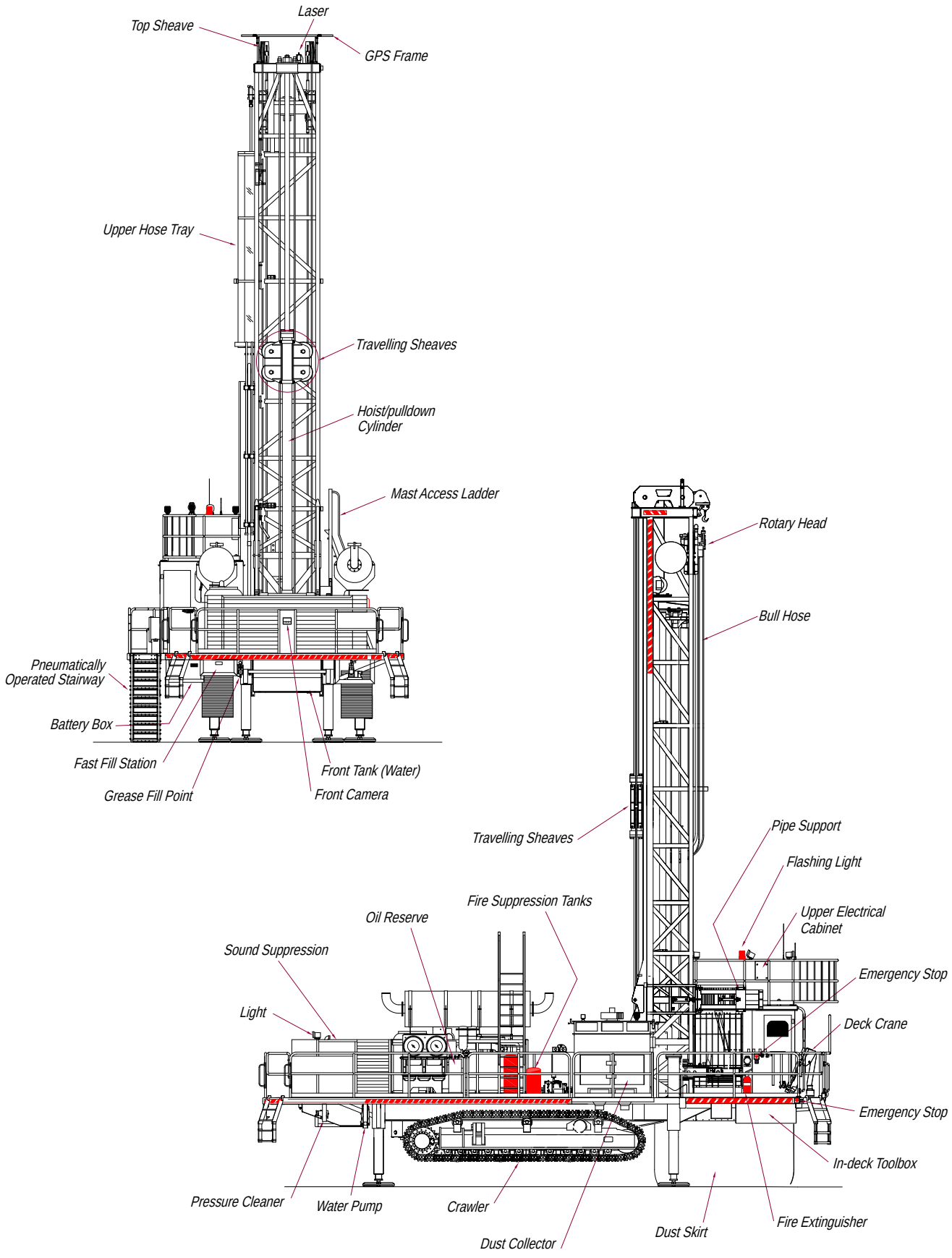
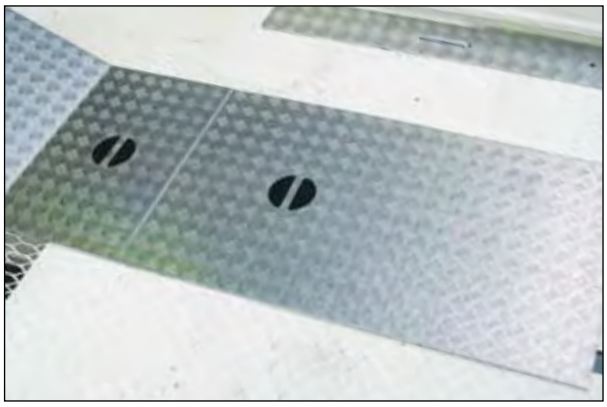
Technical Manual

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.

Circuit Breaker and Instrument Panel (cont.)

1. **Circuit Breakers**
2. **Tachometer / Engine Hourmeter**
3. **Compressor Discharge Temperature**
4. **Drill Hourmeter**
5. **Engine Oil Pressure**
6. **Voltmeter**
7. **Engine Coolant Temperature**
8. **Diagnostic Switch –** Refer to engine manual for engine diagnostics.
9. **Speed Select –** Allows three different engine speed settings: Low - Medium - High
10. **Cabinet handle door opening**
11. **Idle Diagnostic Inching –** Refer to engine manual for engine diagnostics.
12. **12V DC Outlet**
13. **Engine Diagnostic Light (blue) –** Refer to engine manual for engine diagnostics.
14. **Engine Protection Light (amber) –** Refer to engine manual for engine diagnostics.
15. **Engine Stop Light (red) –** Indicates engine is not running and also used in diagnosing engine faults (refer to engine manual for engine diagnostics).
16. **Horn Button –** Push to sound horn.
17. **Engine Stop Switch –** Used as an emergency stop switch, push button to immediately stop engine.
18. **Switch –** Turn and hold switch in override position whilst cranking engine until sufficient air and oil pressure has been reached.
19. **Start Switch –** Push button to crank engine whilst holding key switch in OVERRIDE position. Release button when engine starts.
20. **Fuel Gauge**
21. **Tramming Hourmeter**

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 (194ºF), the roller seals may distort, causing the lubricant to leak out and the roller will fail.

- To aid in cooling the rollers or idlers, if the temperature is found above 90ºC, water can be applied to the components to accelerate the cooling process provided the temperature recorded is under 100ºC (212ºF). If temperatures are recorded above 100ºC they must be allowed to cool naturally to under 90ºC (194ºF) before tramming is recommenced.
- Record all required temperatures on the 'Temperature and Condition Record' chart provided and file the information for machine history.

NOTE: For full operations tramming procedure refer to the operators manual.

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

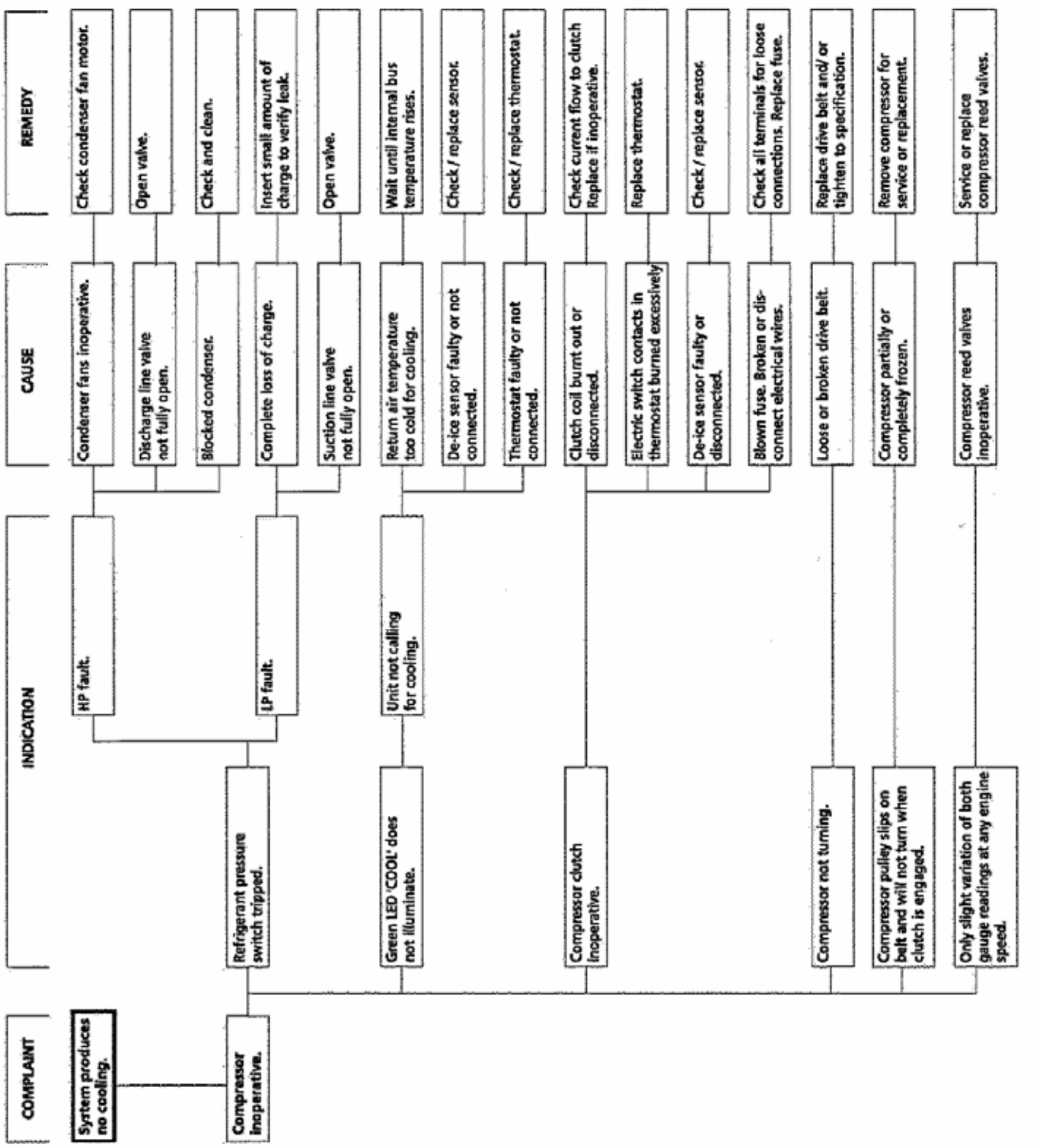
Airflow:	50 l/s (nominal)
Pressure (in cabin):	62 Pa (nominal)

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

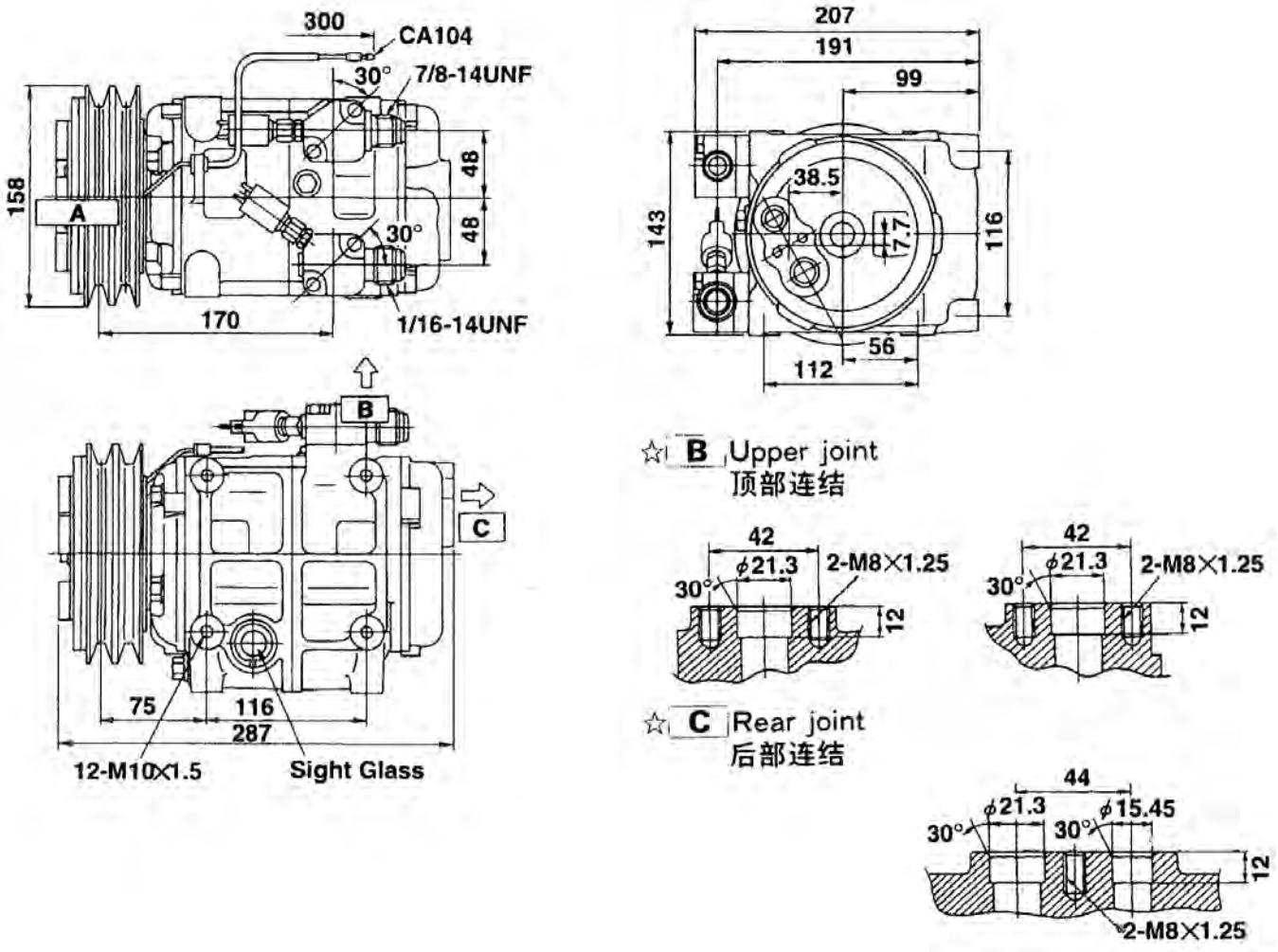
1.4 Unit Mass (Kg)

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

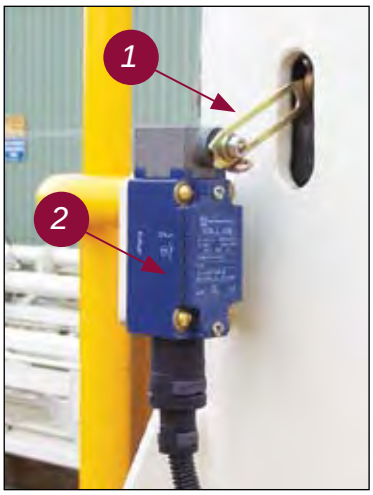
Levelling Jacks

Detecting Levelling Jack Troubles

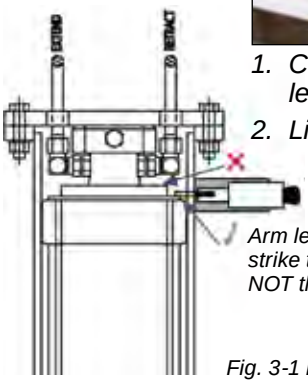
Faulty levelling jacks may be detected through inspection, or through operating difficulties encountered. Refer to Hydraulics in Section 7.

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.



1. *Control arm is slotted for length adjustment*
2. *Limit Switch*



Arm length adjusted to strike the inner casing tube NOT the jack cylinder

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

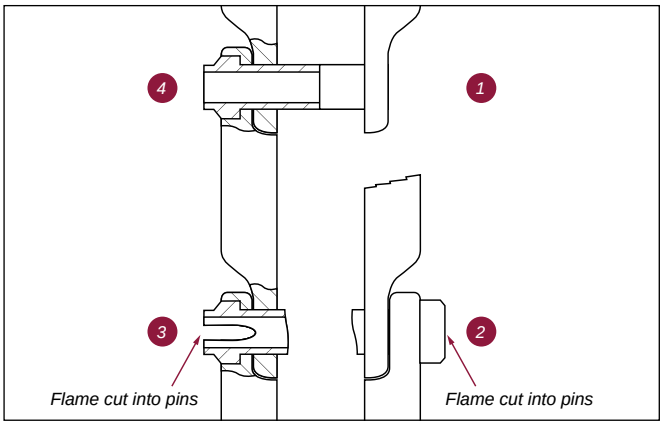
Metric Bolt Torque Specifications

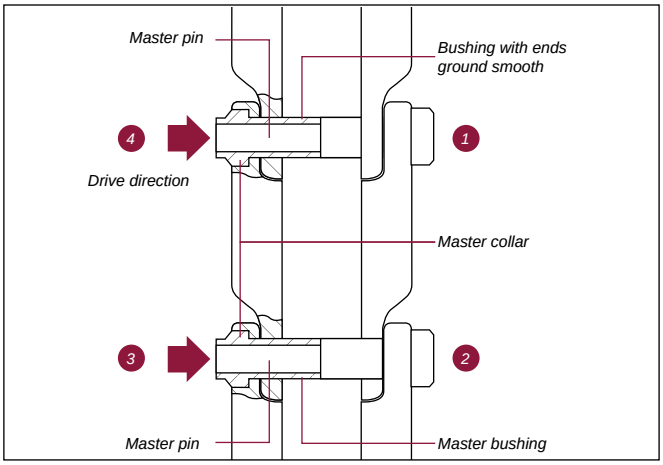
	Screws				Screws with reduced shaft			
	Nm				Nm			
	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9
M4	2,4	2,9	4,1	4,9	1,3	1,6	2,2	2,7
M5	5,0	6,0	8,5	10,0	2,8	3,3	4,6	5,5
M6	8,5	10,0	14,0	17,0	4,7	5,5	8,0	9,5
M8	21,0	25,0	35,0	41,0	12,0	14,0	20,0	24,0
M10	41,0	49,0	69,0	83,0	25,0	29,0	41,0	50,0
M12	72,0	86,0	12,0	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

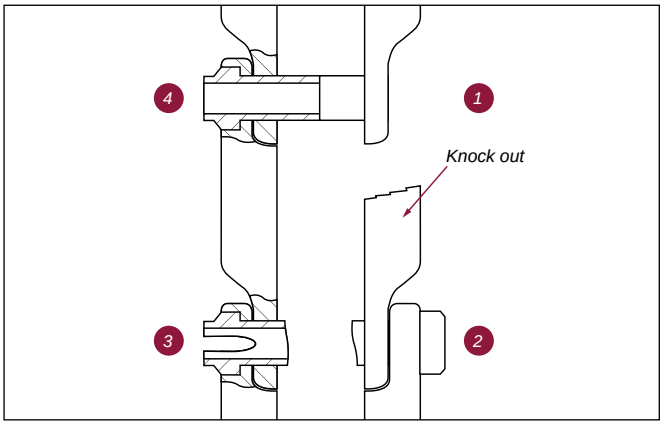
Metric Screw Thread	In Nm	UNF Thread	In Nm
M10X1	85-95	**9/16"-20**	110-120
M12X1	145-160	**1/2"-20**	165-185
M14X1,5	220-250	**9/16"-18**	240-270
M16X1,5	340-380	**5/8"-18**	330-370
M30X2	2360-2400	**3/4"-14**	575-650
		7/7"-14	915-1030
		1"-14	1385-1560

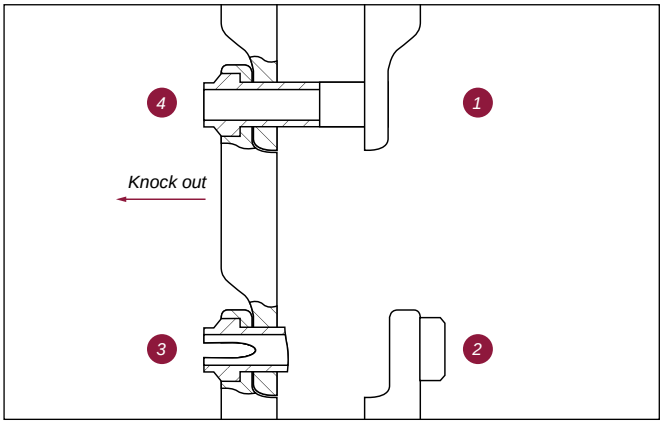
Table 3-1 Metric Torque Table Specifications

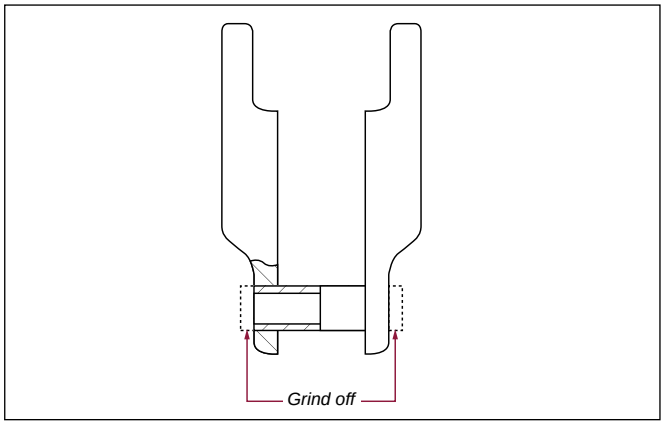
Track Link – Repair and Replace (cont.)











3. Flame cut into the pins in the middle on sides 2 and 3 by about 20-40mm depending on the track size.
4. Knock out remaining track link with remaining bushing on side 2 inwards. Also knock out remaining pins.
5. Knock track link on side 3 from out to in until the bushing emerges from the track seat and the track link rotates around the hinge on side 4. Remove residual pins first if there is not enough play in the track. Then knock the track link with the residual pins on side 4 from in to out.
6. Grind off protruding bushing ends at the sides and grind flat any damage caused by flame cutting the track link at the side.
7. Assemble the new parts using the following procedure. Be sure the links are facing the proper direction.
   a. Connect the track link by putting two master collars in place as shown.
   b. Attach the two ends by driving in the master pin.
   c. Place track chain onto track frame and join the two ends by putting two master collars in place as shown and driving in the master pin.
   d. Assemble track shoe to track chain with the four bolts and nuts. Torque bolts according to specifications listed in bolt torque chart in this section.
8. Tension track chain according to procedure outlined previously.

Final Drive Maintenance

WARNING: HOT OIL will burn. Always wear work gloves and let final drive cool down after a long period of operation, before draining oil.
Place an 'Personal Danger and Out of Service' tag on the ignition switch before doing any service or maintenance work on the machine.

CAUTION: Drain oil into an approved container and dispose of according to local environmental regulations.
Operation of final drive with low or incorrect oil may cause irreparable damage to the gearbox. Follow recommended oil check and change intervals.

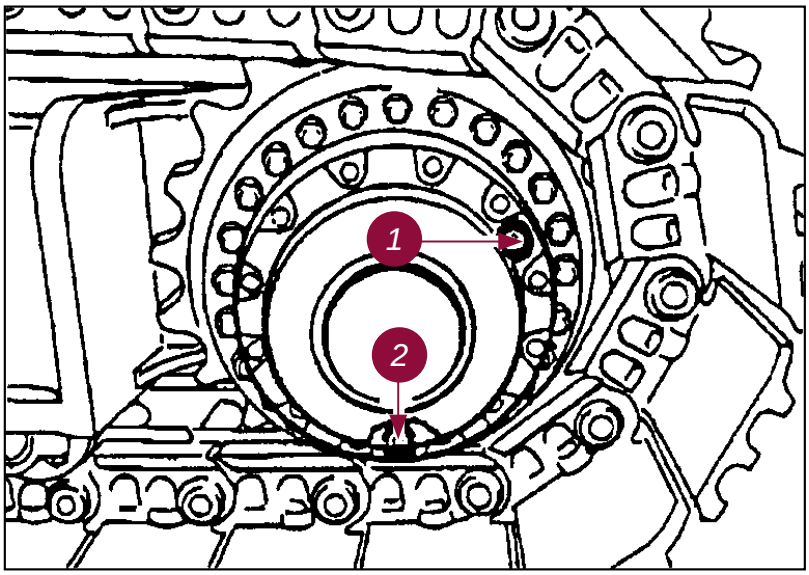


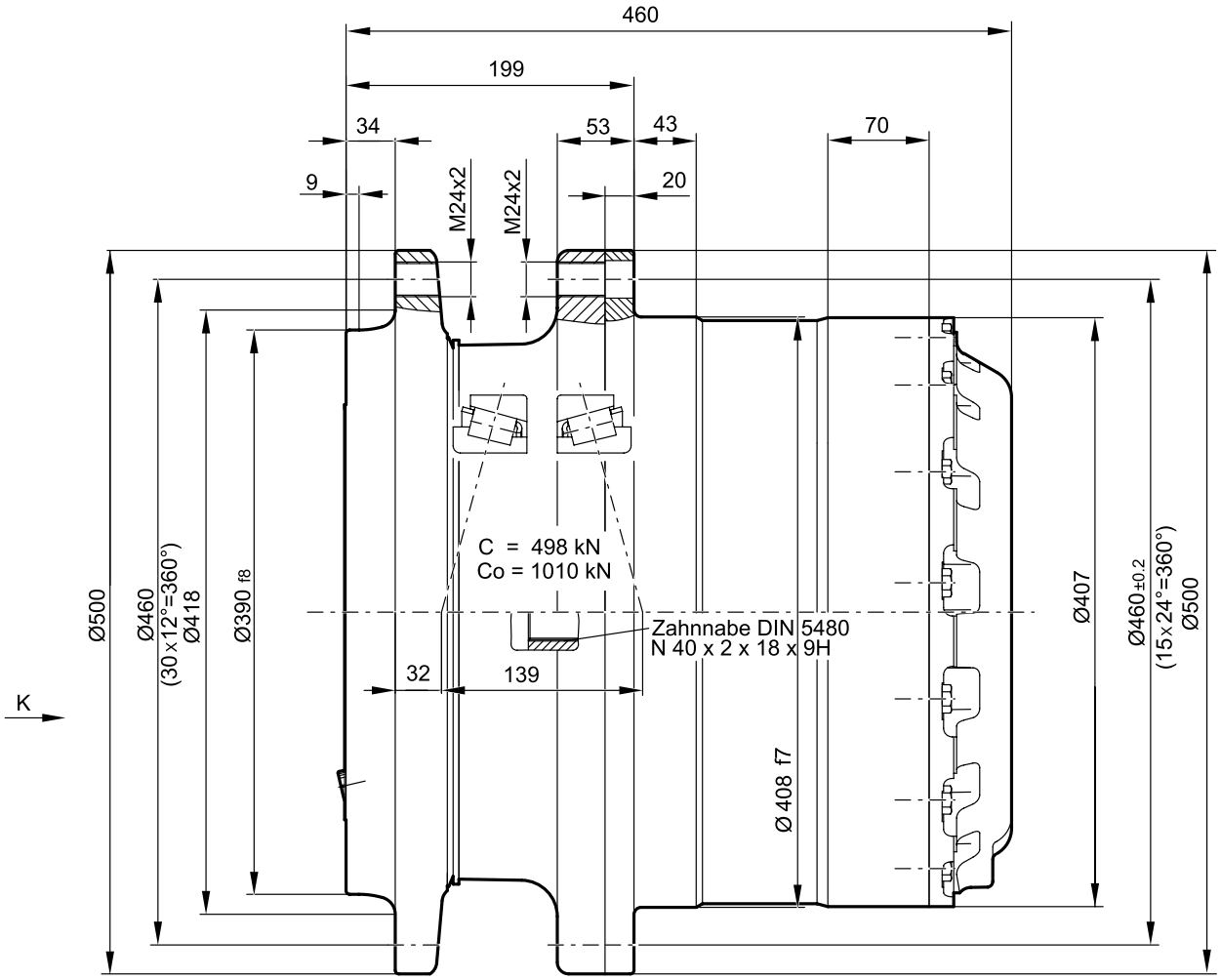
Fig. 3-28 Final Drive Position for Oil Filling and Draining

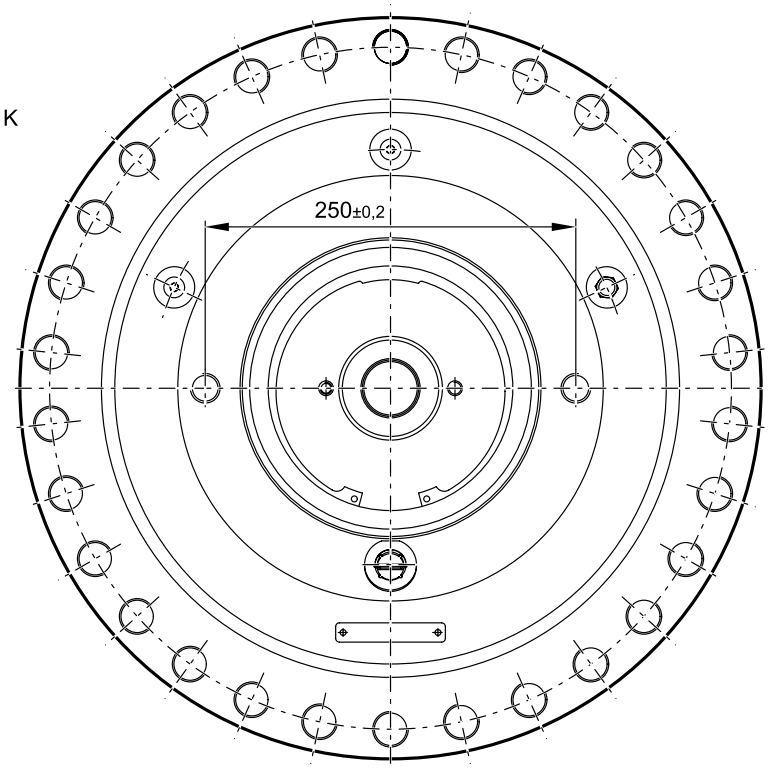
1. *Fill plug*
2. *Drain plug*

Oil Check / Change

1. Machine must be on level surface. Position final drive so drain plug is at bottom and fill plug is at position shown in fig. 3-28.
2. Remove fill plug and check oil. Oil should be at bottom edge of fill plug hole. Check to see that sealing surface of fill plug is not damaged, and install plug. Add oil if necessary. Factory fill is 85W/140 gear oil.
3. Initial oil change is at 200-250 hours of operation.
4. Regular oil change interval is every 500 hours of operation, or based upon oil analysis. Maximum service life is 12 months.
5. When changing oil, machine must be on level surface and final drive in position as shown in fig. 3-28. Place an 'Personal Danger and Out of Service' tag on the ignition switch. Place a suitable container under the drain plug. Remove drain plug and fill plug.
6. Check sealing surface of drain and fill plug and replace if necessary. Install drain plug and fill with correct oil type to bottom of fill plug hole. Install fill plug. Refer to recommended oil list on following page. Factory fill is 85W/140 gear oil.

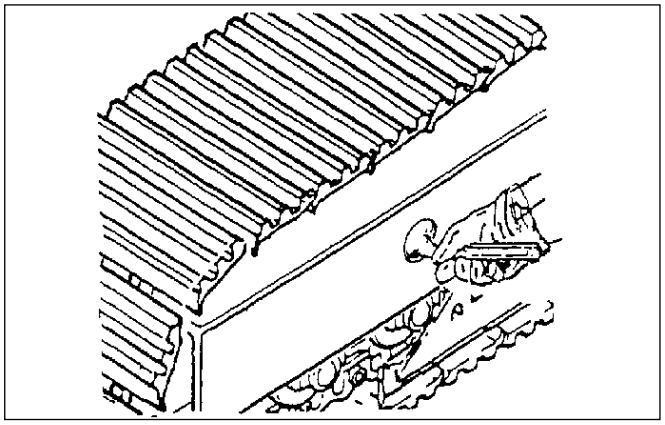
Sealing Compounds and Adhesives (cont.)



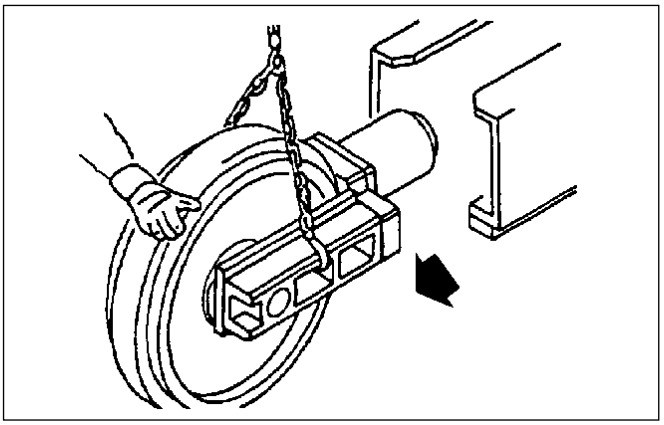


Idler Unit – Removal

WARNING: DO NOT work on track system or undercarriage unless engine is off and controls are locked out and machine is on level ground. MAKE SURE machine and components are well supported before servicing or replacing parts. RELIEVE PRESSURE on hydraulic or pneumatic systems before loosening connections or parts.

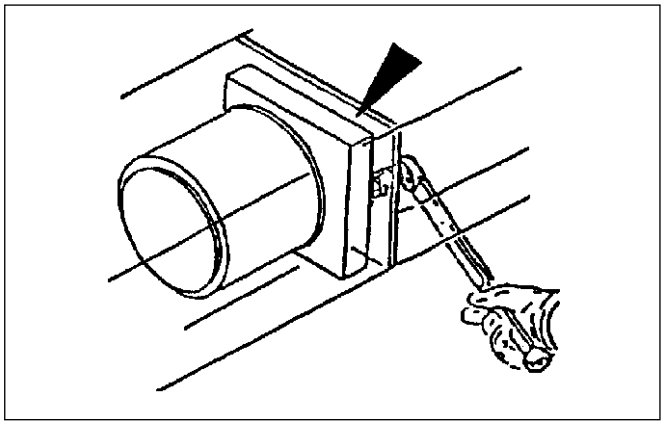


1. Release track chain tension and separate track chain. Follow instructions outlined previously.

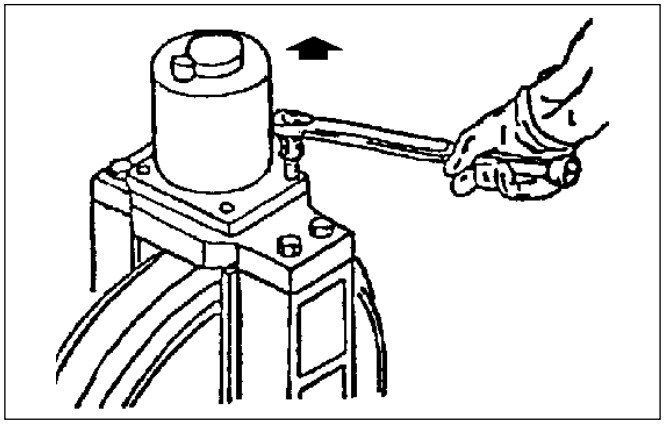


2. Clean dirt from all parts. Using an adequate lifting device, pull out the complete idler unit.

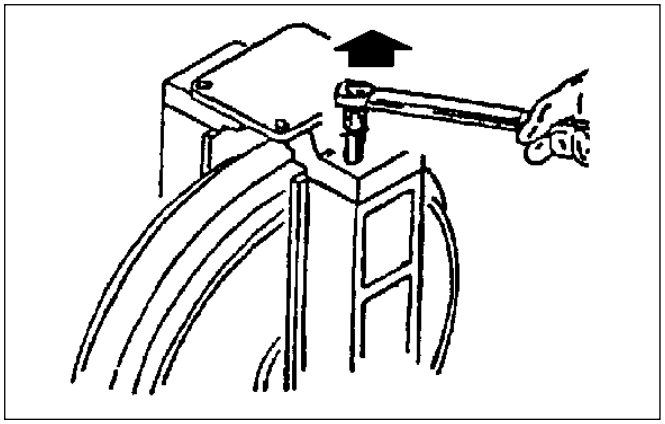
3. If either the idler or nitrogen tensioner is damaged, separate them and replace or repair as required.



4. If the hydraulic tensioner is defective, loosen the attaching bolts and remove the unit. Replace or repair the unit as necessary.

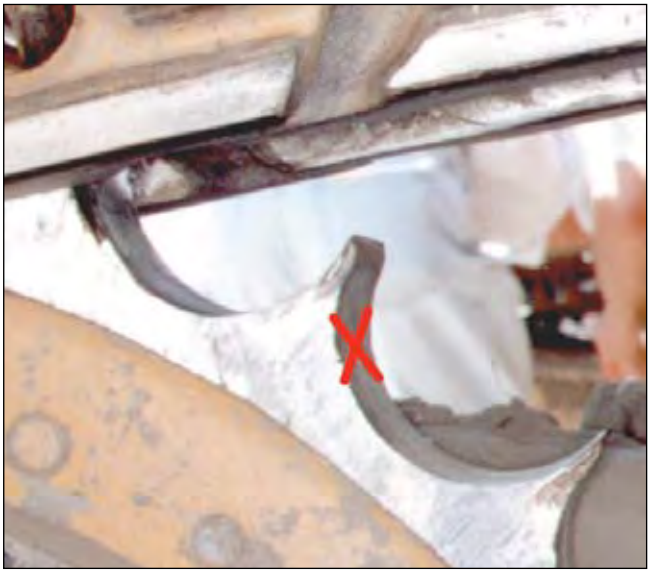


5. If the nitrogen tensioner is defective, loosen the attaching bolts from the sliding block and remove tensioner.



6. If idler unit needs repair, first loosen the sliding block. To disassemble the idler components, refer to 'Idler Assembly' instructions and carry out procedure in reverse order.

Sprocket Wear Patterns



Wear on Forward Drive Side

Considered as normal wear when driving torque of the sprocket is transmitted to the bushing.

Causes:

- Bushing moves and more towards the tooth tip of internal joint wear.
- Abrasive soils in the tooth bottom or on the tooth profile is pushed away by the bushing creating additional wear.
- Side to side movement between the bushing and tooth due to frequent turning and steering manoeuvres also causes wear between the sprocket and the bushing.
- Wear increases as the side clearance between sprocket and links increases thus higher side to side movement and increased wear.
- Sprockets with mud reliefs lead to higher surface load and thus a higher wear rate.
- Accelerated wear due to inadequate track gradient between sprocket and last roller causes bushing to be pushed into tooth bottom by machine weight.
- Tracks with pitch extension cause the contact area between bushing and sprocket move more and more to the tooth tip.

Effects:

- Bushing puts more pressure on the tooth profile.
- Contact area is reduced. Contact pressure and wear increases.
- Excessive wear causes bushing to move closer to the tooth tip. Tracks more easily jump over the teeth causing damage to both the sprocket and bushings.
- Tooth spacing is increased. When changing directions, increased impacts are exerted between the bushing and sprocket. Bushings and sprockets worn beyond 100% can break.

Remedies:

- Normal wear is inevitable
- Use of lubricated track chains eliminates pitch extension allowing the chain and sprocket a more perfect match of pitches as wear occurs.
- If track gradient between sprocket and first roller is insufficient, use of spacers to lower the rollers will produce an adequate gradient.

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).

Construction

The EFS system consists of the following components:

- Electric fuel supply pumps
- Combination fuel filter head and pump manifold
- FS1006 fuel filter with water separator
- Fuel manifolds with integrated fuel shut-off (FSO) valves
- Fuel fittings and connections
- Wiring with efss power relay
- Pressure and temperature sensors

Electric Fuel Supply Pumps

Two electric pumps are used in parallel to deliver fuel from the fuel tank through the filter to the fuel injection pumps. The two pumps are mounted in the fuel filter head and they both discharge into a single fuel filter (see fig. 4-2). The pump set is capable of pumping1000 lbs/hr (454 kg/hr) of fuel at 40psi (276 kPa). The two pumps are wired in series so that they can be powered by a 24V supply but each pump will operate at 12V.

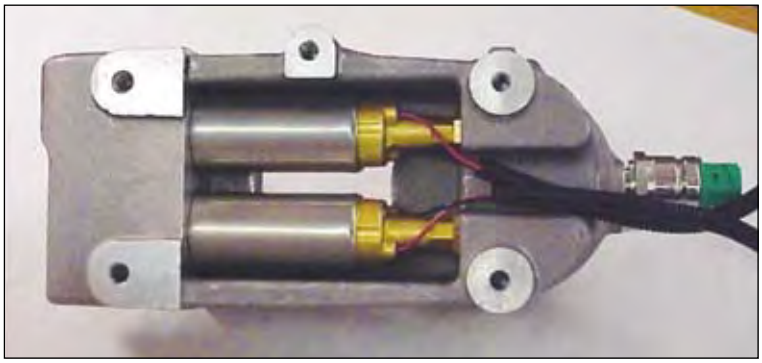


Fig. 4-2 EFS Filter Head Top View

NOTE: Please be aware that the electric fuel supply pumps will draw 6 to 8 amps from the batteries at all times while the engine is running.

Combo Fuel Filter Head and Pump Manifold

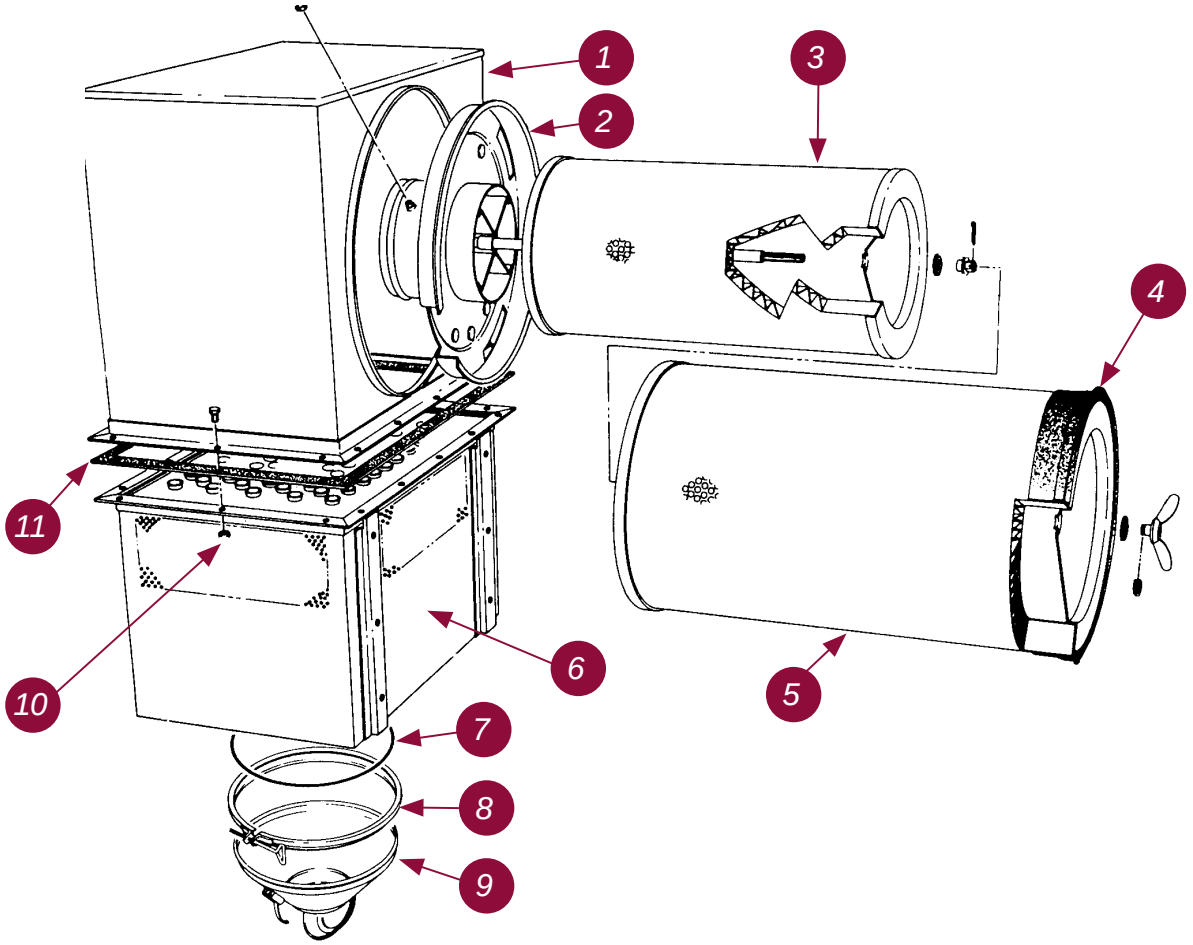
The fuel filter head for the EFS system holds the two electric fuel supply pumps as well as the FS1006 fuel filter (see fig. 4-3). The head also has ports to hold the fuel inlet fitting and the fuel pressure and temperature sensors (optional).

Fig. 4-3 EFS Filter Head Assembly

FS1006 Fuel Filter with Water Separator

The QST30 fuel supply system was originally designed to use two FF202 fuel filters. The FS1006 filter includes the Fleet guard StrataPore™ synthetic media that improves filtration efficiency, contaminate capacity and media life.
The FS1006 filter is efficient at removing contaminates as small as 10 micron which helps to protect the fuel injection pumps from wear. The StrataPore™ media also provides 95% water separation efficiency. The excellent characteristics of the FS1006 filter and the steady pressure supply of the electric fuel pumps make it possible to achieve 500 hour change intervals with a single filter element compared to the two elements that were required for the original fuel supply system design.

Engine and Compressor Air Cleaner Service Assembly



Engine and Compressor Air Cleaner Assembly

1. *Body assembly*
2. *Flange assembly (outlet)*
3. *Safety element*
4. *Gasket*
5. *Primary element*
6. *Body assembly*
7. *O-ring*
8. *Clamp assembly*
9. *Cup*
10. *Nut*
11. *Gaskets*

Pump Drive Gear Box Input Shaft Assembly

The following instructions are for the 76mm (3”) input shaft. Refer to fig. 4-12.

Disassembly

1. Remove retaining ring and spacer from input shaft.
2. Press input shaft out of flange using an arbor press or remove with a gear puller.
3. Remove and discard oil seal.
4. Remove retaining ring, then remove bearing.

Assembly

1. Install bearing into flange bore, then install retaining ring. Be sure bearing is seated all the way in the bore and retaining ring is fully seated into groove.
2. Install oil seal with the lip facing out as shown in fig. 4-12. Coat seal lip with oil before installing input shaft.
3. Coat input shaft shoulder with oil where it will contact the oil seal, then press the input shaft into place using an arbor press. Be sure shaft is seated against the bearing.
4. Install spacer and retaining ring. Be sure retaining ring is seated into the groove all the way.
5. Lubricate and install new O-ring onto flange. Install input shaft assembly to pump drive housing. Use four new capscrews and install with Loctite 262. Torque bolts to standard torque values.

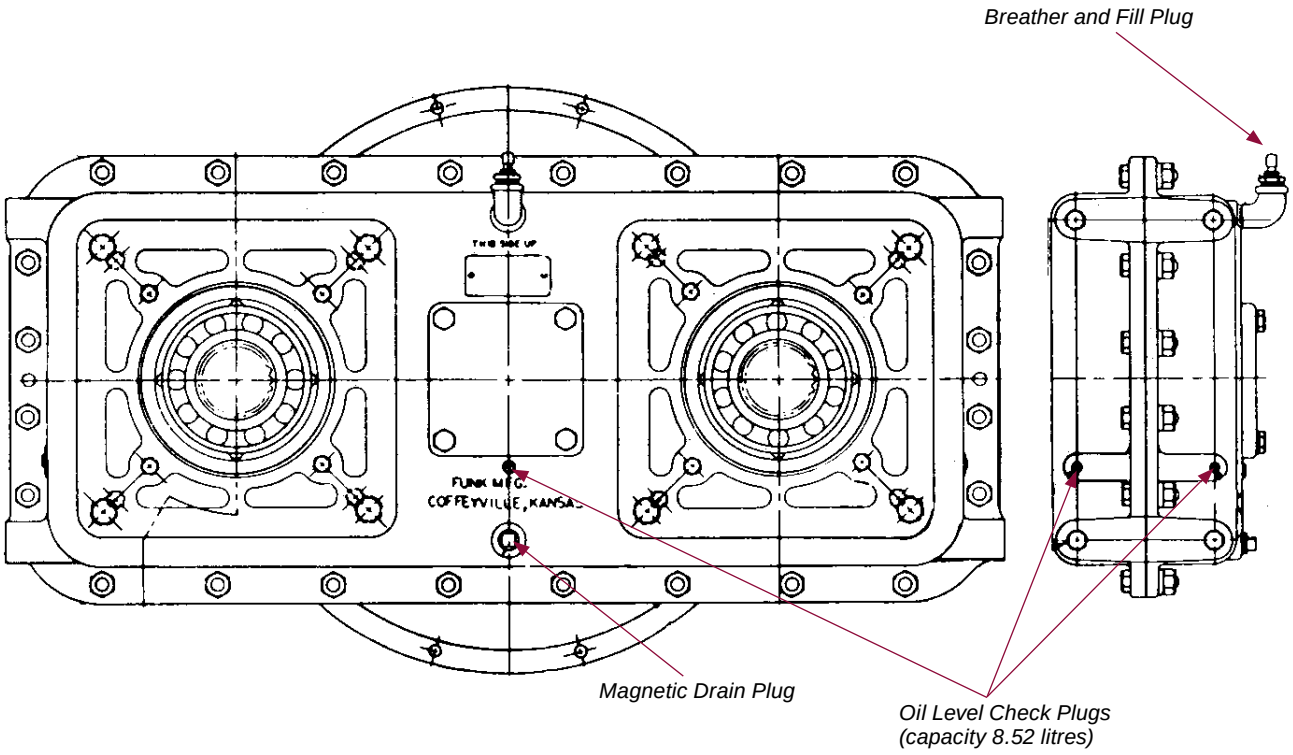


Fig. 4-13 Funk Pump Drive Gearbox

Mounting Instructions for Arcusaflex™ Flywheel Couplings

How to Mount the Taper Bushing

1. The outer taper of the taper bushing and the bore with the inner taper of the element hub shall show bright metal and must be free grease prior to mounting. Preservatives must be removed completely.
2. Insert the taper bushing into the element hub and line up all connecting bores. Make sure that half threaded bores coincide with half plain bores (fig. 1).
3. Screw in lightly greased or oiled assembly screws. Do not tighten the screws yet (fig. 2).
4. Slide the element hub with inserted taper bushing onto the cleaned shaft with keyway and put it into the mounting position 'L' (fig. 3).
5. Tighten the screws uniformly up tot he tightening torque M_{A2} specified in table 2, using a torque wrench.
6. The screws can be retightened again by tapping against the taper bushing with a hammer using an intermediate plate. Repeat, if necessary.

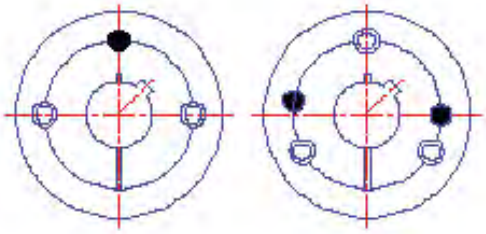


Fig. 1

Fig. 2

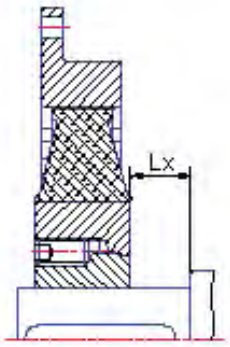


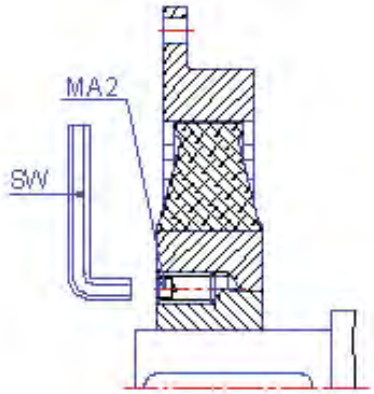
Fig. 3

Tightening for Torque for Mounting the Taper Bushing.

Coupling Size		AC-T5
Taper bushing No.		3535
*UNC screw size		1/2 x 13
Tightening torque	Nm	115
	lb-in	1020
Width across flats SW	mm	10
	in	1-4

* No. 2012/2517/3030 set screw
No. 3535/4040/4545 cap screw

Table 2



How to Remove the Element Hub with Taper Bushing

1. Loosen and remove all screws. Depending on the taper bushing size, screw either 1 or 2 greased screws into the half pulling-off thread(s) of the taper bushing (fig. 4).
2. Tighten the screws uniformly until the taper bushing is loose in the hub element hub.
3. As soon as the taper bushing is loose, the element hub can be pulled off the shaft together with the taper bushing.

Fig. 4

Inlet Valve (cont.)

Oil injection is supplied to Port 1 of the inlet valve from the oil distribution manifold via an 0.15” orifice. The spring chamber of the Inlet Valve is connected to Port 3 via an 0.078” orifice, this line vents off oil back into the compressor intake which allows oil to continuously flows through the spring chamber while ever the machine is running. This line also vents the spring chamber when air is demanded and the poppet piston must move back against the springs to open the inlet valve.

The spring chamber is filled with oil to:

1. Lubricate the O-ring,
2. Dampen spring vibration,
3. To provide a non-compressing medium. This creates quicker response times and prevents the compressor over-pressurising the receiver.

Maintenance

1. Disconnect all controls and piping from the Inlet valve.
2. Remove valve from the compressor unit by removing the six (6) 3/4” bolts and two (2) nuts from studs.
3. Remove cover, care must be taken when removing the last screw as the cover is lightly spring loaded.
4. Cover may be stuck to the housing and can be separated by threading two (2) 3/8” bolts into the tapped holes and jacking apart.
5. Remove the six (6) bolts from the inside cover.
6. Remove shaft and piston from assembly.
7. Inspect piston bore in housing for pitting (erosion) and scoring. Replace if severely damaged.
8. Remove and discard the piston O-ring.
9. Clean shaft and piston thoroughly and re-install the piston and shaft O-rings.
10. Clean housing bore and re-install shaft and piston with O-rings into housing. Apply light coat of sil-glyde provided in kit.
11. All contact surfaces between cover, housing and inner cover must be cleaned with cleaning solution. Wipe dry all surfaces and apply gasket eliminator provided in kit.
12. Reinstall Inlet valve back onto compressor unit and reconnect all controls and piping.

NOTE: When disassembling the Inlet valve, the six (6) retaining bolts for the inside cover are long enough to allow the spring tension of the main springs to be fully relaxed for removal of the piston and springs.

Compressor Air and Oil Circuits – 2000cfm @ 125psi (cont.)

Air Inlet System, Functional Description

Reference air circuit drawings (following pages). The compressor inlet system consists of air filter, restriction indicator, compressor air inlet valve and interconnecting piping to the compressor.

The air filter is a 3-stage dry element type filter. This filter is capable of cleaning extremely dirty air; however, is such cases more frequent checks of the air filter restriction indicator will be required.

The air filter restriction indicator will flag an alarm on the Vigilante screen in the cab when restriction of the air passing through the filter becomes too high. At this time, clean or change the air filter element.

Lubrication Guide

The reliability of the unit is dependent upon the selection and maintenance of the lubricant. The ambient temperature, relative humidity, discharge pressure, and contamination levels must be considered in the lubricant selection. All lubrication oil(s) mentioned will be referred to as 'fluid'.

Application Guide

Sullair Drill Air Compressors are tested with LLL4. Any of these detergent motor oils (SAE 10W, class SE, SF, SG or CD) can also be used as alternative fluid. Any of these oils are suitable under conditions where severe oil oxidations can occur.

Water must be drained from the receiver periodically. In high ambient temperature and high humidity condition, condensed moisture may emulsify with the oil forming a 'milky' colour. ATF is especially prone to this condition. The fluid should be changed if this condition develops.

DO NOT mix different types of fluids. Combinations of different fluids may lead to operational problems such as foaming, filter plugging, orifice or line plugging.

When ambient conditions exceed those noted or if conditions warrant use of other extended life lubricants, contact Sullair for recommendations.

Sullair encourages the user to participate in a fluid analysis program. This could result in a fluid change interval differing from that stated in the manual.

Lubrication Guide Fluid Type	***Change Period Hours***	***Ambient Temperature Range 0°F (0°C)***
Sullair AWF (I)	1200	-20 to 120 (-29 to 49)
D-A Torque Fluid	300	10 to 110 (-12 to 43)
SAE10W SE, SF, SG, CD	300	0 to 100 (-18 to 38)
MIL-L-2104E 10W	300	0 to 100 (-18 to 38)
AS46	500	0 to 125 (-18 to 52)

NOTE: Above guide should be used in conjunction with routine oil sample results.

Capacity Control System With Closed Poppet Inlet Control, Functional Description

The purpose of the control system is to regulate the amount of air intake in accordance with the amount of compressed air demand. The single stage compressor is designed to operate up to 125psi. The control system consists of a poppet valve, system pressure regulator, shutdown blowdown valve, two running blowdown valves.

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.

Minimum Pressure Valve

It is important that the receiver tank pressure is always above 40psi to ensure that lubricating oil is circulated through the cooling system and injected back into the Air end. Should the receiver tank minimum pressure drop below 60psi when the flushing air is turned on, the separator element in the receiver tank can collapse due to increased pressure differential. A tell tale vent hole in the body cap of the Minimum Pressure valve, will exhaust air if the piston O-ring has failed.

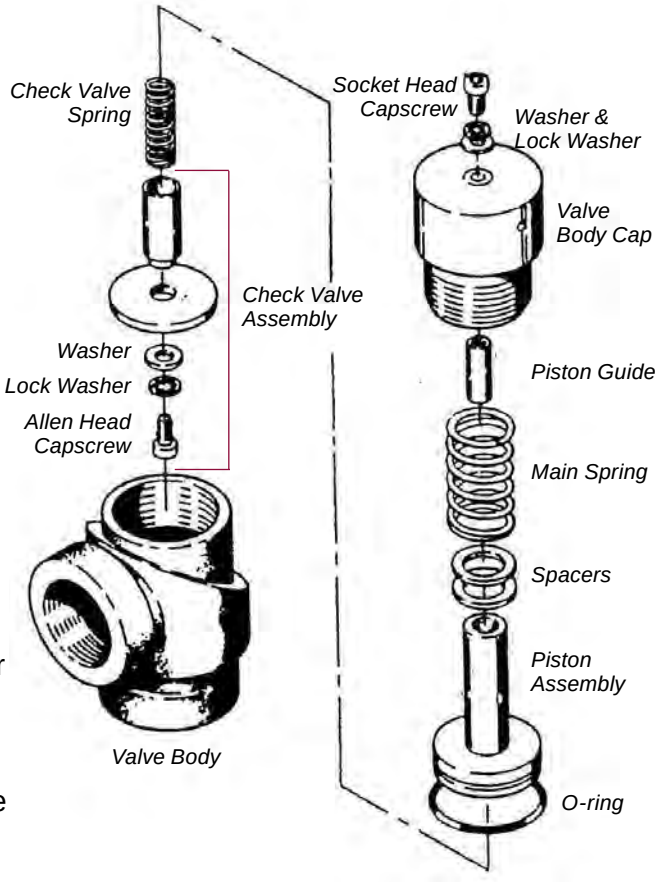
Minimum Pressure / Check Valve Maintenance

Follow the procedure below for proper maintenance instruction.

WARNING: Before starting this procedure, insure that all pressure has been relieved in the machine sump, and all downstream pressure has been vented to atmosphere. Also, be sure that the components of the machine are cool to the touch.

Minimum Pressure Valve

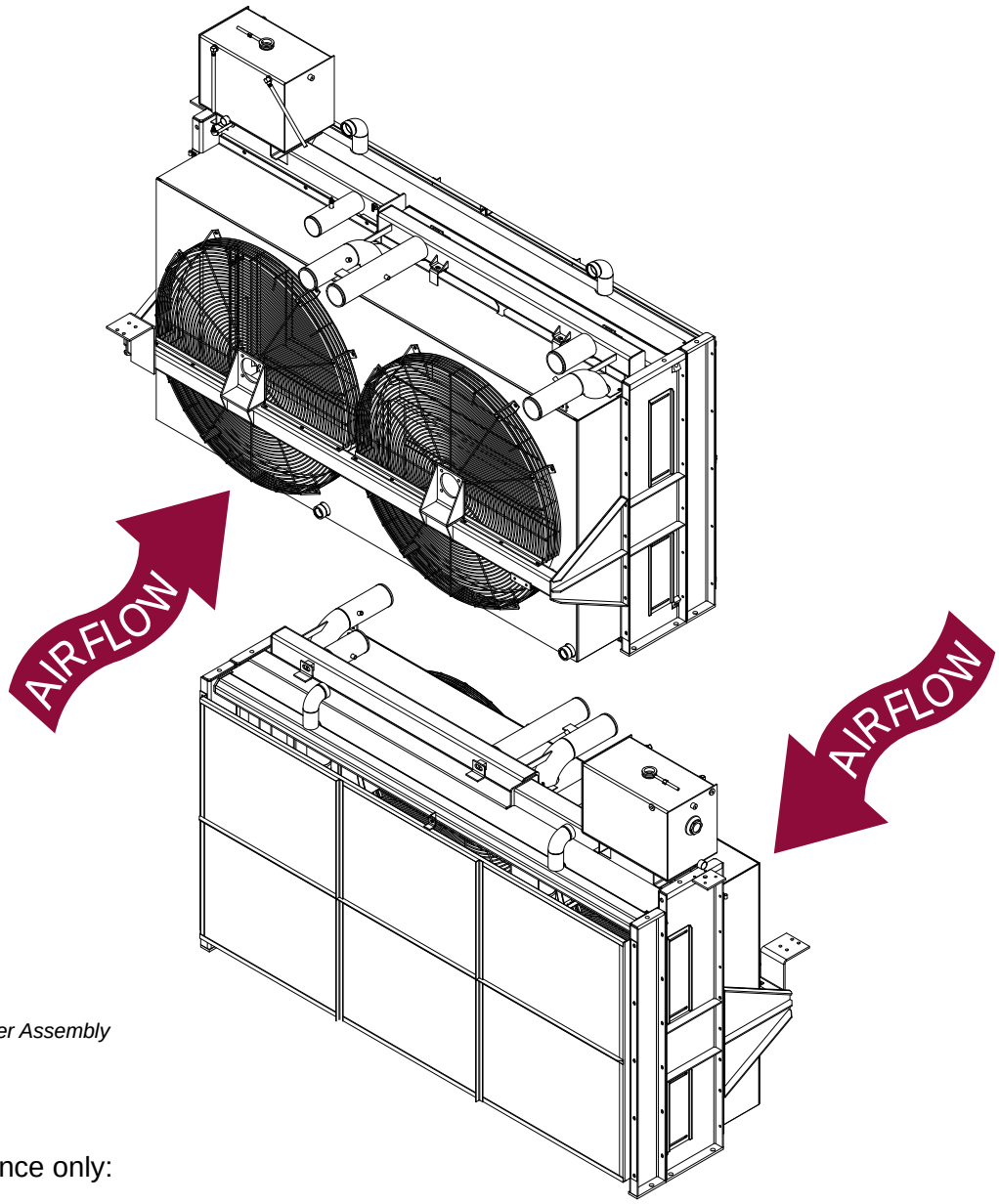
1. Remove valve body cap by rotating the cap counter clockwise with the full length of the threads on the cap disengaged from the valve body.
2. Using proper size allen wrench, remove socket head capscrew, lock-washer, plain washer, and piston guide.
3. Remove main spring by lifting straight up.
4. Remove piston assembly by grasping the assembly and lifting straight up. Care must be taken not to lose the spacers as they are not attached to the piston assembly.
5. Remove O-ring from piston assembly.
6. Reaching into valve body, remove check valve spring and check valve assembly by lifting these parts straight up.
7. Install new check valve assembly and check valve spring which are supplied in the repair parts kit.
8. Install new O-ring on piston assembly and replace piston assembly. Replace spacers on the piston shaft and insure that they are laying flat on the face.
9. Replace main spring on the piston shaft and lower it down until it rests on the spacers.
10. Replace valve body cap. Be certain that the new piston guide and hardware are in place. Screw the valve body cap into the valve body and tighten.



Minimum Pressure Valve

Compressor Oil Cooler

Compressor oil flows from the receiver tank through the thermal / thermostat by-pass valve, through a filter and then to the compressor. Once the thermostat temperature of 110ºC (230ºF) is reached, the thermostat shifts and diverts oil from the receiver through the thermal by-pass valve, through the cooler than back to the receiver.



Compressor Oil Cooler Assembly

Fan Speed

Use as a reference only:

- 1200rpm – 1400psi
- 1300rpm – 1500psi
- 1400rpm – 1800psi
- 1500rpm – 1900psi (nominal)
- 1600rpm – 1950psi max fan speed

NOTE: Always set fan speed using photo – tachometer (photo-tach) and use pressure as a reference only.

Fan speeds should be adjusted to minimum required to maintain optimum compressor temperature of approximately 99-104ºC (210-220ºF)

To set fan speed refer to hydraulic Section 7

Tube Removal (cont.)

Cleaning Tube Ends

Before the original tubes are reinstalled, the tube ends must be clean of foreign material. Polish the tube ends with a polishing wheel and a copper polishing compound. If the debris cannot be removed by polishing, use a piece of fine grit emery cloth or steel wool.

If there is a lot of debris on the tube ends, use a 150mm (6”) or 203mm (8”) diameter wire wheel brush with a wire size of .006 or .008. Larger diameter wire sizes could damage the tube ends. Try installing a tube. If it does not slide easily into the top and bottom seals, try polishing the tube ends as per above.

Seal Installation

Helpful Hints:

- Install new Mesabi seals when tubes are removed.
- After removing the old seals, clean the plate holes of any foreign debris. We recommend a McMaster Carr Chuck Grip with 3/4” brush.
- Clean out inside of tanks and blow out plate holes with air.

ON THE LEFT: Properly installed seal.

ON THE RIGHT: Seal installed too far into header.

Fig. 5

- Install new seals in clean dry holes.
- If the core has a centre tank, do not install seals at the bottom of the top core until all the tubes are installed in the bottom core.
- For ease of seal installation soak seals in hot water just prior to installing.

With your thumb start the new Mesabi seals into the holes and push them part way in. Care must be taken not to install seals too far into the header plate. A properly installed seal has a crowned or convex top surface, and the tube hole is slightly flared at the opening. A seal that is installed too far into the header has a concave top surface and the tube hole is noticeably smaller in diameter as shown in fig. 5. Over installed seals will make tube installation more difficult and are much more likely to be damaged during tube installation.

The use of a hammer directly on the seal can easily cause seals to be installed too far into the header plate. 3/8”x 3”x 6” placed over the seals and hitting with a rubber mallet will allow the seals to be properly installed.

Lubricating Seals and Tube Ends

For ease of tube installation and to minimise the chance of scuffing or tearing rubber seals during tube installation, both top and bottom seals and both tube ends must be thoroughly lubricated, using radiator premixed Lube / Release Agent. The Lube / Release Agent should be brushed into each seal hole, using a 1/2” diameter brush.

For lubricating the tube ends, use a spray bottle to spray the Lube / Release Agent on both tube ends.

Dust Control Systems (cont.)

Water Injection

Water is injected into the main air stream to control dust from the drilling operation. The water injection system consists of a water tank and a hydraulically driven water pump that injects water into the main air header. The pump provides water from the tank at a flow rate controlled by an adjustable flow control valve on the control console. The water is directed to an air control valve which meters the water into the air stream at the main air header.

The operator controls for the dust control system consist of a switch and a water flow control valve on the control console. Because the water injection system and the dry dust control system are not operated at the same time, a single switch operates the water pump hydraulic motor and the dust collector hydraulic motor. Pushing the switch up engages the water pump motor, and pushing the switch down engages the dust collector motor. The water flow control operates a needle valve that controls the amount of water being injected into the main air stream.

Dust Collector

The function of the dust collector is to convey the dust and rock chips from the hole collar to the filter housing and separate the solid particles from the clean air.

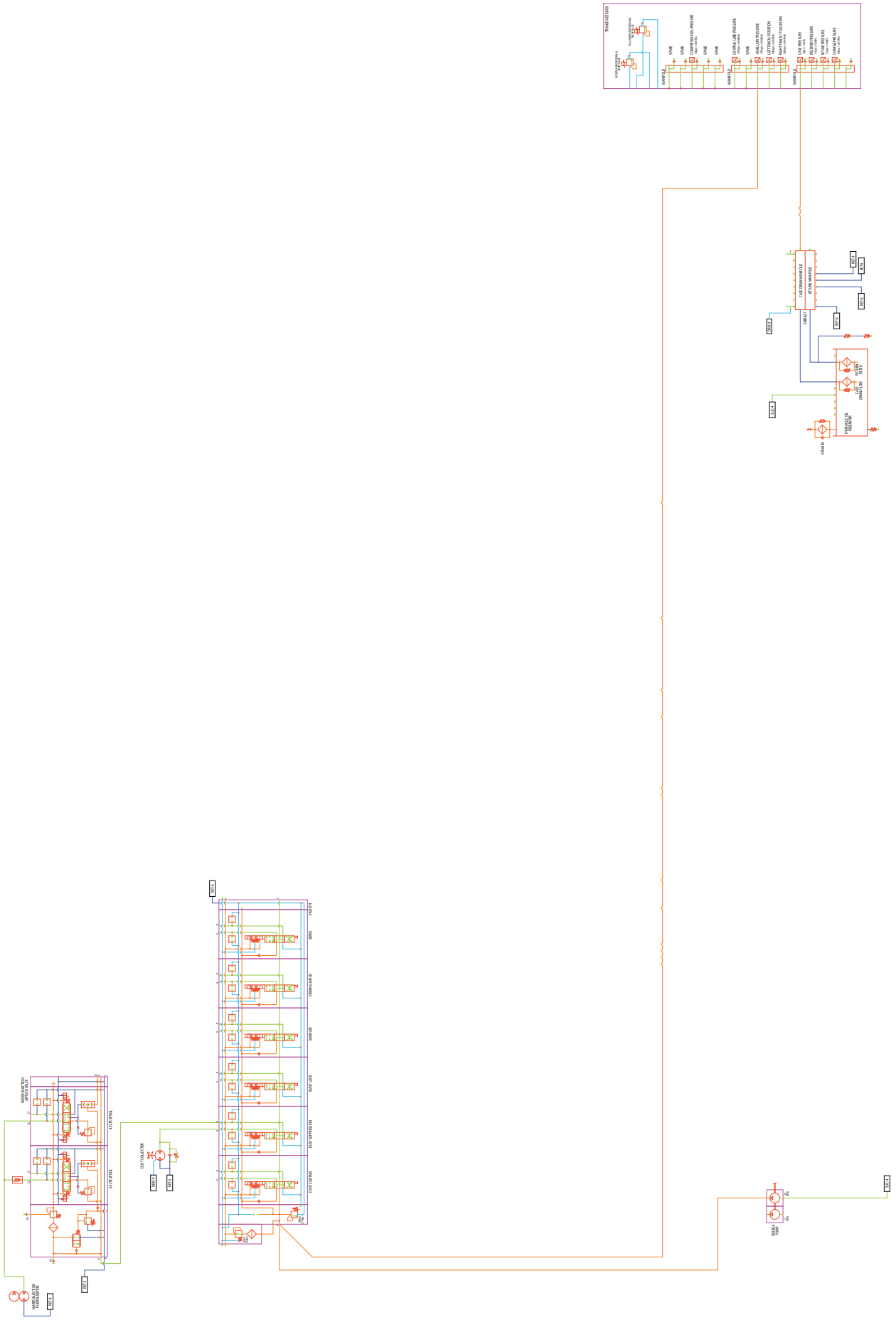
The system consists of a primary drop-out box that ejects the coarse material or fines allowing the super fines or dust to travel onto the main dust collector unit where it is stored and ejected and the end of each drill cycle.

The dust collector system has a hydraulic driven fan that is used to create the suction required. The fan draws the air / dust mixture from the drill skirt area, through the primary box and into the main dust collector.

Dust Collector

Located in the main chamber are four (4) filters that collect the dust allowing clean air to exhaust from the fan outlets. The dust collector filters are cleaned via four (4) ‘back pulse’ valves that are electronically timed. The length of pulse and pulse interval are fully adjustable to suit ground conditions. Fan speed is variable by way of a hydraulic flow control valve. Variances in differential pressure through the dust collector filters are measured and indication as to whether the filters are blocking or damaged is displayed on the vigilante touch screen.

Dust Collector and Water Injection Circuit



Replacing Piston Cup Seals

1. Remove fluid chamber from pump by removing the three cap screws holding it to the power frame, then lift off the top of the ceramic cylinders.
2. Remove the cap screw and piston retainer from each of the two cylinders.

3. Lift the ceramic cylinder off from the top of the power frame. Friction will usually keep the piston inside the cylinder as it is removed. Once the cylinder and pistons are off the pump, take them to a bench and press them out from the top.

4. Inspect all O-rings, gaskets, seals, and other components for signs of damage or wear. Any damaged components should be replaced at this time. Inspect cylinder liners for cracks or grooves by running thumbnail around the bore of the cylinder. Replace if grooves are detected. New cups will wear quickly if operated in cylinders with rough or grooved bores. Note: to provide maximum operational time between services, FMC recommends that both piston cups, not just the one that shows signs of leakage, be replaced whenever piston service is required.
5. Insure that the umbrella fluid shield is not damaged. A damaged umbrella could allow fluid to contaminate the power end oil. If the umbrella requires replacement, the best way to remove it from the pump is to cut it free with a sharp knife.

NOTE: It is recommended that all gaskets or O-rings be replaced at each piston cup service interval.

6. If new umbrellas are required, fold the plastic as shown and insert through the opening and over the ends of the plunger rod. For easier installation of the umbrella, immerse in hot water for 2-3 minutes to soften. Press tops of umbrellas to place pilot washers over ends of plunger rods with groove in up position.

7. Place O-rings and packing holders in position on ends of plunger rod.
8. Place ceramic cylinders and gaskets in counter bore in power frame.
9. Apply light oil or glycerin around the OD of the piston cups, then place them in the open end of the cylinders. Use the thumb to press the cups down firmly into the holder of each cylinder.

10. Insert the cup retainers into the cylinders with the ribbed side facing the piston cup.
11. Secure packing assembly using cap screws. Torque as per specification.
12. Insert top gasket (or O-ring and ring seal) in fluid chamber counter bore using heavy oil or grease to hold in place.
13. Return fluid chamber to position over cylinders and insure that all seals are in place.

14. Replace fluid end cap screws. Torque cap screws in three stages to values shown in the fastener torque requirements section.

Contents

Hoist / Pulldown Cylinder

Repair

Refer to parts manual for specific cylinder and repair part numbers. Refer to cylinder repair information in Section 7 of this manual for type of cylinder on machine. Follow the instructions on the 'General Information' page, then follow the detailed instructions for the type of head and type of piston that matches what is in the cylinder. For this particular cylinder, follow the procedures for 'N' type head and 'Z' type piston. This cylinder is somewhat different, due to the double ended rod. Pay particular attention to the notes and differences on the drawing.

Installation

1. Protect the chrome surface of the exposed cylinder rods by wrapping with cloth or several layers of paper. Wrap the threaded ends of the cylinder rods with tape to protect threads from damage. With cylinder rods centred (equal length of rod exposed on both ends of cylinder body), lift cylinder barrel (do not lift by the cylinder rods) and position under mast with the lower cylinder guide mounts toward bottom of mast (fig. 6-2).
2. Position lower rod end through hole in mast base, then position upper rod end through hole in crown block. Install spacers (item 3, fig. 6-1) and thread nut on rod ends so same length of rod extends beyond nut as before removal.
3. Install lower nut and tighten with chain wrench or special made wrench and a 'cheater' pipe.
4. Remove cap plugs from rod ends and install fittings and hoses (fig. 6-3).

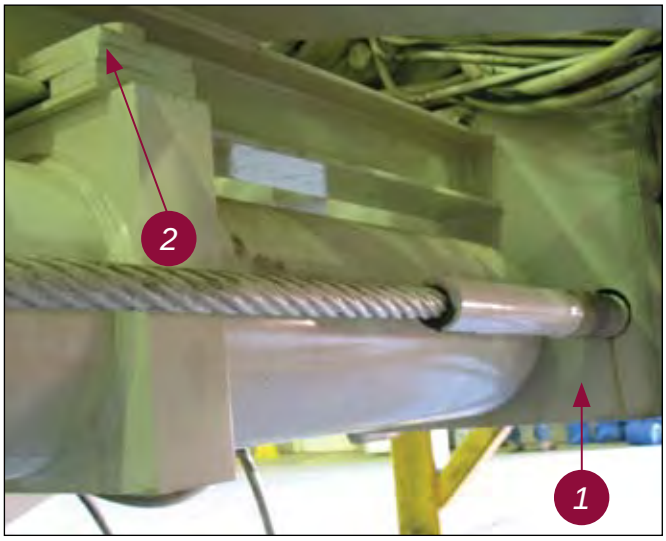


Fig. 6-2 Hoist/Pulldown Cylinder - lower end

1. *Mast base*
2. *Lower cylinder guide mount*

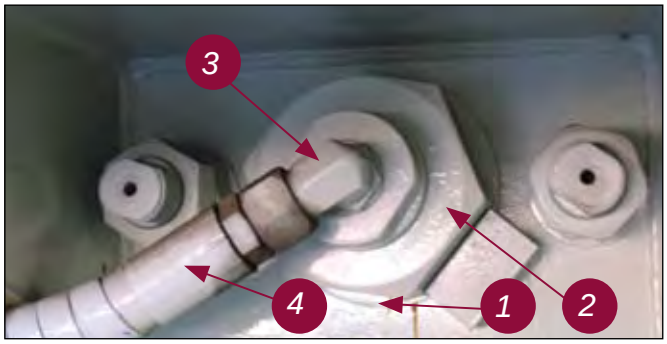
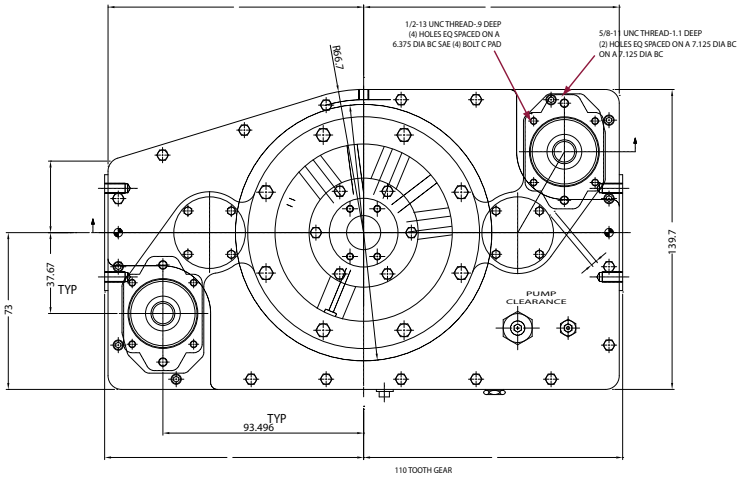


Fig. 6-3 Hoist/Pulldown Cylinder - lower end retaining nut

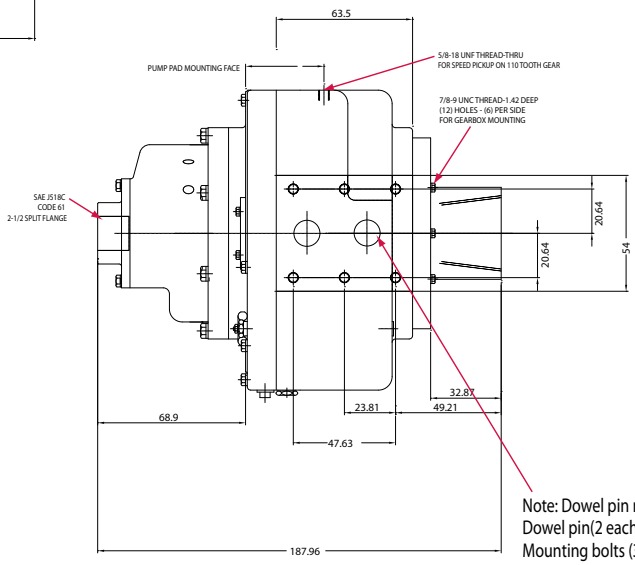
1. *Spacer*
2. *Nut*
3. *Hydraulic fitting*
4. *Hydraulic hose*

Rotary Head Guide Alignment (cont.)



COTTA PART NUMBER TM2116-7

RATIO: 16.04 TO 1
MAX INPUT SPEED: 1600 RPM
MAX OUTPUT TORQUE: 12000 FT-LB
APPX WEIGHT: 1900 LBS
MAX THRUST: 80000 LBS IN EITHER DIRECTION



Note: Dowel pin mod.
Dowel pin(2 each per side)
Mounting bolts (3 each per pin)
Nord-lock washers (3 each per pin)

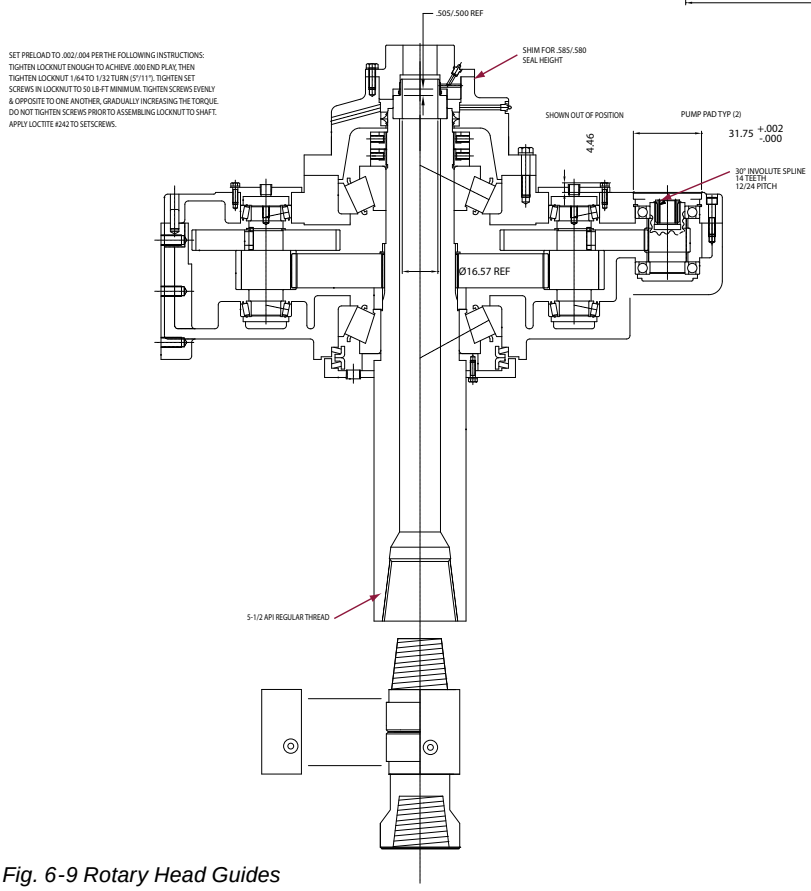


Fig. 6-9 Rotary Head Guides

Plain (Smooth) Drums

Installation of a wire rope on a smooth face drum requires a great deal of care. The starting position should be at the drum end so that each turn of the rope will wind tightly against the preceding turn. Here too, close supervision should be maintained during installation. This will help make certain that:

1. The rope is properly attached to the drum;
2. Appropriate tension on the rope is maintained as it is wound on the drum;
3. Each turn is guided as close to the preceding turn as possible, so that there are no gaps between turns; and
4. There are at least two dead turns on the drum when the rope is fully unwound during normal operating cycles.

Loose and uneven winding on a smooth drum can, and usually does, create excessive wear, crushing and distortion of the rope. The results of such abuse are lower operating performance, and a reduction in the rope's effective strength. Also, for an operation that is sensitive in terms of moving and spotting a load, the operator will encounter control difficulties as the rope will pile up, pull into the pile and fall from the pile to the drum surface. The ensuing shock can break or otherwise damage the rope.

The proper direction of winding the first layer on a smooth drum can be determined by standing behind the drum and looking along the path the rope travels, and then following one of the procedures illustrated. The diagrams (figs. 6-14 and 6-15) show: the correct relationship that should be maintained between the direction of lay rope (right or left), the direction of rotation of the drum (overwind or underwind), winding from left to right, or right to left.

Drums – Multiple Layers

Many installations are designed with requirements for winding more than one layer of wire rope on a drum, winding multiple layers presents some further problems.

The first layer should wind in a smooth, tight helix which, if the drum is grooved, is all ready established. The grooves allow the operator to work off the face of the drum, and permit the minimum number of dead turns.

A smooth drum presents an additional problem, initially, as the wire rope must be wound in such a manner that the first layer will be smooth and uniform, and will provide a firm foundation for the layers of rope that will be wound over it. The first layer of rope on the smooth drum should be wound with tension sufficient to assure a close helix, each turn being wound as close as possible to the preceding turn, and most, if not all, of the entire layer being used as dead turns. The first layer then acts as a helical groove which will guide the successive layers. Unlike wire ropes operating on groove drums, the first layer should not be unwound from a smooth-faced drum with multiple layers.

After the rope has wound completely across the face of the drum (either smooth or grooved), it is forced up to a second layer at the flange. The rope then winds back across the drum in the opposite direction, lying in the depression between the turns of the rope on the first layer. Advancing across the drum on the second layer, the rope, following the 'grooves' formed by the second layer, the rope, following the 'grooves' formed by the rope on the first layer, actually winds back one turn in each revolution of the drum. The rope must then cross two rope 'grooves' in order to advance across the drum for each turn. The point at which this occurs is known as the cross-over. Cross-over is unavoidable on the second, and all succeeding layers.

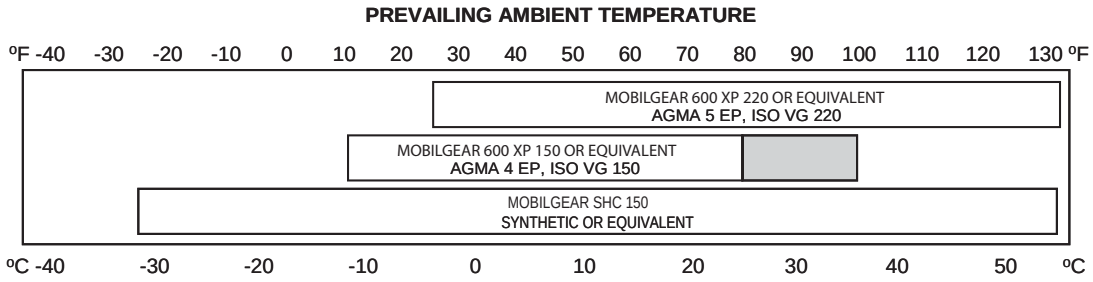
Preventive Maintenance (cont.)

Recommended Planetary Gear Oil

Field experience, supported by extensive engineering tests, indicates the use of the proper planetary gear oil is essential to reliable and safe operation of the brake clutch and obtaining long gear train life.

For simplicity, Braden has listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well. If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.

Braden planetary winches are factory filled with Exxon Spartan 150 or equivalent AGMA No. 4EP gear oil. For Australian applications, refer to Section 9.



NOTE: Shaded temperature range in the chart above are not recommended for severe applications such as: offshore cranes, sustained fast duty cycles or frequent lifting.

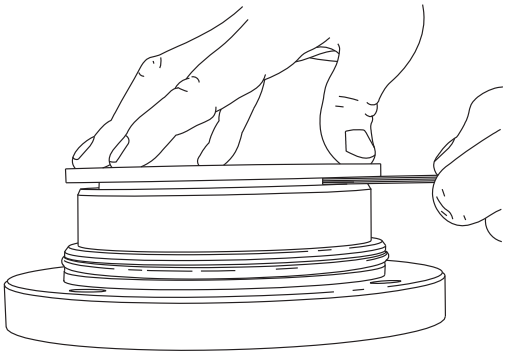
071 Motor

WARNING: The brake valve cartridge is factory set and normally requires no further adjustment. The brake valve can be manually piloted open by its adjusting screw. Manually opening the brake valve could cause internal winch damage and may cause loss of load control during lowering operations which may result in property damage, personal injury or death.

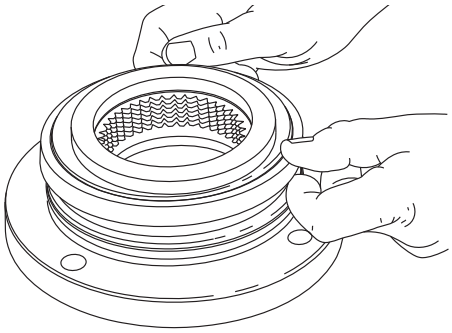
The brake valve cartridge may be unique in that turning the adjusting screw in, clockwise, lowers the release pressure. If it is determined a brake valve adjustment is required, the entire brake valve should be replaced.

The brake valve cartridge is easily removed from the valve block for cleaning, inspection or replacement, but is not designed to be disassembled in the field. In the event it has been determined the brake valve should be disassembled, the entire cartridge should be replaced.

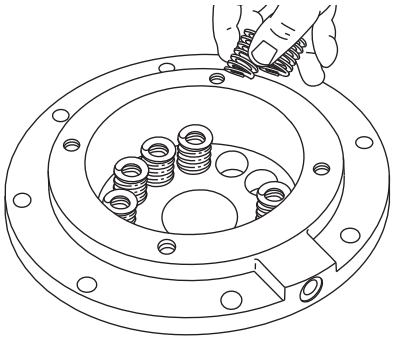
Assembly (cont.)



5. To check brake stack height, place pressure plate on top of brake spacer. Hold pressure plate down firmly by hand and measure clearance in three places between motor support and pressure plate. Average gap must measure between 3mm (.127") maximum and 1.5mm (.060") minimum. If the gap exceeds the maximum limit, there are too many brake discs in stack-up or the discs are distorted. If the gap is less than the minimum, there are too few discs in stack-up or the discs are worn out. When stack height is correct, remove pressure plate and continue assembly.

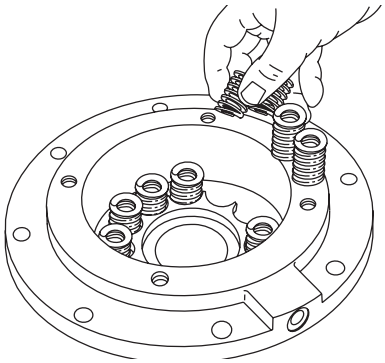


6. Lubricate the brake piston seal and motor support sealing surface with petroleum jelly or hydraulic oil. Install new piston seal to motor sup-port, seal lip down.



Older Style Brake Cylinder

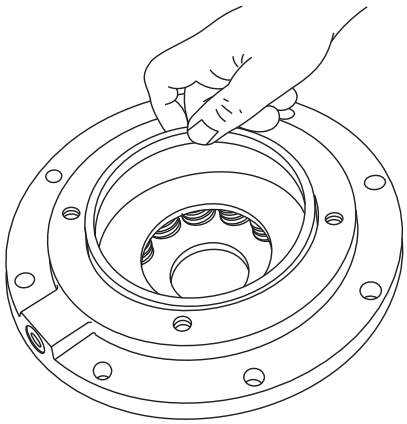
7. Install brake springs into brake cylinder.



New Style Brake Cylinder

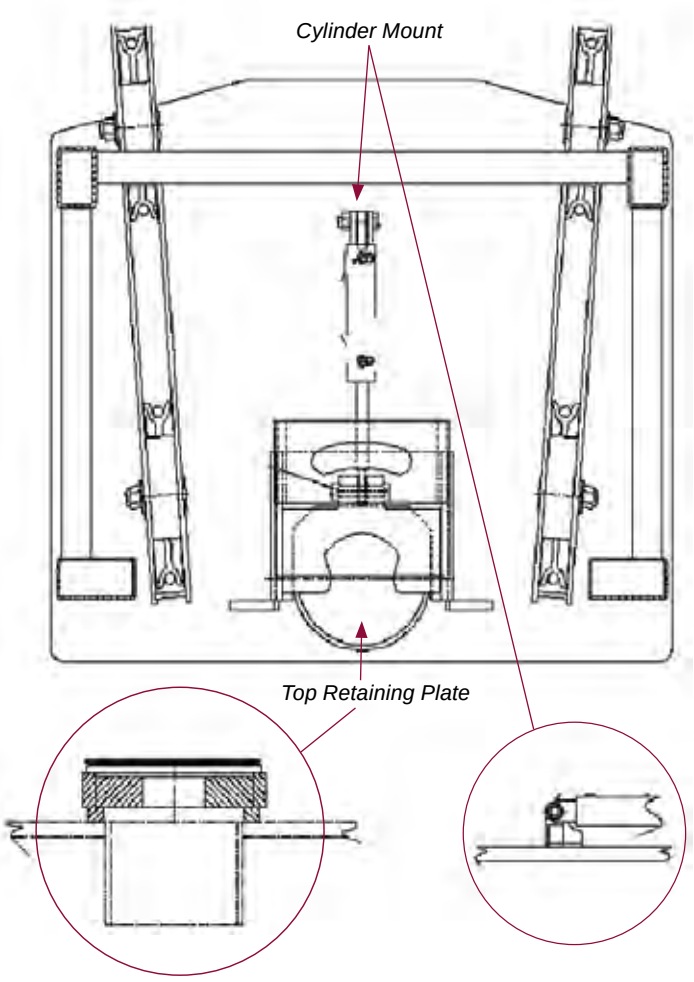
7a. When using the new style brake cylinder with out milled spring pockets, install the spring spacer, then the brake springs.

WARNING: Always use the molded spring spacer with the new brake cylinder. The brake springs must be properly positioned by the spring spacer. Failure to install the spring spacer may allow the springs to contact each other and become damaged. This could result in loss of load control, property damage, injury or death.

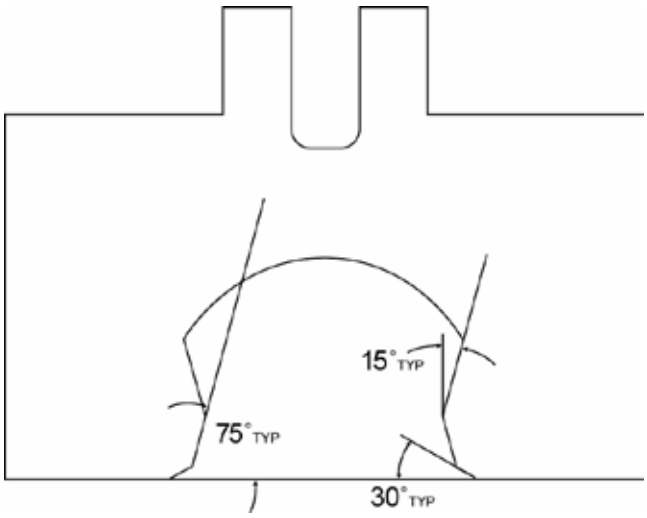


8. Install pressure plate into brake cylinder followed by the piston back-up ring. The close fitting piston back-up ring may be depressed slightly to one side to lodge the back-up ring in the brake cylinder bore and temporarily hold the pressure plate and springs in place while you lower the brake cylinder over the motor support.

Deck Wrench

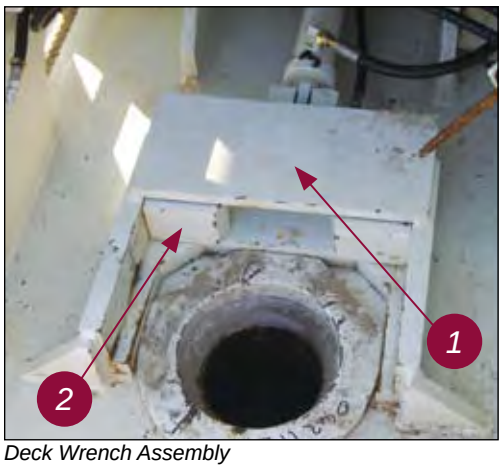


Deck Wrench Arrangement



Deck Wrench

NOTE: The 15° angle must be maintained if the deck wrench requires 'building up' by means of welding



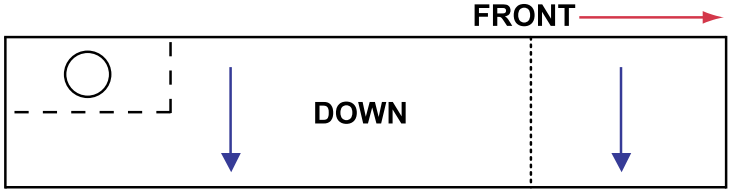
Deck Wrench Assembly

1. *Top retaining plate*
2. *Deck wrench*

If damage has been sustained to either the **deck spanner** cylinder mount or the top retaining plate, it is imperative that the position of both components is back to its exact original location. The extended and retracted position of the deck spanner and cylinder is extremely important to enable the spanner to engage the drill pipe sufficiently, as well as being able to clear the drill pipe when rotating whilst drilling.

The **top retaining plate** must be sitting flush down and level on the spanner guide assembly (refer fig. 6-16), to prevent the spanner from lifting, allowing the **deck bush** to also lift up and jam under the spanner.

NOTE:the deck wrench can physically be fitted upside down. This will lead to damage to the wrench cylinder, should the deck wrench become caught on the drill pipe when being raised.



Side View of Deck Wrench

Fig. 6-16 Side View of Deck Wrench

Pipe Rack – Assembly and Installation

NOTE: Be sure to install the bearings so the grease groove is aligned with the grease fitting.

1. The journal bearings are a slight press fit. Be sure to install the bearings so the grease groove is aligned with the grease fitting. Chill the bearings in a freezer for about 30 minutes before installing and they should drop right in. Clean old grease from tube ends, coat journal bearings with new grease.
2. See fig. 6-20. Install thrust washer onto lower carousel pipe. Install other thrust washer onto pipe rack support tube. Install lower carousel into bottom plate of pipe rack support. Install index plate onto end of carousel tube.
3. See fig. 6-20. Install shims and end cap to bottom of carousel. Install eight capscrews and washers. Tighten capscrews and check for correct clearance between end cap and bottom of carousel pipe. You should have about .08mm (.003”). Add or subtract shims to get correct clearance.
4. See fig. 6-17. Grease and install the upper and lower pipe rack support bearing caps onto the pipe rack support. Grease and install the upper carousel bearing cap onto the upper carousel pipe. Grease mid-point support bushings. Install new bushings if required.
5. Hoist pipe rack assembly into position. Line up bearing cap bolt holes and install bearing cap bolts, nuts and washers (fig. 6-17). Line up swing cylinder rod ends with clevises and install pins (fig. 6-21) and retaining bolts and washers. Tighten bearing cap bolts.
6. Grease and install mid-point support caps and bushings. Fasten with capscrews, washers and locknuts.
7. Line up index cylinder with index plate clevis and install pin and retaining bolt and washer.
8. Install hydraulic hoses to index lock cylinders.
9. Check all connections and all bolts for proper torque. Apply grease to all fittings at all pivot points. Start machine and check to see that pipe rack carousel functions correctly and there are no leaks.

13. Washer, flat
30. Adapter, hydrualic straight
31. Adapter, hydraulic 90º
34. Grease fitting
35. Stop plate, upper pipe rack
37. Capscrew, hex
38. Nut, elastic stop
39. Adapter, hydraulic straight
40. Adapter, hydraulic tee
41. Adapter, hydraulic 90º
42. Valve, counterbalance
45. Cylinder, hydraulic
49. Pin, swing cylinder
50. Capscrew, hex
51. Washer, flat
53. Pin, swing cylinder
54. Capscrew, hex

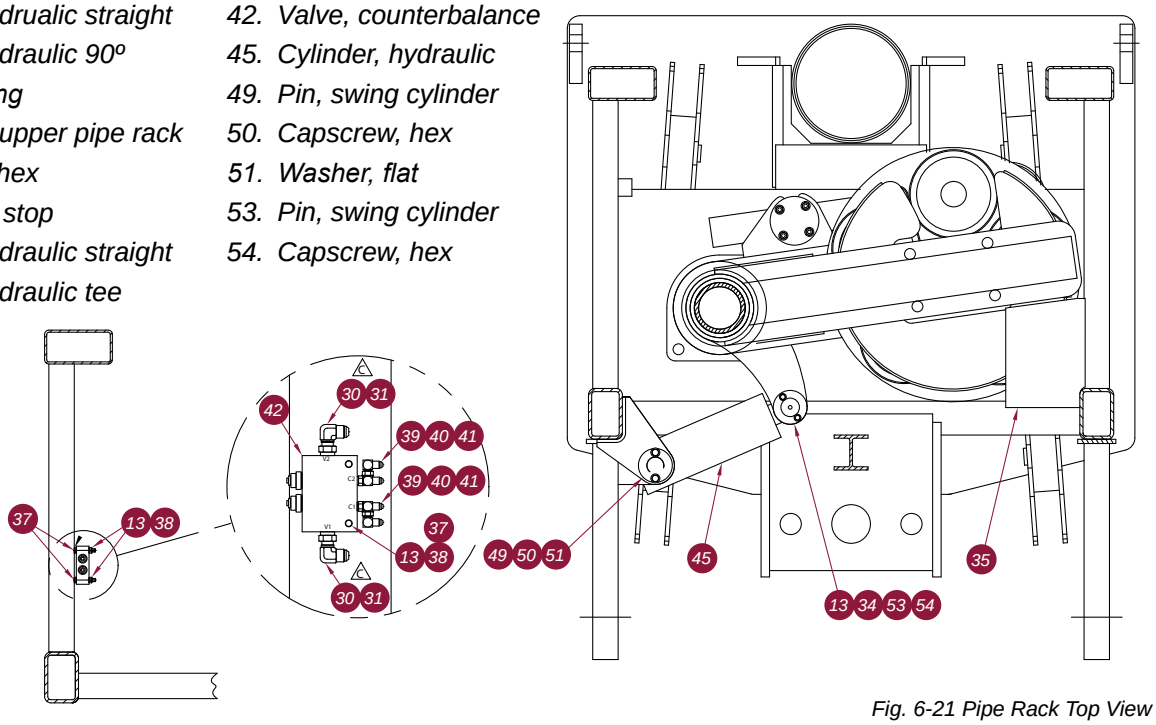


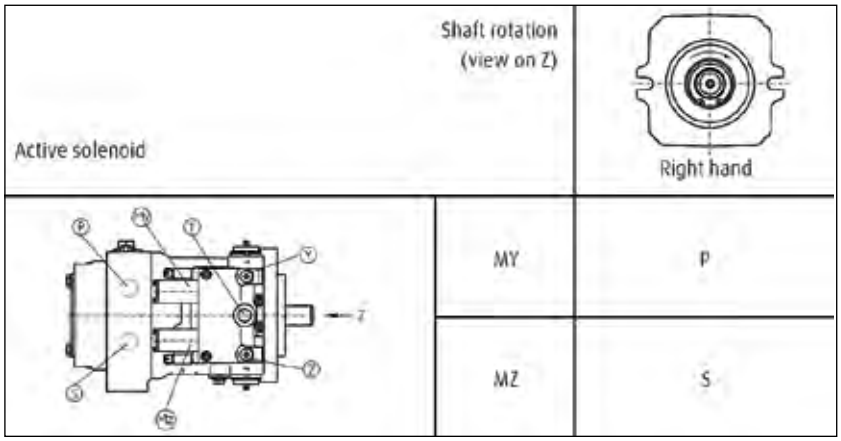
Fig. 6-21 Pipe Rack Top View

Linde HPV-02 Variable Displacement Pump (cont.)

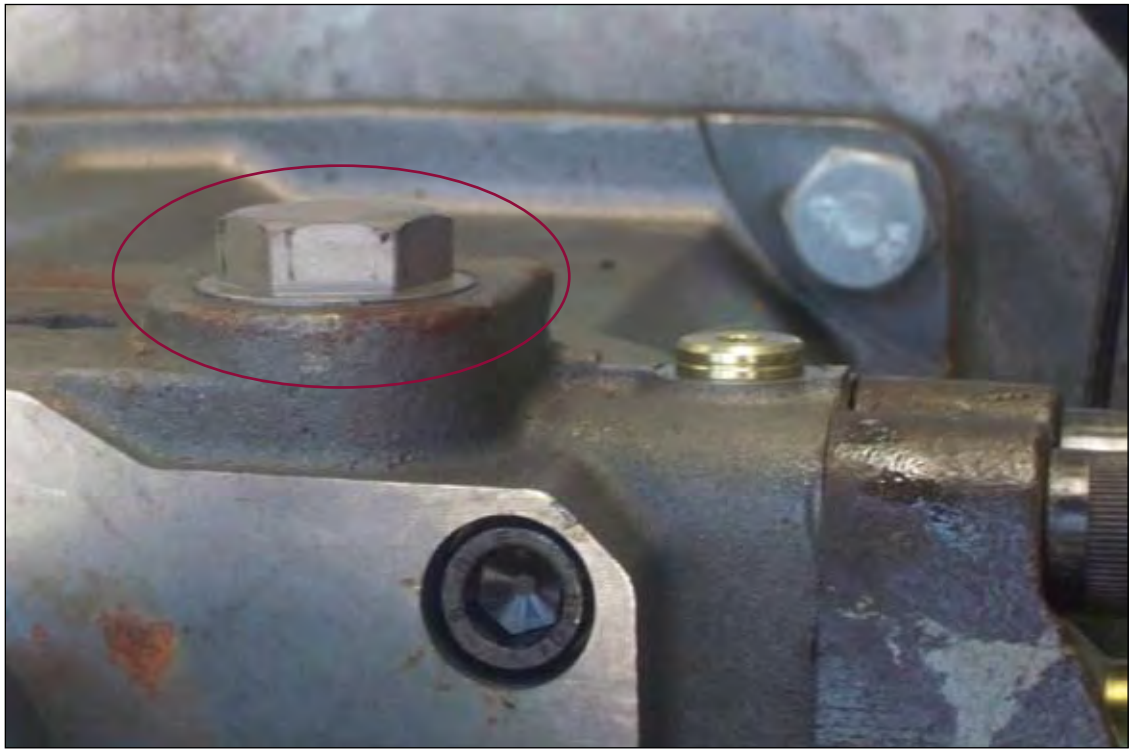
Technical Data

Rated size			**210**
	Maximum displacement	cm^3/rev	210
Speed	Minimum continuous speed at 100% duty cycle	min^{-1}	2300
	Maximum speed (intermittent) higher speed on request	min^{-1}	2500
	Minimum continuous speed	min^{-1}	500
Pressure	Maximum operating pressure	bar	420
	Maximum pressure (intermittent)	bar	500
	Continuous pressure (Δp)	bar	250
	Permissible housing pressure (absolute)	bar	2.5
Torque	Continuous input torque at continuous pressure	Nm	840
	Maximum input torque at max. operating pressure and 19bar boost pressure	Nm	1340
Power	Continuous power at max. continuous speed, continuous pressure	kW	201
	Maximum power at max. continuous speed, max. operating pressure and 19bar boost pressure	kW	322
Permissible shaft loads	Axial input force	N	2000
	Radial	N	on request
Perm. housing temp.	Perm. housing temp. with minimum perm. viscosity >10cSt	ºC	90
Weights incl. IGP (size 55-135 or EGP (size 210-280)	HPV-02 with H1 - control without oil (approx.)	kg	132
	Filling volume HPV-02 housing with filter	dm^3	4.8
	Maximum moment of inertia	$kgm^2 \times 10^{-2}$	4.77

High Pressure Outlet Port

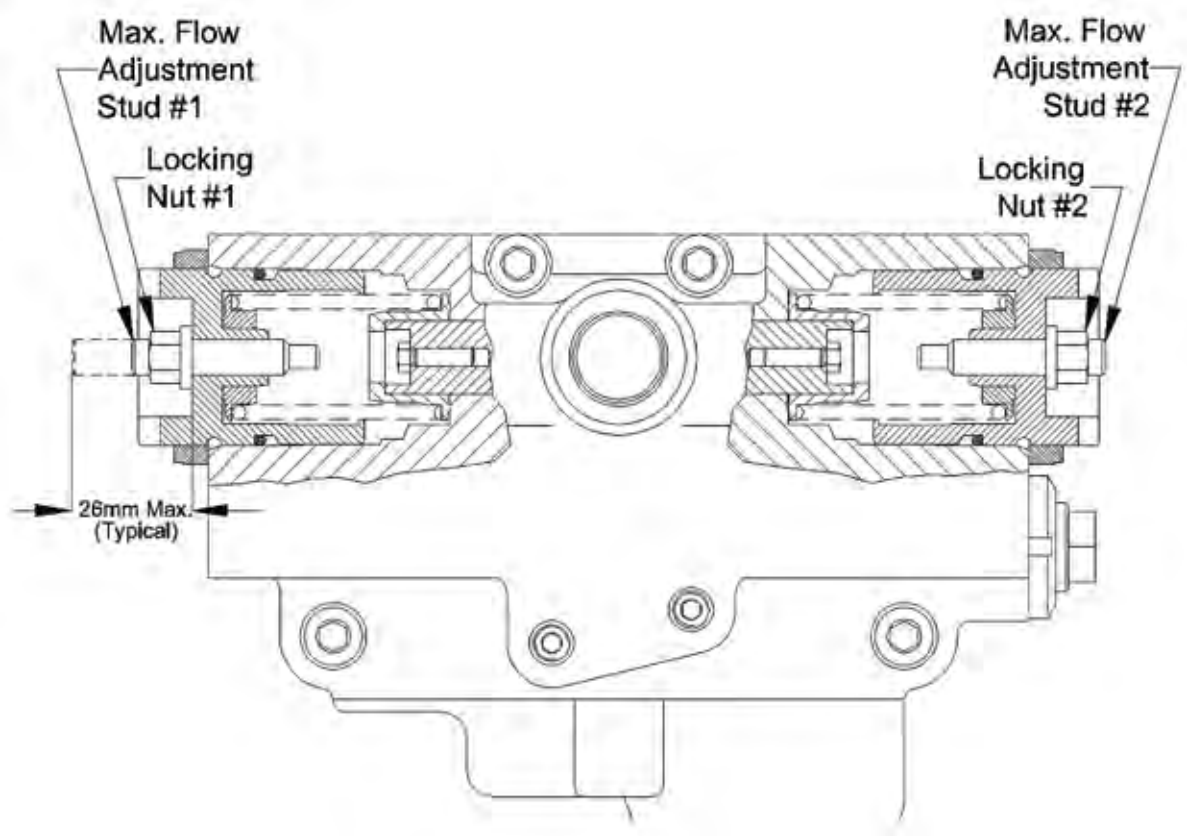


Setting Linde HPV-02 Main Pumps – Pre-setup Checks



Line Relief

NOTE: Ensure line reliefs are secure 125ft-lb (170n-m) – 5550psi (382.7bar)



NOTE: Ensure both max flow adjustments are identical as illustrated

Routine Maintenance

Main return and case drain filters do not normally require special attention except for periodic monitoring of the differential pressure warning device. Schedule replacement of filter element every six months or sooner, and have ample supply of spare elements available.

1. If external leaking is noted, replace O-ring at leak (refer fig 7-7). For cover seal (4) and reservoir to head seal (6) leaks, replace O-rings. If leakage persists, check sealing surfaces for scratches or cracks; replace any defective parts.
2. Differential pressure devices actuate when the element needs changing or because of high fluid viscosity in 'cold start' conditions. If visual indicator is fitted and actuates during 'cold start', reset by depressing the rubber button when the normal operating temperature is reached. If indicator actuates after resetting, replace element.

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 machine and depressurise the system. Open shut-off valve on top of hydraulic tank (item 4, fig. 7-1). After pressure has bled off, close valve.
2. Unscrew and remove filter cover assembly (2) from head assembly (1), counterclockwise when viewed from above. Use a socket wrench on the hexagon on the filter cover assembly (2) to loosen the cover.

CAUTION: DO NOT attempt to clean or reuse element.

3. Remove filter element (7) 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 (7) installed. Check that the O-ring (4 and 5) on the head assembly (1) is not damaged. Refer to parts manual for your specific machine for filter element part numbers.

NOTE: Item 5, lower cover O-ring must be in undamaged condition to ensure all return oil is filtered.

5. Lubricate element O-ring (8) with clean system fluid and push open end of filter element (7) straight onto the nipple in the head assembly (1). Lightly lubricate threads of filter cover assembly with clean system fluid. Screw cover assembly onto head assembly until it bottoms. O-ring sealing in not improved by overtightening.
6. After element change, start machine and check for leaks. When system reaches normal operating temperature, check that the electrical switch has not actuated.

Troubleshooting

Component problems and circuit problems are often interrelated. An improper circuit may operate with apparent success but will cause failure of a particular component within it. The component failure is the effect, not the cause of the problem. This general guide is offered to help in locating and eliminating the cause of the problems by studying their effects.

Effect of Trouble	Possible Cause	Fault Which Needs Remedy
Noisy pump / motor	Air in Fluid	• Leak in suction line • Leak at shaft seal • Low fluid level • Turbulent fluid • Return lines above fluid level • Gas leak from accumulator • Excessive pressure drop in the inlet line from a pressurised reservoir • Suction line strainer acting as air trap
	Cavitation in rotating group	• Fluid too cold • Fluid too viscous • Fluid too heavy • Shaft speed too high • Suction line too small • Suction line collapsed • Suction strainer too small • Suction strainer too dirty • Operating altitude too high • Boost or replenishment pressure too low • Replenishment flow too small for dynamic conditions
Misaligned shaft	Faulty installation	• Distortion in mounting • Axial interference • Faulty coupling • Excessive overhung loads
	Mechanical fault in motor	• Piston and shoe looseness or failure • Bearing failure
Erosion on barrel ports and port plate	Air in fluid Cavitation	• See above • See above
High wear in motor	Excessive loads	• Reduce pressure settings • Reduce speeds
	Contaminant particles	• Improper filter maintenance • Filters too coarse • Introduction of dirty fluid into system • Reservoir openings • Reservoir breather • Improper line replacement

Pilot Control Manifold Assembly

Pilot Control Manifold Assembly

This valve houses, valving for:

1. *Rotation torque control*
2. *Pulldown pressure control and auto feed*
3. *Drill / tram and set-up interlocks*

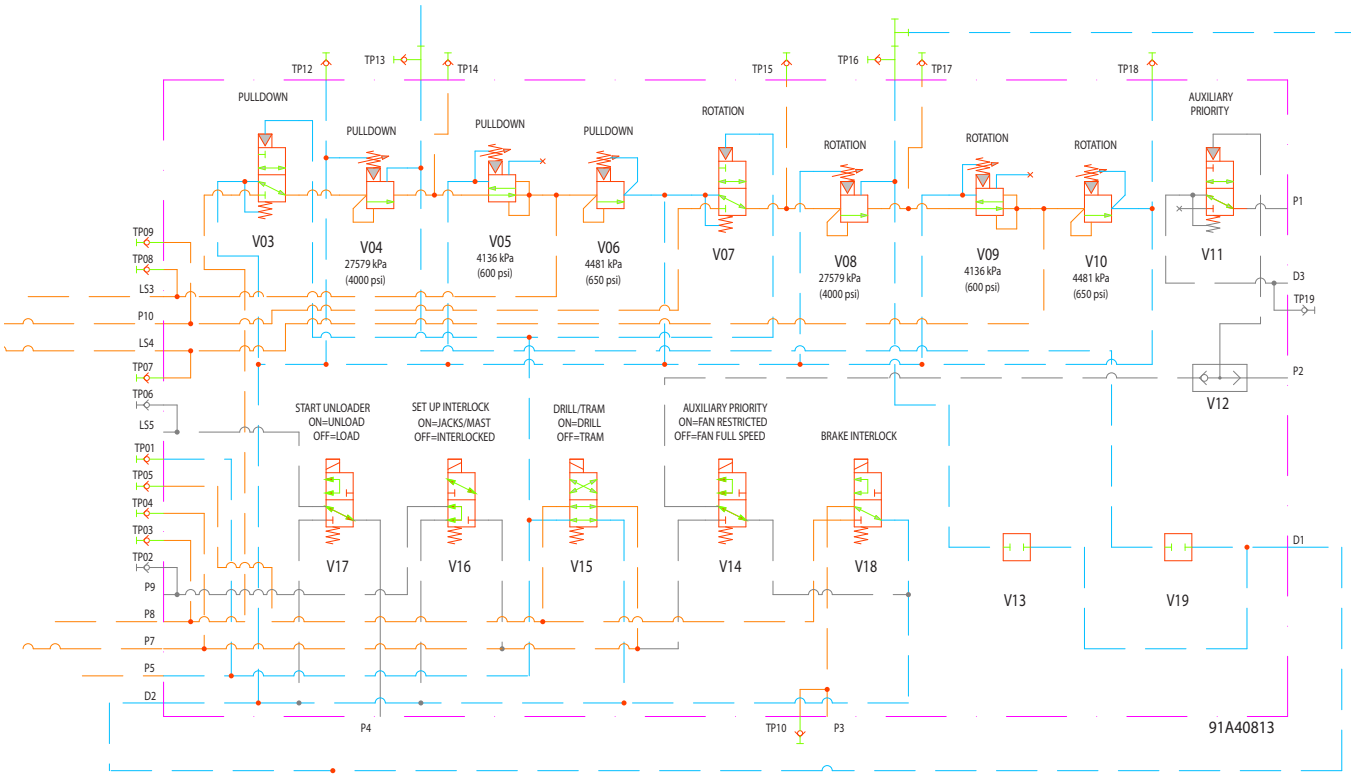
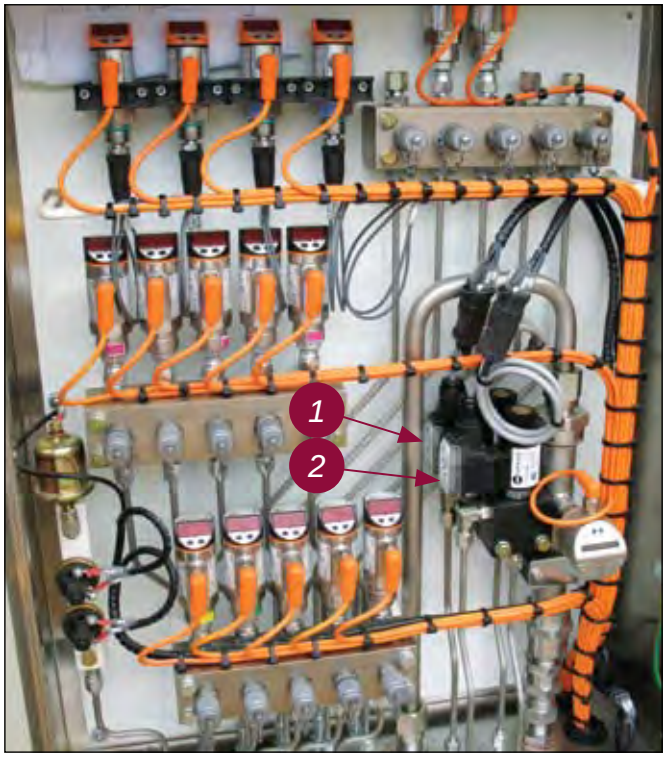


Fig. 7-13 Pilot Control Manifold Schematic

Electro Proportional Valves

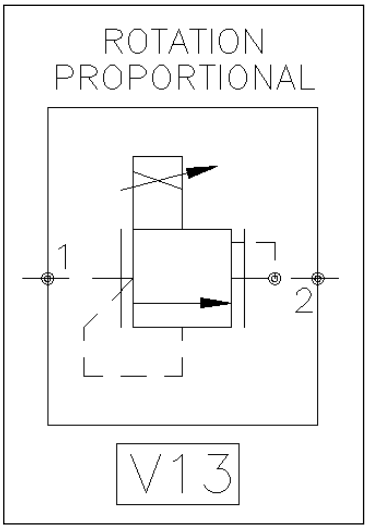


1. *V13 Rotation proportional solenoid*
2. *V19 Pulldown proportional solenoid*

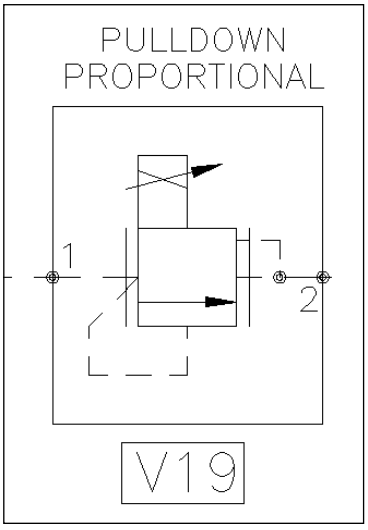
V13 Pulldown / V19 Forward Rotation Proportional Valve

– This 2-port, pilot-stage, direct acting relief cartridge is an electro-proportionally controlled, normally closed pressure regulating valve. The proportional control allows for infinite, step-less adjustability within the selected pressure range. When the pressure at Port 1 (inlet) is sufficient to overcome the solenoid forces, as determined by the analog input signal, the poppet lifts and allows flow from Port 1 to Port 2.

– This valve is used with amplifier valve controller (as on this slide) and is controlled by potentiometer in cab, allowing operator to control pressure from just above charge pressure to maximum setting as set on V04/V08.



Amplifier Plug



Auxiliary Pump Operation

The open loop system consists of the necessary pumps, cylinders and controls to prepare and position the drill rig for operations:

- 30 / 17gpm tandem gear pump 3
- 6gpm gear pump
- Mast elevating cylinders
- Levelling jack cylinders
- Carousel swing and rotation cylinders
- Pipe positioning cylinder
- Tool wrench devices
- Mast locks
- Dust control system
- Cooling fan circuits
- Service winch

Return system flow is filtered at the reservoir

Hydraulic Tank

1. *Service valve – open to relieve pressure after system is shut down.*

H.O.B.O Wrench Circuit

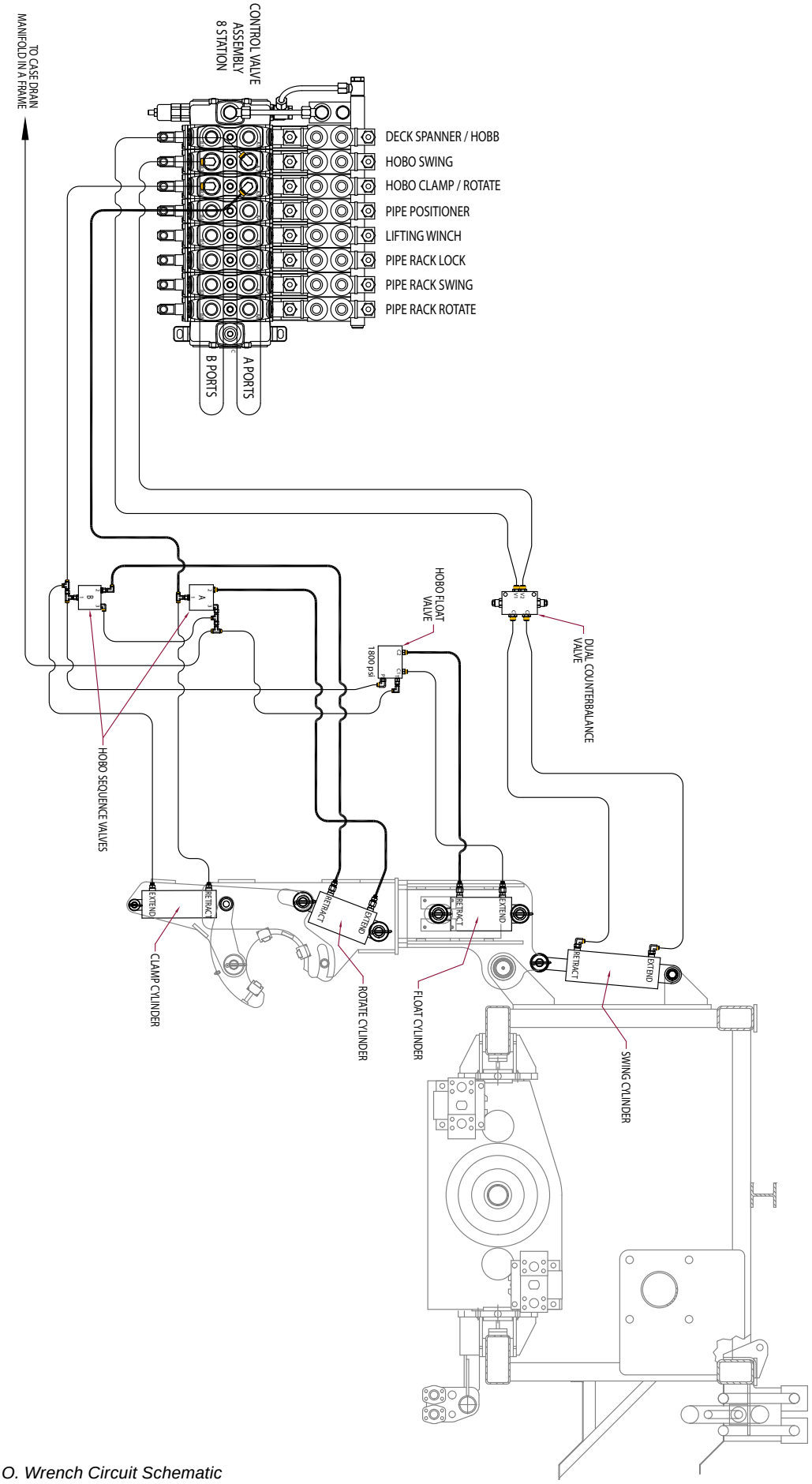
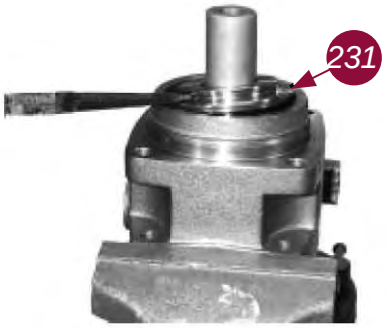


Fig. 7-17 H.O.B.O. Wrench Circuit Schematic

Hydraulic Motor (cont.)

Change of Shaft Seal

1. Remove the retaining ring (item 1).

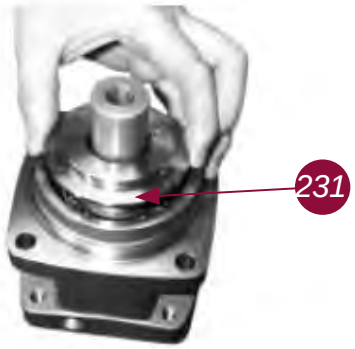


2. Remove the seal carrier (item 231).

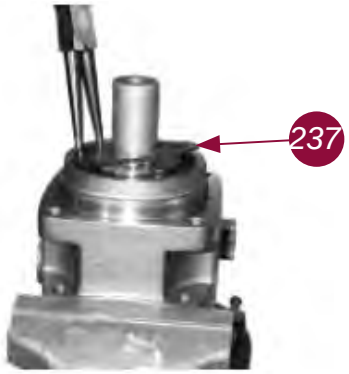
3. Tap the shaft seal out with a hammer and mandrel.

4. Tap the new shaft seal back with a tube and a hammer. The outside diameter on the tube is 65mm.

5. Install the O-ring (Item 225)



6. Install the Seal carrier (Item 231)

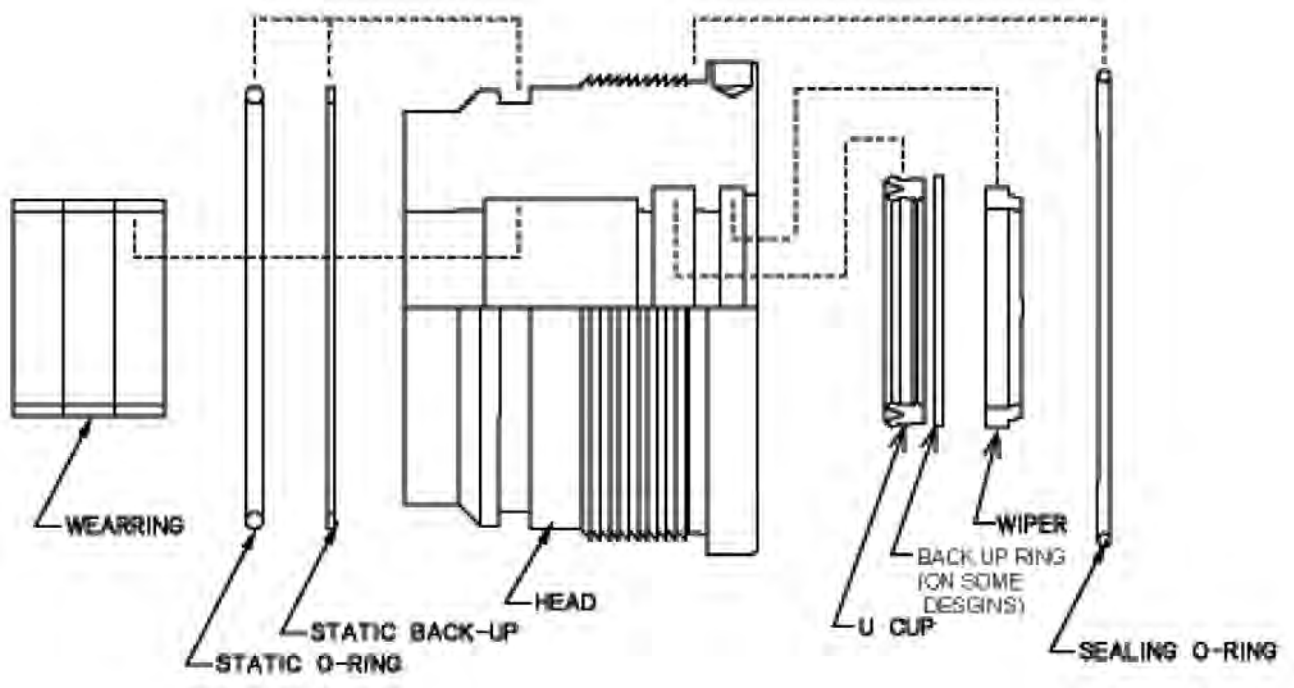


7. Install the retaining ring (Item 237)

Z Head

General

The Z series head uses ductile iron material and has a polyurethane U-cup as the primary sealing element. Cylinders rated for pressures above 3500psi (241.3bar), may have a back up ring behind the U-cup. The wiper is a standard type D polyurethane. The head is retained within the tube by means of its own buttress threads. There is a sealing O-ring that prevents contaminant from reaching the threads and provides an anti-rotation function. General procedures for teardown, inspection and rebuild are contained in the General Procedures Maintenance Manual. Contact Bucyrus if you have any questions.



Teardown

Remove the head as follows: Insert a spanner wrench into the holes provided. Turn the head counter clockwise (it is a right hand thread) to remove it. If the head is difficult to remove or moves erratically, tap the tube adjacent to the head with a brass or plastic mallet while turning it.

Rebuild

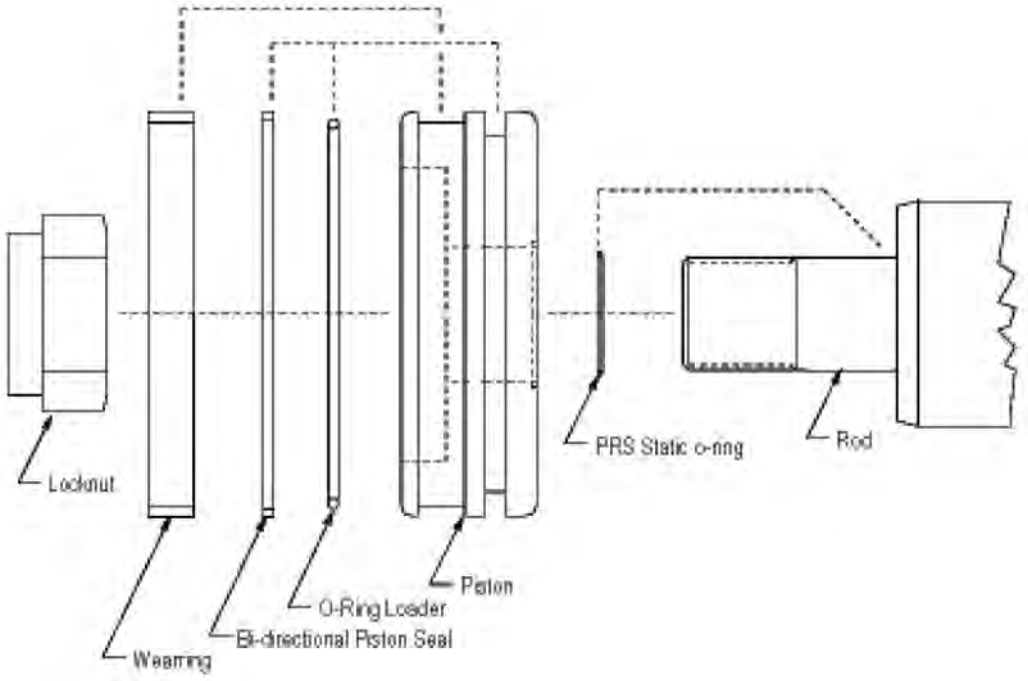
Lubricate the head and all seals with hydraulic fluid prior to installation. Using round nose pliers or special installation tools, twist the dual lip U-cup seal into a 'C' shape and allow it to snap into groove. Use a similar technique for installing the wiper. Install the static O-ring and backup into the static seal groove verifying that the backup is closest to the threads. Install the sealing O-ring into the groove between the threads and the flange lip. If possible, the head/seal assembly should sit for at least one hour to allow the seals to elastically restore.

Slide the head into the tube and engage the threads. Turn the head counter clockwise until the first thread just passes the engagement point (the head will move noticeably) then turn the head clockwise until it is hand tight or fully seated. Insert a spanner wrench into the holes provided and tighten 1/8 to 1/4 turn past fully seated.

N Piston

General

The N series piston uses aluminium material and has both an O-ring energised bidirectional seal and a close tolerance wearing. Cylinders designed for use a pressures above 3500psi may have a back-up ring on one or both sides of the bidirectional seal. See the engineering drawing to determine if your cylinder has this ring and which side of the seal it is located. A small O-ring is used to seal the static side. On some designs it is installed in a groove in the rod, for others, it fits in a groove on the edge of the piston in contact with 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 threaded portion of the rod. Remove the bidirectional piston seal and O-ring loader 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. Remove the wear ring by spreading the ring into a 'C' shape at the split.

Rebuild

Lubricate the piston and all components with hydraulic fluid. Stretch the O-ring loader into the seal groove. Be extremely careful to avoid damaging the seal groove during installation. Scratching the groove may cause bypass leakage. Verify that the rubber O-ring is not pinched or twisted. Start one edge of the bidirectional piston seal into the seal groove. Use your thumb to push the remaining portion of the diameter over the edge of the piston and into the groove. Be very careful not to cut the OD of this seal. Spread the wear ring into a 'C' shape only enough to fit over the outside of the piston and snap it onto its groove.

Jump Starting (cont.)

Precautions

1. DO NOT smoke or use open flame near batteries.
2. DO NOT jump start if the battery fluid is frozen or slushy as the battery may explode. The battery should be warmed to at least 4.4°C (40°F) before attempting a jump start.
3. Jump start only with an external power source, having an electrical system of the same voltage, ground polarity and equipped with battery or batteries of comparable size or larger.
4. DO NOT jump start using motor generator sets, welders or other sources of DC power.
5. DO NOT jump start 24V electrical systems with two 12V batteries connected in series. The current drain will be too high on the 12V batteries possibly causing an explosion.
6. DO NOT permit metal-to-metal contact between the machine and starting vehicle and do not allow jumper cable terminal clips to contact either vehicle as arcing may result in fire or explosion.
7. Use only jumper cables that are clean, in good condition, and are heavy enough to handle the starting current.

Procedure:

1. Turn ignition switch OFF. Turn all accessories OFF.
2. Connect jumper cable to isolator box jump start receptacle on drill. Connect other end of jumper cable to jump start receptacle on source machine.
3. Stand as far away as possible from batteries before actual starting.
4. Charge batteries. The engine will not continue to run after starting if the batteries have not been charged.
5. Start engine. As soon as engine starts, remove jumper cables in reverse order of installation.

1. *Jump start receptacle*

Output Card

The individual outputs on an output card are actually miniature relays with a small current carrying capacity of one (1) amp. The contacts of the relays may burn if a faulty field device or wiring condition occurs. This condition has occurred if the output indication LED light on the card is ON but no output voltage to operate the field device is present on the corresponding output terminal. The LED only indicates that the PLC code is attempting to operate the miniature relay for the corresponding output.

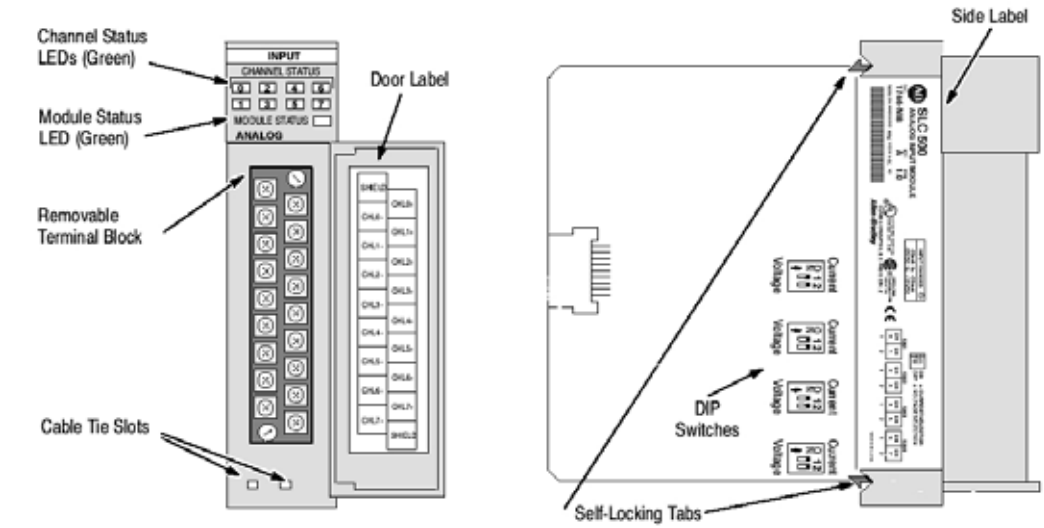
If no output voltage is measured on corresponding output terminal then the output relay (within card) is damaged. Check field device and wiring for faults that could cause a high current situation. Only replace the output card after field fault has been corrected.

Replacing a Faulty Card

1. Turn off power to PLC.
2. Disconnect connector from card (two screws at each end will jack connector from card).
3. Remove faulty card and check if it has any dip switches that need to be set on new card.
4. Set any dip switches if required and install new card.
5. Replace connector and secure with screws.
6. Turn power back on to PLC.

Analog Card Configuration

When replacing an analog card the dip switches must be set correctly (4 or 8 channel card only).



Inclinometers

Two incline sensors (which are mounted under the dash) are used to detect the machine incline angles when tramming. There are two alarm set points.

- Excessive Incline Warning – This warning indication only alarm is preset 2 degrees below machine operating parameters when tramming. The operating parameters vary on type of machine, whether mast is up or down and which direction the drill is facing when tramming up or down an incline.
- Excessive Incline – Tip over Imminent: This shutdown alarm is preset set at an angle of 45 degrees. It is obvious that at this point the Machine will be on its side and the Drill PLC system will automatically shutdown the machine.

The incline sensor is a 4-20mA device and feedback can be measured with a multi-meter.

- 4mA = (-) 80º (degrees)
- 20mA = (+) 80º (degrees).

Inclinometer Setup

To set up newly installed NG4I Inclinometer:

- Machine must be jacked and level to correctly perform Inclinometer setting.
- Connect Inclinometer wiring as per as built Electrical schematics.
- Mount the inclinometer loosely and apply power.
- Slowly rotate the inclinometer and check the indicated angle on the relevant touchscreen display. (Buffering in the PLC will cause the touchscreen incline display to update slowly)
- When the zero point is achieved firmly mount the Inclinometer in that position.

Level Switches

When replacing a capacitive level switch, it is necessary to set the 'zero point'. The level switch should be screwed into a spare adaptor bung and powered up. The zero point can then be set to ignore detecting the adaptor bung. If a spare adaptor bung is not available, then the tank medium must be below the level switch when setting the zero point.

Dust Suppression

Water Injection

Operation

Water Injection (water) solenoid will energise when –

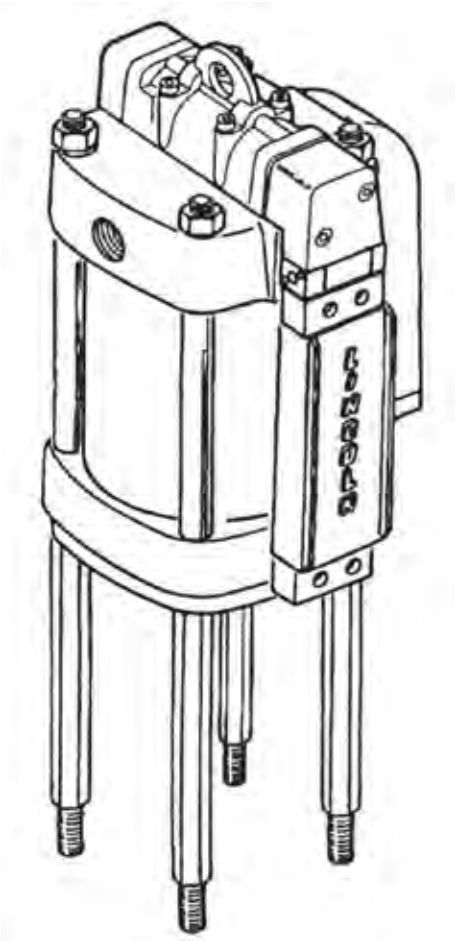
Drill mode selected + engine oil press sw on + Mast raised + Bit Air greater than 20psi + Water Injection switch ON.

Water Flow Control will be enabled when –

Water Injection (water) solenoid is ON + Tank water level is NOT Low.

NOTE: The water flow control module controls the rate of water delivered.

Auto Lube Grease Pump



NOTE: It is the responsibility of the owner and/or operator to properly use and maintain this equipment. Carefully read and understand the instructions and warnings in this manual before operating this equipment.

If the operator is not fluent in English, the instructions and warnings shall be read and discussed in the operator's native language, making sure the operator comprehends the contents. This equipment complies with OSHA standards where applicable.

WARNING: DO NOT exceed the stated maximum working pressure of the air motor 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 pressurised. TIGHTEN all fluid connections securely before using this equipment. ALWAYS read and follow the fluid manufacturer's recommendations regarding fluid compatibility and the use of protective clothing and equipment. CHECK all equipment regularly and repair or replace worn or damaged parts immediately. IMPORTANT: Failure to heed these warnings including misuse, over pressurising, 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.

Specifications

Model	Cylinder Diameter mm (in.)	Effective Piston Area cm^2 (in^2)	Operating Pressure Range psi (bar)	Operating Temp. Range ºC (ºF)	Min. ID or Air Supply mm (in.)	Air Inlet	Air Cons @ 100 psi (7bar) SCF/ Cycle (l(n)/cycle)
84804	108 (4.25)	92 (14)	30-200 (2-14)		12 (1/2)	1/2 NPTF	1.1 (32)
	Max. Recom. Speed CPM	Stroke Length mm (in.)	Weight kg (lb)	Seals Material			
	75	152 (6)	11.7 (26)	Buna-N and *TEFLON			

•Teflon® Seals used with Power Valve Spool (item 13) and Relay Valve (item 17)

Auto Lube Tube Pump (cont.)

NOTE: On models 84997 and 84998 there is an adapter (item 19) between the plunger and connecting rod.

1. To re assemble pump, reverse disassembly procedure (refer to illustration for torque specifications).

Troubleshooting

Problem	Possible Cause	Solution
Pump does not operate.	• Restricted or inadequate air supply. • Obstructed material output.	• Check air supply pressure and air hose diameter (see air motor manual for minimum air supply hose diameter). • Check output line for restrictions.
Erratic or accelerated operation.	• Pup is not primed. • Insufficient material supply. • Material is too heavy for priming.	• Prime pump (see pump priming instructions). • Refill material supply. • Lower output with material valve. Increase pressure to pressure primer (if in use). • Check for inlet restrictions.
Pump operates on DOWN stroke only (missing UP stoke).	• Worn or damaged bushing and plunger (26 or piston check (23, 24 and 26).	• Check and replace if needed.
Pump operates on UP stroke only (missing DOWN stoke).	• Worn or damaged inlet check (34 and 35). • Insufficient material supply. Pump is not in taking enough material to dispense on both strokes	• Check and replace if needed. • Check inlet for restrictions. Lower output with material valve.
Pump is operating but not dispensing material.	• Inlet check (34 and 35) is not sealing or is damaged.	• Check and replace if needed.

Filter Regulator

- Olympian Plus plug in design
- High efficiency water and particle removal
- Quick release bayonet bowl
- High visibility prismatic sight glass*
- Push to lock adjusting knob with tamper resistant option

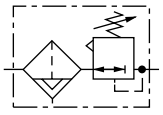
Technical Data

- Fluid: Compressed air
- Maximum pressure:
  – Guarded transparent bowl: 10bar (145psig)
  – Metal bowl: 17bar (250psig)
- Operating temperature*:
  – Guarded transparent bowl: -20° to +50°C (0° to +125°F)
  – Metal bowl: -20° to +80°C (0° to +175°F)

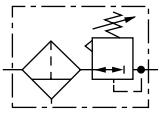
** Air supply must be dry enough to avoid ice formation at temperatures below 2°C (35°F).*

- Partial removal: 5.25 or 40 µm. Within ISO 8573-1, class 3 and class 5
- Typical flow at 6.3bar (90psig) inlet pressure†: 110 dm3/s (233 scfm)
- Automatic drain connection: ISOG1/8
- Automatic drain operating conditions:
  – Drain closes when bowl pressure exceeds 0,7 bar (10 psig) and opens when bowl pressure drops below 0.07bar (1psig).
- Gauge Ports: ISORc 1/8
- Nominal bowl size: 0.2 litre (7 ounce)
- Materials:
  – Body: Zinc
  – Bonnet: Aluminium
  – Standard metal bowl prismatic liquid level indicator lens: Grilamid
  – Valve: Brass
  – Yoke: Zinc
  – Metal bowl: Aluminium
  – Optional metal bowl sight glass: Pyrex
  – Optional transparent bowl: Polycarbonate
  – Element: Sintered plastic
  – Elastomers: Synthetic rubber

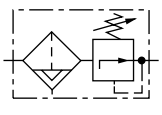
ISO Symbols



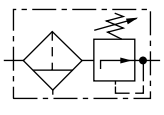
Automatic Drain Relieving



Manual Drain Relieving



Automatic Drain Non-relieving



Manual Drain Non-relieving

Air Operated Pipe Thread Pump (cont.)

Troubleshooting

Of the following procedures do not correct the problem, contact a factory authorised service centre. When submitting equipment to be repaired, be sure to state the nature of the problem and indicate of a repair cost estimate is required.

Problem	Solution
Air motor does not operate.	• Check air supply to pump. • Check for broken trip rod. • Broken toggle or foreign object lodged in priming tube. Check for rust, worn or scored parts.
Air seepage from air exhaust while pump is not operating.	• Check valve slide seat and gasket. Check trip rod packing (236835 and gasket for cut or damaged packing.
Loss of pressure, volume or continuous operation of pump when not in normal use.	• Remove and clean lower inlet checks. Check for foreign material. • Inspect sealing surfaces between upper and lower inlet checks. Replace if rough or pitted. • Replace shovel rod if rough or pitted, Replace shovel rod packing. • Inspect lubricant supply line for leaks and breaks.
Lubricant leaking from weep hole in outlet casting.	• Replace O-ring and U-cup. Make sure gland nut is tight.
Excessive amount of air in lubricant or excessive amount of lubricant coming from air exhaust.	**NOTE: Some lubricant exhausts with air normally.** • Replace gland packing, gland gasket, O-ring and U-cup packing.

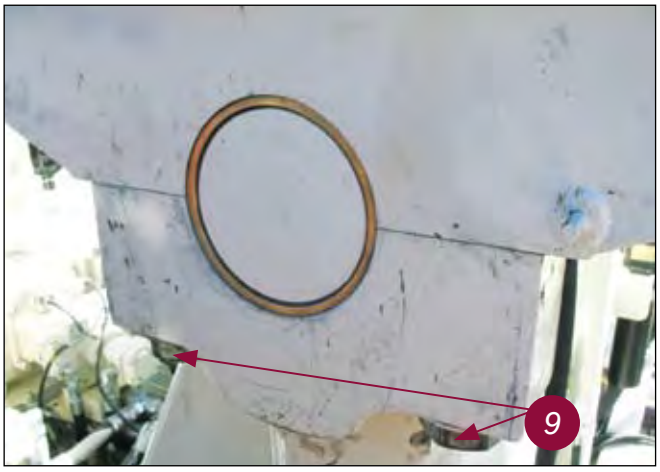
Parts List

1. *Tie rod*
2. *Air piston*
3. *Air piston nut*
4. *Air motor piston rod*
5. *Piston rod connector*
6. *Valve cap*
7. *Trip rod collar*
8. *Trip rod pin*
9. *Trip shoe*
10. *Check washer*
11. *Priming check*
12. *Check stop*
13. *Plunger rod*
14. *Priming plunger*
15. *Priming check seat*
16. *Check seat*
17. *Packing nut*
18. *Packing cap*
19. *Trip sleeve*
20. *Coupling stud*
21. *Coupling adapter*
22. *Coupling nut*
23. *Gland packing nut*
24. *Gland packing spacer*
25. *Packing nut gasket*
26. *Valve cap gasket*
27. *Check seat gasket*
28. *Connector gasket*
29. *Bushing gasket*
30. *Gland gasket*
31. *Pump tube gasket*
32. *Air cylinder gasket*
33. *Gasket*
34. *Air piston packing*
35. *Plunger packing*
36. *Cover gasket*
37. *Gland packing*
38. *O-ring*
39. *O-ring*
40. *Priming check packing*
41. *Slide valve gasket*
42. *U-cup packing*
43. *Outlet body*
44. *Valve guide plate*
45. *Air piston washer*
46. *Gland packing washer*
47. *Plunger packing washer*
48. *Gland packing washer*
49. *Tie rod nit*
50. *Spring*
51. *Spring*
52. *Balls top*
53. *Air cylinder*
54. *Bushing extension*
55. *Pump tube*
56. *Air passage tube*
57. *Ball*
58. *Eye bolt*
59. *Valve slide and seat*
60. *Plunger and bushing assembly*
61. *Trip rod*
62. *Toggle plate*
63. *Cover*
64. *Muffler cover*
65. *Packing washer*
66. *Muffler*
67. *Trip rod packing*
68. *Valve cover screw*
69. *Toggle plate screw*
70. *valve seat bolt*
71. *Extension adapter*
72. *Air valve casting*
73. *Priming tube*
74. *Trip rod packing nut*

A-frame and Pivot Point Maintenance

10hrs/daily – Check mast A-frame for security and damage
– Check mast raise cylinder pins for security/damage
– Check pivot caps for security

500hrs – Check torque on mast mounting caps and shaft pivot caps bolts (970ft lbs) x 16 of
– Check condition of pivot bushes



4. A-frame
9. Mast pivot caps and bolts

Pull Down and Hoist Ropes and Sheaves Maintenance

Daily/10hrs – Check there is sufficient amount of lubrication to all sheave bearings
– Check condition and adjustment of ropes hoist / pulldown

NOTE: If more than 10strands per metre are found to be broken then the cable is to be replaced.

250hrs – Check / adjust pull down and hoist ropes as required

500hrs – Check travelling sheave's tie plate bolts for security
– Check and refill uniquip lubricators on travelling sheaves
– Check security and split pins on pull down and hoist rope clevis's

Rotary Head Maintenance

10hrs/Daily – Check rotary head mounting bolts for security
– Check for leaks
– Check oil level in sight glass

250hrs – Check / replace rotary head wear pads / shim's

500hrs – Drain / refill rotary head oil (85W/140, 76 litres)
– Check rotary head spindle for end float
– Re-torque rotary head mounting bolts
– Change swivel seals if they have not been changed out in the 500hrs previous to current service 1000hrs

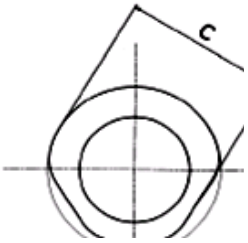
100hrs – Re-torque pre-load on spindle bearings in rotary head (pre-load .002"-.004")

2000hrs – All previous checks to be carried out as required by maintenance schedule

Track Inspection and Wear Limit Guide (cont.)

B7 Track Inspection and Wear Limit Guide SKS-W Series Drills

Master Bushing



New C	10%	20%	25%	30%	40%	50%	60%	70%	75%	80%	90%	100%
LH 71.40	71.0	70.6	70.4	70.2	69.9	69.3	68.8	68.3	68.0	67.7	67.1	66.5
RH 71.40	71.0	70.6	70.4	70.2	69.9	69.3	68.8	68.3	68.0	67.7	67.1	66.5

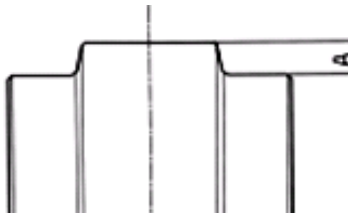
Comments:

Track Pad

New A	10%	20%	25%	30%	40%	50%	60%	70%	75%	80%	90%	100%
LH 30.5	28.5	26.5	25.5	24.5	22.5	20.5	18.4	16.4	15.3	14.3	12.1	10.0
RH 30.5	28.5	26.5	25.5	24.5	22.5	20.5	18.4	16.4	15.3	14.3	12.1	10.0

Comments:

Idler Assembly



New A	10%	20%	25%	30%	40%	50%	60%	70%	75%	80%	90%	100%
LH 24.0	24.5	25.1	25.4	25.7	26.3	27.0	27.7	28.4	28.8	29.3	30.1	31.0
RH 24.0	24.5	25.1	25.4	25.7	26.3	27.0	27.7	28.4	28.8	29.3	30.1	31.0

Comments:

Isolation Information

- Park the machine on a level surface.
- Rack rods and lower the head.
- Turn the key switch off.
- Turn the battery isolation switch to off as per the isolation regulations.

WARNING

- Confirm the isolation by attempting to start the machine at the key-switch

Safety Procedures

WARNING

- Always use a spotter when locating the drill in the workshop or a confined area.
- Always CHECK that maintainers are clear of the drill during testing.
- Always look up and CHECK for overhead power lines before raising the mast.
- Always CHECK for hydraulic leaks with a piece of cardboard and gloves, DO NOT USE YOUR BARE HANDS.
- Always CHECK that the oil pressure has been discharged before dismantling hydraulic hoses and lines.

Lubricants

Reservoir	Specified Capacity Litres	Refill Capacity Litres
Engine Oil Pan	85	85
Hydraulic System	1150	1150
Compressor Tank	159	159
Compressor System	172	172
Pump Drive Gearbox	13	13
Rotary Head	75.7	75.7
Final Drive (Left and Right)	10.5 (each)	10.5 (each)
Water Injection Pump	0.95	0.95
Air (lube) Pumps	0.25	0.25
Thread Lube	20	–
Auto Lube System - Grease	115	–
Auto Lube Canisters	125 ml	–
Coolant	182	182

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

Checks
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 all lights. 3. Compressor, CHECK main control regulator pressure 125psi. Adjust only if required. 4. Compressor, CHECK pilot control regulator pressure 50psi. Adjust only if required. 5. Water pump pressure. Low pressure units 150psi. 6. Air conditioner – CHECK operation. 7. Auto lube system – CHECK operation. 8. CHECK pulse valves for operation in dust collector unit. 9. CHECK voltage. 10. CHECK operation of all gauges.	

Lubrication and Maintenance Chart - 2000hr

Lubrication Service		
1. Park the machine on a level surface 2. Rack rods and lower the head 3. Shut down engine 4. Relieve all hydraulic system pressure 5. Relieve all pneumatic (air system) pressure 6. Isolate the machine		
Item	Task	Comments and Initials
1	***Engine Oil Filters*** 1. Drain and replace engine oil. 2. Change engine oil filters. 3. CHECK for oil leaks.	
2	***Engine Fuel Filters*** 1. Drain engine fuel water trap. 2. Change primary fuel filter. 3. Change secondary fuel filters. 4. Drain sediment from the fuel tank.	
3	***Engine Cooling System*** 1. CHECK coolant, level / leaks. 2. CHECK radiator cap condition. 3. CHECK coolant level. 4. CHECK the condition of the radiator and clean if required. 5. CHECK system for any coolant leaks.	
4	***Engine Air Cleaner*** 1. Remove primary element. 2. Remove the secondary element. 3. CHECK induction pipe-work for dust intrusion. 4. Fit air cleaner protection plugs. 5. Remove the vacuator cups (1 used). 6. Clean the air cleaner housings. 7. Change the safety element. 8. Fit clean primary elements. 9. Clean the cups and refit. 10. Clean engine breather.	
5	***Hydraulic System*** 1. CHECK hydraulic filter indicators (these may pop when the fluid is cold). 2. DRAIN AND REPLACE the hydraulic oil. 3. Clean the hydraulic tank. 4. Change charge system filters and O-rings. 5. Change return oil filters and O-rings. 6. Change hydraulic loop filters and O-rings. 7. CHECK hydraulic hoses for oil leaks or abrasion damage. 8. CHECK hydraulic oil level. 9. Change hydraulic tank breather.	