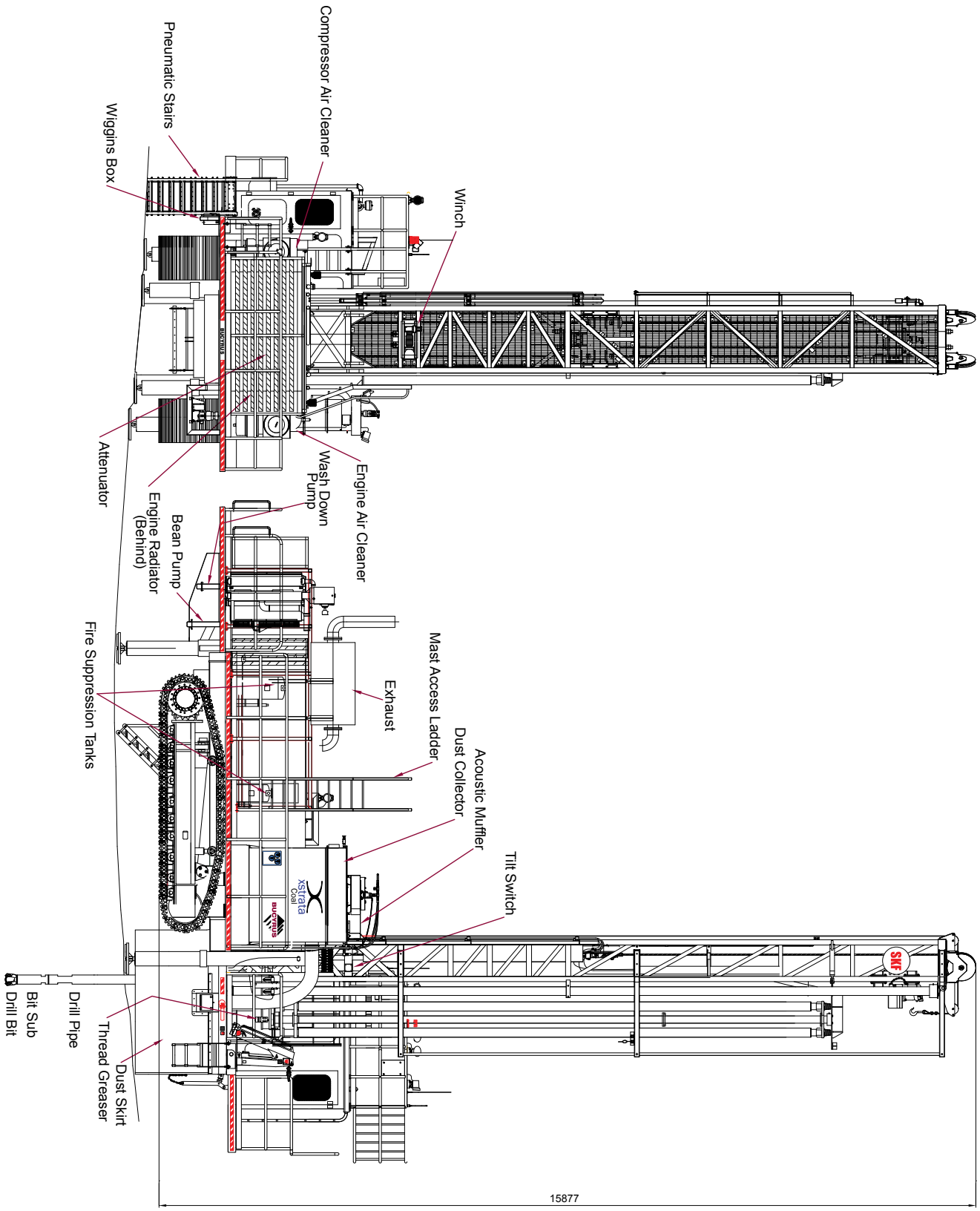
Technical Manual

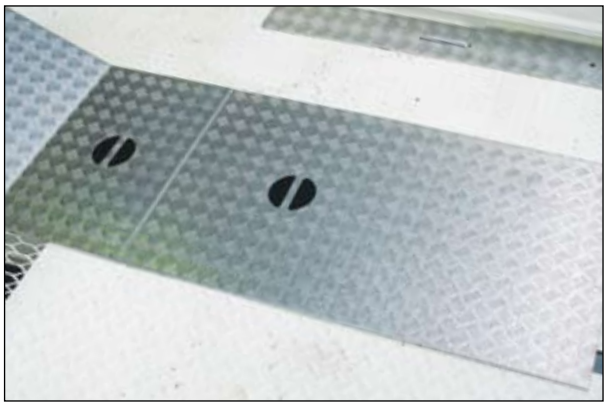
Contents

General Locator (cont.)



Before Operation (cont.)

- Be sure that prior to starting the machine, all controls are in neutral or off positions and that controls are in the position that will generate the least load upon the engine on start-up. Especially ensure the auto pulldown is off and rotation lever is in neutral.
- Be sure that the drill area is clear of all obstructions before operating the machine.
- Ensure that the safety chain is attached when using a towbar.
- Do not operate the machine with: a hydraulic leak, broken or damaged electrical wiring or damaged hydraulic hoses or fittings.
- Do not operate the machine without familiarising yourself with the location of all hand held fire extinguishers.
- Be sure the fire suppression system has not been activated, is still pressurised, and that lines and nozzles are in the correct place and not damaged.
- Do not operate the machine without familiarising yourself with the location of on-board fire suppression activation points.
- Do not operate the machine without first checking that all emergency stops are operational and familiarising yourself as to their location.



Deck Covers

NOTE: when ever work is carried out with mast in horizontal position the supplied deck covers must be in place.

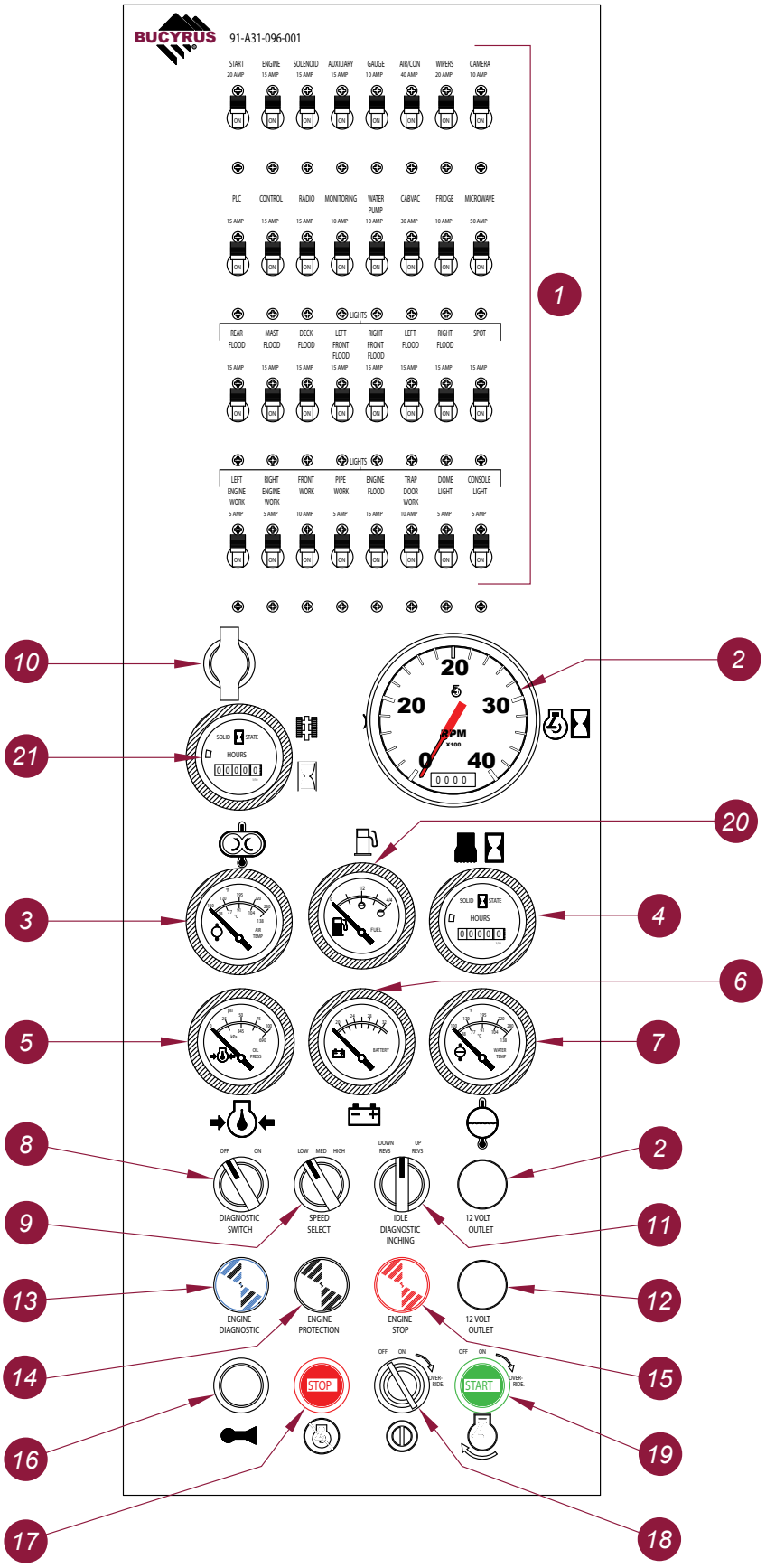
During Operation

- Do not use the machine for anything other than its designed purpose for blasthole drilling.
- Do not wear jewellery or loose fitting clothing when working on the machine. Keep clothing and hands clear of moving parts.
- Do not move the machine if the drill is in a potentially unstable position.
- Always be aware of the drill rigs automated functions and make sure people are clear of all components. The rotary drill has an automated function of the dust curtain raise/lower cylinders when the machine is switched from 'drill' to 'propel' mode.

Dust Curtain Raised

- Do not propel the machine with the mast raised over undulating ground or across grades or over any distance other than short distances on a drill pattern.

Instrument Panel



New Machine Procedure

NOTE: Required for new equipment only

- The mast must be lowered to the horizontal position.
- Initial monitoring of the roller and idler temperatures must be recorded over a 500 metre tramming distance for new machines.
- The machine should be trammed for 250 metres in the forward direction and 250 metres in the reverse direction in either order with the temperatures continually monitored.
- If temperatures over 90ºC (194ºF) are recorded the machine must be stopped until the rollers or idlers have cooled below 60ºC (140ºF).
- As a minimum the following detail must be recorded, the temperatures prior to starting, two intermediate temperatures and the finished temperatures over the 500m distance.

General Maintenance Checks While Tramming

- If the drill is required to walk more than 500 metres, maintenance personnel will be expected to monitor the roller temperatures.
- Were possible while tramming it is favoured that the load rollers, carrier rollers and idler temperatures are continually monitored while the machine is tramming. It is acknowledged that the machine may be trammed through areas that will not allow people to move around the moving machine or this practice may not be permitted under normal site operations.
- If the temperatures cannot be continually monitored the machine should be stopped at 20 minute intervals during tramming and the temperatures must be checked and recorded.
- If any of the roller or the idler temperatures exceeds 90ºC (194ºF) but is less than 100ºC (212ºF) the following is recommended:
  - Machines without two speed tramming; should have the engine reduced to the low idle speed, recommence tramming and recheck the roller temps after 10 minutes.
  - Machines with two speed tramming; the low speed tram setting should be selected, recommence tramming and recheck the roller temps after 10 minutes.

CAUTION: If the drill continues to walk with any of the rollers or the idler temperatures above 90ºC, the roller seals may distort, causing the lubricant to leak out and the roller will fail.

- If temperatures are recorded above 100C they must be allowed to cool naturally to under 90ºC before tramming is recommenced.
- Record all required temperatures on the 'Temperature and Condition Record' chart (page 1-14) provided and file the information for machine history.

1.3 Performance Specifications

1.3.1 Cooling

Cooling capacity:	7.0 kW
Evaporator air on temperature:	29°C DB/19°C WB
Suction temperature:	-2°C
Ambient temperature:	46°C
Supply Airflow:	250 l/s (nominal)
Refrigerant:	R134a

1.3.2 Heating

Heating capacity:	6.0 kW
Coil air on temperature:	21°C
Water flow rate:	9 l/min
Water temperature:	90°C

1.3.3 Pressuriser

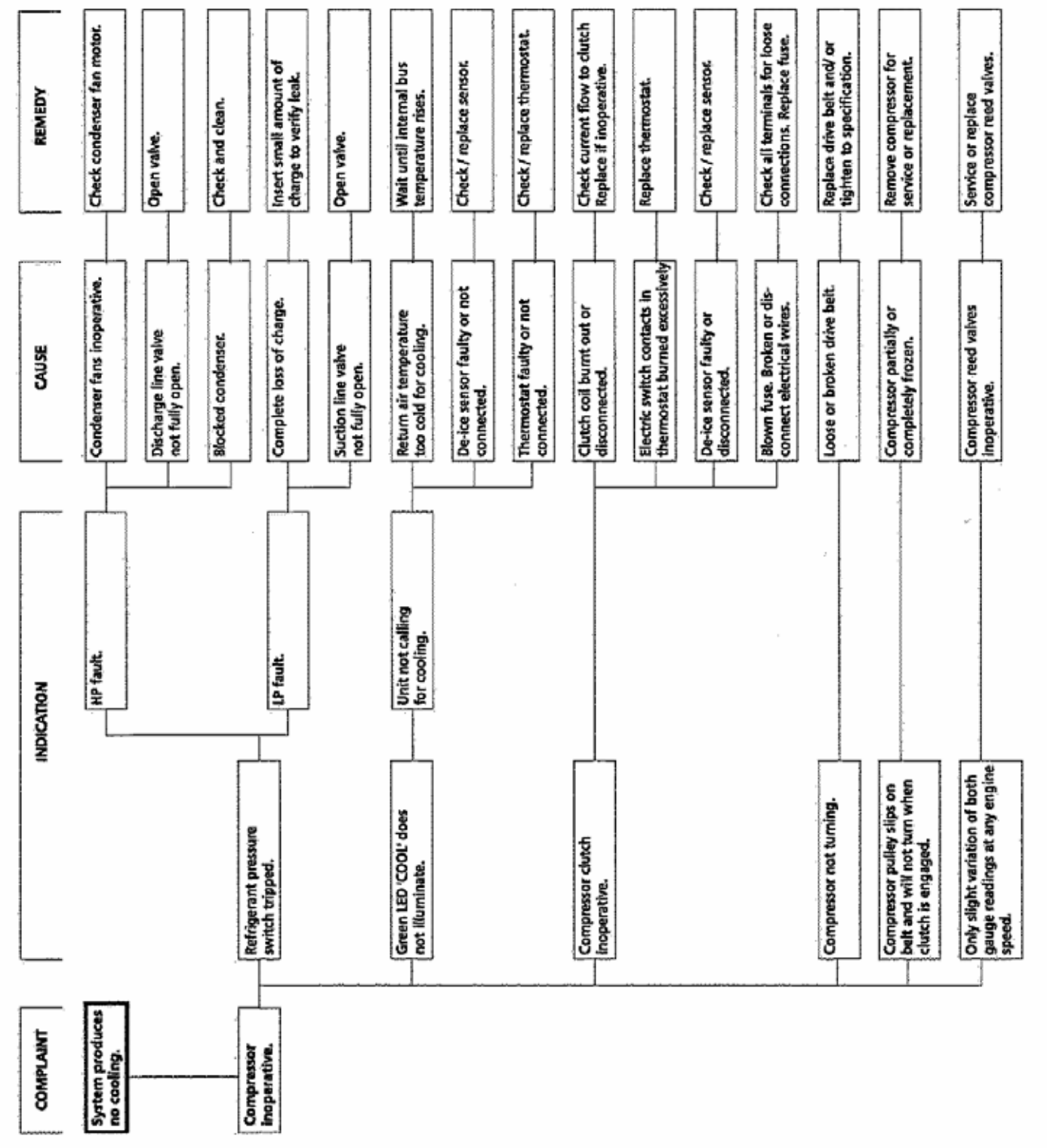
Airflow:	50 l/s (nominal)
Pressure (in cabin):	62 Pa (nominal)

NOTE: Pressure is dependant on filter cleanliness and degree of cabin sealing.

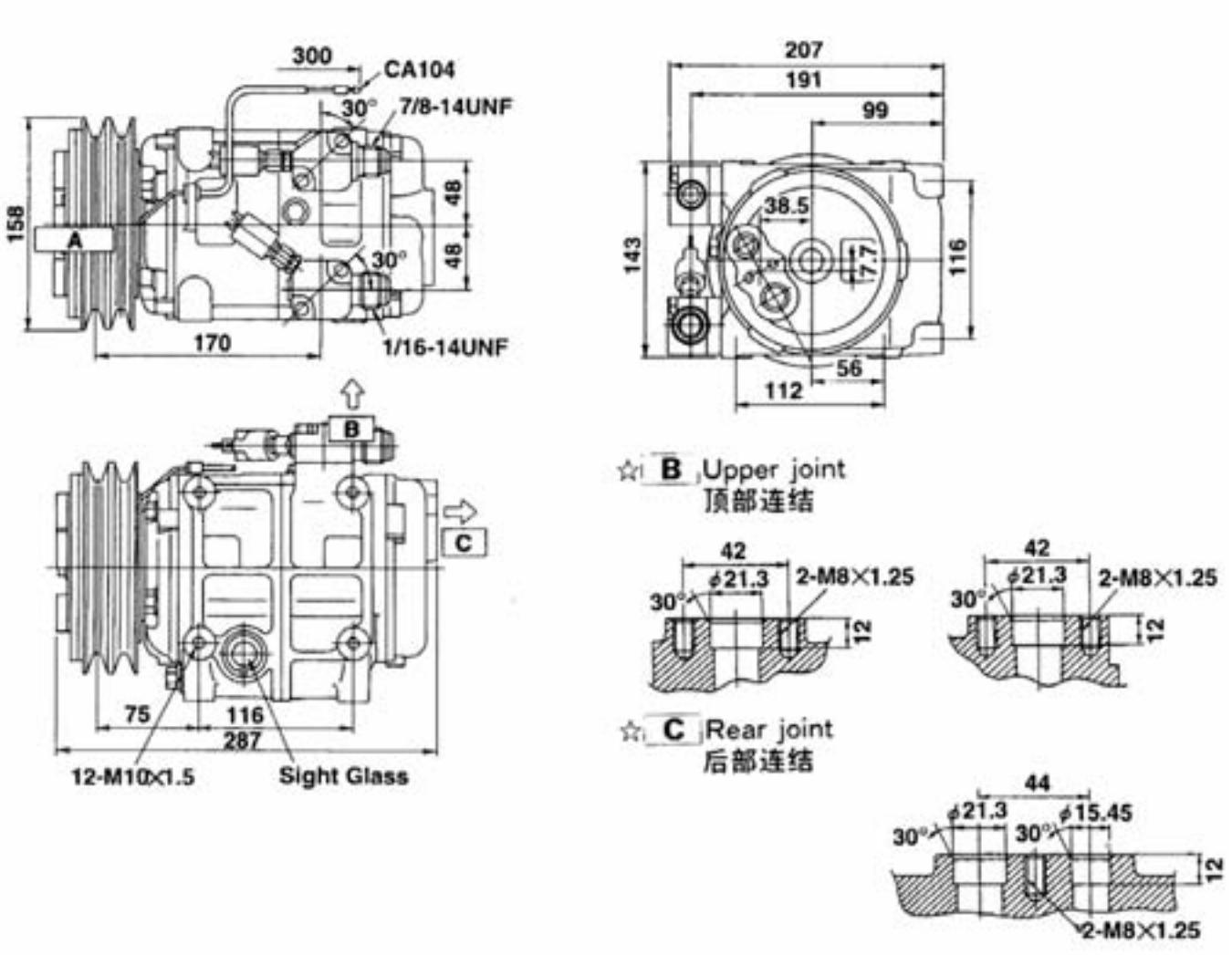
1.4 Unit Mass (Kg)

Unit	TFR7
Mass (kg)	80

4.1.1 System Produces No Cooling



5.4 Compressor



Specifications

Displacement	313cm³/rev
Number of cylinders	10
Maximum speed	7000r/min
Refrigerant	HFC-134a
Lubricant	ZXL 100PG (DH PS)
	500cm³
Weight (without clutch)	14.5kg
Voltage	DC 12/24V
Power consumption	48W

Levelling Jacks

Detecting Levelling Jack Troubles – Faulty levelling jacks may be detected through inspection, or through operating difficulties encountered. Refer to Hydraulics in Section 7.

Limit Switch

The limit switches send a signal via the vigilante that the levelling cylinders are fully retracted to allow tramming functions to activate. It is imperative that the limit switch control arm be adjusted to strike on the inner casing (fig. 3-1) and not the hydraulic cylinder. This is done to prevent damage **should the lower bolt fail or fall out**, leaving the Inner casing tube still lowered but having the hydraulic cylinder fully retracted/raised.

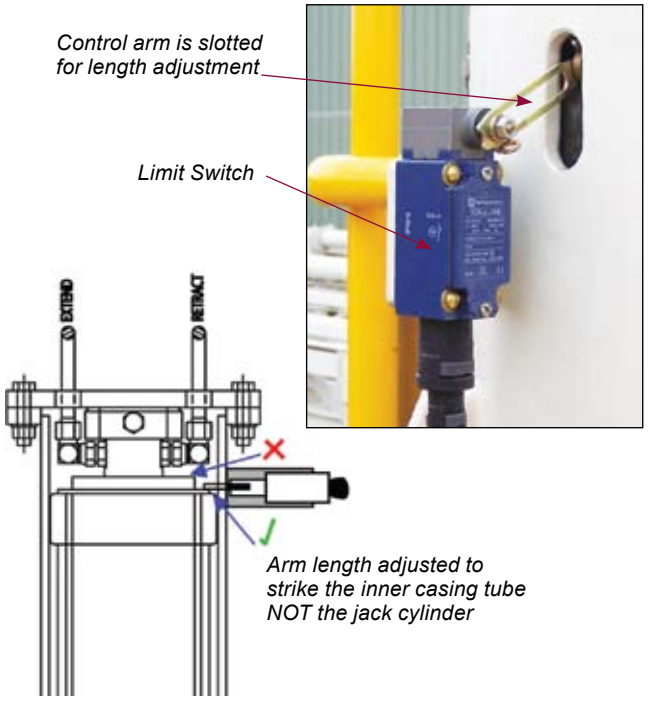


Fig. 3-1 Levelling Jack Cylinder Limit Switch

Levelling Jack Cylinders

Removal

1. Lower jack pad to ground, but do not have weight of machine on jacks.
2. Shut down machine.

WARNING: Relieve pressure on hydraulic and pneumatic systems before loosening connections or parts.

3. Remove lower bolt that holds retainer cap/jack pad to cylinder.
4. With hydraulic pressure relieved, disconnect upper fittings to cylinder and clamps.
5. Remove cap screws and cap from top of cylinder outer casing.
6. Hydraulic cylinder may have a lifting eye installed or it will have tapped holes to install a lifting eye. Using a suitable crane or heavy lifting device lift cylinder out of casing.

Repair

Refer to parts manual for specific cylinder and repair parts. Refer to cylinder repair information in Section 7 for type of cylinder on machine. The levelling jack cylinder has a 'Z' type head and piston.

Replace

1. Replacement is reverse of removal procedure.
2. Rotate jack pad to align bolt hole with cylinder.
3. Cycle cylinder several times to remove trapped air before putting machine into service.

WARNING: Cylinder must be free from air prior to putting under load.

Lubricating Jack Casings

If jack casings have been cleaned of grease, then a thin coating of grease will need to be applied manually, this is done by fully extending the levelling jack and applying directly to casing tube. The central lube system will then maintain adequate lubrication of the casings.

Metric Bolt Torque Specifications

Metric Bolt Torque Specifications

	Screws				Screws with reduced shaft			
	Nm				Nm			
	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9
M4	2,4	2,9	4,1	4,9	1,3	1,6	2,2	2,7
M5	5,0	6,0	8,5	10,0	2,8	3,3	4,6	5,5
M6	8,5	10,0	14,0	17,0	4,7	5,5	8,0	9,5
M8	21,0	25,0	35,0	41,0	12,0	14,0	20,0	24,0
M10	41,0	49,0	69,0	83,0	25,0	29,0	41,0	50,0
M12	72,0	86,0	12,0	145,0	44,0	52,0	74,0	88,0
M14	115,0	135,0	190,0	230,0	71,0	84,0	120,0	140,0
M16	180,0	210,0	295,0	355,0	115,0	135,0	190,0	255,0
M18	245,0	290,0	405,0	485,0	155,0	180,0	255,0	305,0
M20	345,0	410,0	580,0	690,0	225,0	265,0	375,0	450,0
M22	465,0	550,0	780,0	930,0	310,0	365,0	520,0	620,0
M24	600,0	710,0	1.000	1.200	390,0	460,0	650,0	780,0
M27	890,0	1.050	1.500	1.800	600,0	700,0	990,0	1.200
M30	1.200	1.450	2.000	2.400	800,0	950,0	1.350	1.600
M36			2.480					
M8X1	23	27	38	45	14	17	23	28
M10X1,25	44	52	73	88	27	33	46	55
M12X1,25	80	95	135	160	52	61	86	105
M12X1,5	76	90	125	150	48	57	80	96
M14X1,5	125	150	210	250	81	96	135	160
M16X1,5	190	225	315	380	125	150	210	255
M18X1,5	275	325	460	550	190	225	315	380
M20X1,5	385	460	640	770	265	315	445	530
M22X1,5	520	610	860	1.050	365	430	610	730
M24X2	650	780	1.100	1.300	450	530	750	900
M27X2	970	1.150	1.600	1.950	670	790	1.100	1.350
M30X2	1.350	1.600	2.250	2.700	950	1.150	1.600	1.900

Metric Screw Thread	In Nm	UNF Thread	In Nm
M10X1	85-95	**9/16"-20**	110-120
M12X1	145-160	**1/2"-20**	165-185
M14X1,5	220-250	**9/16"-18**	240-270
M16X1,5	340-380	**5/8"-18**	330-370
M30X2	2360-2400	**3/4"-14**	575-650
		7/7"-14	915-1030
		1"-14	1385-1560

Table 3-1 Metric Torque Table Specifications

Track Chain Repair

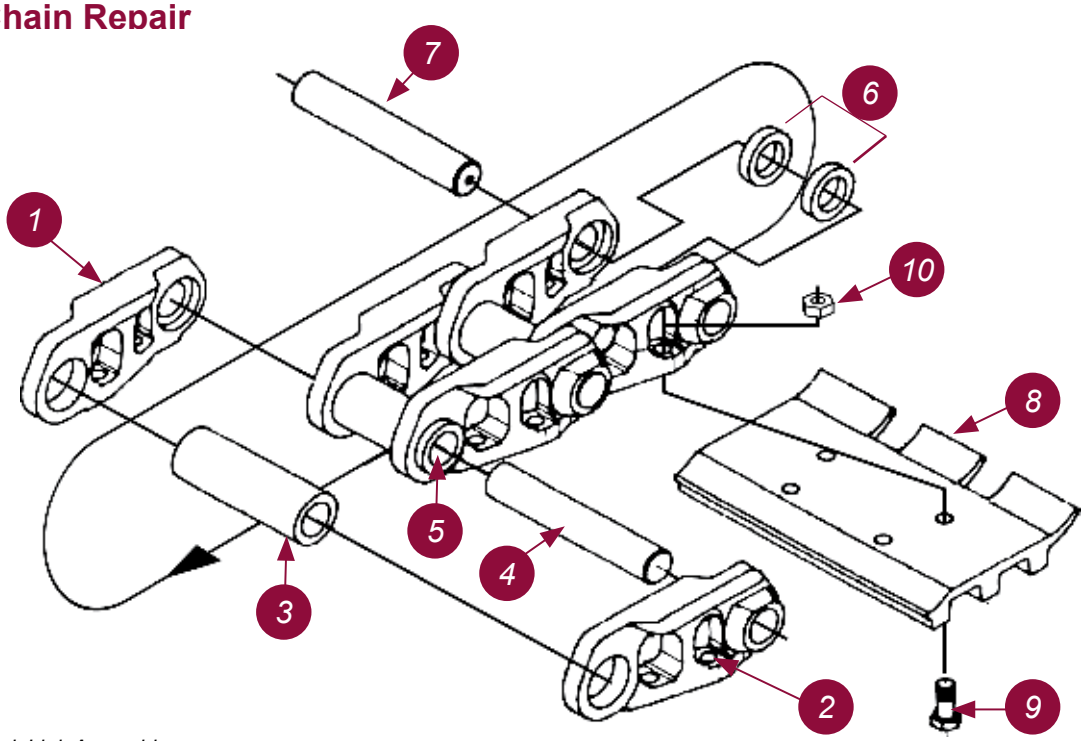
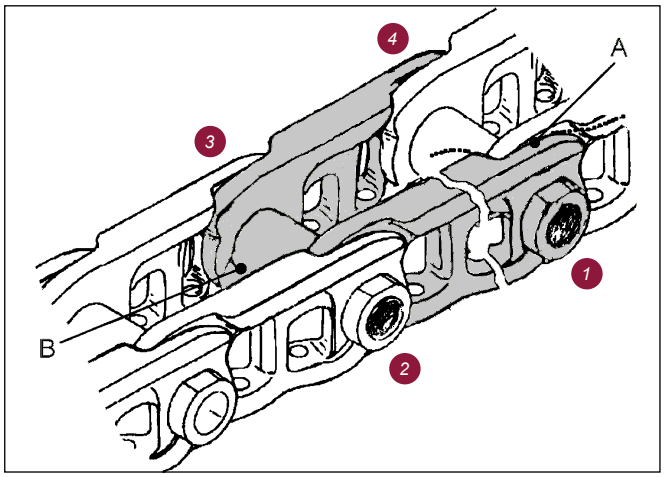
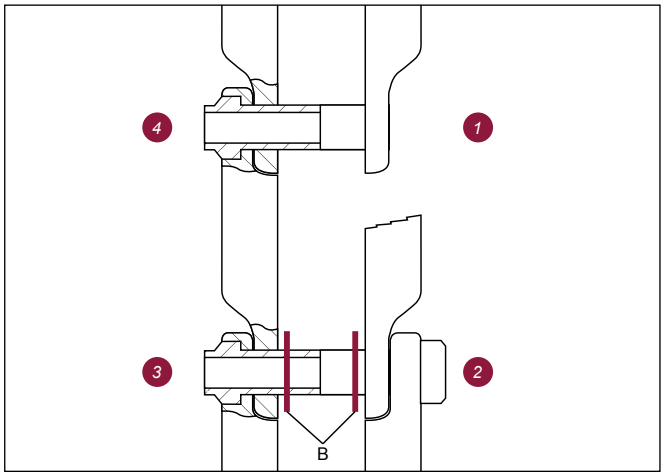


Fig. 3-10 Track Link Assembly

1. *Track link – RH*
2. *Track link – LH*
3. *Master bushing*
4. *Pin*
5. *Bushing*
6. *Master collar*
7. *Master pin*
8. *Grouser shoe*
9. *Capscrew*
10. *Nut*





Track Link – Description

Each track link is made up of the components listed in fig. 3-10. The links are pressed together to form a compound unit, called the track chain. The track link is made up of items 1-7 listed in fig.TCR-1. The track group with grouser shoes is made up of items 1-10.

Track Link – Repair and Replace

1. If a track link has been damaged, a repair segment can replace it. To do so, using a flame cutter cut through the damaged track links from above at point (A). The flame-cut section on side 1 drops out.
2. Also cut through the pins and bushings at the marked points (B) using the flame cutter. Remove cut parts.

Installation into Track Frame

1. Clean all mounting surfaces thoroughly. Lift final drive into place with an adequate lifting device (fig. 3-26).
2. Install the capscrews and washers, hand tight only. Check to make sure the final drive flange is seated properly. The maximum torque is 148ft lbs (200Nm). Tighten bolts in the sequence shown in fig. 3-27. Final torque to be according to 'Metric Bolt Torque specification' in this section.
3. Fill final drive gearbox with clean oil of the specified type (see oil recommendations in this section). Position fill plug with drain plug at bottom. Fill to bottom of filler hole. Check sealing condition of fill plug, replace if damaged.
4. Clean mounting surfaces for sprocket and lift into position with an adequate lifting device. Install capscrews and washers.
5. Tighten bolts to specified torque according to 'Metric Bolt Torque specification' in this section.

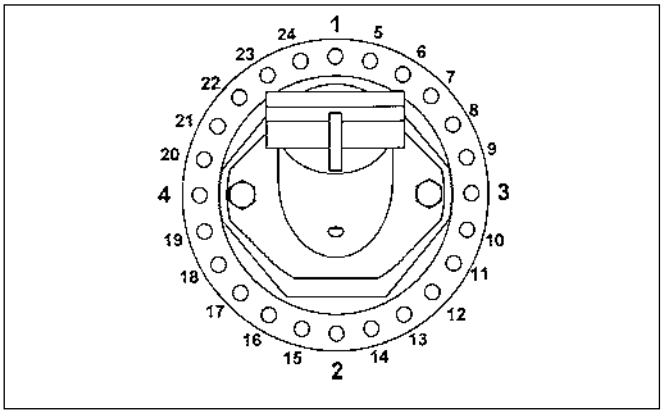
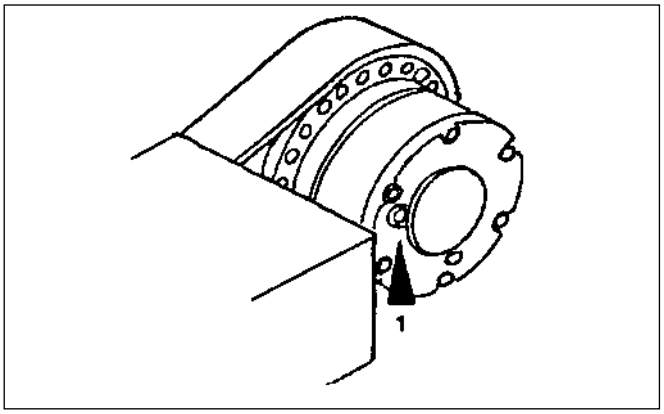


Fig. 3-27 Bolt Tightening Sequence



Oil Filler Plug

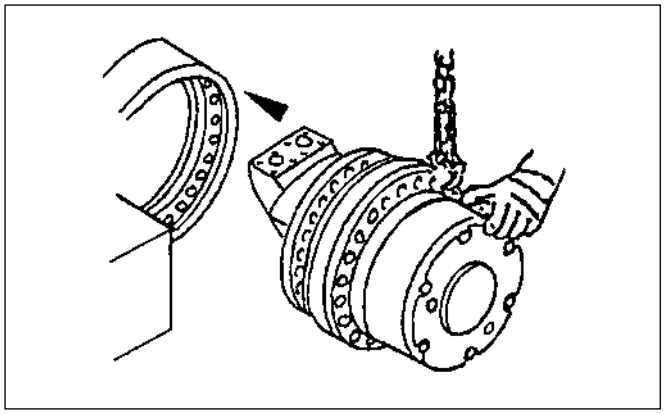
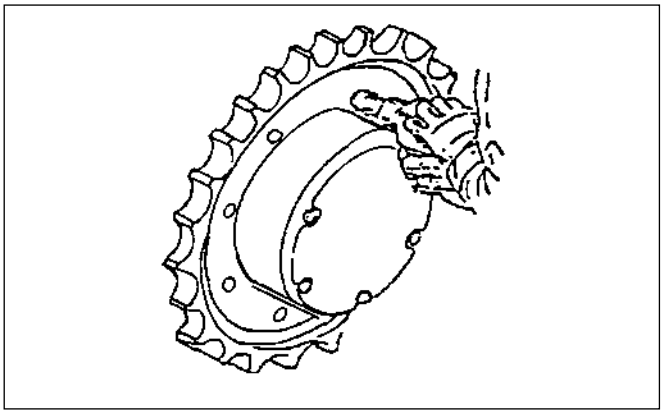
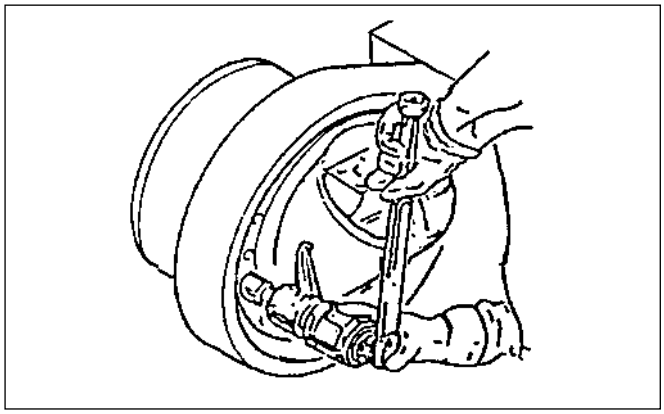


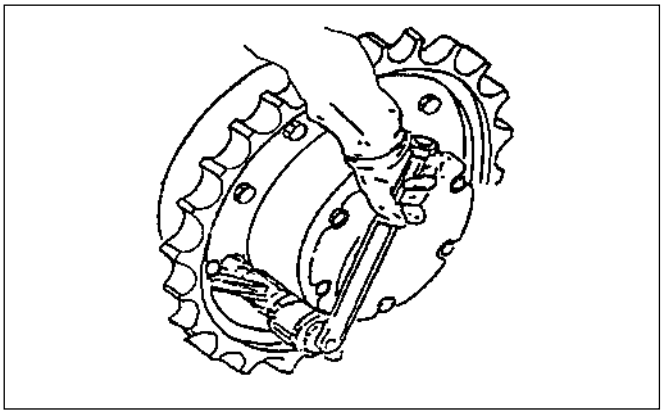
Fig. 3-26 Install Final Drive



Install Sprocket

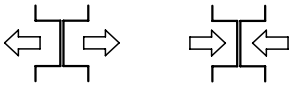
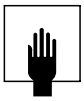
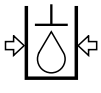


Tighten Mounting Bolts

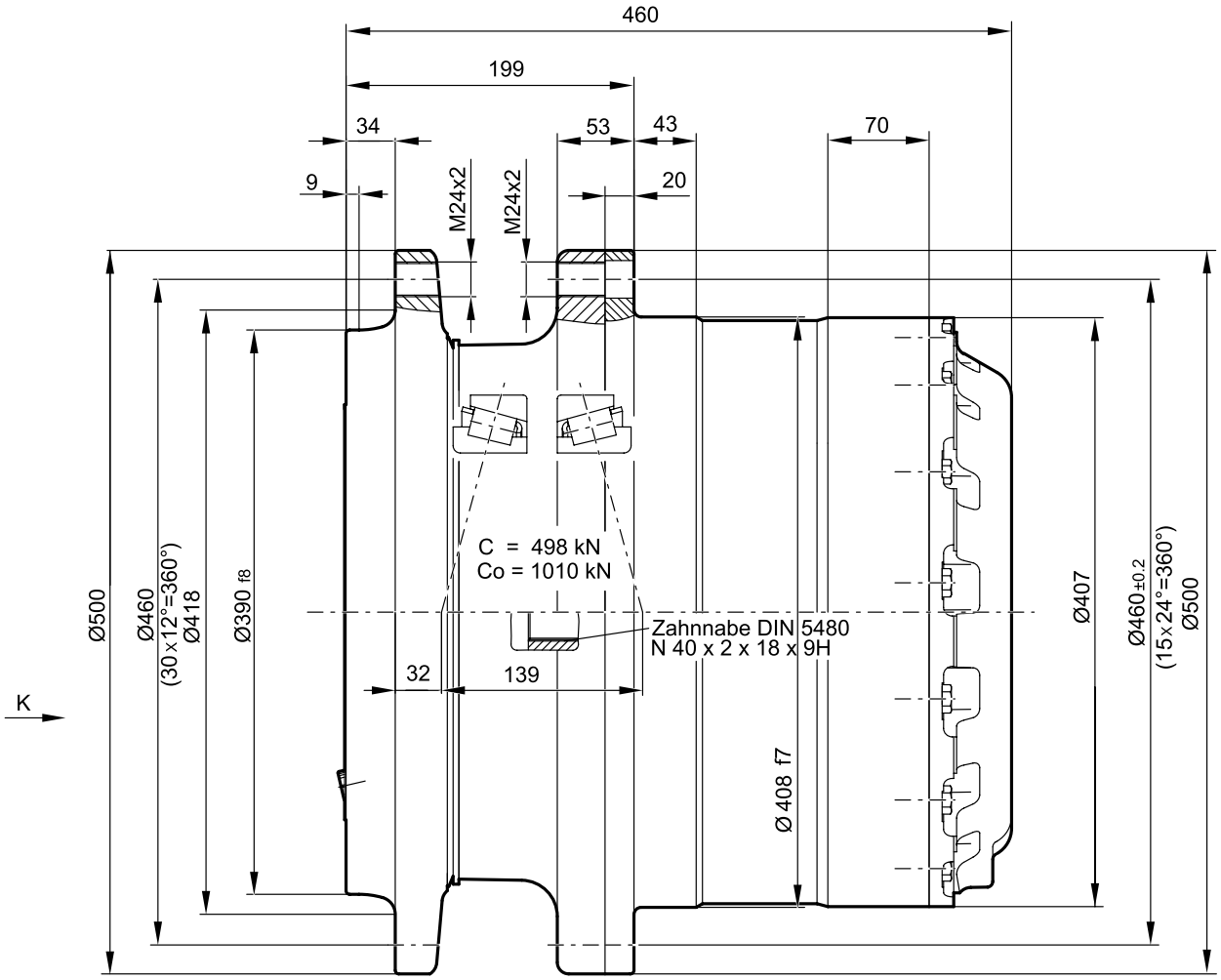


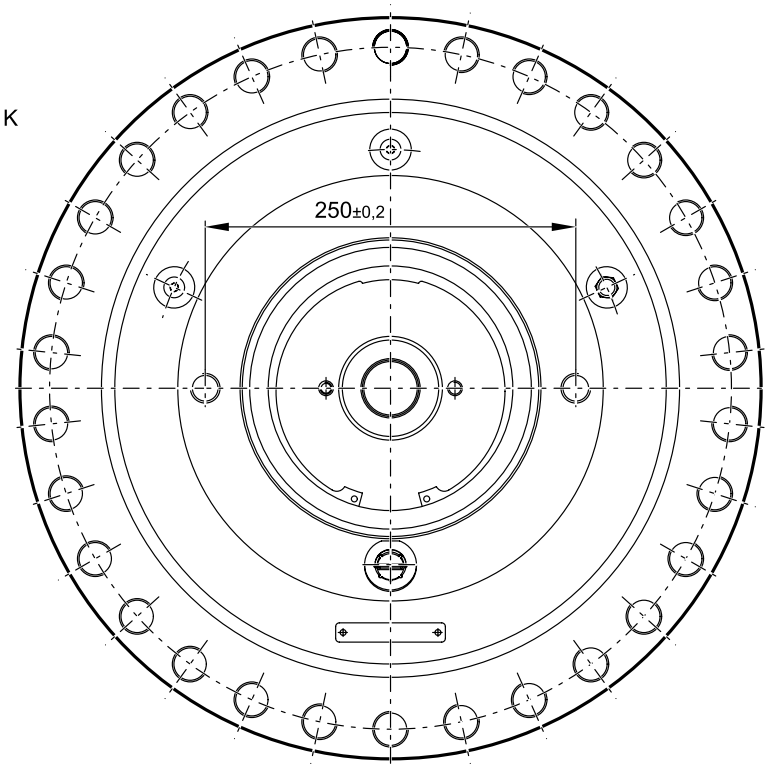
Torque sprocket bolts

A.2.1 Symbology

DESCRIPTION	SYMBOLS
WARNING / DANGER	
REMOVE / INSTALL seals / gaskets / filters	
OIL FILLING OR OIL LEVEL OIL DRAIN	
LUBRICATION / GREASING	
ADJUSTMENTS / MEASUREMENTS tightening torques / preloads / backlash	
SPECIAL TOOLS	
SEALING / LOCKING FLUIDS APPLICATION	
MARK OR INDICATE	
DISASSEMBLY / ASSEMBLY OF BULKY PARTS OR SUBASSEMBLIES	
WARNING: respect assembly orientation	
CLEANING CAREFULLY	
APPLY PRESSURIZED FLUID	

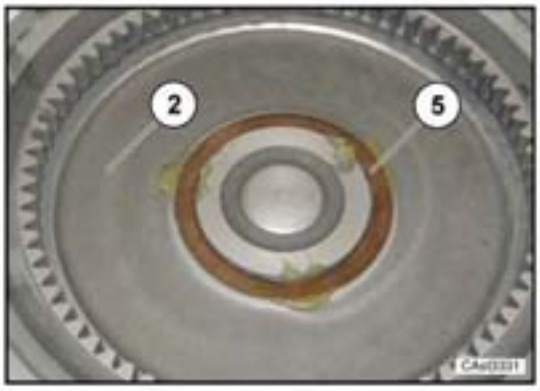
C.4 Sealing Compounds and Adhesives (cont.)





D.6.1 Disassembly (cont.)

Remove cover (2).

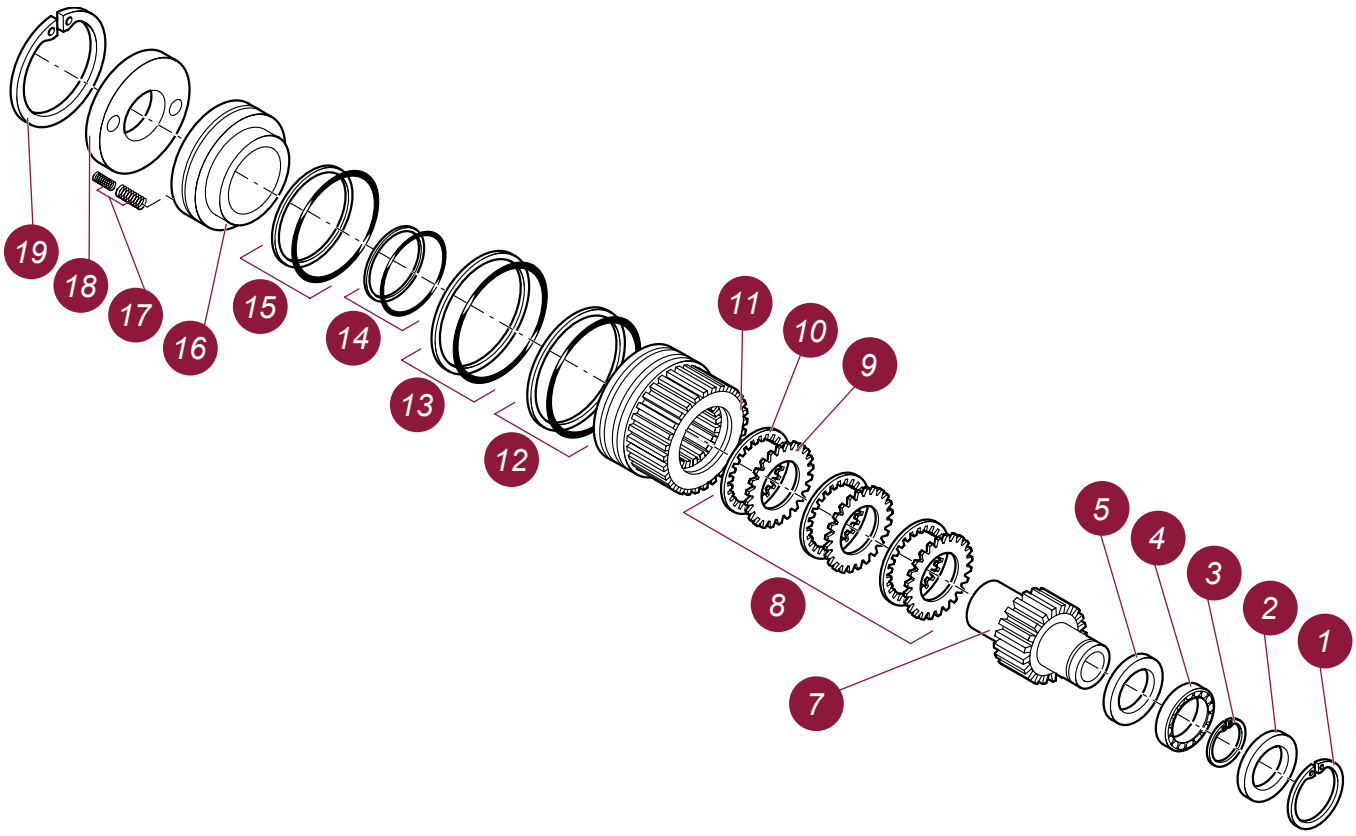


Remove washer (5) from cover (2).

Remove O-ring (3) from cover (2).

Remove side gear carrier assembly (7).

D.7 Brake



D.7.1 Disassembly

Some of the following pictures could not show exactly your transmission, but the procedure is the same.

Assemble two M6 eyebolts to compress the springs.

Remove snap ring (19).

D.7.2 Assembly (cont.)

Assemble springs (17).

Assemble the snap ring (19).

Remove nr.2 eyebolts M6.

Assemble the disk (18).

Assemble nr.2 eyebolts M6 to fasten the disc.

Assemble the brake unit complete.

Repair Manual Final Drive Model F100 – Troubleshooting

PROBLEMS	*POSSIBLE CAUSES*								
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
- Uneven wear of tyre.	•	•	•	•	•	•	•		
- Brake noise.	•			•	•	•		•	•
- Vibration during forward drive, intermittent noise.	•	•	•		•	•			

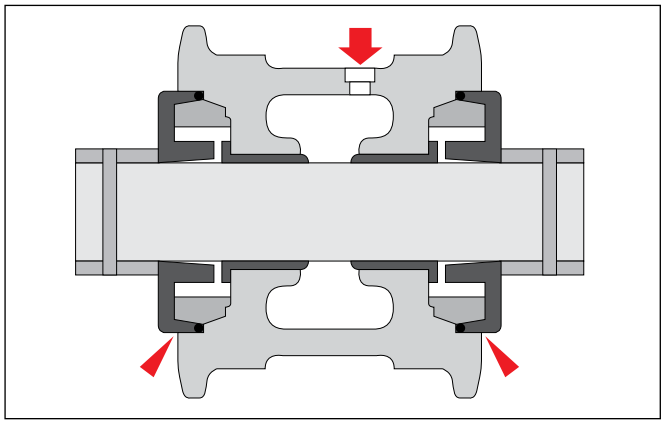
1. • Incorrect installation / defective transmission.
   • Correct installation or repair or replace the transmission in case it does not survive any one of the test phases.
2. • Overloading/ incorrect weight distribution
   • Remove excessive weight and redistribute load, following instructions related to the vehicle.
3. • Broken transmission
   • It is not advisable to operate the vehicle with a broken final drive. It is acceptable to move the vehicle (transmission off unloaded) a few meters away only.
4. • Bent transmission
   • Replace transmission.
5. • Incorrect use of the product.
   • See the vehicle producer‘s instructions once again.
6. • Incorrect wheel adjustment.
   • Verify group integrity and wheel side bearings.
7. • Spoiled or worn out transmission parts.
   • Check the condition of ring gear, pinion gear, seals etc.
   • Replace when ever necessary.
8. • Contamination in the transmission box or incorrect assembly of parts.
   • Look for foreign particles. Check assembly of the various parts of the transmission.

Track and Support Roller – Test and Install

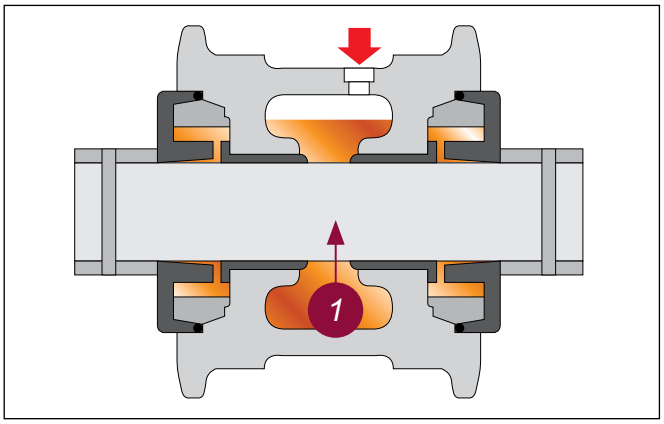
1. Check the end play. Check for air tightness by applying air pressure through the oil fill hole. Test pressure should be not more than 87psi (6bar).
2. If the air test is satisfactory, with no air leakage around the seals, fill roller with SAE 90 oil through the oil fill hole.
3. Hold the roller in such a way so the oil groove is at the bottom and the oil fill hole is at the top. Now apply air pressure into the roller as in step 7 so the oil is pressed into the seal retaining spaces (9).
4. After filling with oil, check for correct level.

- **MAX Oil Level** – Turn the roller so the oil fill hole is 40° from a horizontal line through the centre. Oil should not spill out of the oil fill hole in this position.
- **MIN Oil Level** – Turn the roller so the oil fill hole is 10° from a horizontal line through the centre. Oil MUST spill out of the oil fill hole in this position.

5. Put some loctite on the threads of the oil fill plug and install with a 6mm allen wrench (fig. 3-38).

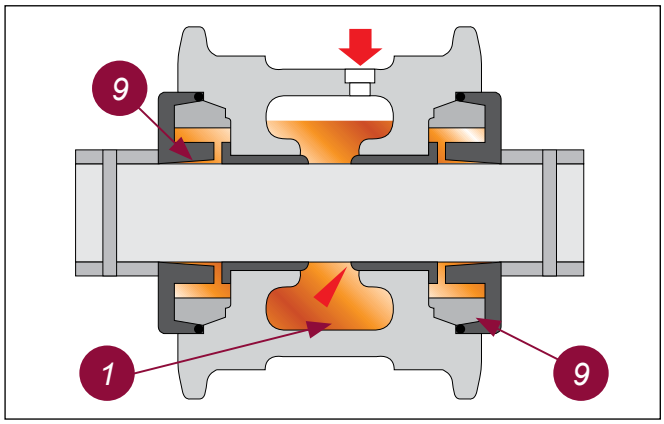


Track roller – air leakage test



Track roller – oil fill

1. Oil



Track roller – air/oil

1. Oil *9. Seal retaining spaces*

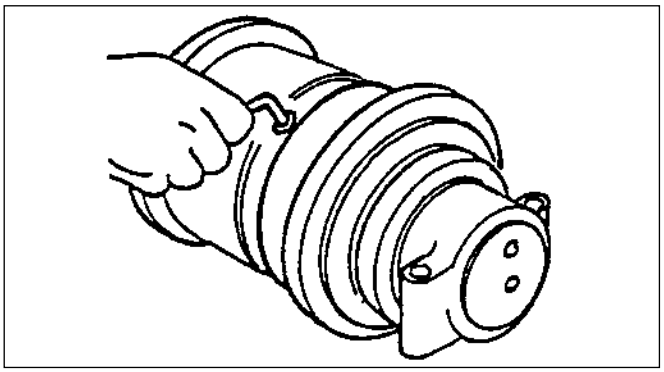
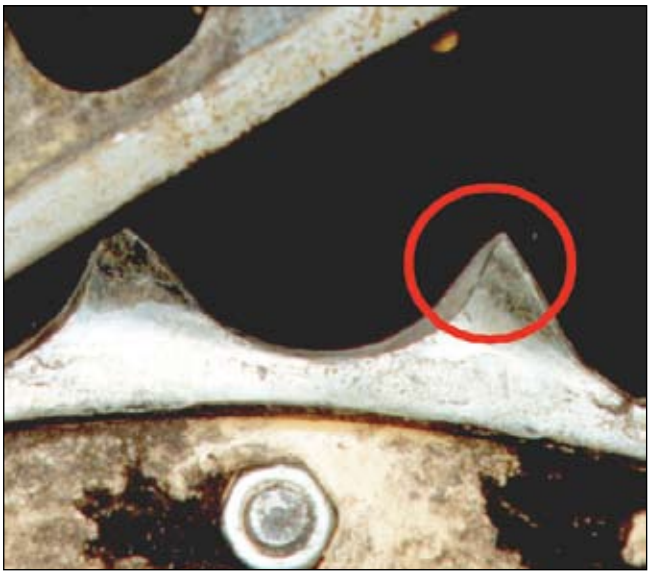


Fig. 3-38 Track roller – oil level

Sprocket Wear Patterns (cont.)

Wear of Tooth Tip



Wear of tooth tip.

Causes:

- Due to internal joint wear, the pitch is increased and the bushings get closer to the tooth tip. In some instances the bushings jump over the tip of the tooth.
- On very cohesive soils, the tooth bottom is packed with soils causing a pitch mismatch. This causes the bushing to ride high on the tooth profile.
- New sprockets run with used tracks causes a pitch mismatch. The larger pitch of the used track is transferred to the new sprocket by an increased wear rate.
- During reverse travel, with loose tracks, a reduced angle of contact between the bushing and sprocket causes the bushing to ride high on the tooth profile.

Effects:

- Track chain tends to jump over the teeth.
- If the tooth tip is extremely worn, the track can not support the forces and may slip over the bushing and reducing traction. Safe operation on slopes is no longer assured.

Remedies:

- If running in cohesive soils use sprockets with mud reliefs.
- Use track shoes with centre mud holes for better cleaning of the track and better engagement between sprockets and bushing.

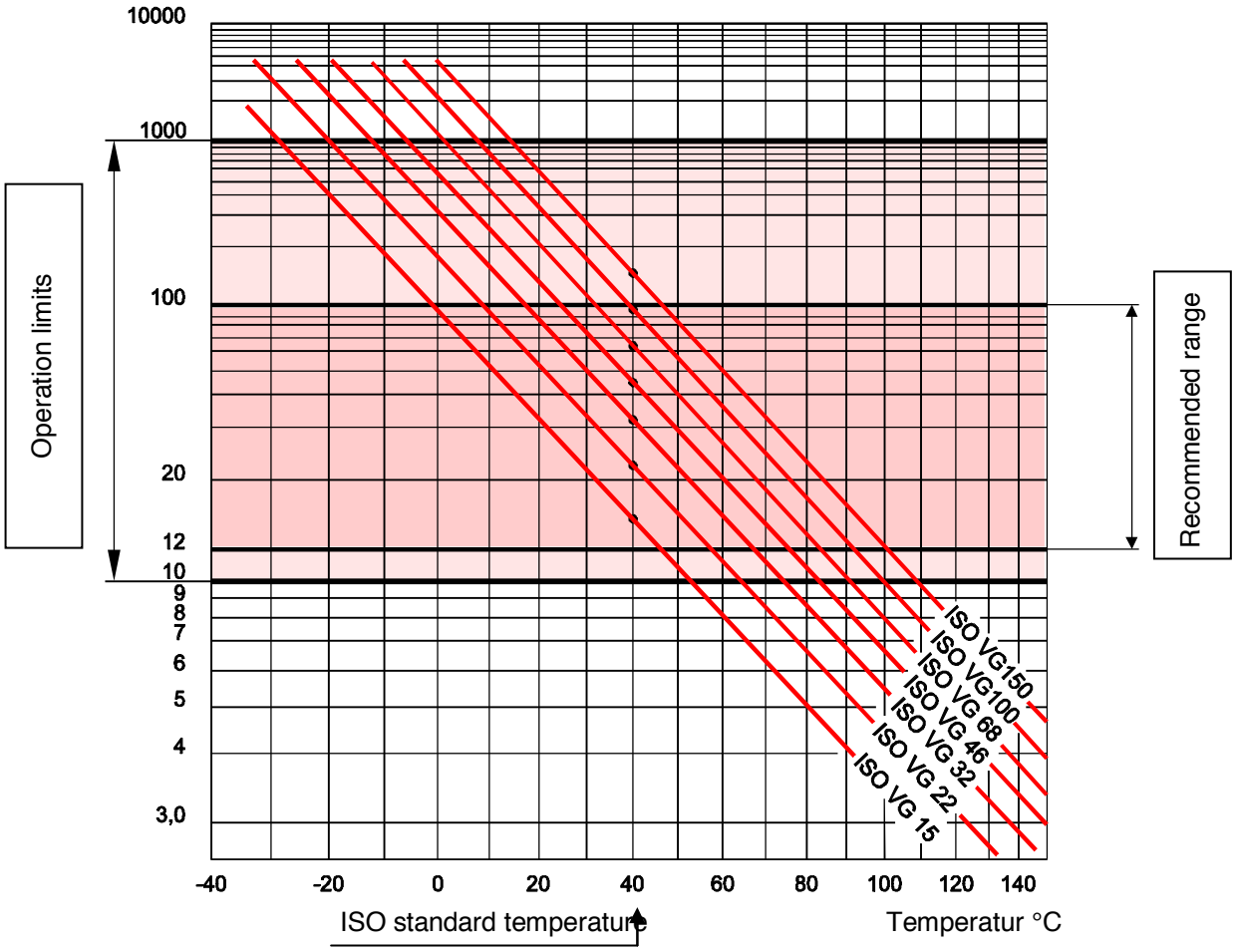
Hydraulic Fluids

For the selection of hydraulic fluids you should get in touch with your service partner.

HLP / ISO hydraulic fluids wth the following properties should be used:

- favourable viscosity/temperature behaviour.
- good thermal and mechanical loading properties.
- extensive resistance to ageing.
- good corrosion protection.
- adequate cold flowability.
- adequate lubrication effect in the marginal lubrication area.
- good air release properties.
- excellent foam behaviour.
- neutrality in contact with seals and hydraulic hoses.

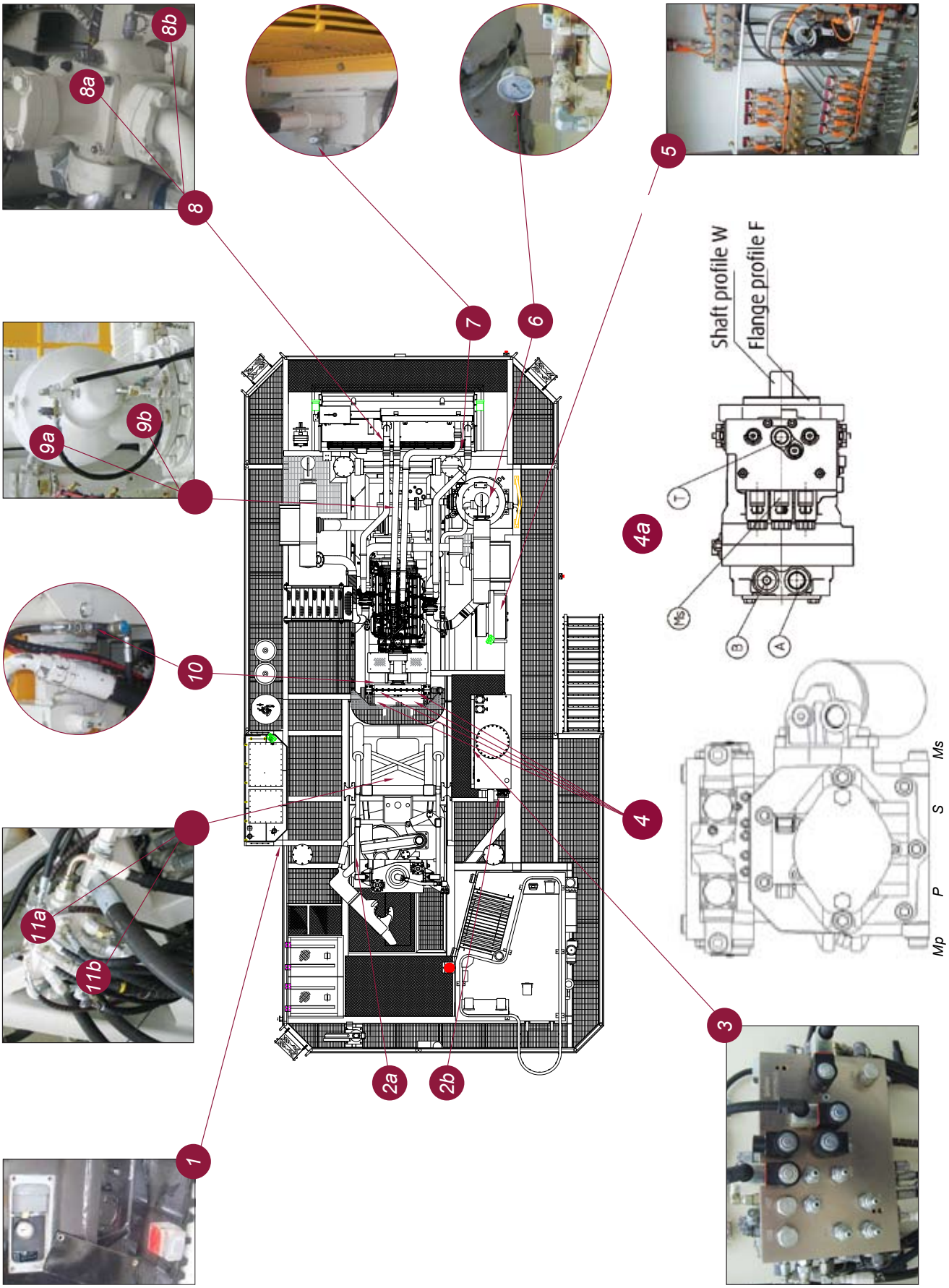
As the viscosity of hydraulic fluids changes considerably through fluctuations in temperature, compromises cannot be avoided in their selection. For your PALFINGER crane the following limit values apply:



- High temperatur range: 10 cSt
- Cold start limit: 1000 cSt
- Purity class: 15/12 (to ISO 4406)

Test Point Locator

Test Point Locator



Engine and Compressor Air Cleaner Service (cont.)

B. Air Cleaner Service

Proper air cleaner servicing will result in maximum engine protection against the ravages of dust, and can also save time and money by increasing filter life and dust cleaning efficiency. Two of the most common servicing problems are:

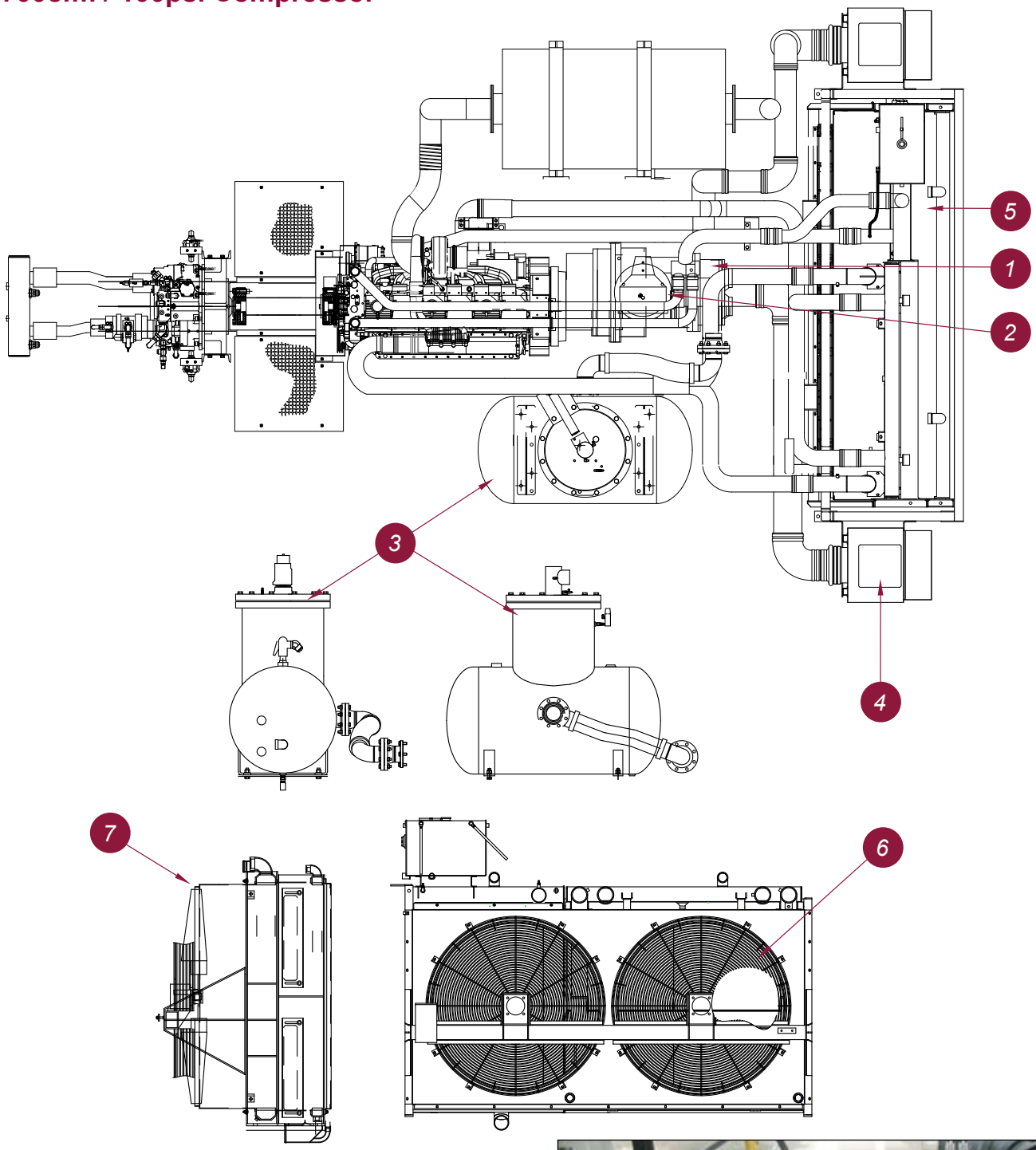
1. **Over servicing** – new filter elements increase in dust cleaning efficiency as dust builds up on the media. Don't be fooled by filter appearance, it should look dirty. By using proper filter restriction measurement tools, you will use the full life of the filter at maximum efficiency.
2. **Improper servicing** – your engine is highly vulnerable to abrasive dust contaminants during the servicing process. The most common cause of engine damage is careless servicing procedures. By following the steps shown, unnecessary dust contamination to the engine can be avoided.
   a. A filter indicator is used to measure the filter restriction. There are two indicators mounted on the operator control console to monitor the right and left filters.
   b. Dust cups should be dumped when 2/3 full. Make sure it seals 360º around the air cleaner body. On vacuator valve equipped models, dust cup service is cut to a minimum; a quick check to see that the vacuator valve is not inverted, damaged, or plugged is all that is necessary.
   c. Light dust plugging of tubes can be removed with a stiff fibre brush. If heavy plugging with fibrous material is evident, remove lower body section for cleaning with compressed air or water not exceeding 71.7ºC (160ºF).

CAUTION: NEVER clean tubes with compressed air unless both the primary and safety elements are installed in the air cleaner. DO NOT steam clean tubes.

C. Element Servicing

1. When restriction indicates that element servicing is required, loosen wing nut and remove primary element. Before installing new element, inspect the element and gasket for shipping or storage damage. Carefully install element and wing nut. Reset the restriction indicator to green. For minimum downtime, replace dirty filter with new or properly cleaned XLP filter element. If element is to be serviced for immediate reuse, reinstall outer cover to protect induction system while cleaning element.
2. Inspect and tighten all air cleaner induction system connections.
3. Inspect all gaskets and replace if worn or damaged. Annual replacement of all gaskets is recommended.

1700cfm / 100psi Compressor



1. *Compressor air end*
2. *Poppet inlet valve*
3. *Receiver tank*
4. *Compressor air filter*
5. *Oil cooler assembly*
6. *Fan guard*
7. *Fan*

Compressor Shaft Seal (cont.)

Installation

Install the seat as follows:

1. If a new pin (A14) is required, install in seal housing (A21) by tapping with a hammer or plastic mallet.
2. Lightly coat the bore of the seal housing (A21) with lubricant provided in seal kit.
3. Unwrap the seat.

WARNING: The finish of the lapped face is easily damaged and must be handled carefully. The lapped face can be identified by its highly polished surface. Coat with same lubricant used in compressor. Keep fingers off the lapped surface. DO NOT USE LUBE FROM SEAL KIT ON LAPPED FACES.

4. Install seat (7) into bore of seal housing (A21) with the lapped surface facing the inside of the compressor. Check to make certain that seat fits over pin (A14).
5. Install snap ring (A15) using a pair of snap ring pliers.
6. Apply adhesive on flange of housing. Lay aside and do not disturb.
7. Install the seal assembly as follows:
8. Coat the shaft with lubricant provided in seal kit.
9. Unwrap the seal assembly. Coat ID of bellows with lubricant provided in seal kit. Coat lapped face with same lubricant used in compressor. Do not use lube from seal kit on lapped faces.
10. Make certain that seal blocking plate (A33) is still on shaft.
11. Install seal assembly on the shaft (with the lapped carbon surface facing out) just far enough to assure that the tail section is past the shaft chamfer.

WARNING: The seal assembly must be started squarely over shaft by hand force against the lapped carbon face. If the seal assembly becomes locked on the shaft, remove and start over. Excessive force should NOT be necessary. Extreme caution must be exercised NOT to damage the lapped carbon surface and to keep it clean. Keep fingers off the lapped carbon surface.

12. Install seal housing (A21) over the shaft and line up the bolt holes. Push down squarely and slowly against the seal assembly until seal housing flange contacts inlet housing. The seal will then be at proper operating height. Hold the housing in position with one hand while the screws (A18) are installed. Torque the screws (A18) to 80ft lbs (108Nm).

WARNING: Seal housing (A21) must be held in position until the screws (A18) are installed, since releasing the seal housing (A21) may allow the spring force to push the rubber bellows (3) out of position. If the bellows (3) grip the shaft while out of position, it will not allow the spring (5) to exert the correct pressure between the lapped faces. This will result in seal failure within a short period of time.

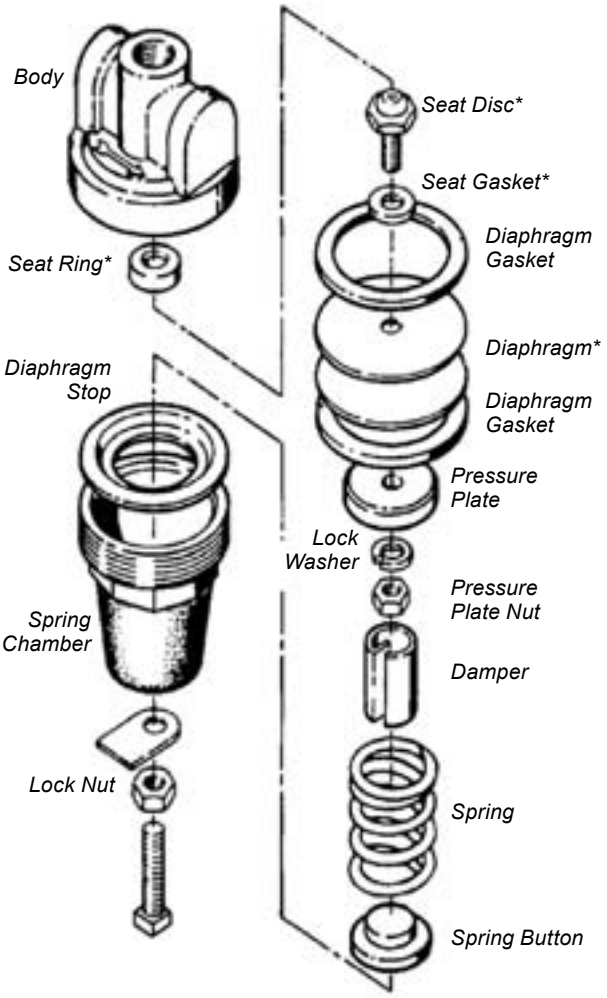
13. Reconnect oil supply line to seal housing (A21).
14. For instruction relative to coupling installations and alignment, refer to pages 4-32 and 4-33.

Relieving Regulator Maintenance (cont.)

4. After removing the spring, remove the diaphragm stop.
5. At this time, remove the pressure plate nut and disassemble the pressure plate, diaphragm, diaphragm gasket, seat disc and seat gasket.
6. Remove and discard the seat ring.
7. Reassemble the regulator using the new parts provided in the repair kit.
8. Reassemble the diaphragm, pressure plate, diaphragm gasket, seat disc, seat disc gasket, and tighten the nut. All of these parts with the exception of the pressure plate are provided in the repair kit.

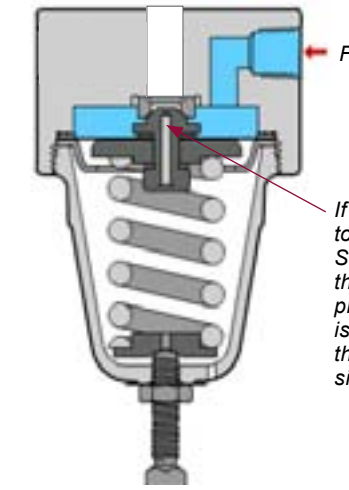
NOTE: * Indicates item is in repair kit

9. Replace the seat ring with the new seat ring provided.
10. Replace the existing diaphragm stop.
11. Next, place these parts in their proper place or the body and replace the spring as it was prior to disassembly.
12. Place the spring button over the spring as shown.
13. With all parts in order, replace the spring chamber and tighten.

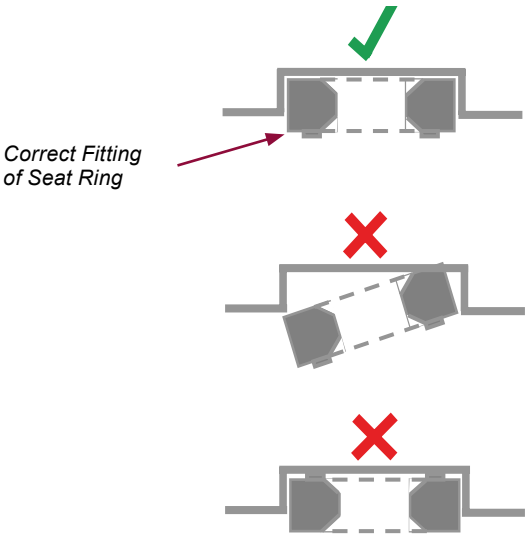


Pressure Control Regulator

14. Tighten the adjusting screw until tension is realised.
15. At this time, refer to control system adjustment procedure to readjust the pressure regulator.



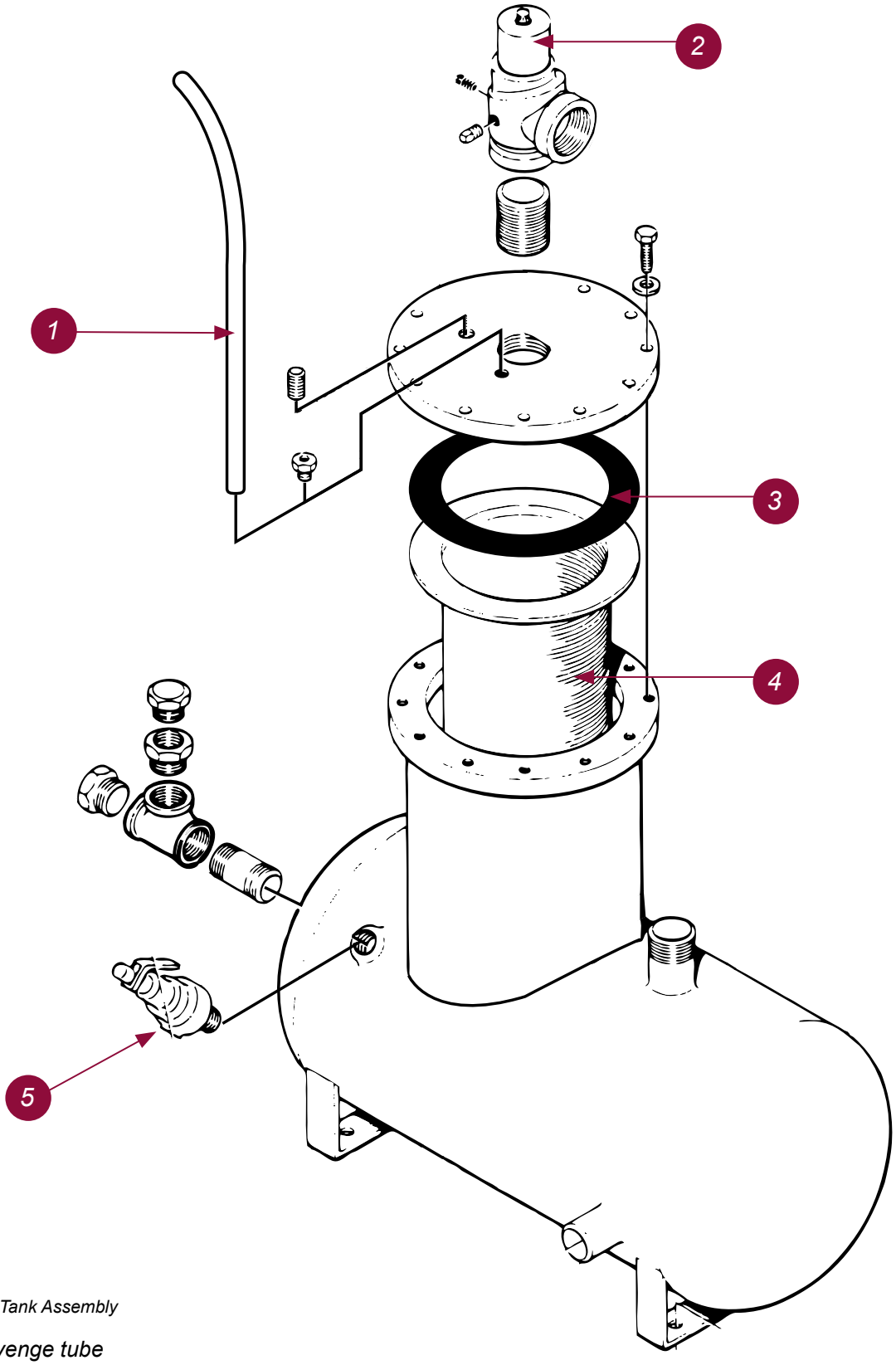
If the Regulator requires a repair kit to be installed, it is imperative the Seat ring is fitted straight/square into the valve body. The Seat ring can physically be installed upside down, it is the completely flat side of the seat that faces the valve body (The opposite side of the Seat ring is grooved)



Operation (cont.)

Control Or Indicator	Purpose
System Pressure Regulators	Opens a pressure line between the receiver / sump tank and inlet control valve allowing the inlet control valve to regulate air delivery according to air demand.
Running Blowdown Valve	Vents excess receiver/sump pressure to the atmosphere when receiver / sump exceeds the desired unload pressure during unloaded operation.
Shutdown Blowdown Valve	Vents receiver / sump pressure to the atmosphere at compressor shutdown.
Compressor Fluid Pressure Transducer (falling fluid pressure) Alarm 35psi, Shutdown 30psi	Opens an electrical circuit to shut the compressor down when the fluid pressure going to the compressor unit bearings falls below minimum requirements (30psig).
Fluid Filter Restriction (Vigilante alarm screen)	Indicates required servicing of fluid filter. Vigilante will flag an alarm when the pressure drop through the filter is excessive.
Separator Scavenge Line Sight Glass	Used to indicate flow of fluid going back to compressor unit from the fluid pickup in receiver/sump tank. When the compressor is running at full load, fluid flow should be visible in this sight glass. There may be little or no flow when the compressor is running unloaded. A sluggish flow at full load indicates a need to clean the fluid return line strainer and / or orifice.
Air Filter Restriction Indicator	Will flag an alarm on the Vigilante screen in the cab and indicates required servicing of air filter primary element only.

Compressor Receiver Tank Assembly



Receiver Tank Assembly

1. *Scavenge tube*
2. *Minimum pressure valve*
3. *Gasket (do not remove staple)*
4. *Separator element*
5. *Safety relief valve*

NOTE: When filter element is changed, it is important to check that all four (4) Bypass check valves are in place. (refer fig 4-12). This is done by looking up into the Filter head from the underneath side once the filter bowl and element have been removed. Inspect/check all four (4) by-pass valves in housing for cracks, chips or damage. There must be a by-pass check in all four (4) ports, if missing and the port is open then there will be no filtration occurring of the compressor fluid. Replacement valve part number V0125559.

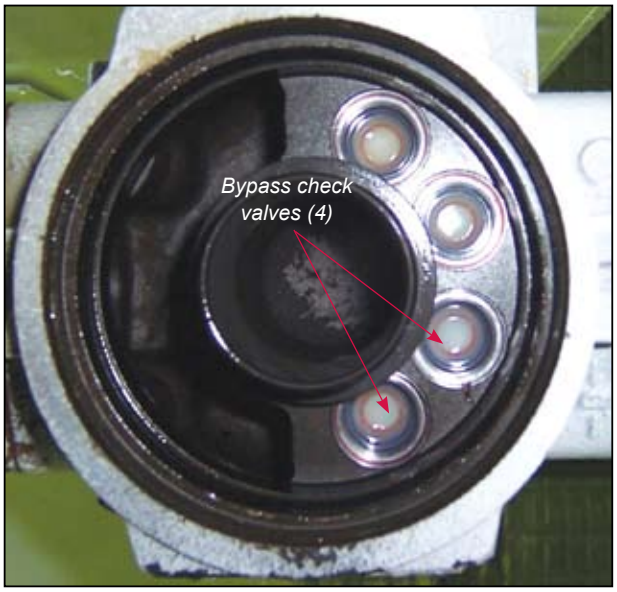


Fig. 4-12 Compressor Fluid Filter

Changing Filter Elements

WARNING: Relieve pressure on hydraulic and pneumatic systems before loosening connections or parts.
Failure to depressurise system before proceeding could result in explosive loss of fluid, damage to equipment, or possible personal injury.

1. Shutdown and depressurise the system. Open bleed plug (if fitted) one and one half turns.
2. Unscrew and remove filter cover bowl from head assembly, counterclockwise when viewed from above. It may be necessary to use a lever on the 'Rotolok Ring' of the filter bowl to loosen the bowl initially.
3. Remove filter element and carefully inspect the surface for visible contamination. Normally no dirt should show, but visible dirt or particles can be an early warning of system component breakdown and can indicate potential failure. Discard both the filter element and its O-ring. The filter element is not cleanable. Any attempt to clean the filter element can cause degradation of the filter medium and allow contaminated fluid to pass through the filter element.
4. DO NOT run the system without a filter element installed. Check that the O-ring on the head assembly is not damaged. Use replacement filter element part number called for on the element change label or in the parts book.

NOTE: The four bypass valves must be checked. A damaged bypass valve will allow fluid to pass unfiltered. These four check valves must be checked visually every service for damage and integrity.

5. Lubricate element O-ring with clean system fluid and push open end of filter element straight onto the nipple in the head assembly. Clean out filter bowl and lightly lubricate threads of filter cover assembly with clean system fluid. Screw cover assembly onto head assembly until it bottoms. O-ring sealing is not improved by overtightening.

Oil Cooler – Internal Cleaning

In cases where it is necessary to clean the inside of the oil cooler, the following procedure can be used.

Remove all the tubes and seals from the oil cooler as described. Flush the inside of the tanks with a high pressure washer (a mild soap can be used but rinse thoroughly). Blow the excess water out with air and make sure the tanks are dry. The tube holes should be clean and dry.

Next remove the turbulators from the tube with the tools shown in **Fig. 1**.

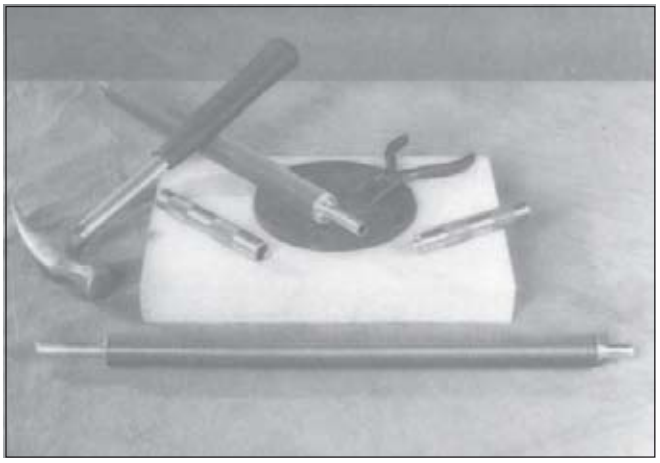


Fig. 1

Note that the tube ends have been crimped at each end to secure the turbulator inside the tube. Also note that there is a long, unfinned portion of the tube and a short, unfinned portion.

Place the tube end on a piece of hard industrial rubber as shown in **Fig. 2**. Holding the tube upright, insert tool in the end of the tube (see **Fig. 3**), with a hammer lightly tap the tool forcing the end of the tube open just far enough to allow removal of the turbulator. **Care must be taken not to mushroom the tube ends.** Open both ends in this manner.

Fig. 2

Fig. 3

Typically, turbulators are removed out of the long unfinned end of the tube with a long nose plier. In this case, the tabs are facing downwards (see **Fig. 4**.) **Care should be taken not to kink the turbulators.**

NOTE: *Although rare, you may find turbulators inserted the opposite way because of flow direction. If so, please remove from the short unfinned end.*

Clean and flush the tube with a high pressure washer. Blow off with air and make sure tubes are thoroughly dry.

Fig. 4

CAUTION: DO NOT weld on any part of the machine without first disconnecting the negative battery cable or place the battery disconnect switch in the open position. On machines equipped with electronic engine, disconnect the connections to the Electronic Control Module (ECM) on the engine before welding (see Section 8).

Electric Timer

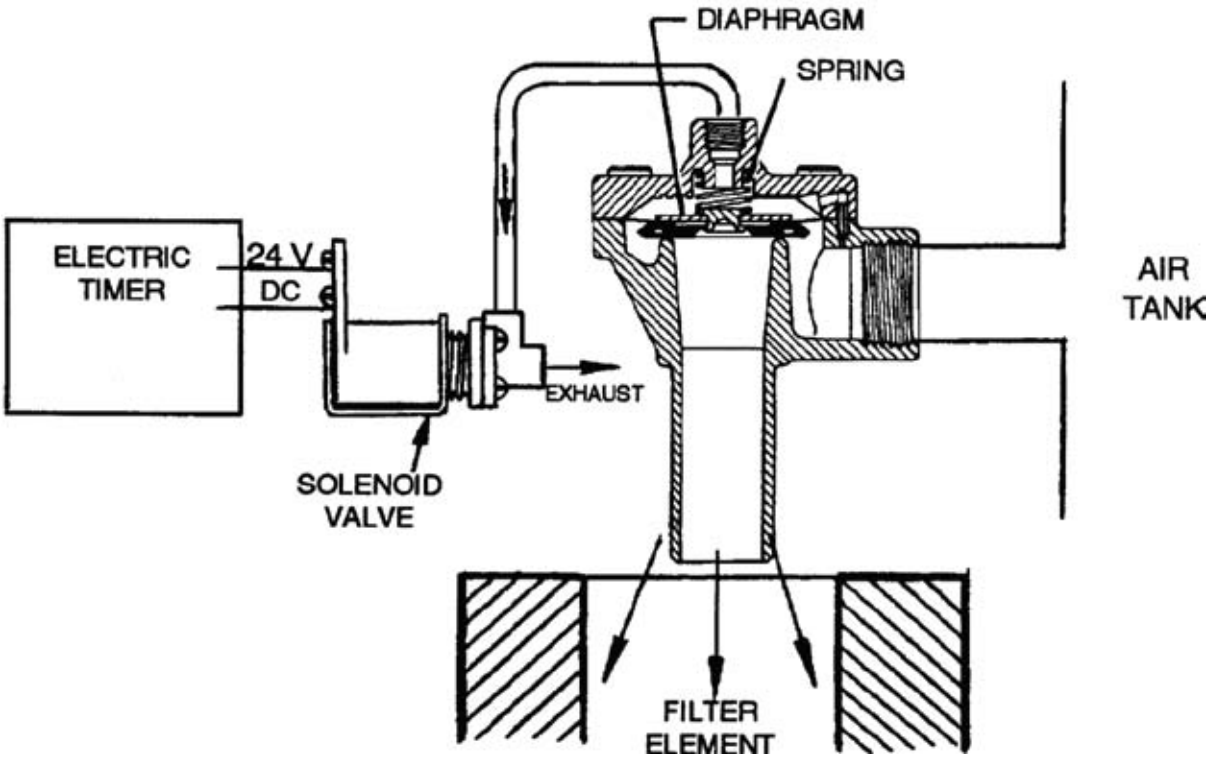


Fig. 5-6 Electric Timer and Air Impulse Valve

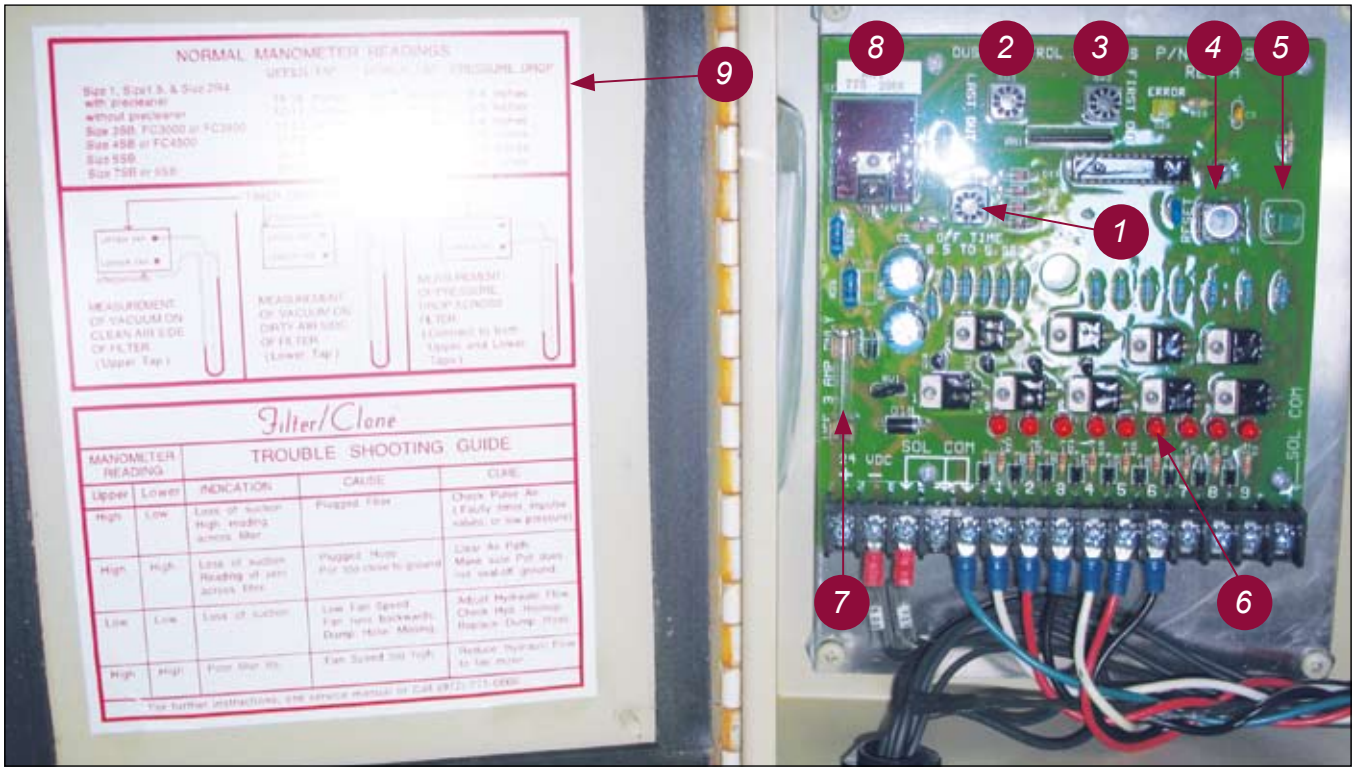
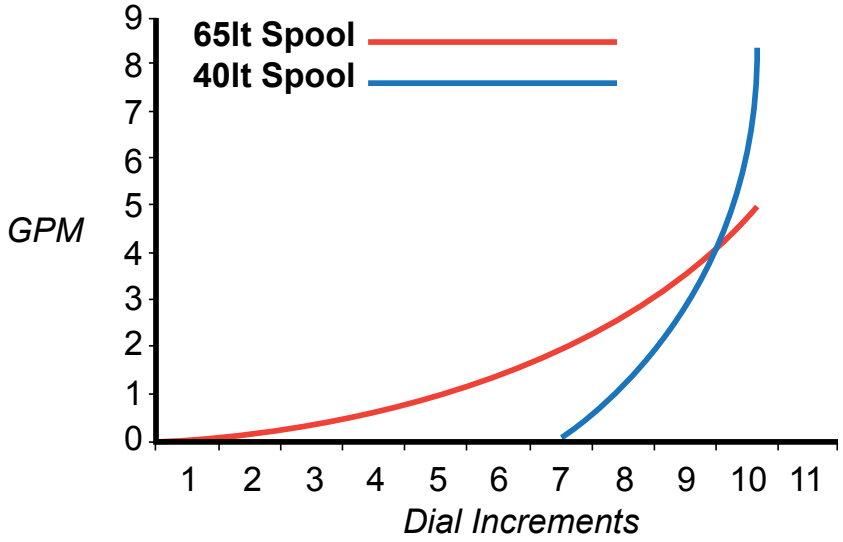


Fig. 5-7 Electric Timer

1. *Off time switch*
2. *Last out switch*
3. *First out switch*
4. *Reset button*
5. *Power light*
6. *Pulse sequence lights (for number of filters)*
7. *Fuse, 3 amp*
8. *Controller*
9. *Operation instructions*

Water Injection Control

TOC 2 Controller



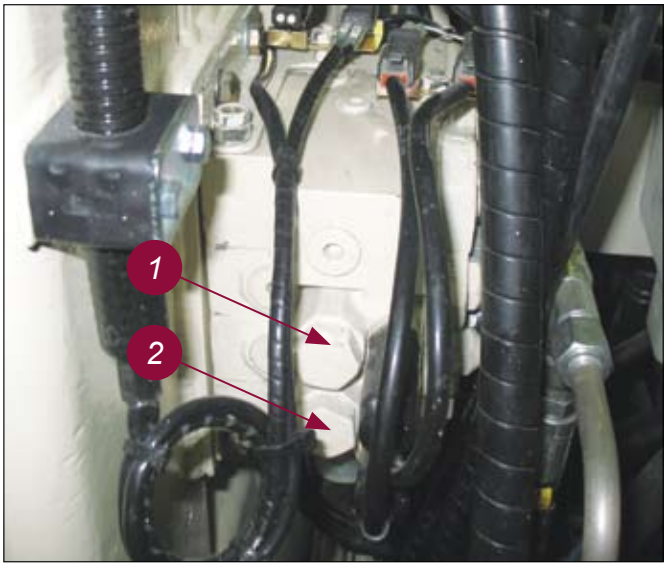
Water Injection Flow Chart

Water injection volume is operated via the **dialler** in the **operators cab.** The dialler in conjunction with the **TOC 2 controller,** signal the **water injection hydraulic spool valve** which supplies the oil flow to the **water pump drive motor.** The water pump drive motor drives the **water injection pump** via a chain and sprocket coupling. The twin spool valve is proportional so as the dialler is turned from **0>10,** more oil flow is delivered to the drive motor thus increasing the speed and output of the water pump.

Water Injection Dial Controller

Apitech Valve

1. Apitech Valve
2. Hoist / Pulldown Valve



Proportional Hydraulic Twin Spool Valve

1. 40 litre spool
2. 65 litre spool

Disassembly (cont.)

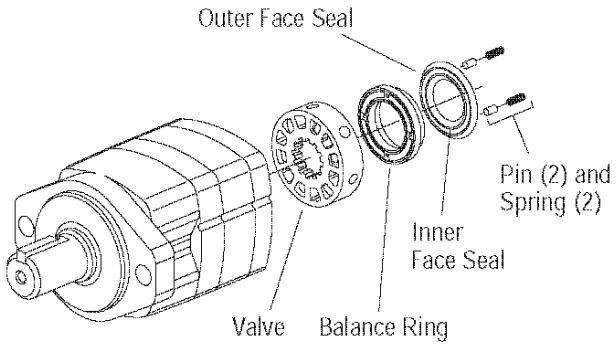


Figure 5

7 Remove balance ring assembly.

8 Remove inner and outer face seals from balance ring.

9 Remove the valve.

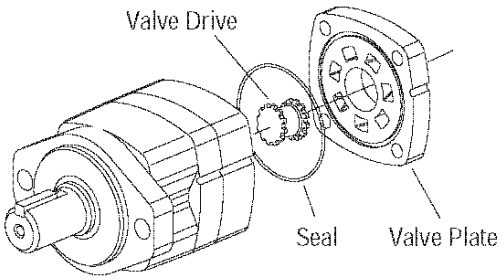


Figure 6

10 Remove the valve plate.

11 Remove the 76,0 [3.00] diameter seal from valve plate.

12 Remove the valve drive.

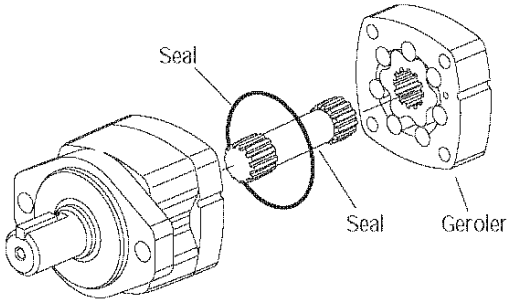


Figure 7

13 Remove the Geroler. Be sure to retain the rollers in the outer ring if they are loose.

14 Remove the drive.

15 Remove the 76,0 [3.00] diameter seal from wear plate, see Figure 7.

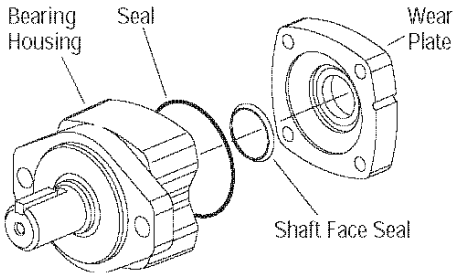


Figure 8

16 Remove the wear plate.

17 Remove the shaft face seal from the wear plate.

18 Remove the 76,0 [3.00] diameter seal from bearing housing.

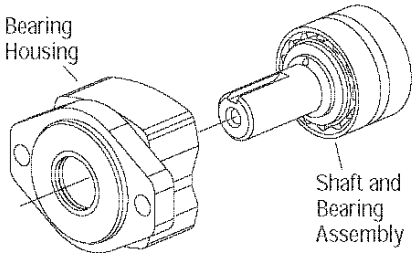


Figure 9

19 You may need a press to remove shaft and bearing assembly from bearing housing. (Key must be removed before removing shaft.)

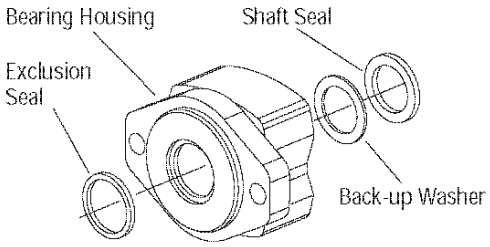


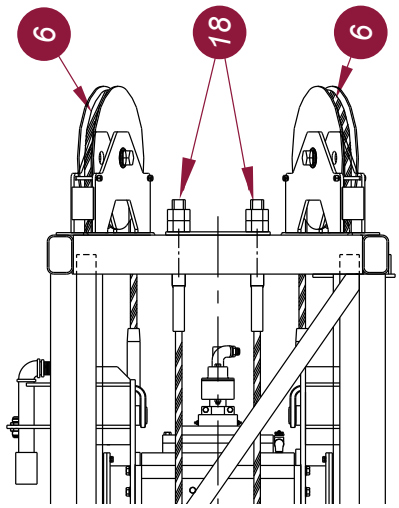
Figure 10

20 Use a small screwdriver to remove shaft seal, back-up washer and exclusion seal from bearing housing, see Figure 10. Do not damage bore of housing.

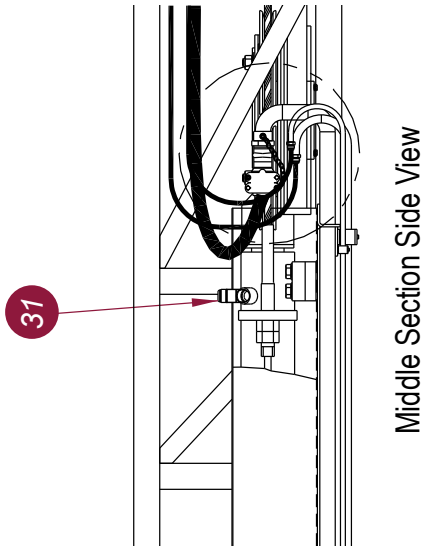
Note: Individual parts of shaft and bearing assembly are not sold separately. Replace as a unit.

Contents

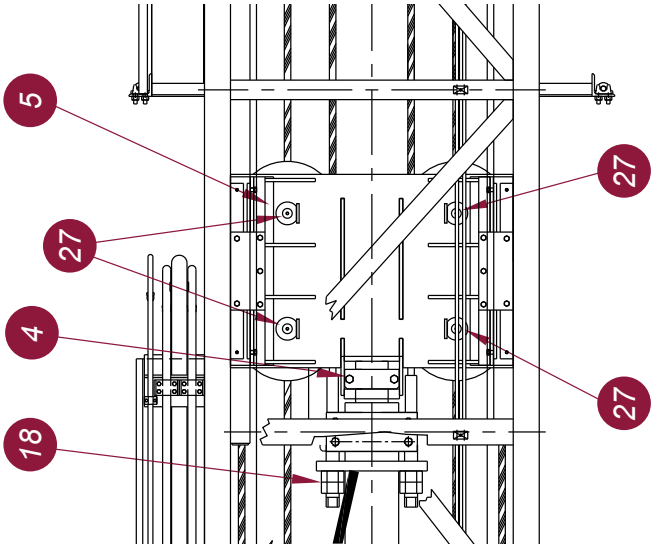
Feed Cylinder Service



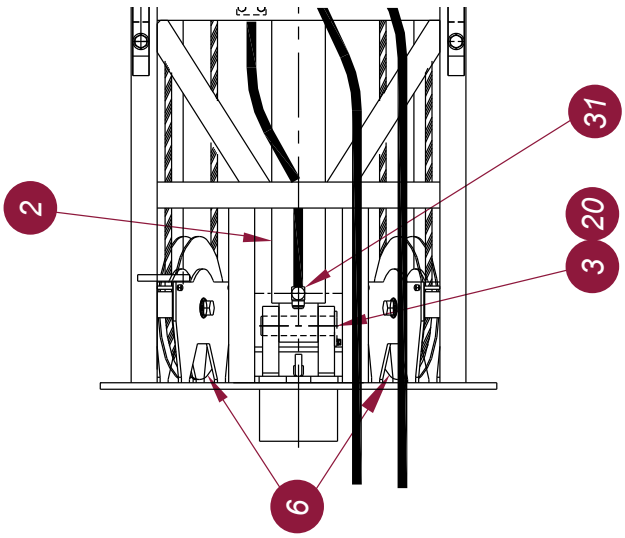
Top Section



Middle Section Side View



Middle Section

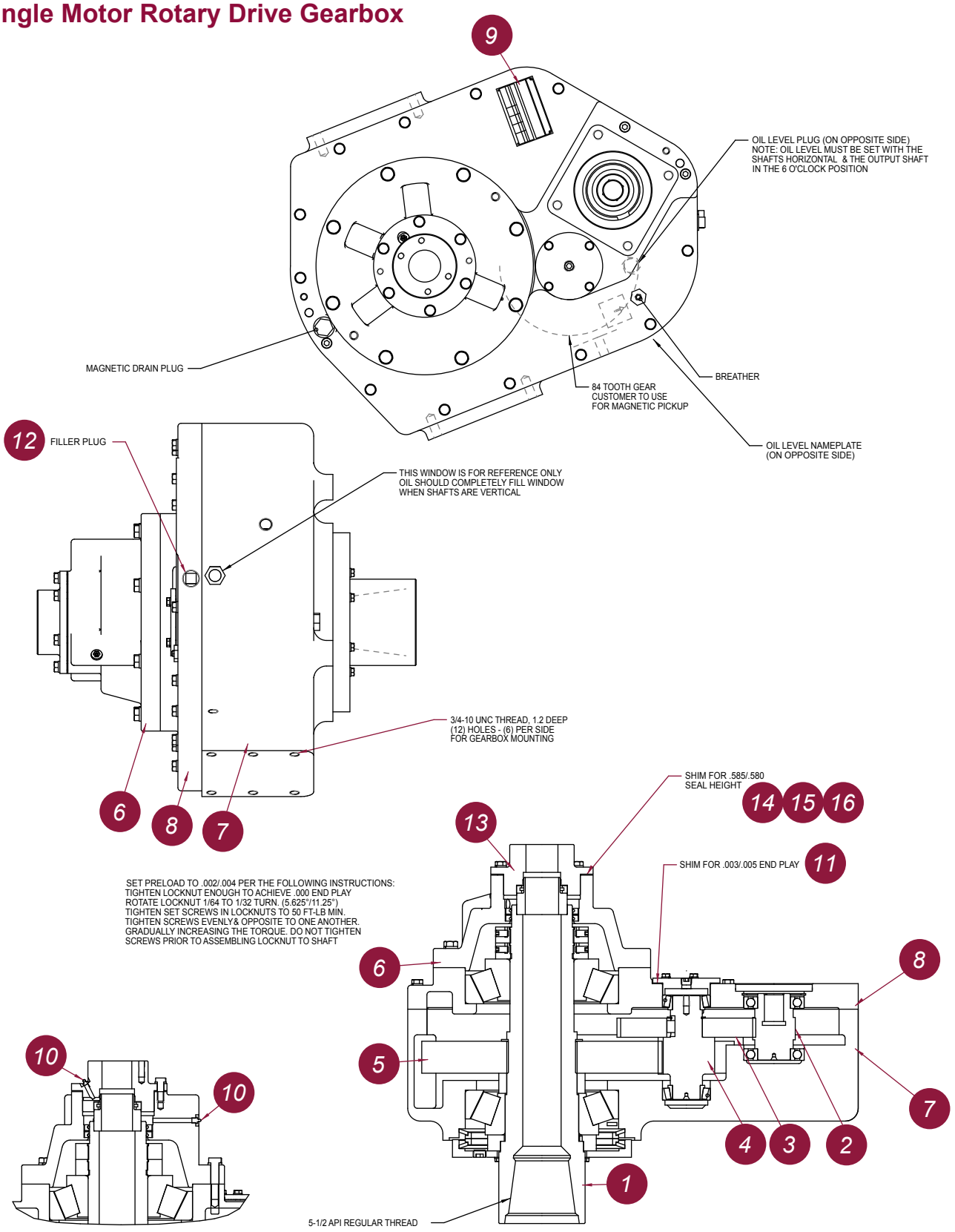


Bottom Section

2. *Hydraulic cylinder (2)*
3. *Pin, sheave (4)*
4. *Hydraulic cylinder clamp*
5. *Sheave guide assembly*
6. *Sheaves 22" (4)*
18. *Hex nut (8)*
20. *Capscrew (8)*
27. *Grease zert (8)*
31. *Connector (2)*

Rotary Drive Gearbox

Single Motor Rotary Drive Gearbox



1. *Shaft, output*
2. *Shaft, 24t*
3. *Gear, 84t*
4. *Shaft, 24t*
5. *Gear, 110t*
6. *Housing, seal*
7. *Case*
8. *Cover*
9. *Nameplate*
10. *Fitting*
11. *Shim set*
12. *Plug, square head*
13. *Housing, seal*
14. *Shim, .005"*
15. *Shim, .007"*
16. *Shim, .020"*

Single Motor Rotary Drive Gearbox with built-in Air Swivel – Dual Seal Style

Torque Limit Table Grade 8 UNC

Bolt Torques									Grade 8 UNC Hex Head Cap Screws	
2A Threads				Non Plated		CAD Plated				
Bolt Size	Clamping Force, Lbs	Nominal Diameter	Safety Factor	Dry Seating torque ft-lbs	Lubed seating torque ft-lbs	Dry Seating torque ft-lbs	Lubed seating torque ft-lbs	Tensile Area, sq in	Width Across Flats	Area under head, sq in
8 - 32	1260	0.1640	1.75	3	3	3	3	0.0140		
10 - 24	1575	0.1900	1.75	5	4	4	4	0.0175		
1/4 - 20	2862	0.2500	1.75	12	11	10	9	0.0318	0.438	0.1170
5/16 - 18	4716	0.3125	1.75	24	22	20	18	0.0524	0.500	0.1398
3/8 - 16	6975	0.3750	1.75	43	39	35	33	0.0775	0.562	0.1631
7/16 - 16	9567	0.4375	1.75	68	63	56	52	0.1063	0.625	0.1880
1/2 - 13	12771	0.5000	1.75	104	96	85	80	0.1419	0.750	0.2908
9/16 - 12	16380	0.5625	1.75	150	138	123	115	0.1820	0.812	0.3225
5/8 - 11	20340	0.6250	1.75	207	191	170	159	0.2260	0.937	0.4535
3/4 - 10	30060	0.7500	1.75	366	338	301	282	0.3340	1.125	0.6542
7/8 - 9	41580	0.8750	1.75	591	546	485	455	0.4620	1.312	0.8894
1 - 8	54540	1.0000	1.75	886	818	727	682	0.6060	1.500	1.1631
1 1/8 - 7	68670	1.1250	1.75	1255	1159	1030	966	0.7630	1.687	1.4706
1 1/4 - 7	87210	1.2500	1.75	1771	1635	1454	1363	0.9690	1.875	1.8173
1 3/8 - 6	103950	1.3750	1.75	2323	2144	1906	1787	1.1550	2.062	2.1972
1 1/2 - 6	126450	1.5000	1.75	3082	2845	2529	2371	1.4050	2.250	2.6170

Coefficient of friction for dry, nonplated bolts =	0.195
Coefficient of friction for oil lubed, nonplated bolts =	0.18
Coefficient of friction for dry, CAD plated bolts =	0.16
Coefficient of friction for oil lubed, CAD plated bolts	0.15

Clamping force = (Proof tensile load) *(tensile area)/(safety factor)

Torque = (Clamping force)*(Coefficient of friction)*(Nominal diameter)

Nominal diameter & tensile area from " Mechanical Engineering Design", by Shigley/Minske 5th ed., pg. 328

Shear area of threads = (Minor diameter)^2 * (pi/4)

#8 - 1 1/2" proof tensile load = 120,000 psi (150 KSI min. tensile)

Assembly Transmission

1 2 3 4 5

Fig.1

Output Shaft Assembly Components:

1. Output Shaft (itm. 03) 2. Roll Pin (itm. 30),
3. Spacer (itm. 10), 4. Bearing Cone (itm. 28),
5. Spacer (itm. 09)

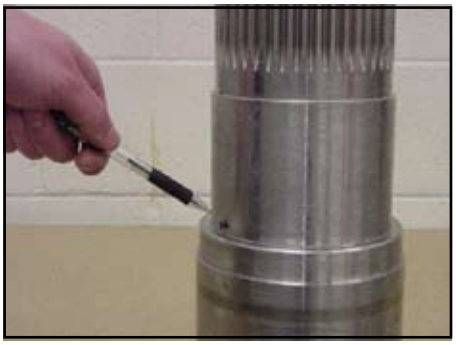


Fig.2

Pre-assemble Output shaft :

Drive Roll pin into hole until it stops.

Fig.3

Install spacer onto shaft until contact with the shoulder is obtained.

Heat or press spacer.
(See general working instructions.)

Note: Pay attention to orientation of spacer. Counter bore faces the shoulder of the shaft. Align notch in spacer with roll pin in shaft.

Fig.4

Install bearing cone onto shaft until contact with spacer is obtained.

Assembly Transmission (cont.)

Fig. 39

Install and align needed shims onto end cover. Install end cover onto gearbox.

Fig. 40

Wet hex head bolts with sealing compound. (Loctite no. 242)
Screw in hex head bolts and lock washers and tighten firmly.

Torque limit (3/8 x 16)……28 ft. lbs.

Fig. 41

Wet threads of plug with sealing compound. (Loctite no. 545)
Install plug in bearing cover and tighten firmly.

Fig. 42

<u>Output seal Housing:</u> (Upper)

Install seal spacer into counter bore of output shaft until contact with the shoulder is obtained.

It is required to under cool the seal spacer prior to installation!

Wire Rope (cont.)

In addition, the following more detailed inspection should be performed monthly or at more frequent intervals dependent upon operating conditions and usage:

WARNING: When running out the wire rope, exercise care that the drum stops at the end of the rope run-out and does not begin rewinding in the reverse direction. Stop run-out before you reach the dead lays on the drum.

1. Run out wire rope completely and note conditions such as the number of broken wires in one lay, the reduction in rope diameter, corrosion, shortening of the lay and lubrication.
2. Run a soft cloth (preferably cotton) over the entire length of wire rope and examine rope lays which pick up threads of cloth. Determine the extent of damage due to broken wires or nicks.
3. Examine sheaves and drums for abnormal wear, breakage or deterioration. Replace any sheave or drum contributing to rope wear.
4. Examine the wire rope closely at the equalizer sheave location. Where wear is noted, the rope can be shortened from the dead end to change the point of wear. (However, two dead wraps must be maintained on the drum and required lift or operating range not reduced.)
5. Examine socketed fittings; if one broken wire is noted adjacent to the socket, resocket the wire rope.

The length and type of service and the severity of operation must be taken into consideration before determining the disposition of a wire rope which shows signs of damage. Where failure might endanger life of equipment, the rope must be condemned and replaced if any of the following conditions are discovered: (refer fig 6-2)

1. Six wires broken in one rope lay.
2. Three wires broken in one strand in one rope lay.
3. Wear of 1/3 the original diameter of outside individual wires.
4. Rope severely kinked, crushed, cut, or unstranded, or any other damage resulting in distortion of rope structure.
5. Considerable corrosion in the valleys between strands.
6. Reduction from nominal rope diameter of more than 1.6mm (1/16”) for 25.4-28.6mm (1”-1 1/8”)

When any of the above conditions exist, the wire rope must be condemned and replaced. Procedures for the proper socketing and seizing of wire rope are pictorially shown in AS2759-2004 Steel Wire Rope.

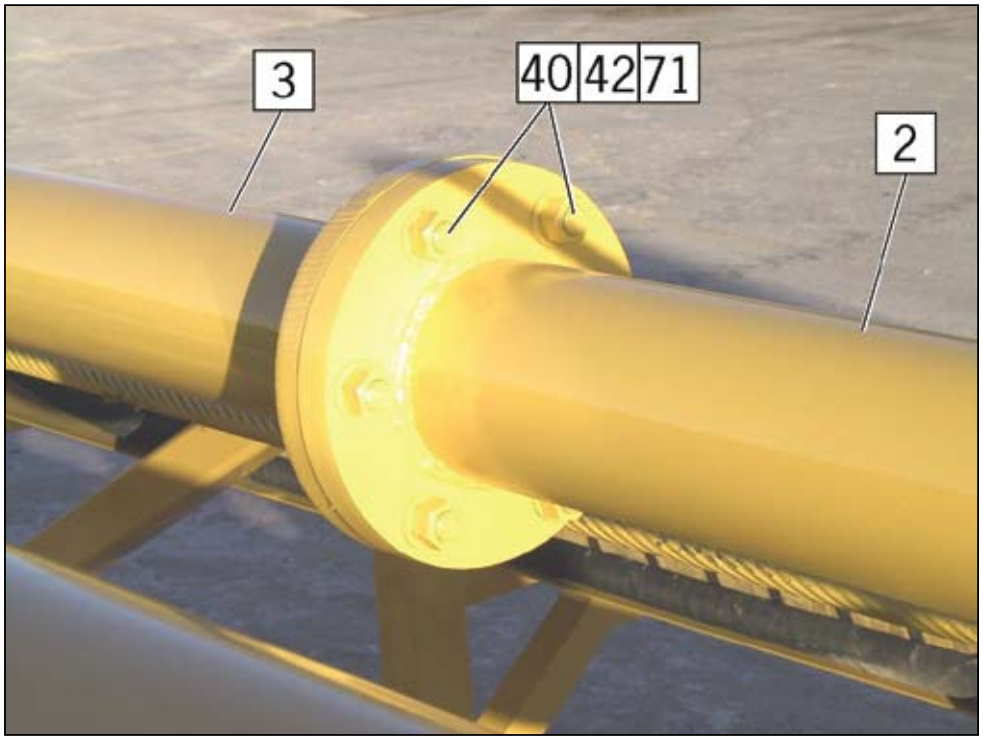
Lubrication is also important in the life of wire ropes, and can be accomplished with little trouble and expense. Regular, frequent applications of lubricant are preferred to infrequent heavy applications. Brush, spray, or dip the wire rope with cable lubricant M-2C-10 as required, depending on service conditions. The lubricant must be applied properly to coat the entire cable, not just the portion in most frequent use. Wire rope subjected to high operating temperatures or corrosive atmosphere should be lubricated semi-monthly.

Keep all wire ropes, including those infrequently used or those in storage, free of contaminants and well protected with lubricant. Dirty cables should be cleaned and flushed with M-99C30 penetrating oil; after one week, the entire surface should be brushed to remove all excess grease, accumulated dirt, metal rust, or other harmful contaminants.

NOTE: NEVER subject a wire rope to shock loads or loads exceeding the safe load rating.

Carousel Top Tube Bearing – Replace

1. With mast in horizontal position and all pipe removed as described previously, support top tube (3) and carousel pipe support (2) with a suitable lifting device.
2. Mark position of top tube at the joint. Separate the top tube from the carousel pipe support by removing the six capscrews (71) at the joint (fig. 6-8).
3. Remove the safety wire (22), four capscrews (32) and flat washers (43) that hold the end cap (8) to the mounting plate. Remove top tube with end cap.
4. Drive the bearing (14) out of the end cap (8). There is a lip on end cap at top where it bolts to the mounting plate, so the bearing must be driven out the bottom.
5. Install new bearing into end cap. Clean upper portion of top tube and apply grease to tube and bearing before installation.
6. Hoist top tube into position with end cap and bearing installed. Line up mark made before disassembly and install all capscrews, but do not tighten.
7. Tighten all capscrews and torque to standard specifications. Install new safety wire (22) on the end cap capscrews (32).



2. Carousel support
3. Top tube
40. Nut (6)
42. Hardened washer (6)
71. Capscrew (6)

Fig. 6-8 Top Tube and Carousel Support

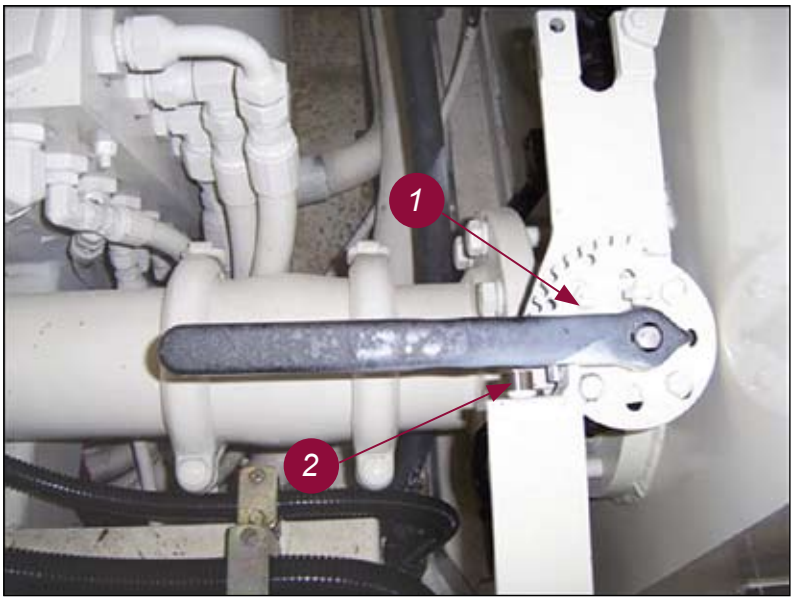
Notes

Hydraulic Tank (cont.)

There is a breather fitted to filter air being drawn into the tank and to allow the tank to vent when oil is returning to the tank. The hydraulic tank is fitted with a ball valve which can be manually opened to vent any residual pressure in the system after the engine has been stopped. The hydraulic tank isolation valve is used to shut off the oil flow from the hydraulic oil tank. It is used when work needs to be done on the circuit, particularly the hydraulic pumps.

WARNING: Only close the Isolation valve when the engine is stopped.

The proximity switch signals the PLC that the valve is open allowing flow. When the valve is closed an audible alarm is sounded and the vigilante alarm screen will show with the hydraulic valve isolated alarm flagged.



1. *Hydraulic tank isolation valve*
2. *Proximity switch*

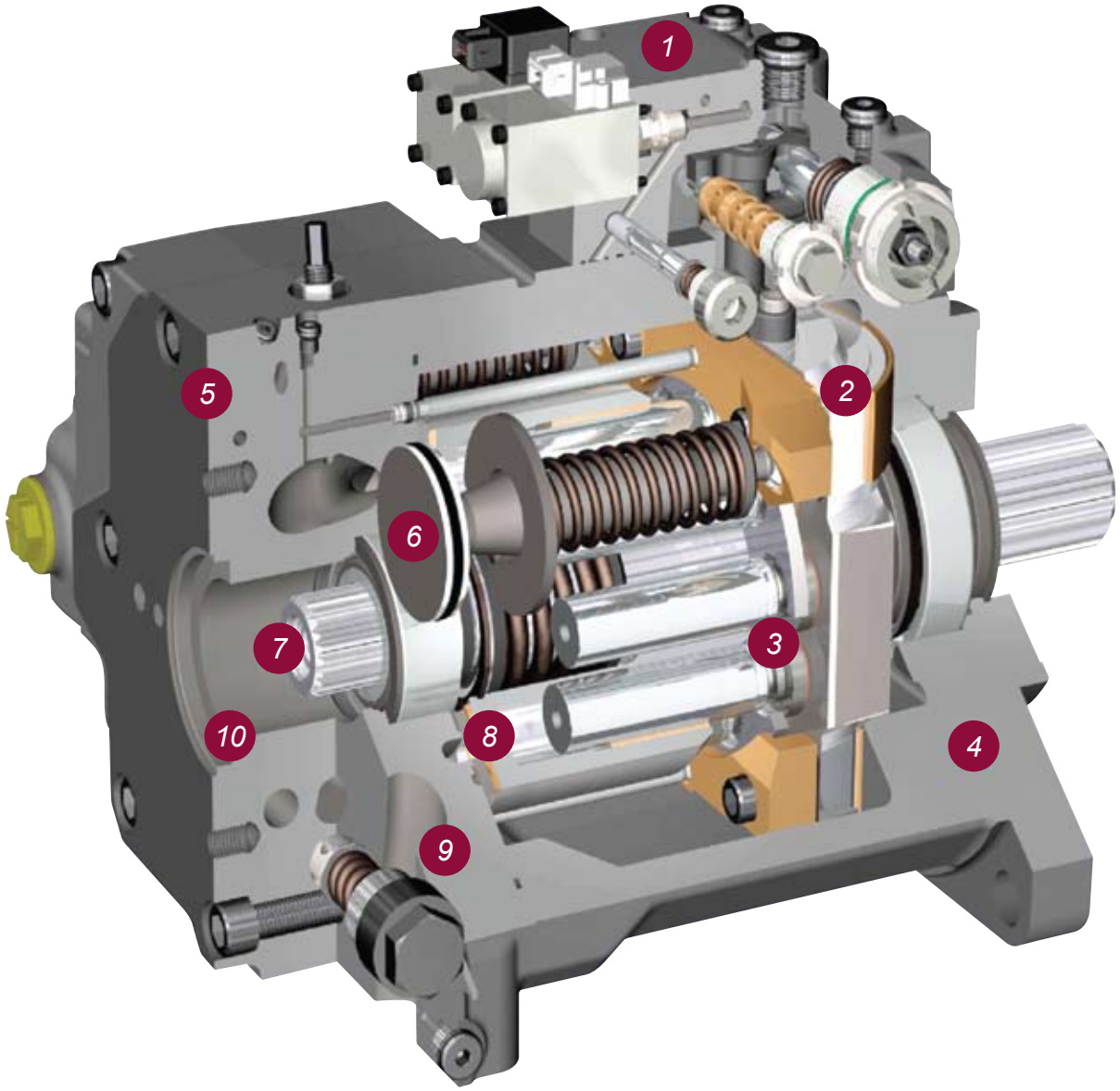
Hydraulic System

The hydraulic system consists of a hydraulic reservoir / tank that supplies oil to hydraulic pumps. These hydraulic pumps provide hydraulic pressure to operate all machine functions outside of the electrical and compressed air circuits. From the pumps oil is supplied to the levers and control valves which operate hydraulic motors or cylinders. Another important feature of hydraulic systems is the filters.

All the oil returning to the tank flows through either the return manifold, the drain manifold, or the case manifold. Oil returning from the return manifold must pass through the return filter before entering the tank. Oil returning from the drain and case manifolds is first teed together before passing through the case return filter. Both these filters have by-pass check valves in case the filters become blocked.

It is important to remember that the pressure in the return, drain, and case manifolds is different. The pressure in the return manifold is around 35psi, and in the drain and case manifolds is only <7psi. This is particularly important when connecting case drains from motors or pumps. If they are connected to the return manifold the increased pressure will prevent the case drain from draining, which will result in too much oil in the case and blowing out the shaft oil seal.

Linde HPR-02 Self-Regulating Pumps



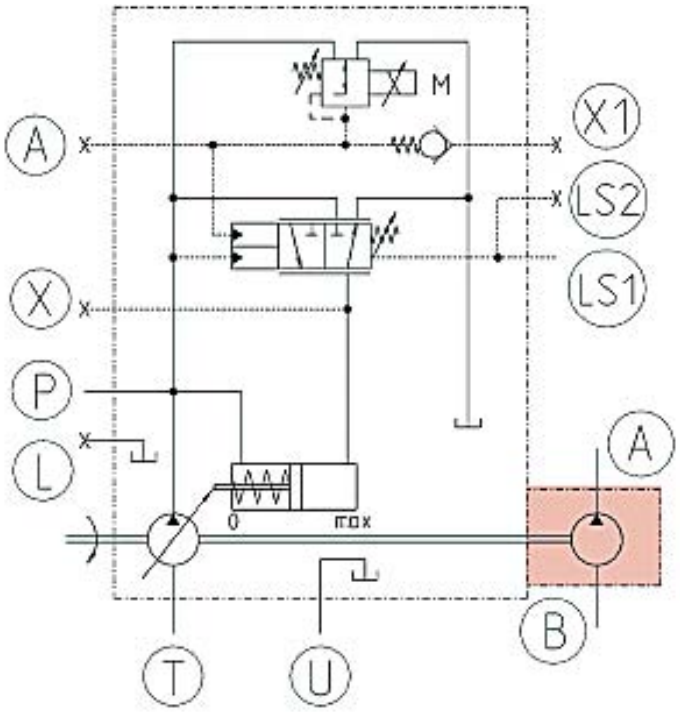
1. *Control device – modular design, precise and load independent*
2. *Swash plate – hydrostatic bearing*
3. *Piston slipper assembly – 21° swash angle*
4. *Housing – monoshell for high rigidity*
5. *Valve plate housing – highly integrated*
6. *Control piston – integrated, hydraulically captured*
7. *Through shaft – for additional pumps*
8. *Cylinder barrel – compact due to 21° technology*
9. *Integrated pressure relief valves – for system and boost pressure*
10. *Optional PTO – pumps and motors are available with this torque transmission*

ChargeExternal charge pump with two separate charge reliefs on common charge system.

Technical Data

Max. displacement volume	cm^2/rev	38
Standard boost pump for HPR-02	Rated size	210
		EGP
Mounting flange and drive shaft profile		SAE A 16/32, 13 t
Type of suction		external
Max. perm. operating pressure (observe max. permissible rated pressures for filter and cooler)	bar	275

External Gear Pump (EGP)



Loop Filters

The high pressure filter arrangement is mounted on both sides (2) of the pump group and consists of four high pressure 10 micron filters. There is one loop filter dedicated to each pressure port on both Main pumps Ports A and B.

The loop filters are placed on the main pump circuits. They are between the main pumps and the diverter valves for the feed/tramming and rotation/tramming circuits.

Routine Maintenance

The loop filters do not normally require special attention except for periodic monitoring of the dirty element warning device. See lubrication section for filter change intervals. Refer to fig.7-7 for item numbers.

1. If external leakage is noted, replace O-ring at leak. For bowl seal leaks, replace O-ring (9) and backup ring (8), locating backup ring away from fluid and toward bowl. If leakage persists, check sealing surfaces for scratches or cracks; replace any defective parts.
2. Differential pressure visual indicator acts as a dirty element warning device on the vigilante alarm screen 3 when differential pressure across the element becomes excessive because of plugging by contaminant. The hydraulic fluid temperature must be greater than 55°C. For this indicator to be accurate, reset the trigger and recheck when the system is up to temperature.

1. Loop filters (left side)

NOTE: Operating temperature is <50ºC before checking indicators on filters

Variable Displacement Motor AA6VM (cont.)

HA Automatic Control High Pressure Related

With the automatic, high pressure related control, setting of the displacement is effected automatically as a function of the operating pressure.

Start of control at $V_{g\,min}$ (min. torque, max. speed)
End of control at $V_{g\,max}$ (max. torque, min. speed)

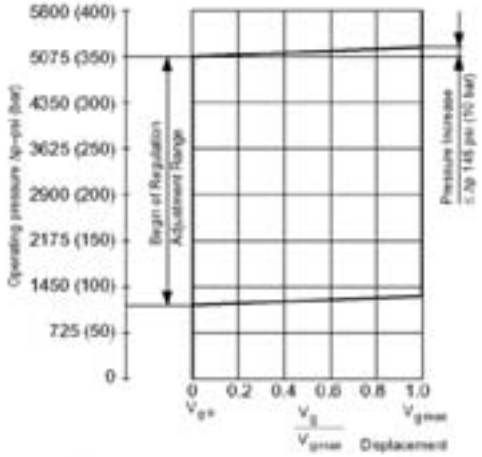
This control device measures the operating pressure at A or B internally (no pilot line required) and swivels from $V_{g\,min}$ to $V_{g\,max}$ once the pressure setting of the control is reached.

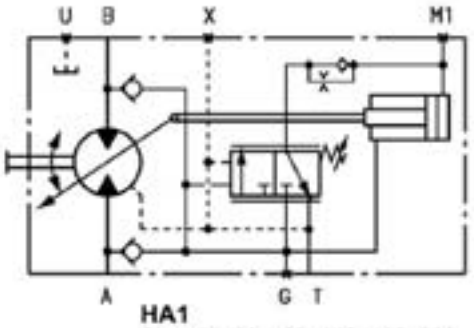
HA1
Version with virtually no pressure increase from start of control to end of control.

Pressure increase ($V_{g\,min}$ to $V_{g\,max}$) ≤ Δp 145 psi (10 bar)

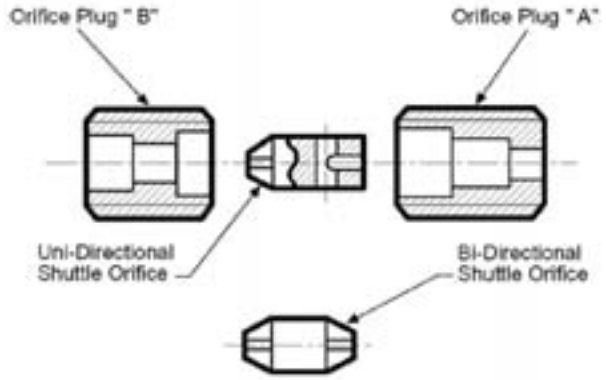
Start of control adjustable between 1160–5100 psi (80–350 bar)
(State required setting in clear text when ordering)

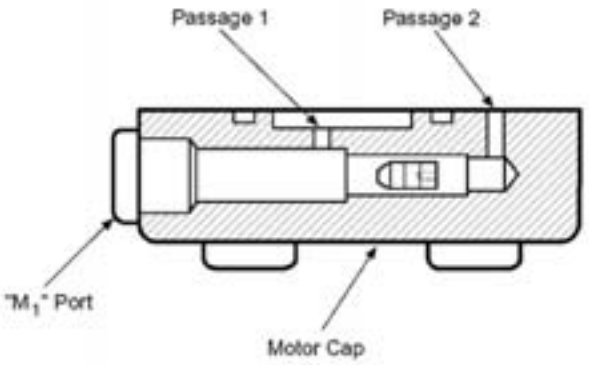
HA1





HA1
Size 55, 60, 107, 140, 160, 200





There are two types of self-cleaning swivel-time orifices available, a uni-directional and a bi-directional. This means that one type of shuttle orifice will control flow in one direction and will free flow in the other. The second type of shuttle orifice will control flow in both directions. Both types of shuttle orifices are shown above.

A swivel-time orifice kit is made up of two orifice plugs and one shuttle orifice. This kit is inserted into the "M_1" port of the motor cap (see page 26 for "M_1" port location). There is only one way to properly insert the swivel-time kit. First, thread orifice plug "A" into the "M_1" port until it bottoms. **Caution:** Do not overtighten this orifice plug. Next, insert the shuttle orifice in it's proper orientation for desired flow control. Finally, thread orifice plug "B" into the "M_1" port until it is tightly against orifice plug "A". Plug port "M_1".

The bi-directional shuttle orifice can be inserted with either tapered end in first. It's orientation does not affect flow control. The orientation of the uni-directional shuttle is important. With the uni-directional shuttle assembled into the motor cap as shown above, controlled flow will be from passage 2 to passage 1 (into the stroking piston). Free flow will occur from passage 1 to passage 2 (out of the stroking piston). To reverse flow control, rotate the uni-directional shuttle orifice 180°. The orifice plug "B" requires a 5mm Allen Wrench and orifice plug "A" requires a 6mm Allen Wrench.

Note: When using a uni-directional shuttle orifice, it will typically be assembled to control motor swivel time from minimum to maximum displacement. Contact Rexroth for more details.

Variable Displacement Motor AA6VM (cont.)

Routine Maintenance

The AA6V variable motors are relatively maintenance free. Maintenance work is confined to the system, by way of oil changes and renewal of filter elements. Both of these measures promote system cleanliness. Monitoring and periodic maintenance of the system can prevent premature breakdowns and repairs. Under normal application conditions, the following maintenance intervals are suggested.:

Renewal of Filter Elements

a. After commissioning.
b. After 500 operating hours
c. Thereafter during a fluid change.
d. With suction filtration, the filter element should be renewed as soon as a charge pump inlet pressure of less than - 3.2 psig (0.8 bar absolute) becomes evident with the transmission in warm running condition.
e. With charge flow filtration, watch for high pressure differential across the filter element. (Refer to filter manufacturer's specifications)

Caution: Use only 10 micron, or finer, filter elements.

Note: Paper inserts cannot be cleaned; use throw-away cartridges (maintain a stock).

Hydraulic Fluid Change

a. After 500 operating hours (1st fluid change).
b. After 2000 operating hours (2nd fluid change).
c. Thereafter every 2000 operating hours or annually irrespective of operating hours achieved.

The fluid should be drained with the system warm from previous running. Before re-filling, the reservoir should be cleaned to remove any sludge.

Caution: Rags or other threading material must not be used.

The recommended interval between fluid changes is based on various factors and should be carried out according to the type of fluid, the degree of aging and contamination of the fluid. The water content is also a contributory factor.

Under application conditions with a heavy occurrence of dust or severe temperature fluctuations the intervals between fluid changes should be shortened accordingly.

Caution: Practical experience shows that most maintenance errors occur during an oil change due to:

a. Use of an unsuitable hydraulic fluid.
b. Use of fluid contaminated due to faulty storage.
c. Failure to clean reservoir.
d. Inadequate cleanliness when filling (dirty drums or containers).

Leakage Inspection

1. After commissioning.
2. The complete transmission (pump, motor and all pipelines, filters, valves, etc.) should be checked for leakage at regular intervals.

Caution: Leaking joints and connections must only be tightened in pressureless conditions.

Cleanliness Inspection

The oil tank breather should be regularly cleaned of dirt and dust to prevent clogging. The cooling surfaces should be cleaned at the same time.

Caution: If hose couplings are used in the high pressure lines, it is imperative that the utmost care be taken that no foreign bodies infiltrate the oil circuit when coupling and uncoupling (danger of damage to rotary group, and even possibility of total breakdown).

Fluid Level Inspection

Inspect fluid level in reservoir after commissioning, thereafter daily.

Caution: Top up only with specified fluid type. Do not mix fluids.

Hydraulic Fluids

Most good quality, mineral oil based, hydraulic fluids exhibiting the following characteristics are suitable for use in a Rexroth hydrostatic transmission.

Good antiwear performance
Resistant to oxidation degradation
Protection against rust and corrosion
Resistance to foaming
Ability to separate water rapidly
Suitable for widely varying temperature conditions
Good low temperature flow properties
Retains viscosity-temperature characteristics in service
Universally available

The prime consideration in the selection of hydraulic fluid is the expected oil temperatures extremes that will be experienced in service. These extremes should be considered when selecting a fluid, so that the most suitable temperature – viscosity characteristics are obtained.

The fluid chosen should permit the system to operate within the following viscosity ranges.

Maximum viscosity at start	7400 SUS	(1600 cSt)
Normal operating viscosity range	66...464 SUS	(12...100 cSt)
Optimum viscosity range	80...170 SUS	(16...36 cSt)
Absolute minimum viscosity	42 SUS	(5 cSt)

When the fluid viscosity is greater than 1000 SUS (216 cSt) the transmission should be operated at reduced speed until the oil has been warmed to a temperature of 40°F (4.5°C).

For applications that will operate near the extremes of viscosity and/or temperature, the fluid manufacturer should be consulted for assistance in selection of the most suitable type and grade of fluid for your application.

Rexroth strongly recommends the selection and use of fluids from reputable and established suppliers.

Auto Pulldown Pressure Reducing Valve (not used with EP interlock)

Provides controlled pressure from Port 1 to shuttle valve (V13), then on to the pilot port on the MP22 feed valve which will then discharge at Port B to engage pulldown. Charge pressure is supplied to Port 2 from the auto pulldown solenoid (V09) when the auto feed switch is on. The valve is adjusted by feeding back down a drilled hole, then adjusting the valve to provide a feed speed just higher than the penetration rate. Feed pressure is set to suit rock formation during the setting.

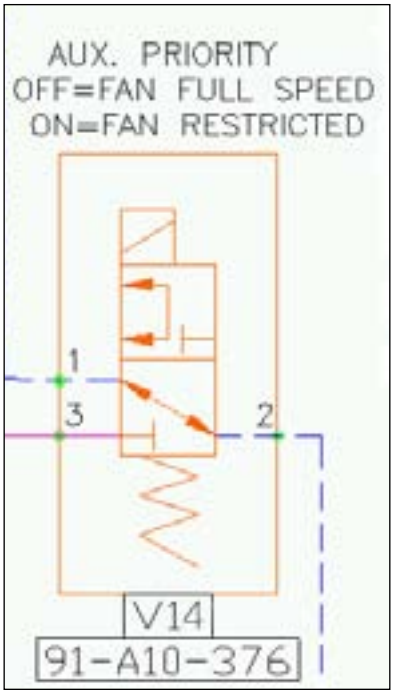
V12

AUTO-PULL DOWN

V13

Shuttle Valve (Not Used)

Joins pressure from Port 1 of the auto feed pressure reducing valve (V12) with pressure from the pulldown side of the hoist / pulldown pilot control in the cab. This will provide pressure at the pilot port of the MP22 feed valve to provide pulldown in auto or manual provided drill mode is selected.



Auxiliary Priority Solenoid Valve

This solenoid operated directional valve is energized via the PLC when any solenoid operated auxiliary function is activated. Charge pressure is directed from Port 3 to Port 1 to provide pilot pressure to V12, then onto V11.

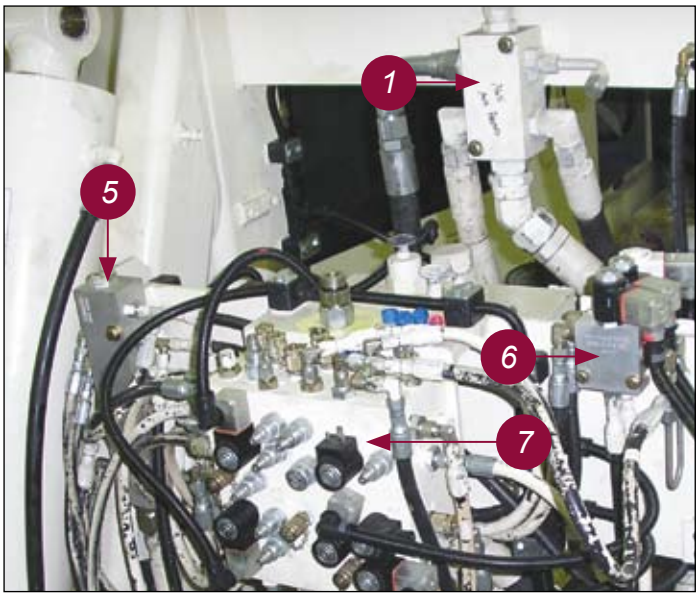
Feed and Auxiliary Pump Circuit

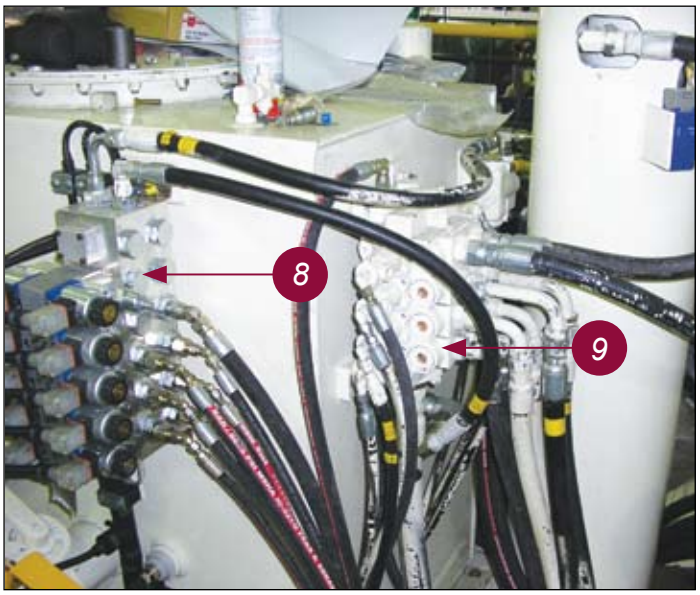
The auxiliary and feed circuits are supplied by a variable displacement piston pump. The pump is a Linde HPR-02 so is pressure compensating and load sensing. Maximum setting of the pump is 3000psi but is reduced by load sense relief's for auxiliary functions and is fully load sensing for pulldown. The only time the pump reaches full pressure is when the hoist is stalled.

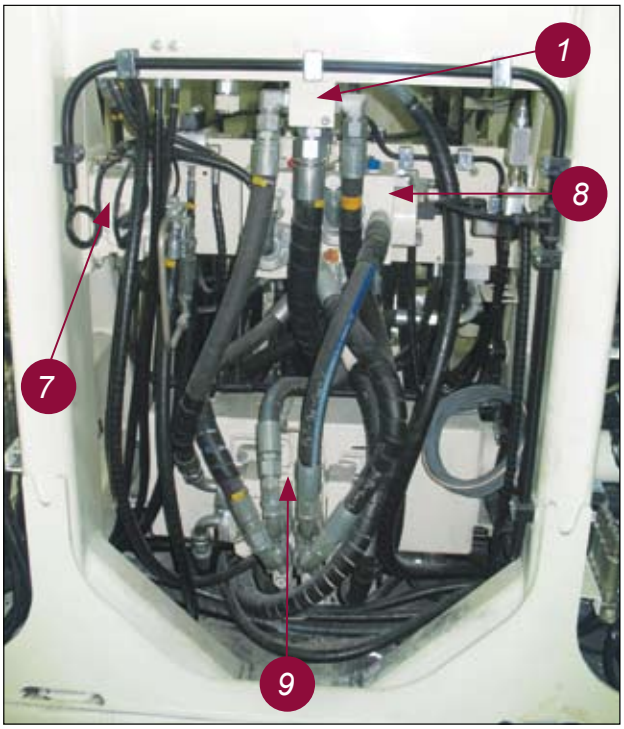
When any function switches on the operators console for the 6 or 9 spool auxiliary valves are operated, the PLC energises the auxiliary. Pump load solenoid (V03) which will load the pump to 2500 psi, set by the auxiliary load relief (V05). The 0.032"orifice at the M port of the pump will generate a pressure drop when the relief reaches its setting and flow begins. The load sense pressure is directed via shuttles (V04) and V19 to the X port on the pump to load it.

The jacks and mast raise functions are fully load sensing and the pressure is limited by the jacks / mast raise load sense relief (V06) set at 2800 psi. Orifice V20 generates a pressure drop when the relief reaches its setting and flow begins.

Pilot pressure to jacks /mast raise pilot valve is supplied from charge pressure via the set-up interlock solenoid valve (V11). (V11) will only allow pilot pressure to the pilot valve when it is energised, (V11) becomes energised when 1. pipe is not in hole, 2. ladder is up 3) hydraulic function enable button 'touchscreen' has been set.



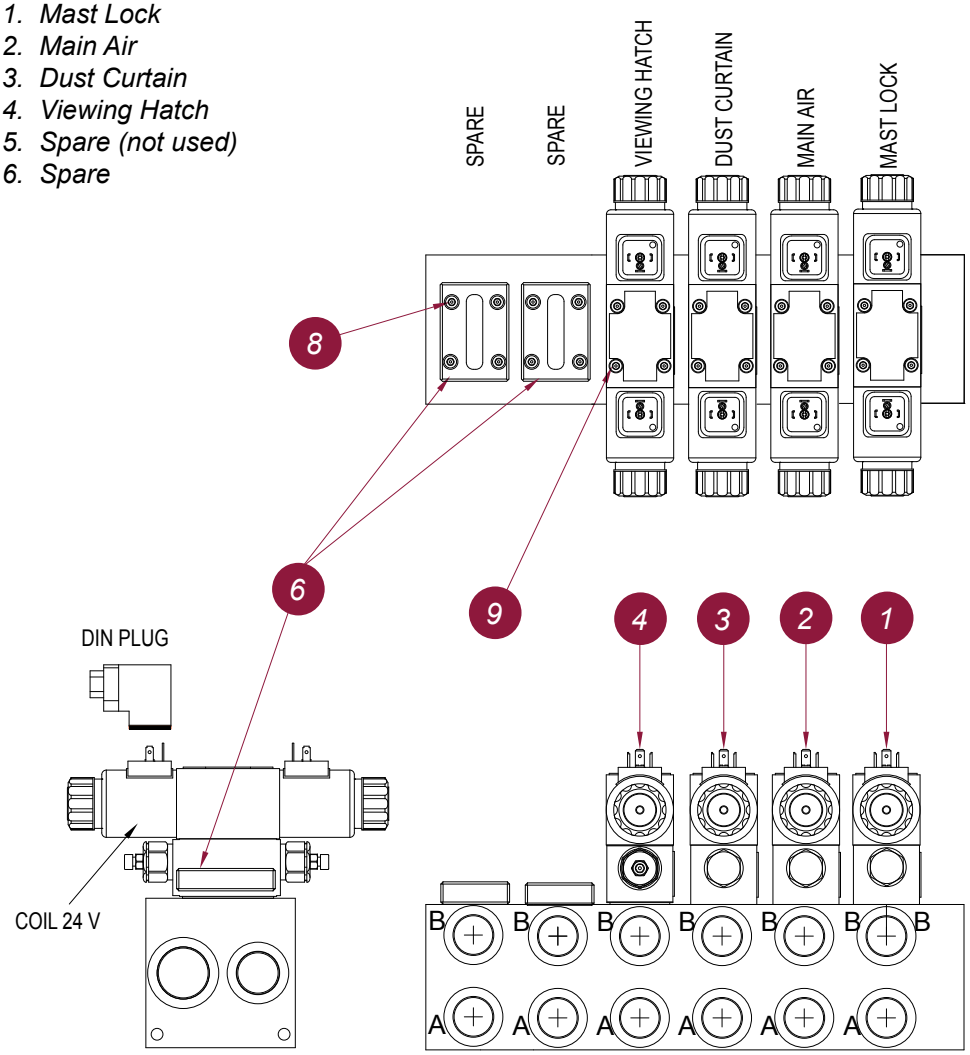




1. *Auxiliary manifold*
2. *Case manifold*
3. *Pulldown and hoist pilot valves*
4. *Manifold pilot control*
5. *Aux function valve assembly*
6. *MP18 jacks / mast raise valve*
7. *Apitech valve*
8. *Feed Valve assembly (regen block)*
9. *MP22 Valve feed and hoist*

Auxiliary Functions Circuit (cont.)

1. *Mast Lock*
2. *Main Air*
3. *Dust Curtain*
4. *Viewing Hatch*
5. *Spare (not used)*
6. *Spare*



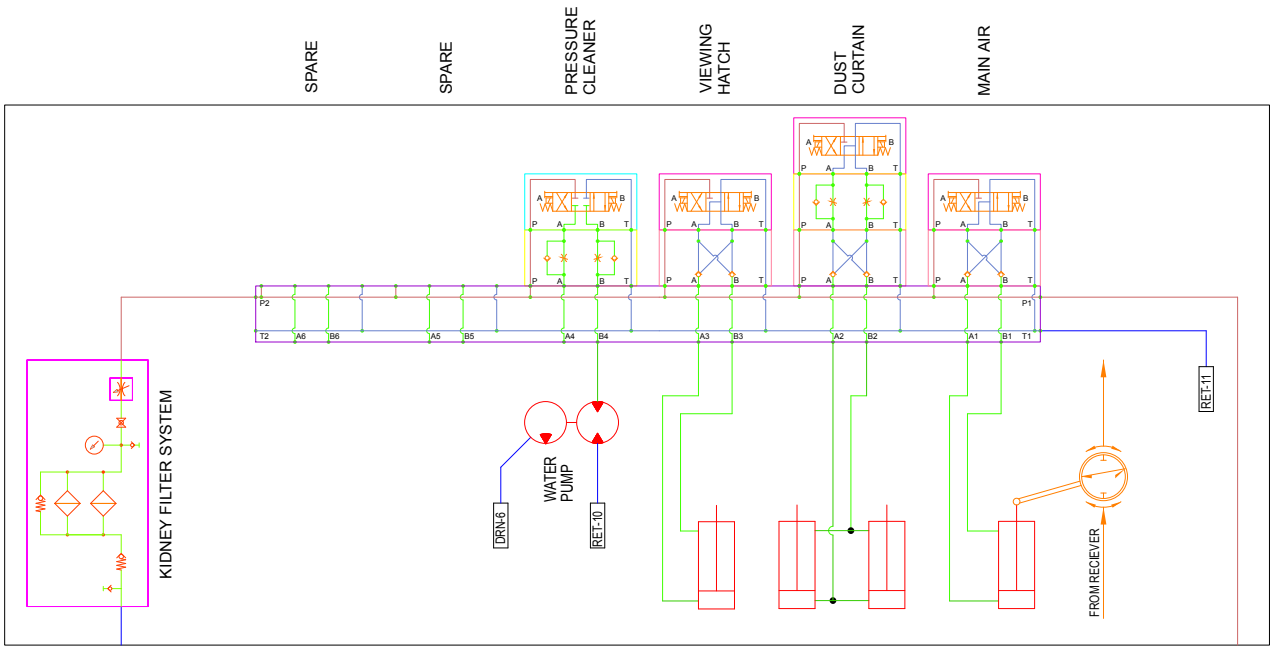
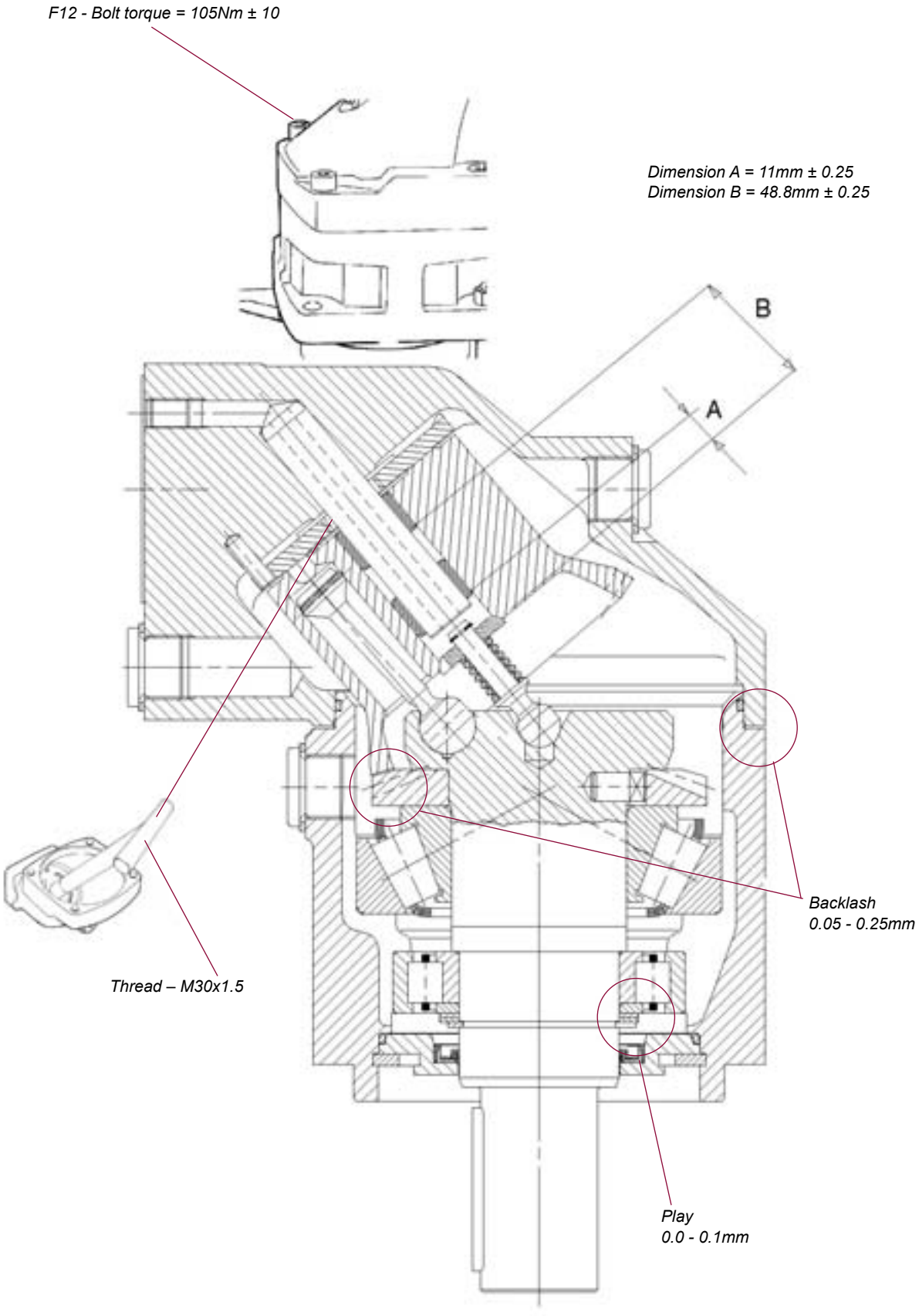


Fig. 7-11 6 Bank Valve

Hydraulic Motor (cont.)

Specifications and Tools



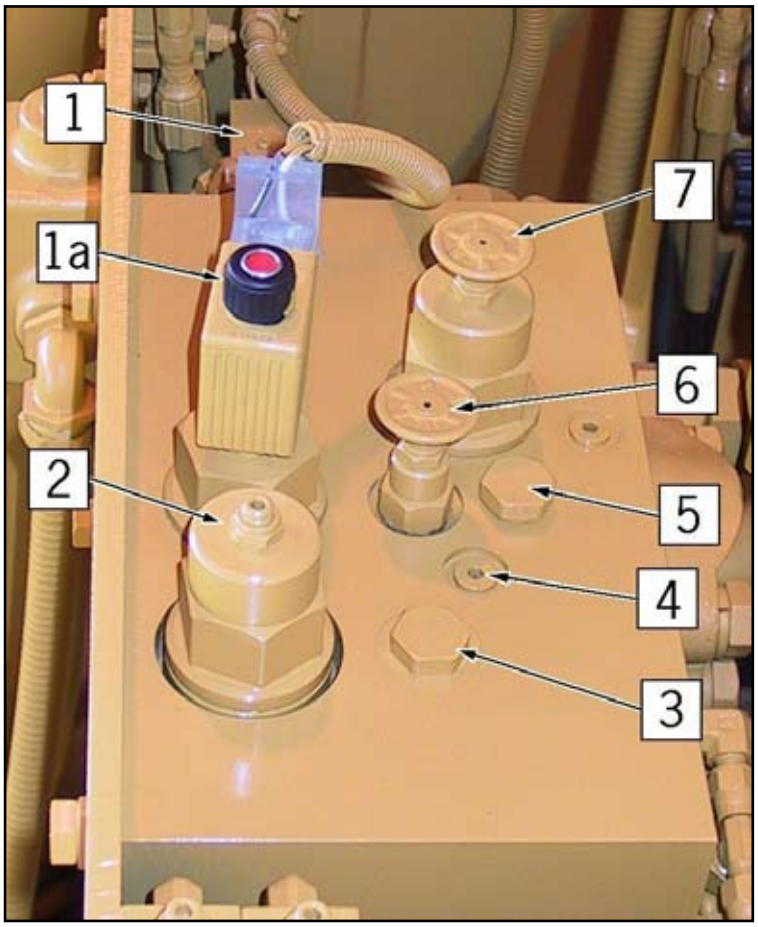
Cooler Fan Motor Cross Section

Technical Data (cont.)

Feed Control Valve

- This manifold contains rotary head counterbalance valve, regeneration for fast down, and hold-back for hammer drilling.
- (Valve 'A') Rotary head counterbalance valve.

Normal operation the valve opens from a pilot signal from the pulldown pressure. This signal is dampened by the (0.016”) orifice. This orifice allows a pressure increase in the pulldown in order for the counterbalance Valve to meter down. Please note that the tension on the counterbalance valve effects the amount of pulldown pressure required.



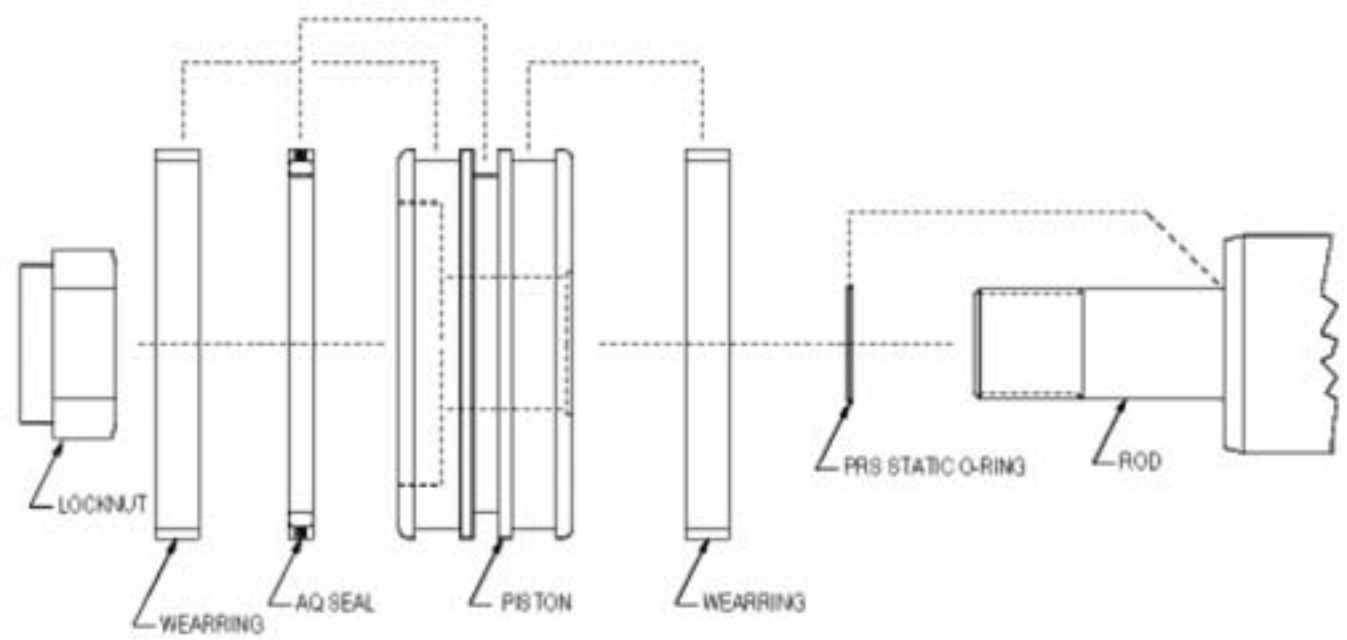
Feed Control Valve

1. *Regeneration valve 'E' (NC) cartridge 'E1' (NC)*
1a. *Regeneration valve 'D' (NC) cartridge 'D1' (NO)*
2. *Counterbalance valve 'A'*
3. *Plug*
4. *Orifice .016”*
5. *Plug*
6. *Hoist control valve 'F'*
7. *Excess flow by-pass valve 'G'*

Z Piston

General

The Z series piston uses ductile iron material and glass filled nylon wear rings (bearing rings). It is available in two basic design styles. The first uses a groove sized for a specially designed teflon seal called the AQ seal. The teflon sealing ring has a small groove on its outside diameter that houses a quad ring seal. The entire ring is energised by a square section rubber loader. The second series uses an interference fit split nylon sealing ring with an oval section rubber loader and is called a Chemcast seal. A small static O-ring seal is fitted to a groove in the piston and is held in place by the shoulder of the rod. General procedures for teardown, inspection and rebuild are contained in the General Procedures Maintenance Manual. Contact Bucyrus if you have any questions.



Teardown

After removing the piston, remove and discard the PRS static O-ring from the rod shoulder. Remove the AQ seal by means of blunt instruments of bronze or aluminium. Be sure there are no sharp edges on these tools. Be particularly careful of scratching the groove surface finish.

Rebuild

Separate the three components of the seal assembly. For easiest installation, warm the teflon outer ring in 65.5 to 93.3ºC (150 to 200^{0}F) hydraulic fluid or water. Lubricate the piston and all components with hydraulic fluid. Stretch the inner rubber expander into the seal groove. Do not use sharp edged tools and verify that is has not twisted. Likewise, stretch the teflon outer ring into the groove. Be extremely careful to avoid damaging the seal grooves during installation. Scratching the groove may cause by pass leakage. The teflon ring will have a memory and may take as long as 24 hours to return to the correct size. This can be accelerated by pushing the piston/seal assembly through a honed or polished tube with an ID equal to the nominal cylinder bore to plus .010 inches. Clean the groove in the teflon ring and install the rubber quad ring. Verify that it has not twisted. Install the wear rings into the wear ring groove. If possible, allow the piston/seal assembly to sit at least one hour to allow the seals to elastically restore.

See next page for information on the alternative style.

CAUTION: DO NOT weld on any part of the machine without first disconnecting the negative battery cable or place the battery disconnect switch in the open position. On machines equipped with electronic engine, disconnect the connections to the Electronic Control Module (ECM) on the engine before welding (see Section 8).

Electrical Circuits

- Wiring exceeds MDG-15 Standard
- All cabling utilises ‘EXANE’ high temp wire
- All cabling/components identified
- Wiring circuit diagrams to Australian Standards
- Stainless steel compartments

Transducers

NOTE: If a transducer is suspected as being faulty, an operation transducer can be swapped for the suspect unit to confirm if in fact the original transducer has failed.

Setting up the Laser

- Mount Laser. With head right down measure a distance 400mm away from Laser to Target position on sheath. Move head to its right up position and hold Target on marking. Apply 24V DC to Laser and make sure red dot is in middle of the Target. Mount the Target in this position.
- Move head from full down position to full up position and make sure the analog signal is reading over full length of head travel in the PLC/touchscreen. For the touchscreen this can be seen in the general 1057 password protected area – calibration – 'Laser Actual' reading.
- Laser is now ready to be calibrated for depth reading.

Safety Instructions and Precautions

Don't stare into the laser beam. A prolonged period greater than 0.25ms (normal eye blink speed) can be harmful. Never point the laser beam intentionally at another person.

A warning label indicating the presence of a class 2 laser should be used and placed in a readily visible spot. The Laser is rated at IP65 and should be protected from direct water blast when washing the machine. A heat shade is recommended when operating environment exceeds 50°C.

Calibration

- Measure the full length of head travel.
- Enter the password protected Calibration area 1295 for a full calibration set up or 1057 for a partial calibration setup (as for tightening ropes) on the touchscreen.
- Type in the value on the keypad in millimetres.
- Set head right up position. Press touchscreen button to accept value.
- Set head right down position. Press touchscreen button to accept value.
- Set head halfway down (midpoint of the rods that are in the rod rack). Press touchscreen button to accept value.
- Attached bit onto head and move head to position where deck wrench can be engaged and then set deck wrench position. Press touchscreen button to accept value.
- Break bit off head and move head to position where pipe rack can be swung under head and set head clear position. Press touchscreen button to accept value.
- With first pipe and bit attached to head. Lower steel approx. 100mm below where deck wrench can be engaged and set pipe-in-hole position. Press touchscreen button to accept value.
- Move the head to a position that allows the Pipe Positioner, Centre guide, H.O.B.O enough time to move out of the way with the head coming down and set the 'Kick-out' set point if fitted. Press touchscreen button to accept value.
- Move the head up and set the 'Head up speed slow down' set point so the head will slow down before the hydraulic cylinder 'bottoms out.' Press touchscreen button to accept value.
- Record the new set-point values and forward them to Bucyrus for file updating.

Notes

Auto Lube Grease Pump (cont.)

WARNING

ALWAYS check equipment for proper operation before each use, making sure safety devices are in place and operating properly. DO NOT alter or modify any part of the equipment as this may cause a malfunction and result in serious bodily injury.

BEFORE CONNECTING AIR MOTOR TO AIR LINE

LINCOLN SERIES III AIRMOTORS are fully pneumatic and require a minimum specified size of air supply hose for proper operation. Check specification for minimum ID. of the air supply hose and select corresponding sizes of air controls and accessories for non-restrictive air flow. Lincoln filter, regulator with gauge and lubricators are available as combination units (FRL).

For 3/8" air line - Model 85387-6
For 1/2" air line - Model 85387-8
For 3/4" air line - Model 85387-12

If quick disconnect coupling should be used, install supplied coupler to insure proper airmotor operation.

NOTE: Whenever flammable materials are pumped, ground Airmotor according to Local Codes.

OPERATING PRECAUTIONS

Use Lincoln replacement parts to assure compatible pressure rating.

Heed ALL warnings.

DO NOT OPERATE Airmotor in excess of recommended pressure range.

Disconnect air line and relieve (vent) pressure when Airmotor sits idle for long periods of time and before servicing.

WARNING

ALWAYS read and follow the fluid and solvent manufacturer's recommendations regarding the use of protective clothing and equipment.

WARNING

To reduce the risk of serious bodily injury or property damage. NEVER exceed the maximum air or fluid working pressure of the lowest rated system component.

ATTACHING AIRMOTOR TO PUMPTUBE

1. Tightly attach the tie rods (Item 41) to the Airmotor lower casting. Use short threaded end of tie rods.
2. Mount Airmotor on top of pump tube outlet and tightly connect pump tube coupling nut to Airmotor Piston Rod (Item 5).
3. Hand tighten tie rods to the pump tube with four nuts (Item 42) supplied with Airmotor.
4. Connect air supply and slowly cycle pump several times using only enough air pressure to operate pump without stalling.
5. STOP pump on "UP" stroke and tighten four nuts to securely fasten Airmotor to pump tube.

SERVICE AND DISASSEMBLY PROCEDURE

WARNING

Always disconnect air supply to Airmotor and relieve pressure before checking, servicing, or repairing any part of Airmotor

TOOLS REQUIRED

1. 7/64 (.109) Hex Wrench
2. 5/32 (.156) Hex Wrench
3. 3/16 (.189) Hex Wrench
4. 3/4 (.750) Open End Wrench (for 6" Airmotor)
5. 15/16" (.937) Open End Wrench (for 8" Airmotor)
6. 1/2" (.500) Open End Wrench (for 4-1/4" and 3" Airmotor)
7. 1-1/8" (1.125) Open End Wrench (for 10" Airmotor)
8. Pliers

The modular design of the Airmotor and accessibility of vital operation parts make service available without taking Airmotor out of line or without complete disassembly.

Power Valve

1. Remove four screws (Items 27 & 34) with 3/16" hex wrench (2 on each side).
2. Remove End Caps (Items 10 & 14).
3. Push out Valve Spool (Item 13).
4. Remove Spool Bumpers (Item 9) (One from each end).
5. Remove "O" Ring (Item 11) (One from each end of valve body).
6. Remove four Screws (Item 37) with 3/16" hex wrench and lift valve body (Item 12).
7. Remove Gasket (Item 15) to complete valve disassembly.
8. To REASSEMBLE, REVERSE procedure.

Pilot Bar Subassembly

1. Remove four Screws (Item 23)(two on each end) with 3/16" hex wrench and pull out Pilot Bar Subassembly.
2. Remove two Screws (Item 39), with 7/64" hex wrench and lift out Valve Body (Item 17).
3. Remove four Screws (Item 40)(two on each side of Pilot Bar) and lift off Upper Bracket (Item 31) and Lower Bracket (Item 32).
4. Remove Air Signal Valves (Item 20).
5. To REASSEMBLE, REVERSE procedure.

Cylinder Tube and Muffler

1. Remove Air Brakes Subassembly (See previous instructions).
2. Remove two Screws (Item 30) with 3/16" hex wrench and pull off Mufler (item 29).
3. Remove Gasket (Items 28).
4. Remove four Nuts (Item 26) with open end wrench.
5. Lift upward and remove Upper Casting (Item 8).
6. Remove four Tie Rods (Item 25).
7. Remove Air Tube (Item 7).
8. Lift upward and remove Cylinder Tube (Item 6).
9. Remove Piston and Piston Rod (Item 5).
10. Remove four Connecting Rods (Item 41) with open end wrench.
11. To REASSEMBLE, REVERSE procedure.

NOTE: Align two holes on the the Cylinder Tube (Item 6) with two holes on the Pilot Bar (Item 24) before tightening Tie Rods (Item 25) so that proper seal with "O"-rings is acheived.

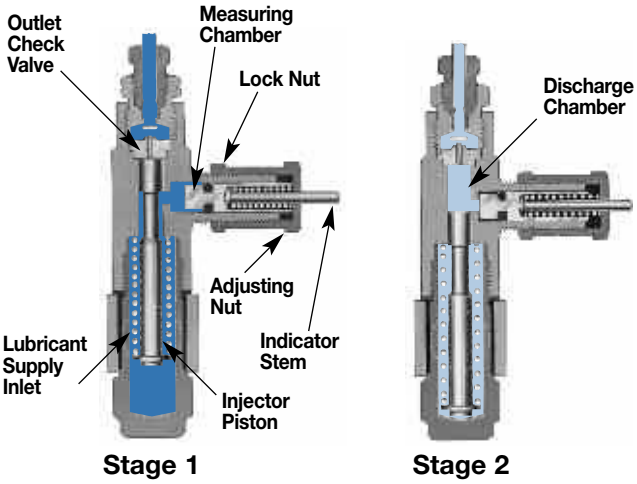
SL-32 Injectors

Stage 1

Incoming lubricant, under pressure from the supply line, moves the injector piston forward. The piston forces a pre-charge of lubricant from the discharge chamber through the outlet check valve to the feed line.

Stage 2

When the system is vented (pressure relieved), the piston returns to the rest position, transferring lubricant from the measuring chamber to the discharge chamber.



SI32 Set At Minimum Delivery 0.016cc

SI-32 Set At Standard Delivery 0.131cc

SI-32 Injector With Protective Cover
SL-32 output with indicator cap hand-tightened is .016cc (.001cu. in.). Maximum output is achieved with five turns at .0014cu. in. / turn.

Pipe Thread Lubricator

Air Operated Pipe Thread Pump (cont.)

⚠ WARNING

FAILURE TO HEED THE FOLLOWING WARNINGS INCLUDING MISUSE, OVER PRESSURIZING, MODIFYING PARTS, USING INCOMPATIBLE CHEMICALS AND FLUIDS, OR USING WORN OR DAMAGED PARTS, MAY RESULT IN EQUIPMENT DAMAGE AND/OR SERIOUS PERSONAL INJURY, FIRE, EXPLOSION, OR PROPERTY DAMAGE.

- Do not exceed the stated maximum working pressure of the pump, or of the lowest rated component in your system.
- Do not alter or modify any part of this equipment.
- Do not operate this equipment with combustible gas.
- Do not attempt to repair or disassemble the equipment while the system is pressurized.
- Make sure all grease connections are securely tightened before using this equipment.
- Always read and follow the grease manufacturer's recommendations regarding grease compatibility, and the use of protective clothing and equipment.
- Check all equipment regularly and repair or replace worn or damaged parts immediately.
- Never point the dispensing valve at any part of the body or at another person.
- Never try to stop or deflect material from dispensing valve or leading connection or component with your hand or body.
- Always check equipment for proper operation before each use, making sure safety devices are in place and operating properly.
- Always follow the pressure relief procedure after shutting off the pump, when checking or servicing any part of the system, and when installing, cleaning or changing any part of the system.

INSTALLATION

Typical drum and pail hookups are described as follows only as a guide in selecting and installing a system. Contact a Lincoln factory representative for assistance in designing a system for a specific requirement.

⚠ WARNING

This pump can develop 7500 PSI working pressure at 150 PSI maximum incoming air pressure. Be sure that all system equipment and accessories are rated to withstand the maximum working pressure of this pump. DO NOT exceed the maximum working pressure of the lowest rated component in the system.

IMPORTANT: Accessory item "whip" hoses for dispensing valve are rated 4500 PSI. DO NOT exceed 90 PSI air pressure to pump when using "whip" hoses.

TYPICAL SYSTEM HOOKUP

Determine the drum or pail system for your requirement.

Obtain an air line filter/regulator/lubricator to use with the inlet air supply and the correct sized air and grease lines/hoses with any required reducers, connectors and accessories.

Clean/flush the supply lines, hoses, reducers, connectors and accessories with mineral spirits or oil based solvent to purge any contaminants such as dirt, moisture, or metal shavings that could damage the pump or system components. Blow dry with air.

⚠ CAUTION

The pump was tested in lightweight oil which was left in to protect the pump from corrosion. Flushing the pump before connecting it to the system might be desired to prevent possible contamination of the grease you are pumping

⚠ WARNING

To reduce the risk of injury from splashing or static sparking when flushing the pump with solvents, always hold a metal part of the dispensing valve firmly to the side of a grounded metal pail and operate pump at lowest possible fluid pressure.

Clean/flush the pump with mineral spirits or oil based solvents if necessary.

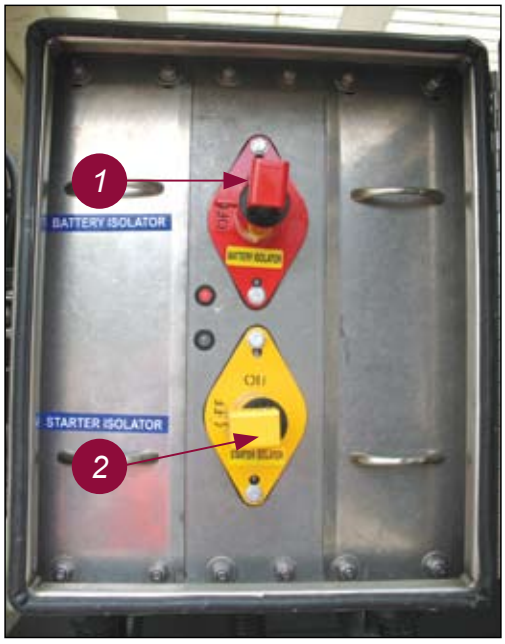
Assemble the cleaned pump and supply line together with any required accessory.

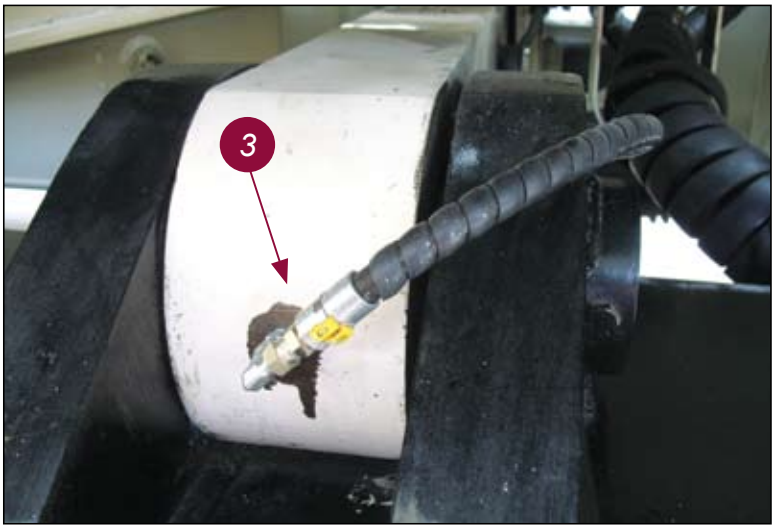
Mount the assembled pump to the drum or pail.

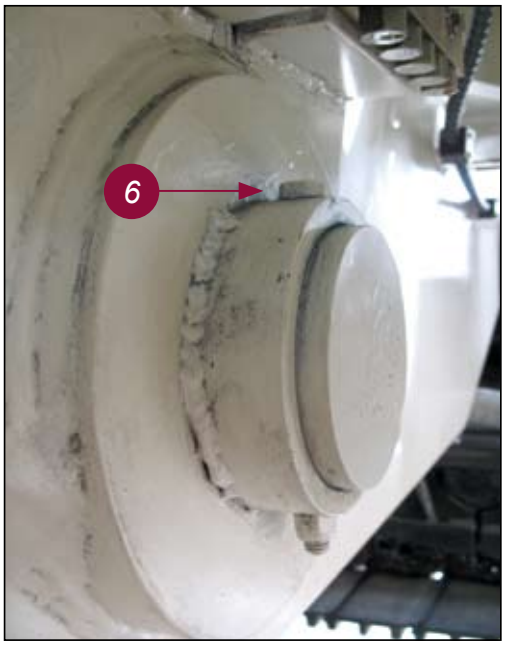
Connect the material output line/hose to the pump.

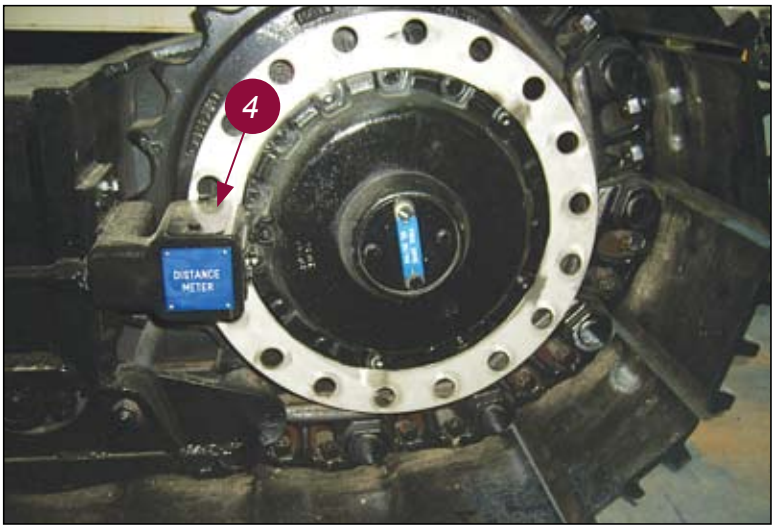
Connect the air regulator to the pump.

Make sure all connections are securely tightened.









Track Gear

10hrs or daily

– Check/clean/adjust track chain's, rollers and sprockets as required

– Check track frames, axles, mounts for security and tension

– Check equalisers pins and bolts for tension

250hrs

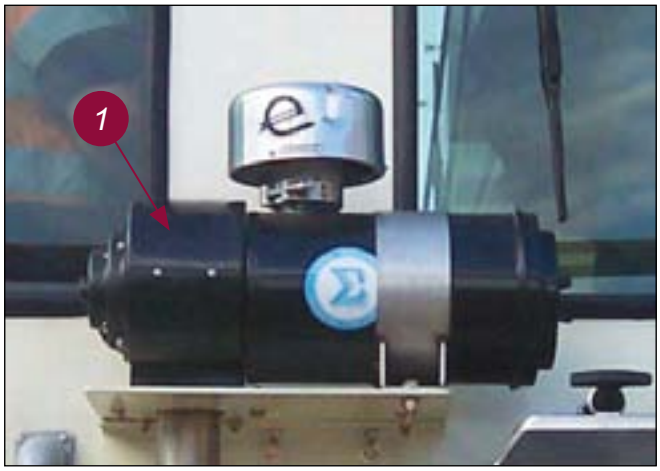
– Check/refill track final drives

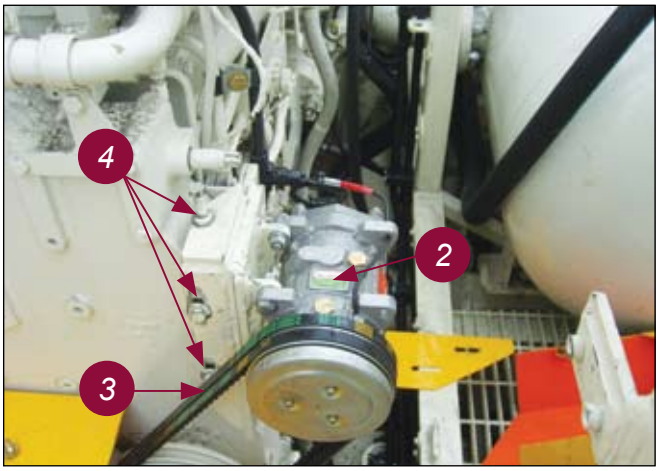
500hrs/1000hrs/2000hrs

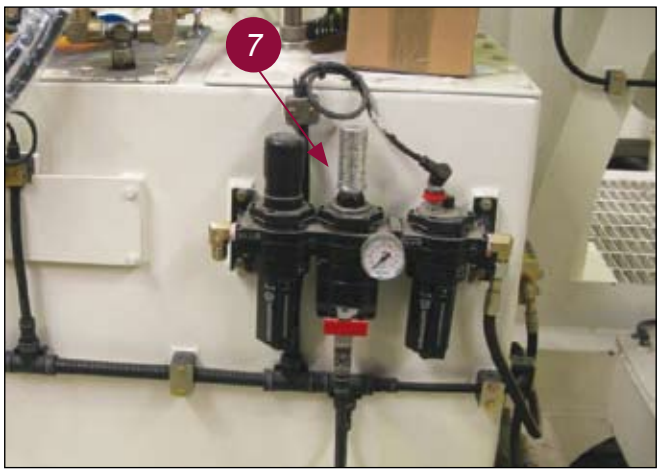
– Track drive gearbox's drain/refill (85W-140, 10.5 litres per final drive)

– Check/adjust track chains

1. *Battery isolator*
2. *Starter isolator*
3. *Equaliser bar and mount*
4. *Track distance proximity and plate*
5. *Final drill fill point and fill level*
6. *Inspect centre pin bolts daily for tightness*



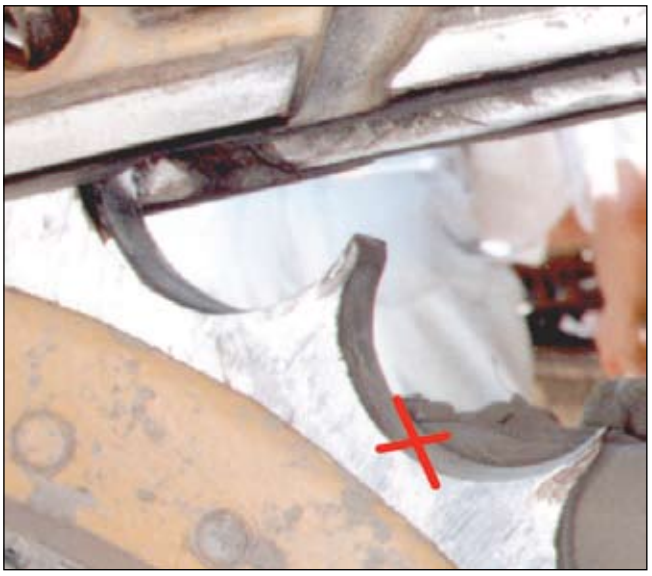




1. *Air conditioner filter and housing*
2. *Air conditioner compressor*
3. *Air conditioner belts*
4. *Belt adjustment*
5. *Battery terminals*
6. *Pipe thread grease pump regulator, solenoid and lubricator*
7. *Central lube pump air regulator, solenoid and lubricator*
8. *Fire suppression tank*

Sprocket Wear Patterns (cont.)

Root Wear



Wear in the tooth bottom.

Causes:

- Transmission of vertical forces.
- Sliding bushing movement from tooth profile to tooth profile when changing machine directions.
- Lubricated track bushings ride in the tooth bottom because of the elimination of pitch extension.
- Bushings slide side to side in the tooth bottom when steering machine.
- Large tooth spacing leads to long sliding distances the bushing must cover when changing machine directions.
- Sprockets with mud reliefs increase surface load leading to higher root wear.

Effects:

- Risk of tooth breakage. Reduction of pitch increases bushing wear rate.

Remedies:

- Root wear in inevitable.
- Do not use sprockets with mud reliefs if the machine is to be used on non-cohesive soils for an extended time.
- Use track guides in order to reduce the side to side movement between bushing and tooth.

Lubrication and Maintenance Chart - 250hr

Lubrication and Inspection
1. Park the machine on a level surface 2. Set parking brake 3. Rack rods and lower the head 4. Shut down engine 5. Relieve all hydraulic system pressure 6. Relieve all pneumatic (air system) pressure 7. Isolate the machine

Item	Task	Comments and Initials
1	**Engine Oil and Lubrication**	
	1. CHECK engine oil level.	
	2. CHECK engine reserve oil system level.	
	3. CHECK for oil leaks.	
	4. CHECK the crankcase breather tube for obstruction or sludge build-up.	
	5. Lubricate the front engine mounting trunnion grease nipple.	
2	**Engine Fuel System**	
	1. Drain engine fuel separator.	
	2. Change element for the stage one Cummins fuel filter.	
3	**Engine Cooling System**	
	1. CHECK coolant, if the reading is less than 0.7, add 19 litres of Maxitreat 3477 concentrate. If the pen reading is between 0.7 and 1.2, no action is required. If the reading is above 1.2 contact Nalco.	
	2. CHECK radiator cap condition.	
	3. CHECK coolant level.	
	4. CHECK system hoses and plumbing for any coolant leaks.	
	5. CHECK the condition of the radiator and clean if required.	
4	**Engine Air Cleaner**	
	1. CHANGE primary element	
	2. CHECK the safety elements for dust contamination.	
	3. Remove the vacuator cup clean and refit.	
	4. CHECK induction pipe-work for cracks, splits and dust intrusion.	
5	**Hydraulic System**	
	1. CHECK hydraulic valves for oil leaks.	
	2. CHECK the hydraulic pumps and motors for oil leaks.	
	3. CHECK hydraulic hoses for oil leaks and abrasion damage.	
	4. CHECK the hydraulic cylinders for oil leaks. INSPECT the rods for damage.	

Lubrication and Maintenance Chart - 500hr

Item	Task	Comments and Initials
	14. RECORD the cleaning pump pressure.	
	15. CHECK the machine for loose bolts, clamps and oil leaks.	
	16. CHECK the rotary drive preload. **Procedure** 1. Place an 8” x 8” wood block under the rotary head. 2. Load the pulldown to 1500psi on the pulldown pressure gauge. 3. There should be no visible movement. **Adjustment of the Rotary Drive Preload to eliminate visible movement.** 1. Place an 8” x 8” wood block under the rotary head. 2. Load the pulldown to 1500psi on the pulldown pressure gauge. 3. Turn the locknut until it contacts the bearing cone, and then turn another 15. 4. Tighten the screws evenly and opposite to one another, gradually increasing the torque. Do Not tighten the screws prior to assembling the locknut to the shaft. 5. Install Loctite 515 master gasket at all split lines unless the shim or gasket is used. Replace seals back to back .	

Lubrication and Maintenance Chart - 1000hr

Functional Checks – Machine Not Isolated
WARNING The machine must not be isolated and a commissioning and testing tag placed as detailed in the isolation regulations. • The task SHALL be completed using the appropriate safe work procedure. • Maintainers who have achieved the required competencies can perform functional CHECKS. 1. Park the machine on a level surface. 2. The observer be visible to the machine operator at all times. 3. All other maintainers should remain clear of the machine during operational tests. 4. The engine is running to perform these checks. With the assistance of an observer CHECK the following.

Item	Task	Comments and Initials
1	1. Operating controls – CHECK all functions.	
	2. CHECK the PLC screen for any alarms.	
	3. CHECK operation of reserve oil system LED in the operators cab when the engine is running.	
	4. CHECK all lights.	
	5. Compressor, CHECK main control regulator pressure. Adjust only if required. • High Pressure (approximately) 500psi, 3447 kPa • Medium Pressure (approximately) 350psi, 2413 kPa • Low Pressure (approximately) 190psi, 1310 kPa	
	6. Compressor, CHECK pilot control regulator pressure 50psi, 344 kPa. CHECK at Port 2 on the inlet valve and adjust only if required.	
	7. Compressor, CHECK pressure reducing regulator pressure, 80psi, 552 kPa. CHECK at port 1 on the inlet valve when pressure is reducing from medium to low mode, adjust only if required.	
	8. Water pump pressure. High pressure units (Approximately) 500psi, 3447 kPa. Plumb gauge into the pump discharge, set at position 4 on the water injection control in the cab and CHECK pressure.	
	9. Air conditioner – CHECK operation.	
	10. Auto-lube system – CHECK all pivot points and bushes.	
	11. CHECK air cleaner restriction indicator for the engine and compressor.	
	12. CHECK the operator's seat for correct function and control.	

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Lubrication and Maintenance Chart - 2000hr

Additional Job Details		
Details of Additional Work Including Parts Requirements (Please include a copy of the parts page indicating the parts required).	Work Order Originator	Work Order Number