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Technical Manual

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CHAPTER 1

SECTION 2 — LOWER WORKS

CRAWLER BELTS

The crawler belts should be inspected frequently to prevent an unexpected breakdown (figure 1).

Check the links for cracks, worn lugs, elongated link pin bores and other damage. Minor cracks in the link do not constitute a major problem. However, cracked links should be repaired by welding or replaced at a convenient time. Links with broken or worn drive lugs should be replaced at the earliest convenient time as they can cause the belt to ride off the rollers or take-up tumblers. Links with elongated pin bores should be checked carefully for cracks at the pin lugs and replaced if badly worn or cracked. Bent, broken, or badly worn link pins should be replaced.

ADJUSTMENT

The crawler belts should be so adjusted that the sag in the belts should be approximately 3″-5″ inches at the center points between the upper rollers (figure 2).

Adjustment of the crawler belts is accomplished at the take-up tumbler end of the belts. The take-up tumblers are mounted on shafts which are clamped in bearing blocks. The bearing blocks are bolted to the crawler frames. Shims placed ahead or behind the bearing blocks position the bearing block and tumbler to provide the desired belt tension (figure 3).

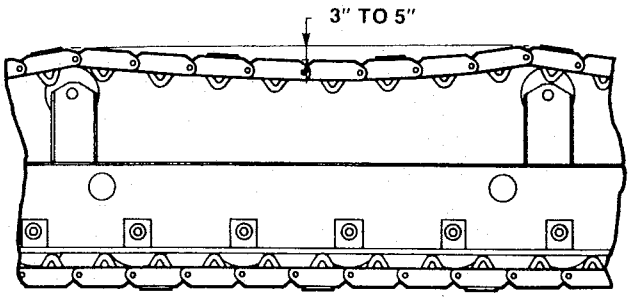
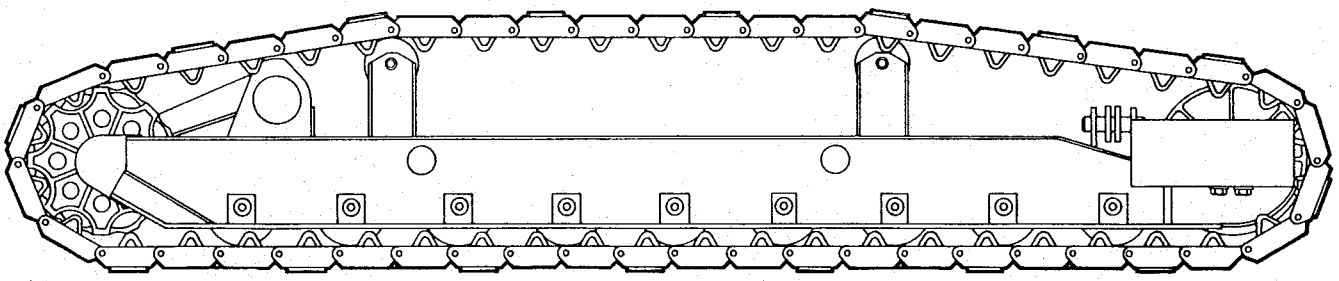


FIGURE 2

To Adjust Belt Tension:

1. Take weight of machine off crawlers using leveling jacks. Block machine in raised position.
2. Remove the tumbler shim guards from the inside and outside of the crawler frame.
3. Loosen the jam nuts and full nuts securing the bearing blocks to the crawler frame on both sides. Loosen the nuts only enough to allow the bearing block to slide on the crawler frame.
4. Position suitable hydraulic jacks behind each of the bearing blocks.
5. Remove several shims from in front of the bearing blocks.



LOWER WORKS

FIGURE 1

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7. Install the inner sleeve bearing on the hoist shaft.

8. Slide the hoist shaft into the gear sleeve. The shaft should be installed from the right side of the sleeve. Install the inner sleeve bearing retaining ring.

9. Install the inner sleeve bearing and seal spacer.

10. Install the collar on the clutch sleeve. Lubricate the splines of the clutch sleeve and gear sleeve and install the clutch sleeve on the gear sleeve.

11. Install the jaw clutch hub key in the shaft. Be sure the key and hub keyway are free of nicks or burrs. Install the clutch hub on the shaft. The key should be filled so as to have 80% contact on both side surfaces in both the shaft and the hub.

12. Install the auxiliary reel bearing in the reel and install the reel on the hoist shaft.

13. Reassemble the hoist shaft left bearing assembly by installing the bearing, bearing retaining ring, bearing seal, seal retaining ring and O-ring in the bearing housing. Install the bearing assembly on the shaft. Be sure the O-ring is properly positioned in the housing.

14. Install the hoist brake drum. Secure the drum with the gib key. The key should be fitted so as to have 80% contact on the wedge and side surfaces. The drum should be located on the shaft so that the distance from the center of the gear to the outer face of the drum is 22-3/8 inches.

15. Install the right bearing spacer on the hoist shaft. Be sure the tapered end of the spacer is facing toward the bearing.

16. Reassemble the hoist shaft right bearing assembly by installing the bearing, bearing labyrinth seal, seal retaining ring, and dowel in the bearing housing. Install the bearing assembly on the shaft.

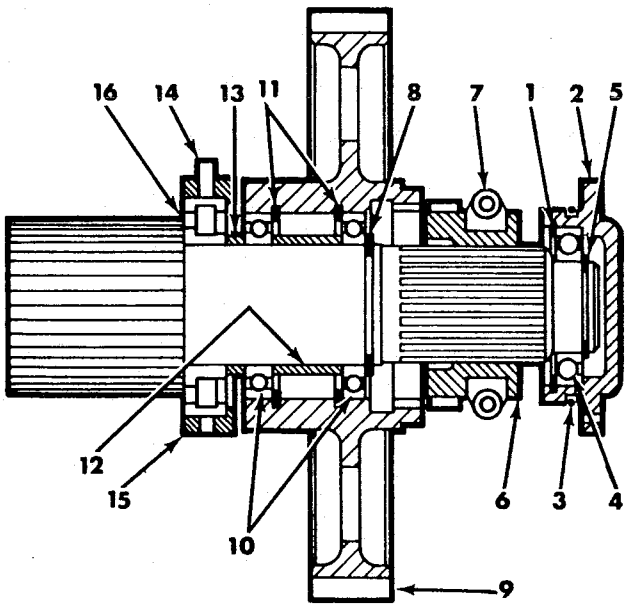
17. Install the right hoist sprocket. Secure the sprocket with the gib key. The key should be fitted so as to give 80% contact on the wedge and side surfaces. The sprocket should be installed the same distance from the end of the shaft as the brake drum and sprocket were installed on the opposite end of the shaft.

18. Repack the shaft and auxiliary reel bearings and lubricate the jaw clutch.

19. Replace the shaft assembly in the gearcase.

SECOND INTERMEDIATE SHAFT

To repair the second intermediate shaft (figure 19) after disassembly of the gearcase proceed as follows:



1. RETAINING RING
2. BEARING HOUSING
3. HOUSING O-RING
4. BEARING
5. RETAINING RING
6. CLUTCH HUB
7. HUB SHIFTER COLLAR
8. RETAINING RING
9. GEAR
10. GEAR BEARING
11. RETAINING RING
12. SPACER
13. SPACER
14. DOWEL
15. BEARING HOUSE
16. BEARING

2ND INTERMEDIATE SHAFT

FIGURE 19

1. Lift the shaft assembly from the gearcase. Remove the dowel from the right shaft bearing housing.

2. Remove the retaining ring from the left shaft bearing housing. Remove the bearing housing.

3. Remove the left shaft bearing retaining ring from the shaft. Remove the left shaft bearing from the shaft.

4. Remove the pulldown clutch hub from the shaft. Remove the shifter collar from the hub.

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CHAPTER 1

SECTION 4 — MAST

MAST STRUCTURE

The 45-R drill mast (figure 33) is a fabricated structure made of steel angles and formed plates. The structure is formed by four vertical angles tied together on three sides with angle lacing. The fourth side is open to allow the rotary drive unit to be raised and lowered the length of the mast.

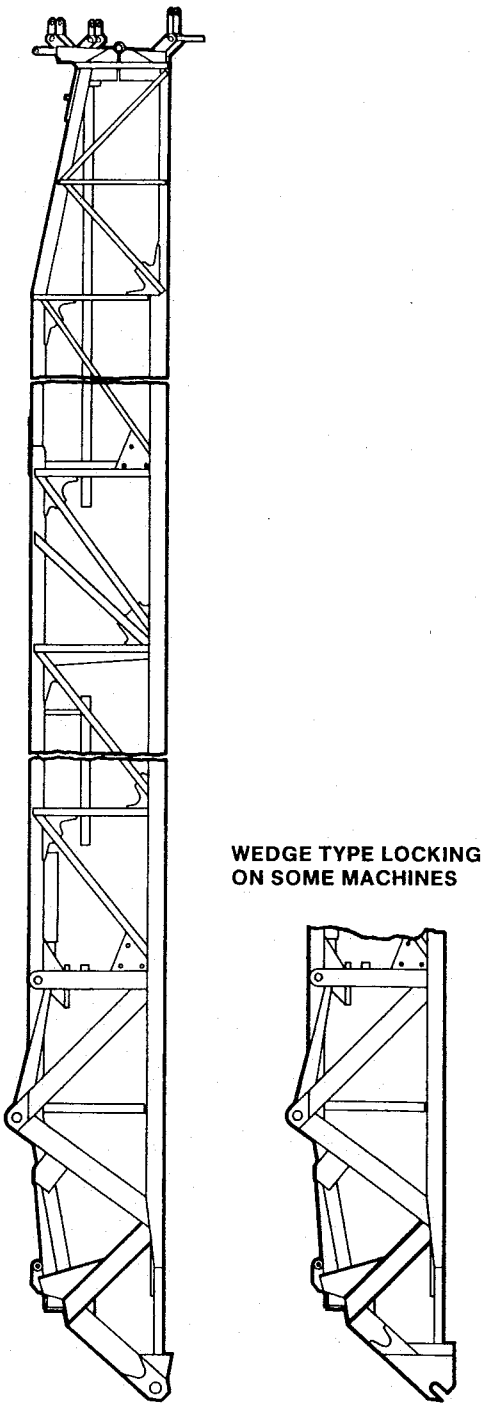
Inspect the mast structure daily for wear or damage. Inspect all mast ladders and platforms for loose hardware and structural integrity. Inspect the racking on the inside of the rear mast angles for proper lubrication and any wear or damage. Inspect the mast hinge pins and the structure surrounding the pins for wear or damage. Verify that the hinge pin keepers are in place and tight. Inspect the mast hoist cylinder attachments for wear or damage. Lubricate the pins weekly with the appropriate grease. Inspect the mast lock pins for wear and damage. Verify that the lock pin keepers are in place and secured with the required cotter pins.

Every 80 operating shifts lower the mast and inspect all welds thoroughly for cracks or damage. Clean the racking on the inside of the two rear mast angles and check the welds securing the racking to the angles. While the mast lock pins are removed from the machine check the pins and pin bores for wear. Replace the pins and remachine the bores if clearance become excessive.

REPAIR

Repair of the mast structure is limited to repair welding of cracked or broken welds or components or replacement of severely damaged structures. Refer to the REPAIR WELDING topic in the APPENDIX for the exact procedures involved in repair welding of the mast.

When repairing mast structures by welding it is important to keep in mind that the repair should return the structure to its original condition. All welds should be smooth and any notches or undercuts should be welded and ground. Do not add reinforcing material or change the geometry of the structure. Replace any damaged components with material of the same strength and cross section.



MAST
FIGURE 33

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2. Lower the tool rack to its lowest position and rest it on the lower stop. Lock and tag all controls to prevent unauthorized operation.

3. Disconnect the air line leading to the pipe gate operating valve.

4. Disconnect the hydraulic cylinder by removing the rod pin cotter pin and rod pin. The hydraulic cylinder may be retracted to gain better access at this time.

5. Using a suitable crane and rigging support the tool rack. Remove the pins securing the tool rack to the upper and lower support arms and remove the tool rack from the machine.

6. Using a suitable crane and rigging support the upper support arm. Remove the bolts securing the bearing blocks to the mast and remove the upper support arm from the machine.

7. Remove the pin securing the upper arm to the arm pivot pin. Remove the bearing blocks from the pin. Remove the pin from the arm.

8. Using a suitable crane and rigging support the lower support arm. Remove the bolts securing the bearing blocks to the mast and remove the lower support arm from the machine.

9. Remove the pin securing the lower arm pivot pin to the arm. Remove the bearing blocks from the pivot pin and remove the pivot pin from the lower arm.

10. Inspect all components. Replace worn or damaged components as necessary. Remove the bushings from the bearing blocks and the upper and lower support arms and replace. Lubricate all pins and bushings.

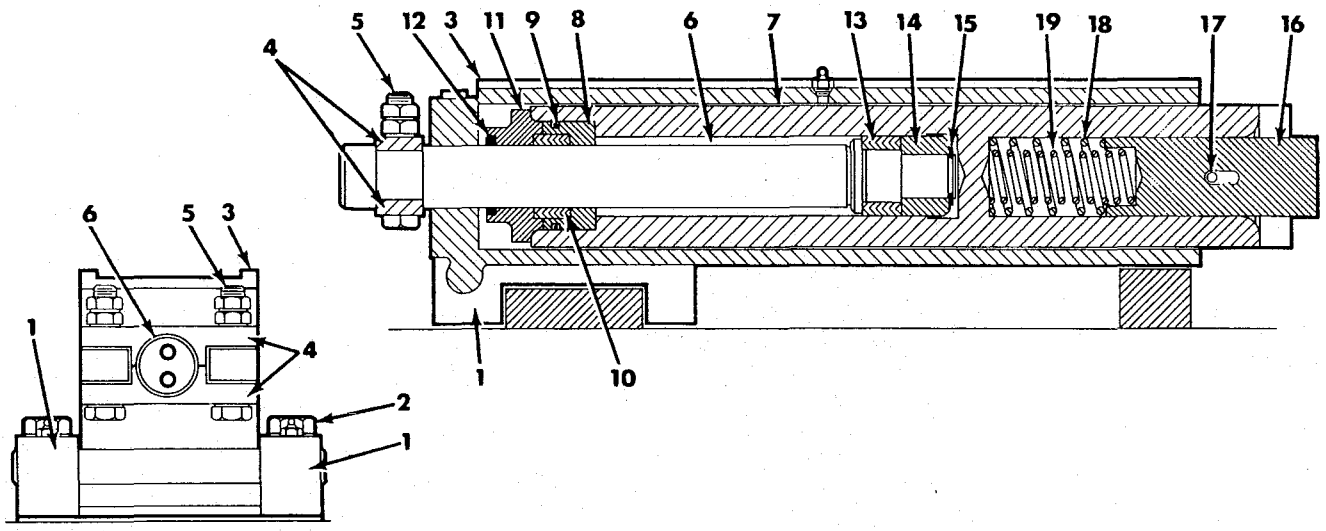
11. Reinstall the tool rack in reverse order of disassembly. Make sure all pins are secured with the proper retainer pins.

12. Check the operation of the tool rack and lubricate all lubrication points.

TOOL WRENCHES

The tool wrenches (figure 48) are use to clamp the drill pipe in order to break a pipe joint. The tool wrenchs are two specially built hydraulic cylinders operating inside a square casing. A spring loaded pawl engages a pocket in the drill pipe to prevent rotation of the pipe.

Inspect the tool wrenches daily for loose or missing hardware, or any wear or damage. Inspect the wrenches each shift for proer operation. Check each wrench and associated hydraulic lines for oil leaks and repair any leaks found immediately.



1. BEARING BLOCK
2. BLOCK BOLT
3. CYLINDER GUIDE
4. RETAINING COLLAR
5. COLLAR BOLT
6. PISTON ROD
7. CYLINDER BODY
8. PACKING HOUSING
9. HOUSING O-RING
10. PACKING
11. CYLINDER CAP
12. CAP OIL SEAL
13. ROD PACKING
14. ROD GUIDE
15. RETAINING RING
16. PAWL
17. PAWL RETAINING PIN
18. PAWL OUTER SPRING
19. PAWL INNER SPRING

TOOL WRENCH

FIGURE 48

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CHAPTER 3

SECTION 1 — SYSTEMS OPERATION

GENERAL

The 45-R drill is equipped with two independent air systems. The main air system (bailing air) supplies air to clean the drilling chips from the hole. The auxiliary air system supplies air to operate various controls on the drill.

MAIN AIR SYSTEM

The main air system (figure 61) supplies compressed air for bailing the hole during drilling. The air also cleans and cools the bearings in the bit. The air is compressed by a rotary vane air compressor or optional screw air compressor. Inlet air passes through a filter before entering the compressor. Compressed air leaving the compressor flows through the main air line and through an unloader directional valve to the mast air pipe. When the main air valve is activated a butterfly valve in the mast air pipe is opened and the air flows through the main air piping and unloader valve to the air seal connection of the rotary gearcase. It flows down through the drill pipe, through the bit and out of the hole, carrying out the cuttings. When the main air valve is deactivated, the unloader directional valve exhausts the air through a muffler to the atmosphere. When the machine is equipped with a vane compressor, it also closes a butterfly valve on the inlet side of the compressor.

AUXILIARY AIR SYSTEM

The auxiliary air system (figure 62) supplies compressed air for control purposes. It supplies air for brakes, clutches, valves and other air activated devices. It consists of the auxiliary air compressor, main and auxiliary air tanks, piping, controls and the air activated devices. Most systems usually also include some type of antifreeze system and/or an air dryer. Air passes from the compressor to the main air tank. The air then passes from the main air tank to the auxiliary air tank and finally to the air controls and air activated devices. The system is protected from and monitored for failure by safety valves, check valves and pressure switches. Normal operating pressure in the auxiliary air system is maintained between 110 and 125 psi.

SAFETY

Whenever work is to be done on the compressed air system, there are three important safety rules to follow:

1. Turn the air compressor switch in the operator's cab to the "off" position and attach a warning tag to the switch.
2. Open the auxiliary power circuit breaker and attach a warning tag to the breaker.
3. Drain the air from the air tanks and air lines.

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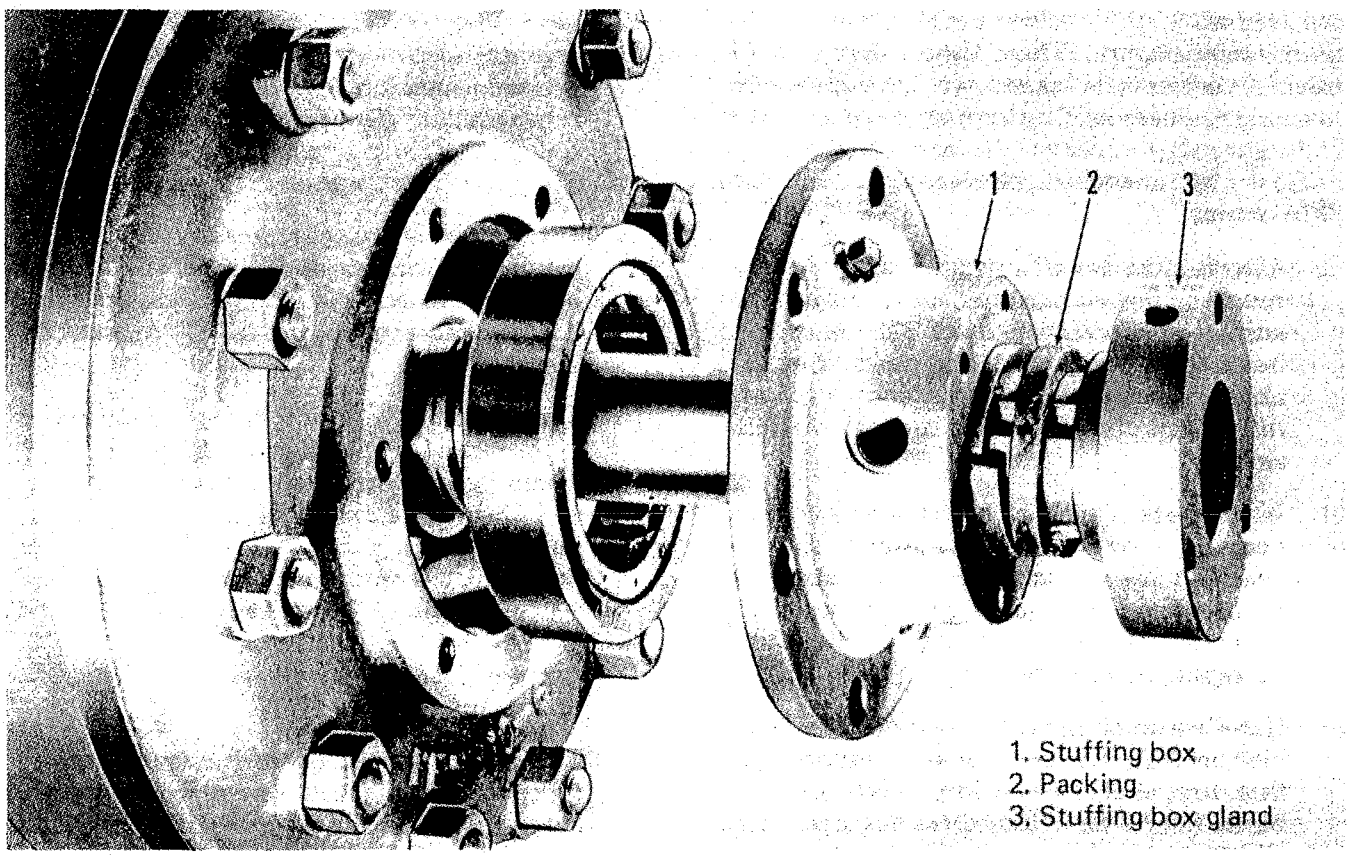


FIGURE 83

4. Through the tapped ports on the discharge side of the cylinder, insert brass shims .002 inches thicker than the rotor bottom clearance. This will take the rotor weight off the bearing inner races.

5. Proceed to the inboard head. Use the jack screws to remove the head evenly. The outer bearing rack with the rollers will come away with the heads. The dowels will remain in the cylinder when the heads are removed.

6. At this time, remove the rotor blades from the rotor shaft before the rotor is removed. Slide the rotor and shaft out of the cylinder as carefully as possible to avoid any damage. The compressor is now dismantled.

7. Thoroughly inspect the inner cylinder. If washboarding wear (figure 84) is evident and is not deeper than .002 inch or .003 inch, this can be removed by polishing with emery. If washboarding is severe enough to rebore, a maximum of .050 inch can be removed from the diameter.

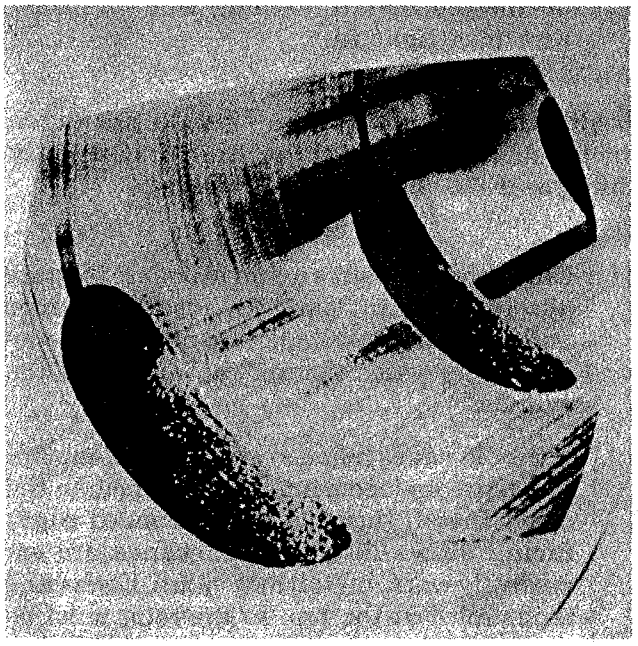


FIGURE 84

If the compressor is maintained properly from the beginning of use, overhaul should not become necessary for a long time. Two conditions usually make overhaul necessary. One is poor maintenance, the other is excessive washboarding. Poor maintenance includes improper lubrication

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The element should be replaced as follows:

1. Loosen the wing nut. Remove the nut and gasket washer.
2. Carefully remove the primary element (clean or replace, if necessary, as described above).
3. Remove the cotter pin and service indicator wing nut holding the safety element in place. Remove the element.
4. Carefully slide a new safety element inside the filter housing. Install the service indicator wing nut and tighten. Install the cotter pin.
5. Carefully slide the primary element into the filter housing. Install the gasket washer and tighten the wing nut until the element is secure against the filter housing.

During intervals between servicing of the filter elements, perform the following inspection:

1. Check to make sure that the filter inlets are clean and not clogged with paper, rags or other debris.
2. Check the connections between the filter and compressor inlet to make sure that all of the clamped and bolted connections are tight and leakproof.
3. Check the "Vacuator" ejector valve to make sure that is not plugged or damaged and is sealing properly around the filter housing cups.

WARNING: Do not operate without a "vacuator" valve on the filter since this will cause short element life.

In addition to the above, the following precautions should be observed in the servicing of the air filters:

1. Do not oil either the primary or safety element before installing.
2. Do not wash the elements in other cleaning fluids.
3. Never operate the compressor without both elements installed.
4. Never use elements that are damaged, ruptured or wet.
5. Never use elements with damaged gaskets.
6. Keep spare primary and safety elements on hand at all times. Store the elements in a protected area where they will be free from damage, dirt and moisture.
7. Handle all filter parts with care.

MAINTENANCE SCHEDULE

The following is the recommended maintenance schedule for the screw compressor.

Daily or Every 8 Hours Operation

1. Check the receiver oil reservoir level with the compressor off and the drill in a level position. Add oil if required. Maintain the oil level within the level gauge bullseye. If oil consumption is high, refer to topic COMPRESSOR OIL SEPARATOR AND EXCESSIVE OIL CONSUMPTION troubleshooting section.

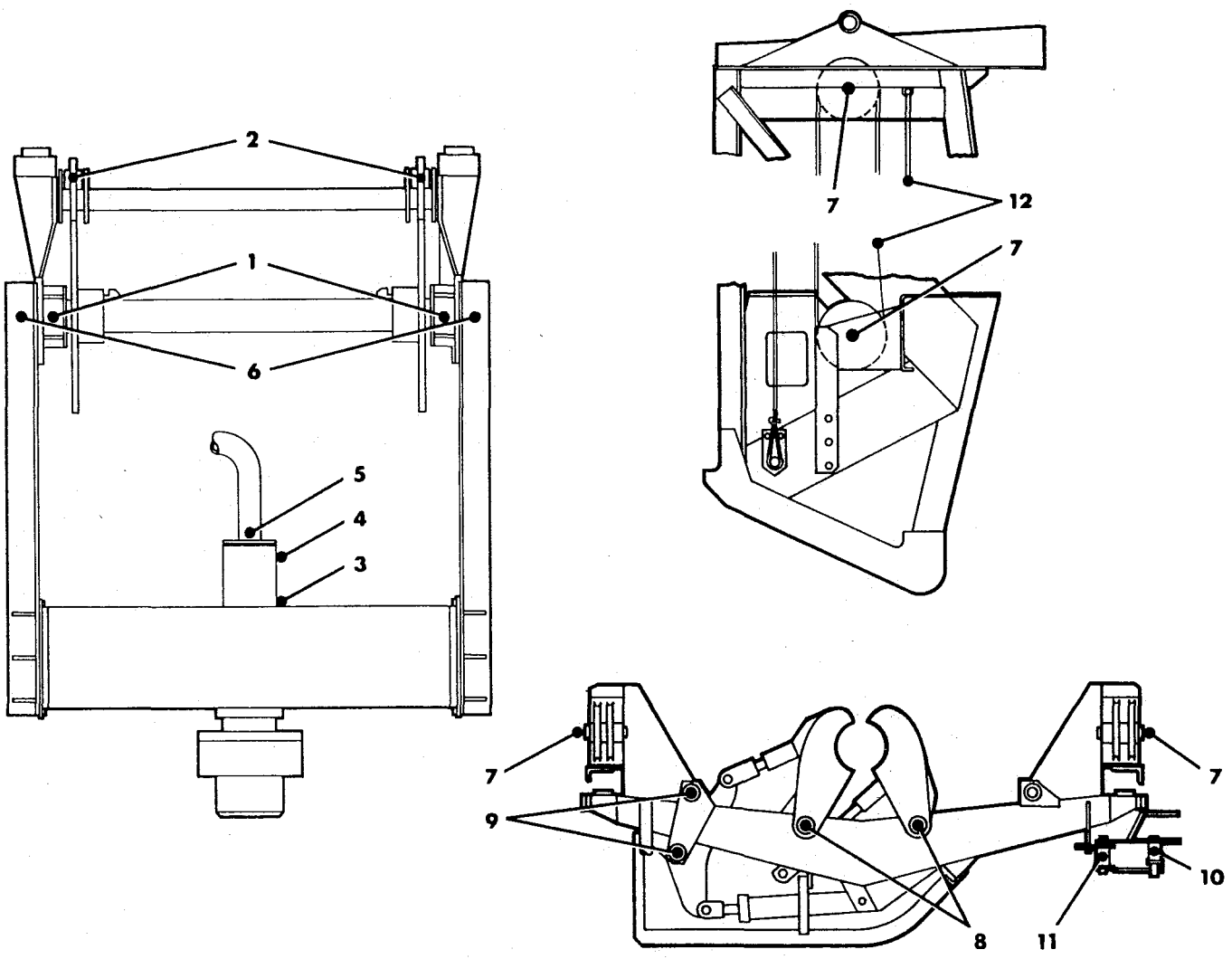
⚠ CAUTION: Compressor must be shut down and reservoir at zero pressure before checking and adding oil.

2. Drain the condensate from the receiver before compressor start-up when the oil is cold. Shut off the drain valve when oil appears.
3. After start-up, check service indicators on inlet air filters, oil filters and oil separator. If indicators are completely red while running, oil filter elements and oil separator must be replaced and air filter primary element must be cleaned or replaced. Refer to topics OIL FILTER ELEMENT AND OIL SEPARATOR REPLACEMENT and AIR FILTER ELEMENT CLEANING AND REPLACEMENT.
4. Observe if the compressor loads and unloads properly.
5. Observe the discharge air pressure, discharge air temperature and oil injection temperature. If the air pressure exceeds either the rating plate pressure when loaded or is 15 psig above the rating plate pressure when unloaded, discharge air temperature exceeds 200°F, or injection oil temperature exceeds 150°F, refer to TROUBLESHOOTING section.

Every 125 Hours of Operation

Check for dirt accumulation on radiator oil cooler core faces and on fan motor. Blow off dirt if accumulation is excessive.

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LUBE POINT	NO. OF POINTS LUBRICATED	TYPE LUBRICANT	HOURS 8	40	160	1000	AS REQ.	(OPTIONAL) AUTOMATED	COMPONENTS
1	2	MPG	X					X	SHIPPER SHAFT BEARINGS
2	2	MPG	X					X	IDLER SPROCKET BEARINGS
3	1	MPG	X					X	VERTICAL SHAFT UPPER BEARING
4	1	MPG	X					X	AIR SWIVEL SEAL
5	1	MPG	X					X	AIR SWIVEL
6	2	MPG	X					X	RACK PINIONS
7	6	MPG				X			CENTER GUIDE SHEAVES
8	4	MPG				X		X	CENTER GUIDE JAW BUSHINGS
9	1	MPG				X		X	CENTER GUIDE BELLCRANK BUSHINGS
10	1	MPG				X		X	PILOT VALVE BRACKET
11	1	MPG				X		X	PILOT VALVE CAM
12	2	RWRL					X		CENTER GUIDE ROPES

NOTE: THE ABOVE FREQUENCIES FOR MANUAL LUBRICATION, IF THE MACHINE IS EQUIPPED WITH AUTOMATIC LUBE SYSTEMS THE FREQUENCIES ARE SET AT THE LUBE CONTROL STATION.

ON AUTOMATIC LUBE SYSTEMS THE INJECTORS SHOULD BE SET AT FULL OPENING AT STARTUP OF A NEW MACHINE AND THEN READJUSTED AS REQUIRED.

MAST LUBRICATION - PART 2

FIGURE 121

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PROBLEM	CAUSE	CORRECTIVE ACTION
Hoist-Propel Transmission (cont.)		
Loss of hoist-propel power.	1. Electrical component failure or out of adjustment.	1. Replace failed component. Make electrical adjustments. Refer to Electrical Instructions Manual.
	2. Dragging propel brake.	2. Adjust.
	3. Clutch failure.	3. Repair.
Hoist jaw clutch malfunction or damage.	1. Operator starting hoist motor before engaging clutch.	1. Use correct procedure.
Cannot steer machine.	1. Propel brakes out of adjustment.	1. Adjust.
	2. Propel brakes not engaging.	2. Check adjustment and action of rotochambers and linkage.
	3. Control valve problem (no air reaching rotochambers).	3. Repair or replace valve (check air lines also).
MAST		
Difficulty in pinning mast in vertical position.	1. Machine not level.	1. Follow correct leveling procedure.
	2. Obstructions.	2. Remove obstructions.
Pipe rack latch will not release.	1. Broken air line.	1. Repair or replace.
	2. Rotochamber frozen up.	2. Remove any condensate, check operation of anti-freezer.
	3. Rotochamber diaphragm ruptured.	3. Repair or replace.
Retaining gate not holding pipe in rack.	1. Control valve not working correctly.	1. Repair or replace.
	2. Retainer cylinder spring broken or cylinder broken off.	2. Repair or replace.
	3. Pin lost or sheared.	3. Replace.
MAIN AIR COMPRESSOR (VANE TYPE)		
Discharge air temperature excessive	1. Excessive discharge air pressure when loaded.	1. a. Reduce discharge pressure by increasing drill bit orifice size. b. Check hoses and piping for abnormal restrictions to air flow.

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APPENDIX A3 — PINION AND COUPLING INSTALLATION

REMOVAL FROM MOTOR SHAFT

⚠ CAUTION: A properly mounted pinion or coupling will have an interference fit with the shaft causing it to release suddenly and violently when broken loose. Loose the shaft nut just enough to allow the pinion or coupling to free itself. The shaft nut will stop the pinion or coupling and avoid injury to personnel.

WARNING: When removing the pinion or coupling from a motor shaft, always use a suitable puller to avoid causing damage to either the pinion, coupling, motor frame, bearings or shaft. Do not heat the pinion or coupling before pulling and do not use wedges between them and the bearing cap. To prevent damage to the anti-friction bearings, avoid the use of a sledge hammer on the puller.

MOUNTING PINION OR COUPLING ON SHAFT

WARNING: Successful operation of the gearing largely depends on the proper mounting of the pinion or coupling on the shaft. Mounting pinions or coupling by heating them in boiling water and driving them on the shaft with a blow from a heavy sledge hammer is not recommended because it resulted in uncontrolled advance of the pinion or coupling on the shaft. Too great an advance can cause breakage of the pinion or coupling core. While insufficient advance can cause slippage and wear in spite of the presence of the key. In addition, hammer blows can injure the finished surface of the anti-friction bearings.

Pinions or coupling must be mounted to a definite advance on the shaft, without hammer blows. This requires heating them to a higher temperature than is obtainable with boiling water, and is based on a difference in temperature between them and shaft. Following is the recommended method for mounting pinions or couplings:

1. Thoroughly clean the pinion or coupling seating surface on the shaft and the bore of the pinion or couplings using toluol or perchloethylene; do not use kerosene.

⚠ CAUTION: Solvents may be toxic or flammable. Adequate ventilation must be provided to minimize fire and health hazards caused by using solvents for cleaning. Use away from sparks, heat or flame to prevent fire or explosion. Follow the manufacturers instructions.

Remove any scoring from either part. Spot the cold pinion or coupling on the shaft by hand to obtain at least a 75 percent fit. Check the fit with bluing. Remove the pinion or coupling.

2. Break all sharp edges of the key and the keyway with a fine file, so there will be a radius of about 1/64 inch at each edge. Fit the key to the shaft, taking care to avoid upsetting the metal of the shaft adjacent to the key. If previously upset, file lightly, checking the fit with bluing until a 75 percent fit results. Try the pinion or coupling on the shaft to make certain it does not bind on the key.

3. Mount the pinion or coupling cold by placing it on the shaft and snapping it into position by hand. Measure the "cold" position of the pinion or coupling, using a micrometer depth gauge (figure 144). Mark the places where the depth gauge was resting so measurements can be made from the same position after the pinion or coupling has been mounted.

4. Remove the pinion or coupling from the shaft and heat it in a suitable oven to the temperature specified. If the pinion or coupling is heated in oil, the bore must be thoroughly cleaned before mounting; to avoid this complication, the use of an oven is recommended.

The pinion or coupling temperature is indicated as a temperature difference between the shaft and pinion; this temperature difference is estimated only and can be adjusted to maintain the specified advance. Heat the pinion or coupling in the oven until the temperature is uniform at the required number of degrees above the shaft temperature. For example, if the shaft temperature is 25°C (77°F) and the estimated difference is 125°C (225°F), heat the pinion or coupling to 150°C (320°F) for mounting.

WARNING: Pinion or coupling temperature must never exceed 190°C.

Some accurate method must be provided for measuring the pinion or coupling and shaft temperatures quickly before mounting the pinion. This is best done with a hand pyrometer (figure 145). When a hand pyrometer is not available, a centigrade thermometer can be used by placing putty

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