Technical Manual

Contents

Notes

Maintenance

- Be sure two personnel are present when performing live service work (machine running), both fully trained and competent in the safety issues. One person shall supervise from the operator's position and have immediate access to an emergency stop in all situations. Visual, audible or verbal communication signals must be established and understood by both personnel prior to the commencement of work.
- Each person must be adequately trained to perform service and maintenance procedures.
- Place warning or danger tags and locks (or as per the site requirements) on starting controls to alert personnel that someone is working on the machine and disconnect battery before making repairs or adjustments to the machine.
- Be sure to have adequate lighting when performing service work at night.
- Relieve pressure on hydraulic or pneumatic systems before loosening connections or parts.
- Be sure the machine and components are well supported before servicing or replacing parts.
- Always maintain metal-to-metal contact between the fill nozzle and the fuel tank when filling the tank. This will prevent sparks and the possibility of an explosion.

Battery Isolation Station

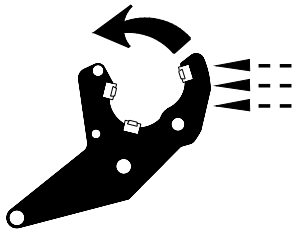
Danger Tag

- Do not strike the bit, or the drill pipe, with a hammer. Use only proper tools to make repairs or adjustments.
- Do not weld or grind near oil lines and always ensure the batteries are isolated prior to welding on the machine.
- Do not attempt to remove the radiator cap when the engine is hot or has overheated.
- When servicing the batteries, do not smoke or use an open flame near the batteries. Batteries can give off hydrogen, which is a highly explosive gas.
- Be sure no tools or other loose objects are left on the engine, the drive mechanisms or the drilling platform as they could be thrown by this equipment with a powerful force.

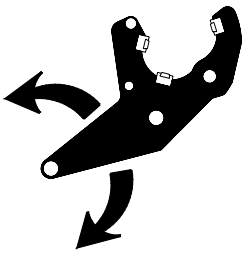
If all or part of the equipment is shipped to a new destination, always include a complete instruction manual or a copy of the following topics:

- Safety section
- Operation instructions including:
  - Pre-start checks
  - Start up
  - After start checks
  - Shutdown procedure
  - Propelling machine
  - Emergency procedures

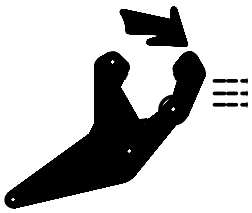
Graphic Symbol Legend



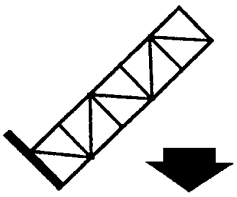
Hydraulically Operated Breakout Wrench (HOBO) – CLAMP



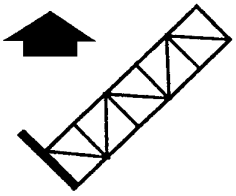
Hydraulically Operated Breakout Wrench (HOBO) – SWING



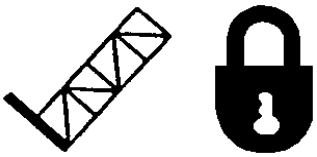
Hydraulically Operated Breakout Wrench (HOBO) – REVERSE



Mast – LOWER



Mast – RAISE

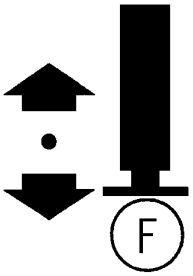


Mast Lock

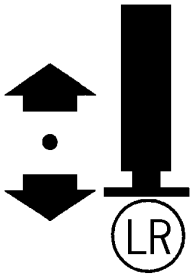
Ignition – ON

Ignition - OFF

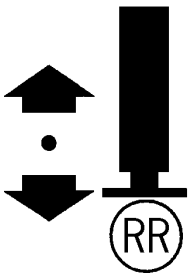
Main Air



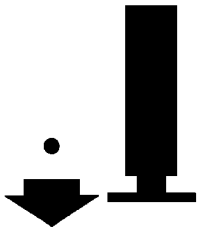
Jack – FRONT



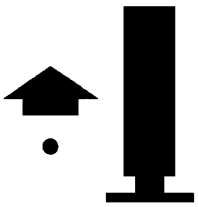
Jack – LEFT REAR



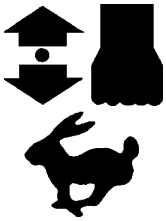
Jack – RIGHT REAR



Jack – DOWN

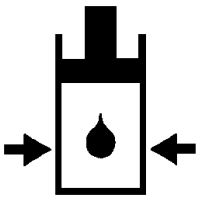


Jack – UP



Hoist/Pulldown – RAISE and LOWER

Winch – RAISES and LOWERS HOOK



Hydraulic System Pressure

Fuel Level

Switch Panel (cont.)

26. Hydraulically Operated Break-Out Wrench (H.O.B.O) – Swing

The break-out wrench is used to undo tight thread connections. This switch is used to swing the break-out wrench into or away from the drill pipe.

- Push and hold switch up to swing break-out wrench out.
- Push and hold switch down to swing break-out wrench in.

27. Hydraulically Operated Break-Out Wrench (H.O.B.O) – Clamp

The break-out wrench is used to undo tight thread connections. This switch is used to clamp and unclamp the break-out wrench and to turn the wrench.

- Push and hold switch right to disengage (open) break-out and unclamp wrench.
- Push and hold switch left to clamp wrench and engage (close) break-out.

28. Drill Pipe Guide

29. Central Lube Test Switch

- Push switch to run central lube system for 30 seconds.

30. Water Injection / Dust Collector

This switch is used to engage the water injection or dust collector systems to control drilling dust.

- Push switch up to engage water injection system.
- Push switch down to engage dust collector system.

31. Trap Door / Viewing Hatch

This is so that the drill operator can view the rod to ensure that he commences drilling in the correct spot (i.e. view the markings on grid) also it enables the operator to view his drilling cuttings to ascertain what ground is currently being drilled, i.e. if drilling in a coal field and the cuttings turn black coal has been reached and drilling needs to stop.

32. Dust Curtain (Optional)

Switch is used to raise or lower the dust curtain at the rear of the machine.

- Push and hold switch up to lift dust curtain.
- Push and hold switch down to lower dust curtain.

33. Mast Lock

WARNING: BE SURE to visually check to see that the mast lock pins are fully engaged in the holes in the mast before drilling. Also be sure pins are fully retracted from holes before lowering mast.

Switch UNLOCKS or LOCKS mast in the vertical or angle drilling positions.

- Push and hold switch left to unlock (retract) mast pins.
- Push and hold switch right to lock (engage) mast pins into mast.

34. Drill Pipe Loader – Swing

This switch is used to swing the drill pipe loader out from and into the center of the mast when adding and retracting drill pipe and for storing the drill pipe loader when propelling or lowering the mast.

35. Drill Pipe Loader – Rotate

This switch is used to rotate the drill pipe loader left or right to the next position.

- Push and hold switch left to rotate drill pipe loader left.
- Push and hold switch right to rotate drill pipe loader right.

Propelling the Machine (cont.)

NOTE: A rig angle alarm is fitted to the machine. The side / side and length angles of the drill are pre-set into the Vigilante system. The angles are set so that they are a few degrees under the maximum tilt angle of the drill. This gives the operator prior warning that he could be approaching a dangerous situation. The operator can then look at better approach angles for the drill or notify superiors to have the drill pad better prepared. Applicable when machine has this option.

To stop propelling the machine once at the work site, move the propel levers back to the neutral position. Select the DRILL mode with the drill/propel switch to assure the parking brake is applied.

WARNING: Always select drill mode once propelling functions is completed as the drill mode engages the parking brake. Never leave the machine unattended unless the drill / propel switch is in the drill mode. Failure to follow these procedures could result in personal injury or property damage caused by the unit running away.

Stability Limits

The position of the centre of gravity changes when the mast is raised or lowered. When the mast is lowered, the weight of the mast is distributed towards the front of the machine

Refer to the relevant stability limit guide inside the cab of the machine before tramming. If the limits are unclear please contact your nearest Bucyrus dealer before tramming.

Included in the following pages are generic limits for the various models that can be used as a guide only for this tramming procedure.

NOTE: The transient stability limits are approximate values only to be used as a guide and not intended as a recommendation for acceptable operation. Actual limits will be based on mast length, size and quantity of drill pipe, optional equipment, fluid levels, ground conditions and operator skill and experience.

To correctly evacuate the system proceed as follows:

1. Check the compressor suction and discharge service valves are both open, i.e. midway between being fully front-seated or fully back-seated.
2. Attach the manifold gauge set to the compressor service vales. Close the manifold set hand valves.

NOTE: Ensure that the manifold gauge set hoses are equipped with 'dill depressor' fittings to enable opening of the Schrader valves.

3. Connect the service (centre) hose on the gauge set to the intake port on the vacuum pump.
4. Ensure that the vacuum pump discharge valve is closed.
5. Switch the vacuum pump on and open the hand valves on the gauge set. Open the vacuum pump discharge valve after the vacuum pump has started. Low pressure gauge should quickly pull down to 0.5mm Hg. of vacuum on the low side gauge of the manifold gauge set.
6. Evacuate for five minutes then close both hand valves and switch off the pump. If the low pressure gauge holds a steady vacuum for five minutes, that is a good indication there are no leaks in the system.
7. Switch on the pump and open the hand valves on the gauge set. Evacuate for a minimum one hour.
8. When the evacuation is complete close both hand valves, switch off the pump and disconnect the service hose from the pump.
9. Fully back-seat both compressor service valves.

2.6 System Charging

The charging operation should be performed at air temperatures of 21ºC and above. Changes in ambient air temperatures, and to a lesser degree humidity, will affect the systems ability to take a charge and will vary gauge readings. Refer to the 'Temperature/Pressure Chart' in Section 4.1 (Table 4.1.1) for the suggested pressure readings in the ambient temperatures being experienced during system charging.

When adding partial charge to a system it is not necessary to discharge and evacuate if there is no evidence of air in the system and there are no system leaks.

NOTE: Up to 0.2 kg of refrigerant loss per year is considered normal. Operating the unit periodically during the off-season will lubricate system seals and reduce the possibility of refrigerant loss.

To correctly charge the system refer to fig. 2-3 and proceed as follows:

1. Install gauge set and purge hose if a partial charge is to be added. Gauge set should already be installed and holding a vacuum if a full charge is to be added. The manifold hand valves should be closed.
2. Loosely connect the charging line from the cylinder of R134a refrigerant to the manifold gauge set.
3. Ensure that the charging line connection to the cylinder is fully secured and that the cylinder stands vertically upwards, to ensure that only refrigerant vapour can be charged into the system.

WARNING: DO NOT invert the R134a container. Liquid refrigerant entering the low side of the system will permanently damage the compressor.

4. Crack the cylinder valve sufficiently to purge the charging line and then tighten the charging line connection onto the manifold.

4.2.8 Thermal Expansion Valve Is Obstructed

Unless the expansion valve is properly protected by a strainer or filter, foreign matter may obstruct the valve port. If the obstruction is small, the resulting operation will be much the same as though the valve were under sized as described in 4.2.7 above. If the obstruction holds the valve open during shutdown, the operation will be as described in 4.2.2 and 4.2.3. An obstructed expansion valve is usually indicated by a partly warm evaporator.

4.2.9 Shortage Of Refrigerant

A shortage of refrigerant will be initially indicated by bubbles in the sight glass. Frequently there will be a hissing or whistle at the expansion valve. The coil and suction line will be relatively warm while the suction pressure will be low due to little or no liquid being supplied to the evaporator if the shortage is severe.

4.2.10 Overcharge Of Refrigerant

An overcharge of refrigerant will cause high head pressure. Liquid will back up in the condenser and decrease the amount of surface available for condensing and as a result the head pressure will rise. In extreme cases, it may rise to a point where high pressure cut-out will stop the compressor. This may result in 'short cycling', (compressor cycles too frequently).

4.2.11 Air In System

If air or other non-condensible gases are present in the system, they will tend to move toward and collect at the condenser. The head pressure will rise to a point above the pressure corresponding to the temperature at which the vapour is condensing. In extreme cases, the pressure may rise to a point where the high pressure cut-out may stop the compressor.

4.2.12 Broken Valves In Compressor

Broken or leaky discharge valves in a compressor are generally indicated by the suction pressure rising rapidly as soon as the machine is stopped. If the suction pressure rises faster than 13 kPa per minute, it is an indication that the compressor discharge valves are not holding. Before the compressor is opened, however, it should be determined that the pressure rise is not due to other causes such as a leaky expansion valve.

4.3 Fault Diagnosis For Electronic Thermostat

Refer Electrical Schematic Drawing AE271515 or AE271551

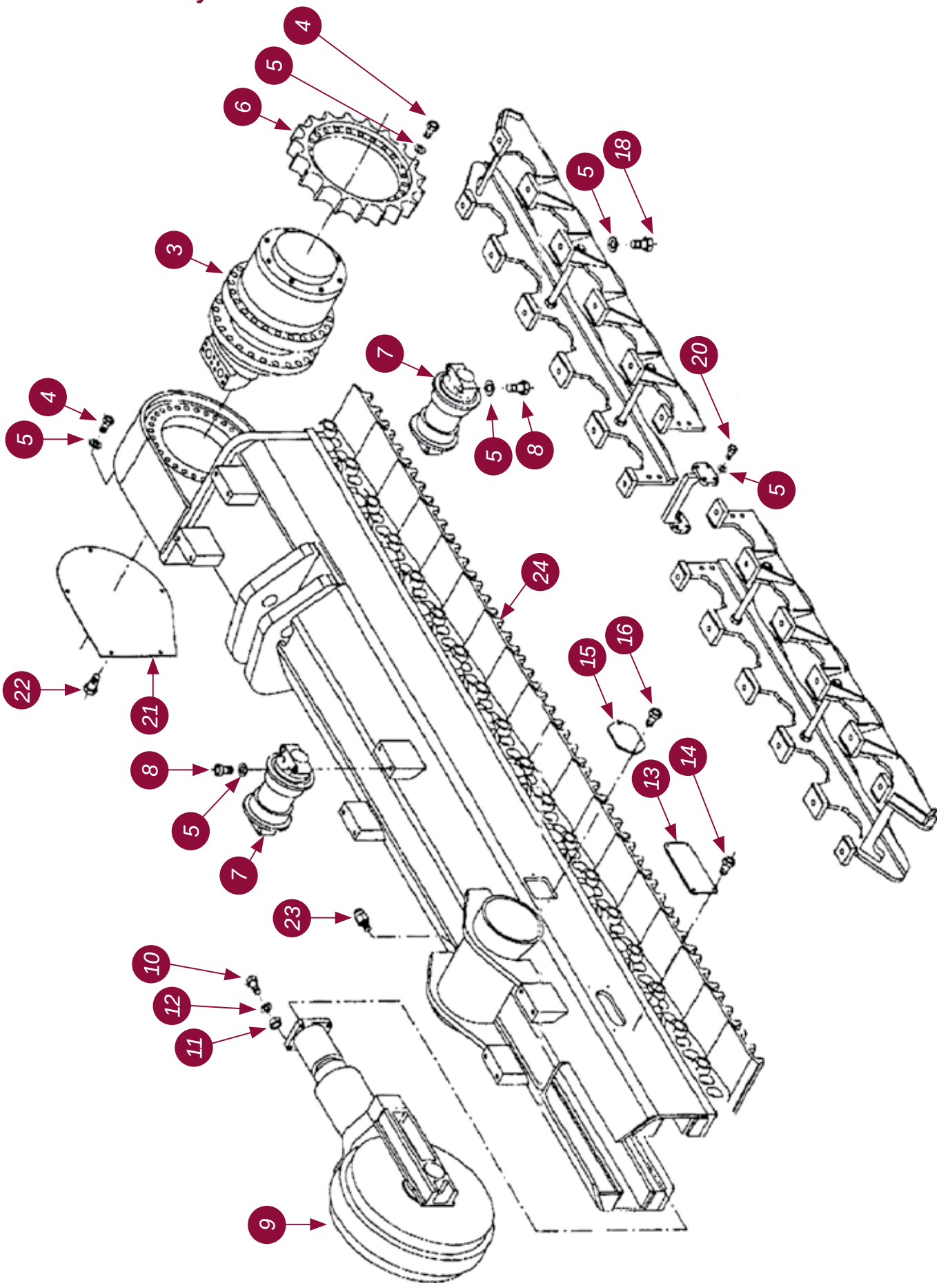
As this is a fully sealed item it cannot be field checked for correct operation and should be returned to Sigma if suspected to be faulty. It is unlikely that the thermostat will fail due to internal causes and therefore external wiring should be checked prior to deeming if failed and especially when replacing with a new unit.

4.3.1 Cautions

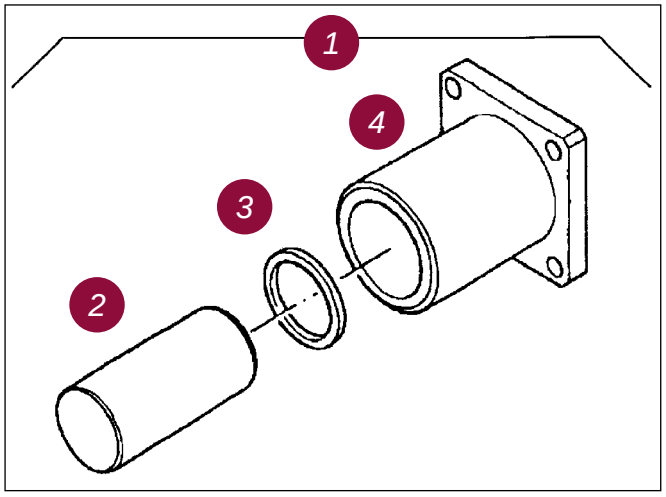
i. Always disconnect thermostat when testing circuit continuity or faults
ii. Always check all wiring prior to replacing a blown thermostat.
iii. Thermostat switches earth; internal contacts are NOT voltage free.
iv. Connecting output wires (blue, white) to power supply connects power to ground through thermostat and will blow internal two switches.
v. Never connect shield from potentiometer to earth.
vi. If circuit breaker (CB3) has tripped, check for wiring fault prior to replacing. Bridging or increasing circuit breaker rating voids warranty.

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).

Crawler Assembly



B-7 Crawler Assembly



Hydraulic tensioner assembly

1. Hydraulic tensioner complete
2. Piston
3. Groove seal
4. Cylinder

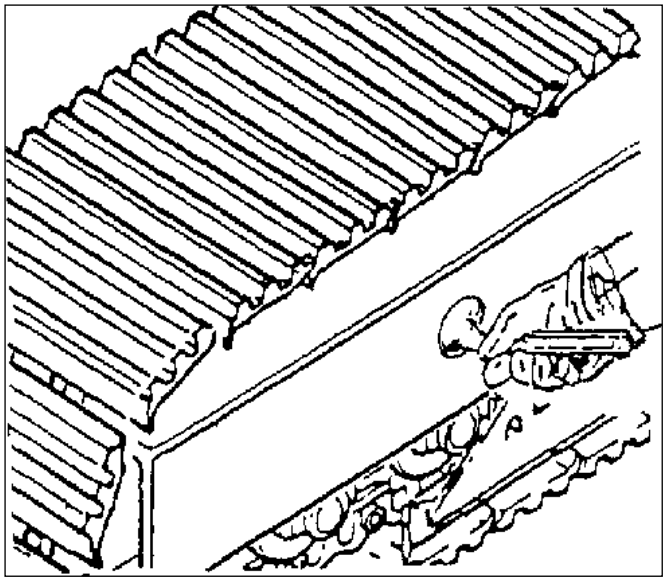


Fig. 3-5 Release track tension

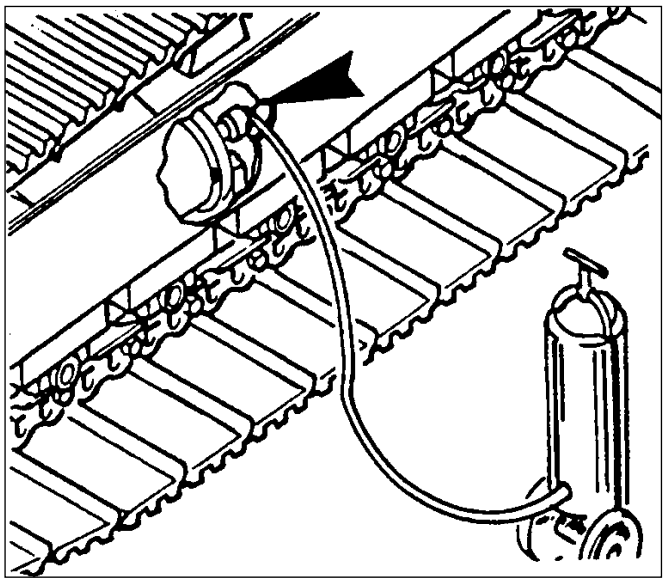


Fig. 3-6 Increase track tension

Hydraulic Tensioner

Proper Track Tension

If chain is too tight, it will cause increased wear of the bearings at the front idler and drive sprocket. Also, wear will be increased at the bushings and pins of the track chain.

If chain is too loose, it will not fit properly on the idler and the chain will slide when tramming the machine. This sliding will cause rapid wear of the chain links.

To Check Tension:

- Lay a straight edge across top of tracks between support roller and idler or support roller and final drive sprocket. The unsupported distance must be at least 1m (3ft).
- Measure track sag at mid-point. It should be about (25-30mm).

If track is too tight:

1. Remove access cover plate on track side frame and loosen grease relief valve one turn maximum (fig. 3-5). If track does not loosen after opening the grease relief valve, move the machine forward and backward until tension is released, then tighten grease relief and adjust as required.
2. Replace access cover plate.

If track is too loose:

1. Remove access cover on track side frame and attach a grease gun to the grease fitting located inside the hole on the side of the track (fig. 3-6). A special adapter is required for this. Adaptor for greasing V014664.
2. Pump grease in until the track chain is properly adjusted. Do not over tighten the track.
3. Replace access cover plate.

Repair

Normally the hydraulic tensioner is not repairable.

If the cylinder is grooved, it will not seal and the entire unit must be replaced.

Track Shoe Bolt Torque (Torque Turn Method)

Bolt Torque KN111

Range of applications: 1. Bolt torque for grouser shoe acc. to supply specifications.

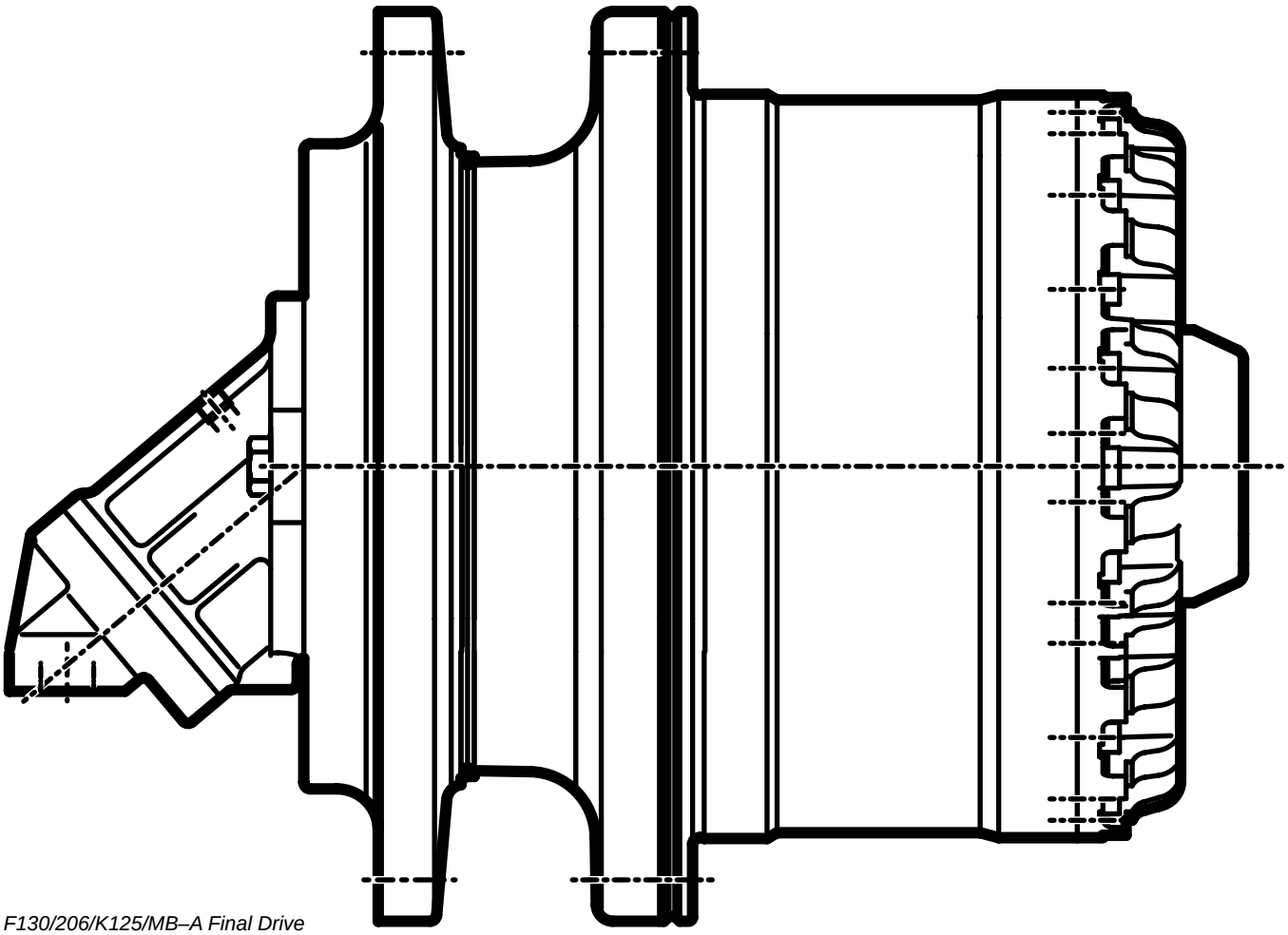
2. a. Data on this page applies only to torque turn method.
   b. Initial torque (data from chart 2) plus an add. 1/3 turn.

Thread metric	Bolt torque	
	Ma = Nm	Ma = ft lbs
M10 x 1	30 ± 5	20 ± 5
M12 x 1	50 ± 10	35 ± 10
M14 x 1,5	80 ± 20	60 ± 15
M16 x 1,5	180 ± 30	130 ± 25
M18 x 1,5	260 ± 40	190 ± 35
M19 x 1,5	320 ± 40	235 ± 35
M20 x 1,5	300 ± 40	220 ± 35
M24 x 1,5	440 ± 50	325 ± 35
M30 x 2	850 ± 70	625 ± 50
M32 x 2	1000 ± 80	740 ± 60
M36 x 2	2270 ± 120	1670 ± 90

Unified fine Thread	Bolt torque	
	Ma = Nm	Ma = ft lbs
7/16" – 20UNF	40 ± 5	30 ± 5
1/2" – 20UNF	60 ± 10	45 ± 10
9/16" – 18UNF	90 ± 20	65 ± 15
5/8" – 18UNF	180 ± 30	130 ± 25
3/4" – 16UNF	320 ± 40	235 ± 35
7/8" – 14UNF	350 ± 60	255 ± 45
1" – 14UNS	520 ± 60	385 ± 45
1 1/8" – 12UNF	760 ± 70	560 ± 50
***7/8" – 14UNF**	650 ± 70	480 ± 50
***1" – 14UNS**	870 ± 70	650 ± 50

*These values are only for bolts in connection with semicircular nuts.

F130 Final Drive



F130/206/K125/MB–A Final Drive

General Description

The transmission should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out transmission cleaning accurately by removing oil/grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized etc. as they could affect proper functioning of the transmission.

Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-ring, oil seals) should be examined carefully, as they are subject to major stress, wearing and ageing. We advise replacing the seals after each maintenance or repair operation.

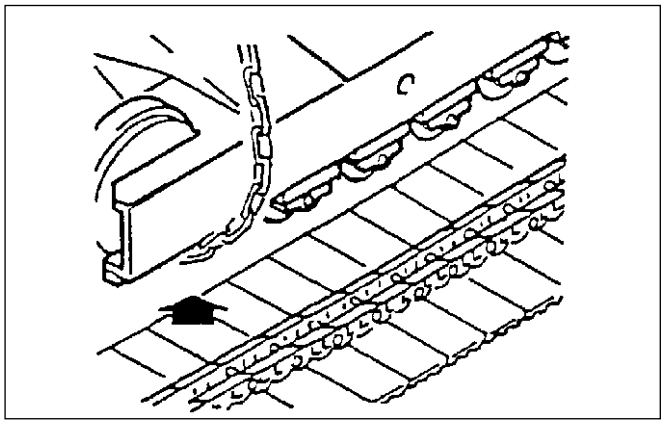
Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and Imperial tools for the others.

Please read the disassembly instructions very carefully because some operations are destructive for some transmission components and that means that they should be replaced with new ones, because when dismantled, they are destroyed.

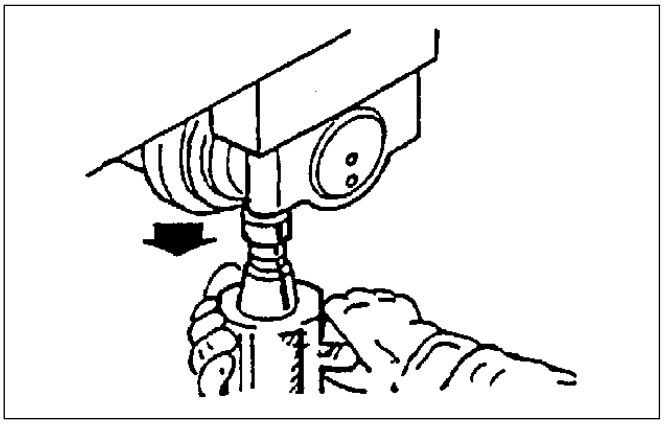
Please read carefully the description of the single steps, to avoid compromising the good operation of the whole unit.

Track Roller – Removal and Disassembly

1. Release track chain tension, by loosening the grease fitting on the track tensioner. Refer to 'Track Tension Adjustment' at the front part of this section.
2. Using and adequate lifting device, lift crawler frame off of track chain high enough to gain access to the track rollers for removal. Support track frame with an adequate support so it can not fall.
3. Clean all dirt and debris from track rollers.
4. Remove attaching bolts and remove track roller from frame. If track frame is fitted with a chain guide, it will have to be removed first.
5. To disassemble track roller, refer to 'Track and Support Roller – Assembly' instructions and carry out procedure in reverse order.



Track Frame – Lift



Track Roller – Remove

Support Roller – Removal and Disassembly

1. Release track chain tension, by loosening the grease fitting on the track tensioner. Refer to 'Track Tension Adjustment' at the front part of this section.
2. Using an adequate lifting device, lift the track chain up off the support roller. Support track chain so it cannot fall.
3. Clean all dirt and debris from support rollers.
4. Remove attaching bolts and with an adequate lifting device, remove support roller from frame (fig's. 3-29 and 3-30).
5. To disassemble support roller, refer to 'Track and Support Roller – Assembly' instructions and carry out procedure in reverse order.

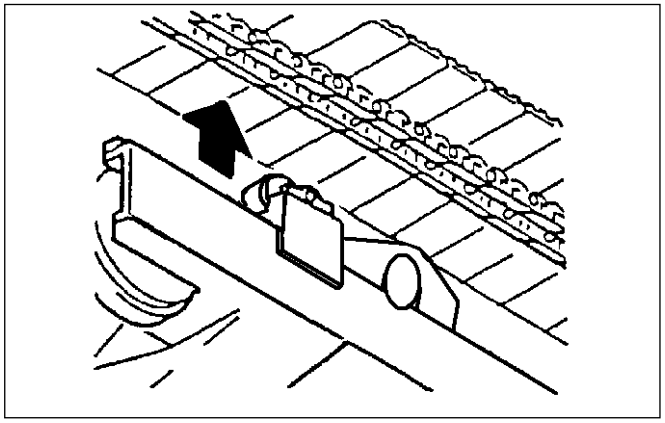


Fig. 3-29 Support Roller – Lift Track

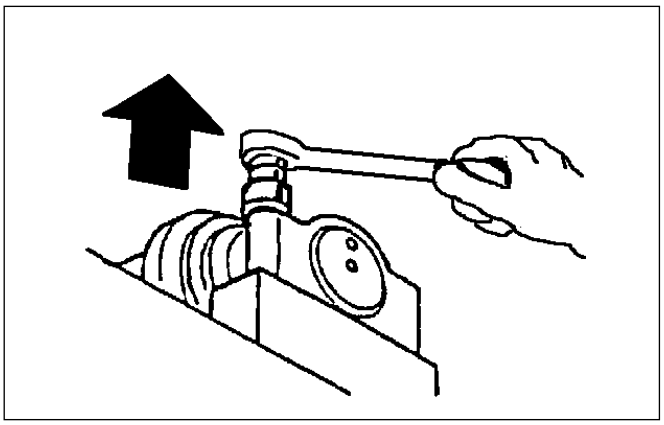
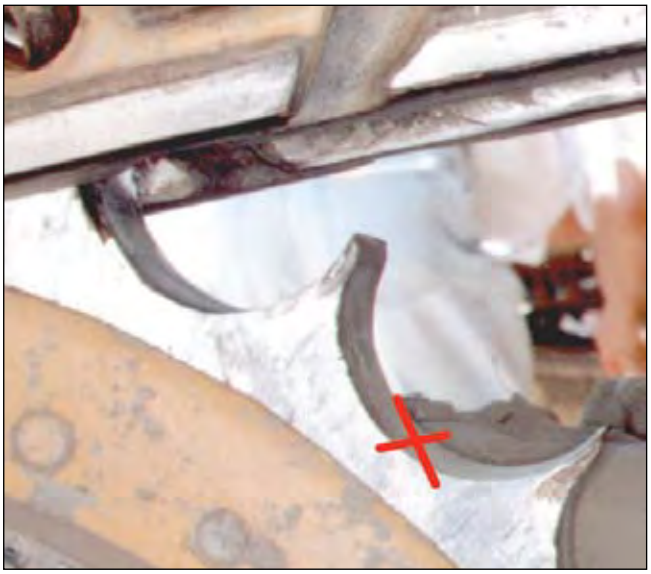


Fig. 3-30 Support Roller – Remove

Sprocket Wear Patterns (cont.)

Root Wear

Wear in the tooth bottom.



Causes:

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

Effects:

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

Remedies:

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

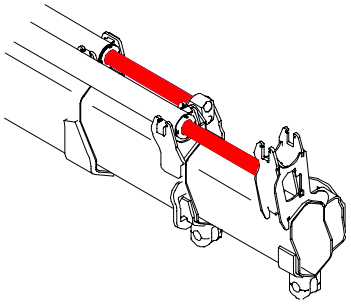
Lubrication (cont.)

CAUTION: Surplus grease is a source of accidents caused by slipping and also contaminates the environment.

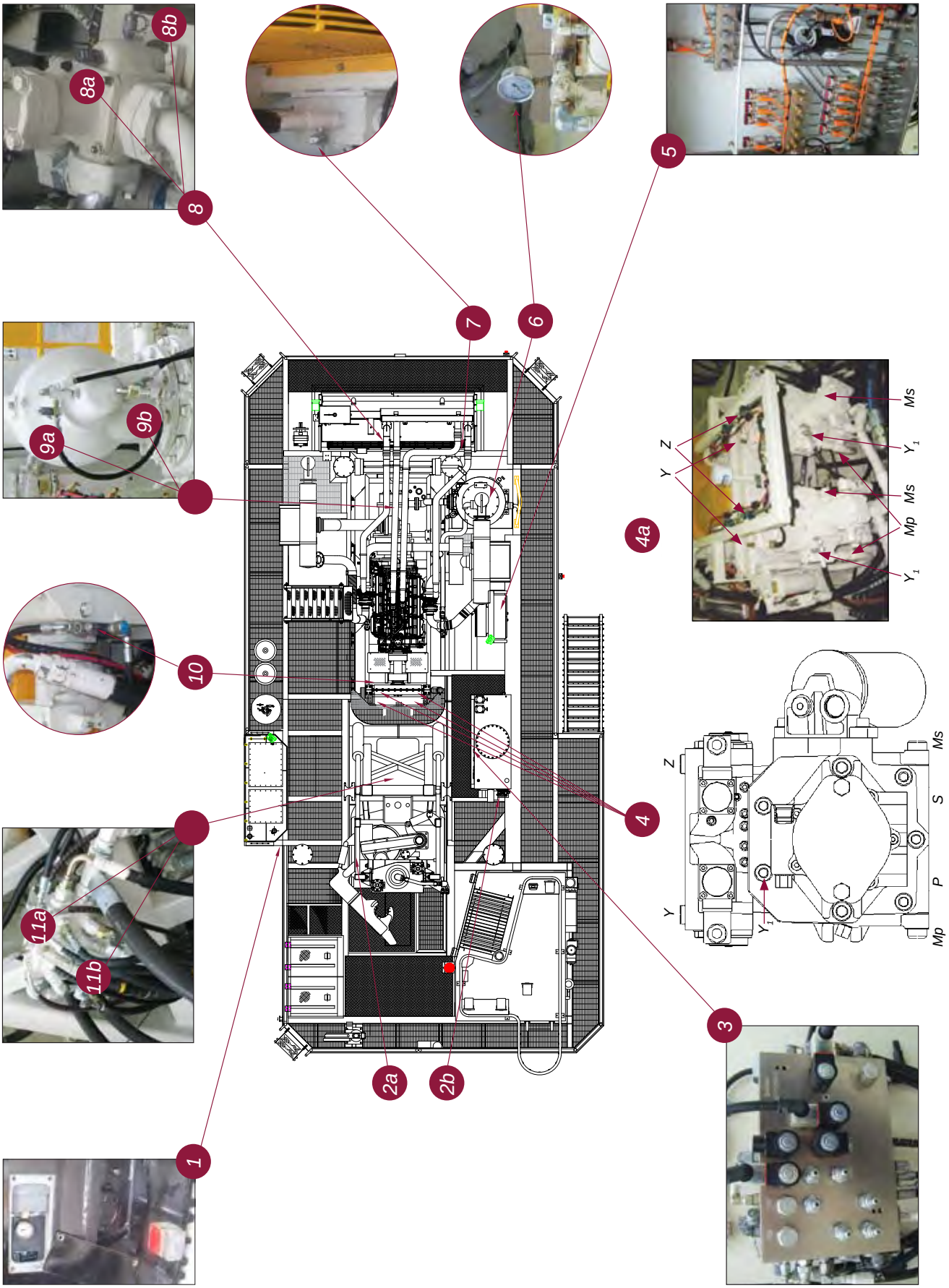
As most of the lubrication points on the crane involve lubrication loss (grease is consumed or enters the environment), we recommend the use of biodegradable greases.

Care of extendable cylinder piston rods

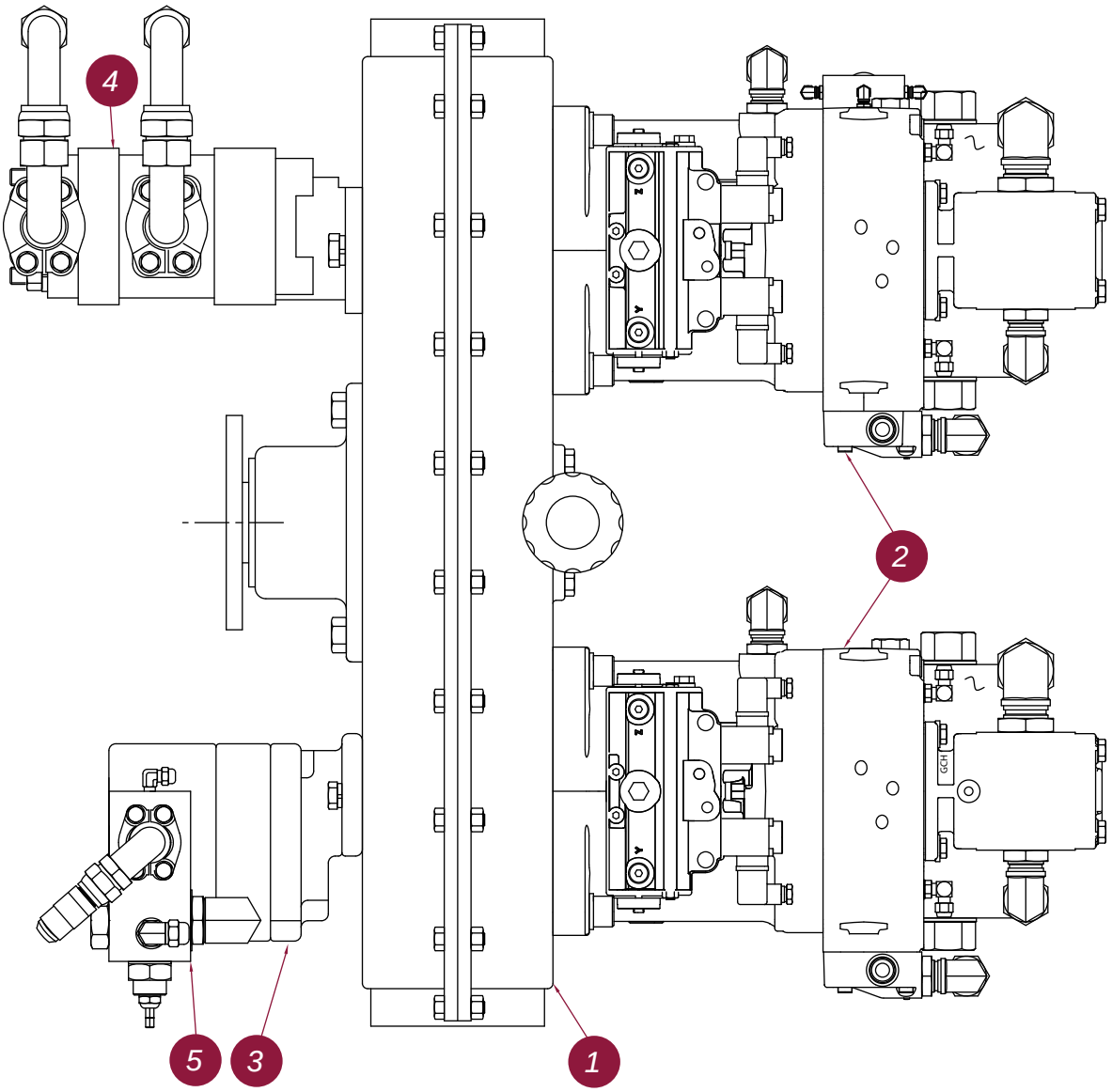
If the extendable arms are never completely retracted to the transport position the extendable cylinder piston rods may suffer oxidation. The extendable cylinders (extendable arms) must therefore be completely retracted once a month.



Test Point Locator



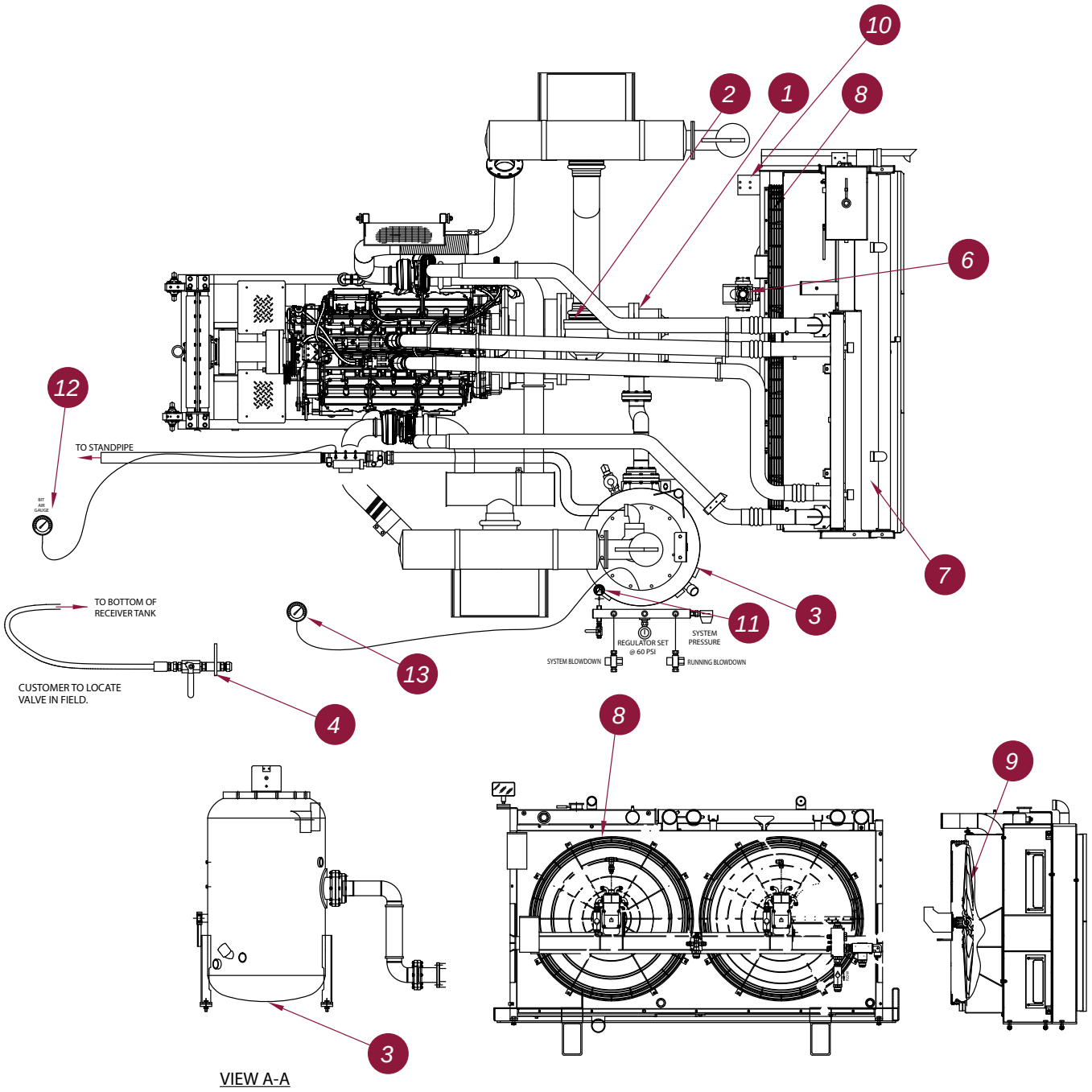
Pump Drive Assembly



Pump Drive Assembly

1. *Gear box – pump drive*
2. *Main pump – closed loop SKS*
3. *Pump, gear fan*
4. *Pump, gear double*
5. *Valve, relief*

Compressor Installation



2000cfm / 100psi Compressor Installation

1. *Compressor air end*
2. *Poppet inlet valve*
3. *Receiver Tank*
4. *Oil Drain Valve*
5. *Air Gauge*
6. *Thermal bypass valve*
7. *Oil cooler assembly*
8. *Fan guard*
9. *Fan*
10. *Compressor oil filter gauge*
11. *Air pressure*
12. *Bit air pressure gauge*
13. *Receiver tank pressure gauge*

Compressed Air Functions (cont.)

The compressed air/fluid mixture enters the sump. Change of direction and reduction in velocity by the air/fluid mixture results in larger droplets of fluid to falling to the bottom of the sump. The fractional percentage of fluid remaining in the compressed air collects on the surface of the final separator element as the compressed air flows through the separator. As more and more fluid collects on the element surface, the fluid descends to the bottom of the separator. A return line (or scavenge tube) leads from the bottom of the separator element to the gearcase of the compressor unit. Fluid collecting on the bottom of the separator element is returned to the compressor gearcase. An orifice (protected by a strainer) is included in this return line to assure proper flow.

The sump is ASME code rated at 150psig (10.34bar) as required by operating pressure. A minimum pressure valve is located downstream from the separator to assure the required minimum receiver pressure during all conditions. This pressure is necessary for proper fluid circulation and air/fluid separation.

A pressure relief valve (located on the wet side of the separator) is set to open if the sump pressure exceeds system rating. Also, a switch will shut down the compressor when the discharge or interstage temperature exceeds normal operating range. This is to be wired into the vigilante control. Fluid is added to the sump via a capped fluid fill opening placed low on the tank to prevent overfilling the sump. A sight glass enables the operator to visually monitor the fluid sump level. The proper fluid level is halfway of the sight glass when unit is shutdown. DO NOT OVERFILL.

WARNING: DO NOT open the fluid fill cap when the compressor is pressurised. Shut down the compressor and bleed the sump to 0psig before removing the cap.

Compressor Cooling and Lubrication System, Functional Description

Refer to 'Compressor Fluid Circuits' on following pages.

The compressor cooling and lubrication system is designed to provide adequate lubrication as well as maintain the proper operating temperature of the compressor. For lubricant life, run the lubricant and discharge temperature as low as possible. However, depending on the inlet temperature and relative humidity of the air entering the compressor inlet and the discharge pressure of the compressor, the compressed air can have water condense in the fluid separator.

Compressor oil temperature must maintain an operating temperature hot enough to vaporise any water introduced through the compressor inlet, 82.2-98.8ºC (180ºF-210ºF).In a climate with high relative humidity this temperature needs to be at the higher side of the scale to prevent water ingress. This temperature must be maintained in the receiver tank not the discharge temperature. In addition to a cooler and fan, the system consists of a fluid filter, thermal valve with pressure bypass valve and fluid stop valve.

Fluid is used in the system as a coolant and a lubricant. The fluid is housed in the receiver/sump upon start-up, the temperature of the fluid is cool and routing to the fluid cooler is not necessary. The fluid flows to the thermal valve from the sump.

The thermal valve has two entrance ports and two exit ports. The entrance ports will be referred to as Port A and Port B. Port A accepts fluid from the sump and Port B accepts fluid from the cooler, Port C sends fluid to the cooler, Port D sends fluid to the compressor. Ports B and D are connected together internally.

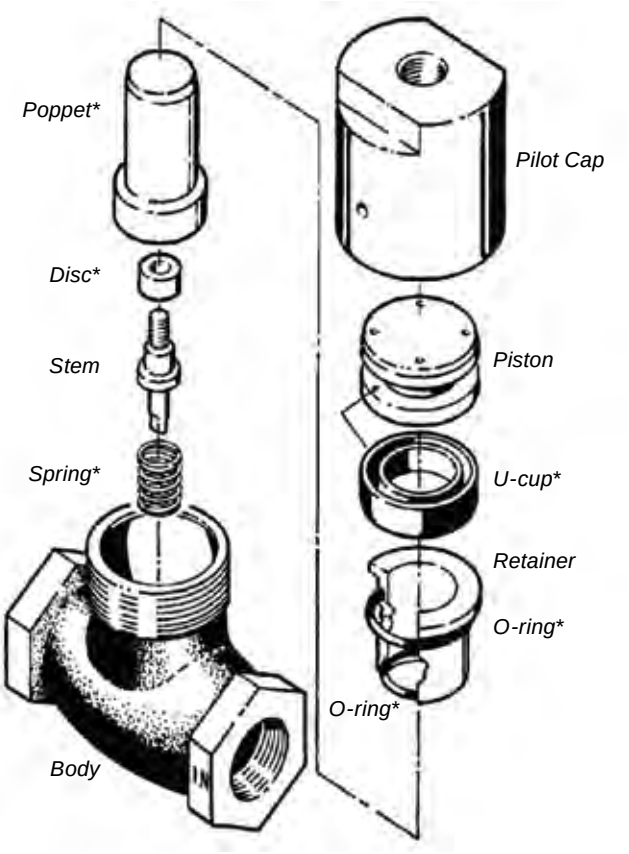
System Blowdown Valve

This is a 2-way normally opened (NO) valve that is piloted closed from the same pilot line that opens the oil stop valve. When the compressor firsts starts up the system blowdown is piloted closed which allows the receiver to build up pressure. When the compressor is shut down the valve opens and vents any remaining receiver pressure. The system blowdown valve will stay open until the compressor starts up again.

When necessary to make repairs on the system blowdown valve use repair kit and follow the instructions provided below.

System (Shutdown) Blowdown valve

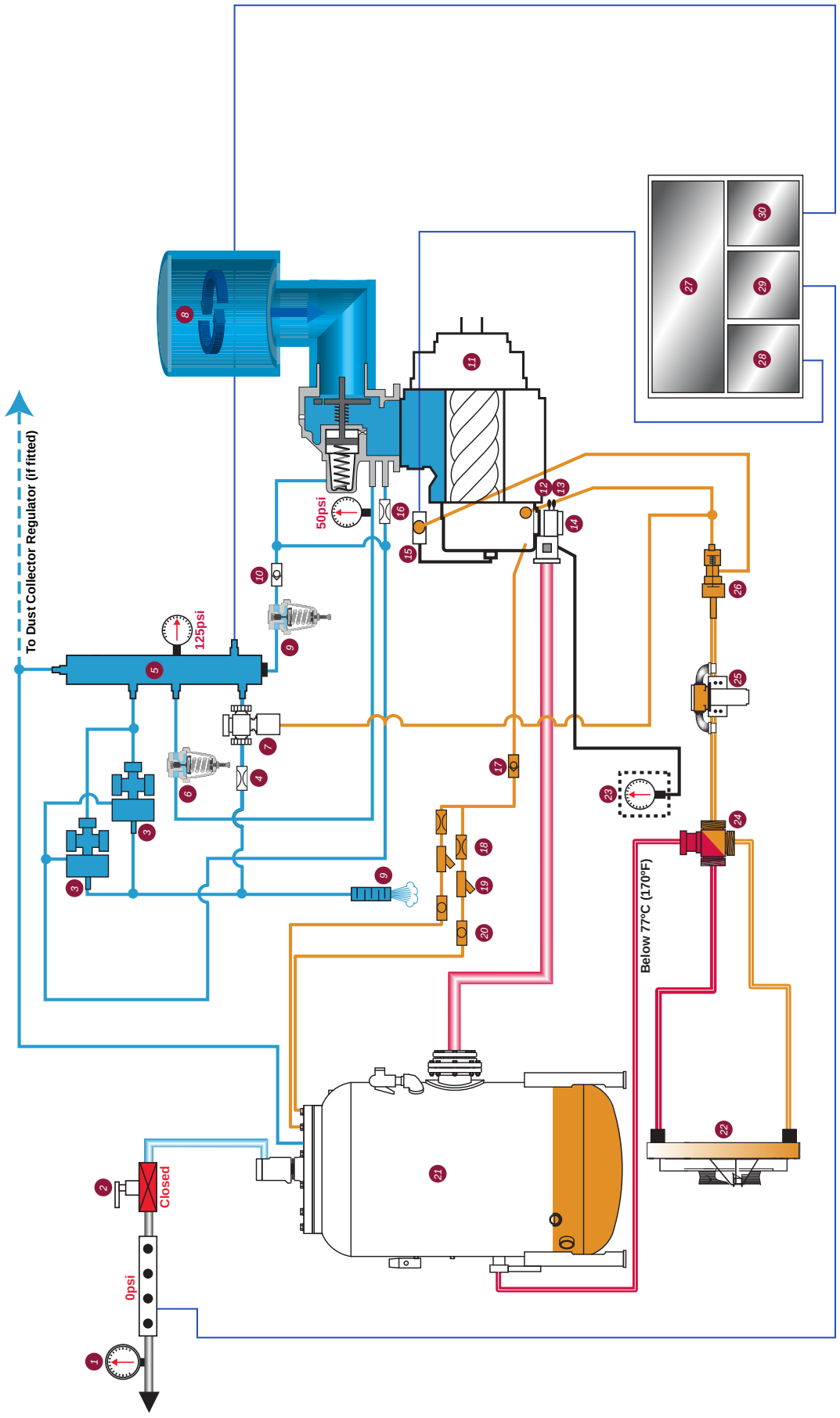
1. Remove the pilot cap and push the piston out of the pilot cap.
2. Remove the U-cup from the piston and replace it with the new one provided in the kit. Lubricate the U-cup with Parker Super O lube or an equivalent quality silicone grease.
3. Thoroughly clean the cap. Place the piston (with the U-cup in position) in the cap so the recessed centre is showing at the valve body end of the cap.
4. Pull the retainer, poppet and spring out of the valve body. Discard the spring and separate the poppet from the retainer.
5. Remove the O-rings from the inside and outside diameters of the retainer.
6. Unscrew the stem portion of the poppet to allow removal of the disc. DO NOT mar the machined finish of the poppet when screwing the stem.
7. Remove the disc and replace it with the new one provided.
8. Replace the stem portion and tighten securely.
9. Clean the poppet and retainer thoroughly.
10. Replace the O-rings in the retainer and lubricate thoroughly with the silicone lubricant used above
11. Place the poppet in the retainer as it was prior to separating it.
12. Clean the valve body and place the new spring in the valve body.
13. Place the poppet and retainer back in the valve body and replace the pilot cap.
14. Tighten the pilot cap securely with a wrench and the shutdown blowdown valve is ready for operation.



NOTE: * Indicates item is in repair kit

Compressor Control Set-up Vented Poppet Inlet – Run Unloaded

Compressor Air Circuit 2000cfm @ 100psi Vented Poppet Inlet



Separator Elements – Remove and Replace

WARNING: Be sure to relieve pressure from hydraulic and pneumatic systems before loosening parts or connections.

Refer to fig's. 4-5 and 4-7 for item listings.

1. Be sure pressure is relieved and system has cooled down before starting any work.
2. Tag and remove piping connected to receiver tank cover. It is not necessary to remove the minimum pressure valve (17).
3. Loosen the two flex tube connectors, then tag and remove the primary and secondary oil return tubes (18 and 19).
4. Remove the twelve capscrews and lock washers that secure the cover to the receiver tank. Pry up on the cover to break the seal between the cover and separator gasket. Use the boom to swing the cover to one side. Be sure to let the edge of the cover rest on the flange of the tank to help support it (fig. 4-6).
5. Lift out the primary and secondary separator elements.
6. Clean the surface of the receiver tank flange of any old gasket material, being careful not to let anything fall into the tank. Do the same with the underside of the cover.
7. Install new primary and secondary separator elements with bonded gaskets.

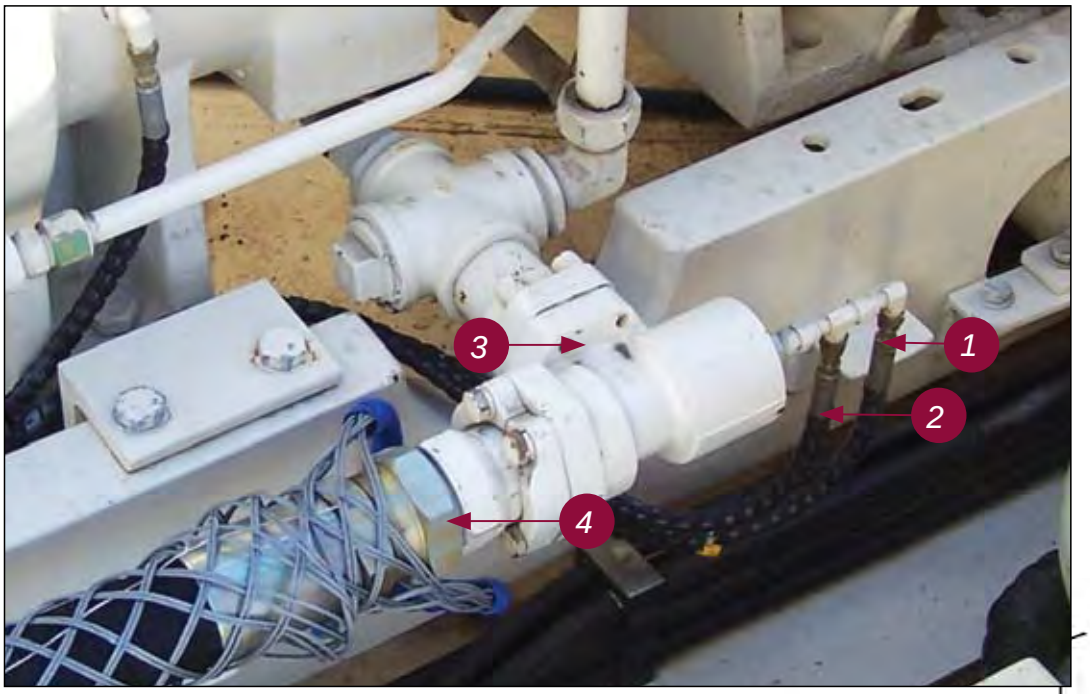
NOTE: DO NOT use a gasket sealer.

WARNING: Be sure the metal staples that hold the gasket to the separator element make contact with the metal of the receiver tank flange and cover. If this is not done, the separator element will not be grounded and a fire could result.
DO NOT REMOVE THE STAPLES

8. Swing cover back into place and install the twelve capscrews and lock washers finger tight. Tighten capscrews evenly in a criss-cross pattern in 4 to 5 steps. Always tighten capscrews alternately at opposite sides of the cover. Torque capscrews to standard torque specifications found in Section 9 of this manual.
9. Install the primary and secondary oil return tubes (18 and 19). Carefully push the tubes all the way down to the bottom of the separator, then lift up not more than 1.6mm (1/16"). Tighten the flex tube connectors.
10. Make sure the orifices are clear, and clean return line strainer (if equipped).
11. Make the remaining connections that were removed and be sure all connections are tight.

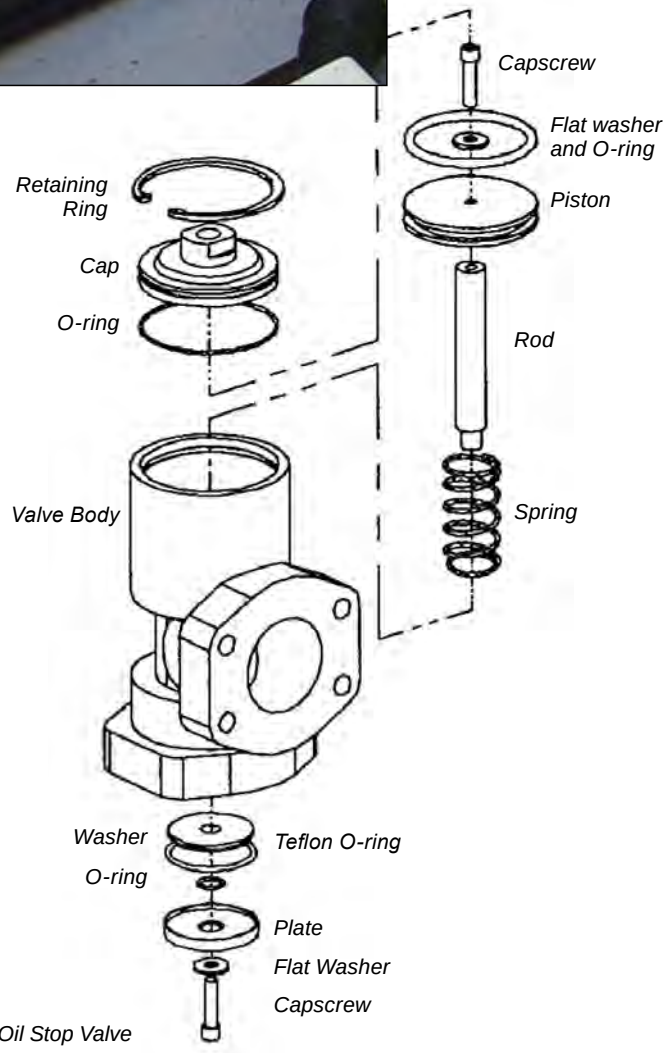
Oil Stop Valve

Compressor oil flows from the compressor oil filter, through the oil stop valve, through a manifold and onto the compressor to lubricate its various parts, such as bearings. The oil stop valve is normally closed and is piloted open at start up. Its pilot comes from the discharge of the compressor. When the compressor first starts up the air pressure created pilots open the oil stop valve open and allows flow through to the compressor. Therefore in order to provide the oil needed for lubrication, air pressure is needed.



Compressor Oil Stop Valve

1. *Pilot pressure from discharge opens valve*
2. *Pilot also supplies pressure to close shutdown blowdown*
3. *Oil stop valve*
4. *Oil from discharge/cooler/filter returning into compressor*



Compressor Oil Stop Valve

Internal Cleaning (cont.)

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

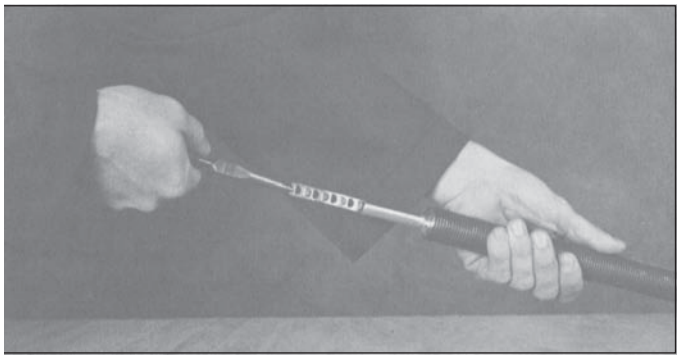
Clean and flush the tube with a high pressure washer. Blow off with air and make sure tubes are thoroughly dry.

Replace the turbulator by pushing the turbulator through the short, unfinned end of the tube (see fig. 5). Push the turbulator far enough into the tube to allow for recrimping.

NOTE: Depending on tolerances 'pushing' the turbulator into the tube may cause kinking. An alternative would be to use a piece of wire with a hook on the end. The turbulator can be pulled into place from the long unfinned end of tube.

Crimp both ends of the tube using tool and a hammer (see fig. 6). Lightly tap, forcing the end closed far enough to hold the turbulator securely in place. (Again, care should be taken not to mushroom the tube ends.)

Finally, check the tube ends for burrs, etc. Lightly buff the tube ends or use a fine emery cloth to remove any debris. Make sure the tube ends are wiped clean prior to installing. Follow the installation procedures to complete the job.



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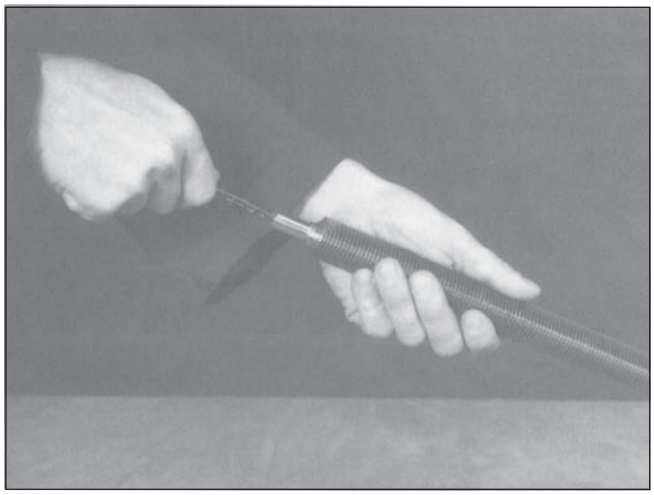


Fig. 5

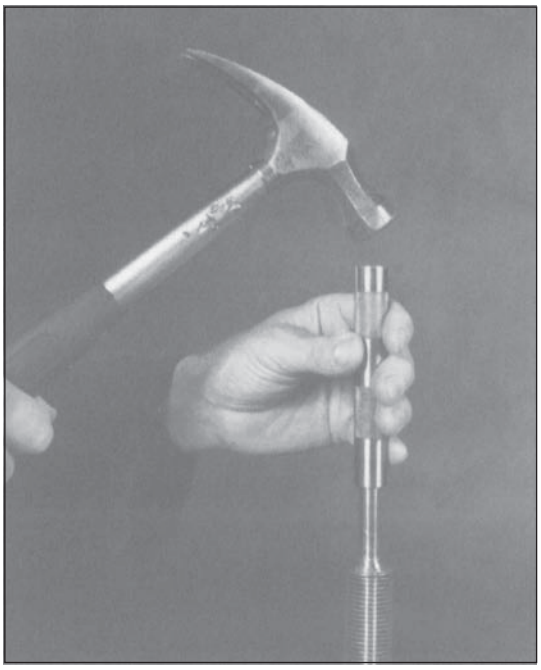


Fig. 6

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).

Water Pump

Pump Specifications

Stroke	---	1”	Oil Capacity	---	1.13 litres (1 quart)
Oil type	---	SAE 30	LPM (GPM)	---	40.9 (9)
Direction of rotation	---	either	Maximum Pressure	---	550psi (38bar)
Number of pistons	---	2	rpm	---	500
Crankcase material	---	Cast iron			

Torque Requirements

Valve chamber studs	15ft lb	Conn rod nuts	7ft lb
Rear cover hhcs	15ft lb	Packing assembly nut	10ft lb

Servicing Instructions

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

General Care of the Pump

a. Drain and refill the pump crankcase with clean SAE 30 API service classification MM or better oil after the first 50 hours of operation, thereafter, every three months the oil should be changed.

b. Keep all piping and mounting bolts tight.

c. Replace all worn parts promptly with bean genuine replacement parts.

d. The water relief valve mounted on the discharge of the water pump should be set 50psi (3.5bar) higher than air pressure in order to inject water into the air stream e.g. low pressure = 150psi (10bar), high pressure = 400-450psi (27-31bar) and mega pressure = 550psi (38bar).

Water Injection Pump

Care in Freezing Weather

NOTE: Precautions must be taken to avoid damage to the pump from liquid allowed to freeze in the valve chamber.

a. Drain all connecting piping.

b. Remove capscrew, clamp, valve cover and valve disc and spring to drain the valve chamber when freezing temperatures are expected. Remove 'top' discharge valves or raise them to be sure that no liquid is trapped under the 'inner' suction valves.

Servicing the Plunger Packings

1. Release the valve chamber from the pump case by removing the three capscrews.
2. Lift the chamber free of the cylinders. Remove the capscrews, cup washers and plunger packings.
3. Lift the cylinders from the pump case.

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).

Hoist / Pulldown Cylinder

1. *Pulldown rope adjustment*
2. *Hoist / pulldown cylinder retaining nut*
3. *Spacer*
4. *Hoist / pulldown cylinder*
5. *Hoist rope adjustment*
6. *Sheave mounting bracket*
7. *Sheave bracket mounting bolts*
8. *Travelling sheave*
9. *Chock bars*
10. *Nut*

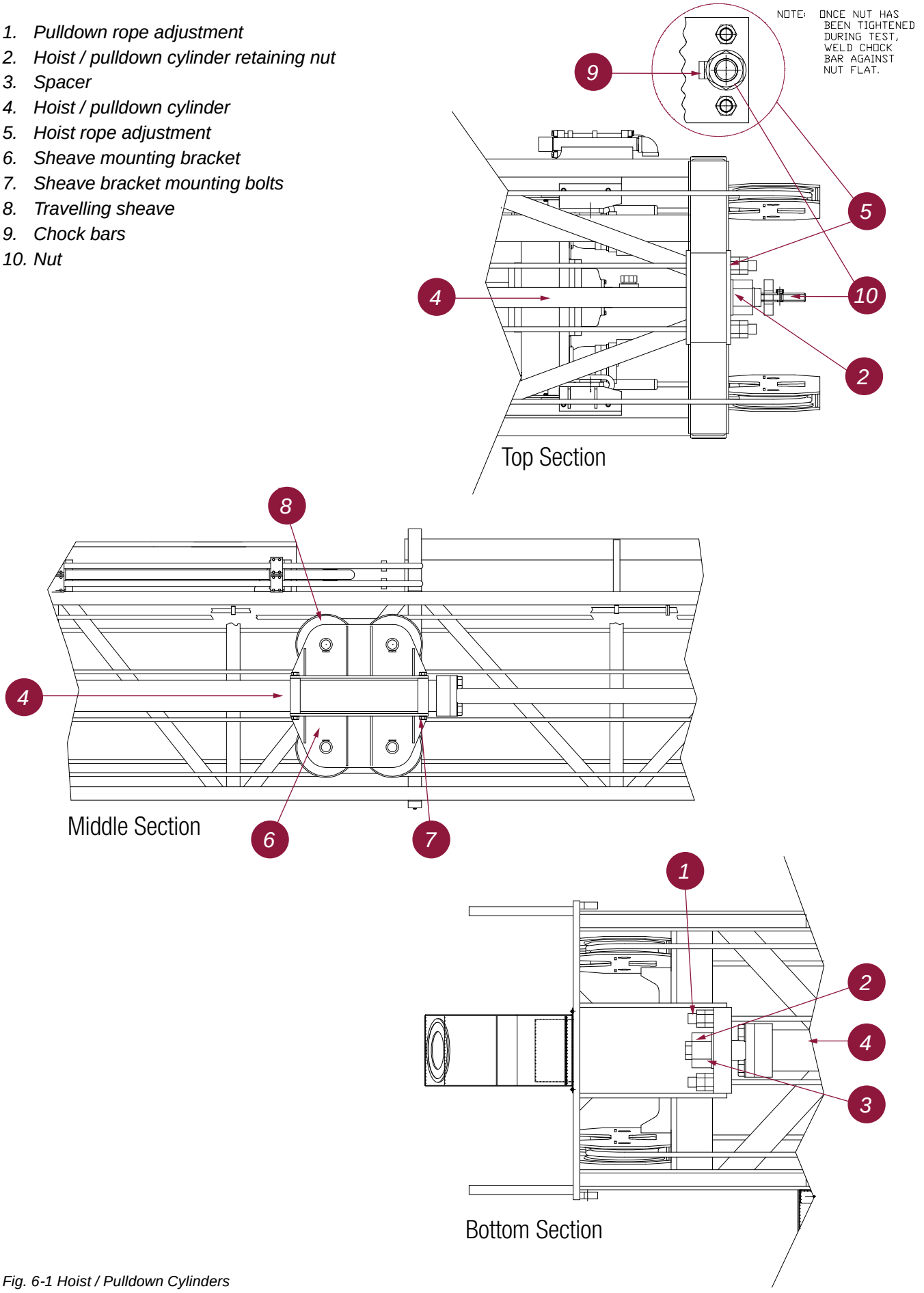


Fig. 6-1 Hoist / Pulldown Cylinders

Rotary Head Guide Alignment

NOTE: Hoist and Pulldown cables MUST be correctly adjusted, before attempting to align rotary head

The following method is used to align the rotary head in relationship to the travel rails in the mast assembly:

Spot and level the machine and raise the mast as in preparation for normal drilling operations. Before drilling the hole, check to be sure pipe is plumb with a level on the pipe. Check this reading against level in cab to be sure they are the same. Drill one pipe into the ground. At the completion of this pass, raise the rotary head just enough to suspend the drill pipe in the hole, approximately 600mm (2ft).

Check alignment of the pipe in the drill bushing. It should be hanging in the centre without touching the sides of the bushing. If it is touching, loosen the hex head screws attaching the wear pads to the rotary guide assembly (fig. 6-8).

If shimming of the rotary head guide is necessary, add or subtract the necessary amount of shims between the pads and guides until the drill stem hangs freely within the drill bushing. Retighten the guide / pad screws.

Follow the sequence below: (refer fig 6-9)

1. Shim the inside wear pad first.
2. Shim the front wear pad (towards the radiator end of the machine).
3. Shim the rear wear pad (cab end of machine).

Wire Rope (cont.)

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

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

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

The length and type of service and the severity of operation must be taken into consideration before determining the disposition of a wire rope which shows signs of damage. Where failure might endanger life of equipment, the rope must be condemned and replaced if any of the following conditions are discovered (refer fig 6-13):

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

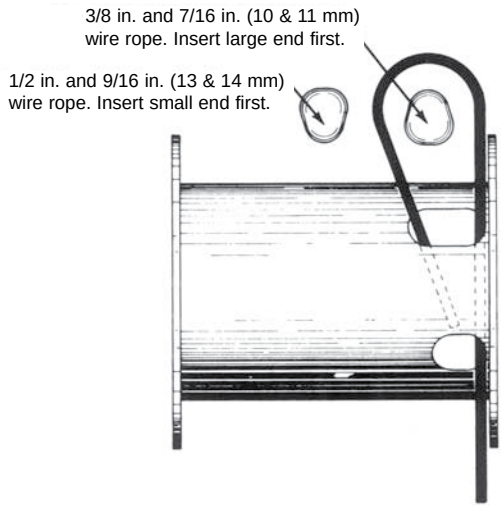
When any of the above conditions exist, the wire rope must be condemned and replaced. Procedures for the proper socketing and seizing of wire rope are pictorially shown in AS2759-2004 Steel Wire Rope.

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

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

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

Wire Rope Installation



NOTE: Standard cable anchor or wedge shipped with the winch will anchor 3/8 to 9/16" wire rope. For 1/4 and 5/16" wire rope, use part no. 24119. For 5/8 and 3/4 poly rope ONLY, use part no. 26095.

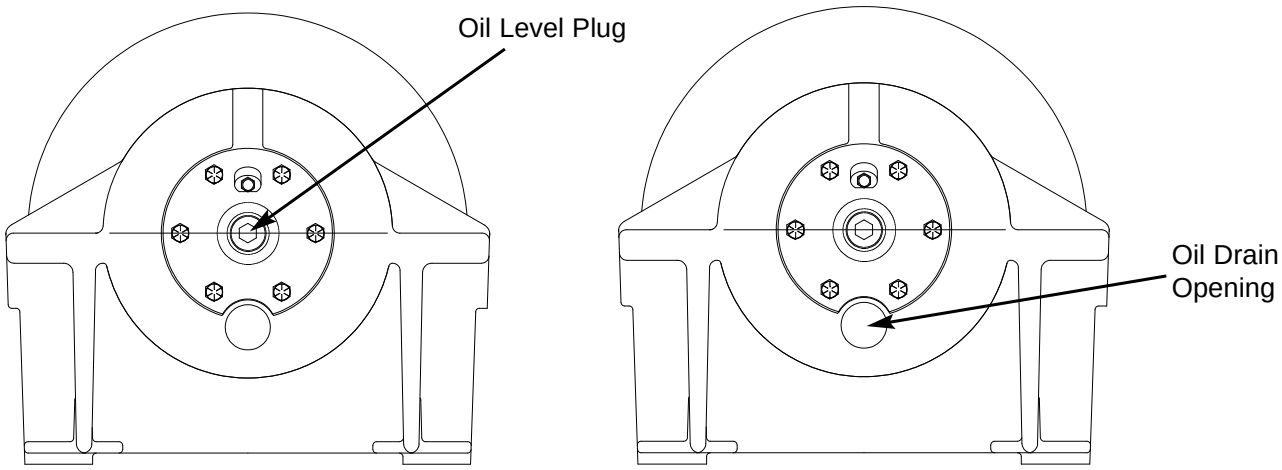
Take the free end of the wire rope and insert it through the small opening of the anchor pocket. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge, then pull the slack out of the wire rope. The wedge will slip into the pocket and secure the wire rope into the drum. The anchor is designed to accommodate several different sizes of wire rope. You may anchor 10 and 11mm. (3/8" and 7/16") wire rope by inserting the wedge, large end first. 13 and 14mm (1/2" and 9/16") wire rope may be anchored by inserting the wedge, small end first.

Preventive Maintenance

Planetary winch is strongly recommended to minimise the need for emergency servicing and promote safe, reliable winch operation. NOTE: The service intervals

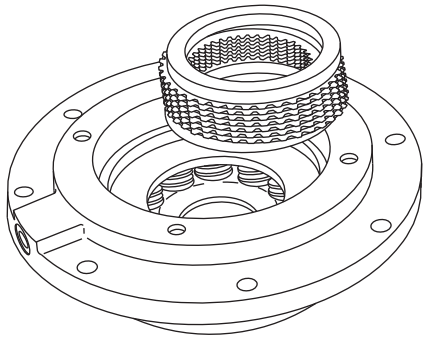
NOTE: The service intervals suggested in this manual will optimise component service life. The intervals maybe gradually increased or decreased with experience of a particular lubricant and the recommendations of an independent oil analysis. All service intervals are specified for operating hours of the prime mover.

1. Oil Level – The gear oil level should be checked every 500operating hours or three (3) months, whichever occurs first. To check the oil level, remove the large plug located in the centre of the drum support. The oil should be level with the bottom of this opening. If additional oil in needed, refer to 'Recommended Planetary Gear Oil'.

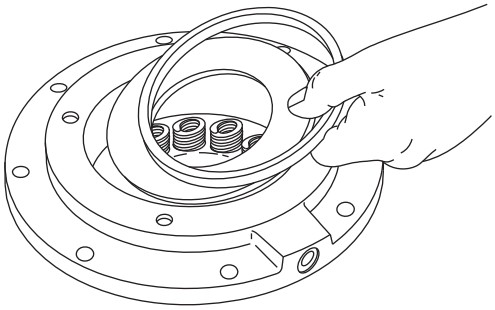


2. Oil Change – The gear oil should be changed after the first 100 hours of operation, then every 1000 operating hours or six (6) months, which ever occurs first. To drain the gear oil, align the drain plug in the drum with the hole in the support side of the base. Install a short piece of 1" pipe into the threaded drum port to prevent oil

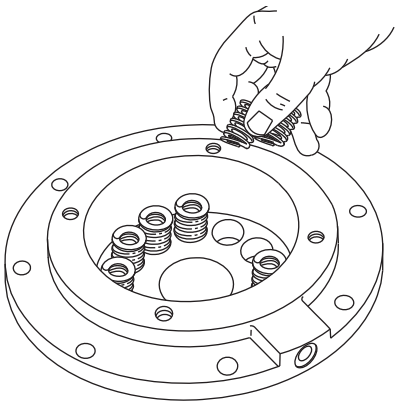
Disassembly



1. After removing the motor support and brake clutch assembly, continue brake cylinder disassembly by removing the spacers, friction brake discs and steel brake discs.

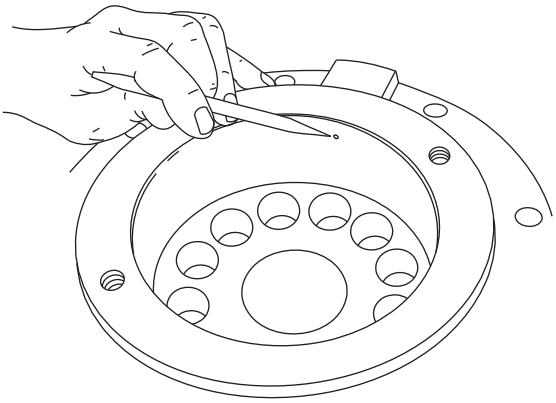


2. Remove the piston back-up ring and pressure plate.

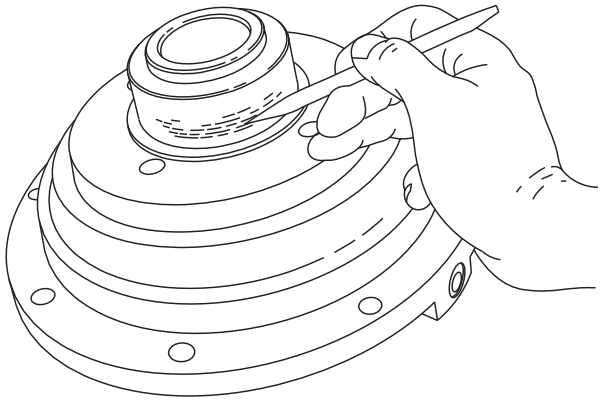


3. Remove the brake springs.

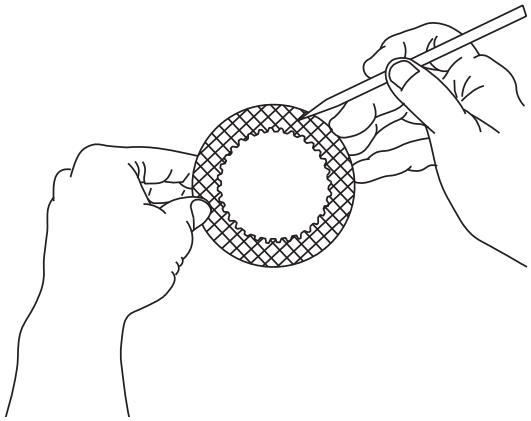
Clean and Inspect



1. Thoroughly clean and inspect all parts at this time. Check brake piston sealing surfaces on brake cylinder and motor support. Be sure brake release port is free of contamination.



2. Check oil seal and bearing surfaces on brake cylinder for damage or wear.



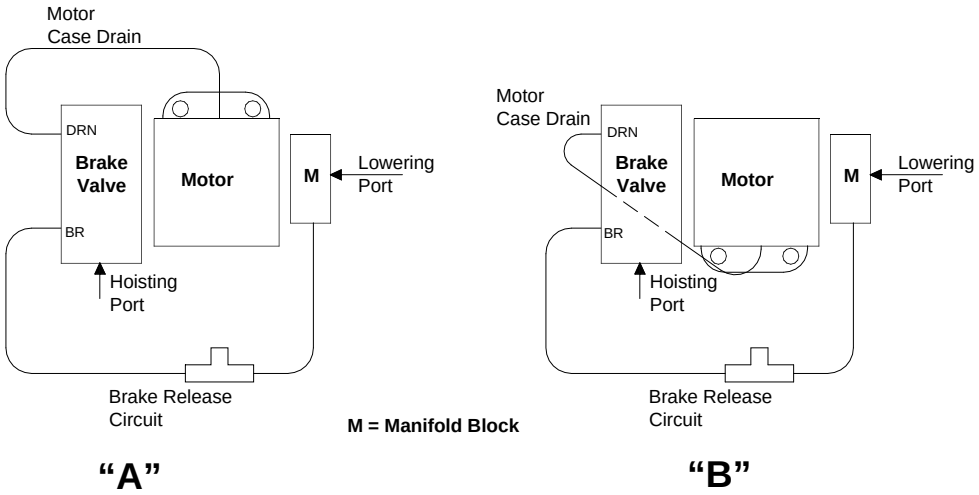
3. Place friction brake disc on flat surface and check for distortion with a straight edge. Friction material should appear even across entire surface with groove pattern visible. Replace friction disc if splines are worn to a point, disc is distorted, friction material is worn unevenly, or groove pattern is worn away.

Assembly (cont.)

the valve housing. Always install the spool from the plug end as shown to minimise the possibility of damaging the O-ring. Install the plug, spool spring and spring retainer.

5. Install the check valve poppet, spring and check valve spring retainer.
6. Install the motor drain check ball, spring and elbow fitting.
7. Install the pilot orifice into the valve housing.
8. The brake valve is complete and ready to be installed on the winch motor.

Reversing Direction of Drum Rotation

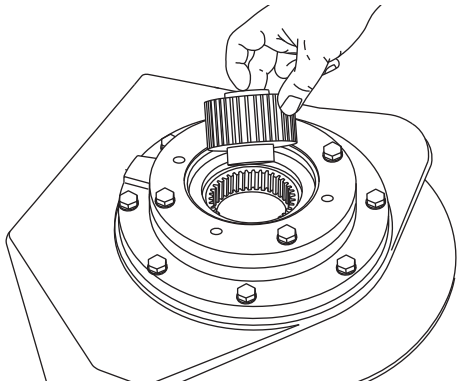


In order to change the direction of rotation, two things must be changed on the winch. First, the motor must be made to rotate in the opposite direction. This is done by exchanging positions of the brake valve and manifold block on the motor. Secondly, the brake clutch assembly must be made effective for the opposite direction of rotation. This is done by reversing the inner race of the brake clutch assembly.

Figures 'A' and 'B' above show typical BG8 motor installations. Note that the only difference between the two drawings is the motor is rotated 180° (the 'belly' of the motor moves to the opposite side). If the motor shaft rotates clockwise in figure 'A' when the hoisting port is pressurized, it will rotate counterclockwise in figure 'B'.

1. Remove the four capscrews securing the brake valve to the motor. Remove the four capscrews securing the manifold block to the motor. Disconnect the motor case drain hose at the motor.

NOTE: Some installations have the brake release hose connected directly to the motor, instead of to the manifold block. In this case, disconnect the brake release hose at the motor port.



Stand winch up on drum support with the motor end up and secure in this position.

2. Before removing the motor, it is a good idea to note or mark the position of the motor in relation to the winch, since it will be rotated 180° when reinstalled. Remove the capscrews securing the motor to the winch and carefully remove the motor.
3. Remove the brake clutch assembly from the motor support. Turn the clutch over and reinstall it into the centre of the brake pack. Be sure the inner race engages the input planet gear shaft.

Pipe Rack Bearings – Removal (cont.)

5. See fig. 6-17. Remove the four capscrews from the upper bearing caps and lower bearing cap.
6. Remove the caps from the mid-supports, by removing the four capscrews.
7. The pipe rack assembly is now free to move. Use caution and watch hoses to be sure they don't get stretched. Move pipe rack assembly far enough to remove bearing caps and to gain access to the capscrews that hold the end cap to the bottom of the carousel.
8. See fig's. 6-19 and 6-20. Remove the eight capscrews that hold the end cap to the bottom of the carousel. Be careful not to lose the shims under the cap.

NOTE: Some units may not have any shims under the cap. They are only used if there is insufficient clearance between the outer flange of the end cap and base of carousel. There needs to be about .76mm (.030") clearance so carousel will not bind when it is rotated.

9. Disconnect the index cylinder from the index plate and remove hoses from the index lock cylinder. Cap or plug all open hydraulic fittings and hose ends.
10. Support the index plate so it cannot fall when carousel pipe is removed. Slide the carousel pipe out of the index plate and carousel support.
11. See fig. 6-19. Using a suitable lifting device, remove the index plate to a convenient working area.

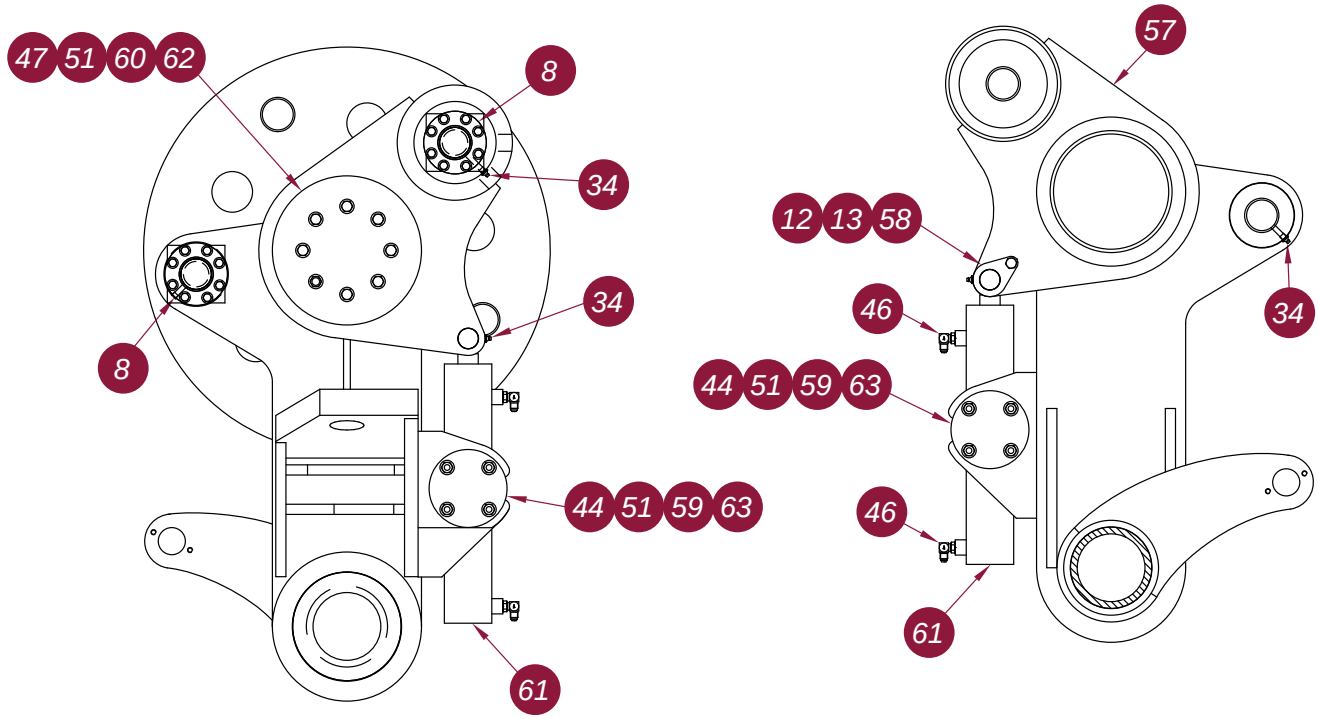


Fig. 6-19 Lower Pipe Rack Assembly

8. Hydraulic cylinder, index
34. Fitting, grease
44. Bushing
46. Adapter, hydraulic 90º
47. Kit, shim pipe rack
51. Washer, flat
57. Plate, index
58. Pin, bolt retained
59. End cap, cylinder
60. End cap, carousel
61. Hydraulic cylinder, index
62. Capscrew, hex
63. Capscrew, hex

Section 7 - Hydraulic Systems 7-1

Hydraulic Piston Pumps – Removal and Replacement

WARNING: Be sure to relieve pressure from hydraulic and pneumatic systems before loosening parts or connections.

1. Tag and remove hoses from pump unit.
2. Cap or plug all connections.
3. Support pump with a suitable lifting device.
4. Remove mounting bolts and lift pump out.
5. Replacement is the reverse of removal.

Main Pumps

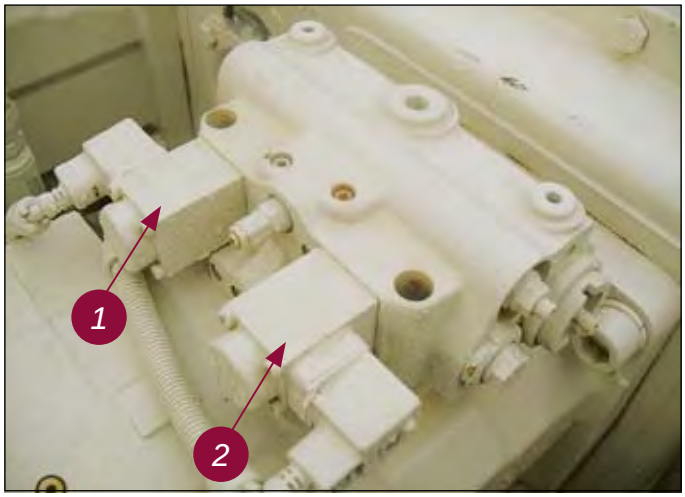
The two main pumps are Linde HPV-02 variable piston pumps. The left main pump supplies pressure to the left hand tram circuit and the rotation circuit. The right main pump supplies pressure to the right hand tram circuit and the pulldown circuit. All these circuits are closed loop circuits.

The positive pressure of 'charge pressure' to the two main pumps is supplied from the two charge pumps via the charge circuit.

Filtration, before the main pump is through the charge filters, and after the main pumps is through the loop filters.

EP (24V DC) Control

EP stands for **Electrical Proportional** control. Pump flow is infinitely varied from 0 to 100 percent, proportional to an electrical current in the range of 145-600mA at 24V DC, supplied to solenoid M_y or M_z. Electrical energy is converted to a force acting on the control spool. The spool then directs control oil in and out of the stroking piston to stroke the pump as required. A feedback lever, connected to the stroking piston, maintains the pump flow for any given current within the control range. The plugs to the solenoid valves are equipped with a green LED light (fig. 7-1). If the light is on, it indicates it is receiving power.



EP Control 24V DC. Solenoids are receiving power if green LED is on.

1. *Solenoid B*
2. *Solenoid A*
3. *Green LED light*

Fig. 7-1

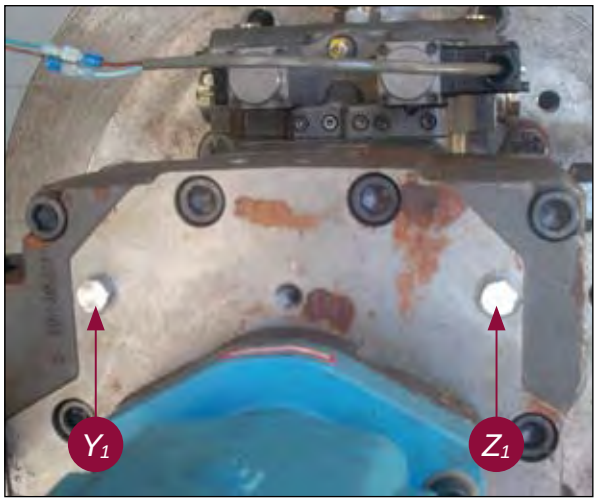
Setting Linde HPV-02 Main Pumps – Neutral Setting

1. Warm oil, all hydraulic settings should be set with 50ºC oil temp
2. Shutdown machine, remove break interlock valve coil (this will stall final drives).
3. Remove and plug hose from Y_1 on pump. Cap Y_1.
4. Fit test points to MS, MP, Y and Z ports.
5. Start machine, jack machine so tracks are clear of the ground, turn to tram mode. Override tram interlock.
6. Test that final drives don't drive through the brakes. If so stop and repair the brakes.
7. Bring engine up to full speed 2100rpm.
8. Check hydraulic neutral using 0-600psi gauge check MS, then using the same gauge check MP. If the maximum difference between the readings is below 29psi (2bar) no hydraulic neutral is required.

NOTE: If difference of more than 29psi (2bar) is recorded hydraulic neutral is required.

9. Loosen spanner nut with hammer and punch
10. Using 16mm wrench and digital callipers adjust the hydraulic neutral adjustment 14.75 as illustrated in fig. 7-2.
11. Repeat step 7 and 8. Continue to make small adjustments to the hydraulic neutral adjustment until the pressure difference between MS and MP is less than 29psi
12. Secure the spanner nut once settings are final.

NOTE: If hydraulic neutral is not achievable contact Bucyrus product support. Pump will need to be removed and set on 'Test Bench'.



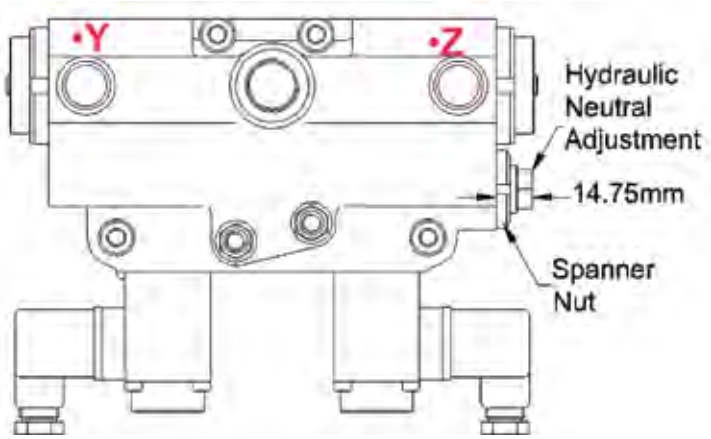


Fig. 7-2 'E' (Electro-hydraulic) Control

NOTE: Always order parts from the parts manual for your specific machine serial number.

Main Pumps Circuit

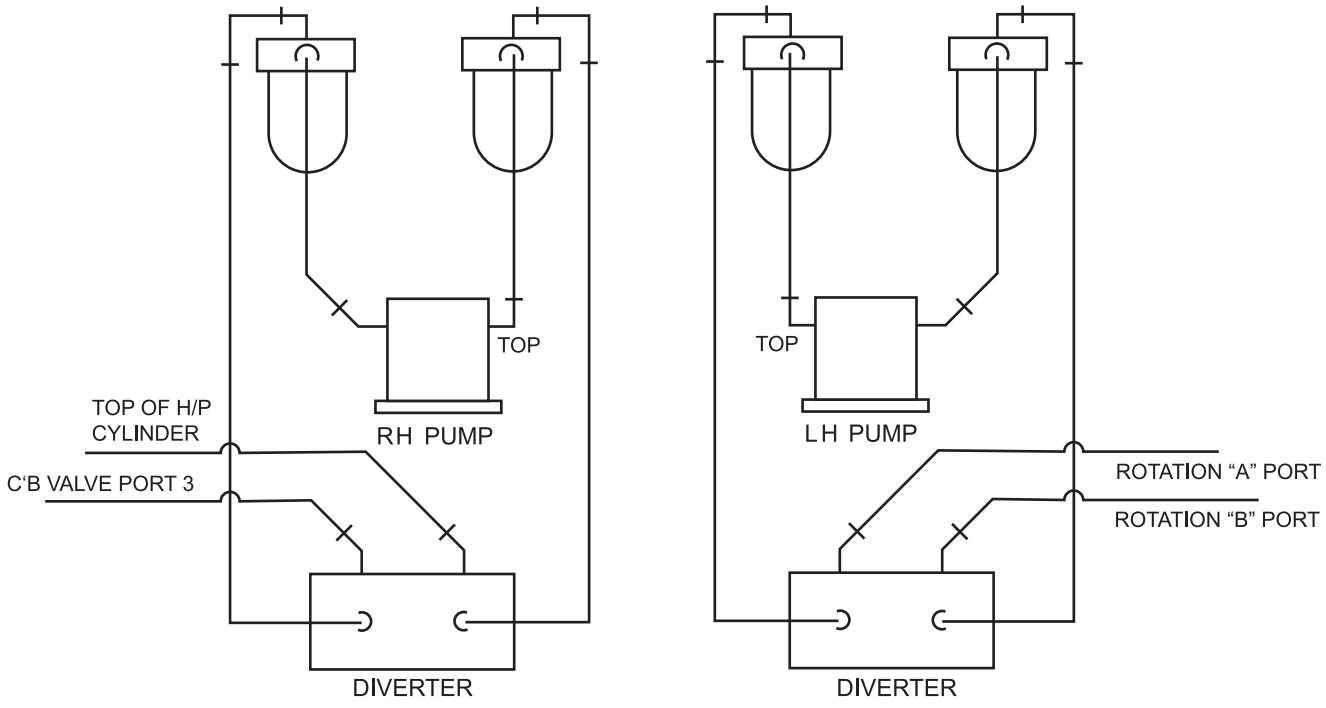
- The main pumps circuit consists of two independent closed loop systems that operate the pulldown/ hoist, rotary drive head motors and the two track assemblies. This is achieved by a directional control valve directing the flow to the desired motor.
- One pump operates both the RH track motor and the pulldown / hoist circuit in drilling mode.
- The other pump has a dual function. This pump operates both the LH track and the rotary drive head motors for drilling. This is achieved by a directional control valve directing the flow to the desired motor.
- There are external charge filters for each pump.
- There is one external charge relief for both pumps.
- Both charge pumps are combined together through the ‘G’ ports and Fa ports. This is done so that the pumps can assist each other with extra charge flow if needed.

Left Track and Rotation Pump

- Drill Mode – In drill mode the pump operates rotary drive head rotation.
- Tram Mode – In drill mode the pump operates the rotary drive head rotation.

Right Track and Pulldown Pump

- Drill Mode – In drill mode the pump operates pulldown circuit.
- Tram Mode – In tram mode the pump operates right hand track.



Basic Closed Loop Circuit

Rotary Gearbox Rotation Motor

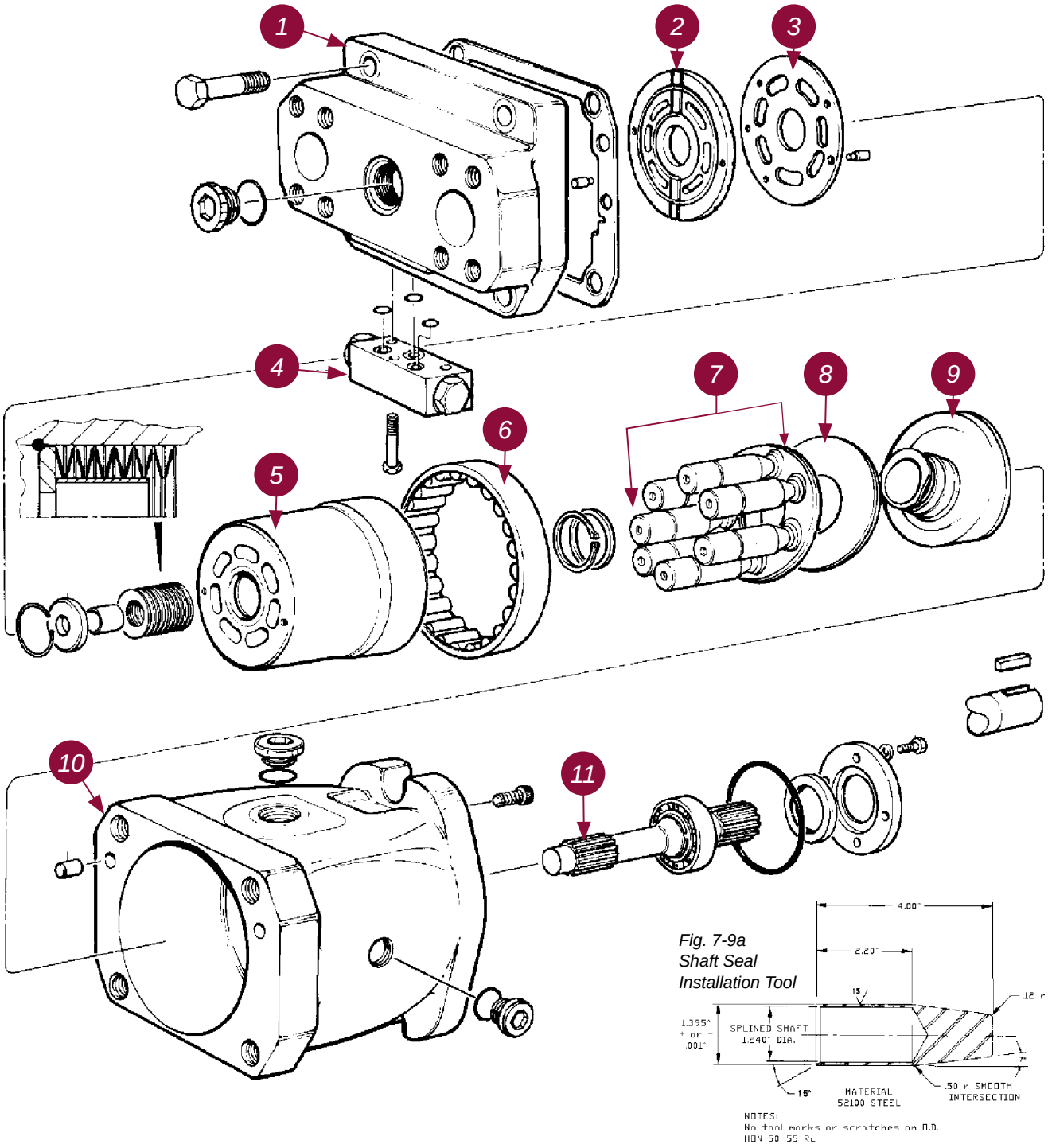


Fig. 7-9a
Shaft Seal
Installation Tool

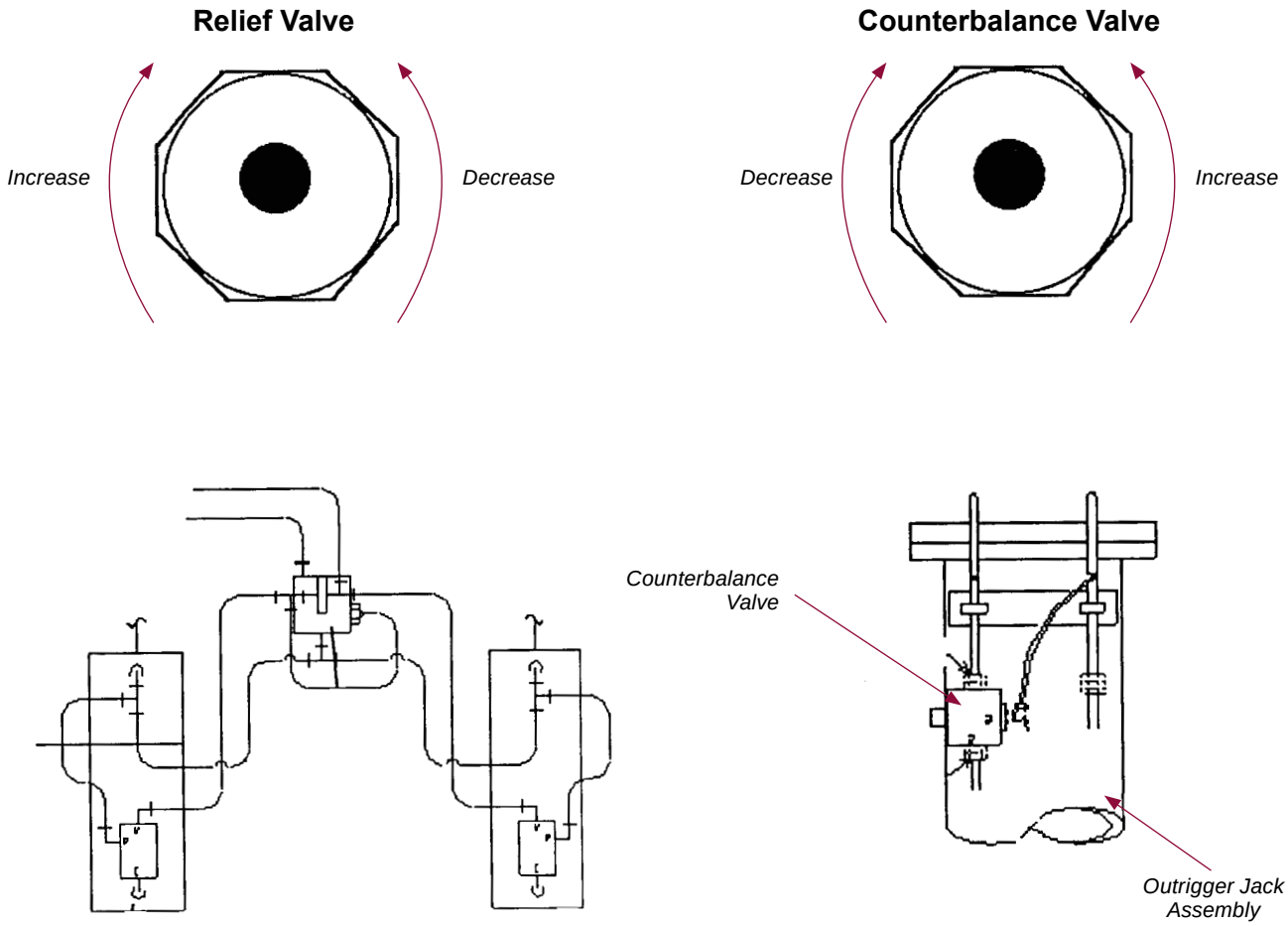
Fig. 7-9 Rotary Gearbox Rotation Motor

1. *Port block w/shuttle (1)*
2. *Port plate, cw (1)*
3. *Face plate (1)*
4. *Shuttle valve (1) (orificed)*
5. *Cylinder barrel (1)*
6. *Barrel bushing (1)*
7. *Piston, shoes and retainer (1)*
8. *Creep plate (1)*
9. *Cam (1)*
10. *Housing (1)*
11. *Shaft, spined (1)*

Counterbalance Valve Adjustments

CAUTION: Over adjustment of a counterbalance valve, i.e. turning the adjusting screw in too far, could result in uncontrolled descent of the mast assembly.

NOTE: Adjustment of the counterbalance valves is directly opposite of relief valves in this system, in that clockwise adjustment of relief valves increases pressure, whereas clockwise adjustment of the counterbalance valves decreases pressure. THIS MUST BE REMEMBERED when performing any adjustments to the system.

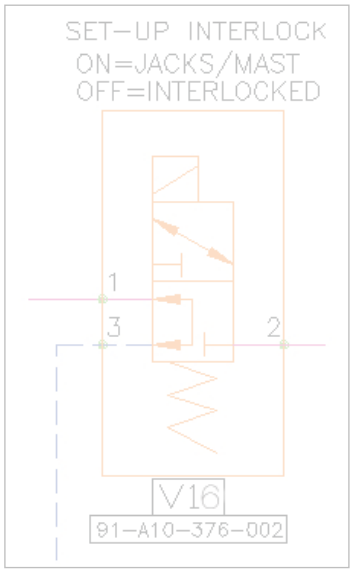


Counterbalance and Relief Valve Adjustments

V16 Set-up Interlock Solenoid Valve (NOT USED ON EP JACKS CONTROL)

This 3-way solenoid operated directional valve takes charge pressure (450psi) at Port 2 and directs it via Port 1 to supply pilot pressure to the jacks/mast raise pilot controls in the cab provided the solenoid is energised. The solenoid is de-energised when:

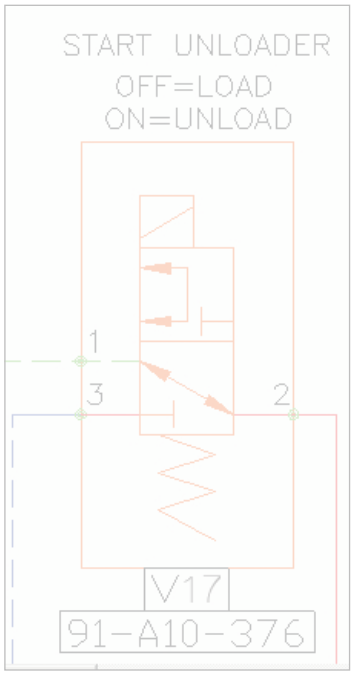
- The ladder is down
- Pipe is in the hole



V19 Set-up Interlock Solenoid Valve

V17 Start Unloader Solenoid Valve (NOT USED ON SKS-W)

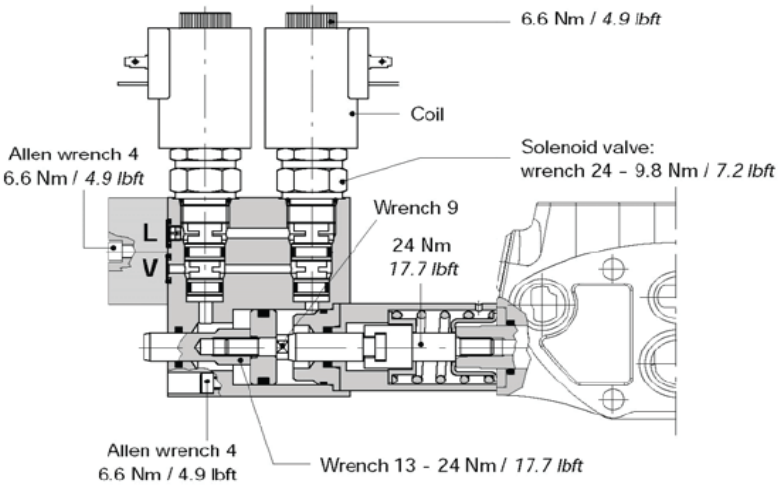
This 3-way solenoid operated directional valve connects pressure from the M Port on the auxiliary / fan pump to the X Port on the controller of the auxiliary / fan pump to load the pump, provided the solenoid is de-energised. The solenoid is energised by the safety bypass switch in the cab. This unloads the auxiliary/fan pump during start-up.



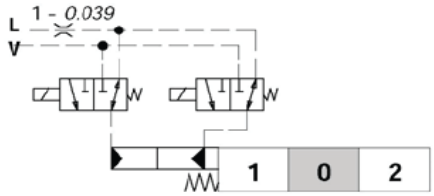
V20 Start Unloader Solenoid Valve

Electro – Hydraulic Kit (24V DC) (cont.)

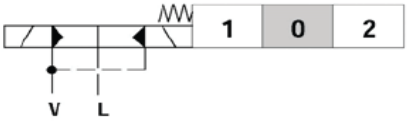
ON/OFF electro-hydraulic control with external pilot and drain.



Detailed scheme



Scheme ISO 1219



Operating features

Pilot pressure ..... : min. 10 bar / *145 psi*
: max. 50 bar / *725 psi*
Max backpressure on drain L ..... : 25 bar / *360 psi*

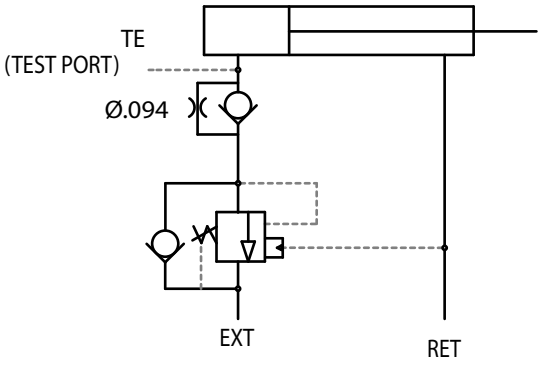
Solenoid operating features

Nominal voltage ..... : 12 VDC / 24 VDC
Power rating ..... : 21 W
Duty cycle ..... : 100%

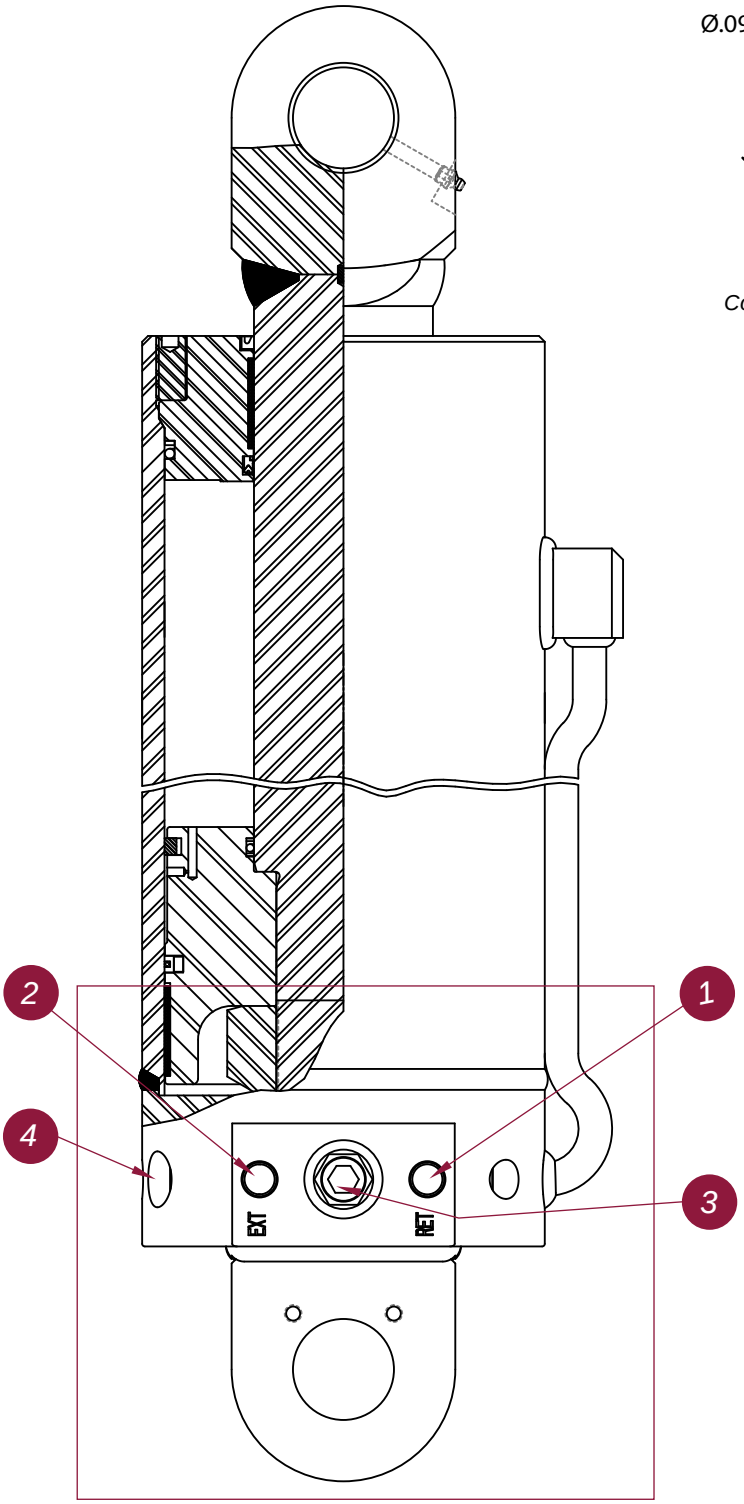
Specifications

Nominal flow rating		80 l/min	
Operating pressure (maximum)		315 bar	*4600 psi*
Back pressure (maximum)	*on outlet port T*	25 bar	*360 psi*
Internal leakage A(B)→T	*Δp=100 bar - 1450 psi fluid and valve at 40°C*	3 cm^3/min	*0.18 in^3/min*
Fluid		Mineral base oil	
Fluid temperature	*with NBR (BUNA-N) seals*	from -20° to 80°C	*-4° to 176°F*
Viscosity	*operating range*	from 15 to 75 mm^2/s	*from 15 to 75 cSt*
	min.	12 mm^2/s	*12 cSt*
	max.	400 mm^2/s	*400 cSt*
Max level of contamination		19/16 - ISO 4406	
Ambient temperature		from -40° to 60°C	*-40° to 140°F*
Tie rod tightening torque (wrench 13)		30 Nm	*22 lbft*

Internal Counterbalance Valve



Counterbalance Valve Block Schematic



Counterbalance Valve Block

1. *Extend port*
2. *Retract port*
3. *Counterbalance valve cartridge adjustment*
4. *Extend test port*

Fig. 7-13 Mast Elevate Cylinders – Internal Counterbalance Valve Type

Hydraulic Motor

General information

Fan motor has a bent axis, fixed displacement heavy duty motor/pump series. They can be used in numerous applications in both open and closed loop circuits.

The fan motor conforms to current ISO and SAE mounting flange and shaft end configurations. A very compact cartridge version is also available.

Thanks to the unique spherical piston design, the fan motor can be used at unusually high shaft speeds. Operating pressures to 480 bar provides for the high output power capacity.

The 40º angle between shaft and cylinder barrel allows for a very compact, lightweight motor/pump.

The laminated piston ring offers important advantages such as low internal leakage and thermal shock resistance.

The pump version has highly engineered valve plates for increased self priming speed and low noise, available with left and right hand rotation.

The fan motor produces very high torque at start-up as well as at low speeds.

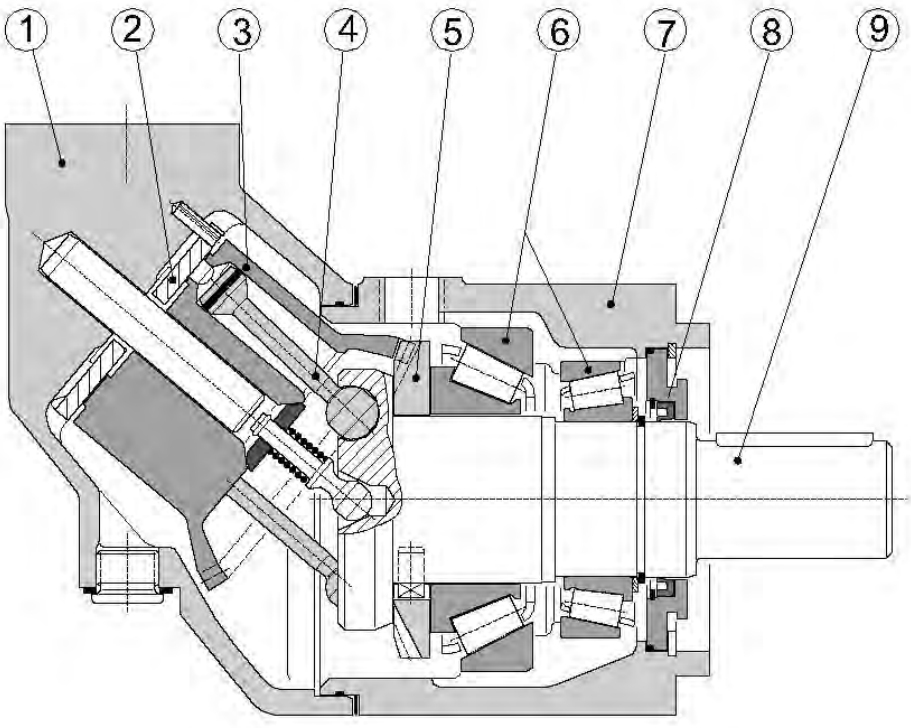
Our unique timing gear design synchronises shaft and cylinder barrel, making the fan motor very tolerant to high 'G' forces and torsional vibrations.

Heavy duty roller bearings permit substantial external axial and radial shaft loads.

The fan motor has a simple and straightforward design with very few moving parts, making them very reliable motors/pumps.

The unique piston locking, timing gear and bearing set-up as well as the limited number of parts add up to a very robust design with long service life and, above all, proven reliability.

1. *Barrel housing*
2. *Valve plate*
3. *Cylinder barrel*
4. *Piston with piston ring*
5. *Timing gear*
6. *Tapered roller bearing*
7. *Bearing housing*
8. *Shaft seal*
9. *Output/input shaft*

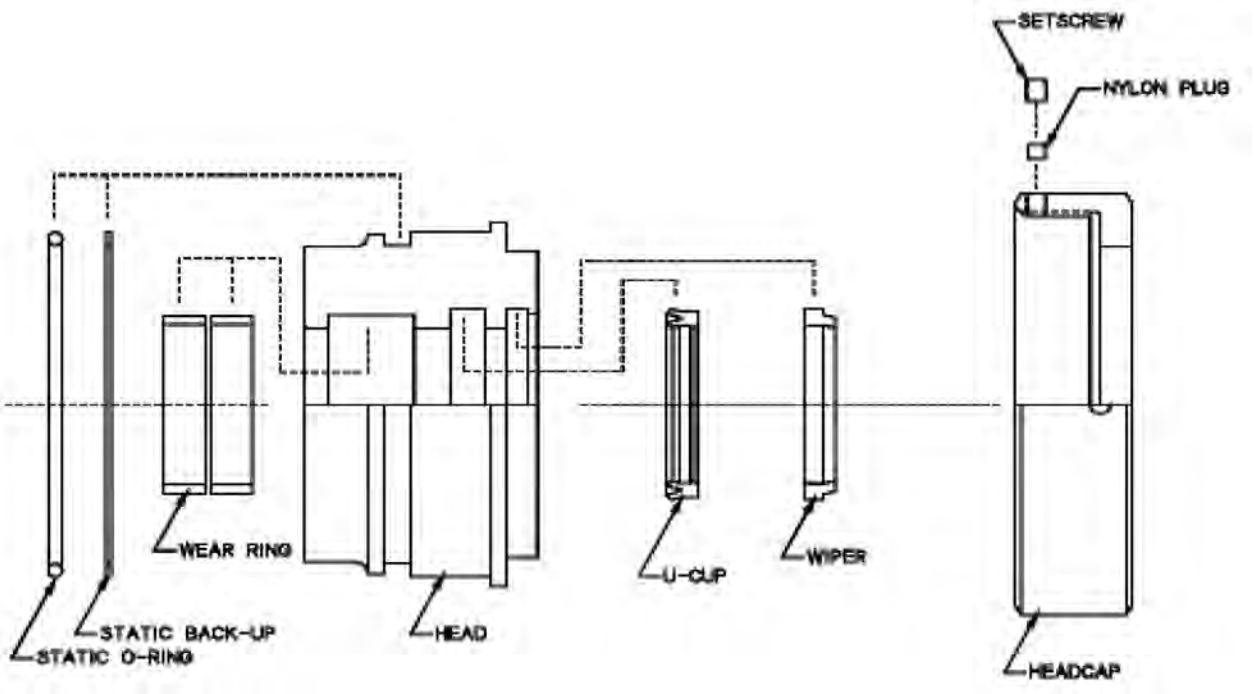


Cooler Fan Motor Cross Section

H Head

General

The H series head uses aluminium material and has a polyurethane U-cup as the primary sealing element. The wiper is a standard type D polyurethane. The head is retained within the tube by means of an internally threaded headcap. 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 retaining device as follow: Locate the setscrew in the headcap (a headcap is the internally threaded head retaining nut threaded onto the tube external threads). Remove this setscrew and insert a spanner wrench into the holes provided. Turn the headcap counter-clockwise (it is a right-hand thread) to remove it. If the headcap is stuck or moves erratically, tap the headcap with a brass or plastic mallet while turning it. Warp the headcap with a soft cloth or provide some other means to insure that the inner diameter of the headcap does not contact the chromed surface of the rod.

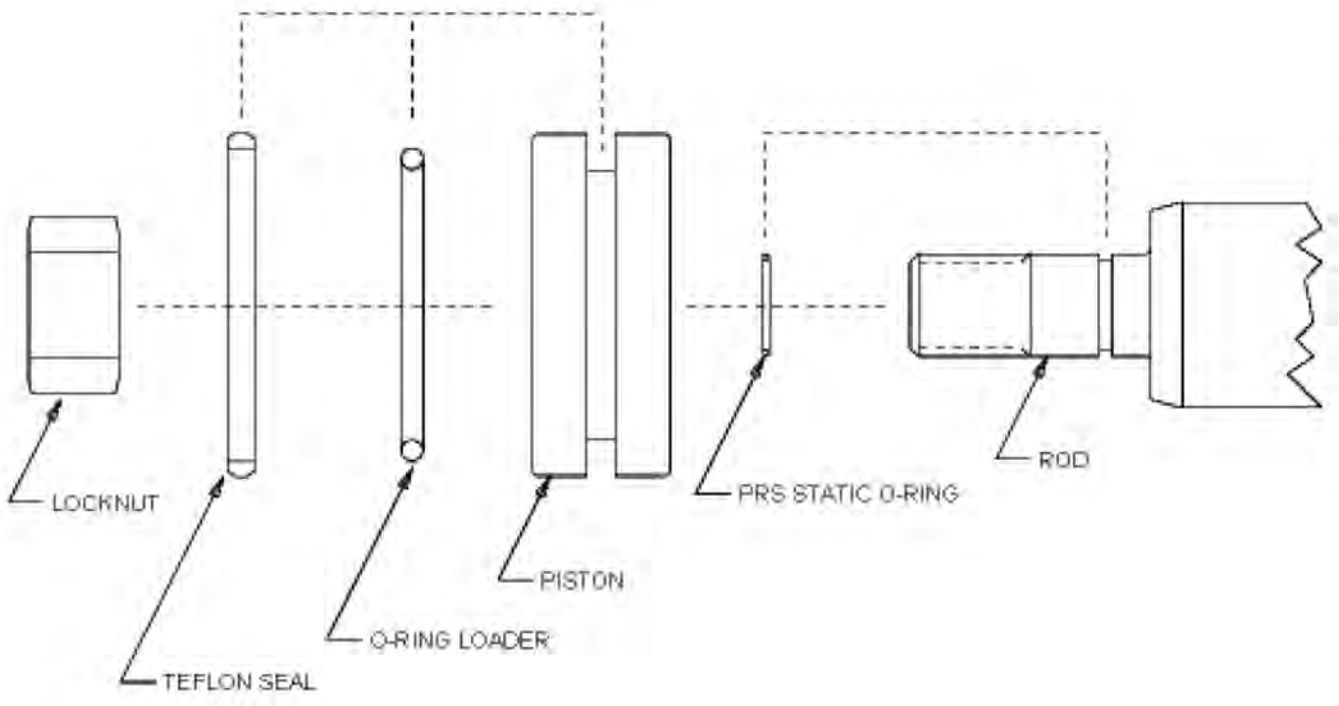
Rebuild

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 closed to the headcap retaining lip. If possible, the head/seal assembly should sit for at least one hour to allow the seals to elastically restore.

Place the rod on a clean table. Slide the headcap onto the rod. Wrap it so that it does not damage the chromed surface. Install the head followed by the piston onto the rod noting the proper orientation of each component.

Slide the headcap onto the tube and engage it with the threads. Turn the headcap counter-clockwise until the first thread just passes the engagement point (The headcap will move noticeably) then turn the headcap 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. Insert the nylon plug and setscrew into the setscrew hole and tighten the setscrew securely.

M Piston (cont.)



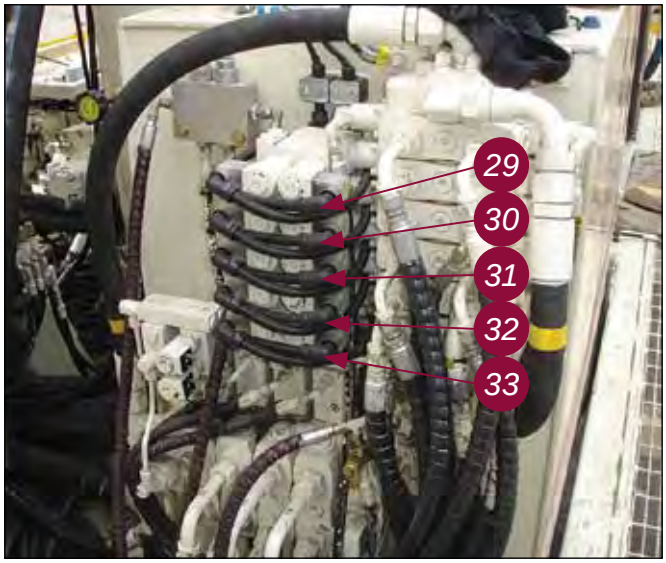
Teardown

After removing the piston, remove and discard the PRS static O-ring from the groove in the rod. Remove the teflon 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.

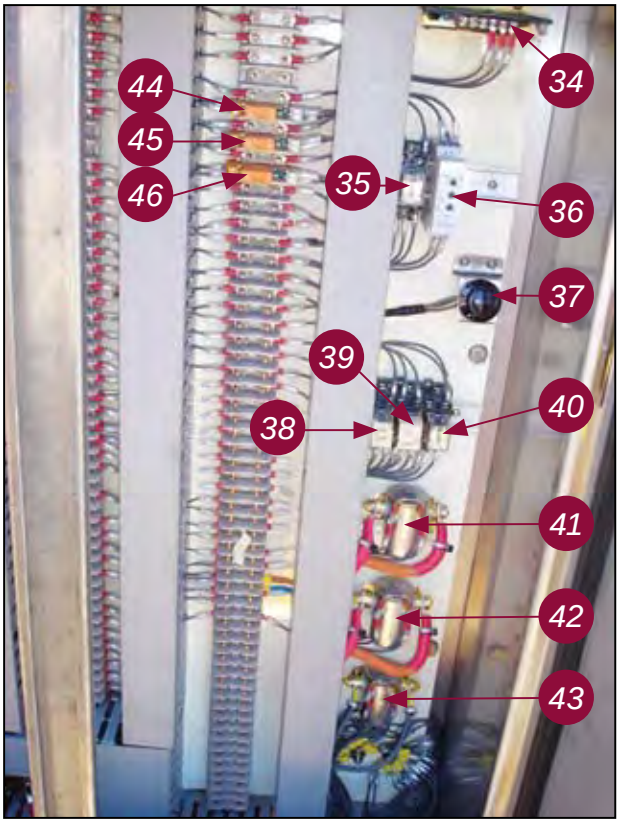
Rebuild

For easiest installation, warm the teflon seal in 49 to 65.5ºC (120 to 150ºF) hydraulic fluid. Lubricate the piston and all components with hydraulic fluid. Install the O-ring loader in the groove and verify that the O-ring has not twisted. Place one side of the teflon seal in the groove and stretch remaining portion into place. Never use sharp instruments of any kind. Be extremely careful to avoid damaging the seal grooves during installation. Scratching the groove may cause by pass leakage. If possible, allow the piston/seal assembly to sit at least one hour to allow seals to elastically restore.

Electrical Component Location (cont.)

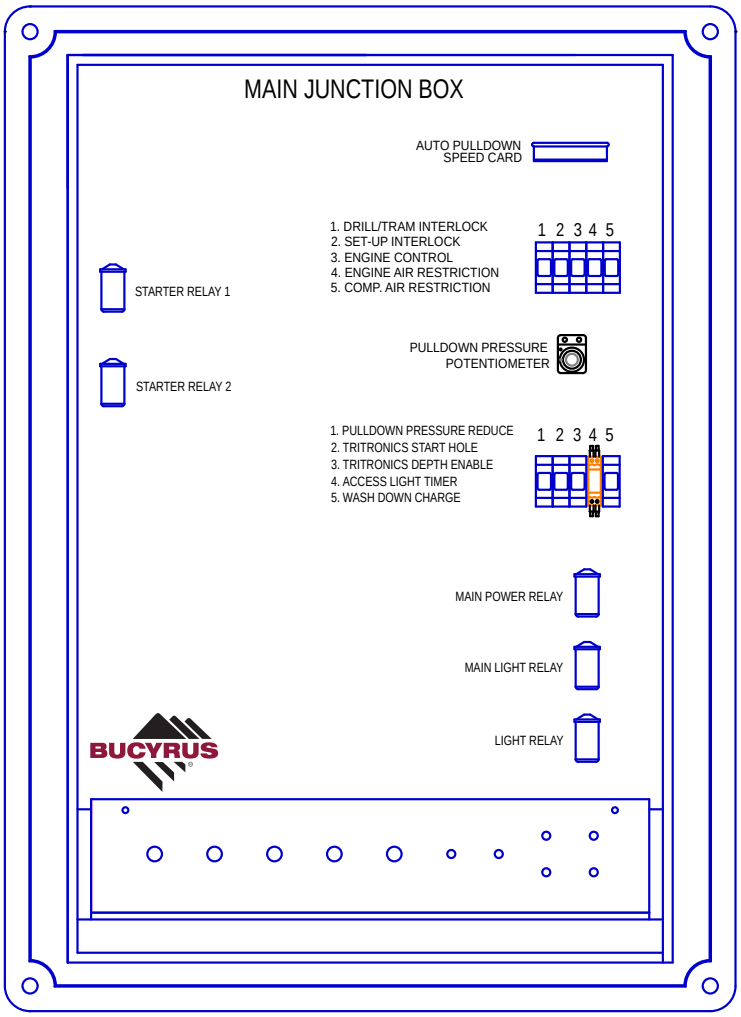


Lower Solenoid Bank



Engine J Box

29. *Trapdoor solenoid*
30. *Main air solenoid*
31. *Mast lock solenoid*
32. *Water hydraulic / washdown solenoid*
33. *Dust curtain solenoid*
34. *Auto pulldown module*
35. *Hydraulic function enable relay*
36. *Access light timer*
37. *Pulldown pressure reduce pot*
38. *Engine control relay*
39. *Drill / tram interlock relay*
40. *Feed pressure reduce relay*
41. *Main relay*
42. *Main light relay*
43. *Light relay*
44. *Pipe positioner kickout relay*
45. *Dust curtain raise relay*
46. *Pipe rack swing inhibit relay*
47. *Main junction box label*



PLC

Run / Rem / Program Key-switch

RUN Position

This position places the processor in the Run mode. The processor scans/executes the ladder program, monitors input devices, energises output devices, and acts on enabled I/O forces. You can only change the processor mode by changing the key-switch position. You cannot perform online program editing. To change the processor mode to RUN, toggle the key-switch from PROG or REM to RUN. When the key-switch is left in the RUN position, you cannot use a programmer/operator interface device to change the processor mode.

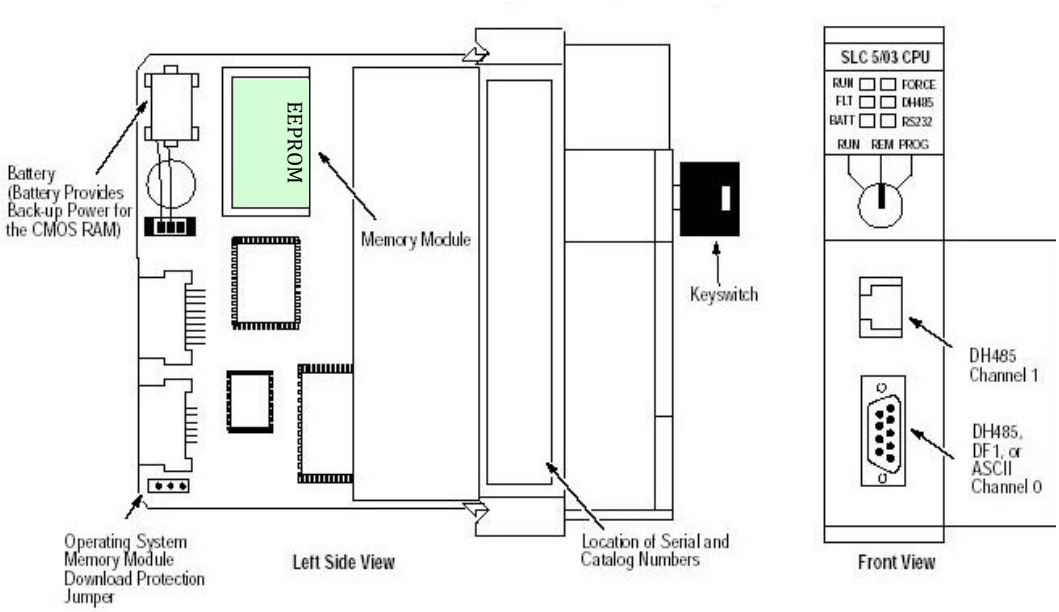
PROG Position

This position places the processor in the program mode. The processor does not scan / execute the ladder program, and the controller outputs are de-energised. You can perform online program editing. You can only change the processor mode by changing the key-switch position. To change the processor mode to Program, toggle the key-switch from REM or RUN to PROG. When the key-switch is left in the PROG position, you cannot use a programmer/operator interface device to change the processor mode.

REM Position

This position places the processor in the remote mode: either the REMote Run, REMote Program, or REMote Test mode. You can change the processor mode by changing the key-switch position or by changing the mode from a programmer/operator interface device. You can perform online program editing in this position. To change the processor mode to REM, toggle the key-switch from RUN or PROG to REM.

When the key-switch is in the REM position, you can use a programmer/operator interface device to change the processor mode.



Auto Lube

Operation

- The lube cycle time and lube pressure setting can be set from the password protected area.
- The time is set in seconds.
- If a 1200 second cycle is set. The lube solenoid is activated at the 1080 second mark. (Lube solenoid will run for 2 minutes).
- If the lube pressure switch is not up to pressure within 118 seconds a Lube Alarm will occur.
- If the manual lube is activated. The lube solenoid will run for 30 seconds. If pressure is not reached in 30 seconds, a Lube Alarm will occur.
- If the Lube Alarm continually occurs then inspect for broken grease lines or faulty field devices.

Gauges

General Info

All gauge transducers are 4-20mA signals.

- 4mA = zero on the gauge
- 20mA = maximum reading of transducer on the gauge (as indicated in the electrical drawings)

Operation checks

Check for blockages in feed line to transducers.

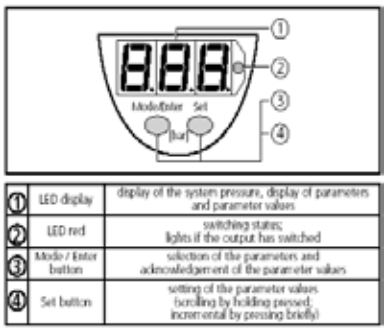
Verify 4-20mA signal back at PLC with a multi-meter in series on the signal wiring.

Pressure Transducer

The pressure transducers are factory calibrated and preset.

Error code table for error codes as seen on transducer display

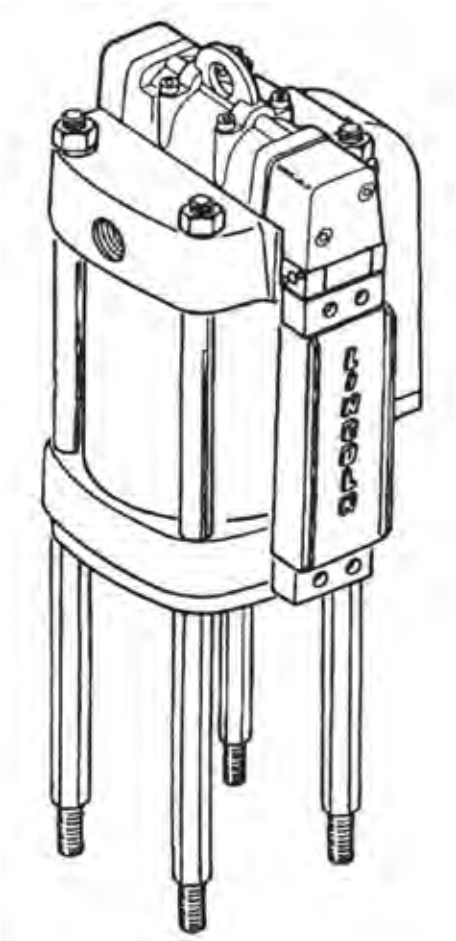
OL	= overload pressure (system pressure > 110% of the max. nominal pressure)
SC !	(flashing) = short-circuit in the switching output; the output is switched off



①	LED display	display of the system pressure, display of parameters and parameter values
②	LED red	switching status; lights if the output has switched
③	Mode / Enter button	selection of the parameters and acknowledgement of the parameter values
④	Set button	setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly)

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)	BUN-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 (item 26 or piston check (items 23, 24 and 26).	• Check and replace if needed.
Pump operates on UP stroke only (missing DOWN stoke).	• Worn or damaged inlet check (items 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 (item 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

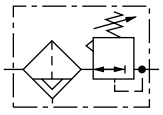
Technical Data

- 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)

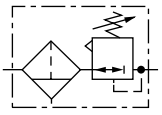
** Air supply must be dry enough to avoid ice formation at temperatures below 2°C (35°F).*

- Partical 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

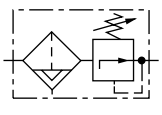
ISO Symbols



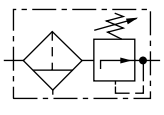
Automatic Drain Relieving



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.

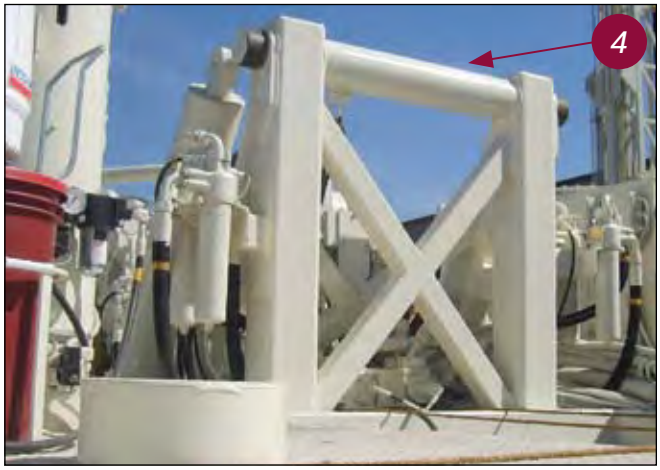
Parts List

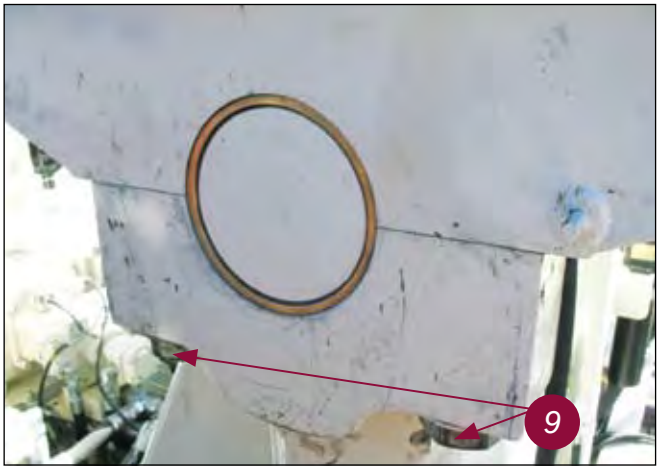
1. *Tie rod*
2. *Air piston*
3. *Air piston nut*
4. *Air motor piston rod*
5. *Piston rod connector*
6. *Valve cap*
7. *Trip rod collar*
8. *Trip rod pin*
9. *Trip shoe*
10. *Check washer*
11. *Priming check*
12. *Check stop*
13. *Plunger rod*
14. *Priming plunger*
15. *Priming check seat*
16. *Check 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 or 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

10hrs or daily – 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 or 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

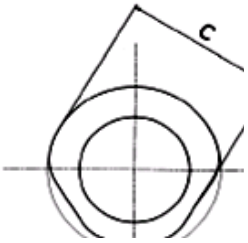
100hrs – Re-torque pre-load on spindle bearings in rotary head (pre-load .002"-.004")

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

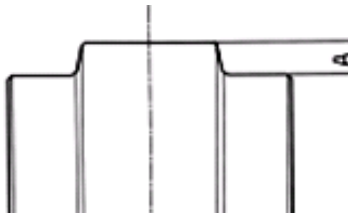
Comments:

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 100psi. 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.	