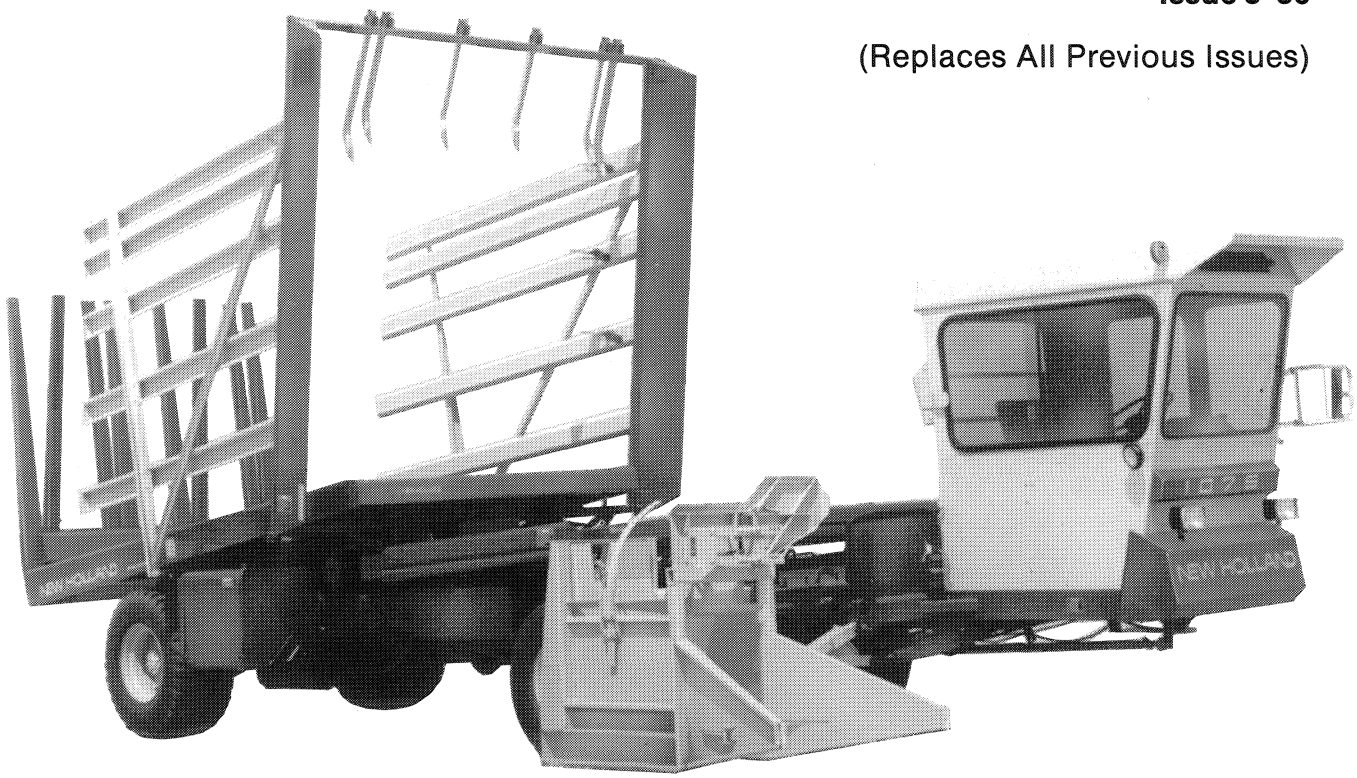
SERVICE MANUAL

Stackcruiser® Self-Propelled Automatic Bale Wagon 1068, 1069 and 1075

Round Bale Wagon 8500

Issue 3-89

(Replaces All Previous Issues)



NEW HOLLAND

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Reprinted

INTRODUCTION

This service manual provides the technical information needed to properly service New Holland self-propelled automatic bale wagons. Use this manual in conjunction with the operator's manual supplied with bale wagon.

This manual details the procedures for removal, disassembly, and reassembly that have been found to be the easiest and least time-consuming. There may be several ways of completing a job, but generally the methods described are best.

On Ford New Holland equipment, left and right are determined by standing behind the unit, looking in the direction of travel.

Certain hardware on self-propelled bale wagons must be tightened to particular torque specifications. If specific torque specifications are not noted, tighten the hardware to the standard torque chart specification listed in this manual.

The descriptions and specifications contained in this manual were in effect at the time the book was released for printing. Ford New Holland, Inc. reserves the right to discontinue models at any time, or to change specifications and design without notice and without incurring obligation.

ACKNOWLEDGEMENTS

Preparation of this manual required assistance and cooperation from many sources. We wish particularly to thank our major suppliers who furnished technical data on their components used on New Holland automatic bale wagons.

York-Division of Borg-Warner Corp.
TRW Ross Gear Division
Bendix - The Bendix Corp.
New Process Gear Corp.
Eaton Corporation, Axle Division
Cessna Fluid Power Division
Gresen Manufacturing Company
Char-Lynn, Eaton Fluid Power

CONTENTS

PRECAUTIONARY STATEMENTS

PERSONAL SAFETY

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

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

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

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

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

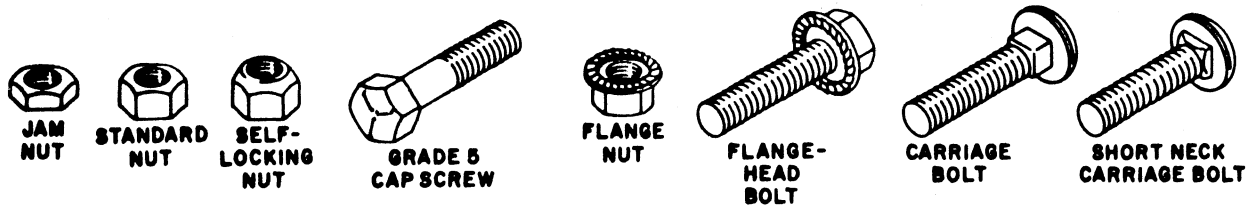
MACHINE SAFETY

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

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

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

HARDWARE KEY



Cap Screw — CS
Carriage Bolt — CB
Short Neck Carriage Bolt — SNCB
Flat Washer — FW
Lock Washer — LW
Lock Nut — LN
Regular Nut — N
Jam Nut — JN

National Fine Thread — N.F.
Grade 5 — GR. 5
Grade 8 — GR. 8
Cotter Pin — CP
Machine Screw — MS
Flange Nut — FN
Flange Head Bolt —FHB

STAINLESS STEEL BOLT
(TORQUE-USE GRADE 5 SPECIFICATIONS)

MINIMUM HARDWARE TIGHTENING TORQUES

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

	GRADE 2 SAE	GRADE 5 SAE		GRADE 8 SAE	
Bolt Size	Unplated or Plated	Unplated	Plated	Unplated	Plated
1/4"	5 (7)	8 (11)	7 (9)	12 (16)	10 (13)
5/16"	10 (13)	18 (24)	15 (20)	26 (35)	21 (28)
3/8"	18 (24)	31 (42)	25 (34)	48 (65)	39 (53)
7/16"	31 (42)	53 (72)	43 (58)	75 (101)	60 (81)
1/2"	45 (61)	82 (111)	66 (89)	115 (155)	92 (124)
5/8"	82 (111)	170 (230)	140 (189)	235 (317)	190 (256)
3/4"	155 (209)	290 (392)	230 (310)	415 (560)	330 (445)
7/8"	165 (223)	430 (580)	340 (459)	600 (810)	480 (648)
1"	250 (337)	640 (864)	510 (688)	900 (1215)	720 (972)

SECTION 1
AIR-CONDITIONER
OPERATION

The air-conditioner pressurizer controls are conveniently located on the air-conditioner and clearly identified. Adjustable louvres provide air flow direction control and air throttling capabilities. The condenser is radiator-mounted using the cooling fan air for cooling.

The air filters are made of specially constructed rubber filter foam and may be cleaned by washing in a mild soap solution. The air filters may be removed, cleaned, and replaced without tools.

The system is provided with a high-low pressure safety switch which will shut off the compressor clutch in the event of a plugged condenser, plugged expansion valve, or the loss of Freon 12, thereby eliminating possible compressor damage.

The sight glass on the receiver-dryer also houses a litmus moisture indicator which changes color when the system becomes wet. This safety device alerts the operator so he may change the receiver-dryer before the water in the system can cause damage.

The moisture content of the air-conditioner system can be determined by examining the color-coded paper on the top of the receiver-dryer. This indicator paper should only be examined immediately after the air-conditioning system has been in operation a minimum of six consecutive hours. Compare the color-coded paper to the code on the label of the receiver-dryer. If the indicator paper indicates a wet system, replace the receiver-dryer and evacuate and recharge the air-conditioning system.

MAINTENANCE

CONDENSER

Clean the condenser-radiator screen with a brush or compressed air whenever dirt or crop residue accumulates. Open the screen and check the condenser and radiator daily. Clean as required by blowing compressed air or water through the cores in the direction opposite to normal air flow.

DRIVE BELT

The compressor drive belt must be retensioned after the first 36 to 40 hours of operation. The belt tension should then be checked after each 100 hours of operation. Belt tension can be accurately determined with a belt tension gauge which gives a direct reading of belt load as determined by the deflection. A belt tension of 100 lbs. (45 kg) is considered normal.

NOTE: The belt should deflect ½" (13 mm) when a 22 lb.-25 lb. (10 kg-11 kg) force is applied at the center of the span.

NOTE: A belt which is too taut may cause damage to the compressor or bearings. Do not overtension the belt.

FILTERS

Clean the outside and return air filters weekly. Remove the filters and wash them in a mild soap solution. Then rinse the filters in clear water and wring them dry.

OIL CHARGE

The compressor oil level must be checked at the time of installation and again after the system has been fully charged with refrigerant and the system has been operated and balanced to the desired compartment interior temperature. The oil level must also be checked prior to putting the system into operation at the beginning of each season.

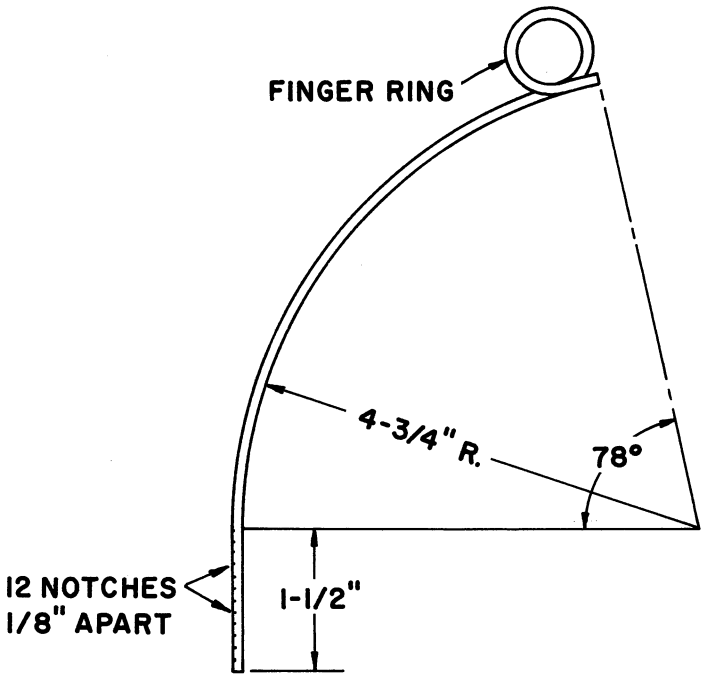


FIGURE 1-1

Remove one oil fill plug with its O ring (either plug on a vertical mount installation, the upper side plug on other than vertical mount installations). The oil dipstick, Figure 1-1, can be made locally and is suitable for use on compressors in any mounting position. It can be formed from ⅛" (3 mm) diameter round stock, 8-5/16" (211 mm) long, and preferably made from nonferrous material which is not subject to corrosion. When checking compressors mounted on a gas engine, check the oil when the shaft key is in the down position. For diesel engine compressor mounts, check the oil when the shaft key is in the up position.

OIL CHARGE VS. DIP STICK DEPTH

OIL CHARGE, OUNCES	6	8	10	12	16
HORIZONTAL MOUNT	13/16"	1"	1-3/16"	1-5/8"	1-15/16"
VERTICAL MOUNT	7/8"	1"	1-1/8"	1-7/16"	1-7/8"

FIGURE 1-2

Figure 1-2 shows the crankcase oil charge in ounces at various dipstick measurements. The oil charge after the system is stabilized should be maintained between 6 ounces (13/16") (21 mm) minimum and 10 ounces (1-3/16") (30 mm) maximum.

When adding or changing oil, use only SUNISO No. 5, Texaco Capella "E", or equal 500 viscosity oil. Keep the oil storage containers tightly capped at all times because refrigerant oil will absorb moisture from the atmosphere and contaminate the system.

Turn the valve stem all the way forward (clockwise) to shut off the connecting line. This is "front seating." Turn the valve stem all the way backward (counterclockwise) to shut off the gauge port and allow connection of the service line (hose) to the gauge port. This is "back seating." In normal operation, the valve stem is "back seated" to allow full flow through the valve.

PROCEDURE FOR CHECKING COMPRESSOR OIL LEVEL

To check the oil level, the system should be in operation and the compressor crankcase warm. With the service gauges connected to the compressor service valve ports, Figure 1-3, the suction service valve is slowly closed until the suction pressure gauge reads "0" or a little below. Stop the engine at this point and quickly close the suction service valve the rest of the way when the suction gauge reads a little above "0." Close the discharge service valve. The suction service valve must be closed slowly when pumping down the system because an abnormal amount of oil may leave the compressor due to the sudden pressure reduction on the refrigerant saturated oil in the compressor crankcase.

COMPRESSOR SERVICE VALVES AND CONNECTIONS

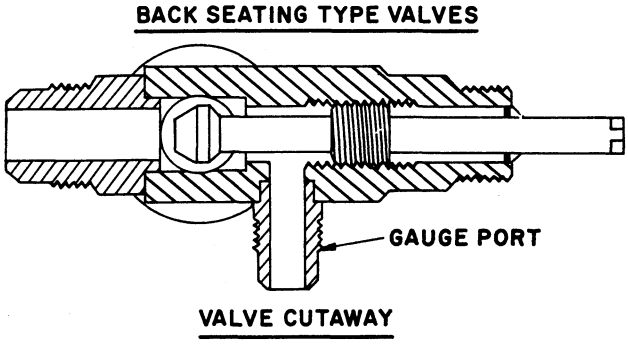


FIGURE 1-3

After both service valves are closed, the suction pressure will slowly rise to about 5 PSI (0.3 bar) gauge pressure. The remaining pressure in the compressor is then relieved by unscrewing the oil check-fill plug five full turns and bleeding off the pressure until the gauge reads "0." Remove the oil check-fill plug and O ring and determine the oil level.

If oil must be added, the oil level should not exceed 10 ounces because an excessive amount of oil is detrimental to the proper functioning of the entire system.

When inserting the oil check-fill plug, the sealing O ring is slipped over the oil fill plug threads so the O ring is not twisted. Insert the oil plug in the oil fill opening and tighten the plug to 30 in. lbs. (3.4 N·m) torque.

RECEIVER-DRYER

At the beginning of each season, check the receiver-dryer for a wet system and check the sight glass to determine if the system is full of Freon 12.

If the litmus moisture indicator, Figure 1-4, on top of the receiver-dryer indicates that the system is wet, drain the system, replace the receiver-dryer with a new unit, and recharge the system with Freon 12. (Refer to "Repair and Replacement" for the charging procedure.)

If gas bubbles can be seen in the sight glass on the top of the receiver-dryer when the compressor is running, the system is low on Freon 12. Add Freon 12 while the air-conditioner is in operation until the bubbles disappear and then add ¼ lb. (0.1 kg) more Freon 12 after the bubbles have disappeared. The system is now fully charged.

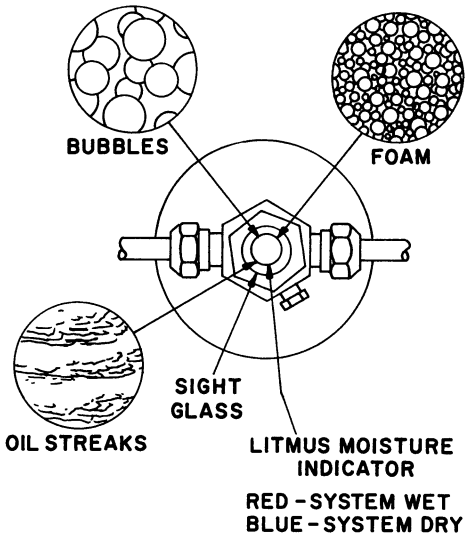


FIGURE 1-4

REPAIR AND REPLACEMENT

DRIVE BELT

To remove the compressor drive belt, slacken the tension on the fan drive belt, remove the hydraulic pump and the compressor, and remove the damaged or worn belt.

To remove the hydraulic pump, unscrew the three 5/16" cap screws which attach the pump drive coupling to the engine balancer pulley. The pump may then be pulled toward the front of the machine without disconnecting the hydraulic lines. The 5/16" cap screws are captive and will not fall out of the coupling.

To remove the compressor, remove the tension arm adjusting cap screw and the single ½" bolt at the end of the compressor mount pivot shaft and pull the compressor toward the front of the machine.

Replace the compressor drive belt by pulling it over the engine drive sheave and then reinstall the compressor and mount on its pivot. Tension the compressor drive belt to 100 lbs. (45 kg).

NOTE: The belt should deflect ½" (13 mm) when 22 lbs.-25 lbs. (10 kg-11 kg) force is applied at the center of the span. Install the compressor pivot mount retaining cap screw.

Replace the hydraulic pump and draw the coupling into the crankshaft pulley with the three 5/16" cap screws. Torque the three 5/16" cap screws to 15 ft. lbs. (20 N·m) and retension the fan drive belt.

CLUTCH

To remove the clutch, first remove the compressor clutch assembly from the machine (refer to section on compressor replacement). Remove the 5/16" cap screw which retains the sheave assembly on the compressor. Use a gear puller and remove the sheave assembly. Remove the four cap screws which hold the clutch field assembly on the compressor body and remove the assembly.

To replace the clutch, first install the clutch field assembly on the compressor with the electrical lead wire toward the head of the compressor. Use the four new self-locking cap screws which are supplied with the clutch assembly. Torque the cap screws to 8 ft. lbs. (11 N·m).

Seat the woodruff key in the compressor crankshaft. The top of the key must be parallel to the shaft taper. Install the sheave assembly on the compressor crankshaft, using the 5/16" nylock cap screw and flat washer supplied. Torque the 5/16" cap screw to 25 ft. lbs. (34 N·m).

COMPRESSOR

NOTE: Shaft seals depend on oil for sealing; it is normal to find oil in the shaft seal cavity. Do not replace a seal or compressor until the unit has been allowed to run in.

The allowable Freon 12 leakage rate for this compressor is one ounce per year. Be sure the leak detection equipment is calibrated to allow for this leakage. Use extreme care in handling and hookup to insure that no dirt or foreign materials enter the compressor.

NOTE: Apply compressor oil to all fittings, O rings, mating flanges, and gaskets of the air-conditioner Freon system prior to their assembly into the unit.

To remove the compressor-clutch assembly, close both rotalock valves by turning them clockwise until they seat. This prevents the loss of Freon 12 from the remainder of the system. After the valves have been firmly closed, remove the valves with the hoses attached from the head of the compressor. (Use care as there will be a small amount of Freon 12 gas trapped in the compressor cylinders which will escape when the valves are removed.) Next, loosen the tension on the compressor drive belt, remove the four 3/8" cap screws which attach the compressor to its mounting plate and remove the compressor clutch assembly from the machine.

Check the replacement compressor's oil charge (see Figures 1-1 and 1-2). The compressor should have no less than 6 ounces (170 gr.) or more than 10 ounces (284 gr.) of oil. Mount the compressor on the compressor mounting plate. Start the four 3/8" cap screws through the mounting plate into the compressor block. Align the V-belt sheaves and tighten the four 3/8" cap screws to 10 ft. lbs. (14 N·m) torque. Install the compressor drive belt and tension to 100 lbs. (45 kg).

NOTE: The belt should deflect 1/2" (13 mm) when a 22 lb.-25 lb. (10 kg-11 kg) force is applied at the center of the span.

Install new O ring gaskets in the compressor head and assemble rotalock valves and compressor. Be sure the large #12 hose is connected to the suction port on the compressor head. Open the system by turning both rotalock valves counterclockwise until they backseat. Start the engine and turn on the air-conditioner. Check the sight glass to see if the system is full of Freon 12. If the system is low, add Freon.

CHECK FILL PLUG

If the oil check-fill plug leaks, do not attempt to stop the leak by overtightening the plug. The leak may be caused by dirt under the O ring, a fractured O ring, or a damaged seat on the fill plug or oil fill opening. To stop the leak at the check-fill plug, correct the mechanical damage and insert a new O ring. Torque the plug to 30 in. lbs. (3.4 N·m).

RECEIVER-DRYER

To remove the dryer, remove the cap on the suction service valve and turn the valve on. Turn the valve clockwise to bleed the Freon from the system. Remove the high-low pressure switch and the two hoses from the dryer. Remove the dryer from its bracket.

To replace the dryer, install the unit in its mounting bracket. Remove the plugs and attach the hoses, making sure the outport is connected to the hose which goes to the evaporator. Remove the screw-in plug and install the high-low pressure switch.

NOTE: Do not open the receiver-dryer to the atmosphere until the unit is ready for final hook up.

Charge the air-conditioning system as follows:

AIR CONDITIONER - FREON R12 CHARGING PROCEDURE

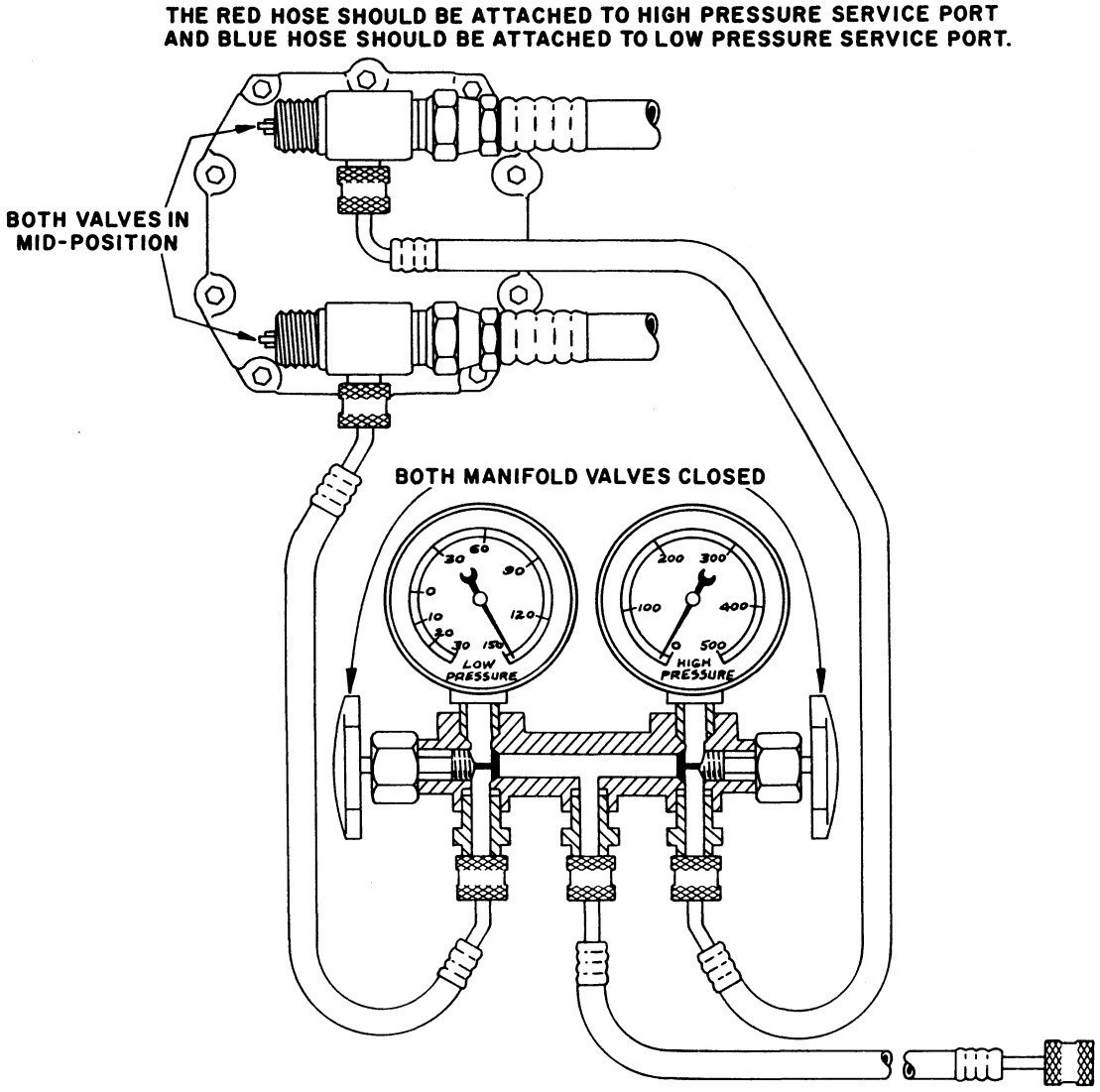


FIGURE 1-5

IMPORTANT: Compressors are designed and furnished for use with refrigerant-12 only. The use of any other refrigerant will void the warranty.

NOTE: Any foreign material such as water or dust will adversely affect the performance of the air-conditioning system. Cleanliness must be observed at all times. Clean and dry the fittings before making any connections.

EVACUATING THE SYSTEM

Evacuate the system with a vacuum pump to remove all air until a vacuum is created. This removes the moisture-laden air that has entered the system and components. The moisture in the system's air reacts with the refrigerant to form hydrochloric acid which will damage and contaminate the system.

A suitable vacuum pump that will pull the system down to 28"-29½" (711 mm-749 mm) HG (mercury) is required. This level of vacuum will only be reached at sea level, and for each 1000 ft. (300 km) of altitude will be 1" (25 mm) less of HG.

To evacuate the system:

1. Remove the cover caps on the compressor service valves.
2. Connect the manifold lines to the valves (Figure 1-5):
   a. Red to high side marked "Discharge" on head of compressor.
   b. Blue to low side marked "S" suction on head of compressor.

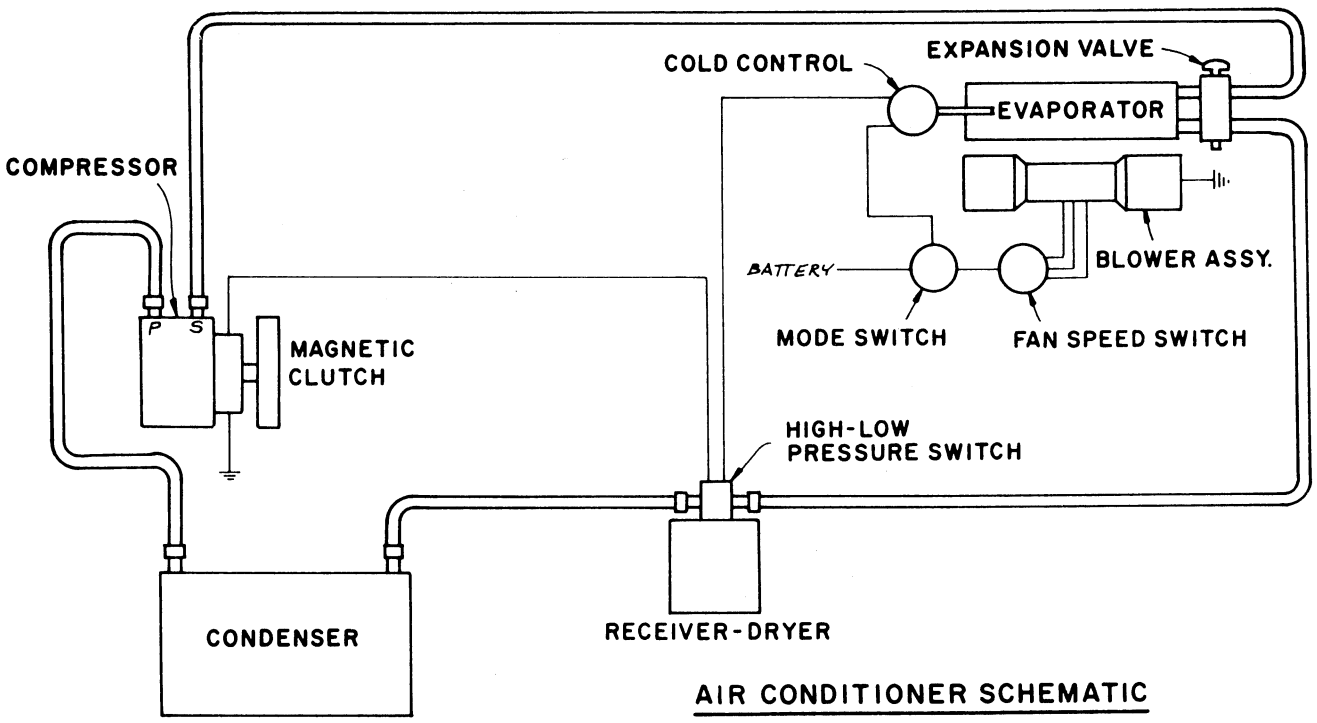


FIGURE 1-6

3. Open the high side (red) valves on the gauge manifold (several turns).
4. Centerseat (2 to 3 turns) both high and low service valves on the compressor.
5. Close the inline hand valve to the charging cylinder.
6. Open the inline hand valve to the vacuum pump.
7. Start the vacuum pump.
   a. Open the vented exhaust on the vacuum pump one complete turn.
   b. Evacuate until maximum vacuum is attained. The low pressure gauge on the manifold will read between 25" and 30" (635 mm and 762 mm) of mercury.
   c. Check the vacuum for a major leak in the system by closing both valves on the manifold gauge and observing the vacuum on the blue gauge which should hold constant for 3 to 5 minutes. Vacuum drop indicates a leak which must be located and corrected.
   d. Close the vented exhaust on the vacuum pump and continue evacuation for 15 minutes by opening both valves on the gauge manifold.

CHARGING SYSTEM USING 15-OUNCE CONTAINERS

WARNING: FOLLOW THESE SAFETY PRECAUTIONS WHEN HANDLING REFRIGERANT AND WORKING WITH THE SYSTEM.

1. **REFRIGERANT-12 (ABBREVIATED R-12) IS NONTOXIC, NONCORROSIVE, NONIRRITATING, AND NONFLAMMABLE IN ITS NORMAL STATE. HOWEVER, IT BECOMES VERY TOXIC WHEN EXPOSED TO AN OPEN FLAME.**

   WHEN LEAK TESTING WITH A PROPANE GAS TORCH, WORK IN A WELL VENTILATED AREA. PHOSGENE GAS IS FORMED WHEN REFRIGERANT-12 COMES IN CONTACT WITH THE TORCH FLAME. THIS IS VERY POISONOUS AND CAN BE DANGEROUS IF INHALED.

2. **ALWAYS WEAR SAFETY GOGGLES WHEN HANDLING REFRIGERANT, AS YOUR EYEBALL MAY BE FROZEN IF STRUCK BY LIQUID REFRIGERANT.**

3. **DO NOT ALLOW LIQUID REFRIGERANT TO STRIKE YOUR SKIN AS FROSTBITE MAY OCCUR. OBSERVE CARE WHEN HANDLING CONTAINERS OR OPENING LINE CONNECTIONS.**

   USE CAUTION WHEN DISCONNECTING CHARGING HOSES TO AVOID REFRIGERANT CONTACT WITH YOUR SKIN.

4. **NEVER HEAT REFRIGERANT CONTAINERS OVER 125°F (52°C) TO AVOID RISK OF BURSTING. NEVER APPLY A DIRECT FLAME OR USE AN ELECTRICAL HEATER NEAR (OR IN DIRECT CONTACT WITH) THE CONTAINER FOR THE SAME REASON.**

The system can be charged with refrigerant only after it has been evacuated and leak tested. Add only the specified quantity of refrigerant. Charging can be done using 15-ounce (425 gr.) containers or using a charging station.

1. Install the refrigerant dispensing valve on the container. Close the shutoff valve on the dispensing valve, and pierce the can with the control provided on the dispensing valve.
2. Install the charging hose on the dispensing valve, and loosen the charging hose connection to center the connector on the gauge manifold. Crack open the dispensing valve to purge air from the hose. Retighten the hose connection and close the dispensing valve.
3. Start the engine and set the throttle in the intermediate position. Adjust the air-conditioning temperature control to maximum cooling (fully clockwise). Set the blower switch to the maximum position (left position).
4. Open the low side valve on the manifold gauge to allow the refrigerant into the system.

   IMPORTANT: Make sure the refrigerant enters the system as a vapor. Liquid refrigerant entering the system can damage internal parts. Regulate the low side valve so low side pressure does not exceed 40 PSI (3 bar). This will insure the refrigerant vaporizes before entering the compressor.

   IMPORTANT: If ambient temperature is below 80°F (27°C), warm the refrigerant cans to help vaporize the refrigerant. Do not warm the cans over 125°F (52°C).

5. Watch the sight glass on the receiver-dryer until the bubbles disappear. Continue to add refrigerant until this happens. When bubbles disappear, add an extra ¼ lb. (0.1 kg) of refrigerant to the system.
6. Close the low side valve on the manifold gauge, and remove the hose from the manifold gauge having the shutoff valve on the dispenser. Back seat the service valves and remove the gauge set. Replace the caps on the service valve fittings.

LABOR GUIDE

The following labor amounts are listed as a guide only. Working conditions and experience will vary the time it actually takes to complete each job.

Job	Man-Hours
Remove and replace the compressor drive belt	0.5
Remove and replace the compressor clutch	0.25
Remove and replace the compressor assembly	0.5
Recharge the system with Freon R-12	2.0
Remove and replace the air-conditioning pressurizer controls and blower	1.0
Remove and replace the receiver-dryer and expansion valve	2.5

SECTION 2
POWER STEERING GEAR
DESIGN

The Ross Hydrapower™ unit is a fully integral steering gear incorporating a hydraulic control valve, a power cylinder, and a mechanical means of steering control.

The power of the cylinder is transmitted to the steering gear output shaft by gear teeth on the rack piston mating with the sector gear on the output shaft. The flow of oil from the engine-driven pump is directed to the power cylinder via the control valve. The valve is concentric with the input shaft.

OPERATION

The action of the steering gear is both manual and hydraulic in effect. When the input shaft is turned by the driver's effort on the steering wheel, the piston is moved by the interaction of balls spaced between an external groove on the shaft and an internal groove inside the "rack piston." Whenever the driver's effort at the steering wheel exceeds the force of the centering springs and the "hydraulic reaction" provided by the control valve, the valve is actuated and the power of the system is applied to provide the driver with power steering.

Power steering control valves, Figure 2-1, generally utilize the hydraulic pressure in the steering system to move the valve spool to its neutral position. This is called "hydraulic reaction." As the pressure in the hydraulic cylinder builds up, the hydraulic centering force increases. Thus, the driver's effort on the steering wheel in turning a corner is greater than for a straight-ahead road correction. Because the hydraulic pressure is low in the straight-ahead driving, it is necessary to add centering springs to assist the valve's hydraulic reaction in giving the system "road feel." The feel and steering effort created by the centering springs is constant for any steering condition.

When the valve is in the center position, the oil pressure at its two cylinder ports is low and equal and produces ineffective forces in the cylinder. This results in no movement of the piston and no circulation of oil in the lines to the cylinder. However, oil is circulating from the pump through the control valve to the reservoir with sufficient pressure only to overcome friction of lines and fittings.

Whenever the driver's effort at the steering wheel overcomes the valve centering springs and hydraulic reaction, the valve spool is moved axially restricting one of the return passages to the outlet port. This causes an immediate increase in pressure at one of the cylinder ports and in one end of the cylinder. At the same time, the other return passage is enlarged, allowing the oil from the discharging end of the cylinder free passage to the outlet port and return to the reservoir. The immediate effect is increased pressure in one end of the cylinder to actuate the piston, thereby applying hydraulic power directly to the steering gear pitman arm. The slightest movement of the valve spool from the center position results in a pressure differential at the valve ports, see Figure 2-1.

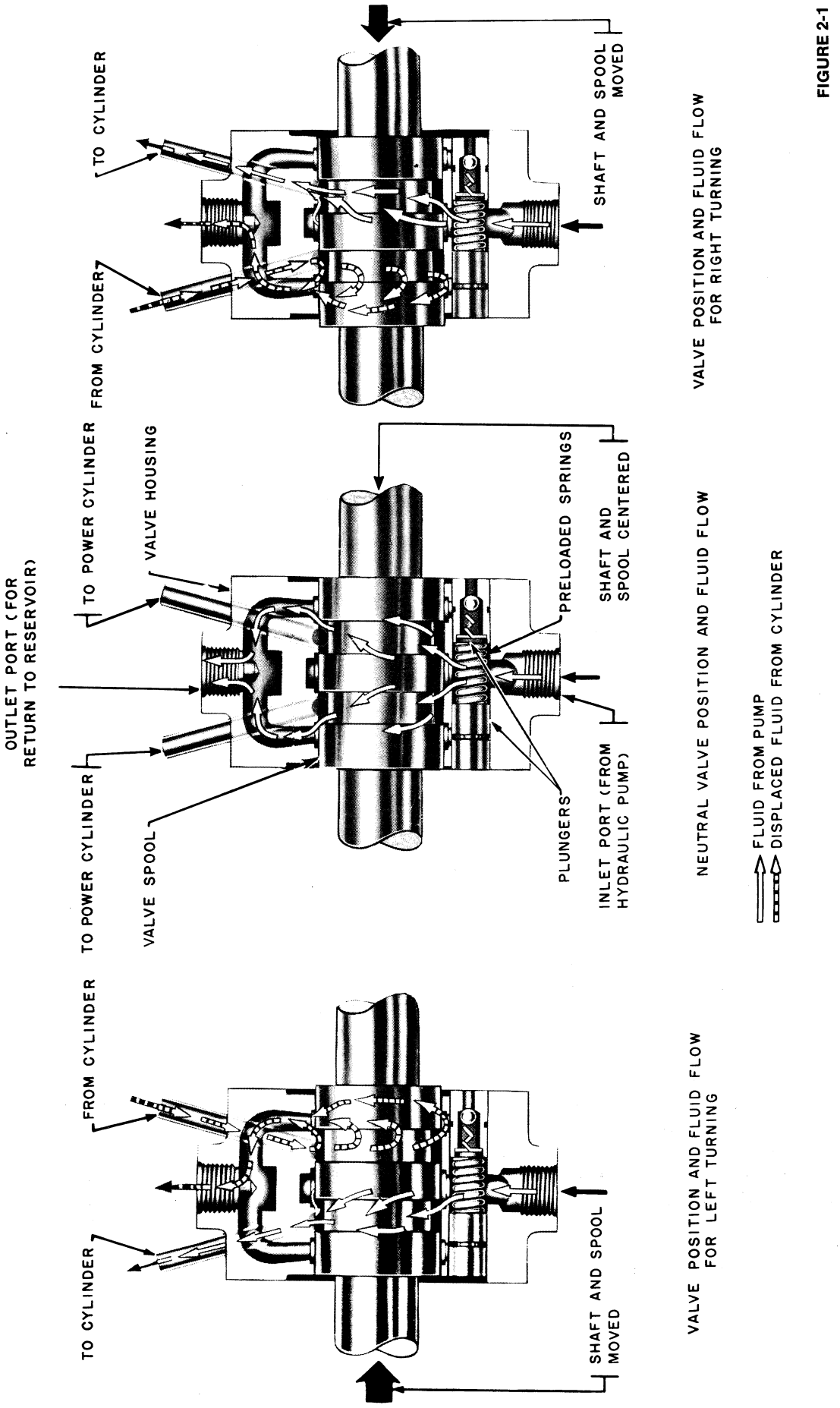

TO CYLINDER
FROM CYLINDER
SHAFT AND SPOOL MOVED
VALVE POSITION AND FLUID FLOW FOR RIGHT TURNING
OUTLET PORT (FOR RETURN TO RESERVOIR)
TO POWER CYLINDER
VALVE HOUSING
PRELOADED SPRINGS
SHAFT AND SPOOL CENTERED
TO POWER CYLINDER
VALVE SPOOL
PLUNGERS
INLET PORT (FROM HYDRAULIC PUMP)
NEUTRAL VALVE POSITION AND FLUID FLOW
FLUID FROM PUMP
DISPLACED FLUID FROM CYLINDER
FROM CYLINDER
TO CYLINDER
SHAFT AND SPOOL MOVED
VALVE POSITION AND FLUID FLOW FOR LEFT TURNING

FIGURE 2-1

NOTE: To assist in the elimination of pump heat, the power cylinder has an unloading (or poppet) valve incorporated in the rack piston so the pressure may be reduced at each end of the piston stroke. An adjusting screw is provided to enable the pressure relieving point to be varied slightly in one direction.

Whenever the effort at the steering wheel is released, the valve spool is returned to the center position.

If the steering wheels are subjected to shock loads, the pitman arm, acting through the inner parts of the gear, shifts the input shaft worm and control valve spool axially in the appropriate direction. This directs the fluid to the proper side of the piston to resist the shock forces. This "blocking action" prevents kickbacks at the steering wheel.

WARNING: ALL STEERING MECHANISMS ARE LIFE AND LIMB ITEMS. AS SUCH, IT IS IMPERATIVE THAT THE INSTRUCTIONS IN THIS MANUAL ARE FOLLOWED EXACTLY. FAILURE TO OBSERVE THE PROCEDURES DETAILED IN THIS MANUAL MAY RESULT IN LOSS OF STEERING AND CONTROL OF THE BALE WAGON.

SPECIFICATIONS

Oil flow required to satisfactorily operate the steering gear is 2 GPM-2.5 GPM (7.6 L/min.-9.5 L/min.). This results in a steering speed in excess of 1.5 wheel turns per second. A flow divider spool in the back plate of the hydraulic pump maintains the oil flow to the desired amount.

NOTE: Excessive oil flow may cause an oil heating problem and other undesirable effects. A pressure relief valve is incorporated in the hydraulic pump (priority-power steering circuit) and is set at 1500 PSI (100 bar) (maximum pressure).

The power steering gear receives its oil from the hydraulic pump connected to the engine crankshaft. A flow divider on the pump insures a constant oil flow of 2.5 GPM (9.5 L/min) to the power steering. The pump flow divider contains a built-in relief valve set at 1500 PSI (100 bar) which regulates the pressure of the steering oil circuit. Check the pressure by installing a tee in the line from the pump to the steering gear and attaching a 3000 PSI (200 bar) gauge. Block the front wheels in the center position by inserting a wood block between a tire and the frame or suspension spring. With the engine running at one-half to full speed, turn the steering wheel to cause the relief valve in the pump to bypass.

NOTE: The relief valve setting cannot be checked if the wheels are allowed to turn against the spindle stops, due to the characteristics of the steering gear.

Adjust the relief valve in the pump by removing the small hex plug on the front plate and adding or removing #511543 shim washers between the plug and the relief valve spring. Adding washers increases the pressure. Add or remove only one washer at a time, then recheck as previously detailed.

PRELIMINARY STEERING GEAR CHECKS

VERIFYING THE PROBLEM

When a customer reports a problem, pinpoint the problem by asking the customer to describe the symptoms. If hard steering is mentioned, check to determine if the steering is hard when making a left or a right turn. Or, it may be hard to steer when turning the steering wheel while the machine is stationary.

If possible, test-drive the bale wagon. As most of the driving will be done with a loaded wagon, try to test the wagon when it is loaded. This may be necessary to produce the symptoms described by the customer.

After the symptoms have been verified, do not immediately begin to disassemble the steering gear. The following items must be checked first:

1. Tire pressure. Be sure the pressure is correct and equal in all tires.
2. Misaligned front end. Check the tires for abnormal wear. Check the steering linkage for excessive looseness.
3. Slip joint on steering. Be sure it is free and well-lubricated. A tight slip joint can cause many steering problems.
4. Reroute any hoses that are kinked or have sharp bends. Replace any hoses which are not the same as the original equipment.
5. Check the hydraulic pump reservoir to make sure the oil is at the correct level.

These are just a few of the checks to make before working on the pump or the steering gear. A troubleshooting chart is included in this section. Match the symptom against the chart and follow the suggested checking sequence. This will save time and may prevent unnecessary repairs.

In the hydraulic system, the cause of many power steering problems can be traced to lack of pressure or insufficient flow. Restricted hydraulic lines, loose fittings, and plugged filters should be checked first. If these items are satisfactory, then more detailed troubleshooting is required.

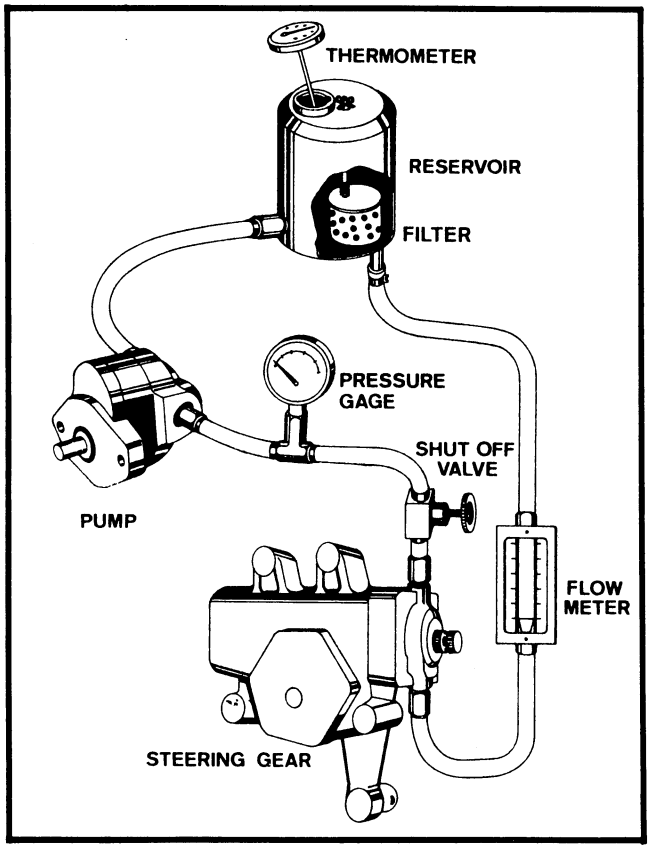


FIGURE 2-2

PREPARATION FOR HYDRAULIC TESTS

Install a pressure gauge and a shutoff valve in the line from the pump outlet to the gear inlet. Install a flowmeter in the line from the gear outlet to the reservoir and a thermometer in the reservoir, Figure 2-2.

With the shutoff valve open, start the engine and steer the bale wagon lock-to-lock several times to heat the system. Fluid temperature as shown by the thermometer in the reservoir should be approximately 130° F (54° C) for the tests.

HYDRAULIC PUMP PRESSURE TEST (Priority Circuit)

With the engine running at 1200 RPM-1300 RPM, close the shutoff valve and read the pressure gauge. If the pressure is below the minimum specified, repair or replace the pump.

IMPORTANT: Do not keep the shutoff valve closed for longer than five seconds to avoid damage to the pump. Closing the shutoff valve causes the pump to operate at relief pressure and the fluid temperature will increase significantly. Allow the fluid to cool to approximately 130° F (54° C) before continuing the tests.

HYDRAULIC PUMP FLOW TEST

With the engine running at idle speed and fluid temperature at approximately 130° F (54° C), slowly close the shutoff valve until the pressure gauge reads about 1000 PSI (69 bar). Read and record the flow rate shown by the flowmeter. This value will be used later.

Open the shutoff valve and, if necessary, allow the fluid to cool to 130° F (54° C). Increase the engine speed to 1200 RPM-1300 RPM; read and record the flow rate shown by the flowmeter. Now slowly close the shutoff valve until the pressure gauge reads about 1000 PSI (69 bar). Read and record the flow rate shown by the flowmeter. The second flowmeter reading should be no more than 20% less than the first flowmeter reading.

STEERING GEAR INTERNAL LEAKAGE TEST

To check the internal leakage in the gear, it is necessary to prevent operation of the gear's internal unloading valves (poppets) so full system pressure can be developed. To do this, place a 1" (25 mm) square x 6" (152 mm) long steel spacer block between the axle stops, first at one wheel and then at the other as shown in Figure 2-3.

With the fluid temperature at approximately 130° F (54° C), turn the steering wheel until the linkage bottoms on axle stops on the spacer block. Apply at least 20 lbs. (9 kg) to the rim of the wheel during this test to be sure the steering gear control valve is closed. The pressure gauge should now read the system relief pressure as noted during the pump pressure test, and the steering gear internal leakage can be read on the flowmeter.

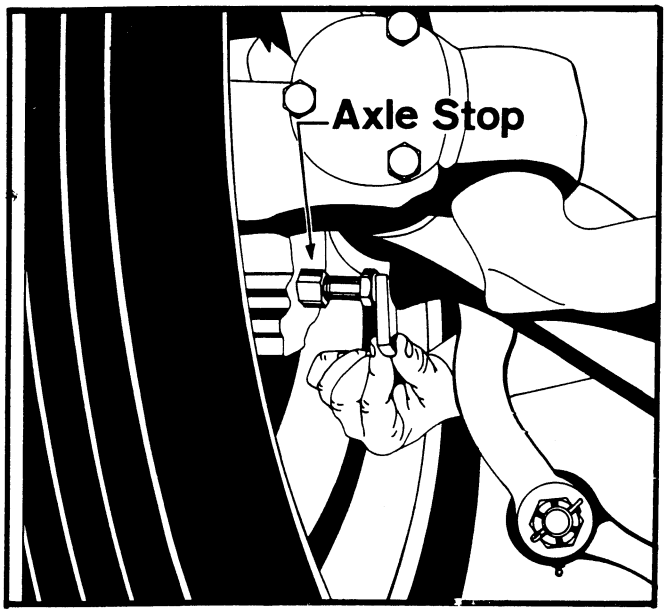


FIGURE 2-3

If the steering gear leakage is greater than 1.5 GPM (6 L/min), repair the gear.

When running the internal leakage test, do not hold the steering wheel in the maximum turn position longer than 5 to 10 seconds at a time to avoid damage to the pump.

Care must be taken in interpreting the flowmeter readings in the very low flow ranges required to check internal leakage. Some flow measuring devices may not be accurate under these conditions.

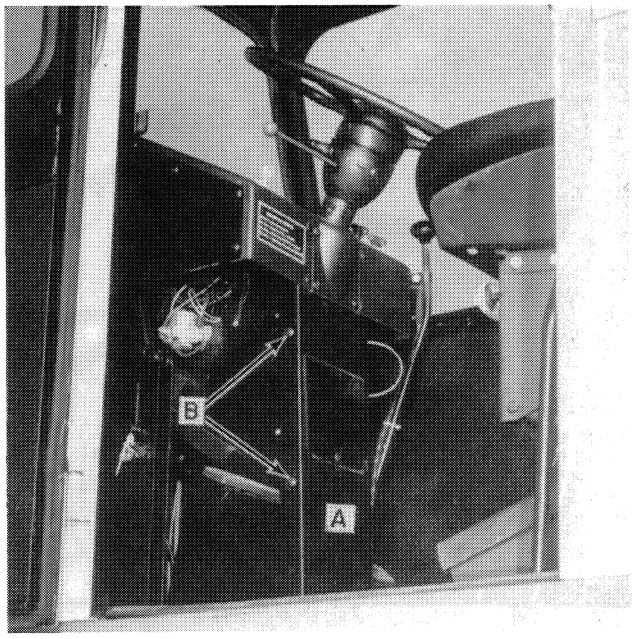


FIGURE 2-4

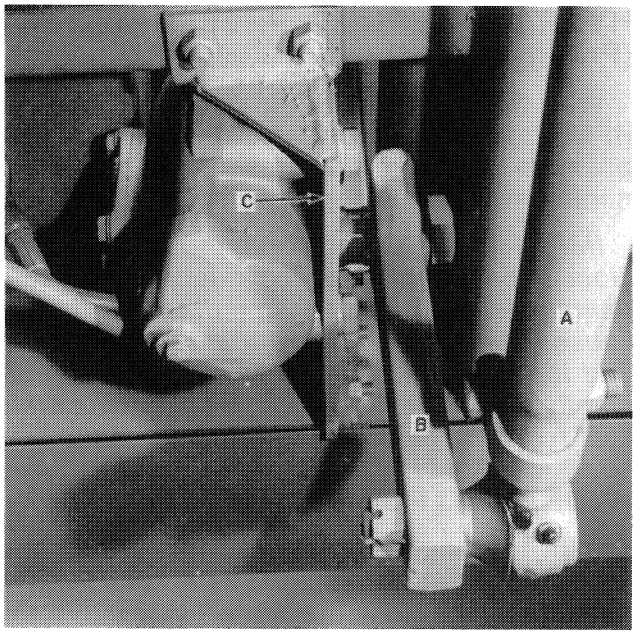


FIGURE 2-6

REMOVING THE STEERING GEAR

Removing of the steering gear is time-consuming. After becoming proficient in servicing the steering gear on a bench, make future adjustments and minor repairs without removing the steering gear.

Remove the steering column cover channel, A, Figure 2-4, by removing the six truss-head machine screws, B. Remove the flexible coupling retaining bolt, A, Figure 2-5, from the input shaft of the steering gear, and move the steering column to the side.

Disconnect the two hydraulic hoses from the two steel lines that are connected to the steering gear under the cab and cap ends to prevent dirt entry. Also, plug the two steel lines before removing the steel gear from the bale wagon.

Remove drag link, A, from steering gear pitman arm, B, Figure 2-6. Remove the steering gear and mounting bracket, C, as one complete assembly. Remove pitman arm, A, and mounting bracket, B, Figure 2-7, to ready the box for disassembly.

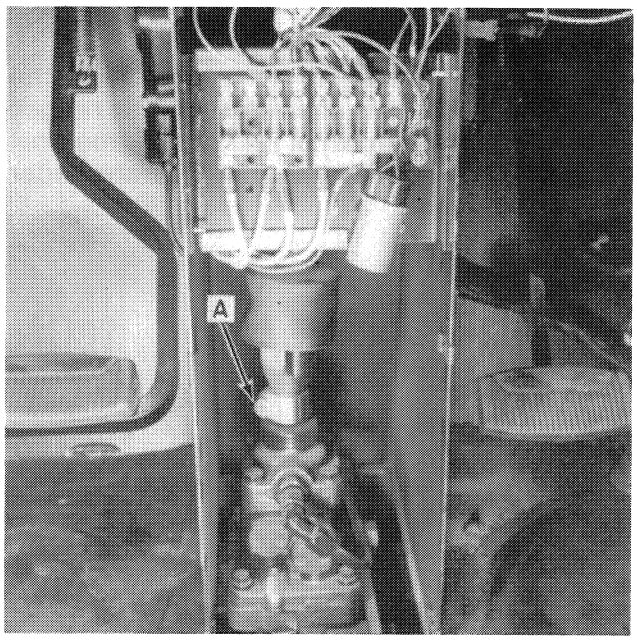


FIGURE 2-5

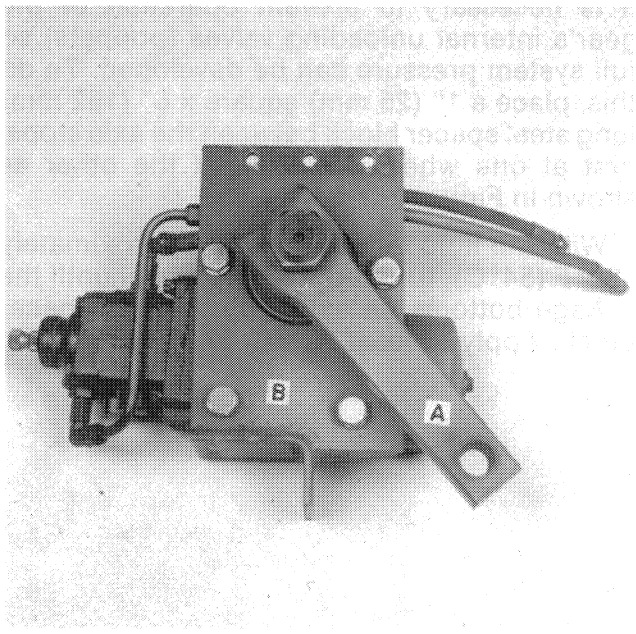


FIGURE 2-7

ADJUSTMENTS AND REPAIRS OF STEERING GEAR STYLE I

(See Figure 2-8 for Reference Items)

1068 below serial number 513384

1069 below serial number 3076

1075 below serial number 437144

SECTOR SHAFT

Adjust adjusting screw (50) in side cover (43) to engage gear teeth in a "no-lash", "no-bind" condition, assemble nut (40) and tighten. Then adjust following this procedure:

After rotating the worm shaft (23) through its full travel for a minimum of five cycles, adjust sector shaft adjusting screw (50) to provide 20 in. lbs.-25 in. lbs. (2.3 N·m-2.8 N·m) torque as worm shaft (23) is rotated 90° each side of center. Back out the adjusting screw one turn and note the torque required to move the worm shaft 90° each side of center position. Move the adjusting screw in to provide an increase in torque of 2 in. lbs.-4 in. lbs. (0.2 N·m-0.5 N·m) at a point within 45° each side of center after the adjusting screw jam nut is first tightened snugly. Then, finally torque to 20 ft. lbs.-25 ft. lbs. (27 N·m-34 N·m).

NOTE: Input torque of the completely assembled gear, minus hydraulic oil, should not exceed 15 in. lbs. (1.7 N·m) for full travel of the output shaft.

VALVE THRUST BEARINGS (Worm Shaft)

Clamp the worm shaft (23) in a soft-faced vise to permit access to the serrated and threaded shaft end.

Assemble thrust bearing (13), thrust washer (14), valve assembly (15), thrust washer (14), thrust bearing (13), thrust washer(12), internal tang washer (11), external tang washer (10), and bearing adjustment nut (9). Adjust the valve by tightening nut (9) to solid height. (Torque not to exceed 20 ft. lbs.) (27 N·m). When components are at solid height, back off approximately 20° or one tang of washer (10). Bend one tang of washer (10) into matching slot in nut (9).

NOTE: Valve to rotate with torque of 2 in. lbs.-3½ in. lbs. (0.2 N·m-0.4 N·m).

PRESSURE RELIEF SCREW (Poppet)

Proper adjustment of the pressure relief screw (poppet) can only be made with the steering gear installed on the vehicle and under load. Thus, allowances can be made for the variations and deflections in the other components that make up the linkage system.

1. The purpose of this procedure is to set the lower poppet adjusting screw so that the poppet contacts the screw just before full wheel cut is attained. Then, at full wheel cut (when steering against axle stops), the poppet should be fully tripped and the pressure shown by a gauge in the supply line should be between 200 PSI and 500 PSI (14 bar and 35 bar). The following procedure is for the lower poppet only. The upper poppet is tripped by contact with a nonadjustable internal stop.
2. Adjustment procedure. Steer the vehicle against the axle stops in the direction of the turn which causes the rack to move away from the input shaft. Note the pressure on the gauge in the supply line as the wheel contacts the axle stop. If this pressure reading is less than the system relief pressure, back the poppet adjusting screw out until the system is operating at relief pressure while steering against the axle stops. Screw the adjusting screw in until the pressure on the gauge reads less than 500 PSI (35 bar) while steering against the axle stops. Lock the adjusting screw in this position by tightening the jam nut to the specified torque.
3. *IMPORTANT: During the above procedure, do not operate the system at relief pressure for more than a few seconds at a time or damage to the system may result due to excessive heat generation.*
4. The 500 PSI (35 bar) figure used above is the approximate value for hydraulic fluid at 130°F (54°C) and flow rate of 3.0 GPM (9.5 L/min.).

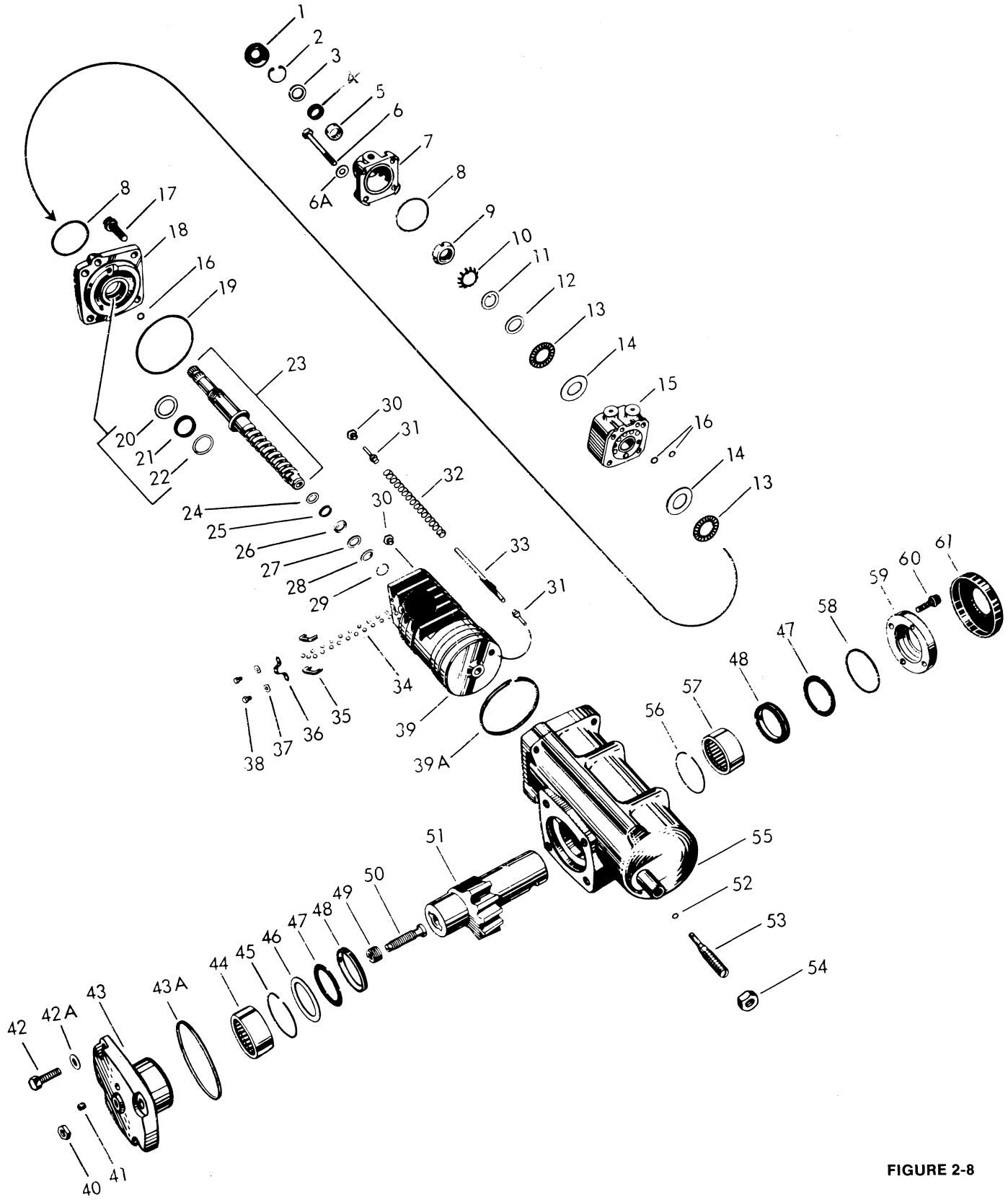

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FIGURE 2-8

FIGURE 2-8

1 Seal
2 Retaining ring
3 Washer
4 Seal
5 Bearing
6 Bolt, 3/8-16 x 3¼ (4)
6A Washer (4)
7 Upper cover
8 Seal ring (2)
9 Nut
10 Washer
11 Washer
12 Thruster washer
13 Thrust bearing (2)
14 Thrust washer (2)
15 Valve assembly
16 O ring (2)
17 Bolt, 7/16-14 x 1½ (4)
18 Adaptor
19 Seal ring
20 Backup washer
21 Seal
22 Retaining ring
23 Worm shaft
24 Washer (steel)
25 Seal
26 Seal cup
27 Backup washer
28 Retaining washer
29 Retaining ring
30 Poppet seat (2)
31 Poppet (2)
32 Spring
33 Rod
34 Ball (22)
35 Ball return guide (2)
36 Clip
37 Lock washer (2)
38 Screw (2)
39 Rack piston
39A Piston ring
40 Nut
41 Vent plug
42 Bolt, 7/16-14 x 1 (4)
42A Washer
43 Side cover
43A Seal ring
44 Bearing
45 Retaining ring
46 Backup washer (steel)
47 Backup washer (2)
48 Seal (2)
49 Retainer
50 Adjusting screw
51 Sector shaft
52 O ring
53 Adjusting screw
54 Nut
55 Housing
56 Retaining ring
57 Bearing
58 Seal ring
59 Trunnion cover
60 Screw, 5/16-18 x 1 (4)
61 Seal

REPAIRS

SECTOR SHAFT SEALS (SIDE COVER)

Remove side cover (43) from the steering gear. Remove the old seals from the side cover. Reassemble backup washer (47) and two-piece seal (48) into the side cover. If vent plug (41) is to be replaced, press in new plug flush.

NOTE: Seal (48) has "oil side" molded in the face and must be visible after assembly.

WORN SHAFT SEALS

Remove upper cover (7), valve assembly (15), and adaptor (18) plate. Seals can be replaced in the cover and valve adaptor plate. Refer to the disassembly and assembly section of the valve and adaptor.

DISASSEMBLY PROCEDURE
STYLE I

(Reference - Figure 2-8)

PREPARATION BEFORE DISASSEMBLY

Drain the gear assembly. Thoroughly clean off all dirt around the fittings before disconnecting the hoses. (Plug the port holes immediately after disconnecting the hoses and before removing the assembly from the bale wagon.) Finish cleaning and drying the assembly before placing it on the workbench.

CLEAN WORK CONDITIONS

If it is necessary to disassemble any of the component parts, make sure that a clean workbench or table is used (a piece of clean wrapping paper makes an excellent disposable top).

All internal parts should be cleaned in clear/clean solvent and blown dry with clean air. Keep each part separate to avoid nicks and/or burrs.

IMPORTANT: Never steam clean hydraulic steering assemblies. Do not force or abuse closely fitted parts, as damage will usually result.

DISASSEMBLING THE MAJOR SUBASSEMBLIES

1. Rotate worm shaft (23) so that the index mark on the end of sector shaft (51) is perpendicular to the center line of the steering gear (straight ahead position).
2. Remove four bolts (42) from side cover (43).
3. Tap lightly with a soft-faced hammer on the end of sector shaft (51) to disengage seal ring (43A) and let drain.
4. Remove the side cover (43) and sector shaft (51) as a unit.
5. Remove trunnion cover (59) by removing four screws (60).
6. Remove four bolts (17) from adaptor (18).
7. Remove as a subassembly, upper cover (7), valve assembly (15), adaptor (18), worm shaft (23) and rack piston (39) from housing (55).

DISASSEMBLING THE SIDE COVER AND SECTOR SHAFT ASSEMBLY

1. Remove nut (40) from adjusting screw (50). Disengage side cover (43) from sector shaft (51) by turning adjusting screw (50) clockwise.
2. Remove seal (48), backup washer (47), and backup washer (46) from side cover (43). Check vent plug (41); it should be flush with the face of side cover (43).

REMOVING OF WORM SHAFT FROM RACK PISTON

1. Disassemble poppet seats (30) and remove poppets (31), spring (32), and rod (33), from rack piston (39). Position rack piston (39) with ball return guides (35) up and disassemble screws (38) and lock washers (37). Remove clip (36) and ball return guides (35) and tilt assembly to allow balls to fall out. Turn worm shaft (23) to empty assembly of balls. When empty, discard all balls and replace with a new matched set. Remove worm shaft (23) from rack piston (39).
2. Inspect helical grooves in rack piston (39) and on worm shaft (23) for excessive wear or brinelling. Inspect rack piston teeth for pits, wear or scoring. Inspect piston OD and piston ring for scoring or grooving. Inspect inside ends of ball return guides (35) for wear or damage.
3. Carefully clamp worm shaft (23) in padded vise jaws.
4. Cut seal (25) and seal cup (26) and remove.
5. Remove retaining ring (29), retaining washer (28), backup washer (27), and washer (24).

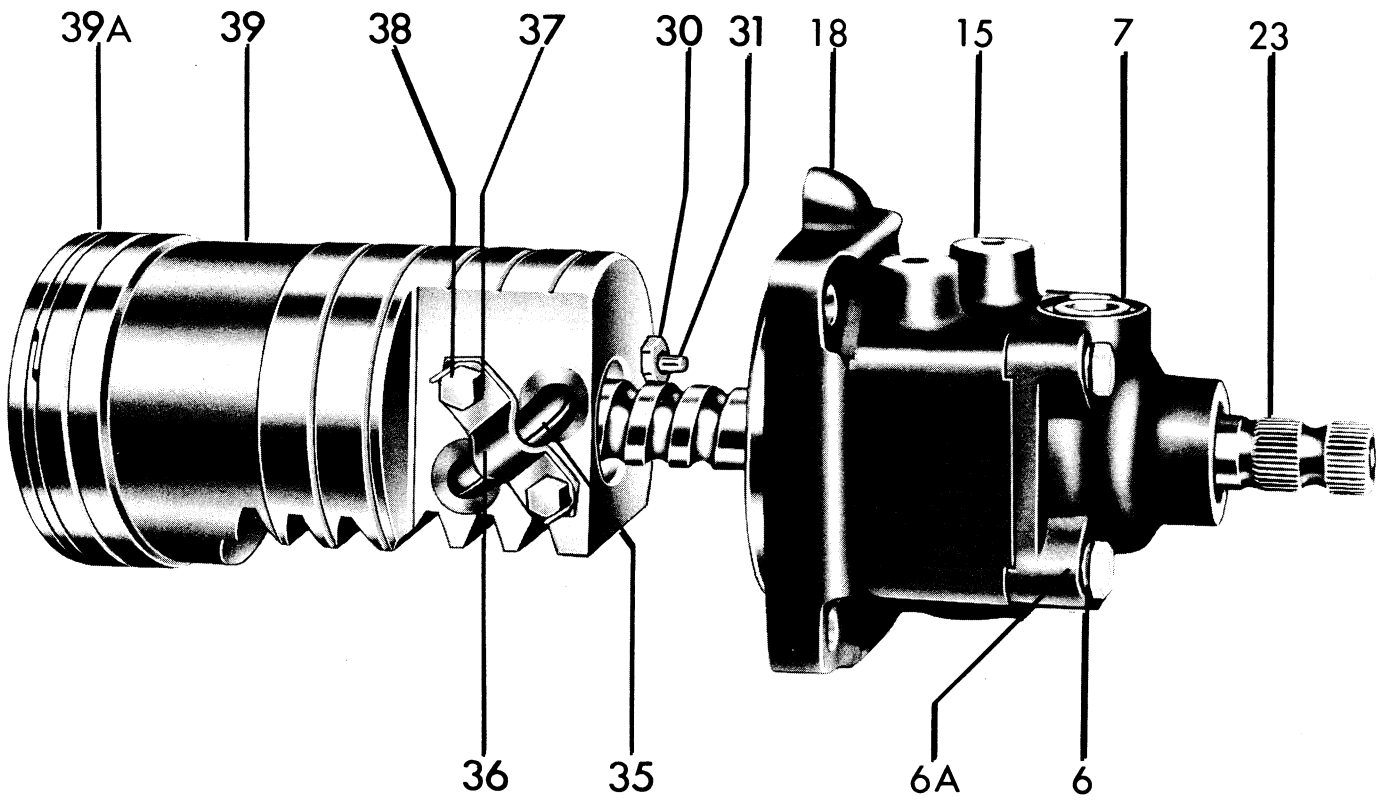

FIGURE 2-9

DISASSEMBLING VALVE ASSEMBLY AND ADAPTOR

1. Remove seal (1) and four bolts (6) from upper cover (7).
2. Remove upper cover (7) from valve assembly (15).
3. Unstake washer (10) from nut (9).
4. Remove nut (9), washer (10), washer (11), thrust washer (12), thrust bearing (13) and thrust washer (14) from worm shaft (23).
5. Remove valve assembly (15) from worm shaft (23).
6. Remove adaptor (18).
7. Remove retaining ring (22), seal (21) and washer (20) from adaptor (18). Discard items 20 and 21.

NOTE: Do not disassemble the valve unless absolutely necessary.

The valve assembly is the control center of the hydraulic system. The major parts, the body and spool, are machined to very close tolerances and with precision machined edges. The spool and valve body are selectively fitted at the factory and are not separately replaceable. If either is damaged or excessively worn, replace the whole valve assembly. Good performance of the power steering is not possible if a "mismatched" valve spool and body are used. Handle these parts carefully to prevent damage. Do not break the sealing edges of the valve bore and the spool. Breaking the seal will result in excessive leakage and reduced hydraulic power. Should the valve spool be removed from the valve body, assemble the spool with the end having the internal groove toward the valve adaptor (see Figure 2-4).

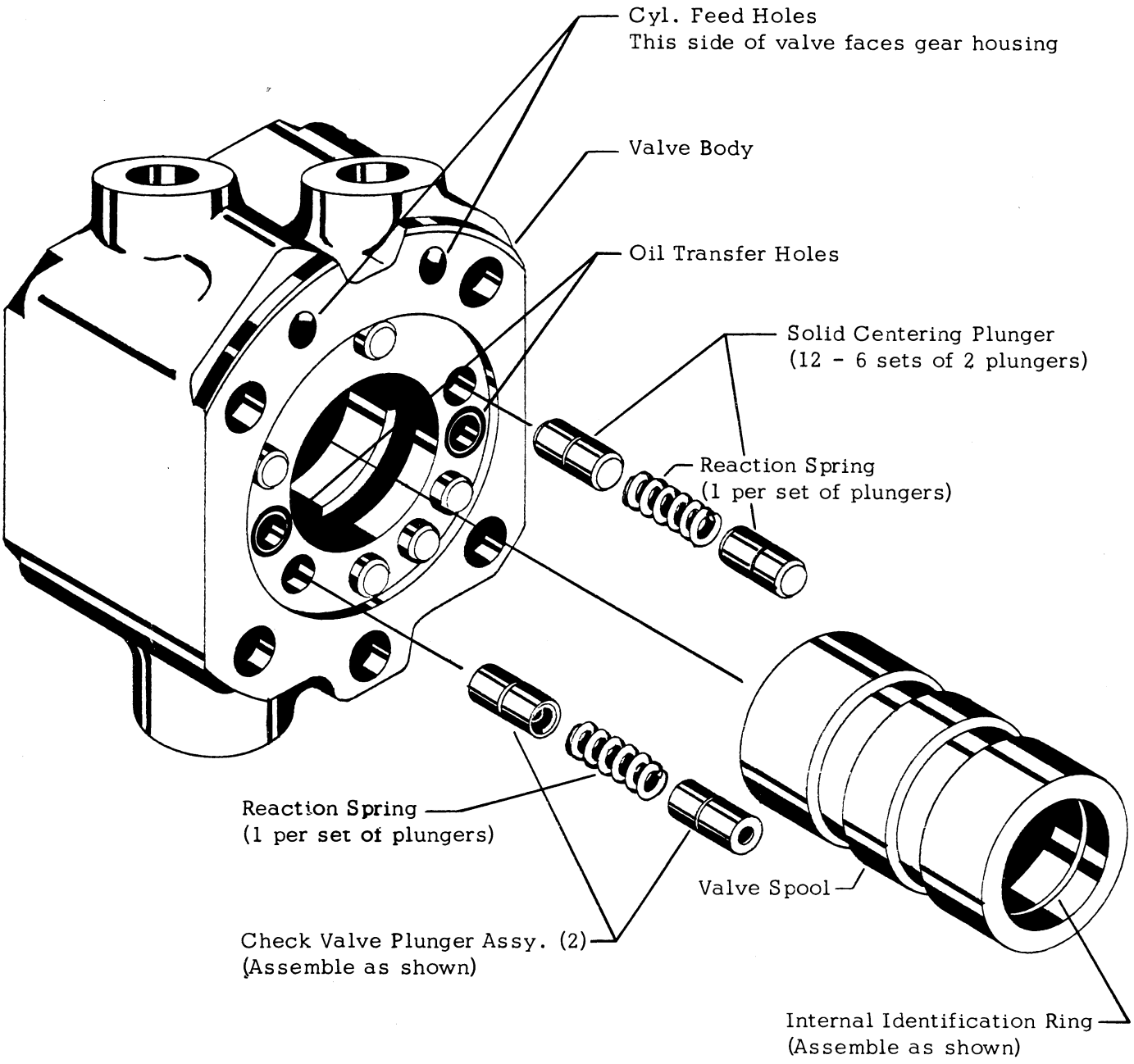

FIGURE 2-10

OUTBOARD CROSS SHAFT BEARING - SPECIAL LUBRICATION

The internal moving parts of the gear are lubricated by the hydraulic system oil, except the outboard side cover sector shaft bearing (item 44). Repack the bearings with Aero-Shell #14 grease or E.P. equivalent each time the outboard sector shaft seal kit (item 46, 47 and 48) is replaced.

ASSEMBLY PROCEDURE

(See Figure 2-8 for Reference Items)

All parts (including nuts, screws, seals, etc.) must be genuine replacement parts. Before assembly, clean all parts in clean petroleum base solvent and blown them dry with clean, dry air. Lubricate all rubber seals before assembly.

HOUSING ASSEMBLY

1. Assemble sector shaft bearing retaining ring (56). Place the housing (55) on a wooden block to protect the side cover face and carefully press the bearing (57) into the housing until flush.

   NOTE: Position the bearing so it is pressed on the numbered end. Check the freedom of the rolls in the bearing after assembling.

2. Carefully clamp the housing (55) into a convenient assembly position and inspect the large rack-piston bore for scratches or damage.
3. Coat the O ring (52) liberally with clean grease or oil and install it carefully over the nonthreaded end of adjusting screw (53) and into the groove provided.
4. Insert the above assembly into the tapped hole provided and thread into the housing leaving ⅞" (22 mm) exposed thread.
5. Assemble the jam nut (54) on the adjusting screw and torque to 17 ft. lbs.-22 ft. lbs. (23 N·m-30 N·m).

WORM SHAFT, VALVE AND ADAPTOR ASSEMBLY

1. Carefully clamp the worm shaft (23) into a vise with soft-faced jaws to permit access to the serrated and threaded end. Assemble thrust bearing (13), thrust washer (14), valve assembly (15), thrust washer (14), thrust bearing (13), thrust washer (12), internal tang washer (11), external tang washer (10), and bearing adjustment nut (9). For adjustment details, see "Adjusting the Sector Shaft."
2. See Figure 2-12. Assemble backup washer (20), seal (21) and retaining ring (22) into valve adaptor (18).

   NOTE: Assemble the lips of the seal (21) toward the retaining ring (22).

   Using clean grease for retention, assemble seal ring (8) and two O rings (16) into the recesses provided in the face adjacent to the valve.
3. Reclamp the worm shaft (23) on the serrated end using a vise with soft-faced jaws. Assemble the adaptor (18) over the worm shaft, engage the pilot flange on the valve (15) and retain with one bolt (6) through the valve into the adaptor. (This bolt is only used to facilitate assembly and need only be finger-tight.)
4. See Figure 2-11. Assemble washer (24), a new rubber seal (25), a new seal cup (26) (cup side toward seal), backup washer (27) and retaining washer (23) on the worm shaft. Compress the washer and seal assembly and install retaining ring (29). Use care to insure complete seating of the ring in the groove and that the ring (29) has entered the recessed area of the retaining washer (28).

RACK PISTON ASSEMBLY

1. Using a soft-faced vise, clamp the rack piston (39) in a horizontal position with the ball guide holes facing up. Carefully inspect the bores and outer ground surfaces for damage and stone off any burrs. Carefully expand piston ring (39A) and install in the ring groove at the end of the rack piston.
2. Clean the threaded hole in the face of the large end of the rack piston (39) with clear/clean solvent and blow dry with clean dry air. Apply Locquic™ grade "T" primer to the threads (allow to dry 10 minutes). Insert items 31, 32, 33, and 31, see Figure 2-8, in the threaded hole. Apply "Locquic" grade "T" primer to the threads of seats (30) (allow to dry 10 minutes). Apply stud lock to the threads in the rack piston and to the threads of the seats. Insert the seats and torque to 20 ft. lbs.-25 ft. lbs. (27 N·m-34 N·m) (allow to dry 20 minutes).
3. Coat seal (25) at the end of the worm shaft with clean grease and enter into the lubricated rack piston bore.

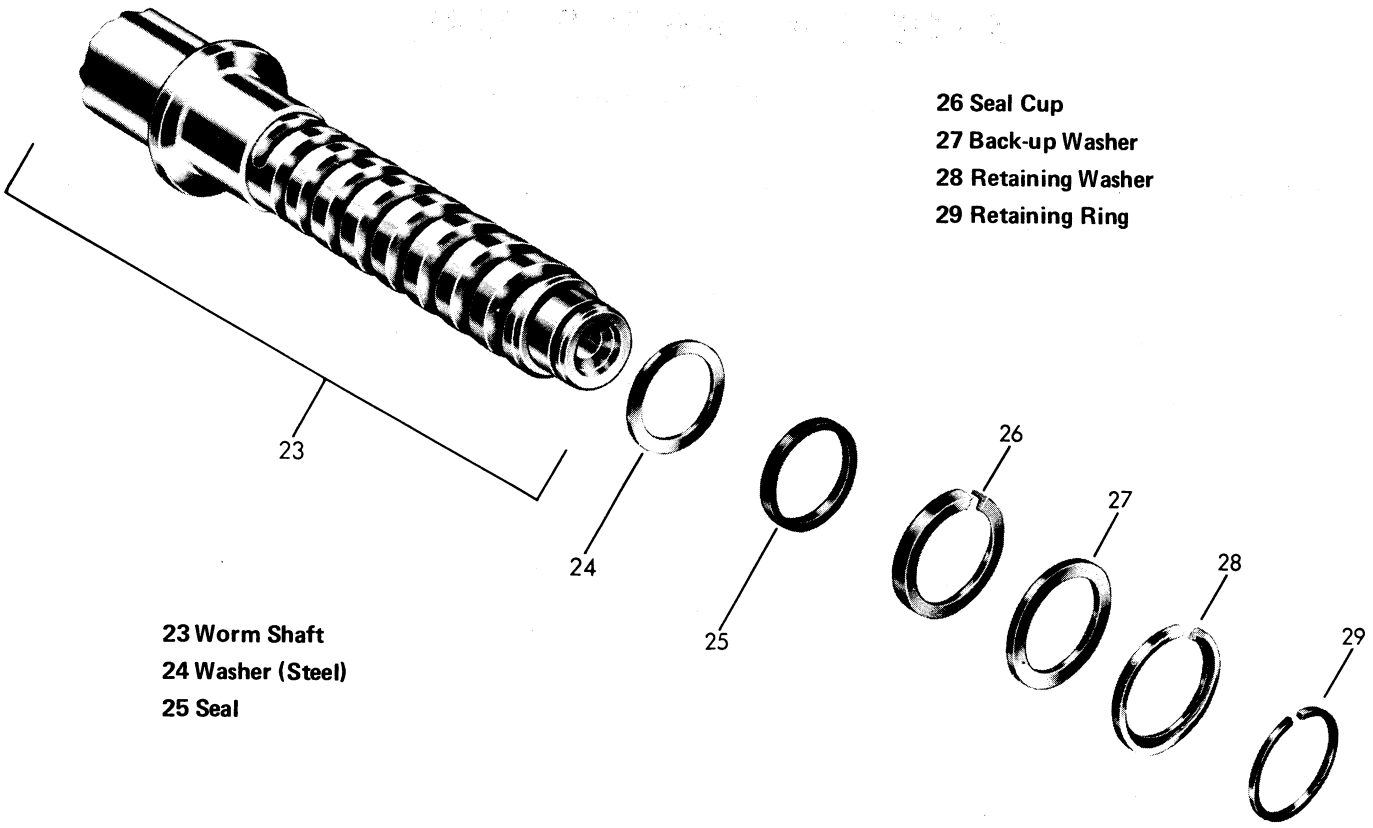

FIGURE 2-11

4. **NOTE: When assembling steel balls (34), alternate the bright and dark balls. Assemble sixteen steel balls (34) into rack piston (39) while slowly rotating worm shaft (23) counterclockwise. (See Figure 2-12.) Assemble the six remaining steel balls (34) into the ball return guide (35). Plug the ends of the ball return guide with grease or petroleum jelly and install in the rack piston (39). Assemble ball return guide clip (36), lock washers (37) and hex-head screws (38). Torque the screws to 8 ft. lbs.-10 ft. lbs. (11 N·m-14 N·m) and turn up ears on lock washers (37), Figure 2-9.**

WARNING: BE SURE THAT A BALL DOES NOT BECOME TRAPPED AT THE BLIND END OF THE RACK PISTON BALL TRACK, OUTSIDE THE BALL RETURN GUIDES. IF A BALL IS TRAPPED, IT CAN RESULT IN A STEERING GEAR LOCKUP WHICH COULD CAUSE AN ACCIDENT.

SECTOR SHAFT AND SIDE COVER ASSEMBLY

1. Clamp the sector shaft (51) into a soft-faced vise by gripping the serrated end. Coat the expanded end of sector adjusting screw (50) with a suitable grade of wheel bearing grease and insert into the recess in the end of the shaft. Thread a new sector shaft screw retainer (49) into the shaft and adjust to permit free rotation of the sector shaft adjusting screw without perceptible end play.

   Stake the new retainer (49) into the two slots provided and again check freedom of the adjusting screw movement.

2. If vent plug (41) must be replaced, press in new plug flush.

3. Assemble retaining ring (45), steel backup washer (46), backup washer (47) and two-piece seal (48) into side cover (43).

   NOTE: Seal (48) has "oil side" molded in the face and must be visible after assembly.

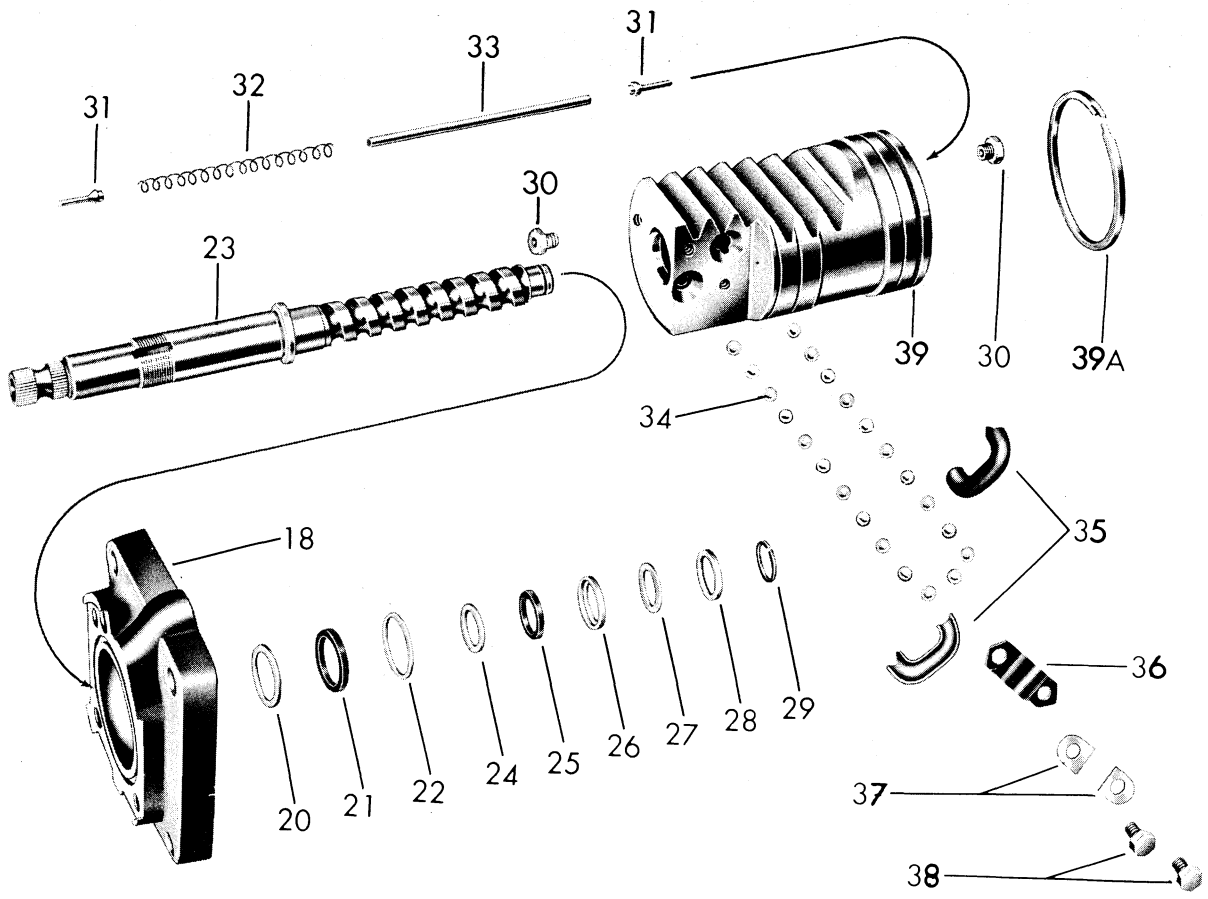

FIGURE 2-12

4. Coat the end of the sector shaft (51) with clean grease. Insert the shaft in the side cover to the point of contact of the sector shaft adjusting screw (50) and the inner cavity of the side cover. Using a screwdriver, turn the sector shaft adjusting screw counterclockwise to engage the threads and rotate the screw until a firm stop is reached.

   NOTE: Check shaft seal (48) to make sure it has not fallen from the bore.

SECTOR SHAFT SEAL ADAPTOR ASSEMBLY

Inspect adaptor (59) for damage and assemble leather backup washer (47). Position seal (48) with the words "oil side" to be visible after assembly. Coat the seal (58) with clean grease and install.

CONTROL VALVE COVER ASSEMBLY

1. If the worm shaft needle bearing (5) has been removed from the upper cover (7), fabricate a suitable pressing mandrel which will pilot on the inner diameter of the bearing and have clearance in the bearing bore. Press the bearing (5) on the numbered end and position it 1⅛" (29 mm) from the face of the upper cover (7). After pressing, check for freedom of the needles in the bearing.
2. Assemble worm shaft seal (4) with the seal lip toward the needle bearing (5). Assemble the backup washer (3) (after coating it with grease) and the retaining ring (2). Check to insure proper seating of the retaining ring (2) in the groove. Pack seal (1) with suitable Lubriplate™ or wheel bearing grease to inhibit water and assemble.

FINAL ASSEMBLY

1. Clamp the housing (55) as before, to permit access to all bores. Assemble new lubricated seal ring (19) and two new O rings (16) in the recesses provided in adaptor (18) using grease for retention and set aside.
2. Insert rack piston (39) into the housing and position the teeth to be visible through the housing side cover opening. As the rack piston enters the lubricated bore, compress piston ring (39A) and place it into the assembled position.

3. Recheck the position of the seals (19 and 16) in the adaptor (18), align the oil transfer holes, and carefully move the adaptor into contact with the housing.
4. Assemble four bolts (17) through adaptor (18) and torque to 45 ft. lbs.-55 ft. lbs. (61 N·m-75 N·m). Remove bolt (6) previously assembled through the valve.
5. Lightly coat the ground portion of the worm shaft (23) with oil and carefully install the control valve cover assembly over the worm shaft.
6. Assemble four bolts (6) and plain washers (6A) and torque to 25 ft. lbs.-35 ft. lbs. (34 N·m-47 N·m).
7. Coat seal (43A) with clean grease and assemble in the recessed groove provided in the side cover (43).
8. Look through the side cover opening, and align the rack piston center tooth with the sector shaft center space. Assemble the sector shaft (51) and side cover (43) into the housing (55).
9. Assemble four bolts (42) and plain washers (42A) and torque to 45 ft. lbs.-55 ft. lbs. (61 N·m-75 N·m).
10. Adjust screw (50) in side cover (43), see "Adjusting the Sector Shaft."
11. Cover the serrations on the sector shaft (45) with an assembly thimble or a single layer of Scotch tape. Assemble the lubricated sector shaft seal adaptor assembly over the lightly greased shaft.
12. Assemble four bolts (60) through seal adaptor (59) and torque to 20 ft. lbs. (27 N·m). Before assembly of the pitman arm, pack seal (61) with a suitable grade of Lubriplate or wheel bearing grease to inhibit water.

FINAL CHECKS

1. After rotating the worm shaft through its full travel for a minimum of five cycles, recheck the sector shaft adjustment. No rotational lash or bind of the sector shaft (51) in center position is permissible.
2. If the gear is properly assembled and adjusted, the input torque should not exceed 15 in. lbs. (1.7 N·m) over full travel of the sector shaft.
3. Reverse torque applied to the sector shaft for full gear travel should not exceed 50 ft. lbs. (68 N·m).

TORQUE CHART

PART NAME	ITEM NO.	TORQUE
NUT (½ - 20 HEX HEAD)	40	20 - 25 FT. LBS.
NUT(7/16 - 20 HEX HEAD)	54	17 - 22 FT. LBS.
POPPET SEAT	30	20 - 25 FT. LBS.
SCREW (5/16 - 18 x 1 SOC HEAD)	60	13 - 23 FT. LBS.
BOLT (7/16 - 14 x 1 HEX HEAD)	42	45 - 55 FT. LBS.
BOLT (⅜ - 16 x 3¼ HEX HEAD)	6	25 - 35 FT. LBS.
BOLT ASSY., PITMAN ARM CLAMP (Fig. HF54-8)(⅞ - 18 GRADE 8)	63	220 - 240 FT. LBS. (Dry) 160 - 180 FT. LBS. (Lube)
BOLT (7/16 - 14 x 1½)	17	45 - 55 FT. LBS.
SCREW	38	85 - 95 INCH LBS.

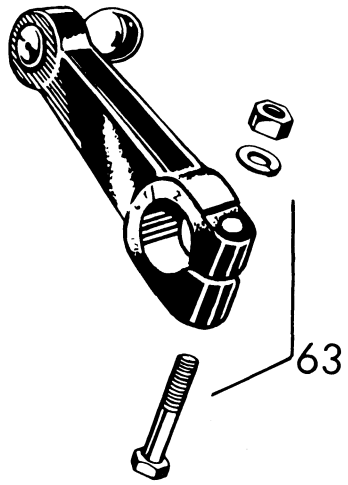

FIGURE 2-13