



Technical Manual

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GENERAL INFORMATION**1.3.2 FBL-40 Loading Charts**

Distance From Fork Face (mm)	Maximum Load (kg) Standard
300	42,000
600	40,000
900	38,000
1200	36,000
1500	34,000
1800	32,000

4.1 MACHINE ISOLATION

Before commencing work on the machine, it is imperative to ensure the system to be worked on is correctly isolated. This may also require the isolation of other systems that affect the safe completion of the job.



NOTICE

Any site/mine specific isolation procedures override those listed on the following pages. The procedures presented here are the minimum required to perform any work on the machine. Before commencing check with the relevant people regarding any site/mine specific isolation procedures.

1.4.1 Engine Isolation

To isolate the engine perform the following procedure:

1. Select "NEUTRAL" on transmission directional control lever
2. Apply the "Park Brake"
3. Shutdown the diesel engine.
4. Fit a Danger tag to the ON/OFF toggle valve. (Figure 4.1.1)
5. Connect the steering lock and chock the wheels.
6. Close the Main air Isolating valve (Figure 4.1.2)



WARNING:

Be careful of hot surfaces, allow time for them to cool down.

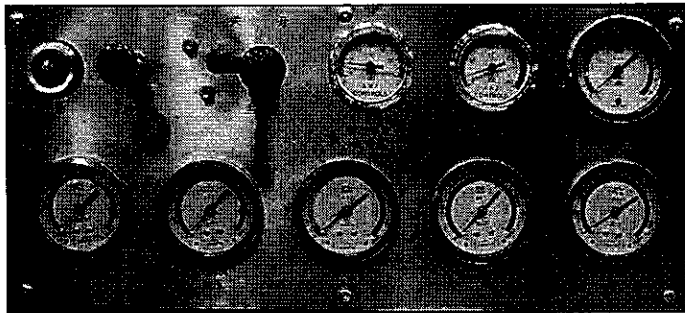


Figure 4.1.1 Air pressure isolation and indication in operators compartment

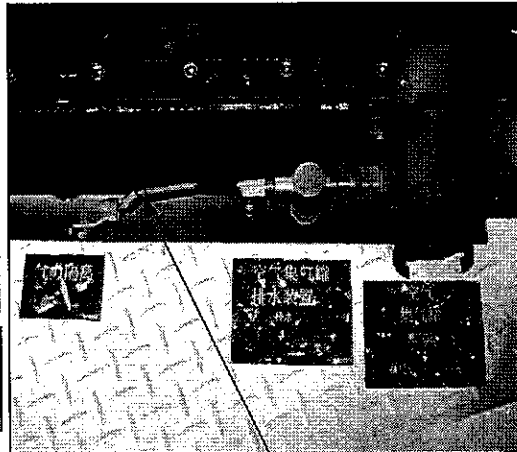


Figure 4.1.2 Main Air Isolation Valve

GENERAL INFORMATION

- Keep your FBL-40 clean. A clean machine makes for a safer machine.
- No diesel engine should be operated underground if it is smoky, running unevenly, or if the exhaust system is not in good condition
- In areas where auxiliary ventilation is used, the operator should make sure fans are operating before starting the machine.
- The engine shall not for any reason be left running unattended underground.
- The engine should not be shut down from full load and must be allowed to idle for a few minutes before stopping.
- Never operate a machine that you feel is mechanically unsafe.

2.1.6 Secondary Spin On Fuel Filter

Servicing

To replace filter element (every 250 hours):-

1. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in section 1.4.
2. Have the replacement element filled with fuel and ready to install immediately after the used element is removed. This will prevent fuel system aeration. Fill via the outer ring of small holes (inlet holes) and coat the sealing gasket with clean fuel.
3. Place a suitable container under the filter and unscrew the cartridge.
4. Unscrew the used cartridge and dispose of in a responsible manner.
5. Immediately install the new filter and tighten until the sealing gasket just touches the mounting adaptor head, then tighten a further three quarter turn (HAND TIGHT ONLY).
6. Hand prime the fuel system before attempting to start the engine.
7. Start the engine and check for leaks. (REMEDY ANY LEAKS IMMEDIATELY)



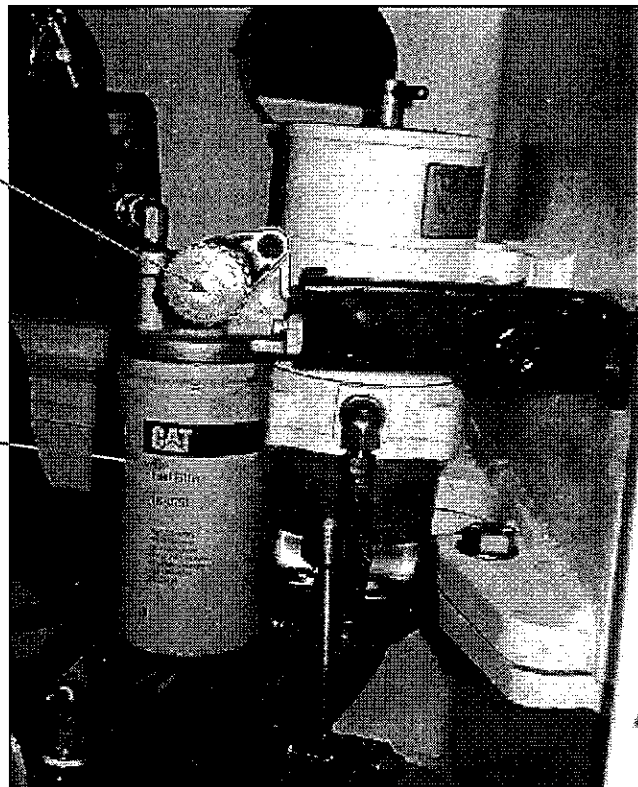
CAUTION

Do not use tools to tighten the filter cartridge. Over tightening will result in damage.

Ensure that the seal between the filter cartridge and mounting adaptor head is in the correct position before tightening the last three quarter turn.

Fuel priming pump

Secondary spin on fuel filter



2.3.5 Servicing air intake system

As with other maintenance and examination schedules the flameproof intake system should be inspected, by a suitably appointed and qualified person, at intervals consistent with mine site and statutory maintenance schemes. The following is the suggested intervals for maintenance and inspection of the flameproof air intake components,

Daily or every 10 service hours

1. Visually check joint fasteners (nuts, bolts and studs) securing flameproof joints ie flame trap flange to after-cooler, after-cooler to cylinder head.

Monthly or every 250 service hours

1. Remove the intake flame trap and inspect the element and housing for accumulation of debris or damage. The element may be cleaned using compressed air.
2. Replace the element if damage is evident. Repair or replace the housing flanges if pitting or flame path defects are evident.



NOTE

Refer to the Diesel Engine System approval drawings for flame path dimensions and conditions

Indicator

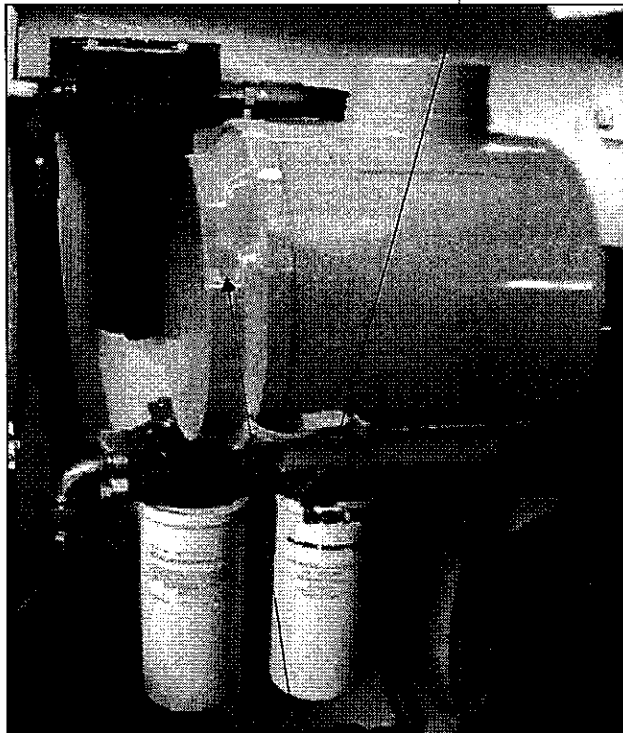


Figure 2.3.5.1 Air Cleaner & Indicator assy

Intake clamps and rubber boots

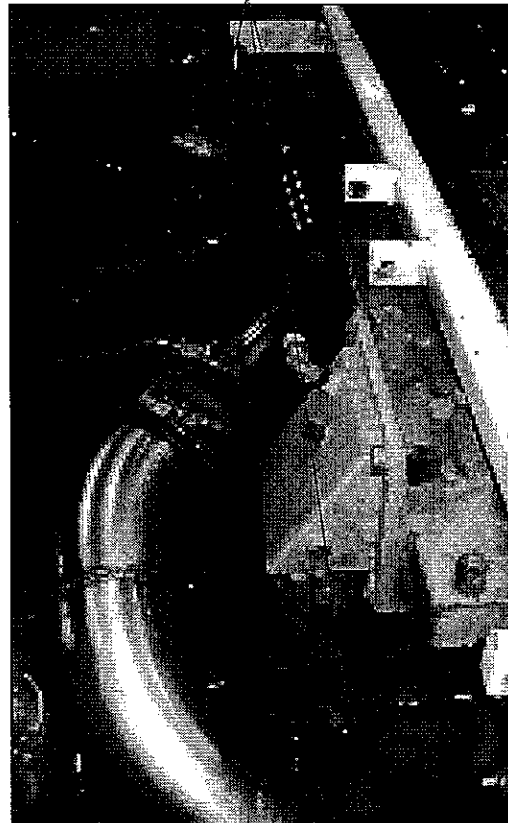


Figure 2.3.5.2 Intake System

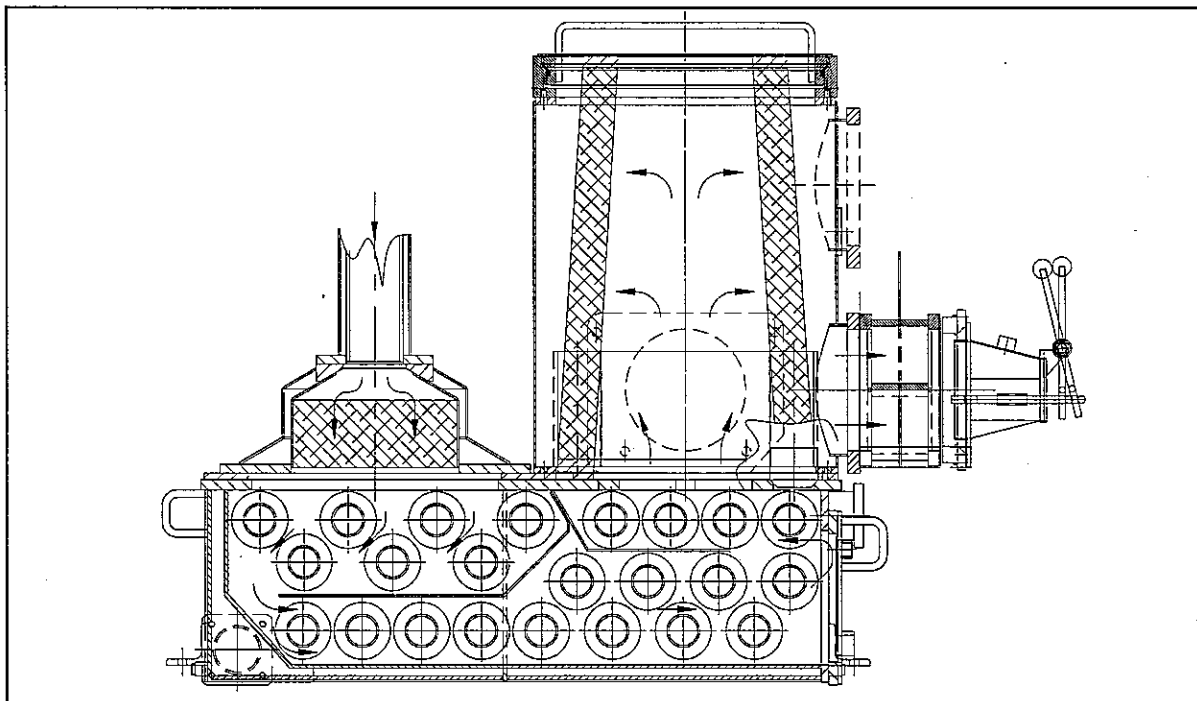
2.5.1 General Description

The flame proofing of the exhaust system is designed to withstand an internal explosion without damaging the structural integrity of engine components and the internal explosion will not propagate to the outside atmosphere with sufficient energy to cause an external explosion. The system is designed to limit the temperature of the external surfaces of the engine exhaust system and the exhaust gasses to a maximum of 150°C under all operating conditions.

The exhaust system component surface temperature is controlled by water jacketed housings while the exhaust gas temperature is controlled via a dry type air / water heat exchanger.

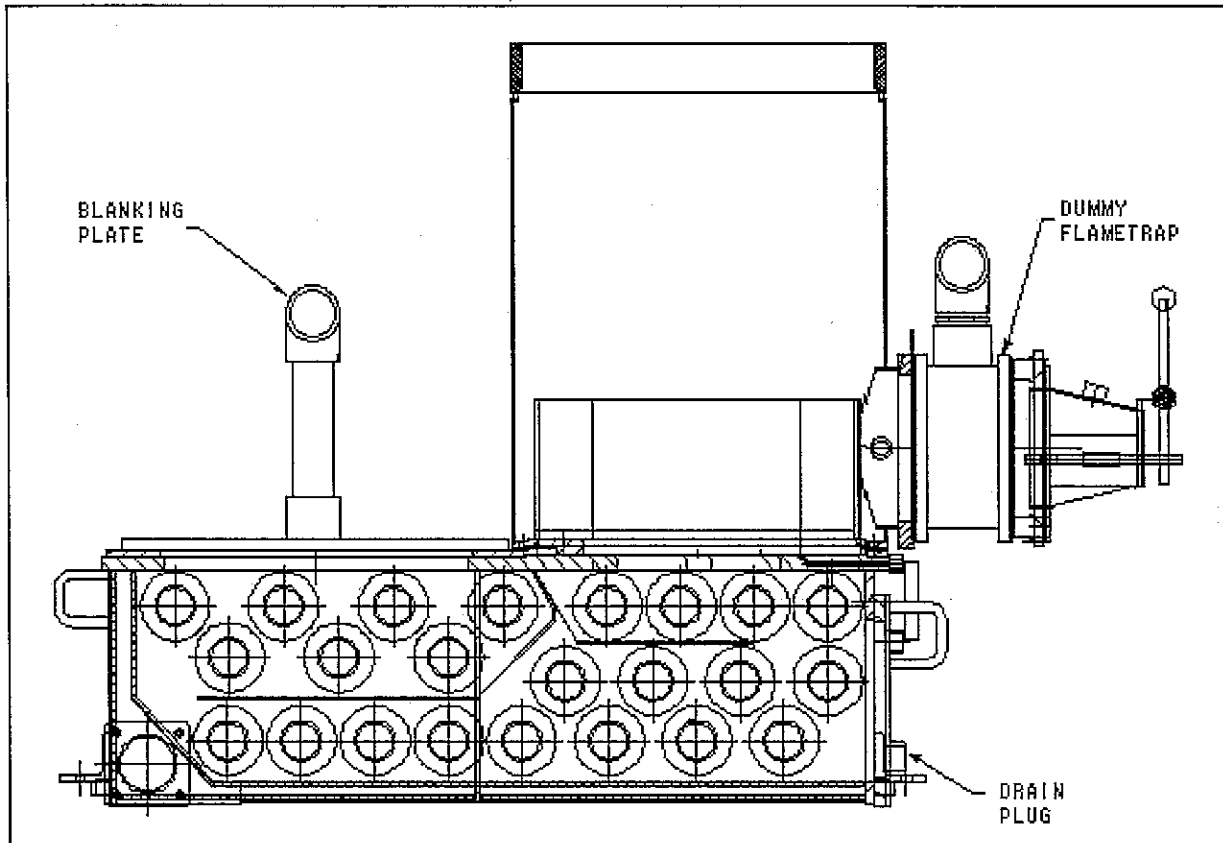
Raw exhaust gasses are expelled from the engine cylinder exhaust ports and into exhaust manifolds located on the side of the cylinder head. The exhaust manifold is connected to solid riser pipes which direct exhaust gasses into the turbine side of the turbo charger. Exhaust is expelled from the turbo charger through a water jacketed down pipe, it then flows to the catalytic purifier which treats the exhaust gasses, the gas then continues and is cooled by the heat exchanger.

The solid particulate matter is then removed by the particulate filter, the gas then passes through the flame-trap and is diluted and expelled into the mine atmosphere in the engine and exhaust cooling fan air flow. Water jacketed exhaust chambers using exhaust coolant as the heat transfer medium include manifolds, turbo charger, down pipe, purifier and heat exchanger. Engine coolant is also forced through heat transfer elements inside the heat exchanger to limit the temperature of the exhaust gas as it enters the mine atmosphere.



2.5.5.2 1000 hr Cleaning of Heat Exchanger (Cont)

2.5.5.2.4 Connecting the cleaning system



1. Place the dummy flame trap in its housing.
2. Install the blanking plate and gasket over the intake of the heat exchanger.
3. Disconnect the 50mm cleaning system hosing from nipple and remove plug from 25mm hosing.
4. Connect the 50mm hosing from the cleaning system outlet to the fitting on the blanking plate.
5. Connect the 50mm hosing from the cleaning system return to the dummy flame trap and the 25mm hose to the drain hole fitting.

2.5.10 Cooling the exhaust system

The FBL-40 cooling system performs three prime functions:

1. To effectively dissipate the heat generated by the engine and the engine lubricant during the combustion process.
2. To effectively limit the surface temperature of the engine external components, including exhaust gasses, to the maximum allowable limit of 150°C.
3. To effectively cool the exhaust gases via a heat exchanger to less than 150°C

To cool the exhaust system a separate water pump is used to send continuous coolant from the cool radiator core (45% of the radiator is employed) through the exhaust cooling tubes of the exhaust heat exchanger system, this also supplies cooling water through the down pipe, catalytic converter and intake side of the turbo-charger, this system is continuous flow and not controlled by the engine thermostat. A separate cooling line comes from the top of the Exhaust heat exchanger to the top of the down pipe through the intake turbocharger cooling jacket and the flame-trap housing back to the header tank, this also acts to bleed the circuit of air. This system is completely separate to the engine cooling system (The engine system utilises the other 55% of the radiator)

Pressurised header tanks provide top up coolant into the suction side of the water pumps and the cold radiator core via gravity feed. They are filled via the recovery tank. See engine cooling system.

**DANGER**

The exhaust cooling system runs at a nominal 100kPa pressure and can reach temperatures of more than 100°C. Release stored pressure and wear personal protective equipment when accessing.

Safety Precautions

The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

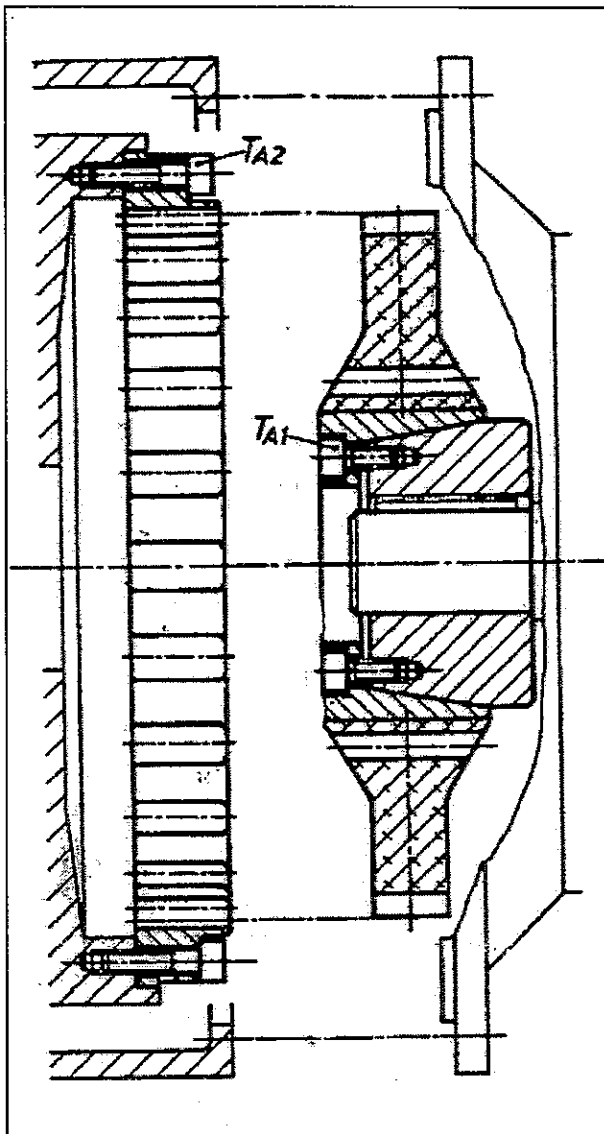
ALWAYS Give the diesel engine system an opportunity to cool down before performing cooling system servicing.

ALWAYS Wear personal protective equipment including safety glasses, gloves and suitable clothing, particularly when accessing the coolant system.

ALWAYS Be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.

Symptom	Probable cause	Caused by	Remedy
High lubricating oil consumption	External leaks	Oil lines or connections leaking	Visually inspect and rectify as required
		Gasket or oil seal leaks	Clean engine with degreaser and run at operating temperature to reveal leaks. Replace gaskets as required
		Overfilled crank case	Check oil level after allowing sufficient time for the oil to settle and drain as required.
		Obstruction or damage to engine oil breather	Remove breather and clean out or replace as required.
	Internal leaks	Blower oil seals leaking	Remove air inlet housing and flame trap. Operate the engine at half throttle and idle and inspect blower end plates for leakage past the seals. Overhaul blower if excessive leakage is evident. Consult DBT for overhaul
		Turbo oil seals leaking	Remove intake air and exhaust piping and check for oil on the compressor or turbine sides of the turbocharger.
		Oil cooler core leaking	Pressure test cooling system. Replace oil cooler if leak is found. Check for coolant / oil contamination and flush as described in sections 2.2.6 and 2.4.7
		Worn exhaust valve guides	Replace valve guides. Consult DBT for valve guide replacement.

3.1.4 Removing Centamax drive coupling



1. Isolate machine as per procedure section 1 Service manual
2. Remove out-put driveline
3. Remove bolts from drive coupling housing and sling housing for lifting
4. Take weight of drive housing and slide back towards front of machine until rubber Centamax drive clears the engine Fly wheel housing
5. Remove the outer toothed aluminium ring bolted to the flywheel by removing the bolts shown as TA2
6. The rubber disc is removed by removing the bolts shown as TA1 and withdrawing it of the taper

3.1.4 Installing Centamax drive coupling

1. Fit the new aluminium ring to the flywheel
2. Tighten the bolts in a cross sequence to pull the ring up squarely to the flywheel face
3. Torque the bolts (Reference TA2) to 110 Nm
4. Ensure ring is fully bedded against the flywheel face
5. The driven hub is fitted onto the driven shaft
6. The rubber disc with the vulcanised ring is then assembled to the driven hub with bolts (Reference TA1) which must be tightened to the correct torque of 85 Nm
7. After these are fitted slide the drive coupling assembly back and line up the rubber coupling teeth with the corresponding teeth on the ring bolted to the flywheel
8. Fit the bolts and bolt drive assembly to the Engine flywheel housing
9. Fit the out-put driveline and replace all covers.
10. Grease coupling as per instructions in section 3.1.3

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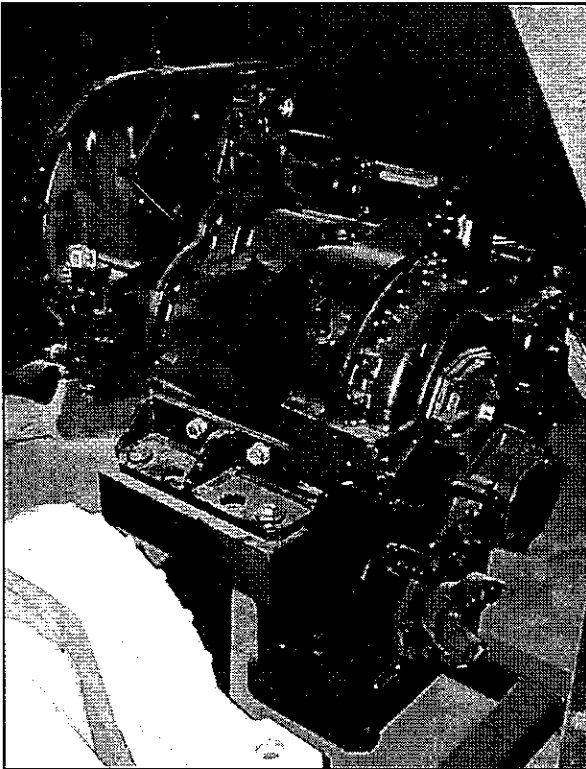
3.2.7 Service Data

Clutch Pressure

The clutch pressure is measured from the clutch pressure port on the top of the transmission. The normal clutch pressure operating range is 1680 to 1930 kPa (240 to 280 psi).

To check the transmission clutch pressure:-

1. Release the park brake as the transmission is fitted with a park brake actuated declutch valve in the forward and reverse directions and pressures will not be a true reading.
2. Allow the transmission oil to warm up to 82.2° to 93.3°C (180° to 200°F).
See section 3.2.3.
3. With the service brake applied and the engine at idle speed (650rpm) shift through the direction and speed clutches taking note of the pressures indicated at each shift.
4. All clutch pressures must be within 35kPa (5 psi) of each other. If pressure varies outside the 35kPa tolerance then clutch repair is required.



3600 Powershift Transmission
assembly

3.4.2**Safety Precautions**

The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

- ALWAYS** chock all wheels before removing any of the drive lines.
- ALWAYS** be careful of hot surfaces when accessing the drive lines.
- ALWAYS** wear personal protective equipment including safety glasses, gloves and suitable clothing
- ALWAYS** clean up any spilled grease immediately to remove the potential for slip or fall injuries.
- ALWAYS** fit the tow link / articulation lock before commencing work on the drive lines.
- ALWAYS** be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.

Section 4 Hydraulic System

4.1 General Description

Main Hydraulic Circuit:

The main hydraulic circuit is supplied via fixed displacement gear pump driven from a output of the transmission torque converter. Hydraulic oil is supplied to the open centre main valve bank at a fixed displacement, depending on engine speed. System relief of 20.7MPa (3000psi) is provided at the inlet to the main valve bank.

Each working section of the valve bank is fitted with 22.4MPa (3250psi) port relief's.

The working sections of the main hydraulic valve bank control, Boom Lift, Tilt and the Winch and attachments which are fitted to PTO. These are pilot activated via a 4-way proportional operator hand controlled joy-stick for the lift and tilt.

The Winch system and PTO attachments are controlled by two 2-way proportional operator hand controlled joy-sticks.

Relief pressure is by a separate inline port relief valves and the main relief valve all situated in the valve bank,

Auxiliary Circuits:

The Auxiliary Circuits for the cooling fan are supplied by a separate pump driven from the transmission, pressure relief is by a separate inline relief valve set at 17.2 Mpa (2500 psi)

The Fan motor receives a constant flow of 79 lpm at 2600 rpm ,Hydraulic oil is supplied through the fan motor which then returns back to tank.

.The auxiliary circuit for the Heat exchanger motor and alternator motor are supplied by a gear pump piggy backed on the cooling fan pump. It has an inline relief valve set at 17.2 Mpa (2500 p.s.i) and a priority valve set at 19 lpm for the heat exchanger water pump motor.

Hydraulic oil is supplied through the heat exchanger water pump motor which then flows through the alternator motor and then back to tank.

Section 4 Hydraulic System

4.4 Hydraulic tank

4.4.2 Changing Hydraulic Fluid

The hydraulic fluid should be changed every 2000 service hours

To change the hydraulic fluid:-

1. Park the FBL-55 such that all machine cylinders are collapsed and the steering cylinder are such that the vehicle is straight.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in section 1.4.
3. Release hydraulic tank pressure by slowly removing the filler cap.
4. Remove the filler cap to allow breathing when draining hydraulic oil.
5. Locate the hydraulic tank drain plug on the underside of the hydraulic tank.
6. Place a suitable container under the drain plug. The hydraulic tank contains approximately 250 litres.
7. Remove the drain plug and allow hydraulic fluid to drain out of the tank.
8. When the oil has drained from the tank remove the inspection covers from the tank wall to enable the inside of the tank to be accessed. Clean around the floor of the tank with clean lint free rags.
9. Replace the inspection cover and the drain plug then refill the tank as described in section 4.4.1.



CAUTION.

Ensure that the hydraulic pumps are primed after refilling the hydraulic tank, Failure to prime pump will result in pump failure

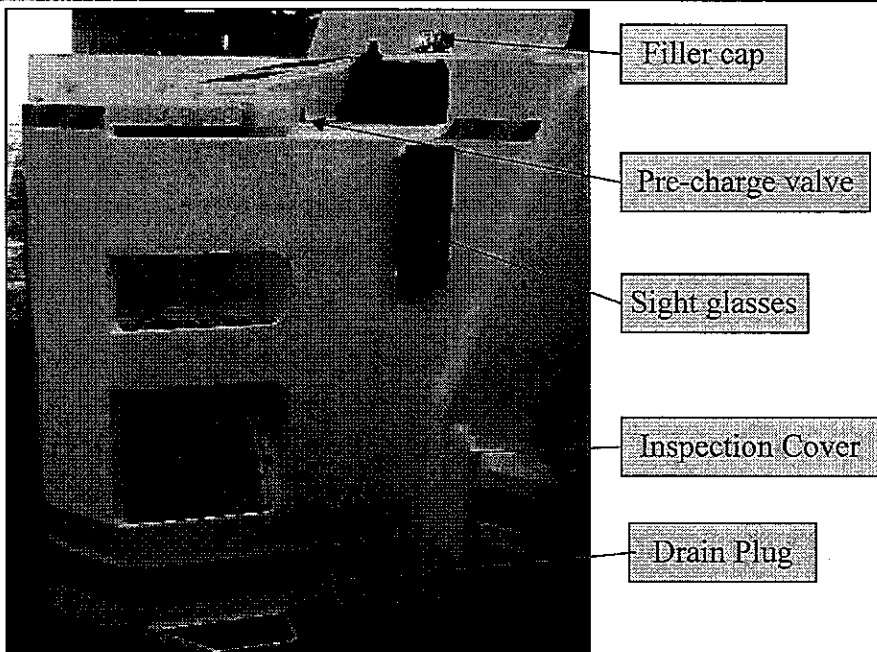


Figure 4.4.2 Hydraulic tank

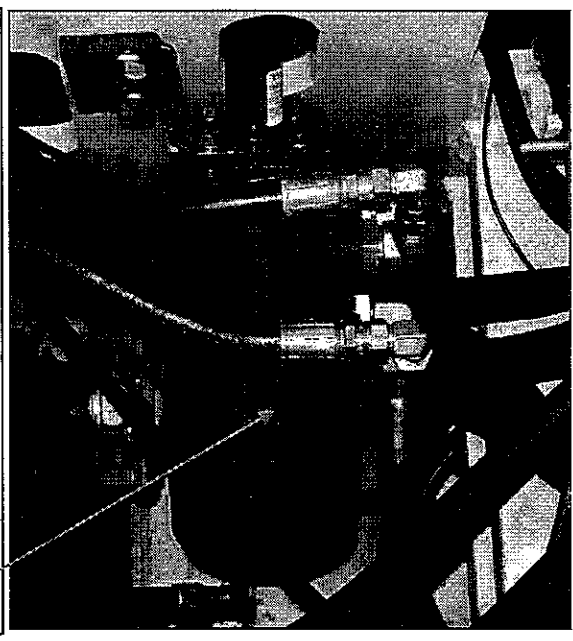
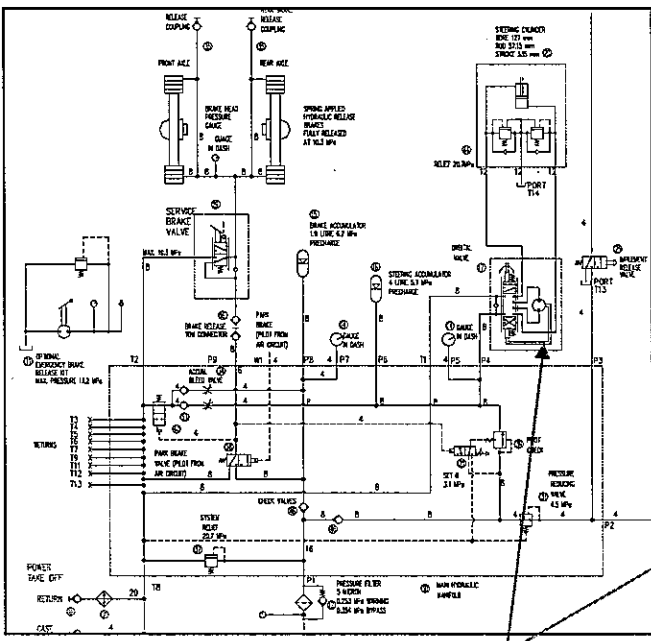
Section 4 Hydraulic System

4.7 Steering Circuit

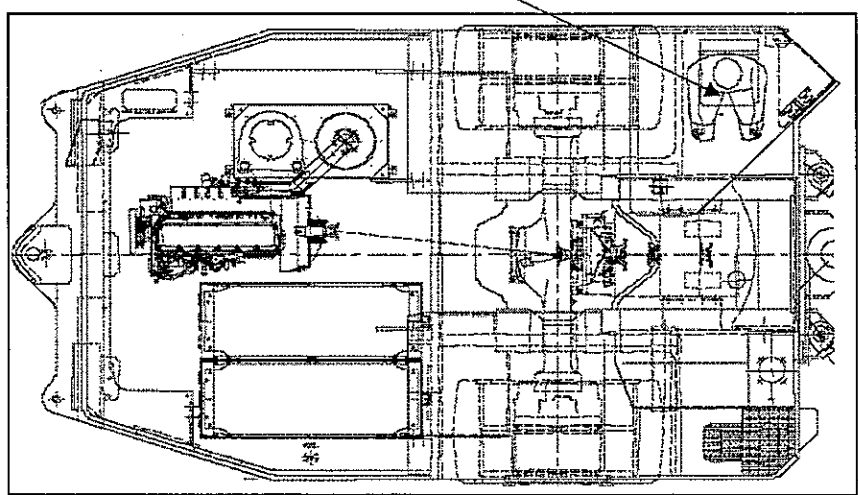
4.7.2 Steering Control Valve

The steering orbital control valve controls the direction of flow of oil to and from the articulation steering cylinder. This is achieved at a metered rate and is unaffected by pump flow. The steering cylinder valve is fitted with relief valves, set at 20.68 MPa (3000psi) to provide pressure relief for the cylinder in the event of an excessive external force.

No routine servicing is required on the steering control valve assembly other than routine checking for the presence of oil leaks. A service kit is available for seal and spring replacement and is detailed in the FBL-55 parts manual.



Steering orbital control valve



Section 4 Hydraulic System

4.9 Implement Controls

4.9.3 Tilt and Lift Circuits

The tilt and lift circuits are controlled by the five-position pilot joystick, operating the first two sections of the main valve bank. Pilot oil is delivered to the actuating ends of the relative valve bank working section and operates the main valve bank spool. This spool diverts main hydraulic pump flow into the cylinder lines and the system develops pressure to actuate the cylinders at the pump flow.

Both tilt and lift cylinders are fitted with over centre valves for load hold should hydraulic pressure be removed from the system. These over centre valves are set to relieve at 21MPa (3050 psi).

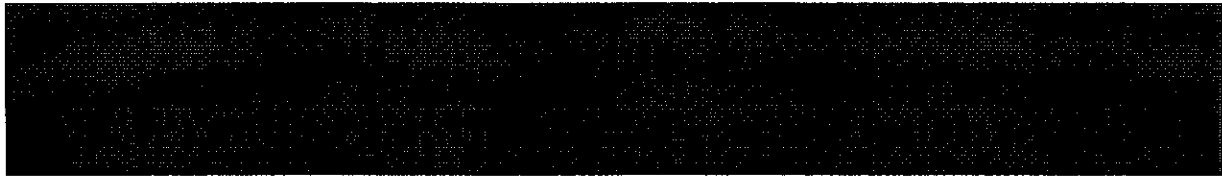
The function of the over centre valves can not be confirmed in situ. It is recommended that the over centre valve be removed from each cylinder every 2000 service hours and bench tested.



WARNING

Ensure that the lift arm lift and tilt is lowered completely to ground level and are resting on the stops or the LIFT ARM LOCK PINS are installed before removing cylinder over centre valves.

Removal of these valves removes the machine ability to hold load.
Removal of the over centre valves when the cylinder is loaded will force pressurised oil from the open port when the valve is removed.



5.2 Alternator and Drive Assembly

5.2.4 Alternator Drive Assembly

Every 250 service hours :check the condition of drive coupling from the hydraulic drive motor to the alternator.

To check drive coupling:-

1. Ensure that the engine has had sufficient time to cool and is isolated and tagged as appropriate.
2. Remove coupling guard.



NOTE

No lubrication of the alternator Coupling is required

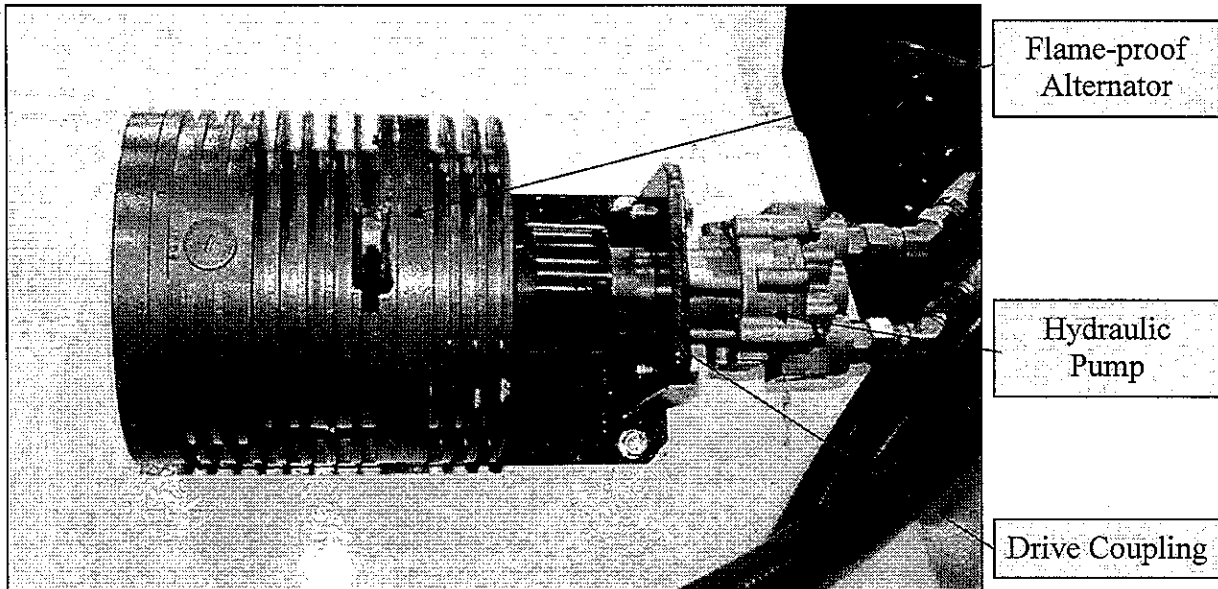


Figure 5.2.4.1 Hydraulically driven alternator and motor arrangement

CALIBRATION**NOTE:**

Since the voltage is regulated inside the head, the supply voltage is not critical as long as it is between +5V and +7V. The output from the head should be either 1 volt for "NOALARM" or 2 volts for "ALARM". The switching levels are adjusted with the trimpots which MUST be adjusted in sequence, first the LO Alarm (1k R7) trimpot, then the HI-Alarm (20K, R13 trimpot). If the output voltage differs by more than 10% from 1V or from 2V, there is a fault in the electronic circuitry.

When adjusting a new sensor, the adjusters are likely to be a long way from where they should be, so make sure that with no methane in the pellistor, both outputs read 1V. If either output reads 2V, turn the adjusters anticlockwise until the reading drops to 1V. When calibrating the head use methane gas calibrated to 90% of the alarm level you require the SEMS to read.

INITIAL SETUP:

1. Connect power: GND terminal = 0 volt, SUP terminal between +5 and +7 volts.
2. Connect voltmeter to LO-Alarm terminal. Reading should be 1V +/-10%. If it is not, turn the LOAL adjuster (R7, 1K) anticlockwise.
3. Insert pellistor opening into the test chamber and fill test chamber with LO-Alarm concentration of methane.
4. Adjust the LO-Alarm trimpot (R7, 1k) until the voltmeter reading just goes up to 2V. To raise the reading from 1 to 2V, turn the adjuster clockwise and vice versa.
5. Increase the methane concentration in the chamber to HI-Alarm level and transfer the voltmeter probe to the HI-Alarm terminal.
6. Adjust the HI-Alarm trimpot (R13,20k) until the voltmeter reading just goes from 1 to 2V.
7. Remove the pellistor from the test chamber and note that after some 20 seconds both the HI and LO alarms read 1V.

CHECKING AN ALREADY ADJUSTED HEAD

1. Connect power: GND terminal = 0 volt, SUP terminal between +5 and +7 volts.
2. Connect voltmeter to LO-Alarm terminal (reading should be 1V +/-10%).
3. Insert pellistor into test chamber.
4. Power up and check voltmeter reading (should be 1V).
5. While watching the voltmeter, gradually fill chamber with methane of
6. LO-Alarm concentration. Voltmeter reading should rise to 2V just before the LO-Alarm concentration is reached.
 1. If adjustment is needed, turn the LO-Alarm(R7,1k)trimpot clockwise to increase the voltmeter reading (from 1 to 2 volts), and vice versa.
 2. Clear methane from chamber, and check that voltmeter reading goes down to 1 volt after a delay (of about 20 seconds).
 3. Transfer voltmeter probe to HI-Alarm terminal and while watching the voltmeter, fill the chamber with methane HI-Alarm concentration, Voltmeter reading should rise to 2V just before the HI-Alarm concentration is reached.
 4. If adjustment is needed, turn the HI-Alarm (R13,20k) trimpot clockwise to increase the voltmeter reading (from 1 to 2 volts), and vice versa.
 5. Clear methane from chamber and check that voltmeter reading goes down to 1 volt after a delay of about 20 seconds.

5.3 Operators Instrument Panel

5.3.4 Driver's Park Brake / Emergency Brake Control

The park brake valve has two positions and it is held in the release position by pilot air pressure. By pushing the button inwards, the park brake is applied, and by pulling the button out the park brake will be released. The park brake cannot be released until the system pressure is sufficient to overcome the spring force of the brake control, it also will not release unless the door is closed (there is a roller cam valve inside the door lock which needs to be activated to release the park brake).

If the Engine of the FBL-55 shuts down the emergency brake will **AUTOMATICALLY APPLY** itself by dumping the pilot air pressure via the low oil pressure pilot valve. The **BRAKE HEAD PRESSURE GAUGE MUST READ ZERO** when the brake is applied.



Warning:

Never use the door interlock to actuate the park brake when exiting the machine, If there is a malfunction on the door interlock system, the brake could possibly not apply when exiting machine and the machine could run away resulting in serious damage or injury



NOTE:

The park brake must be applied for the starter motor to engage whenever an engine start is required.

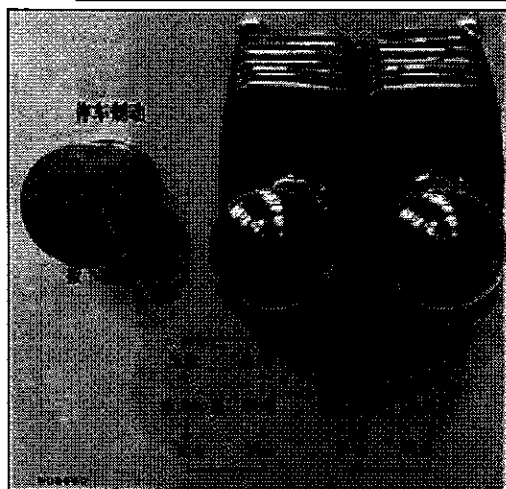


Figure 5.3.2 Park brake valve

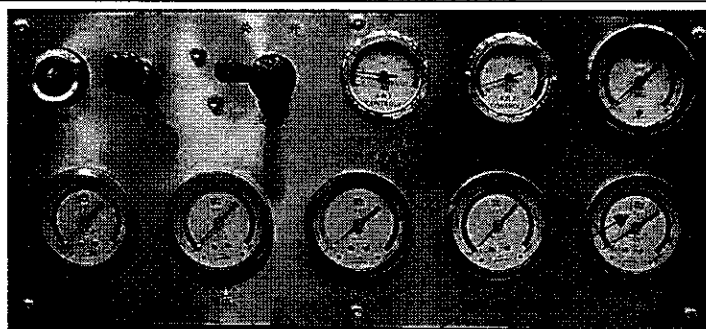


Figure 5.3.3 Brake Head Pressure

3.1.27 Engine Hand Fuel Primer Pump

If the diesel engine fuel system has been run dry or serviced the fuel system should be primed via manual activation of the hand fuel primer pump. The pump is located adjacent to the fuel water separator in the engine compartment.

Normally no priming is required to start the motor.

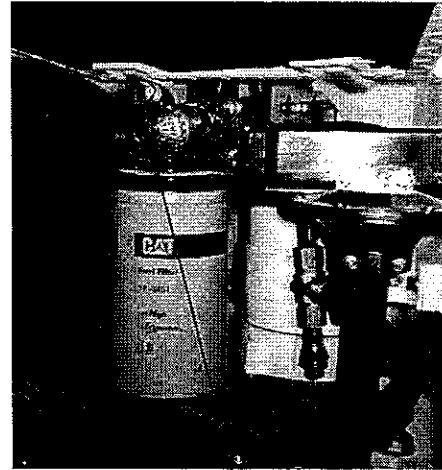
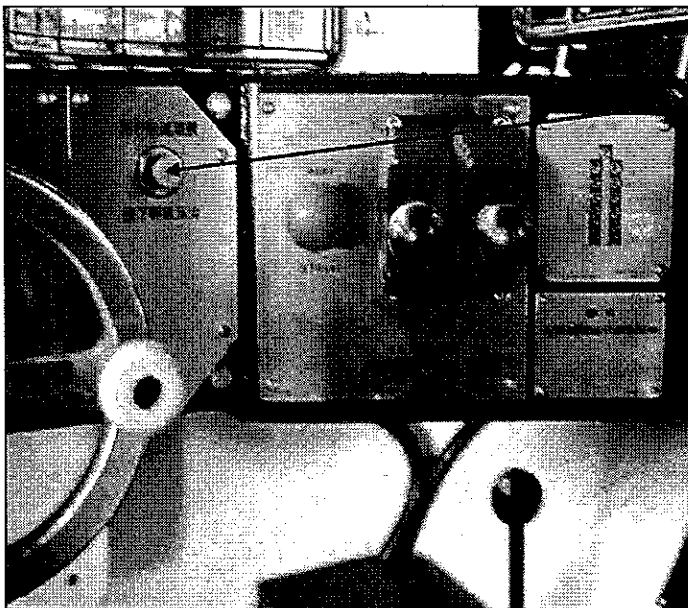


Figure 3.1.15 Engine Hand Fuel Primer Pump

3.1.29 PTO Attachment Pressure Release Valve

This valve releases all of the pressure in the PTO attachment lines to allow the couplings to be easily released. To release the pressure, release both of the PTO control levers and press in the release button for 2 seconds.



RAS Attachment Pressure Release Valve

Figure 3.1. 18 RAS Release Valves

6.6 Rear Frame

The rear frame is a welded chassis coupled to the front frame via the articulation joint. The rear frame houses the diesel engine system, transmission, hydraulic pumps, filters, fluid tanks and operator compartments. The front frame also houses the rearward facing headlights.

Care and maintenance

Daily service

1. Visually inspect the rear frame and associated components including access covers for damage.
2. Visually inspect the tow clevis, coupling pin and retaining device for signs of structural damage

Servicing

Daily;-

1. Grease the rear bolster axle trunnions and the steering cylinder rear pins. Check the engine and radiator mounting point fasteners per bolt torque specifications.(1.6)

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