



Technical Manual

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! **CAUTION:** Many of the components of the 49-RII drill are heavy, bulky items. Extreme caution should be used when lifting. Personnel should be certain of the weights of components before attempting to lift them, either manually or with some lifting device. Follow all applicable safety rules when using cranes or other lifting equipment. Be sure of the load, lifting height and radius, and capacity of the lifting device before lifting. Failure to follow all applicable safety rules when lifting can cause serious or fatal injury to personnel.

! **CAUTION:** When removing certain machine parts for maintenance or replacement purposes, it may be a practice to loosen these parts by striking them with a sledge-hammer. Use extreme caution when striking metal parts as chips may fly off with great force and possibly cause serious injury. Wear adequate protective clothing including a face shield. Alternate methods of removal might involve using a soft metal hammer or a hydraulic jack with applicable fixtures.

WARNING: Failure to thoroughly clean dirt from joints before opening hydraulic lines could lead to component failure if dirt gets into the system.

3. Remove the hydraulic line from the gearbox brake port. Tag and plug the line. Plug the brake port.
4. The gearbox is mounted in the crawler frame so that the hydraulic motor mounting is 15° from horizontal. Before removing gearbox match mark the gearbox and crawler frame so that at reassembly the gearbox will be at the desired angle.
5. Secure a crane to the gearbox and remove the mounting bolts. Remove the gearbox from the crawler frame.


NOTE: The gearbox mounting bolts are metric bolts.

6. Clean and inspect the gearbox. Repair or replace the gearbox as required and reinstall in reverse of removal.

Refer to figure 1-2-8 for bolt torquing values.

To disassemble the planetary gearbox (figure 1-2-9) completely, proceed as follows:

1. If the lubricant was not drained from the gearbox prior to removal from the crawler frame, drain the gearbox now.

 **CAUTION: The planetary gearbox weighs approximately 2860 lbs. When disassembling the unit, a hoist will be required to handle the larger parts.**

NOTE: All the bolts in this unit are metric.

2. Remove the 4 socket head bolts that secure the motor mount to the housing. Remove the motor mount. As the motor mount is removed, watch that the shift ring does not fall as it slides from the input shaft.
3. To disassemble the brake assembly and shift fork from the motor mount, proceed as follows:
 - a. Remove the socket head bolt that holds the shift fork to the shift shaft.
 - b. Remove the hex head bolt that secures the shift shaft in the motor mount and slide the shift shaft from the mount and shift fork.
 - c. Remove the shift fork. Remove the shift shaft o-ring and seal from the motor mount.

- d. Remove the brake disc stay ring snap ring from the motor mount. Slide the stay ring and disc assembly from the mount. There are 9 inner and 10 outer discs in the assembly.
 - e. Install a clamp to secure the piston to the back-up plate to prevent the springs in the piston from flying out when the back-up plate snap ring is removed. Remove the snap ring and the clamped piston and back-up plate. Remove the piston seal and back-up rings from the motor mount.
 - f. Slowly release the clamp to allow the spring compression to fully release. Remove the plate, springs, seal and seal back-up rings from the piston.
4. Remove the motor mount o-ring from the housing.
 5. Remove the input shaft bearing snap ring and remove the shaft with bearings from the housing. Separate the bearings from the shaft. The bearing cage of the inner bearing will remain in the housing.
 6. Remove the 1 inner socket head bolt and 15 outer hex head bolts that hold the housing to the twin ring gear.
 7. Remove the spur gear assembly, ball bearing and sun shaft from the housing. Also remove the input shaft inner bearing cage. If required, separate the spur gear from the coupler by removing the 12 socket head bolts.
 8. Slide the first stage planetary gear assembly from the twin ring gear.
 9. Separate the first stage planetary gear assembly as follows:
 - a. Remove the gear snap ring and slide the gear assemblies from the carrier shafts.
 - b. Remove the bearings, stay rings and snap rings from the gears.
 - c. Remove the sun shaft snap ring and remove the sun shaft from the carrier.
 10. Remove the 24 hex head bolts that secure the twin ring gear to the back-up plate and remove the twin ring gear. The second stage planetary gear assembly front bearing cage will remain in the twin ring gear. Remove it, if required.
 11. Remove the 8 hex head bolts that secure the tumbler sprocket hub retainer to the second stage planetary gear assembly. Separate the retainer, hub, face seal and back-up plate from the second stage planetary

5. For rear jack repair, with an open-end wrench, remove the female half of the quick disconnect from the male half that is attached to port PR of the counterbalance valve. Leave the 1/4" hose attached to the female half of the quick disconnect.

6. When step 5 has been completed, disconnect the 1/4" hose at the electric junction box.

! CAUTION: Always maintain a firm grip on the hose while the oil is flowing from it. Do not allow the stream of oil to contact your skin as injury can occur.

7. Point the open end of the 1/4" hose into an empty 5 gallon pail and re-attach the female half of the quick-disconnect to the male half that is still attached to port PR. When the quick disconnect opens, a stream of oil from the rod side of the cylinder will exhaust from the 1/4" hose into the pail. This will allow the jack pad to lower by gravity to the ground at which time the oil will stop flowing.

8. Again remove the female quick-disconnect half with 1/4" hose as in step 5 and reconnect the 1/4" hose onto port of electric junction box.

9. For front jack repair, uncouple the quick-disconnect at both front jacks, using a 1 1/4" open-end wrench. The male half of the quick-disconnect will remain attached to the valve.

10. At one front jack only, remove the other end of the quick-disconnect hose from the electrical junction box on the jack.

11. Place the hose end, removed from the electrical junction box, into a clean five gallon container. (Two additional 5 gallons will be required to handle the oil from both front jacks.)

! CAUTION: Always maintain a firm grip on the hose while the oil is flowing from it. Do not allow the stream of oil to contact your skin as injury can occur.

12. Re-couple the quick-disconnect. As the connection nears completion, oil will run out of the hose-end in the container and the jack pad will drop to the ground! This will relieve all pressure on the piston rod and create a vacuum on the housing-end of the cylinder.

13. To remove the oil from the other front jack, a helper will be required. Have the helper continue to hold the disconnected hose into a empty 5-gallon container while you re-couple the quick-disconnect on the other front jack. The oil from this jack will now flow from the hose being held by the helper.

14. When the oil flow has stopped and the jack pad is on the ground, the loose end of the hose can be re-connected to the electrical junction box.

15. Remove male half of quick-disconnect from port PR and thread it loosely into female half. Cover open end with protection cap.

16. Remove 3/8" hose at counterbalance valve and plug open end of hose.

17. Insert SAE-6 steel O-ring boss plug into ports PR and PH.

18. Remove the casing cover bolts.

NOTE: If one of the front jacks is to be repaired, the mast brace support must be removed and an eyebolt installed in the cover for removal purposes.

19. Remove the capscrew securing the shoe retainer to the spud. Separate the shoe from the spud and remove the retainer and split retainer from the shoe.

20. Attach a suitable lifting device to the lifting lug or eyebolt on the casing cover and carefully lift the spud and cylinder from the casing.

21. To remove the cylinder from the spud, remove the pipe plugs securing the spud foot pin and remove the pin.

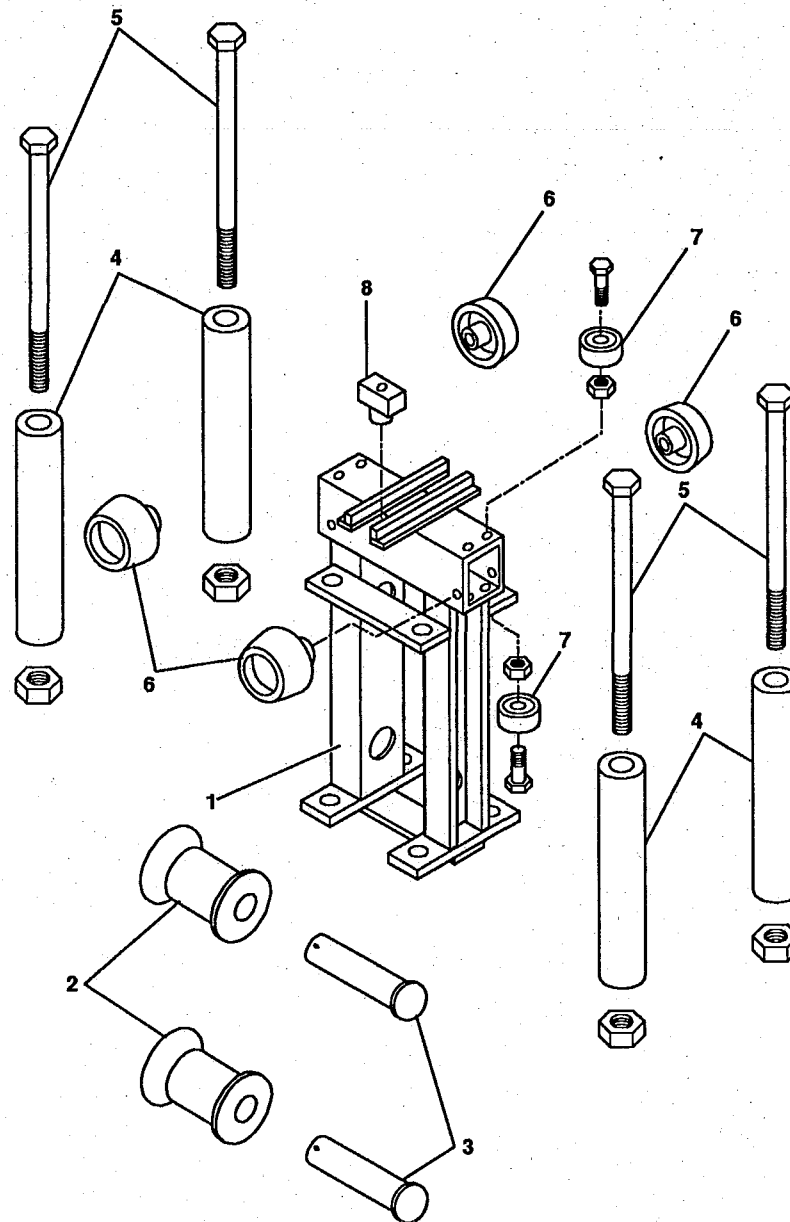
22. Slide the cylinder from the spud. Remove the casing cover from the cylinder.

23. Repair or replace components as necessary.

24. Install the casing cover on the cylinder.

NOTE: The cylinder rod should be retracted fully into the cylinder body. If not, using hydraulic pressure, retract the hydraulic cylinder to the fully retracted position. Note that hydraulic pressure must be used and pressure be exerted at port VR before the counterbalance valves will allow the cylinder to move. Use oil similar to what is used in the hydraulic system.

25. Using a suitable lifting device, slide the



1. TROLLEY FRAME
2. HORIZONTAL ROLLER
3. ROLLER SHAFT
4. VERTICAL ROLLER
5. ROLLER BOLT
6. SUPPORT ROLLER
7. ALIGNMENT ROLLER
8. DRIVE LINK

**CABLE REEL
LEVEL WIND
FIGURE 1-3-18**

43. Install the intermediate gear (figure 1-4-5) and block in place. Set the seal sleeve on top of the gear. Align the bore of the gear with the bore of the shaft.
44. Heat the lower bearing in an oil bath to 250°F maximum and install the bearing on the shaft. Secure the bearing with the retainer and lockwire the capscrews.
45. Install the O-ring in the lower cover. Insert the shaft assembly into the gearcase. Install the lower cover and secure it with the cover capscrews. Tighten and lockwire the capscrews.
46. Install the upper oil seal. Heat the inner race of the upper bearing in an oil bath to 250°F maximum and install on the shaft. Be sure the race is tight against the spacer, then secure the race with the bearing retainer. Tighten and lockwire the retainer capscrews. Allow the race to cool to ambient temperature.
47. Install the upper bearing cage in the gearcase. Install the O-ring on the upper cover and install the cover on the gearcase. Tighten and lockwire the cover capscrews.
48. Install the motor per topic, ROTARY MOTOR and fill the gearcase with an approved lubricant. Lubricate all lube points with an approved lubricant.

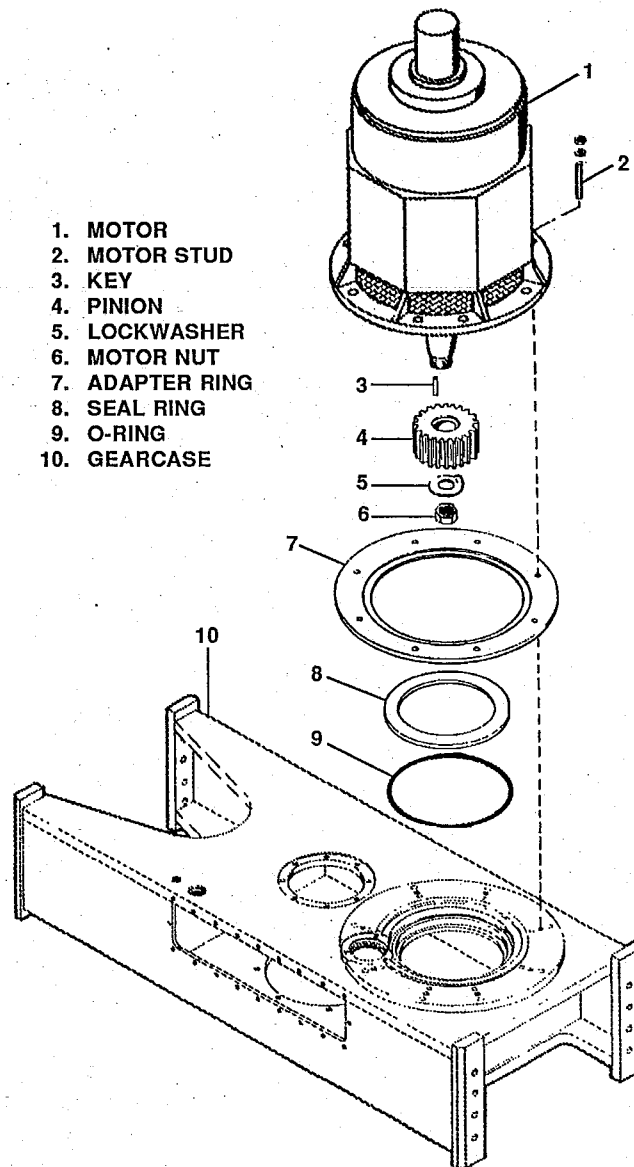
ROTARY MOTOR

Inspection, lubrication and maintenance instructions for the rotary motor are described in the manufacturer's Motor Manual. To remove the rotary motor (figure 1-4-7) proceed as follows:

1. Lower the rotary drive unit to the bottom of the mast and rest it on the lower stops.

⚠ CAUTION: Open and tag the auxiliary power and control breakers in the machinery house. Do not attempt to disconnect the motor leads with these breakers closed. A voltage hazard is present and electrocution is possible if these breakers are left closed.

2. Have an electrician identify and disconnect the electrical leads to the rotary motor. Remove the cable from the junction box on the motor.
3. Remove the motor attachment stud nuts and washers.



ROTARY MACHINERY ROTARY MOTOR

FIGURE 1-4-7

4. Using a suitable crane and rigging, lift the motor from the rotary gearcase.
5. Repair or replace the motor as necessary.
6. The motor pinion is press fit to the motor shaft. Refer to the APPENDIX for instructions regarding replacement or installation of the motor pinion.
7. Prior to installation of the motor clean the mounting surfaces on both the gearcase and the motor
8. Install the rotary motor in reverse order of removal. Torque the attachment stud nuts using turn-of-the-nut method. Tighten nuts snug, and then an additional 1/3 turn.

case. Refill the gearcase to the required level with an approved lubricant.

REPAIR

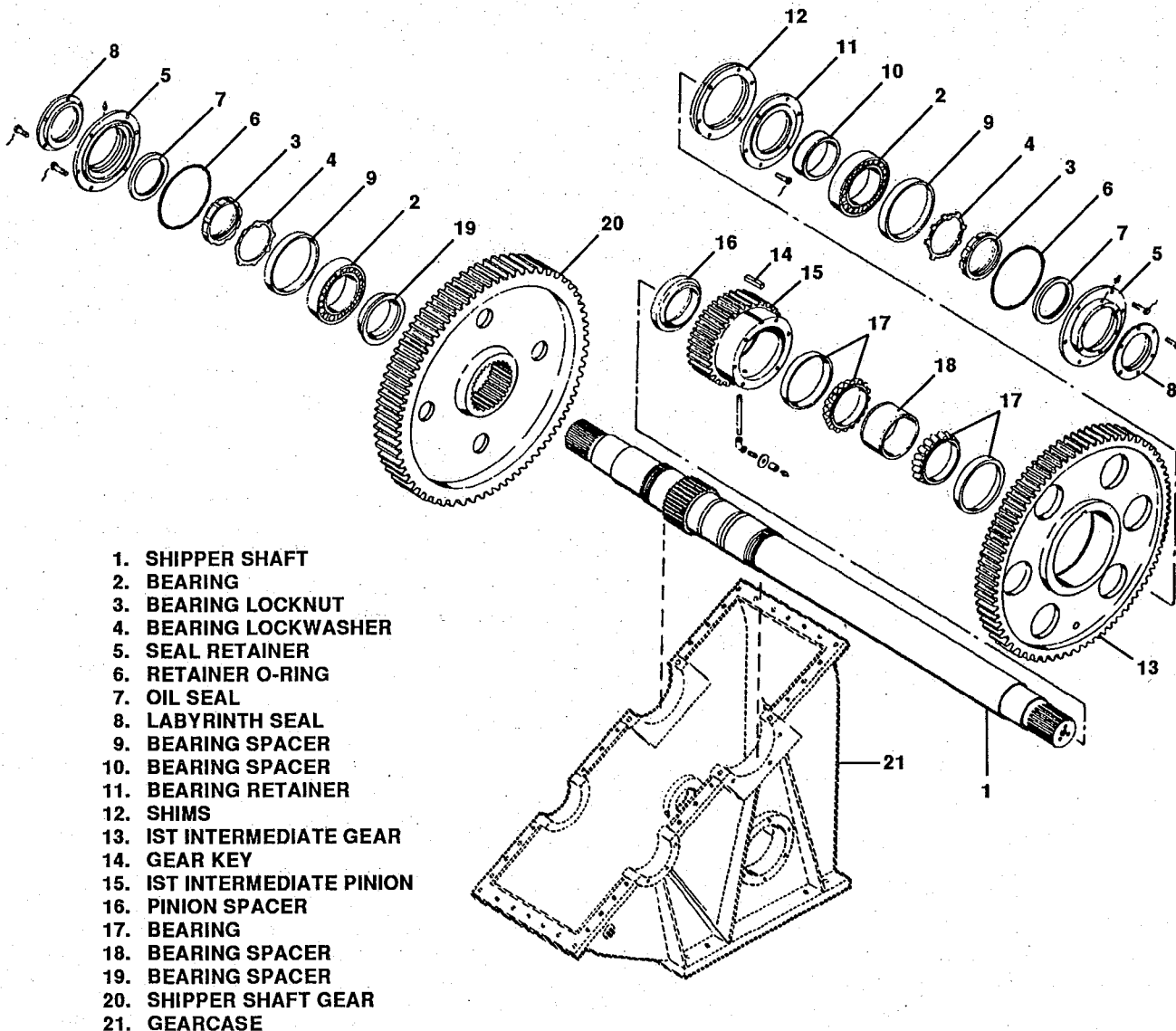
Repair of the pulldown gearcase is limited to replacement of worn or damaged components. The unit may be repaired in place on the machine or may be removed from the machine and repaired elsewhere. Refer to the topic ROTARY/PULLDOWN GUIDE FRAME for the procedure necessary to remove the assembly from the machine.

To repair the pulldown gearcase (figure 1-4-14 thru 1-4-17), proceed as follows:

NOTE: For this procedure we will consider the pulldown gearcase has been removed from the machine per Steps 17 through 20 of the topic ROTARY/PULLDOWN GUIDE FRAME - REPAIR.

CAUTION: Be sure the rotary/pulldown guide frame is secured to the mast by cable or other means. Since the rack pinions and upper guide rollers have been removed.

1. Remove the bearing spacer from the ends of the shipper shaft. Use a puller to remove the end bearing from the shaft. The bearings have an interference fit of .0018-.0038 to the shaft.



PULLDOWN MACHINERY
 FIRST INTERMEDIATE & SHIPPER SHAFT
 FIGURE 1-4-15

Inspect the support daily for loose or missing hardware. Lubricate the pivot point bushings monthly.

Repair of the unit will consist of repair or replacement of worn or damaged parts. Refer to figure 1-4-23 for the parts of the unit.

PIPE POSITIONER

The pipe positioner (figure 1-4-24) is used to align the drill pipe ends when making or breaking joints when angle hole drilling.

The pipe positioner is mounted to the mast and is moved in and out of position by two hydraulic cylinders. A third hydraulic cylinder operates the positioner jaws.

When angle hole drilling inspect the positioner daily for loose or missing hardware or any wear or damage. Replace any missing hardware and repair or replace any worn or damaged parts. Repair welding techniques can be found in the APPENDIX. Daily check the cylinders and hoses for leaks.

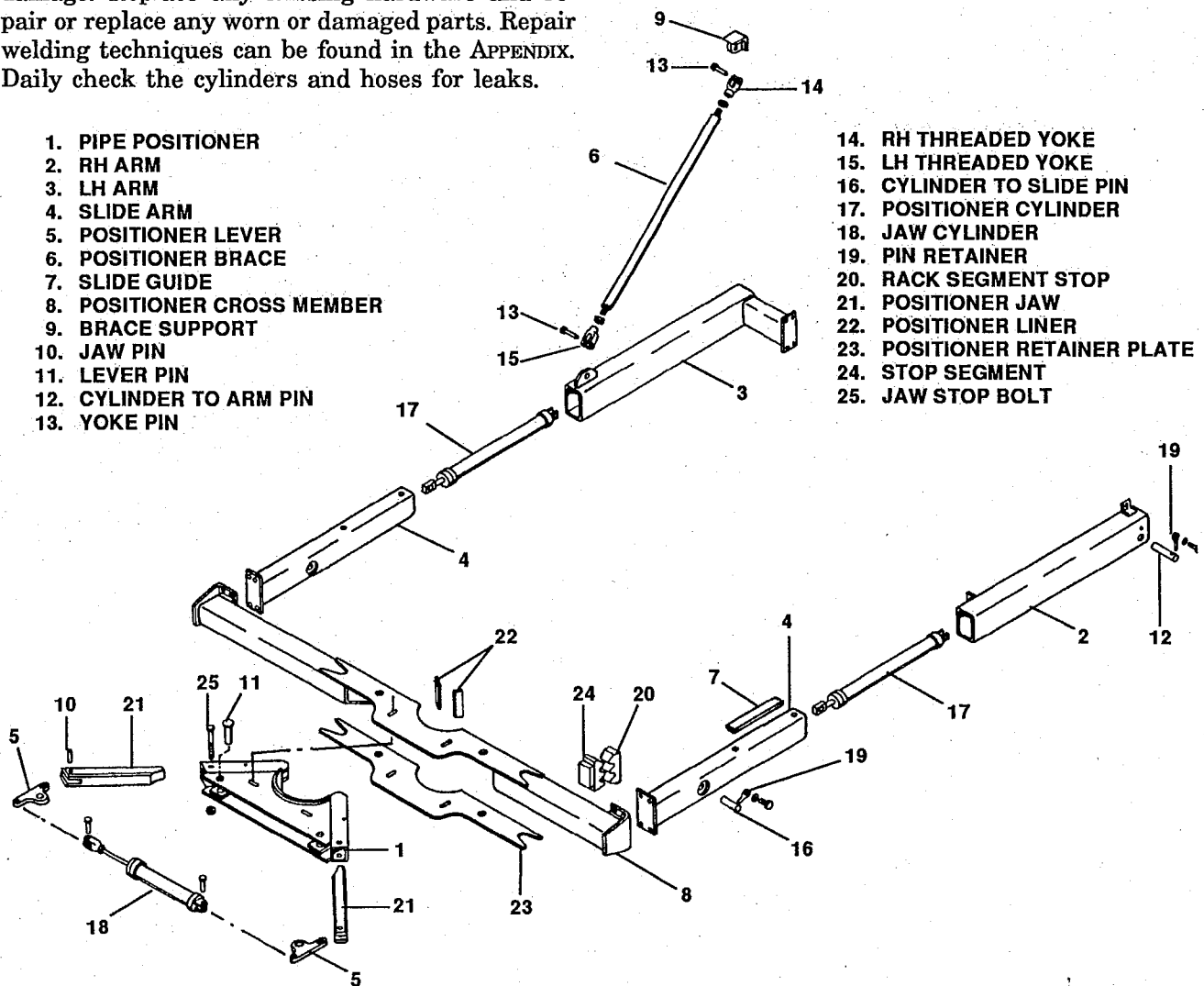
Lubricate the sliding arms and jaws of the positioner, as required.

Repair of the pipe positioner would consist mainly of replacement of worn or damaged parts. The parts of the positioner are shown on figure 1-4-24.

AUXILIARY WINCH

The auxiliary winch is used to lift tools on and off the drilling deck. The winch consists of a hydraulically driven reel mounted at the bottom of the mast, a cable with hook, and cable guide sheaves at the top of the mast (figure 1-4-25).

The oil level in the winch should be checked monthly. The sheaves at the top of the mast should be checked monthly for wear or damage. Once a year the sheave bearings should be re-packed with lubricant.



- 1. PIPE POSITIONER
- 2. RH ARM
- 3. LH ARM
- 4. SLIDE ARM
- 5. POSITIONER LEVER
- 6. POSITIONER BRACE
- 7. SLIDE GUIDE
- 8. POSITIONER CROSS MEMBER
- 9. BRACE SUPPORT
- 10. JAW PIN
- 11. LEVER PIN
- 12. CYLINDER TO ARM PIN
- 13. YOKE PIN

- 14. RH THREADED YOKE
- 15. LH THREADED YOKE
- 16. CYLINDER TO SLIDE PIN
- 17. POSITIONER CYLINDER
- 18. JAW CYLINDER
- 19. PIN RETAINER
- 20. RACK SEGMENT STOP
- 21. POSITIONER JAW
- 22. POSITIONER LINER
- 23. POSITIONER RETAINER PLATE
- 24. STOP SEGMENT
- 25. JAW STOP BOLT

PIPE POSITIONER
FIGURE 1-4-24

pumps and depress the drill/propel ON pushbutton. Record the pressure at test ports 8 and 18. Test port 18 should be the same as pressures noted in step 2 of CONTROL PRESSURE CHECK.

2. With pump still running, first lift one propel joystick out of the DETENT position and then release it. Do the same with the other joystick.

NOTE: There is no need to move joysticks out of NEUTRAL. Just lift the joystick clutch straight up to engage solenoid Propel Active Valve (PAV).

Accomplishing step 2 will cause PAV to energize which should cause pressure at test port 18 to go from 600 PSI to 0 and test port 8 should go from 0 to 600 PSI.

3. With a 1500 PSI gauge at test port 9 and the pumps running, rotate Propel Selector Switch to SLOW speed and record pressure.
4. Pressure in step 3 should be within 50 PSI of control pressure check step 2.
5. With Propel Selector in NORMAL, record pressure at test port 9. (Should read zero.)

JACK CYLINDER CHECK IN MANUAL MODE

NOTE: Under no circumstances must either 3-spool valve (item 5, figure 2-1-1) or relief valve adjustments be allowed to bottom-out. The spool valve is located on the back wall of the machinery house to the left of the hydraulic oil tank and slightly below the top of the tank. The main relief is near the inlet port.

1. With a 7,500 PSI gauge at test port 16 and pumps running, energize auto level in RETRACT mode. With all cylinders fully retracted, adjust 3-spool valve relief to show exactly 3,300 PSI on the gauge.
2. Check all jacks for operation versus manual lever movement (i.e. moving the right front jack control to EXTEND, extends the right front jack. Check both directions with all 4 jacks).

NOTE: Re-check hydraulic oil level and add oil as required.

WARNING: Set flow controls per FLOW CONTROL CHECK before continuing with step 3.

3. Back-out adjustment of relief valve (item 35, figure 2-1-1) 1/8th of a turn and then tighten the jam nut.
4. Install a 0-1,500 PSI gauge at test port 70, located at inlet to back pressure valve underneath and slightly to the left (rear) of the 3-spool valve.
5. With the right front jack manually extending from full RETRACT position, adjust back pressure relief as necessary to see 400 PSI.
6. With step 5 complete, install a 7,500 PSI gauge at test port 16 and with right front jack extending from full RETRACT towards the ground, adjust relief valve (item 35, figure 2-1-1) located at inlet of jack spool valve on jack stand. Adjust to see 3,200 PSI.

NOTE: Do not bottom any relief valve adjustments.

7. Re-check all jacks for operation versus manual lever movement.
8. Install all four jack pads.

FLOW CONTROL CHECK

1. Remove hose nearest wall from 3rd flow control (counting from left to right) on jack valve stand and install a -10 ORS steel plug into the open hose.
2. Install a 20 GPM Hedland flow meter #700-020 (inlet side) into the open port of flow control.
3. Disconnect hose coming from the spool valve to the 7th flow control. Install a steel -10 ORS cap onto the flow control's open port.
4. Connect the outlet side of the flow meter to the hose just removed from the 7th flow control.
5. With pumps running and with the aid of a helper, energize left rear jack, in either UP or DOWN mode, to show flow in the meter. Adjust flow regulator, as required, to see EXACTLY the flow as shown on the following chart.

NOTE: If all 4 jack cylinders are the same size (i.e. all are 8" bore diameter or all are 9" bore diameter), then do not use flow setting chart. Instead, set all 8 flow controls to 15 GPM for 60 Hz machines as well as for 50 Hz machines running at 3,000 RPM input speed. All other 50 Hz machines are to be set at 12.5 GPM.

TEST POINT NUMBER *		TEST POINT LOCATIONS ON MACHINE (for machines through 141001)	
1	Left Crawler Pump at Port "A"		
2	Left Crawler Pump at Port "B"		
3	Right Crawler Pump at Port "A"		
4	Right Crawler Pump at Port "B"		
5	Right Crawler Motor Brake Release Port		
6	Left Crawler Motor Brake Release Port		
7 (b)	Immediately Below Solenoid Valve at Station 6 of 6-Station Manifold Assembly		
8 (b)	Immediately Below Solenoid Valve at Station 4 of 6-Station Manifold Assembly		
9 (b)	Immediately Below Solenoid Valve at Station 3 of 6-Station Manifold Assembly		
10 (f)	At Port B-1 of 4-Station Valve		
11 (f)	At Port B-2 of 4-Station Valve		
12 (f)	At Port A-2 of 4-Station Valve		
13 (f)	At Port A-1 of 4-Station Valve		
14	At Left Crawler Pump Filter Outlet		
15	At Right Crawler Pump Filter Outlet		
16	At Jack Cylinder Pump Discharge Port (Back of LH Crawler Pump)		
17 (b)	At Port "A" of Station 6 of 6-Station Manifold Assembly		
18 (b)	At Port "A" of Station 4 of 6-Station Manifold Assembly		
19 (b)	At Station 2 of 6-Station Manifold Assembly		
20 (b)	At Station 1 of 6-Station Manifold Assembly		
21 (c)	At Station 6 of 7-Station Manifold Assembly		
22 (c)	At Station 5 of 7-Station Manifold Assembly		
23 (c)	At Station 4 of 7-Station Manifold Assembly		
24 (c)	At Station 3 of 7-Station Manifold Assembly		
25 (c)	At Port "A" of Station 1 of 7-Station Manifold Assembly		
26 (c)	At Port "B" of Station 1 of 7-Station Manifold Assembly		
27 (d)	At Port A-1 of 6-Station Valve		
28 (d)	At Port B-1 of 6-Station Valve		
29 (d)	At Port A-2 of 6-Station Valve		
30 (d)	At Port B-2 of 6-Station Valve		
31 (d)	At Port A-3 of 6-Station Valve		
32 (d)	At Port B-3 of 6-Station Valve		
33	Top Front Pilot Port of Pilot-Operated Valve on Jack Stand		
34	Top Rear Pilot Port of Pilot-Operated Valve on Jack Stand		
35	Second From Top, Front Pilot Port of Pilot-Operated Valve on Jack Stand		
36	Second From Top, Rear Pilot Port of Pilot-Operated Valve on Jack Stand		
37	Third From Top, Front Pilot Port of Pilot-Operated Valve on Jack Stand		
38	Third From Top, Rear Pilot Port of Pilot-Operated Valve on Jack Stand		
39	Bottom Front Pilot Port of Pilot-Operated Valve on Jack Stand		
40	Bottom Rear Pilot Port of Pilot-Operated Valve on Jack Stand		
41	On Rear-Most Flow Control on Jack Stand		
42	On Flow Control, 2nd from Rear on Jack Stand		
43	On Flow control, 3rd From Rear on Jack Stand		
44	On Flow control, 4th From Rear on Jack Stand		
45	On Flow control, 5th From Rear on Jack Stand		
46	On Flow control, 6th From Rear on Jack Stand		
47	On Flow control, 7th From Rear on Jack Stand		
48	On Front-Most Flow control on Jack Stand		
51 (h)	At Port "P" Nearest Station 4 of 4-Station Valve		
52 (g)	At Port "P" Nearest Station 8 of 8-Station Valve		
53 (i)	At Station 2 of 2-Station Valve		
54 (i)	At Station 1 of 2-Station Valve		
55 (j)	At Station 1 of 3-Station Valve		
56 (g)	At Station 1, Port "B" of 8-Station Valve		
57 (g)	At Station 7, Port "B" of 8-Station Valve		
58 (g)	At Station 5, Port "B" of 8-Station Valve		
59 (f)	At Rear Facing Port "P" of 4-Station Valve		
60	At front facing port of mast brace constant pressure valve		
61	At rear facing port of mast lock constant pressure valve		
64	At inlet port of lube enable valve (for machines 140980, 140990 and future)		
65	At bottom facing port of A-frame Constant Pressure Valve		
66	Left Mast Hoist Cyl. Manifold Ass'y. at Test Port Nearest Rod		
67	Left Mast Hoist Cyl. Manifold Ass'y. at Test Port Nearest Base		
68	Right Mast Hoist Cyl. Manifold Ass'y. at Test Port Nearest Rod		
69	Right Mast Hoist Cyl. Manifold Ass'y. at Test Port Nearest Base		
70	At inlet to back pressure valve.		
71 (c)	Immediately below Solenoid Valve at Station 2 of 7-Station Manifold Ass'y.		

VALVE	CATALOG REF. NO.	ILLUSTRATION NUMBER	MACHINE LOCATION DESCRIPTION
a	AH25	Item 1 (Fig.2-1-6)	5-Station manifold assembly located on jack valve stand (Left side of house)
b	AH287	Item 1 (Fig.2-1-1)	6-Station manifold assembly located immediately above and to rear of jack valve stand.
c	AH24	Item 12 (Fig.2-1-1)	7-Station manifold assembly located above and forward of (b).
d	AH288	Item 4 (Fig.2-1-1)	6-Station valve located on sloped roof [Left side of house, to rear of (b)].
e	AH421	Item 7 (Fig.2-1-6)	Line mounted immediately below (d).
f	AH290	Item 7 (Fig.2-1-7)	4-Station valve mounted near piston pump.
g	JH52	Item 16 (Fig.2-1-2)	8-Station valve located directly above auxiliary winch.
h	JH53	Item 1 (Fig.2-1-1)	4-Station valve located in center of mast directly above manifold and (g).
i	JH50	Item 1 (Fig. 2-1-2)	2-Station valve located on left side of mast at same vertical height as (g).
j	JH55	Item 4 (Fig. 2-1-2)	3-Station valve located directly above (i).
k	AH441	Item 29 (Fig. 2-1-1)	Line mounted below 7-station manifold assembly.
l	AH442	Item 30 (Fig. 2-1-1)	Line mounted immediately to the rear of (k).

*Test Points: (1-15 & 59 shown on figure 2-1-7)

(16-32, 60, 61 & 65-71 shown on figure 2-1-1)

(33-48 shown on figure 2-1-6)

(51-58 shown on figures 2-1-2 through 2-1-5)

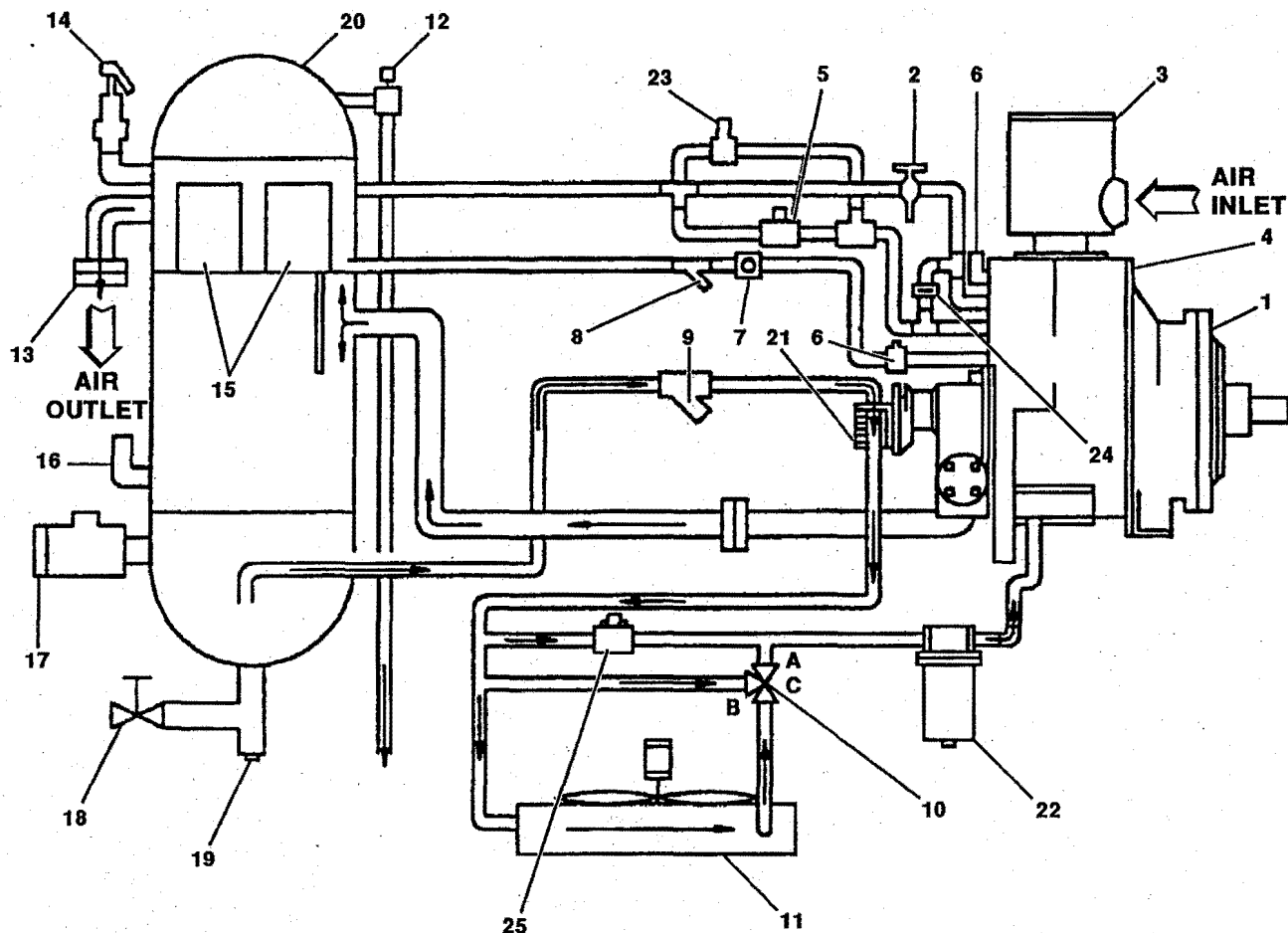
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- | | | |
|---------------------------------|--------------------------------|------------------------------------|
| 1. COMPRESSOR AIR END | 10. THERMOSTATIC CONTROL VALVE | 19. DRAIN MAGNETIC PLUG |
| 2. VACUUM BREAKER VALVE | 11. OIL COOLER RADIATOR | 20. AIR/OIL RECEIVER |
| 3. INLET AIR FILTER | 12. BLOWDOWN SOLENOID VALVE | 21. OIL PUMP |
| 4. INLET REGULATING VALVE | 13. MINIMUM PRESSURE ORIFICE | 22. OIL FILTER |
| 5. AIR PRESSURE CONTROL VALVE | 14. SAFETY RELIEF VALVE | 23. VARIABLE VOLUME CONTROL VALVE |
| 6. OIL FILL CONNECTION | 15. OIL SEPARATOR ELEMENTS | 24. INLET VALVE BLEED ORIFICE |
| 7. ORIFICE/SIGHT FLOW INDICATOR | 16. OIL FILL CONNECTION | 25. BACK PRESSURE REGULATING VALVE |
| 8. SCAVENGING LINE STRAINER | 17. OIL LEVEL GAUGE | |
| 9. PUMP INLET STRAINER | 18. RECEIVER OIL DRAIN VALVE | |

TYPICAL FOR AC DESIGN UNITS
COMPRESSOR PACKAGE COMPONENTS AND FLOW DIAGRAM
 FIGURE 3-3-5A

tors produces a vacuum downstream from the inlet regulating valve (figure 3-3-6 or figure 3-3-6a). This drop in pressure causes the atmospheric pressure upstream of the valve to "push" the inlet valve completely open and thus provides full flow of air into the compressor. As explained above, the inlet valve is closed by the air pressure control valve admitting air to the diaphragm (figure 3-3-6) or piston (figure 3-3-6a). The orifice in the regulating valve (figure 3-3-6) or system (figure 3-3-6a) is required to bleed air off the inlet valve piston or diaphragm when full air is required again.

In addition to regulating the inlet air volume, the inlet valve also acts as a check valve when the compressor shuts down. When the compressor shuts down, the regulating valve spring will rapidly close the inlet valve. This prevents the pressurized air and oil in the compressor and downstream system from flowing back through the inlet air filters.

Air Pressure Control Valve

As explained above, the purpose of the air pressure control valve is to control the receiver pressure by opening or closing the inlet regulating

NOTE: Cold ambient temperatures may cause the lubricant to thicken in the cooler and result in unit shutdown after a short run. The use of synthesized hydrocarbon or synthetic lubricant may be required. Any synthetic lubricant must be authorized by the compressor manufacturer.

FILLING OIL SYSTEM (Initially)

1. Remove pipe plug from receiver oil fill connection (figure 3-3-5 or figure 3-3-5a).
2. Fill the receiver with recommended oil to top of the gauge glass with approximately 55 gal. (208 liters) for models KS27LU or KS27AC, and 66 gal. (249 liters) for model KS31LU and 80 gal. (303 liters) for model KS31AC.
3. Replace and tighten pipe plug.
4. Remove plug from fill connections on top of radiator cooler and fill to top.

NOTE: Capacity will vary with cooler size from 7-26 gallons (26-99 liters).

5. Replace cooler fill plugs and tighten.
6. For LU design compressors, remove plug from oil (initial) fill connection on compressor scavenging line near the inlet regulating valve (figure 3-3-8). Fill the compressor body with 12 gal. (45 liters) for model KS27LU and 14 gal. (53 liters) for model KS31LU.

For AC design compressors, remove plug from oil (initial) fill connection on compressor vacume breaker line near the inlet regulating valve. Fill the compressor body with approximately 1-1/2 gal. (5.7 liters) for model KS27AC and 3 gal. (11 liters) for model KS31AC.

7. Replace oil fill plug and tighten.
8. Start compressor and run compressor for approximately 15 minutes. Shut-down compressor, check oil level, and replace oil if necessary.

OIL LEVEL GAUGE


The receiver oil level gauge should be observed daily to check the oil level. If the oil level is below the level gauge bull's-eye, while running, stop the compressor and check the level with the receiver at zero pressure. The oil level must be maintained within the bull's-eye.

NOTE: The drill must be level when checking oil level.

ADDING OIL BETWEEN CHANGES

If the receiver oil level is below the level gauge bull's-eye, while running, stop the compressor and allow the receiver to blow-down to zero pressure. If the oil level is below the bull's-eye, add oil until the level is at the top of the bull's-eye.

NOTE: The drill must be level when checking oil level

 **CAUTION:** Receiver reservoir contains hot oil under pressure. Before adding oil, compressor must be stopped and receiver at zero pressure before removing fill plug. Make sure plug is tight after filling.


OIL CHANGE INTERVALS

Oil and oil filter change intervals are to be determined by oil sampling and analysis. Oil sampling and analysis is recommended every 200 hours of compressor operation, or at least until and oil/oil filter change pattern or schedule is established.

DRAINING OIL SYSTEM

Before draining the oil system, compressor must be stopped and receiver at zero pressure. Always drain the complete system. Draining while the oil is hot will help to prevent varnish deposits and to carry away impurities. To drain the system, use the following procedure:

1. Stop compressor and wait until receiver pressure is zero.

 **CAUTION:** Use care not to touch hot oil while draining.

2. Open valve on oil reservoir and drain the oil. Close drain valve. Remove magnetic drain plug and clean it. Replace plug and tighten.
3. Open drain connections on oil cooler and drain completely.

NOTE: Open fill plugs slightly to vent the cooler while draining. Replace plugs and tighten.

4. Remove plugs from oil drains on compressor air end and drain oil completely.

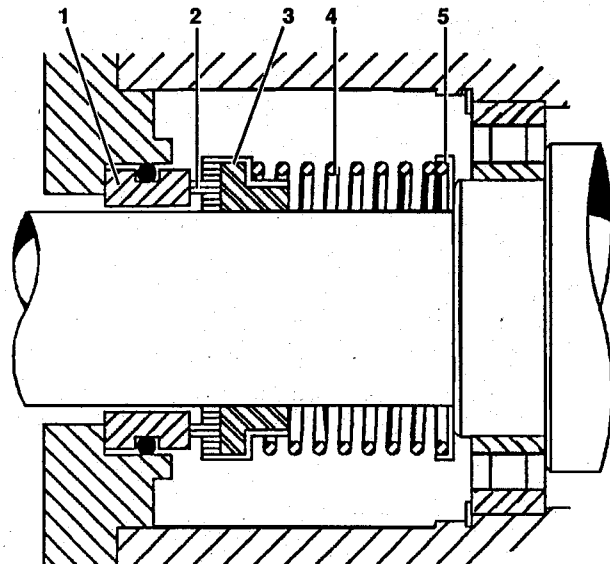
NOTE: Place a large oil pan under drains before removing plugs. Replace and tighten plugs.

13. Apply a small (1/16" diameter) continuous bead of sealer (Loctite 515 or equivalent) to the piston cylinder mounting face of the air end cylinder.
14. Re-install the piston cylinder (with capscrew holes correctly aligned) on the mounting face on the air end cylinder.
15. Coat the threads of the piston cylinder capscrews with locking compound (Loctite® 242 or equivalent) and install the piston cylinder. Tighten securely.
16. Install new seals on the piston. Position the seals so that the upper seal-lip is turned up and the lower seal-lip is turned down.
17. Lubricate the piston seals and piston cylinder bore with silicon lubricant (Dow Corning® 55M or equivalent).
18. Insert the piston into the piston cylinder. Take care not to deform or damage the seals during installation.
19. Re-install the piston springs.
20. Apply a small (1/16" diameter) continuous bead of sealer (Loctite 515 or equivalent) to the top end of the operating piston cylinder.
21. Coat the threads of the piston retainer capscrews with locking compound (Loctite 242 or equivalent).
22. Install piston retainer with capscrews. Tighten capscrews securely.
23. Re-install the intake valve plate spring.
24. Re-install the intake valve plate. Make certain the valve plate slides freely on the operating piston rod.
25. Apply a small (1/16" diameter) continuous bead of sealer (Loctite 515 or equivalent) to the valve plate retaining flange mounting surface of the air end cylinder (inlet opening).
26. Carefully re-install the valve plate retaining flange with capscrew holes correctly aligned. Re-install the flange retaining capscrews, if used.
27. Install a new air cleaner mounting flange gasket.
28. Re-install the air cleaner. Re-install the capscrews and tighten securely.

AIR END INPUT SHAFT OIL SEAL REPLACEMENT (figure 3-3-15) (for AC design units only)

The air end input shaft rotary oil seal may be replaced as follows:

1. Remove the coupling guard.
2. Remove coupling center member.

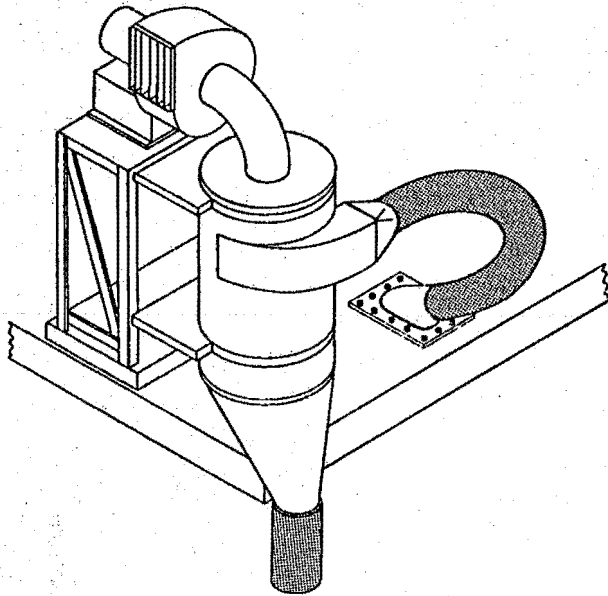


1. OIL SEAL FACE INSERT
2. CARBON RING
3. SHAFT SEAL ASSEMBLY
4. SPRING
5. SPRING GUIDE

FOR AC DESIGN UNITS
AIR END INPUT SHAFT OIL SEAL
FIGURE 3-3-15

NOTE: Motor may have to be moved to remove air end drive coupling hub.

3. Loosen the air end drive hub setscrews. Remove the air end drive hub.
4. Disconnect and remove the oil line from the seal retainer.
5. Match-mark the seal retainer and gear housing cover to assist with correct re-assembly.
6. Remove the oil seal retainer capscrews and remove the retainer.
7. Remove the oil seal assembly, including the spring and spring guide, from the input shaft.



TYPICAL DRY DUST COLLECTOR
FIGURE 4-1-3

SIX MONTH MAINTENANCE CHECKS

Inspect the impulse and solenoid valves. Inspect the suction hose leading to the housing for dust build-up and clean if necessary. Inspect the blower to be sure there is no dust build-up or abrasive wear on the blades or housing.

WATER INJECTION

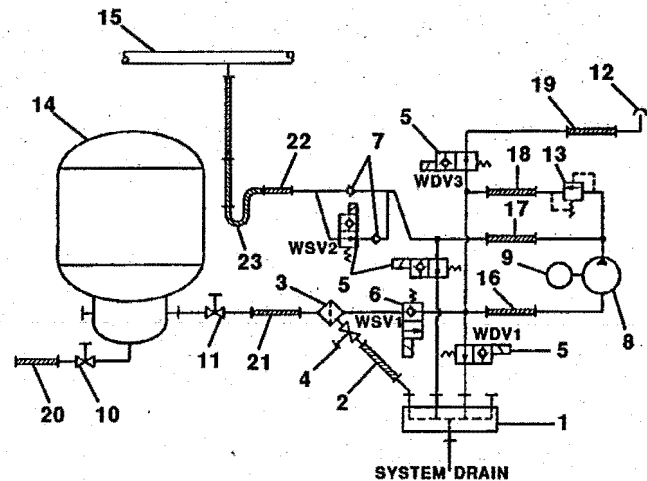
The maintenance of the water injection system (figures 4-1-4 and 4-1-4a) consists mainly of keeping the water tank full of clean water, checking weekly that the pump and valves are operating correctly, and that all hoses and fittings are not leaking.

OPERATION (for machines 140916 thru 140962)

With the operating mode switch in the DRILL position, the main compressor operating, and butterfly valve open, solenoid valve WSV2 will be closed, blocking bailing air from the system.

Verify that tank shutoff valve is open and that tank and strainer drain valves are closed.

Turn the water injection switch on the operator's console to the ON position, which will open solenoid valve WSV1 and one second later close solenoid valves WDV1 and 3. The motor rotates the pump for 2 seconds, then solenoid valve WDV2 closes and the pump starts to build pressure in the system.



- | | |
|-------------------------|----------------------------|
| 1. MANIFOLD | 13. RELIEF VALVE (100 PSI) |
| 2. HOSE ASSEMBLY | 14. WATER TANK |
| 3. STRAINER | 15. MAST AIR PIPE |
| 4. STRAINER DRAIN VALVE | 16. HOSE ASSEMBLY |
| 5. SOLENOID VALVE | 17. HOSE ASSEMBLY |
| 6. SOLENOID VALVE | 18. HOSE ASSEMBLY |
| 7. CHECK VALVE | 19. HOSE ASSEMBLY |
| 8. WATER PUMP | 20. HOSE ASSEMBLY |
| 9. ELECTRIC MOTOR | 21. HOSE ASSEMBLY |
| 10. TANK DRAIN VALVE | 22. HOSE ASSEMBLY |
| 11. TANK SHUTOFF VALVE | 23. HOSE ASSEMBLY |
| 12. BREATHER | |

WATER INJECTION
(for machines 140916 thru 140962)
FIGURE 4-1-4

Turning the flow control valve on this operator's console will increase motor speed and pump output. As the water pressure overcomes the bailing air pressure at the check valve, the water will be injected into the mast air pipe.

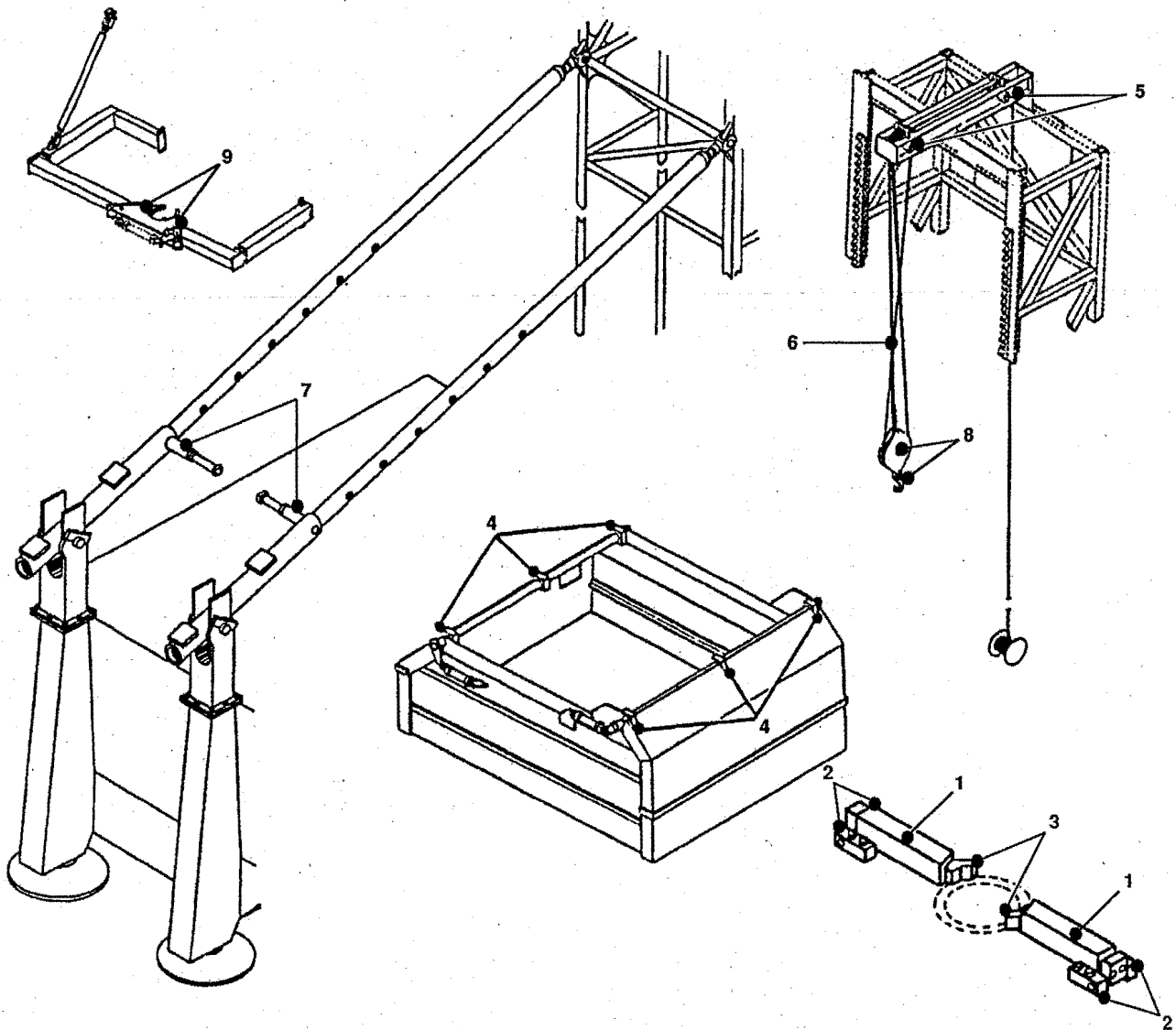
At the end of drilling the hole, return the flow control to "0" position to stop the flow of water. Turning the compressor switch on the operator's console to VENT position will close the butterfly valve and unload the compressor. During the 9 seconds it takes for the butterfly valve to close, solenoid valve WSV2 opens allowing bailing air to be used to purge water from the system.

Turning the water injection switch to the OFF position will close solenoid valve WSV1 and open solenoid valves WDV1, WDV2 and WDV3.

OPERATION (for machines 140963 thru 141001)

With the operating mode switch in the DRILL position, the main compressor operating, and butterfly valve open, solenoid valve WDV1 will energize.

Verify that tank shutoff valve is open and that the tank and strainer drain valves are closed.



LUBE POINT	NO. OF POINTS LUBRICATED	TYPE LUBRICANT	HOURS				AS REQ.	AUTOMATED	COMPONENTS
			8	40	160	1000			
1	2	MPG	X					X	TOOL WRENCH CYLINDER GUIDES
2	4	MPG	X					X	TOOL WRENCH BEARING BLOCKS
3	2	MPG	X						TOOL WRENCH CYLINDER PINS
4	6	MPG			X				DUST CURTAIN LEVER BUSHINGS
5	2	MPG			X				AUXILIARY WINCH ROPE SHEAVE BEARINGS
6	1	RWRL					X		AUXILIARY WINCH ROPE
7	2	MPG				X			MAST BRACE LOCK PINS
8	2	MPG					X		HOOK BLOCK (OPTIONAL)
9	2	MPG	X						PIPE POSITIONER JAWS

NOTE: The above frequencies are 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 start-up of a new

MAST LUBRICATION - PART 1
FIGURE 5-1-4

rings and seals when you disassemble the pump. A repair kit is available.

NOTE: Assembly tool 181-619 is required for reassembling the reciprocator.

NOTE: For the following step 12, **LOCTITE® 242** thread sealant and **LOCTITE PRIMER T** or **PERMA-LOC® 115** thread sealant and **PERMA-BOND® SURFACE CONDITIONER I** are required. Be sure their shelf-life is within the manufacturer's recommendations.

1. Loosen both nuts on the fluid tube. Use a wrench to rotate the tube fittings to the side, and then remove the tube. Check the O-rings on the fittings and replace them if they are worn or damaged. Install plugs in the fittings to prevent contamination.
2. Remove the capscrews (3), nuts (36) and lockwashers (37) on the top of the reciprocator. See figure 5-2-5.
3. Remove the four capscrews (46) and the base (33). Tap the adapter (43) with a plastic mallet to loosen it and pull it off the bottom cap (32). See figure 5-2-5. If needed, replace the seals.

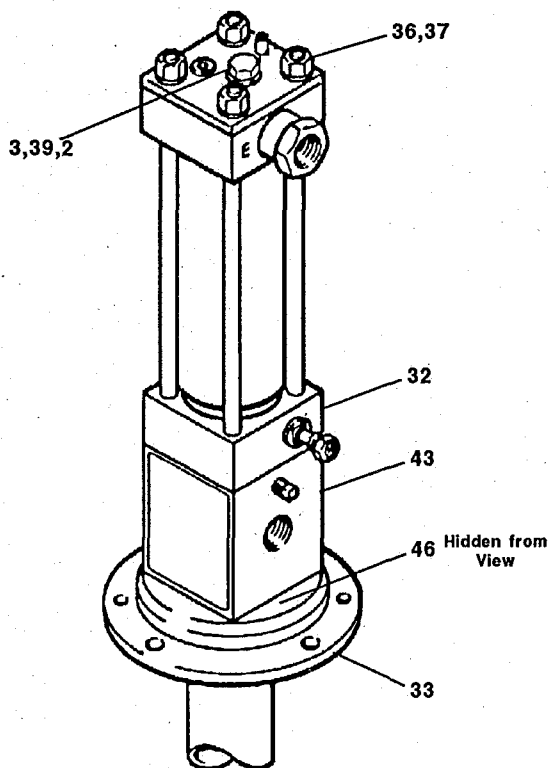


FIGURE 5-2-5

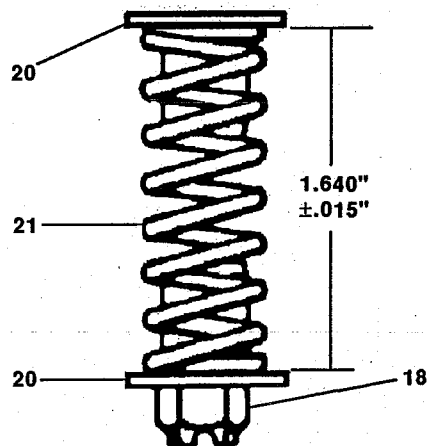


FIGURE 5-2-6

NOTE: See figure 5-3-7 for steps 4 to 14 except where noted.

4. Tap the bottom of the displacement rod (34) with a plastic mallet to loosen the cylinder (25).
5. Grasp the valve spool (31) and pull it off the cylinder and tie rods (38). Pull the cylinder and piston off the bottom cap (32). It is not necessary to remove the tie rods from the cap.
6. Lay the assembly on its side. Place a clean rag over the valve mechanism to prevent losing the detent balls. Slide the guide clamp (28) down off the valve sleeve (29) while holding the balls (7) and spring (6) in place.
7. Slide the cylinder (25) off the displacement rod (34). Hold the hex end of the displacement rod in a vise and use a spanner wrench in the pin holes of the piston (22) to screw it off the rod.

WARNING: Be careful not to scratch the outside of the displacement rod.

8. Visually inspect the spring (21). If there is wear or damage, proceed with this step. Remove the nut (18), spring (21) and retainers (20) from the stop rod (12). Reassemble with a retainer (20) on each end of the new spring (21). Adjust the nut to obtain the dimension shown in figure 5-2-6.
9. Inspect the guide clamp (28) for wear or damage. If replacement is necessary, remove the screw (11) from the rod (12). Replace damaged parts and the trip rod guides (27). Thoroughly clean any adhesive residue from the screw (11) and the internal threads of the rod (12).

PROBLEM	CAUSE	CORRECTIVE ACTION
	3. Jack leaking, machine off level. 4. Operator neglect.	3. Relevel machine, repair jack at earliest opportunity. 4. Use care in operating.
No water delivered to bit.	1. Empty water tank. 2. Level switch setting wrong. 3. Water line frozen.	1. Fill it. 2. Check setting of level switch. 3. Thaw water lines.
ROTARY DRIVE UNIT		
Leaking air swivel.	1. Worn out seal. 2. End play in rotary drive shaft. 3. Strain on swivel housing by air pipe to rotary head frame due to loose bolts.	1. Replace seal. 2. Preload the drive shaft bearings as outlined in the maintenance section. 3. Tighten bolts.
Loss of rotation.	1. Overload tripped on motor circuit.	1. Reset.
Loss of rotary power.	1. Electrical component failure or out of adjustment.	1. Replace failed component. Make electrical adjustments. Refer to Electrical Instructions Manual.
Rotary motor pinion breakage.	1. Loose bolts on motor mounting flange.	1. Tighten bolts to correct torque.
Rotary drive shaft thrust bearing failure.	1. Dirty oil. 2. Loss of oil. 3. Operator drops drill against bottom of hole too hard. 4. Excessive drive shaft end play or lack of proper bearing preload. 5. Misalignment of rotary drive unit.	1. Change oil at proper interval or as necessary. 2. Check seals. 3. Use care in operating. 4. Check bearing adjustment periodically dial indicator and adjust as outlined in the maintenance section. 5. Check alignment and adjust as necessary.
PULLDOWN UNIT		
Oil seepage in seal areas.	1. Retainer O-rings or gaskets damaged or missing. 2. Damaged seals. 3. Retainer capscrews not properly tightened.	1. Replace damaged or missing O-ring or gasket. 2. Replace seals. Check seal riding surfaces for nicks or burrs if possible or replace item. 3. Tighten capscrews.

APPENDIX A2 - BOLT TORQUING

TORQUE WRENCH METHOD

The bolts should be torqued to the specified total value in increments, alternating from bolt to bolt to assure gradual, even pull up of mating parts. Tightening should progress systematically

from the most rigid part of a joint to its free edges.

NOTE: The following tables show torque values for bolt grades 2, 5 and 8 with UNC threads only. Table 1 lists torque values for dry thread and table 2 for lubricated or plated threads

TABLE 1 - DRY THREADS

Bolt Dia.		Grade 2		Grade 5		Grade 8	
In.	Cm.	Ft. Lbs.	Nm.	Ft. Lbs.	Nm.	Ft. Lbs.	Nm.
.250	.63	5.5	6	8.3	10	12	16
.375	.95	20	27	30	40	46	62
.500	1.27	46	62	73	98	106	143
.625	1.58	100	135	146	197	226	306
.750	1.90	173	234	266	360	373	505
.875	2.22	166	225	426	577	613	831
1.000	2.54	253	343	639	866	906	1228
1.250	3.17	506	686	1120	1518	1810	2454
1.500	3.81	860	1165	1950	2643	3150	4270
1.750	4.44	1330	1803	2270	3077	4980	6751
2.000	5.08	2070	2806	3470	4704	7500	10168
2.250	5.71	3010	4080	5040	6833	11000	14913
2.500	6.35	4130	5599	6880	9327	15000	20337
2.750	6.98	5600	7592	9330	12649	20400	27658
3.000	7.62	7330	9938	12300	16676	26800	36335

TABLE 2 - LUBRICATED OR PLATED THREADS

Bolt Dia.		Grade 2		Grade 5		Grade 8	
In.	Cm.	Ft. Lbs.	Nm.	Ft. Lbs.	Nm.	Ft. Lbs.	Nm.
.250	.63	4.2	5	6.3	8	9	12
.375	.95	15	20	23	31	35	47
.500	1.27	35	47	55	74	80	108
.625	1.58	75	101	110	149	170	230
.750	1.90	130	176	200	271	280	379
.875	2.22	125	169	320	433	460	623
1.000	2.54	190	257	480	650	680	921
1.250	3.17	380	515	840	1138	1360	1843
1.500	3.81	650	881	1460	1979	2360	3199
1.750	4.44	1000	1355	1700	2304	3740	5070
2.000	5.08	1550	2101	2600	3525	5625	7626
2.250	5.71	2260	3064	3780	5124	8240	11171
2.500	6.35	3100	4202	5160	6995	11250	15252
2.750	6.98	4200	5694	7000	9491	15300	20743
3.000	7.62	5500	7456	9250	12541	20150	27319

NOTE: As a general rule, a jam nut should follow a full nut and be torqued to 50% of the tabulated full nut torque value.

SPECIFIC REQUIREMENTS FOR ALL TYPES OF LUBRICANTS

1. Must pass the United States Steel Retention Test Using Timken Tester.
2. Shell Four Ball E.P. - (ASTM D-2596)
Load wear index, kg., min.40
Load weld kg., min.250
3. Shell Four Ball Wear - (ASTM D-2266)
Wear scar diameter mm., max.0.60
4. Timken O.K. Load lbs., min. - (ASTM D-2782)45
5. Copper Strip Corrosion - (ASTM D-130), pass
6. Suggested Application Temperature Range

There should be a lubricant for each of the following temperature ranges:
110° to 30°F 40° to 0°F 10° to -50°F

NOTE: These performance requirements are bench marks and not a specification. Therefore, meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.

**TABLE 2
MATERIAL IDENTIFICATION**

SD NO.	SPECIFICATION	DESCRIPTION
NONE	AISI C-1030	PLAIN CARBON BILLET STEEL
3010	AISI C-1020	PLAIN CARBON BILLET STEEL
3116	ASTM A36	STRUCTURAL STEEL
3150	ASTM A514	QUENCHED & TEMPERED ALLOY STRUCTURAL STEEL
3155	ASTM A572	LOW ALLOY STRUCTURAL STEEL
3156	ASTM A633	LOW TEMPERATURE STRUCTURAL STEEL
NONE	AISI A-8630	ALLOY BILLET STEEL
3510	NONE	MEDIUM CARBON CAST STEEL
3515	NONE	SPEC. LOW ALLOY CAST STEEL
3520	NONE	CR-MO ALLOY CAST STEEL
3710	AISI MT-1015	SEAMLESS MECHANICAL TUBING

ature indicating crayons at frequent intervals during the course of the repair and the minimum temperature maintained until welding is completed.

REMOVAL OF CRACKS

In repair welding structural members which have cracked, it is important to completely remove the cracks, if possible, prior to welding. Any remnant of a crack left in the structure will probably grow in service to ultimately cause a failure or at least a repetition of the repair operation. Welding over partially removed cracks will conceal their presence temporarily but will not prevent their recurrence.

Cracks can be removed by air-carbon arc gouging or grinding. After removal, the cavity should

be inspected by dye penetrant or magnetic particle testing for assurance that removal is complete. For cracks that are suspected or known to extend through the thickness of the member it would be well to consider how the repair is to be made before the crack is removed. If both sides of the member are accessible for welding the best approach is to partially remove the crack from one side first, weld that side then gouge and weld from the second side. Inspection for complete crack removal is done after gouging the second side. If the second side is accessible but too restrictive for welding it may be possible to insert steel backing material to permit a complete penetration full thickness weld from one side. When the opposite side is completely inaccessible there are two methods of obtaining a full thickness weld. The first is to cut out a section of material containing the crack and replace with new material fitted in with backing strips. The other method is to completely remove the crack from one side and prepare a groove for open root welding.

The foregoing methods of crack removal and preparation for welding are illustrated in Figure A5-2.

WELD GROOVE PREPARATION

The details of weld groove preparation depend upon which of the foregoing method of crack removal is used, and also the position in which welding is to be done. Correct groove preparation is important because it determines the welder's ability to make a sound repair. The various recommended groove details are shown in Figure A5-2.

**TABLE 3
WELDING ELECTRODES AND PREHEAT TEMPERATURES**

STEEL SD NO.	WELDING ELECTRODE		MINIMUM PREHEAT TEMPERATURE °F BASED ON MAX. THICKNESS OF STEEL			
	AWS CLASSIF.	TYPE OF WELD DEPOSIT	UP TO 3/4"	OVER 3/4" TO 1-1/2"	OVER 1-1/2" TO 2-1/2"	OVER 2-1/2"
AISI C-1030 3010 3116 3155 3510 3710	E7018 ⁽¹⁾	CARBON STEEL	WHEN BASE METAL IS BELOW 32° F, PREHEAT TO 70° F & MAINTAIN	70	150	225
3156	E8018-C1	NICKEL ALLOY STEEL				
3150 AISI C-8630 ⁽²⁾	E11018-M	NI-CR-MO ALLOY STEEL	50	125	175	225
3515 3520	E11018-M	NI-CR-MO-STEEL	70	150	225	300

(1) E8018-C1 can also be used.

(2) Use E7018 for welding rack to structure

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