Technical Manual

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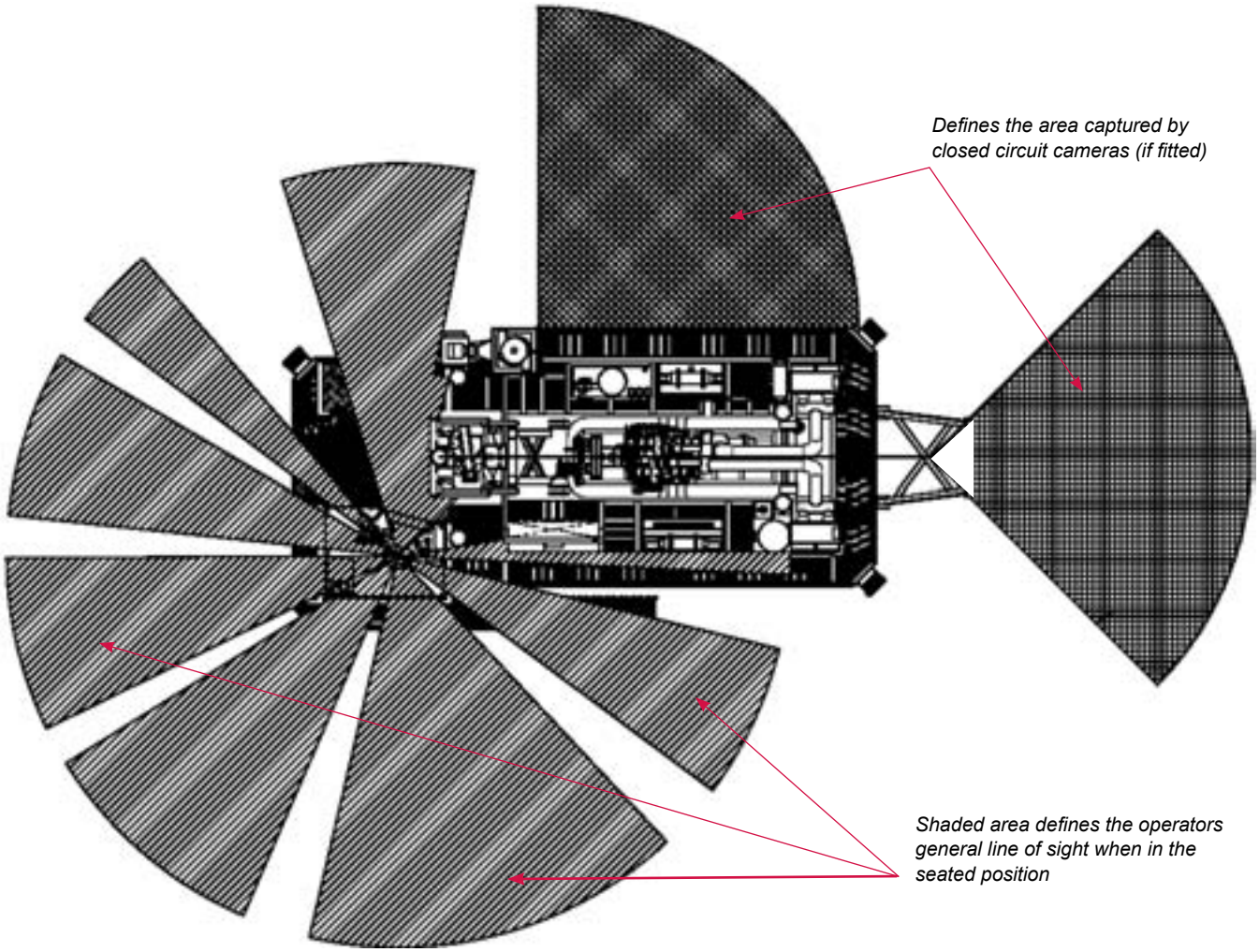
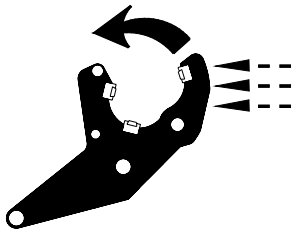
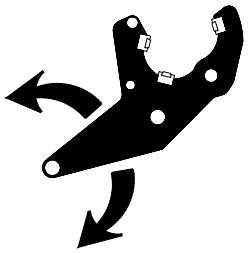


- Always check blind spots prior to propelling.
- Do not carry out any drilling activity on a bench until it has been examined for misfires.
- Do not drill a hole so that any portion of the hole is closer than 6 metres to a hole containing explosives. Site rules may stipulate further distances.
- Ensure adequate ventilation when running the engine in an enclosed area. Exhaust gases contain carbon monoxide, a deadly poison which is colourless and odourless.
- Ensure the drill pipes are secure in the carousel before raising or lowering the mast.
- Before lowering the mast, do make sure the carousel is rotated, locked in the non-pipe-loading centre position to ensure pipes are secured so they cannot possibly slide back and fall out of the carousel. Then swing the carousel in towards the centre of the mast.
- Do make sure dust is suppressed whilst drilling using either the dust collector or water injection.
- Do not climb the ladder to the operator cabin roof whilst the machine is running and always ensure secure footing.
- Do not under any circumstance climb the ladder giving access to the mast without wearing the appropriate safety harness. Only ever perform service work on the mast wearing approved fall arrest equipment.
- Do not travel on steep inclines, soft or unstable ground or close to unsupported excavations.
- Do not propel the machine with the mast up.

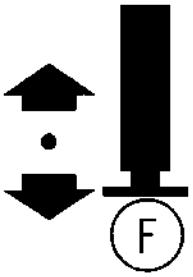
Graphic Symbol Legend



Hydraulically Operated Breakout Wrench (HOBO) – CLAMP



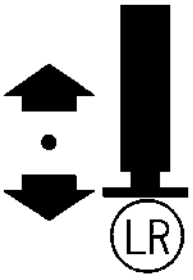
Hydraulically Operated Breakout Wrench (HOBO) – SWING



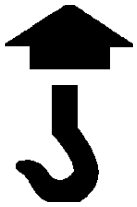
Jack – FRONT

Ignition – ON

Ignition - OFF

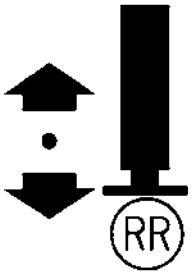


Jack – LEFT REAR



Winch – RAISES HOOK

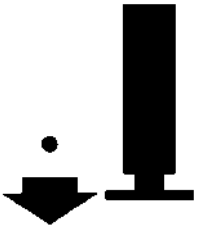
Hoist/Pulldown – RAISE and LOWER



Jack – RIGHT REAR

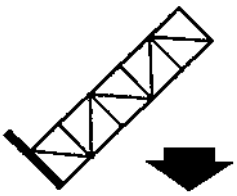
Winch – LOWERS HOOK

Main Air

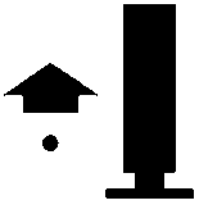


Jack – DOWN

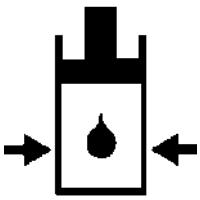
Fuel Level



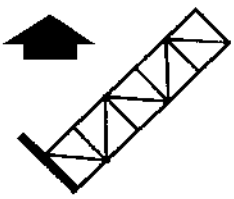
Mast – LOWER



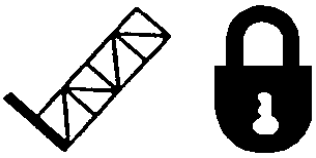
Jack – UP



Hydraulic System Pressure

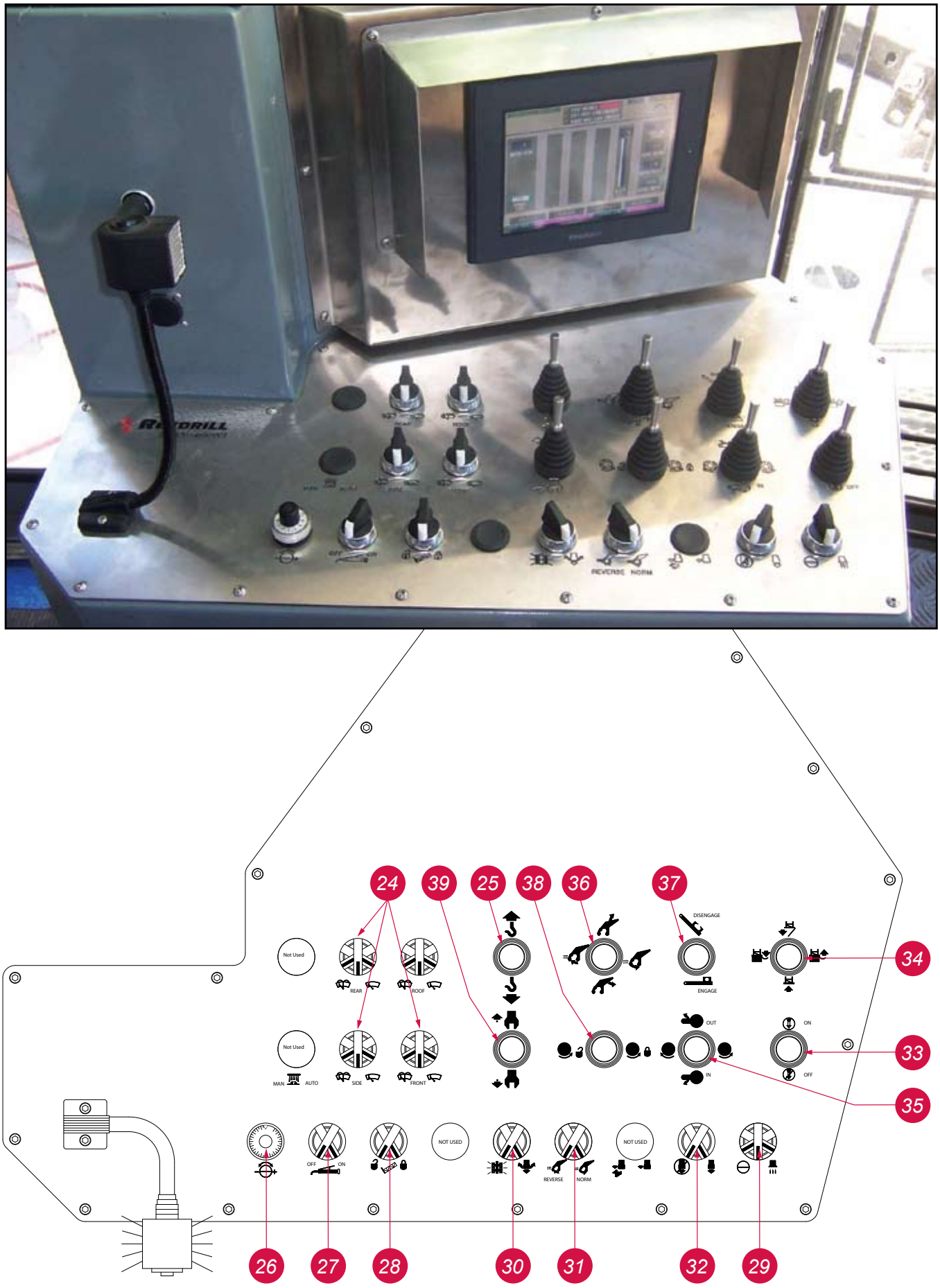


Mast – RAISE



Mast Lock

Left Hand Control Panel



Section 2.0 Installation and Commissioning

2.1 Compressor Installation

1. If a special P.T.O. drive pulley is required this should be installed by an experienced tradesman, taking care not to damage any seals or disturb any gear trains within the P.T.O. drive.
2. The compressor bracket should be designed and manufactured by SIGMA or alternatively, manufactured by customer to SIGMA specifications. All hardware used to mount the bracket to the engine should be of the correct grade, size and length to suitably support the bracket. Ensure that the bracket sits square on the engine and that the mounting bolts are tightened to the correct torque.
3. Check that the belt section of the clutch pulley groove matches with that of the drive pulley.
4. Mount the compressor assembly onto the bracket and check for any interference, between the compressor and engine, along the full path of the compressor adjustment travel. Correctly align the compressor clutch groove with the drive pulley groove. If a separate eccentric adjusting pulley is utilised, ensure that this also is in correct alignment. Shim if necessary.
5. Install belt(s) and tension as required. Check for any possible interference between drive belts and any engine components during operation. On applications that require long belt runs check for excessive belt 'whip'.
6. To ensure maximum operator and service personnel safety, wherever possible, guards should be provided to cover any exposed drive belts and/or pulleys.
7. After running the unit for approximately one hour, re-check the belt tension and adjust accordingly.
8. During commissioning of unit visually check the compressor/bracket assembly for any undue vibrations through the engine rev. range and also make the compressor 'cut-in' to check the bracket for any undue flexing under conditions of compressor start-up at full load.

2.1.1 Compressor Selection

Various compressors can be utilised with this system.

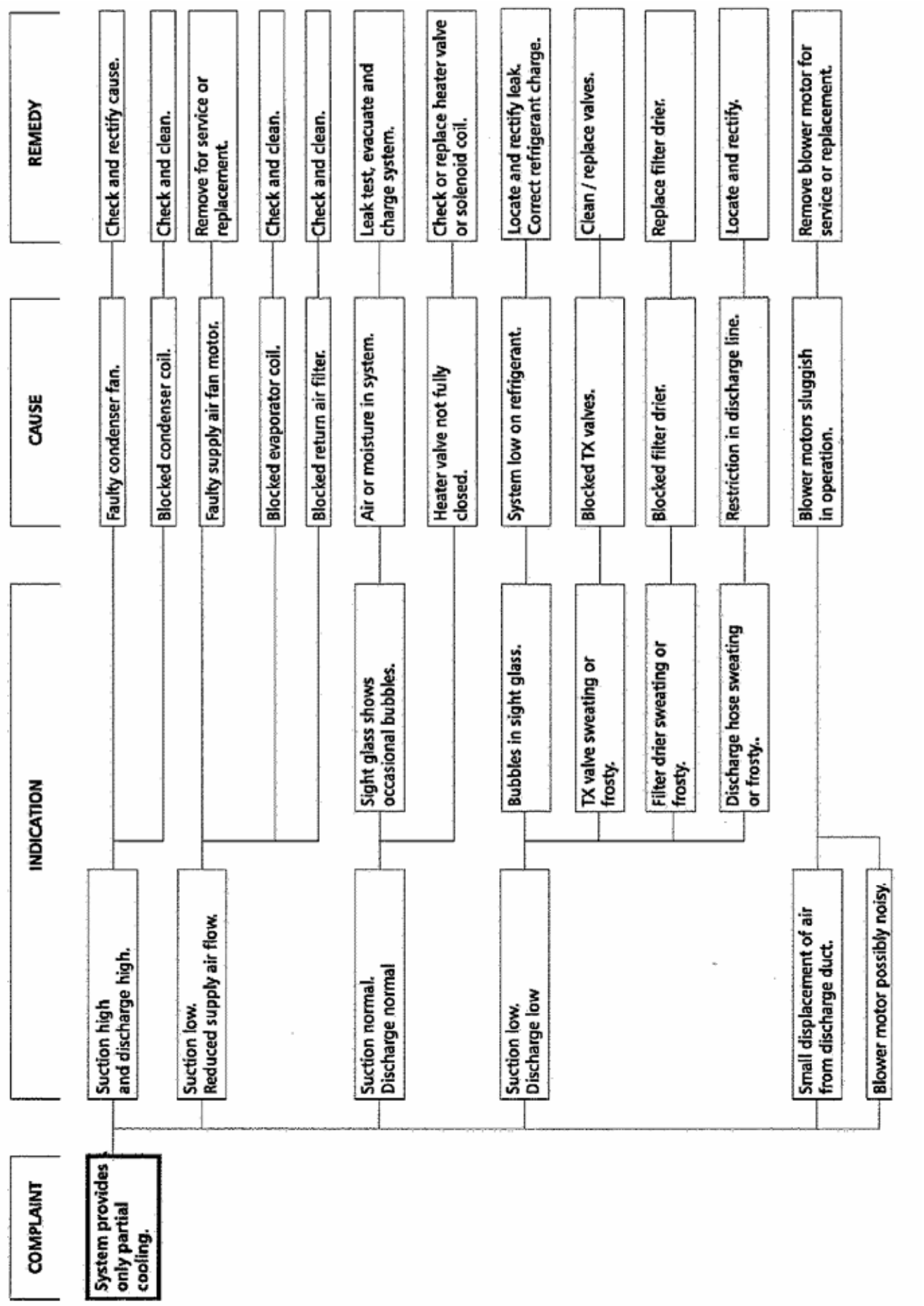
MAKE	SANDEN	TECUMSEH	DELCO	UNICLA
MODEL	SD7H15	HGB1000	UP170	
Displacement	161cc	169cc	207c	172
No. of Cylinders	5	2	6	10
Refrigerant Type	R134a	R134a	R134a	R134a
Oil Type	RL68S	RL68S	RL68S	Unidap 7(PAG)
Oil Capacity	135ml	297 ml	300 ml	150
Rotation	Bidirectional	Bidirectional	Clockwise	Bidirectional
Mounting Angle	45o of TDC	45o of TDC	N/A	45o of TDC
Max Speed	4000 RPM	6000 RPM	6500 RPM	7000RPM

2.2 Power Supply Connection

Check power supply to unit. Alternator capacity must be sufficient for air conditioners as well as other accessories; determine if night operation is required.

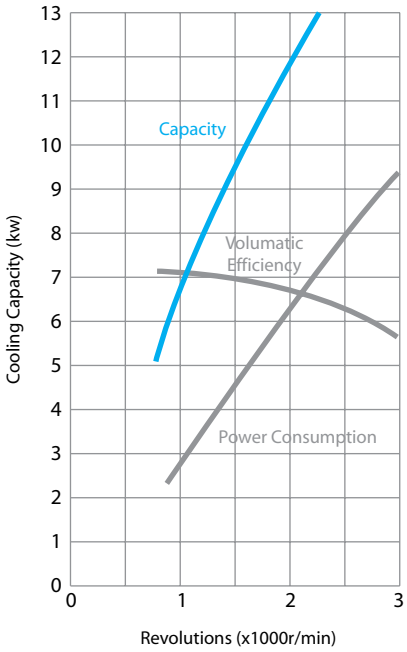
1. Connect the electrical supply wiring harness to unit and run wiring to clutch and power source ensuring that it is suitably secured and does not run over hot exhausts, etc.

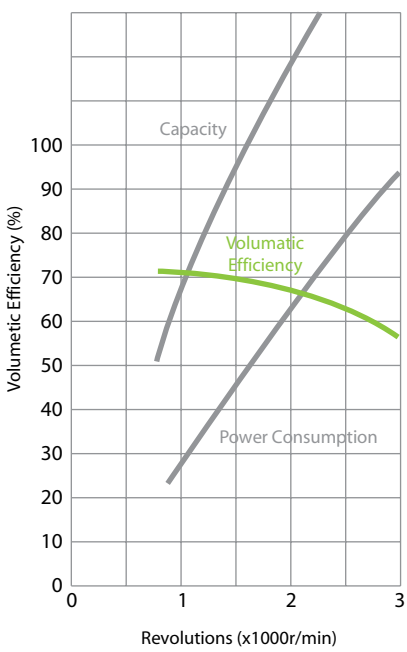
4.1.2 System Only Partially Cools

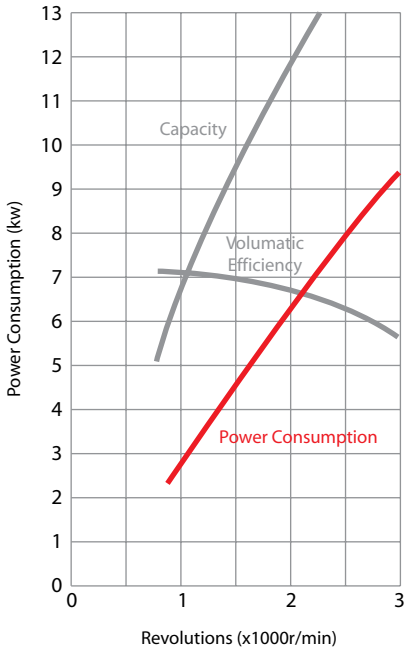


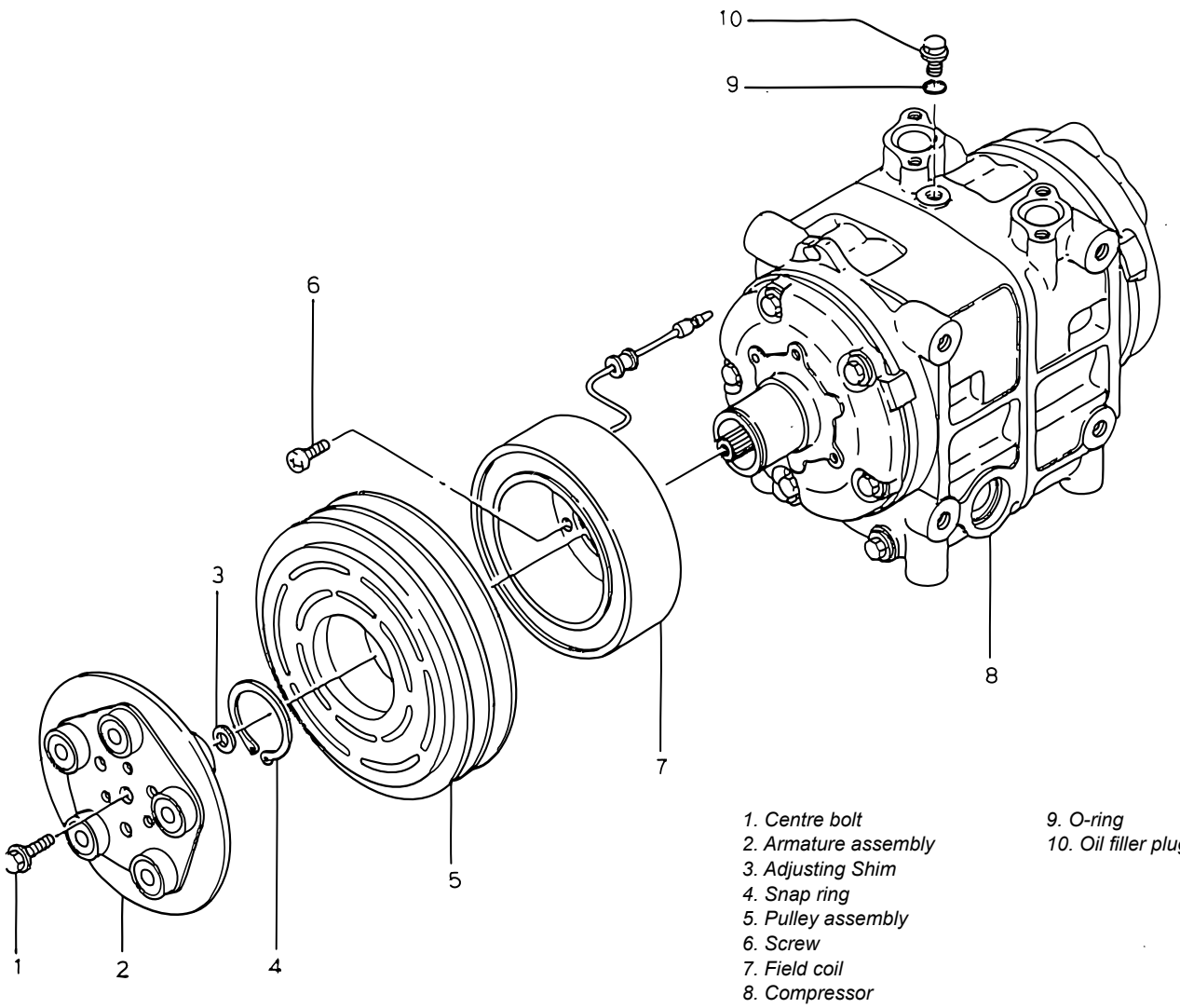
5.5 Performance Curve

Test Conditions: Dis. Pressure: 1.52MPa (gage)
Suc. Pressure: 0.182MPa (gage)









1. Centre bolt
2. Armature assembly
3. Adjusting Shim
4. Snap ring
5. Pulley assembly
6. Screw
7. Field coil
8. Compressor
9. O-ring
10. Oil filler plug

Levelling Jacks

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

Limit Switch

The Limit Switches send a signal via the Vigilante that the levelling cylinders are fully retracted to allow tramming functions to activate. It is imperative that the Limit switch control arm be adjusted to strike on the Inner Casing (Fig LJ-2) and not the Hydraulic cylinder. This is done to prevent damage **should the lower bolt fail or fall out**, leaving the Inner Casing Tube still lowered but having the Hydraulic cylinder fully retracted/raised.

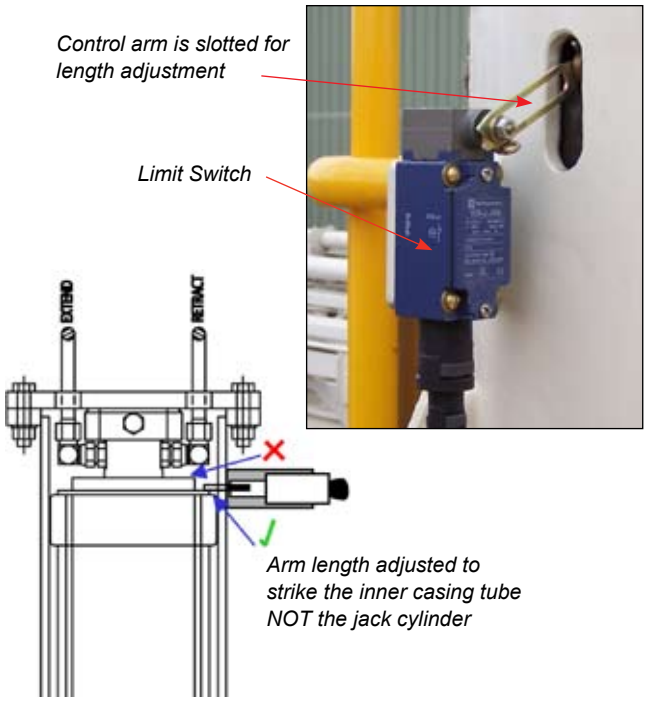


Fig. LJ-2 Levelling Jack Cylinder Limit Switch

Levelling Jack Cylinders

Removal

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

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

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

Repair

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

Replace

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

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

Lubricating Jack Casings

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

Idler Unit Description

- The idler wheel is filled with oil and the running surfaces are induction hardened for reduction in wear.
- The sliding block (3) is designed in such a way that no dirt can enter the idler.
- The hydraulic tensioner (4) serves to tighten the track chain when grease is inserted with a grease gun.
- The nitrogen tensioner (5) is pressurised at the factory and normally requires no other maintenance.

WARNING: HIGH PRESSURE The nitrogen tensioner is under high pressure. Bleed off all pressure before any service work is performed on the unit. Follow instructions in this section. It is recommended that service work on the nitrogen tensioner be done only by factory authorised service agents. If service work is performed by non-factory authorised personnel, all liability and/or damage is assumed by party(ies) performing the work. If unit is disassembled, always discard all fasteners and replace with new ones.

WARNING: Grease in the hydraulic tensioner is under high pressure. Grease coming out of the relief valve at the back of the hydraulic tensioner is under high pressure and can penetrate the body causing personal injury or death. When loosening the tension on the track, loosen the relief valve only one turn. DO NOT visually inspect the relief valve to see if grease is being released from the track adjuster. Instead, watch the track to see if it loosens. If the track does not loosen after opening the relief valve, move the machine forward and backward to release the tension.

When assembling the track shoes in the field, this method must be used because the final torque is not done with a calibrated torque wrench and although the deviation may be small, the tightening of a third of a turn more, gives the necessary clamping force independent for the required friction factor.

Track Shoe – Retightening

DO NOT merely retorque the bolts in the field. This would lead to failure of the joint due to the altered friction factor and a reduced preload of the bolts.

The CORRECT METHOD of retightening the bolts, is to loosen the bolts until they turn freely. Now torque the bolts using the 'torque turn' method described above.

NOTE: This can only be done once and only after a short time of machine operation (approximately 50 hours). After extended operation, loose bolts and nuts must be replaced with new ones for safety reasons.

Final Drive Assembly

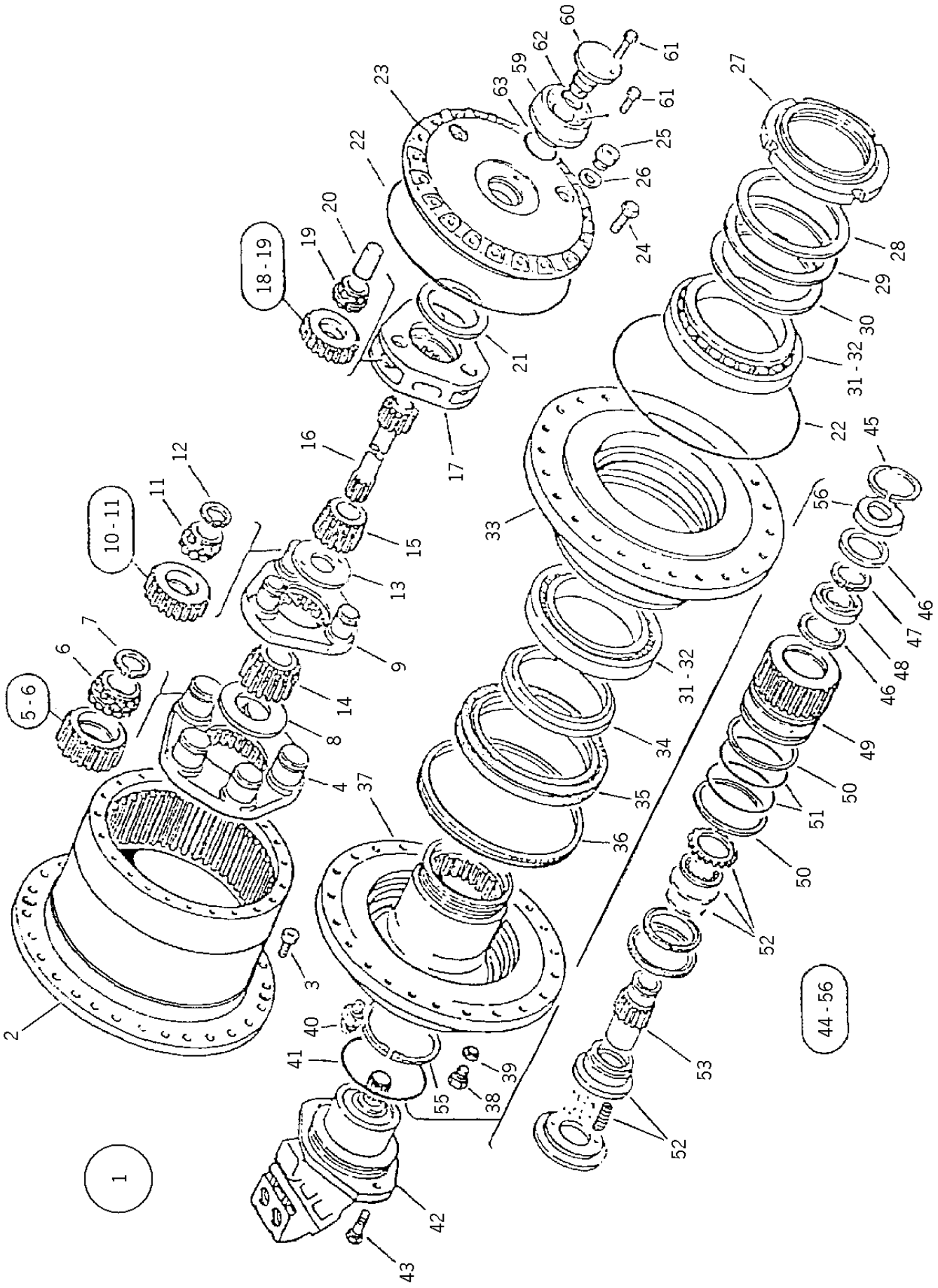


Fig. 3-51 Final Drive Assembly

Track and Support Roller – Assembly

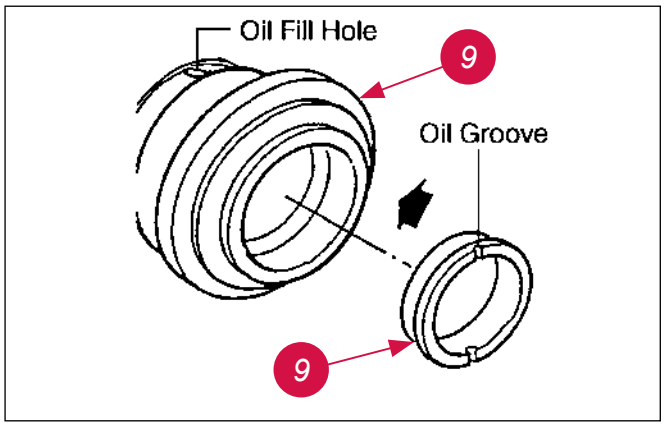


Fig. TSR-6 Bushing – Install

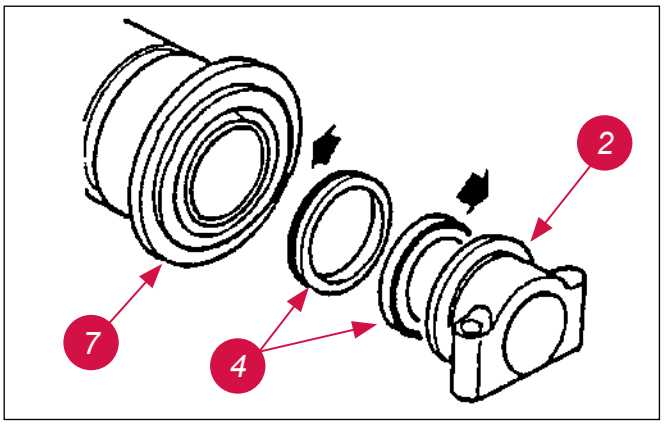


Fig. TSR-7 Seals – Install

1. Clean all parts thoroughly and press the bushings (9) into the roller body so that the oil grooves in the bushing are aligned with the oil fill hole (fig. TSR-6).

2. Place the seals (4) in position in the roller body (7) and brackets (2), (fig. TSR-7). Be sure the seal lips face away from each other.

NOTE: If reusing the old seals, be sure to mark them, so they go back into the same bore they came out of. Otherwise they may not seal properly.

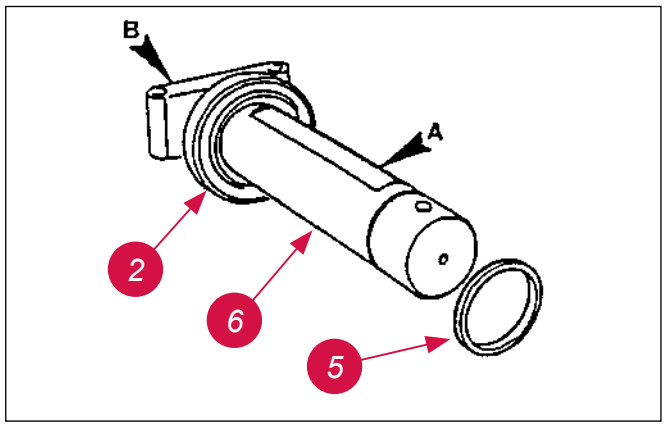


Fig. TSR-8. Shaft – Install

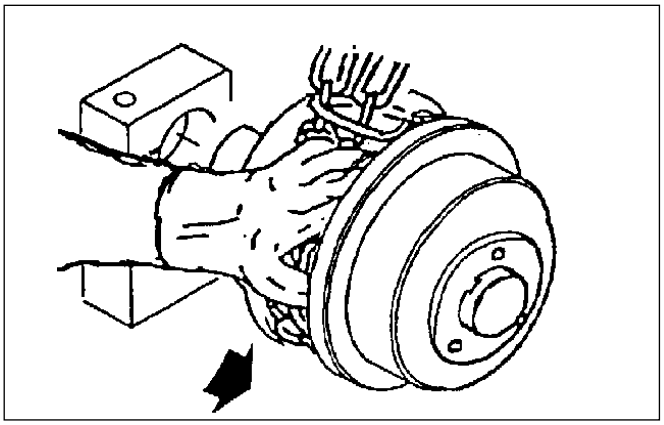


Fig. TSR-9 Shaft – Install Into Roller Body

3. Install o rings (5) onto shaft (6). Install shaft into one bracket (2) making sure the oil groove (A) faces the same direction as the mounting surface (B) of the bracket (fig. TSR-8).

4. Align hole in shaft (6) with hole in bracket (2), place a wood block under bracket and install roll pin (3). Push assembled shaft into roller body (fig. TSR-9).

NOTE: Place a block of wood under the bracket when driving in roll pin to avoid damage to the seal retainer.

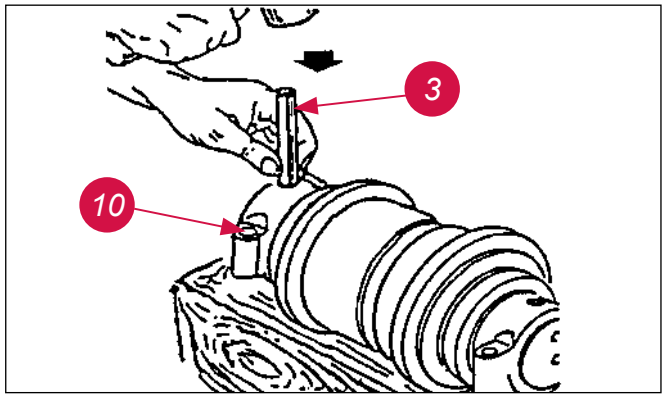
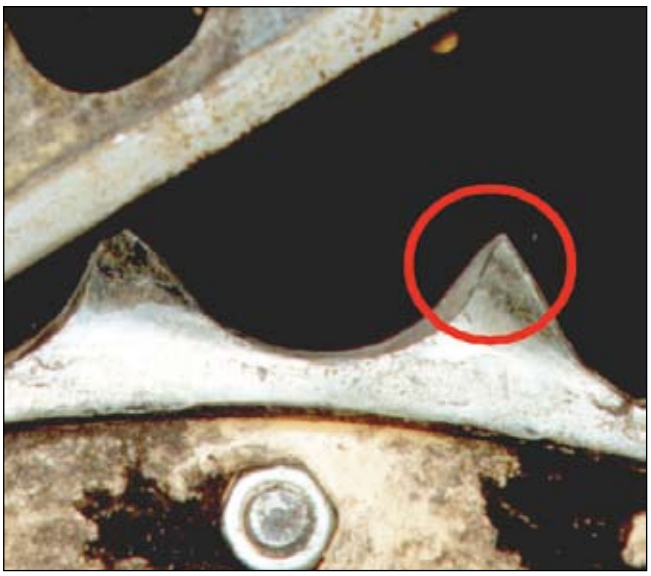


Fig. TSR-10 Roll Pin – Install

6. Install other bracket (2) onto shaft, align holes as in step 4, place a wood block under bracket and drive in roll pin (3). Fig. TSR-10.

Sprocket Wear Patterns (cont.)

Wear of Tooth Tip



Wear of tooth tip.

Causes:

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

Effects:

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

Remedies:

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

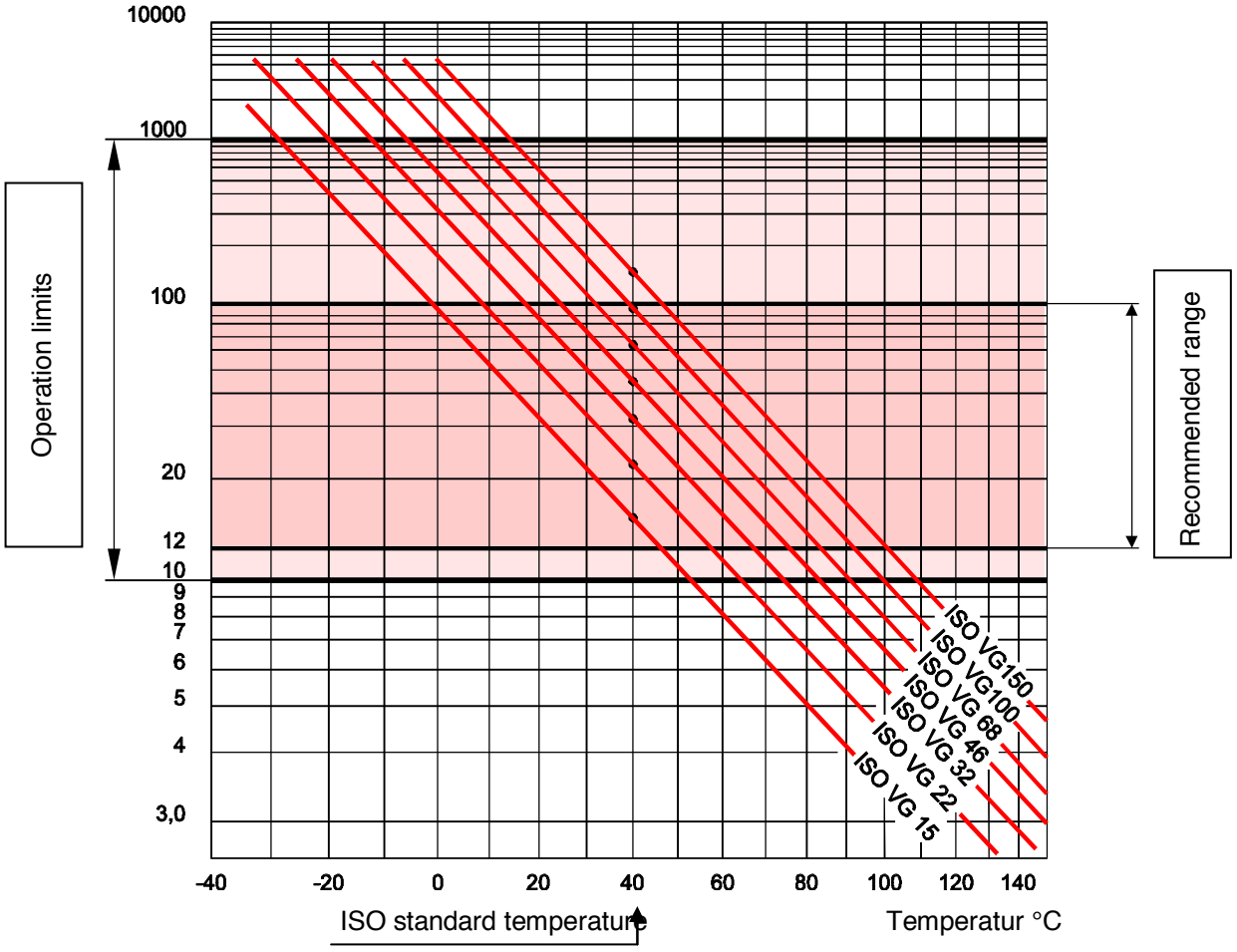
Hydraulic Fluids

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

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

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

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



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

Caterpillar C27 Engine

The SKS-W has a turbocharged and after cooled **Caterpillar C27** twelve cylinder diesel engine producing **800Hp** at **2100rpm**.

Engine Service Procedures

Lubrication requirements, fluid levels, and general service requirements are covered in Section 9. Refer to the engine manufacturer's manual on the specific engine for more detailed service requirements.

Fig. 4-2 Caterpillar C27 Engine

Engine Oil Pressure Switches

- **Oil pressure gauge sender** – this measures engine oil pressure. This sender provides a reading of the engine oil pressure to the gauge in the cab. The sender has no visual or audible alarm.
- **Engine Oil Pressure switch –** This switch closes when adequate Engine Oil pressure is reached upon start- up. If the Engine Oil pressure falls below **15psi,** the switch will open and flag an alarm on the Vigilante.

NOTE: The two switches are mounted on a tee which screws on the engine oil filter housing on the left hand side of the engine.

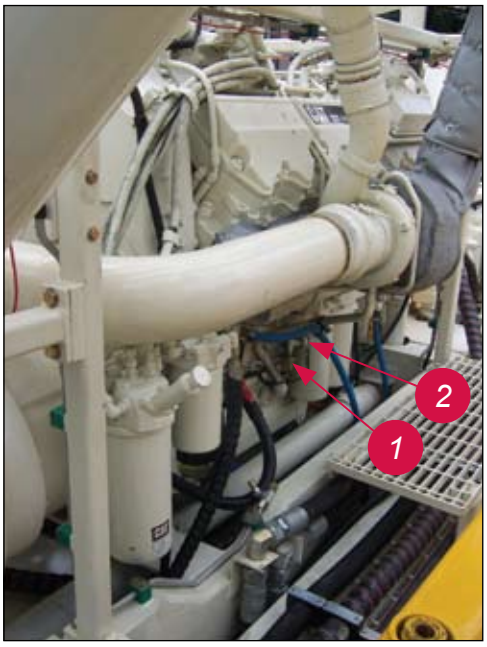


Fig. 4-3 Engine Switches

1. *Oil pressure gauge sender*
2. *Oil Pressure switch*

Pump Drive Gearbox

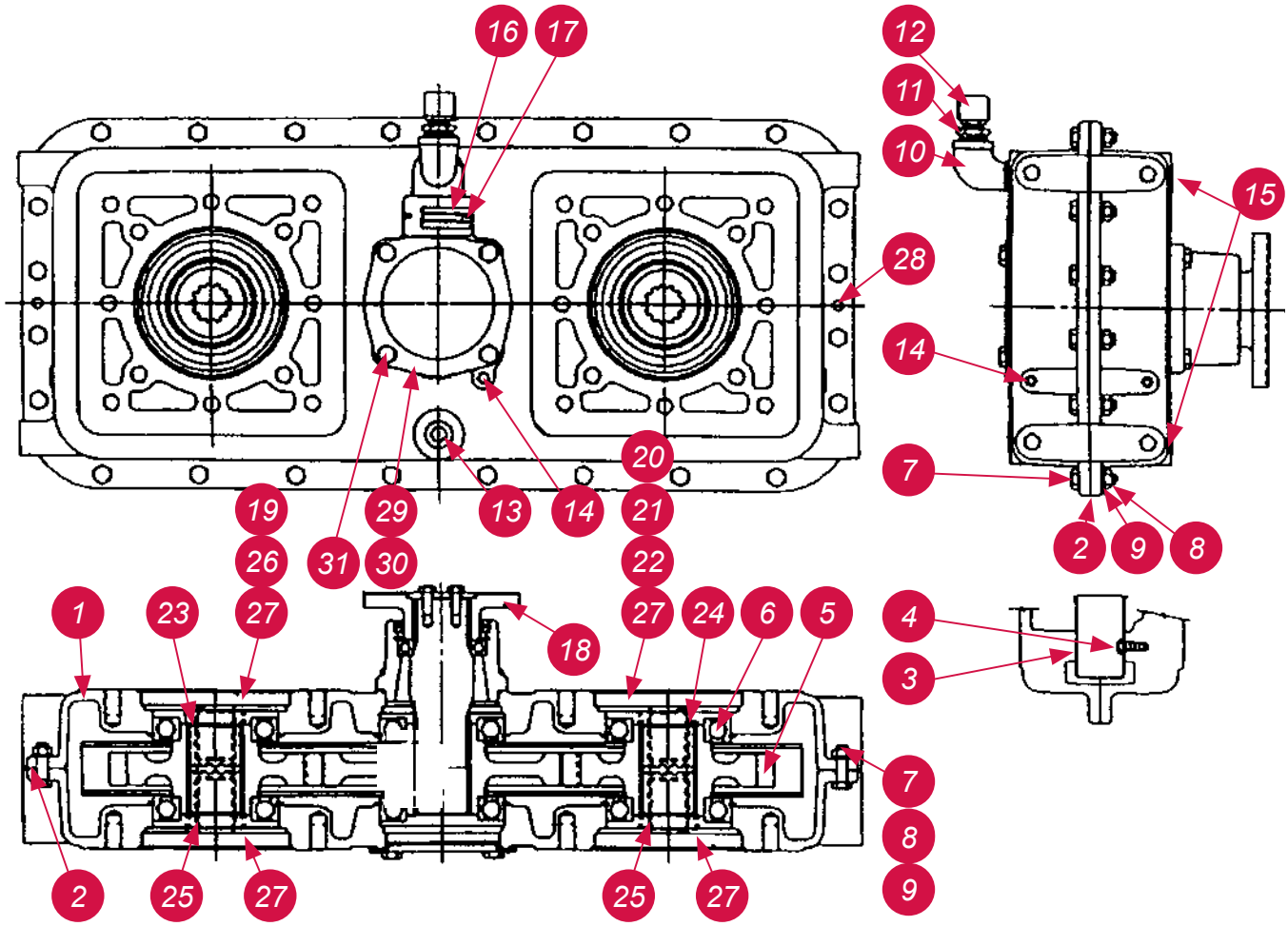
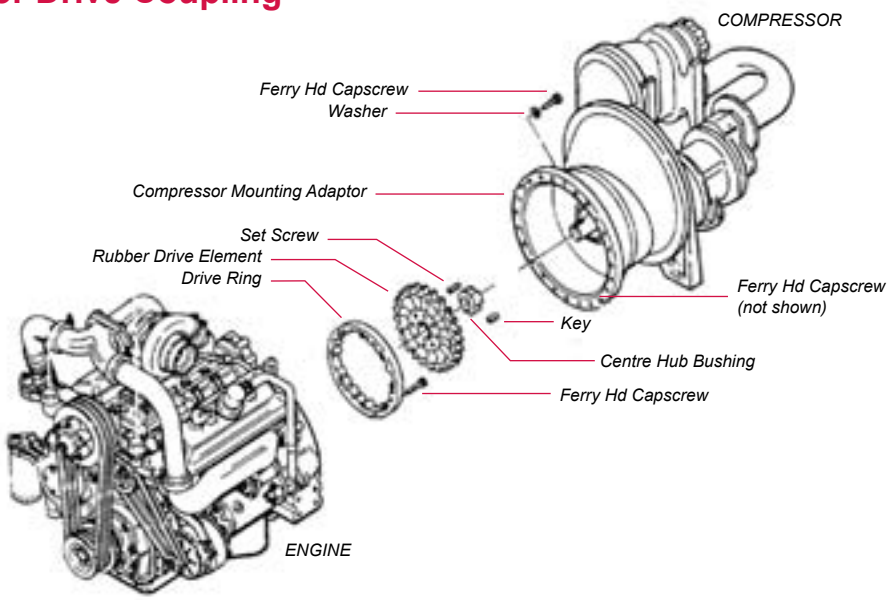


Fig. 4-21 Funk Pump Drive Gearbox

1. *Housing*
2. *Gasket, housing*
3. *Oil trough*
4. *Capscrew (2)*
5. *Gear, 30T (3)*
6. *Bearing (6)*
7. *Capscrew (24)*
8. *Nut, hex (24)*
9. *Washer, lock (24)*
10. *Elbow, 90°*
11. *Bushing, reducing*
12. *Breather*
13. *Plug, magnetic*
14. *Plug, pipe (3)*
15. *Plug, pipe (2)*
16. *Plate, ID*
17. *Screw, drive (2)*
18. *Shaft, input assembly*
19. *Adapter, SAE C*
20. *Ring, adapter*
21. *Adapter, pump, SAE B*
22. *O-ring*
23. *Drive shaft C, 19T*
24. *Sleeve, adapter*
25. *Drive shaft D/E, 19T (2)*
26. *O-ring*
27. *O-ring (4)*
28. *Pin, dowel (2)*
29. *Plate, cover*
30. *O-ring*
31. *Capscrew (4)*

Compressor Drive Coupling



Compressor Drive Coupling – Removal and Replacement

The compressor is driven off the rear of the engine via a torsional drive coupling (item 2, fig. 4-6). The coupling consists of a rubber element, flange, and taper lock bushing. Usually no service is required other than replacement when the rubber element is worn out.

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

Compressor Unit – Removal:

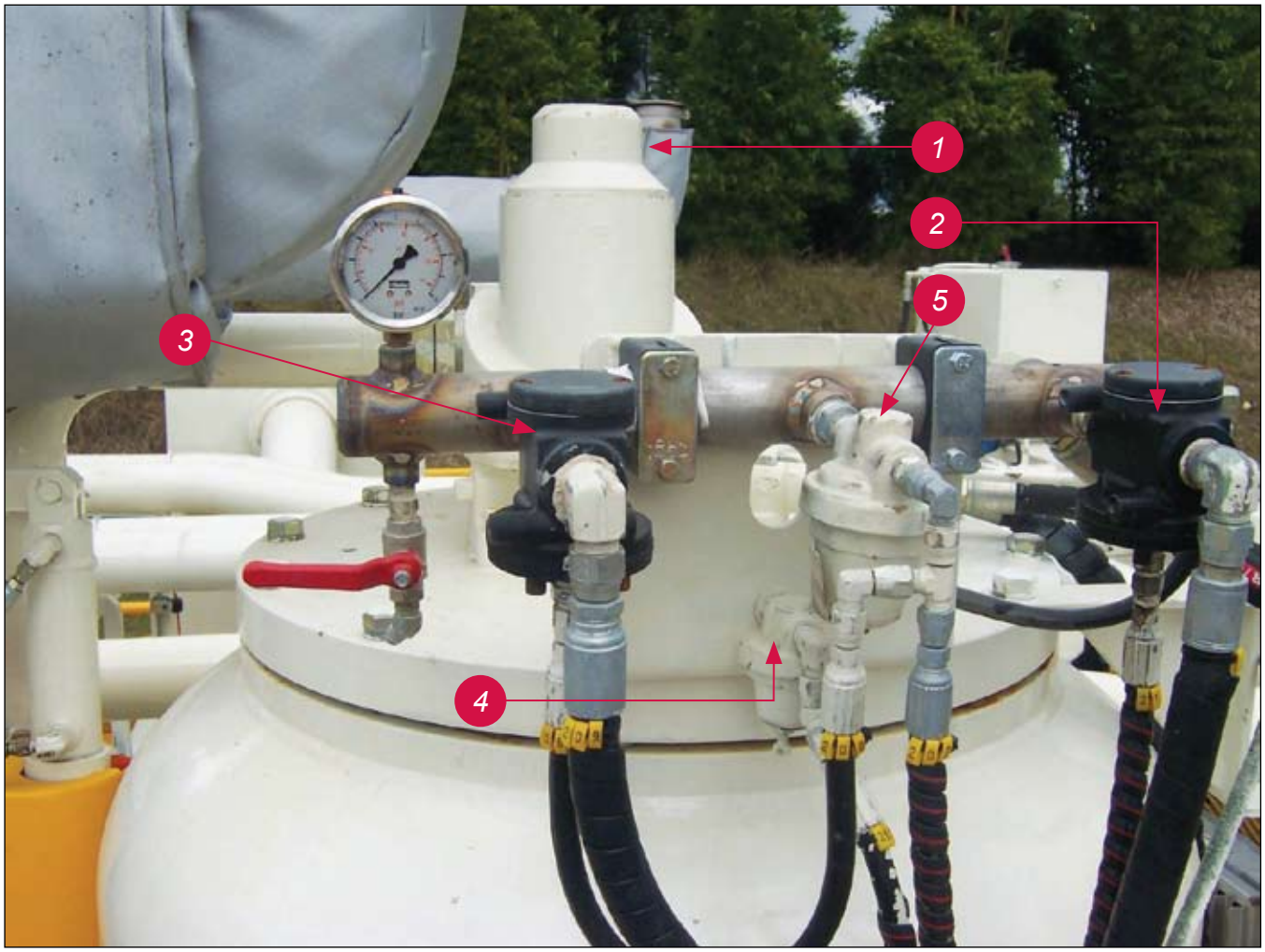
1. Support the compressor unit with a suitable lifting device.
2. Remove the four bolts and nuts (6 and 7) that attach compressor to the mounting bracket (5).
3. Remove the seven nuts (16) and nine capscrews (10) that secure the compressor to the engine flywheel housing.
4. Loosen main air connection so compressor unit can be moved back far enough to allow access to drive coupling.

NOTE: Compressor oil will need to be drained to do this.

5. Replace rubber element in drive coupling. Inspect taper-lock bushing and replace if required. Refer to parts manual for part numbers. Ensure rubber element is fully engaged in the aluminium ring bolted to the engine fly wheel.

NOTE: If engine or compressor seals leak onto the rubber element the rubber will deteriorate quickly so will require replacement.

Compressor Regulation



Air Regulator Manifold

1. *Minimum pressure valve*
2. *Shutdown blowdown*
3. *Running blowdown*
4. *Reducing regulator to 50psi*
5. *Relieving regulator 125psi*

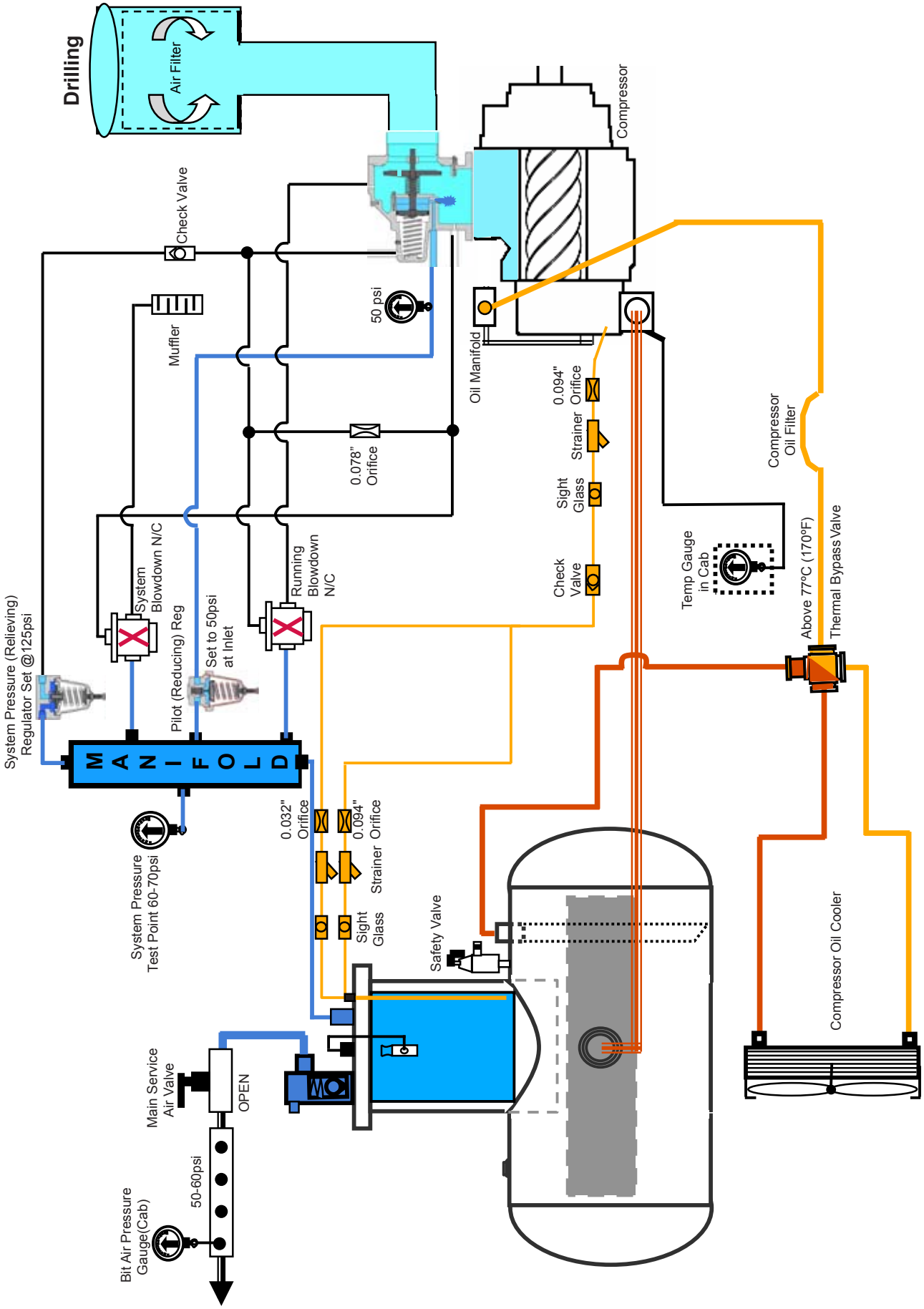
System pressure regulator / relieving regulator – This is a relieving type pressure regulator. It is connected between the receiver and the inlet control cylinder. The regulator controls the receiver pressure by closing the inlet valve when their settings are reached. When air pressure builds up to 125psi, flow is allowed through to the Port 1 to close the inlet valve on the poppet.

Pilot regulator – is a pressure reducing regulator connected to Port 2 on the poppet inlet valve. Its pressure is adjusted to just above 50psi in order to provide 50psi to Port 2 on the inlet valve. Port 2 enters the chamber opposite the large spring which closes the valve. The 50psi in the Port 2 chamber provides enough pressure to overcome the spring and open the valve. The chamber is vented via Orifice 1 into the compressor side of the inlet valve.

The Port 2 chamber must have 50psi pressure. Too little and the spring will not be overcome and the inlet valve will not fully open. Therefore the compressor will draw less air into its intake which will cause a reduced discharge volume. If its too high the system regulator will not supply enough pressure to overcome the pilot pressure and close the inlet. Therefore the compressor will continually make air, causing the safety relief valve to discharge. This will also happen if the pilot reducing regulator has failed.

Compressor Control Set-up Closed Poppet Inlet (cont.)

Compressor Air Circuit 2000 cfm @ 100psi Closed Poppet Inlet



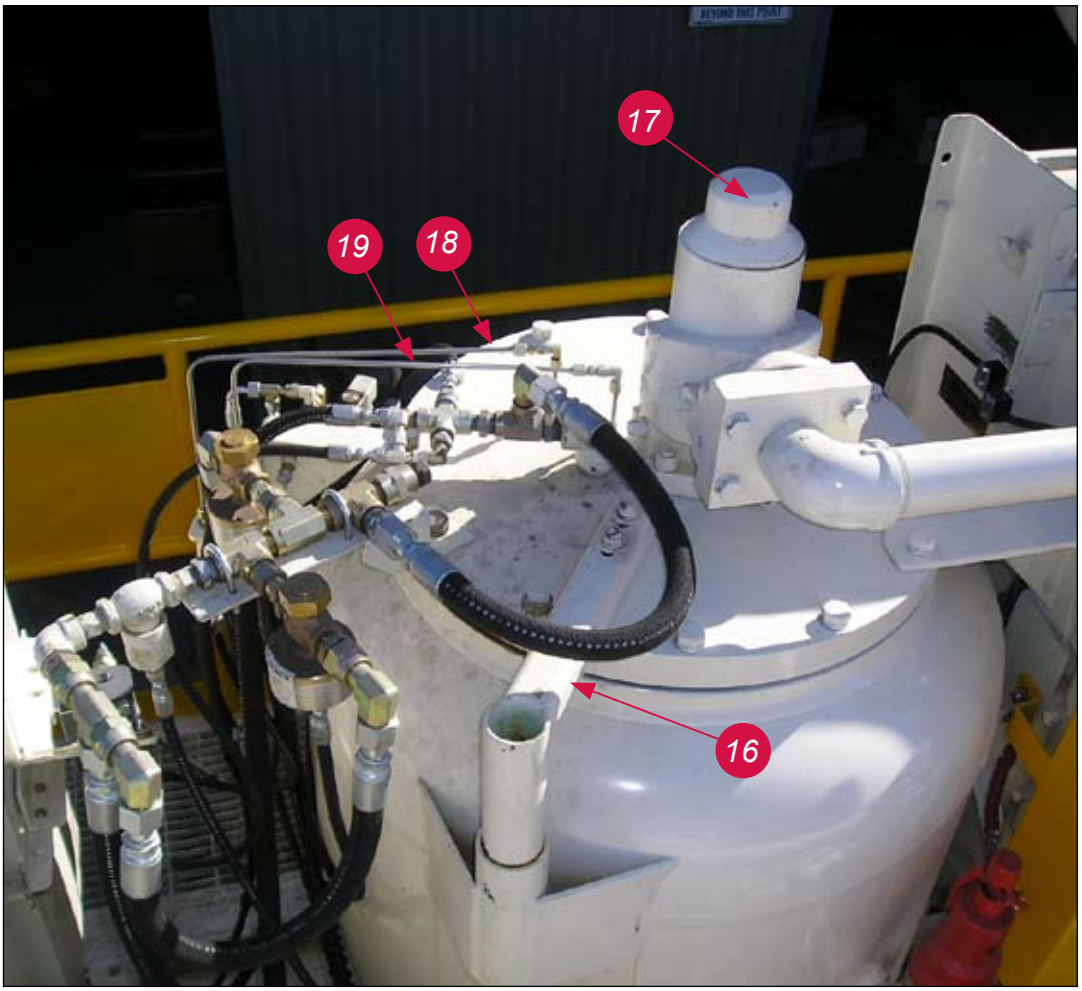


Fig. 4-34 Receiver Tank Assembly (ref. 2000/125 compressor)
(Item numbers correspond with items in fig. 4-33)

12. *Boom, for lifting receiver tank cover*
17. *Minimum pressure valve*
18. *Oil return tube, primary (scavenge line)*
19. *Oil return tube, secondary (scavenge line)*

Separator Elements

When the filter restriction indicator (24) indicates too high differential pressure, the separator elements need to be changed. First check to be sure the orifices (7, 8 and 15d) are clear. Check that the return line strainer (if equipped) is clear. If all these are found to be in good shape, then follow procedure for replacing separator element on next page.

A small amount of compressor oil will pass through the separator element. The oil return tubes (scavenge tubes), items 18 and 19 are to return this oil to the air end. A blocked or broken scavenger tube will allow the oil to build up in the separator elements and will cause the elements to collapse and fail.

NOTE: Oil return tubes must be set at 1.5mm above base of each element.

Troubleshooting

The information contained in the Troubleshooting chart has been compiled from field report data and factory experience. It contains symptoms and usual causes for the described problems. However DO NOT assume that these are the only problems that may occur. All available data concerning the trouble should be systematically analysed before undertaking any repairs or component replacement procedures.

A detailed visual inspection is work performing for almost all problems. Doing so may prevent damage to the compressor. Always remember to:

1. Check for loose wiring.
2. Check for damaged piping.
3. Check for parts damaged by heat or an electrical short circuit, usually noticeable by discolouration or a burnt odour.

NOTE: Should your problem persist after making the recommended check, consult your Reedrill representative.

Symptom	Probable Cause	Remedy
Compressor shuts down with air demand present	Compressor discharge temperature switch is open	• Compressor overheating. Refer to compressor overheating as a symptom • Cooling air flow is insufficient; clean cooler and check for proper fan speed • Low fluid sump level; add fluid • Temperature regulating valve is not functioning properly; change the thermostat element • Defective discharge temperature switch; check for a short or open circuit. Should this check out normal, it could be possible that the temperature switch itself is defective
Compressor will not build-up	• Air demand is too great • Dirty air filter • Pressure regulator out of adjustment • Defective pressure regulator • Defective minimum pressure valve • Shutdown blowdown and running blowdown valve are jammed open	• Check service lines for leaks or full discharge pressure open valves. • Check the filter indicator and change or clean element if required. • Adjust regulator according to of adjustment control adjustment instruction in the maintenance section • Check diaphragm and replace if necessary (kit available) • Check that piston is moving freely • Check at silencers

Cleaning

STANDARD EXTERNAL CLEANING

To maintain efficiency and assure maximum life of a MESABI Core, reasonable care must be taken when cleaning.

Most radiator shops use a hot alkaline soap, caustic soda or chemical additives in their boil-out tanks which attacks solders. If a MESABI tube is soaked in such a solution, the solder bond between the finning and tube will be adversely affected. If it is known that the particular solution used is not harmful to solder, then it will not hurt the solder used on the MESABI tube. Be sure to completely rinse the cleaned tube/core in clean water after removing from the boil-out tank.

In most cases, it may be best to blow out any dry dirt with a high pressure air gun prior to washing the core with the high pressure hot water washer.

For general external cleaning, a high pressure, hot water washer (with or without soap) can be used at pressures up to 1200 psi. **(CAUTION! To prevent fin deformation, stay a few inches away from the core and you must spray straight into the core ... not at an angle. If the cooler is still in the machine, you may have to use an offset angled nozzle so that you can spray straight into the core. If there is any doubt, try your cleaning method on a small portion of the core first.)** It is important to start on the air exit side. Work from the top to the bottom. Concentrate on small areas and work slowly. Wash until the water exiting the opposite side is free from dirt and debris. Complete this side and then repeat the process from the other side.

EPOXY COATED CORES

Epoxy coated cores must be cleaned with care to assure the coating is not damaged.

1. A high pressure hot water washer can normally be used. Use a "fresh" water supply. Water temperature should not exceed 180ºF. Do not steam clean. The nozzle should be kept approximately 300mm (12") away from the core.

   CAUTION! We do not recommend a pressure rating because as Epoxy ages the coating does become brittle and might be damaged at higher pressures. We recommend that you try your cleaning method on a portion of a single tube first.

2. Wash the core thoroughly and methodically, starting at the top and working towards the bottom. Do not wash in one area for extended periods. The core will be clean when the water exiting the core is clean.
3. Blow off excess water with air.

Epoxy coatings are not meant for submergent duty. L&M Radiator does not warrant against corrosion, but this coating, properly cared for, will help increase the service life and efficiency of your cooling system.

INTERNAL CLEANING

In most cases just flushing the inside of the tubes with a high pressure hot water washer, with soap, will do the job.

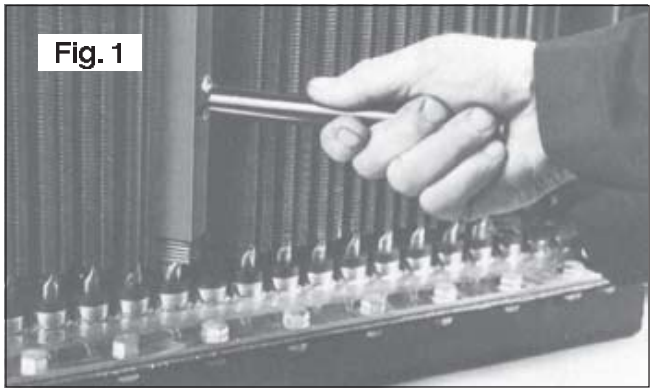
Tube Removal

HELPFUL HINTS:

- Clean the core prior to removing tubes.
- To avoid bending or kinking tube ends, reduce the angle of the tube as it's being pulled from the top seal
- If the core has a center tank, remove the top core tubes and seals first.
- If the core has an ITS (Individual Tube Support) system, mark the bars front and back before removing, to ease reassembly.
- To assist in the removal process, spray WD40 on the top end of tubes.
- If tubes are difficult to remove, try using the breaker tool and removal tool simultaneously.

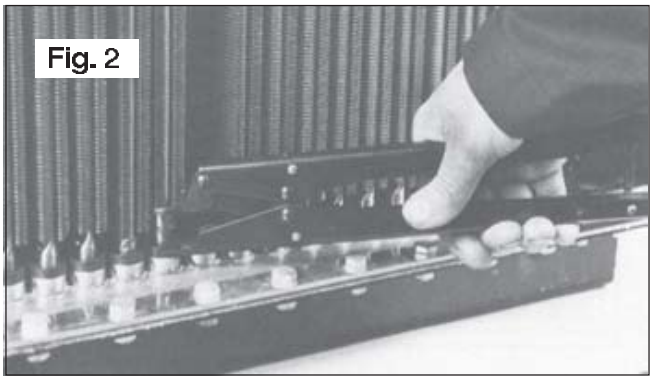
STEP 1.

Loosen the tube by using Breaker Tool, as shown in **Fig 1**. The Breaker Tool should be placed at top or bottom, not at middle when freeing tube from seal. Lightly twist the tube back and forth, to loosen tube from seals.



STEP 2.

After tube is free, place upper jaw of Installation Tool around the round portion of tube, just below the flattened portion. Place lower jaw on top of bottom seal, see **Fig. 2**. Squeeze handles of tool together and raise tube only enough to clear bottom seal.



Dust Collector


Duraquip Dust Collector

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

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

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

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

Operating Principle

The DURAQUIP Dust Collectors are constructed from three bolted sub-assemblies:

1. Fan housing assembly, containing the centrifugal fan and either the hydraulic, air or electric drive motor.
2. Main housing, which is divided into upper (clean air) chamber and lower (dirty air) chamber, separated with a bulkhead. The upper chamber contains solenoid valves which supply and regulate the purging air supply to the filter cartridges. It also provides access to the compressed air reservoir, which is attached to the bulkhead between the chambers. The lower chamber is divided into compartments, one for each filter cartridge. The cartridges are accessible from the bottom of the housing. Each chamber contains a test port for the manometer, for sensing the amount of vacuum created by the suction fan. The timer is located in a separate dust tight box, accessible from the front of the housing.
3. Hopper assembly, the lowest section, contains the suction inlet pipe, heavy particle and water separator, flap valve or discharge tubes for the discharge of cuttings and storage space for cuttings. A dust curtain is attached around the outside of the discharge valve if the collector is installed higher than approximately 508mm (20") from the ground, to prevent dust from blowing around by the wind.

Water Injection Control

Fig. 5-9 TOC 2 Controller

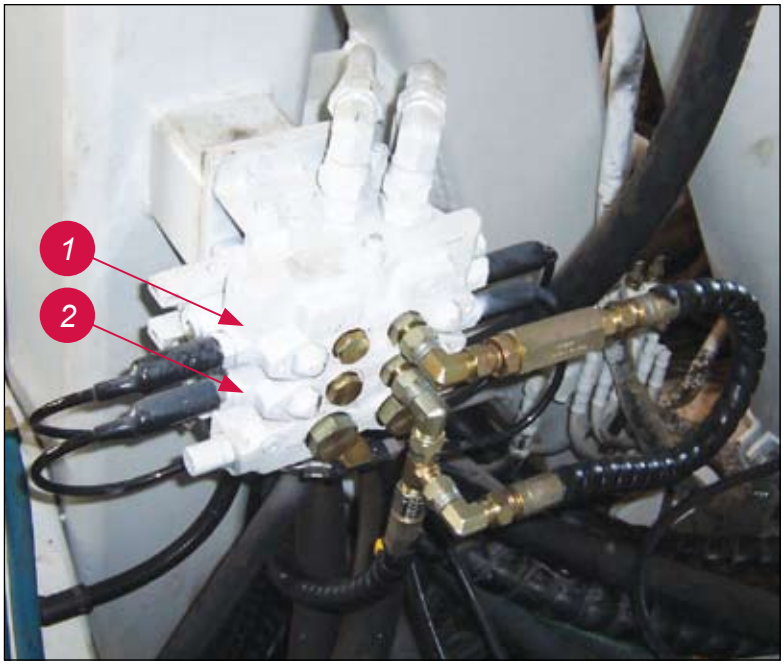


Fig. 5-10 Proportional Hydraulic Twin Spool Valve

1. 40 litre spool *2. 65 litre spool*

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

Fig. 5-13 Water Injection Dial Controller

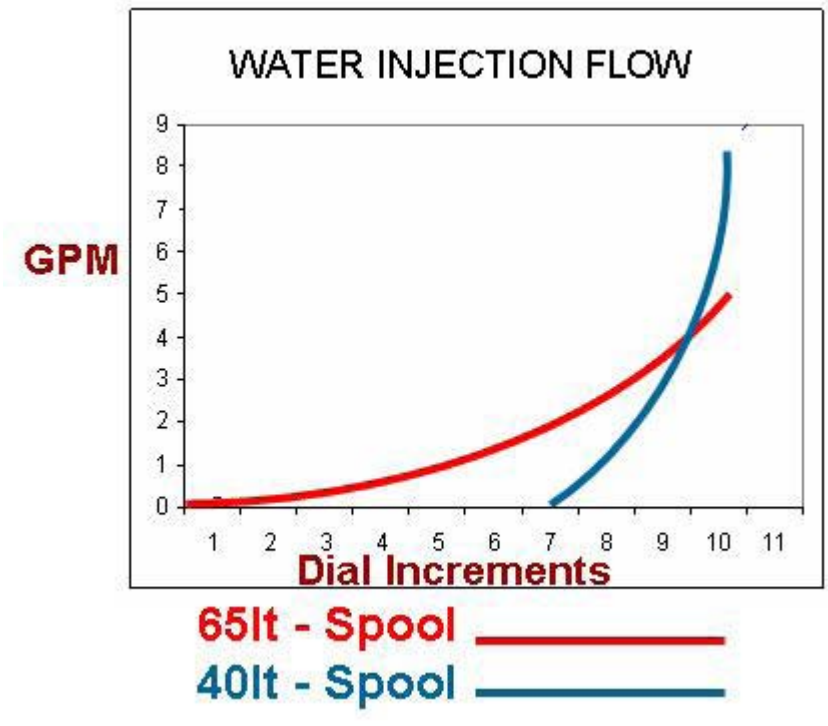


Fig. 5-11 Water Injection Flow Chart

Notes

Removal From Mast Assembly

WARNING: DO NOT climb on mast, serious injury or death can occur. BE SURE to relieve pressure on hydraulic or pneumatic systems before loosening connections or parts.

1. Place mast in horizontal position and remove chock bars (item 9, fig. 6-6) that hold cylinder end nuts at top and bottom of mast. Raise mast back up to vertical position and lock in place.
2. Remove drill pipe from top sub-adapter and rack in carousel. Extend auto tool wrench and place hardwood block on top of tool wrench. Place a steel plate on top of the hardwood block.
3. Bring rotary head with sub-adapter down on top of steel plate and wood block.
4. Switch drill / propel switch to drill mode, switch pulldown system switch to engage pulldown. Set pulldown system pressure to 4000psi (275bar) with pulldown system pressure control. Lower mast to horizontal position.

NOTE: Be careful not to damage threads on cylinder rod when removing nuts.
Record number of threads showing from top of nut.

5. With mast in horizontal position and pulldown still engaged, loosen lower cylinder nut using a chain wrench or a wrench made to fit nut. Nut may have to be broken loose with a sledge hammer. If nut does not break loose, increase pulldown pressure to 5000psi (345bar) and apply heat to nut. Once lower nut is loose, decrease pulldown pressure and switch pulldown switch to disengage pulldown.
6. Run rotary head to top of mast. Secure rotary head to mast crown with chain, so it can not move. Remove the eight bolts that hold the sheave mounts to the cylinder, four per side (item 7, fig. 6-6). Move the cylinder so the rods are centred on both ends. This is done to balance the cylinder for safer and easier removal.
7. Shut off engine and relieve pressure from system by opening vent on top of hydraulic tank. Remove the hydraulic hoses and fittings from both ends of the cylinder rods. Plug ports with cap plugs (not shop rags).
8. Make a note of how many threads are showing above the cylinder rod nuts. When cylinder is installed, you will need to have the same amount of thread showing as before removal.
9. Support cylinder barrel (do not lift cylinder by the cylinder rods) with lifting straps and using an adequate lifting device, place slight tension on the cylinder barrel. Remove the lower and upper cylinder rod nuts. Remove the two lower cylinder guide bolts and the four upper cylinder guide mounting bolts (item 2, fig. 6-2).
10. Protect chrome finish on exposed cylinder rods before lifting cylinder out of mast. Gently lift cylinder and move forward enough to clear the lower mount them move opposite to clear upper mount. Now carefully move cylinder out from under mast. Repair cylinder in an enclosed shop if possible. Use caution not to damage threaded ends of cylinder rods or chrome surface of rods.

Rotary Drive – Removal from Mast

WARNING: DO NOT climb on mast, serious injury or death can occur.
BE SURE to relieve pressure on hydraulic or pneumatic systems before loosening connections or parts.

1. Slacken hoist cables as per steps 1 and 2 of 'Hoist, pulldown cable replacement procedure'.
2. Remove pipe from sub-adapter and lower mast to horizontal position. Be sure machine is on level ground and position rotary head in an accessible working position. Grind the weld from the two chock bars that secure the sub-adapter to the rotary drive shaft and remove sub-adapter.
3. Remove air hose from swivel.
4. Remove the two hydraulic motors and suspend with wire. Do not let motors hang by their hoses.

NOTE: You must remove the centre gearbox cover bolt on each outer edge of the gearbox, so it will clear the upper stop blocks when lifting out.

5. Grind the welds from the two chock bars on the bottom of the rotary gearbox so you can lift the gearbox out of the mast.
6. Support rotary gearbox with suitable lifting device in two places. Cut lock wires (30) in fig. 6-13 and remove capscrews (14) that hold gearbox to guides (3 and 4). Carefully slide gearbox up and out of the mast and take to shop for repair.

Rotary Drive – Installation

1. Hoist rotary drive into position with suitable lifting device. Align unit between upper and lower stop blocks and slide into guides (3 and 4). Align the six bolt holes in the rotary drive with the holes in the right and left guides.
2. Install the six capscrews and washers (14 and 15) on each side and torque to 282 ft lbs (384Nm). Install lock wires as shown in fig. 6-13. Order lock wire from parts book, or use 16 gauge, 304 stainless steel wire.

WARNING: BE SURE to install lock wires correctly, as per drawing.
NEVER reuse lock wires.
INSPECT lock wires daily to be sure none are broken or missing.

3. Install seal housing, air swivel and rotation motors along with all hoses and any other connections that were removed, don’t forget the two gearbox cover bolts at the outer edges.
4. Set main shaft bearing preload per procedure on page 6-22.
5. Start machine and check that rotary drive functions properly and there are no leaks. Shut down machine and install sub adapter or shock sub and tighten joint. Weld new chock bars in place on the sub-adapter according to fig. 6-13. Also weld new chock bars in place under gearbox that were removed earlier.
6. Adjust hoist and pull down cables as per adjustment procedure.

Forward

Read and understand this entire publication before operating or servicing your BRADEN/GEARMATIC winch. Retain this manual for future reference.

The minimum service intervals specified are for operating hours of the prime mover.

This manual contains instructions which provide installation, preventive maintenance and service information for the Model BG8 series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

Some illustrations in this manual may show details or attachments that are different from your winch. Also, some components have been removed for illustrative purposes.

Continuing product improvement may cause changes in your winch which may not be included in this manual.

Safety and informational callouts used in this manual include:

⚠ WARNING ⚠

WARNING – This emblem is used to warn against hazards and unsafe practice which COULD result in severe personal injury or death if proper procedures are not followed.

⚠ CAUTION ⚠

CAUTION – This emblem is used to warn against potential or unsafe practices which COULD result in personal injury and product or property damage if proper procedures are not followed.

This symbol is used for informational callouts or service tips.

Explanation of Model Number

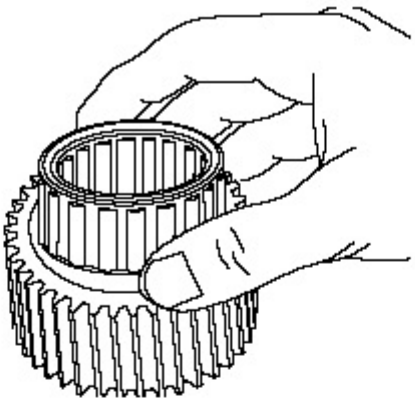
BG	8	B	34	039	01	1
BRADEN GEARMATIC	MAX RATING	DESIGN MODEL	GEAR RATIO	MOTOR SIZE	DRUM SIZE	PERSONNEL HANDLING

BG DESIGNATES BRADEN GEARMATIC
8 DESIGNATES 8,000 LB. APPROXIMATE FIRST LAYER LINE PULL
B DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
34 DESIGNATES TOTAL GEAR REDUCTION
(23 = 23.06:1; 34 = 34.2:1; 59 = 59.06:1; 69/23 { 69.19:1 Hoist / 23.06:1 Lower })
039 DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV
(DECIMAL POINT ELIMINATED. EXAMPLE 039 = 3.9 CU IN/REV)
01 DESIGNATES THE DRUM OPTION
-1 PERMITS TESTING AND INSPECTION PER API 2C RECOMMENDATIONS

Trouble Shooting (cont.)

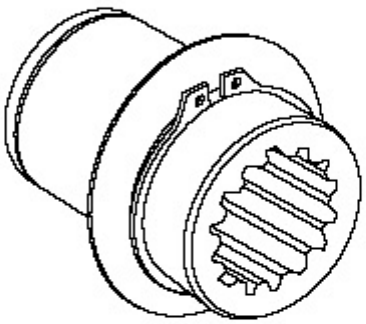
TROUBLE	PROBABLE CAUSE	REMEDY
F Winch "chatters" while raising rated load.	1. Same as D2. 2. Hydraulic oil flow to motor may be too low. 3. Controls being operated too quickly.	Same as remedies for Trouble D2. Same as remedies for Trouble E2. Conduct operator training as required.
G The wire rope does not spool smoothly on the drum.	1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1-1/2 degrees. 2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave. 3. Could possibly be using the wrong lay rope. There is a distinct advantage in applying rope of the proper direction of lay. When the load is slacked off, the several coils on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. Then, when winding is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is apt to be a flattened and crushed rope. 4. The winch may have been overloaded, causing permanent set in the wire rope.	Check mounting distance and fleet angle. Reposition winch as required. Refer to "Winch Installation". Consult wire rope manufacturer for recommendation of wire rope that best suits your application. Replace wire rope and conduct operator/rigger training as required.

Brake Clutch Service (cont.)

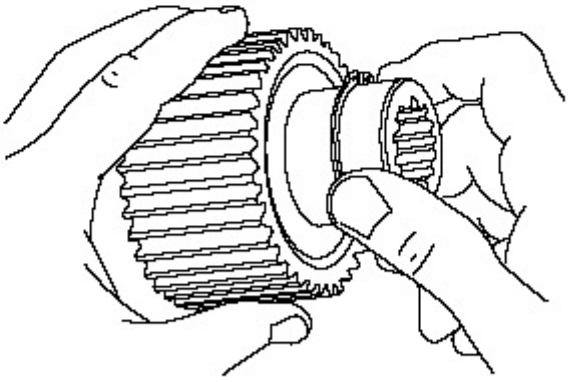


2. Turn the assembly over and install the sprag clutch in the bore of the outer race.

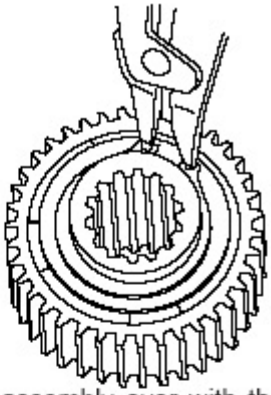
3. Press the remaining bushing into the race. Again, make sure the bushing is against the shoulder.



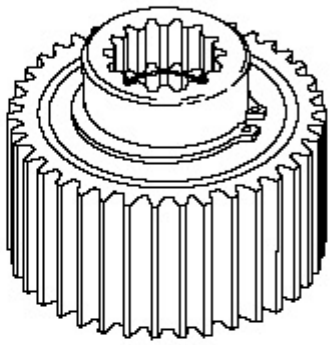
4. Next, install a sprag bushing retainer, then a snap ring on the inner race. Be sure the snap ring is seated in the snap ring groove.



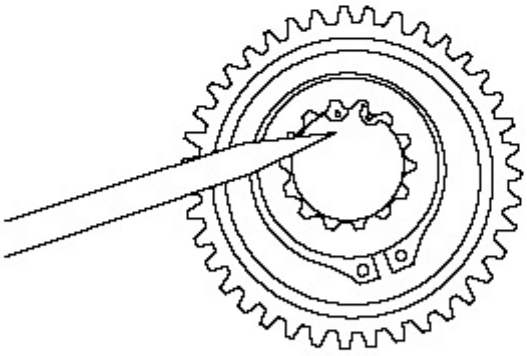
5. Slide the inner race through the bushings and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). If the inner race will not go through the bushings, the bushings have probably been damaged and should be replaced.



6. Turn the assembly over with the snap ring down. Install the second retainer and snap ring. Make certain the snap ring is seated in the groove properly.



7. This is a completed brake clutch assembly.



⚠ WARNING ⚠

Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.

Breakout System – H.O.B.O

The H.O.B.O has three dies which grip the drill pipe. They are secured by means of die holders which have a 'female' dovetail shape that the dies then slide down into. The holders are bolted to the H.O.B.O with two capscrews that must be checked regularly for tightness, as any movement will damage the cut-outs in the H.O.B.O weldment and the die holders will continually come loose. The dies are made from hardened steel and should be a neat tap in fit to the holder. The die holders have a socket headed set screw at the top and bottom of the die which prevents the dies from slipping out. When the dies become worn they WILL NOT grip the pipe, so they must be checked regularly.

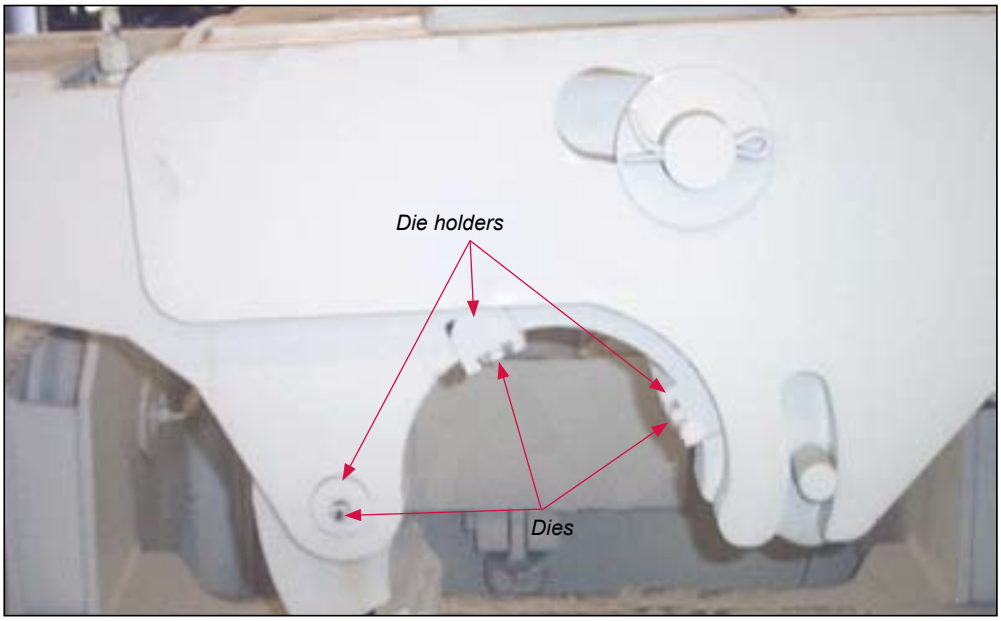


Fig. 6-25a HOBO Dies and Holders

NOTE: If the diameter of the drill string pipe is changed, then the H.O.B.O die holders require changing to a size to match the drill string.

Optional Hydraulic Operated Bit Basket – H.O.B.B

Used in the process of changing drill bits.

Hydraulic Operated Bit Basket

Pipe Rack Roller – Disassembly and Assembly

1. Remove the two capscrews from the retainer plate (fig. 6-41) and remove retainer plate.

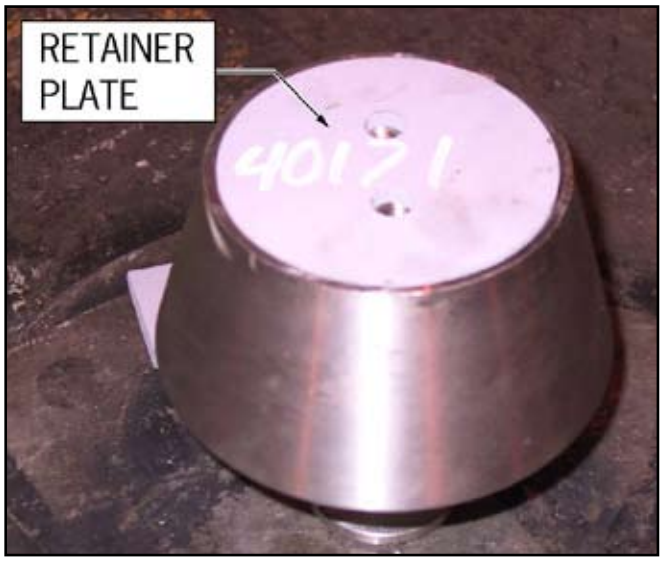


Fig. 6-41 Pipe Rack Roller Retainer Plate.

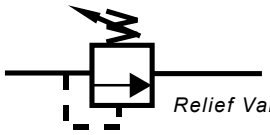
2. Turn roller over and remove the inner retaining ring as shown in fig. 6-42.

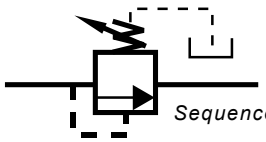
Fig. 6-42 Pipe Rack Roller Inner Retaining Ring.

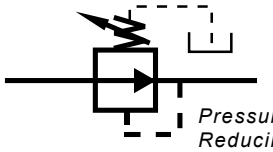
3. Remove seal retainer (fig. 6-43) by pressing out shaft from opposite end using an arbor press. The inner bearing cup will come out with the seal retainer.

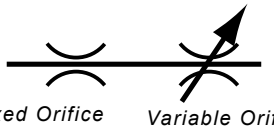
Fig. 6-43 Pipe Rack Roller Seal Retainer.

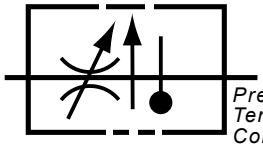
HYDRAULIC SYMBOLS

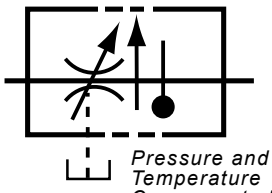

Relief Valve

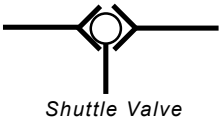

Sequence Valve

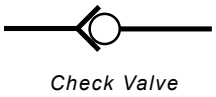

Pressure Reducing Valve


Fixed Orifice Variable Orifice

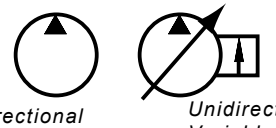

Pressure and Temperature Compensated Flow Control Valve (Restrictive Type)


Pressure and Temperature Compensated Flow Control Valve (Bypass Type)


Shuttle Valve

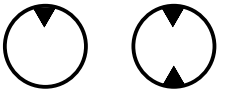

Check Valve


Spring Loaded Check Valve


Unidirectional Fixed Displacement Pump

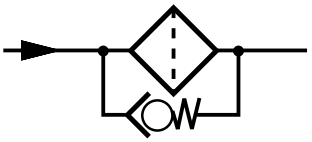
Unidirectional Variable Displacement Pump with Pressure Compensator

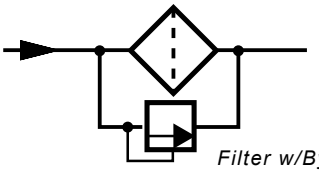

Bidirectional Variable Pump with Integral Charge Pump


Unidirectional Motor

Bidirectional Motor

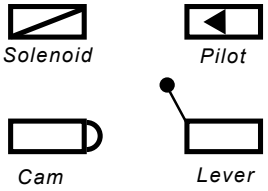

Bidirectional Variable Displacement Motor


Filter w/Bypass


Filter w/Bypass


Oil Cooler or Heat Exchanger

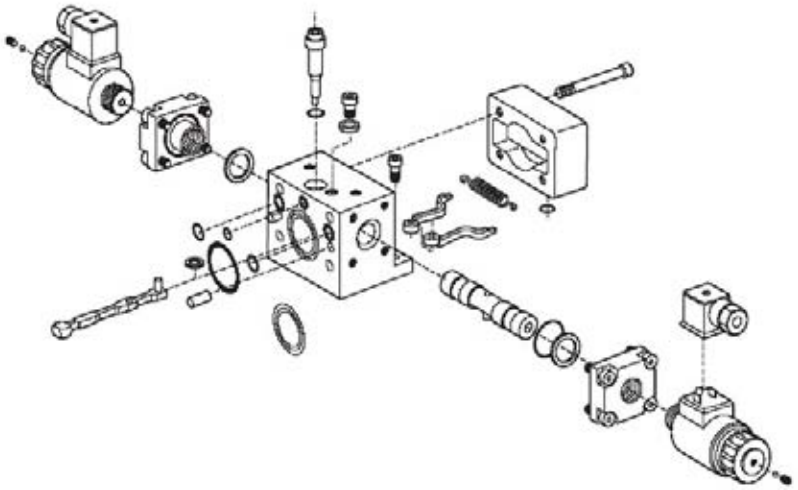
Valve Operators

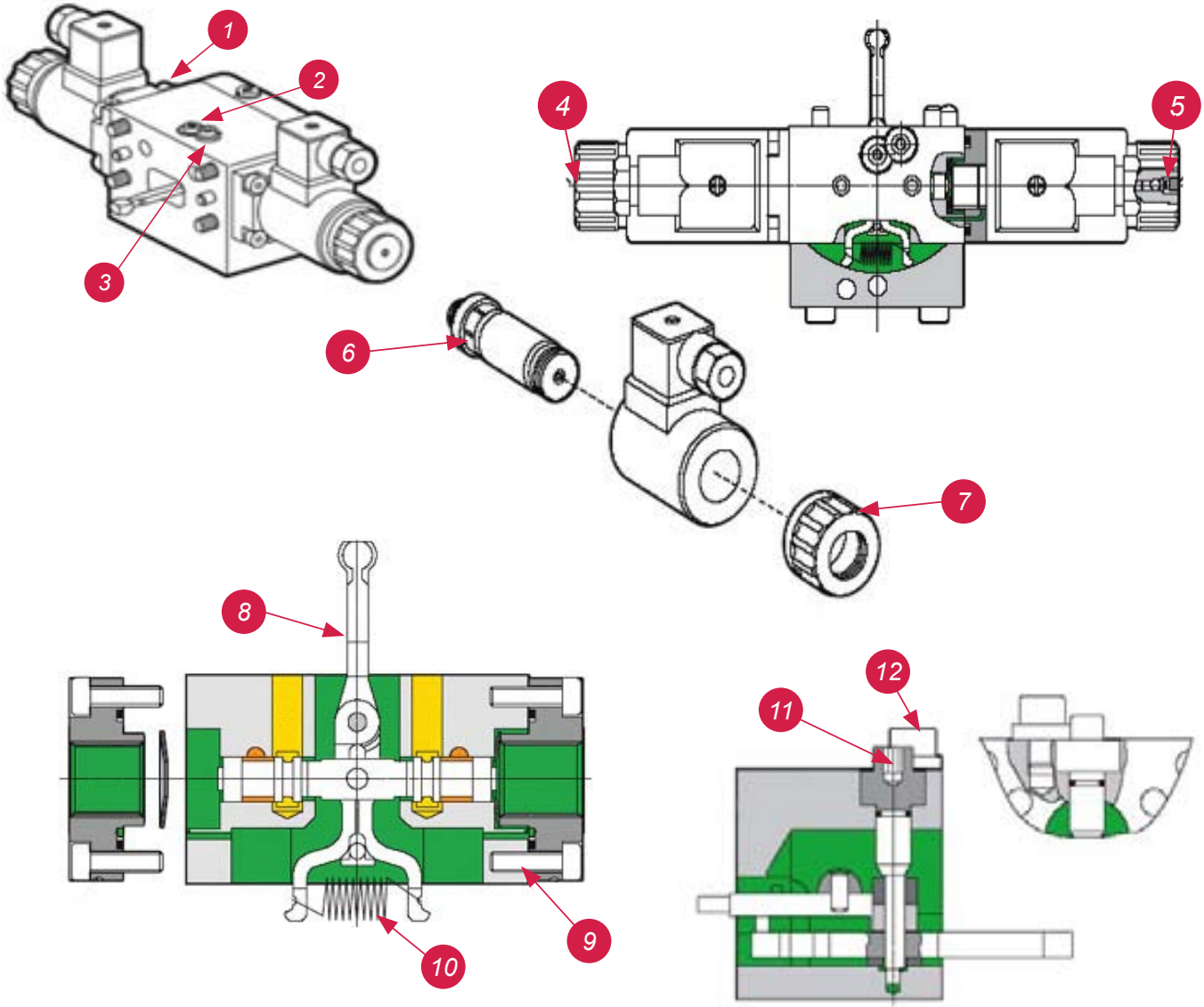

Solenoid Pilot Cam Lever


Accumulator

AA4VG EP Controller

The new proportional solenoids must be bled during commissioning. If air is not removed from the armature chamber, oscillations at the control can occur. One the end of the solenoid in the brass component a small set screw M4, 2A/F for bleeding purposes. This can be unscrewed by a maximum of two turns and then after completion of the bleeding tightened to a maximum of 2Nm.





1. *Assembly position marker EP*
2. *Hydraulic zero position*
3. *Clamping screw*
4. *Bleed screw unscrew by a max of two turns*
5. *Bleed screw*
6. *Pole tube tightening torque 19Nm*
7. *Tightening torque 5+1Nm 26 A/F socket spanner*
8. *Feedback arm*
9. *Assembly position marker EP*
10. *Feedback spring*
11. *Hydraulic zero point eccentric pin*
12. *Clamping screw 6.1Nm*

CAUTION: When loosening the clamping screw hold the eccentric pin – hydraulic zero point. 2x 4mm allen key required.

Set Hydraulic Zero Position – EP Pump Control

When the control module is replaced, it is generally necessary to centre the new module. Follow the steps listed below:

NOTE: Mechanical zero position must be checked first before hydraulic zeroing can be performed

1. Shut down machine and relieve standing pressure.
2. Remove the track brake release solenoid (fig.7-6).
3. Disconnect the plugs from both the pump control solenoid coils.
4. Install a test fitting in both M_a and M_b ports, as well as X_1 and X_2 ports.
5. Start up machine, allow time to warm up and set at high idle (maximum rpm).
6. Loosen the locking screw on top of the control module with a 4mm allen wrench. Use a 4mm allen wrench to turn the adjusting screw. The adjustment screw is an eccentric, therefore turning the screw more than 90° in either direction will have no further effect, and could cause damage to the eccentric pin.
7. With Y_1 and Y_2 pump control coils removed vented to atmosphere, the neutral position is correctly adjusted when:
   a. Equal pressures are at X_1 and X_2 ports. Use one 600psi gauge (fig 7-9) and swap between test ports.
   b. The hydraulic motor does not turn when the brake is released.
   c. Charge pressure registers equal at M_a and M_b ports when the pump is deadheaded.

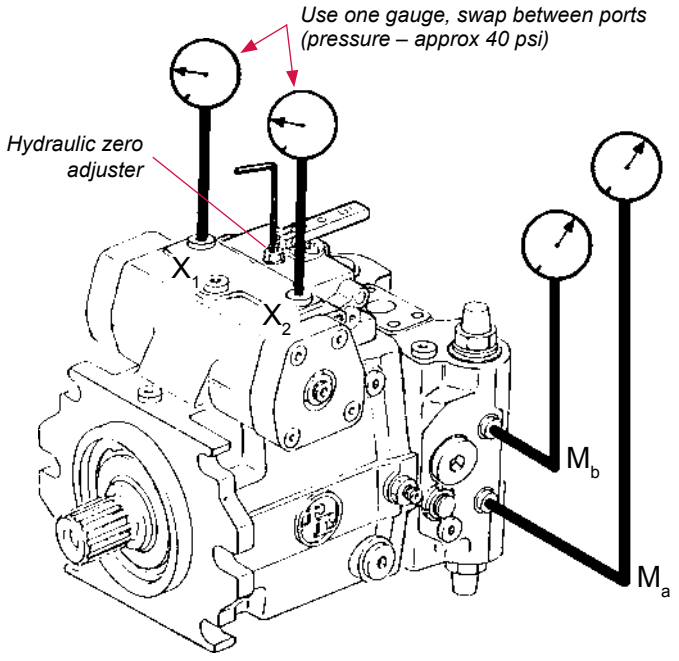


Fig. 7-9 Hydraulic zero position – type HD pump control

Fig. 7-6 Brake Release Solenoid

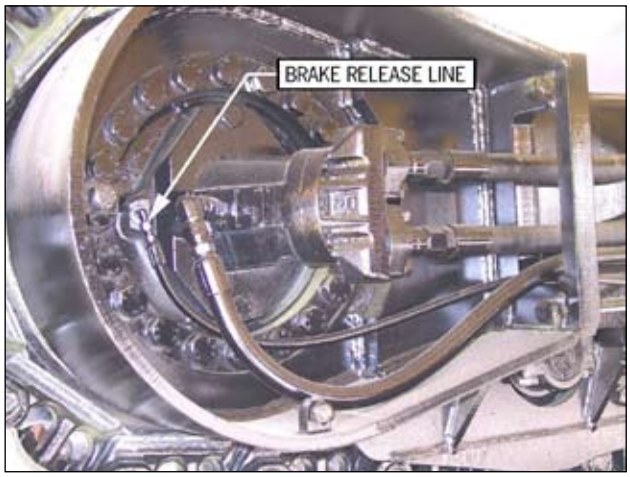


Fig. 7-6a Right Track Motor and Final Drive

Routine Maintenance

The loop filters do not normally require special attention except for periodic monitoring of the dirty element warning device. See lubrication section for filter change intervals. Refer to fig.7-14 for item numbers.

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

Loop Filters Cabside

Loop Filters Offside

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

Tram Circuit

The tram circuits are closed loop circuits. The RH tram pump is dedicated to the RH track and the LH tram/ rotation pump powers the LH track via a diverter valve. Each final drive has a integral brake pack which is spring applied and pressure released. The pilot pressure to release the brake is from the drill/ tram select solenoid valve (V08) when the tram mode is selected (solenoid de-energized). This pilot pressure is supplied to (V08) from the drill/tram interlock solenoid (V07) which will only provide pilot pressure to (V08) when it is energised. The drill/tram interlock solenoid (V07) is energised in the tram mode when;

1. The pipe is out of the hole
2. All pipes are racked
3. The stairs are raised
4. The jacks are up.

Pilot pressure is discharged from Port 3 of (V08) and out through port P3 of the control manifold and on to the tram pilot valves and the brake release ports on the final drives. The Tram control valves provide controlled pilot pressure to either the Y1 or Y2 ports on each pump. This controls the stroke of the pump which governs the tram speed.

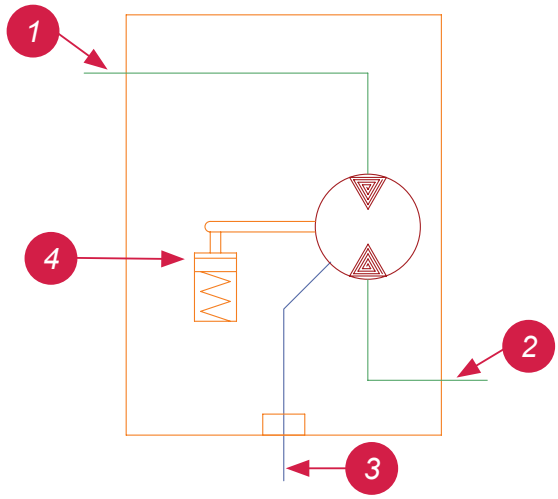


Fig. 7-19 Final Drive Assembly

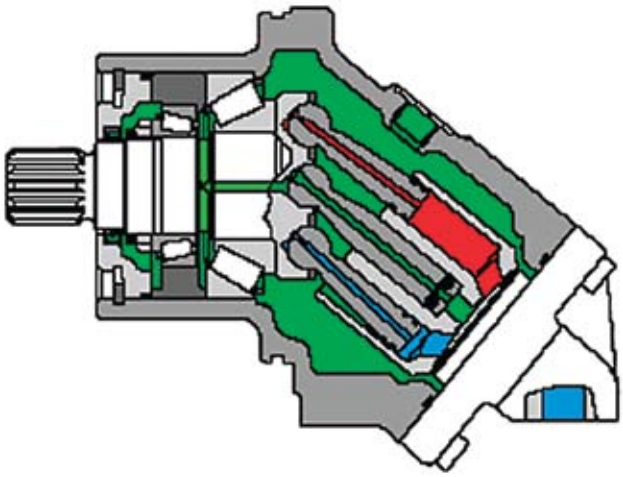


Fig. 7-20 Tram Motor

1. *A port*
2. *B port*
3. *Case drain port*
4. *Brake release port*
5. *Case drain port*
6. *Final drive motor*
7. *Motor mounting bolts*
8. *A and B ports (forward and reverse)*

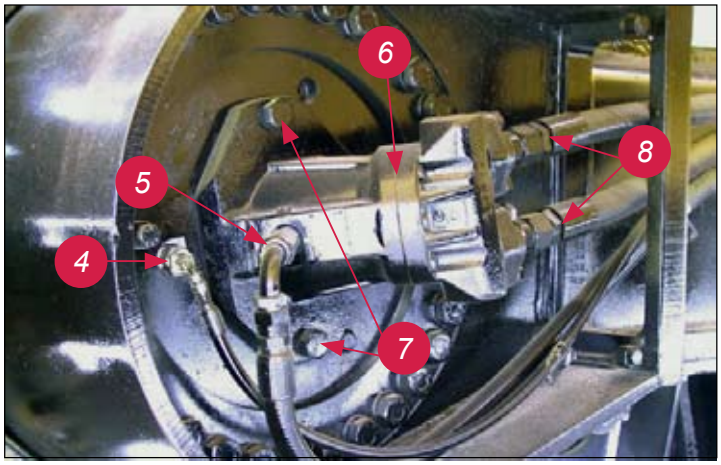


Fig. 7-21 Brake Assembly

V03 Pilot Operated Directional Valve (Pulldown Pressure Control On/Off)

Piloted from Port 1, from the drill/tram solenoid (V15). This valve switches the feed pressure control on in the drill mode, by allowing pressure from Mb Port on the RH tram/feed pump, through Ports 2 and 3, then on to the maximum pulldown pressure relief.

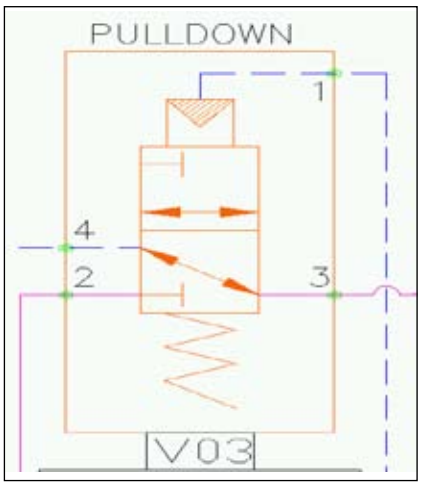
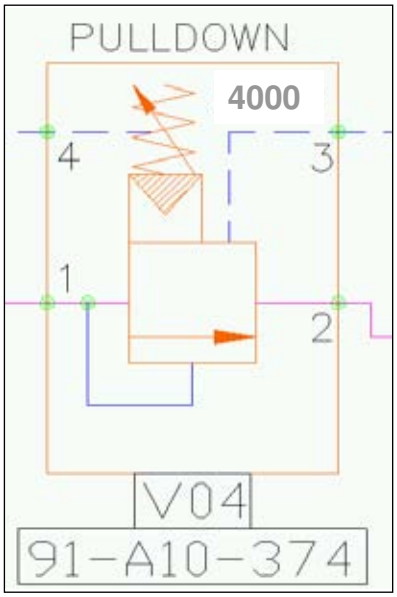


Fig. 7-10f V03 Pilot Operated Directional Valve (Pulldown Pressure Control ON/OFF)

V04 Maximum Pulldown Pressure Relief

This pilot operated, vented relief is set to the highest pulldown pressure required for the rock formation. This setting can be remotely lowered by venting through Port 3 through the pulldown proportional relief valve in the transducer box. Pressure from the MS Port on the RH tram/feed pump via V03 enters at Port 1 and when the relief pressure is reached, pressure exits from Port 2 to Y1 on the servo or the RH tram/feed pump, which de-strokes the pump. 4000psi is the standard setting (maximum 5000psi) but can be reduced if over feeding is causing drilling difficulties.



Setting to 4000psi

1. Lower the rotary head to the mast base and hold the feed lever on.
2. Slowly increase the pull down pressure control in the operator cab until the pull down pressure gauge stops climbing or reaches 4100psi.
3. Switch auto feed on.
4. Adjust V04 relief until the pull down pressure gauge reads 4000psi.
5. Reduce the pull down pressure control to avoid overfeeding when drilling commences. Any pressure up to 4000psi can now be selected. This value can be set lower to suit application.

Fig. 7-10g V04 Maximum Pulldown Pressure Relief Valve

Proportional Valve Set Up

To set proportional valves pulldown force control / rotary torque control.

1. Fit test adaptor 0419301 between coil and din plug amplifier assembly.
2. With ignition on and machine in drill mode (engine shutdown) set dither frequency turn counter clockwise till stop then quarter turn clockwise or 140 Hz.
3. Set potentiometer control on RH control console pulldown / rotation to minimum (fully clockwise).
4. Set minimum current to 120mA.
5. Set potentiometer to full (fully clockwise).
6. Set maximum current to 500 mA.

Parts List:

- Proportional Valves (91A21153801)
- Cartridge (91A11489001)
- Body Steel (91A21153003)
- Coil (91A11487)
- Amplifier Assembly (91A11488001)

1. Test Adaptor (419301)
2. Max Current – 500mA
3. Min Current – 85mA
3. Dither frequency – 1/2 turn clockwise

Auxiliary Pump Operation (cont.)

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

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

Return system flow is filtered at the reservoir

Fig. 7-1 Hydraulic Tank

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

The hydraulic circuit of the mast elevating cylinders is protected by three counterbalance valves. There is one valve at the piston end of each cylinder (fig. 7-40c), as well as, one that is tee'd into the rod end of both cylinders.

The single valve on the rod ends (fig. 7-32) is for controlling the mast when it breaks over centre during setup. This is basically acting as a snubber valve to prevent the mast from running away when gravity overcomes the pivot support balance.

The mast elevating cylinder and repair is included in cylinder repair instructions This cylinder has a 'N' head and 'Z' Piston.

Internal Counterbalance Valve Test Procedure

If a counterbalance valve is suspected to be faulty, use the following procedure to check. Refer to fig. 7-40 for mast elevate counterbalance valve block.

1. Set the machine up level in a suitable service location.
2. Lift mast to 150mm above mast rest and shut down machine.
3. Completely adjust 'out' counterclockwise adjustment on RH extend adjuster.
4. Remove extend hose from extend port and plug hose only.
5. Slowly adjust in (clockwise) extend adjuster until mast start to creep down.
6. Wind extend adjuster 'out' (counterclockwise) one turn and lock in place.
7. Repeat on LH side.
8. Restart machine, lower mast to just rest on mast rest.

NOTE: If valve does not hold load it is to be considered faulty and should be immediately replaced.

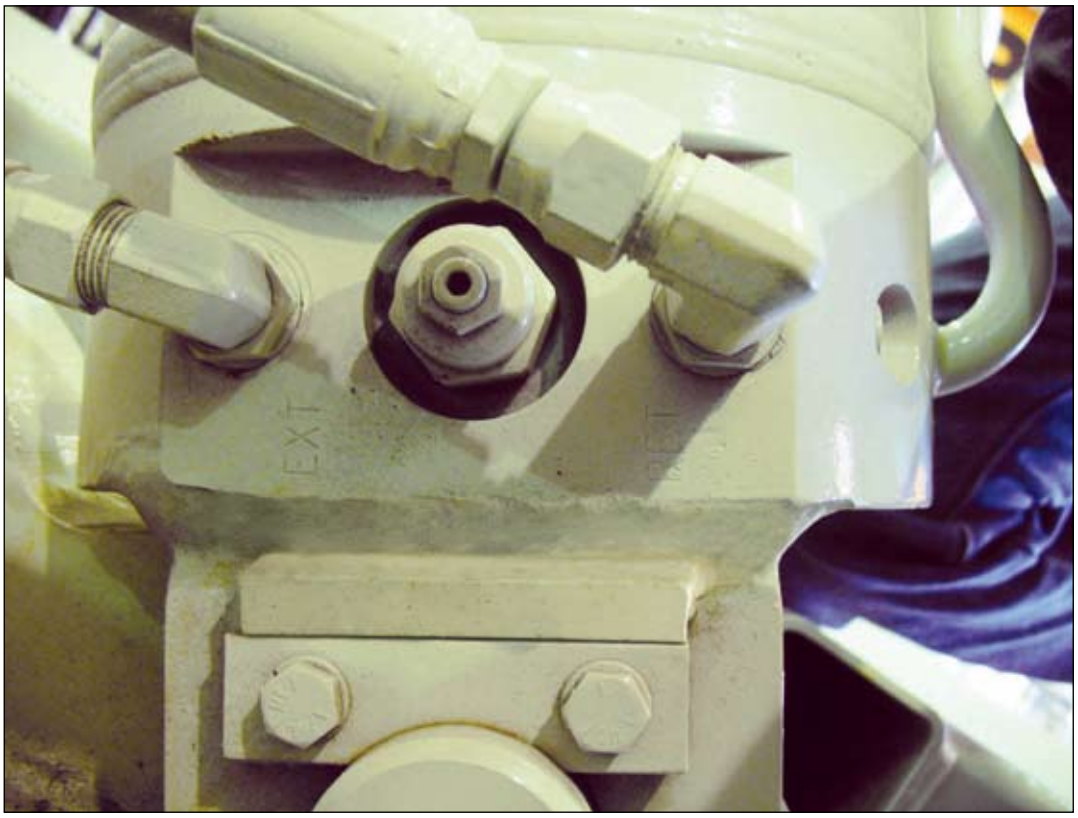
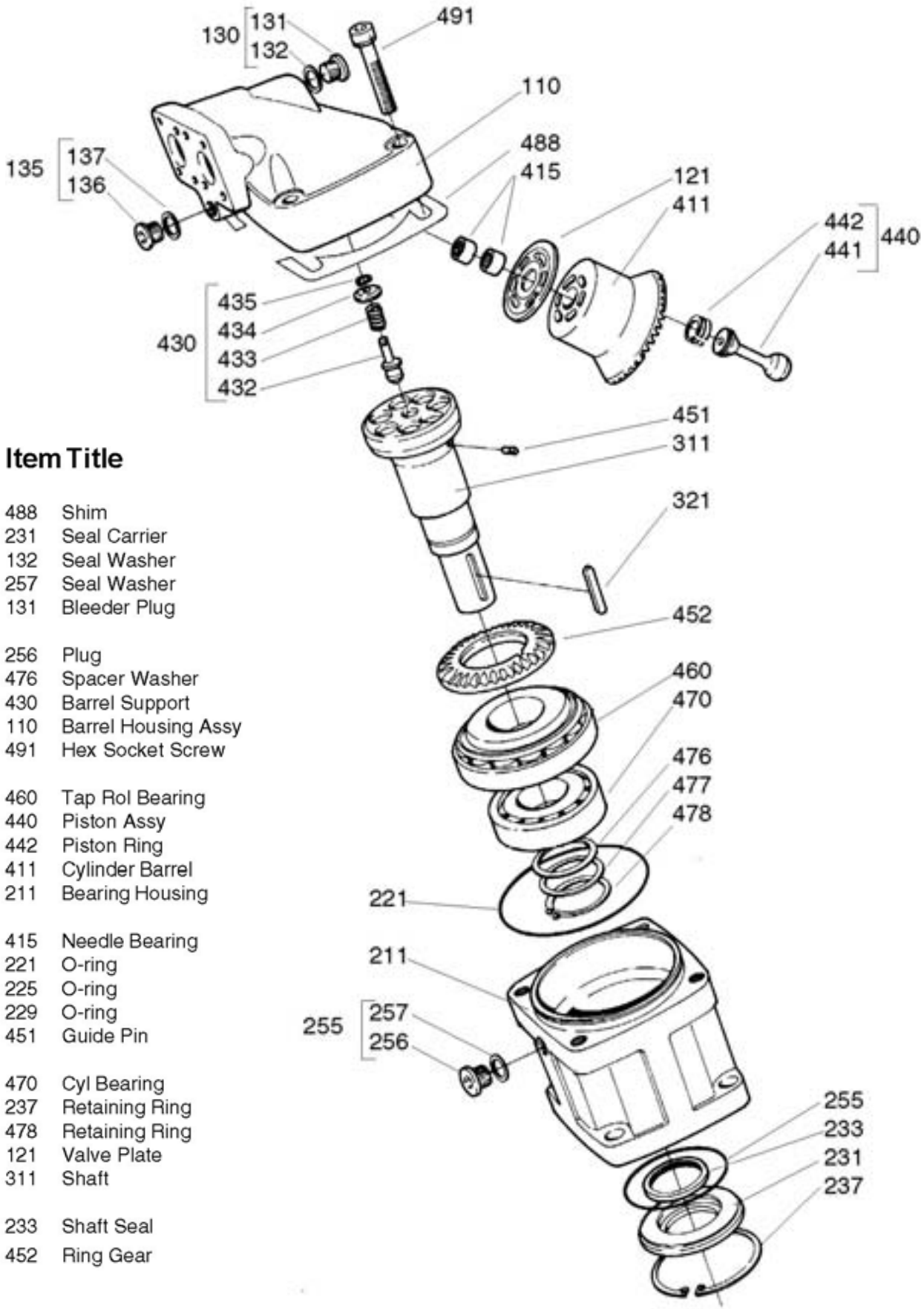


Fig. 7-40c Mast Cylinder Base End showing Counterbalance Valve Block



Item Title

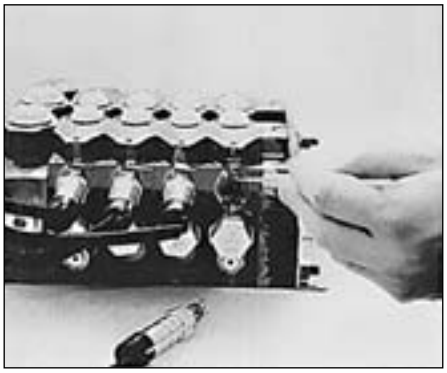
488	Shim
231	Seal Carrier
132	Seal Washer
257	Seal Washer
131	Bleeder Plug
256	Plug
476	Spacer Washer
430	Barrel Support
110	Barrel Housing Assy
491	Hex Socket Screw
460	Tap Rol Bearing
440	Piston Assy
442	Piston Ring
411	Cylinder Barrel
211	Bearing Housing
415	Needle Bearing
221	O-ring
225	O-ring
229	O-ring
451	Guide Pin
470	Cyl Bearing
237	Retaining Ring
478	Retaining Ring
121	Valve Plate
311	Shaft
233	Shaft Seal
452	Ring Gear

Fig 7-47f Cooler Fan Motor Assembly

Pulsar™ Solenoid Removal and Plug

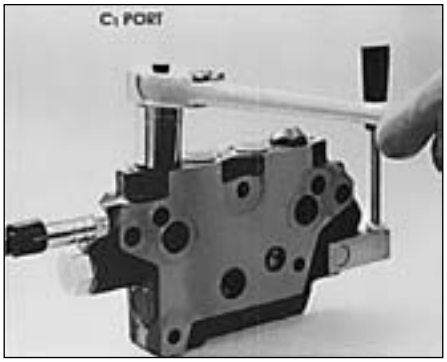
General

For applications requiring only two position operation, only one Pulsar™ solenoid cartridge is required. Therefore, it is necessary to remove one cartridge, and plug the remaining cavity. Unless otherwise specified. VPL Series valves direct flow to the C1 cylinder port.



Procedure

1. Remove the existing C2 solenoid cartridge
2. Remove the included O-ring with the O-ring pick. As needed, use a clean pencil magnet to remove the orifice disk in the bottom of the cavity, it removing the old design Pulsar™
3. Unpack the solenoid plug kit (VNPK1)and verify the assembly contents: two (2) solenoid plugs, four (4) O-rings.
4. Install the solenoid plug using 6.5ft lb (9Nm) torque.



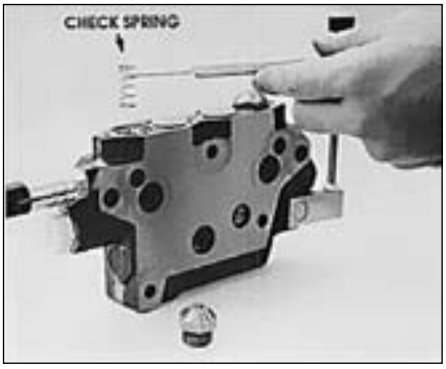
Work Port Option Exchange

General

The work segments may have options for the work ports: anti-cavitation check valve, relief with anti-cavitation, and defeat plug.

Replacement or Exchange Procedure

1. Remove the check valve plug from either C1 or C2 option port on top of the working segment. A 7/8” socket wrench is required.
2. Pull the spring out of the cavity. Either the 1/2” ball or a relief cartridge VPLRA*KP) will be found under the spring.
3. Now either an exchange for a different setting or a change to a different option can be made. Reinstall the check valve plug to 40ft lb (54Nm).



WARNING: RELIEVE all pressure before attempting service or maintenance procedures to this machine.
RELIEVE pressure in both hydraulic and pneumatic systems before loosening any connections or parts.

The following maintenance manual provides information on repair of *Texas Hydraulics* cylinders.

Refer to your parts manual to identify and order replacement parts for the cylinder you are working on. Identify the specific type of head and piston in the cylinder and then follow the steps as outlined below:

1. Follow the **General Information** steps.
2. Follow the **Teardown** steps.
3. Follow the **Inspection** steps.
4. Follow the specific **Rebuild** steps for head and piston type you are working on.

Hydraulic Cylinders

Description	Location (Qty)	Comments Head Type	Option Codes Piston Type
76mm (3”) bore x 355.5mm (14”) stroke	Viewing hatch cylinder (1)	M	M
50.8 mm (2”) bore x 101.6mm (4”) stroke	Main service air cyl (1) Mast lock cyl (2)	Cunningham or texas hydraulics	
76mm (3”) bore x 203.2mm (8”) stroke Rear dust skirt (1) Pipe positioner (1)	Front dust skirt (1)	H	H
63.5mm (2 1/2”) bore x 203.2mm (8”) stroke	Deck spanner cylinder (1)	H	H
Cylinder, lock	Pipe rack lock cylinder (2)	Miller cylinder	
50.8 mm (2”) bore x 152.4mm (6”) stroke	Pipe positioner extend cylinder (1)	H	H
Mast hoist 254mm (10”) bore	Mast elevating cylinder (2)	N	Z
101.6mm (4”) bore x 139.7mm (5 1/2”) stroke	H.O.B.O clamp cylinder (1)	Z	N
Index 76mm (3”) bore x 330.2mm (13”) stroke	Pipe rack index cylinder (1)	Z	N
127 mm (5”) bore x 76mm (3”) stroke Extend cylinder (2)	H.O.B.O rotate cylinder/	K	K
Cylinder, jack 1.2m (48”) stroke	Jack leg cylinder (4)	Z	Z
165.1mm (6 1/2”) bore x 9.1m (360”) stroke	Feed cylinder (1)	Z	Z

Z Piston (Threaded)

General

The Z series piston uses ductile iron material, glass filled nylon wear rings (bearing rings), and a specially designed teflon seal called the AQ seal as the primary sealing element. The teflon sealing ring has a small groove on its outside diameter that houses a qual ring seal. The entire ring is energised by a square section rubber loader. A small static O-ring seal is fitted to a groove in the piston and is held in place by the shoulder of the rod. General procedures for teardown, inspection and rebuild are contained in the General Procedures Maintenance Manual. Contact Terex if you have any questions.

Teardown

Remove the piston as follows: locate and remove the setscrew (it may be underneath one of the wear rings). Insert a spanner wrench into the holes provided and turn the piston counter clockwise (it is a right handed thread) to remove it. After removing the piston, remove and discard the PRS static O-ring from the rod shoulder. Remove the AQ seal by means of blunt instruments of bronze or aluminium. Be sure there are no sharp edges on these tools. Be particularly careful of scratching the groove surface finish.

Rebuild

Separate the three components of the seal assembly. For easiest installation, warm the teflon outer ring in 49 to 65.5ºC (120 to 150^{0}F) hydraulic fluid or water. Lubricate the piston and all components with hydraulic fluid. Stretch the inner rubber expander into the seal groove. Do not use sharp edged tools and verify that is has not twisted. Likewise, stretch the teflon outer ring into the groove. Be extremely careful to avoid damaging the seal grooves during installation. Scratching the groove may cause by pass leakage. The teflon ring will have a memory and may take as long as 24 hours to return to the correct size. This can be accelerated by pushing the piston/seal assembly through a honed or polished tube with an ID equal to the nominal cylinder bore to plus .010 inches. Clean the groove in the teflon ring and install the rubber quad ring. Verify that it has not twisted. If possible, allow the piston/seal assembly to sit as least one hour to allow the seals to elastically restore.

Place the rod on a clean table. Slide the piston onto the rod noting the proper orientation. Turn the piston clockwise until it is hand tight or fully seated (it is a right handed thread). Insert a spanner wrench into the holes provided, torque the piston and install setscrews as indicated on the print. Install the wear rings into the wear ring grooves.

Safety Instructions & Precautions

Don't stare into the laser beam. A prolonged period greater than 0.25ms (normal eye blink speed) can be harmful. Never point the laser beam intentionally at another person.
A warning label indicating the presence of a class 2 laser should be used and placed in a readily visible spot.

Calibration

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

Calibration of the depth system is now complete.

Password protected Calibration screen:

Value indicates feedback from Laser.

Actual head position from TOP of mast. (mm)

Touching number 'Display' sets the Calibration point.

EEPROM

The EEPROM is a backup of the PLC programme.

The PLC has been set up to load from an EEPROM. Loading will occur every time the PLC is powered up and has the EEPROM installed. This has been done to facilitate minor updates via changing the EEPROM.

When the PLC is turned on (powered up) it will "look" to see if the EEPROM is installed in the Processor Card. If it is detected, it will then load the programme from the EEPROM into the Processor Card. If it is not detected it will just use the current programme already in the Processor Card.

The EEPROM should never be left in the Processor Card as it will overwrite stored values every time the PLC is turned off and on. E.g. battery isolator turned off for lunch break, during shifts, maintenance work.

This means that the EEPROM should be removed immediately from the card (and kept in a safe location as a backup) after initial loading to prevent a reload and loss of information every time the drill is started.

Procedure to load from a EEPROM

1. Turn off power to PLC
2. Remove the Processor Card (the card with a key in it)
3. Install the EEPROM into the Processor Card
4. Replace Processor Card
5. Ensure key is in the "RUN" position
6. Restore power to PLC
7. LED lights on Processor cards will toggle off-on "FLT", "DH" and "RUN".
8. Loading process is ok when the "RUN' light is ON.
9. After PLC has entered "Run Mode". Turn power off to PLC.
10. Remove the Processor Card
11. Remove the EEPROM from the Processor Card
12. Replace the Processor Card into the PLC

Restore power to the PLC.

Recover from a Processor Fault

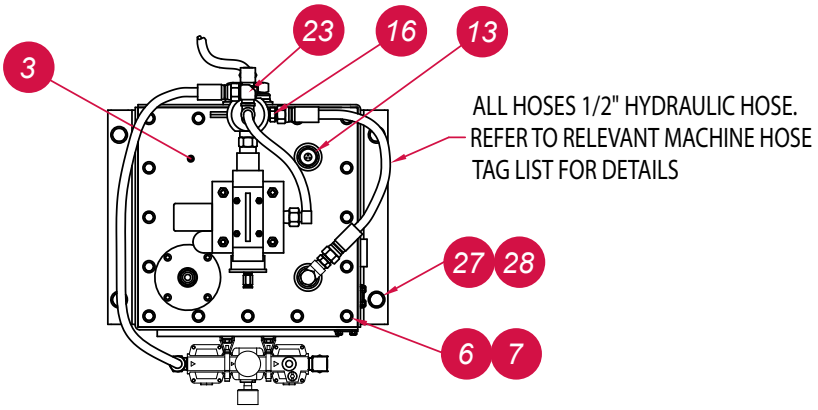
This procedure will erase all current operating and stored data in the programme i.e. calibration set points.

1. Turn processor key switch from RUN to PROGRAM mode
2. PLC power switched off for 10 seconds and then re-power
3. Key switch to RUN mode
4. If the PLC does not recover then turn power off and remove the processor card.
5. Reload the PLC processor memory with the EEPROM (refer to section "Procedure to load from an EEPROM")
6. If this does not fix the problem, then call Terex for assistance.

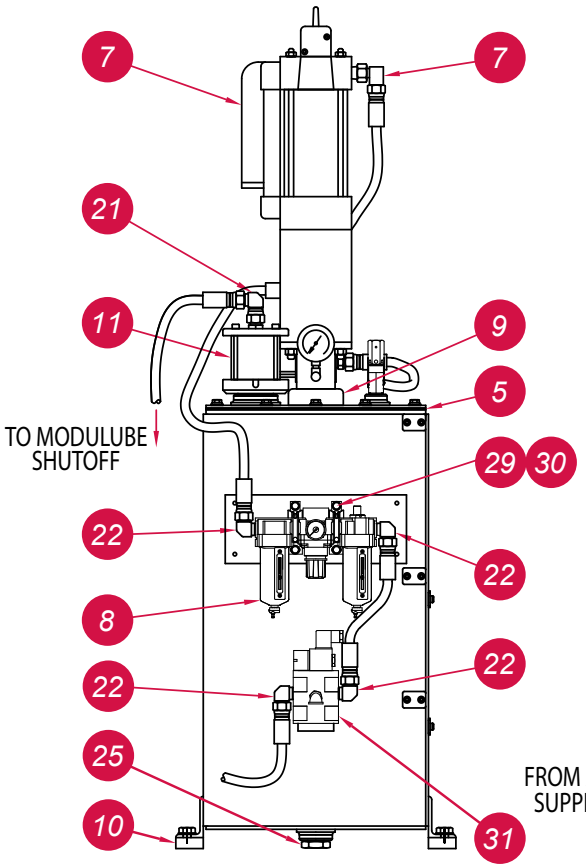
Output Card

The individual outputs on an Output card are actually miniature relays with a small current carrying capacity of one (1) amp. The contacts of the relays may burn if a faulty field device or wiring condition occurs. This condition has occurred if the output indication LED light on the card is ON but no output voltage to operate the field device is present on the corresponding output terminal. The LED only indicates that the PLC code is attempting to operate the miniature relay for the corresponding output. If no output voltage is measured on corresponding output terminal then the output relay (within card) is damaged.
Check field device and wiring for faults that could cause a high current situation.
Only replace the Output card after field fault has been corrected.

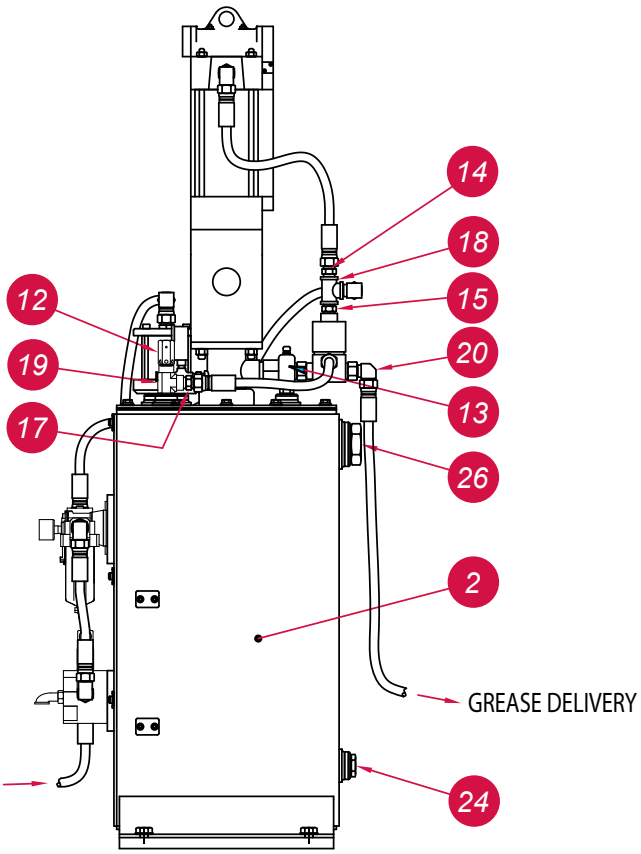
Central Lube Tank Assembly



PLAN



ELEVATION



END

2. *Tank weldment*
3. *Lid weldment*
4. *Lube pump assembly - Lincoln*
5. *Lid gasket*
6. *Bolt, hex 3/8"ø UNC x 1" lg*
7. *Washer, 3/8"ø flat std*
8. *Air service - Lincoln*
9. *Pump mount collar*
10. *Lube tank mount bar*
11. *Grease filler shut off valve*
12. *Relief valve*
13. *Breather*
14. *Nipple, 3/8" NPT - 3/4" JIC*
15. *Nipple, 1/4" NPT - 3/8" NPT*
16. *Nipple, 1/4" NPT - 3/4" JIC*
17. *Nipple, 1/2" BSPT - 3/4" JIC*
18. *Tee, F-F-F, 3/8" NPT*
19. *Tee, M-F-F, 1/2" BSPT*
20. *90° elbow, M-M, 3/4" NPT - 3/4" JIC*
21. *90° elbow, M-F swivel, 3/4" jic - 3/4" JIC*
22. *90° elbow, M-M, 1/2" BSPT - 3/4" JIC*
23. *Elbow, M-M, 3/8" NPT - 3/4" JIC*
24. *Hex plug, M, 1" BSPT*
25. *Hex plug, M, 1 1/4" BSPT*
26. *Hex plug, M 2" BSPT*
27. *Bolt, hex, 5/8" UNC x 1" lg*
28. *Washer, 5/8" flat std*
29. *Bolt, hex, 5/16" UNC x 1" lg*
30. *Washer, 5/16" flat std*
31. *Valve, air 3 way*

Auto Lube Lincoln Pneumatic Pump Owners Manual (cont.)

Instructions – Vent Valve

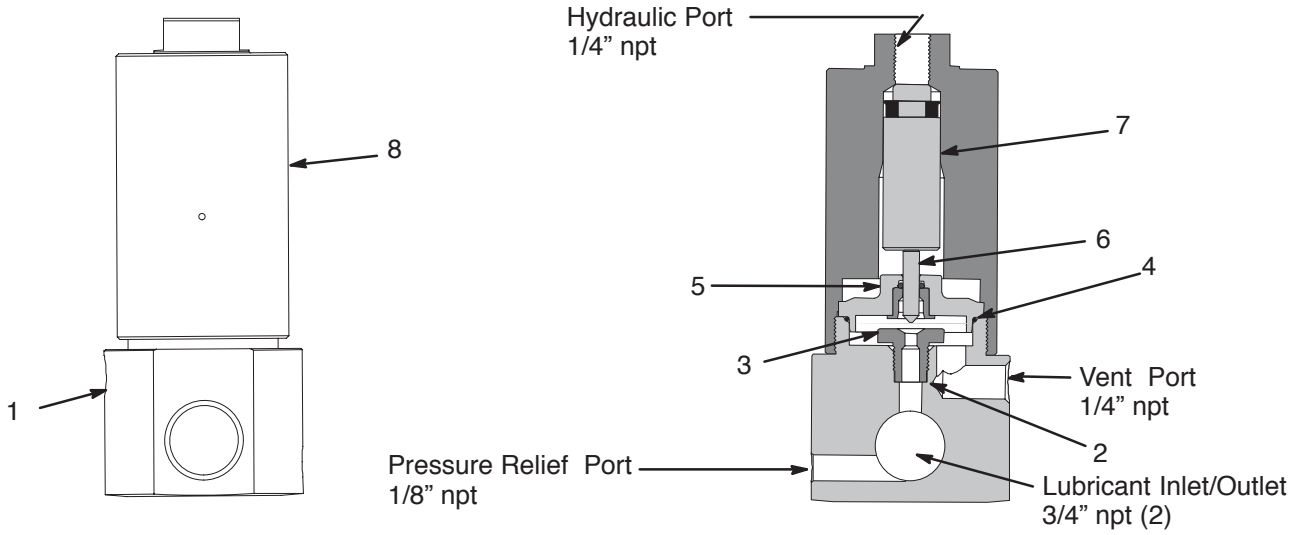
This manual contains important warnings and information.
READ AND KEEP FOR REFERENCE.

INSTRUCTIONS

For Hydraulic Powered Single-Line Parallel Automatic Lubrication Systems

⚠ WARNING

INJECTION HAZARD
Fluid from the vent valve, leaks, or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate medical attention.** Fluid splashed in the eyes or on the skin can also cause serious injury. The equipment may be pressurized already, or it could become pressurized by an automatic lube cycle initiated by the Lubrication Controller (timer). Disconnect power to the timer, and disconnect the hydraulic supply to the pump module to ensure that the system is depressurized. **See the pressure relief procedure in Pump Module manual.**

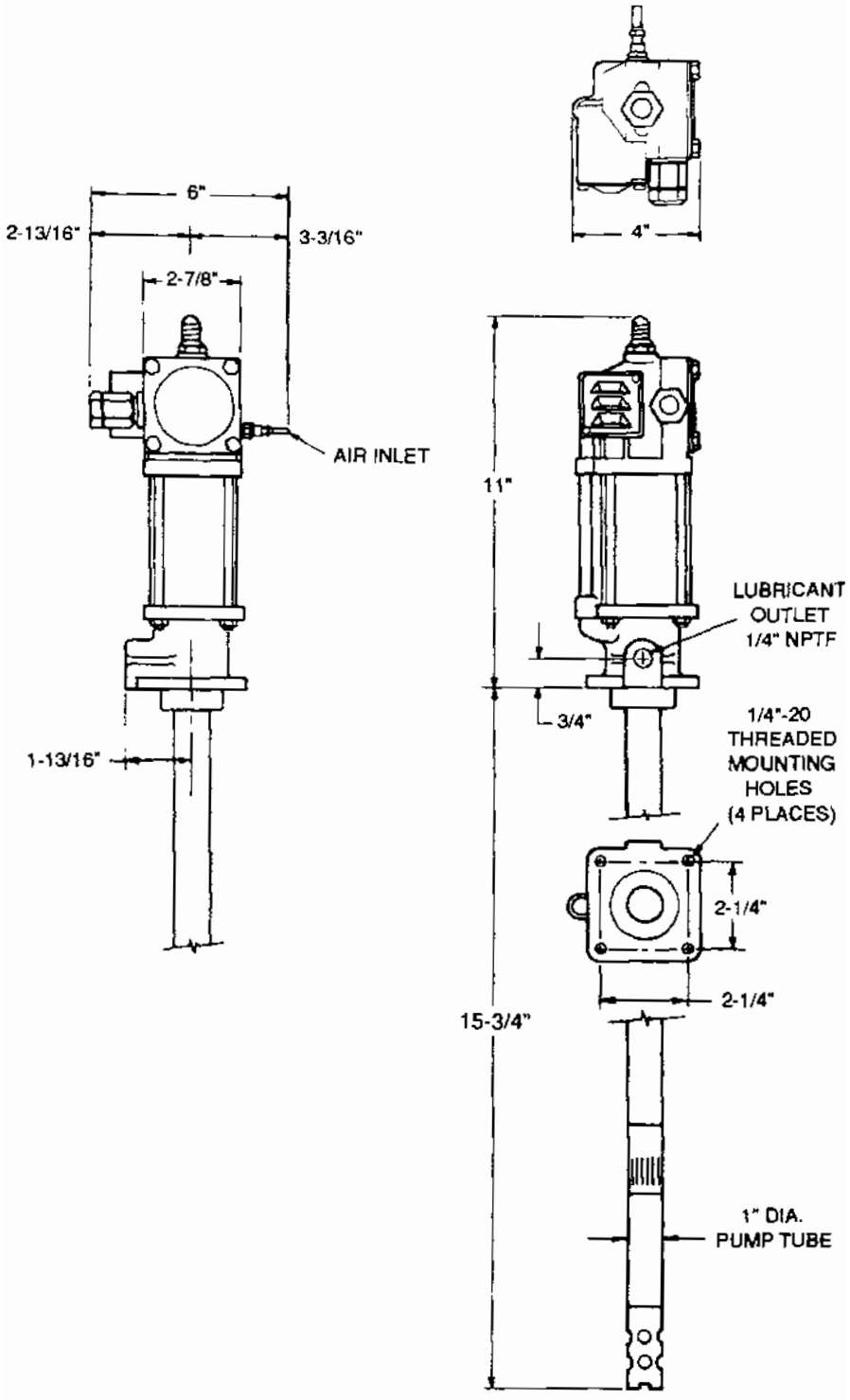


Service Parts

Use Only Genuine Graco Repair Parts

⚠ WARNING

To prevent system overpressurization, a pressure relief valve must be used in conjunction with all vent valve installations. Failure to comply with this warning could result in serious injury.



GENERAL DIMENSIONS

DISASSEMBLY

⚠ WARNING

To prevent personal injury, perform PRESSURE RELIEF PROCEDURE before and after operating the pump and before performing any disassembly or assembly.

NOTE

If complete disassembly is required, order the repair kit and replace ALL gaskets, O-rings and packings.

A. Remove Valve Cap (11470), Trip Rod Pin (11472) and 11471 Collar. Unscrew (11947) Trip Sleeve from (90691) Trip Rod.

B. Unscrew four Tie Rod Nuts (51009) from Tie Rods (10294) and lift Air Valve Casting (237562) off of Air Cylinder (61041).

C. Remove Packing Nut (11904) and Packing Cap (11905) from Air Valve Casting.

D. Remove four Valve Cover Screws (236868) and Cover (236286).

E. Remove four Toggle Plate Screws (236869), Toggle Plate (91331), Trip Shoe (11475) and (11947) Sleeve.

F. Remove four Valve Seat Bolts (236870), Springs (55138), Valve Guide Plate (45605) and Valve Side, Seat and Gasket (83063).

G. Unscrew Trip Rod Packing Nut (11476) from Air Valve Casting and remove all packing parts.

H. Remove Priming Tube (61275) from Bushing Extension (61273).

I. Extend Plunger Rod (11723) out of (61273) Bushing Extension. Place wrench on the (11724) Priming Plunger, place on awl or other small tool through the opening in the (11726) check, and remove priming check parts, Plunger Rod (11723), and (61273) Extension Tube.

Air Cleaners

The air cleaner should be inspected periodically to maintain engine and compressor protection and maximum service life. These inspections should include the following points:

1. Inspect the air transfer duct between the air cleaner and the engine to be sure all clamps are tight, all flange joints are tight, and there are no cracks in the ducting.
2. Air cleaner mounting bolts and clamps must be tight to hold the air cleaner securely.
3. Check the dust cup to make sure it is sealing 360º around the air cleaner body.
4. Vacuator valve must be in place, not inverted, and free from obstruction.
5. Check for dents and damage to the air cleaner which could mean a leak.
6. Make sure all accessories are free from obstructions and securely mounted.

Air Filter Elements

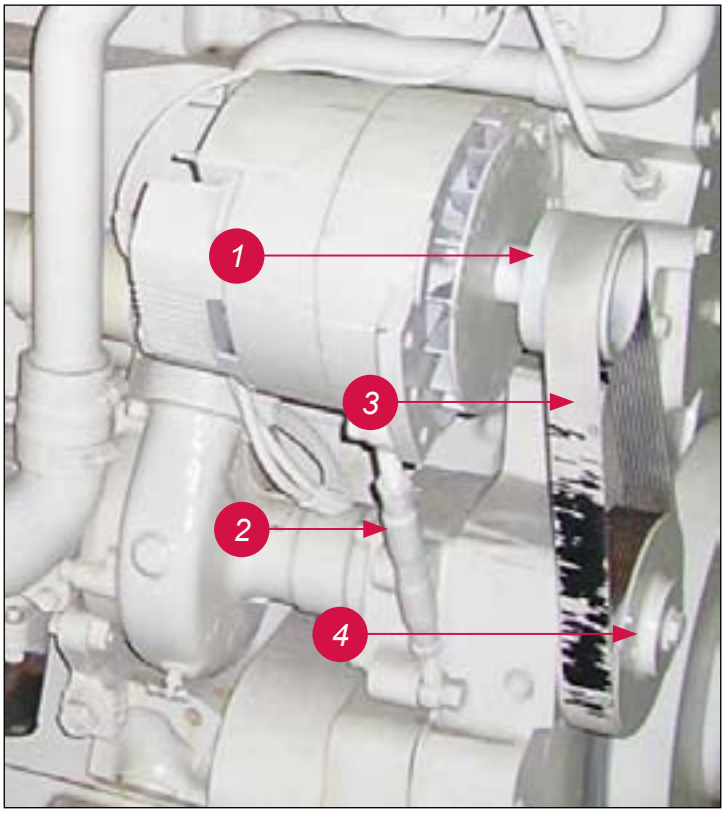
Replace air filter elements as required. Refer to 'Preventive Maintenance' chart.

CAUTION: DO NOT clean filter element with high pressure air (30psi maximum). Advise replacement of filter element.
DO NOT start engine when the filter element(s) is removed from the air cleaner.
NEVER attempt to clean the element by rapping it. Rapping the element will dent the metal covering. The inner paper element will in turn rub this dent, causing the element to puncture.

Alternator Maintenance

250hrs

– Check alternator condition and belt tension



1. *Alternator pulley*
2. *Alternator belt tension adjustment*
3. *Alternator drive belt*
4. *Alternator drive pulley*

WARNING: DO NOT operate machine with belt or pump drive guards removed!

RIO TINTO
COAL AUSTRALIA

SKS Blast Hole Drill – 250 Hour Service	
Work Order Number: _____	
Equipment Hours: _____	**Service Start Date:** _____

Reference Material:	• [Manuals, reference documents etc with page numbers to be referred to if more information is needed]

	PLEASE PRINT YOUR NAME CLEARLY	INITIAL	PLEASE PRINT YOUR NAME CLEARLY	INITIAL
Maintainer				
Maintainer				
Maintainer				
Maintainer				

SAFETY PROCEDURES

- **All Isolation Procedures and Safe Work Procedures MUST be followed.**
- **Use Take 5 if nominated tasks present any risks**
- **Use Workshop Manuals for references**
- **Seek clarification from supervisor on any issues that you are not sure of.**
- **Ensure Correct PPE is Used**

Warning Glossary	Service Completion Checked
	**Sign -** _____ **SHIFT MAINENANCE SUPERVISER** **Date** _____

Lubrication and Maintenance Chart - 500hr

Document No. [ ]

Rev	Issue Date	Revision	Writer	Authorised
0				
1				
2				
3				
4				
This document is scheduled for review in: X years				

Job Information	
Trade	[eg. Lube Technician]
Frequency	500 Hours
Access	[Isolated, not running]
Duration	[1.5 hours]
Special Tooling	• [eg. Digital Dial indicator with Extension] • [Digital Tachometer}

Hazard	Control
Example - Grease	Apply barrier cream to hands and wear glove

Additional Job Details		
Job Comments / Parts Information	**Originator**	**Workorder #**

FOLLOW ISOLATION PROCEDURE BEFORE COMMENCING WORK
RECORD ALL FAULTS ON JOB CARD

A = Completed, no problems found **B** = Completed, problems corrected **C** = Completed, problems noted, needs further repairs **N** = Problems causing Asset to not be Serviceable *Leave blank if work incomplete*	**Code** **A** **B** **C** **N**	**Equipment / Location**	**Comments** SKS Blast Hole Drill	**Initials**
A. Samples				
1. Take a sample of the engine oil **Rimula MV 15W40.**				
2. Take a sample of the gearbox rotary head oil **Spirax AX LS90.**				
3. Take a sample of the air compressor oil **Corena AS46.**				
4. Take a sample of the final drive (left) oil **Spirax AX LS90.**				
5. Take a sample of the final drive (right) oil **Spirax AX LS90.**				
6. Take a sample of the hydraulic oil **Tellus S 46.**				
7. Take a sample of the pump drive gearbox oil **Spirax AX LS90.**				
B. Operational				
1. Operating controls – check all functions.				
2. Check all lights.				
3. Compressor – Check main control regulator pressure (120 psi max). Adjust only if required.				
4. Compressor - Check pilot control regulator pressure (50 psi max). Adjust only if required.				
5. Check Water pump pressure (Low pressure units - 150 psi)				
6. Air conditioner – Check operation.				
7. Auto lube system – Check operation.				

A = Completed, no problems found **B** = Completed, problems corrected **C** = Completed, problems noted, needs further repairs **N** = Problems causing Asset to not be Serviceable *Leave blank if work incomplete*	**Code** **A** **B** **C** **N**	**Equipment / Location**	**Comments** SKS Blast Hole Drill	**Initials**
8. Check all hydraulic pump pressure settings – adjust only if required.				
9. Check all hydraulic valve bank pressure settings – adjust only if required.				
C. Engine				
1. Engine Oil Filters • Drain and replace engine oil. • Change engine oil filters. • Check for oil leaks.				
2. Engine Fuel Filters • Drain engine fuel water trap. • Change primary fuel filter. • Change secondary fuel filters. • Drain sediment from the fuel tank.				
3. Engine Cooling System • Check coolant Level and Leaks • Check radiator cap condition. • Check coolant level. • Check the condition of the radiator and clean if required. • Check system for any coolant leaks.				
4. Engine Air Cleaner • Remove primary element. • Remove secondary element. • Check induction pipe-work for dust intrusion. • Fit air cleaner protection plugs. • Remove the vacuator cups (1 used). • Clean the air cleaner housings. • Change the safety element. • Fit clean primary elements. • Clean the cups and refit. • Clean engine breather.				