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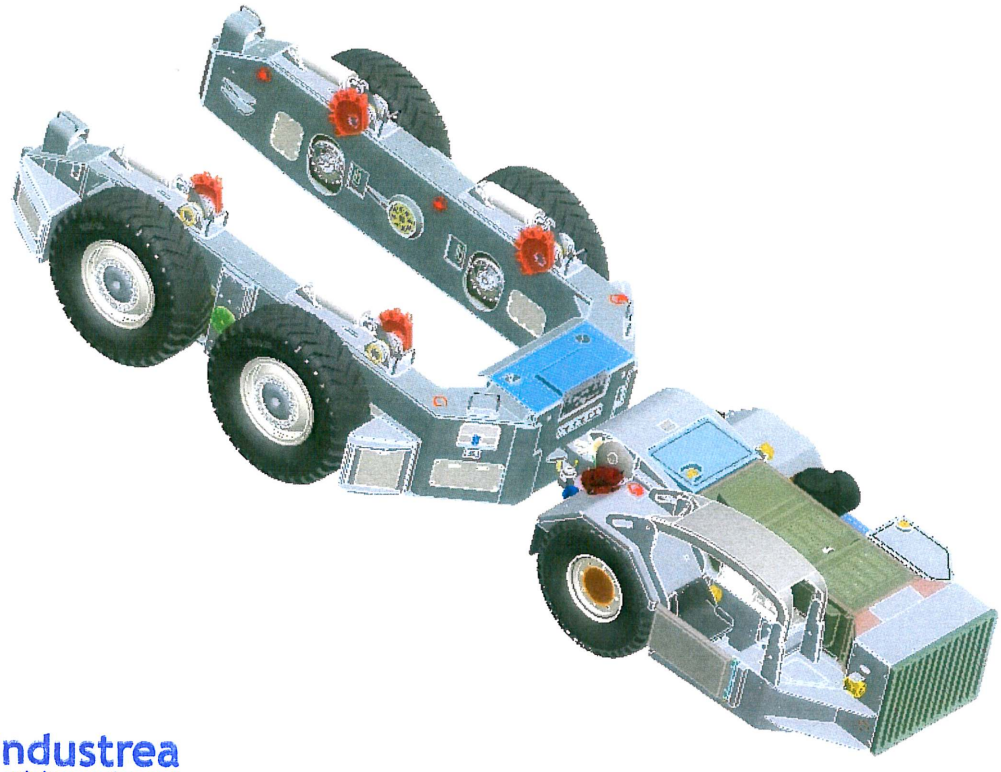
Operators Manual

BOOK NUMBER
7-190910-700
Rev A
16 NOV 2011

Longwall Chock Carrier 50Tonne

7-220727-700 SN161-165, 180-181



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LONGWALL CHOCK CARRIER 50T
OPERATOR MANUAL

SN 161 - 165, 180 - 181
GA 7-220727-700
DOC NUMBER 7-190910-700

CONTENTS

IMPORTANT SAFETY INFORMATION

Most accidents involving machine operation, maintenance or repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

IMPROPER OPERATION, LUBRICATION, MAINTENANCE OR REPAIR OF THIS PRODUCT CAN BE DANGEROUS AND COULD RESULT IN INJURY OR FATALITY TO YOU OR OTHER PERSONS.

- Do not operate or perform any lubrication, maintenance or repair on this product until you have read and understood the information contained in this manual.

- Industrea Mining Equipment cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in the publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by Industrea Mining Equipment is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

- Where repair or maintenance procedures are not documented in this manual, seek assistance from Industrea Mining Equipment's site service operation or workshop facilities.

1. LONGWALL CHOCK CARRIER 50T

1.1. INTRODUCTION

Industrea Mining Equipment introduce a re-engineered LWC for use in underground coal mines known as the **LWC 50T**.

1.1.1. Features of the LWC 50T include:

- **Fast, Reliable underground chock transport.**
- **Purpose built, the right tool for moving chocks**
- **Robust Reliability.**
- **CAT 3126 turbo diesel engine.**
- **50 Tonne pay load**

1.1.2. The LWC is the vehicle behind **longwall chock handling**.

1.1.3. The LWC is a free steered articulated vehicle on rubber tyres powered by a explosion proof diesel engine and capable of transporting longwall chocks up to 50 tonne.

1.1.4. The LWC has a top speed of 23.2 kph, weighs 22.5 tonnes unladen and has a rated pay load of 50 tonnes.

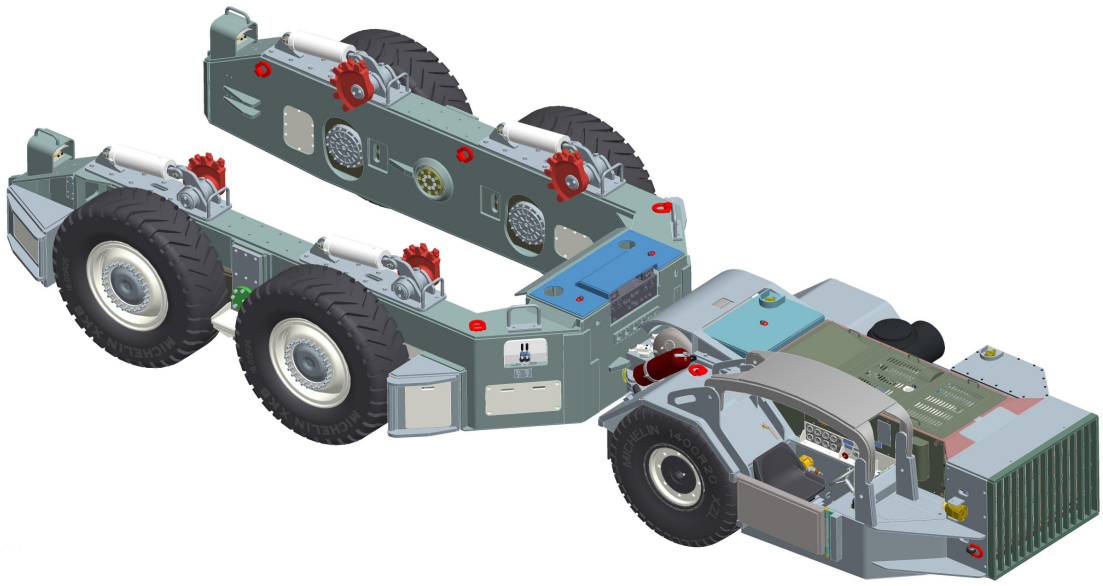


Figure 1. LWC CAD Illustration

1.2. VEHICLE DESCRIPTION

1.2.1. The Longwall Chock Carrier 50T is a purpose built machine designed specifically for the transportation and positioning of longwall chocks.

1.2.2. As a delivery system, it is many times faster than a rail driven alternative and utilises far less labour. Being rubber tyred it also saves the cost and delay of laying access track.

1.2.3. The unit is a combination of prime mover & a U-shaped trailer specially designed to fit around and lift any type of roof support or other equipment not exceeding 50 tonnes.

1.2.4. Forward or reverse motion is infinitely variable. Combined with skid steering this makes the carrier highly manoeuvrable and able to place the support in almost any final position.

1.2.5. The trailer yoke on the LWC is designed to pick up, carry and drop off supports (or other equipment) with a four-point linkage arrangement that is hydraulically lowered and raised.

1.2.6. Steering the machine is achieved by articulation of the chassis at the hitch point at 45 degrees either side of centre or alternatively skid steering.

1.2.7. The LWC Trailer has 4 hydraulically driven wheel motors and the prime mover has 1 freewheeling axle.

1.2.8. The LWC makes chock transport a one-man operation without a need for manual handling.

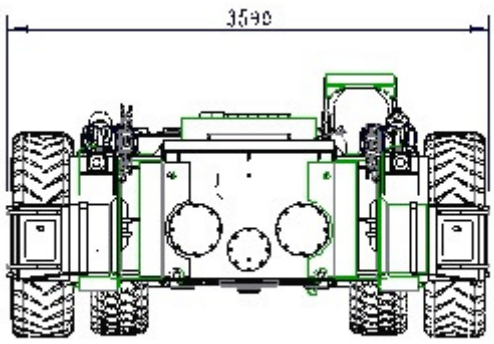
1.2.9. The vehicle is powered by an explosion proof diesel engine that is built to Australian Standard AS3584-2003 for use in underground coal mines. The engine is complete with an intake flametrap, exhaust flametrap, water cooled exhaust pipe and exhaust conditioner (scrubber tank).

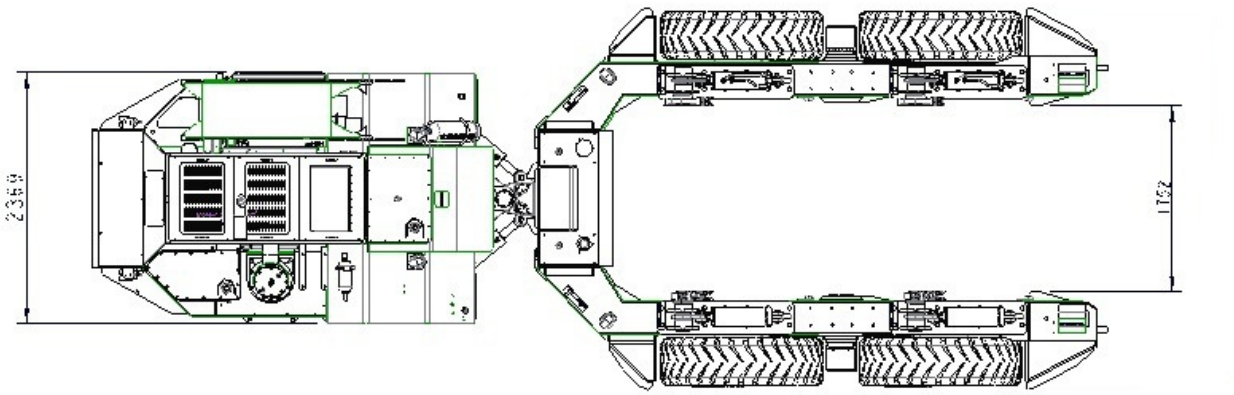
1.2.10. Hydraulic pumps are mounted on the rear of the diesel engine, which operate all hydraulic functions on the machine.

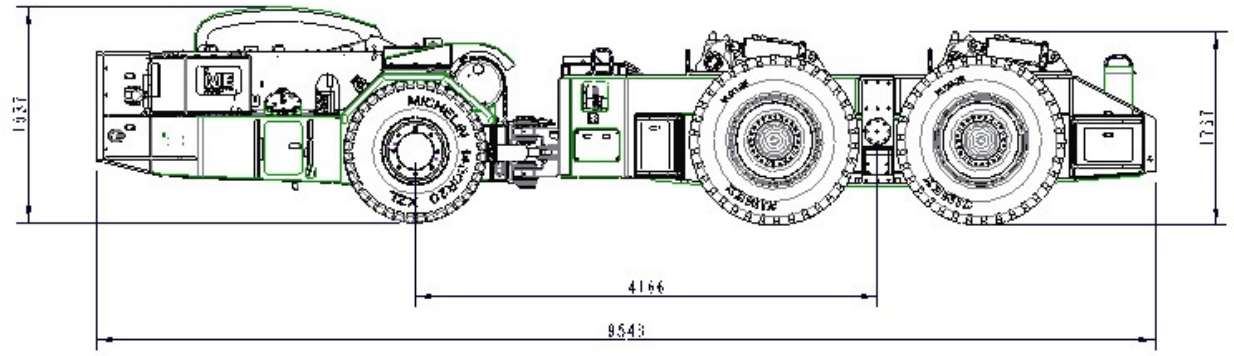
1.2.11. Service braking, emergency and park brakes operate on four wheels. Park/emergency brakes are spring applied multiple disc, and fail safe.

1.2.12. The driver's cabin is situated at the front right hand side of the machine, and is fitted with a protective canopy rail. A door is fitted to give the driver protection against the ingress of materials from the roadway or ribs of the mine.

1.3. VEHICLE DIMENSIONS







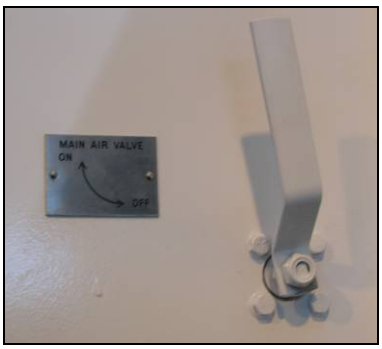
2. DRIVER COMPARTMENT CONTROLS

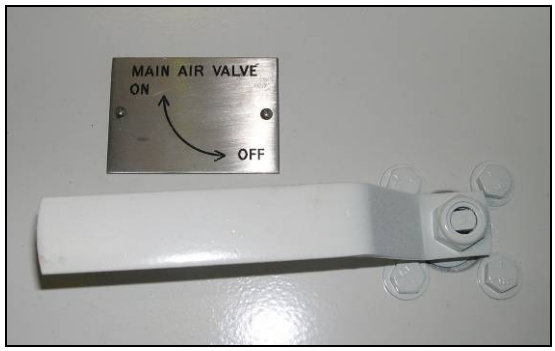
2.1. DRIVER CONTROLS

MAIN AIR VALVE

The main air valve turns off the air supply from the air receiver and is positioned behind the driver's seat on the mudguard in the operator's compartment.

It is recommended that the main air valve be turned off every time the machine is to be left for any period of time. This will ensure a full tank of air for the next time the machine is to be started.





STEERING WHEEL:

The steering wheel is mounted directly in front of the driver. It is rotated either clockwise or anti-clockwise to articulate the vehicle.

THROTTLE PEDAL:

Positioned at the driver's right foot. This pedal will operate engine speed from which 'Diesel Automation' automatically controls the hydraulic traction system. That is, the more you apply the foot pedal the higher the engine revs, and the more hydraulic flow to the 4 wheel motors will occur.

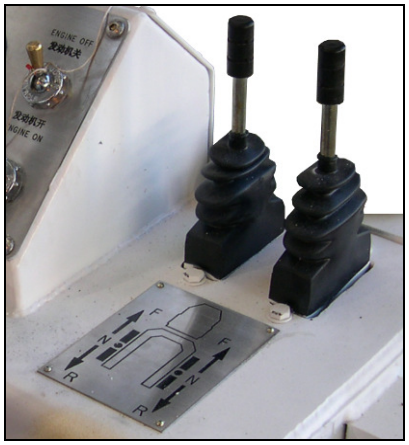
SERVICE BRAKE PEDAL:

Positioned at the driver's left foot. This pedal when depressed will (through the reverse modulating valve on the back of the foot pedal) release the hold off brake pressure to 0 kPa i.e. (brakes fully applied). The machine should be allowed to brake hydrostatically in most situations by releasing the throttle pedal.

DIRECTIONAL CONTROLS:

The direction is selected using the two valves mounted in front of the driver and to the right of the forward facing dash panel.

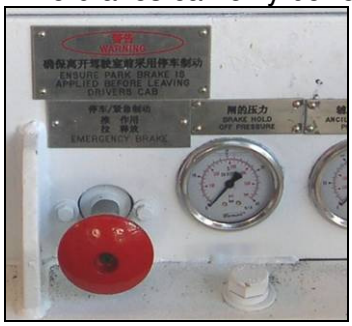
1. These two levers when both pushed forward will cause the Carrier to go forward.
2. These levers when both pulled back will cause the Carrier to move backwards.
3. These levers when in the centre position will cause the Carrier to go into neutral.
4. When the two levers are moved opposite to each other the Carrier will skid steer when unladen.



BRAKE CONTROL VALVE:

The large red button on the panel releases the park brake when pulled out.

Note: The brakes can only be released when the engine is running.



HORN BUTTON:

Sounds audible warning.

ENGINE STOP VALVE:

This valve is a toggle switch. When in the up (ON) position allows the engine to be started and run thereafter. Switching to the down (OFF) position shuts down the engine.

START BUTTON:

Depressing the start button cranks the air start motor to start the diesel engine. Release button when engine starts. The button is located on the driver's dash panel.

LUBRICATOR and FILTER ASSEMBLY

This is fitted against the inner wall of the driver's cab and conditions the compressed air prior to control and safety circuits.

TRACTION PRESSURE GAUGES:

8 gauges positioned on the side instrument panel indicate the hydraulic pressure in the loop circuit for each side of the trailer. (4 per side).

1 - Loop forward pressure. 0 – 310 bar
2 - Loop reverse pressure. 0 – 310 bar
3 - Charge pressure. 30 bar
4 - Stroker pressure 6 – 22 bar

WATER TEMPERATURE GAUGE:

Indicates the temperature of the coolant in the radiator and engine block system.
85℃ normal

AIR PRESSURE GAUGE:

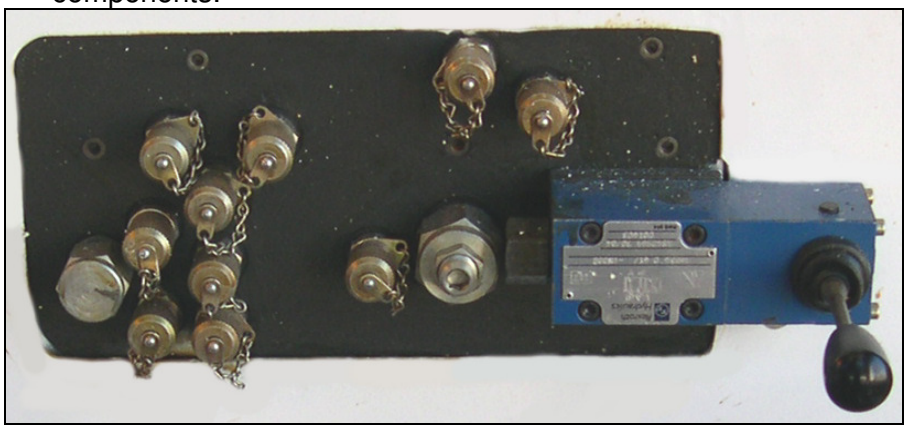
Indicates the pressure in the air receiver. Normal 100 – 120 psi

ANCILLIARY PUMP PRESSURE GAUGE:

Indicates pressure available in the load sense hydraulic system and accumulator, for the steering system and trailer functions. Standby pressure 25 bar, against closed end 210 bar.

VALVE BANK:

This is the hydraulic control manifold. It acts as a test point for hydraulic components.

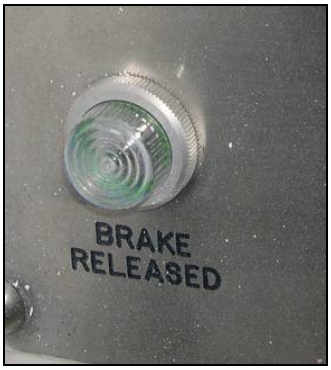


ENGINE OIL PRESSURE GAUGE:

Indicates the engine oil lubrication pressure. Normal 40 psi @ idle, 60 psi @ 2200 rpm

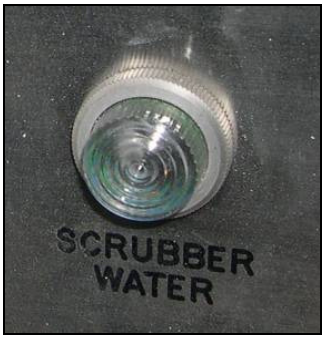
BRAKE RELEASE INDICATOR:

This is an indication of the status of the LWC brakes. Green eye-ball indicates brakes released. Clear eye-ball indicates that brakes are applied.



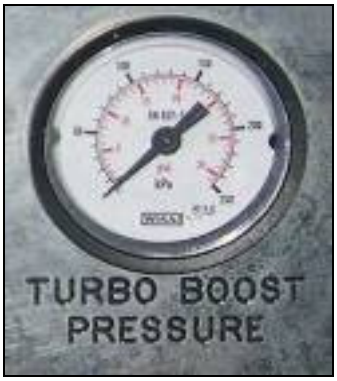
SCRUBBER WATER INDICATOR:

This is an indication of the status of the exhaust conditioner water level. Green eye-ball indicates adequate Exhaust Conditioner (Scrubber) Water. Clear eye-ball indicates low exhaust conditioner (scrubber) water.



TURBO BOOST PRESSURE GAUGE:

This is an indication of the boost pressure in the inlet manifold from the turbo.



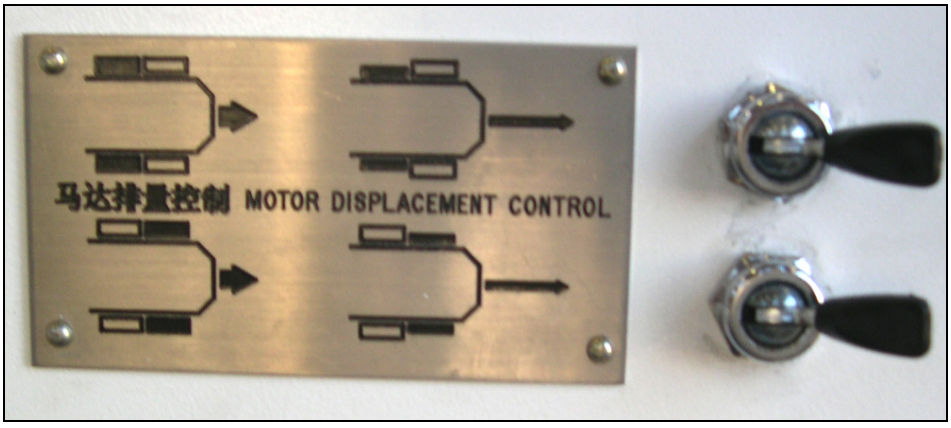
2WD / 4WD SWITCH:

This switch toggles between 2WD and 4WD. With the switch in the up position 2WD drive is active and with the switch in the down position 4WD is activated. (the LWC must be stopped with the park brake applied before switching between the drive modes can take place).

MOTOR DISPLACEMENT CONTROL:

This switch toggles hi and low displacement.

For shifting down gears, change one gear at a time (don't skip gears) and make sure the vehicle is travelling at the appropriate speed for the desired gear. Failure to do so will result in engine over speed and possible engine failure.



BRAKE HOLDOFF PRESSURE GAUGE:

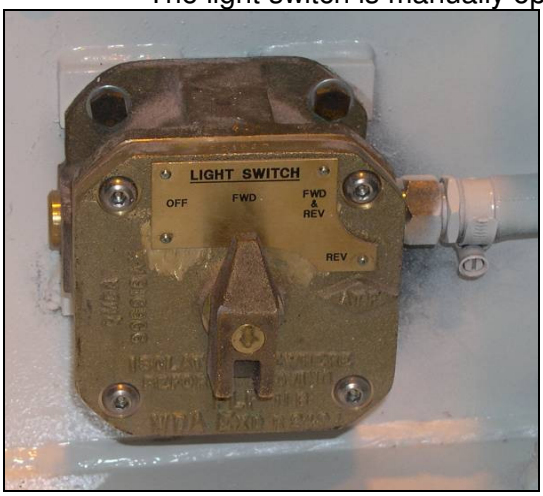
This gauge indicates the brake hold off pressure. 14 bar brake release.

BOOST PRESSURE GAUGES (CHARGE PUMP):

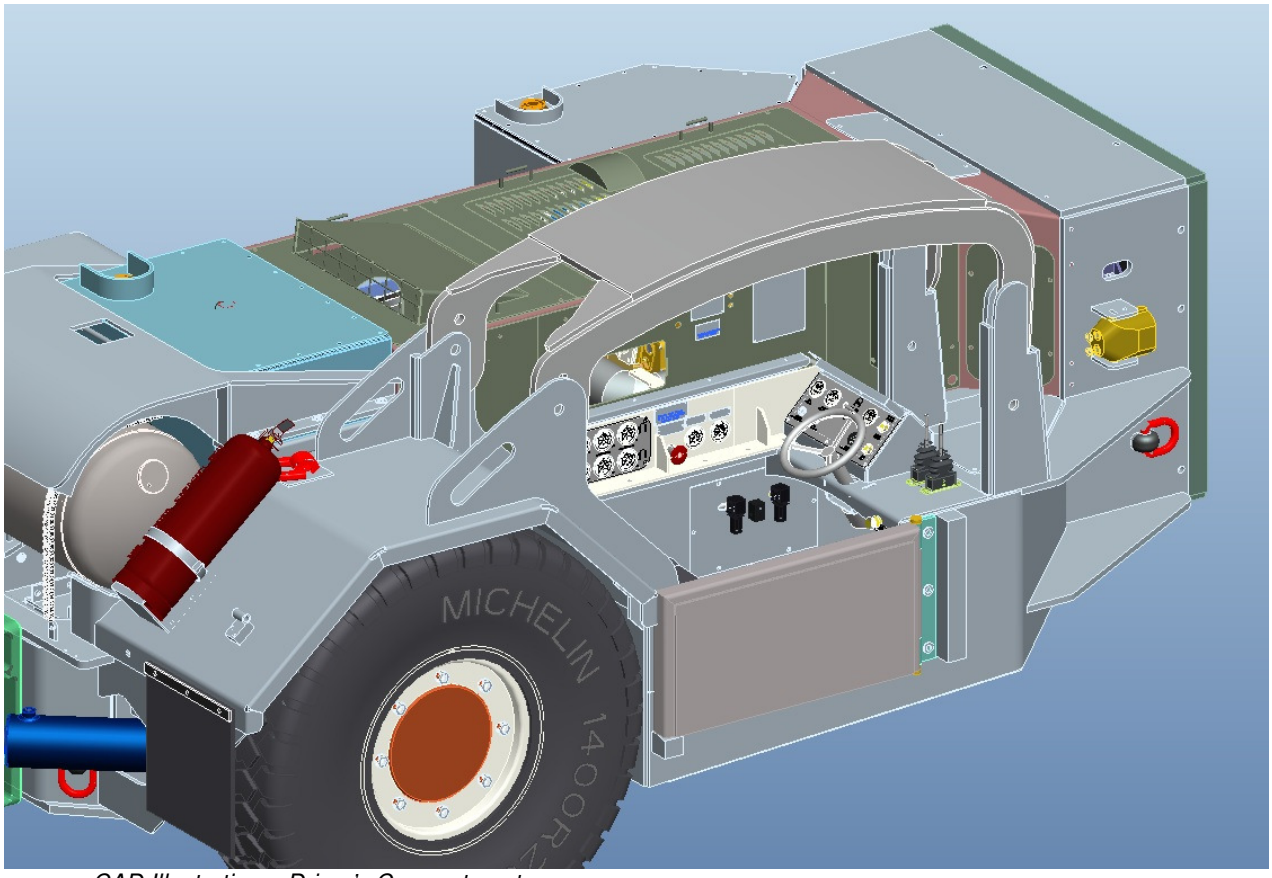
This gauge indicates the boost pressure at the traction pumps.

LIGHT SWITCH:

The light switch is manually operated to suit the direction of travel.

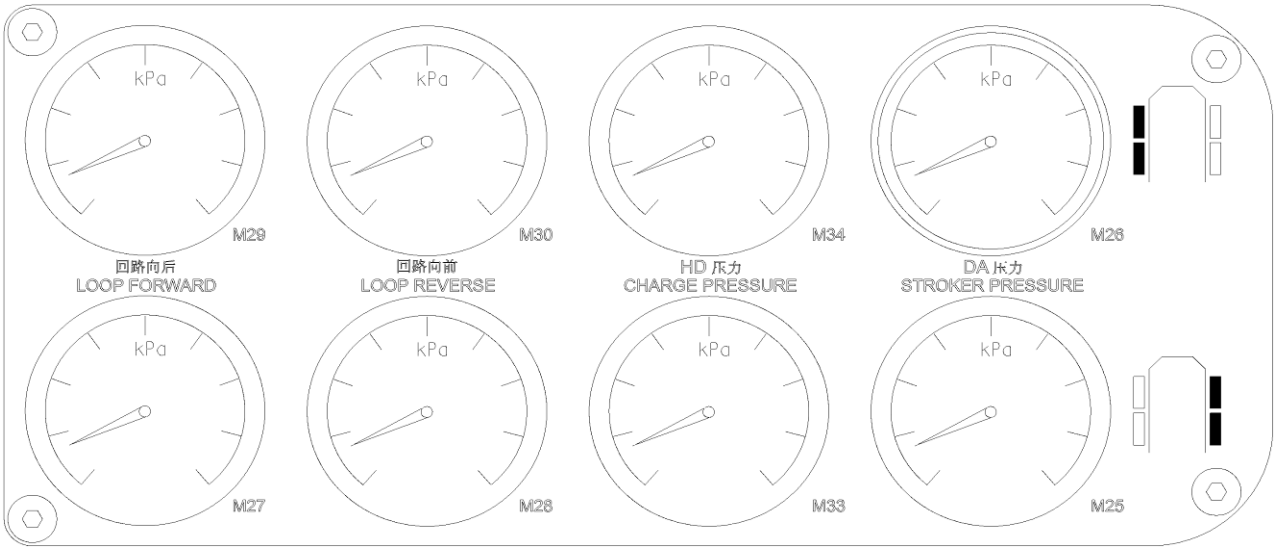


2.2. DRIVER'S COMPARTMENT LAYOUT



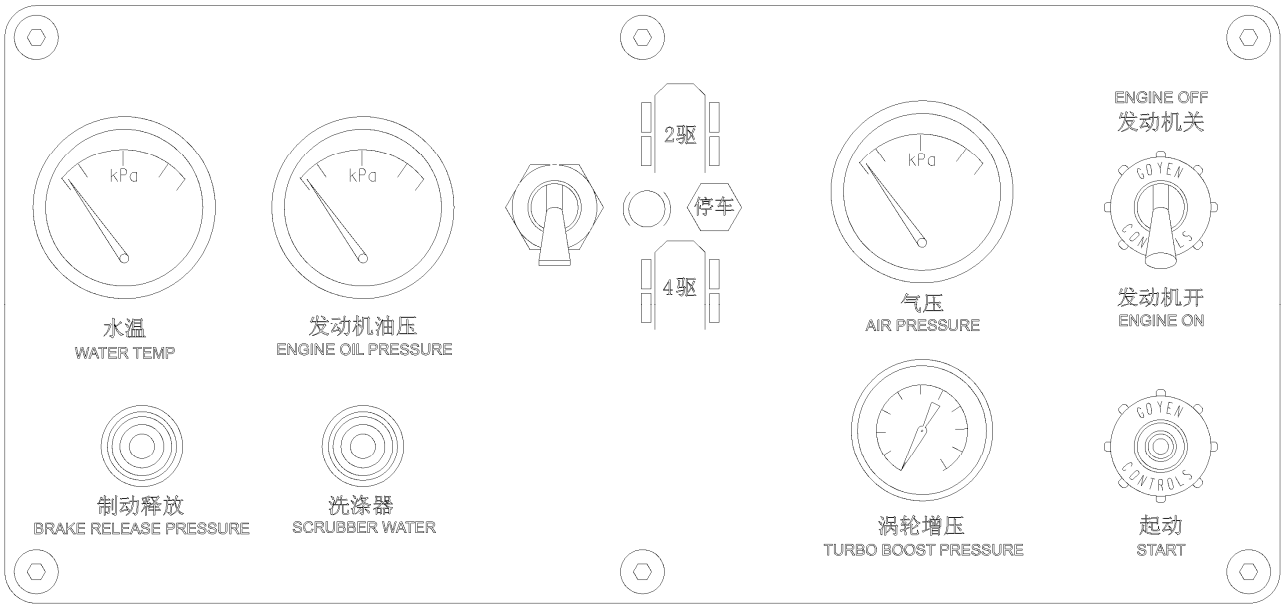
CAD Illustration – Driver's Compartment

2.3. SIDE DASH PANEL DIAGRAM



Loop pressure	Charge pressure	Stroker pressure
Stationary 36 bar Driving 36-310 bar	36 brake released, reduced with articulation	6 bar idle 22 bar

2.4. MAIN DASH PANEL DIAGRAM



Water temp 85ºC Engine oil Pressure 40-60 psi Air - 70psi min to start
Turbo boost pressure 1.8 bar Max

3. DIESEL ENGINE SYSTEM

3.1. The LWC is powered by a Caterpillar 3126 DITA diesel engine system designed by Industrea Mining Equipment to meet Australian Standard AS3584-2003 'Diesel Engine Systems for Underground Coal Mines'. This standard specifies the requirements for the flameproofing and the limiting of surface temperature and exhaust emission control of systems for use in underground coal mines.

3.2. The engine system approved as AS3584 2003 and features a water cooled exhaust manifold and pipe, water based exhaust scrubber, flame trap on the air intake, flame trap on the exhaust.

3.3. Maintenance requirements for the explosion proof engine system is detailed in draft Australian Standard AS3584.3 (DR99282)

3.4. A **Maintenance Management System**, including AS3584.3 Codes A, B, C, and D should be provided by the mine to control and document any examination, inspection, service, maintenance, overhaul, modification and testing of the diesel engine system.

3.5. **Caution:** Use genuine Industrea Mining Equipment components and service facilities to ensure that the integrity of the explosion protection is maintained. Overhauls and modifications of the diesel engine system should be carried out in Industrea Mining Equipment's Thornton workshop.

3.6. Service work on site should be carried out in a non-hazardous zone, i.e. an area in which, during the normal course of events, there is no possibility that there may be an accumulation of flammable or explosive gas that may create a hazard for the operation, service or maintenance of a diesel engine system. Work should be carried out with adequate ventilation and illumination for the task.

3.7. Industrea Mining Equipment recommend examinations coded A,B,C,D as determined in the draft Australian Standard AS/NZS 3584.3 at the following frequency

- ✓ Code A Daily
- ✓ Code B 50 Hours
- ✓ Code C 200 Hours
- ✓ Code D 2000 Hours or yearly

3.8. Details required for mechanical inspection of flame proof components are tabulated below.

LWC 50T PARTS	P/N	FACE 1 Surface	FACE 2 Surface	Flatness	Pressure Test Gas Path		Pressure Test Water Jacket
Water Cooled Exhaust Pipe	7-052154-700	1.6um	1.6um	0.15mm	1858 kPa @ 3mins		800Kpa @ 3mins
Exhaust Pipe Inspection Scrubber	7-052155-700	1.6 um	N/A	0.15mm	N/A		N/A
						Flame path length	Housing Diameter
Modified Inlet Manifold	7-052170-700	1.6um	1.6um	0.2mm	800 kPa @ 3mins	62.25 / 63.15	666.8 / 666.7
Modified Turbo Housing	7-052304-700	1.6um	N/A	N/A	N/A	15 min	79.60 / 79.65

						Flame path length	Flame path Gap
Exhaust Flame Trap	7-052145-700					79 min	0.45
		1.6um	1.6um	0.075mm	N/A		800 kPa @ 3mins
Inlet Flame Trap	7-052169-700	1.6um	1.6um	0.075mm		55 min	0.45

3.9. The engine system must use FRAS (Fire resistant anti Static) fan blades and fan belts.

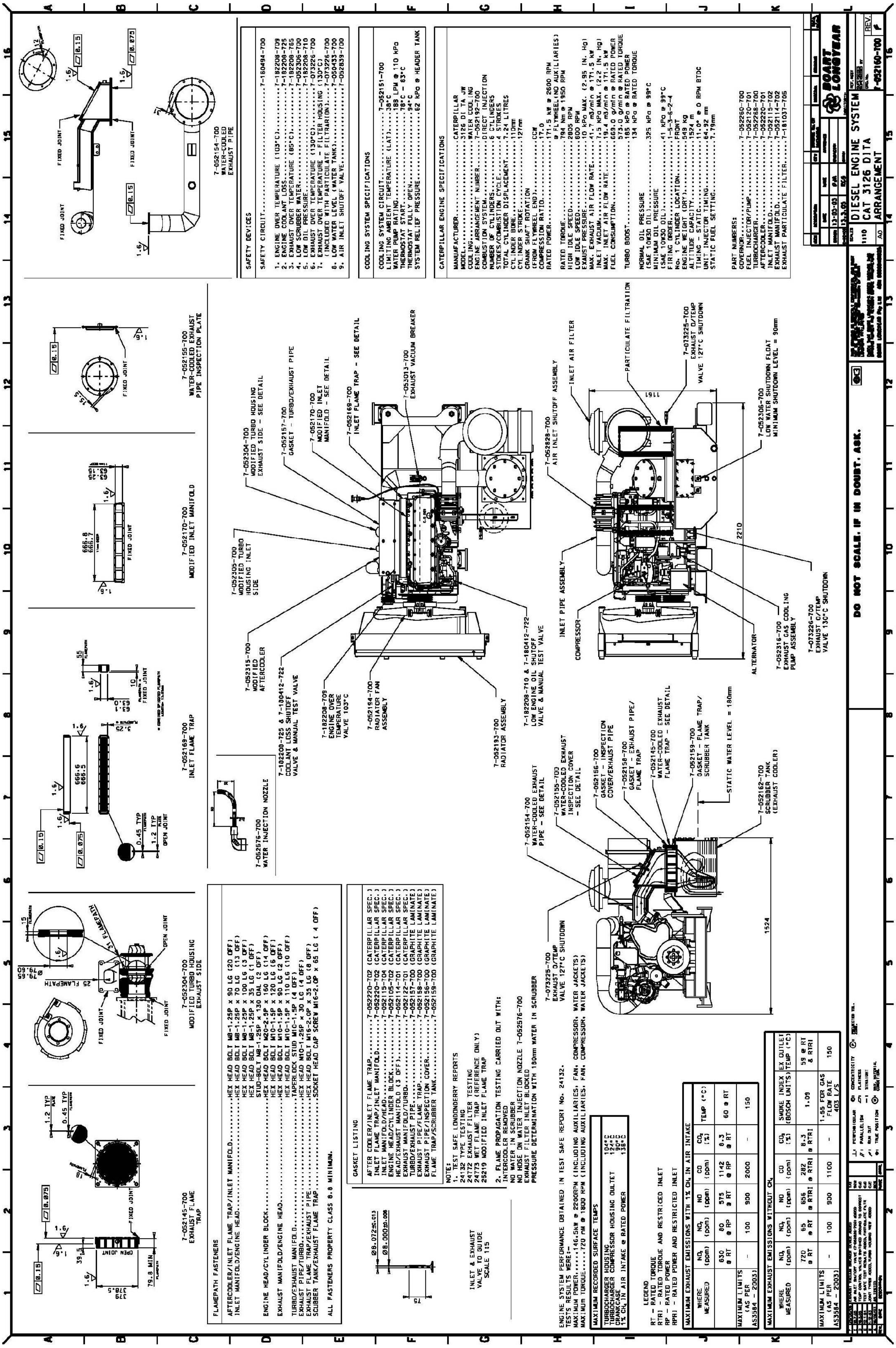
3.10. The engine system incorporates the following shutdown systems. Note: brakes will apply on engine shutdown.

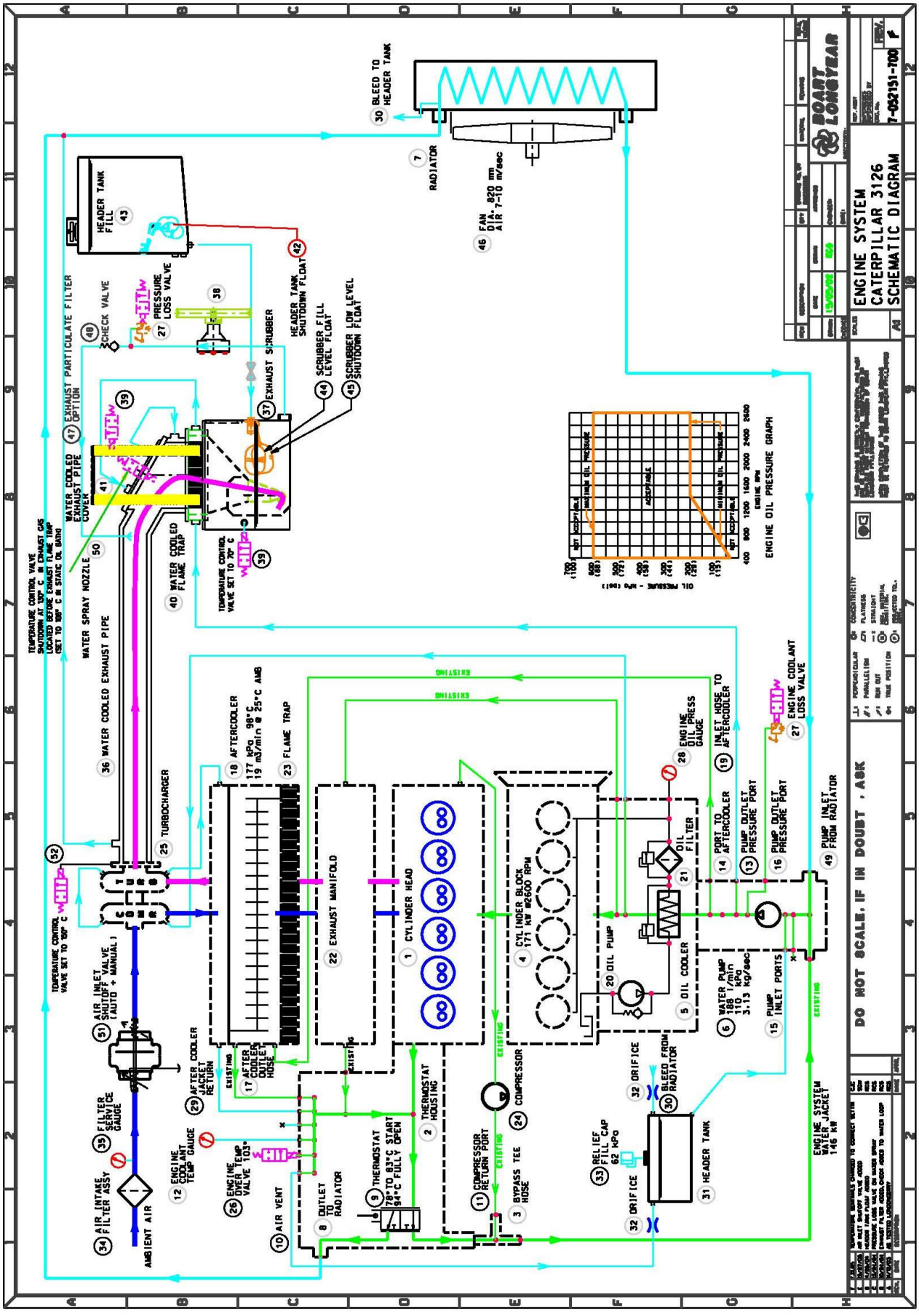
- Low water shutdown
- Surface over temperature
- Exhaust over temperature
- Engine over temperature
- Coolant over temperature
- Hydraulic oil over temperature
- Low engine oil pressure
- Coolant loss
- Engine overspeed
- Methane detection (optional)

3.11. The diesel engine system incorporates a spring loaded poppet valve designed to automatically stop the engine by closing down the air intake should engine overspeed occur due to abnormal combustion of methane rich atmosphere. The intake air passing through provides the closing force on the valve. As the airflow increases, the closing force builds up. This is resisted by the spring force, the pre-load of which is adjustable such that at a given air flow the resulting force overcomes the spring resistance and causes the valve to close. Once the valve is closed the valve will not reset to the open condition until the engine stops. Below are procedures for adjustment and maintenance

3.12. Exhaust gas and engine water jacket temperature sensors should be replaced or re-calibrated yearly.

Certificates required for Approval	**Report No.**
☐ Exhaust Gas Analysis	_____
☐ C-CP 02-4 Routine Testing	_____
☐ C-CP 02-9 DES Component Inspection sheets	_____
☐ Air Receiver Inspection Certificate	_____
☐ C-CGP 006-15 Electrical Equipment Final Inspection	_____
☐ Alternator Inspection Certificate	_____
☐ Headlights Inspection Sheets	_____
☐ J-Box Inspection Sheets	_____
☐ Switch Inspection Sheets	_____
☐ Methane Monitoring System Inspection Sheets	_____


DIESEL ENGINE SYSTEM
CAT 3126 DITA
ARRANGEMENT
DO NOT SCALE. IF IN DOUBT, ASK.
7-052160-700



...\052151-CAT 3126 WATER CIRCUIT. 12/9/2005 3:48:01 PM

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PARTS LIST **Page:** 01

Drawing No: 7-052151-700 ENGINE SYSTEM SCHEMATIC

Rev: E **Author:** RCS **Date Approved:** 31-JAN-2003

Item	Parts list	Rev	Description	Unit	Quantity
1	7-052187-700		CYLINDER HEAD GROUP	EA	1
2	7-052177-709		REGULATOR - TEMPERATURE	EA	1
3	MISC872		BYPASS TEE HOSE	EA	1
4	7-052104-700		CYLINDER BLOCK GP	EA	1
5	7-052201-700		COOLER GP - ENGINE OIL	EA	1
6	7-052216-700		PUMP GP - WATER	EA	1
7	7-052299-700		RADIATOR	EA	1
8	MISC873		OUTLET TO RADIATOR	EA	1
9	7-052247-708		REGULATOR - WATER	EA	1
10	MISC874		AIR VENT	EA	1
11	MISC875		COMPRESSOR RETURN PORT	EA	1
12	7-181801-712		WATER TEMP GAUGE	EA	1
13	MISC876		PUMP OUTLET PRESSURE PORT	EA	1
14	MISC877		PORT TO AFTERCOOLER	EA	1
15	MISC878		PUMP INLET PORTS	EA	1
16	MISC879		PUMP OUTLET PRESS PORT	EA	1
17	7-052220-705		HOSE (6 CM)	EA	1
18	7-052315-700	B	AFTERCOOLER - MODIFIED	EA	1
19	7-052220-706		HOSE	EA	1
20	7-052119-700		PUMP GP - ENGINE OIL	EA	1
21	7-052440-700		REMOTE OIL FILTER ASSY	EA	1
22	7-052114-700		MANIFOLD GP - EXHAUST	EA	1
23	7-052169-700		FLAME TRAP - INLET	EA	1
24	7-052240-700		AIR COMPRESSOR ASSY	EA	1
25	7-052122-700	A	TURBOCHARGER GP - FLAMEPROOF	EA	1
26	7-182208-709	A	TEMP CONTROL VALVE 103C	EA	1
27	7-182208-725		COOLANT LOSS VALVE	EA	2
28	7-181804-722		PRESSURE GAUGE ENGINE OIL	EA	1
29	MISC880		AFTERCOOLER JACKET RETURN	EA	1
30	7-073284-055		HOSE ASSY - T14D	EA	1
31	7-052302-700		HEADER TANK - LWC 025	EA	1
32	MISC881		ORIFICE	EA	2
33	7-181014-712		RAD CAP PRESSURE RELEASE	EA	1
34	7-052285-700		AIR FILTER ASSY	EA	1
35	7-052276-700		SERVICE INDICATON KIT	EA	1
36	7-052154-700	J	EXHAUST PIPE - WATER COOL	EA	1
37	7-052161-700	A	SCRUBBER TANK ASSEMBLY	EA	1
38	7-052316-700		PUMP ASSY - EXHAUST GAS	EA	1
39	7-073226-700		TEMP CONTROL VALVE 77 C	EA	2
40	7-052145-700	G	WATER COOLED FLAME TRAP	EA	1
41	7-073225-700		TEMP CONTROL VALVE 106 C	EA	1
42	7-050433-700		FLOAT VALVE(LWC CUTOUT)	EA	1
43	7-052342-700		FUEL AND WATER TANK ASSY	EA	1
44	7-052307-700		WATER LEVEL FLOAT VALVE	EA	1
45	7-052306-700	A	LOW WATER SHUTDOWN FLOAT	EA	1
46	7-052194-700		MULTIWING FAN LWC	EA	1
47	7-181037-705		FILTER ELEMENT DA100	EA	1
48	7-180402-723		CHECK VALVE 316SS 1/2"	EA	1
49	MISC882		PUMP INLET FROM RADIATOR	EA	1
50	7-052576-700		NOZZLE WATER INJECTION	EA	1
51	7-052839-700		ENGINE OVERSPEED DEVICE &	EA	1

4. Exd ELECTRICAL SYSTEM

4.1. All components on the LWC are explosion proof for operation in explosive atmospheres that may occur at times in underground coal mines. The LWC utilizes a belt driven alternator to generate electrical power for lighting.

4.2. Electrical equipment on the LWC should be maintained according to AS2290.1-1990.

4.3. Frequency and type of examination for flameproof electrical components are as follows.

Description of Component	External examination **Code A**	Semi internal examination **Code B**	Internal Examination **Code C**	Examination **Code C1**
Lights, J-box, Hour meter, Service meter	Daily	3Monthly	6Monthly	4Years
Alternator, Light switch		3Monthly	6Monthly	4Years
All readily accessible machine cables and glands	Daily			4Years
All not readily accessible machine cables and glands and hosing		3Monthly	6Monthly	4Years

4.4. Overhaul and Repair requirements for electrical equipment operated in explosive atmospheres is detailed in AS/NZS 3800-1997. Overhaul of electrical components is recommended every 4 years.

5. BRAKES

WARNING
A Deadman or Throttle actuated brake has NOT been fitted to this machine.

5.1. SERVICE BRAKE

NOTICE
The service brake is the inside pedal to be operated by the operator's right foot.

5.1.1. Hydrostatic braking should be used in normal operation of the machine. Release of the throttle pedal will cause the hydraulic traction system to retard the machine. Always use the correct displacement selection to ensure that retardation is suitable for the situation. That is, select maximum displacement (1st speed) when travelling down an incline, do not ride disc brakes down an incline.

5.1.2. The pedal operated disc brake is applied by the release of hydraulic pressure, 17 – 0 bar.

5.2. EMERGENCY BRAKE

5.2.1. The emergency brake system is a "SAHR" (Spring Applied Hydraulic Release) design and as such is a fail to safety system. The spring brake will start to apply when the hydraulic system pressure falls below 14 Bar (200 psi).

5.2.2. The emergency brake red button is situated to the left of the driver when seated on the panel next to the side dash on this machine.

5.3. BRAKE TESTING

5.3.1. In Service Testing of brake systems is recommended to be carried out on the LWC at intervals of 250 hours or monthly, whichever occurs first. The in service testing procedure is outlined in appendix F of the Guideline MDG 39, summarized below. A Vipac Heavy Vehicle Brake Tester is recommended.

5.3.2. SERVICE BRAKES

a) Hydrostatic Service brakes shall be tested while the vehicle is unladen, at tare mass on a flat surface at max speed 4wd, subject to safety considerations. Loop pressure gauges should show retardation pressure during deceleration.

b) Tests should be repeated a minimum of three times to confirm correct operation of the hydraulic system.

c) Where the machine is operated at high speed 2wd, the hydrostatic retardation assisted by the pedal service brake testing should be tested using a brake meter. Multiple tests should be spaced at 15 minute intervals.

5.3.3. SECONDARY and AUTOMATIC

a) The secondary braking control system shall be tested by applying the Park/Emergency brake while the machine is travelling at low speed. The brake system should apply within 0.7 seconds from activation.

b) Activation of the brake control valve (Red Button in cabin) indicates operation of the engine 'Off' switch and safety circuit activation of the automatic brake.

5.3.4. PARK BRAKES

a) Park brakes shall test the holding capacity of a laden machine by parking on a 25% gradient. This test should not submit the operator or observers to any danger. (e.g. do not test at the top of the drift.)
b) Alternatively, the brakes can be tested by applying the service brake and driving at full loop pressure (310 bar) against the brake.

WARNING
Maximum gradient for operation of the LWC not to exceed 1 in 8 for normal operation

Maximum payload is not to exceed 50 tonnes.

Operator training is required to guide operators to select a speed and gear ratio appropriate to mine conditions and gradient.

5.4. STEERING

The vehicle is steered by a combination of machine articulation and AFD (Automatic Forced Differential). AFD slows the inside motor pair during cornering to greatly assist the turning of the machine. This function is automatic and requires the operator only to use the steering wheel. The motor speed control can be operated manually by using the FWD/REV joy sticks. This control may be useful when unladen to skid steer, however AFD is optimized for tight manoeuvring when laden with a chock.

Should a hydraulic fault occur on the machine that affects any function - but particularly steering and brakes - the vehicle should be switched off and the brakes applied immediately. The fault should be rectified prior to any further operation of the vehicle. Note that in the event of hydraulic failure the emergency brake will begin to apply once pressure drops below 200 psi (14 bar).

6. FIRE

IN CASE OF FIRE

As soon as you become aware of a fire, perform the following steps:

6.1.1. Turn the machine off.

6.1.2. Get away from the machine, to ensure personal safety. Take a hand portable extinguisher along if you can.

6.1.3. Take up a position where access to the fire is unrestricted.

6.1.4. Stand up-wind to the fire to avoid smoke and flames.

6.1.5. Stand up-hill of the fire to avoid dangerous run off.

6.1.6. Take a crouching position to keep clear of smoke and heat.

6.1.7. Identify your line of retreat before tackling fire.

6.1.8. Test the extinguisher before moving into the immediate area of the fire.

6.1.9. If in any doubt about electricity being involved treat it as a fire involving electrical equipment and use the correct extinguisher (refer extinguisher selection chart below).

6.1.10. If there is any chance of chemicals or explosives being in the fire, or you are unsure of your ability to extinguish the fire, evacuate the area immediately and do not attempt to extinguish it yourself.

Fire Extinguishers

PORTABLE FIRE EXTINGUISHER SELECTION CHART

INDICATORS → / TYPE OF EXTINGUISHER →		 WATER	 FOAM	 DRY CHEMICAL	 CARBON DIOXIDE
CLASS & TYPE OF FIRE		CONTENTS ELECTRICALLY CONDUCTIVE		CONTENTS ELECTRICALLY NON-CONDUCTIVE	
A	ORDINARY COMBUSTIBLES (WOOD, PAPER, ETC)	YES (MOST SUITABLE)	YES	YES	YES
B	FLAMMABLE LIQUIDS	NO	YES (SPECIAL FOAM REQUIRED FOR ALCOHOL TYPE FIRES)	YES	YES
C	FLAMMABLE GASES	NO	NO	YES	YES
D	COMBUSTIBLE METALS	NO	NO	NO	NO
		← USE SPECIAL PURPOSE EXTINGUISHERS ONLY →			
E	FIRE INVOLVING LIVE ELECTRICAL EQUIPMENT	NO	NO	YES	YES

6.2. Explanation

6.2.1. If you leave the machine running, it may add fuel to the fire or restart the fire with sparks.

6.2.2. React quickly so the fire is caught before it grows too large.

6.2.3. By leaving the immediate fire area, you protect yourself from windblown flames, explosions or other dangers created by the fire.

6.2.4. Heat remaining from the fire could cause re-ignition after the fire suppression system has discharged. Because of this, it is important that someone stand by, at a safe distance, with a hand portable extinguisher. This standby should be maintained until all possibility of re-ignition is past.

6.3. After the fire is out

6.3.1. Report the incident immediately and do not operate the machine until notified by a mine official that it is safe to do so.

6.3.2. Machinery should not be restarted until it has been serviced and cleaned.

7. SERVICING

7.1. NOTICES & WARNINGS

Before commencing any maintenance on this machine make sure that you have read the “Operators Handbook”, have been trained in the proper operation of this machine, and are thoroughly familiar with all controls on this machine.

7.1.1. Notice: Service Site

Always service the machine on level ground with adequate lighting and protection from passing traffic.

7.1.2. Notice: Immobilisation

Stop the engine at the Engine Stop valve. Apply the park brake, chock wheels. Fit lock bar at articulation hitch to disable steering. Tag out the engine Off/Run switch and the main air supply tap.

7.1.3. Notice: Isolation

Use colliery tag system to notify that the machine is not to be started. Turn engine Off/Run toggle switch to ‘Off’ and close the main air supply tap located behind the driver to the ‘Off’ position. Lock the air supply tap in the “Off” position.

7.1.4. Warning: Articulation Hazard

Reserve steering pressure is stored in hydraulic accumulators. Until the accumulated pressure is discharged the steering is functional and will articulate the machine when the engine is stopped. As the brakes are applied when the engine is stopped there is resistance to articulation, however caution should be taken when working in the articulation area of the machine. Always fit the lock bar at the articulation hitch.

7.1.5. Warning: Stored Pressure

Hydraulic lines are under high pressure. Shut-off the machine and always vent residual hydraulic pressure before working on the hydraulic system.

7.1.6. Warning: High Pressure Hydraulics

The LWC uses high pressure hydraulic systems. Persons working on the system should be trained and have experience and understanding of the task and associated hazards.

7.1.7. Warning: Cooling System

The engine cooling system operates under pressure and at high temperature. This may cause hot fluid to be ejected from the system at high pressure and cause burn injuries. The cap must be retained by a chain to ensure the cap does not become a projectile. Release all pressure from the cap before opening the header tank.

7.2. CODE A EXAMINATION

(DAILY SERVICE AND INSPECTION)

This section describes the normal daily servicing required by the operator to keep the vehicle in good running order in between regular maintenance by colliery fitters.

7.2.1. Daily greasing of all points shown on the lubrication chart is required. Five pumps (or shots if using a power greaser) should be sufficient at each grease nipple. (Check Auto Lube circuit if fitted).

7.2.2. Pressure/steam clean exhaust flame trap

7.2.3. Hose out the driver's cabin daily to prevent a build up of dirt and rubble on the floor. A slip or fall on this build up could cause an injury.

7.2.4. Hose down the whole machine regularly and inspect for loose and damaged hydraulic hoses, fittings, and airlines, missing bolts and chassis damage.

7.2.5. Check the engine oil level and top up as required.

7.2.6. Check the hydraulic oil tank level and fill as required, using filling pump.

7.2.7. Check that the vacuum indicator on the engine intake air filter is not showing red. If it is, the filter element requires changing and the indicator is to be reset by depressing the button on top.

7.2.8. Check the level of diesel in the fuel tank and top up as necessary.

7.2.9. Fill the exhaust conditioner header tank with clean water and add cleaning agent.

7.2.10. Check conditioner low water shutdown is operational (refer section 7.3).

7.2.11. Check the engine coolant level in the radiator header tank and fill with CLEAN water as necessary. BEWARE, care must be taken when removing the pressure cap. Release pressure from system using lever on the cap. ALL pressure must be vented before the cap can be removed. Check coolant level when system is less than 55 degrees Celsius whenever possible.

7.2.12. Inspect the condition of the tires and rims, and replace where necessary.

7.2.13. Check that all wheel nuts and studs are in place and secure.

7.2.14. Wipe down the control panel so that all gauges, indicators, and information are legible.

7.3. LOW WATER SHUTDOWN TEST

EXHAUST CONDITIONER SHUTDOWN TEST. (Check once per shift).

7.3.1. Close Exhaust Conditioner isolation valve (See item 1).

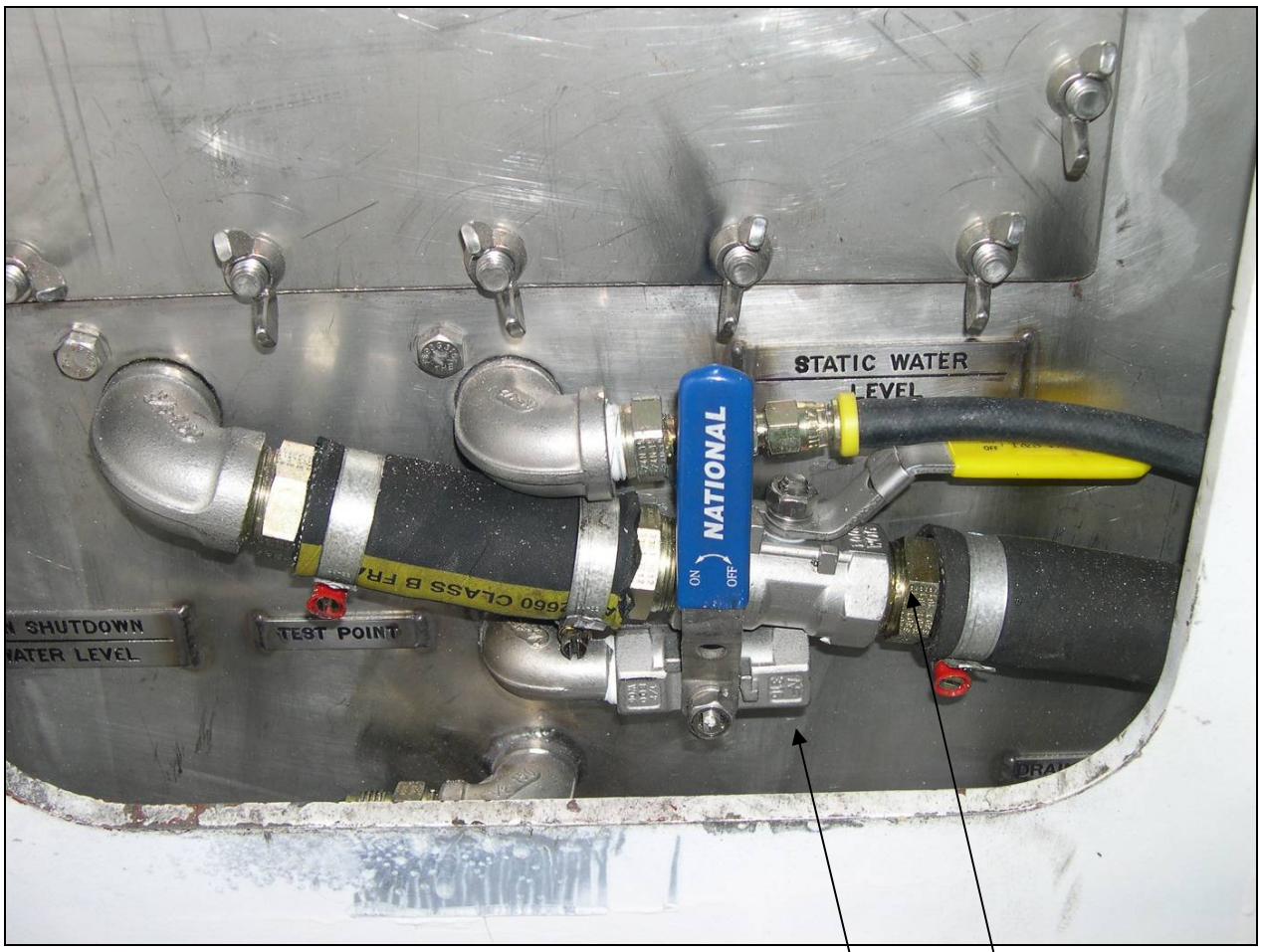
7.3.2. With engine running at idle open the Exhaust Conditioner “TEST POINT” (See item 2).

7.3.3. Engine should shut down.

7.3.4. Water should still be draining from the "TEST POINT" at engine shutdown. If the engine shuts down after water stops draining from the "TEST POINT", tag the machine out immediate and have the fault rectified.

7.3.5. Close Exhaust Conditioner “TEST POINT” (See item 2).

7.3.6. Open Exhaust Conditioner isolation valve (See item 1).



View from front of scrubber tank

7.4. CODE B EXAMINATION (50 engine hours)

7.4.1.	☐	Clean engine / compartment free of coal dust and lose particles
7.4.2.	☐	Check there are no diesel fuel leaks
7.4.3.	☐	Check all fasteners securing flameproof joints are secure
7.4.4.	☐	Check for leakage of exhaust gas (Soapy water test)
7.4.5.	☐	Check engine oil level
7.4.6.	☐	Check the cooling system for leakage and correct coolant level
7.4.7.	☐	Check all Vee belts are in place, undamaged, tensioned and FRAS
7.4.8.	☐	Check low-water shut down of exhaust conditioner operates correctly
7.4.9.	☐	Check the engine mountings are secure
7.4.10.	☐	Check radiator hoses are in good condition and correctly fitted.
7.4.11.	☐	Check radiator core is clean and free of leaks
7.4.12.	☐	Clean air filter element
7.4.13.	☐	Drain Water separator
7.4.14.	☐	**CLEAN exhaust flame trap.**
7.4.15.	☐	Check the internals of the scrubber, flush and clean.
7.4.16.	☐	Check condition of fire extinguisher Charge
7.4.17.	☐	Check for correct ‘static water level’ in conditioner 180 mm
7.4.18.	☐	Check coolant loss shutdown at test point provided
7.4.19.	☐	Check Floats in scrubber are secure
7.4.20.	☐	Check low oil pressure shutdown at test point provided
7.4.21.	☐	Check the Compressor delivery line (PTFE) is in good condition
7.4.22.	☐	Check the air receiver is drained to remove condensation
7.4.23.	☐	Check air filter (pneumatic etc.) is emptied
7.4.24.	☐	Check Hydraulic oil level
7.4.25.	☐	Check Air lubricator is full
7.4.26.	☐	Check fuel shutdown cylinder is secure
7.4.27.	☐	Check scrubber header tank water level
7.4.28.	☐	Check throttle linkages/operation in good condition
7.4.29.	☐	Check tyres, rims and fasteners
7.4.30.	☐	Check operation of lights and hour meter
7.4.31.	☐	Check all gauges are operating correctly and clearly legible
7.4.32.	☐	Check machine operations, brakes, steering, hydraulics
7.4.33.	☐	Check all switches/valves/controls are operating correctly
7.4.34.	☐	Check all warning devices and signs

7.5. CODE C EXAMINATION (200 engine hours)

7.5.1.	☐ Clean engine/ compartment free of coal dust and lose particles
7.5.2.	☐ Clean air filter element
7.5.3.	☐ Check there are no diesel fuel leaks
7.5.4.	☐ Check all fasteners securing flameproof joints are secure
7.5.5.	☐ Check condition of fire extinguisher
7.5.6.	☐ Check for leakage of exhaust gas (Soapy water test)
7.5.7.	☐ Check coolant loss shutdown at test point provided
7.5.8.	☐ Check low oil pressure shutdown at test point provided
7.5.9.	☐ Check the cooling system for leakage and correct coolant level
7.5.10.	☐ Check charge and return filter service indicators.
7.5.11.	☐ Check all Vee belts are undamaged, tensioned and FRAS
7.5.12.	☐ **CLEAN exhaust flame trap**
7.5.13.	☐ Check low-water shut down of exhaust conditioner
7.5.14.	☐ Check Hydraulic oil level
7.5.15.	☐ Check the engine mountings are secure
7.5.16.	☐ Check scrubber header tank water level
7.5.17.	☐ Check radiator hoses are in good condition and correctly fitted.
7.5.18.	☐ Check tyres, rims and fasteners
7.5.19.	☐ Check radiator core is clean and free of leaks
7.5.20.	☐ Check machine for structural damage
7.5.21.	☐ Check articulation points and steering pivots and clevis
7.5.22.	☐ Check operation of lights and hour meter
7.5.23.	☐ Check the internals of the scrubber, flush and clean.
7.5.24.	☐ Check machine hydraulic operation and settings
7.5.25.	☐ Check for correct ‘static water level’ in conditioner 260 mm
7.5.26.	☐ Check all warning devices and signs
7.5.27.	☐ Check Floats in scrubber are secure
7.5.28.	☐ Check the Compressor delivery line (PTFE) is in good condition
7.5.29.	☐ Check the air receiver is drained to remove condensation
7.5.30.	☐ Clean the air intake flame trap
7.5.31.	☐ Check air filter (pneumatic) is emptied
7.5.32.	☐ Change out the Fuel filter and water separator
7.5.33.	☐ Check Air lubricator is full
7.5.34.	☐ Check service, emergency and automatic brakes
7.5.35.	☐ Check fuel shutdown cylinder is secure
7.5.36.	☐ Change out the Engine oil and filter
7.5.37.	☐ Check throttle linkages/operation in good condition
7.5.38.	☐ Check all engine safety system shut-down functions
7.5.39.	☐ Check the air receiver safety valve is operating correctly
7.5.40.	☐ Check all gauges are operating correctly and clearly legible
7.5.41.	☐ Check the starter motor is securely mounted
7.5.42.	☐ Check all switches/valves/controls are operating correctly
7.5.43.	☐ Check accumulator pre charge pressures
7.5.44.	☐ Check the engine sump
7.5.45.	☐ Check the engine crank case breather
7.5.46.	☐ Emission test
7.5.47.	☐ Fully grease machine

7.6. EMISSION TESTING

7.6.1. Australian Coal mines are required to have raw undiluted exhaust emission tests on diesel powered equipment conducted by an approved laboratory every 6 months and in house testing on a monthly basis. Or alternatively, testing can be carried out at intervals of three months by an approved laboratory.

7.6.2. Testing is to determine the concentration by volume of the constituents of raw exhaust gases, Carbon Dioxide, Carbon Monoxide and Oxides of Nitrogen.

Test reports should nominate:

- Diesel Engine serial number
- The engine type (Caterpillar 3126 DITA)
- The method of loading and whether sampled direct from the exhaust manifold to the analysis system or by the use of gas sample bags.
- Engine rpm for each test and hour meter reading.

7.6.3. Industrea Mining Equipment recommend loading the engine for gas testing by engaging drive and driving the engine against the foot brake. A test point for sampling undiluted raw exhaust gas is located on the exhaust pipe.

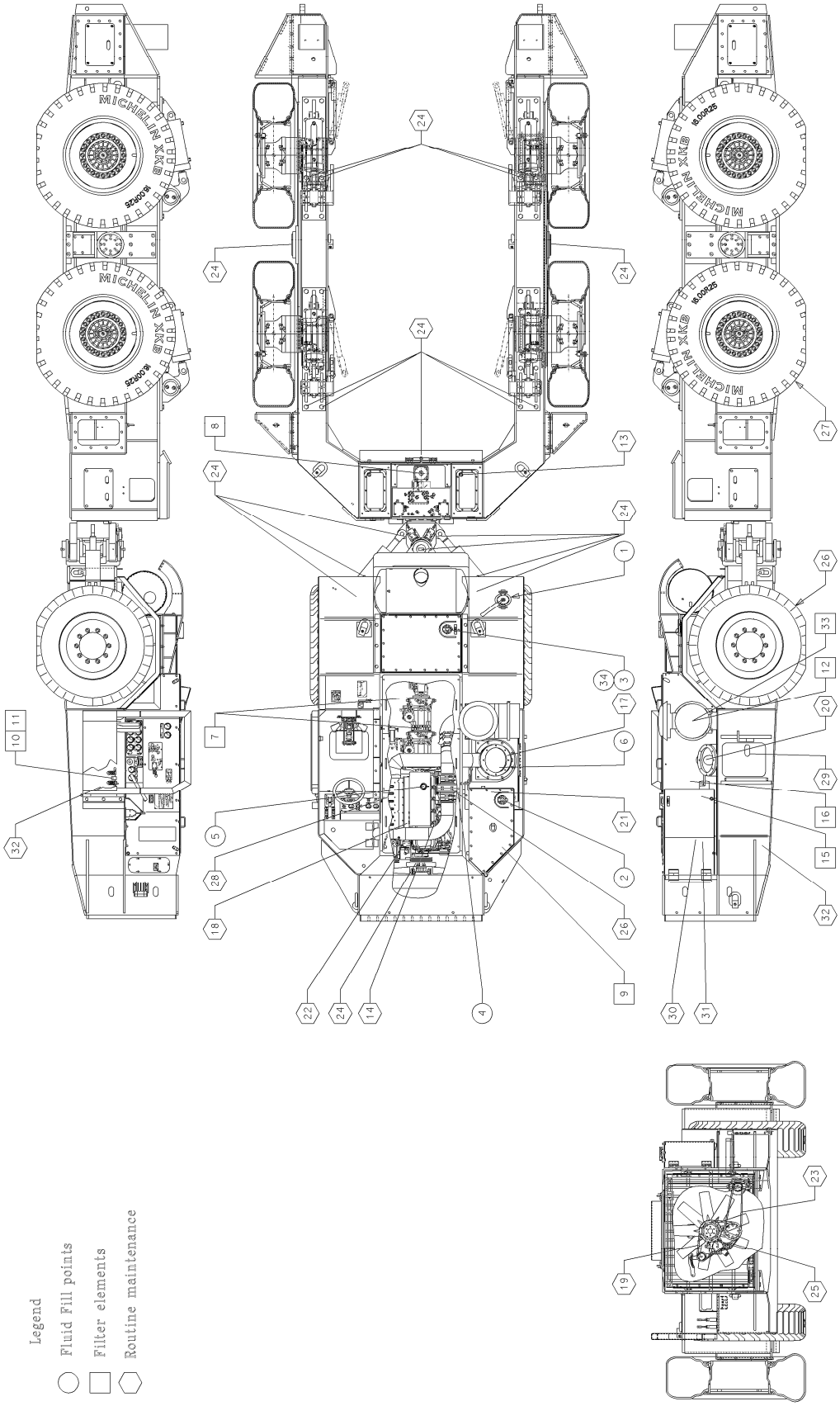
7.6.4. Where undiluted and untreated exhaust gas smoke and aerosols are to be measured, a Bosch smoke meter can be used. A maximum weighted smoke emission of 1.55 bosch units and a maximum smoke emission of 3.1 bosch units has been calculated for the 3126 DITA engine according to AS 3584.2-2003 appendix C.

7.6.5. Emission testing must be carried out in a non-hazardous zone.

7.7. CODE D EXAMINATION (2000 engine hours)

- 7.7.1. ☐ Clean the air intake flametrap
- 7.7.2. ☐ Replace all gaskets on flameproof connections
- 7.7.3. ☐ Disassemble and check all flameproof connections
- 7.7.4. ☐ External surface temperature test
- 7.7.5. ☐ Hydrostatic testing of exhaust/inlet components
- 7.7.6. ☐ Check the internals of the scrubber, flush and clean.
- 7.7.7. ☐ Check for leakage of exhaust gas (Soapy water test)
- 7.7.8. ☐ Check coolant loss shutdown at test point provided
- 7.7.9. ☐ Check engine oil level
- 7.7.10. ☐ Check low oil pressure shutdown at test point provided
- 7.7.11. ☐ Check the cooling system for leakage and correct coolant level
- 7.7.12. ☐ Change out Transmission filter and oil
- 7.7.13. ☐ Check all Vee belts are undamaged , tensioned and FRAS
- 7.7.14. ☐ Check low-water shut down of exhaust conditioner
- 7.7.15. ☐ Check Hydraulic oil level change filter
- 7.7.16. ☐ Check low water shutdown in water header tank
- 7.7.17. ☐ **CLEAN exhaust flame trap**
- 7.7.18. ☐ Check the engine mountings are secure
- 7.7.19. ☐ Check scrubber header tank water level
- 7.7.20. ☐ Check radiator hoses are in good condition and correctly fitted .
- 7.7.21. ☐ Check tyres , rims and fasteners
- 7.7.22. ☐ Check radiator core is clean and free of leaks
- 7.7.23. ☐ Check machine for structural damage
- 7.7.24. ☐ Check articulation points and steering pivots and clevises
- 7.7.25. ☐ Check operation of lights and hour meter
- 7.7.26. ☐ Check condition of fire extinguisher Charge
- 7.7.27. ☐ Check machine hydraulic operation and settings
- 7.7.28. ☐ Check for correct ‘static water level’ in conditioner
- 7.7.29. ☐ Check all warning devices and signs
- 7.7.30. ☐ Check Floats in scrubber are secure
- 7.7.31. ☐ Check there are no diesel fuel leaks
- 7.7.32. ☐ Check the Compressor delivery line (PTFE) is in good condition
- 7.7.33. ☐ Clean air filter element and pre-cleaner bowl
- 7.7.34. ☐ Check the air receiver is drained to remove condensation
- 7.7.35. ☐ Clean engine/ compartment free of coal dust and lose particles
- 7.7.36. ☐ Check air filter (pneumatic etc.) is emptied
- 7.7.37. ☐ Change out the Fuel filter and water separator
- 7.7.38. ☐ Check Air lubricator is full
- 7.7.39. ☐ Check service, emergency and automatic brakes
- 7.7.40. ☐ Check fuel shutdown cylinder is secure
- 7.7.41. ☐ Change out the Engine oil and filter
- 7.7.42. ☐ Check throttle linkages/operation in good condition
- 7.7.43. ☐ Check all engine safety system shut-down functions
- 7.7.44. ☐ Check the air receiver safety valve is operating correctly
- 7.7.45. ☐ Check all gauges are operating correctly and clearly legible
- 7.7.46. ☐ Check the starter motor is securely mounted
- 7.7.47. ☐ Check all switches/valves/controls are operating correctly
- 7.7.48. ☐ Check the engine sump
- 7.7.49. ☐ Check the engine crank case breather
- 7.7.50. ☐ Check oil level in rear oil immersed brake hubs
- 7.7.51. ☐ Fully grease machine
- 7.7.52. ☐ Adjust engine valve lash
- 7.7.53. ☐ Emission test

7.7.54. ☐ Check all fasteners securing flameproof joints are secure


Legend
Fluid Fill points
Filter elements
Routine maintenance

ITEM	DESCRIPTION	QTY	SERVICE OR CAPACITY	PERIOD CHECKED	PART NUMBERS	HOURS CHANGED
35	EXHAUST WATER PUMP	1	CHECK	WEEKLY	7-160523-700	
34	SCRUBBER ADDITIVE	1	80:1 RATIO	DAILY	7-18104-705	
33	AIR CLEANER ELEMENT	1	REPLACE	6MONTHLY	7-051679-702	1000
32	Y STRAINER	2	CLEAN FILTER	MONTHLY		250
31	LOW ENGINE OIL TEST	1	SHUTDOWN TEST	DAILY		
30	COOLANT LOSS TEST	1	SHUTDOWN TEST	DAILY		
29	WATER SHUTDOWN TEST	1	SHUTDOWN TEST	DAILY		
28	SURFACETEMP SENTINAL	1	REPLACE	6MONTHLY	7-052785-700	1000
27	TRAILER WHEELS	4	SOLID FILL	MONTHLY	7-041752-700	250
26	PRIME MOVER WHEELS	2	SOLID FILL	MONTHLY	7-041728-700	250
25	AIR SHUTOFF DEVICE	1	INSPECT/CLEAN	3MONTHLY	7-052814-700	500
24	GREASE POINTS	20	GREASE	DAILY	EPL2	50
23	FRAS ALTERNATOR BELT	1	CHECK TENSION	WEEKLY	7-181211-733	50
22	WATER TEMP SENTINAL	1	REPLACE	6MONTHLY	7-182208-709	1000
21	EXHAUST SENTINAL	1	REPLACE	6MONTHLY	7-073225-700	1000
20	ENGINE TEMP SENTINAL	1	REPLACE	6MONTHLY	7-073226-700	1000
19	FRAS FAN BELTS	2	CHECK TENSION	WEEKLY	7-181211-723	50
18	INLET FLAME TRAP	1	CLEAN	YEARLY	7-052169-700	2000
17	EXHAUST FLAME TRAP	1	CLEAN	WEEKLY	7-052145-700	50
16	FUEL WATER SEPERATOR	1	DRAIN/REPLACE	WEEKLY	7-052126-701	250
15	FUEL FILTER	1	REPLACE	MONTHLY	7-052125-702	250
14	ENGINE BREATHER	1	CLEAN	MONTHLY	7-052100-700	250
13	HYD TANK BEATHER	1	CLEAN	MONTHLY	7-073254-700	250
12	AIR CLEANER ELEMENT	1	RELPACE	MONTHLY	7-051679-701	250
11	AIR LUBRICATOR	1	FILL OIL	WEEKLY	7-160188-703	50
10	AIR FILTER	1	DRAIN WATER	DAILY	7-160188-701	
9	ENGINE OIL FILTER	1	REPLACE	MONTHLY	7-052440-712	250
8	HYD RETURN FILTER	1	REPLACE	MONTHLY	7-073174-700	500
7	HYD CHARGE FILTER	2	REPLACE	MONTHLY	7-073182-700	500
6	SCRUBBER CLEANER	1L	CLEAN & FLUSH	WEEKLY	7-181041-701	50
5	ENGINE COOLANT	1	FILL 30L	DAILY	CAT EC-1	1000
4	ENGINE OIL	1	FILL 28L	DAILY	15W40	250
3	WATER	1	FILL 321L	DAILY	WATER	50
2	DIESEL FUEL	1	FILL 168L	DAILY	DIESEL	1000
1	HYDRAULIC OIL	1	FILL 420L	DAILY	ISO 68 VI	2000

7.8. DAMAGE REPORT

C-QP 03-1

industrea
Industrea Mining Equipment

QUALITY SYSTEM

FORM No. C-QP 03-1

REPORT No.

PLEASE TICK REPORT: ☐ AUDIT NON-CONFORMANCE ☐ DEFECT REPORT
☐ CORRECTIVE ACTION REQUEST ☐ ENGINEERING REQUEST

ISSUE

JOB No/AUDIT No.	LOCATION:	QTY:
PART No.:	DRW. No.:	SUPPLIER:
1. DESCRIPTION		
ORIGINATOR (PRINT):		DATE:
2. CLIENT NOTIFIED ☐ YES ☐ NO		DATE:
3. ACTION:	RETURN TO SUPPLIER ☐ / REWORK ☐ / SCRAP ☐ / USE BY CONCESSION ☐	
DETAILS:		
SUPERVISOR:		DATE:

RESOLUTION

CORRECTIVE ACTION:	DRW/SPEC CHANGE ☐	QA DOC. CHANGE ☐	SUPPLIER ☐	OTHER ☐ (SPECIFY)
'OTHER' SPECIFICATION:-				
ISSUED TO:				
CORRECTIVE ACTION TAKEN:				
PREVENTATIVE ACTION TAKEN:				
SIGNED:		DATE:		
Engineering File No: _____ Design Control Reference: _____ Not Applicable ☐				
FAILURE MODE:	DESIGN ☐	SUPPLIER ☐	HUMAN ERROR ☐	PROCEDURE ☐ / OTHER ☐
4. RE-INSPECTION: ☐ YES ☐ NO		ACCEPTED AS CONFORMING ☐ YES ☐ NO		
SUPERVISOR'S/ CLIENT SIGNATURE:		DATE APPROVED:		
		CLOSED:		

White Copy to Issued Party. Yellow Copy to QA Manager Pink Copy to Remain in Book.

Page 1 of 1 Revised Date 14.01.2008 Form No.: C-QP 03-1

FORM No. C-QP 03-1 Can also be located on Industrea Mining Equipments online Document Repository.

8. OPERATION

8.1. PRE START CHECK

8.1.1. Walk around the machine and inspect for damage.
Minor problems when rectified early will prevent major repair jobs.

8.1.2. Check the following fluid levels and top up as required.

(a) Clean exhaust flame trap
(b) Exhaust conditioner makeup tank: WATER plus Cleaning agent
(c) Engine crankcase: SAE 15w 40 ENGINE OIL.
(d) Radiator expansion tank: CAT EC-1.
(e) Hydraulic oil tank: ISO 68 VISCOSITY IMPROVED HYDRAULIC OIL.
(f) Fuel tank: GOOD QUALITY DIESEL FUEL

8.1.3. Inspect the condition of the tyres, tyre inflation and wheel nuts.

8.1.4. Check that the vacuum indicator on the air intake filter is not indicating a blocked element.

8.1.5. Ensure that a fire extinguisher is fitted and fully charged.

8.1.6. Ensure guards and covers are properly secured.

8.1.7. Check the condition of the canopy rail and driver's safety door.

8.1.8. If transporting chock, check payload is secure.

NOTICE
REPORT ANYTHING YOU CONSIDER TO BE UNSAFE TO A MINE OFFICIAL.
The mine "Out of Service" Tag system should be used.

8.2. START PROCEDURE

8.2.1. Turn the **"MAIN AIR VALVE"** to the **"ON"** position.

8.2.2. Check that the **"AIR PRESSURE GAUGE"** on the instrument panel reads approximately 700 kPa or 100 psi.

8.2.3. Check that the park brake control valve is in the applied position.

8.2.4. The brakes are automatically applied when the engine stops, but ensuring that the park brake control valve is in the applied position is a check that the automatic brake system is operating correctly.

8.2.5. The **"GREEN"** light situated on the main dash panel indicates when the brakes have been released.

8.2.6. Place the engine stop valve to the **"ON"** position. (Toggle up).

8.2.7. Hearing protection and eye protection must be worn.

8.2.8. Check that the direction of travel selector is in the **" NEUTRAL "** position.

8.2.9. Depress the **" START BUTTON "** to crank the engine. A couple of seconds will pass while the safety shutdown system double checks itself before the start motor operates.

8.2.10. Release the button when the engine fires.

8.2.11. Allow engine to idle for 30 seconds to build oil pressure before loading engine.

8.2.12. Check Charge Pressure is 36 bar

8.2.13. Check ancillary pump Pressure gauge read 25 bar at standby.

8.2.14. Select Reverse to confirm reversing bell is operational, return transmission to neutral.

8.2.15. With right foot on service brake, release the **" PARK BRAKE / EMERGENCY BRAKE ".**

8.2.16. Check Spring Brake hold off pressure is 14 bar (200 psi).

8.2.17. Check that steering is light at idle (brakes must be released)

8.2.18. Select the direction of travel and gear required by operating the controls positioned beside the steering wheel.

8.2.19. Drive the machine conservatively at less than top speed to allow hydraulic system to warm up to operating temperature.

8.3. MACHINE AVAILABILITY OPTIMISATION

8.3.1. Appoint experienced service person to oversee and attend machines immediately as required during a wall move.

8.3.2. Replace engine oil and filters to schedule or more frequently

8.3.3. Use Viscosity improved hydraulic oil, 46 during winter, 68 during summer.

8.3.4. Clean flame trap every day of operation

8.3.5. Use cleaning agent in scrubber water

8.3.6. Check charge pressure is maintained at all times

8.3.7. Check hydraulic cooling system is operational at all times

8.3.8. Check water pump is primed

8.3.9. Inspect for loose bolts/components, fix immediately

8.3.10. Check for oil leaks

8.3.11. Check for air leaks

8.3.12. Train drivers to allow engine/hydraulics to warm up at the beginning of a shift and cool down after use.

8.3.13. Drivers must select low gear when travelling up and down a gradient

8.3.14. Drivers must shift gears without overspeeding the engine

8.3.15. Train drivers to drive at the appropriate speed for the conditions

8.3.16. Filter hydraulic oil - 3 micron after each wall move

8.3.17. Service machine after wall move

8.3.18. Wash machine

8.3.19. Build a record of machine operating hours and in service problems.

8.3.20. Carry spare parts to reduce downtime.

8.3.21. Report details of item failures to Industrea Mining Equipment.

8.4. OPERATOR CHECK LIST

8.4.1. SERVICE BRAKE OPERATION

8.4.2. BRAKE HOLDOFF PRESSURE 17 bar (246 psi)

8.4.3. LOOP CHARGE PRESSURE 36 BAR

8.4.4. ANCILLARY PUMP PRESSURE 25 bar

8.4.5. PARK BRAKE OPERATION.

8.4.6. STEERING OPERATION.

8.4.7. REVERSE ALARM OPERATION.

8.4.8. LIGHTS OPERATION.

8.4.9. OPERATOR DOOR SECURED

8.4.10. PERSONAL PROTECTION

8.5. NORMAL WORKING PROCEDURES

8.5.1. After following the starting procedures and control testing procedures for proper functioning as previously described, the LWC is ready for operation.

8.5.2. The operator's door is interlocked such that it must be closed and latched before the spring brakes can be released.

8.5.3. With right foot on service brake, release the park brake.

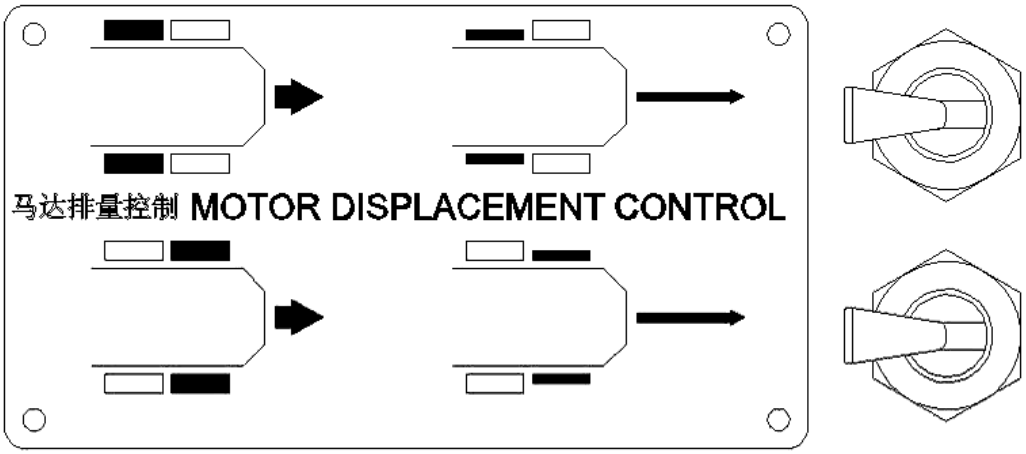
8.5.4. Select the direction of travel required and first gear by operating the controls positioned to the right of the steering wheel. The driver must always be seated when travelling for safe operation of the machine.

8.5.5. Always check 30 bar charge pressure before driving machine.

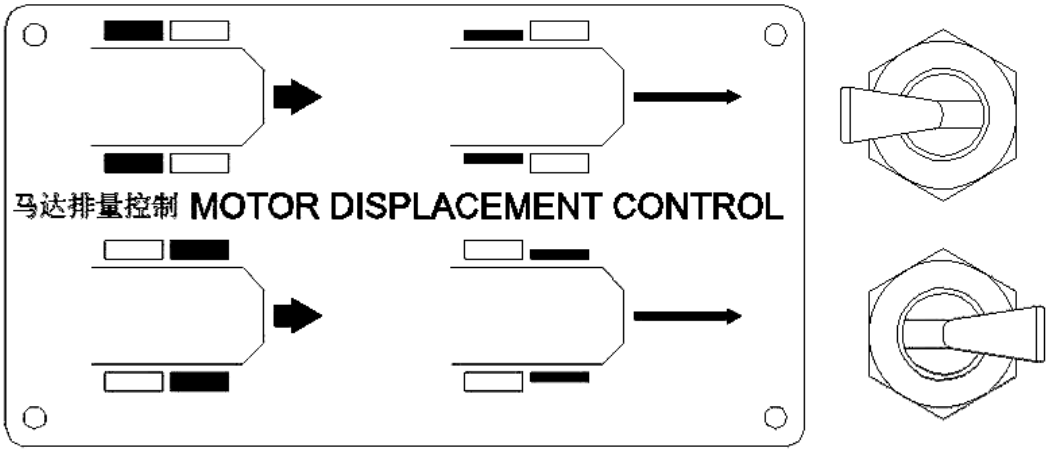
8.5.6. Release the service brake pedal and depress the throttle pedal to move the vehicle off in a smooth manner, changing gears as the vehicle approaches its maximum speed for that gear. The maximum speed of each gear is:

4WD mode

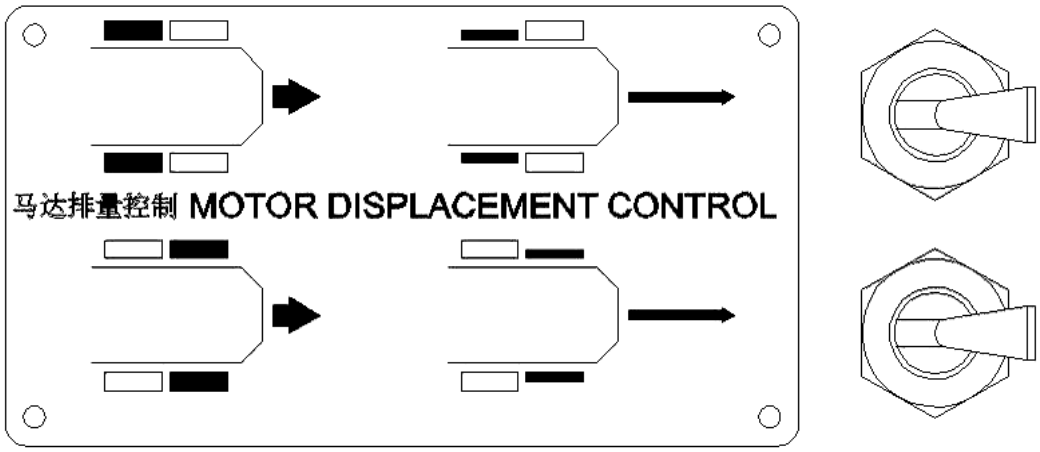
(a) 1st gear 4WD: 6.7 km/h
(b) 2nd gear 4WD: 8.9 km/h
(c) 3rd gear 4WD: 13.3 km/h



This is the switch position for 1st Gear 4WD, maximum motor displacement (i.e. minimum speed & maximum torque)



This is the switch position for 2nd Gear 4WD, half motor displacement (i.e. medium speed & medium torque) levers can be in the same alternate position as the figure shown above to activate 2nd gear.



This is the switch position for 3rd gear 4WD, minimum motor displacement (i.e. maximum speed & minimum torque)

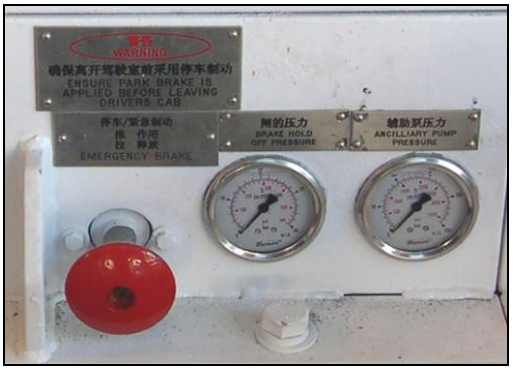
When changing down gears, ensure that the machine speed is below the maximum range of the gear required, before shifting. The gear change will not

take effect until zero throttle is achieved (i.e. you have lifted foot completely off the throttle pedal)

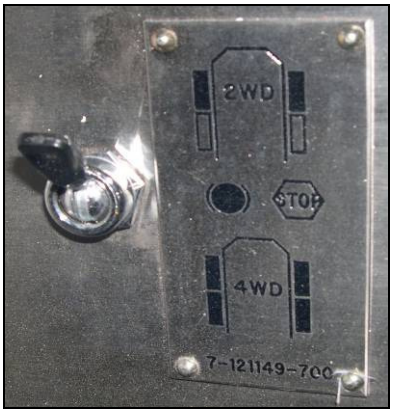
<u>WARNING</u>: When changing down gears switches must be in positions illustrated above. For shifting down gears, change one gear at a time (not skipping gears) and make sure the vehicle is travelling at the appropriate speed for the desired gear. Failure to do so will result in engine overspeed and possible engine failure.

2WD Mode

(a) low gear 2WD: 14 km/h (Travel Only)
(b) high gear 2WD: 27 km/h (Travel Only)

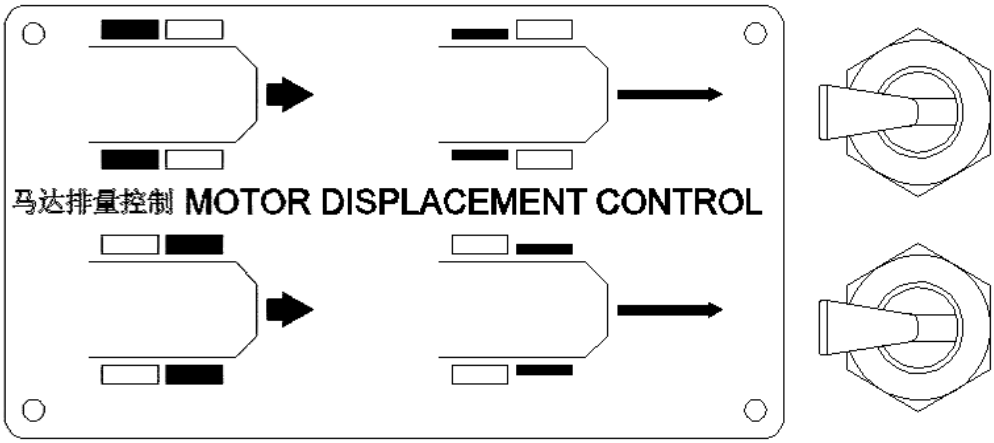


To select 2WD the machine must be stopped and the park brake applied

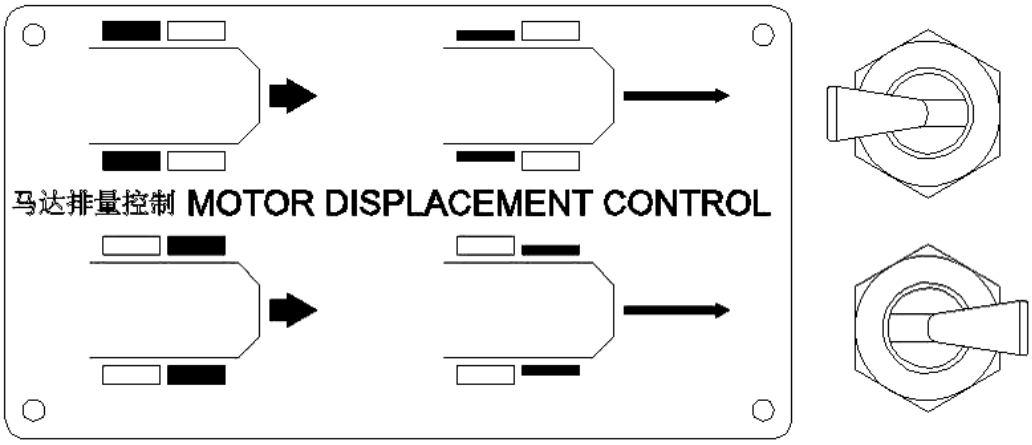


Once the park brake is applied the 2WD switch can select the 2WD position.

Always check that 30 bar charge pressure is available before diving in all speed modes.



This is the lever position for low gear 2WD, minimum motor displacement (i.e. maximum speed & minimum torque). The bottom switch only is relevant to control speed in 2wd.



This is the switch position for low gear 2WD, minimum motor displacement (i.e. maximum speed & minimum torque)

8.5.7. When changing down gears, ensure that the machine speed is below the maximum range of the gear required before shifting. The gear change will not take effect until zero throttle is achieved (i.e. you have lifted foot completely off the throttle pedal)

8.5.8. Always be conscious of the roadway conditions and the load being carried when controlling vehicle speed. Avoid riding service brakes down inclines, select 1st gear 4WD as appropriate to harness engine retardation.

8.6. DIFF LOCKING PROCEDURE

The diff lock function will only work in first gear with the lever held in the forward position.

8.7. SAFE OPERATION OF THE LWC

8.7.1. The LWC is intended to normally work on longitudinal gradients up to 1 in 8, transverse gradient up to 1 in 15 and carry up to a 50 tonne payload.

8.7.2. Give right of way to vehicles travelling out-bye.

8.7.3. Give right of way to vehicles that are less manoeuvrable such as LHDs with trailers.

8.7.4. Always apply the park brake when leaving the driver's cabin, to ensure control of the vehicle during the transition. The LWC will creep forward if left on slight incline without brakes applied.

8.7.5. Maintain a safe distance between vehicles when travelling in convoy.

8.7.6. Always test the braking system before driving down major grades and after driving through deep water.

8.7.7. Turn the machine off whenever the LWC is unattended. The vehicle may be left running with the park brake applied in the circumstances where brief stops are part of normal operation such as opening and closing ventilation doors, vehicle exhaust gas testing and maintenance, or power take-off applications. The vehicle should not be unattended in these situations.

8.7.8. Drivers should not deliberately drive over or around items such as props, pipes, drums hoses etc. The driver should stop and make the road safe and report any changed road conditions to a mine official.

8.7.9. Do not drive over cables or drive under cables that are not properly secured to the roof.

8.7.10. Do not stand the LWC in an unventilated dead end or operate in an unventilated stub or roadway. The vehicle shall only be operated on roads which are positively ventilated. The LWC requires 10.2 m^3/sec air flow to meet statutory requirements. Follow the Manager's Transport Rules in the event of the stoppage of the main fan. Report the position of the LWC if the vehicle is parked under these circumstances.

8.7.11. Do not drive the LWC into a return air way unless it is equipped with an approved automatic methane detector and a senior mining official has inspected the area.

8.7.12. In the event of the methane detector being activated, the driver of a diesel vehicle shall immediately stop the vehicle and engine. The driver should place an out of service tag on the vehicle and any necessary warning devices on the roadway. The driver should remove the methane detector and carry it with him and report immediately to a mining official the circumstances.

8.7.13. Observe the speed nominated in the Transport Rules at which any vehicle can pass a pedestrian.

8.7.14. Do not proceed past a warning device unless the obstruction has been personally examined by the driver on foot and has found it safe to pass.

8.8. ASCENDING & DESCENDING

8.8.1. A door is provided for access to the driver's compartment; it must be closed for the brakes to be released and drive to be available.

8.8.2. Care must be taken when entering and leaving the driver's compartment with regard to debris on the roadway and in the driver's compartment itself. Regular hosing out of the compartment will keep debris, oil and grease to a minimum.

8.9. PARKING

8.9.1. After working the machine, allow at least 30 seconds at engine idle to let the system cool before stopping the engine.

8.9.2. When parking the LWC always ensure that the **park brake is applied before leaving the driver's compartment**.

8.9.3. Stop the engine before leaving the machine and turn off the main air valve to ensure that an adequate air supply is available for the next time the vehicle is started.

8.9.4. Always park the vehicle in its designated area, close to compressed air and water supply points.

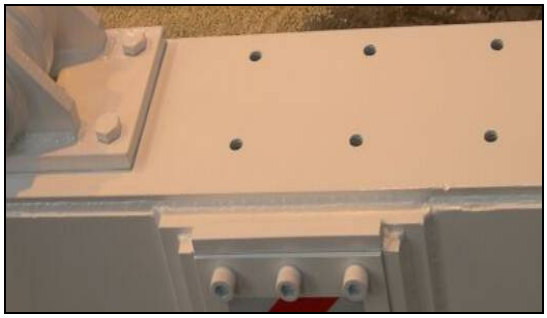
8.9.5. When parking the vehicle on a grade, always point the machine into the rib or chock the wheels. Do not park on the rise side of an area where people congregate, such as crib areas, unless a suitable barrier is placed between the vehicle and the people.

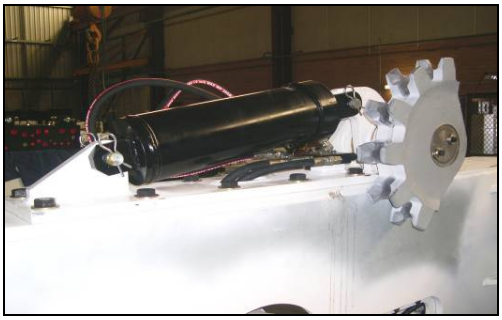
8.9.6. If, in an emergency, the vehicle is left in a main travelling roadway, markers should be placed to give adequate warning to other vehicles that the roadway is obstructed.

8.9.7. Park the machine in a suitable place such that freezing will not occur in extreme weather.

9. CHOCK HANDLING

1. In preparation for longwall relocation, adjustment of the lifting cylinder assembly may be required to suit the specific chock and can be done by undoing the hold down bolts and sliding the lifting cylinder assembly either forward or backwards and re-bolting. Note the lifting cylinder assembly can be rotated and moved to the other side to accommodate the best lifting arrangement for the Longwall Support or other equipment. Once the correct position is obtained then further adjustment is no longer required for that type of equipment. The chock must be positioned such that its centre of gravity is in line with the swing beam pivot point.





2. Prior to attaching any Chock to the LWC, the chock should be checked for weight, security and readiness for transportation.

Ensure relay bars are secured, flippers retracted and hosing secure.

Ensure roadway has been surveyed for sufficient travel height and loading/unloading domains are identified.

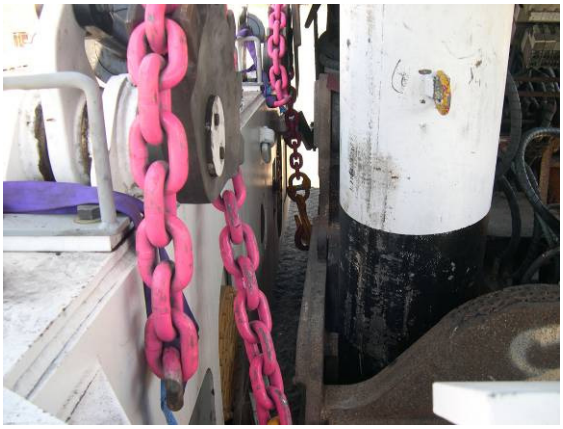
3. **Immobilize the vehicle by applying the park/emergency brake.** Remove the lifting chains from the vehicle and secure to the chock by hooking in place, then using a rope to lift the end of the chain. Apply magnets to hold the chain in place.

4. To pick up a chock, line up the trailer section of the machine with the chock to be moved. Reverse the trailer fork around the chock until the lifting sprockets on the trailer line up with the lifting chains on the chock. **Immobilize the vehicle by applying the park/emergency brake.** If chains dislodge from the chock, repeat operation 3.

5. Climb up the centre of the trailer between the rear wheels by using the step and two handholds. Lift the rear chains off the chock. Pull the chains taut and place onto the rear sprockets on the trailer, making sure that they are secure and unable to slip off.

6. Drive the vehicle forward to tension the rear lifting chains.

7. **Immobilize the vehicle by applying the park/emergency brake.** Climb up the trailer to access the two front lifting chains. Lift the front chains off the chock. Pull the chains taut and place onto the front sprockets on the trailer, making sure that they are secure and unable to slip off.



8. The Longwall Support is then lifted free of the ground by partially lifting both front and rear lift cylinders, by means of the spool bank handles located either side of the trailer at the hitch point (as shown below). Pull lift mechanism lever towards to lift.

9. Clamp the Longwall Support by closing the anti-sway mechanisms (shown below). Push the anti-sway mechanism lever forward to clamp.

10. To drop off a Longwall Support, position the Longwall Support over the required resting-place. Retract the anti-sway mechanism and lower the Longwall Support to the ground by means of the spool bank handles located either side of the trailer at the hitch point. Using a rope to lift the chains, unlatch from the front and rear sprockets on the trailer and secure the chains to the chock by applying magnets to hold the chain in place. Drive away in a forward direction leaving the Longwall Support behind.

11. Once the carrier is clear of the chock, remove the lifting chain set from the chock and replace on the sprockets on the trailer and proceed for the next cycle.

The driver is responsible for the loads being transported and should not move the LWC or a Chock if not satisfied that it can be done safely.

Chocks should be marked with reflective media and placed in designated areas. If it is necessary to drop a chock on a main travelling road, the driver should advise control of the location so that others may be alerted.

9.1. ENGINE SHUTDOWN

9.1.1. Apply the Park Brake

9.1.2. **After working the machine, allow at least 30 seconds at engine idle to let the system cool before stopping the engine.**

9.1.3. To stop the diesel engine, the engine stop lever on the main control panel is switched downwards into the engine off position. The engine will shut down within 5 seconds.

9.1.4. If the engine is not to be started again, the main air valve on the driver's side mudguard should be turned off to ensure air pressure is not depleted due to leakage.

9.1.5. In the event that the engine shuts down due to safety circuit operation (i.e. Engine over temperature, Low scrubber water, Low engine oil, Coolant loss, Water over temperature or Exhaust over temperature) the brake will apply automatically. The service brake should be applied by the operator when indications are that engine shutdown is imminent, this will ensure that retardation is as controlled as possible.

9.1.6. The following safety interlocks will automatically apply the park brake.

a) Operation of the engine system safety circuit.

b) Manually switching off the engine.

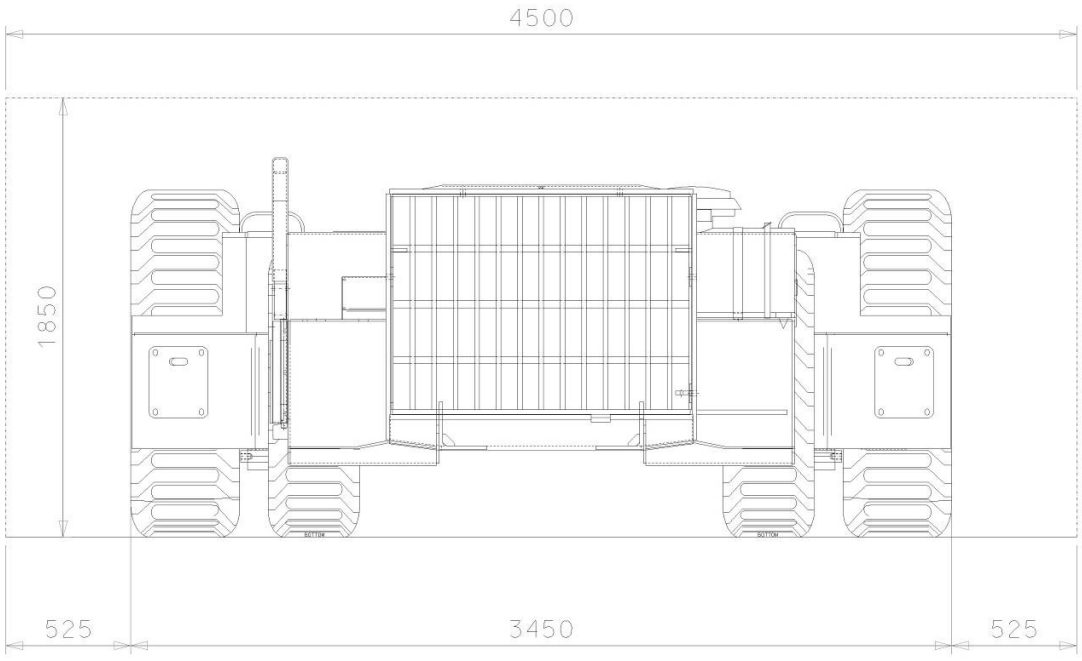
c) Opening the driver's door

9.1.7. The park brake, once applied, must be manually released after any of the above operations have occurred.

9.1.8. Automatic systems are employed as a safety barrier to catch operator error. The machine is under the control of the operator while in the operator's cabin. The operator is responsible for the movement and operation of the machine and is required to park the machine safely before leaving the controls.

CAUTION
DO NOT RELY SOLEY ON AUTOMATIC SYSTEMS TO APPLY THE PARK BRAKE.

9.2. MINIMUM RECOMMENDED ROADWAY DIMS



9.3. OVERHEATED MACHINE

9.3.1. Industrea Mining Equipment recommend that an overheated machine be left to cool until the cooling system temperature is below 60 degrees Celsius. Report the event to a mine official. Evaluate whether the machine can be towed to a position out of traffic. Remove from service until overheating problem is identified and corrected.

9.3.2. Where it is not possible to let the machine fully cool, the following procedure must be followed.

9.3.3. Shutdown, immobilize and isolate the machine. Wear protective clothing gloves and glasses.

9.3.4. Stand clear of the vent outlet, vent pressure from the cooling system by lifting the toggle valve on the radiator cap.

9.3.5. *WARNING* Severe Burn Hazard. Do Not open cap until all pressure is released. Water will boil at a lower temperature when the pressure is reduced, slight pressure remaining in the system will cause the water to boil and gush out of the radiator system.

9.3.6. Remove the cap to service the cooling system once **all** pressure is released.

9.3.7. Refer to the trouble shooting section at the rear of this manual. Overheating problems must be addressed to prevent further hazardous operation and downtime.

9.4. DEFECTS AND HAZARDS

If the LWC has been damaged or is malfunctioning in any way **DO NOT OPERATE THE MACHINE** and report any defects or hazards to the appropriate official of the mine.

9.4.1. Report any accidents or near misses or any potential safety problems to a mine official.

9.4.2. Use the Damage report as shown in section 10.9 to advise Industrea Mining Equipment of damage or issues relating to the machine. Feedback of this kind is important to the continuing development of the machine design. Industrea Mining Equipment are not obliged to respond to all Damage reports, tick the appropriate box to confirm your requirements from Industrea Mining Equipment.

9.4.3. It is an offence to override any system designed to protect the safety of the operator or others at the mine.

9.4.4. If the machine has broken down on a roadway, attach danger tags and set up warning devices to notify passing traffic.

10. TOWING PROCEDURES

10.1.TO TOW ANOTHER VEHICLE

Although the LWC has not been designed to tow other vehicles, the need to move other vehicles in an emergency is recognized. The distance towed should be kept to a minimum, to minimise disruption to normal traffic.

Industrea recommends towing using a rigid link, attached to the rear of the LWC via the tow points on the back of the trailer weldment.

In emergency situations, the two rudd lugs located on the front sides of the machine can be used for short distance towing on level ground. Note, these are rated for 5 tonne capacity each.

10.2. TOWING THE DISABLED LWC

IF ENGINE AND HYDRAULICS ARE RUNNING, BUT DRIVE IS UNAVAILABLE:

a) Secure LWC to towing machine using a rigid link.

b) With the service brake pedal depressed, release the park brake valve.

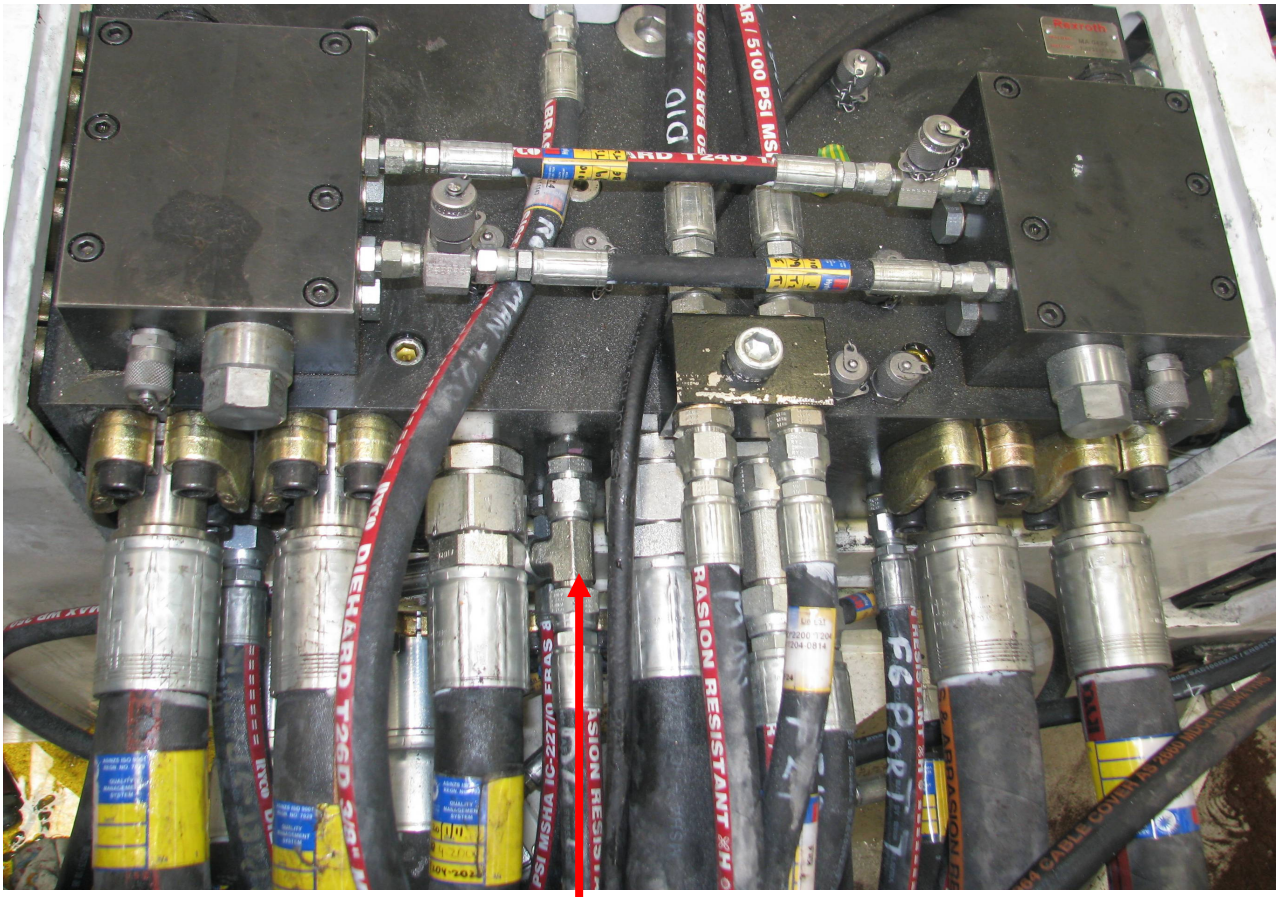
c) The machine can now be towed with brakes and steering available to the operator.

d) Ensure park brakes are applied before disconnecting the towing machine.

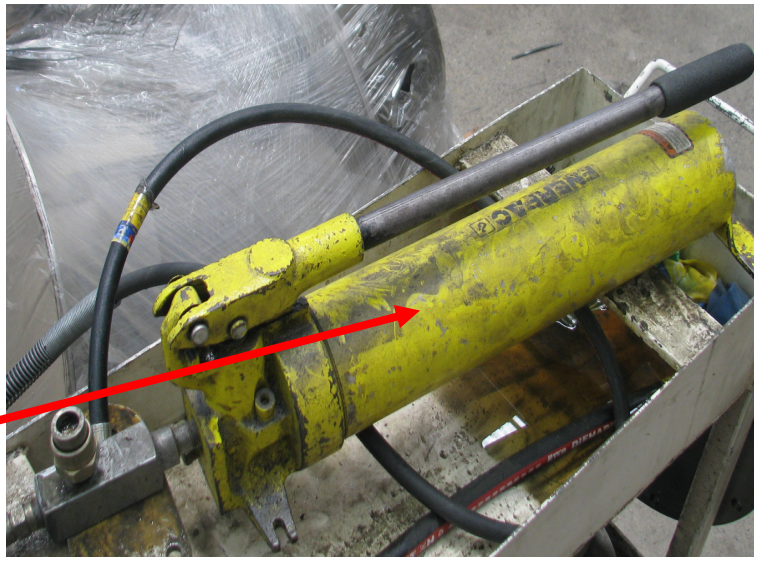
IF ENGINE AND HYDRAULICS ARE NOT RUNNING:

In the event the LWC is disabled and requires towing to a place where repairs can be performed, the following procedure is to be followed:

- Secure the machine by chocking wheels.
- Connect to the tow vehicle with a rigid link connected to the tow points on the rear of the trailer weldment.
- Disconnect either the input of the brake pedal valve, or, the brake hose connected to port 5 on the distribution manifold located on the trailer, and cap the hose. Connect a porta-pump to the inlet fitting of the service brake pedal or port 5 via a tee piece on the distribution manifold and pump to 20 bar - this will release the brakes on the wheel motors. Do not pressurise to over 28 bar otherwise the wheel motors will be damaged. The LWC can now be towed, but steering will not be permitted. The service brake can be used to slow or stop the machine but the inlet pressure must not fall below 20 bar (below this figure the brakes will be dragging). Once the LWC has reached its destination the porta-power can be released and the hose work put back to its original position.



PORT 5 ON TRAILER DISTRIBUTION MANIFOLD



PORTA-POWER

11. ON-SITE PROCEDURES FOR SERVICE AND MAINTENANCE

11.1. NOTICES & WARNINGS

Before commencing any maintenance on this machine make sure that you have read the “Operators Handbook”, have been trained in the proper operation of this machine, and are thoroughly familiar with all controls on this machine.

11.1.1. Notice: Service Site

Always service the machine on level ground with adequate lighting and protection from passing traffic.

11.1.2. Notice: Immobilisation

Stop the engine at the Engine Stop valve. Apply the park brake. Chock wheels. Fit lock bar at articulation hitch to disable steering.

11.1.3. Notice: Isolation

Use colliery tag system to notify that the machine is not to be started. Turn engine Off/Run toggle switch to ‘Off’ and close the main air supply tap located behind the driver to the ‘Off’ position. Lock the air supply tap in the “Off” position. Tag out the engine Off/Run switch and the main air supply tap.

11.1.4. Warning: Articulation Hazard

Caution should be taken when working in the articulation area of the machine. Always fit the lock bar at the articulation hitch.

11.1.5. Warning: Hydraulic Pressure

Hydraulic lines are under high pressure. Shut-off the machine and always vent residual hydraulic pressure before working on the hydraulic system.

11.1.6. Warning: Cooling System

The engine cooling system operates under pressure and at high temperature. This may cause hot fluid to be ejected from the system at pressure and cause burn injuries. To ensure the cap does not become a projectile, a chain must retain it. Release pressure from the cap before opening the header tank.

11.2. ENGINE SYSTEM MAINTENANCE & OPERATION

Refer to Caterpillar Operation and Maintenance Manual for 3114, 3116 and 3126 Industrial and Generator set Engines for a complete guide to engine maintenance.

Air shutoff device adjustment procedure

Once the Chalwyn valve is installed, adjustment of the overspeed trip setting is carried out using the adjuster and locknut (refer to diagrams). Basically rotating the adjuster clockwise will increase the engine speed at which automatic shut down occurs.

As supplied, the valve will be adjusted such that shut down will generally occur well below the engine high idle speed. To increase the speed at which automatic shut down occurs, proceed as follows:

1. Check that the manual shut down cable is in the run condition i.e. the 'T' handle is pushed inwards.

2. Start engine. Slowly accelerate. Note speed at which shut down occurs.

3. Remove hose at **air inlet** to Chalwyn valve to expose the adjuster and locknut (see diagram).

4. Release locknut. Turn adjuster clockwise one turn. Tighten locknut.

5. Refit inlet hose to valve.

6. Start engine. Slowly accelerate. Note speed at which shut down occurs.

7. Repeat steps '**3**' to '**6**' until the first setting at which the engine does not shut down at high idle speed (i.e. full throttle, no load). Then either:

a) Use the results of shut down speed versus adjuster setting as a calibration check to make a final adjustment to give the required setting (typically 10% to 15% over high idle).

or

b) If a very precise setting is not required, turn the adjuster a further one turn clockwise to take the shut down above high idle speed by a suitable margin. When using this setting procedure it may be found that the engine occasionally shuts down during the normal operation. If so, turn the adjuster clockwise by a further one half turn.

8. Ensure the adjuster locknut is fully tightened. (Use a thread lock adhesive on the locknut threads).

Air shutoff device maintenance procedure

The recommended routine maintenance period is three months. This period is dependent on the operating conditions of the engine and, by experience, may need to be varied.

Routine Maintenance

1. Disconnect intake pipework and release the valve from any support brackets etc. to allow it to be removed.

2. Inspect the valve internally for cleanliness. If necessary, clean in paraffin or white spirit taking normal precautions. Dry the valve thoroughly.

3. Check there is no excessive wear and that the valve moves smoothly over its complete operating stroke. **DO NOT LUBRICATE.**

4. Refit valve. Check valve setting based on the "Adjustment" instructions given herein.

5. With the engine running at medium speed pull the manual stop handle. The engine should come to a complete stop within a few seconds.

Valve Reconditioning

When excessive wear is noted or the valve damaged it should be returned to Chalwyn Limited for appraisal and reconditioning.
(All such work is dealt with on an urgent basis.)

11.3. WORKING ON THE PNEUMATIC SYSTEM

11.3.1. Caution

Use safety glasses, ear protection and protective clothing when working with compressed air.

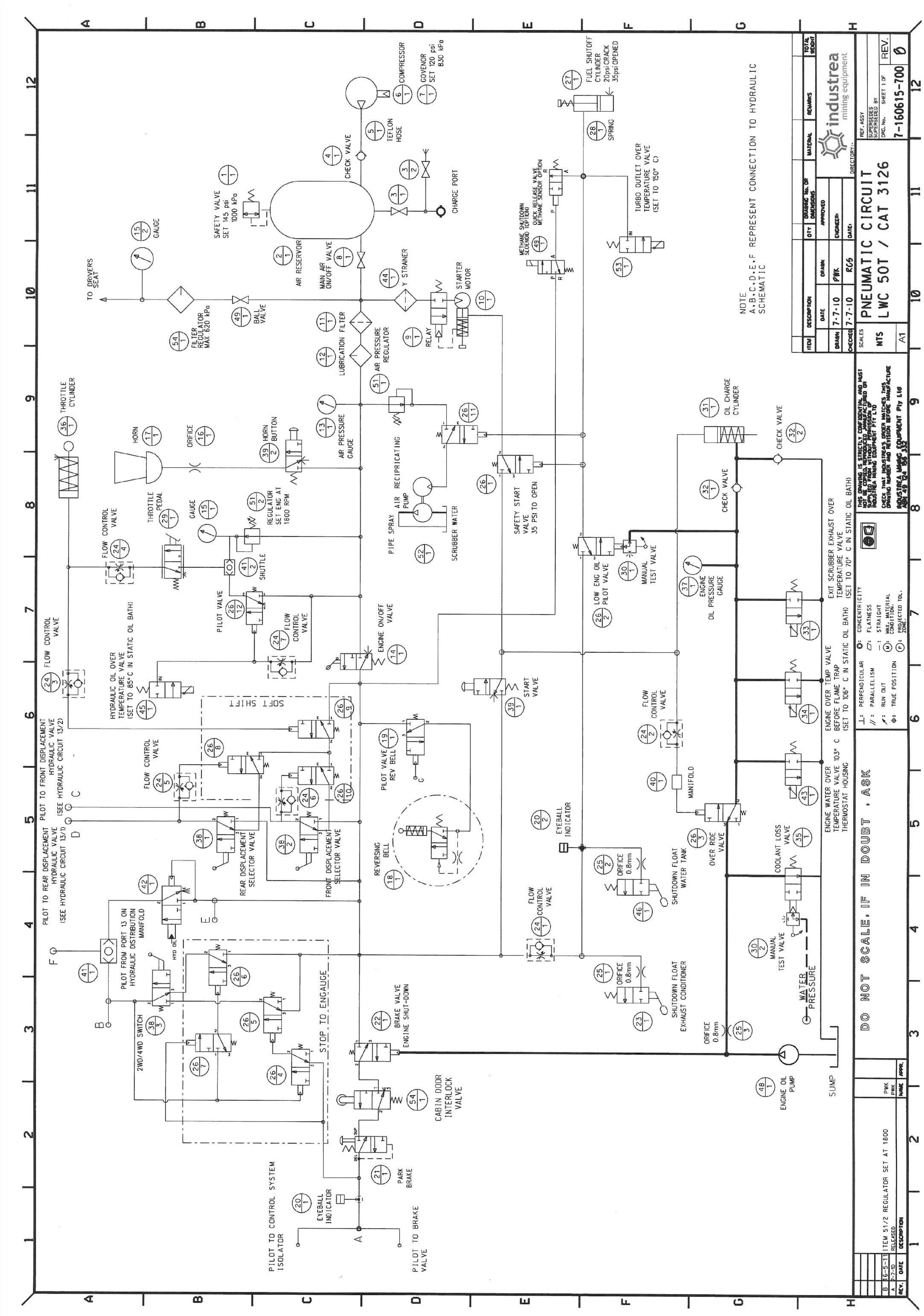
11.3.2. Charging the Reservoir

a) Before connecting the mine air supply to the LWC, blow out any water that may be present in the hose.
b) Connect and pin the Minsup coupling.
c) Open the tap to charge the reservoir.
d) To disconnect the mine supply hose, close the tap on the LWC and the tap on the mine supply. Open the bleed tap on the LWC to discharge compressed air trapped in the length of the hose.
e) Once the joint is loose, the coupling can be disconnected.

11.3.3. Leakage

a) The engine shutdown system is supplied by a fixed orifice to meter in air flow. Orifices are also fitted to the scrubber floats to cushion shutdown against bouncing float movement. The system is balanced to achieve shutdown and tolerate bouncing. Leakage from the shutdown system (after engine on/run valve) will cause an unbalance and can cause the system to shutdown prematurely. Leakage can be detected by sound or soapy water sprays.

Always use genuine valves and springs as these items operating pressures are matched for correct operation.
b) Check the scrubber is clean and floats are secure.
c) Check that the shutdown cylinder is secure without leakage.


PNEUMATIC CIRCUIT
LWC 50T / CAT 3126
7-160615-700
REV. Ø
NTS
A1
DRAWN 7-7-10 PWK
CHECKED 7-7-10 RGG
DO NOT SCALE, IF IN DOUBT, ASK
NOTE
A,B,C,D,E,F REPRESENT CONNECTION TO HYDRAULIC SCHEMATIC
B 16-5-11 ITEM 51/2 REGULATOR SET AT 1800
A 7-7-10 RELEASED
COMPRESSOR
GOVENOR SET 120 psi 830 kPa
TEFLON HOSE
CHECK VALVE
CHARGE PORT
SAFETY VALVE SET 145 psi 1000 kPa
AIR RESERVOIR
MAIN AIR ON/OFF VALVE
Y STRAINER
STARTER MOTOR
RELAY
AIR PRESSURE REGULATOR
LUBRICATION FILTER
BALL VALVE
FILTER REGULATOR MAX 620 kPa
TO DRIVERS SEAT
GAUGE
AIR PRESSURE GAUGE
HORN BUTTON
HORN
ORIFICE
THROTTLE CYLINDER
THROTTLE PEDAL
FLOW CONTROL VALVE
REGULATOR SET ENG AT 1800 RPM
SHUTTLE
PILOT VALVE
AIR RECIPRICATING PUMP
PIPE SPRAY
SCRUBBER WATER
SAFETY START VALVE 35 PSI TO OPEN
ENGINE ON/OFF VALVE
START VALVE
HYDRAULIC OIL OVER TEMPERATURE VALVE (SET TO 85° C IN STATIC OIL BATH)
SOFT SHIFT
PILOT TO FRONT DISPLACEMENT HYDRAULIC VALVE (SEE HYDRAULIC CIRCUIT 13/2)
PILOT TO REAR DISPLACEMENT HYDRAULIC VALVE (SEE HYDRAULIC CIRCUIT 13/1)
REAR DISPLACEMENT SELECTOR VALVE
FRONT DISPLACEMENT SELECTOR VALVE
PILOT VALVE REV BELL
REVERSING BELL
PILOT FROM PORT 13 ON HYDRAULIC DISTRIBUTION MANIFOLD
2WD/4WD SWITCH
STOP TO ENGAGE
BRAKE VALVE ENGINE SHUT-DOWN
CABIN DOOR INTERLOCK VALVE
PARK BRAKE
EYEBALL INDICATOR
PILOT TO CONTROL SYSTEM ISOLATOR
PILOT TO BRAKE VALVE
FUEL SHUTOFF CYLINDER 20psi CRACK 35psi OPENED
SPRING
METHANE SHUTDOWN SOLENOID (OPTION)
QUICK RELEASE VALVE METHANE SENSOR OPTION
TURBO OUTLET OVER TEMPERATURE VALVE (SET TO 150° C)
OIL CHARGE CYLINDER
CHECK VALVE
LOW ENG OIL PILOT VALVE
MANUAL TEST VALVE
ENGINE OIL PRESSURE GAUGE
MANIFOLD
ORIFICE 0.8mm
SHUTDOWN FLOAT WATER TANK
SHUTDOWN FLOAT EXHAUST CONDITIONER
OVER RIDE VALVE
COOLANT LOSS VALVE
WATER PRESSURE
ENGINE OIL PUMP
SUMP
EXIT SCRUBBER EXHAUST OVER TEMPERATURE VALVE (SET TO 70° C IN STATIC OIL BATH)
ENGINE OVER TEMP VALVE BEFORE FLAME TRAP (SET TO 106° C IN STATIC OIL BATH)
ENGINE WATER OVER TEMPERATURE VALVE 103° C THERMOSTAT HOUSING

industrea mining equipment

PARTS LIST **Page:** 01

Drawing No: 7-160615-700 PNEUMATIC CIRCUIT

Rev: B **Author:** SM **Date Approved:** 09-JUL-2010

Item	Parts list	Rev	Description	Unit	Quantity
1	7-182208-702		MAIN AIR TANK SAFETY	EA	1
2	7-160310-700		AIR RECEIVER	EA	1
3	7-180412-715		3/8 BALL VALVE	EA	2
4	7-182208-704		CHECK VALVE	EA	1
5	7-160153-700		BRAIDED TEFLON HOSE	EA	1
6	7-052240-700		AIR COMPRESSOR ASSY	EA	1
7	7-052224-700		GOVERNOR GP - AIR	EA	1
8	7-182208-703		AIR ISOLATION BALL VALVE	EA	1
9	7-160344-702		RELAY VALVE	EA	1
10	7-160486-700		STARTER MOTOR	EA	1
11	7-160188-701		FILTER	EA	1
12	7-160188-703		LUBRICATOR	EA	1
13	7-181804-725		AIR PRESSURE BRAKE GAUGE	EA	1
14	7-182208-746		LEVER STOP VALVE	EA	1
15	7-182208-792		SAFETY CIRCUIT GAUGE	EA	2
16	7-160311-700		ORIFICE FITTING 0.5MM	EA	1
17	7-181701-704	A	AIR HORN ASSY	EA	1
18	7-160322-700		REVERSING BELL ASSY	EA	1
19	7-182208-819		3/2 WAY VALVE AIR/OIL PIL	EA	1
20	7-182208-767		EYE BALL INDICATOR	EA	2
21	7-090831-700		SPRING BRAKE CONTROL	EA	1
22	7-182208-773		MINIATURE POPPET VALVE	EA	1
23	7-052306-700	A	LOW WATER SHUTDOWN FLOAT	EA	1
24	7-182208-727		FLOW CONTROL VALVE	EA	7
25	7-160397-700	A	ORIFICE FITTING 0.8MM	EA	3
26	7-182208-710		PILOT VALVE	EA	12
27	7-182207-711		AIR CYLINDER	EA	1
28	7-180704-744		COMPRESSION SPRING	EA	1
29	7-160336-700		THROTTLE PEDAL	EA	1
30	7-180412-722		KITZ 3 WAY BALL VALVE	EA	2
31	7-182207-712		START PUMP	EA	1
32	7-181132-712		CHECK VALVE	EA	2
33	7-073404-700		TEMP CONTROL VALVE 70 C	EA	1
34	7-073225-700		TEMP CONTROL VALVE 106 C	EA	1
35	7-182208-725		COOLANT LOSS VALVE	EA	1
36	7-160317-700		THROTTLE CYLINDER	EA	1
37	7-181804-722		PRESSURE GAUGE ENGINE OIL	EA	1
38	7-182208-813		SPOOL VALVE	EA	3
39	7-182208-745		PUSH BUTTON VALVE	EA	2
40	7-160445-700		AIR MANIFOLD SAFETY CIRCT	EA	1
41	7-182208-726		SHUTTLE VALVE	EA	2
42	7-073224-700		HYD PILOT PNEUMATIC VALVE	EA	1
43	7-182208-709	A	TEMP CONTROL VALVE 103C	EA	1
44	7-160464-702		STRAINER	EA	1
45	7-182208-765		TEMP/SHUTDOWN VALVE	EA	1
46	7-050433-700		FLOAT VALVE(LWC CUTOUT)	EA	1
47	7-052191-700		PUMP GP - ENGINE OIL	EA	1
48	7-182208-820		BALL VALVE MINI	EA	1
49	7-073364-700		AIR OPERATED DCV CART.	EA	2
50	7-160188-702		REGULATOR	EA	2
51	7-160523-700		DIAPHRAGM PUMP	EA	1
52	7-052785-700		TEMP CONTROL VALVE 150 C	EA	1
53	7-182208-733		FILTER REGULATOR 1/4"BSP	EA	1
54	7-052598-700		DOOR INTERLOCK VALVE		1

11.3.4. Oil pressure

a) Check engine oil pressure is greater than 20 psi at idle.
b) Water pressure must be at least 0.8 psi to seat engine oil at the coolant loss valve. Note that the water pump is capable of 20 psi water pressure at pump stall conditions.
c) If engine oil pressure is low, check the oil pump suction in the sump. Build up of mud between LWC belly plates and the sump can cause the sump to crush onto the suction pipe.
d) If the machine will start but not run due to lack of oil pressure, the orifice controlling the 'override' delay may require adjustment. This orifice meters air out of the storage chamber which holds oil pressure generated by the oil charge cylinder for 5~7 seconds. Do not close the orifice.

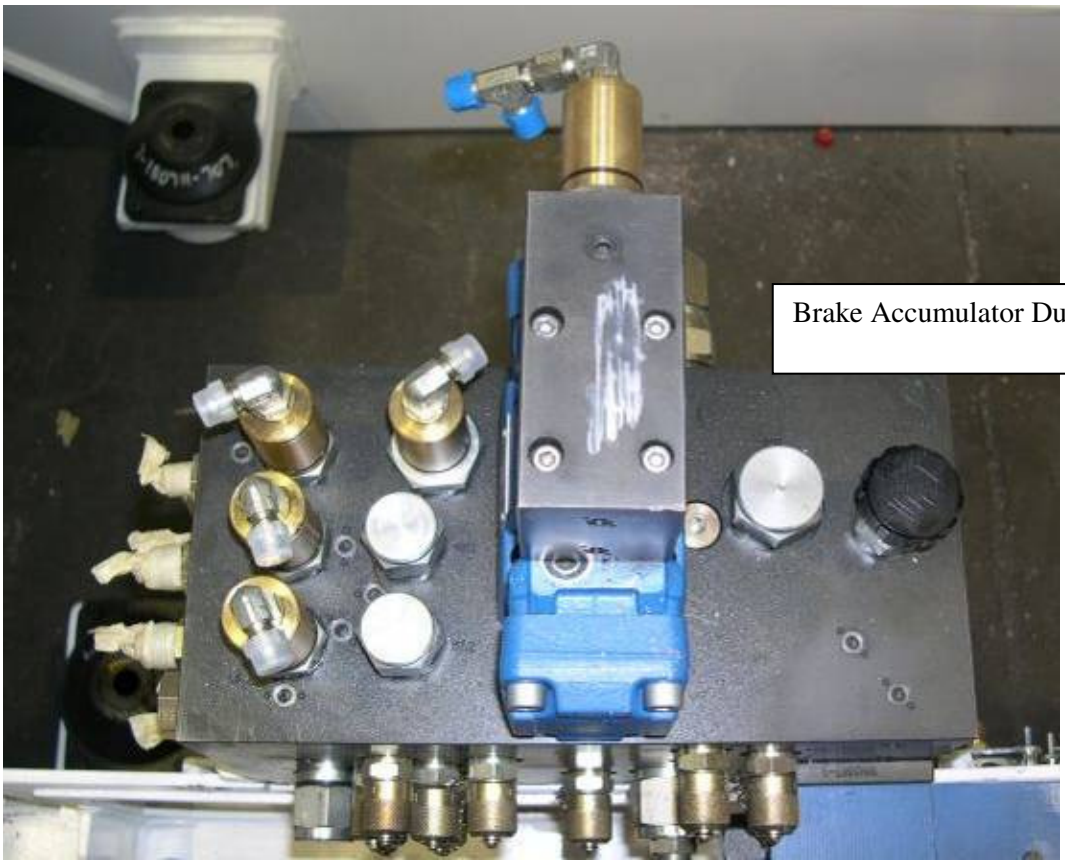
11.3.5. Temperature Sensors

a) Industrea Mining Equipment recommend that temperature sentinels be changed out regularly (6 - 12 months) to ensure reliable operation. Attention must be given to ensure the appropriate temperature range is fitted to each application.
b) Exhaust gas stream (before flame trap) 130°C
c) Exhaust gas stream (exit scrubber) 130°C
d) Engine cooling water 103°C

11.4.WORKING ON THE HYDRAULIC SYSTEM

11.4.1. Warning: Stored Pressure

Always dump hydraulic pressure before working on the hydraulic system.



11.4.2. Cleanliness

Cleanliness is essential for reliable operation of the hydraulic system. Contamination within the hydraulic system comes from four main are:

1) Built in contaminants - cylinders, fluids, hoses
2) Generated contaminants - from assembly and operation of the system, breakdown of fluids
3) External ingression - reservoir breathing, cylinder rod seals, hosing down of reservoirs
4) Contaminants introduced via maintenance – disassembly/assembly of components and make-up oil.

To manage the above four cleanliness issues:

a) Ensure external filtration has been employed during assembly
b) Ensure return filtration collects generated contaminants
c) Change oil every 2000 hours or 12 months
d) Avoid hosing directly on the tank breather

e) Return filtration collects contaminants from cylinder rod seals

f) Change tank breather every 2 years or as required

g) Change return filter every 12 months or as required

h) Pressure gauges and test points are provided to assist in trouble shooting the system

i) Use the fill pump provided to fill the hydraulic tank through the filter.

j) Take extra care if maintenance requires the circuit to be opened to the mine atmosphere.

11.4.3. Control System

a) The control system for this machine is a combination of hydraulic and pneumatic systems interconnected and matched with components. The system is designed to allow the operator to control the machine and to protect the components of the machine by ensuring conditions for component functions are within design parameters. Small changes to the system can cause consequential problems in driver control or component environment. Do not make adjustments or modifications outside the original design without first consulting Industrea Mining Equipment.

b) The following 10 inputs are available to the operator to control the machine for the function of moving chocks.
   i) Start
   ii) Park brake
   iii) Fwd/rev
   iv) Steering wheel
   v) Throttle pedal
   vi) Brake pedal
   vii) Motor displacement control
   viii) Speed range control
   ix) Chock handling controls
   x) Stop

c) The park brake valve is automatically applied when the engine is stopped, coupled by oil pressure. This ensures that the brake is on and control pressure to the traction system is not available when the machine is started.

d) Consistent charge/purge pressure is essential for the health of the hydraulic system. The gyrator type charge pump is integral to each of the main piston pumps and has a pressure filter with a bypass to suction fitted directly to the pump.

e) Once the park brake is released, control pressure becomes available such that the driver can select direction and speed for travel.

f) As the driver actuates the throttle pedal to increase engine speed, the traction pump control pressure is increased as the charge pump flow increases. This brings the traction pump onto stroke in proportion to engine speed.

g) Control of dual displacement motors and various combinations of the front and rear wheel motor displacement make four speed selections available to the operator. Displacement or speed change can be made while the machine is in motion, however the driver's skill is required such that the appropriate speed is selected for the gradient, and that when changing down, the engine is not subject to over speed as a result of regeneration.

h) Two traction pumps are used, one to control the Drivers Side (DS) trailer wheels, the other for the Off Drivers Side (ODS). This configuration allows the wheels on opposing sides of the machine to be controlled closely to manoeuvre a heavy load

around a tight corner. A cam arrangement located on the articulation hitch will reduce the wheel speed of the inside wheel when the machine is articulated. This Automatic Forced Differential (AFD) responds to the input of the driver's steering wheel and therefore does not require specialized skill from the driver.

i) The pumps and motors are in a closed loop system. This configuration enables hydrostatic braking on release of the throttle pedal and can control a heavy load down a decline without disc brake operation required. In this case retardation torque is in proportion to motor displacement and maximum displacement should be selected for downhill operation.

j) The closed loop is cooled by purging oil from the loop, forced out by incoming oil at slightly higher pressure. Oil purged from the loop is passed through a cooler to maintain an operating temperature within the design range of components and fluid.

k) A flow divider is used to equally split pump flow to each motor pair. The flow divider or Diff Lock is automatically engaged when both motors are in maximum displacement. Wheel slip will be most evident in the unladen condition due to flotation of large tyres, engage 4wd maximum displacement to engage the diff lock function.

l) To increase the return (unladen) speed of the LWC, the rear wheel drive motors are disengaged and all pump flow passes through the front drive wheels, doubling the ground speed. In this condition the pistons in the idling motors are lifted from the motor cam track by case pressure and the motor will free wheel. To engage the 2wd function the control system demands that the machine must be stopped and the park brake applied before the 2wd mode will be switched at the free wheel valve.

m) The chock handling and steering functions are powered by a load sense piston pump coupled in line with the traction pumps. This pump will 'stand-bye' at 25 bar until the load sense signal from the function brings the pump onto stroke. The pump will pump oil in proportion to the movement of the valve bank handle displacement or the steering wheel rotation speed.

n) Test points are provided on the control manifold located in the drivers cabin and the distribution manifold located on the trailer.

o) Hydraulic hoses can be supplied specifically for the LWC 50T application as numbered on the schematic diagram. In some cases hose length and fitting angle will be critical to fitting of the hose.

p) Do not make changes to settings or systems without first consulting Industrea Mining Equipment.

Accumulators

a) Pre-charge pressures are nominated on the schematic 7-073349-700 (uncontrolled copy page 61).
   (i) Motor case accumulators 1 bar
   (ii) Brake release accumulator 800 psi

b) IMPORTANT
   (i) Accumulators should be charged with nitrogen gas only.

(ii) All accumulators are supplied without pre-charge unless specifically asked for at the time of ordering. Prior to installation in the hydraulic circuit all accumulators must be pre-charged with nitrogen.

(iii) Always use a nitrogen pressure regulator valve when accumulator shell pressure rating is lower than gas pressure in nitrogen cylinder. Commercial nitrogen H size cylinders 138 bar, K size cylinder 172 bar.

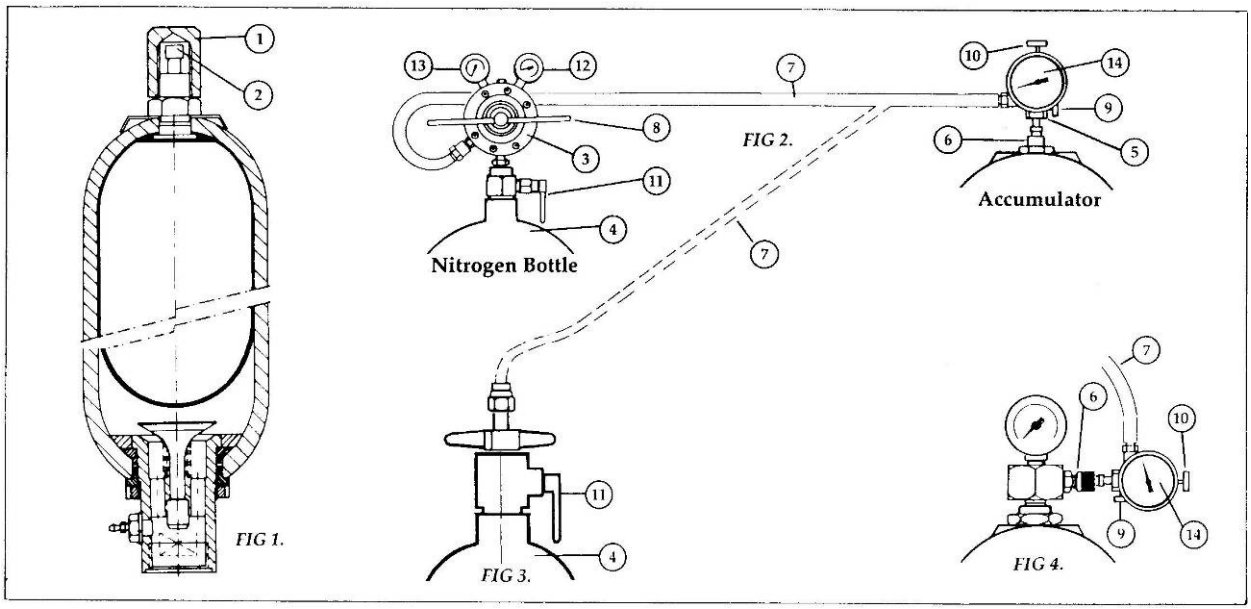
(iv) Ensure bladder has been lubricated with system fluid before commencing pre-charging.

(v) Pre-charge to pressures nominated above.

Ensure that the dump valves have released all pressure within the system to achieve the correct nitrogen charge pressure.

Accumulator Pre-charge Procedure

a) **Release hydraulic pressure**. In the case of the tractor suspension accumulators, select dump on the suspension select valve in the driver's cabin to dump pressure, observe the machines suspension lower. To release pressure from the main and brake accumulators, open the needle valves located on the top of the hydraulic block under the rear engine bonnet cover, observe pressure gauges 'Hydraulic Pressure' and Service Brake Pressure' drop to zero.



Gas Charge

a) Remove the protective cap and sealing cap.

b) Attach a Nitrogen Pressure Regulating Valve (NPRV) to the nitrogen cylinder.

c) Attach the charging set (gauge and taps) to the accumulator gas valve

d) Connect hose between NPRV and charging set.

e) Back handle 8 CCW until loose, check gas bleed valve 9 on charging set is closed and screw hand wheel 10 CW to open gas valve.

f) Open nitrogen cylinder valve by turning key 11, cylinder pressure will register on right hand gauge 12, this pressure should be checked against the required pre-charge.

g) Turn handle 8 CW until outlet pressure on left hand gauge 13 registers 10% higher than required pre-charge pressure. When pressure on the charging set and outlet gauges are equal, close nitrogen cylinder valve.

h) Turn hand wheel 10 CCW to seal gas valve.

i) Crack bleed valve 9 to exhaust gas from charging hose and remove hose from charging set and replace hose connection sealing cap.

j) Close bleed valve, turn hand wheel 10 CW to open gas valve and crack bleed valve 9 to vent down to required pre-charge pressure. Close bleed valve.

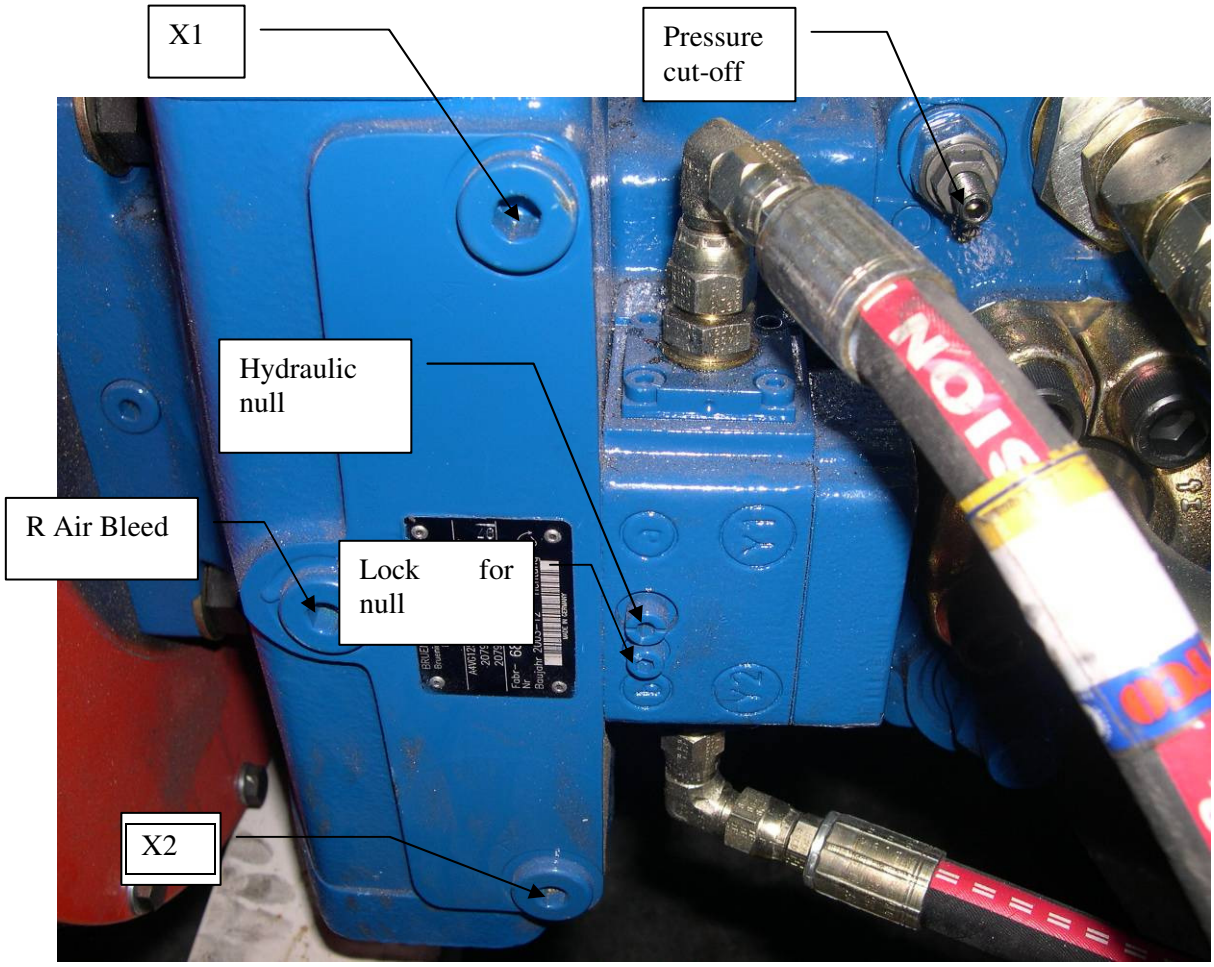
k) Turn hand wheel 10 CCW to reseal gas valve, crack bleed valve and remove charging set from accumulator.

l) Test accumulator gas valve for leaks using a leak detection spray or a soapy water solution.

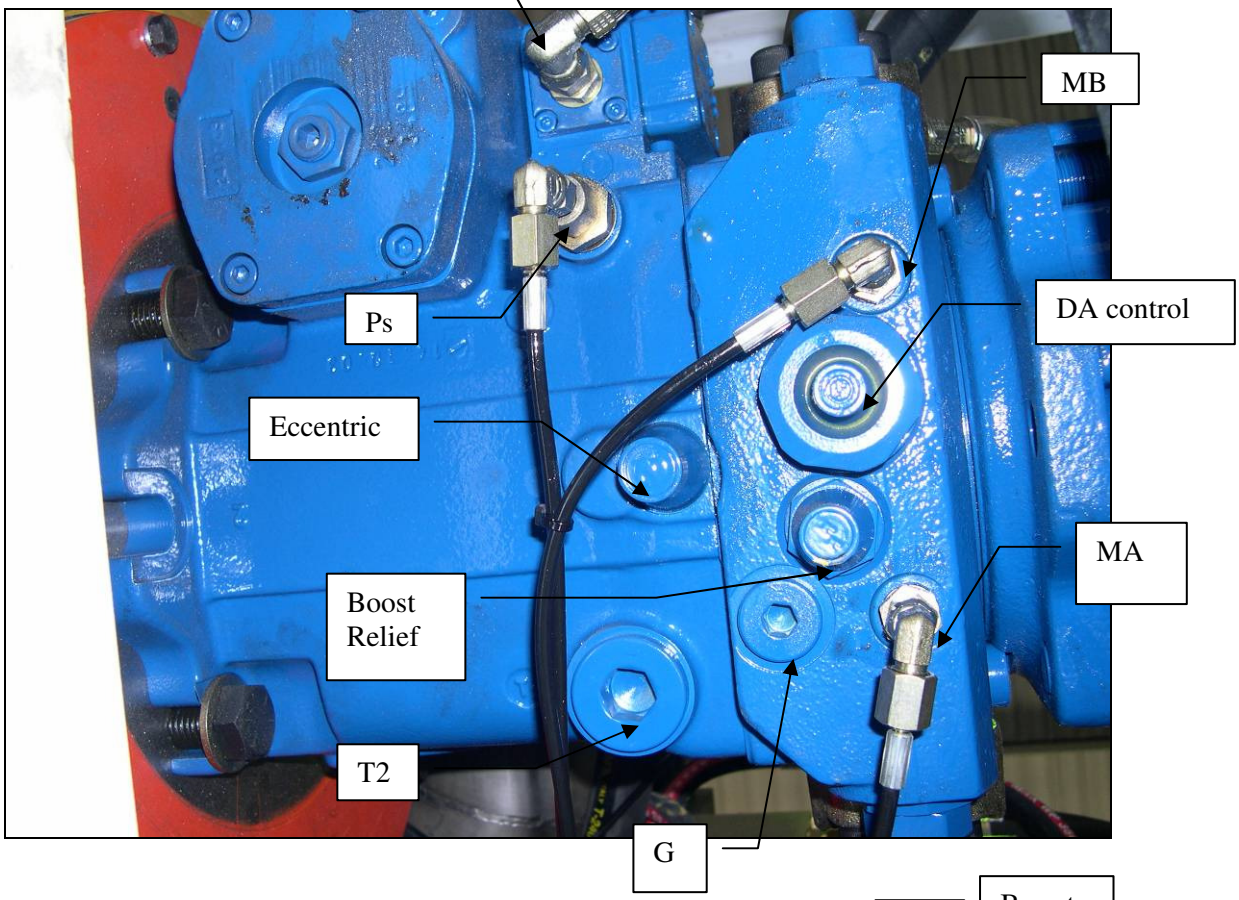
m) Replace sealing cap and tighten with pliers and protective cap.

12. PUMP ADJUSTMENT PROCEDURE

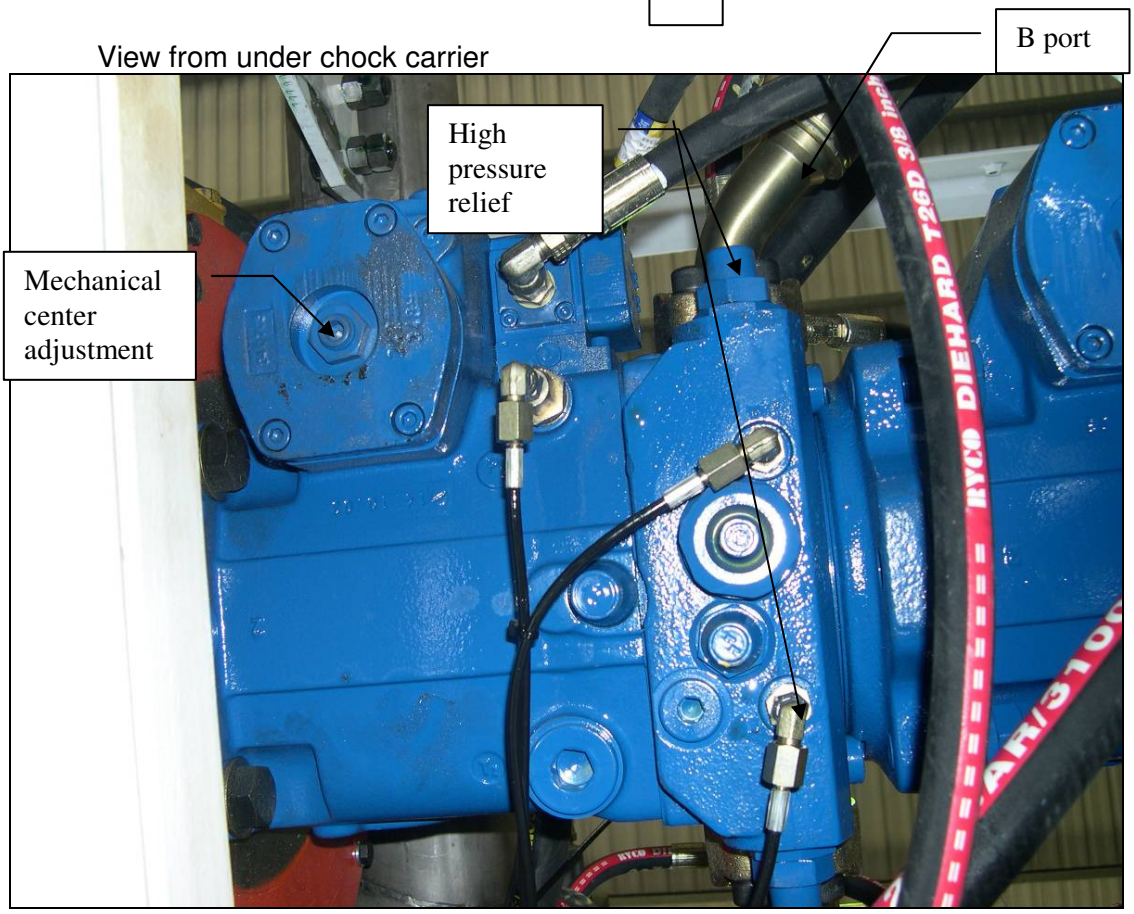
Pump adjustments and connections



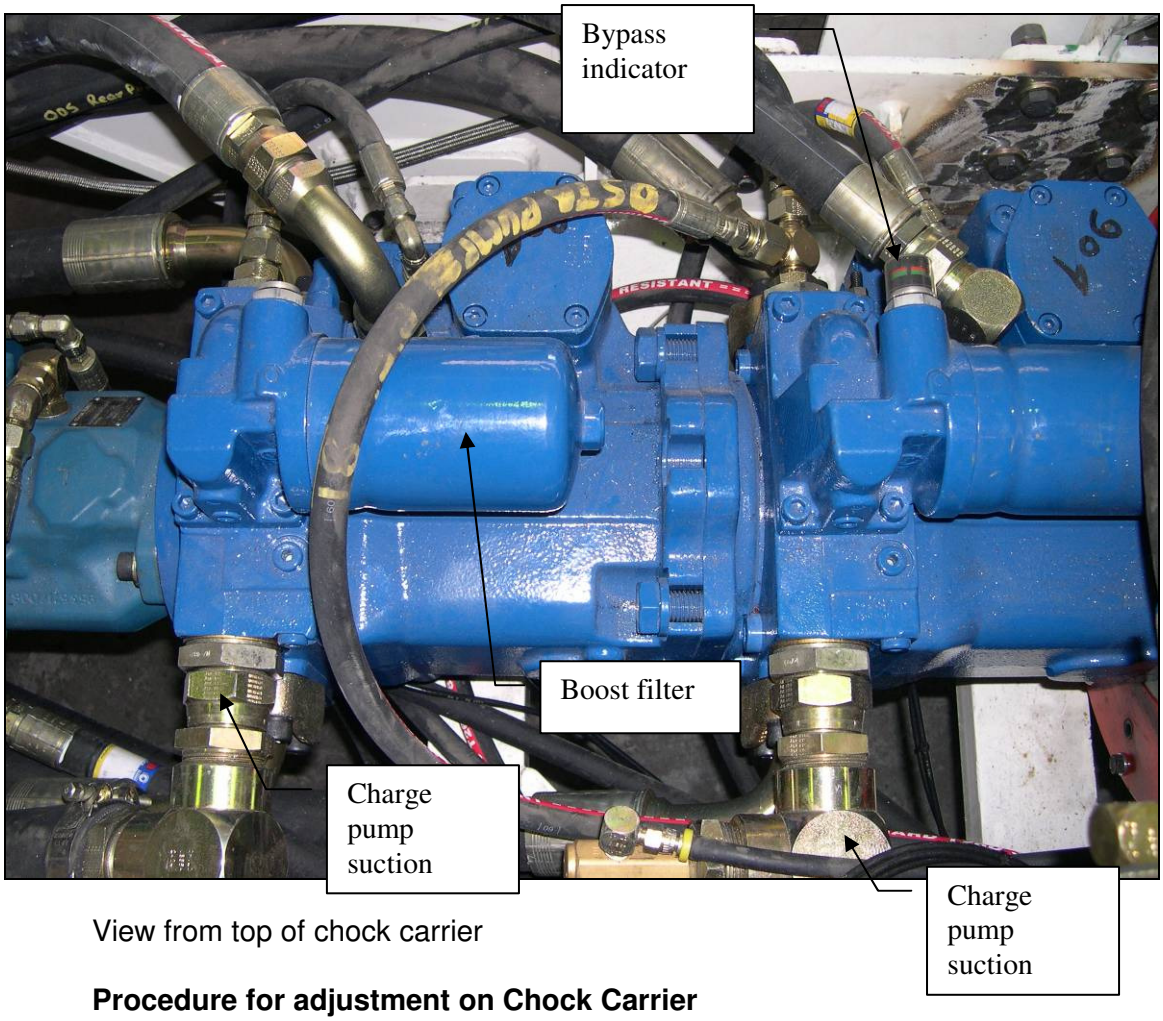
View from off driver's side of chock carrier



View from under chock carrier



View from under chock carrier



View from top of chock carrier

Procedure for adjustment on Chock Carrier

12.1. APPARATUS

- Pressure gauge
- Test point fitting
- Tachometer

1. Lift machine onto stands so that the wheels are off the ground.

2. Fit gauges to X1 and X2 port (0-50 bar)

Note: if machine articulation is straight and articulation valves are adjusted fully closed, and the forward/ reverse controls are functioning correctly, the striker pressure on the gauge panel can be used to indicate X1,X2 pressure.

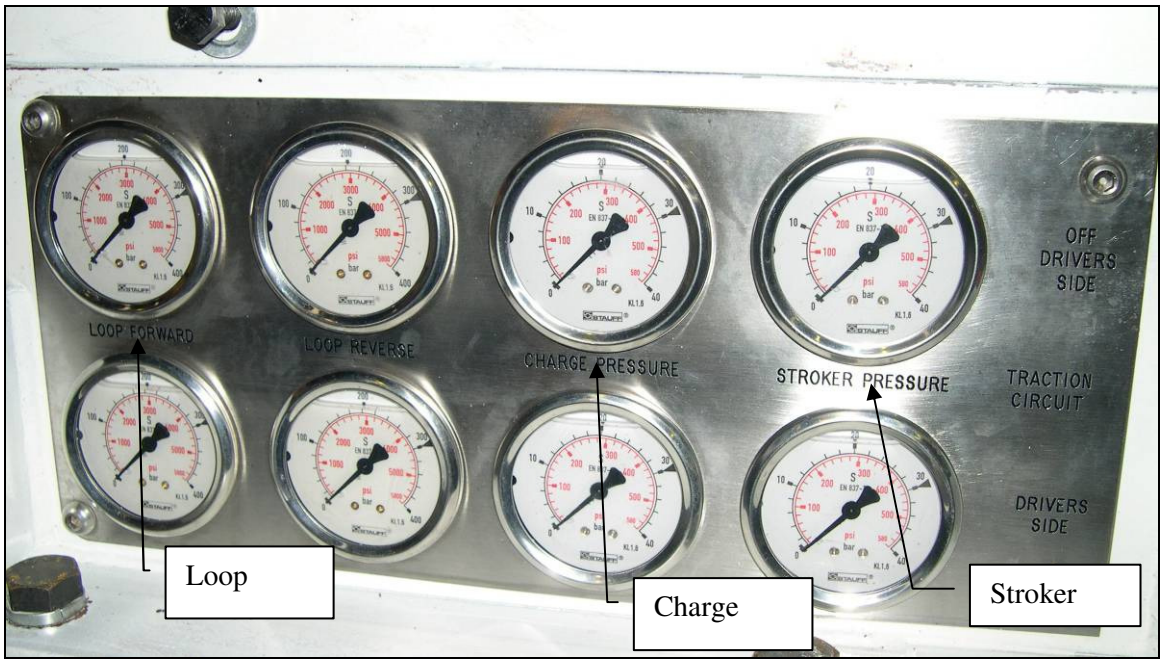
3. Check that eccentric screw is in line with pump shaft axis

4. Increase engine speed until reading 900rpm on the tachometer
5. Adjust the DA valve to achieve 6 to 7 bar in the appropriate X port. Note: This is the point where the wheels will just start to move.

6. Increase the engine speed further up to 1950 rpm. Check that the X port pressure is 18 to 20 bar.

7. Apply the service brake
8. Increase the engine speed to 900rpm
9. The pressure in the loop should be between 30 and 50 bar

10. Increase the engine speed to 1950 rpm
11. Check that the pressure is about 280 bar
12. If the loop pressure is low, adjust the eccentric screw towards the off drivers side.



Gauge panel

12.2. CHANGING A PRIME MOVER WHEEL

12.2.1. Isolate and immobilise machine, observe warnings nominated in handbook.

12.2.2. Place the articulation lock provided between the chassis and the trailer.

12.2.3. Place the machine up on blocks. To do so, utilize a crane or jack, and some stands or sleepers to place the machine onto. The LWC has 6 main lifting points: 2 located on the chassis and 4 located on the trailer. Use these lifting points and lift the machine evenly onto the stands making sure that the articulation lock is in place and secure. If a designated lifting apparatus is not available at a breakdown site, the machine can be lifted using the machine's hydraulic system. Ensure there is notification to, and protection from, passing traffic, a level site, and hardwood packing available. Allow adequate clearance from the rib. Packing should be placed from the side of the machine, there is no reason to work under the machine. Ensure that the machine is packed and stable before commencing work.

12.2.4. Now that the machine is on stands, the wheels can be removed. Use a rattle gun (3/4" or 1" drive), socket to suit the wheel nuts and a jig for removing wheels using either a crane or a fork lift.

12.2.5. Remove wheel nuts one by one leaving the last nut on loose (hand tight), normally the top one is the best to leave loose.

12.2.6. Using the crane or fork lift, place the jig for removing wheels under the wheel and secure the tyre to it.

12.2.7. Use the crane or fork lift to take the weight of the wheel and jig. Remove the last wheel nut by hand, and slide the wheel off smoothly. In some cases the rim may not come off the flange easily due to corrosion, In that case use a large pinch bar and manually bar the wheel off.

12.2.8. **Installation: Warning:** Never attempt to repair a damaged wheel by brazing, soldering or welding with the tyre still fitted to the wheel. Do not apply heat to the wheel or rim when the tyre is still fitted.

12.2.9. **Warning:** Ensure the tyre is well positioned and seated on the rim before inflation.

12.2.10. Place the wheel into the jig for changing tyres and secure the tyre to it.

12.2.11. Clean and inspect the axle flange for damage or cracking. Ensure all studs are present and threads are good, replace as required. Clean any paint or corrosion from axle and rim flanges.

12.2.12. Lift the wheel into position on the axle using the crane or fork lift and begin to put a few nuts on by hand, engaging at least 10mm of thread. Note that spherical nuts must be used to locate the wheel.

12.2.13. Remove the jig making sure that the wheel is not going to fall off. Once the jig is removed put the remaining nuts on and tighten progressively alternative nuts

on opposite side of bolt pattern to 611 Nm (450lb ft), to obtain an even clamping force. Where anti seize lubrication is used, tightening torque required is reduced to 427 Nm (315lb ft).

12.2.14. Lift the machine off the stands with the crane using the 6 lifting points and place it on the ground.

12.2.15. When the machine is on the ground check the tyre pressure. Industrea Mining Equipment recommend 80psi tyre pressure for Michelin tyre 7-181301-728. Optimum tyre pressure may vary according to tyre make and mine conditions. Do not exceed pressure rating of the rim or tyre as applicable. Where tyre fill is used, inflation is not required.

12.2.16. Remove the articulation lock and make sure that everything is secure. The machine is ready to go back into service.

12.3. CHANGING A TRAILER WHEEL

12.3.1. Isolate and immobilise machine, observe warnings nominated in handbook.

12.3.2. Place the articulation lock provided between the chassis and the trailer.

12.3.3. Ensure there is notification to, and protection from, passing traffic, a level site, and hardwood packing available. Place the machine up on blocks. To do so utilize a crane or jack, and some stands or sleepers to place the machine onto. The LWC has 6 main lifting points 2 located on the chassis and 4 located on the trailer, Use these lifting points and lift the machine evenly onto the stands making sure that the articulation lock is in place and secure. If designated lifting apparatus is not available at a breakdown site, the machine can be lifted using the machine's hydraulic system. Allow adequate clearance from the rib. Packing should be placed from the side of the machine, there is no reason to work under the machine. Ensure that the machine is packed and stable before commencing work.

12.3.4. Now that the machine is on stands, the wheels can be removed. Use a rattle gun (3/4" or 1" drive), socket to suit the wheel nuts and a jig for removing wheels using either a crane or a fork lift.

12.3.5. Remove wheel nuts one by one leaving the last nut on loose (hand tight), normally the top one is the best to leave loose.

12.3.6. Using the crane or fork lift, place the jig for removing wheels under the wheel and secure the tyre to it.

12.3.7. Use the crane or fork lift to take the weight of the wheel and jig. Remove the last wheel nut by hand, and slide the wheel off smoothly. In some cases the rim may not come off the flange easily due to corrosion, In that case use a large pinch bar and manually bar the wheel off.

12.3.8. **Installation: Warning:** Never attempt to repair a damaged wheel by brazing, soldering or welding with the tyre still fitted to the wheel. Do not apply heat to the wheel or rim when the tyre is still fitted.

12.3.9. **Warning:** Ensure the tyre is well positioned and seated on the rim before inflation.

12.3.10. Place the wheel into the jig for changing tyres and secure the tyre to it.

12.3.11. Clean and inspect the hydraulic motor flange for damage. Clean any paint or corrosion from unit and rim flanges.

12.3.12. Lift the wheel into position on the motor and begin to put a few nuts on by hand engaging at least 10mm of thread.

12.3.13. Remove the jig making sure that the wheel is not going to fall off. Once the jig is removed put the remaining nuts on and tighten progressively alternative nuts on opposite side of bolt pattern to 810 Nm (600 lb ft), to obtain an even clamping force.

12.3.14. Lift the machine off the stands with the crane using the 4 lifting points and place it on the ground.

12.3.15. When the machine is on the ground check the tyre pressure. Industrea Mining Equipment recommend 116 psi tyre pressure for Michelin tyre 7-181301-729. Optimum tyre pressure may vary according to tyre make and mine conditions. Do not exceed pressure rating of the rim or tyre as applicable. Original supply of tyres are mono filled and do not require pneumatic inflation.

12.3.16. Remove the articulation lock and make sure that everything is secure. The machine is ready to go back into service.

12.4. INSPECTING/CHANGING AN ALTERNATOR

Inspect an alternator

a) Ensure work area is safe
b) Isolate & tag machine appropriately
c) Drain air receiver
d) Open lid at front of the prime mover on the off drivers side to allow access to alternator.
e) Inspect alternator
f) Re-fill air tank
g) Remove isolation tags
h) Machine fit for service

Change out Alternator

a) Ensure work area is safe

b) Isolate & tag machine appropriately

c) Isolate air receiver by closing main valve on driver's side mudguard

d) Open lid located at the front of prime mover off driver's side.

e) Loosen and remove the adjusting bolt; remove alternator belt.

f) Unplug the alternator

g) Remove the two (2) alternator pivot bolts (to remove alternator from machine)

h) Remove the four (4) cap head bolts (so that the alternator mount can be removed from the alternator)

i) Re-fit alternator mount to the alternator

j) Remove the pulley from the old alternator (measure to ensure correct pulley distance from mount)

k) Re-fit pulley to new alternator and measure distance from pulley to the mount. Torque pulley nut to 77Nm / 57 ft.lbs.

l) Fit the alternator back onto the machine using the two pivot point bolts – nip up the two bolts but DO NOT TIGHTEN.

Re-fit the belt for correct tension:

m) To obtain correct tension on the ‘a’ section vee belt, place a straight edge on top of alternator pulley and engine pulley, and using a spring balance achieve a 7MM gap between vee belt and straight edge at 10 to 15 Nm.

n) Plug the alternator into the system via flameproof plug

o) Re-fill air receiver

p) Remove isolation tags

q) Start machine and check operation of lights and hour meter

r) Machine is now fit for use.

12.5. CHANGING A STARTER MOTOR

WARNING – ensure area to be worked in is safe

12.5.1. Isolate the machine and fit the appropriate danger / out of service tag

12.5.2. Drain the air receiver

12.5.3. Remove the forward facing driver's seat

12.5.4. Remove the starter motor cover plate (located on inside wall within driver's cabin) to gain access to the starter motor

12.5.5. Decide whether the starter with the relay valve and ‘y’ strainer, or just the starter, is to be changed out.

12.5.6. If it is the whole lot, undo the hose off the relay valve

12.5.7. If it is just the starter undo the swivel fitting after the relay valve which will separate the starter from the relay valve and ‘y’ strainer

12.5.8. Secure a sling or rope around the starter to support the starter when the three retaining bolts are removed (this is made easier with a two man operation - one to support the starter with the rope, and the other to remove the bolts)

12.5.9. Remove the three bolts, then slide the starter towards the front of the machine until the pinion is clear of the bell housing. Lower the starter and remove it through the starter motor cover plate hole

12.5.10. **Safety Alert -** watch fingers when lowering and removing the starter

12.5.11. Change all relevant fittings etc. to the new starter. Ensure all fittings are at the same angles and directions as on the old starter (for ease of re assembly)

12.5.12. Clean ‘y’ strainer

12.5.13. Inspect starter ring gear and record any damage (wind engine over by hand to fully inspect the entire ring gear)

12.5.14. Refit the starter into the machine using the sling to support the starter

12.5.15. Guide the starter into position and fit the 3 retaining bolts. Use lubricant on the threads.

12.5.16. Refit the hosing/relay valve etc.

12.5.17. Refill the air receiver

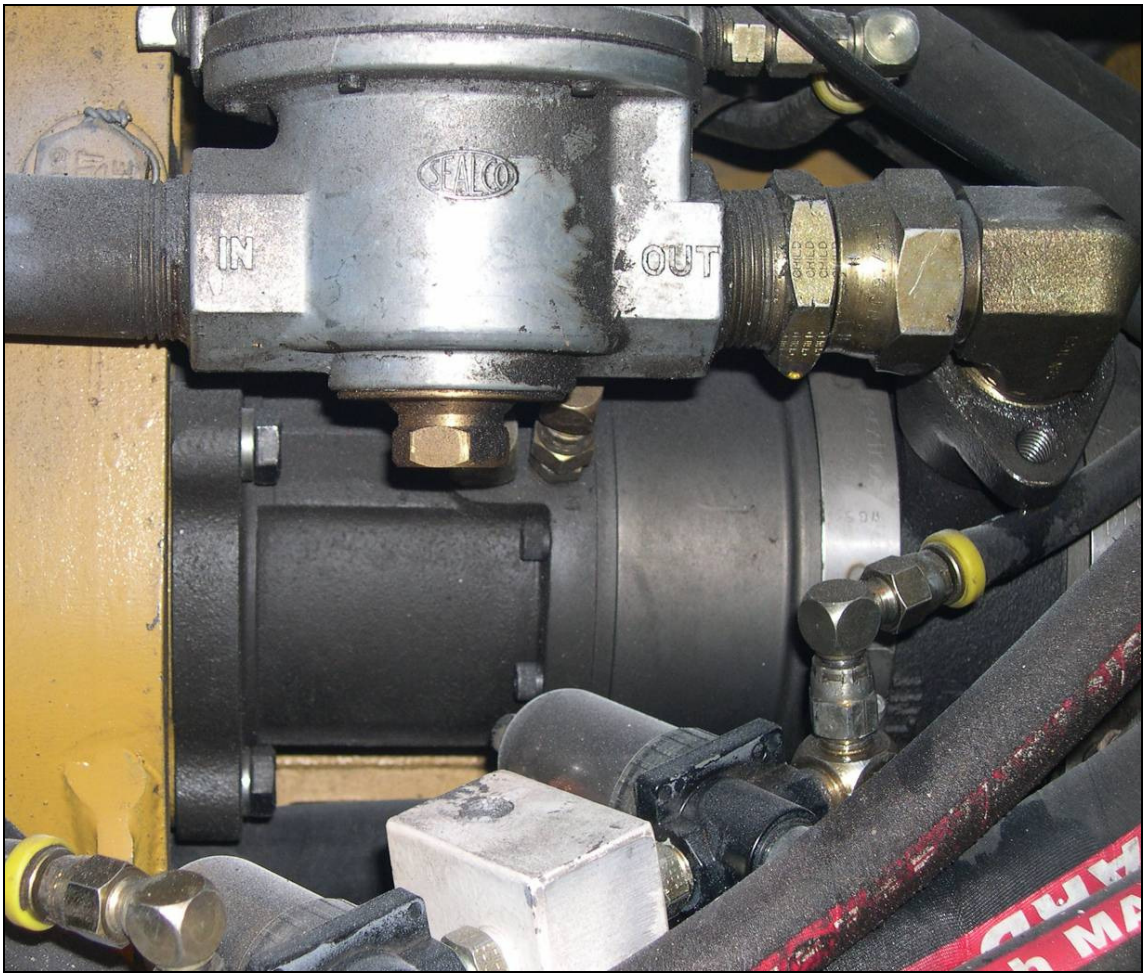
12.5.18. Test the new starter

12.5.19. If ok, refit the starter motor cover plate

12.5.20. Refit the driver's seat

12.5.21. Remove isolation tags

12.5.22. Machine is now fit for use



12.6. CHANGING THE PUMPS

12.6.1. When changing the main pump first you will have to isolate the machine so that it cannot be operated whilst you are performing maintenance.

12.6.2. Disconnect, seal, and mark the hydraulic hoses on the pumps.

12.6.3. Now the bottom bolts from the support bracket need to be removed. These are located underneath the rear traction pump.

12.6.4. Remove the bolts from around the flange on the front traction pump.

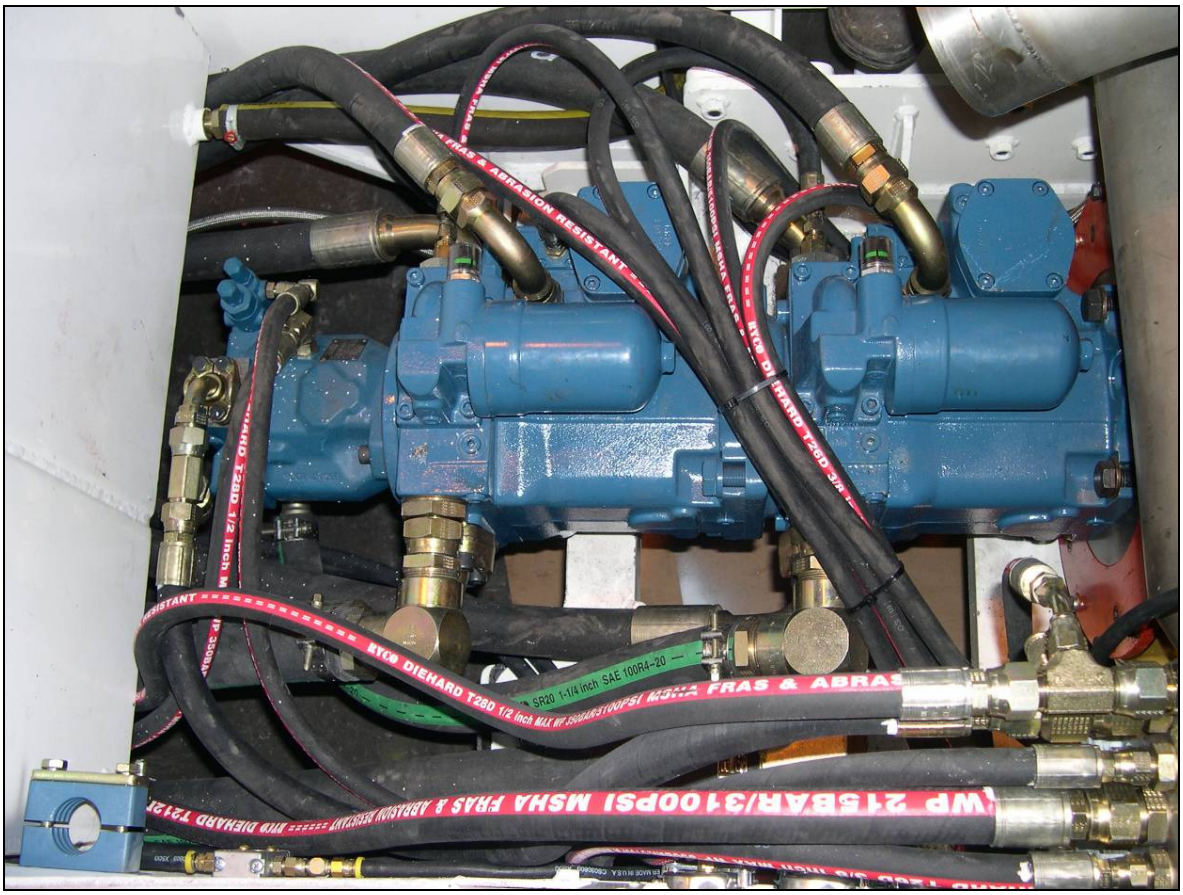
12.6.5. Now that all the hoses have been disconnected you can connect the crane to the pumps and slowly slide the pumps out, being careful not to strain yourself.

12.6.6. Once the old pumps are removed, obtain a new pump / pumps and prepare to install them. Begin by getting your bolts ready then getting the new pumps and making sure that they are the correct pumps.

12.6.7. Install the pumps using a crane to lift the pump into position. Ensure that the spline is lined up correctly and that you have the gasket in place along with some Loctite 515 flange sealant to help seal the joint.

12.6.8. Once the traction pumps are in place, install the bolts around the flange and reconnect the hydraulic hoses, ensuring that you get the right hose onto the right fitting.

12.6.9. When the tank is back in place start the machine up and test all hydraulic equipment and traction of the machine. If all the equipment is working fine then the machine is ready to go back into use.



13. LWC 50T COMMISSIONING DATA

1. Date
2. Ambient temperature
3. Hydraulic oil, ISO 68

4. ☐ Fill all fluids
5. ☐ Fill hydraulic oil through 3um filter
6. ☐ Fill radiator 50% glycol 50% water
7. ☐ Ensure system fills freely without air entrapment
8. ☐ Add scrubber additive (7-181041-705) and water to scrubber header tank
9. ☐ Prime water spray pump
10. ☐ Fill engine with 31 litres engine oil 15W40, mark dipstick
11. ☐ Check engine oil level
12. ☐ Prime fuel system
13. ☐ Prime and bleed hydraulic pumps
14. ☐ Remove steering wheel, lock articulation
15. ☐ Fill air reservoir and listen for leakage
16. ☐ Remove pilot line to safety start line and cap
17. ☐ Bleed oil charge cylinder
18. ☐ Check gauge at fuel cylinder and check operation
19. ☐ Check operation of throttle, check mounting secure
20. ☐ Bleed oil safety circuit
21. ☐ Set override flow control for seven seconds
22. ☐ Test low engine oil shutdown
23. ☐ Test low water float shutdown (90mm minimum water level)
24. ☐ Test horn
25. ☐ Refit pilot line to safety start valve

26. Start engine
27. ☐ Allow engine to run for a short time
28. ☐ Check oil pressure
29. ☐ Check water spray
30. ☐ Check hydraulic charge pressure 30 bar
31. ☐ Check auxiliary standby pressure 25 bar
32. ☐ Check stroker pressure 6 bar
33. ☐ Fill cooling system as required
34. ☐ Check safety circuit pressure
35. ☐ Bleed cooling system
36. ☐ Check lights are on

37. Stop engine
38. ☐ Refill engine oil to level
39. ☐ Refill hydraulic oil to level
40. ☐ Check for leaks and loose fasteners
41. ☐ Check belt tension fan and alternator

42. Restart engine
43. ☐ Check/bleed F port pilot signal
44. ☐ Check /bleed Y1,Y2 lines
45. ☐ Check/bleed brakes
46. ☐ Check/bleed load sense line
47. ☐ Check/bleed displacement signal
48. ☐ Check/bleed flow divider pilot signal
49. ☐ Check/bleed wheel motor cases
50. ☐ Check motor direction

51. ☐ Fit filter loop and circulate oil for 15 minutes @ 2000 rpm
52. ☐ Check pump null
53. ☐ Check start of control 900 rpm, 50 bar loop pressure, 6-8 bar stroker pressure
54. ☐ Check end of control 1950 rpm, 280 bar loop pressure, 20 bar stroker
55. ☐ See pump adjustment procedure in operator manual if pump adjustment is required

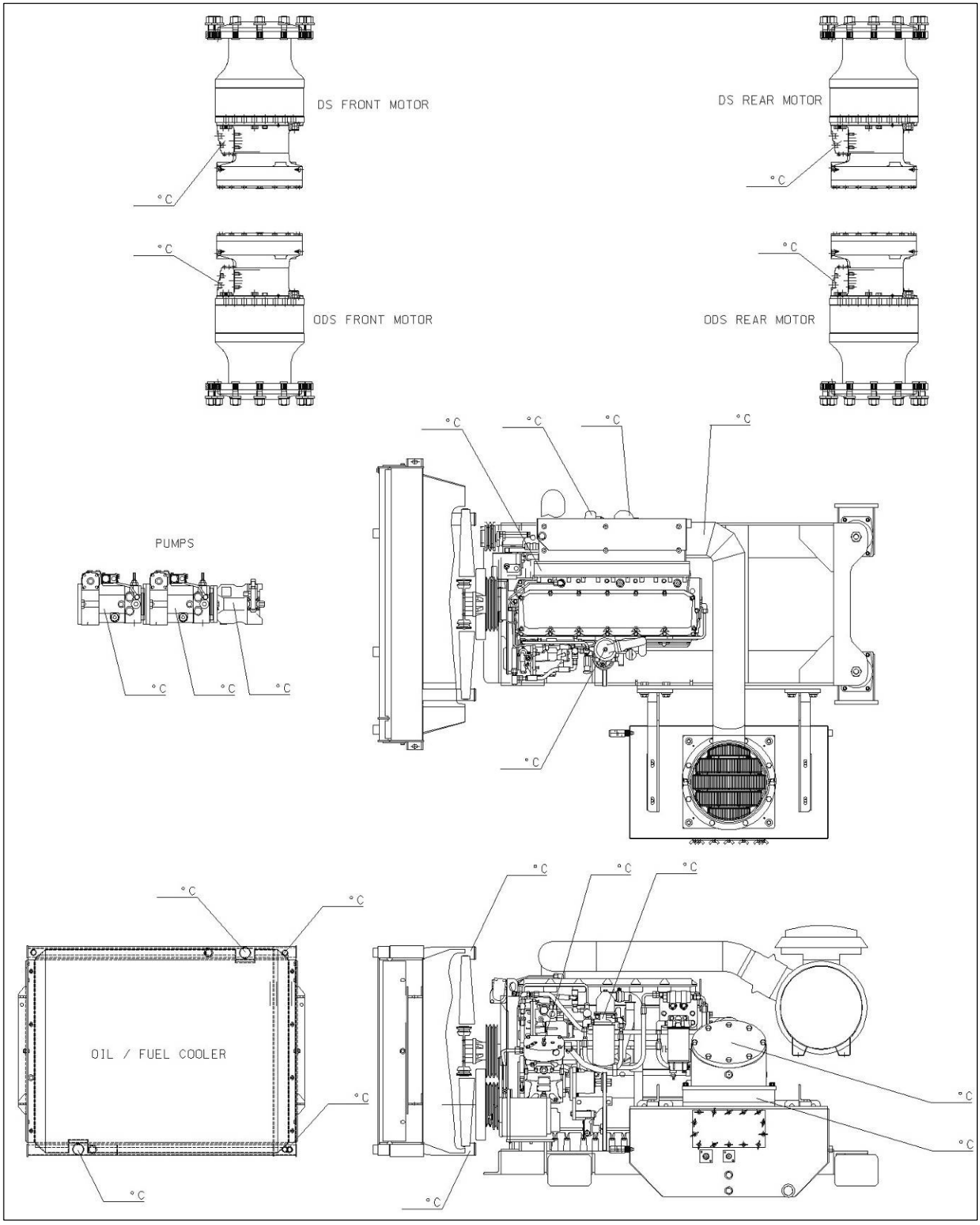
Before adjusting pump consult with engineering department.

56. ☐ Check motor speed 1 27rpm
57. ☐ Check motor speed 2 36 rpm
58. ☐ Check motor speed 3 54 rpm
59. ☐ Check motor speed 4 108 rpm
60. ☐ Check flushing flow, set purge relief 25 to obtain 50l/min combined flow to cooler (measure with flow meter)
61. ☐ Grease all grease points
62. ☐ Check all labels are fitted
63. ☐ Check for any oil leaks
64. ☐ Check operation of lift and anti sway cylinders
65. ☐ Test operation of park brakes
66. ☐ Test operation of service brakes
67. ☐ Test operation of steering
68. ☐ Test operation of horn
69. ☐ Carry out Surface temperature checks (as per sheet on next page)

Control System Checks

	Unit	DS	ODS			
		Test Points	Test Points	Test Points	Test Points	Test Points
Charge Pressure	30 Bar	M18:	M15:			
DA Pressure	6-40 Bar	M25:	M26:			
Stroker pressure	0-30 Bar	M33:	M34:			
Left turn	0-30 Bar	M33:	M34:			
Right turn	0-30 Bar	M33:	M34:			
DS loop brake appl.	350 Bar	Fwd M28:	Rev M27:	M1:	M31:	
ODS loop brake appl	350 Bar	Fwd M30:	Rev M29:	M2:	M31:	
2WD	0-30 Bar	M24:		M22:	M23:	M20:
4WD	0-30 Bar	M24:		M22:	M23:	M20:
Displacement (top)	Slow 0-30 Bar	M19:		M22:	M23:	M20:
Displacement (top)	Fast 0-30 Bar	M19:		M22:	M23:	M20:
Displacement (btm)	Slow 0-30 Bar	M21:		M22:	M23:	M20:
Displacement (btm)	Fast 0-30 Bar	M21:		M22:	M23:	M20:
Anc. pump	25-210 Bar	M32:	Brakes on	M17:	M16:	M31:
			Brakes off	M17:	M16:	M31:
Cooler flow	50 l/min	M3:	Flow:	Temp in:	Temp out:	
Return filter		Indicator				
Hyd.component	Below 60ºC					
Engine temp.	85ºC					
Radiator	ΔT = 8-10ºC	Temp in:	Temp out:			

Temperature Test Points



14. TROUBLE SHOOTING GUIDE

Note:

Sections 14.1 to 14.7 contain tabular information to guide fault diagnosis. Information contained in these tables is not conclusive. Obscure or multiple faults may compound problems. To overcome these, it is essential to have a thorough understanding of the system diagrams and the theory of operation of the equipment.

14.1. ENGINE SYSTEM

Symptom	Probable Cause	Remedy	Measure
Engine will not start	Main air valve not turned on.	Turn main air valve on.	
	No air in tank. Minimum air pressure, 90psi.	Fill air tank.	90psi min
	Air regulator setting too low. Regulator setting – 70psi.	Adjust air regulator.	
	Start relay valve stuck	Tap lightly with a hammer. Plan replacement relay valve.	
	Air blow by in starter motor.	Repair or replace as necessary.	
	Insufficient starter motor crank speed. Normal speed – 170rpm.	Ensure no blockage in exhaust port. Repair or replace as necessary.	
	Low conditioner water level. Minimum static water level – 180mm.	Ensure there are no leaks in the conditioner tank and test valve is closed. Fill conditioner header tank and ensure inlet valve is fully open.	
	Defective shutdown float valves in conditioner tank.	Ensure float is secure on lever and float is not full of water. Repair or replace as necessary.	.
	Defective or loose fuel rack cylinder.	Replace any broken springs. Check operation. Ensure cylinder mounting tight.	
	No fuel in tank	Fill fuel tank with diesel.	110L

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Restricted fuel delivery.	Isolate restriction. Rectify.	
	Activated or defective Sentinel over temperature valve. Coolant - 103°C.	If activated see F (engine overheated). Otherwise replace as necessary.	Coolant 103°C
	Activated or defective Sentinel over temperature valve. Exhaust - 130°C.	If activated see C (exhaust overheated). Otherwise replace as necessary.	Exhaust 130°C.
	Activated or defective Sentinel over temperature valve. Exhaust exit scrubber - 130°C.	If activated see C (exhaust overheated). Otherwise replace as necessary.	Exhaust 130°C.
	Pneumatic hosing defective or damaged.	Isolate defective or damaged hose. Repair or replace as necessary.	
	Pneumatic hosing incorrect.	Check for correct hosing of pneumatic circuit (7-160490-700).	
Engine will start but shuts down after several seconds	Coolant loss test valve in open position.	Close coolant loss test valve.	
	Low oil pressure test valve in open position.	Close low oil pressure test valve.	
	Low engine oil pressure.	Check engine oil level. Check engine block orifice for blockage. Plan engine maintenance.	
	(Insufficient time for oil pressure to build)	adjust flow control.	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Low coolant pressure. 0.8psi shutdown pressure.	Fill header tank. Ensure no air locks present in system. Check for leaks in hosing or radiator core. Check pressure cap condition. Check for damage to water pump, replace as necessary.	0.8psi
	Low fuel.	Fill fuel tank. Prime injectors before starting.	
	Restricted fuel delivery	Isolate restriction (squashed fuel line etc). Rectify.	
Engine stops automatically.	Low conditioner water level. Shutdown water level – 180mm.	Ensure there are no leaks in the conditioner tank and test valve is closed. Fill conditioner header tank and ensure inlet valve is fully open.	180mm min.
	Exhaust flametrap sensor activation	Water pump supply line clogged Check water pump operation Blocked water nozzle	
	Defective shutdown float valves in conditioner tank.	Check floats are attached to rods and buoyant (not full of water). Repair or replace as necessary.	
	Low engine oil pressure. Normal oil pressure – 60psi at 2200 rpm	Check engine oil level. Check engine block orifice for blockage. Check for oil leaks on engine and hosing. Plan engine maintenance.	60psi normal
	Low coolant pressure. 0.8psi shutdown pressure.	Check test valve is closed. Fill header tank. Ensure no air locks present in system. Check for leaks in hosing or radiator core. Check pressure cap condition. Check for damage to water pump, replace as necessary.	0.8psi
	Engine coolant overheating.	Check sensor temperature setting. Replace as necessary. See F.	Coolant 103°C

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Loose shutdown cylinder.	Replace any broken springs. Check operation. Ensure cylinder mounting tight.	Loctite thread
	Exhaust over temperature. Maximum exhaust outlet temperature 130°C.	Ensure there are no leaks in the conditioner tank and test valve is closed. Check conditioner tank for baffle/flute failure. Check water supply and float valves to ensure correct operation. Fill conditioner header tank and ensure inlet valve is fully open.	130°C max
	Engine over speed detection	See adjustment procedure 11.2.1	
	Low air pressure. Minimum air pressure 90psi.	Check for damaged hose or leaking connection. Check main air pressure.	90 psi
Engine will not stop	Fuel rack cylinder defective or loose. Air pressure at rack cylinder for engine shutdown ≤ 25psi.	Check fuel rack cylinder operation. Tighten fuel rack cylinder body. Manual activation of intake shutdown valve	≤ 25 psi
	Defective or blocked engine on/off valve.	Clean or replace as necessary. Ensure discharge breather unblocked.	
	Blocked engine block orifice.	Clean as necessary.	
	Defective or blocked low engine oil valve.	Clean or replace as necessary.	
	Blocked low engine oil valve orifice.	Clean as necessary.	
Poor performance	Air inlet system restricted.	Replace air inlet filters as necessary. Clean inlet flame trap as necessary.	
	Air in fuel	Examine fuel system for leaks	
	Faulty unit injector	Inspect unit injectors, clean or replace as necessary	
	Restricted exhaust system. Maximum exhaust back pressure - 10 kPa	Clean conditioner tank with suitable detergent. Ensure exhaust outlet free of foreign materials. **Clean exhaust flame trap.** Use cleaning agent in scrubber header tank	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Blocked engine oil breather.	Clean as necessary.	
	Throttle linkage out of adjustment. Pedal output pressure – 65psi.	Adjust as necessary.	65 psi
	Wrong fuel type.	Use summer and winter fuel appropriately.	
	Worn rings or bores.	Replace rings and liners as necessary.	
	Intake temperature to high	Check that air inlet pipe has insulation blanket on.	
	Fuel pump out of calibration.	Recalibrate fuel pump.	
	Restricted fuel (tank) return.	Locate and remove restriction.	
Engine fails gas test (CO)	Excess fuel.	Adjust fuel injection pump.	
	Wrong fuel.	Use specified fuel for conditions.	
	Worn engine.	Plan engine maintenance.	
Overheating.	Low coolant level. Nominal temperature drop across radiator – 10°C.	Check cooling system for leaks. Repair or replace damaged lines or components. Fill cooling system (see service chart).	
	Blocked or defective radiator.	Check radiator cooling fins and baffling. Clean or repair as necessary.	ΔT - 10°C
	Incorrect fuel setting	Ensure that the fuel setting is correct	
	Incorrect fuel injection timing	Ensure that the setting for the fuel injection timing is correct	
	Restricted air flow through the aftercooler	Check for debris or deposits which would prevent the free flow of air though the aftercooler	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Damaged or stalled radiator fan. Blade angle – 25°	Check blade angle. Repair or replace as necessary.	25°
	Loose or worn fan belts.	Adjust fan belts to correct tension.	
	Incorrect drive gear selected (torque converter slippage).	Select correct drive gear for conditions.	
	Faulty thermostat.	Replace as necessary.	
	Inlet air filter blocked.	Replace as necessary.	
	Restricted exhaust. Maximum back pressure – 63mmHg.	Check for blockages in exhaust system. Clean.	63mmHg
	Transmission overheating.	See section 1.2(D).	
	Water pump failure or stall. Water pump pressure – approx. 110kPa @ 2200rpm (nominal).	Check water pump pressure. Check for blockages in cooling system. Remove blockages. Repair or replace pump as necessary.	110kPa
	Fuel pump out of calibration.	Have fuel pump re-calibrated.	
	Methane (CH_4) rich environment.	Take MPV out of service under these conditions.	
	Faulty radiator cap	Pressure test cooling system, if fails check seal on cap. Replace as necessary	
	Extreme conditions	Determine if machine is operation under outside temperatures or high altitudes	
Abnormal noise or vibration.	Fan / alternator belt and/or pulleys / damper loose.	Adjust belt tension. Tighten pulleys or damper. Replace where necessary.	
	Engine mounting loose.	Tighten engine mounts.	
	Engine misfiring	Check for inlet air restrictions, fuel quality, valve settings and fuel system	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Improper unit injector synchronization	Check for proper unit injector synchronization. Perform any necessary adjustments	
	Hydraulic pumps not secure. Bolt torque – 124 Nm.	Tighten hydraulic pump mountings.	124 Nm
	Incorrect engine adjustment and timing.	Plan engine maintenance.	
	Unbalanced fan blade	Remove fan drive belts and operate engine for short period of time. If vibration is not present replace the fan assembly.	
Excessive engine oil consumption	Excess Engine Oil	Check oil level. If level increases during engine operation fuel may be leaking into the oil. Check for fuel in engine oil.	
	Oil leaks	Find any oil leak and repair as necessary.	
	High oil temperature	Check operation of oil cooler and oil temperature regulator. Install new parts as required, clean the oil cooler cores.	
	Worn valve guides and / or valve guide seals	Inspect valve guides and seals for wear and replace where required. If necessary, recondition cylinder head	
	Worn piston rings and cylinder walls	Use blowby / air flow indicator to check the amount of crankcase blowby. Inspect piston rings and replace as necessary.	
	Failure of turbocharger oil seal	Check inlet manifold for oil. If present, repair the turbocharger	
Excessive fuel consumption	Excessive load	Ensure that the engine is not operating under excessive load	
	Fuel system leaks	Inspect fuel system for leaks. Repair any leaks found.	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Air inlet or exhaust restriction	Using a water manometer or vacuum gauge check for restrictions in the inlet and exhaust system at full load rpm. Max restrictions Air inlet – 6.25 kPa (25 inches of Water) Exhaust – 10 kPa (40 inches of water)	
	Fuel quality	Check the API of the fuel	
	Incorrect fuel timing dimension	Ensure fuel timing dimension is correct.	
	Incorrect valve lash setting	Check the valve lash setting, refer to adjusting valve lash on pg 74	
	High fuel setting	Ensure that the fuel setting is correct, make the necessary adjustments.	
Excessive valve lash	Loose rocker arm adjustment and screw locknut	Check for proper installation of the rocker arm adjustment screw locknut. If the rocker arm adjustment screw locknut is loose, adjust the valve lash.	
	Insufficient lubrication	Check the lubrication in the valve compartment. There must be a strong flow of oil at high engine rpm and low oil flow at low rpm. Oil passages must be clean.	
	Worn rocker arm	Check rocker arms for signs of wear. Replace as necessary.	
	Worn push rods	Inspect push rods for signs of wear. If too much wear is present install new push rods and adjust the valve lash.	
	Worn valve lifters or broken valve lifters	Clean valve train and install new valve lifters	
	Worn camshaft	Check the camshaft for wear. Adjust the valve lash	
	Worn valve stem	Check valve stems for wear. Check for free movement of the valves or bent valve stems.	

14.1: Engine System
(cont.)

Symptom	Probable Cause	Remedy	Measure
	Incorrect valve settings	Check the valve lash. Adjust the valve lash if necessary	
Fuel in the cooling system	Faulty cylinder head sleeve	Remove the unit injectors and inspect the sleeves in the cylinder head bore. If any problems are seen remove and replace the sleeve	
Fuel in the engine oil	Faulty upper seal on unit injector	Check for a faulty 'o'ring seal on top of the unit injector. Remove the fuel supply line at the bottom of the cylinder head. Plug the return line to the fuel tank. Pressurize the fuel gallery. Look for fuel that is leaking between the unit injectors and the cylinder head. If leaking remove upper unit injector and replace upper 'o'ring seal. Change oil & filter also.	
	Porosity in the cylinder head	Pressurize the fuel gallery and check for porosity around the oil drain lines. If found replace cylinder head	
	Porosity in the fuel filter base	Check the fuel filter base for porosity or defects. Fuel can be transferred to the crankcase though a faulty fuel filter base	
	Faulty seal in the fuel transfer pump	Check for faulty seal at the bottom of the sleeve in the fuel transfer pump.	
	Excessive internal clearances in the fuel transfer pump	Check for excessive clearance between the tappet and the sleeve in the fuel transfer pump.	
	Faulty unit injector	Faulty unit injectors will normally cause the engine to misfire which will cause the engine to run rough. Faulty unit injectors may also provide a path for fuel leakage into the engine oil. Remove the unit injectors and check the injectors for proper operation. Replace any faulty unit injectors.	
Little or no valve lash	Worn valve seat or worn valve face	Recondition the cylinder head. Reassemble the engine and adjust valve clearance.	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
Suction line taking air.	Low oil level. Suction line connections taking air. Worn oil pump.	Fill to correct level. Check oil line connections and tighten securely. Replace.	
Coolant in engine oil	Engine oil cooler failure Failure of cylinder head gasket Crack or defect in cylinder head Crack or defect in cylinder block Failure of seal between cyl head and sleeve in unit injector bore	Install new engine oil cooler, change oil and replace filters Check head gasket by removing radiator cap and look for air bubbles. Replace head gasket if necessary Install new cylinder head Install new cylinder block Replace the sleeve	
Engine oil in cooling system	Defect in core of engine oil cooler Failure of cylinder head gasket	Inspect engine oil cooler, repair or replace as necessary Check head gasket by removing radiator cap and look for air bubbles. Replace head gasket if necessary	
Engine oil in exhaust system	Failed turbocharger seals Worn valve guides or faulty valve guide seals Worn piston rings	Check inlet and exhaust manifold for oil, if present replace turbocharger. Inspect valve guides and seals for wear and replace where required. If necessary, recondition cylinder head Inspect piston rings and install new parts as required	

14.1: Engine System
(cont.)

Symptom	Probable Cause	Remedy	Measure
Low engine oil pressure	Dirty oil filter or dirty oil cooler	Check the operation of the bypass valve on the oil filter. Clean oil cooler or replace the oil cooler core. Change engine oil	
	Fuel in engine oil	Refer to troubleshooting “fuel in engine oil”	
	Excessive clearance between the rocker arm shaft and the rocker arms	Check for proper lubrication in valve compartments. Replace parts as required	
	Oil pressure relief valve stuck open	Clean the valve and the housing. Install new parts as required. Check bypass valve in oil cooler and oil filter	
	Faulty oil pump or faulty oil pump suction pipe	Repair or replace the oil pump or the suction pipe as necessary	
	Excessive clearance between the crankshaft and crankshaft bearings	Inspect the crankshaft bearings. Look for excessive clearance between crank and bearings. Replace bearings if necessary	
	Excessive clearance between the camshaft and camshaft bearings	Inspect the camshaft bearings. Look for excessive clearance between camshaft and bearings. Replace camshaft and bearings if necessary	
	Faulty oil pressure gauge	Check oil pressure gauge and replace if required	
	Low engine oil supply	Ensure that the engine has the correct amount of oil	
Low Power	Poor fuel quality	Ensure that the vent on the fuel tank is not plugged and ensure that there is good quality clean fuel in the tank	
	Plugged fuel filter or plugged oil filter	Inspect the air filter and replace if necessary. Check water separator and fuel filter and replace if required	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Excessive engine oil	Check engine oil level. If the engine oil level is high, drain the oil and refill. Determine source of the extra oil	
	High fuel temperature	Verify that the temperature of the fuel in the fuel tank is less than 78ºC. A low fuel level can cause high temperature.	
	Air inlet leak after the turbocharger	Check for loose connections between the turbocharger and the inlet manifold. Check the aftercooler for visible signs of leaking.	
	Exhaust leak before the turbocharger	Exhaust leak between the exhaust manifold and the turbocharger can reduce boost pressure. Check exhaust manifold and turbocharger mounting flange for the turbocharger	
	Air inlet or exhaust restriction	Using a water manometer or vacuum gauge check for restrictions in the inlet and exhaust system at full load rpm. Max restrictions Air inlet – 6.25 kPa (25 inches of Water) Exhaust – 10 kPa (40 inches of water) Clean Flame Trap	
	Fuel ratio control setting	Stop engine. Remove the control line that connects the FRC to the inlet manifold. Apply 140 kPa to 200 kPa air pressure to the FRC. Listen for air leakage in the governor. If leaking air is detected, replace the FRC.	
	Damage to the valve train or the unit injectors	Remove the valve cover and inspect the unit injectors, push rods and rocker arms. Replace where necessary	
	Improper fuel injection timing	Check the fuel injection timing for correct setting	
	Incorrect valve adjustment	Check the valve adjustment for correct setting	

14.1: Engine System
(cont.)

Symptom	Probable Cause	Remedy	Measure
	Incorrect fuel setting	Check the fuel setting is correct	
	Faulty turbocharger	Inspect the turbocharger compressor wheel. If excessive deposits are found on the compressor wheel or the compressor wheel is damaged, determine the cause. Rotate the compressor wheel in order to check for dragging and binding. Check for excessive play in bearings	
	Low fuel pressure	Check the fuel pressure. Minimum fuel pressure with clean fuel filters is 50 kPa at low idle or 200 kPa at high idle. If fuel pressure is low then check the fuel filter.	
	Air in the fuel	Examine the fuel system for leaks. Repair any leaks found.	
	Faulty unit injectors	Faulty unit injectors will normally cause the engine to misfire which will cause the engine to run rough. Faulty unit injectors may also provide a path for fuel leakage into the engine oil. Remove the unit injectors and check the injectors for proper operation. Replace any faulty unit injectors.	
	Low cylinder compression	Check for signs of broken piston rings, faulty cylinder head gasket, and worn cylinders or valves. If the engine runs properly and there is not excessive blowby or excessive oil consumption, the cylinder compression is probable acceptable.	
Mechanical noise (knock) in engine	Failure of connecting rod bearing	Inspect all bearings for the connecting rods and the bearing surfaces (journals) on the crankshaft. Install new parts as required	
	Damaged timing gears	Inspect the timing gears. Install new parts as required	
	Damaged crankshaft	Replace the crankshaft	

14.1: Engine System (cont.)

Symptom	Probable Cause	Remedy	Measure
	Damaged rocker arm on the unit injector, missing insert, or broken socket	Check for broken or damaged components. Repair or install new components	
Noise coming from cylinder	Air in fuel	Check fuel system for leaks	
	Low fuel quality	Remove the fuel from the tank. Install new fuel filter. Put good grade clean fuel into the tank	
	Incorrect fuel timing dimension	Check the fuel timing dimension and make necessary adjustments.	
	Faulty unit injectors	Faulty unit injectors will normally cause the engine to misfire which will cause the engine to run rough. Faulty unit injectors may also provide a path for fuel leakage into the engine oil. Remove the unit injectors and check the injectors for proper operation. Replace any faulty unit injectors.	
	Improper unit injector synchronization	Improper unit injector synchronization will cause more fuel to be delivered to one cylinder. This will cause engine knock. To determine if cylinder is receiving excess fuel, move each injector to the fuel on position and listen for engine knock. Synchronize the injectors, if necessary.	
	Mechanical problem	A mechanical problem could cause noise. Find and correct the problem. Possible items to check would be, incorrect valve adjustment, sticking valve or a internal mechanical problem	
Soot in the inlet manifold	Engine design	A small amount of soot in the inlet manifold is normal for diesel engines. Valve overlap allows the inlet valve to open slightly before the exhaust stroke has been completed. This will allow some soot to be pushed into the inlet manifold.	

14.1: Engine System
(cont.)

Symptom	Probable Cause	Remedy	Measure
	Faulty valve or valve seat	A faulty valve or valve seat allows a large quantity of soot to be pushed into the inlet manifold. Reconditioning of the cylinder head is required	
Valve train noise	Excessive valve lash	Check the valve lash. Ensure that the valve lash is adjusted to the correct specification	
	Damaged valve train components	Inspect the following valve train components: Valves, springs, camshaft, lifters, retainers, pushrods and rocker arms. Check for worn and damaged parts and also replace parts that are significantly worn	
	Insufficient lubrication	Check the lubrication in the valve compartment. There must be a small flow of oil at low engine revs and a strong flow at high engine revs. Oil passages must be clean. The oil passages that carry oil to the cylinder head are particularly important	

14.2. HYDRAULIC SUPPLY SYSTEM

(refer hydraulic circuit 7-075113-700)

Symptom	Probable cause	Remedy	Measure
No oil supply	Low oil level in tank.	Fill tank to level on sight glass.	
	Air leak in suction line.	Locate leak and repair.	
	Suction line blocked.	Remove obstruction.	
	Oil viscosity too heavy.	Drain tank and replace oil with ISO 68 VI summer and ISO 46 VI winter.	
	Pump case drain back pressure high. Maximum pressure – 2 bar Absolute	Check hosing for blockage. Clean or replace hoses as necessary.	2 bar abs
	Defective pump.	Repair or replace as necessary.	
No system pressure. System pressure – 310 bar Traction	Pressure filter bypass Low DA pressure	Change filters	
Low charge pressure	Displacement control handles in between positions.	Displacement control handles in between positions. Shift position fully	
	Pressure reduced by articulation	Straighten articulation	
	Worn articulation cam	Replace cam	
	Filter bypass	Filter bypass-Change charge filter	
Engine shutdown	Hydraulic oil temperature shutdown	Check cooling system	
High oil temperature shutdown	Incorrect gear used up an incline or excessive hydrostatic braking	Park the machine at idle – 1500rpm and allow oil to pass through cooler for 5 minutes	50l/min @2600rpm
	High ambient temperature	Install flow meter and set pressure to obtain 50 l/min to cooler	
	Pressure setting purge relief		
No auxiliary system pressure. System pressure – 210 bar Auxiliary	Auxiliary hydraulic pump differential setting to low.	Wind differential pressure setting in to 25 bar at standby.	25 bar
Hydraulic motor rattles	Low charge pressure, pistons not held on cam	Restore charge pressure to 30 bar Ensure correct oil temperature Ensure free wheel valve fully shifted	30 bar charge

14.2: Hydraulic Supply System (cont.)
(refer hydraulic circuit 7-074936-700)

Symptom	Probable Cause	Remedy	Measure
	Abrasive matter in hydraulic oil circulating through pump.	Replace hydraulic oil and return filter element.	
Noisy pump	Partial blockage in suction line or filter. Air in system from leaking pipes or hoses. Air lock in system. Tank breather blocked. Worn or broken components.	Remove blockage from suction line and clean or replace filter. Test for leaks in joints. Tighten as required. Check hoses and replace as necessary. Bleed system as required. Clean or replace breather as necessary. Replace as necessary.	
External oil leakage from pump. Hose leakage	Shaft seals worn. Extruded o-ring	Replace o-rings and oil seals. Replace o-ring Check bolt length Tighten flange bolt	
	Damaged JIC taper seal	Replace hose/fitting	
	Damaged gaskets.	Replace.	
Internal pump components damaged.	Pump seizure through oil starvation. Foreign matter wedged in pump. Hoses defective Excessive tightening of cover studs Excessive oil pressure.	Check oil tank level, filter and feed lines. Repair or replace as necessary. Dismantle pump and remove blockage. Check condition of hoses and replace as necessary Check stud torque settings and adjust as necessary. Check relief valve settings and adjust as necessary.	
Excessive wear in pump.	Viscosity of oil too low for operating conditions. Cold start cavitation.	Check oil viscosity is correct (see lubrication chart).	

14.2: Hydraulic Supply System (cont.)
(refer hydraulic circuit 7-074936-700)

Symptom	Probable Cause	Remedy	Measure
	Pump case drain back pressure high. Maximum pressure – 14.5 psi.	Check hosing for blockage. Clean or replace hoses as necessary.	

14.3. STEERING SYSTEM

Symptom	Probable Cause	Remedy	Measure
No system pressure and system inoperative.	Refer table 14.2 Hydraulic Supply System.	-	
Steering creep when wheel is in neutral position.	Internal leakage in steering cylinders.	Check components for scores. Replace as necessary.	
	Defective steering valve.	Locate faulty unit. Repair or replace as necessary.	
	Foreign matter between steering valve components	Disassemble valve and clean components. Replace those components which are defective.	
Sluggish operation. Standard operation at idle - 60 turns/minute	Worn pump.	Replace pump.	
	Relief valve not operating correctly. Pressure settings Steering – 210 bar	Check pressure setting and adjust.	
	Steering valve cross over relief valves incorrectly set. Pressure setting – 200 bar	Check pressure setting and adjust.	200 bar
	Air in system.	Bleed system.	
	Internal leak in steering cylinder or orbital valve.	Locate faulty unit. Replace or repair as necessary.	
	Wrong viscosity oil in system.	Drain system and replace oil with ISO 68 VI in summer or ISO 48 VI in winter.	
External oil leakage.	Defective oil seals	Replace defective gasket seals and o-rings.	
	Worn or defective bushings or bearings.	Locate defective item. Replace as necessary.	
Abnormal noise or vibration at hitch point.	Insufficient lubrication.	Lubricate all points in the steering linkage.	
	Worn or defective bushings or bearings.	Locate defective item. Replace as necessary.	
Loose or erratic steering at hitch point.			

14.4. BRAKING SYSTEM

Symptom	Probable Cause	Remedy	Measure
Brakes Dragging	Reverse modulator setting	Adjust 14-30 bar	
Reduced brake holding capacity	Worn wheel motor brake discs.	Check performance. Replace discs as necessary.	
Brakes applying too slow when park brake button pushed. Brakes shall apply within 0.7 seconds.	Hydraulic brake hosing kinked or damaged.	Check hydraulic brake hosing free and undamaged. Repair or replace as necessary.	
	Pneumatic brake hosing kinked or damaged.	Check pneumatic brake hosing free and undamaged. Repair or replace as necessary.	
	Engine oil pressure hose to low engine oil shutdown brake valve kinked or damaged.	Check engine oil pressure hosing free and undamaged. Repair or replace as necessary.	
	Low engine oil shutdown brake valve defective.	Repair or replace as necessary.	
Park brakes not releasing. Brake hold off pressure – 14bar minimum	Brake pilot valve malfunction.	Remove pilot valve and replace.	14 bar min
	Reverse modulator set too low. Pressure reducer setting – 14 bar minimum	Adjust pressure reducing valve.	14 bar
Abnormal noise, vibration or overheating.		Isolate faulty unit. Repair or replace as necessary and fill with oil to the correct level. Use hydrostatic braking	
	Defective, worn or broken parts in system components.	Isolate faulty unit and repair or replace as necessary.	
	Riding brakes downhill.	Do NOT ride brakes while travelling downhill.	

14.5. TRAILER FUNCTION

Symptom	Probable Cause	Remedy	Measure
Trailer implements not responding	Park brake not applied	Apply park brake	
Trailer will not lift chock.	Chock weight too high. Incorrect pressure setting on valve pump. Pressure setting – 210 bar.	Refer load chart. Check relief valve pressure setting. Adjust as necessary.	 2300 psi
Trailer will lift chock but falls when handle released.	Incorrect hosing. Hoses leaking.	 Check for leaks in lift hoses and connections. Repair or replace as necessary.	
Abnormal noise or vibration	Insufficient lubrication. Worn or defective bushings or bearings.	Lubricate all points in the trailer linkages. Locate defective item. Replace as necessary.	

14.6. GENERAL PNEUMATIC SYSTEM

(refer pneumatic circuit 7-160615-700)

Symptom	Probable Cause	Remedy	Measure
No/low air pressure. System – 110 psi.	Main air valve not turned on.	Turn on main air valve.	110 psi
	Air receiver empty.	Fill air receiver.	
	Audible air leak in pneumatic system.	Fill air receiver. Check hosing and valves for air leak. Repair or replace valves or hosing as necessary.	
	Blocked filter-lubricator.	Clean filter-lubricator.	
	Faulty compressor.	Repair or replace as necessary.	
	Incorrect setting on compressor regulator. Regulator setting – 110psi.	Adjust compressor regulator.	120 psi
Horn will not operate	See A.	–	
	Defective horn.	Repair or replace as necessary.	
	Defective horn button.	Locate defective valve. Repair or replace as necessary.	
	Air line damaged.	Check air hoses for damage. Repair or replace as necessary.	
Reversing bell does not work	See A.	-	
	Defective reversing pilot valve.	Repair or replace as necessary.	
	Air line damaged.	Check air hoses for damage. Repair or replace as necessary.	
	Defective reversing bell.	Repair or replace as necessary.	

14.7. ELECTRICAL SYSTEM

Symptom	Probable Cause	Remedy	Measure
Lights and hour meter not working	No power. Alternator drive belt slipping. Belt tension – 20-27N/16mm.	Adjust alternator drive belt.	20-27N/ 16mm
	Fuse blown.	Replace as necessary.	
	Cut or damaged cables.	Repair or replace as necessary.	
	Incorrect wiring.	Wire circuit to 7-190332-700.	
	Loose connections.	Locate faulty connection. Repair as necessary.	
Lights not working	Light globe blown.	Locate defective globe. Replace as necessary.	
	Cut or damaged cables.	Repair or replace as necessary.	
Light colours not switching when reversing	Incorrectly wired with regards to polarity.	Re-connect in correct manner.	
	Defective light switch.	Repair or replace as necessary.	
Hour meter not working	Incorrectly wired with regards to polarity.	Re-connect in correct manner.	
	Defective hour meter.	Repair or replace as necessary.	

15. MACHINE SPECIFICATION

MACHINE:	**Longwall Carrier (LWC)**
GENERAL ARRANGEMENT:	**7-220730-700**

Operating Parameters:

Max. longitudinal gradient	1:4 (14^0)
Max. transverse gradient	1:8 (7.5^o)
Min. width of roadway	4500 mm
Min. height of roadway	1850 mm
Structure Type	Articulated 2 section
Max Load	50 tonne

Machine Parameters:

Overall length	9421 mm
Overall width	3484 mm
Overall height	1596 mm
Length of disintegrated section	Prime mover – 4730 mm Trailer – 5200 mm x 2500mm wide
Ground clearance	264 mm hitch, 292 mm adj wheel
Wheel base	4164 mm front/pivot 1860 tandem beam
Axle gauge Rear/Front	3011 mm / 1910 mm

Speed of each gear (unloaded)	
1st (4WD max displacement)	4.6 kph
2nd (4WD min displacement)	6.6 kph
3rd (4WD min displacement)	11.6 kph
4th (2WD min displacement)	23.2 kph
Tractive effort	
1st (4WD max displacement)	23226 kg
2nd (4WD min displacement)	16260 kg
3rd (4WD min displacement)	9292 kg
4th (2WD min displacement)	4646 kg
Gradeability laden 50t	
1st (4WD max displacement)	15.8 degrees
2nd (4WD min displacement)	10.1
3rd (4WD min displacement)	4.5
4th (2WD min displacement)	0
Speed of each gear (50 t load)	
1st (4WD max displacement)	4.6 kph
2nd (4WD min displacement)	6.6 kph
3rd (4WD min displacement)	11.6kph
4th (2WD min displacement)	0 kph
Ideal speed (50 tonne load)	11 kph

Climbing speed (50 tonne load)	4.4 kph @ 1 in 10 gradient
Ground pressure	Front – 318kPa (50 tonne load) Rear – 536kPa (50 tonne load)
Tare weight	22.5 tonnes
Total Power	170 kW
Maximum load	50 tonnes
Total Weight laden	72.5 tonnes
Turning circle inner radius unladen	2670mm
Turning circle inner radius laden	3000-4000mm dependent on ground condition
Service interval under normal conditions	250 hrs (engine service)

Engine:

Type	Caterpillar 3126 DITA, 4 stroke, 6 cylinder, water-cooled, Turbo aspirated diesel engine with Direct Fuel Injection
Maximum power	170kW @ 2600rpm
Peak torque	779N.m @ 1950rpm
Displacement	7.24 litres
Bore & stroke	110mm x 127mm
Cylinder arrangement	In line
Maximum exhaust back pressure	6.7kPa
Maximum inlet vacuum	7.5kPa
Fuel consumption	48.2 l/hr @ 171 kW
Arrangement of cylinders	In line
High idle	2600rpm
Low idle	800rpm
Start mode	Compressed air
Cooling method	Water cooled / Radiator
Oil tank capacity (fuel)	200 Litres
Type of fuel	Diesel fuel / Commercial standard
Exhaust System	Water scrubber plus flame trap

Air intake system:

Components	Air cleaner Dry filter element Flame trap Explosion proof inlet manifold

Exhaust system:

Water cooled manifold	Caterpillar
Exhaust temperature @ flame trap	< 300^0Celsius
Flame trap	Plate type
Spark arrester	Water bath
Secondary heat exchanger	Water bath
Exhaust exit temperature	$<70^0$ Celsius
Exhaust shutdown probe	85^0Celsius (set point)
Water tank capacity	400 Litres

Safety circuit:

Engine shutdown devices	High exhaust temperature High coolant temperature Low water – scrubber tank Low coolant Low engine oil pressure Manual engine stop

Transmission:

Type	Closed loop Hydraulic system
Make	Rexroth pump driving Poclain motors
Gearshift mode	4-mode manual selection
Number of forward gearshift	Four selections
Number of reverse gearshift	Four selections

Brakes:

Number of brake wheels	Four (4)
Braking mode	Oil immersed and spring applied multiple disc.
Braking distance at speed 20 kph	6.9 m (unladen) (confirmed by testing)
Braking distance at speed 10.5 kph	3.6 m (laden) (confirmed by testing)
Emergency brake method	Spring applied, fail safe
Emergency brake distance unladen	<8m @ 20kph
Emergency brake distance laden	<8m @ 10.5kph

Steering System:

Type	Machine articulation plus AFD (Automatic Forced Differential) Inside trailer wheels driven slow Outside trailer wheels driven faster
Steering mode	Steer wheel / Hydraulic orbitrol valve
Manufacturer	Rexroth
Articulation mode	Swivel hitch / Hydraulic cylinder
Material of articulation	Steel

Traction Hydraulic System:

Pump type	Rexroth A4VG
Power rating	183 kW /pump
Displacement variable pump	125 cc/rev
Maximum flow	325 L/m
Pressure setting	35MPa
Displacement auxiliary pump	25.7 cc/rev
Maximum flow	67 L/m
No. Traction pumps	2
Power setting	2 x 73 kW
Diff lock	Hydraulic flow divider 5% accuracy

Motor Type	Poclain two speed radial piston design
No. Motors	4
Motor displacement (max/min)	8.349 / 3.340 litres/rev
Motor power rating	200 kW full displacement 135 kW small disp.
Torque per 100 bar	13250 Nm / 5300 Nm / motor
Filtration	Loop charge pressure, and return filtration
Filtration accuracy	10um Rexroth

Auxiliary Hydraulic System:

Pump type	Pressure compensated Axial piston pump
Rated flow	104 litres per minute @ 2600 engine rpm
Working pressure	200 Bar
Filtering method	Return filter
Filtering accuracy	10 micron absolute
Type of filter element	Synthetic material element

Operators compartment:

Location of operator compartment	Front RHS of the machine.
Controls	Steering Throttle Service brakes Emergency/Parking brakes Diff lock 2wd/4wd + hi/low selector Horn Engine stop/start Pick-up control Winch control
Instruments	Engine oil pressure Engine water temperature Air pressure Brake pressure Steering/lifting pressure Tachometer Charge/stroker & loop pressure
Seating	Adjustable, spring cushioned
Protection device	Approved type canopy

Tyres:

Type	Michelin hard rock lug
Material	Steel belted rubber, radial ply
Tyre fill	Light density foam
Specification of front tyres	1400 x R20 x 16 ply 580mm rolling radius
Specification of rear tyres	1600 x R25 x 36 ply 687mm rolling radius

Service life under normal conditions	Two (2) years

Chock Handling Parameters:

	Hydraulic lifting mechanism
Jacks	4 x 6” bore
Lifting capacity – machine	50 tonnes
Lifting capacity – per lifting mechanism	30 tonnes
Material of lifting mechanism	Steel

Carry Frame:

Wheel unit carry capacity Dynamic	28.5 tonne / wheel unit
Wheel unit carry capacity Static	36 tonne / wheel unit
Number of wheel units	4
Wheel unit mounting	Walking beam
Carry weight distribution	Equal load on 4 wheel units
Brake torque	42000Nm /wheel unit
Pay load width	1800mm

Electrical system:

System voltage	12 volts
Type	DC
Method of explosion-proof	Ex (d)
Protection mode	Fuse
Power output & voltage of engine	30 amps @ 12 volts

Lighting:

Number of front lights	Two (2)
Power, lighting distance, voltage & visible distance	50 watts, 30 metres, 12 volts & 100 metres
Number of rear lights	Two (2)
Power, lighting distance, voltage & visible distance	50 watts, 30 metres, 12 volts & 100 metres
	Signal system (red light) is manually selected for direction of travel. Opposite end to direction of travel switches to red.

Methane Monitor option:

Manufacturer	Austdac
Type	NGVG1 continuous monitoring
Set points	2 warning, 1 trip (engine shutdown)
Set point values	0.5%, 1% trip
Power supply	12 Volt
Ingress protection rating	IP66
Explosion protection methods	Ex e m [ia] I
Sensor head	Trolex

Audio signalling device:

Type	Air horn
Operation method	Hand operated button valve
Volume	117 dBa

Fire extinguisher:

Extinguishing method	80 BE dry chemical powder (portable)
Number of extinguishers	Two (2)

Noise level:

Noise level	85 dBa @ one (1) metre

Features

- **Drive wheels directly under the load for maximum traction**
- **4 radial tyres under payload to minimize ground pressure**
- **Single articulation for maximum manoeuvrability, control and speed**
- **Automatic forced differential steering**
- **12 kph laden speed, 24 kph return speed**
- **Purpose built for moving heavy chocks in a coal mine**