Disconnect the radiator overflow hose (Fig. 10-50, 1) from radiator filler neck fitting (2) and drain the overflow bottle (3) into the container.
12. Transfer the coolant to a container with a cover and label the container as “Used Antifreeze.” Dispose of the coolant at an approved recycling facility.

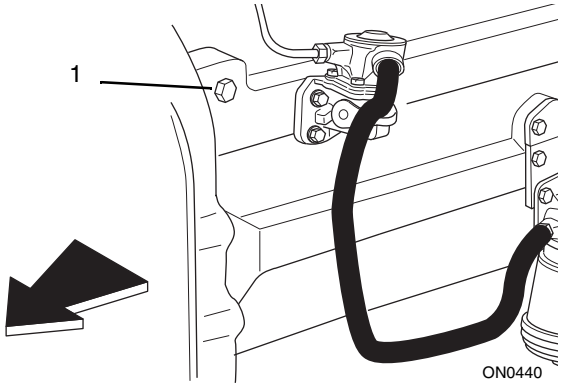


Figure 10-51 Cylinder Block Drain Plug

13. Place the drain container under the engine coolant drain plug (Fig. 10-51, 1) on the left side of the cylinder block. Remove the plug (1) and drain the block completely.
14. Reinstall and tighten the plug.

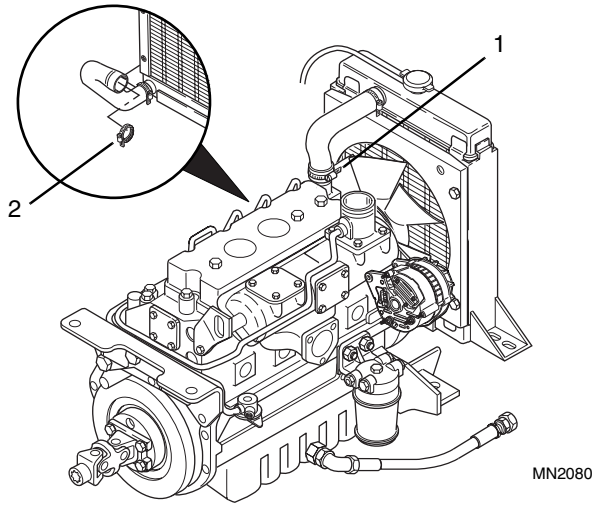


Figure 10-52 Radiator Hose Removal

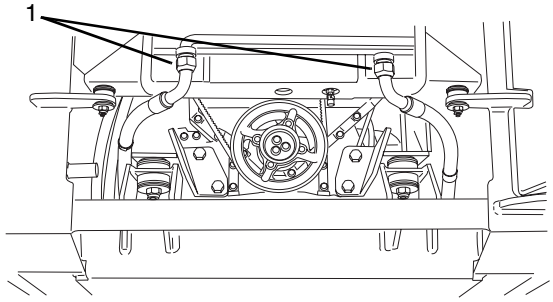
15. Loosen the upper engine side radiator hose clamp (Fig. 10-52, 1) and remove the hose end from the thermostat housing outlet. Loosen the lower engine radiator hose clamp (2) and remove the hose end from the water pump inlet.

WARNING: Relieve hydraulic pressure before servicing any hydraulic component. Escaping hydraulic system oil under pressure can penetrate the skin causing serious injury.

16. Operate travel-steering levers (forward and backward) and foot pedals (forward and backward) after the engine has stopped to relieve any trapped hydraulic pressure.

WARNING: Wait for the hydraulic fluid to cool before servicing any hydraulic component. Hot hydraulic system oil can cause severe burns.

Model 1750D, 2000D, 2300D



Model 2000DX, 2300DX

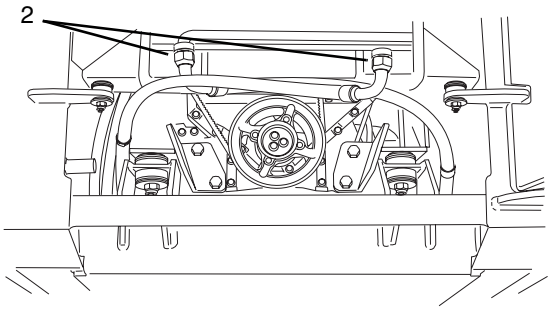


Figure 10-53 Hydraulic Oil Cooler Connections

17. Place a drain pan under the hydraulic oil cooler lines (Fig. 10-53, 1 or 2) to catch any oil that comes out of the oil cooler or lines as they are removed. Loosen and remove one line from the bottom of the cooler. Plug the hose end and cap the cooler fitting immediately. Loosen and remove the remaining cooler line. Plug the hose end and cap the line.
18. Transfer the oil to a container with a cover and label the container as “Used Oil.” Dispose of the oil at an approved recycling facility.

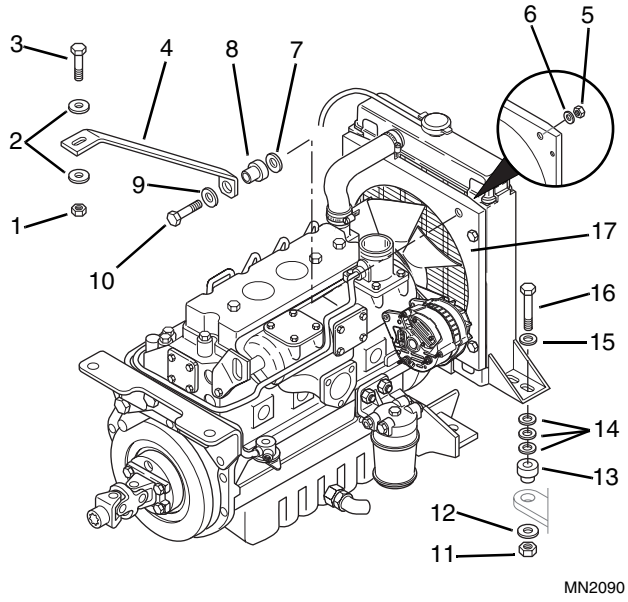


Figure 10-54 Radiator Removal

19. Remove the hex elastic locknut (Fig. 10-54, 1), flat washers (2) and capscrew from the top of the upper radiator support (4).
20. Remove the hex elastic locknut (Fig. 10-54, 5), flat washer (6), rebound washer (7), isolator (8), rebound washer (9) and capscrew (10) from the bottom of the upper radiator support (4), and remove the radiator support.
21. Remove the hex elastic locknut (Fig. 10-54, 11), rebound washer (12), isolator (13), washers (14) flat washer (15) and capscrew (16) from the left and right side of the bottom of the radiator.
22. Remove the radiator, with shroud (Fig. 10-54, 17), upper and lower radiator hoses, and oil cooler as an assembly from the vehicle, and set aside.

Note: *Use care when handling the radiator/oil cooler assembly. To prevent damage to the radiator drain valve,* ***DO NOT*** *place the radiator on its bottom surface without support blocks used on each side.*

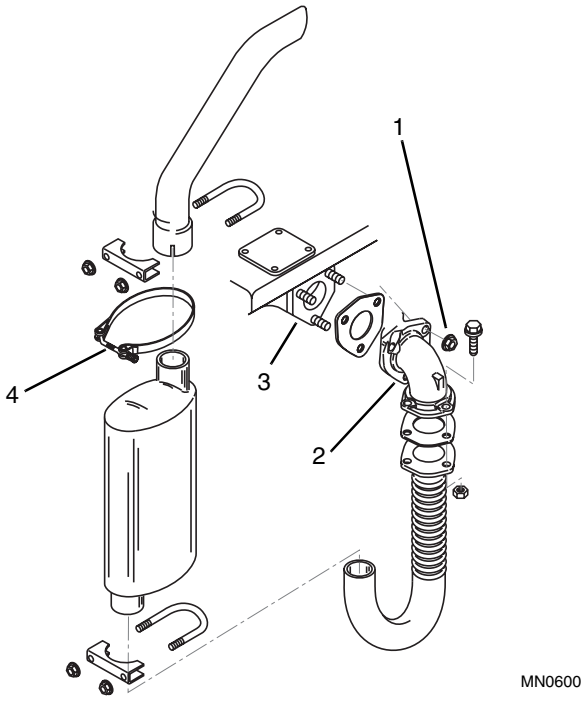


Figure 10-55 Exhaust System Removal

23. Remove hex locknuts (Fig. 10-55, 1) securing the exhaust elbow (2) to the engine exhaust manifold (3). Loosen the muffler body clamp (4), and lift and remove the muffler/tailpipe assembly with flexible exhaust pipe from the vehicle.

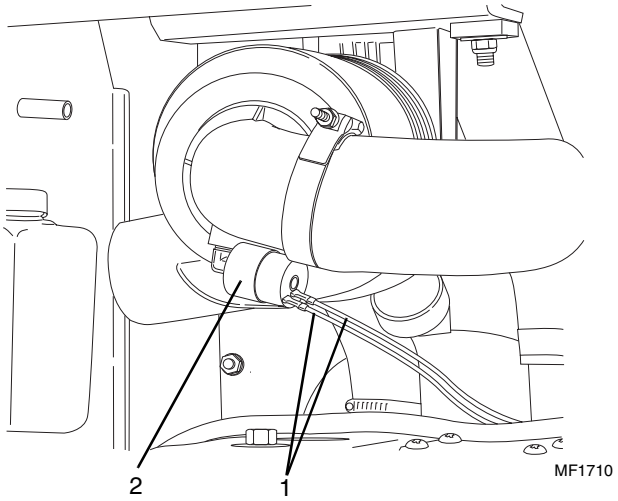


Figure 10-56 Air Restriction Indicator Switch

24. Disconnect red/blue wire #28 and black wire #2H (Fig. 10-56, 1) from the air cleaner restriction switch (2).

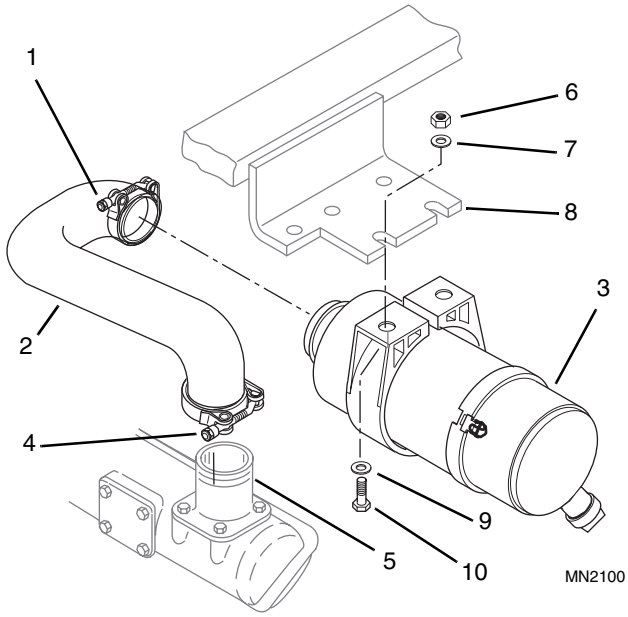


Figure 10-57 Air Cleaner Removal

25. Loosen the hose clamp (Fig. 10-57, 1) that secures the air intake hose (2) to the air cleaner assembly (3). Loosen the hose clamp (4) that secures the air intake hose (2) to the engine induction manifold (5) and remove the intake hose (2). Plug or cover the induction manifold intake port (5) to prevent entry of dirt or debris into the engine.
26. Remove hex locknut (Fig. 10-57, 6), rebound washer (7), flat washer (9), and capscrew (10), and remove the air cleaner (3) from the frame crossmember (8).

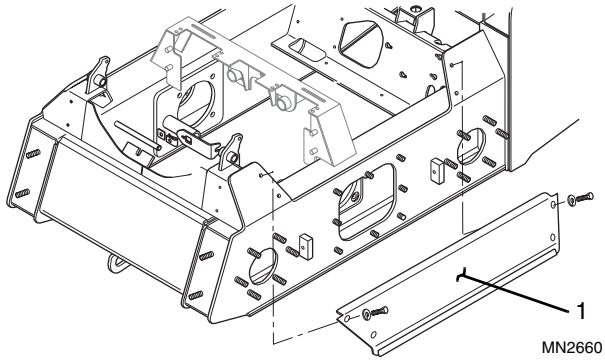


Figure 10-58 Frame Side Cover Removal

27. Remove the left (Fig. 10-58, 1) and right (not shown) side covers from the vehicle.

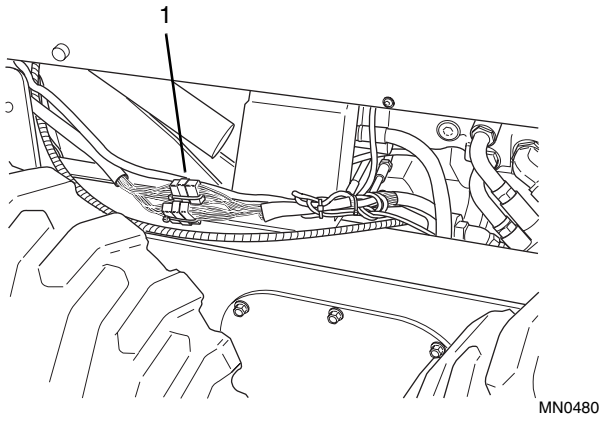


Figure 10-59 Wiring Harness Connectors

Note: *It is NOT necessary to remove the engine/chassis wiring harness from the vehicle to remove the engine.*

28. Disconnect three wiring harness connectors (Fig. 10-59, 1) attaching the Operator's Protective Structure and Engine/Chassis Wiring Harnesses.

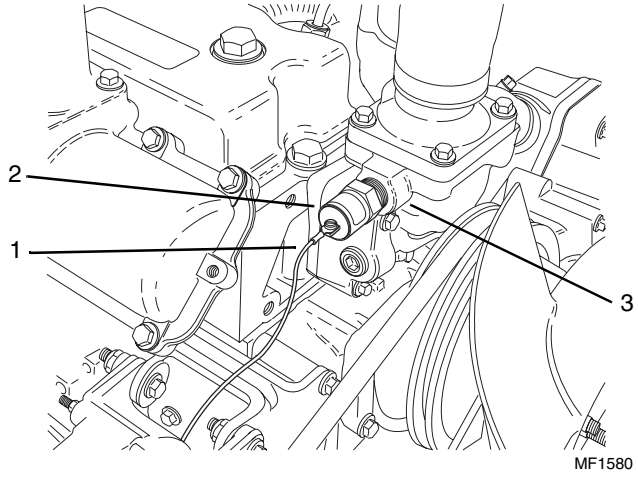


Figure 10-60 Engine Water Temperature Wiring

29. Disconnect light blue wire #8 (Fig. 10-60, 1) from the water temperature switch (2), and remove the temperature switch (2) from the housing (3).

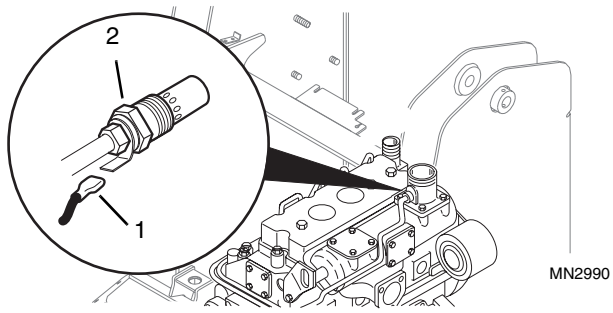


Figure 10-61 Thermo Start Plug

30. Disconnect white/brown wire #4 (Fig. 10-61, 1) from the thermo start plug (2).

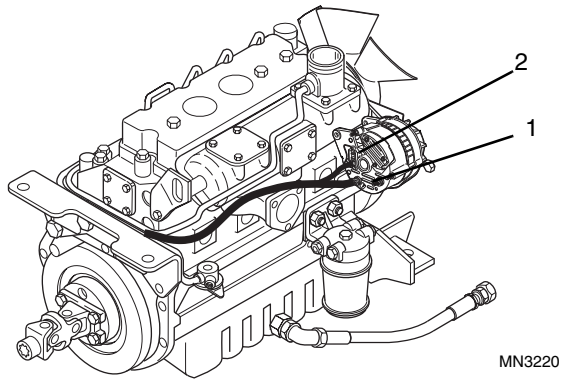


Figure 10-62 Alternator Wiring

31. Disconnect red/gray wire #19 (Fig. 10-62, 1) from B+ alternator terminal.
32. Disconnect yellow wire #7 (Fig. 10-62, 2) from alternator spade terminal.

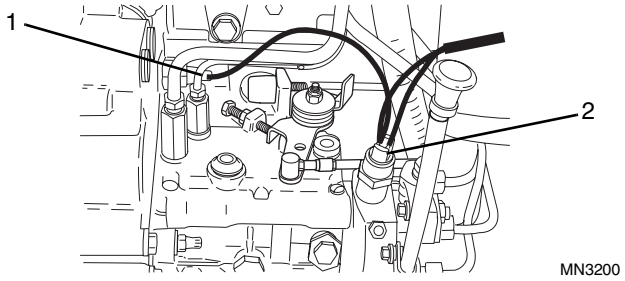


Figure 10-63 Fuel Injection Pump Wiring

33. Disconnect orange wire #20C (Fig. 10-63, 1) from the cold start timing advance switch.
34. Disconnect green/white wire #20 and black wire #2E (Fig. 10-63, 2) from the fuel solenoid on the injection pump.

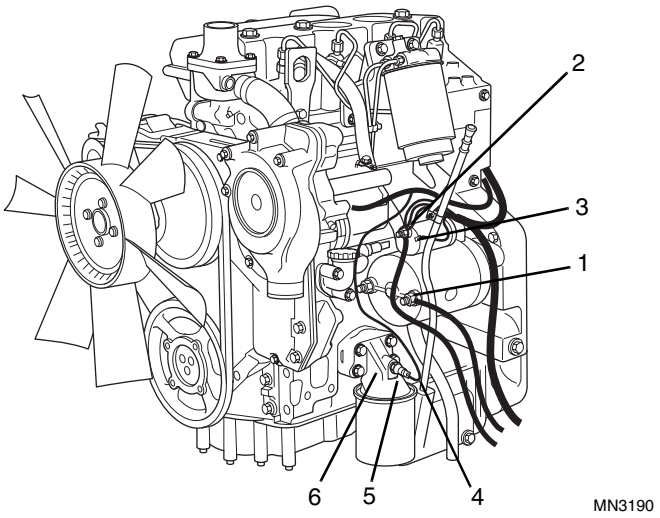


Figure 10-64 Starter Wiring

35. Disconnect the black (negative) battery cable (Fig. 10-64, 1) at the starter housing.
36. Disconnect the red (positive) battery cable, red wire #3, and red/gray wire #19 (Fig. 10-64, 2) from the large stud on the starter solenoid.
37. Disconnect white/blue wire #1 (Fig. 10-64, 3) from the blade terminal on the starter solenoid.
38. Disconnect brown wire #9 (Fig. 10-64, 4) from the oil pressure switch (5), and remove the switch from the filter housing (6).

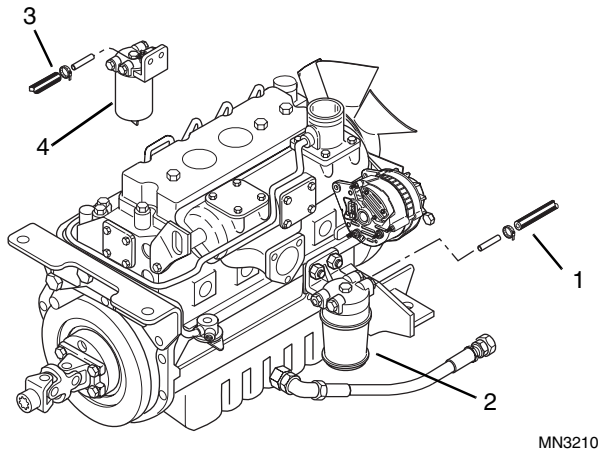


Figure 10-65 Fuel Lines

39. Disconnect and plug the fuel supply line (Fig. 10-65, 1) at the water separator (2) on the left side of the engine.
40. Disconnect and plug the fuel return line (Fig. 10-65, 3) at the fuel filter (4) on the right side of the engine.

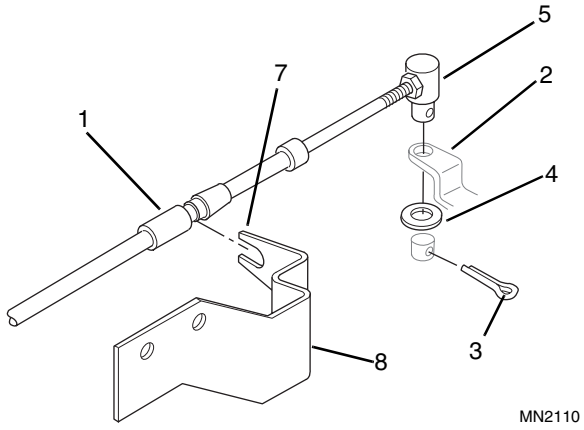


Figure 10-66 Throttle Cable Removal

41. Disconnect the throttle cable (Fig. 10-66, 1) from the fuel injection pump lever (2) by removing the cotter pin (3) and flat washer (4) from the rod end (5), and lift the rod end (5) from the fuel injection pump lever (2).
42. Spread the tangs (Fig. 10-66, 7) on the throttle cable mounting bracket (8) just enough to release the throttle cable (1), and pull the cable (1) out of the mounting bracket (8).

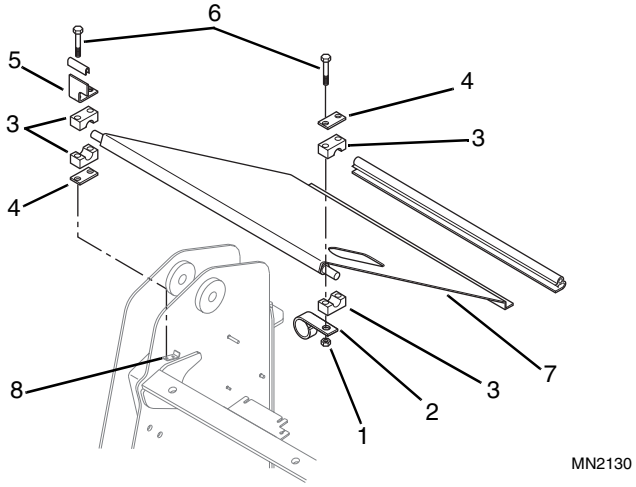


Figure 10-67 Engine Rear Cover

43. Remove four hex elastic locknuts (Fig. 10-67, 1), left "J" clip (2), half clamps (3), cover plate clamps (4), right stop plate (5), and capscrews (6) securing the engine cover (7) to the tabs (8) on the inner walls of the fuel and hydraulic tank. Remove the engine cover (7).

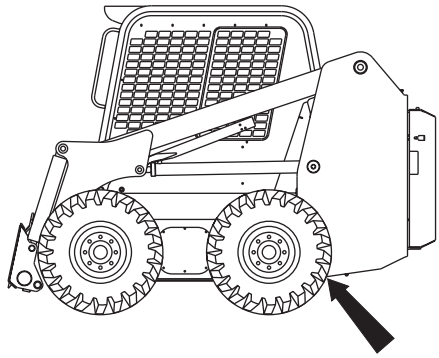


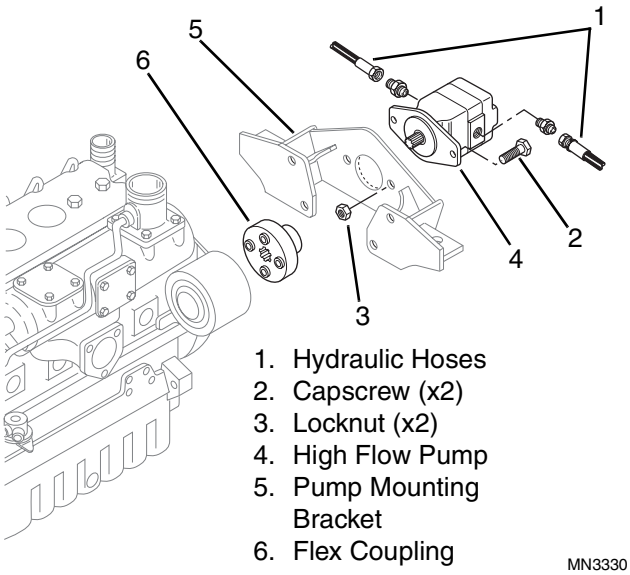
Figure 10-68 Hydraulic Reservoir Drain Plug

44. **For DX Models Only:**

a. Place a receptacle under reservoir drain plug (Fig. 10-68) and remove drain plug. Clean loose particles from plug, allow oil to drain completely into the receptacle and dispose of properly.

Note: *Use a drain receptacle of adequate size to reduce the possibility of spillage. The reservoir capacity is 17.1 gallons (64,7 liters) for Model 1750D and 2000D/DX, and 18 gallons (68,1 liters) for 2300D/DX.*

b. Install drain plug in reservoir and torque it to 40 lb/ft (54 Nm).



1. Hydraulic Hoses
2. Capscrew (x2)
3. Locknut (x2)
4. High Flow Pump
5. Pump Mounting Bracket
6. Flex Coupling

Figure 10-69 High Flow Pump Mounting

c. Remove and tag (for proper reassembly) both hydraulic hoses (Fig. 10-69, 1) connected to the high flow pump (4).

d. Remove the capscrews (Fig. 10-69, 2) and locknuts (3) that secure the pump (4) to the mounting bracket (5).

e. Remove the pump (Fig. 10-69, 4) by sliding the pump shaft out of the flexible coupler (6).

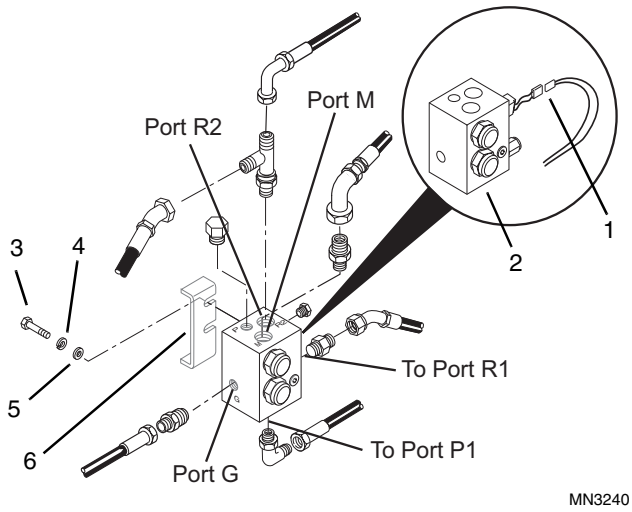


Figure 10-70 High Flow Valve

f. Disconnect and tag hoses (for proper reassembly) from the high flow valve (Fig. 10-70). Cap all hoses to prevent entry of dirt or other contamination into the hydraulic system.

g. Unplug the electrical connector (Fig. 10-70, 1) with red wire # 87 and black wire #23 from the solenoid on the valve (2).

h. Remove the socket head capscrews (Fig. 10-70, 3), lockwashers (4), and flat washers (5) that secure the valve (2) to the mounting bracket (6) on the frame, and remove the valve (2) from the vehicle.

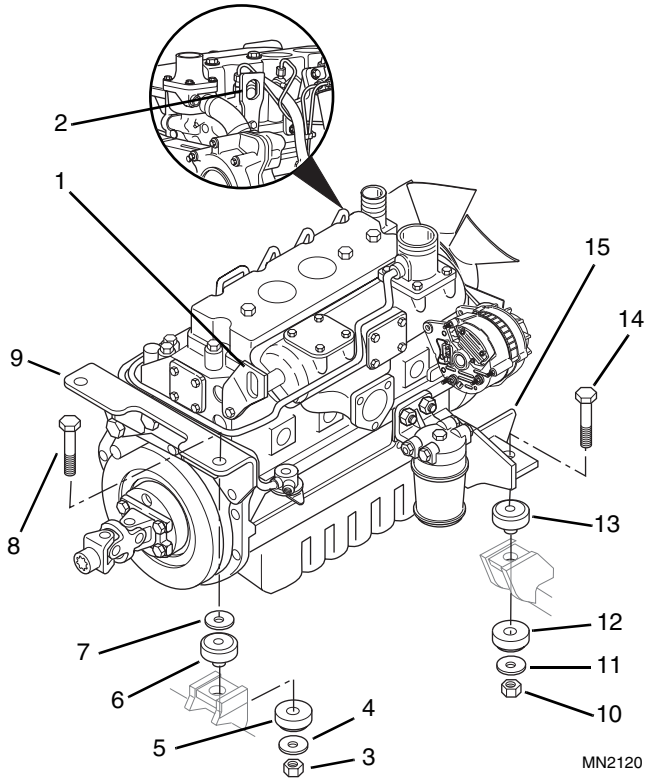


Figure 10-71 Engine Mounting

IMPORTANT: *The engine must be lifted from the vehicle using an overhead or frame type hoist and lift sling or frame rated at a minimum capacity of 1100 lbs (500 kg). The lifting equipment used (Fig. 10-72, 4) MUST be connected to the front (Fig. 10-71, 1) and rear (2) engine lift eyes. Before lifting the engine, ensure that the lift eye mounting capscrews are torqued to 33 lb/ft (44 Nm). Inspect the lift eyes for damage. If any damage is noted,* ***DO NOT*** *lift the engine until the eye(s) are replaced.*

45. Connect the lifting equipment (Fig. 10-72, 4) to the front (Fig. 10-71, 1) and rear (2) lift eyes, and remove all slack in the lift equipment to prevent the engine from unintended movement during removal of the engine mounting hardware.
46. Remove hex elastic locknut (Fig. 10-71, 3), rebound washer (4), bottom isolator (5), top isolator (6), flat washer (7) and capscrew (8) from the right and left side of the front engine mount (9).
47. Remove hex elastic locknut (Fig. 10-71, 10), rebound washer (11), bottom isolator (12), top isolator (13), and capscrew (14) from the right and left rear engine mount (15).

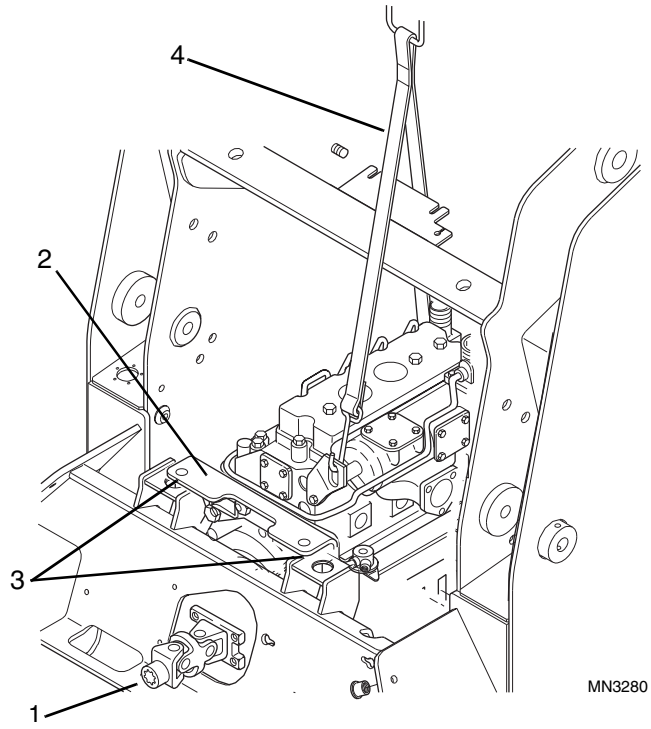


Figure 10-72 Engine Removal

48. Lift and move the engine slightly toward the rear of the vehicle, until the transmission universal drive joint (Fig. 10-72, 1) drops free of the splined transmission drive shaft.
49. Slowly lower the engine, until the engine front mount (Fig. 10-72, 2) can be securely placed on the rear of the middle frame mount brackets (3).

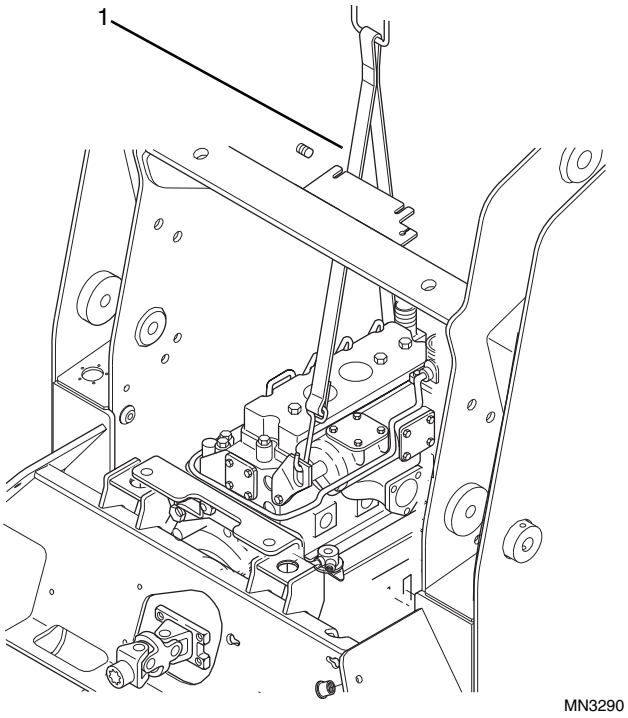


Figure 10-73 Engine Removal

50. Reconfigure the lifting equipment (Fig. 10-73, 1) to the rear of the frame crossmember, lift the engine, and remove it from the vehicle.
51. If this engine is to be replaced, it may be necessary to remove the following components from the original engine, and install them onto the replacement engine. These components may not be included with the replacement engine. Switch the following components as required:

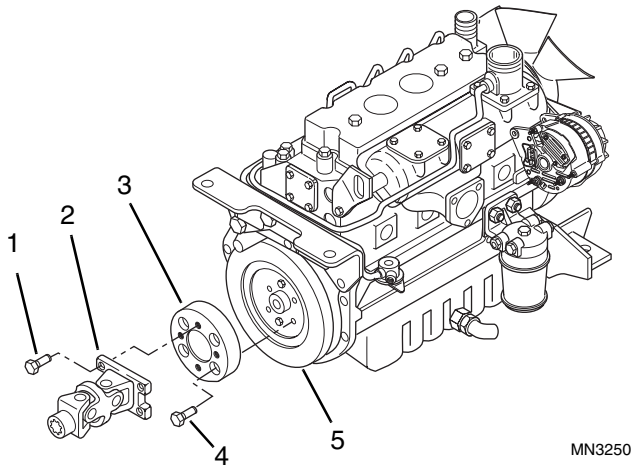


Figure 10-74 Transmission Drive Assembly

a. Remove four capscrews (Fig. 10-74, 1) that secure the transmission drive assembly (2) to the flywheel drive adapter (3) on the original engine, and remove the drive assembly (2) from the adapter (3).
b. Remove four capscrews (Fig. 10-74, 4) that secure the flywheel drive adapter (3) to the original engine flywheel (5), and remove the drive adapter (3) from the flywheel (5).
c. Install the flywheel drive adapter (Fig. 10-74, 3) to the replacement engine flywheel (5), apply Loctite 242 to the threads of four capscrews (Fig. 10-74, 4), and torque to 77 lb/ft (104 Nm).
d. Install the transmission drive assembly (Fig. 10-74, 2) to the flywheel drive adapter (3), apply Loctite 242 to the threads of the four capscrews (1), and torque to 59 lb/ft (80 Nm).

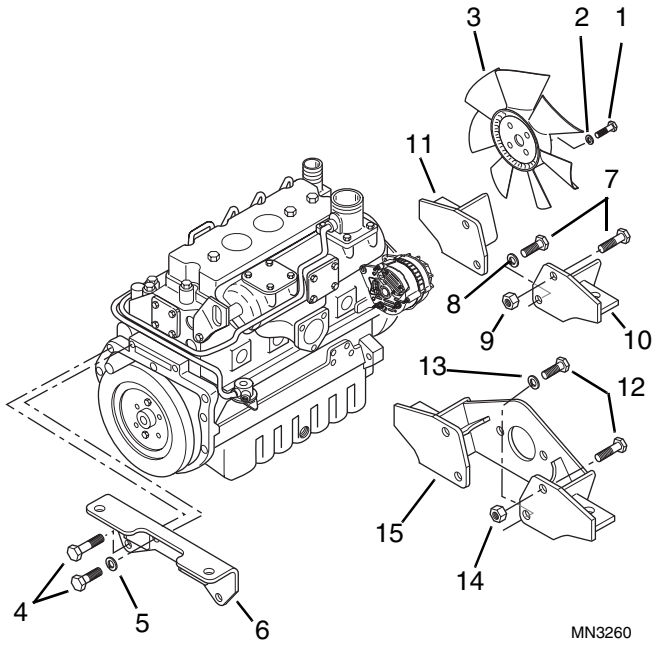


Figure 10-75 Engine Component Removal

e. Remove four capscrews (Fig. 10-75, 1) and lockwashers (2) that secure the fan blade (3) to the original engine, and remove the fan (Note the blade orientation for reassembly).
f. Install the fan blade (Fig. 10-75, 3) to the replacement engine [ensure that the cupped (concave) side of blades face the radiator], and secure with four capscrews (1) and lockwashers (2). Torque the capscrews to 14 lb/ft (19 Nm).
g. Remove four capscrews (Fig. 10-75, 4) and lockwashers (5) that secure the front mount (6) to the original engine, and remove the mount.
h. Install the front mount (Fig. 10-75, 6) to the replacement engine, and secure with four capscrews (Fig. 10-75, 4) and lockwashers (5).

i. Remove the rear engine mount(s) as follows:

- **Model 1750D, 2000D, 2300D Only:** Remove the capscrews (Fig. 10-75, 7), lockwashers (8) and hex locknuts (9) securing the left (10) and right (11) rear mount to the original engine, and remove the mounts.
- **Model 2000DX, 2300DX Only:** Remove the capscrews (Fig. 10-75, 12), lockwashers (13) and hex locknuts (14) securing the rear mount (15) to the original engine, and remove the mount.

j. Install the rear engine mount(s) as follows:

- **Model 1750D, 2000D, 2300D Only:** Install the the left (Fig. 10-75, 10) and right (11) rear mount to the replacement engine, and secure with capscrews (7), lockwashers (8) and new hex locknuts (9).
- **Model 2000DX, 2300DX Only:** Install the rear mount (Fig. 10-75, 15) to the replacement engine, and secure with capscrews (12), lockwashers (13) and new hex locknuts (14).

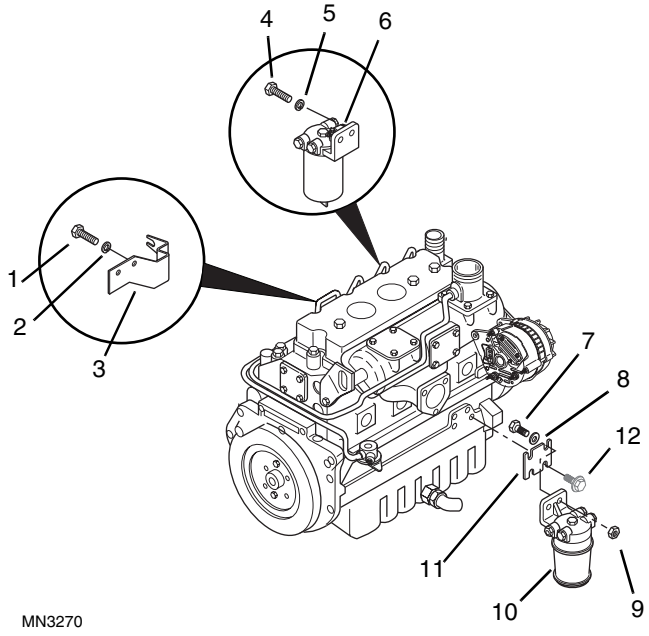


Figure 10-76 Engine Component Removal

k. Remove two capscrews (Fig. 10-76, 1) and lockwashers (2) that secure the throttle cable mounting bracket (3) to the original engine, and remove the bracket.

l. Install the throttle cable mounting bracket (Fig. 10-76, 3) to the replacement engine, and secure with two capscrews (1) and lockwashers (2).

m. Remove two capscrews (Fig. 10-76, 4) and lockwashers (5) that secure the fuel filter (6) to the original engine, and remove the filter.

n. Install the fuel filter (Fig. 10-76, 6) to the replacement engine, and secure with two capscrews (4) and lockwashers (5).

o. Remove two capscrews (Fig. 10-76, 7), lockwashers (8) and locknuts (9) that secure the water separator (10) to the mounting bracket (11) on the original engine, and remove the water separator.

p. Remove two capscrews (Fig. 10-76, 12) that secure the water separator mounting bracket (11) to the original engine, and remove the mounting bracket.

q. Install the water separator mounting bracket (Fig. 10-76, 11) to the replacement engine, and secure with two capscrews (12).

r. Install the water separator (Fig. 10-76, 10) to the mounting bracket (11) on the replacement engine, and secure with two capscrews (7), lockwashers (8) and new locknuts (9).

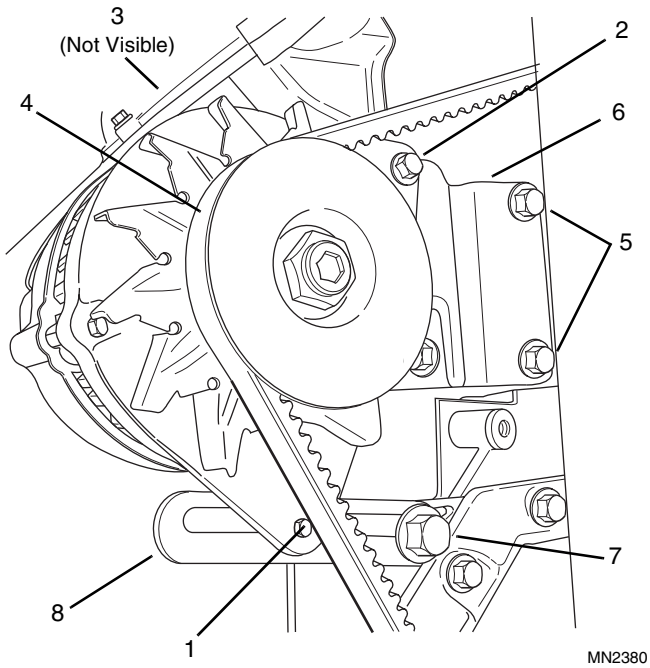


Figure 10-77 Alternator & Bracket Removal

s. Loosen the bottom alternator mounting capscrew (Fig. 10-77, 1) and two top capscrews (2 & 3 - capscrew at rear of alternator is not visible), and pivot the alternator toward the engine. Remove the fan belt (4).

t. Remove three capscrews (Fig. 10-77, 1-3), and remove the alternator from the original engine.

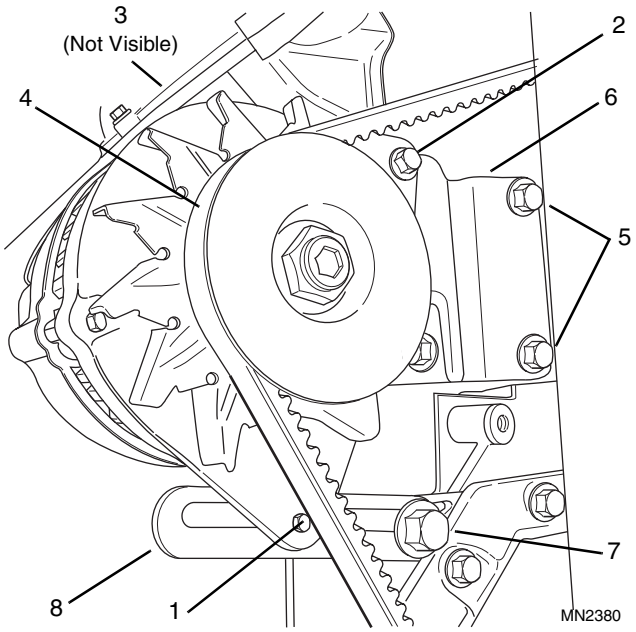


Figure 10-78 Alternator & Bracket Removal

u. Remove two capscrews (Fig. 10-78, 5), and remove the top alternator bracket (6) from the original engine.

v. Remove one capscrew (Fig. 10-78, 7), and remove the bottom alternator bracket (8) from the original engine.

w. Position the bottom alternator bracket (Fig. 10-78, 8) on the replacement engine, and loose install one capscrew (7).

x. Install the top alternator bracket (Fig. 10-78, 6) to the replacement engine, and secure with two capscrews (5).

y. Position the alternator on the replacement engine, and loose install the two top alternator mounting capscrews (Fig. 10-78, 2 & 3 - one capscrew at rear of alternator is not visible) and the bottom capscrew (1).

z. **DO NOT** reuse a worn fan belt. Inspect the fan belt (Fig. 10-78, 4) for cracking, checking, fraying, or wear, and replace the belt if required. Position the fan belt on the alternator and replacement engine pulleys.

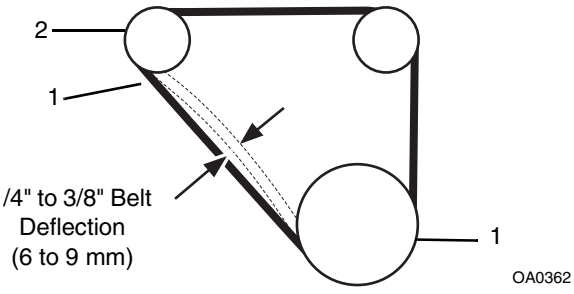


Figure 10-79 Engine Fan Belt Tension

aa. Check the belt tension midway between the crankshaft (Fig. 10-79, 1) and alternator pulleys (2). Deflection should be 1/4" to 3/8" (6 to 9 mm) with an applied force of 13 to 15 lb (6 to 7 kg). Tighten three capscrews (Fig. 10-78, 1, 2 & 3 - capscrew at rear of alternator not visible).

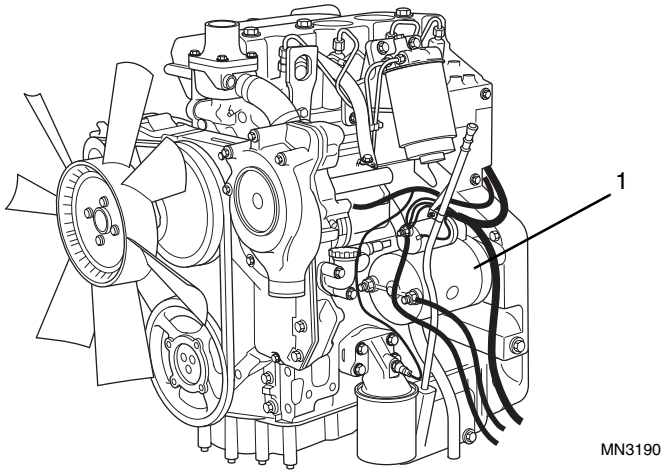


Figure 10-80 Starter

ab. Remove the hardware securing the starter (Fig. 10-80, 1) to the original engine, and remove the starter.

ac. Install the starter (Fig. 10-80, 1) on the replacement engine, and secure with the original hardware.

52. Depending upon the configuration of your replacement engine, there may be other components that will be required to be transferred from the original engine to the replacement engine. Examples include:

- Intake Manifold
- Exhaust Manifold
- Oil Pan
- Flywheel

Refer to the appropriate Perkins User Handbook and/or Workshop Manual for detailed procedures that cover the replacement of these components.

10.17 ENGINE INSTALLATION

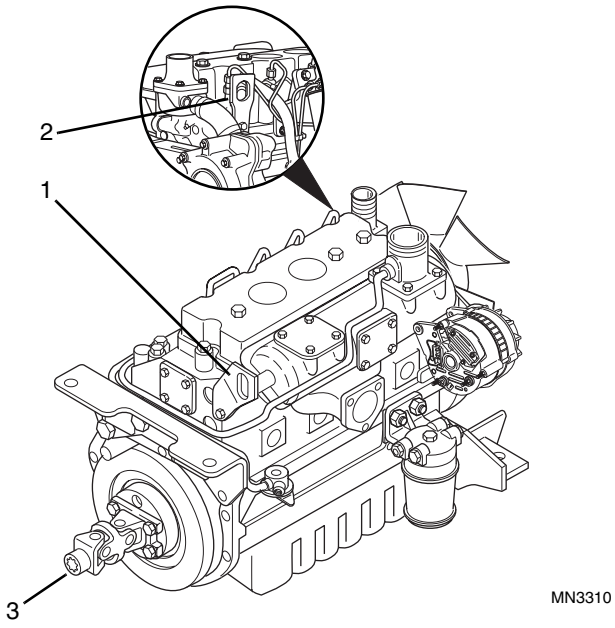


Figure 10-81 Engine Lift Eyes

1. Clean the inside of the spline coupling on the drive shaft (Fig. 10-81, 2) and coat with a molybdenum disulfide anti-seize compound.
2. Clean the input shaft of the hydrostatic transmission pump and coat with a molybdenum disulfide anti-seize compound.

IMPORTANT: *The engine must be lifted using an overhead or frame type hoist and lift sling or frame rated at a minimum capacity of 1100 lbs (500 kg). The lifting equipment used* (Fig. 10-82, 3) *MUST be connected to the front (Fig. 10-81, 1) and rear (2) engine lift eyes. Before lifting the engine, ensure that the lift eye mounting capscrews are torqued to 33 lb/ft (44 Nm). Inspect the lift eyes for damage. If any damage is noted,* ***DO NOT*** *lift the engine until the eye(s) are replaced.*

3. Connect the lifting equipment (Fig. 10-82, 3) to the front (Fig. 10-81, 1) and rear (2) lift eyes, and remove all slack in the lift equipment to prevent the engine from unintended movement during installation.

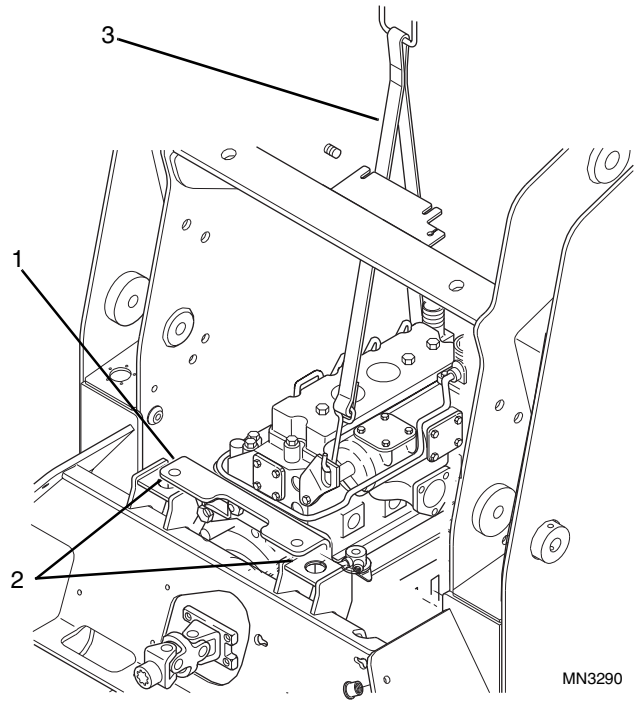


Figure 10-82 Engine Installation

4. Slowly lower the engine into the vehicle, until the engine front mount (Fig. 10-82, 1) can be securely placed on the rear of the middle frame mount brackets (2).

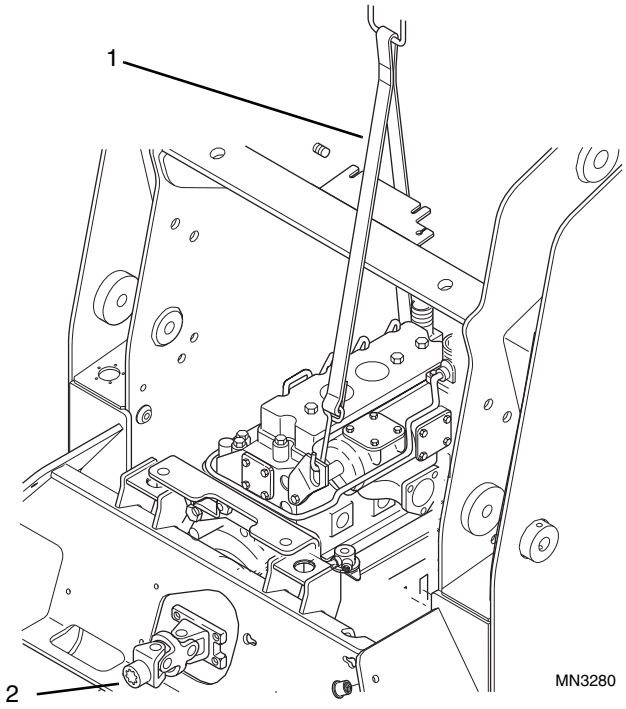


Figure 10-83 Engine Installation

5. Reconfigure the lifting equipment (Fig. 10-83, 1) to the front of the frame crossmember, and lift the engine. Guide the transmission drive assembly (2) onto the transmission input shaft as the engine is moved into its final position.

Note: *To align the splined transmission input shaft with the universal joint, it may be necessary to turn the input shaft. Use care to prevent damage to the splines on the input shaft as it is turned.*

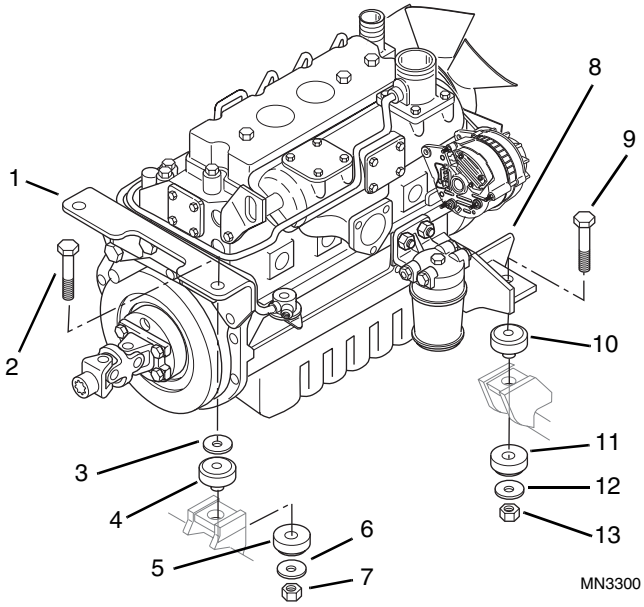


Figure 10-84 Engine Mounting

6. Align the front engine mount (Fig. 10-84, 1) with the frame mounting brackets, and loose install capscrew (2), flat washer (3), top isolator (4), bottom isolator (5), rebound washer (6), and new hex elastic locknut (7), to the right and left side of the front engine mount (1).
7. Align the rear engine mount (Fig. 10-84, 8) with the frame mounting brackets, and loose install capscrew (9), top isolator (10), bottom isolator (11), rebound washer (12), and new hex elastic locknut (13), to the the rear engine mount (7).
8. Fully lower the engine, disconnect and remove the lifting equipment.
9. Tighten all four mounting capscrews (Fig. 10-84, 2 & 9) and hex locknuts (7 & 13) securely.

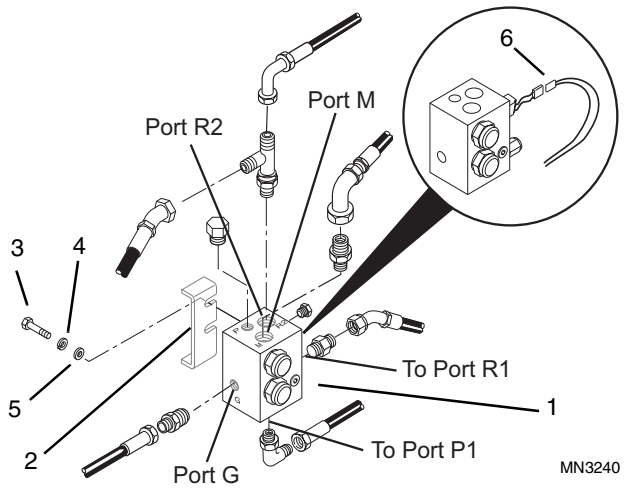


Figure 10-85 High Flow Valve Installation

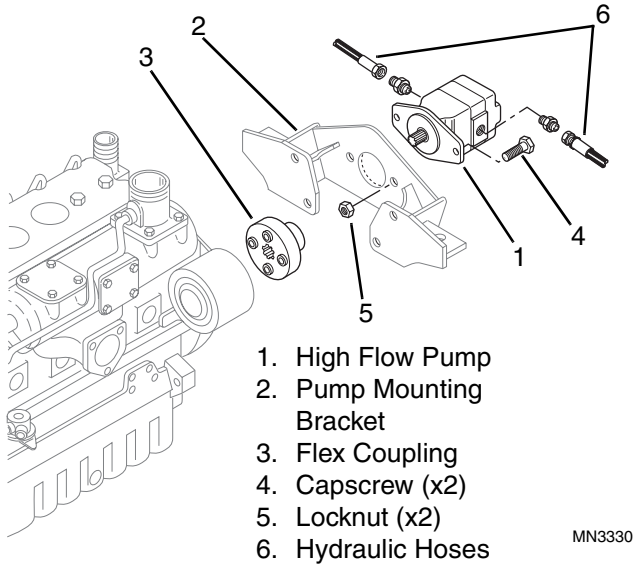
10. **For DX Models Only:**

    a. Install the high flow valve (Fig. 10-85, 1) to the mounting bracket (2) located inside the engine compartment on the fuel tank, and secure with socket head capscrews (3), lockwashers (4), and flat washers (5).

    b. Plug the electrical connector (Fig. 10-85, 6) with red wire # 87 and black wire #23 into the solenoid on the valve.

    c. Uncap all hydraulic hoses, and connect hoses to the high flow valve (Fig. 10-85, 1). If the hoses were not tagged during disassembly, refer to Figure 4-71, “High Flow - Supply, Return and Cooling Circuits” and Figure 4-72, “High Flow (DX) Hydraulic Circuit” for hose connection diagrams.

    d. Torque all hydraulic hose fittings (Refer to Section 2.8, “Torques”).



1. High Flow Pump
2. Pump Mounting Bracket
3. Flex Coupling
4. Capscrew (x2)
5. Locknut (x2)
6. Hydraulic Hoses

Figure 10-86 High Flow Pump Mounting

    e. Install the high flow pump (Fig. 10-86, 1) onto the mounting bracket (2) while rotating the pump slightly to insert the pump input shaft into the flexible coupler (3). Secure with two capscrews (4) and new hex locknuts (5).

    f. Uncap and connect both hoses (Fig. 10-86, 6) to the high flow pump. If the hoses were not tagged during disassembly, refer to Figure 4-71, “High Flow - Supply, Return and Cooling Circuits” for hose connection diagrams.

    g. Torque both hydraulic hose fittings (Refer to Section 2.8, “Torques”).

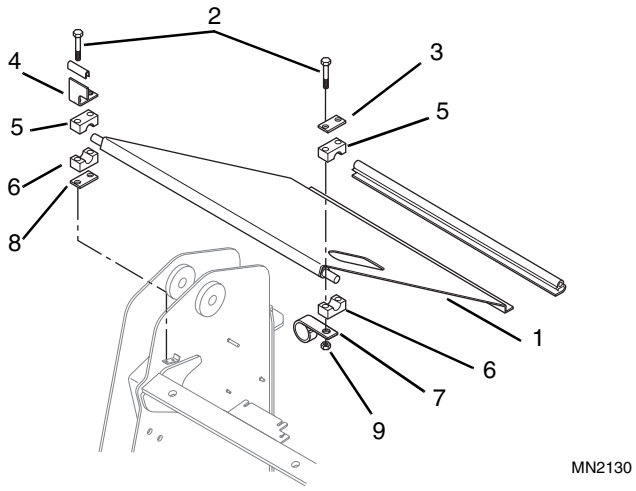


Figure 10-87 Engine Rear Cover

11. Install the engine cover (Fig. 10-87, 1), and secure with capscrews (2), clamp cover plate (3) on left side only, stop plate (4) on right side only, upper half clamps (5), lower half clamps (6), J-clamp (7) on left side only, clamp cover plate (8) on right side only, and new elastic locknuts (9).

Note: *Check the holding tension of the half clamps by lifting the cover (Fig. 10-87, 1) up to a vertical position. The clamps should be tight enough to hold the cover in this position. The clamps should NOT be tight to the point that the cover requires excessive force to move. Adjust as required for proper operation.*

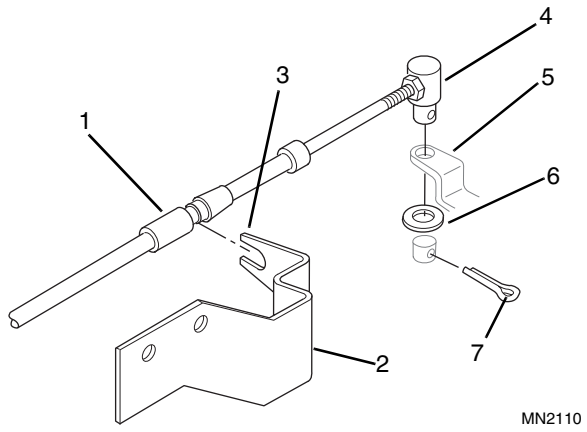


Figure 10-88 Throttle Cable Removal

12. Install the throttle cable (Fig. 10-88, 1) into the slot in the mounting bracket (2). Squeeze the tangs (3) on the throttle cable mounting bracket (2) just enough to secure the throttle cable (1) into the bracket (2).
13. Install the throttle cable rod end (Fig. 10-88, 4) to the fuel injection pump lever (5), and secure with flat washer (6) and cotter pin (7). Adjust the throttle cable (refer to Section 7.6.3, “Throttle Control Maintenance”).

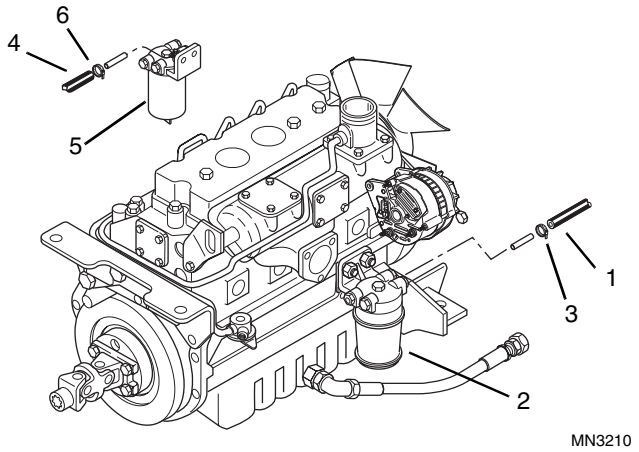


Figure 10-89 Fuel Lines

14. Unplug the fuel supply line (Fig. 10-89, 1) and connect to the water separator (2) on the left side of the engine. Tighten the hose clamp (3) securely.
15. Unplug the fuel return line (Fig. 10-89, 4) and connect to the fuel filter (5) on the right side of the engine. Tighten the hose clamp (6) securely.

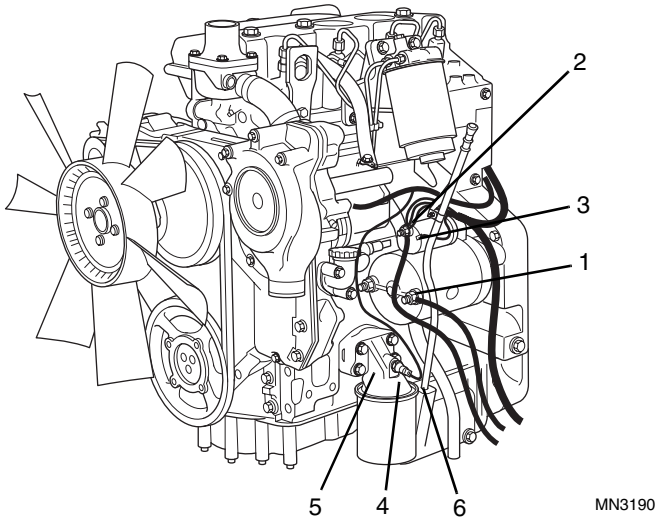


Figure 10-90 Starter Wiring

16. Connect the black (negative) battery cable (Fig. 10-90, 1) to the starter housing.
17. Connect the red (positive) battery cable, red/gray wire #19, and red wire #3 (Fig. 10-90, 2) to the large stud on the starter solenoid.
18. Connect white/blue wire #1 (Fig. 10-90, 3) to the blade terminal on the starter solenoid.
19. Install the oil pressure switch (Fig. 10-90, 4) to the filter housing (5), and connect brown wire #9 (6) to the switch terminal.

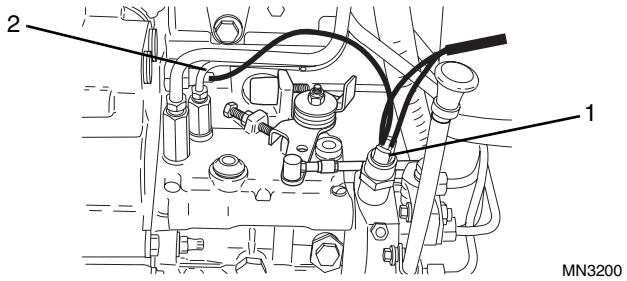


Figure 10-91 Fuel Injection Pump Wiring

20. Connect green/white wire #20 and black wire #2E (Fig. 10-91, 1) to the fuel solenoid on the injection pump.
21. Connect orange wire #20C (Fig. 10-91, 2) to the cold start timing advance switch.

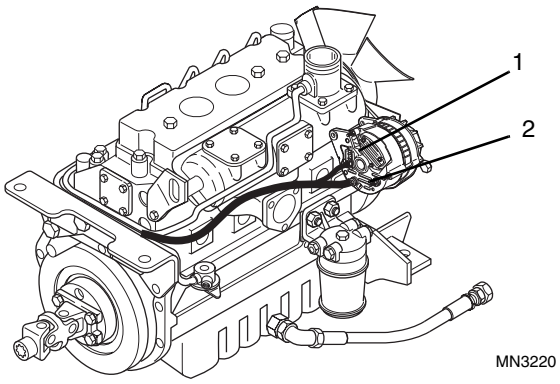


Figure 10-92 Alternator Wiring

22. Connect yellow wire #7 (Fig. 10-92, 1) to alternator spade terminal.
23. Connect red/gray wire #19 (Fig. 10-92, 2) from B+ alternator terminal.

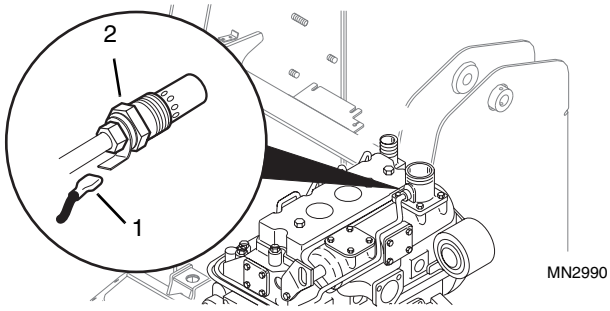


Figure 10-93 Thermo Start Plug

24. Connect white/brown wire #4 (Fig. 10-93, 1) to the thermo start plug (2).

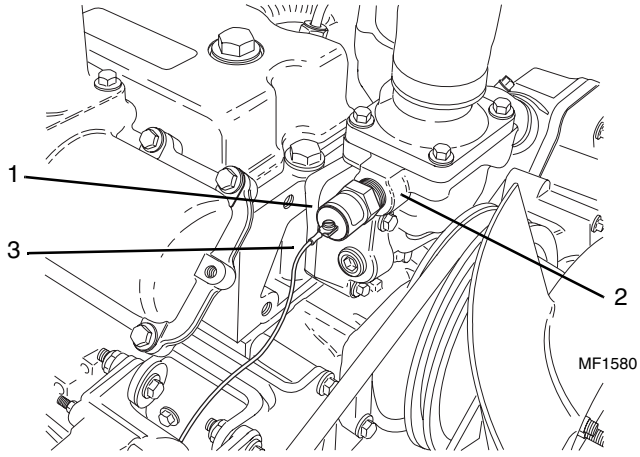


Figure 10-94 Engine Water Temperature Wiring

25. Install the water temperature switch (Fig. 10-94, 1) to the thermostat housing (2), and connect light blue wire #8 (3) to the water temperature switch (1).

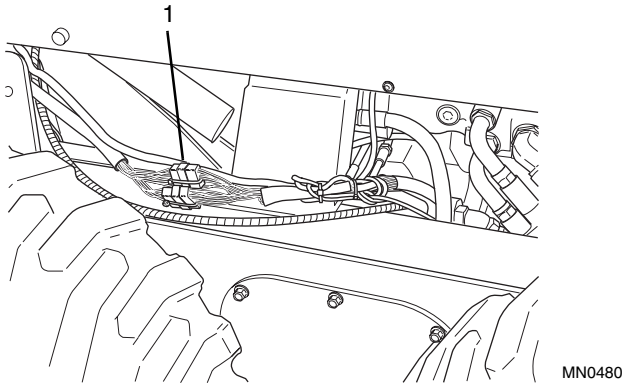


Figure 10-95 Wiring Harness Connectors

26. Connect three wiring harness connectors (Fig. 10-95, 1) attaching the Operator's Protective Structure Wiring Harness and Engine/Chassis Wiring Harness.

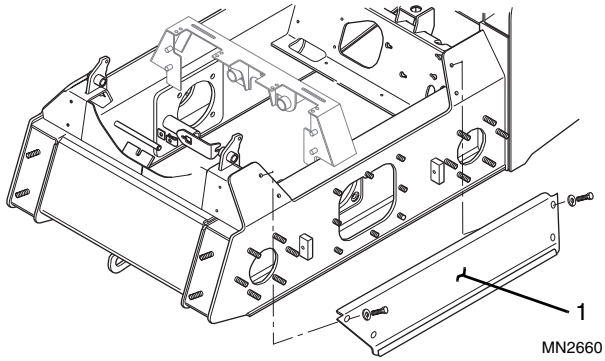


Figure 10-96 Frame Side Cover Installation

27. Install the left (Fig. 10-96, 1) and right (not shown) side covers to the vehicle.

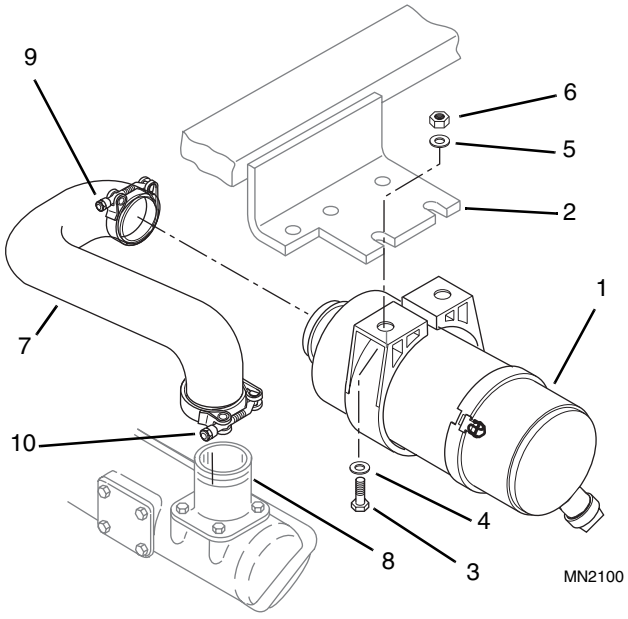


Figure 10-97 Air Cleaner Installation

28. Install the air cleaner (Fig. 10-97, 1) to the frame crossmember (2), and secure with capscrew (3), flat washer (4), rebound washer (5), and new hex locknut (6).
29. Install the intake hose (Fig. 10-97, 7) between the air cleaner (1) and induction manifold (8), and secure with clamps (9 & 10).

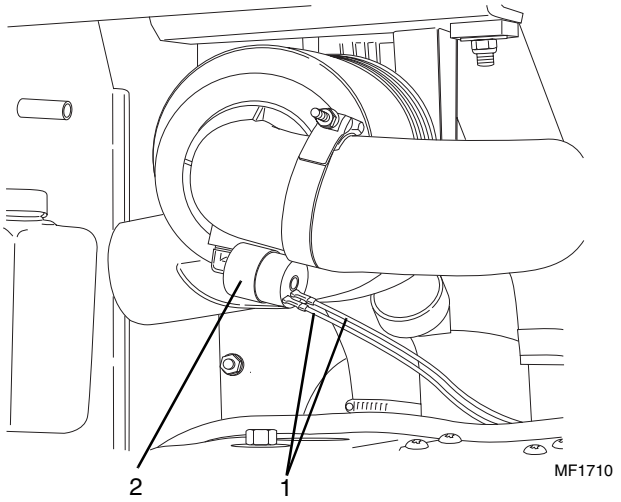


Figure 10-98 Air Restriction Indicator Switch

30. Connect red/blue wire #28 and black wire #2H (Fig. 10-98, 1) to the air cleaner restriction switch (2).

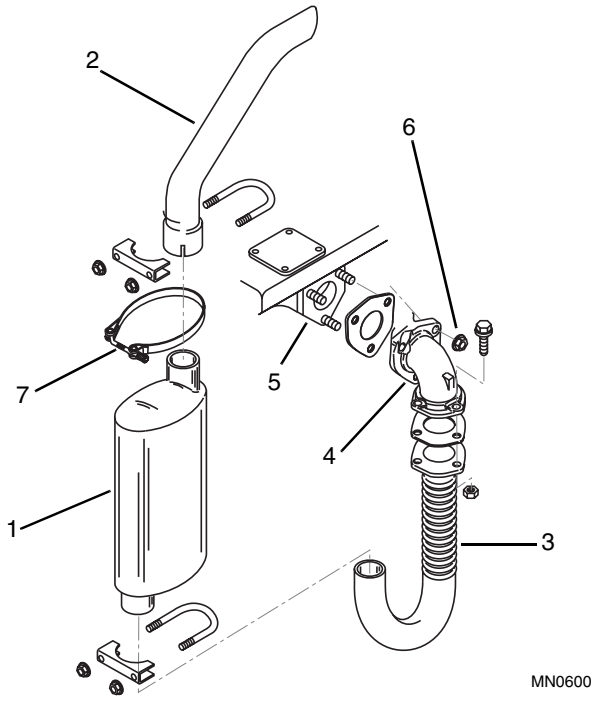


Figure 10-99 Exhaust System Removal

31. Position the muffler/tailpipe assembly (Fig. 10-99, 1 & 2) with flexible exhaust pipe (3) in the vehicle, and secure the exhaust elbow (4) to the engine exhaust manifold (5) with new hex locknuts (6). Position the muffler body clamp (7), and tighten securely.

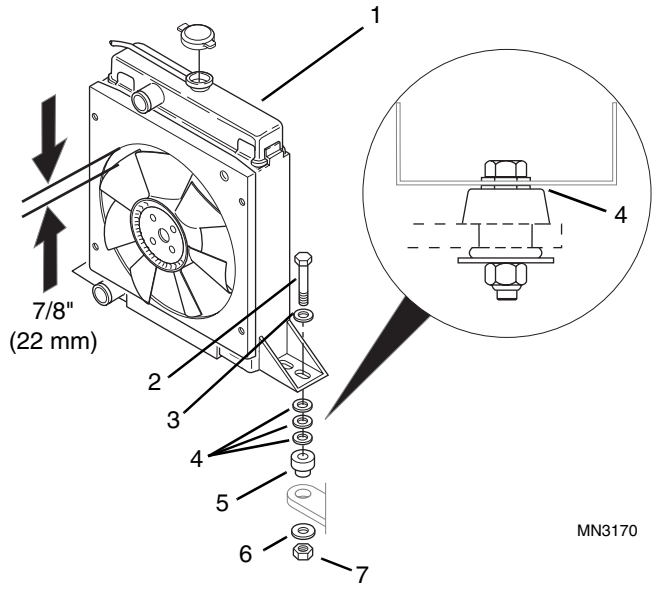


Figure 10-100 Radiator Installation

32. Position the radiator/oil cooler assembly (Fig. 10-100, 1) on the vehicle.
33. Loose install the capscrew (Fig. 10-100, 2), flat washer (3), fender washers (4), isolator (5), rebound washer (6), and new hex elastic locknut (7) to the left and right side of the bottom of the radiator.
34. By adjusting the quantity of flat washers (Fig. 10-100, 4), adjust the radiator assembly position to achieve a clearance of 7/8" (22 mm) between the shroud and fan blade tips. When the clearance is adjusted as required, tighten all capscrews (2) and hex elastic locknuts (7) securely.

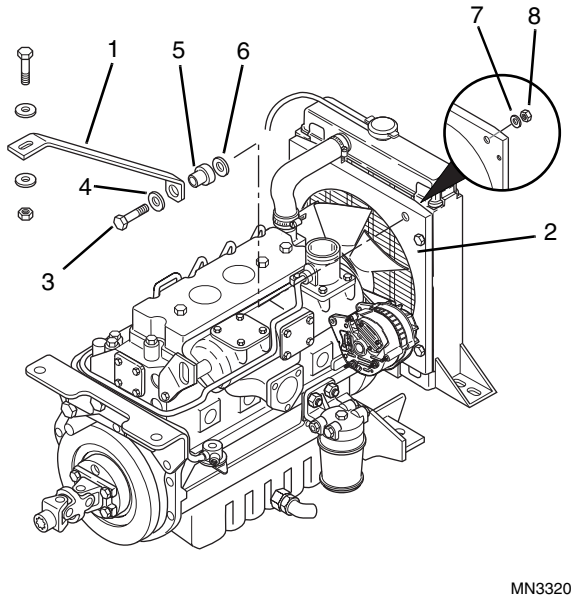


Figure 10-101 Radiator Installation

35. Loose install the upper radiator support (Fig. 10-101, 1) to the radiator shroud (2), using a capscrew (3), rebound washer (4), isolator (5), rebound washer (6), flat washer (7), and a new hex elastic locknut (8).

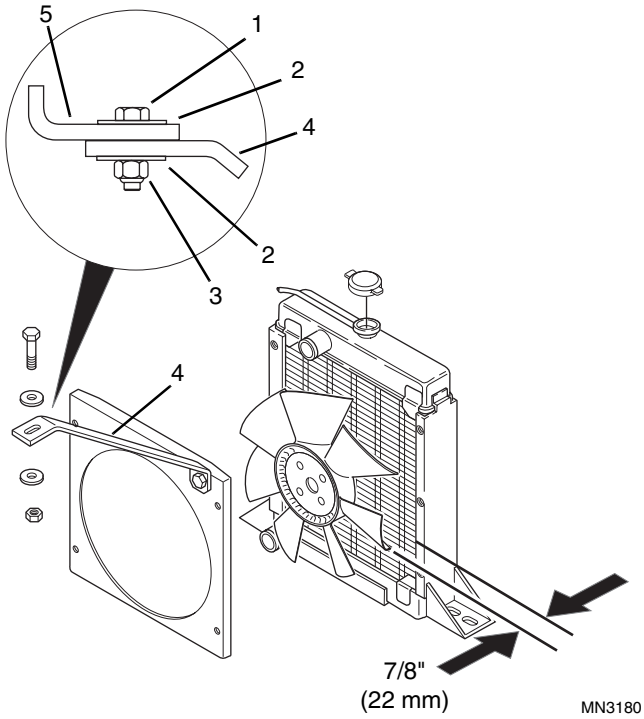


Figure 10-102 Radiator Installation

36. Loose install the capscrew (Fig. 10-102, 1), flat washers (2), and new hex elastic locknut (3) that secure the top of the upper radiator support (4) to the frame crossmember (5).
37. The top hole of the radiator support (Fig. 10-102, 4) is slotted, to allow adjustment of the radiator assembly for front-to-back fan clearance with the radiator core. Adjust this clearance to 7/8" (22 mm), and tighten capscrew (1) and hex elastic locknut (3) securely.
38. Tighten capscrew (Fig. 10-101, 3) and hex elastic locknut (8), and torque to 40 lb/ft (54 Nm).

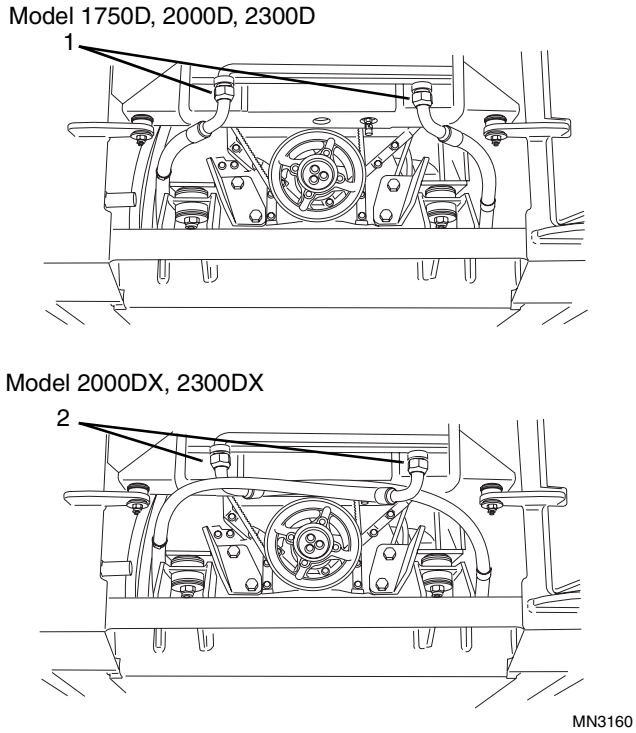


Figure 10-103 Hydraulic Oil Cooler Connections

39. Place a drain pan under the hydraulic oil cooler lines (Fig. 10-103, 1 or 2) to catch any oil that comes out of the oil cooler or lines as they are connected.
    a. Remove a plug from one cooler hose and the cap from the corresponding oil cooler fitting, and install the hydraulic hose to the fitting. Torque the hose (Refer to Section 2.8, “Torques”).
    b. Remove the plug from the second oil cooler hose and the cap from the corresponding oil cooler fitting, and install the second hydraulic hose to the fitting. Torque the hose (Refer to Section 2.8, “Torques”).
    c. Transfer the oil to a container with a cover and label the container as used oil. Dispose of the used oil at an approved recycling facility.

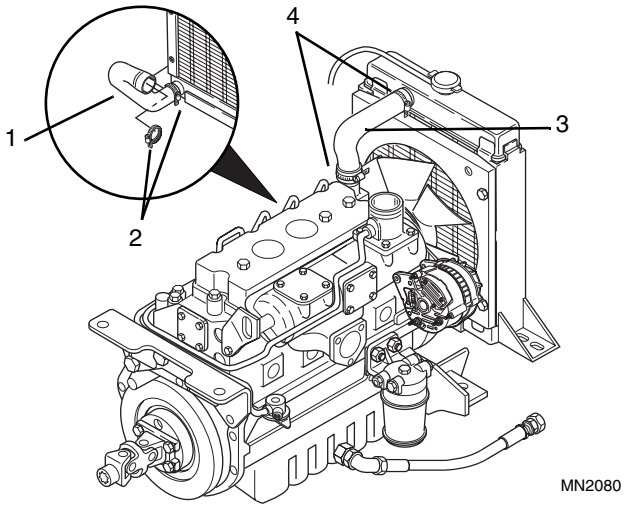


Figure 10-104 Radiator Hose Connections

40. Connect the lower radiator hose (Fig. 10-104, 1) to the engine, and tighten both clamps (2). Connect the upper radiator hose (3) to the engine, and tighten both clamps (4).

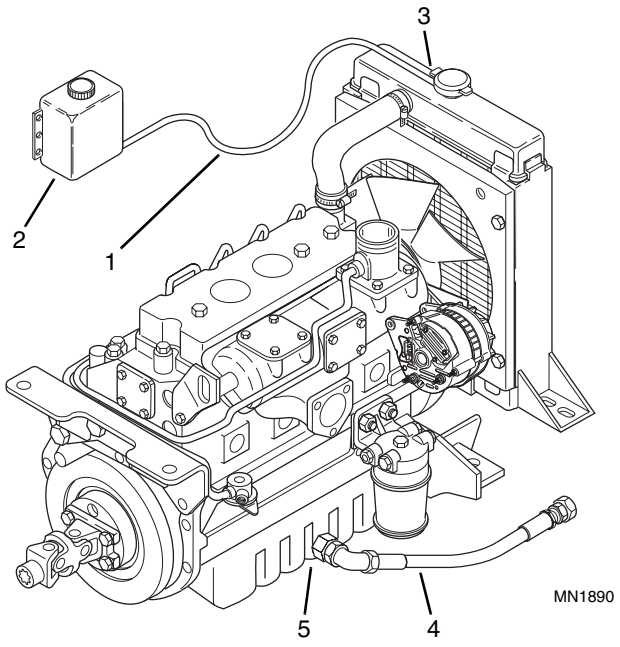


Figure 10-105 Radiator Overflow Bottle

41. Connect the radiator overflow hose (Fig. 10-105, 1) from the overflow bottle (2) to the radiator filler neck fitting (3).

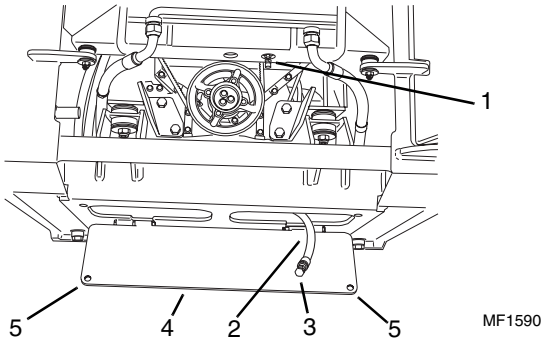


Figure 10-106 Radiator/Engine Oil Drain

42. Ensure the radiator drain valve (Fig. 10-106, 1) is securely closed.
43. Fill the radiator completely with 50/50 mixture of ethylene glycol and water. The cooling system capacity is listed in “Specifications,” Section 11.
44. Replace radiator cap.
45. Add coolant to the overflow bottle (Fig. 10-105, 2) until it is about 1/4 to 1/2 full - approximately 1 quart (0,9 liter).
46. Install the oil drain hose (Fig. 10-105, 4) to the oil pan (5).
47. Ensure that the drain hose plug (Fig. 10-106, 3) is securely tightened.
48. Swing the access cover (Fig. 10-106, 4) up into place and secure in each corner (5) with the original capscrews.
49. Fill engine with 10W30 motor oil equal to API, CD or CE (severe duty diesel engine) specifications. The engine oil capacity is listed in “Specifications,” Section 11.
50. Connect the negative (-) battery cable to both batteries, and replace the floor plate between the foot pedals.
51. Refer to Section 4.5, “Startup After Hydraulic System Repairs,” for instructions on checking the level of the hydraulic system oil before initial engine startup.

IMPORTANT: *When the engine is initially started, run it briefly at low idle, and check the vehicle for any visual sign of fluid leakage.* ***STOP*** *the engine immediately if any leakage is noted, and make any necessary repairs before continuing.*

52. Recheck the engine oil level. If it is below the minimum mark, add 10W30 motor oil equal to API, CD or CE (severe duty diesel engine) specifications as required (Refer to Section 10.6.2, “Check Engine Oil Level”).
53. Wait for engine to cool, and check the coolant level. Top it off as required by adding coolant through the overflow bottle.
54. Lower the Operator’s Protective Structure from the service position (Refer to Section 2.11, “Operator’s Protective Structure Tilt Service Position”).
55. Lower the engine cover, and close and lock the rear engine compartment door.

10.18 ENGINE/CHASSIS ELECTRICAL WIRING DIAGRAM

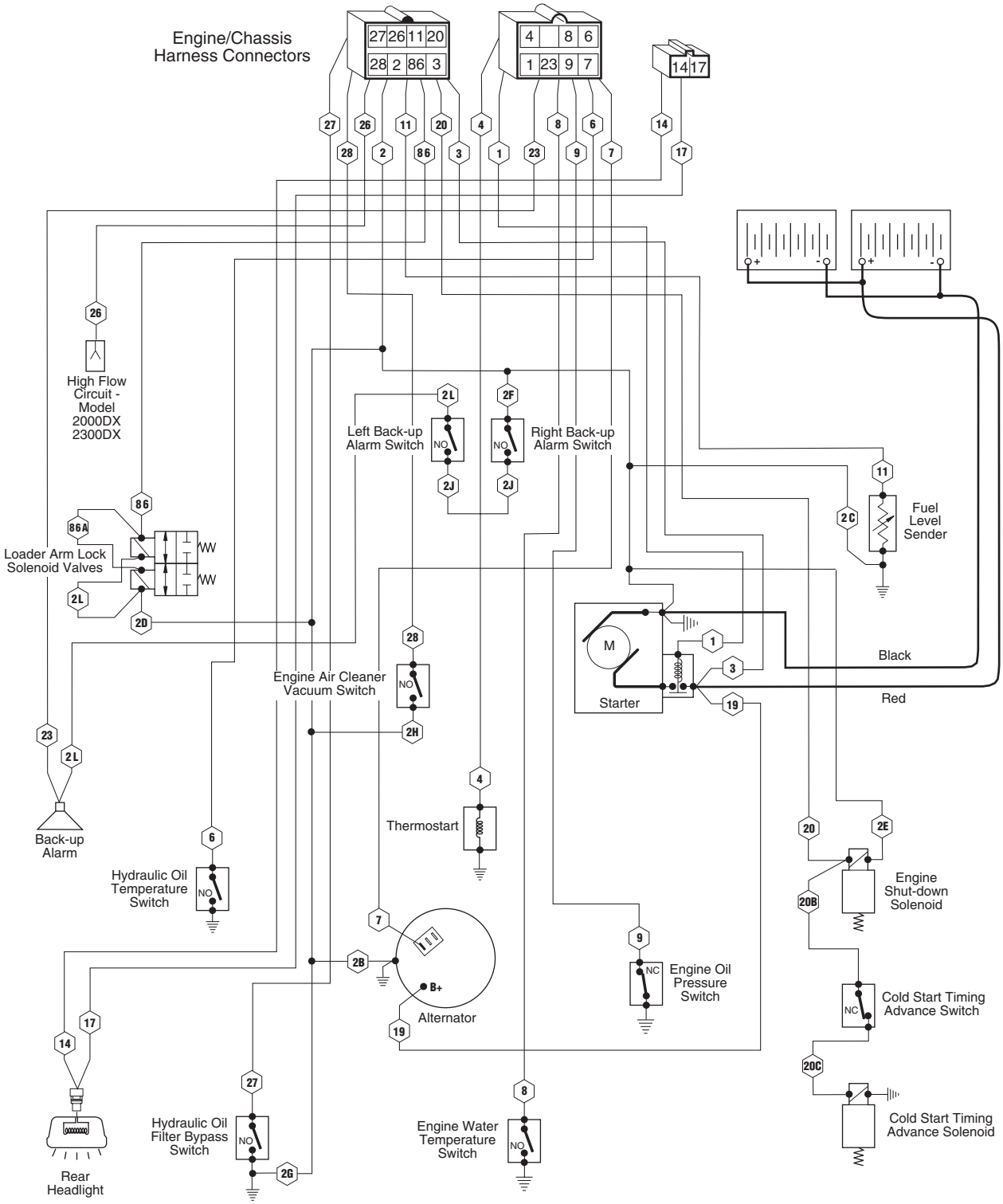


Figure 10-107 Engine/Chassis Electrical Diagram

10.19 ELECTRICAL SYSTEM SCHEMATIC

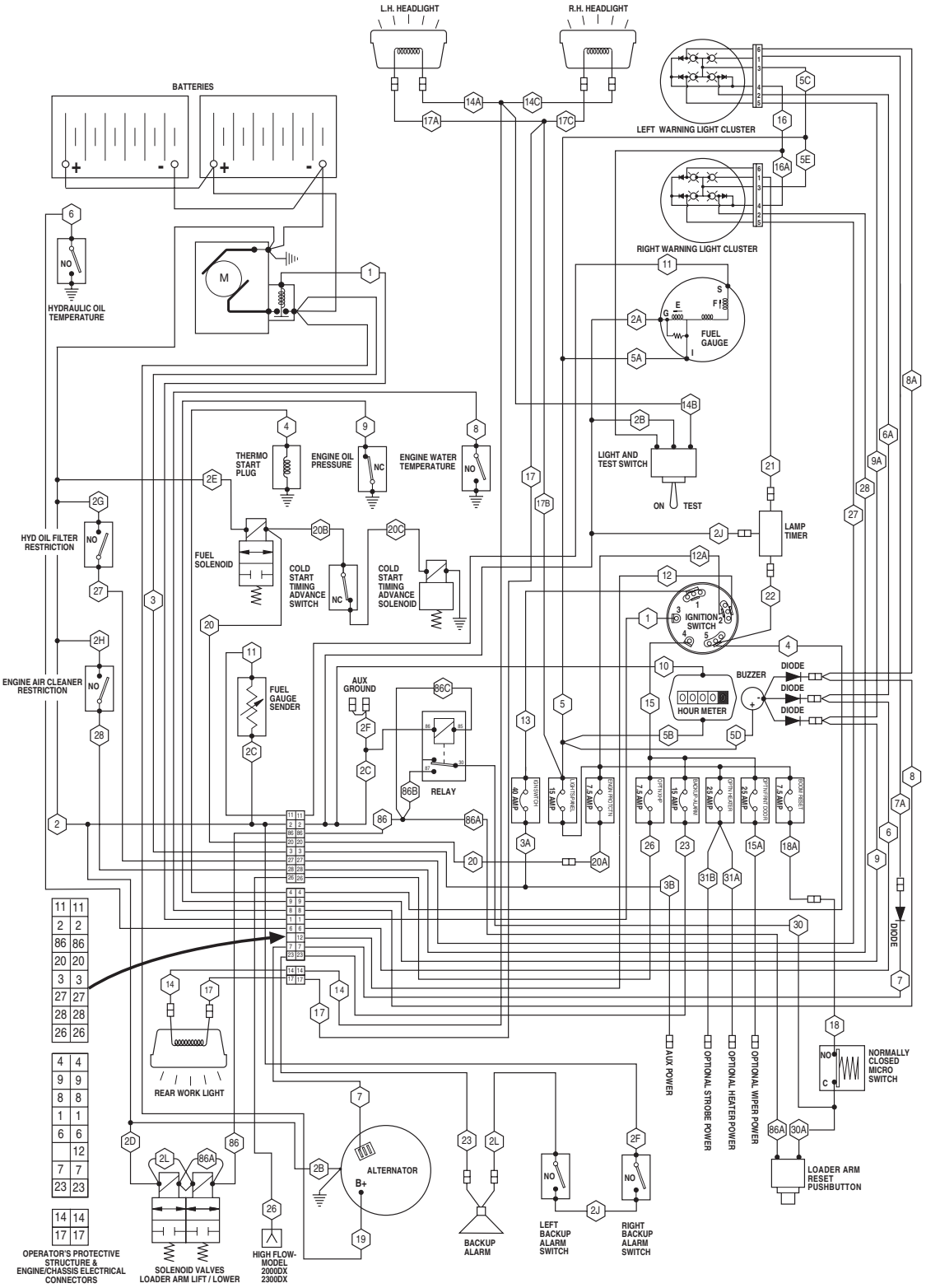


Figure 10-108 Electrical System Schematic

10.20 ELECTRICAL WIRING COLOR CODE/FUNCTION CHART

CIRCUIT	WIRE COLOR	WIRE GAUGE	FUNCTION
1	White/Blue	12	Ignition Switch “3” to Starter Solenoid
2	Black	14	Main Ground Circuit from Operator Protective Structure Harness through Engine/Chassis Harness to Starter Mounting Bolt/Battery Ground Cable
2A	Black	20	Fuel Gauge “G” spliced to Wire #2
2B	Black	16	1) Light Switch Center Terminal Spliced to Wire #2 2) Light Switch Center Terminal and Alternator Ground Spliced to Wire #2
2C	Black	14	1) Loader Arm Lock Relay Spliced to Wire #2 2) Fuel Gauge Sender Spliced to Wire #2
2D	Black	16	Loader Arm Lockout Solenoid Spliced to Wire #2
2E	Black	14	Engine Fuel Solenoid Spliced to Wire #2
2F	Black	14	1) Two Ground Connectors at Loader Arm Lock Relay Spliced to Wire #2 2) One Terminal on Right Backup Alarm Switch Spliced to Wire #2
2G	Black	20	Hydraulic Oil Filter Base Housing Spliced to Wire #2
2H	Black	20	One Terminal on Air Cleaner Switch Spliced to Wire #2
2J	Black	16	1) Lamp Timer (Black Pigtail Connector) to Wire #2 2) Jumper Between Left and Right Backup Alarm Switches
2L	Black	16	1) Left Backup Alarm Switch to Alarm Assembly 2) Jumper Between Loader Arm Lock Solenoids
3	Red	10	Power (12 VDC) from Starter Solenoid/Positive Battery Cable Spliced to #3A and #3B
3A	Red	10	Splice from Wire #3 to 40 amp Fuse in Fuse Panel
3B	Red	10	Splice from Wire # 3 and #3A to Auxiliary Power (12 VDC) Connector
4	White/Brown	12	Ignition Switch Terminal #4 to Thermostart Assembly
5	White	20	15 amp Fuse (12 VDC) Spliced to #5A, #5B, #5C, #5D, & #5E
5A	White	20	Splice from Wire #5 (12 VDC) to Fuel Gauge Terminal “L”
5B	White	20	Splice from Wire #5 (12 VDC) to Hourmeter (Not Polarity Sensitive)
5C	White	20	Splice from Wire #5 (12 VDC) to Left Warning Light Cluster “3”
5D	White	20	Splice from Wire #5 (12 VDC) to Warning Light Alarm “+”
5E	White	20	Splice from Wire #5 (12 VDC) to Right Warning Light Cluster “3”
6	Green	20	Hydraulic Oil Temperature Signal from Sending Unit to Connector (with Wire #6A) at Warning Light Alarm Harness
6A	Green	20	Hydraulic Oil Temperature Signal from Warning Alarm Harness Connector (with Wire #6) to Left Warning Light Cluster “2”
7	Yellow	20	Alternator Warning Light Signal from Alternator through Diode to Connector Located Near Fuse Panel
7A	Yellow	20	Alternator Warning Light Signal from Connector with Wire #7 to Left Warning Light Cluster “1”
8	Light Blue	20	Engine Temperature Signal from Sending Unit to Connector (with Wire #8A) at Warning Light Alarm Harness
8A	Light Blue	20	Engine Temperature Signal from Warning Alarm Harness Connector (with Wire #8) to Left Warning Light Cluster “6”
9	Brown	20	Oil Pressure Light Signal from Sending Unit to Connector (with Wire #9A) at Warning Light Alarm Harness
9A	Brown	20	Oil Pressure Buzzer Signal from Warning Alarm Harness Connector (with Wire #9) to Left Warning Light Cluster “5”
10	Orange	20	Hourmeter (Not Polarity Sensitive) Spliced to Wire #2
11	Gray (Slate)	20	Fuel Level Sender to Fuel Gauge “S”

12	Violet (Purple)	10	Ignition Switch “2” to Main Harness Connector (Not Used In Engine/Chassis Wiring Harness)
12A	Violet (Purple)	10	Ignition Switch “2” to Fuse Panel
13	Red/Blue	10	40 amp Fuse (Vdc) to Ignition Switch “1”
14	White/Black	16	Light Switch to Rear Worklight (Negative)
14A	White/Black	16	Splice from #14B to Left Front Worklight (Negative)
14B	White/Black	16	Light Switch Spliced to #14A/#14C Front Worklights (Negative)
14C	White/Black	16	Splice from #14B to Right Front Worklight (Negative)
15	White/Red	10	Ignition Switch “4” to Fuse Panel
15A	White/Red	14	25 amp Fuse (12 VDC) to Connector for Optional Wiper and Fan
16	White/Green	20	Light Switch to “4” of Left and Right Warning Light Clusters
17	White/Yellow	16	Splice at 17B to Rear Worklight Connector
17A	White/Yellow	16	Splice at 17B to Left Front Worklight Connector
17B	White/Yellow	16	15 amp Fuse (12 VDC) Spliced to 17, 17A, and 17C (Worklights)
17C	White/Yellow	16	Splice at 17B to Right Front Worklight Connector
18	Red/White	16	Power (12 VDC) from #18A Connector to Loader Arm Lock Micro Switch “Normally Open” Terminal
18A	Red/White	16	7.5 amp Fuse (12 VDC) to #18 Connector
19	Red/Gray	10	Alternator (12 VDC Charge) to Starter Solenoid (Positive Battery Cable)
20	Green/White	14	Power (12 VDC) from #20A Connector to Engine Shutdown Solenoid
20A	Green/White	14	7.5 amp Fuse (12 VDC) to #20 Connector
20B	Green/White	14	Power (12 VDC) from Engine Shutdown Solenoid to Cold Start Timing Advance Switch
20C	Orange	16	Cold Start Timing Advance Switch to Cold Start Timing Advance Solenoid
21	White/Green	18	Lamp Timer (White Pigtail Connector) to Right Warning Light Cluster “1”
22	Red/Green	18	Ignition Switch “5” to Lamp Timer (Red Pigtail Connector)
23	Pink	16	15 amp Fuse (12 VDC) to Backup Alarm Assembly
26	Dark Blue/ Yellow	16	7.5 amp Fuse (12 VDC) to Optional High Flow Connector
27	Red/Yellow	20	Hydraulic Oil Filter Restriction Signal from Switch to Right Warning Light Cluster “5”
28	Red/Blue	20	Air Cleaner Restriction Signal from Switch to Right Warning Light Cluster “2”
30	Red/Black	16	Loader Arm Lockout Micro Switch “Common” to Relay
30A	Red/Black	16	Loader Arm Lockout Micro Switch “Common” to Reset Pushbutton
31A	Yellow/Blue	14	25 amp Fuse (12 VDC) to Optional Heater Connector
31B	Yellow/Blue	14	25 amp Fuse (12 VDC) to Optional Strobe Connector in Instrument Panel
86	Dark Blue	18	Splice from #86A, #86B, & #86C to Loader Arm Lockout Solenoid
86A	Dark Blue	18	1) Loader Arm Lockout Pushbutton Switch Spliced to #86 Wire 2) Loader Arm Lockout Solenoid to Solenoid
86B	Dark Blue	16	Loader Arm Lockout Relay Spliced to #86 Wire
86C	Dark Blue	16	Loader Arm Lockout Relay Spliced to #86 Wire

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Section 11
Specifications

Contents

Note: *Unless otherwise specified, vehicle specifications listed throughout Section 11 are taken with a full fuel tank, 165 lb (75 kg) operator, 72 in (1828,8 mm) 456 lb (207 kg) dirt bucket, 12.00 x 16.5 6 ply tires, and standard equipment.*

11.1 ENGINE

Description	All Models
Engine Make/Model	Perkins 1004.42 Naturally Aspirated Diesel
Engine Build Number	AR70419
Horsepower	86 hp @ 2400 rpm
Displacement	258 in³ (4,2 liters)
Number of Cylinders	4
Engine High Speed Idle with No Load	2600 ± 50 rpm
Engine Low Idle Speed	1200 ± 50 rpm
Fuel Supply	Fuel Injection
Air Cleaner	Dry Type, Replaceable Primary and Safety Elements
Engine Oil Starvation Angle:	
Fore and Aft	35°
Side to Side	35°

11.2 POWER TRAIN

Description	1750D	2000D/DX	2300D/DX
Power Train Type	Hydrostatic with single stage chain drive to wheels	Hydrostatic with single stage chain drive to wheels	Hydrostatic with single stage chain drive to wheels
Transmission	Tandem Pump Assembly	Tandem Pump Assembly	Tandem Pump Assembly
Sauer Sundstrand Variable Displacement Hydrostatic Pumps:	2.65 in³/rev (43,4 cm³/rev)	2.8 in³/rev (45,9 cm³/rev)	2.8 in³/rev (45,9 cm³/rev)
Relief Setting	4700 psi (323,8 bar)	4700 psi (323,8 bar)	5000 psi (344,36 bar)
Eaton Hydrostatic Drive Fixed Displacement Motors:	30 in³/rev (491,7 cm³/rev)	30 in³/rev (491,7 cm³/rev)	49 in³/rev (802,9 cm³/rev)

11.3 ELECTRICAL SYSTEM

Description	All Models
Battery:	
Type, Rating	Maintenance Free Lead Acid, 12 V dc Negative Ground, Group Size 24
Quantity	2 (parallel)
Reserve Capacity	Standard: 109 minutes @ 80° F (27° C) Optional Heavy Duty: 125 minutes @ 80° F (27° C)
Cold Cranking Amps	Standard: 525 CCA @ 0° F (-18° C) Optional Heavy Duty: 800 CCA @ 0° F (-18° C)
Alternator	12 V, 55 A
Starter	12 V, 2.8 kW
Fuses - Standard Blade Style:	
7.5 Amp	Loader Arm Lock Valve Solenoid, Fuel Solenoid, High Flow Solenoid (DX Models Only)
15 Amp	Back-up Alarm, Gauges, Work Lights
25 Amp	Strobe (Option), Defroster and Windshield Wiper (Front Door Option), Heater (Enclosed Cab Option)
40 Amp	Ignition Switch Feed for Entire Electrical System
Front and Rear Work Light	35 W, 12.8 V Sealed Beam (Hobbs 80746)
Warning Light Bulbs	Qty. 7 (GE 161)
Loader Arm Lockout Solenoid:	
Type	Positive Terminal Circuit Ground
Min. Pull In Voltage	10.2 V

11.4 ENGINE COOLING SYSTEM

Description	1750D	2000D/DX	2300D/DX
Radiator:			
Core Size (Frontal Area)	365 in^2 (2355 cm^2)	365 in^2 (2355 cm^2)	365 in^2 (2355 cm^2)
Rows of Tubes	4	4	4
Fins per Inch	8	8	8
Cooling Fan:			
Diameter	17 in (432 mm)	17 in (432 mm)	17 in (432 mm)
Ratio - Fan to Engine	1.25:1	1.25:1	1.25:1
Coolant:			
Capacity	4 gal (15,1 liters)	4 gal (15,1 liters)	4 gal (15,1 liters)
Type of Fluid	50/50 ethylene glycol and water	50/50 ethylene glycol and water	50/50 ethylene glycol and water
Anti-freeze Protection	to -34° F (-37° C)	to -34° F (-37° C)	to -34° F (-37° C)

11.5 FLUID AND LUBRICANT CAPACITIES

Description	1750D	2000D/DX	2300D/DX
Engine Crankcase Oil:			
Capacity with Filter Change	10.5 quarts (9,9 liters)	10.5 quarts (9,9 liters)	10.5 quarts (9,9 liters)
Filter	0.5 quarts (0,47 liters)	0.5 quarts (0,47 liters)	0.5 quarts (0,47 liters)
Type of Oil	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE
Fuel Tank:			
Total Capacity	22.9 gallons (86,7 liters)	22.9 gallons (86,7 liters)	23.6 gallons (89,3 liters)
Usable Capacity	21.6 gallons (81,7 liters)	21.6 gallons (81,7 liters)	22.5 gallons (85,2 liters)
Type of Fuel Above 32° F (0° C)	Standard No. 2 Diesel	Standard No. 2 Diesel	Standard No. 2 Diesel
Type of Fuel Below 32° F (0° C)	Winterized No. 2 Diesel	Winterized No. 2 Diesel	Winterized No. 2 Diesel

11.5 FLUID AND LUBRICANT CAPACITIES (CONTINUED)

Description	1750D	2000D/DX	2300D/DX
Cooling System:			
Capacity	4 gallons (15,1 liters)	4 gallons (15,1 liters)	4 gallons (15,1 liters)
Type of Fluid	50/50 ethylene glycol and water anti-freeze protection to -34° F (-37° C)	50/50 ethylene glycol and water anti-freeze protection to -34° F (-37° C)	50/50 ethylene glycol and water anti-freeze protection to -34° F (-37° C)
Overflow Bottle	3 quarts (2,8 liters)	3 quarts (2,8 liters)	3 quarts (2,8 liters)
Final Drive Chain Case:			
Capacity	12 quarts (11,4 liters) total [6 quarts (5,7 liters) per side]	12 quarts (11,4 liters) total [6 quarts (5,7 liters) per side]	18 quarts (17 liters) total [9 quarts (8,5 liters) per side]
Type of Oil	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE
Hydraulic System:			
Reservoir Capacity	17.1 gallons (64,7 liters)	17.1 gallons (64,7 liters)	17.3 gallons (65,5 liters)
Main Hydraulic System Filter	3.3 quarts (3,1 liters)	3.3 quarts (3,1 liters)	3.3 quarts (3,1 liters)
Drive System Filter	N/A	1.5 quarts (1,4 liters)	1.5 quarts (1,4 liters)
Type of Oil	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE	10W30 equal to API, CD or CE
Grease Fittings:			
Quantity	2 - Loader Arm to Frame, 2 - Attachment Tilt Pivot Pins, 2 - Quick Attach Lock Lever Pins	2 - Loader Arm to Frame, 2 - Attachment Tilt Pivot Pins, 2 - Quick Attach Lock Lever Pins	2 - Loader Arm to Frame, 2 - Attachment Tilt Pivot Pins, 2 - Quick Attach Lock Lever Pins
Type of Grease	Multi-Purpose Lithium Base Grease	Multi-Purpose Lithium Base Grease	Multi-Purpose Lithium Base Grease

11.6 VEHICLE DIMENSIONS (WITH STANDARD TIRES)

Description	1750D	2000D/DX	2300D/DX
Height to Hinge Pin	120.5 in (3061 mm)	121 in (3073 mm)	121 in (3073 mm)
Dump Height	93.6 in (2377 mm)	94.1 in (2390 mm)	94.1 in (2390 mm)
Dump Angle	37°	37°	37°
Reach	24.2 in (615 mm)	24.2 in (615 mm)	24.2 in (615 mm)
Maximum Roll Back (Attachment on Ground)	30°	30°	30°
Ground Clearance	7.1 in (180 mm)	7.4 in (188 mm)	7.4 in (188 mm)
Wheelbase	40 in (1016 mm)	42.0 in (1067 mm)	43.4 in (1102 mm)
Overall Length (Without Bucket)	109 in (2769 mm)	109.0 in (2769 mm)	112.0 in (2845 mm)
Overall Length (With 72 in (1829 mm) Dirt Bucket)	137.8 in (3500 mm)	137.8 in (3500 mm)	140.8 in (3576 mm)
Angle of Departure	26°	26°	26°
Overall Height	80.0 in (2032 mm)	80.5 in (2045 mm)	80.5 in (2045 mm)
Clearance Width (Without Bucket)	71.8 in (1824 mm)	71.8 in (1824 mm)	71.8 in (1824 mm)
Clearance Circle Front (Without Bucket)	50.5 in (1283 mm)	51.0 in (1295 mm)	52.5 in (1334 mm)
Clearance Circle Front (With 72 in (1829 mm) Dirt Bucket)	82.9 in (2106 mm)	82.9 in (2106 mm)	83.6 in (2123 mm)
Clearance Circle Rear	64.0 in (1626 mm)	64.0 in (1626 mm)	66.0 in (1676 mm)
Tread Width	59.5 in (1511 mm)	59.5 in (1511 mm)	59.5 in (1511 mm)

11.7 OPERATING DATA

Description	1750D	2000D/DX	2300D/DX
Operating Capacity (with standard 72" (1829 mm) dirt bucket)	1750 lb (794,5 kg)	2000 lb (907 kg)	2450 lb (1111 kg)
Tip Load (SAE Rating) (with standard 72" (1829 mm) dirt bucket)	3912 lb (1774 kg)	4000 lb (1814 kg)	4900 lb (2223 kg)

11.8 VEHICLE WEIGHTS

Description	1750D	2000D	2000DX	2300D	2300DX
Approximate Operating Weight: [includes full fuel tank; 165 lb (75 kg) operator; 72" (1829 mm) 456 lb (207 kg) standard dirt bucket; 12 x 16.5 tires and standard equipment]	6825 lb (3096 kg)	6945 lb (3150 kg)	7045 lb (3196 kg)	7675 lb (3481 kg)	7775 lb (3527 kg)
Shipping Weight: [includes 4 gallons (15,1 liters) of fuel, no operator, no bucket, 12 x 16.5 tires, and standard equipment]	5915 lb (2685 kg)	6035 lb (2740 kg)	6135 lb (2785 kg)	6765 lb (3071 kg)	6865 lb (3117 kg)

11.9 TRAVEL SPEEDS

Description	1750	2000D	2000DX	2300D	2300DX
Forward, with 12 x 16.5 tires	0-6.0 mph (0-9,7 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)
Reverse, with 12 x 16.5 tires	0-4.1 mph (0-6,6 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)	0-6.3 mph (0-10,1 km/h)
Forward, with 14.00 x 17.5 tires	NA	NA	NA	0-7.0 mph (0-11,2 km/h)	0-7.0 mph (0-11,2 km/h)
Reverse, with 14.00 x 17.5 tires	NA	NA	NA	0-7.0 mph (0-11,2 km/h)	0-7.0 mph (0-11,2 km/h)

11.10 HYDRAULIC SYSTEM

Description	1750D	2000D/DX	2300D/DX
Charge System:			
Type	Pressure Priority Valve	Gerotor	Gerotor
Relief Setting	150 psi (10,34 bar) minimum at Low Engine Idle	285 psi (19,63 bar) minimum @1800 ±20 RPM	350 psi (24,11 bar) minimum @1800 ±20 RPM
Implement Pump:			
Type	Gear	Gear	Gear
Capacity	21 - 18.5 gpm (1,32 - 1,16 liter/sec)	21 - 18.5 gpm (1,32 - 1,16 liter/sec)	23.0 - 20.0 gpm (1,45 - 1,26 liter/sec)
Displacement	2.17 in^3/rev (35,5 cm^3/rev)	1.92 in^3/rev (31,5 cm^3/rev)	2.17 in^3/rev (35,5 cm^3/rev)
Main Control Valve:			
Relief Setting	2700 ± 50 psi (186 ± 3,45 bar)	2700 ± 50 psi (186 ± 3,45 bar)	2700 ± 50 psi (186 ± 3,45 bar)
Main Hydrostatic Travel Control Pump:			
Capacity	24.5-19.5 gpm (1,55 - 1,23 liter/sec)	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)	29.0 - 26.0 gpm (2,02 - 1,79 liter/sec)
Displacement	2.65 in^3/rev (43,4 cm^3/rev)	2.8 in^3/rev (45,9 cm^3/rev)	2.8 in^3/rev (45,9 cm^3/rev)
Relief Setting	4700 +180/-0 psi (323,8 +12,4/-0 bar)	4700 +285/-0 psi (323,8 +19,63/-0 bar)	5000 +350/-0 psi (344,36 +24,1/-0 bar)
Hydrostatic Travel Motor:			
Displacement	30 in^3/rev (491,6 cm^3/rev)	30 in^3/rev (491,6 cm^3/rev)	49 in^3/rev (802,9 cm^3/rev)

11.11 HIGH FLOW SYSTEM

Description	2000DX	2300DX
Pump:		
Type	Gear	Gear
Capacity	31 - 30 gpm (1,96 - 1,89 liter/sec)	31 - 30 gpm (1,96 - 1,89 liter/sec)
Displacement	2.95 in^3/rev (48,4 cm^3/rev)	2.95 in^3/rev (48,4 cm^3/rev)
High Flow Valve Relief	3000 ± 50 psi (206,6 ± 3,4 bar)	3000 ± 50 psi (206,6 ± 3,4 bar)

11.12 TIRES

Description	1750D	2000D	2000DX	2300D	2300DX
12.00 X 16.5, 6 ply, Flotation (standard) Air Pressure:	50 psi (344,7 kPa)	N/A	N/A	N/A	N/A
Maximum Ground Pressure (1750 lb. load):	80 psi (551,6 kPa)	N/A	N/A	N/A	N/A
12.00 X 16.5, 10 ply, Flotation (Optional on 1750, Standard on 2000D/DX & 2300D/DX). Air Pressure:	65 psi (448,2 kPa)	65 psi (448,2 kPa)	65 psi (448,2 kPa)	65 psi (448,2 kPa)	65 psi (448,2 kPa)
Maximum Ground Pressure (1750 lb. load):	80 psi (551,6 kPa)	---	---	---	---
Maximum Ground Pressure (2000 lb. load):	---	80 psi (551,6 kPa)	80 psi (551,6 kPa)	---	---
Maximum Ground Pressure (2300 lb. load):	---	---	---	80 psi (551,6 kPa)	80 psi (551,6 kPa)
14.00 X 17.5, 14 ply (optional) Air Pressure:	N/A	N/A	N/A	75 psi (517,1 kPa)	75 psi (517,1 kPa)
Maximum Ground Pressure (2300 lb. load):	N/A	N/A	N/A	70 psi (482,6 kPa)	70 psi (482,6 kPa)
33.0-15.5 X 16.5, 12 ply, Super Flotation (optional). Air Pressure:	60 psi (413,7 kPa)	60 psi (413,7 kPa)	60 psi (413,7 kPa)	60 psi (413,7 kPa)	60 psi (413,7 kPa)
Maximum Ground Pressure (1750 lb. load):	78 psi (537,8 kPa)	---	---	---	---
Maximum Ground Pressure (2000 lb. load):	---	78 psi (537,8 kPa)	78 psi (537,8 kPa)	---	---
Maximum Ground Pressure (2300 lb. load):	---	---	---	78 psi (537,8 kPa)	78 psi (537,8 kPa)

11.13 LOADER BUCKETS - ALL MODELS

Type	Width inch (mm)	Struck Capacities ft³ (m³)	SAE Heaped Capacities ft³ (m³)	Weight lb (kg)
Dirt	60 (1524,0)	8.8 (0,25)	12.0 (0,34)	389 (176)
Utility	60 (1524,0)	11.3 (0,32)	16.8 (0,47)	411 (186)
Dirt	66 (1676,4)	9.8 (0,28)	13.6 (0,39)	417 (189)
Utility	66 (1676,4)	12.5 (0,35)	17.1 (0,48)	435 (197)
Dirt	72 (1828,8)	12.6 (0,36)	16.7 (0,47)	456 (207)
Utility	72 (1828,8)	13.6 (0,39)	18.7 (0,53)	456 (207)
Dirt (High Capacity)	72 (1828,8)	13.0 (0,37)	18.2 (0,51)	463 (210)
Landscape	72 (1828,8)	14.4 (0,41)	20.1 (0,57)	523 (237)
Light Material	72 (1828,8)	---	26.0 (0,74)	528 (240)
Dirt	80 (2032,0)	14.0 (0,40)	18.6 (0,53)	480 (218)
Light Material	80 (2032,0)	---	30.2 (0,85)	646 (294)

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DANGER
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Accident Prevention Tags

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