



SHOP MANUAL

MODEL _____

SERIAL NO. _____

Shop Service Manual

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This manual contains servicing procedures for removing, repairing, and installing various components comprising a heavy duty industrial machine. Because of the size and weight of the machine, and high pressures in some of the components and systems, performing service on the machine is inherently dangerous.

Warnings and cautions are included to reduce the probability of personal injury, when performing service procedures known to be dangerous. Failure to comply with these warnings and cautions can result in serious injury and possible death.

Inadequate compliance with the safety precautions outlined in the manual can nullify the effectiveness of the safety procedures, and create a dangerous situation. Some of the unintentional noncompliance with safety precautions that could occur are as follows:

1. Use of hoisting devices not capable of supporting the weight of the component being lifted.
2. Improper attachment of slings to heavy components being hoisted.
3. Use of inadequate or rotten timbers for support, or improper alignment of supporting material.
4. Failure to securely block the wheels, when disconnecting or removing components that hold the machine stationary under normal conditions.
5. Failure to be aware of the safety precautions in the manual, because the manual was not read.

All circumstances and conditions under which service will be performed cannot be anticipated. It is the responsibility of personnel involved in performing service on the machine to use their best judgment in ascertaining that servicing is being performed safely.

SECTION 01

ENGINE, 4-53 GM

INTRODUCTION.

The following procedures are for the removal of the 4-53 GM Diesel Engine from a machine that has been in service. It is not necessary to perform the procedures in the following order. However, all tasks pertaining to disconnecting the engine must be performed prior to hoisting the engine clear of the frame. Refer to Figure 01-1 for location and identification of parts to perform these procedures.

WARNING

Do not depend on the service brakes or the parking brake to hold the machine stationary. Park the machine on a level surface and block the wheels.

DISCONNECTING THE ENGINE (Figure 01-1).

1. Remove fan assembly from engine.
2. Remove the radiator and transmission oil cooler. (Refer to Section 05).
3. Remove bolts (34) to disconnect pump drive shaft (28). Lower the disconnected end and let it hang.
4. Disconnect the heater hose (3), radiator hoses (1 and 2), auxiliary tank hoses (5 and 6), fuel lines (10 and 11), air hoses (19 and 20) and the air filter service indicator hose (12).
5. Remove oil pressure tube (17) at union on firewall.
6. Loosen clamps (27) and remove air intake duct (9).
7. Remove bolts (29) and remove exhaust flange (8) and any remaining part of exhaust system which may interfere with engine removal.
8. Remove nut (30) and loosen nut (31) to remove throttle cable (14), then replace nut (30).
9. Loosen screws (32 and 33) to remove pull to stop cable (15).

10. Remove heater hose guide (7).

11. Tag and disconnect the electrical connections at the firewall and remove electrical connections.

12. Tag and disconnect any other hoses or electrical leads.

13. Use the above as a check list to ensure that all items have been disconnected and secured so as not to become entangled during engine removal.

ENGINE REMOVAL

WARNING

Do not use a hoisting device of less than one ton capacity for removal of engine assembly.

1. The 160 through 300 series lift trucks utilize either a TC-28 or TRT transmission. The TC-28 transmission is driven by fiber drive ring mounted to the engine fly wheel. Disconnecting the engine from this transmission requires only that the transmission flange bolts (35) be removed and the engine pulled away from the transmission. A simple identification of the TC-28 transmission is the utilization of a roll shift transmission control. If the machine has no roll shift then the truck has a TRT transmission. To disconnect the engine from a TRT transmission proceed with the following.

2. Remove plug (21).

3. Rotate the engine until a flexplate bolt comes into view. Remove the flexplate bolt (22). Repeat this procedure until all eight flexplate bolts are removed.

4. Position a support under the aft end of the transmission (engine end of transmission) to prevent damage to the mounting bolts when the engine is disconnected from the transmission.

5. Attach a suitable hoisting device to the two lifting lugs mounted at each end of the rocker arm cover.

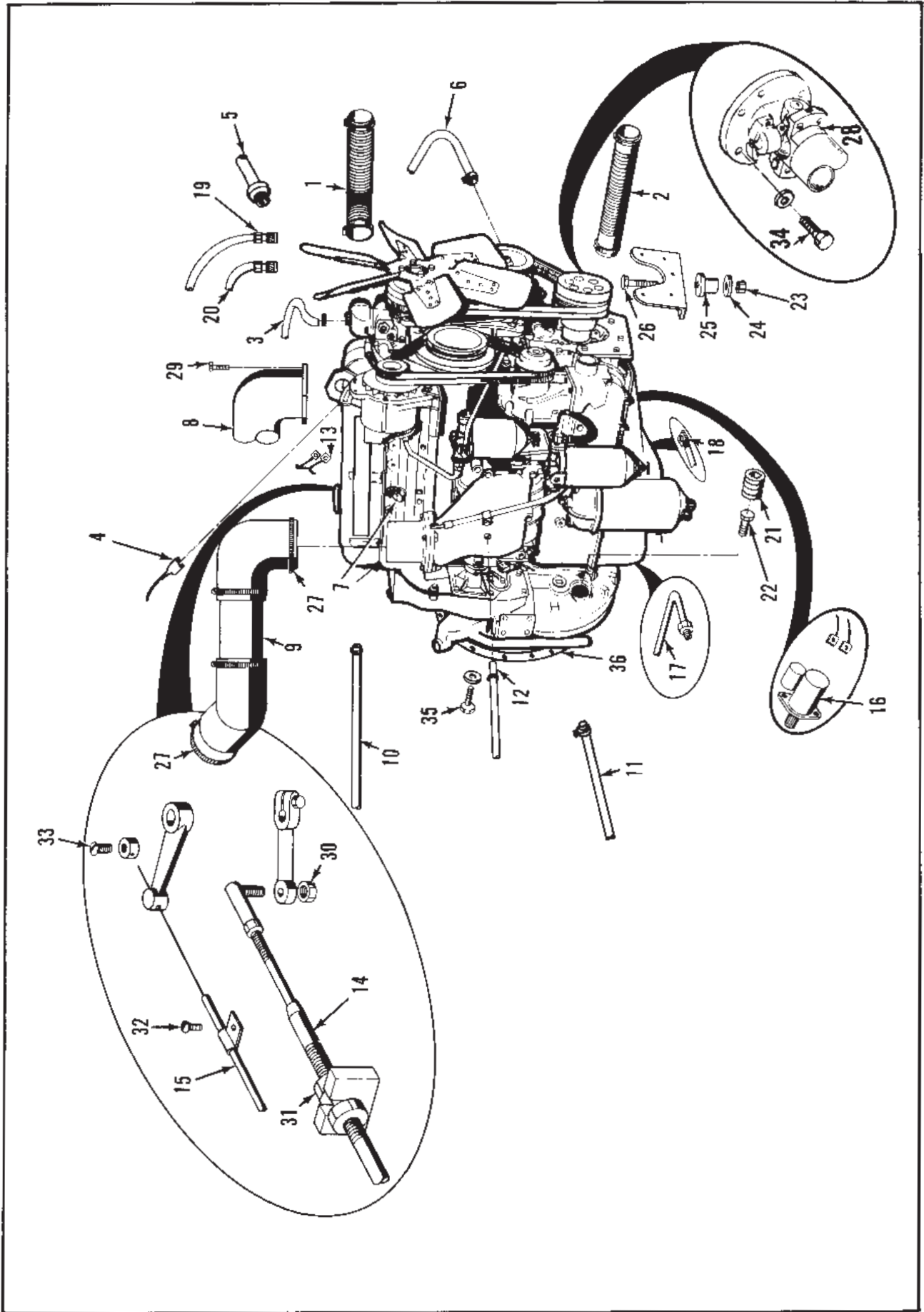


Figure 01-1. Engine Disconnection (View 1 of 2)

- | | |
|---------------------------------------|--------------------------------|
| 1. UPPER RADIATOR HOSE | 20. GOVERNOR AIR HOSE |
| 2. LOWER RADIATOR HOSE | 21. PLUG |
| 3. UPPER HEATER HOSE | 22. FLEX PLATE BOLTS |
| 4. COOLANT TEMPERATURE SENDER WIRE | 23. NUT |
| 5. AUXILIARY TANK HOSE | 24. WASHER |
| 6. LARGE AUXILIARY TANK HOSE | 25. RUBBER BUSHING |
| 7. HEATER HOSE GUIDE | 26. BOLT |
| 8. EXHAUST FLANGE | 27. CLAMP |
| 9. AIR INTAKE DUCT | 28. HYDRAULIC PUMP DRIVE SHAFT |
| 10. FUEL HOSE | 29. BOLT |
| 11. FUEL HOSE | 30. NUT |
| 12. AIR FILTER SERVICE INDICATOR HOSE | 31. JAM NUT |
| 13. ALTERNATOR WIRES | 32. SCREW |
| 14. THROTTLE CABLE | 33. SCREW |
| 15. PULL TO STOP CABLE | 34. BOLT |
| 16. STARTER MOTOR WIRES | 35. BOLT |
| 17. OIL PRESSURE TUBE | 36. TRANSMISSION FLANGE |
| 18. OIL TEMPERATURE SENDER WIRE | |
| 19. AIR PRESSURE HOSE | |

Figure 01-1. Engine Disconnection (View 2 of 2)

6. Remove nut (23), washer (24) and bolt (26).
7. Apply sufficient lifting force with the hoist to support the weight of the engine.
8. Remove bolts (35) and lockwashers securing transmission flange (36) to bellhousing.
9. Maneuver the hoist to move the engine toward the rear of the machine until it clears the transmission.
10. Lift the engine clear of the frame assembly.

ENGINE INSTALLATION

Installation of an engine assembly can be achieved by following the removal and disconnection procedures in reverse order, with the following additional procedures.

1. Refer to the table of torques in the back of this manual for values to be applied to all nuts and bolts when installing the engine.
2. Fill the cooling system with approved coolant before operating engine. Refer to Section 05 for filling instructions.

3. Make sure crankcase has been filled with the specified type of oil before operating the engine.

4. Adjust the accelerator linkage so that the engine operates at idle rpm with no pressure on the accelerator pedal. As the pedal is depressed, the engine rpm must increase from idle to full governed rpm.

5. Check operation of pull to stop control. If the control does not shut down the engine, manually move the control arm on top of the governor to shut down the engine. Reposition the screw lock (33) as necessary to effect shutdown when the control is actuated.

6. Operate engine and bring to normal operating temperature. Check coolant hose connections for leaks. Check fuel line connections for leaks. Check oil line connections for leaks.

7. Recheck coolant level after engine has warmed up.

8. To check air intake duct for leaks, refer to Section 03 air cleaner installation and system check.

SECTION 01

ENGINE, 4-71 GM

INTRODUCTION

To remove a 4-71 GM Diesel Engine from a machine that has been in operation, the following procedures must be performed. It is not necessary to perform the procedures in the exact order as listed. However, all procedures pertaining to disconnecting the engine must be performed prior to hoisting the engine clear of the frame. Refer to Figure 01-1 for location and identification of parts when performing the following procedures.

WARNING

Do not depend on either the air brakes or parking brake, or both, to hold the machine stationary when personnel must work underneath the machine. Park the machine on a level surface and block the wheels.

DISCONNECTING THE ENGINE (Figure 01-1)

1. Remove the radiator and transmission oil cooler (Refer to Section 05 for procedures).

2. Remove the five bolts attaching the pump drive shaft (1) to the crankshaft drive pulley. Lower the aft end of the pump drive and let it hang, with the forward end of the shaft still attached to the pump.

3. Loosen the hose clamp and disconnect the heater hose (2).

4. Disconnect the de-aeration hose (3) from the thermostat housing.

5. Disconnect the normal pull to stop wire (4) from the governor control arm. Loosen the clamp (5) and remove the stop cable (6). Reinstall the stop nut (7) on the cable wire (4).

6. Disconnect the hose (8) that connects the water pump to the auxiliary coolant tank. Disconnect the hose (8) at the suction side of the water pump.

7. Remove nut (10) and lockwasher to remove exhaust flange (9).

8. Remove the nut (11) and disconnect the ball joint (12) from the arm (13). Loosen the nut (14) and remove the cable assembly (15) from the slot in the bracket (16).

9. Loosen the hose clamps (17) and remove the air intake ducting (18) as an assembly.

10. Disconnect the fuel lines (19 and 20).

11. Disconnect the air filter service indicator hose (21) from the blower housing.

12. Disconnect the air hose (22) from the air compressor.

13. Disconnect the air hose (23) from the governor.

14. Disconnect the water temperature electrical lead (24).

15. Disconnect the hour meter electrical lead (25).

16. Disconnect the oil pressure line (26).

17. Disconnect the three electrical leads from the starter solenoid (27).

18. Disconnect the two electrical leads from the alternator (28).

19. Disconnect emergency pull to stop cable.

20. Using the above procedures as a check list, ensure that all items that have been removed or disconnected are secured in a position that will prevent them from becoming entangled when the engine is removed from the frame assembly.

REMOVING THE ENGINE

1. Position supports under the aft section of the transmission, to prevent any strain on the transmission mounting bolts when the engine is disconnected from the transmission.

2. Attach a suitable hoisting device to the two lifting lugs, mounted at each end of the engine rocker arm cover.

3. Remove the hex nuts, washers, and engine mounting bolts (29).

4. Apply sufficient lifting force with the hoisting device to support the weight of the engine.

5. The 160 through 300 series lift trucks utilize either a TC-28 or TRT transmission. The TC-28 transmission is driven by fiber drive ring mounted to the engine fly wheel. Disconnecting the engine from this transmission requires only that the transmission flange bolts (30) be removed and the engine pulled away from the transmission. A simple identification of the TC-28 transmission is the utilization of a roll shift transmission control. If the machine has no roll shift then the truck has a TRT transmission. To disconnect the engine from a TRT transmission proceed with the following.

6. Remove plug (34) for access to flexplate bolts. Remove flexplate bolts.

7. Remove the bolts (30) and lockwashers (31) attaching the transmission flange (32) to the engine bell housing.

8. Maneuver the hoisting device to move the engine toward the rear of the machine until it clears the transmission.

9. Lift the engine clear of the frame assembly.

ENGINE INSTALLATION.

Installation of an engine assembly can be achieved by following the removal and disconnection procedures in reverse order, with the following additional procedures.

1. Refer to the table of torques in the back of this manual for values to be applied to all nuts and bolts when installing the engine.

2. Fill the coolant system with approved coolant before operating engine.

3. Make sure crankcase has been filled with the specified type of oil before operating the engine.

4. Adjust the accelerator linkage so that the engine operates at idle rpm with no pressure on the accelerator pedal. As the pedal is depressed, the engine rpm must increase from idle to full governed rpm.

5. Check operation of pull to stop control. If the control does not shut down the engine, manually move the control arm on top of the governor to shut down the engine. Reposition the stop nut (7) as necessary to effect shut-down when the control is actuated.

6. Operate engine and bring to normal operating temperature. Check coolant level and hose connections for leaks. Check fuel line connections for leaks. Check oil line connections for leaks.

7. To check air intake duct for leaks, refer to Section 03 air cleaner installation and system check.

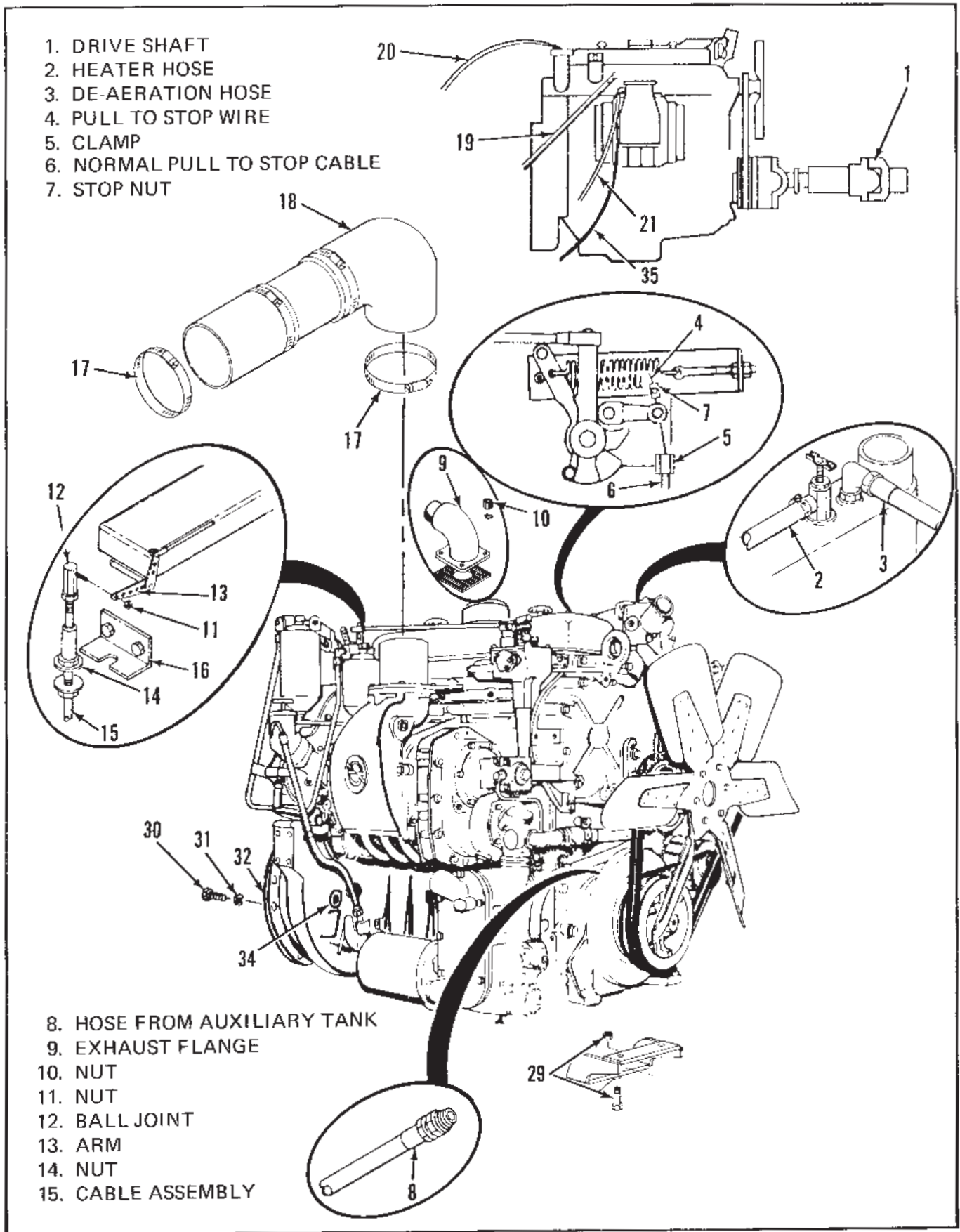


Figure 01-1. Engine Removal (View 1 of 2)

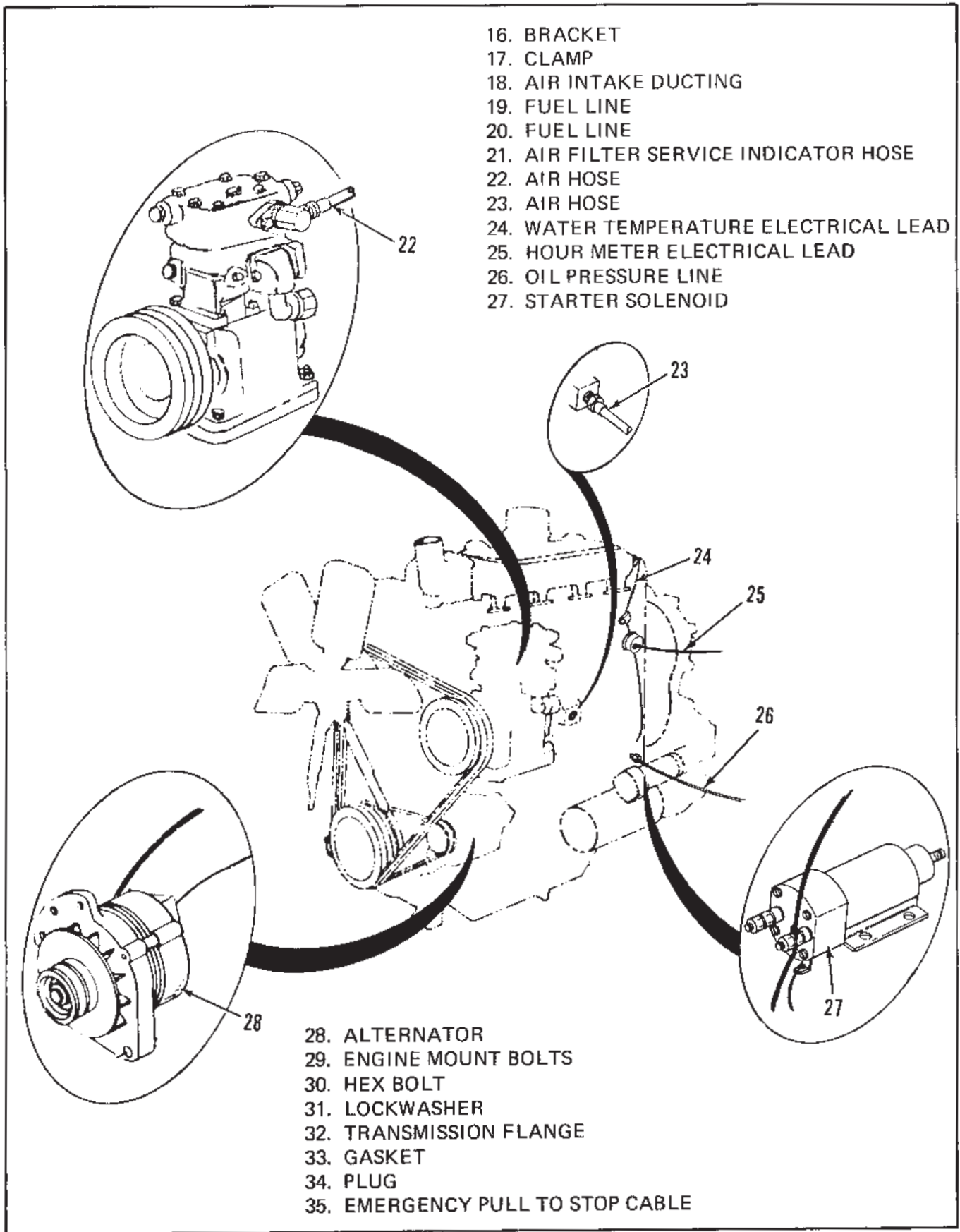


Figure 01-1. Engine Removal (View 2 of 2)

SECTION 01

ENGINE, CUMMINS

INTRODUCTION

To remove a 378 or 504 Cummins Diesel from a machine that has been in operation, the following procedures must be performed. It is not necessary to perform the procedures in the exact order as listed. However, all procedures pertaining to disconnecting the engine must be performed, prior to hoisting the engine clear of the frame. Refer to Figure 01-1 for location and identification of parts when performing the following procedures.

WARNING

Do not depend on either the air brakes or parking brake, or both, to hold the machine stationary when personnel must work underneath the machine. Park the machine on a level surface and block the wheels.

DISCONNECTING THE ENGINE (Figure 01-1)

1. Remove the radiator and transmission oil cooler (Refer to Section 05 for procedures).
2. Remove the five bolts attaching the pump drive shaft (1) to the crankshaft drive pulley. Lower the aft end of the pump drive and let it hang, with the forward end of the shaft still attached to the pump.
3. Loosen the hose clamp and disconnect the heater hose (2).
4. Disconnect the de-aeration hose (3) from the thermostat housing.
5. Disconnect the clevis (4) from the control arm. Loosen the nut (6) and remove cable housing from slotted bracket. Reinstall the clevis pin (7) and keeper (5) in the clevis.
6. Disconnect the hose (8) that connects the water pump to the auxiliary coolant tank. Dis-

connect the hose (8) at the suction side of the water pump.

7. Loosen clamps (9) and remove intake duct (10) as an assembly.
8. Disconnect fuel lines (11 and 12).
9. Disconnect air filter service indicator line (13)
10. Disconnect air line (14) from compressor.
11. Disconnect air line (15) to governor.
12. Tag and disconnect coolant temperature electrical lead (16) from sender.
13. Tag and disconnect hour meter electrical lead (17).
14. Disconnect oil pressure line (18).
15. Tag and disconnect starter motor leads (19).
16. Tag and disconnect alternator electrical leads (20).
17. Disconnect exhaust system from manifold flanges.
18. Disconnect 2 oil by-pass filter hoses.

REMOVING THE ENGINE

1. Position supports under the aft section of the transmission, to prevent any strain on the transmission mounting bolts when the engine is disconnected from the transmission.
2. Attach a suitable hoisting device to the two lifting lugs, mounted at each end of the engine rocker arm covers.
3. Remove the hex nuts (23), washers (24), and engine mounting bolts (26).
4. Apply sufficient lifting force with the hoisting device to support the weight of the engine.

5. Determine which type of transmission is being utilized, TRT or TC-28. The TC-28 can be identified by its roll shift control mechanism. Disconnecting the TC-28 requires only the removal of the flange bolts and lockwashers (28 and 29).

To disconnect the TRT transmission, remove the bolts (31) and the bellhousing cover plate (32). This will permit access to the bolts securing the flexplate to the engine flywheel. Remove the flexplate bolts. Next remove the bolts and lockwashers (28 and 29), securing the transmission flange to the engine.

6. Maneuver the hoisting device to move the engine toward the rear of the machine until it clears the transmission.

Lift the engine clear of the frame assembly.

ENGINE INSTALLATION.

Installation of an engine assembly can be achieved by following the removal and disconnection procedures in reverse order, with the following additional procedures.

1. Refer to the table of torques in the back of this manual for values to be applied to all nuts and bolts when installing the engine.

2. Fill the coolant system with approved coolant before operating engine. Refer to Section 05 for filling instructions.

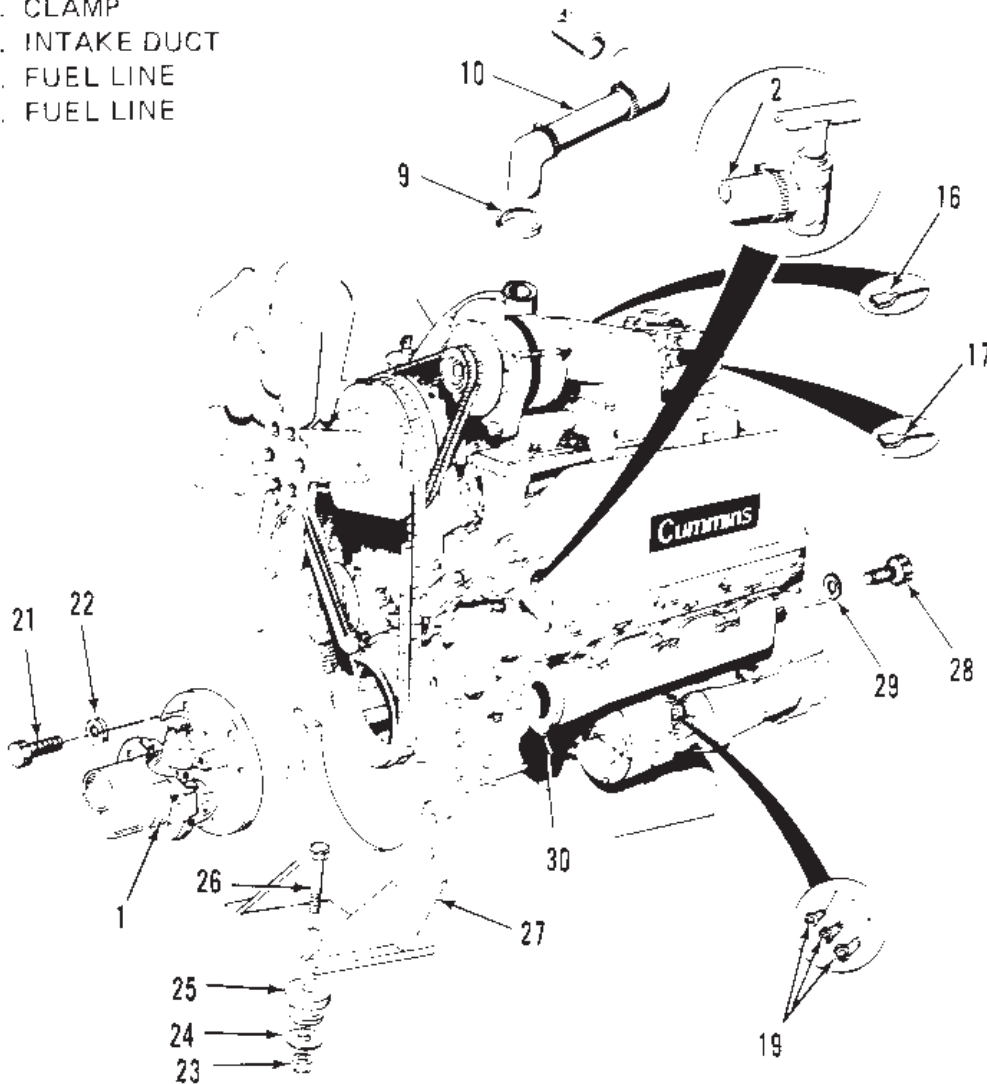
3. Make sure crankcase has been filled with the specified type of oil before operating the engine.

4. Adjust the accelerator linkage so that the engine operates at idle rpm with no pressure on the accelerator pedal. As the pedal is depressed, the engine rpm must increase from idle to full governed rpm.

Operate engine and bring to normal operating temperature. Check coolant level hose connections for leaks. Check fuel line connections for leaks. Check oil line connections for leaks.

To check air intake duct for leaks, refer to Section 03 air cleaner installation and system check.

- | | |
|-----------------------------------|---|
| 1. HYDRAULIC PUMP DRIVE SHAFT | 13. AIR FILTER SERVICE INDICATOR LINE |
| 2. HEATER HOSE | 14. COMPRESSOR AIR LINE |
| 3. DE-AERATION HOSE | 15. AIR HOSE TO GOVERNOR |
| 4. THROTTLE CABLE CLEVIS | 16. COOLANT TEMPERATURE ELECTRICAL LEAD |
| 5. PIN KEEPER | 17. HOUR METER ELECTRICAL LEAD |
| 6. NUT | 18. OIL PRESSURE LINE |
| 7. CLEVIS PIN | 19. STARTER MOTOR ELECTRICAL LEADS |
| 8. HOSE TO AUXILIARY COOLANT TANK | |
| 9. CLAMP | |
| 10. INTAKE DUCT | |
| 11. FUEL LINE | |
| 12. FUEL LINE | |



- | | |
|---------------------------------|------------------------|
| 20. ALTERNATOR ELECTRICAL LEADS | 27. ENGINE MOUNT |
| 21. BOLT | 28. BOLT |
| 22. LOCKWASHER | 29. LOCKWASHER |
| 23. NUT | 30. EXHAUST FLANGE |
| 24. WASHER | 31. BOLT |
| 25. RUBBER MOUNT | 32. ACCESS COVER PLATE |
| 26. BOLT | |

Figure 01-1. Engine Removal (View 1 of 2)

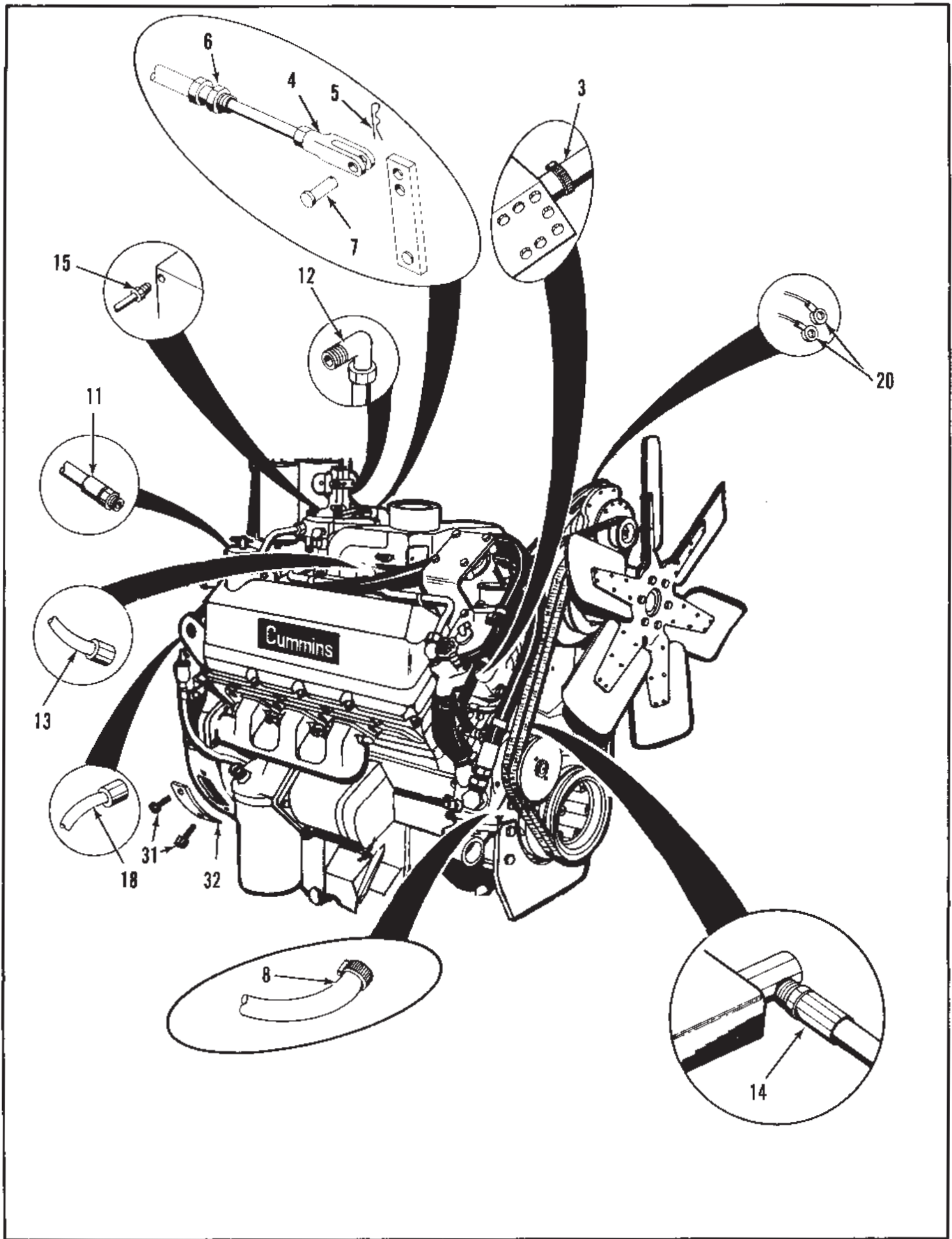


Figure 01-1. Engine Removal (View 2 of 2)

SECTION 02

FUEL TANK

INTRODUCTION

The following are the procedures necessary for removal and replacement of the fuel tank. Refer to Figure 02-1 for location and identification of parts.

NOTE

The space available for sliding the fuel tank out from under the machine is minimal. Therefore, the machine should be parked with the fuel tank over a depression in the terrain or an equivalent method for providing clearance should be implemented.

FUEL TANK REMOVAL

1. Provide a suitable container and remove the drain plug (11) to drain the tank. Once drained replace the plug.
2. Disconnect fuel lines (13).
3. Disconnect fuel quantity sending unit electrical connection (9).

4. Disconnect ground connection (8).

5. Support the fuel tank (4).

NOTE

The fuel tank must be supported in a manner which will allow the supports to be removed to lower the fuel tank to the ground.

6. Remove nuts (3), lockwashers (2) and bolts (1).

7. Remove supports then slide the tank from under the machine.

8. Remove the screws (5) then remove sending unit (6) and gasket (7).

INSTALLATION

Install the fuel tank by following the removal procedures in reverse order. With tank installed, fill with fuel and check connections for leaks.

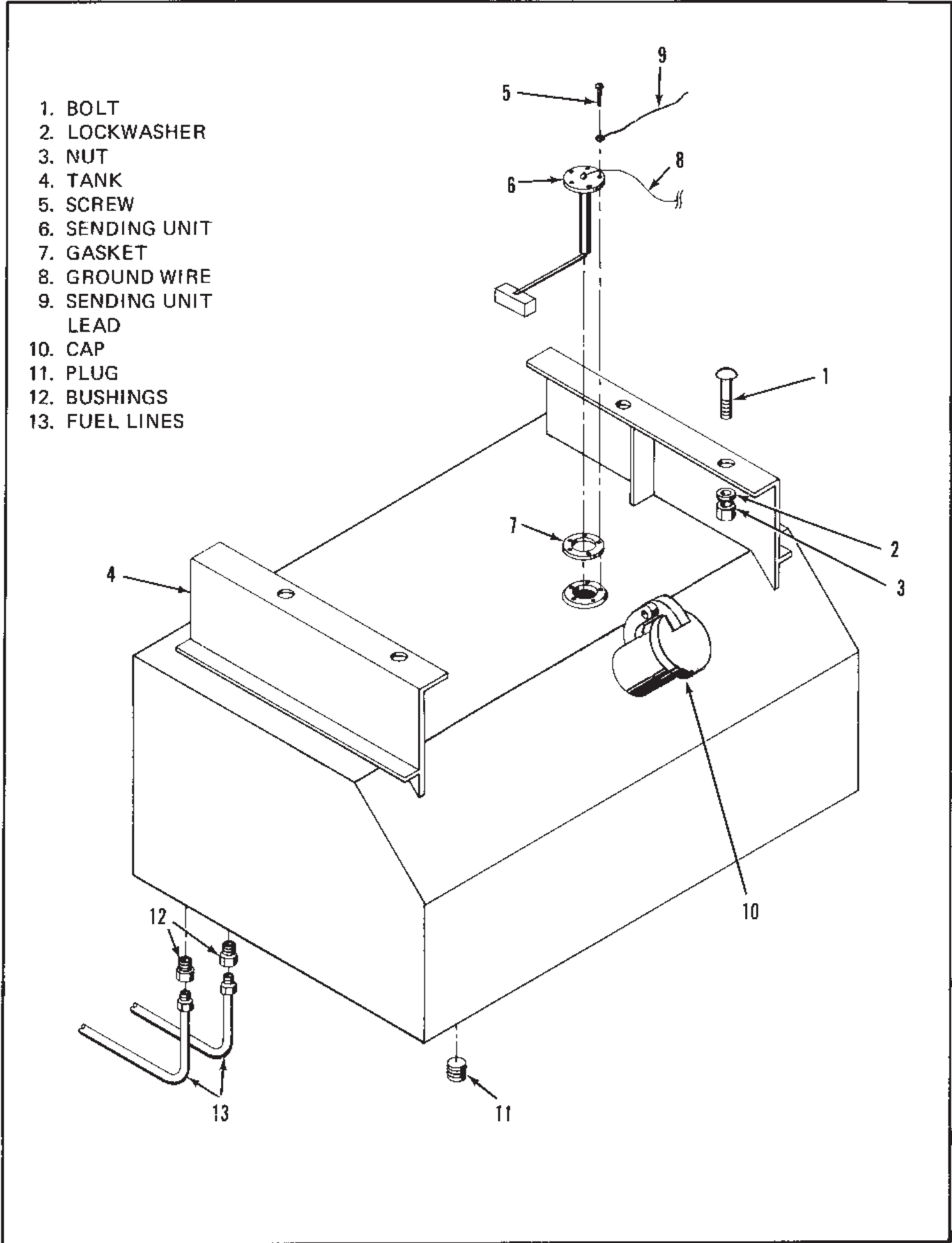


Figure 02-1. Fuel Tank Removal

SECTION 03

AIR INTAKE SYSTEM

INTRODUCTION

The air intake system has a two stage air cleaner. Air enters the system through a pre-cleaner panel. The design of the pre-cleaner panel causes the air to spiral. This spiraling action separates dust particles from the air. The dust particles fall to the bottom of the pre-cleaner panel, and collect in the dust bin on the bottom of the panel. This is the first stage of the two stage cleaning. An air hose is connected from the exhaust port of the quick release valve to the dust bin. After each application of the service brakes, when the brake pedal is released, the air pressure used to apply the brakes is released through the quick release valve to the dust bin. This action blows the dust particles out of the dust bin at irregular intervals while the machine is working and keeps the dust bin clean. The second stage of cleaning occurs as the air passes through the filter cartridge after it has passed through the pre-cleaner panel.

AIR CLEANER REMOVAL (Figure 03-1).

1. Disconnect the air hose (1) from the fitting (2) on the dust bin (3).
2. Remove the fitting (2) from the dust bin (3).
3. Loosen the clamp (4).
4. Remove the nuts (5), lockwashers (6), flat washers (7), and remove the air cleaner (8) and mounting brackets (9) as an assembly.

AIR CLEANER INSTALLATION AND SYSTEM CHECK.

1. Install a new filter cartridge (17), and re-install the air cleaner by reversing removal procedures.
2. Check the condition of the air hose (1) between the dust bin (3) and the quick release valve (12).

3. If the hose (1) requires replacement, disconnect the hose (1) from fittings (2) and (11). Remove the nut (13), lockwasher (14), flat washer (15), clamp (16), and remove the hose (1).

4. Install a new hose assembly (1) by reversing removal procedures above.

5. Check the condition of the air hose (19) between the blower housing (20) and the air filter service indicator (21). Replace the hose (19) if necessary, and make sure that all connections are right.

NOTE

An air leak in this hose assembly can cause the air filter service indicator to show a green indication when the air cleaner is actually in need of servicing. An air leak also allows dirt to enter the engine resulting in engine damage.

6. Check the air intake ducting (22 thru 26) between the air cleaner and the engine to be sure there are no leaks. With the engine idling spray all connections with starting fluid. If a leak exists a noticeable increase in engine speed will occur. Care should be exercised not to spray the starting fluid in a manner that will allow the fluid to enter the pre-cleaner. If the starting fluid enters the pre-cleaner it will give a false indication that a leak exists in the intake ducting.

CAUTION

Do not spray starting fluid in an area where open flames are present, or welding equipment is in operation.

7. Check the condition of the hose assembly (27) replace if necessary. Make sure that the hose clamps (28) are tight on both ends of the hose assembly (27).

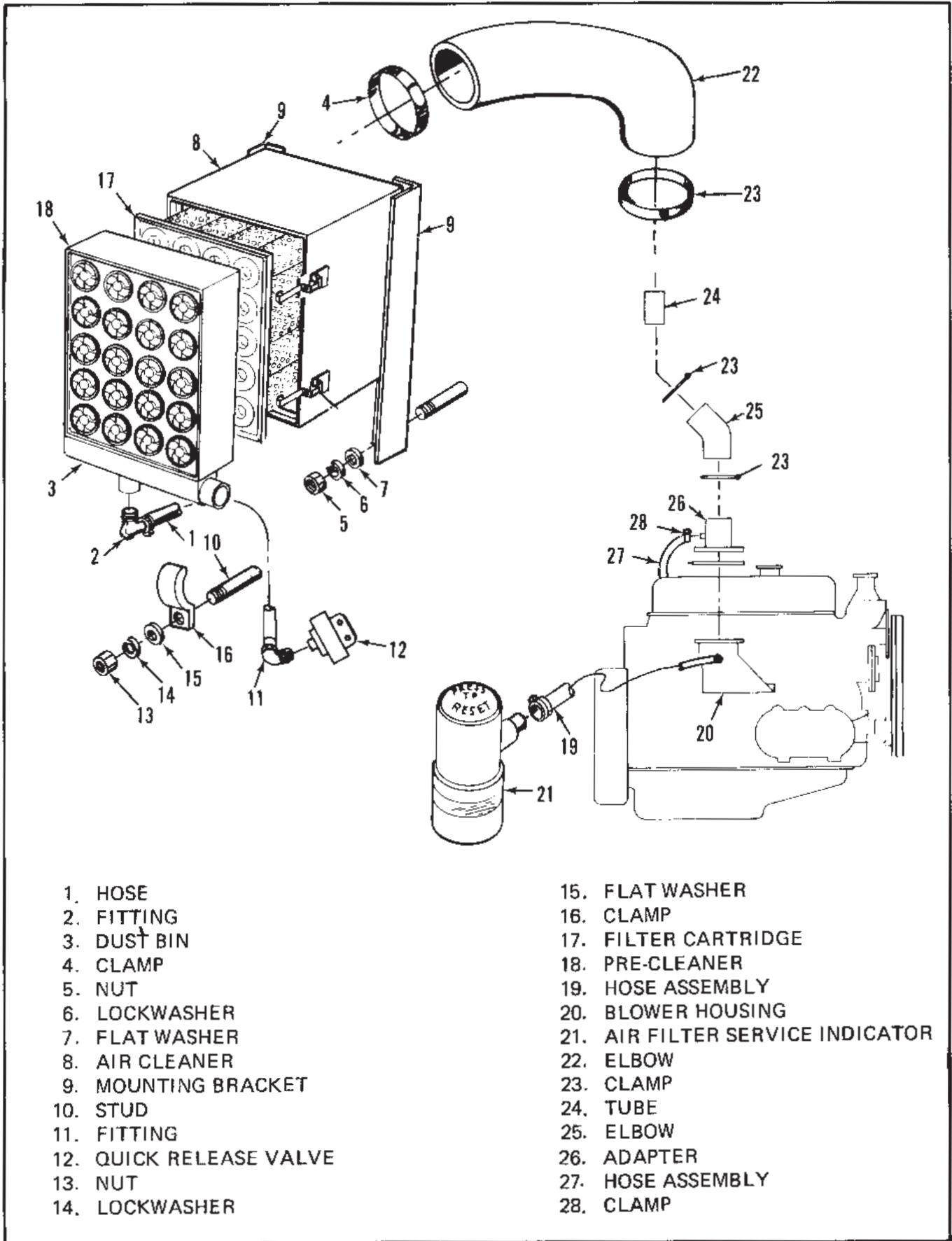


Figure 03-1. Air Intake System

NOTE

A break or leak in the hose assembly (27) will allow uncleaned air to enter the compressor, and be used to charge the air brake system.

8. Set the parking brake. Operate the machine and apply and release the service brakes several times. When the service brakes are released, check to be sure that air from the quick release valve blows out through the dust bin.

SECTION 04

EXHAUST SYSTEM, 4-53 GM

INTRODUCTION

Some components of the exhaust system are more susceptible to failure because of the exhaust heat from the engine than others. Some components are more susceptible to failure because of vibration. Anticipation of which components will fail is impossible, therefore, the following instructions include procedures for complete removal and disassembly of the exhaust system. The exhaust system should be disassembled only to the extent necessary to effect repair. Refer to Figure 04-1 for location and identification of parts when performing the following procedures.

REMOVAL AND DISASSEMBLY

1. Remove the nuts (1), lockwashers (2), spacers (3), clamp bolt (4), and exhaust stack (5). Do not remove the brace (8) unless replacement is necessary.

2. Remove the muffler clamp (9) and remove the muffler and muffler guard (10 and 11) as an assembly.

3. Remove the nut (12), bolt (13), and remove the muffler guard (11) from the muffler (10).

4. Do not remove the muffler mount adapter (14) unless replacement is necessary.

5. Remove the muffler clamps (17) and the exhaust elbow (18).

6. Remove the muffler clamp (19) and exhaust tubing (20).

7. Remove the nuts (21), exhaust outlet (22) and gasket (23).

8. Do not remove the studs (24) unless the threads are damaged or the stud has been eroded by moisture and exhaust gases.

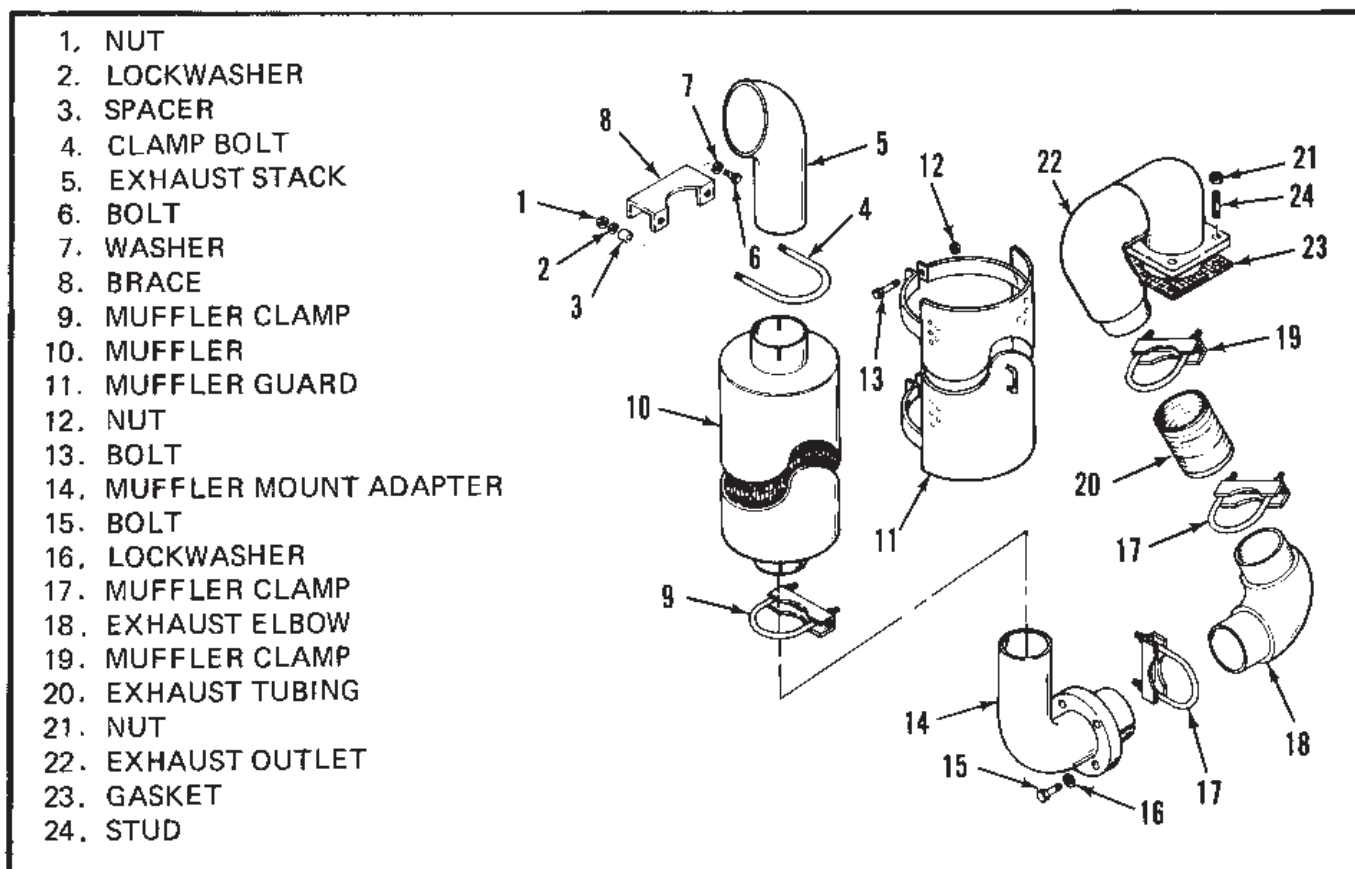


Figure 04-1. Exhaust System

NOTE

If the exhaust outlet (22) has been removed, use a new gasket (23) when installing the exhaust outlet (22).

REASSEMBLY AND INSTALLATION

Repair or replace any parts that are no longer serviceable, and reassemble and install the exhaust system components by reversing removal and disassembly procedures.

SECTION 04

EXHAUST SYSTEM, CUMMINS V6-378

INTRODUCTION

Some components of the exhaust system are more susceptible to failure because of the exhaust heat from the engine than others. Some components are more susceptible to failure because of vibration. Anticipation of which components will fail is impossible, therefore, the following instructions include procedures for complete removal and disassembly of the exhaust system. The exhaust system should be disassembled only to the extent necessary to effect repair. Refer to Figure 04-1 for location and identification of parts when performing the following procedures.

REMOVAL AND DISASSEMBLY

1. Remove the nuts (1), lockwashers (2), spacers (3), clamp bolt (4), and exhaust stack (5). Do not remove the brace (8) unless replacement is necessary.

2. Remove the muffler clamps (9) and remove the muffler and muffler guard (10 and 11) as an assembly.

3. Remove the nut (12), lockwasher (27), bolt (13), and remove the muffler guard (11) from the muffler (10).

4. Do not remove the muffler mount adapter (14) unless replacement is necessary.

5. Remove the muffler clamp (17) and the exhaust elbow (18).

6. Remove the muffler clamps (19) and exhaust tubing (20).

7. Remove the clamps (21) and exhaust outlet header (22).

8. Remove nuts (23), lock washers (24), bolts (25), gaskets (26) and exhaust outlets (15 and 16).

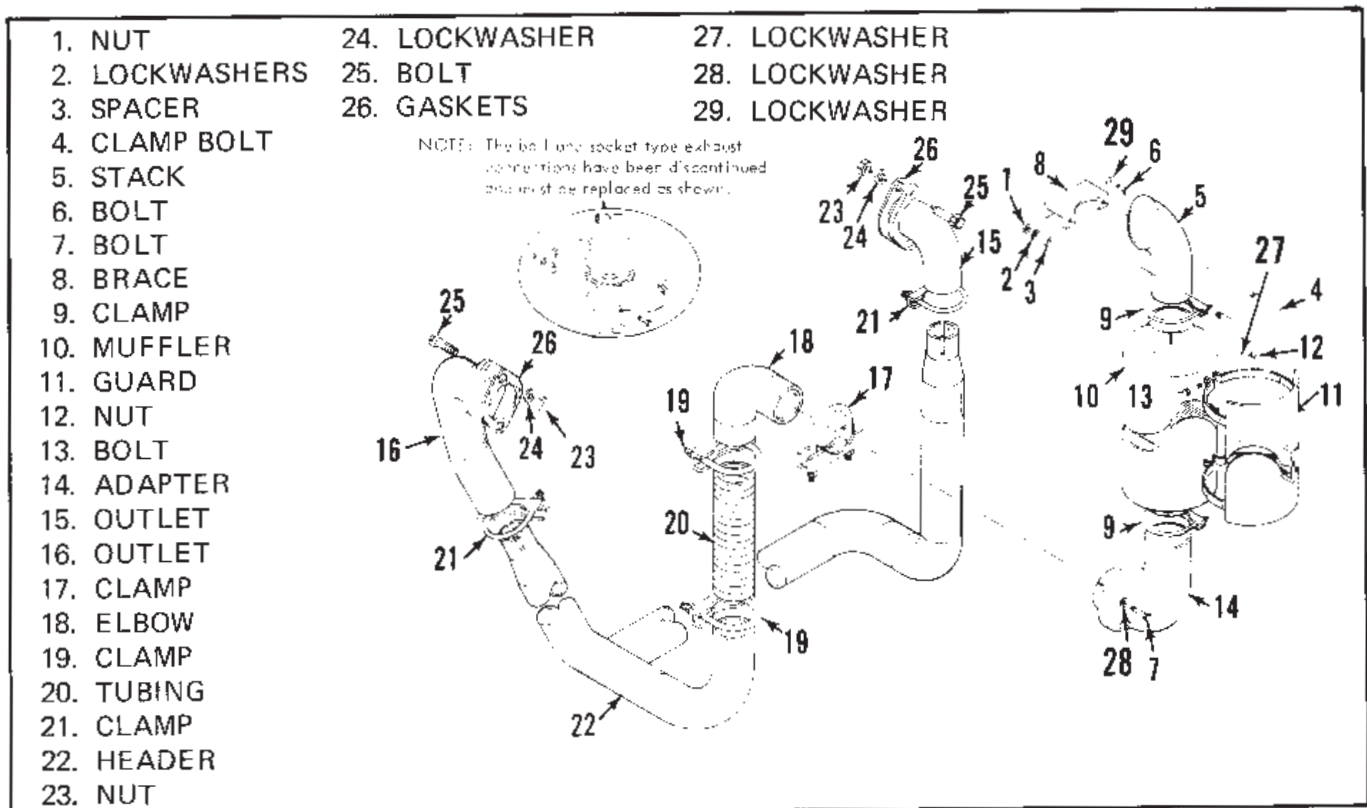


Figure 04-1. Exhaust System

SECTION 04

EXHAUST SYSTEM, CUMMINS V8-504

INTRODUCTION

Some components of the exhaust system are more susceptible to failure because of the exhaust heat from the engine than others. Some components are more susceptible to failure because of vibration. Anticipation of which components will fail is impossible, therefore, the following instructions include procedures for complete removal and disassembly of the exhaust system. The exhaust system should be disassembled only to the extent necessary to effect repair. Refer to Figure 04-1 for location and identification of parts when performing the following procedures.

REMOVAL AND DISASSEMBLY

1. Remove the nuts (1), lockwashers (2), spacers (3), clamp bolt (4), and exhaust stack (5). Do not remove the brace (8) unless replacement is necessary.

2. Remove the muffler clamps (9) and remove the muffler and muffler guard (10 and 11) as an assembly.

3. Remove the nut (12), lockwasher (23), bolt (13), and remove the muffler guard (11) from the muffler (10).

4. Do not remove the muffler mount adapter (14) unless replacement is necessary.

5. Remove the muffler clamp (17) and the exhaust elbow (18).

6. Remove the muffler clamps (19) and exhaust tubing (20).

7. Remove the clamps (21) and exhaust outlet header (22).

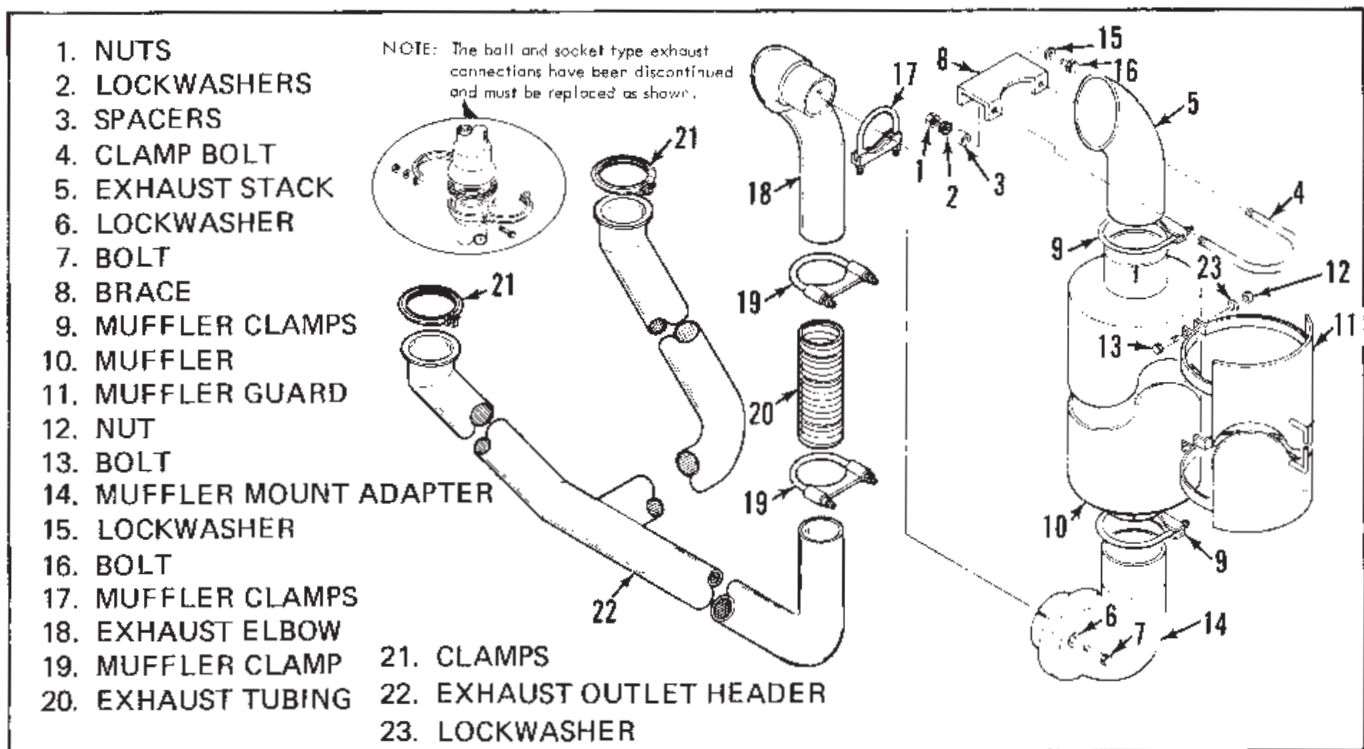


Figure 04-1. Exhaust System

SECTION 05

RADIATOR

INTRODUCTION

If the radiator is to be removed as preparation for engine removal, the radiator and transmission oil cooler should be removed as a unit. If the radiator is to be repaired, it will have to be separated from the oil cooler, however, removing the two as a unit will simplify the procedure. Refer to Figure 05-1 for identification and location of parts.

REMOVAL

1. Remove fan from engine.
2. Provide a suitable container then remove the drain plug (1) and drain radiator.
3. Loosen the hose clamps (2 and 4) and remove hoses (3 and 5).

NOTE

If the radiator is being removed in preparation for engine removal, loosen the clamps securing the upper and lower radiator hoses to the engine and remove the hoses completely.

4. Disconnect the hose (6).
5. Remove grill on rear of machine.
6. Remove recirculation baffles.
7. Disconnect the hoses (7 and 8) from the transmission oil cooler (14).
8. Attach a suitable hoisting device to the radiator and transmission cooler.
9. Remove the bolts (9), lockwashers (10) and flatwashers (11) then hoist the radiator and cooler clear of the machine.

10. Remove the bolts (12) and lockwashers (13) then separate the transmission cooler (14) from the radiator (15).

11. Remove the bolts (16), washers (17) and brackets (18).

INSTALLATION

Install the transmission cooler and radiator by following the removal procedures in reverse order. When installation is complete and the system is replenished with coolant, operate engine and bring to normal operating temperature. Check system for leaks. Check coolant level once operating temperature is reached. Refer to Section 05 for filling instructions.

NOTE

The radiator cap is a sealing cap. Be sure it is installed securely.

REPLACING DE-AERATION TANK

The cooling system is designed with a system to remove all air from the coolant. This is done by routing hoses from the highest point of both the radiator and the engine block, the points where air bubbles are most likely to accumulate, to an auxiliary tank. The air is carried to the top of the tank by internal piping where it remains. Coolant which enters the tank will be drawn back into the coolant system via a hose from the bottom of the de-aeration tank to the water pump.

Refer to 05-2 for location and identification of parts.

1. REMOVAL

- a. Disconnect the hoses (1, 14 and 15).
- b. Remove bolts (4), lockwashers (5) and washers (6) to remove tank.

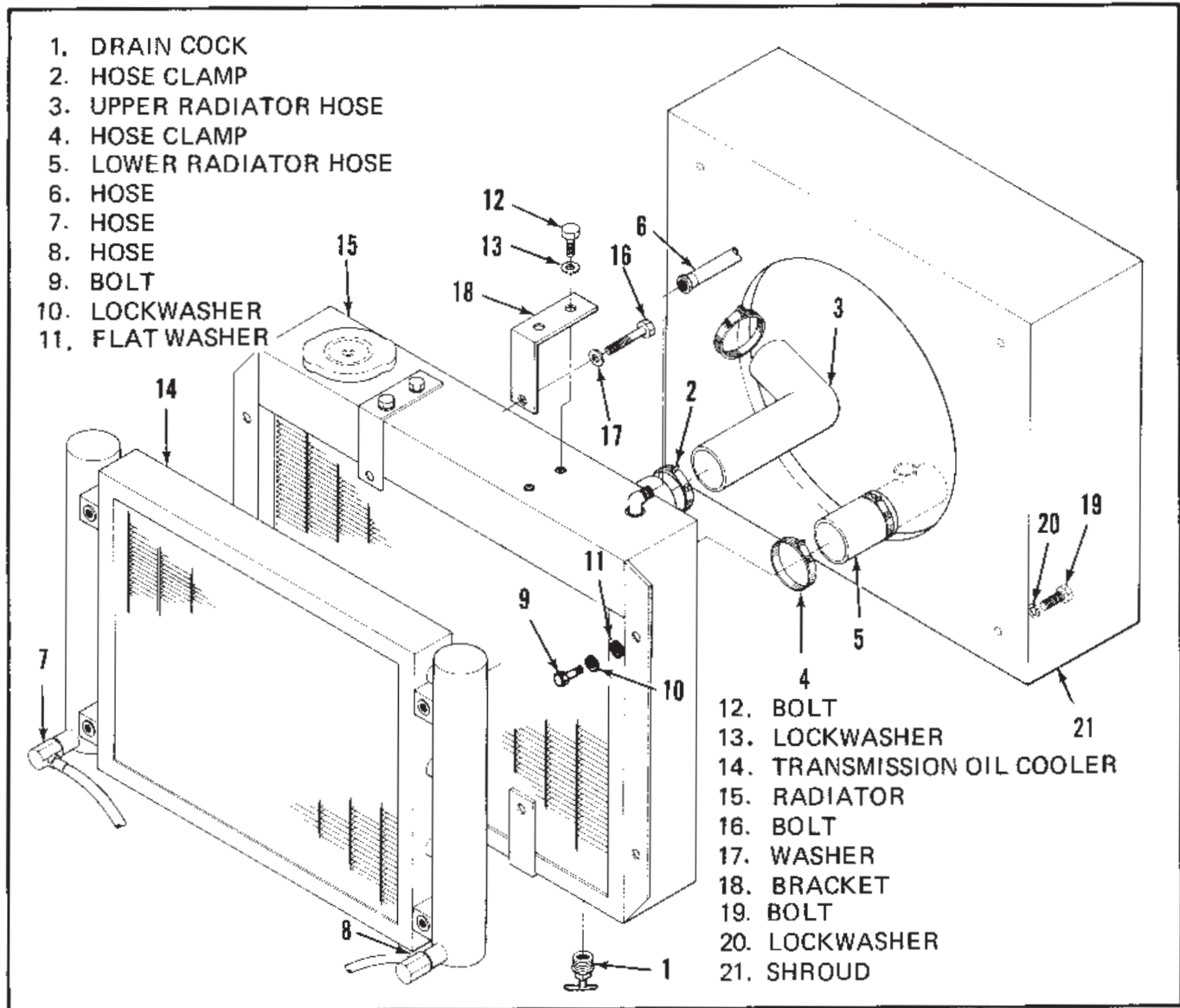


Figure 05-1. Radiator and Transmission Oil Cooler Removal

CAUTION

Do not switch connections of radiator and thermostat hoses as it will cause the coolant system to draw air into the coolant and overheating will result.

INSTALLATION

Refer to Figure 05-2 for proper connection of hoses (1, 14 and 15), and install de-aeration tank by following removal procedures in reverse order. Transfer all fittings to new tank.

FILLING THE COOLING SYSTEM.

1. Refer to the operator's manual for instructions on mixing antifreeze. A mixture of 33-1/3 percent water and 66-2/3 percent antifreeze is recommended for year round operation.

CAUTION

If the machine is to be operated in an extremely cold environment, refer to the operator's manual for the amount of antifreeze needed to provide adequate protection against freezing.

2. Remove the radiator cap and fill the system to the top of the radiator. Replace the cap. The radiator cap is a sealing cap. Make sure it is properly installed. Remove de-aeration tank cap and fill with coolant to top sight glass.

3. Operate the engine until the coolant is at normal operating temperature.

4. Check the cooling system for leaks while the engine is operating.

5. Recheck coolant level and add coolant if necessary at deaeration tank only. Do not remove radiator cap unless system is to be refilled.

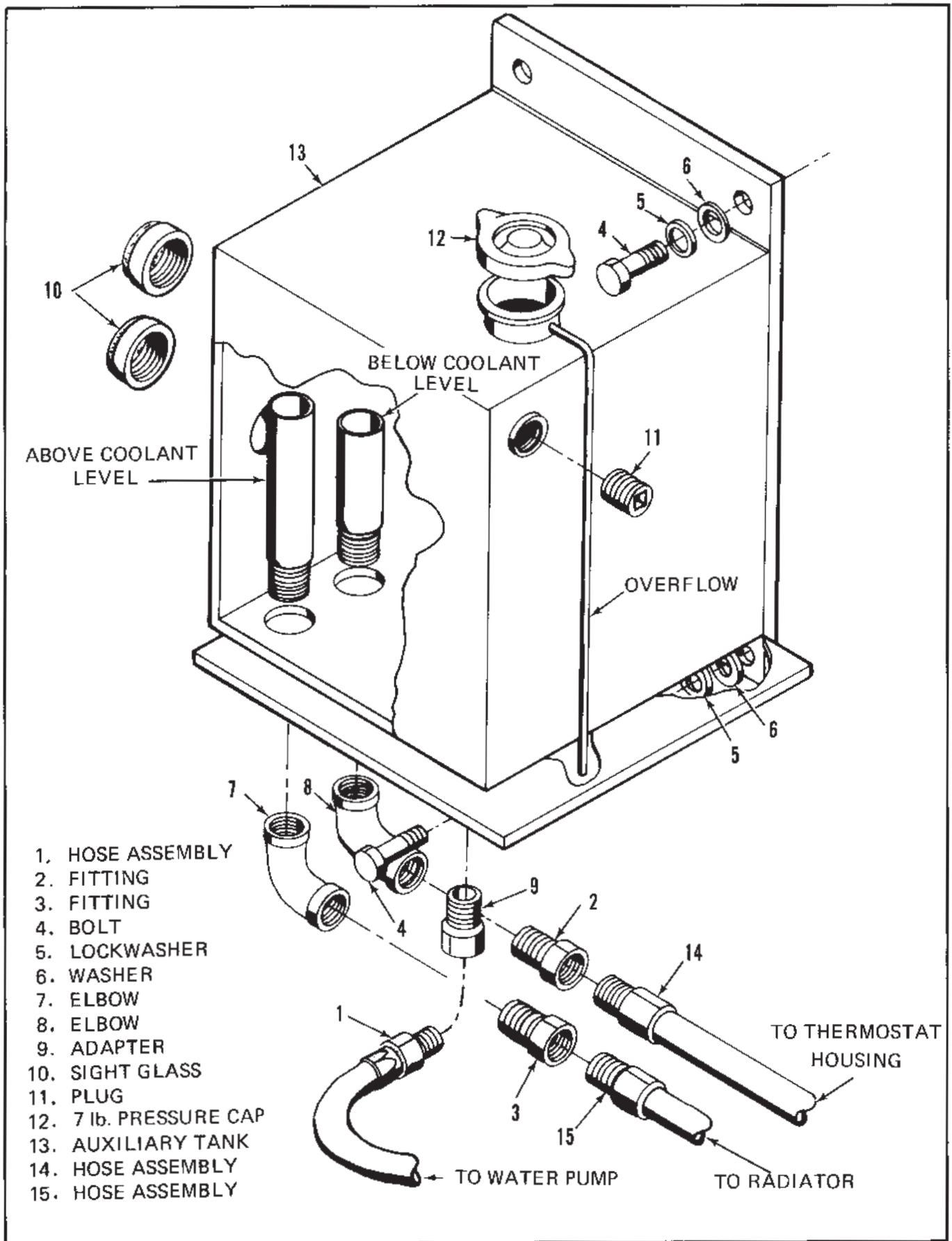


Figure 05-2. De-Aeration Tank

SECTION 06

ELECTRICAL SYSTEM

DESCRIPTION

The electrical system consists of a battery, (or batteries), battery disconnect switch, battery charging alternator, voltage regulator, ignition and starter switch, starter, and starter solenoid. The remainder of the electrical system consists of instruments, switches, circuit breakers, and accessory circuits. The above items are included as standard equipment in the electrical system. Optional equipment selected by the customer will determine the electrical equipment to be installed in addition to the standard electrical system.

BATTERIES

Some machines use a single battery in the electrical system, while others use two. The voltage of the electrical system remains the same, whether the machine is equipped with one or two batteries. If a machine is equipped with two batteries, the batteries are connected in parallel by connecting the positive terminals of both batteries together, and connecting the negative terminals of both batteries together. Two batteries connected in parallel will increase the ampere hour capacity for cranking the engine, and will usually extend the service life of the batteries. The batteries are perishable and require servicing on a regular basis. Batteries that are properly cared for can be expected to give long trouble-free service. Perform the following procedures to maintain the batteries in a serviceable condition.

1. Check the level of the electrolyte regularly. Add distilled water if necessary to bring the electrolyte level to $3/8$ inch above the separator plates. Do not overfill.

CAUTION

Overfilling can cause poor performance or early failure.

2. Keep the top of the batteries, terminals, and cable clamps clean. When necessary, wash them with a solution of baking soda and water, and rinse with clean water.

TY-160--300 (8/80)

CAUTION

Do not allow the soda and water solution to enter the battery cells.

3. Inspect the cables, clamps, and hold down bracket regularly. Replace any damaged parts. Clean and re-apply a light coating of grease to the terminals and cable clamps when necessary.

NOTE

A number of devices and applications are available on the commercial market to deter corrosion on battery terminal connections.

4. Check the electrical system if the battery becomes discharged repeatedly.

5. Use the following quick in-the-unit check as an indication of faulty components in the battery charging circuit.

- (a) A fully charged battery and low charging rate indicates normal alternator-regulator operation.

- (b) A low battery and high charging rate indicates alternator-regulator operation.

- (c) A fully charged battery and high charging rate condition usually indicates the voltage regulator is set too high or is not limiting the alternator output.

CAUTION

A high charging rate on a fully charged battery will damage the battery and other electrical components.

- (d) A low battery and low or no charging rate condition could be caused by loose connections, loose belts, damaged wiring, defective battery,

improper regulator setting or defective alternator.

ALTERNATOR

The alternator can be expected to give long trouble-free service, however, the diodes and transistors in the alternator circuit are very sensitive and can be easily destroyed. The following precautions should be observed when working on or around the alternator.

Do not operate machine with switch off — will cause damage to alternator.

Avoid grounding the output wires or the field wires between the alternator and the regulator. Never run an alternator on an open circuit.

Grounding an alternator's output wires or terminals, which are always hot regardless of whether or not the engine is running or accidentally reversing of the battery polarity will destroy the diodes. Grounding the field circuit will also result in the destruction of the diodes. Some

voltage regulators provide protection against some of these circumstances. However, it is recommended that extreme caution be used.

Accidentally reversing the battery connections must be avoided. If a booster battery is to be used, the batteries must be connected positive (+) to positive (+) and negative (—) to negative (—).

Never disconnect the battery while the alternator is in operation. Disconnecting the battery will result in damage to the diodes, caused by the momentary high voltage and current induced by the instantaneous collapse of the magnetic field surrounding the field windings.

DIAGRAM

An Electrical diagram is included in the appendices in the back of this manual, to assist in troubleshooting malfunctions of the electrical system.

SECTION 09

TRANSMISSION, TRT

INTRODUCTION

The following outlines the procedures for removal of the TRT transmission from a machine that has been in operation. The disconnecting procedures need not be performed in the following order, however, all tasks pertaining to disconnection must be performed prior to removing the transmission from the frame. Refer to Figure 09-1 for identification and location of parts.

DISCONNECTING THE TRANSMISSION (Figure 09-1)

The space available for sliding the transmission out from under the machine is not adequate, therefore, the machine must be either parked with the transmission over a depression in the terrain or an equivalent method of raising the machine at least 8" must be implemented.

WARNING

Do not depend on the air brakes alone to hold the machine stationary while disconnecting the transmission. Wherever the machine is to be serviced, block the wheels prior to disconnecting the parking brake cable or drive line assembly.

NOTE

Tag the control cables as they are disconnected, to ensure that they are connected to the correct control valve when the transmission is reinstalled.

1. Remove floorboards of cab.

2. Remove nuts (2 and 3) to disconnect control cable ends. Loosen nuts (26 and 27) to remove

cable controls (1 and 4).

3. Remove bolts (5) to disconnect driveshaft (6).

4. Remove cotter pin (7) and clevis pin (8) to disconnect parking brake cable (9).

5. Tag and remove transmission cooler lines In and Out (10 and 11) and plug ends to prevent foreign material from entering.

6. Remove nut (12) and neutral start electrical lead (13).

7. Remove and plug oil pressure line (14).

8. Remove transmission temperature sender lead (23).

9. Lift trucks equipped with Detroit Diesel engines have a plug (21) (figure 01-1) to remove for access to the flexplate bolts (19). Lift trucks equipped with Cummins Diesel engines require the removal of bolts (31) and cover plate (32) (figure 01-1) from the bellhousing for access to the flexplate bolts (19). Remove flexplate bolts (19).

10. Remove bolt (22) (Figure 09-1) to disconnect ground lead.

NOTE

If for some reason, the transmission cannot be removed by lowering it out the bottom through the frame, it must be hoisted out the top. To accomplish this the cab must first be removed or at least moved off to the left far enough to clear the transmission. For cab removal, refer to Section 20.

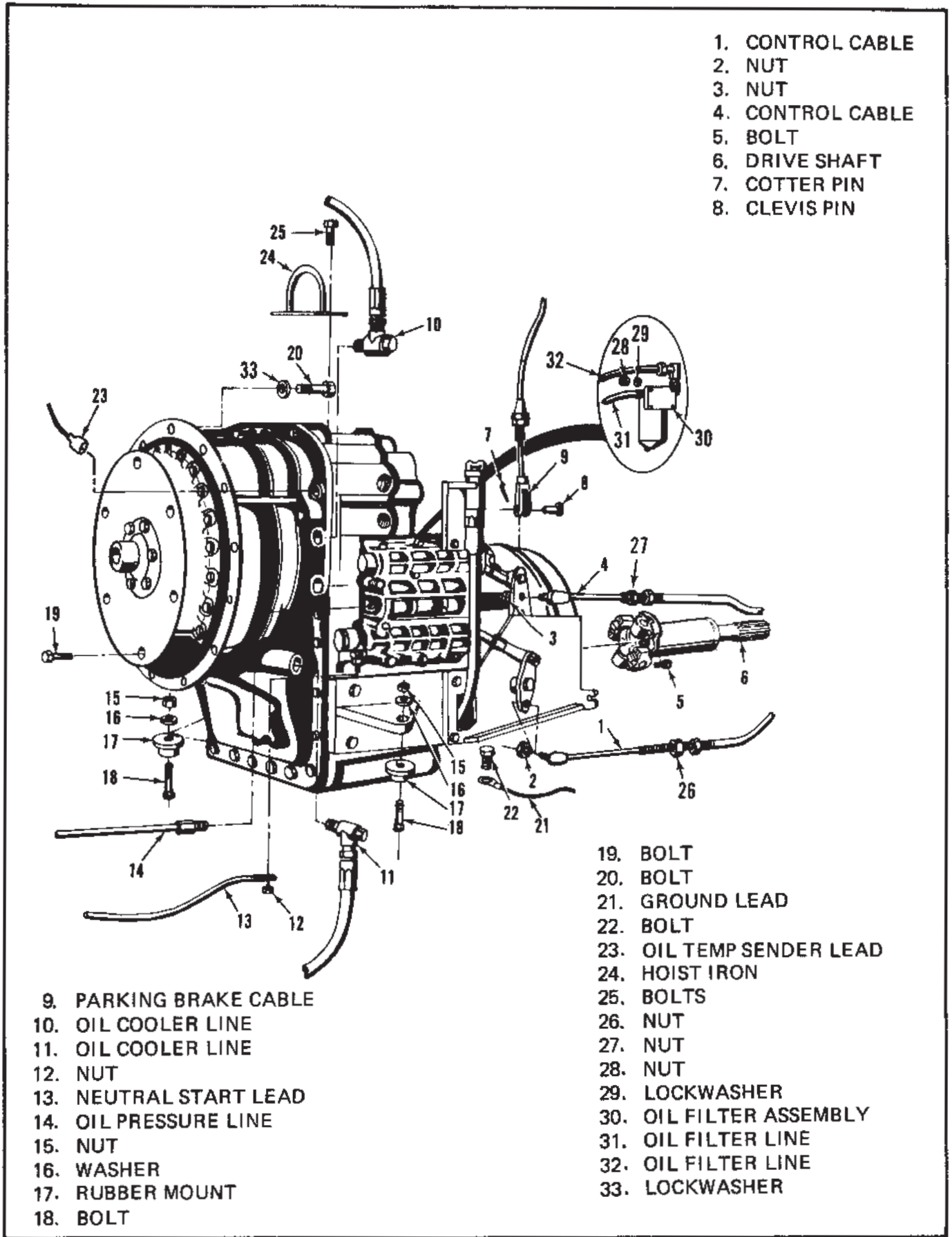


Figure 09-1. Disconnecting the Transmission

11. Tag and disconnect oil filter lines (31 and 32) from transmission body. Remove nuts (28) and lockwasher (29) to remove oil filter assembly from mounting plate with oil lines attached. Cap oil lines and openings to prevent foreign material from entering openings.

12. Position a sling around the transmission case and attach the sling to a suitable hoisting device.

CAUTION

Make sure the sling is positioned so that the lifting force will be exerted on the transmission case and not on the control valve assembly or any other component which could sustain damage.

REMOVING THE TRANSMISSION

WARNING

Do not use a hoisting device of less than 750 lb. capacity for transmission removal.

1. Position supports under the engine bell housing to prevent any strain on the front engine mount when the transmission is disconnected from the engine.

2. Apply sufficient lifting force with the hoist to support the weight of the transmission.

3. Remove nuts (15), washers (16) and bolts (18).

4. Remove bolts (20) and lockwashers (33) that attach the transmission flange to the engine bell housing.

5. Check to see that all lines, harnesses, cables, etc. are disconnected and secured in a position to clear the transmission.

6. At this point, a sled or equivalent device should be positioned under the transmission. This will be necessary for moving the transmission out from under the machine.

7. Maneuver the transmission forward, away from the engine until it clears the frame mounting tabs.

8. Lower the transmission down onto the sled. With the transmission on the sled, provide enough slack in the hoisting cable or chain to allow the transmission to be moved out from under the machine.

CAUTION

Be sure there is still adequate clearance, with the transmission on the sled, to slide the transmission from under the machine.

9. Slide transmission out from under machine.

TRANSMISSION INSTALLATION

Install the transmission by following the removal and disconnection procedures in reverse order, and performing the following additional procedures.

NOTE

If transmission failure has occurred, replace the transmission oil cooler, filter, flow valve and connecting lines. Fill the transmission with clean, previously unused transmission fluid. See appendix for correct fluid.

1. Check condition of rubber mounts (17) and replace if necessary.

2. Raise the transmission up into the frame and align the flex plate bolt holes with the holes in the flywheel.

3. Refer to the torque table in the back of this manual for torque values to be applied to all nuts and bolts when installing the transmission.

CAUTION

Do not reverse the transmission cooler lines. Reversing these lines will back flush the transmission cooling system.

4. After transmission filter assembly has been installed, perform the following procedures to properly connect the transmission filter hoses.

a. The hose exiting the aft side of the filter housing enters the transmission case in the lower of the two openings.

b. The hose exiting the forward side of the filter housing, enters the transmission case in the upper of the two openings.

5. After the shift and inching control linkages are connected, check operational travel of the control valve spools. If adjustment is necessary refer to Section 09C for procedures.

NOTE

Since the shift and inching control linkages in the cab are not

disturbed when changing the transmission, any necessary adjustment should be accomplished at the transmission end of the linkages.

FILLING THE TRANSMISSION

1. Fill the transmission to the LOW mark on the dipstick.

2. Operate the engine and check for oil leaks. With the engine running at 500 to 600 rpm, recheck the oil level and add oil to bring the level to the LOW mark on the dipstick.

3. When the oil temperature reaches +180°F to 200°F, make a final oil check and add oil to bring to FULL mark on dipstick.

SECTION 09

TRANSMISSION, TC-28

INTRODUCTION

The following outlines the procedures for removal of the TC-28 transmission from a machine that has been in operation. The disconnecting procedures need not be performed in the following order, however, all tasks pertaining to disconnection must be performed prior to removing the transmission from the frame. Refer to Figure 09-1 for identification and location of parts.

DISCONNECTING THE TRANSMISSION (Figure 09-1)

The space available for sliding the transmission out from under the machine is not adequate, therefore, the machine must be either parked with the transmission over a depression in the terrain or an equivalent method of raising the machine at least 8" must be implemented.

WARNING

Do not depend on the air brakes alone to hold the machine stationary while disconnecting the transmission. Wherever the machine is to be serviced, block the wheels prior to disconnecting the parking brake cable or drive line assembly.

1. Remove the nut (1), washer (2), and bolt (3) to disconnect the parking brake cable assembly (4) from the parking brake actuating lever (5).

2. Loosen the nut (6) and remove the cable assembly (4) from the slot in the left transmission mounting bracket (7).

3. Remove the bolt (8) and lockwasher (9) to disconnect the drive shaft (10) from the parking brake assembly (11).

NOTE

Tag the control cables as they are disconnected, to ensure that they are connected to the same control valve when the transmission is reinstalled.

4. Remove nuts (12, 13 and 15) to disconnect control cables (25, 27 and 28).

5. Loosen the nuts (24) and remove the cable assemblies from the slots (26) in the right transmission mounting bracket (16).

6. Remove the floor board in the cab.

7. Remove the bolts (33) and washers (34) attaching the clamps (35) to the transmission case rear cover. Move the clamps (35), and the harnesses, lines, cables, etc., that are routed through the clamps, toward the rear of the machine to a position that will clear the transmission when it is ready to be hoisted. Reinstall the washers (34) and bolts (33) in the transmission case rear cover.

8. Disconnect the transmission oil pressure line (36) and transmission oil filter hoses (37 and 38).

9. Disconnect the transmission oil temperature line (39) and transmission oil cooler hoses (40 and 41).

10. Remove the nuts (42), washers (43), bolts (44), and remove the transmission oil filter assembly (45).

11. Disconnect neutral start switch electrical lead (56).

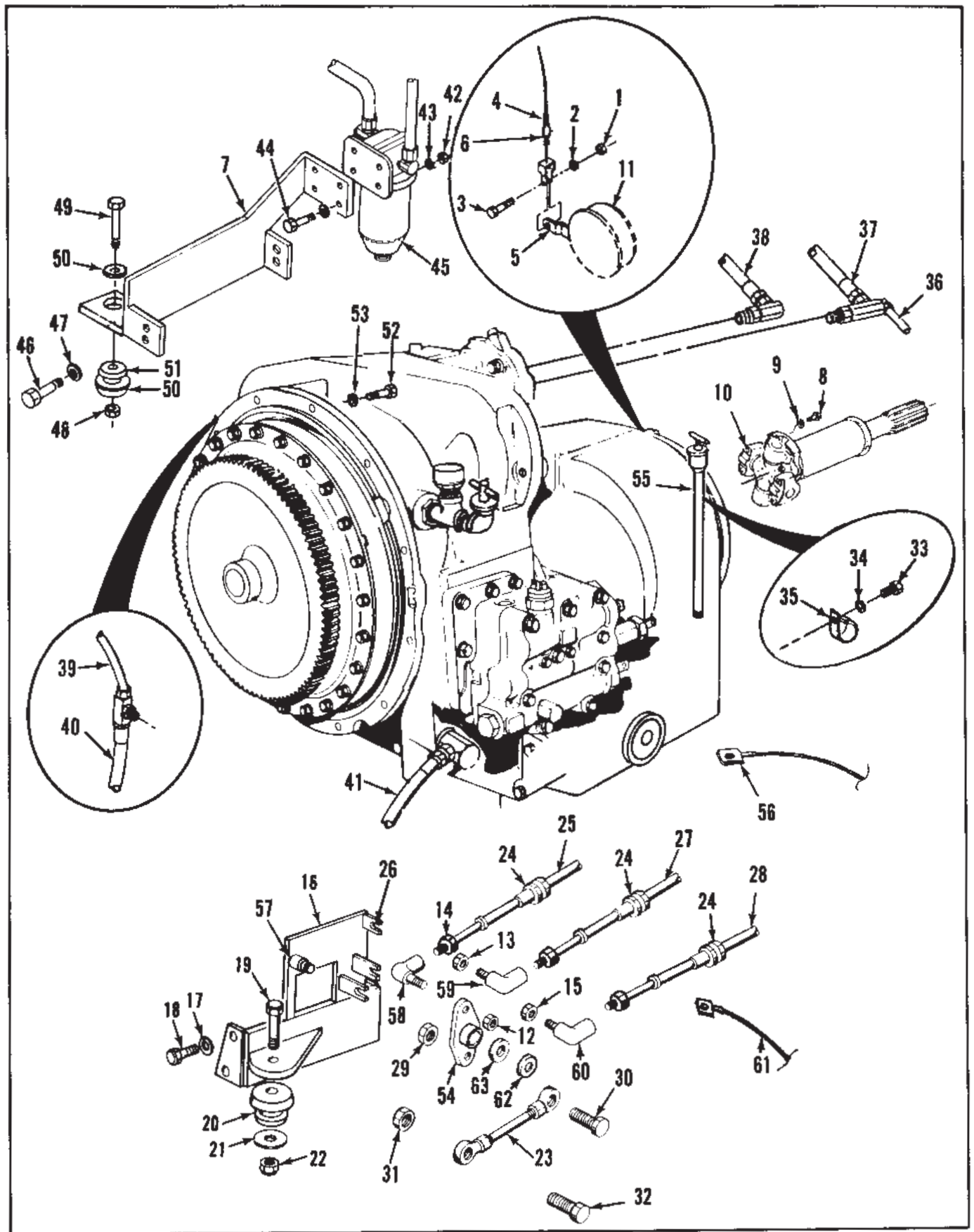


Figure 09.1. Disconnecting the Transmission (View 1 of 2)

- | | |
|---------------------------------------|---------------------------------------|
| 1. NUT | 33. BOLT |
| 2. WASHER | 34. LOCKWASHER |
| 3. BOLT | 35. CLAMP |
| 4. PARKING BRAKE CABLE | 36. TRANSMISSION OIL PRESSURE LINE |
| 5. PARKING BRAKE LEVER | 37. TRANSMISSION OIL FILTER HOSE |
| 6. NUT | 38. TRANSMISSION OIL FILTER HOSE |
| 7. TRANSMISSION MOUNTING BRACKET | 39. TRANSMISSION OIL TEMPERATURE LINE |
| 8. BOLT | 40. TRANSMISSION OIL COOLER HOSE |
| 9. LOCKWASHER | 41. TRANSMISSION OIL COOLER HOSE |
| 10. DRIVE SHAFT | 42. NUT |
| 11. PARKING BRAKE ASSEMBLY | 43. WASHER |
| 12. NUT | 44. BOLT |
| 13. NUT | 45. TRANSMISSION OIL FILTER |
| 14. NUT | 46. BOLT |
| 15. NUT | 47. WASHER |
| 16. TRANSMISSION MOUNTING BRACKET | 48. LOCKNUT |
| 17. WASHER | 49. BOLT |
| 18. BOLT | 50. SNUBBING WASHER |
| 19. BOLT | 51. RUBBER MOUNT |
| 20. BUSHING | 52. BOLT |
| 21. WASHER | 53. LOCKWASHER |
| 22. LOCKNUT | 54. LINKAGE PIVOT |
| 23. LINKAGE ROD | 55. DIPSTICK |
| 24. NUT | 56. NEUTRAL START SWITCH LEAD |
| 25. FORWARD AND REVERSE CONTROL CABLE | 57. BUSHING |
| 26. SLOT | 58. ROD END |
| 27. INCHING CONTROL CABLE | 59. CLEVIS |
| 28. SPEED RANGE CONTROL CABLE | 60. ROD END |
| 29. NUT | 61. GROUND LEAD |
| 30. BOLT | 62. SNAP RING |
| 31. NUT | 63. WASHER |
| 32. BOLT | |

Figure 09-1. Disconnecting the Transmission (View 2 of 2)

NOTE

If the transmission oil filter assembly (45), or the transmission oil filter lines (37 and 38) are not being replaced, then the transmission oil filter may be removed with the lines attached.

12. Position a sling around the transmission case, and attach the sling to a suitable hoisting device.

CAUTION

Be sure the sling is positioned so that the lifting force will be exerted on the transmission case, and not on the control valve assembly or any other component of the transmission that could sustain damage.

REMOVING THE TRANSMISSION

NOTE

If for some reason, the transmission cannot be removed by lowering it out the bottom through the frame, it must be hoisted out the top. To accomplish this, the control cab must first be removed or at least moved off to the left far enough to clear the transmission. For cab removal, refer to Section 20.

1. Position supports under the engine bell housing to prevent any strain on the engine front supports, when the transmission is disconnected from the engine.

2. Apply sufficient lifting force with the hoisting device to support the weight of the transmission.

3. Remove the bolts (46) and washers (47) attaching the left transmission mount (7) to the transmission.

4. Remove the locknuts (22 and 48), bolts (19 and 49) and snubbing washers (21 and 50).

5. Remove the bolts (52) and lockwashers (53) attaching the transmission flange to the engine bell housing.

6. Check to see that all lines, harnesses, cables, etc., that have been disconnected or routed over the transmission, are in a position to clear the transmission.

7. Maneuver the hoisting device to move the transmission toward the front of the machine until it clears the engine.

8. Lower the transmission clear of the frame on to a sled-type device.

9. Slide the transmission out from under the machine.

16 – HOLE RING GEAR INSTALLATION

(See Figure 09-2)

The transmission is driven by a fiber drive ring attached to the engine flywheel. The fiber drive ring, including special bolts and washers, is supplied as a kit (P/N 4443-298). Perform the following procedures to install the kit.

1. Remove all burrs from flywheel mounting face and pilot bore. Clean with solvent to remove any loose burrs.

NOTE

The engine flywheel and housing must conform to standard tolerance specifications S.A.E. No 3 (S.A.E. J927) for pilot bores, eccentricities, and mounting face deviations.

2. Position the fiber drive ring on the flywheel mounting face.

3. Install the special washers and bolts furnished in the kit.

4. Refer to the transmission cooling circuit in Section 09-A to ensure that the transmission cooling hoses are properly connected to the inlet and outlet ports in the transmission.

CAUTION

Do not reverse transmission cooler lines. Reversing these lines will back flush the transmission cooling system.

5. After the transmission filter assembly has been installed, perform the following procedures to properly connect the transmission filter hoses.

a. When standing beside the cab, observe the transmission while looking toward the engine. The oil filter hose connection port on your right is the transmission oil out port. The Left port is the transmission oil in port.

b. Connect the transmission filter oil hose (38) to the transmission oil out port and to the inlet port on the transmission oil filter assembly (45).

NOTE

The inlet and outlet ports on the oil filter assembly are marked IN and OUT.

c. Connect the transmission oil filter hose (37) to the transmission oil in-port and to the outlet port on the transmission oil filter assembly (45).

NOTE

The transmission oil pressure line (36) is also connected to the transmission oil in port.

6. After the transmission shift and inching control linkages are connected, check operational travel of the control valve spools. If adjustment is necessary, refer to Section 09C for procedures.

NOTE

Since the shift and inching control linkages in the cab are not disturbed when changing a transmission, any necessary adjustment should be accomplished with the linkages connected to the transmission control valve.

FILLING THE TRANSMISSION

1. Fill the transmission to the LOW mark on the dipstick.

2. Operate the engine and check for oil leaks. With the engine running at 500 to 600 rpm, recheck the oil level, and add oil to bring the oil level to the LOW mark on the dipstick.

3. When the oil temperature reaches +180° F to +200° F, make a final oil check and add oil to bring the oil level to the FULL mark on the dipstick.

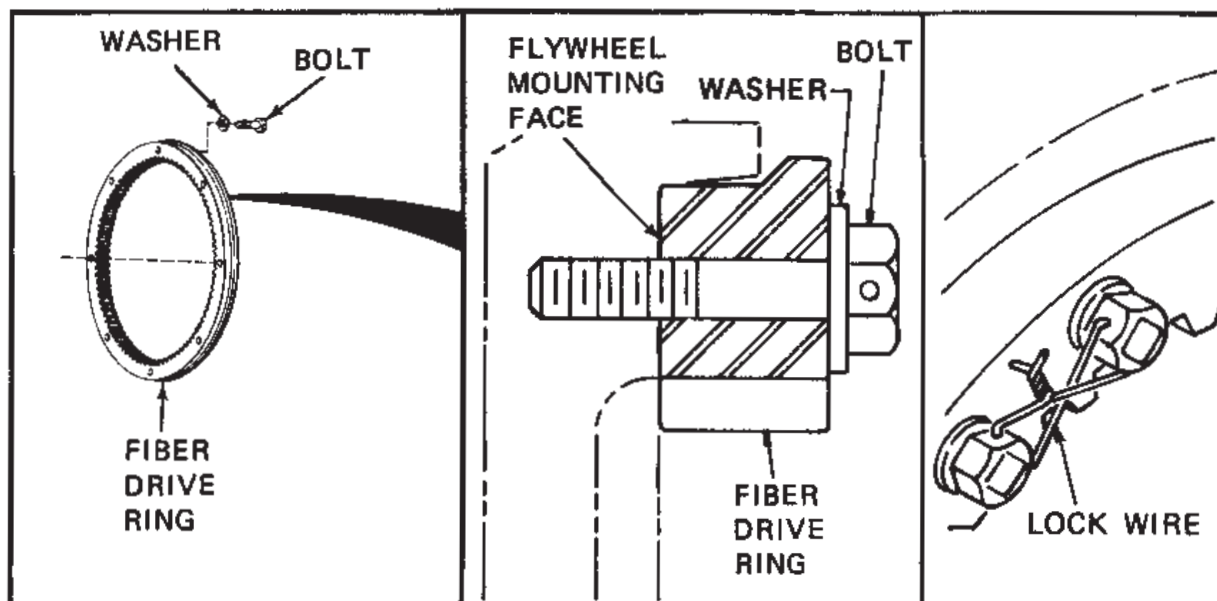


Figure 09.2. Installing Fiber Drive Ring

4. Tighten the bolts alternately. Measure the amount of torque required to run the bolts in. Torque the bolts 30-33 foot pounds more than the torque required to run the bolts in.

EXAMPLE

If 7 foot pounds of torque is required to run the bolts in, then final torque should be 37-40 foot pounds.

5. Install the lock wire as shown.

TRANSMISSION INSTALLATION

Install the transmission by reversing the procedures under removing the transmission and disconnecting the transmission above, and performing the following additional procedures.

NOTE

If transmission failure has occurred, replace the transmission oil cooler, filter, flow valve, and connecting lines. Fill the transmission and

transmission cooling system with clean, previously unused, transmission fluid.

1. Check the condition of the rubber mounts (51), and replace if necessary.

2. Lower the transmission into the main frame assembly, and align the transmission converter with drive ring.

CAUTION

As the transmission is moved toward the engine, make sure the splints are accurately aligned and started to mesh, before pressure is applied to the transmission to pull it up to the flywheel housing.

3. Refer to the torque table in the back of this manual for torque values to be applied to all nuts and bolts when installing the transmission.

SECTION 09A

TRANSMISSION COOLER CIRCUIT

INTRODUCTION

A cooler mounted in front of the radiator is provided to cool the transmission oil. A flow valve in the interconnecting lines between the transmission and the cooler controls the flow of oil through the cooler. When the viscosity of the oil is high, the resistance of oil flow through the cooler causes a pressure buildup in the system higher than the pressure required to open the flow valve. When this condition exists the flow valve opens, allowing the oil to bypass the cooler and return to the transmission for recirculation. As the oil warms up the viscosity decreases and the pressure required to force the oil through the cooler decreases. When the pressure required to force the oil through the cooler drops below the pressure required to open the flow valve, the flow valve closes and all the transmission oil circulates through the oil cooler.

FLOW VALVE REPLACEMENT (Figure 09A-1)

1. Removal.

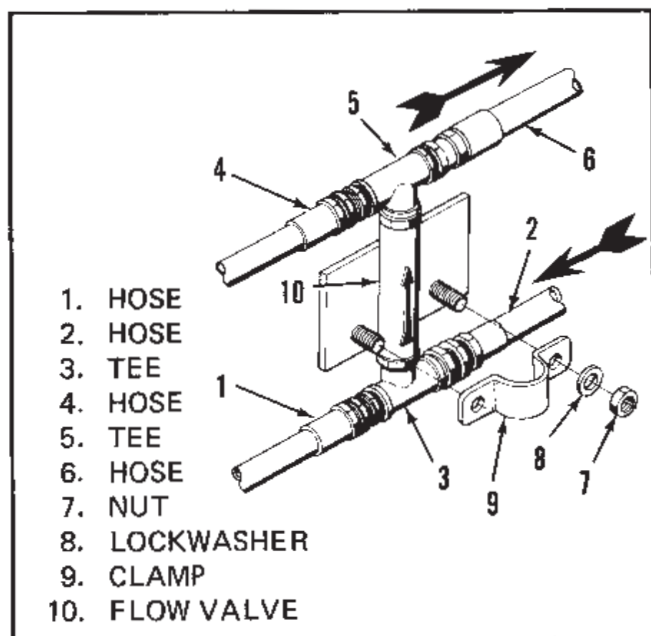


Figure 09A-1. Flow Valve Removal

a. Disconnect hoses (1 and 2) from the tee (3).

b. Disconnect hoses (4 and 6) from tee (5).

c. Remove nuts (7), lockwashers (8), and clamp (9), to remove the flow valve (10).

2. Installation.

a. Check the direction of flow of the replacement flow valve. The flow valve must be installed with the arrow pointing upward.

b. Transfer all serviceable fittings from the old flow valve to the replacement flow valve.

c. Install the replacement flow valve by reversing removal procedures.

CAUTION

Do not reverse transmission cooler lines. Reversing these lines will back flush the transmission cooling system.

TRANSMISSION OIL COOLER (Figure 09A-2)

1. Removal

a. Tag and disconnect hoses (1 and 2) from the transmission oil cooler (3).

b. Remove bolts (4), lockwashers (5), and remove the transmission oil cooler.

c. Remove bolts (6), washers (7), and brackets (8).

2. Installation. Install the cooler by reversing removal procedures.

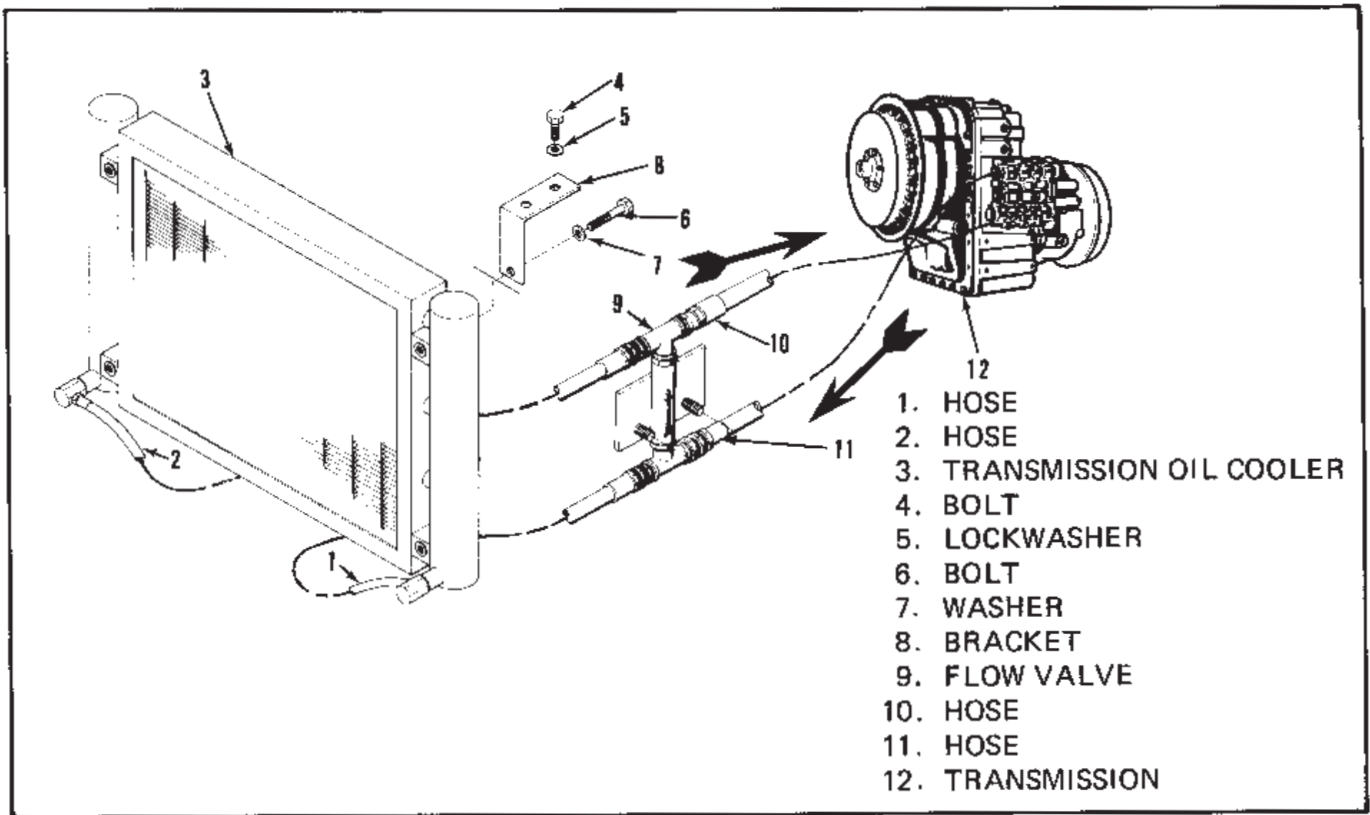


Figure 09A-2. Transmission Oil Cooler

SECTION 09C

TRANSMISSION CONTROLS AND LINKAGE, TRT

INTRODUCTION

The following procedures are for the removal, installation and adjustment of the transmission control linkage. Refer to figures as indicated for identification and location of parts.

NOTE

Set parking brake before servicing linkages.

1. Removal (Figure 09C-1).

a. Remove nut (9) and disconnect rod end (10) from the inching control pedal (7).

b. Remove the cotter pin (6), pin (5) and control pedal (7) with bushings (8).

NOTE

Do not remove nuts (4), lock-washers (3) and bolts (2) unless the inching pedal mount (1) requires replacement.

c. Remove nut (20) to disconnect rod end (21) from bell crank (16).

d. Loosen nuts (11) to remove cable from brackets.

e. Remove nuts (15) to disconnect rod ends (12) from bell crank (16) and valve spool.

f. Remove snap ring (18), washer (17), bell-crank (16) and bushing (19).

2. Installation. Obtain the necessary replacement parts and reinstall the inching control linkage by following removal procedures in reverse order.

NOTE

If the bell crank bushing (19) requires replacement, it must be pressed from the bell crank (16) and the replacement pressed in.

3. Adjustment. When final adjustment of the inching control linkage is completed, the spool in the control valve should bottom and the control pedal should reach the end of its travel simultaneously. The pedal should have 1/4 inch-free travel in the released position. As the pedal is depressed, the control valve spool should start to move as the 1/4 inch free travel is surpassed. This free travel is caused by slack in the linkage connections.

a. If the spool bottoms before the pedal, assuming that both the pedal and spool reach their released positions simultaneously, then the connecting rod (14) adjustment length must be shortened.

b. If the pedal bottoms first then the connecting rod (14) must be lengthened.

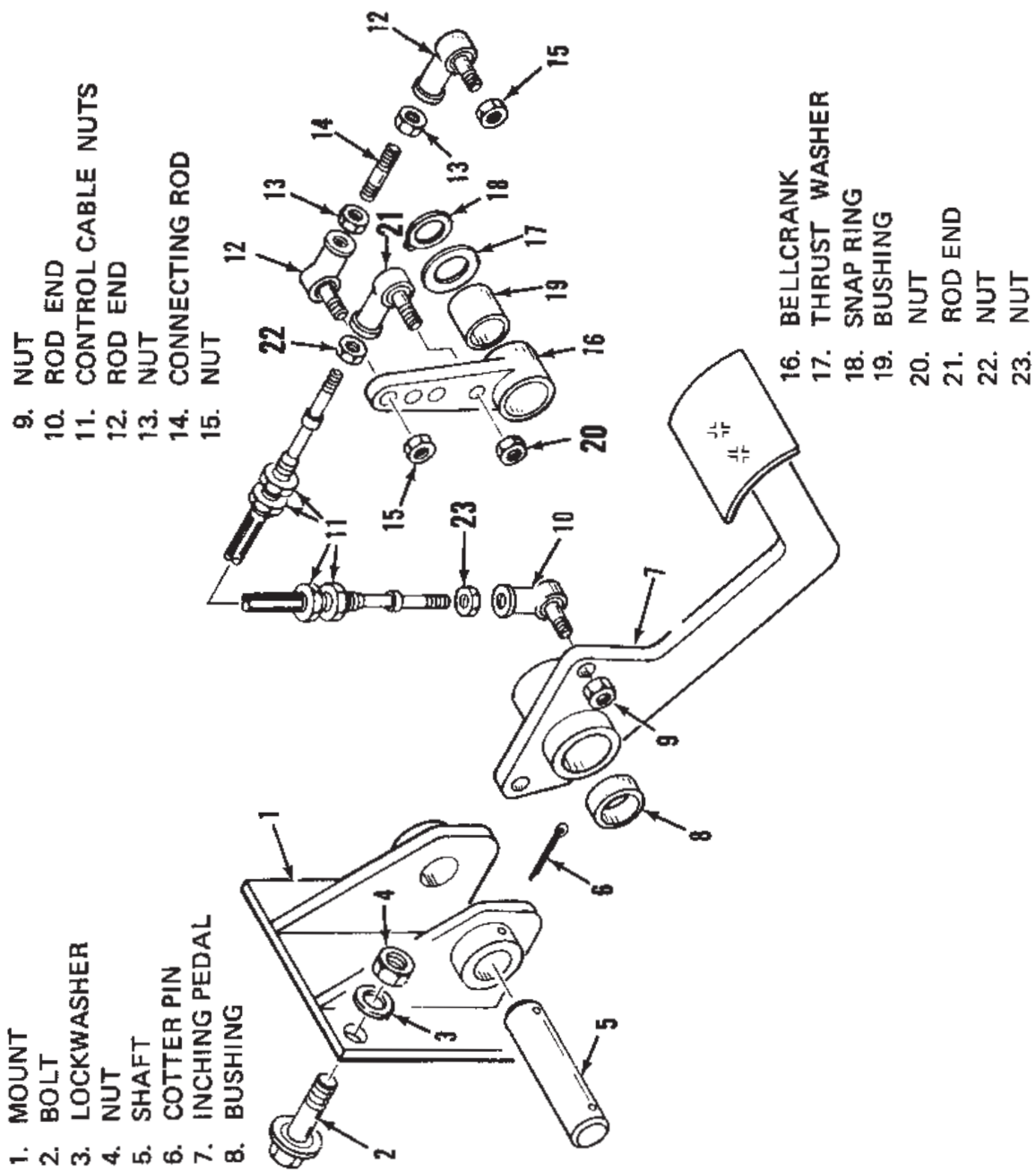


Figure 09C-1. Inching Control and Linkage

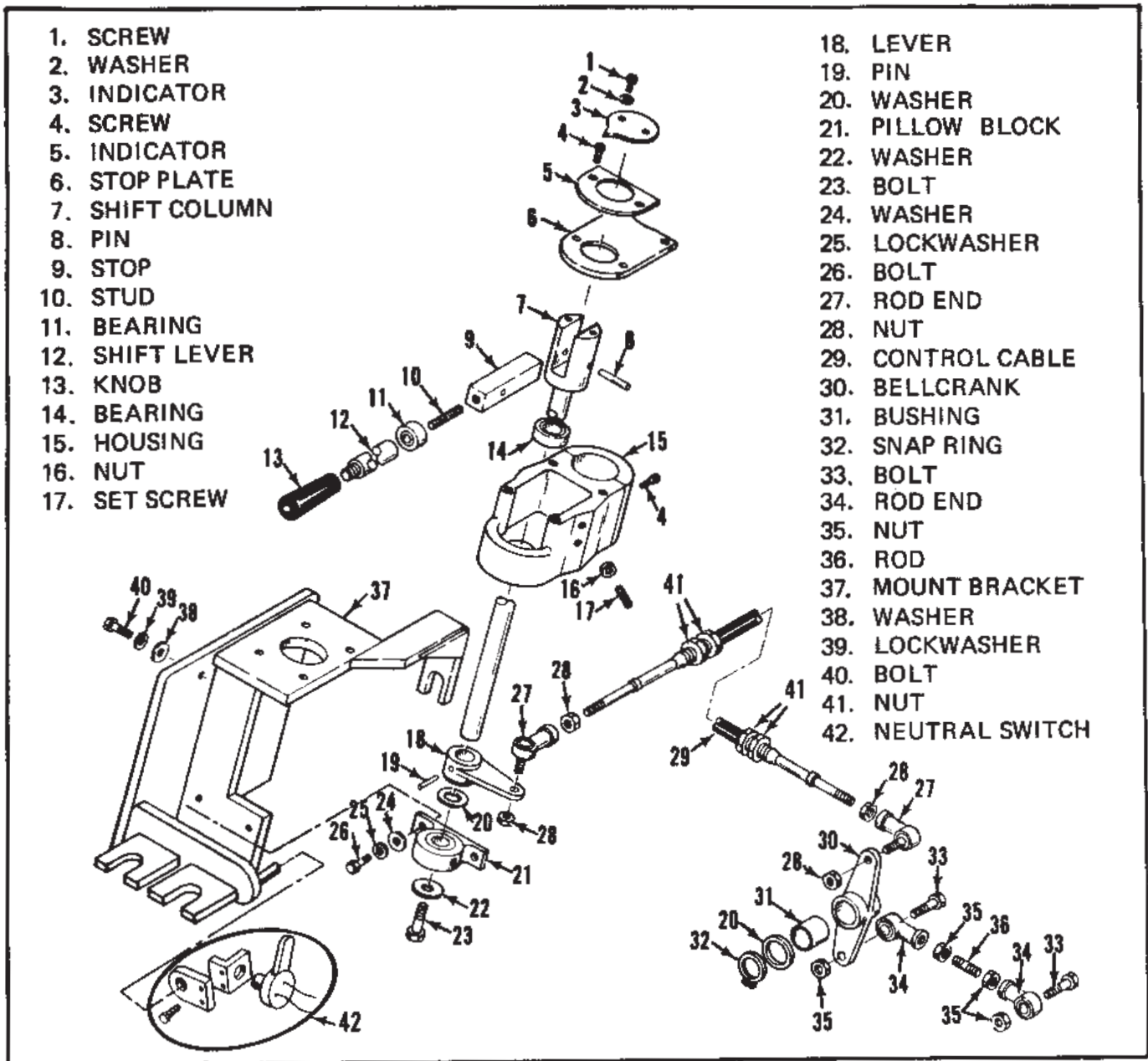


Figure 09C-2. Transmission Control Linkage

c. When adjustments are completed, operate the machine and check inching control. When the pedal is fully depressed, the machine should be neutralized.

b. Remove nuts (28) to disconnect rod end (27) from bell crank (30) and lever (18).

c. Remove snap ring (32), washer (20) and bell crank and bushing assembly (30 and 31).

FORWARD AND REVERSE CONTROL LINKAGE

1. REMOVAL (Figure 09C-2)

a. Place gear selector in NEUTRAL position. Down on the transmission remove nuts (35) and bolts (33) to remove linkage arm assembly (34, 35, and 36).

NOTE

If the bellcrank bushing (31) is to be replaced, it must be pressed out of the bell crank and a new one pressed in.

- d. Loosen nuts (41) to slip cable from mounts.
- e. Remove bolt (23) and washer (22).
- f. Remove pin (19) from lever (18).
- g. Remove screws and lockwashers (1 and 2) to remove shift indicator (3).
- h. Remove screws (4), gear indicator (5) and plate (6).
- i. Pull column (7) up through housing (15) far enough to clear the pillow block (21) then slide lever (18) down off column. Pull column completely out of housing.
- j. Unscrew knob (13) from shift lever (12).
- k. Unscrew shift lever (12) from stud (10) to release bearing (11).
- l. Remove pin (8) to remove shift stop (9).

NOTE

Do not remove bolts (40), lockwashers (39) and washers (38) unless bracket (37) is to be replaced. Do not remove bolts (26) and washers (24 and 25) unless the pillow block (21) is to be replaced.

2. INSTALLATION. Obtain necessary replacement parts and reinstall the forward reverse control linkage by reversing the removal procedures and performing the following additional procedures.

- a. Move the forward reverse valve spool (top spool on the transmission control valve) to the center detent position (neutral).
- b. Position bell crank (30) vertical then adjust control rod assembly (34, 35 and 36) so that once installed in the top hole of the bell crank, the bell crank remains vertical.

NOTE

Make sure the rod ends (34) are screwed a sufficient number of turns onto the connecting rod (36) to provide a reliable connection. Be sure of the same for the cable ends (27) on the control cable (29).

c. Slide the control cable (29) into the slots in the transmission mounting bracket and the orbitrol mount bracket (37). With the shift selector in the NEUTRAL position, check to see if the rod ends (27) line up with the holes in the shift lever (18) and bell crank (30). If the cable is short, lengthen the cable an equal amount on each end. If the cable is too long, shorten the cable an equal amount on each end.

d. Connect the rod ends (27) to the shift lever (18) and bellcrank (30) and secure with nuts (28). Tighten jam nuts (28) and cable mount nuts (41).

NOTE

With the above procedures completed both the selector and transmission should be in NEUTRAL.

e. Move the shift selector (12) forward from the neutral position to F-1 position. As the valve spool moves into the F-1 detent position it can be felt in the selector. Continue moving the selector forward to the F-2 position. As the valve spool moves into the F-2 position detent it too should be felt in the selector. If a slight additional forward pressure is applied, the shift stop (9) should contact the stop screw (17).

f. Moving the selector to the rear from the neutral position should yield the same results for the R-1 detent and R-2 detent. Both should be felt in the selector. Additional pressure should cause the selector to contact the stop screw.

NOTE

If the shift selector does not operate as described in steps (e and f), perform the following adjustment procedures.

g. Loosen jam nuts (16) and back out stop screws (17) a few turns.

h. Move lever (12) to the F-2 position detent. Turn the forward stop screw in until it contacts the shift stop (9) then back the screw out 1/2 to 3/4 turn then tighten the jam nut (16).

i. Move the shift lever (12) to R-2 position detent. Screw the reverse stop screw in until it contacts the shift stop (9), then back out the screw 1/2 to 3/4 turn and tighten jam nut (16).

SECTION 09C

TRANSMISSION CONTROLS AND LINKAGE, TC-28

INTRODUCTION

The following procedures are included for removal, installation, and adjustment of the transmission control linkage. Refer to the figures as indicated for identification and location of parts when performing the following procedures.

INCHING CONTROL LINKAGE (Figure 09C-1)

1. Removal

- a. Remove the nut (1) to disconnect control cable end (2) from the inching pedal (3).
- b. Loosen the nuts (4) to remove the cable from its bracket mounts.
- c. Remove the return spring (5).
- d. Remove the nut (6) to disconnect cable end (7) from the valve body on the transmission.
- e. Remove cotter pin (8) and slide the pivot pin (9) from the mounting bracket (10) to remove the pedal (3).

NOTE

Do not remove bushings (11) from pedal (3) unless they are to be replaced. If the bushings are to be replaced, they must be pressed out of the pedal and replacements pressed in.

Do not remove the nuts, washers and bolts (12, 13 and 14) unless mounting bracket (10) is to be replaced.

2. Installation. Obtain the necessary replacement components and reinstall the inching control linkage by following the removal procedures in reverse order.

3. Adjustment (Figure 09C-1). When final adjustment of the inching control linkage is completed, the spool in the control valve should bottom out and the inching control pedal (3) should strike the stop simultaneously when the pedal is depressed. The inching control pedal should have 1/4 inch free travel when the pedal is in the released position. As the pedal is depressed, the control valve spool should start to move as the 1/4 inch free travel is surpassed. This free travel is normal, and is caused by slack in the clevis pin connection, rod end connections, etc.

a. If the spool bottoms out before the control pedal (3) strikes the stop, the linkage may be too long.

b. If the control pedal (3) strikes the stop before the spool bottoms out in the control valve, the linkage may be too short.

c. Make the necessary adjustments according to which of the above conditions exist. When making adjustments, the amount of adjustment should be equally balanced on both ends of the linkage.

d. When adjustments are completed, operate the machine and check the inching control. When the pedal is fully depressed the machine should be neutralized.

FORWARD AND REVERSE CONTROL LINKAGE (Figure 09C-2)

1. Removal

a. Remove the nuts (1 and 29) and disconnect the cable ends (2 and 28) from the actuating lever (3) and the bellcrank (5).

b. Loosen the nuts (4) and remove the control cable assembly (6).

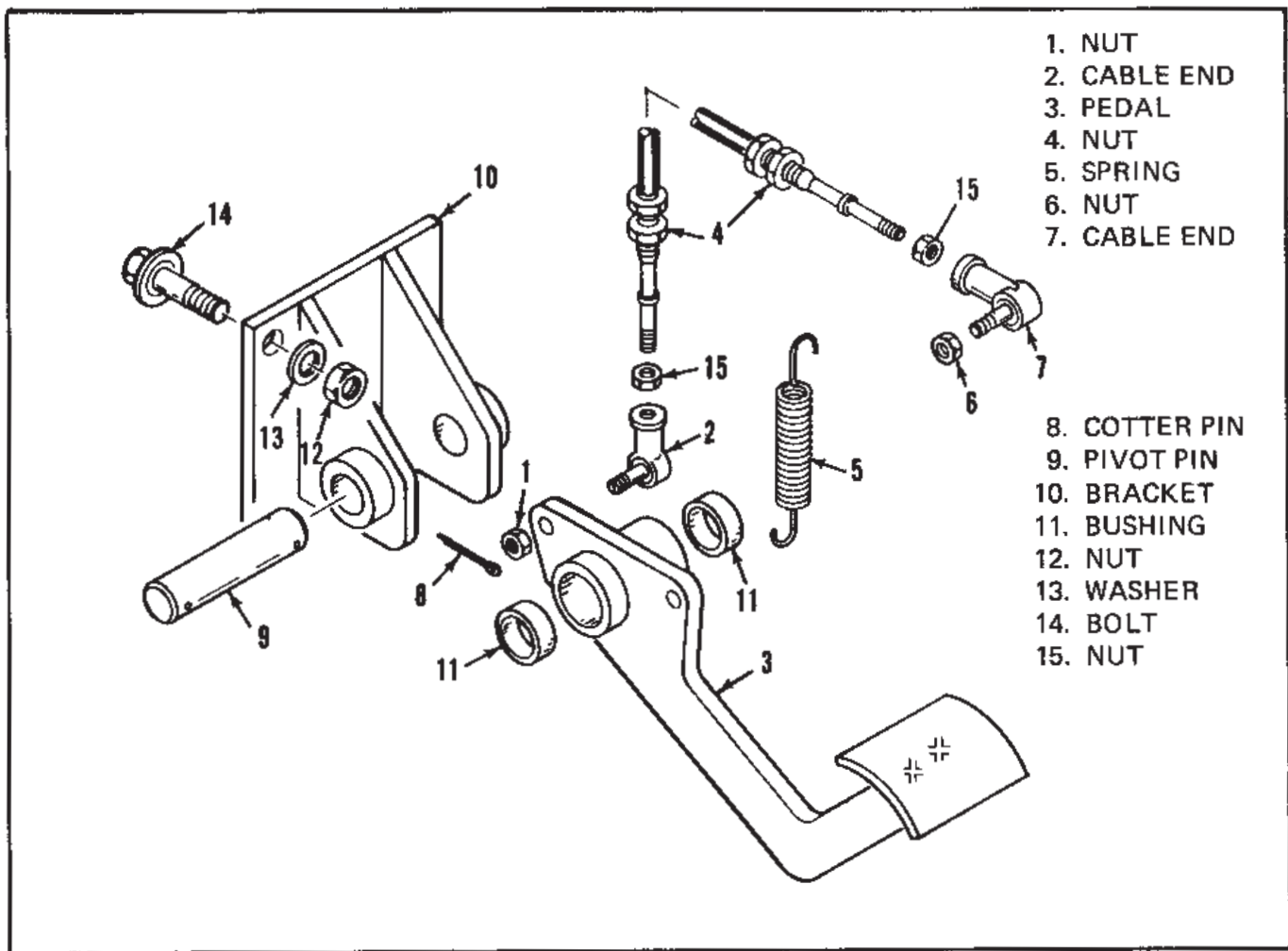


Figure 09C-1. Inching Control Linkage

c. Remove the nuts (10), washers (11) and bolts (12) to remove the rod assembly (13, 14 and 15).

d. Remove the retaining ring (7) and thrust washer (8) to remove the bellcrank (5) and its bushing (9) as an assembly.

NOTE

If the bushing (9) is to be replaced, it must be pressed out of the bellcrank (5) and a replacement pressed in.

2. Installation. Obtain the necessary replacement parts and reinstall the forward reverse control linkage by following the removal procedures in reverse order, and performing the following additional procedures.

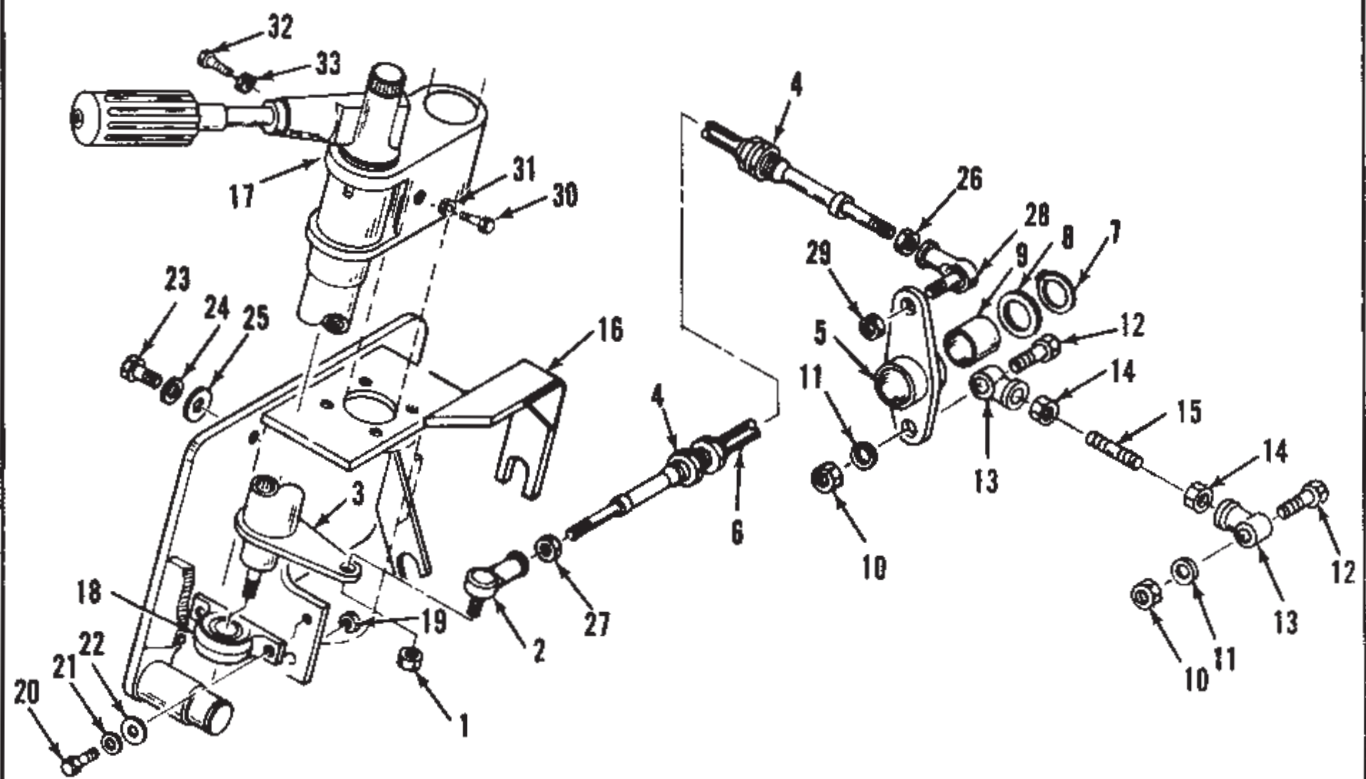
a. Reinstall the bellcrank (5) and position it so the holes for the connecting rod ends (28 and 13) are aligned in the vertical position.

b. Position the valve spool in the center or neutral detent.

c. Install thread rod assembly (13, 14 and 15) and secure with bolts, washers, and nuts (12, 11 and 10).

NOTE

Bellcrank (5) must remain positioned such that the holes are aligned vertically with the rod assembly installed. If the bellcrank (5) is not vertical, loosen the jam nuts (14) and adjust the rod assembly length accordingly. Be sure the rod ends (13) are threaded a sufficient number of turns to provide a reliable connection.



1. NUT
2. ROD END
3. LEVER
4. NUT
5. BELL CRANK
6. CABLE ASSEMBLY
7. RETAINER RING
8. THRUST WASHER
9. BUSHING
10. NUT
11. WASHER
12. BOLT
13. ROD END
14. NUT
15. THREADED ROD
16. MOUNTING BRACKET
17. ROLL SHIFT CONTROL

18. PILLOW BLOCK
19. NUT
20. BOLT
21. LOCKWASHER
22. WASHER
23. BOLT
24. LOCKWASHER
25. WASHER
26. NUT
27. NUT
28. ROD END
29. NUT
30. STOP BOLT
31. JAM NUT
32. STOP BOLT
33. JAM NUT

Figure 09C-2. Forward Reverse Control Linkage

d. Move the shift lever to the neutral position. Connect cable end (28) to bellcrank (5) and secure with nut (29). Check to see if cable end (2) is aligned with the hole in the shift lever (3). If so, connect cable end (2) to shift lever (3) and secure with nut (1). If not, loosen nut (27) and adjust length of cable to align with the hole in the shift lever (3), then secure it with nut (1).

NOTE

Make sure that the cable ends (2 and 28) are threaded a sufficient number of turns on to the cable (6) to provide a reliable connection.

e. Secure the cable assembly to the slots in the mounting brackets (16) and on the transmission with the jam nuts (4).

NOTE

When the above procedures have been completed, with the bellcrank (5) in the vertical position and the forward reverse valve in the center detent, both the shift lever and the transmission are in the neutral position.

f. Move the shift lever forward from the neutral position to the forward position. As the valve spool on the transmission moves to the forward detent, it can be felt on the shift lever. With slight additional pressure, the shift lever should contact the stop bolt.

g. Move the shift lever to the rear from the neutral position to the reverse position. As the valve spool moves to the reverse detent, it can be felt on the shift lever. With slight additional pressure, the shift lever should contact the stop bolt.

NOTE

If the shift lever does not operate as described in steps (f and g), perform the following procedures to adjust the stops.

h. Loosen jam nuts (31 and 33) and back the stop bolts (30 and 32) out a few turns.

i. Move the shift lever forward until the forward detent is felt. Turn the stop bolt (32) in until it contacts the shift stop, then back the stop bolt (32) out 1/2 to 3/4 turn and tighten the jam nut (33).

j. Move the shift lever to the rear until the reverse position detent is felt. Turn the stop bolt (30) in until it contacts the shift stop, then back it out 1/2 to 3/4 turn and tighten the jam nut (31).

SPEED RANGE CONTROL LINKAGE (Figure 09C-3)

1. Removal.

a. Remove the nut (1) and disconnect the cable end (2) from the bellcrank (3).

b. Loosen the nut (4) and remove the cable assembly (5) from the slot in the shift mount (6).

c. Remove the nut (7) to disconnect the rod end (9) from the transmission control valve.

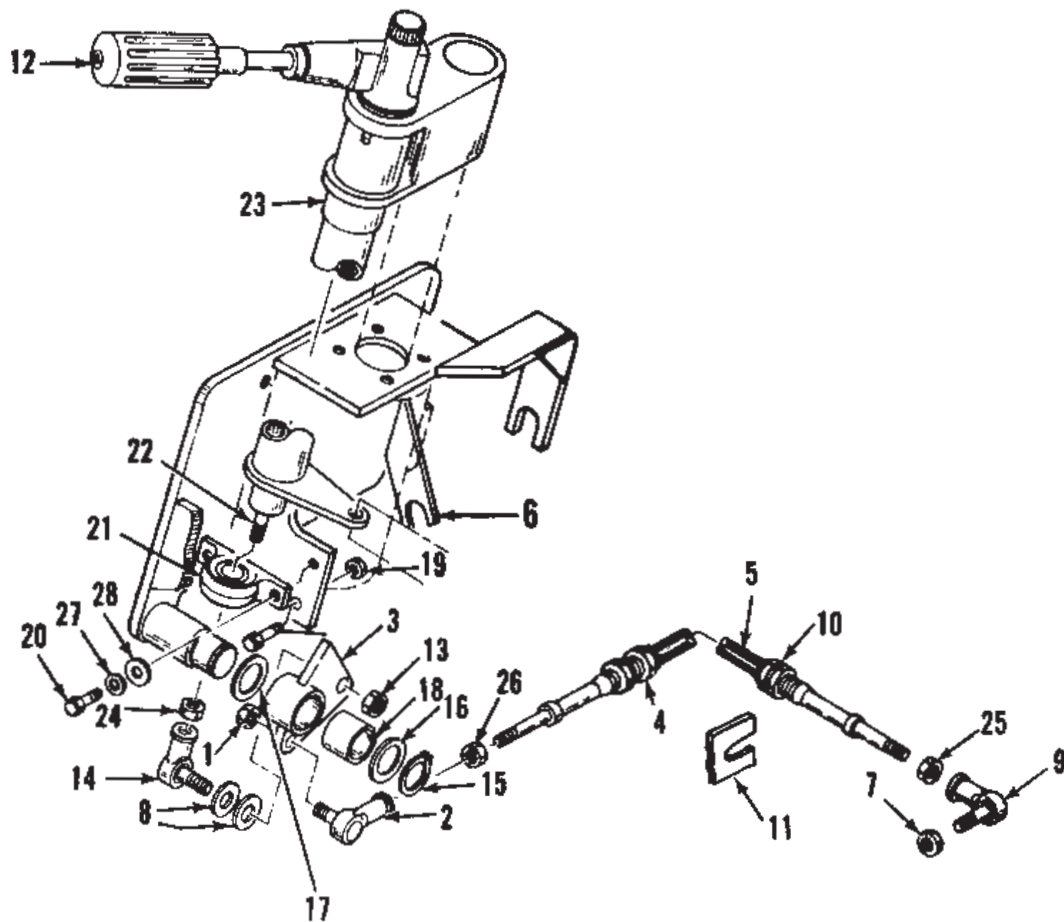
d. Loosen the nut (10) and remove the cable assembly (5) from the slot in the transmission mounting control bracket (11).

e. Rotate the shift lever (12) to the highest speed range. Remove the nut (13) and disconnect the rod end (14) from the bellcrank (3).

f. Remove the retainer ring (15), thrust washer (16), remove the bellcrank assembly (3) and washer (17).

NOTE

If the bellcrank bushing (18) requires replacement, the bushing must be pressed out of the bellcrank (3) and the replacement bushing pressed into position in the bellcrank.



- | | |
|--------------------------|--------------------|
| 1. NUT | 15. RETAINER RING |
| 2. ROD END | 16. WASHER |
| 3. BELL CRANK | 17. WASHER |
| 4. NUT | 18. BUSHING |
| 5. CABLE ASSEMBLY | 19. NUT |
| 6. MOUNT BRACKET | 20. BOLT |
| 7. NUT | 21. PILLOW BLOCK |
| 8. WASHER | 22. SHIFT ROD |
| 9. ROD END | 23. SHIFT ASSEMBLY |
| 10. NUT | 24. JAM NUT |
| 11. TRANSMISSION BRACKET | 25. NUT |
| 12. SHIFT LEVER | 26. NUT |
| 13. NUT | 27. WASHER |
| 14. ROD END | 28. WASHER |

Figure 09C-3. Speed Range Control Linkage

g. Unscrew the shift rod (22) from the shift assembly (23). Loosen the jam nut (24) and remove the rod end (14).

2. Installation. Obtain necessary replacement parts and reinstall the speed range control linkage by reversing removal procedures, and performing the following additional procedures.

a. When installing the shift rod (22), screw the shift rod into the shift assembly (23) as far as it will go, and tighten the shift rod (22).

b. When connecting the rod end (2) to the bellcrank (3), ensure that the rod end (2) is threaded onto the cable assembly (5) far enough to provide a reliable connection. Tighten the jam nut (26).

c. Position the cable assembly (5) in the slot in the shift mount (6) and tighten the nut (4).

d. Insert the threaded part of the rod end (14) through the hole in the bellcrank (3), and rotate the shift lever to the highest speed range. Install the nut (13).

e. Pull the speed range valve spool (bottom spool on the transmission control valve) out to highest speed range detent.

NOTE

The speed range valve spool has three detent positions. When pulling the spool out, the last detent is the highest speed range.

f. Position the cable assembly (5) in the slot in the transmission mounting bracket (11) and check to see if the rod end (9) is in alignment with the hole in the control valve spool. Turn the rod end (9) in the direction necessary to align the holes, and install the nut (7). Tighten the nuts (10 and 25).

g. Remove the cap (18, Figure 09-C-4) and observe the teeth on the shaft (11) and rack (13). Rotate the shift handle (6) to the lowest speed range. The gear teeth should be in the position

shown in Figure 09C-4, Detail A. Rotate the handle through its full range of travel in both directions. The linkage must be adjusted so that the handle will shift the transmission into all of the three speed ranges. The detents for the different speed ranges can be felt as the handle is rotated.

ROLL SHIFT ASSEMBLY (Figure 09C-4)

1. Removal and Disassembly

a. Refer to Section 16 and remove the steering wheel.

b. Remove the snap ring (1) and pull the housing assembly (2) out of the shift column (3) and roll shift housing (4).

c. Remove the screw (5) and handle (6).

d. Remove the setscrew (7) and indicator (8).

e. Remove the plug (9), seal (10), and shaft (11).

NOTE

Do not remove the housing seal (12) unless replacement is necessary.

f. Unscrew the rack (13) from the shift rod (14) and remove the rack.

g. If the shift stop (15) is to be removed, move the shift rod (14) downward to clear the shift stop (15) and remove the shift stop.

NOTE

If the shift stop (15) cannot be removed after moving the shift rod (14) down as far as it will go, (refer to Figure 09C-3) and disconnect the rod end (14) on the lower end of the shift rod (22) from the bellcrank (3) to obtain sufficient clearance.

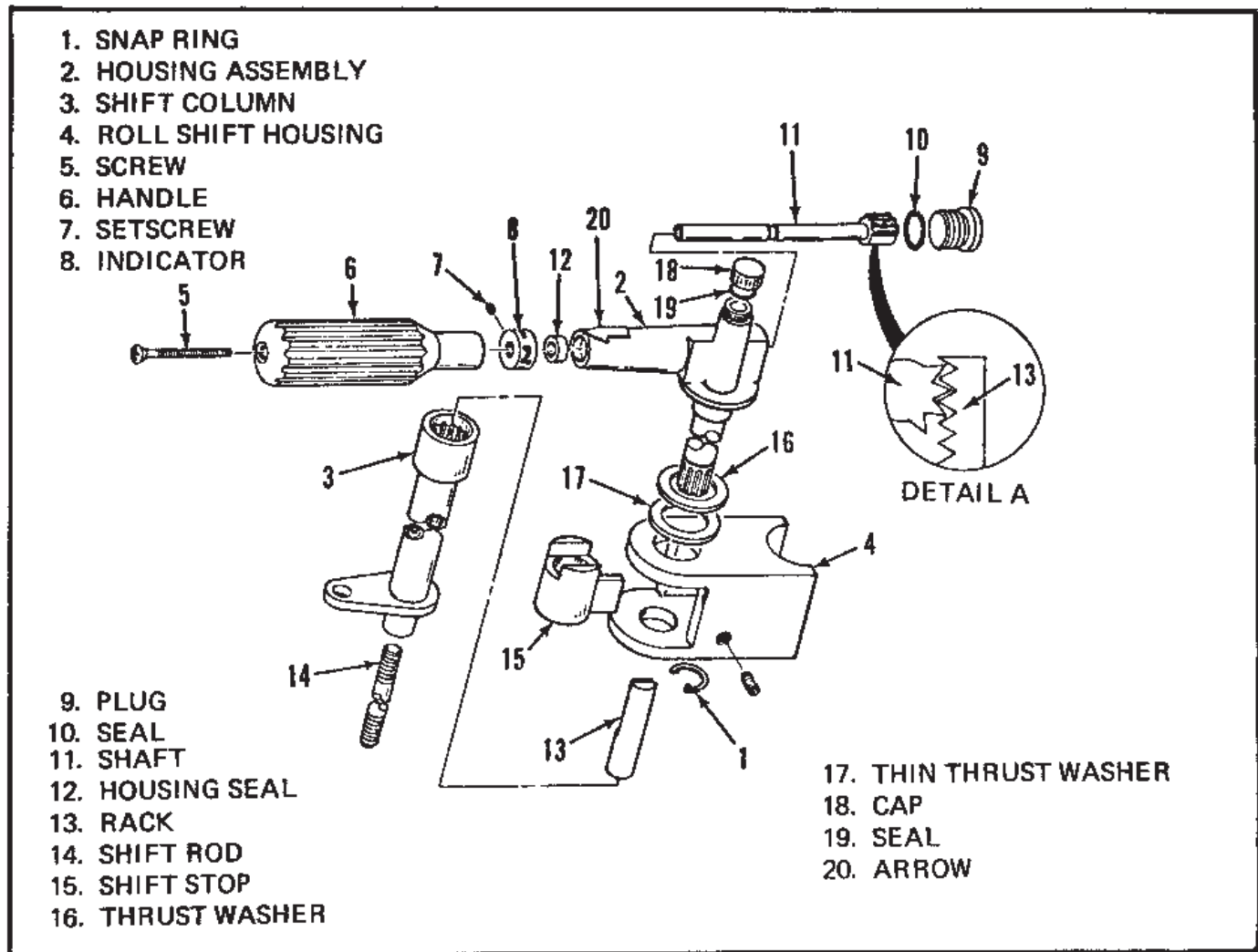


Figure 09C-4. Roll Shift Assembly

2. Installation. Obtain necessary replacement parts and reinstall the roll shift assembly by reversing removal and disassembly procedures, and performing the following additional procedures.

- a. Install the shift stop (15), if removed.
- b. If the rod end on the bottom of the shift rod (14) was disconnected from the bellcrank (see Figure 09C-3), reconnect the rod end to the bellcrank.
- c. Install the rack (13) on the shift rod (14).
- d. Position the thick thrust washer (16) and the thin thrust washer (17) on the shaft of the housing assembly (2), and insert the housing assem-

bly through the roll shift housing (4) and shift stop (15) into the shift column (3). Secure the housing (2) to the shift column (3) with snap ring (1).

- e. Pull the speed range valve spool (bottom spool on the transmission control valve) out to the last detent position.

NOTE

This is the highest speed range detent.

- f. Remove the cap (18) and seal (19).
- g. Partially insert the shaft (11) into the housing (2). Observe the top of the rack (13) and the shaft (11) through the hole in the housing (2). Position the shaft (11) so that the gear tooth

segment on the shaft is in the lowest speed range position. Continue to insert the shaft (11) into the housing (2) until the teeth on the shaft (11) start its mesh with the teeth on the rack (13). As the teeth mesh, the rack must be in position so that one tooth on the rack (13) is above the last tooth on the gear tooth segment of the shaft (11), (see Figure 09C-4, detail A).

- h. Replace the housing seal (12), if removed.
- i. Slide the indicator (8) onto the shaft (11).
- j. Install the handle (6) and screw (5).

k. Rotate the handle (6) through its full range of travel in both directions. The three detents for the three speeds must be felt. Rotate the handle to the lowest speed range and observe the position of the teeth on the rack (13) and shaft (11), (see Figure 09C-4, Detail A).

l. With the shift linkage in the lowest speed range position, rotate the indicator (8) until the arrow (20) is pointing midway at the numeral 1 and tighten the setscrew (7).

m. Install the seal (19), cap (18), seal (10), and plug (9).

SECTION 11

DRIVE SHAFTS

INTRODUCTION

The following procedures are included for removal and replacement of the hydraulic pump drive shaft, and the transmission to axle drive shaft. Refer to the figures as indicated for location and identification of parts when performing these procedures.

WARNING

Be sure the master BATTERY disconnect switch is in the OFF position and disconnect the negative (-) battery cable.

HYDRAULIC PUMP DRIVE SHAFT (Figure 11-1).

1. Removal

- a. Support the hydraulic pump drive shaft (1).
- b. Remove the bolts (2) and lockwashers (3).
- c. Lower the aft end of the drive shaft (1), and slide the shaft off the pump splines (5).

2. Installation. Install the main hydraulic pump drive shaft by reversing removal procedures.

TRANSMISSION TO AXLE DRIVE SHAFT (Figure 11-2).

WARNING

Do not depend on the air brakes alone to hold the machine stationary. When the transmission to axle drive shaft is disconnected

the machine will be free to roll even though the parking brake lever is in the brakes applied position. Park the machine on a level surface and block the wheels.

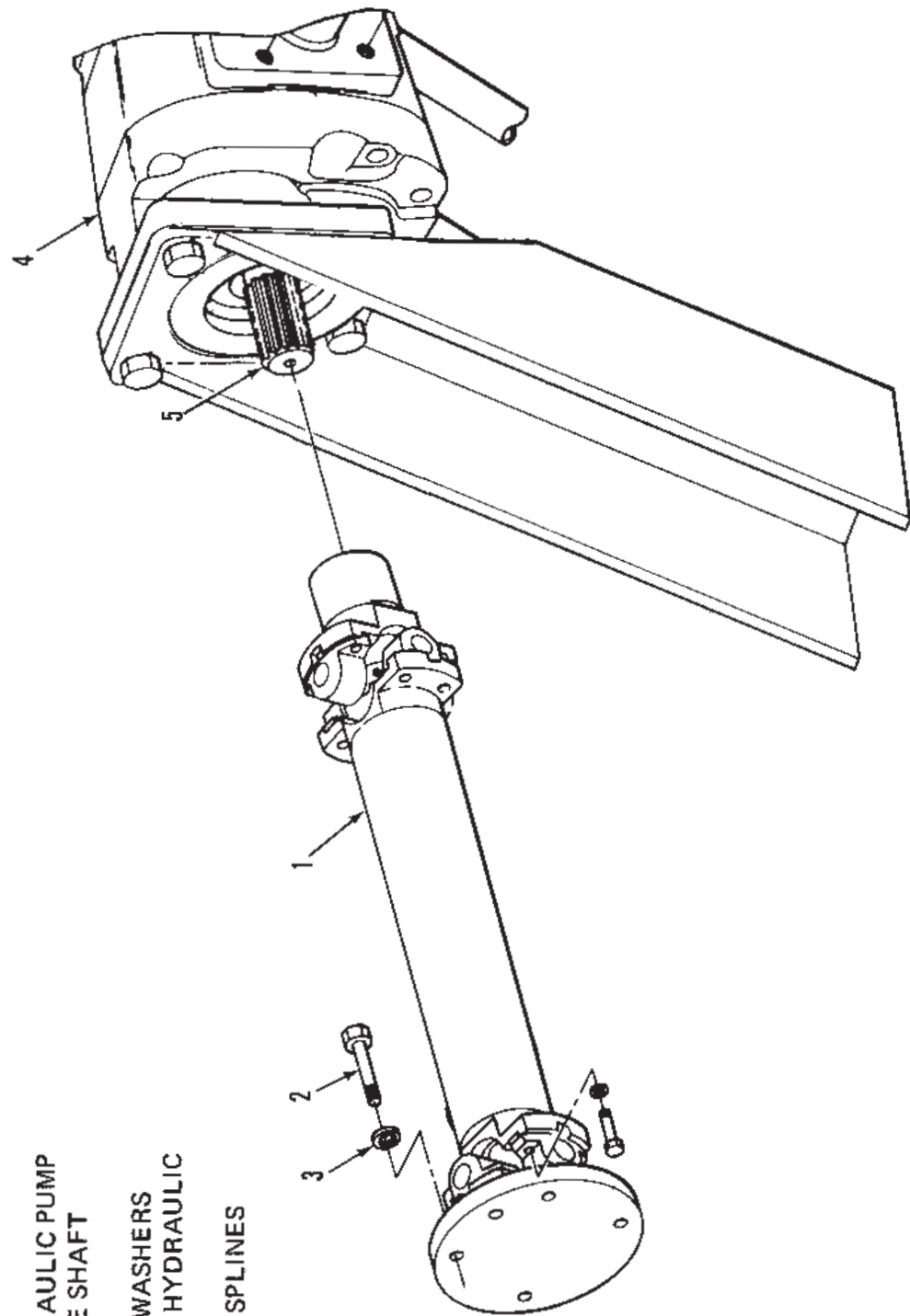
1. Removal

- a. Support the transmission to axle drive shaft (1).
- b. Remove the bolts (2) and lockwashers (3) to disconnect the drive shaft (1) from the transmission brake drum and flange assembly (4).
- c. Remove bolts (5) and washers (6) to disconnect the drive shaft (1) from the drive axle (7).
- d. Remove the drive shaft (1).

2. Installation. Install the transmission to axle drive shaft (1) by reversing removal procedures.

NOTE

When the transmission to axle drive shaft is installed the flanges (8 and 9) on the drive shaft must be aligned as shown in Figure 11-2. If the flanges are not aligned, reposition the splines (10) to bring the flanges into alignment.



- 1. HYDRAULIC PUMP DRIVE SHAFT
- 2. BOLT
- 3. LOCKWASHERS
- 4. MAIN HYDRAULIC PUMP
- 5. PUMP SPLINES

Figure 11-1. Hydraulic Pump Drive Shaft

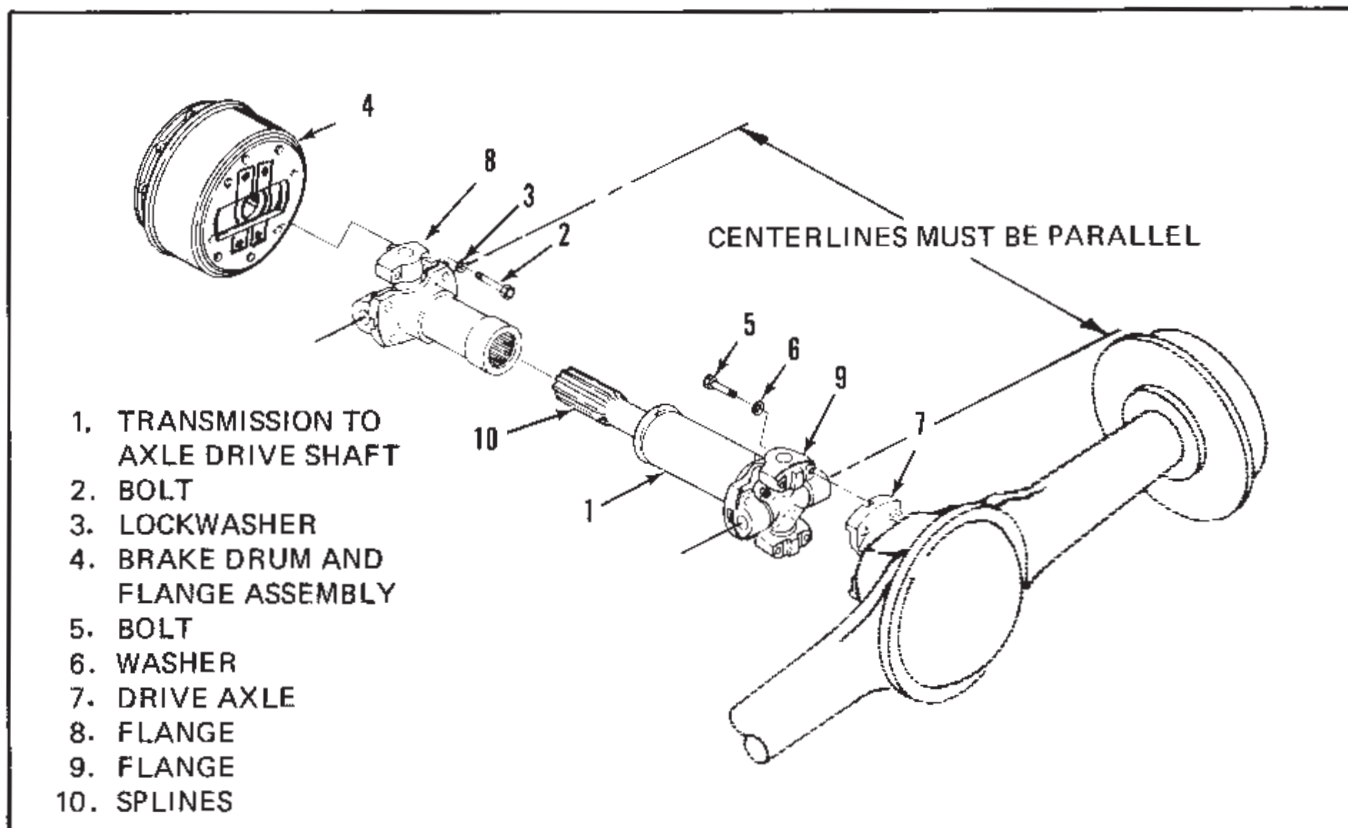


Figure 11. 2. Transmission to Axle Drive Shaft

SECTION 12

PARKING BRAKE ASSEMBLY

INTRODUCTION

If a component of the parking brake assembly requires replacement, refer to Figure 12-1 for location and identification of parts, and perform only that portion of the following procedures necessary to effect repairs.

CAUTION

Block wheels before servicing parking brake.

REMOVAL

1. Remove the cotter pin (1), flat washer (2), and clevis pin (3), to disconnect the cable assembly (4) from the parking brake lever (5).

2. Remove the nuts (6), lockwashers (7), bolts (8), spacers (9), and parking brake lever (5).

3. Remove the nut (10), clevis (11), nuts (12 and 13), and pull the cable assembly (4), through the cab floor (14) from below.

NOTE

If difficulty is encountered in removing the nut (13) because of limited clearance, wedge a screwdriver or other tool be-

tween the nut (13) and mounting bracket (15) to prevent the nut (13) from turning. Turn the hex fitting (16) from below the cab floor (14) only enough to loosen the nut (13), and remove the nut (13).

4. Remove the nut (17) and bolt (18) to disconnect the clevis (19) from the parking brake assembly (20).

5. Loosen the nut (21) and remove the cable assembly (4) from the slot in the transmission mounting bracket (22).

INSTALLATION

Obtain necessary replacement parts, and reinstall the parking brake assembly by reversing removal procedures.

ADJUSTMENT

Adjust the parking brake by rotating the knurled knob (23) on the top of the parking brake lever. As the knob is rotated to increase the braking force applied, it will be more difficult to move the parking brake lever to the brakes applied position. Rotate the knob as necessary to obtain the desired braking action.

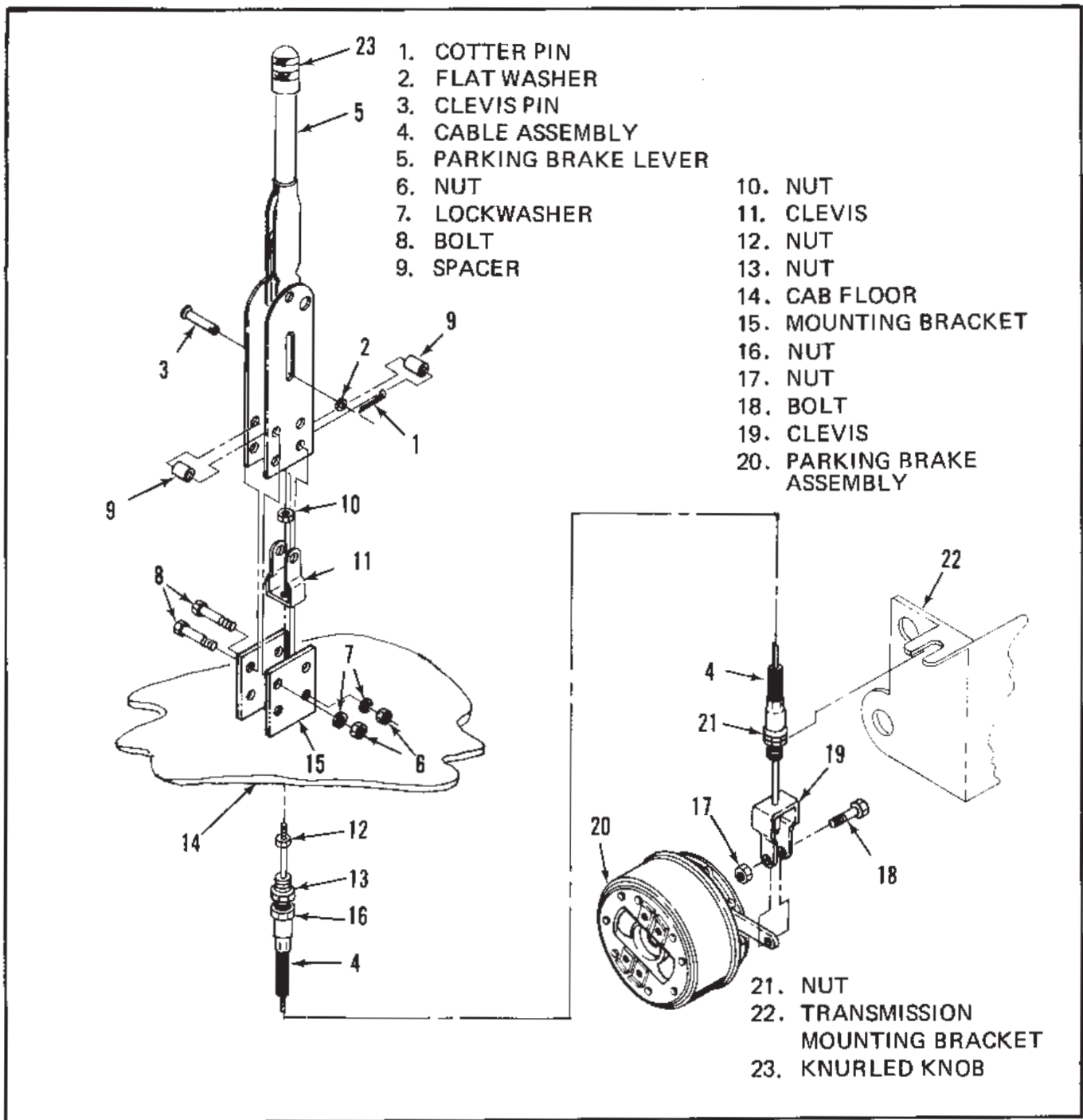


Figure 12-1. Parking Brake Assembly

SECTION 13

STEER AXLE

INTRODUCTION

The steer axle is mounted to the frame with two pivot pins. The pivot pins are an integral part of the axle. A pivot pin bushing is installed on the front and rear pivot pins, and two caps over the bushings are bolted to mating caps on the frame to mount the steer axle on the frame. All maintenance and replacement of components can be accomplished with the steer axle connected to the frame, except the replacement of pivot pin bushings or the steer axle itself. Refer to the figures as indicated, for location and identification of parts, when performing the following procedures.

STEER AXLE REMOVAL (Figure 13-1).

The steer axle can be removed with the wheels and tires mounted on the axle, or the wheel and tire assemblies can be removed prior to removing the axle, as desired.

1. Hoist or jack the rear of the machine sufficiently to relieve the weight of the machine from the pivot pins (1).

NOTE

Do not hoist or jack the machine high enough to clear the ground, because this would cause the weight of the steer axle to be resting on the pivot pins (1) and caps (2).

2. Disconnect the hose assemblies (3) from the bracket (4).

3. Remove the bolts (5), lockwashers (6), and caps (2). Mark the cap's orientation as they are matched pairs.

4. Hoist the machine high enough to obtain sufficient clearance, and roll the steer axle clear of the machine.

NOTE

If the wheels and tires are to be removed prior to removing the steer axle, provision for supporting the steer axle during removal will have to be implemented.

5. If the bushings (7) are to be replaced, remove the bushings and replace with new bushings.

STEER AXLE INSTALLATION.

Install the steer axle by reversing removal procedures.

STEER AXLE REPAIR.

If components of the steer axle fail or require replacement, perform only that portion of the following procedures necessary to repair the affected part.

1. Tie Rod Assembly (Figure 13-2).

- a. Remove the cotter pins (1), castellated nuts (2), and tie rod assembly (3).

NOTE

If a tie rod end requires replacement, disconnect only the end of the tie rod requiring replacement.

- b. Loosen the clamps (4) sufficiently to unscrew and remove the tie rod ends (5 and 6).

- c. Obtain necessary replacement parts and reinstall the tie rod assembly by reversing above procedures.

2. Spider Assembly (Figure 13-2).

- a. Disconnect the tie rods (3) from the spider (7).

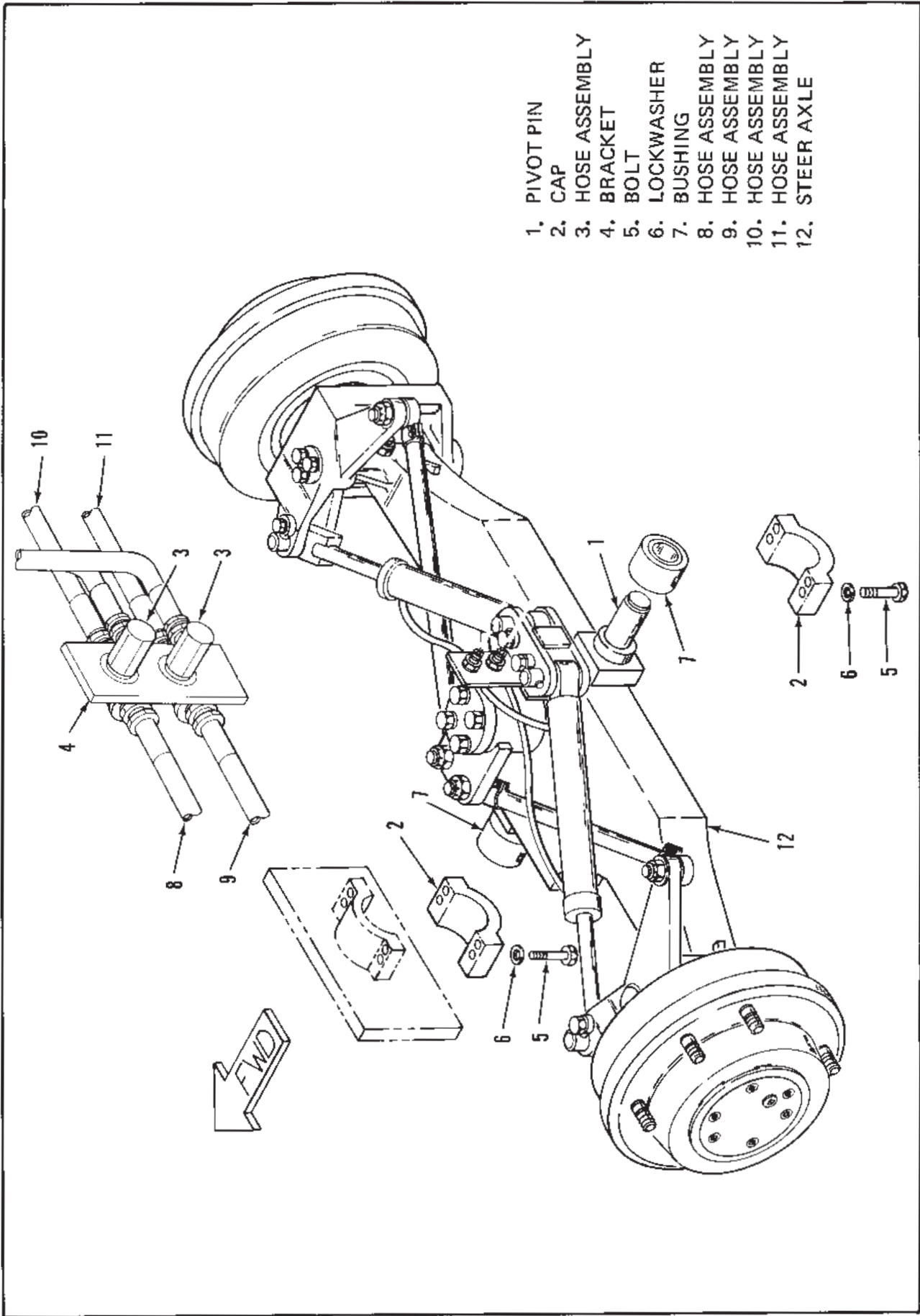


Figure 13-1. Steer Axle Removal

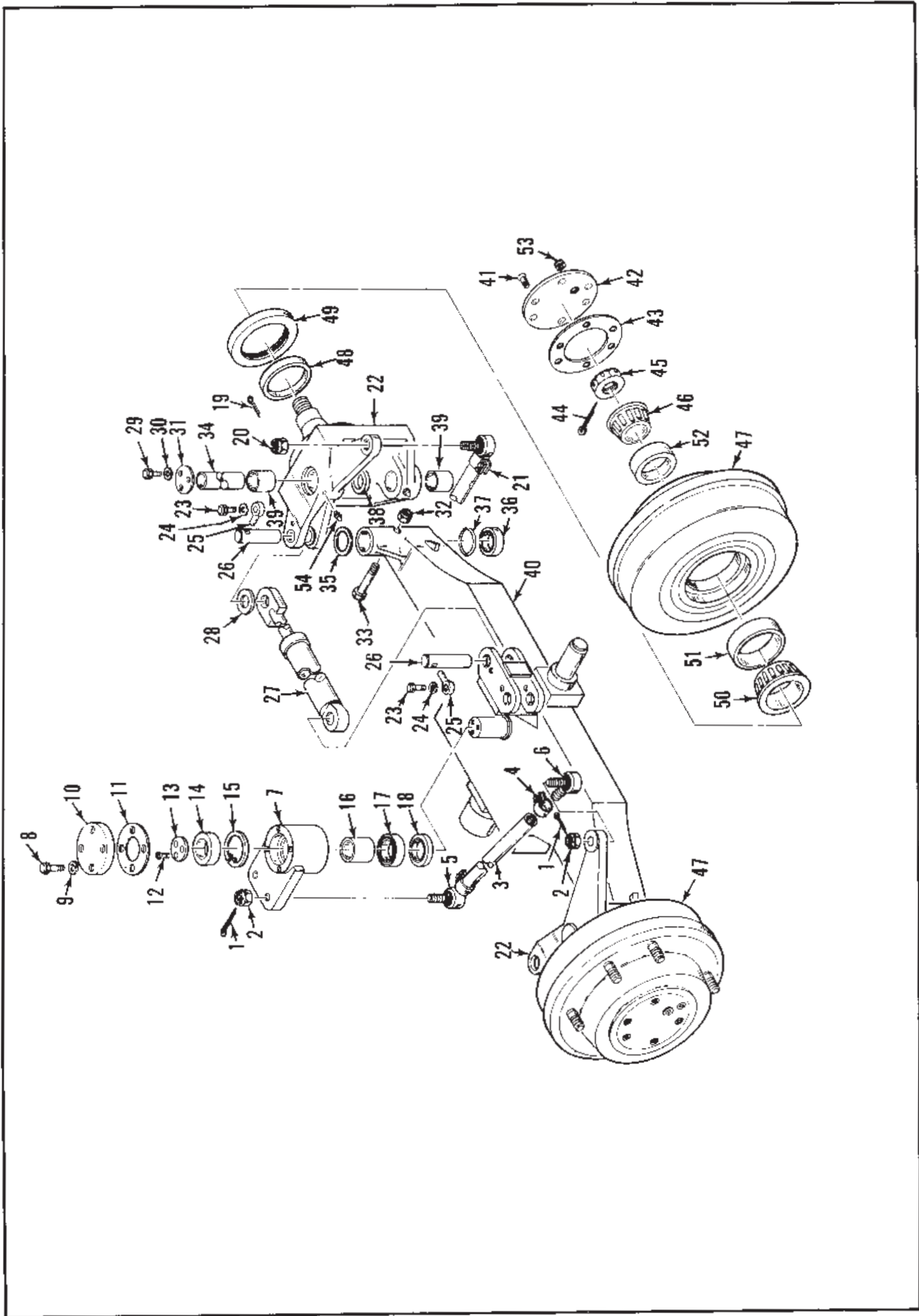


Figure 13-2. Steer Axle, Exploded View (View 1 of 2)

- | | |
|-----------------------------|------------------------|
| 1. COTTER PIN | 28. SHIM |
| 2. NUT | 29. BOLT |
| 3. TIE ROD | 30. LOCKWASHER |
| 4. CLAMP | 31. KINGPIN COVER |
| 5. TIE ROD END | 32. NUT |
| 6. TIE ROD END | 33. BOLT |
| 7. SPIDER | 34. KINGPIN |
| 8. BOLT | 35. SHIM |
| 9. LOCKWASHER | 36. THRUST BEARING |
| 10. CAP | 37. THRUST SEAL |
| 11. GASKET | 38. SPINDLE SEAL |
| 12. BOLT | 39. BUSHING |
| 13. BEARING RETAINER
CAP | 40. STEER AXLE |
| 14. BEARING | 41. SCREW |
| 15. SNAP RING | 42. HUB CAP |
| 16. BEARING SPACER | 43. GASKET |
| 17. BEARING | 44. COTTER PIN |
| 18. SEAL | 45. NUT |
| 19. COTTER PIN | 46. OUTER BEARING |
| 20. NUT | 47. HUB ASSEMBLY |
| 21. TIE ROD | 48. WEAR RING |
| 22. SPINDLE ASSEMBLY | 49. SEAL |
| 23. BOLT | 50. INNER BEARING |
| 24. LOCKWASHER | 51. INNER BEARING RACE |
| 25. KEEPER | 52. OUTER BEARING RACE |
| 26. ANCHOR PIN | 53. PLUG |
| 27. STEER CYLINDER | 54. GREASE FITTING |

Figure 13-2. Steer Axle, Exploded View (View 2 of 2)

b. Remove the bolts (8), lockwashers (9), cap (10), and gasket (11).

c. Remove the bolts (12), bearing retainer cap (13), bearing (14), and snap ring (15).

d. Remove the spider (7), bearing spacer (16), bearing (17), and bearing seal (18).

e. Obtain necessary replacement parts and reassemble the spider by reversing the above procedures.

3. Kingpins and Bushings (Figure 13-2).

a. Hoist or jack the machine up and place supports under the steer axle.

b. Refer to Section 17 and remove the tires and wheels.

c. Remove the cotter pin (19), castellated nut (20), and disconnect the tie rod (21) from the spindle assembly (22).

d. Remove the bolt (23), lockwasher (24), keeper (25), cylinder anchor pin (26), and disconnect the steer cylinder (27) from the spindle assembly (22).

NOTE

Note the position and number of shims (28) so that they can be installed in the same position during reassembly.

e. Remove the bolts (29), lockwasher (30), and kingpin (31).

f. Remove the nut (32), bolt (33), and remove the kingpin (34) and spindle assembly (22).

g. Remove the shims (35), thrust bearing (36), thrust seal (37), and spindle seal (38).

h. Press bushings (39) out of the spindle assembly (22).

i. Press new bushings (39) into the spindle assembly (22).

NOTE

These bushings are pre-reamed and require no reaming after installation.

j. Install the seal (37) and thrust bearing (36).

k. Coat a new kingpin (34) with anti-seize compound and install the spindle assembly (22), shims (35), seal (38), and kingpin (34) on the axle (40).

NOTE

Install shims (28) as necessary to remove slack between the axle and spindle assembly. Install

shims on top of the axle and below the top spindle bushing.

l. Reinstall the bolt (33), nut (32), kingpin cover (31), and lockwashers and bolts (30 and 29).

m. Install the shims (28) in the same position from which removed, and reconnect the steer cylinder (27) to the spindle assembly (22).

n. Reconnect the tie rod (21) to the spindle assembly (22), and install the castellated nut (20) and cotter pin (19).

STEER CYLINDER

a. Disconnect the hoses (8 and 9 or 10 and 11, Figure 13-1) depending on which steer cylinder is to be removed.

NOTE

If the hoses are not being replaced, disconnect only the hose connections attaching the hoses to the steer cylinder.

b. Remove the bolts (23, Figure 13-2), lockwashers (24), keepers (25), cylinder anchor pins (26), to disconnect the steer cylinders (27) from the spindle assembly (22) and steer axle (40).

c. Note the position and number of shims (28) so that they can be reinstalled in the same position during installation, and remove the steer cylinder (27) and shims (28).

NOTE

If the steer cylinder is to be repaired, refer to Section 26 for procedures to install a repair kit.

d. Reinstall the steer cylinder (27) by reversing the above procedures.

e. Start the machine and operate the steering control until the steer cylinders bottom out several times in both directions. This will expel air entrapped in the steer cylinder.

WHEEL BEARINGS

- a. Remove the screws (41), hub cap (42), and gasket (43).
- b. Remove the cotter pin (44), castellated nut (45), outer bearing (46), hub assembly (47), and wear ring (48).
- c. Remove the seal (49) and inner bearing (50).
- d. Do not remove the inner and outer bearing races (51 and 52) unless replacement is necessary.

NOTE

If the bearing races are to be replaced, the old races must be driven out of the hub assembly. The new bearing races must be tapped in evenly around the entire circumference during installation.

- e. Install the inner bearing (50) and seal (49) in the hub assembly (47).

CAUTION

Wheel hub must be slid on spindle squarely to prevent damage to wheel seals.

- f. Install the wear ring (48), hub assembly (47), outer bearing (46), and castellated nut (45).

NOTE

Rotate the hub assembly (47) while tightening the castellated nut (45). Tighten the nut until a slight drag is felt on the hub, then back the nut off until the next castellation is aligned with the cotter pin hole in the spindle assembly (22), and install the cotter pin (44).

- g. Use a new gasket (43) and install the hub cap (42).

- h. Refill with oil.

WHEEL ALIGNMENT

1. Park the machine on a hard level surface with the steer wheels in position for the machine to roll straight, center spider.
2. Measure the distance vertically from the surface to a point in the center of the tire tread 14 to 18 inches above the surface. Make a visible mark in the center of the tire tread at this point.
3. Repeat the above procedure and mark the other steer tire.
4. Measure the distance between the marks on the two steer tires.
5. Move the machine straight, either forward or backward, until the marks on the tires are the same distance above the surface on the opposite side of the axle.

NOTE

If the distance between the marks on the two steer tires was the same on both measurements the wheels are properly aligned. If the distance between the marks on the two steer tires was not the same, the tie rods must be adjusted to attain identical measurements. If the distance between the marks was longer when measured with the marks behind the axle, the tie rods must be shortened. If the distance between the marks was longer when measured with the marks in front of the axle, the tie rods must be lengthened. No camber is required with this steer axle.

7. Adjust the tie rods in the direction necessary. Adjust the tie rods to change the distance between the marks on the two steer tires one half the difference between the two measurements.

EXAMPLE

If the distance between the marks on the tires was 75 inches when measured with the marks behind the axle and 73 inches when measured with

the marks in front of the axle, then the tie rods must be shortened to attain a distance of 74 inches between the marks.

8. Recheck the distance between the marks and adjust the tie rods as necessary until identical measurements are obtained when the tire marks are in front of the axle, and when the marks are behind the axle.

SECTION 15

BRAKE CONTROL

INTRODUCTION

Components of the air brake system can be changed individually, depending on which component has failed or is in need of repair. Perform the appropriate procedures below to remove and reinstall the components to be repaired or replaced. Refer to the figure number as indicated for location and identification of parts.

AIR TANKS (Figure 15-1)

1. Removal

a. Park the machine on a level surface and set the parking brake. Shut off engine.

b. Bleed the air pressure from the brake system by applying and releasing the service brakes.

c. Depress the plunger on the automatic drain valve (1) to be sure there is no air pressure inside the tank. If air escapes from the tank when the plunger is depressed, hold the plunger in the depressed position until air flow ceases.

NOTE

If only one air tank is to be removed perform only those procedures necessary to remove that particular tank.

d. Unscrew and remove the automatic drain valve (1).

e. Remove the safety valve (2).

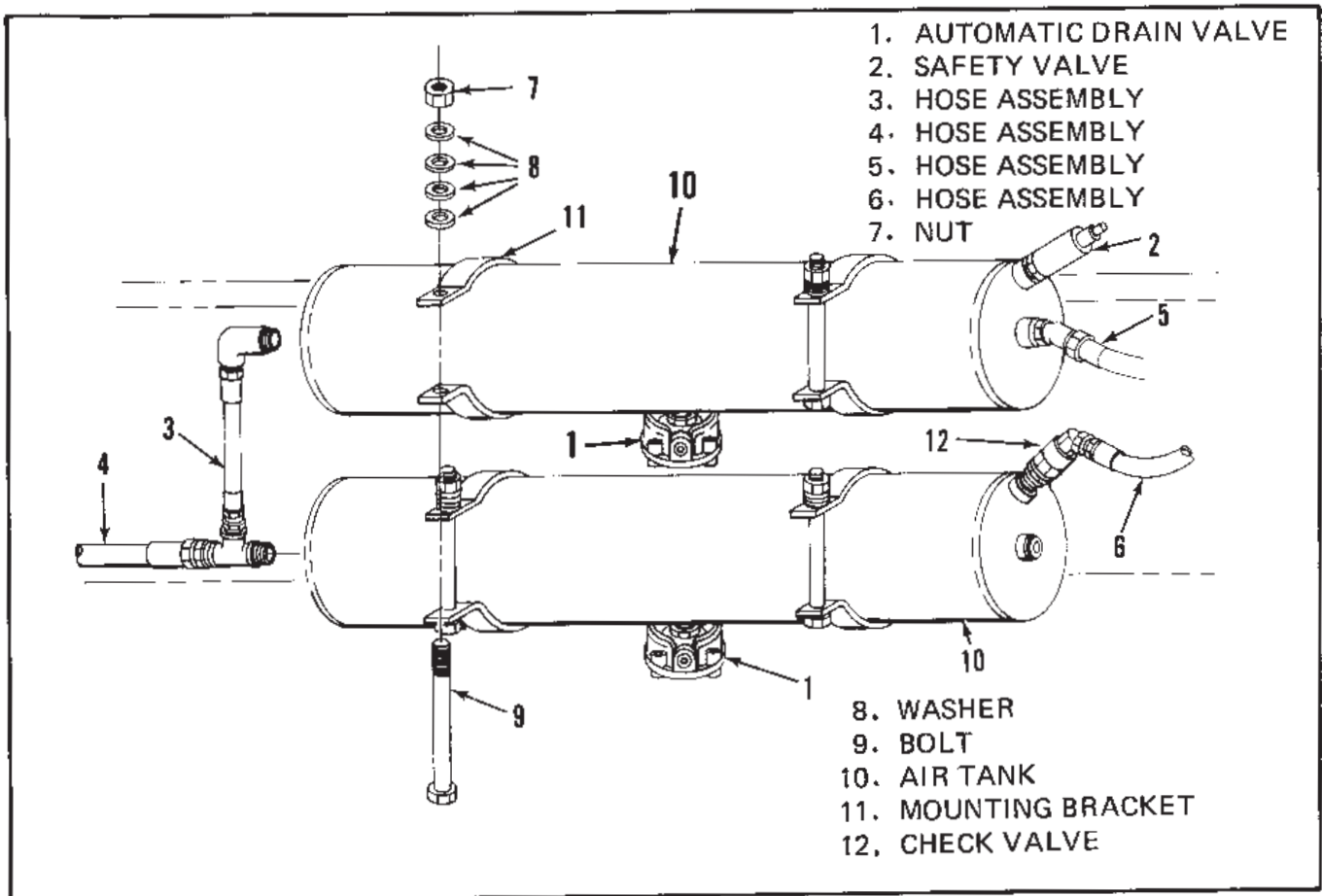


Figure 15-1. Air Tanks

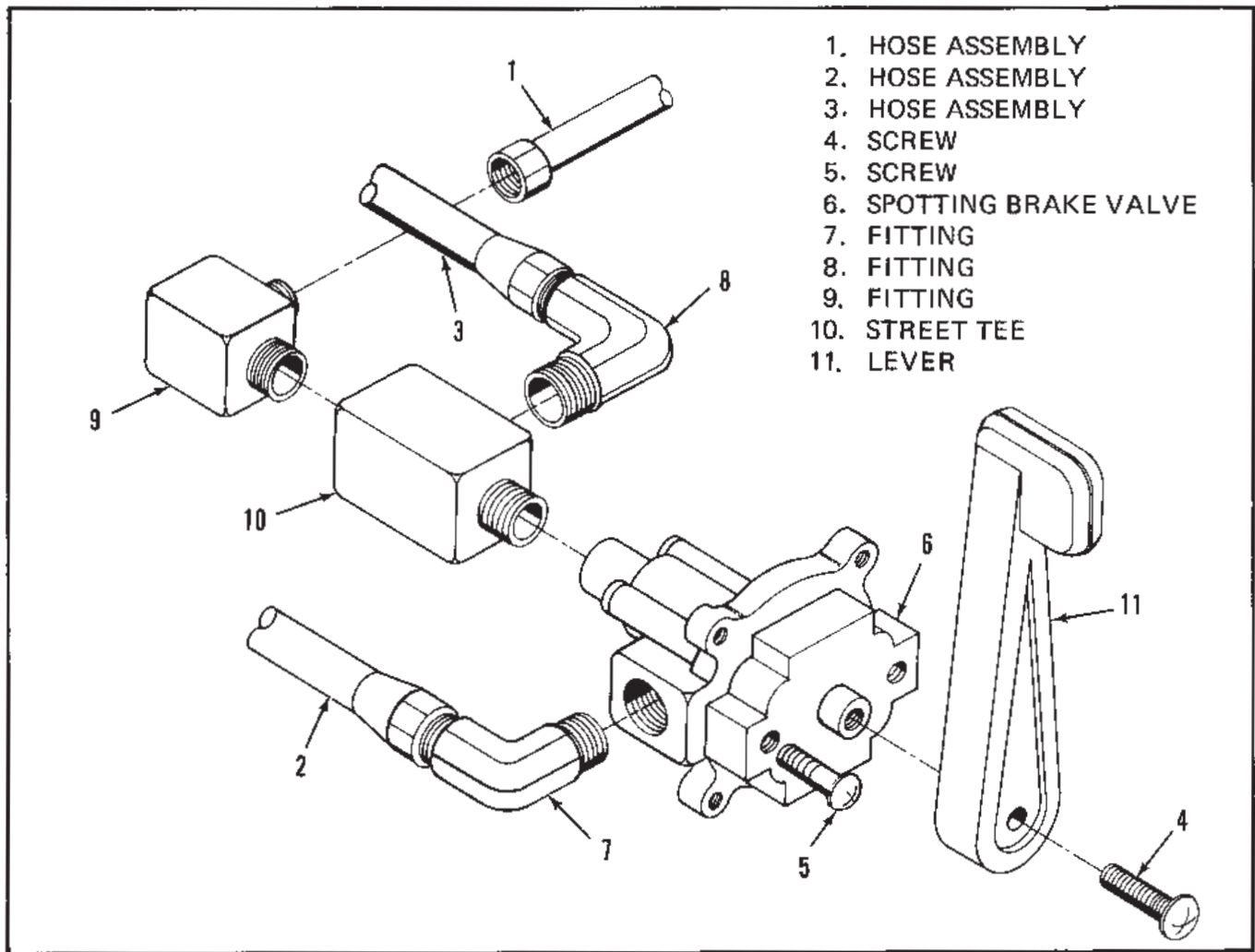


Figure 15-2. Spotting Brake Valve

CAUTION

The safety valve (2) has been preset at factory to release air pressure at 135 psi. Do not attempt to change the adjustment.

- f. Disconnect and remove the hose assembly (3).
- g. Disconnect hose assemblies (4, 5, and 6).
- h. Remove nuts (7), washers (8), bolts (9), and remove the air tank (10) from the mounting brackets (11).
- i. Remove the check valve (12).

NOTE

The check valve (12) prevents air pressure in the brake system from bleeding off through a bad compressor or faulty hose assembly (5) connecting the compressor to the air tank. The check valve should be checked for serviceable condition before being reinstalled.

2. Installation

- a. Install the air tanks by reversing removal procedure.
- b. Operate the system and check for leaks.

CAUTION

Load machine to perform test of brake system before putting machine into service.

SPOTTING BRAKE VALVE (Figure 15-2).

1. Removal.

a. Park the machine on a level surface and set the parking brake.

b. Bleed the air pressure from the brake system by applying and releasing the service brakes.

c. Remove the two wing bolts from the top corners of the instrument panel, and swing the instrument panel out and down for access to the spotting brake.

d. Disconnect the air pressure gauge hose assembly (1).

e. Remove screw (4) to remove handle lever (11).

f. Disconnect hose assemblies (2 and 3).

g. Remove the screws (5), and remove the spotting brake valve (6).

2. Installation

a. Transfer the street tee (10) and fittings (7, 8, and 9) to the valve to be installed.

b. Install the spotting brake valve by reversing removal procedures.

c. Operate the engine and check for air leaks, prior to securing the instrument panel in position with the wing bolts.

BRAKE VALVE (Figure 15-3)

1. Removal

a. Park the machine on a level surface and set the parking brake.

b. Bleed air pressure from the brake system by applying and releasing the service brakes.

c. Remove the bolts (1), washers (2), and raise the brake valve (3) with mounting plate (4) attached, above the floor of the cab for easier access to the hose assemblies.

d. Disconnect the spotting brake air supply hose (5) from the brake valve (3).

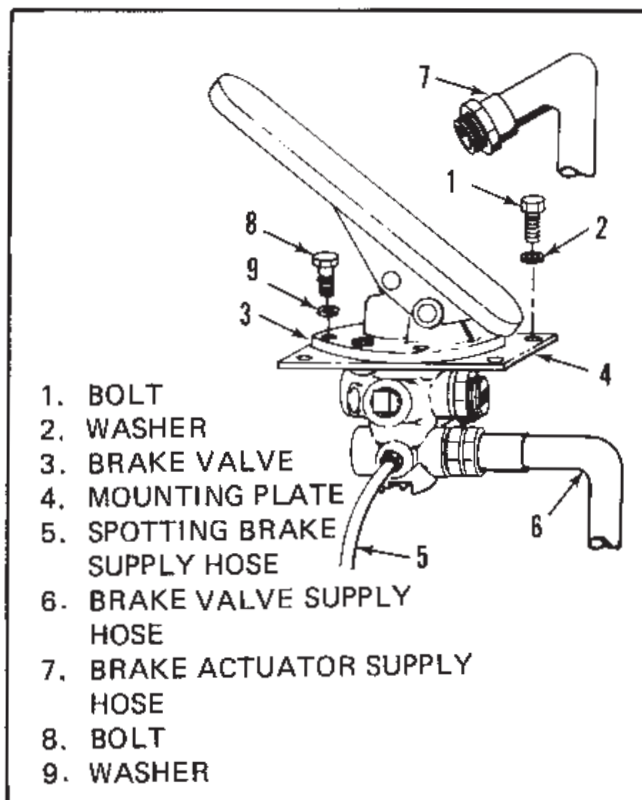


Figure 15-3. Brake Valve

e. Disconnect the brake valve air supply hose (6).

f. Disconnect the brake actuator air supply hose (7) and remove the brake valve (3) and mounting plate (4) as an assembly.

g. Remove the bolts (8) and washers (9) to separate the mounting plate (4) from the brake valve (3).

2. Installation

a. Install the brake valve by reversing removal procedures.

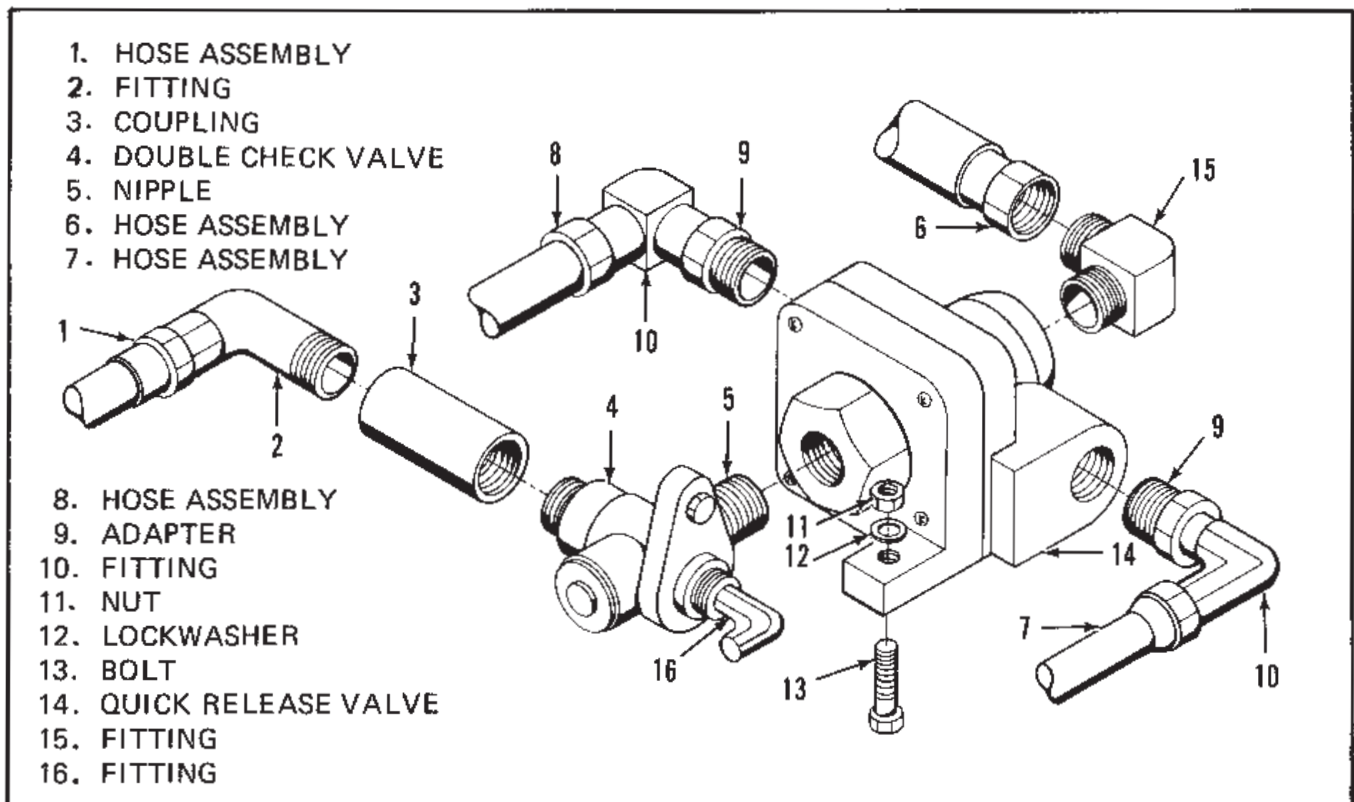


Figure 15-4. Double Check and Quick Release Valves

b. Operate the engine and check for air leaks.

DOUBLE CHECK VALVE (Figure 15-4)

1. Removal

- a. Park machine on a level surface and set the parking brake.
- b. Bleed air pressure from brake system.
- c. Disconnect hose assembly (1).
- d. Unscrew double check valve (4) from nipple (5).

2. Installation.

- a. Transfer coupling (3) and fittings (2 and 16) to the new valve.
- b. Screw new valve onto nipple (5) and connect hose assembly (1).
- c. Pressurize air brake system and check for leaks.

QUICK RELEASE VALVE (Figure 15-4)

1. REMOVAL.

- a. Park machine on a level surface and set parking brake.
- b. Bleed pressure from brake system.
- c. Disconnect hose assemblies (6, 7 and 8).
- d. Remove nut (11), lockwasher (12) and bolt (13) to remove valve (14).
- e. Unscrew valve from nipple (5).

2. INSTALLATION

- a. Transfer adapters (9) and fittings (10 and 15) to the new valve.
- b. Thread new valve onto nipple (5).
- c. Install bolt (13), lockwasher (12) and nut (11).

d. Connect hose assemblies (6, 7 and 8).

e. Pressurize brake system and check for leaks.

f. Operate machine with a load and check for good operation of brakes before machine is put into service.

SECTION 16

STEERING SYSTEM

INTRODUCTION

1. General. The Demand Sensing Valve performs the function of diverting oil to the steering orbitrol to perform the steering functions. When the steering wheel is turned, it causes a drop in the oil pressure in line (3) (figure 16-2). This permits the valve spool (15) to open allowing oil to be pumped directly to the steering orbitrol through line (1) where it is directed to the steer cylinders. When the steering wheel stops rotating the pressure in line (3) rises and closes the valve spool which shuts off the oil flow to the orbitrol and essentially locks the steer cylinders at their present position.

The following procedures are for the removal and replacement of the steering valve. Refer to Figure 16-1 for location and identification of parts.

NOTE

Plug and tag all hydraulic hoses when they are disconnected, to prevent foreign material from entering the system.

STEERING COLUMN AND VALVE

2. Removal (Figure 16-1).

- a. Remove horn button (1).
- b. Depress the plate (2) and rotate it slightly counterclockwise until it is released. Remove the plate (2).
- c. Remove the horn contactor (3).
- d. Remove the screws (4) and plate (5).
- e. Remove the nut (6).
- f. Use a puller and remove the steering wheel (7).
- g. Remove the screws (9) and cap (8).

- h. Tag, disconnect and plug hose assemblies (14 and 15).

- i. Remove bolts (10) and lockwashers (11) to remove valve (13) and column (12).

3. Installation. Install by following removal procedures in reverse order and perform the following additional procedures.

- a. With hose assemblies connected, operate system and check for leaks. Check that wheels travel through their full arc.

- b. If the system does not operate properly, check the hoses for correct location.

STEERING DEMAND SENSING VALVE (Figure 16-2).

1. Removal.

- a. Tag, disconnect and plug hose assemblies (1, 2, 3, 4 and 7).

- b. Remove bolts and lockwashers (11 and 12) to remove sensing valve (13).

2. SERVICE (Figure 16-2)

- a. Clean all parts, particularly the flow restricting orifices (5 and 6), and blow dry with filtered compressed air.

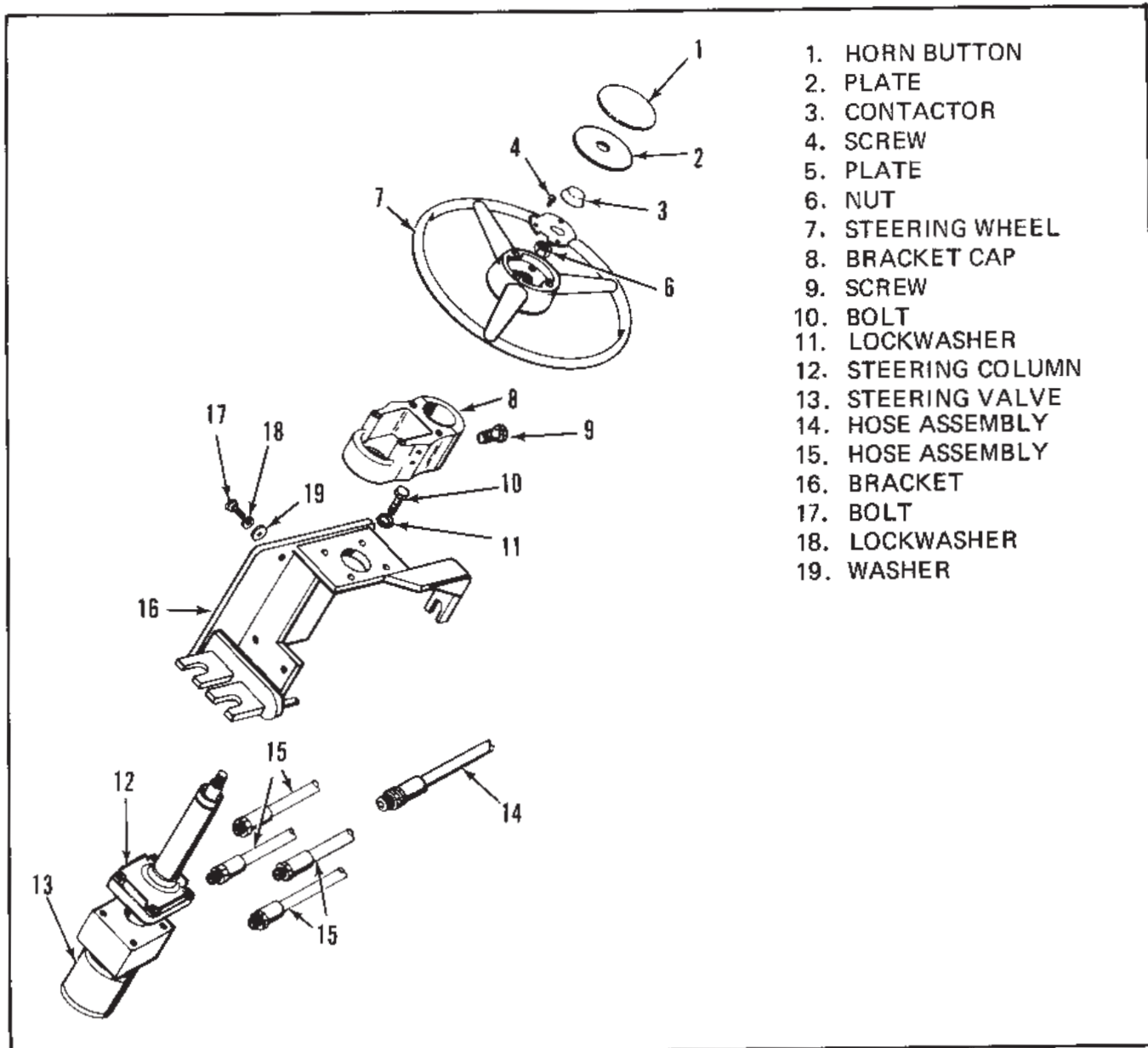
- b. Make sure valve spool piston (15) and its oil passageways are clean.

- c. Inspect spool piston (15) and valve body cylinder for scuffing, scratches or excessive wear. Replace if necessary.

3. Installation.

- a. Transfer adapters (5, 6, 8, 9, and 10) to new valve body.

- b. Install bolts and lockwashers (11 and 12).



1. HORN BUTTON
2. PLATE
3. CONTACTOR
4. SCREW
5. PLATE
6. NUT
7. STEERING WHEEL
8. BRACKET CAP
9. SCREW
10. BOLT
11. LOCKWASHER
12. STEERING COLUMN
13. STEERING VALVE
14. HOSE ASSEMBLY
15. HOSE ASSEMBLY
16. BRACKET
17. BOLT
18. LOCKWASHER
19. WASHER

Figure 16-1. Steering Column

c. Connect hoses (1, 2, 3, 4 and 7).

CHECKING STEERING PRESSURE

Refer to the appendices in the back of this manual for procedures to check and adjust steering pressure.

STEERING RETURN LINE FILTER REPLACEMENT (Figure 16-3).

1. Disconnect hydraulic lines (1 and 2).

2. Remove bolts (3) and washers (4) to remove the filter assembly (5).

3. Transfer the adapters (6 and 7) to the new filter assembly.

4. Install the new filter assembly by reversing the removal procedures.

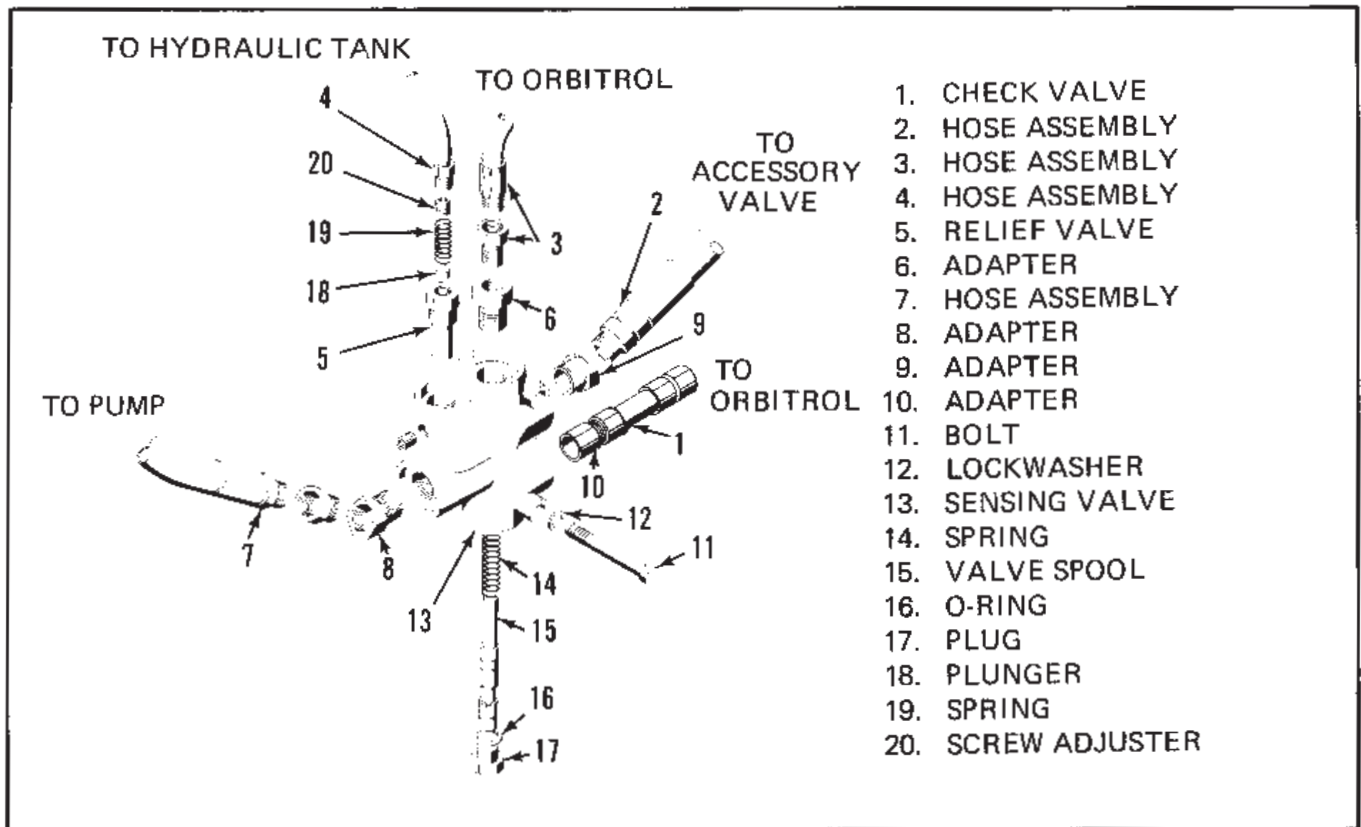


Figure 16-2. Steering Demand Sensing Valve

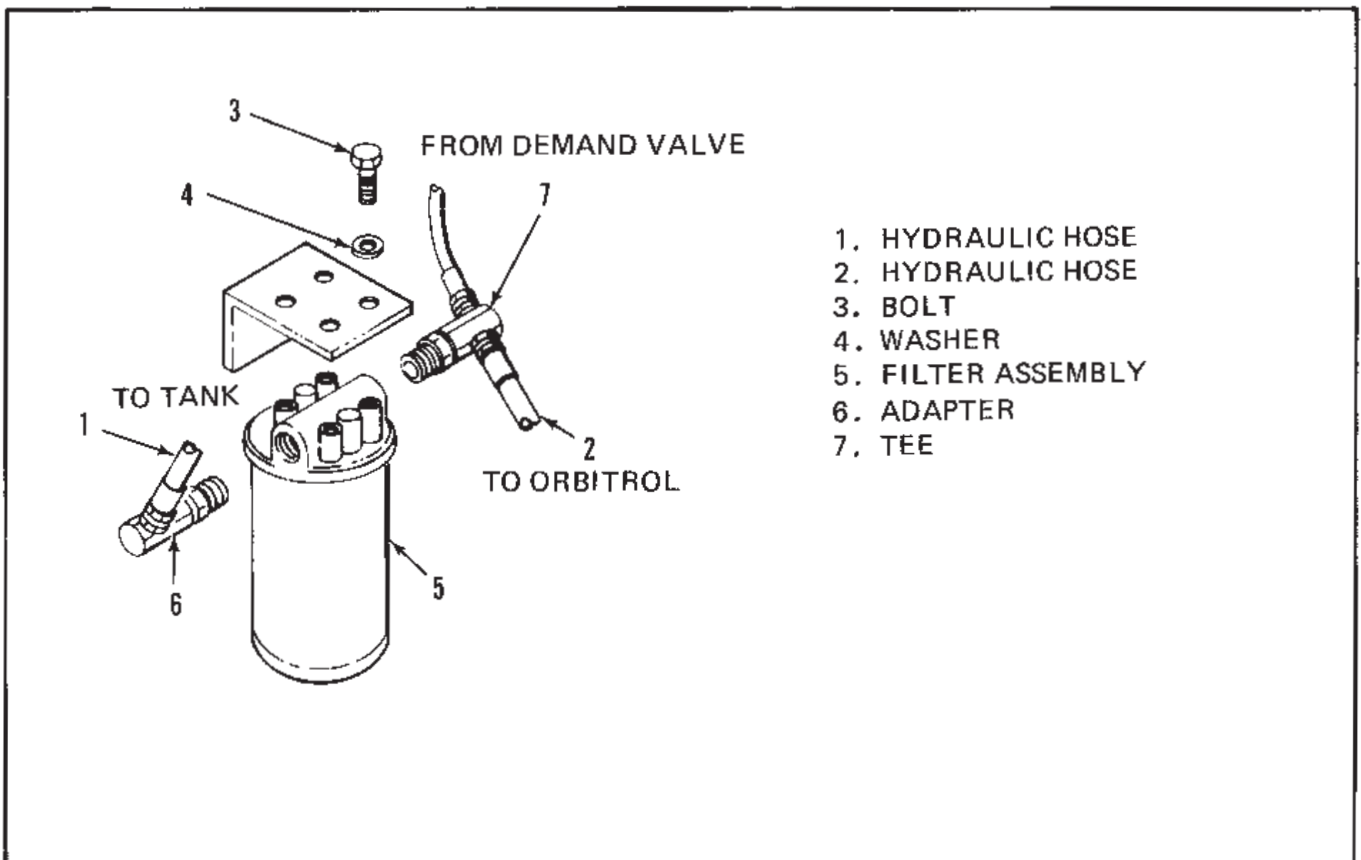


Figure 16-3. Steering Return Filter

SECTION 17

TIRES AND WHEELS

INTRODUCTION

This section contains safety precautions that should be followed when servicing tires and wheels. Also included are instructions for mounting wheels on the axle, and procedures to ensure that the wheel clamps or wedge lug ring are properly torqued.

GENERAL

1. Never attempt to weld on an inflated tire/ Rim Assembly.
2. Do not let anyone mount or demount tires without proper training.
3. Do not, under any circumstances, attempt to rework, weld, heat, or braze any rim components that are cracked, broken, or damaged and which are of the same size, type and make.
4. Don't hammer on rims or components with steel hammers. Use rubber, lead, plastic or brass faced mallets if it is necessary to tap components together.

DEMOUNTING

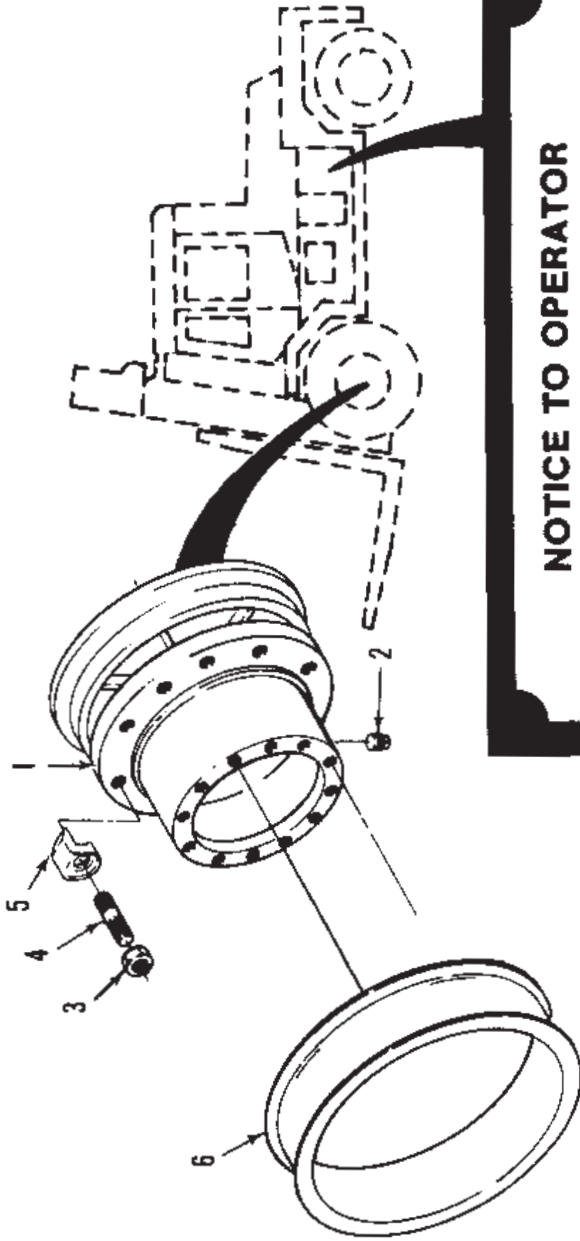
1. Always exhaust all air from a single tire and from both tires of a dual assembly prior to removing any rim components such as nuts and rim clamps.
2. Make sure to remove valve core to exhaust all air from the tire. Remove both cores from a dual assembly.
3. Check the valve stem by running a piece of wire through the stem to make sure it is not plugged.
4. Demounting tools apply pressure to rim flanges to unseat tire beads. Keep your fingers clear. Slant demounting head tool about 10° to keep it firmly in place. If it slips off, it can fly with enough force to kill. Always stand to one side when you apply hydraulic pressure.

INSPECTION

1. Check rim components periodically for fatigue cracks. Replace all cracked, badly worn, damaged and severely rusted components.
2. Clean rims and repaint to stop detrimental effects of corrosion. Be very careful to clean all dirt and rust from the lock ring gutter. This is important to secure the lock ring in its proper position. A filter on the air inflation equipment to remove the moisture from the air line prevents a lot of corrosion. The filter should be checked periodically to see that it is working properly.
3. Make sure correct parts are being assembled. Check your distributor or the manufacturer if you have any doubts.
4. Mixing parts of one manufacturer's rims with those of another is potentially dangerous. Always check manufacturer for approval.
5. Don't be careless or take chances. If you are not sure about the proper mating of rim and wheel parts, consult a wheel and rim expert. This may be the tire man who is servicing your fleet or the rim and wheel distributor in your area.

MOUNTING AND INFLATION (Figure 17-1)

1. Hardware for dual wheel mounting is shown in the figure. Single wheel mounting and torque procedures are identical except that the spacer (6) is not used. Wheel clamps (5) are standard equipment for wheel mounting.
2. Don't seat rings by hammering while the tire is inflated. Don't hammer on an inflated or partially inflated tire/rim assembly.
3. Don't inflate tire before all side and lock rings are in place. Double check to make sure all components are properly seated.



NOTICE TO OPERATOR

WHEEL AND MOUNTS REQUIRE RUN IN PERIOD ON A NEW MACHINE AND AFTER EACH TIRE CHANGE.
 TIGHTEN CLAMP NUTS TO 175 TO 200 FOOT POUNDS TORQUE BEFORE MACHINE IS PUT IN SERVICE AND EACH 10 HOURS UNTIL CLAMPS ARE SEATED.

NOTE: APPLICABLE FOR WHEELS WITH 3/4 STUDS WITH 1-1/4 WRENCH SIZE.

WHEELS WITH 5/8 STUDS WITH 1-1/16 WRENCH SIZE, TIGHTEN 100-120 FT. LB: CARE SHOULD BE TAKEN TO KEEP GREASE AND OTHER FOREIGN MATL FROM RIM SEATING SURFACES

- 1. HUB AND CUP ASSEMBLY
- 2. PLUG
- 3. NUT
- 4. STUD
- 5. WHEEL CLAMP
- 6. SPACER

Figure 17-1 Wheel Mounting Hardware and Torque Procedures

4. Inflate in a safety cage or use safety chains during inflation.

5. Check components for proper assembly again after inflating to approximately 5 PSI.

6. Never sit on or stand in front of a tire and rim assembly that is being inflated. Use a clip-on chuck and make sure inflation hose is long enough to permit the person inflating the tire to stand to the side of the tire, not in front or in back of the tire assembly.

OPERATION.

1. Don't overload rims or over-inflate tire/rim assembly. Check your rim manufacturer if special operating conditions are required.

2. Don't use undersized rims. Use recommended rim for the tire.

3. Never run a vehicle on one tire of a dual assembly. The carrying capacity of the single tire and rim is dangerously exceeded and operating a vehicle in this manner can result in damage to the rim and tire.

4. Don't reinflate a tire that has been run flat without first inspecting the tire, rim and wheel assembly. Double check the lock ring for damage; make sure that it is secure in the gutter before inflation.

SERVICING TIRE AND RIM ON VEHICLE

1. Block the tire and wheel on the opposite side of the vehicle before you place the jack in position.

2. Regardless of how hard or firm the ground appears, put hardwood blocks under the jack. Always crib up vehicle with blocks just in case the jack should slip.

3. Remove the bead seat band slowly to prevent it from dropping off and crushing your toes. Support the band on your thigh and roll it slowly to the ground. This will protect your back and toes.

4. When using a cable sling, stand clear; it might snap and lash out.

COMPRESSOR PRECAUTIONS

There have been instances of tires exploding violently while on vehicles. The forces involved in this type explosion are sufficient to cause serious personal injury to anyone in the immediate vicinity. Some of these explosions are believed to have been caused by flammable vapors entering the tire during inflation. When the machine is operating, the temperature of the air and vapor mixture inside the tire will increase. The temperature inside the tire will also increase with an increase in ambient temperature, and when subjected to direct sunlight. If the vapor and air mixture inside the tire is within the ratio limits that will support combustion, and any or all of the above heat increasing factors cause the temperature of the mixture to reach combustion temperature, an explosion will occur. Following are some precautions that can prevent flammable vapors from entering the compressor, and subsequently be entrapped in tires.

1. Do not locate the compressor in a utility room used for storing flammable solvents, paints, thinners, etc. The flammable vapors will be sucked into the compressor intake while the compressor is charging.

2. Do not clean the compressor air filter with a flammable solvent. Use a non-flammable solvent, such as carbon tetrachloride.

3. Do not use alcohol, methanol, or other flammable agent in the compressor to prevent freezing of the condensation inside the compressor. Drain the compressor tank frequently or locate the compressor inside to eliminate the freezing problems.

4. Do not locate the compressor near a battery charger. Batteries emit hydrogen gas during the charging process, which is highly flammable, and could be sucked into the compressor intake.

SECTION 20

CAB

INTRODUCTION

In event it becomes necessary to remove the cab, the following procedures must be performed to ensure that all hoses, linkages, and electrical wiring have been disconnected and positioned so that damage will not be incurred when the cab is lifted off the frame.

DISCONNECTING COMPONENTS FOR CAB REMOVAL (Figure 20-1)

WARNING

Do not depend on the air brakes alone to hold the machine stationary. Park the machine on a level surface and block the wheels prior to disconnecting the parking brake.

1. Remove cover plate in front of cab for access to mounts.
2. Remove the nut (1) and bolt (2) to disconnect the parking brake cable from the parking brake on the rear of the transmission. Loosen the nut (3) and remove the linkage from the slot in the bracket (4).
3. Remove the floor boards.
4. Disconnect the lift and tilt control linkage from the control valve. Remove the cotter pins (5), clevis pins (6), to disconnect the clevises (7) from the clevis spools (8). Loosen the nuts (9) and remove the lift and tilt cable assemblies from the slots in the bracket (10). Coil the cable assemblies and secure the coils with wire or tape in a position under the cab that will prevent them from becoming entangled when the cab is hoisted from the frame.
5. Disconnect the accelerator linkage at the rear of the engine. Remove the nut (11) and disconnect the rod end (12) from the arm (13). Loosen the nut (14) and remove the linkage from the slot in the bracket (15). Coil the cable assembly and secure the coils with wire or tape in a position under the cab that will prevent them from becoming entangled when the cab is hoisted from the frame.

6. Loosen the clamps (16) and disconnect the heater hoses (17).

7. Disconnect the two hoses (18) from the rear of the air brake control valve.

8. Tag and disconnect the five hydraulic lines (19) from the steering control valve.

9. Remove the two wing bolts (20) and swing the instrument panel out and down for access to components behind the panel.

10. Disconnect electrical harness from the firewall. Remove the cab harness with the cab.

11. Disconnect the accessory lights not attached to the cab.

NOTE

Do not disconnect all electrical connections from the terminal strip. Electrical connections between the terminal strip and instruments mounted on the panel can be left intact during cab removal.

12. Disconnect the engine oil pressure gauge line (23) from the firewall union.

13. Disconnect the trans oil pressure gauge line (24) from the firewall union.

14. Disconnect the air line (25) from the spotting brake valve.

NOTE

It is not necessary to disconnect the air line from the spotting brake valve to the air pressure gauge and the air line connecting the spotting brake valve to the brake control valve.

15. Disconnect the hose (26) from the air filter service indicator.

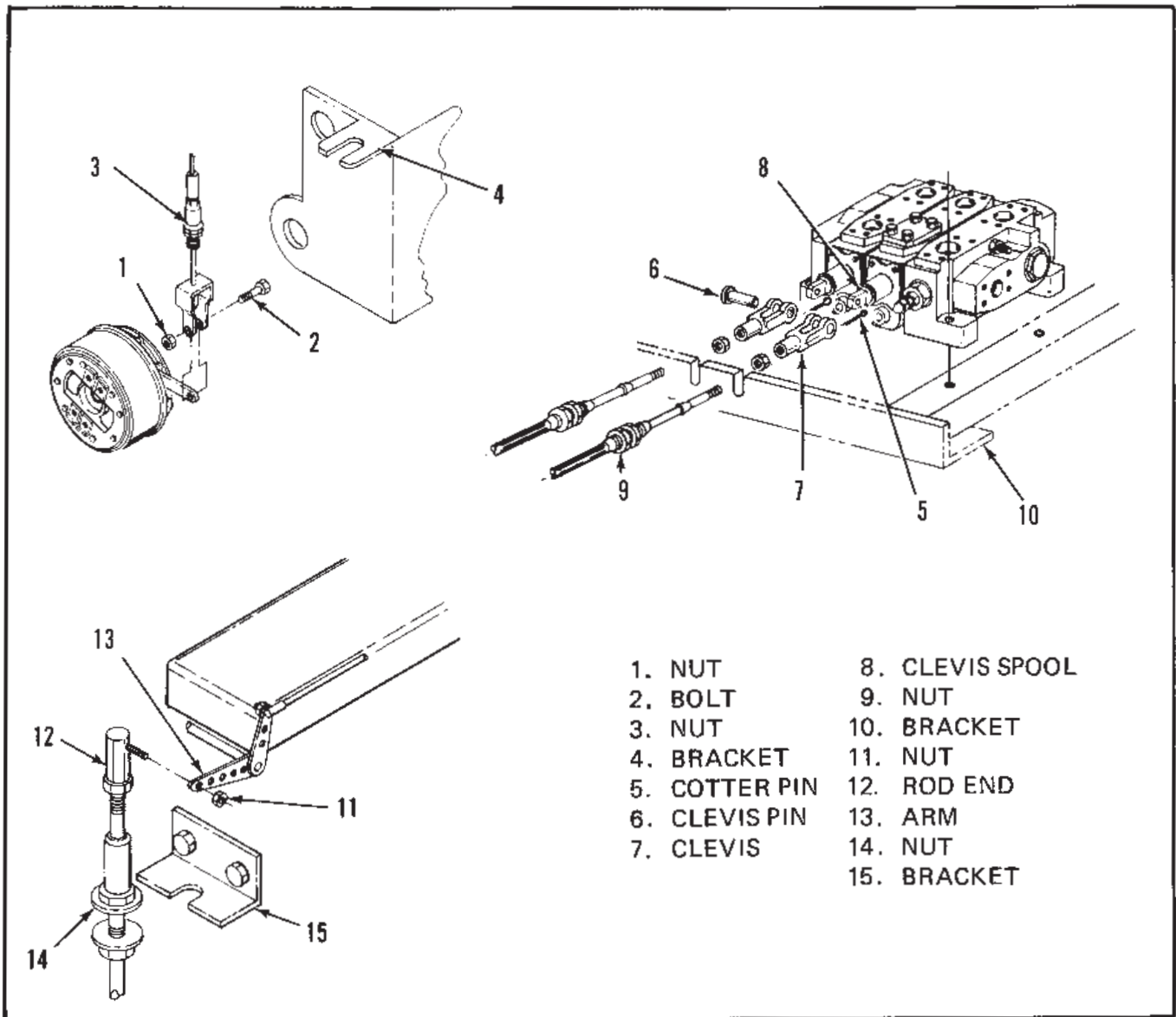


Figure 20-1. Cab Removal (View 1 of 3)

16. Disconnect the electrical lead (27) from the terminal marked S on the back of the ignition switch.

17. Disconnect the electrical lead (28) from the neutral start solenoid.

NOTE

There are several electrical leads connected to the neutral start solenoid. Disconnect only the one electrical lead that is routed through the slot in the floor of the right front corner of the cab.

18. Remove pull to stop switch (29) and master switch (30) by removing the nuts and bolts (31 and 32) which secure their mounting plate (33) to the rear of the cab, then moving the controls out the rear of the cab.

19. Remove the nuts (34), lockwashers (35), and disconnect the ground strap (36). Remove the clamp (37) and bolt (38).

20. Check all wires leading from the electrical harness to see that they are disconnected, and remove any cable ties that attach these electrical leads to other lines or electrical leads that are not being disconnected.

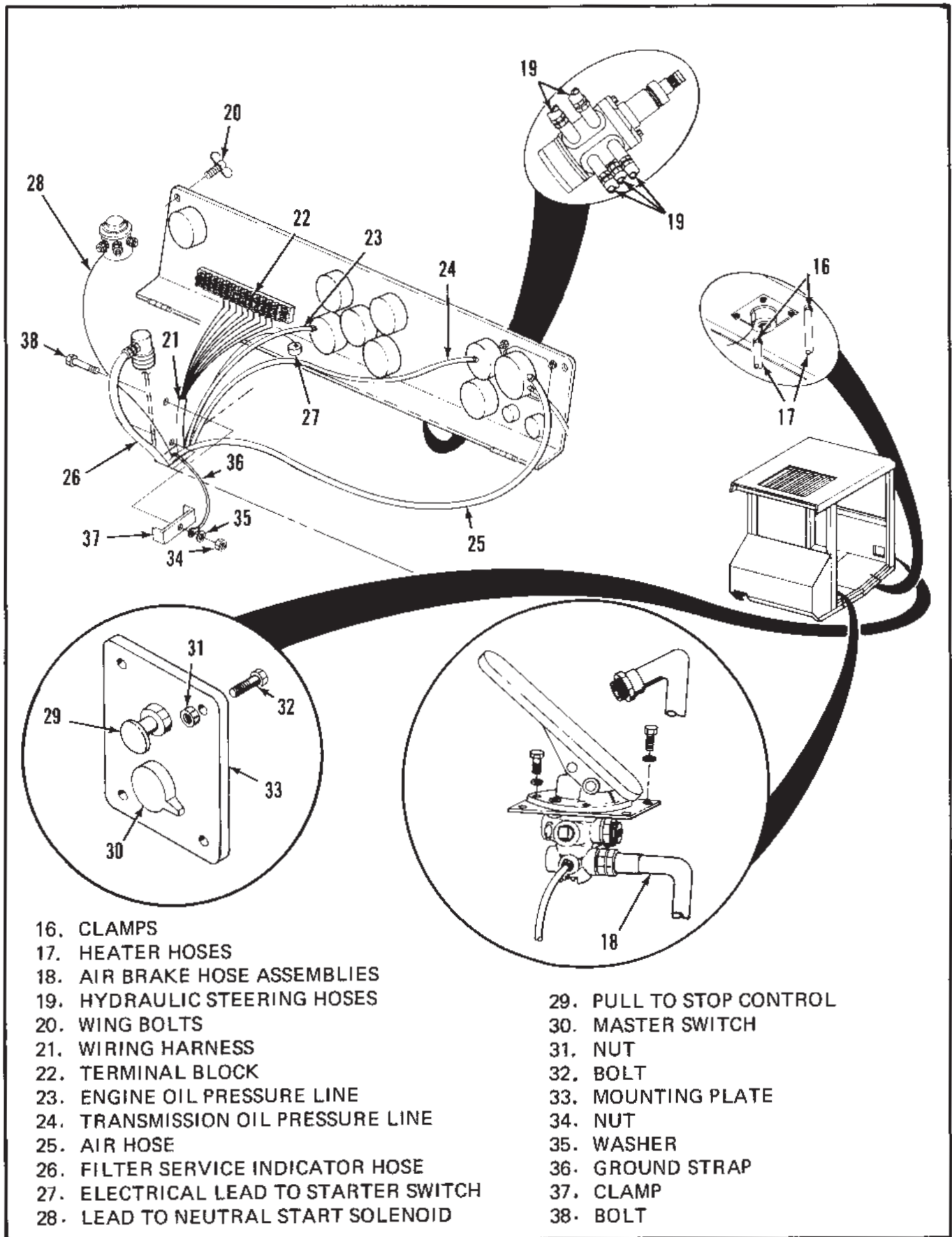


Figure 20-1. Cab Removal (View 2 of 3)

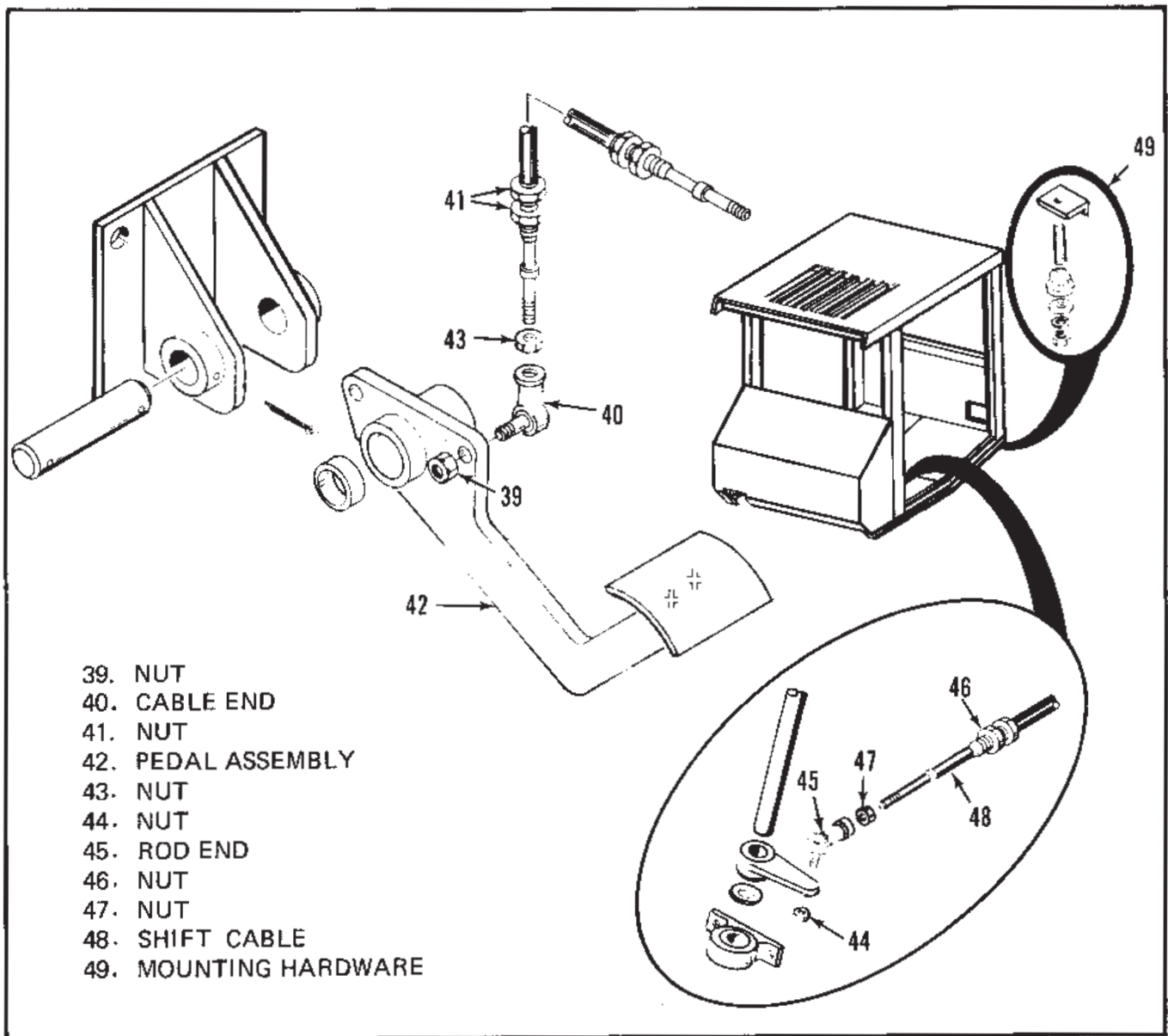


Figure 20-1. Cab Removal (View 3 of 3)

21. Check the electrical harness, all other electrical leads, hoses, control cables, and hydraulic lines that are routed through the slot in the floor of the cab near the right front corner, to see that they are free. Pull the above items through the slot until the end of each is below the bottom of the cab.

22. Disconnect inching control by removing nut (39) to remove cable end (40). Loosen nut (41) to free cable from mounting bracket slot.

23. Disconnect shift linkage by removing nut (44) to release cable end (45), then loosening nuts (46) to free cable from mounting bracket slot.

TILT CYLINDER REMOVAL (Figure 20-2).

WARNING

Lower carriage to lowest position and secure mast so as to prevent the mast from falling forward or back. Failure to do so will create an extremely dangerous situation.

WARNING

The tilt cylinders weight is substantial. Arrange a sling to support the tilt cylinders before removing their mount pins.

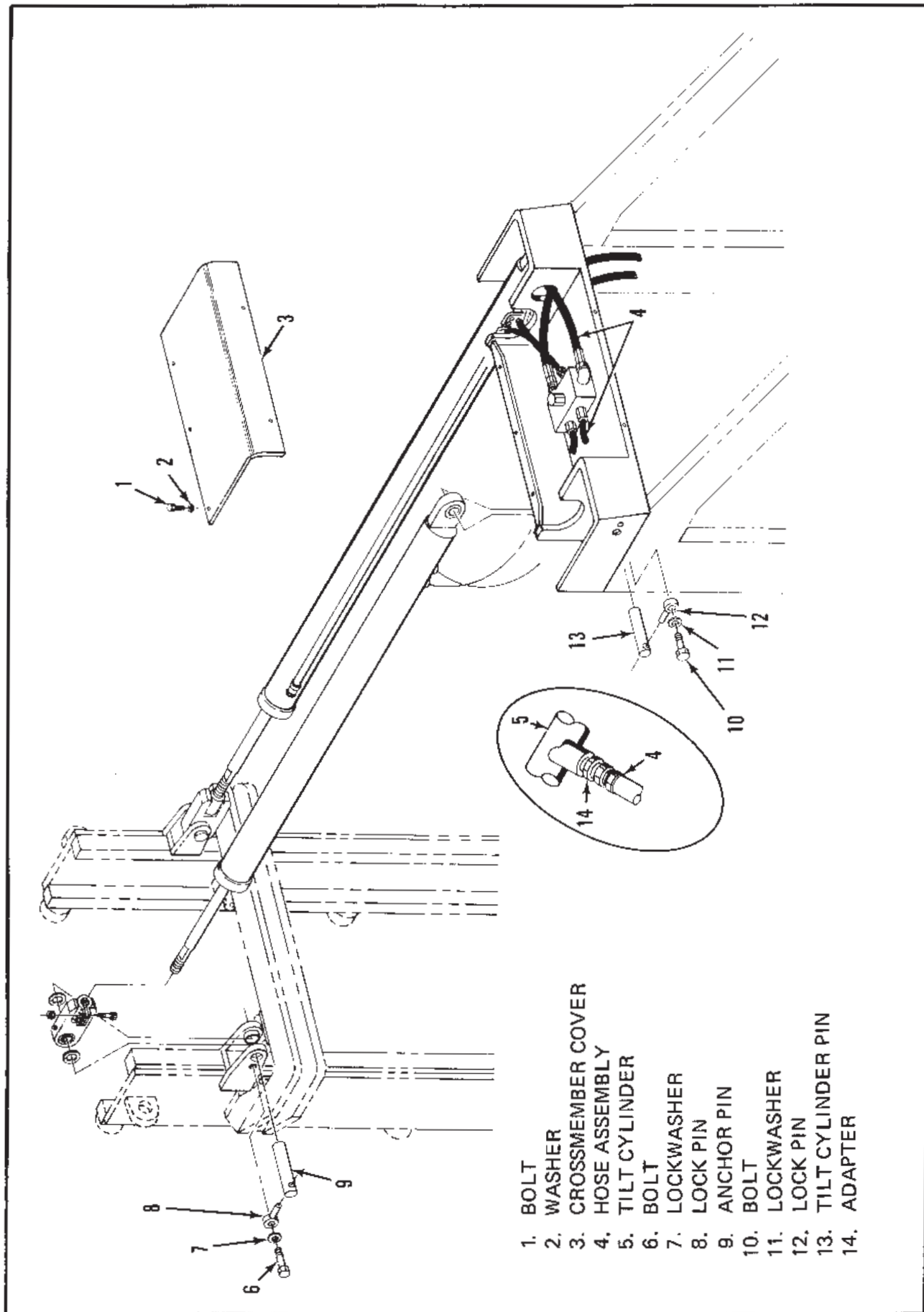


Figure 20-2. Tilt Cylinder Removal

1. Remove bolts (1), washers (2) and cover (3).
2. Disconnect hose assemblies (4) from tilt cylinders.
3. Position sling to support cylinder (5) and apply sufficient lifting force to support the cylinder. Remove bolts (6), washers (7) and lock pins (8), to extract anchor pin (9).
4. Remove bolts (10), washers (11) and lock pins (12) then extract anchor pins (13). Lift cylinders (5).

REMOVING THE CAB

1. Attach a suitable hoisting device to the cab.
2. Remove the mounting hardware (49) (Figure 20-1) attaching the cab to the frame, at each of the four corners on the floor of the cab.
3. Slowly raise the cab off the frame. Check to see that no lines, cables, hoses, etc., extending below the bottom of the cab have become snarled. Lower the cab if necessary to free any snarled item, then lift the cab clear of the frame assembly.

CAUTION

A support for the cab assembly should be prepared prior to removing the cab. When the cab

is lowered onto the support, care must be exercised to prevent damage to any items that protrude below the cab.

CAB INSTALLATION

The cab can be installed by reversing the procedures under removing the cab, and disconnecting components for cab removal above. The following additional procedures must also be accomplished during cab installation.

1. Refer to the torque table in the back of this manual for torque values to be applied to all nuts and bolts when installing the cab.
2. Refer to the appropriate Sections in this manual for adjusting linkages.
3. Reinstall the left tilt cylinder by reversing procedures under tilt cylinder removal above.

CAUTION

Use extreme caution when clamping all hoses. Restriction of air flow could result in faulty brake operation.

SECTION 22

HYDRAULIC SYSTEM

INTRODUCTION

This section contains procedures for removal and replacement of some of the components in the main hydraulic system. Removal and replacement procedures for simple repairs, such as replacing a ruptured hose, are not included. Refer to the figures as indicated for location and identification of parts when performing the following procedures. For reference, a hydraulic schematic is located in the appendix.

NOTE

Plug all hydraulic hoses when they are disconnected, to prevent foreign matter from entering the hydraulic system.

HYDRAULIC TANK REMOVAL (Figure 22-1).

1. Provide a suitable container and remove the drain plugs (1) to drain both sections of the hydraulic tank. Once empty, reinstall the drain plugs.
2. Place a suitable container under the suction line tank outlet (2). Remove the bolts (3), washers (4), and split flange (5) to disconnect the suction hose assembly (6).
3. Remove the O-ring (7).
4. Disconnect hose assemblies (8, 9, 10 and 11).
5. Remove bolts (12), lockwashers (13) and washers (14).
6. Remove breather (19) from adapter (20).
7. Attach a sling arrangement to the tank and use a suitable hoisting device to lift the tank clear of the machine.

HYDRAULIC TANK INSTALLATION

Install the hydraulic tank by reversing removal procedures, and complying with the following additional instructions.

1. Use new O-rings in all connections that require O-rings.

2. The threads on the adapter (20) will probably be damaged during removal. If the threads are damaged, replace the nipple.

3. Check all other threaded parts, and replace any that have damaged threads.

TILT CYLINDER LOCK VALVE REPLACEMENT (Figure 22-2).

1. Removal

- a. Remove the bolts (1), washers (2), and remove the tilt cylinder crossmember cover (3).

- b. Tag or mark the two supply hose assemblies (9 and 10) to assure proper connection during assembly.

- c. Disconnect the two left tilt cylinder hose assemblies (11 and 12) from the tilt lock valve (8).

- d. Disconnect the two right tilt cylinder hose assemblies (13 and 14) from the tilt lock valve (8).

- e. Remove the nuts (15), lockwashers (16), flat washers (5), bolts (4), and remove the tilt lock valve (8).

2. Installation. Install by following removal procedures in reverse order.

NOTE

Connect supply hose assemblies (9 and 10) as marked during removal.

CAUTION

The tilt lock valve adjustment is very sensitive. The valve adjustment is preset at the factory and should not be tampered with.

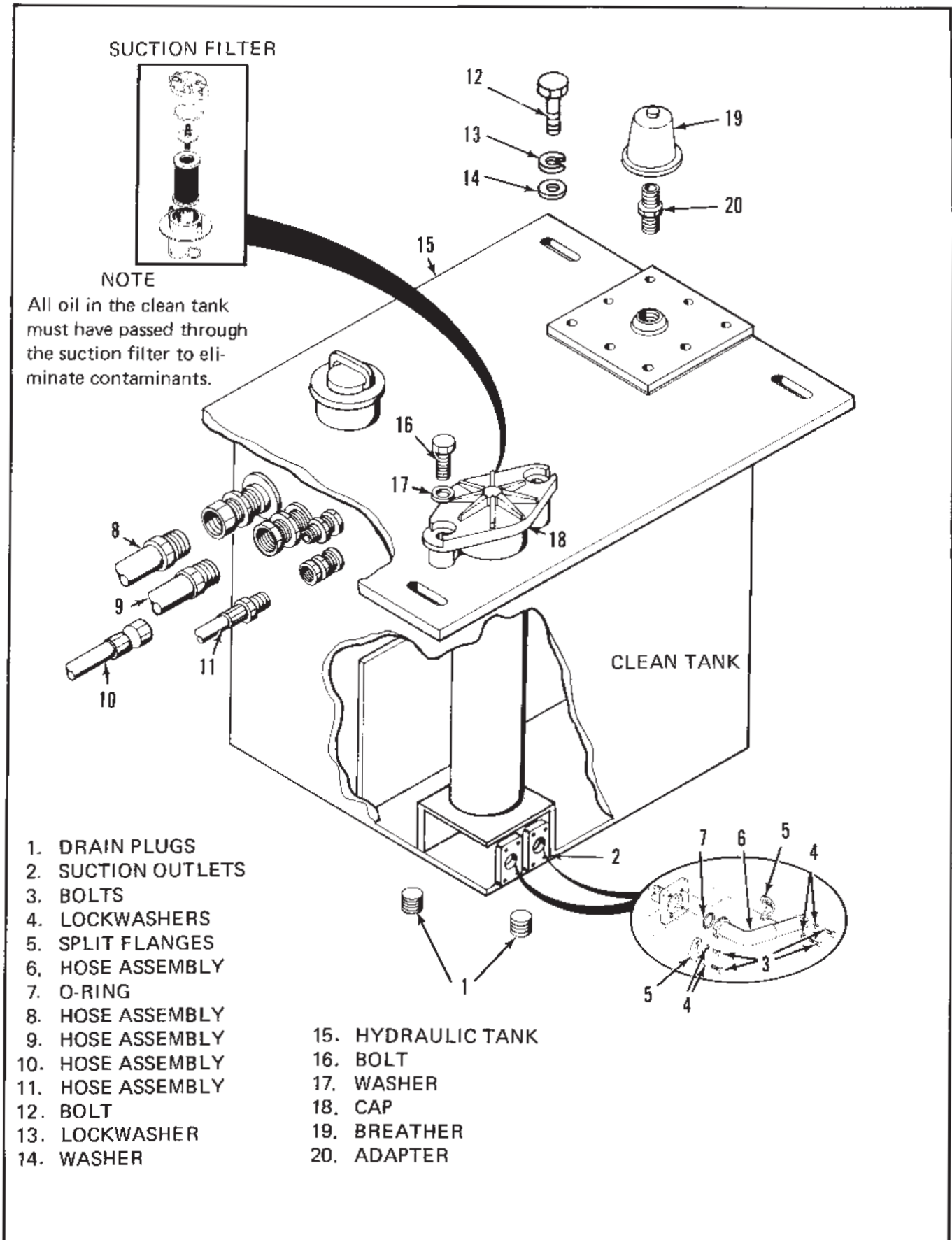


Figure 22-1. Hydraulic Tank Removal

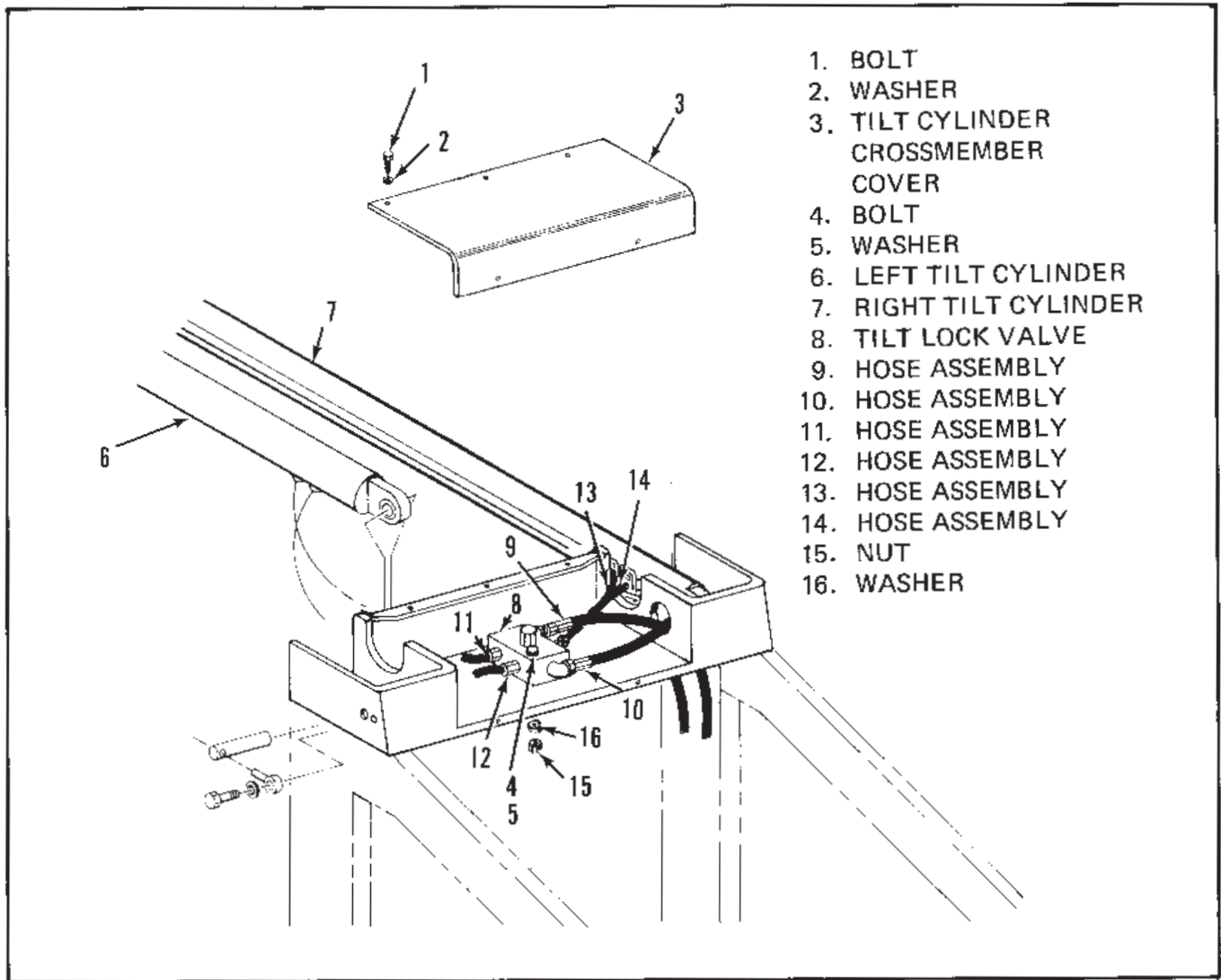


Figure 22-2. Tilt Lock Valve

SECTION 22A

ACCUMULATOR

INTRODUCTION. The following procedures are for the checking and recharging of the accumulator. The accumulator acts as a shock absorber in the hydraulic system by supplying an expandable chamber to relieve momentary pressure spikes.

Pressurizing the accumulator is done so that during normal operation of the hydraulic system, the expandable area within the accumulator remains a constant size, yielding consistent operation of the hydraulic controls. The expandable area is meant to expand only during instants of extreme pressure.

REMOVAL.

1. Disconnect the hydraulic hose assembly from the accumulator.
2. Loosen mounting brackets or clamps and remove accumulator.

NECESSARY TOOLS.

1. To charge the accumulator, the following items are required. A gauging head assembly (see figure D-1), consisting of an air chuck, bleeder valve, gas charging tank valve, and pressure gauge mounted into an adapter and attached, as one unit, directly to the gas valve assembly of the accumulator. Once attached, the gauging head assembly enables the precharge to be checked, increased or decreased. Readings of normal accumulator operating pressure may also be taken with the gauging head assembly.
2. A charging hose assembly is also required to connect the gauging head assembly to gas cylinders in order to increase the precharge to proper pressure. The charging hose assembly consists of a 10-foot hose with a swivel connector on one end and a gland nut

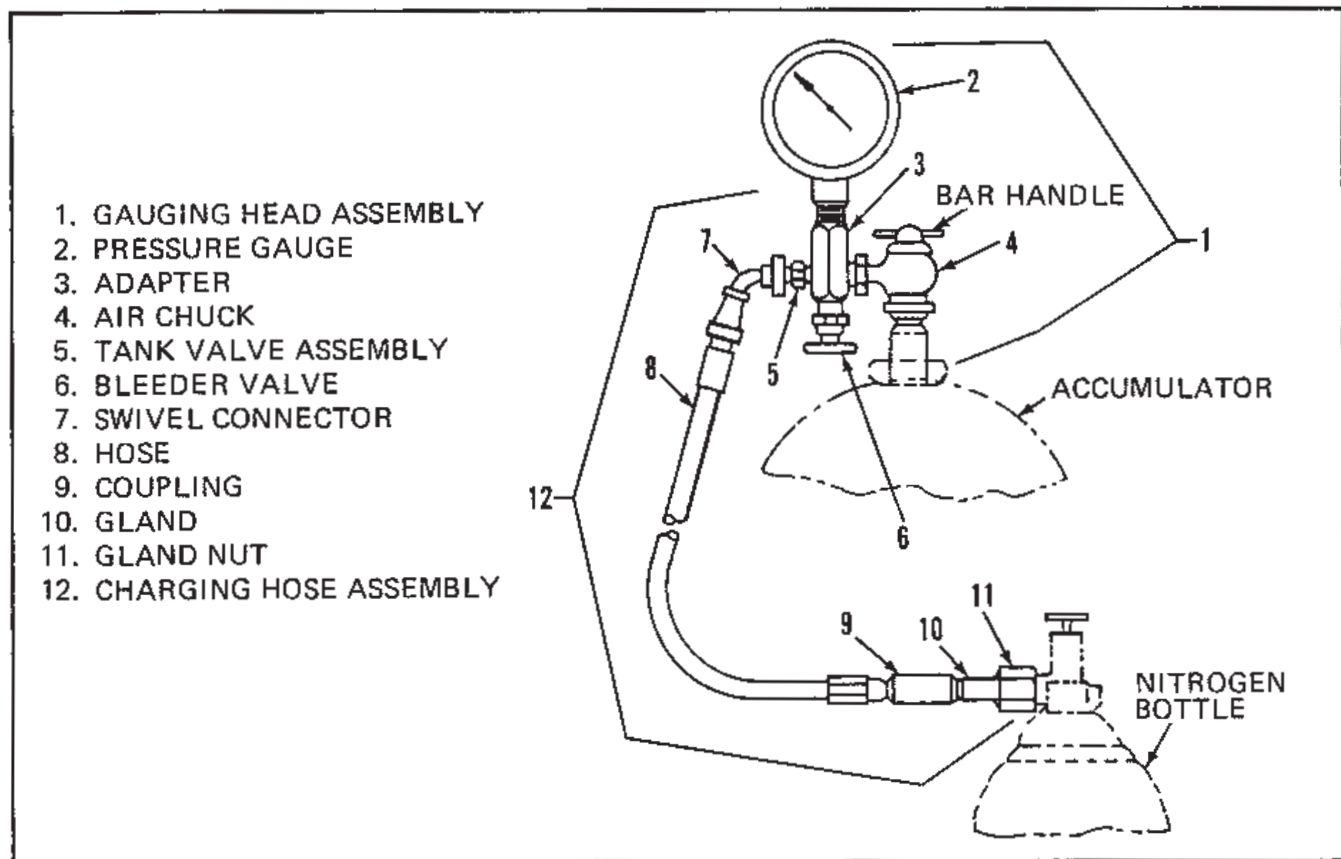


Figure D-1. Charging Accumulator

assembly on the other.

CHECKING PRECHARGE.

NOTE

To read and adjust the gas pressure or "precharge" pressure, all the hydraulic fluid must be drained from the fluid side of the accumulator to zero hydraulic pressure. To accomplish this, let the lift cylinder down and hold lever in DOWN position for approximately one minute.

1. Remove the valve guard, cap and dynaseal from the accumulator.
2. Retract the shaft in the air chuck (4) by turning the bar handle counterclockwise until it stops rotating.
3. Mount the swivel of the air chuck (4) on the accumulator's valve stem, compressing the gasket in the swivel to prevent gas leakage.
4. Turn the bar handle clockwise until the shaft depresses the valve stem core of the accumulator. The precharge pressure should now be indicated by the pressure gauge (2).

ADJUSTING PRECHARGE PRESSURE.

CAUTION

DO NOT use oxygen, use ONLY DRY NITROGEN.

1. Install the gauging head assembly (1, figure D-1) as explained in "Checking Precharge".
2. Install the gland nut (11) of the hose assembly (12) on a nitrogen bottle.
3. Remove the cap from the tank valve (5) and attach the swivel connector (7) of the hose assembly (12). Hand tighten a sufficient amount to compress the gasket in the swivel to prevent gas leakage.
4. Inflate the accumulator to the predetermined pressure by opening the valve on the nitrogen bottle slowly, closing it occasionally to allow the needle of the pressure gauge (2) to settle into position giving an accurate pressure reading.
5. When the proper precharge pressure is reached, close the valve on the nitrogen

bottle.

6. To release pressure in excess of the desired precharge, slowly open the bleeder valve (6) until the pressure drops to the desired level.
7. Rotate the bar handle counterclockwise to full stop position, then disconnect the swivel (7) from the adapter (3).
8. Remove the air chuck (4) from the accumulator valve stem.
9. Check the valve stem for leaks with a soapy water solution or oil. If the core is leaking, depress quickly once or twice to reseal the core. It may be necessary to further tighten or replace the core if leakage persists.
10. Install the dynaseal and valve stem cap, then tighten 1/2 turn beyond hand tight.
11. Install the valve guard.
12. Recheck precharge one week after charging for pressure loss.

OPERATING PRESSURE CHECK.

NOTE

To avoid excessive wear and damage to gauges, do not test operating pressures continuously.

1. Remove the valve guard, cap and dynaseal from the accumulator.
2. Retract the shaft in the air chuck (4) by turning the bar handle counterclockwise until it stops rotating.
3. Mount the swivel of the air chuck (4) on the accumulator's valve stem, compressing the gasket in the swivel to prevent gas leakage.
4. Turn the bar handle clockwise until the shaft depresses the valve stem core of the accumulator.
5. Hold lift lever in DOWN position for one minute to be sure no hydraulic pressure is in the lift circuit.
6. Rotate the bar handle counterclockwise to full stop position.
7. Remove the air chuck (4) from the accumulator valve stem.
8. Check the valve stem for leaks with a soapy

water solution or oil. If the core is leaking, depress quickly once or twice to reseal the core. It may be necessary to further tighten or replace the core if leakage persists.

9. Install the dynaseal and valve stem cap, then tighten 1/2 turn beyond hand tight.
10. Install the valve guard.

Part Number/Size	PSI Setting
2215-121 / 1 qt.	1000 psi
2788-970 / 1 qt.	1000 psi
2215-124 / 1 qt.	1500 psi
2788-955 / 1 qt.	1500 psi
2788-940 / 1 gal.	65 psi
2788-960 / 1 gal.	800 psi
2788-950 / 1 gal.	1000 psi
2788-951 / 1 gal.	1500 psi
2788-952 / 1 gal.	1500 psi
2788-961 / 1 gal.	1500 psi
2788-965 / 2-1/2 gal.	800 psi
2788-966 / 2-1/2 gal.	1500 psi

We have a charging kit available. Taylor part number 1000-503.

SECTION 23

MAIN HYDRAULIC PUMP

INTRODUCTION

The main hydraulic pump is heavy. Adequate support must be provided when the pump is disconnected from the mounting bracket. Refer to Figure 23-1 for location and identification of parts and perform the following procedures to remove the main hydraulic pump.

REMOVAL

1. Refer to Section 22 and remove the nuts and bolts securing the cap on the filter head of the hydraulic tank. Momentarily lift the cap to break the suction.

NOTE

The above procedure will prevent the loss of hydraulic fluid in the hydraulic tank, however, the fluid in the lines will still be lost.

2. Rotate the Master Switch in the cab to OFF position and disconnect the battery cable from the negative (-) terminal.

WARNING

Failure to perform the above procedure could result in serious personal injury in the event someone attempted to crank the engine while the pump is being serviced.

3. Remove grill and recirculator baffles from rear of machine.

4. Remove bolts (1), lockwashers (2), split flanges (3) to remove hose assemblies (4 and 6). Then plug the hoses to prevent foreign material from entering.

5. Remove O-rings (5).

6. Disconnect hose assemblies (8 and 9), and plug to prevent foreign material from entering.

7. Position a suitable support under the hydraulic pump (13).

8. Remove nuts (10), lockwashers (11) and bolts (12).

9. Maneuver pump away from mounting bracket (14) until it clears the splines of the driveshaft (15).

10. Remove the pump.

INSTALLATION

NOTE

Determine cause of failure and correct problem before installing new pump. Check for contamination. Replace lines if necessary, and replace all filters and hydraulic fluid.

1. Inspect O-rings, split flanges and mounting hardware for serviceable condition.

2. Use new o-rings and reinstall the main pump by following the removal procedures in reverse order.

CAUTION

Once installation is complete, back off the adjustments on the relief valves, (steer, lift, tilt, and accessory), then operate engine and bring hydraulic oil to normal operating temperature before pressurizing (operating by controls) the system. Check and reset pressures. Check for leaks.

1. BOLT
2. LOCKWASHER
3. SPLIT FLANGE
4. HOSE ASSEMBLY
5. O-RING
6. HOSE ASSEMBLY
7. HOSE ASSEMBLY
8. HOSE ASSEMBLY
9. HOSE ASSEMBLY
10. NUT
11. LOCKWASHER
12. BOLT
13. HYDRAULIC PUMP
14. MOUNT BRACKET
15. DRIVE SHAFT

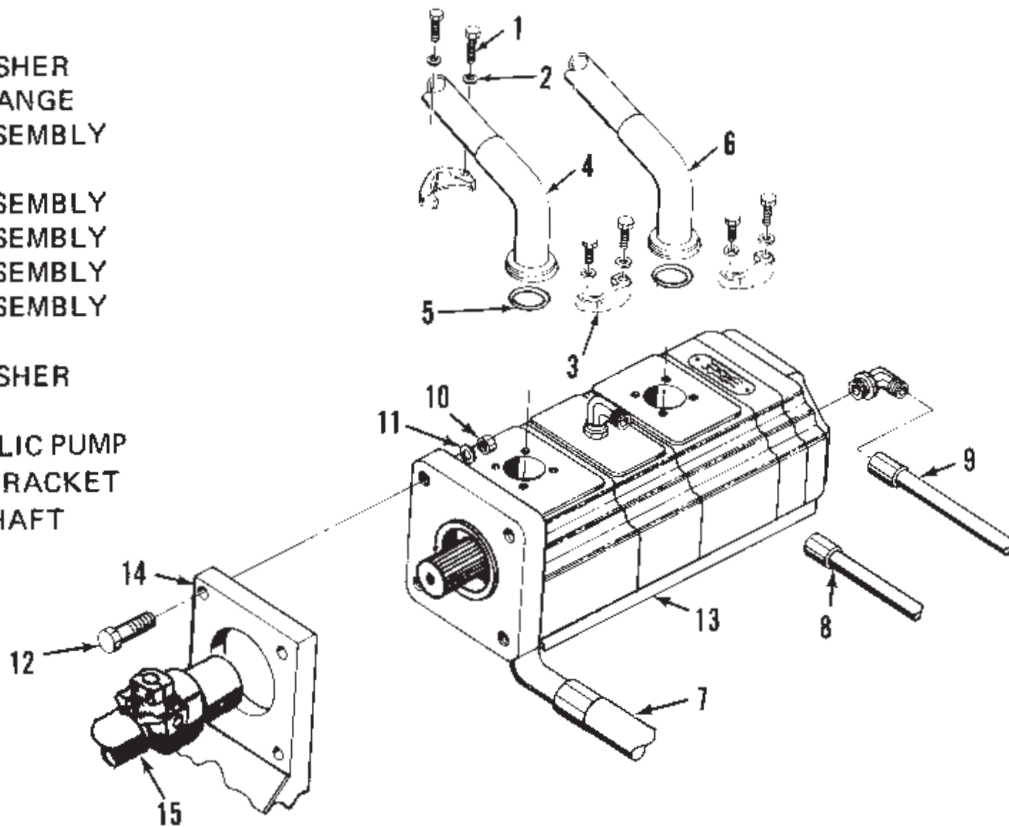


Figure 23-1. Main Hydraulic Pump

SECTION 24

HYDRAULIC CONTROL VALVES

INTRODUCTION

The hydraulic control valves or a section of the main valve, may require replacement for various reasons. To remove the main control valve, refer to Figure 24-1 for location and identification of parts and perform the following procedures. To remove the accessory valve, refer to Figure 24-2.

MAIN CONTROL VALVE REMOVAL

1. Refer to Illustration 22-1 and remove the nuts and lockwashers from either of the two filter heads on top of the hydraulic tank. Momentarily lift the filter head assembly off the filter neck to break the suction.

NOTE

The above procedure will prevent the loss of all the hydraulic fluid in the hydraulic tank. The fluid in the hydraulic lines will still be lost.

2. Remove the bolts (1), washers (2), and split flange (3) to disconnect the hydraulic hose assembly (4). Remove the O-ring (5).

3. Repeat the above procedure and disconnect all other hydraulic hose assemblies and remove O-rings.

4. Remove nut (6) to disconnect rod end (7) from valve spool (9).

5. Remove the bolts (10), washers (11) and remove the main control valve (12).

INSTALLATION

Install the main hydraulic control valve by reversing removal procedures, and performing the following additional procedures.

1. When the control rod (8) is connected to the valve spool (9), check operation of the lift control. If the lift control linkage requires

adjustment, refer to Section 25 for procedures.

2. Use new O-rings with all hose connections that require O-rings.

3. When main control valve installation is complete, operate the machine and check for leaks.

4. Check lift operation.

CHECKING LIFT PRESSURE

Refer to the appendices in the back of this manual for procedures to check and adjust lift pressure.

ACCESSORY CONTROL VALVE REMOVAL (Figure 24-2).

1. Refer to Illustration 22-1 and remove the nuts and lockwashers from the filter head on top of the hydraulic tank. Momentarily lift the cap off the tank filter neck to break the suction.

NOTE

The above procedures will prevent the loss of hydraulic fluid from the hydraulic tank, however, the fluid in the lines will be lost.

2. Disconnect all hydraulic hoses (1).

3. Remove cotter pins (4), and clevis pins (5) to disconnect control cables (8).

4. Remove bolts (2) and lockwashers (3).

5. Lift out control valve (9).

INSTALLATION. Install by following removal procedures in reverse order and performing the following additional procedures.

1. When the clevises (6) are connected to the valve spools (7), check operation of tilt control and accessories. If the linkages require adjustment, refer to Section 25 for procedures.

2. When installation is complete, operate the machine and check for leaks.

CHECKING HYDRAULIC PRESSURE

Refer to appendices in the back of this manual for the procedures to check and adjust hydraulic pressure.

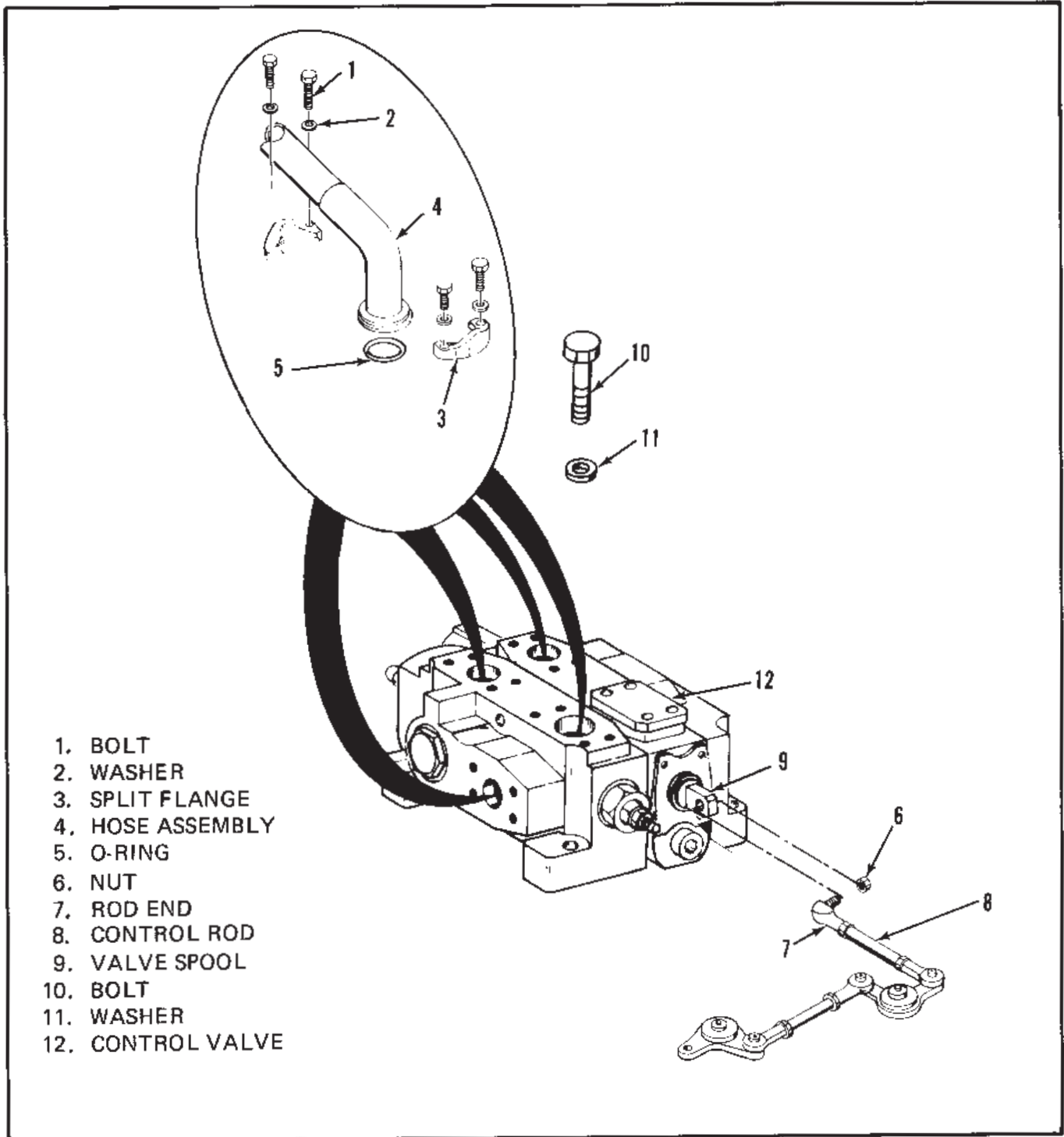


Figure 24-1. Main Hydraulic Control Valve

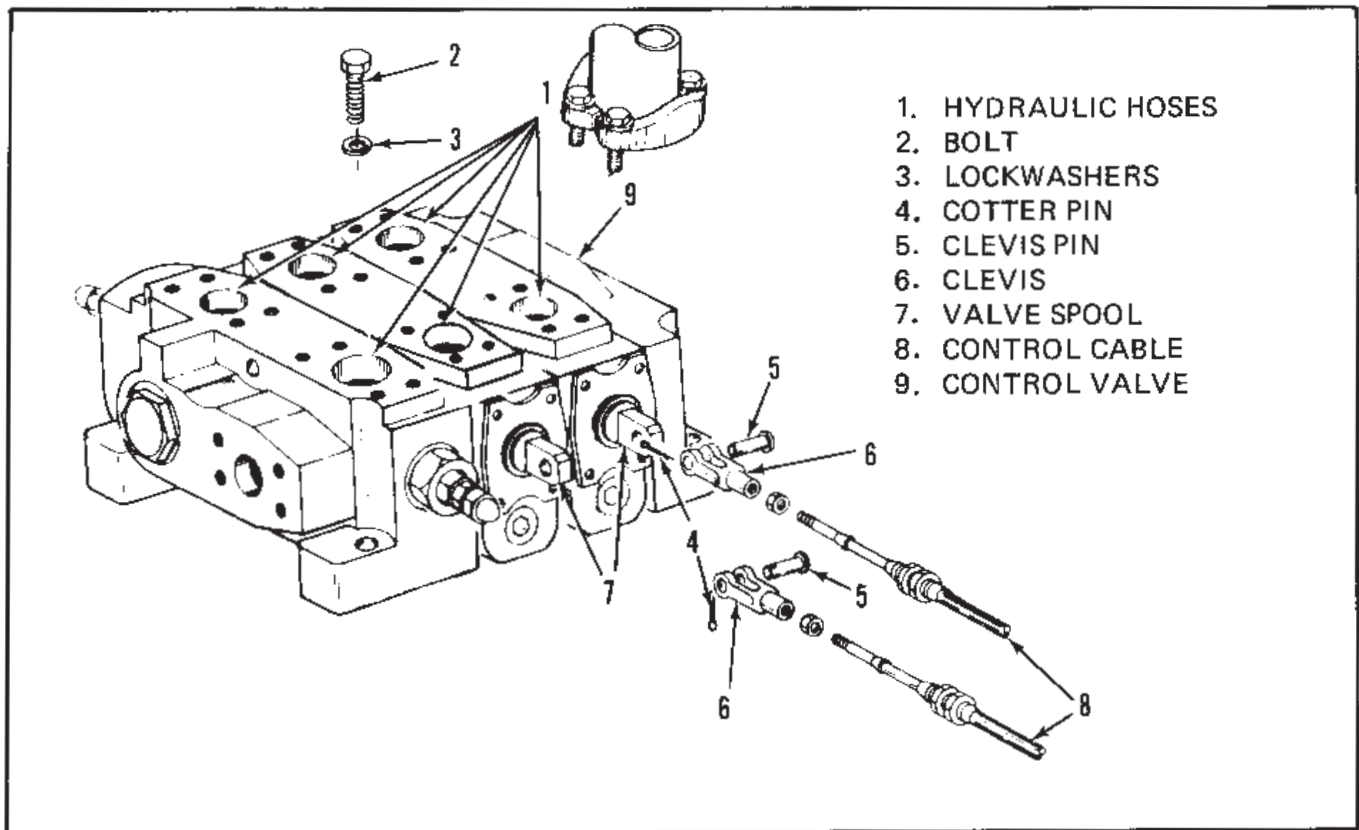


Figure 24-2. Accessory Valve

CHECKING LIFT PRESSURE

Refer to the appendices in the back of this manual for procedures to check and adjust lift pressure.

ACCESSORY CONTROL VALVE REMOVAL (Figure 24-2).

1. Refer to Section 22 and remove the nuts and lockwashers from the filter head on top of the hydraulic tank. Momentarily lift the cap off the tank filter neck to break the suction.

NOTE

The above procedures will prevent the loss of hydraulic fluid from the hydraulic tank, however, the fluid in the lines will be lost.

2. Disconnect all hydraulic hoses (1).

3. Remove cotter pins (4), and clevis pins (5) to disconnect control cables (8).

4. Remove bolts (2) and lockwashers (3).

5. Lift out control valve (9).

INSTALLATION. Install by following removal procedures in reverse order and performing the following additional procedures.

1. When the clevises (6) are connected to the valve spools (7), check operation of tilt control and accessories. If the linkages require adjustment, refer to Section 25 for procedures.

2. When installation is complete, operate the machine and check for leaks.

CHECKING HYDRAULIC PRESSURE

Refer to appendices in the back of this manual for the procedures to check and adjust hydraulic pressure.

SECTION 25

HYDRAULIC CONTROLS AND LINKAGE

INTRODUCTION

The following procedures are provided for removal, installation, and adjustment of the hydraulic controls and linkage. The lift and tilt controls are covered in this section. Refer to Figure 25-1 for location and identification of parts, and perform only that portion of the following procedures necessary to effect repairs.

REMOVAL LINKAGE

1. Remove the nuts (1).
2. Loosen the nuts (2) and remove the control cables (3) from the slots (4).
3. Disconnect the rod ends (5) from the control lever pivots (6).
4. Remove the cotter pins (7) and clevis pins (8).
5. Loosen the nuts (9) and remove the control cables (3) from the slots (10).
6. Remove the control cables (3) completely.
7. Remove the bolts (11), lockwashers (12), flat washers (13), lever pin (14), and remove the control lever assemblies.
8. Loosen the jam nuts (15), and remove knobs (16) and jam nuts (15).
9. Remove the pins (17), and control levers (18).
10. Do not remove the grease fittings (19) unless replacement is necessary.

INSTALLATION

Obtain the necessary replacement parts and re-install the controls and linkage by reversing removal procedures.

ADJUSTMENT

When final adjustment is completed and the control levers are released to the neutral position, the control knobs should be aligned. When the control levers are moved either forward or to the rear, the spool in the control valve (22) should bottom out as the control lever pivot (6) contacts either stop bolt (21).

NOTE

If the jam nuts (20) are tight and the stop bolts (21) have not been disturbed, then adjustment should be possible by adjusting the control cable linkage.

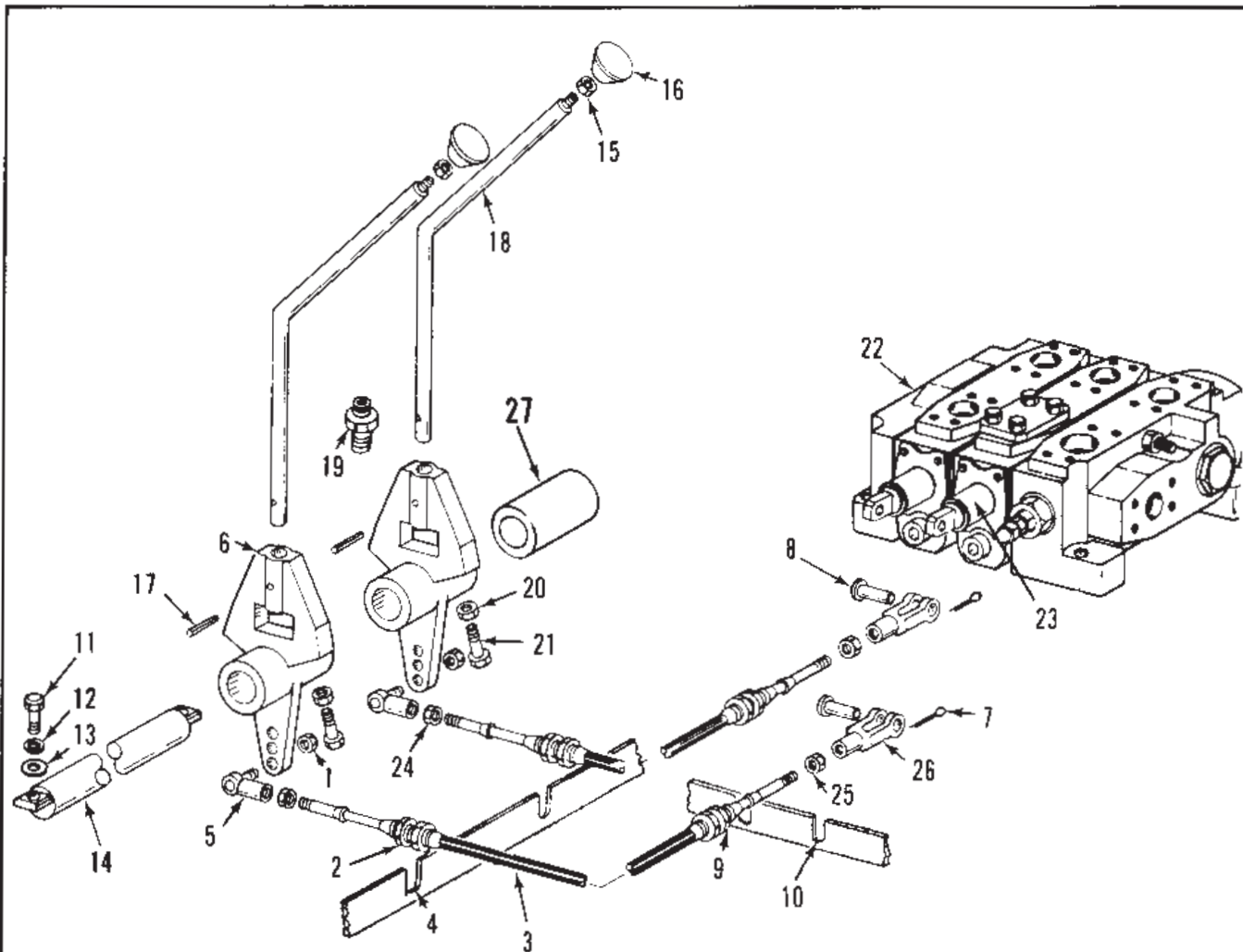
1. Checks

a. If the control lever (18) is pulled to the rear and the spool (23) bottoms out in the control valve (22) before the control lever pivot (6) strikes the stop bolt (21), then the control cable (3) is too short. If the control lever pivot (6) contacts the stop bolt (21) before the spool (23) bottoms out in the control valve (22), then the control cable (3) is too long.

b. If the control lever (18) is moved forward and the control lever pivot (6) strikes the stop bolt (21) before the spool (23) bottoms out in the control valve (22), then the control cable (3) is too short. If the spool (23) bottoms out in the control valve (22), then the control cable (3) strikes the stop bolt (21), then the control cable (3) is too long.

NOTE

When moving the levers forward, it is possible for the spool in the control valve to bottom out before the control lever pivot contacts the



- | | |
|------------------------|-------------------------|
| 1. NUT | 14. LEVER PIN |
| 2. NUT | 15. JAM NUT |
| 3. CABLE | 16. KNOB |
| 4. SLOT | 17. PIN |
| 5. ROD END | 18. CONTROL LEVER |
| 6. CONTROL LEVER PIVOT | 19. GREASE FITTING |
| 7. COTTER PIN | 20. JAM NUT |
| 8. CLEVIS PIN | 21. STOP BOLT |
| 9. NUT | 22. CONTROL VALVE |
| 10. SLOT | 23. CONTROL VALVE SPOOL |
| 11. BOLT | 24. JAM NUT |
| 12. LOCKWASHER | 25. JAM NUT |
| 13. FLAT WASHER | 26. CLEVIS |
| | 27. SPACER |

Figure 25-1. Lift and Tilt Controls and Linkage

stop bolt, and the control lever can still be moved forward far enough to contact the stop bolt. If this happens the control cable will bend or bow between either the slot (4) and the control lever pivot (6), or between the slot (10) and the control valve spool (23). If this happens the cable is too long.

c. If either of the above conditions exist, perform the appropriate procedures below to attain the correct control cable length.

2. Adjustments.

a. To Lengthen Cable

(1) Disconnect the rod end (5) from the control lever pivot (6).

(2) Loosen the jam nut (24) and unscrew the rod end (5) from the control cable (3).

NOTE

Ensure that sufficient threads remain engaged to provide a reliable connection.

(3) Tighten the jam nut (24) and reconnect the rod end (5) to the control lever pivot (6).

(4) Remove the cotter pin (7) and clevis pin (8).

(5) Loosen the jam nut (25) and unscrew the clevis (26) from the control cable (3).

NOTE

Ensure that sufficient threads remain engaged to provide a reliable connection.

(6) Tighten the jam nut (25) and reconnect the clevis (26) to the valve spool (23).

b. To shorten cable

(1) Refer to the above procedures to disconnect the rod end (5) or clevis (26).

(2) Loosen the appropriate jam nut and turn the rod end (5) or clevis (26) onto the control cable (3).

NOTE

When making either of the above adjustments, the amount of adjustment should be equally balanced on both ends of the control cable.

c. Stop Bolt Adjustment

(1) Loosen the jam nut (20) and turn the stop bolt (21) in or out, as necessary.

(2) Tighten the jam nut (20).

SECTION 27

TELESCOPIC MAST ASSEMBLY

INTRODUCTION

This section contains the procedures for removing the mast assembly, inner mast, lift cylinder and other components of the mast assembly. Refer to figures as indicated for location and identification of parts when performing these procedures.

COMPLETE MAST (Figure 27-1)

1. Removal

- a. Refer to Section 28 and remove the carriage.
- b. Attach a sling and clevis assembly to the lifting eyes (1).
- c. Attach a suitable hoisting device to the sling assembly, and apply sufficient lifting force to tighten the sling and support the mast.
- d. Remove the bolt (2), lockwasher (3), lock pin (4) and tilt cylinder anchor pin (5) to disconnect the tilt cylinder (6).
- e. Retract the tilt cylinder (6).
- f. Remove the bolt (7), lockwasher (8), split flange (9), hose assembly (10), o-ring (11), and lift cylinder check valve (12) from the lift cylinder (13).

CAUTION

Check the orientation of the lift cylinder check valve (12), to be sure that it will not be installed backward when reinstalled on the lift cylinder.

- g. Disconnect the lift cylinder return hose (14) from the top of the lift cylinder (13).
- h. Remove bolts (15) and anchor pin stops (16).
- i. Raise the mast slightly with the hoisting

device.

- j. Back the machine away from the mast.

2. Inspection. Check condition of the seals (18), bearings (19), and pin (17). Replace any parts found to be unserviceable.

3. Installation. Reinstall the mast by reversing removal procedures, and performing the following additional procedures.

- a. Use a new o-ring when installing the hose assembly (10).
- b. Refer to the torque table in the back of this manual for torque values to be used on all mounting hardware during installation.
- c. Refer to Section 28 for procedures to reinstall the carriage.

TILT CYLINDER ADJUSTMENT (Figure 27-2).

When the mast assembly has been removed for servicing, the tilt cylinders should be checked for proper adjustment.

1. Loosen the nuts (1) and bolts (2).
2. Use a wrench on the flats (3) on the tilt cylinder rod (4), and turn the rod in or out to achieve the desired adjustment.

NOTE

When the tilt cylinders are properly adjusted, the mast will be square with the frame when the cylinders are fully retracted. The cylinders should be operated throughout their full range of travel several times in order to expel any air that might be trapped in the system.

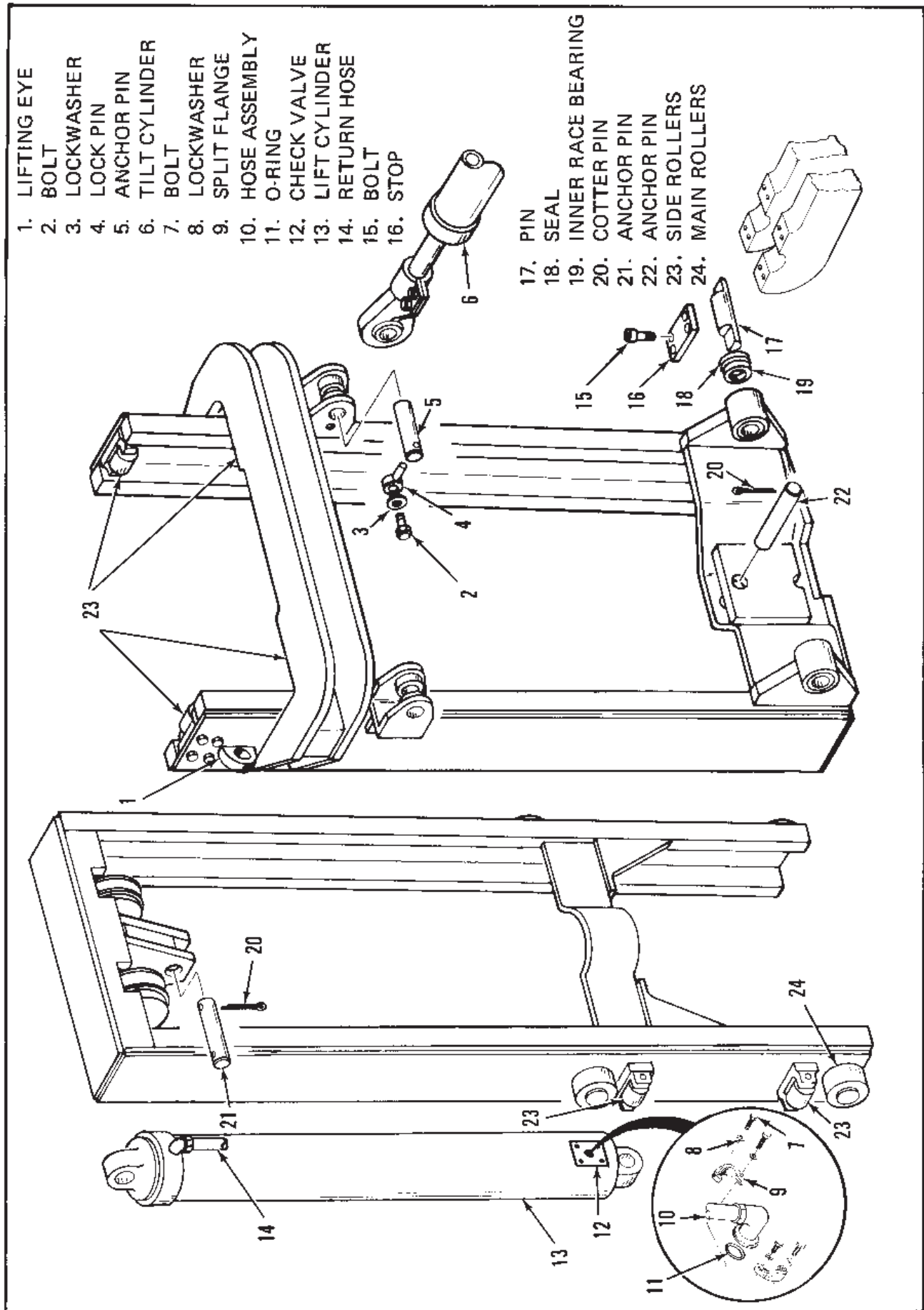


Figure 27-1. Telescopic Mast Assembly

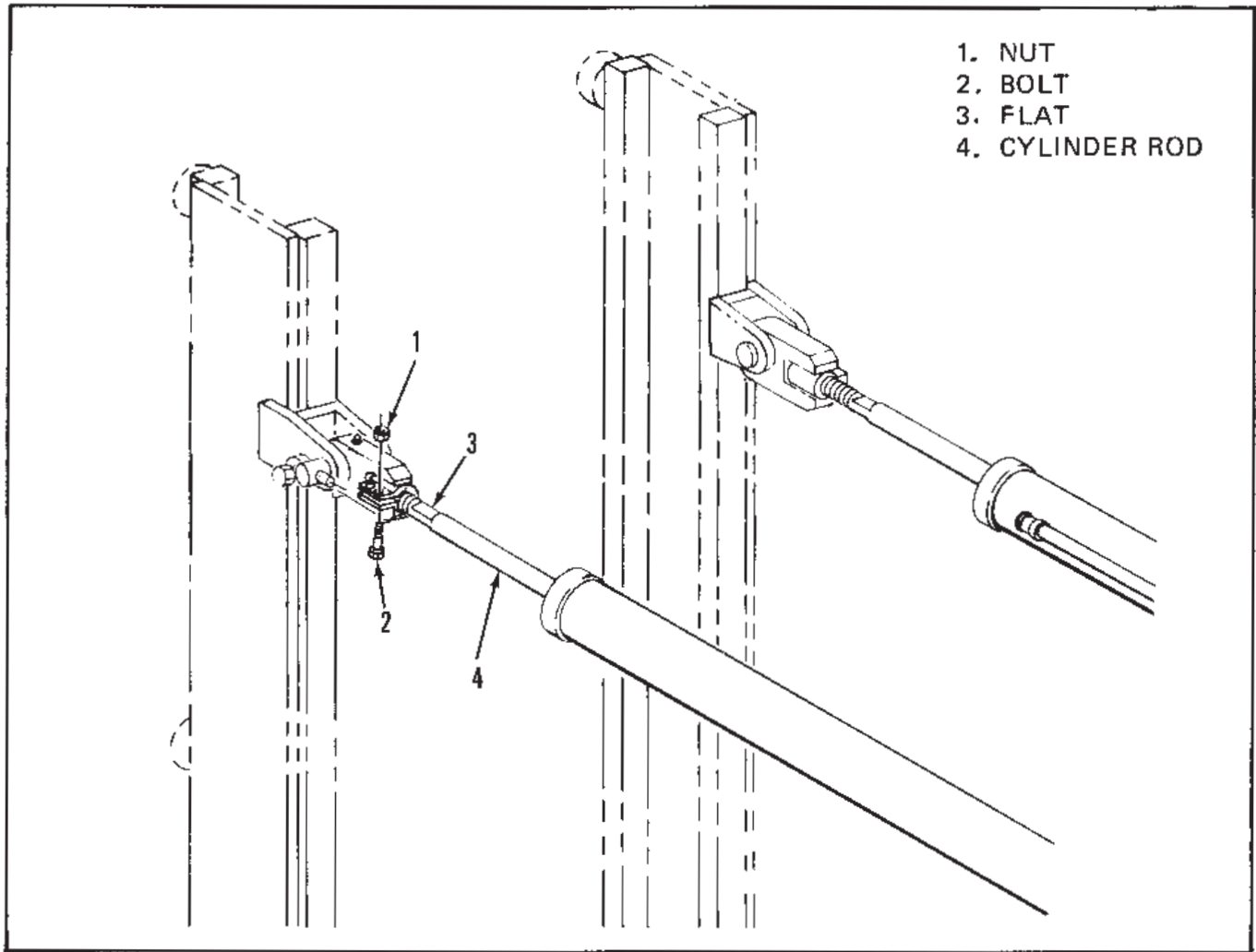


Figure 27-2. Tilt Cylinder Adjustment

INNER MAST

1. Removal. (Figure 27-3)

a. Refer to Section 28 and remove the carriage.

NOTE

When performing procedures referenced in step (1) above, do not tie the ends of the chains together when they are disconnected from the carriage.

b. Pull chains from chain rollers manually.

WARNING

Be sure there are no personnel

directly in front of the mast when the chains are disconnected from the outer mast assembly. When disconnected, the chains will run through the chain rollers and fall in front of the mast assembly.

c. Remove one of the cotter pins (1) and remove the chain anchor pin (2) to disconnect the chain (3) from the anchor (4).

d. Remove the bolts (5), lockwashers (6), to remove the outer mast side roller assembly (7) and shims (8) from outer mast (9).

e. Remove the cotter pin (10) and upper lift cylinder anchor pin (11).

f. Attach a sling to the inner mast and attach the sling to a hoisting device. Operate the hoisting

device to tighten the sling, being sure that the sling remains in position in the slots (12) in the upper corners of the inner mast (13).

NOTE

When hoisting the inner mast, as soon as the upper lift cylinder mount clears the upper eye of the lift cylinder, the lift cylinder will fall to one side or the other of the inner mast.

g. Hoist the inner mast (13) straight up to clear the outer mast.

2. Inspection and Repair. Check the condition of the rear thrust and side roller assemblies. Replace any parts found to be unserviceable.

a. Remove cotter pin (14), roller pin (15) and roller (16).

b. Use a new cotter pin (14) and reassemble the rear thrust and side roller assemblies by reversing procedures in step (a) above.

3. Installation. Reinstall the inner mast by following the removal procedures in reverse order and perform the following additional procedures.

a. When reinstalling chains (3) to outer mast (9), tie a rope to the end of the chain. Pass the rope over the chain roller, and pull the rope and chain over the roller until the chain is in position to be attached to the outer mast.

b. When installation of the inner mast is completed, check contact between the rear thrust roller (16) and the inner mast (13). Add or remove shims (8) as necessary to attain the desired adjustment.

LIFT CYLINDER

1. Removal

a. Refer to Section 28 and remove the carriage.

b. Raise the inner mast approximately one foot. This will extend the lift cylinder the same distance.

c. Tie the inner and outer mast together, using a chain, choker, or other means to hold the inner and outer mast in their present position.

d. Lower the lift cylinder only enough to relieve pressure on the upper lift cylinder anchor pin (11, Figure 27-3).

e. Remove the cotter pin (10) and upper lift cylinder anchor pin (11).

f. Secure a hoisting device to the lift cylinder, using a chain or choker around the cylinder.

g. Lower the lift cylinder to the bottom.

h. Remove the bolt (7, Figure 27-1), lock-washer (8), split flange (9), hose assembly (10), O-ring (11), and lift cylinder check valve (12) from the lift cylinder (13).

i. Disconnect the lift cylinder return hose (14) from the top of the lift cylinder (13).

j. Remove the cotter pin (17, Figure 27-3) and remove the lower lift cylinder anchor pin (18).

k. Operate the hoisting device and remove the lift cylinder (19).

2. Repair. If the lift cylinder is to be repaired, refer to Section 26 for procedures.

3. Installation. Reinstall the lift cylinder by reversing removal procedures.

BLEEDING LIFT CYLINDER (Figure 27-3).

1. Open the air release (20).

2. Pressurize the lift cylinder slowly and with caution.

3. Allow all air to escape. When a clean flow of hydraulic oil starts flowing from the air release, close the air release.

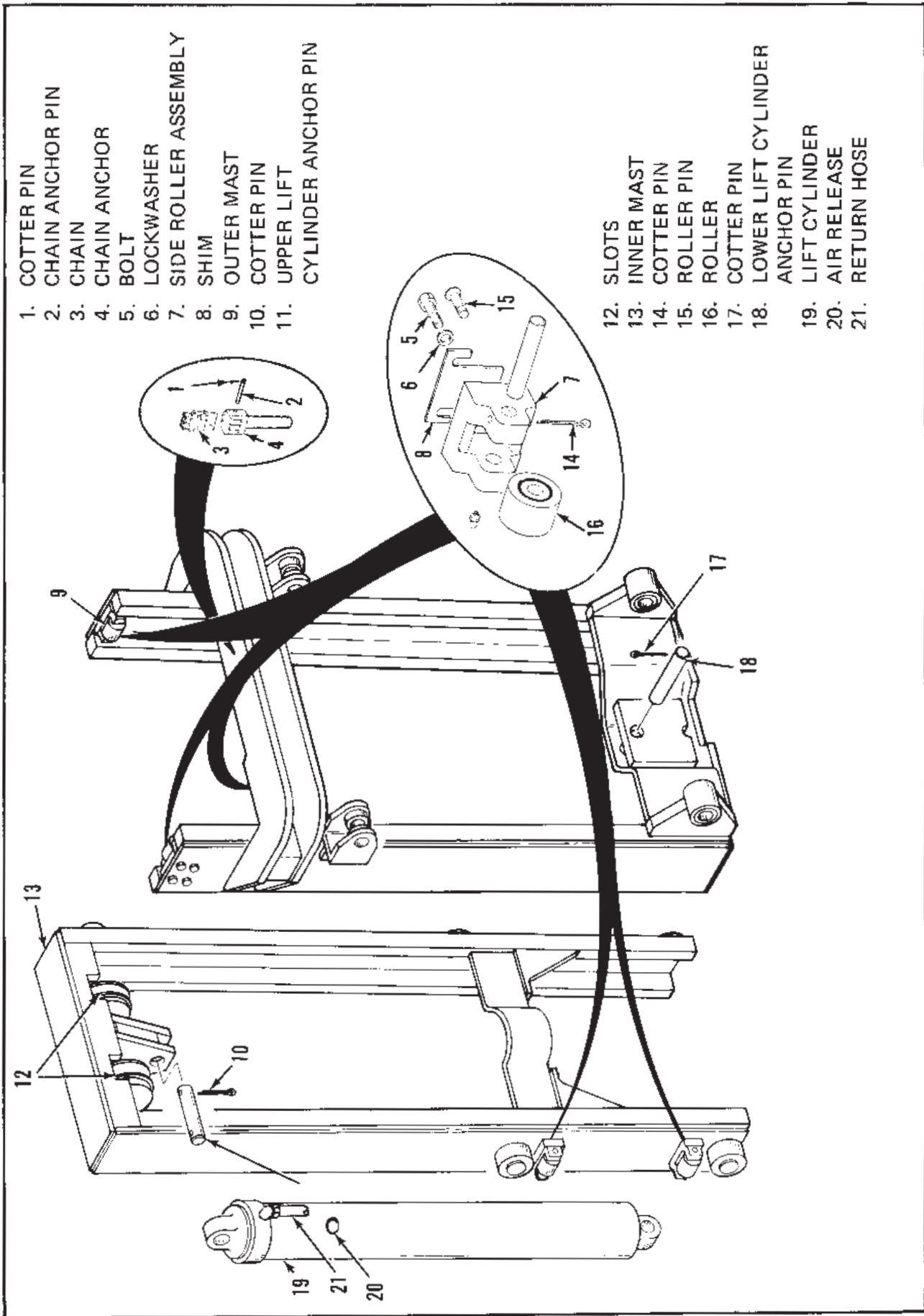


Figure 27-3. Removing Inner Mast

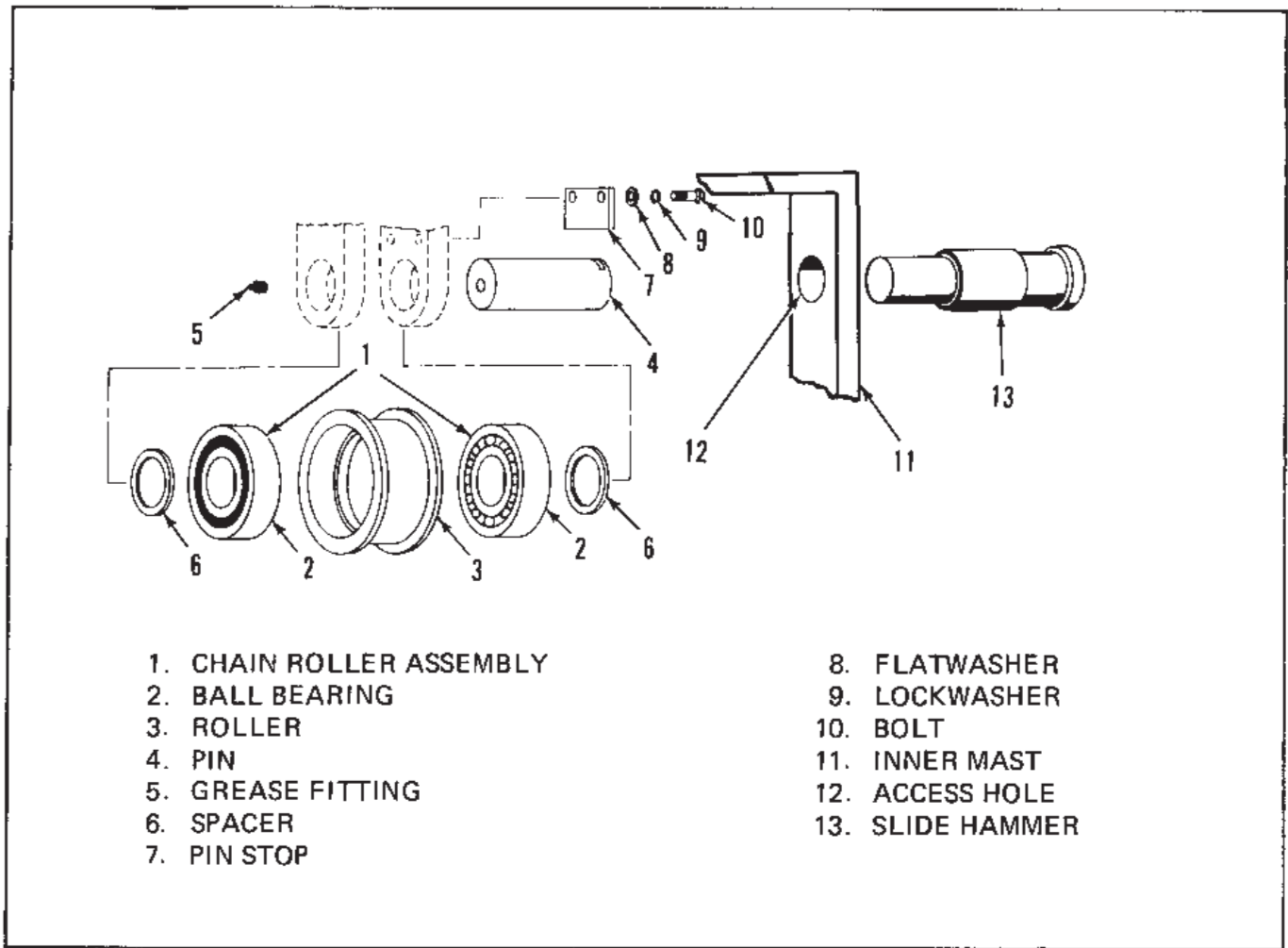


Figure 27-4. Chain Roller Assembly

NOTE

The machine is now ready for operation.

CHAIN ROLLER ASSEMBLY (Figure 27-4).

1. Removal.

a. Refer to procedures under inner mast above and disconnect the chains from the outer mast.

b. Clear the upper ends of the chains completely from the chain roller assemblies.

c. Remove grease fitting (5).

d. Remove the bolts (10), lockwashers (9) and washers (8) to remove pin stop (7).

e. Raise the inner mast (11) until the access hole (12) is above the top of the outer mast.

f. Insert the end of a slide hammer (13) through the access hole (12), and weld it to the end of the chain roller pin (4).

g. Support the roller assembly (3) and operate the slide hammer (13) to withdraw the roller pin (4).

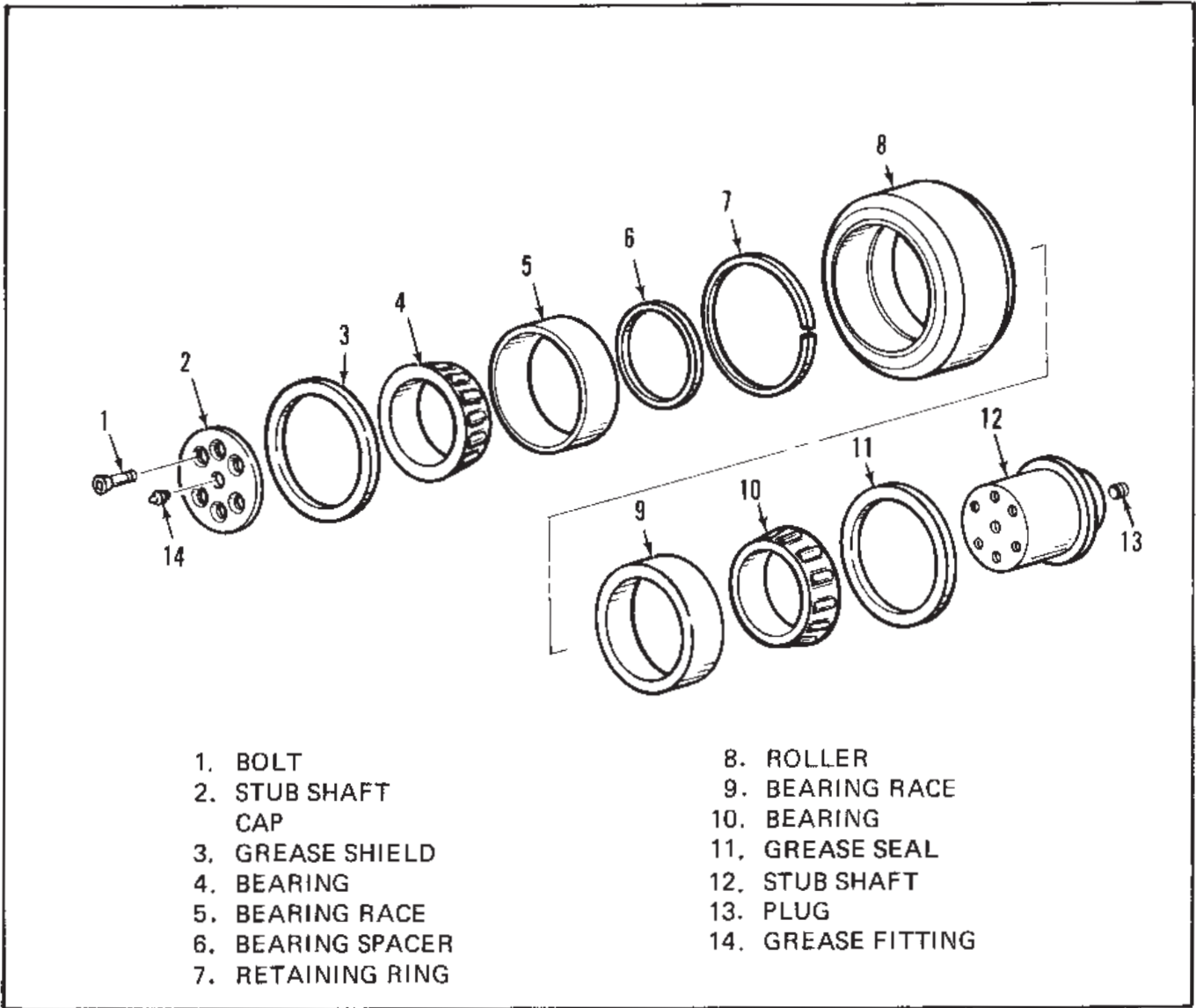


Figure 27-5. Main Roller Assembly

h. Remove the roller assembly (3) and spacers (6).

2. Inspection and Repair.

a. Check condition of the roller assembly (3). If the roller or bearings (2) require replacement, perform the following:

(1) Remove the bearings (2) from the roller (3).

(2) Obtain the necessary replacement parts and reassemble the chain roller assembly (3).

b. Inspect all other parts and replace any found to be unserviceable.

c. Remove the slide hammer (13) from the chain roller pin (4).

NOTE

If the chain roller pin has been damaged, replace the pin.

3. Installation. Reinstall the chain roller assembly by following removal procedures in reverse order.

MAIN ROLLER ASSEMBLY (Figure 27-5)

1. Removal.

a. Heat the bolts (1) to about 300°F to loosen Loctite, and remove the bolts.

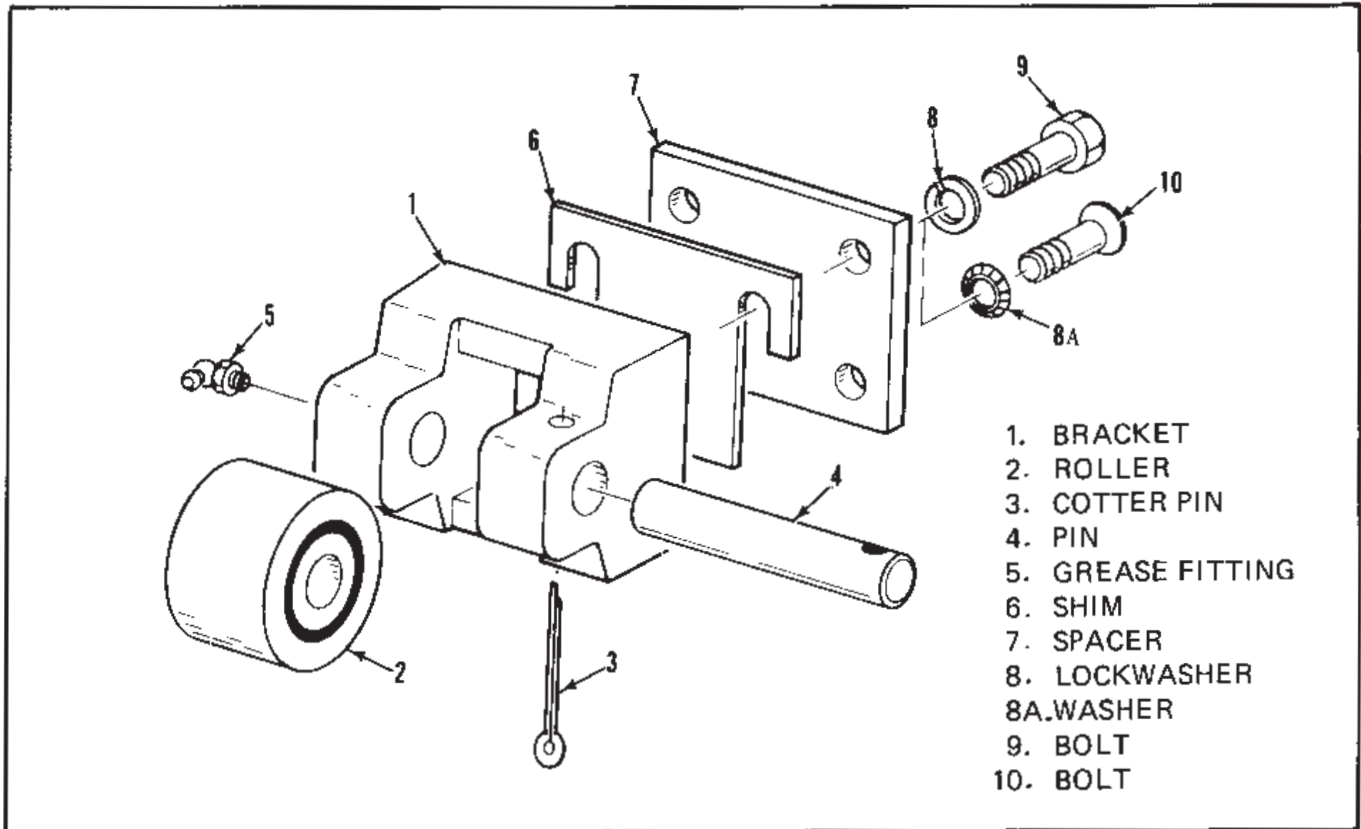


Figure 27-6. Side Roller Assembly

b. Remove the stub shaft cap (2), grease shield (3), bearing (4), bearing race (5), and bearing spacer (6).

c. Remove the retaining ring (7), roller (8), bearing race (9), bearing (10), and grease seal (11), from the stub shaft (12).

d. Do not remove the plug (13) and grease fitting (14) unless replacement is necessary.

2. Installation.

a. Obtain necessary replacement parts and reinstall the main roller assembly by reversing removal procedures.

b. It will be necessary to run a tap in the threaded holes and a die on the bolts to remove the Loctite residue.

c. The bolts and tapped holes must be clean and free of oil.

d. Apply Loctite to the bolt threads.

e. Tighten the bolts (1) in a circular manner until the bolts hold the torque. Refer to the torque chart in the back of this manual for the torque to be used. New bolts may be needed.

f. Stake each bolt head in 3 places with a center punch.

SIDE ROLLER ASSEMBLY (Figure 27-6).

1. Removal.

a. Remove bolts (9 and 10) and washers (8 and 8A) to remove spacer (7), shim (6) and bracket (1).

b. Remove cotter pin (3), grease fitting (5) and pin (4) to remove roller assembly (2).

2. Installation.

a. Obtain necessary replacement parts and reinstall by following removal procedures in reverse order.

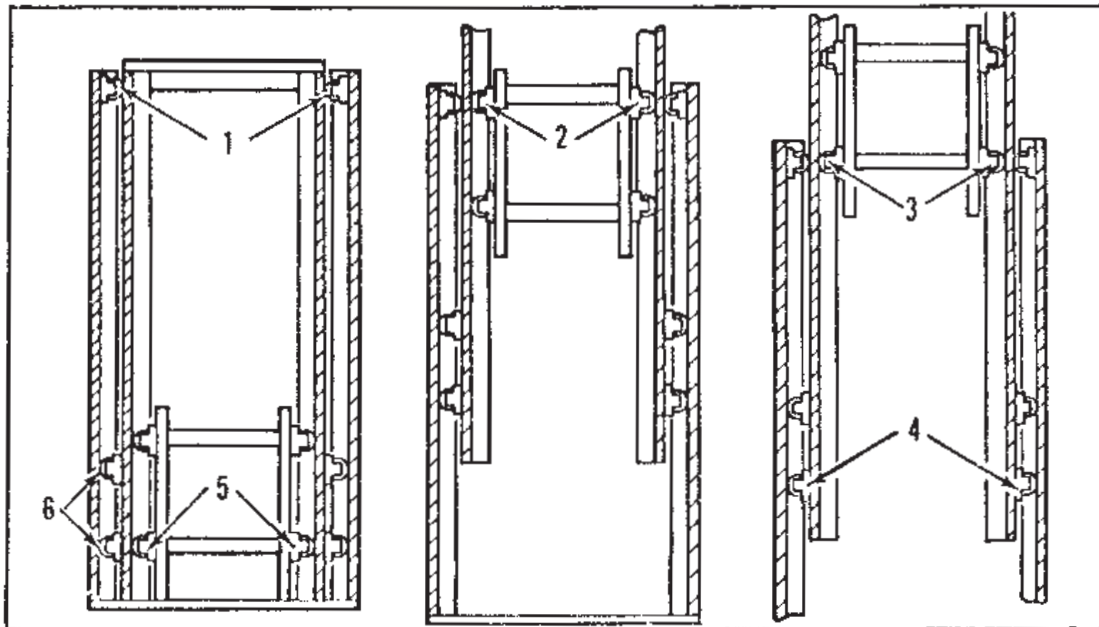


Figure 27-7. Shimming Side Rollers

SHIMMING SIDE ROLLERS (Figure 27-7)

To prevent undue flexing of the inner mast on a telescopic mast assembly, it is essential for all side rollers to be properly shimmed. Because of a number of instances of improper shimming technique the correct procedure is outlined here.

1. With carriage lowered, shim outer mast rollers until all slack is removed (1).
2. With top carriage rollers in line with outer mast rollers, shim top carriage rollers until all slack is removed (2).
3. With bottom carriage rollers in line with outer mast rollers, shim bottom carriage rollers until all slack is removed (3).
4. With carriage in same position, shim inner mast rollers until all slack is removed (4).

5. Lower carriage to bottom and check bottom carriage side rollers (5). If too tight, carriage will not come down. Do not reshim carriage. Proceed by installing thinner or fewer shims in inner mast (bottom) rollers. If carriage is loose, do not reshim it; add shims to inner mast rollers until they are snug to outer mast.

CAUTION

The most common error is excessive shimming of the carriage side rollers, forcing the inner mast outward. Thus adjusted, the inner mast is forced back inward as it passed the roller mounted at the top of the outer mast. Repeated excessive flexing will result in metal fatigue and ultimate failure at the flex point.

SECTION 27A

LIFT CHAINS

INTRODUCTION

If the lift chains or any component parts of the chain assemblies require replacement, refer to the Figures as indicated for location and identification of parts and perform the following procedures to effect necessary.

REMOVAL (Figure 27A-1)

1. Refer to Section 28 and remove the carriage.

WARNING

Be sure the carriage is supported solidly enough on the forks and blocks, so that it will not fall over backward, before performing the following procedures.

2. Remove the jam nut (4), nut (5), inner bearing (6), outer bearing (7), and remove the chain anchor (3) from the carriage (10).

3. Remove one of the cotter pins (1) and disconnect the chain (8) from the chain anchor (3) on the outer mast (11), and remove the chain (8).

4. Remove the nut (5), jam nut (4), inner bearing (6), outer bearing (7), and remove the chain anchor (3) from the outer mast (11).

DETERMINING CHAIN PITCH AND SERIES (Figure 27A-2)

NOTE

The distance between chain pins is the PITCH of the chain.

1. Measure the distance in inches between two pin centers to determine the pitch of the chain.

2. Check the series chain installed on the machine against the chain series listed in Figure 27A-2.

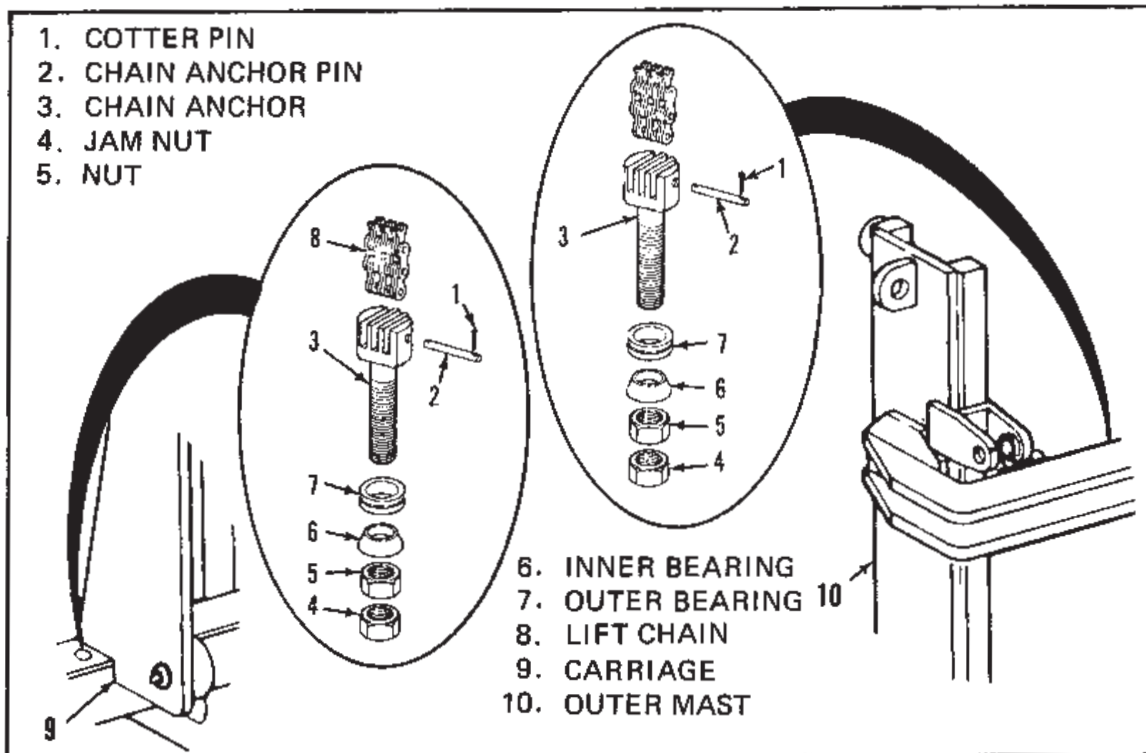


Figure 27A-1. Lift Chain, Exploded View

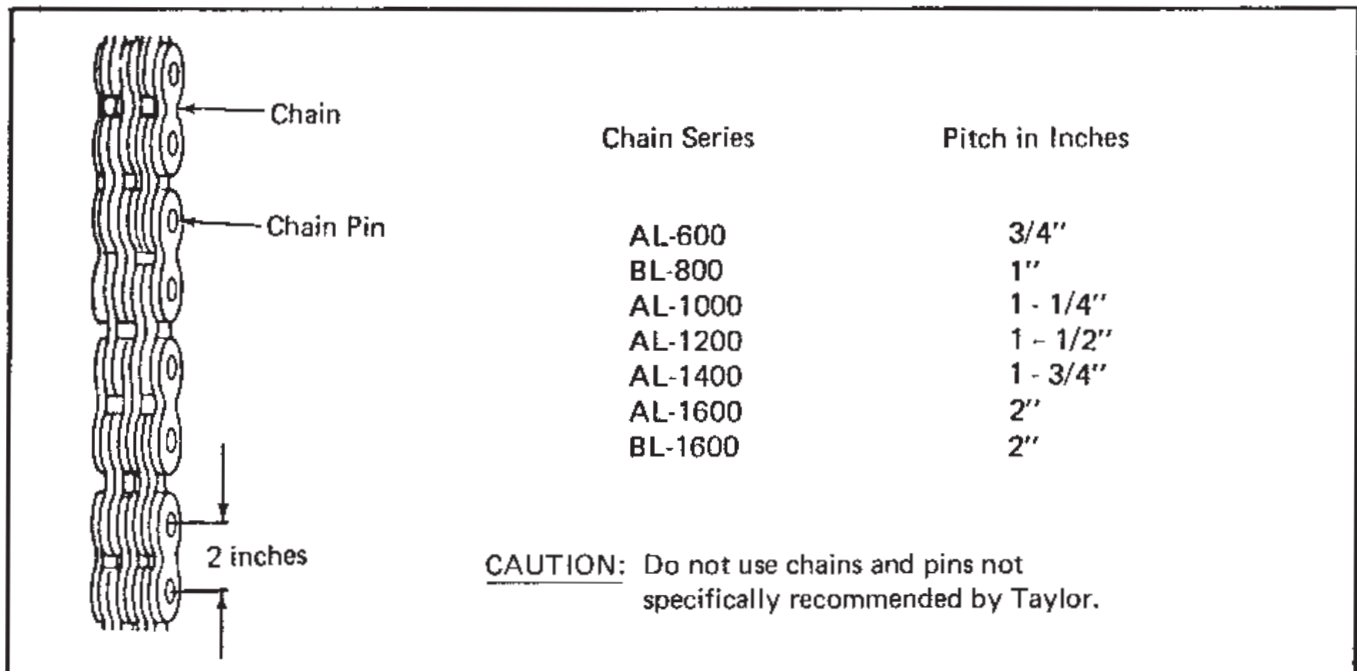


Figure 27A-2. Chain Pitch and Type

CHECKING CHAIN WEAR (Figure 27A-3)

1. Use the appropriate scale A or B depending on the pitch of the chain being checked.
2. Place the arrow on the left end of the gauge on a chain pin.
3. Check the position of the arrow on the right end of the gauge. If the arrow falls between two chain pins the chain still has life.
4. If both arrows fall on a chain pin (as shown in Figure 27A-3) the chain has stretched and must be replaced.

NOTE

When checking chain wear, measure a segment of chain that operates over a sheave. Do not repair chains by cutting out the worn section and splicing in a new piece. If part of chain is worn, replace the entire chain.

MEASURING AND INSTALLING LIFT CHAINS (Figure 27A-4)

1. Insert the chain anchors in both the carriage and mast assemblies.
2. Install chain anchor nuts with the thinner jam nut being installed first. Install the regular nut and screw the nut on the chain anchor until the nut is flush with the end of the chain anchor.
3. Refer to Section 28 for procedures and install the carriage on the mast.
4. With the carriage and inner mast resting on the bottom of the outer mast, lift the chain anchors until the jam nuts contact the bottom of the chains anchor brackets.
5. With the chain anchors in this position, measure the distance from the chain anchor pin eye, over the chain roller, to the other anchor pin eye.
6. Add one full link or two pitches, to the measured distance to allow for the difference between the measured length and the centerline length of the chain.
7. Adjust the chain anchor until there is 1/4 inch clearance between the lowest point on the carriage and the bottom plate on the outer mast.

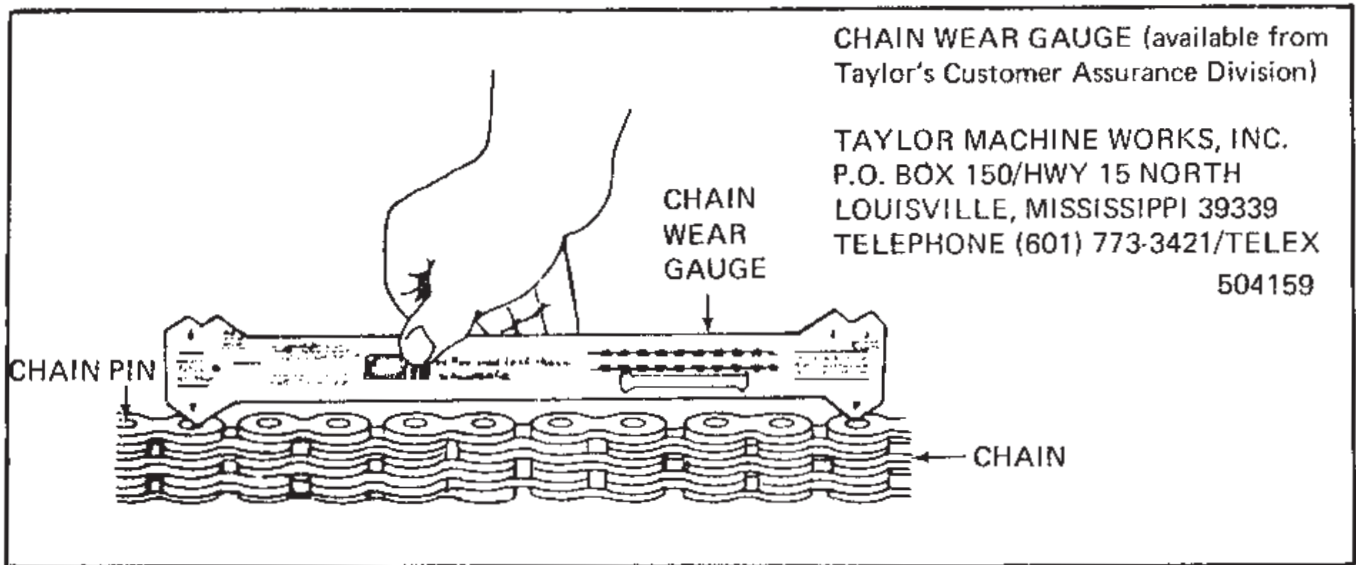


Figure 27A-3. Using Chain Wear Gauge

NOTE

Chain adjustment should be maintained at approximately 1/4 inch with no load on the carriage, and the carriage fully lowered.

8. When the carriage is in the fully raised position, there must be clearance between the highest point on the carriage and the inner mast top plate.

CAUTION

Make sure of this clearance when mast components are changed or new components installed.

9. Check the mast and carriage for clearance before working under loaded conditions.

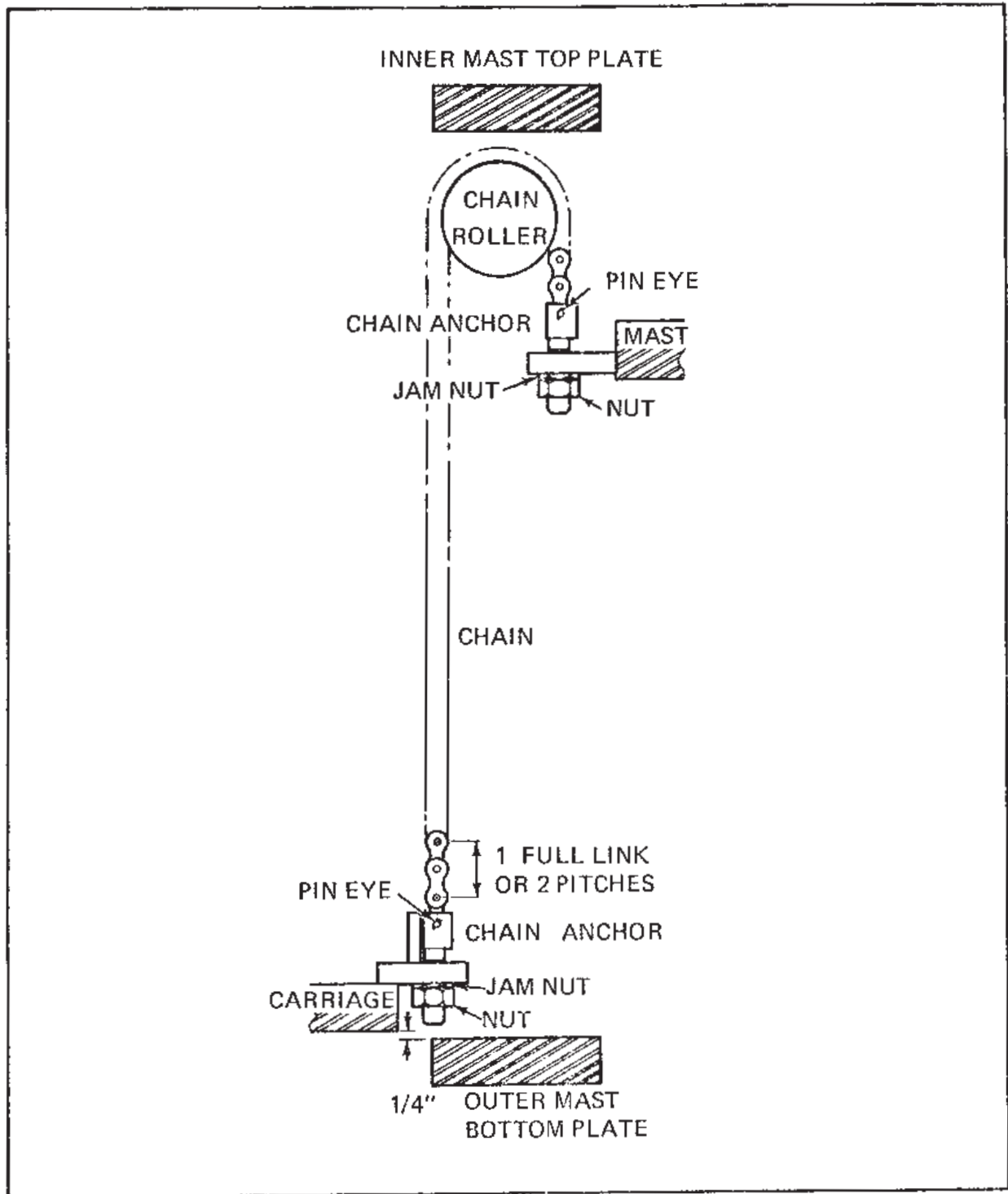


Figure 27A-4. Installing Lift Chains

SECTION 28
CARRIAGE — TYPE C

INTRODUCTION

The following procedures pertain to removing the carriage assembly. Refer to Section 27 for procedures to remove and replace the main and side rollers. Refer to Figure 28-1 for location and identification of parts when performing the following procedures.

REMOVAL

1. Raise the carriage (1) high enough so that blocks (2) can be placed under the carriage next to the mast.

2. Lower the carriage onto the blocks to get slack in the chains (3).

NOTE

If forks (4) are installed, the forks and blocks will prevent the carriage from falling over backward when the machine is moved away from the carriage.

3. Remove one of the cotter pins (5) and remove the chain anchor pin (6) to disconnect the chain (3) from the chain anchor (7).

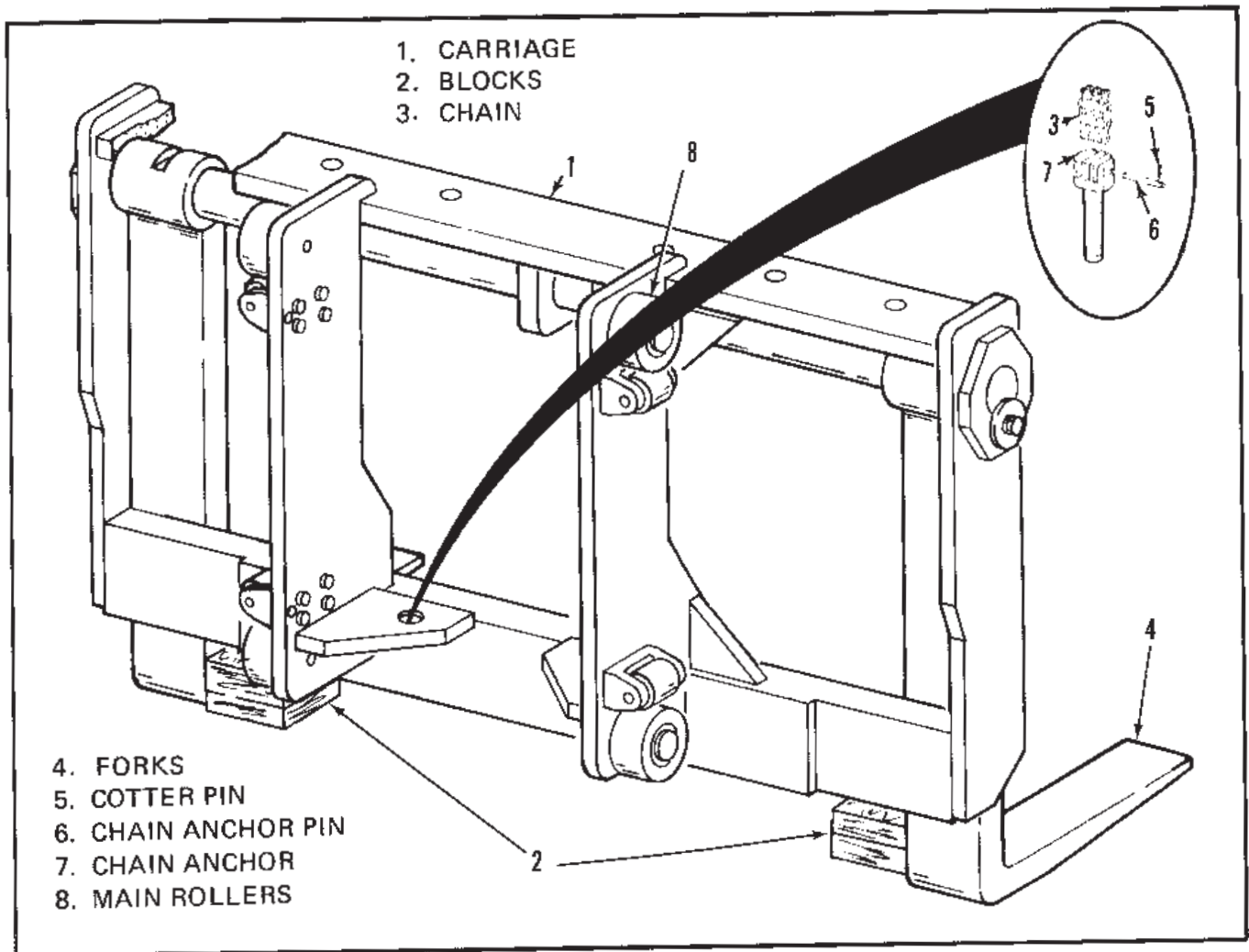


Figure 28-1. Carriage Assembly - Type C

4. Tie the ends of the two chains (3) together to prevent them from running through the chain rollers, mounted at the top of the mast.

5. Raise the inner mast high enough to clear the top main rollers (8) on the carriage.

6. Back the machine away from the carriage.

INSTALLATION

Reinstall the carriage by reversing removal procedures.

HYDRAULIC PRESSURE SETTINGS

INTRODUCTION

Maximum life expectancy from hydraulic components in the lift and tilt, steering, and accessory hydraulic circuits can be realized, if the systems are operated at the lowest practical hydraulic pressures. The following pressure settings have been determined as the ideal pressure settings for long component life, and to sustain operation of the machine to its full capabilities.

PRESSURE PORT LOCATIONS (Figure A-1).

Two plugged couplings are provided for checking pressure settings. These check ports are located on the left side of the machine above and to the rear of the steer axle. The front check port is used to check lift pressure. The rear check port is used to check unloader, tilt, steering, and accessory pressures.

LIFT AND UNLOADER PRESSURES.

Check and adjust the lift and unloader pressure with the hydraulic oil at operating temperature.

1. Checking Lift Pressure.

a. Remove the plug from the front check port and install a pressure gauge (see Figure A-1).

b. Raise the lift cylinder until it tops out. The pressure gauge should indicate 2500 psi.

2. Adjusting Lift Pressure

a. Remove the plug from the front check port and install a pressure gauge (see Figure A-1).

b. Remove the acorn nut (see Figure A-2).

c. Raise the lift cylinder until it tops out.

d. Loosen the locknut and turn the adjusting screw clockwise to increase pressure or counter-clockwise to decrease pressure.

e. When the correct pressure setting is achieved, tighten the locknut and reinstall the acorn nut.

f. Remove the pressure gauge and reinstall the plug.

3. Checking Unloader Pressure

a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).

HYDRAULIC PRESSURE SETTINGS

MODEL	LIFT PRESSURE	TILT PRESSURE	STEER PRESSURE	UNLOADER CIRCUIT	ACCESSORY CIRCUIT
TY-160	1900	1200	2000	1200	1200
TYB-160	1900	1200	↓	↓	↓
TY-180	2100	1300			
TYB-180	2100	1400			
TY-200	2300	1450			
TYB-200	2300	1650			
TY-220	2500	1550			
TYB-220	2500	1800			
TY-250	2000	1800			
TYB-250	2000	2150			
TY-300	2450	2200			
TYH-300	2500	2500			
TYG-300	2500	2500			

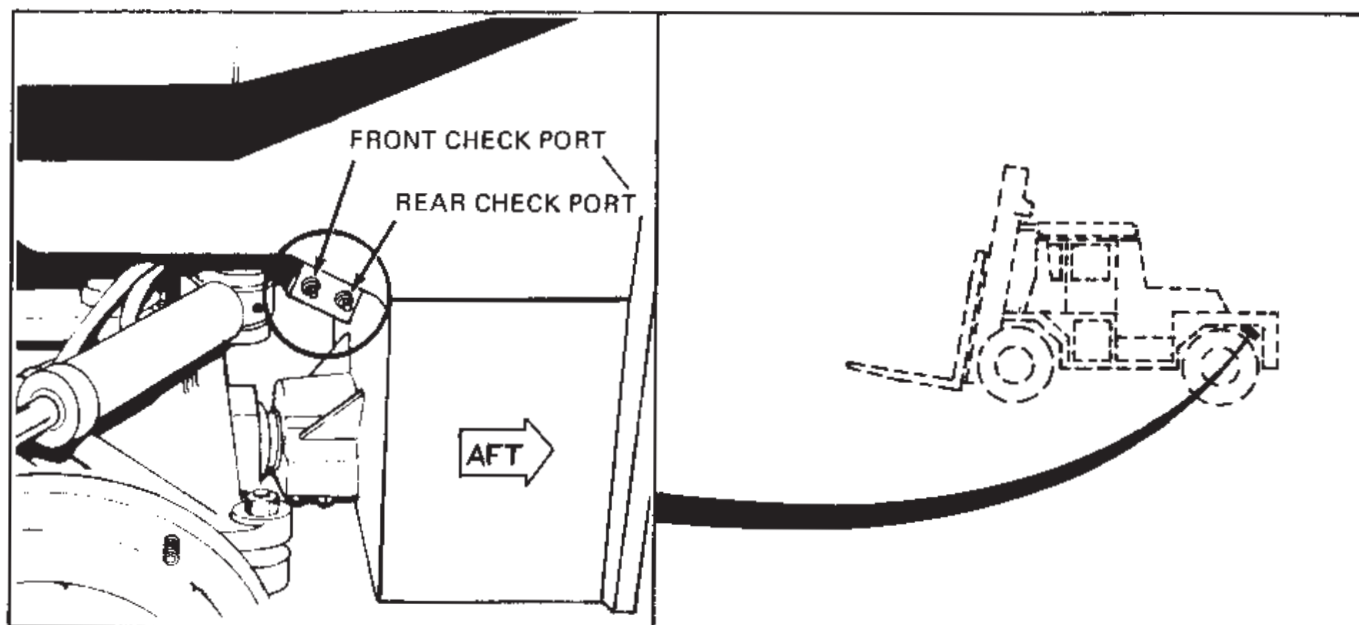


Figure A-1. Location of Pressure Check Ports

b. Raise the lift cylinder until it tops out. Observe the pressure gauge as the lift cylinder is being raised. At some point the pressure indication will make a sudden drop. The unloader pressure should be 1200 psi when the sudden drop occurs.

4. Adjusting Unloader Pressure

- a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).
- b. Remove the acorn nut from the unloader relief valve (see Figure A-2).
- c. Loosen the locknut on the unloader relief valve, and turn the adjusting screw clockwise to increase pressure or counterclockwise to decrease pressure.
- d. Refer to Checking Unloader Pressure above, and recheck unloader pressure. Readjust the pressure setting if necessary.
- e. When the correct pressure setting is achieved, tighten the locknut and reinstall the acorn nut.

f. Remove the pressure gauge and reinstall the plug.

TILT PRESSURE

Check and adjust the tilt pressure with the hydraulic oil at operating temperature.

1. Checking Tilt Pressure

- a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).
- b. Extend the tilt cylinders until they top out. The pressure gauge should indicate 2000 psi.

2. Adjusting Tilt Pressure

- a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).
- b. Extend the tilt cylinders until they top out.
- c. Loosen the locknut on the relief valve on the inlet section of the tilt and accessory valve (see Figure A-3).

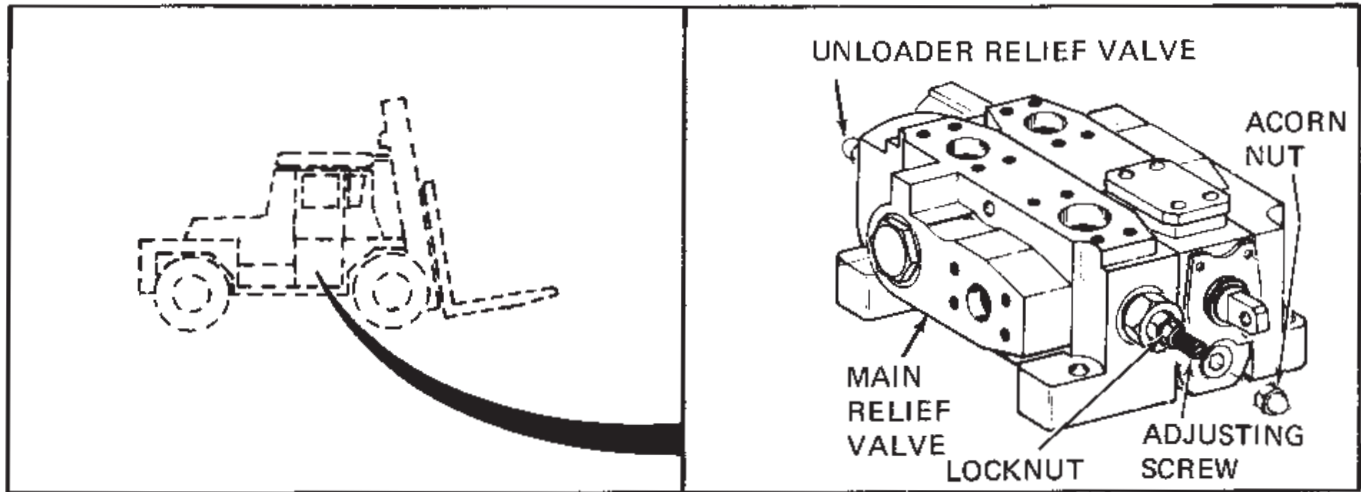


Figure A-2. Lift and Unloader Valve Location and Adjustment

d. Turn the adjusting screw clockwise to increase pressure or counterclockwise to decrease pressure.

e. When the correct pressure setting is achieved, tighten the locknut.

f. Remove the pressure gauge and reinstall the plug.

ACCESSORY PRESSURE

Check and adjust accessory pressure with the hydraulic oil at operating temperature.

1. Checking Accessory Pressure.

a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).

b. Operate the accessory until the actuating cylinder bottoms out in both directions. The pressure gauge should indicate 1200 psi.

NOTE

The pressure gauge should indicate 1200 psi when the engine is operating slightly above idle rpm.

2. Adjusting Accessory Pressure

a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).

b. Operate the accessory until the actuating cylinder bottoms out in both directions.

c. Loosen the locknut on the relief valve on either end of the accessory section requiring a pressure adjustment (see Figure A-3).

d. Turn the allen screw clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE

The pressure should be adjusted with the engine operating slightly above idle rpm.

e. When the correct pressure setting is achieved, tighten the locknut.

f. Remove the pressure gauge and reinstall the plug.

STEER PRESSURE

Check and adjust the steer pressure with the hydraulic oil at operating temperature.

1. Checking Steer Pressure

a. Remove the plug from the rear check port and install a pressure gauge (see Figure A-1).

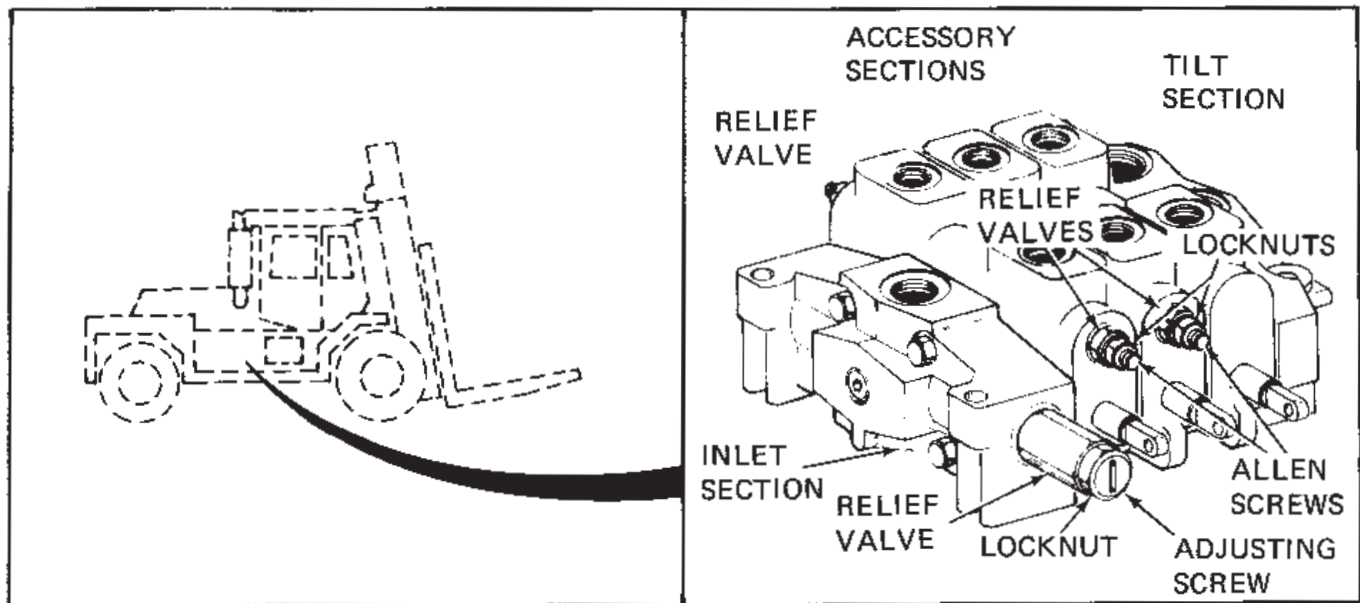


Figure A-3. Tilt and Accessory Valve Location and Adjustment

b. Steer the machine until the steer cylinders bottom out. The pressure gauge should indicate 2000 psi.

2. Adjusting Steer Pressure

a. Disconnect the 1/4 inch return line hose from the top of the steer sensing valve (see Figure A-4).

NOTE

This will expose an allen plug in the sensing valve which can be adjusted to increase or decrease the steering pressure.

b. Insert an allen wrench in the plug, and turn the plug clockwise to increase the pressure or counterclockwise to decrease the pressure.

c. Remove the allen wrench and reconnect the 1/4 inch return line hose.

d. Operate the machine and check the steer pressure. Repeat the above procedures and re-adjust the pressure if necessary.

e. When the correct pressure setting is achieved, remove the allen wrench and reconnect the 1/4 inch return line hose.

f. Remove the pressure gauge and reinstall the plug.

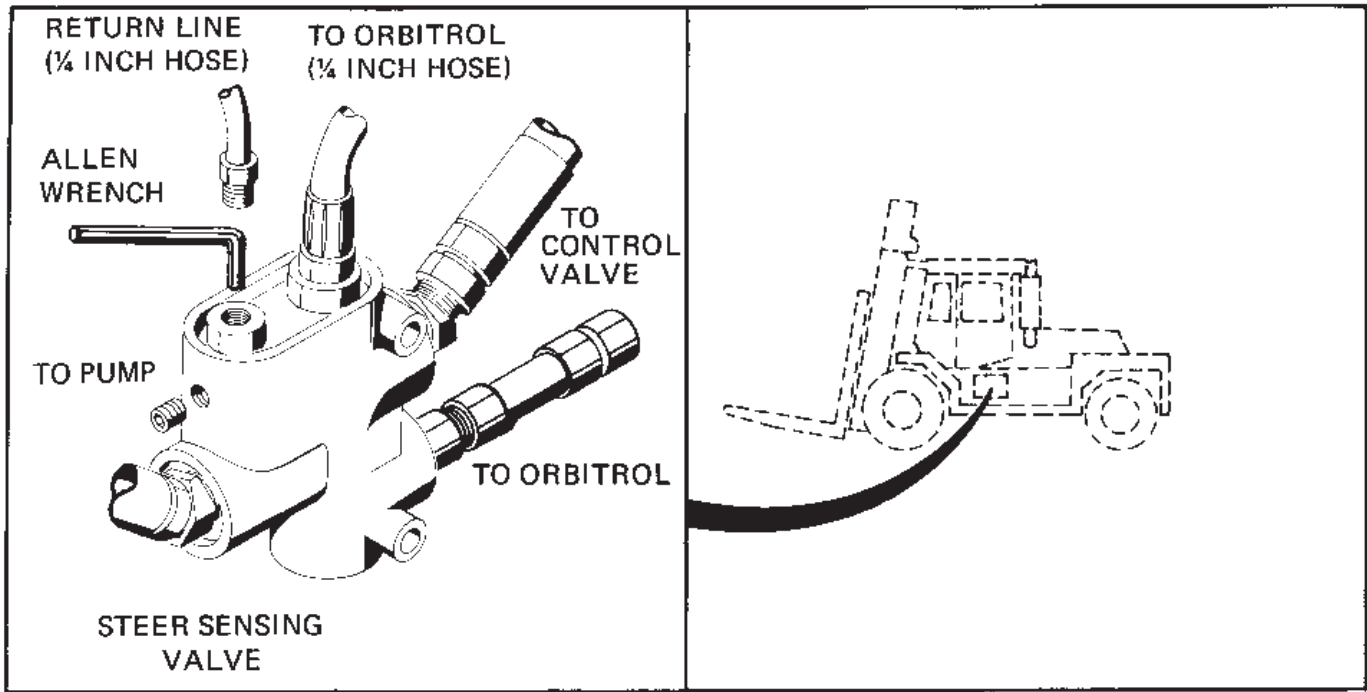
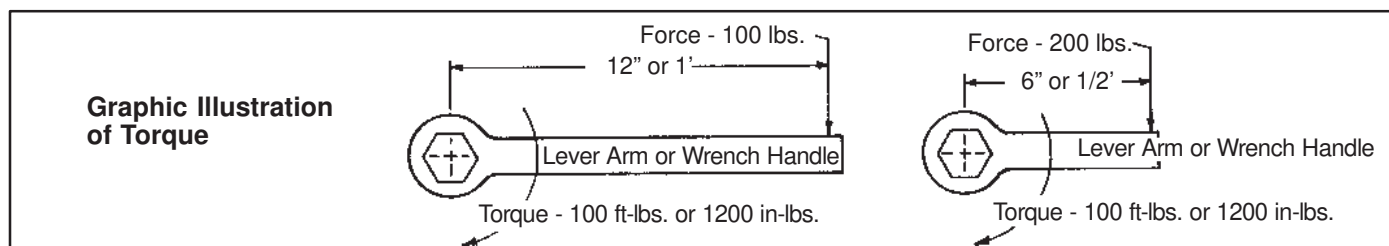


Figure A-4. Steer Sensing Valve Location and Adjustment

Torque Chart - Nuts and Bolts



NOTE: This chart is intended as a guide for the wrench torque that should be applied to tightening nuts and bolts or studs, or capscrews when no torque is specified on the assembly print or separate instructions.

When tightening a bolt with a castellated nut, torque to the low value shown on the chart. Then continue to tighten until the hole in the bolt and the slot in the nut register. Nuts must be of the

same SAE grade as the bolts on the chart. When nuts and bolts are of different grades, use the torque value for the lower of the two.

This chart is not intended for use in seating a stud in a housing. These values were calculated on approximately 75% of the proof-load for dry unplated bolts, and should be reduced by approximately 25% for lubricated fasteners.

Recommended Torque, Foot-pounds, (ft-lbs)

NF Threads	SAE Grade 3		SAE Grade 5		SAE Grade 6		SAE Grade 7		SAE Grade 8	
	Max.	Ade*	Max.	Ade*	Max.	Ade*	Max.	Ade*	Max.	Ade*
1/4 - 28	10	9	10	9	12	11	12	11	14	13
5/16 - 24	19	17	19	17	25	23	24	22	25	23
3/8 - 24	35	32	35	32	45	41	45	41	50	45
7/16 - 20	55	50	55	50	72	65	70	63	80	72
1/2 - 20	85	77	90	81	110	99	100	90	120	108
9/16 - 18	114	103	120	108	157	141	150	135	170	153
5/8 - 18	160	144	180	162	210	189	210	189	240	216
3/4 - 16	—	—	300	270	—	—	360	324	420	378
7/8 - 14	—	—	470	423	—	—	580	522	660	594
1 - 14	—	—	730	657	—	—	900	810	1020	918
1-1/8 - 12	—	—	880	792	—	—	1260	1134	1440	1296
1-1/4 - 12	—	—	1240	1116	—	—	1760	1584	2000	1800
1-3/8 - 12	—	—	1680	1512	—	—	2380	2142	2720	2448
1-1/2 - 12	—	—	2200	1980	—	—	3100	2790	3560	3200
NC Threads										
1/4 - 20	8	7.2	8	7.2	11	9.9	10	9	12	10.8
5/16 - 18	18	15.3	17	15.3	22	19.8	21	18.9	25	22.5
3/8 - 16	31	28	31	28	40	36	40	36	45	40.5
7/16 - 14	49	44	50	45	64	58	60	54	70	63
1/2 - 13	75	68	75	68	98	88	95	86	110	99
9/16 - 12	102	92	110	99	141	127	135	122	150	135
5/8 - 11	141	127	150	135	186	167	190	171	220	198
3/4 - 10	—	—	260	234	—	—	320	288	380	342
7/8 - 9	—	—	430	387	—	—	520	468	600	540
1 - 8	—	—	640	576	—	—	800	720	900	810
1-1/8 - 7	—	—	800	720	—	—	1120	1008	1280	1152
1-1/4 - 7	—	—	1120	1008	—	—	1580	1422	1820	1638
1-3/8 - 6	—	—	1460	1314	—	—	2080	1872	2380	2142
1-1/2 - 6	—	—	1940	1746	—	—	2780	2500	3160	2844

*Adequate

Taylor Engineering Standards

Tightening procedure for countersunk socket-head bolts used for holding caps on tapered Timken bearings:

1. The bolts and tapped holes must be clean and free of oil. (This can be done by using a spray degreaser (Zep Aerosolve® or equivalent) and drying with compressed air.)
2. Apply Loctite® to bolt threads.
3. Tighten all bolts in a circular manner to the amount of torque shown in the table below.
4. Repeat Step 3 until bolts hold at least the minimum value. Stake head at three places with a center punch.
5. When bearings are removed, it is necessary to run a tap in the threaded holes and a die on the bolts to remove Loctite® residue. If a die is not available, use new bolts.

Bolt Size	Torque (ft-lbs)	
	Min.	Max.
5/16 - 18	7.5 (90 in-lbs)	8.5 (102 in-lbs)
3/8 - 16	14 (168 in-lbs)	12 (192 in-lbs)
7/16 - 14	24 (288 in-lbs)	26 (312 in-lbs)
1/2 - 13	38 (456 in-lbs)	42 (504 in-lbs)
5/8 - 11	74	81
3/4 - 10	135	150

ES-3B (3/80)

Installation of Bonded Rubber Mounts on Engine / Transmission Assemblies

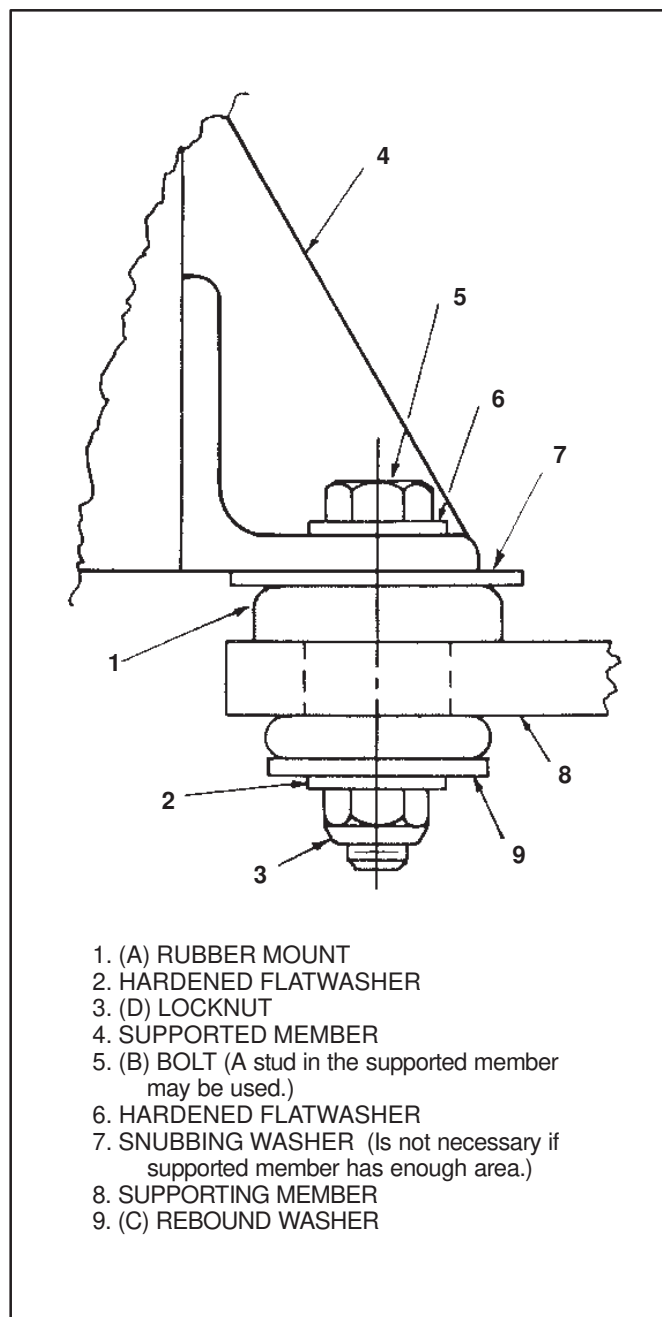
It is recommended that any time an engine or transmission is removed that the rubber mounts be changed out.

Installation Procedure

1. Clean supporting member with degreaser (Zep Aerosolve® or equivalent), and then dry with shop air.
2. Lubricate mounting socket lightly with Lord P-80®, Atlas Ruelyde®, or equivalent, or water. **Do Not** use oil or grease.
3. Place rubber mount in socket and twist in by hand as far as it will go without cocking. Insert a bolt of the proper size into the rubber mount and apply a load to the head of the bolt. Push the mount into the socket such that when the force is removed there is no gap between the under surface of the mount and the top of the supporting member.
4. Remove bolt and anchor structure as shown, being sure to use proper size rebound washer. Torque nut on bolt with recommended tightening torque shown below.

(A) Rubber Mount Taylor Part No.	(B) Bolt Size	(C) Washer Min. Dia.	(D) Torque ft-lbs
3255-130	1"	4.0"	800
3255-100	3/4"	2.75"	285
3255-107	5/8"	2.5"	145
3255-105	5/8"	2.5"	145
3255-125	5/8"	2.25"	90
3255-110	5/8"	1.75"	60
3255-120	1/2"	1.5"	22

NOTE: Torque is that recommended by rubber mount manufacturer. It is not dependent upon bolt size.



Flywheel and Housing Tolerance

Introduction. The following tests should be performed whenever either the engine or transmission are removed especially if ring gear failure has occurred.

⚠ WARNING: Before making any indicator readings, be certain, when rotating the flywheel, that the engine cannot fire or start.

1. To check the flywheel housing bore eccentricity and face deviation, securely clamp (or use magnetic base) base of dial indicator on engine flywheel, Figure B-1.

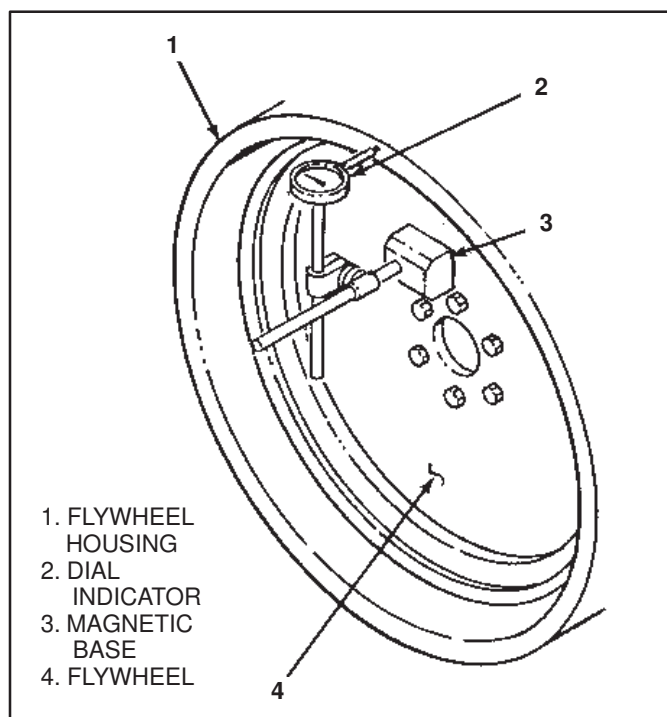


Figure B-1. Housing Face Deviation

2. With the tip of the dial arm against the flywheel housing face, rotate the engine flywheel. The following total indicator readings must not be exceeded:

Flywheel Housing Diameter	Total Indicator Reading
SAE No. 3 - 16.125/16.130 Dia.	.008 in.
SAE No. 1 - 20.125/20.130 Dia.	.008 in.
SAE No. 3 - 25.500/25.510 Dia.	.010 in.

3. With the tip of the dial arm against the flywheel housing pilot bore, rotate the engine flywheel, Figure B-2. The following total indicator readings must not be exceeded.

SAE No. 3 - .008 in.
SAE No. 1 - .008 in.
SAE No. 0 - .010 in.

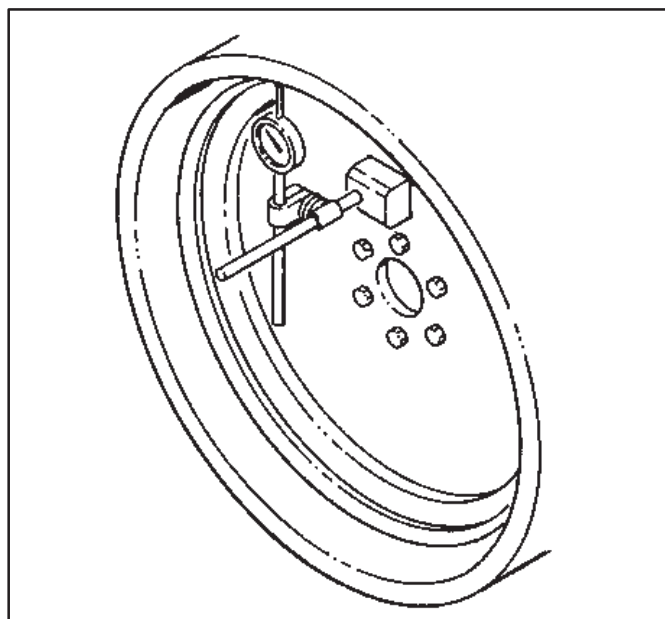


Figure B-2. Housing Pilot Bore

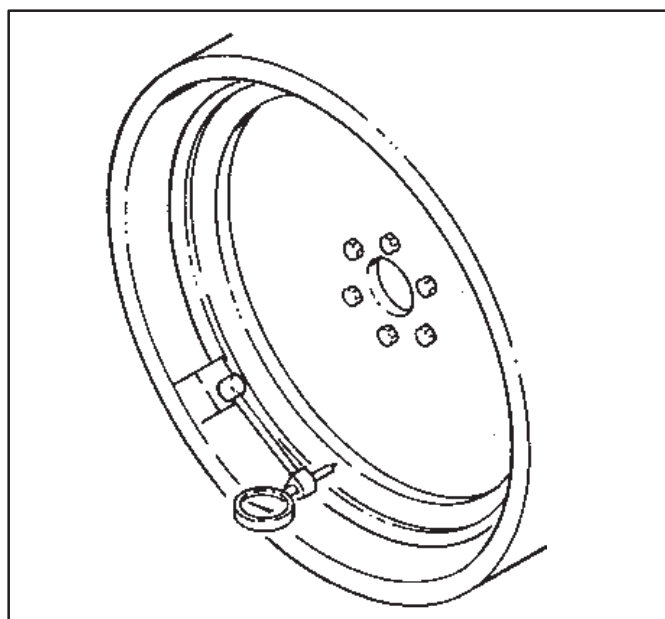


Figure B-3. Flywheel Face Deviation

-
4. Check the flywheel face deviation by mounting the dial indicator base to the flywheel housing and locating the dial arm tip against the coupling gear mounting surface, Figure B-3. Rotate the flywheel and check that the total indicator reading does not exceed .005 in.

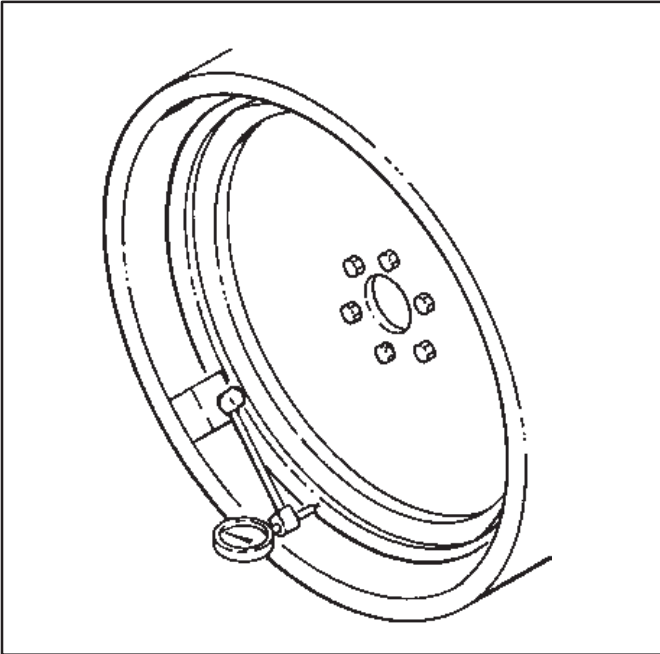


Figure B-4. Pilot Counterbore

5. With the dial indicator arm tip against the flywheel coupling gear pilot counter bore, Figure B-4, rotate the flywheel and check that the total indicator reading does not exceed .005 in.
6. Flywheels and housings out of tolerance must be resurfaced, rebored, or if excessively out of specification, replaced.
7. For converter flywheel ring gear installation refer to the information tag supplied with each ring gear.
8. Check end play on engine crankshaft and record. (End play to be specified by engine manufacturer.)
9. Use guide pins in engine flywheel housing and install converter. Tighten converter to flywheel housing bolts evenly and to specified torque.
10. Check end play on engine crankshaft after converter is mounted. End play to be the same value as measured in item number 8.

Welding Precautions

Introduction

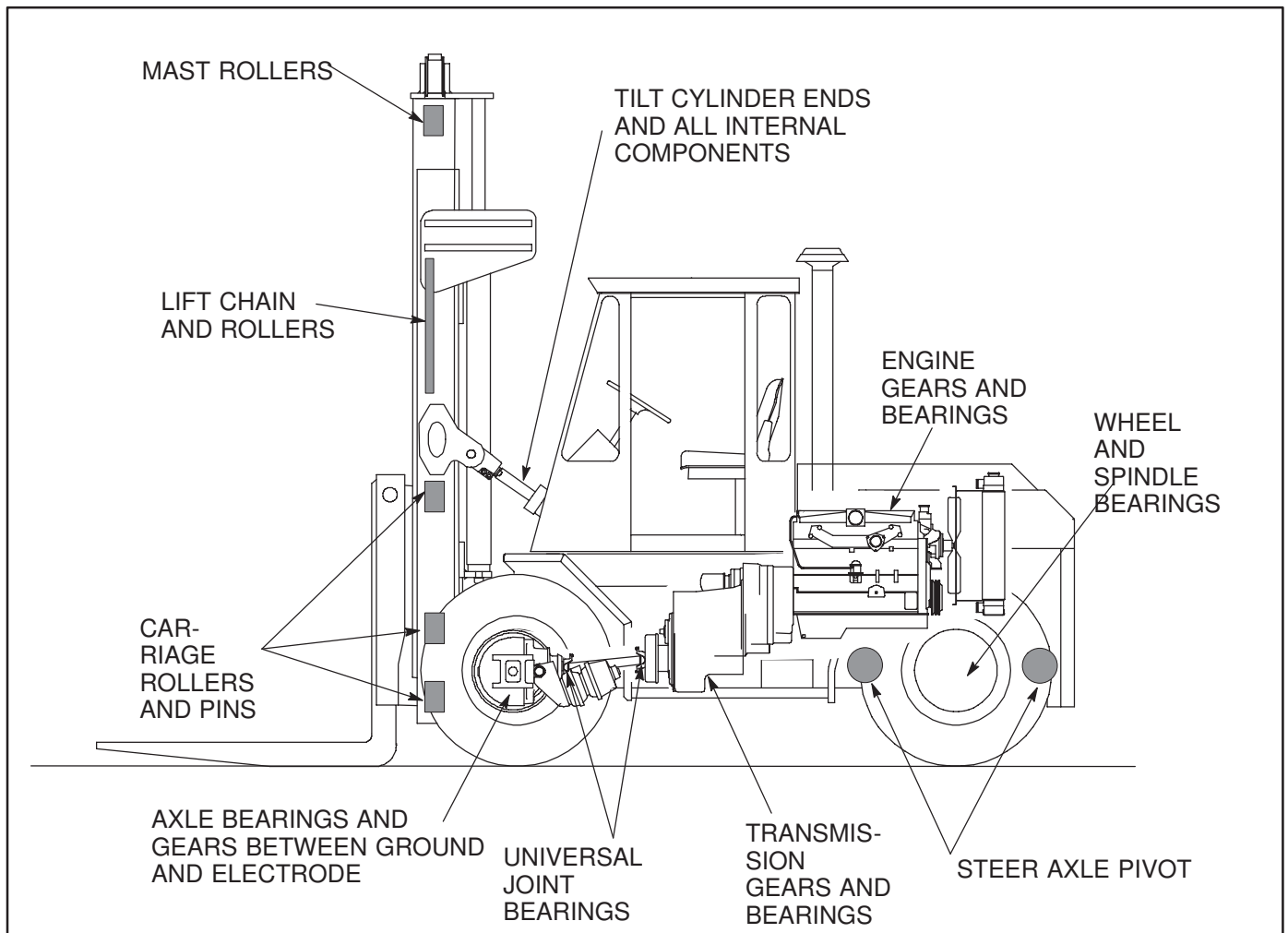
 **CAUTION: Always connect the ground to the part or welded assembly that is to be welded.**

Occasionally parts have failed because of electric arc damage that occurred during welding. This damage (starting the failure), occurred when the

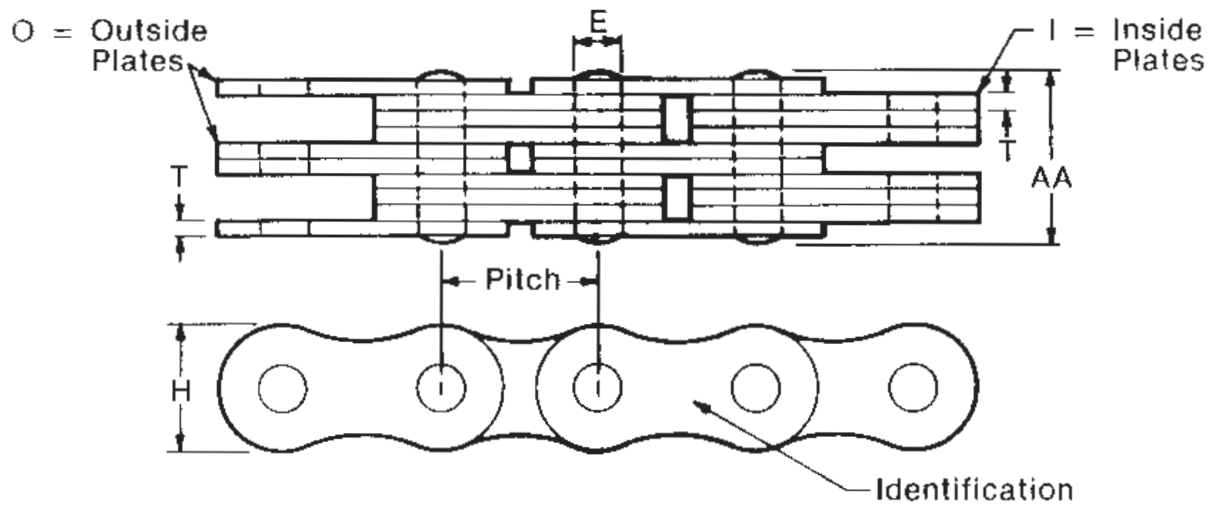
current passed from the electrode through a pin, bearing, cylinder piston, or other moving part, seeking the ground.

Shown below are **some** of the parts on lift trucks subject to damage by the passage of welding current.

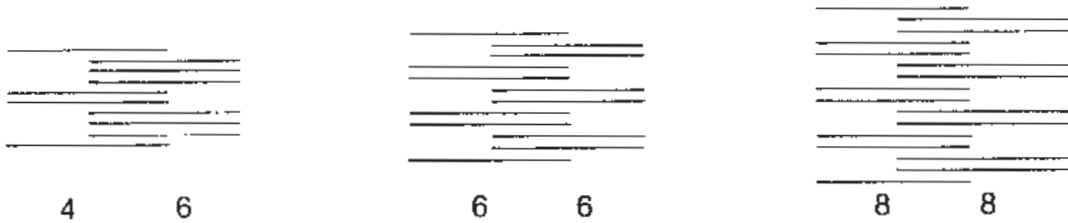
Care and common sense are the best guides to avoid such damage to the components.



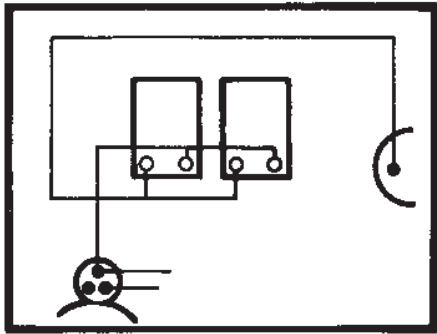
Lift Chain Chart



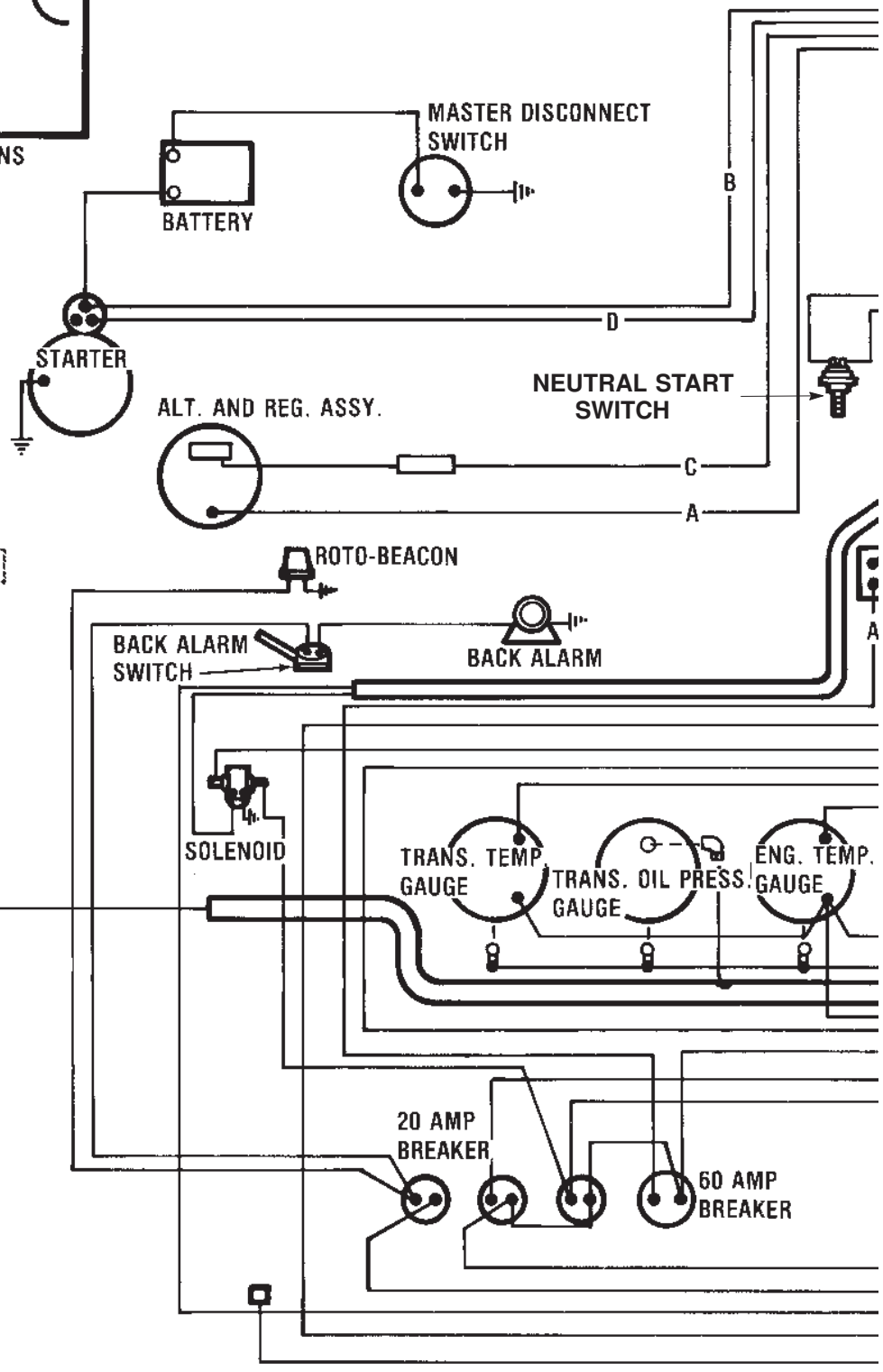
Lacing



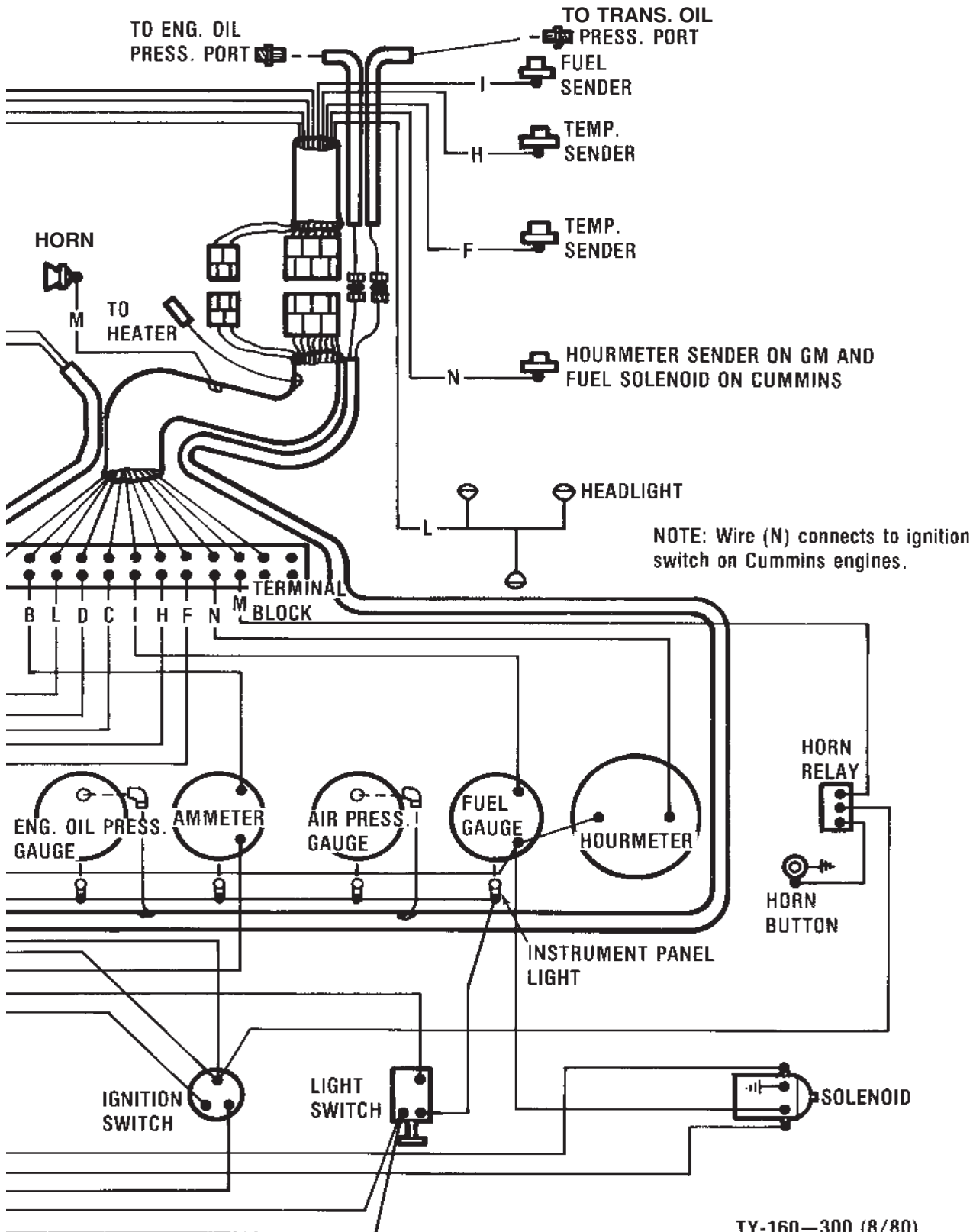
Taylor Part No.	Chain Size	Lacing		Pitch Inches	Ident. Number	AA Overall Width	H Plate Height	T Plate Thickness	E Pin Dia.
		O	I						
3205-020	BL 846	4	6	1	BL 800	1-13/16	61/64	.156	.374
3204	432	6	6	1	None	1-13/16	61/64	.156 O .125 I	.427
3217	AL 1066	6	6	1 1/4	AL 1000	2-9/64	1-1/32	.156	.374
3216	1046	4	6	1 1/4	None	2-9/64	1-5/32	.187	.522
3219-020	AL 1266	6	6	1 1/2	AL 1200	2-35/64	1-7/32	.187	.437
3219-050	AL 1466	6	6	1 3/4	AL 1400	2-63/64	1-7/16	.220	.499
3217-200	AL 1666	6	6	2	AL 1600	3-7/16	1-5/8	.250	.562
3219-070	BL 1666	6	6	2	BL 1600	3-53/64	1-7/8	.281	.687
3219-075	BL 1688	8	8	2	BL 1600	5-1/32	1-7/8	.281	.687
3219-055	2466	6	6	3	None	5	2-13/16	.375	.935

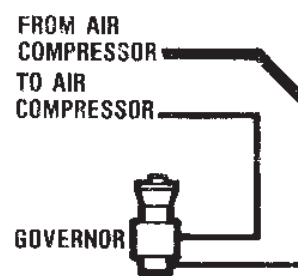
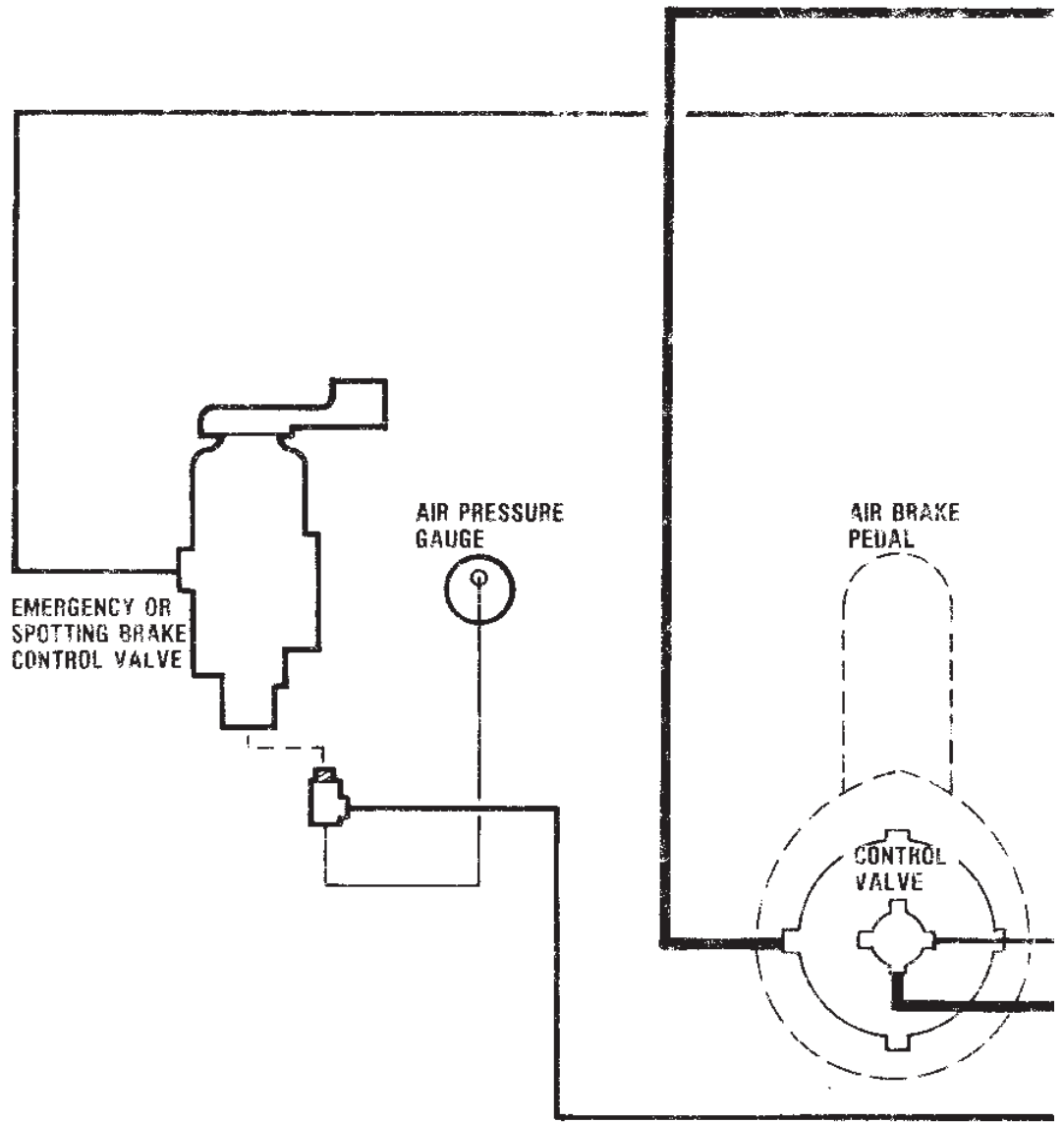


4-53 GM & 504 CUMMINS

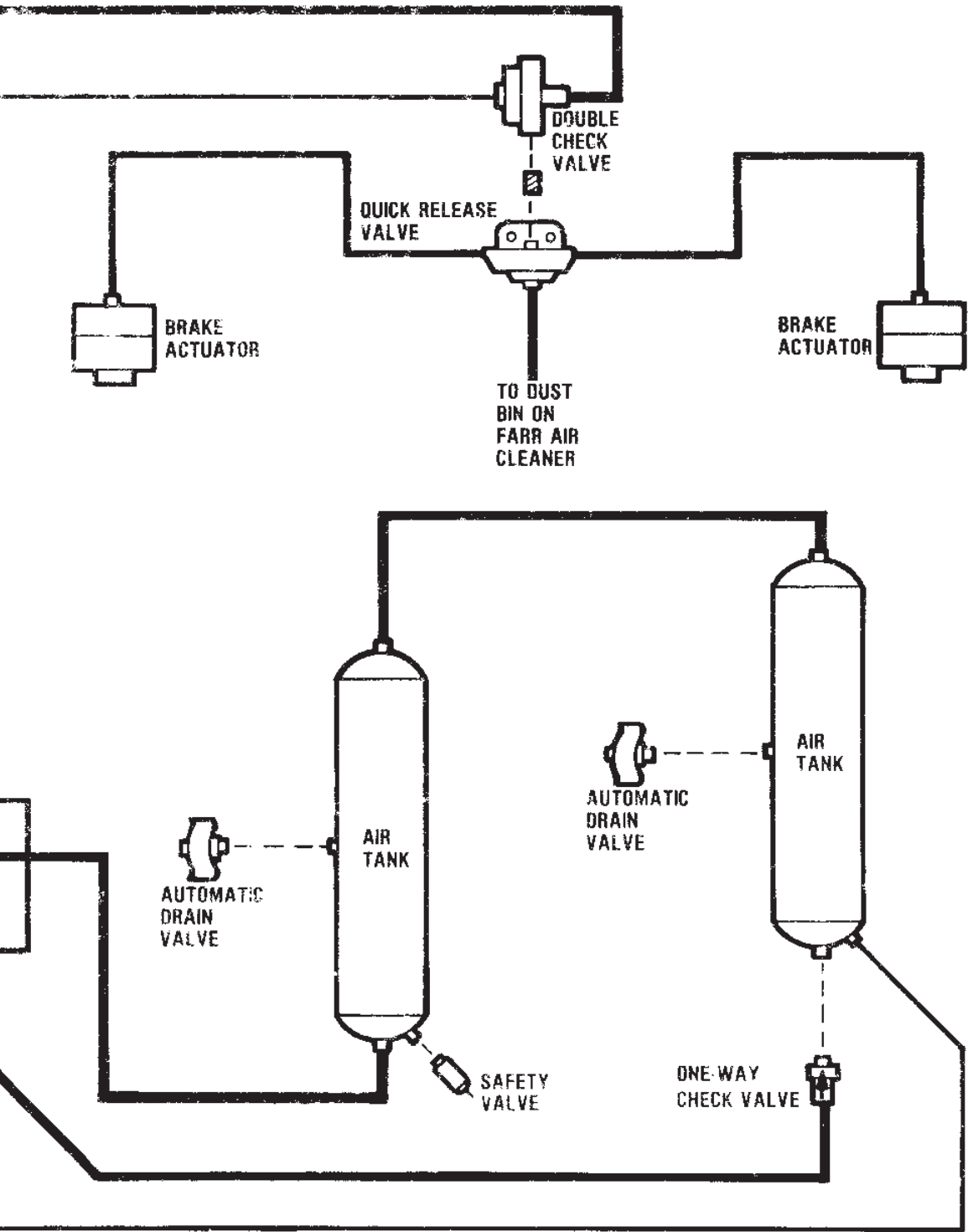


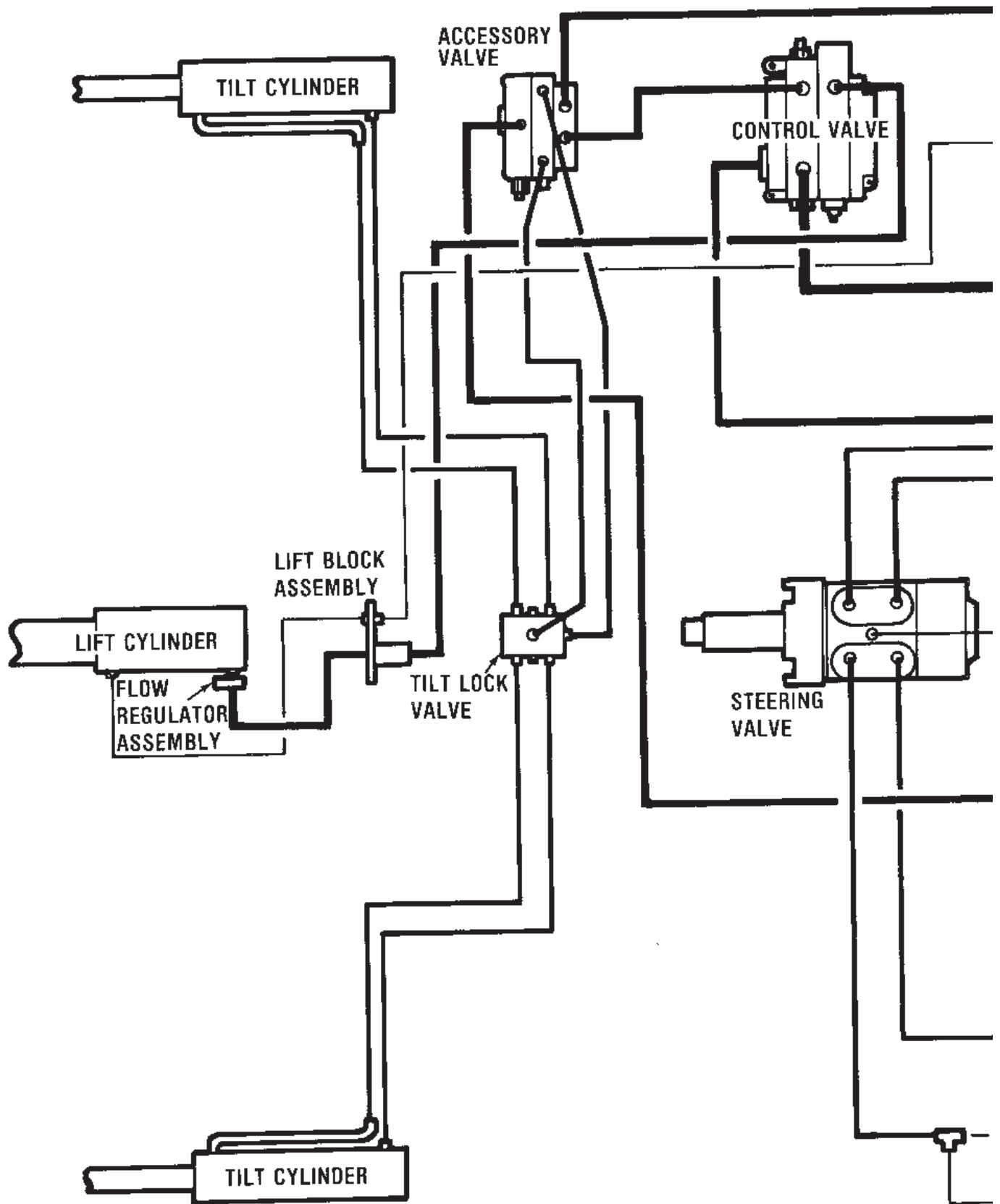
ELECTRICAL AND MECHANICAL GAUGE CIRCUIT GM & CUMMINS



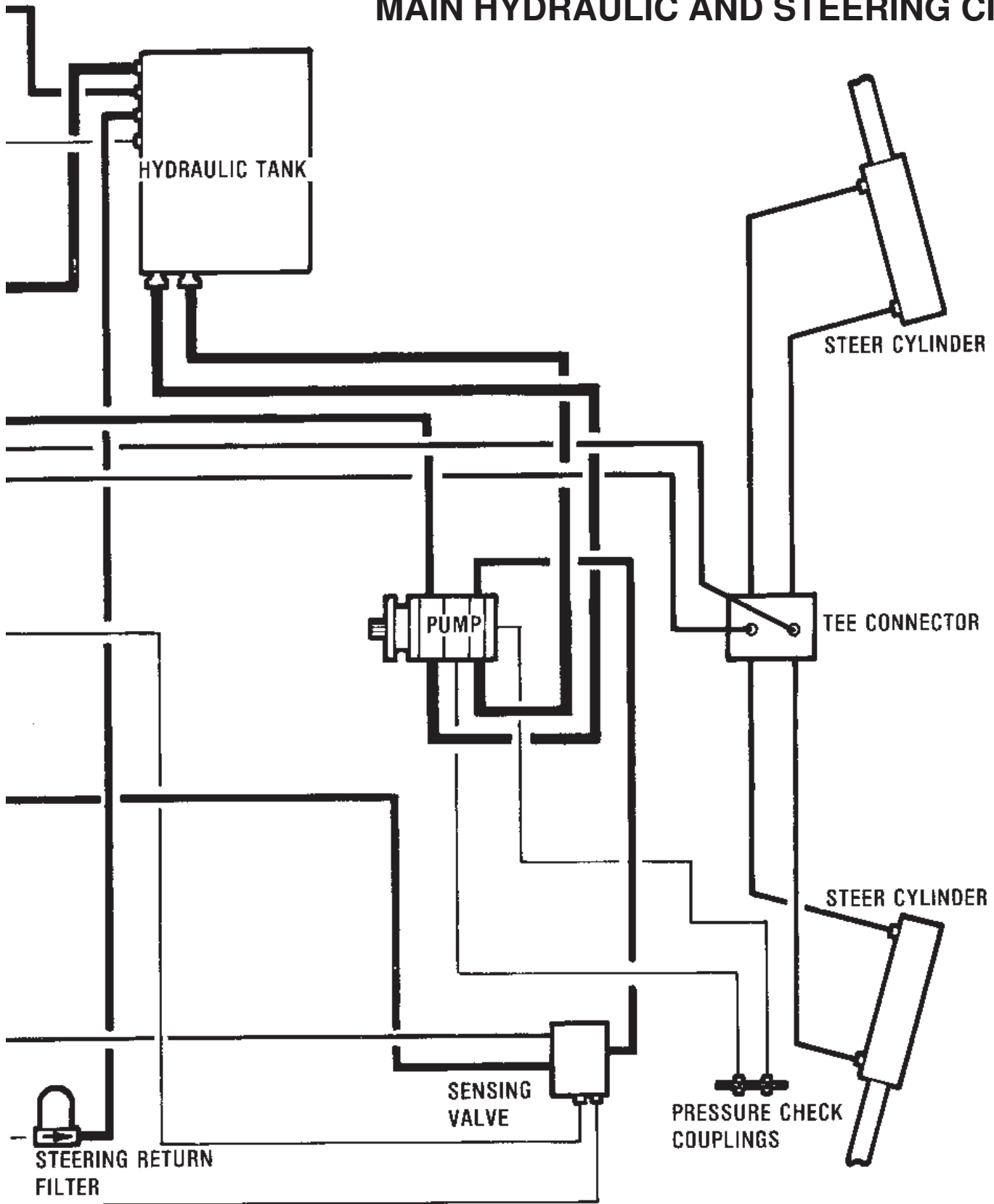


AIR BRAKE CIRCUIT





MAIN HYDRAULIC AND STEERING CIRCUIT



TY-160-300 (8/80)



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