

DEMU

The DPC (Driving Power Car) has a single power pack consisting of a diesel engine, model KTA-50-L (Kirloskar Cummins Ltd).

1.4 SPECIFICATION

01	Exact description and Model of the engine	: Cummins KTA-50-L
02	Rated output	: 1400 BHP
03	Maximum intermittent traction rating at site condition given below	: 1600 BHP @ 2100 RPM
04	Site conditions	
	Ambiant température	: 55Deg. C
	Altitude above mean Sea level	: 1000M
	Relative Humidity	: Above 40%
05	Rated speed at continuous rating	: 1800 RPM
06	Type of cycle	: Four stroke
07	Method of pressure charging	: Turbo charging
	♦ Pressure ratio of the compressor at the rated output	: 2.4
	♦ Single stage/ Two stage	: Single stage
	♦ No. of Turbochargers used	: Two
	♦ Make and model of Turbocharger	: Cummins
08	Type of exhaust system	: Pulse type
09	Cooling method of the charge air	: By engine coolant.
10	Type of combustion chamber	: Direct injection chamber
11	Fuel Injection equipment	: Unit type FIP and injector
12	Fuel pump	: PT-fuel pump
13	Number of cylinders	: 16 Cylinder (8 cyl. per bank)
14	Arrangement	: "V"-Type 60 degree
15	Cylinder bore	: 159mm
16	Piston Stroke	: 159 mm
17	Total displacement	: 50 Lts
18	Cubic capacity/ Cylinder	: 3.13 Lts./ Cyl.
19	Compression Ratio:	: 13.8: 1
20	Firing Order	: 1R-1L-3R-3L-7R-7L-5R-5L-8R-8L-6R-6L-2R-2L-4R-4L
21	Mean piston speed at the rated speed	: 9.5 m/s.
22	Brake mean effective pressure	: 12.58 Kg/Cm ²
23	Maximum combustion pressure at the rated output	: 141 Kg/Cm ² (2000 PSI)
24	Compression pressure at No load at Minimum idling speed	: 350 PSI
25	Minimum No-load idling speed (A low idle features is provided on the Engine)	: 700 RPM
26	Max. no load RPM under steady conditions	: 2070 RPM
27	Minimum firing speed	: 150 RPM.
28	Piston	
	♦ Piston cooling method	: By engine Lube oil.

- 29 Cooling System
- ◆ Cooling system type : Pressurized
 - ◆ Water tank capacity : 153 Litre
 - ◆ Treatment recommended for water : Borate base compound
- 30 Lube Oil System
- ◆ Sump Capacity : 151 Liters
 - ◆ Brand of oil recommended : Multi grade CF4 15-W-40
- 31 Lube oil Consumption at the rated output : 0.14 Lit / Hr
- 32 LOC % of fuel consumption : 0.14% of fuel consumption
(Max. is 0.25% of fuel consumption)
- 33 Lubricating oil pressure at the rated speed at the normal operating temperature : 3.4 to 6.16 Kg/Cm²
- 34 Maximum pressure of charge air in the intake manifold at the rated output : 1.278 Kg/Cm² (37" of Hg)
- 35 Maximum pressure of gases in the exhaust manifold at the rated output (At output of TSC) : 3" of Hg
- 36 Maximum RPM of turbocharger at the rated output : 63600 RPM
- 37 Maximum permissible RPM of the turbocharger : 100000 RPM
- 38 Temperature of exhaust gases at Turbo Inlet at the rated output : 600 to 630 Deg.C.
- 39 Maximum permissible temperature for Which the turbocharger components have been designed : 735 Deg. C.
- 40 Heat balance of the engine:
- Useful output : 38.6%
 - Exhaust : 35.3%
 - Coolant : 24.4%
 - Ambient : 1.7%
- 41 Weight of the engine complete with all items excluding water and lubricating oil : 4858 Kg.
- 42 Weight of the water contained in the engine : 155 Kg. approx.
- 43 Weight of the oil contained in the engine : 150 Kg. approx.
- 44 Specific fuel consumption.
- ◆ Indicate the lower heating value of the fuel used in arriving at the specific fuel consumption figures : 10000Kcal/Kg.
(154.17gm/BHP/Hr)
- 45 Fuel oil consumption at idle in L/H : 4.16 Lit/ Hr.
- 46 Type of governor : LCC CGA Make
- 47 Safety devices provided on the engine.
- ◆ Over speed trip safety device
 - ◆ Low lubricating oil pressure safety device
 - ◆ High water temperature safety device
 - ◆ Low water level safety device
- 48 Transmission System
- ◆ Alternator type : BHEL TA 7003 BX
C. Greaves C1012 TA
 - ◆ Maximum speed : 1800 rpm
 - ◆ Maximum voltage : 900 V

◆ Maximum current	: 2145 A
◆ Continuous rating low voltage	: 550 V, 1660 A, 1800 rpm
◆ Continuous rating high voltage	: 900 V, 990 A, 1800 rpm
◆ Weight with accessories (Approx.)	: 4400 Kg
◆ Traction motor type	: BHEL TM 4303 AZ C. Greaves C1005 TM
◆ Maximum speed	: 2772 rpm
◆ Number of TM per DPC	: Four
◆ Continuous voltage	: 550 V
◆ Continuous current	: 415 A
◆ One hour rating	: 455 V, 550 A,
◆ Weight per unit (Approx.)	: 2200 Kg
◆ Gear ratio	: 20: 91
◆ Suspension	: Axle hung, nose suspended
◆ Auxiliary generator	: KEL A 18122 FM
◆ Rating	: 110A DC, 135V DC, 18.5KW
◆ Unit weight	: 445 Kg.

Leading Particulars of 1400 HP DEMU Power Car

1. Length over headstock	:	21417 mm
2. Distance between bogie centers	:	14783 mm
3. Bogie wheel base	:	2896 mm
4. Wheel diameter	:	952 mm (New)
5. Tread wear	:	37.5 mm
6. Overall width	:	3245 mm
7. Height from rail level to top of roof	:	3886 mm
8. Height from rail to floor level	:	1282 mm
9. Maximum height of center line of centre buffers above rail level for unloaded vehicles.	:	1104 mm

DIESEL ENGINE AND ITS RELATED SUB –ASSEMBLIES

INTRODUCTION

One diesel engine, model KTA-50-L (Kirloskar Cummins Ltd) is provided in each DPC which produces required power to drive the DEMU. During run, both the engines in both DPC works together.

SYSTEMS OF DIESEL ENGINE

The various systems of the Diesel engine used in DEMU are as follows:

Air Intake and Exhaust system

Fuel system

Lube oil system

Cooling water system

Hydraulic oil system

1. AIR INTAKE AND EXHAUST SYSTEM

The main components of the air intake and exhaust system are :-

- i. Air filter :-** It is fitted in the air intake side of engine air manifold at both sides (RHS & LHS), which cleans the engine air intake from air dust and foreign particles.
- ii. Vacuum indicator :-** This unit is mounted on the air filter outlet , it indicates a red band when the accumulated dust is beyond the permitted level.
- iii. After cooler :-** This unit is mounted to cool the compressed air , supplied from rotary compressor of Turbo Supercharger unit . It increases the density of air.
- iv. Supercharger :-** This is a combined unit of Rotary compressor & Turbine which is separated by a seal . The turbine unit is driven by the hot flue gases from the exhaust of engine cylinder, which in turn drives the rotary compressor. The Rotary compressor unit is provided to supply compressed air to air manifold and then finally to the engines cylinder.
- v. Exhaust manifold:-**This unit is fitted to collect the exhaust hot flue gas coming out from engine which in turn is utilized for driving the turbine.
- vi. Silencer:-** This unit is fitted at the exhaust outlet of turbine to reduce noise of hot flue gases

DESCRIPTION :-

Air is drawn through the supercharger portion of the turbo supercharger which compresses and feeds the compressed air to the cylinders via an after cooler which cools the air. The cooling of air helps in increasing the density.

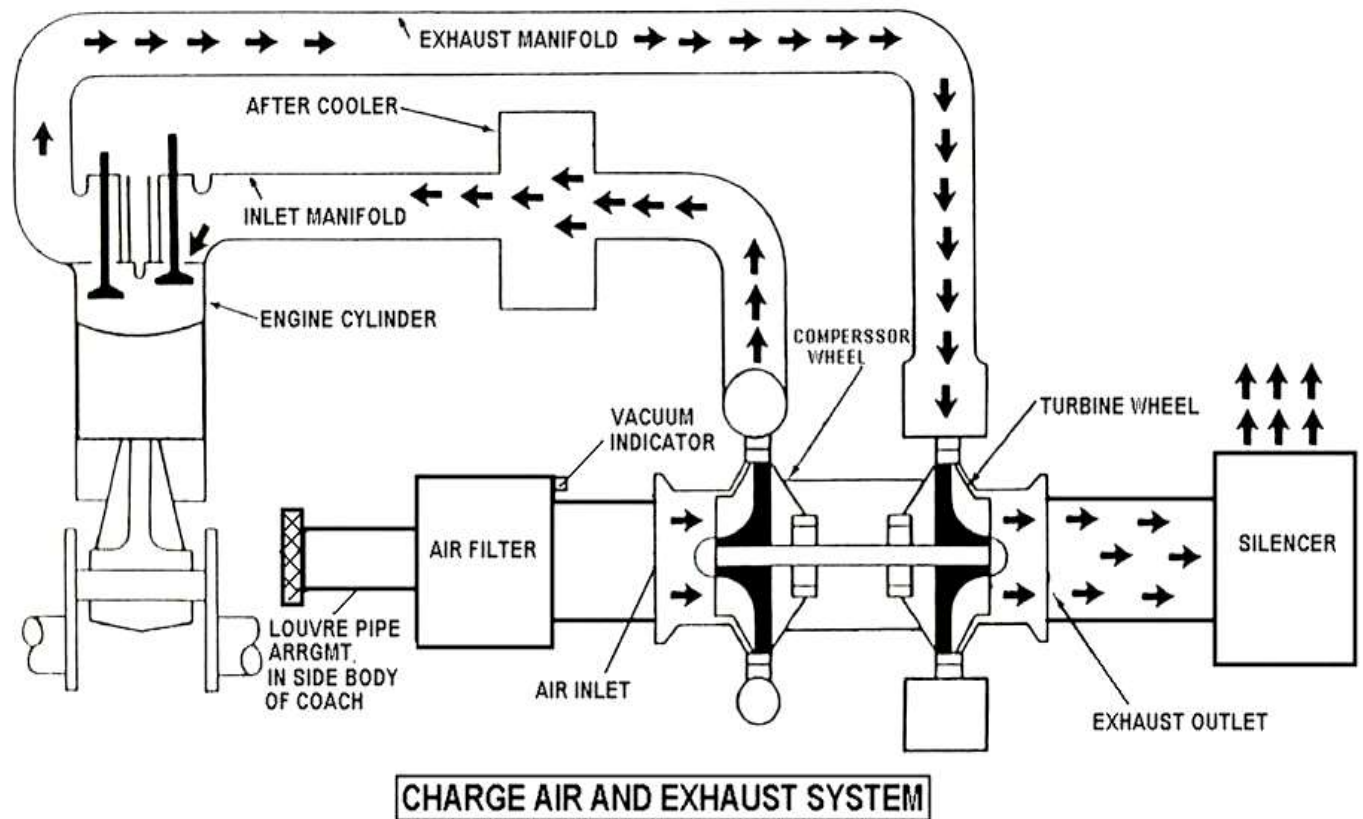
The air filter is provided to remove harmful dust, abrasive particles from the air. If these particles are permitted to enter the engine, the particles will mix with the

lubricating oil to form an abrasive paste which will quickly wear out piston rings, cylinder liners, pistons, valve guides etc. causing high lubricating oil consumption and blow by.

A vacuum indicator is fitted at the air filter outlet that indicates a red band when the accumulated dust is beyond the permitted level, so it is necessary to clean the air cleaner element. Air cleaner element can be cleaned with pressurized air at not more than 30 PSI.

The exhaust air from the cylinder drives the turbine portion of the turbo super charger, which helps in utilisation of residual heat of exhaust gases.

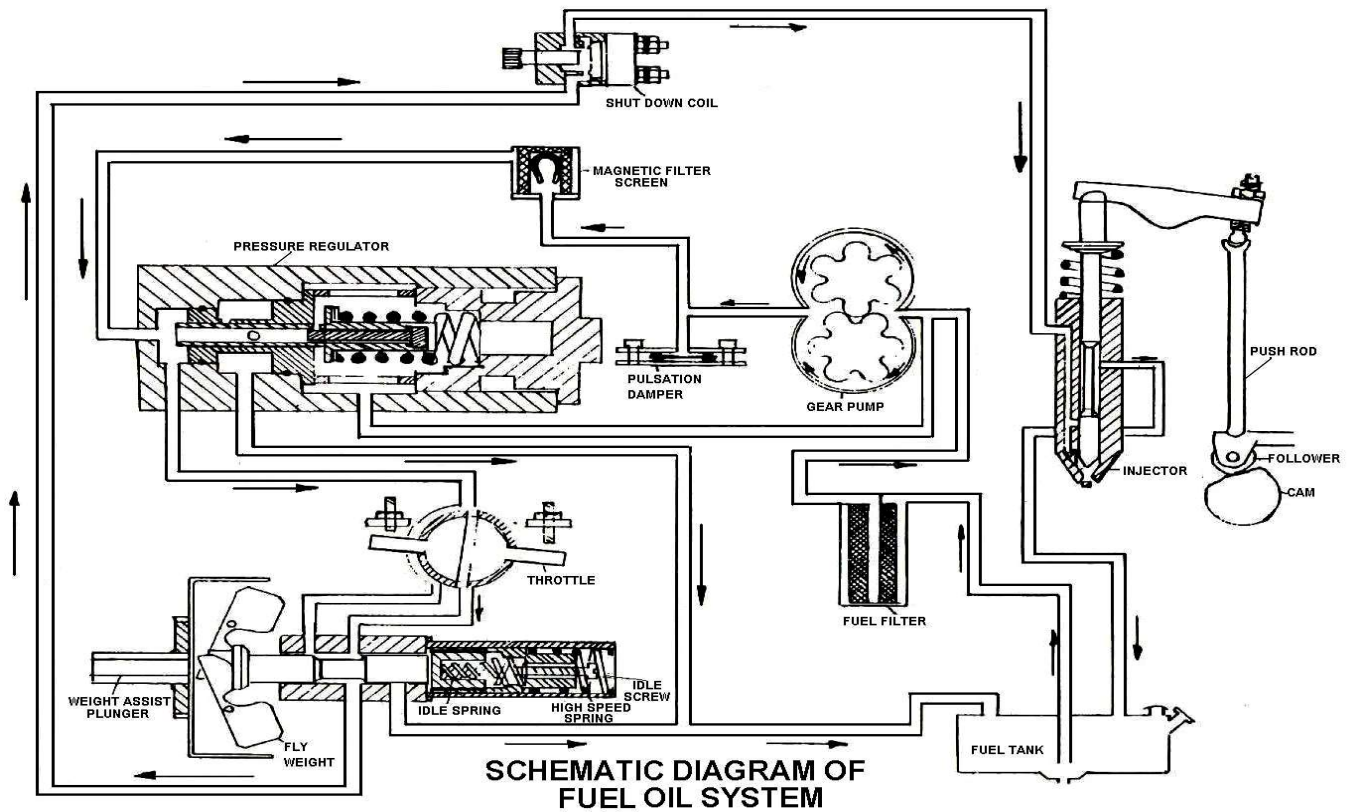
The exhaust gases are exhausted through a silencer kept on the dished rooftop of the DPC. Flexible stainless steel connection between the turbo supercharger & silencer allows for expansion due to heat of the exhaust gases.



2. FUEL OIL SYSTEM

The main components of the fuel system are :-

- i. **Fuel tank** :- It is a storage tank having capacity of fuel oil 3000 Lts .
- ii. **Fuel filter** :-This unit is fitted to remove foreign particles suspended in fuel oil
- iii. **Fuel Oil Pump (Gear type)**:- The fuel oil pump is driven by accessory drive gear shaft rotates at engine speed which draws fuel oil from the tank & supplies oil to the system.
- iv. **Pulsation damper**:- During engine running as the fuel oil pump teeth mesh and unmesh , considerable turbulence is created in the fuel . To eliminate this roughness a pulsation damper is fitted.
- v. **Magnetic filter screen**:- Pressurized fuel flows into the centre of the filter screen , which is located at the top of the fuel pump. Dirt and other materials are removed at by this filter.
- vi. **Pressure regulator** :- It regulates the fuel oil pressure in the system.
- vii. **Governor** :- Governor controls engine speed by varying the supply of the fuel oil, as per throttle position.
- viii. **Injector Assembly** :- This assembly consists unit type FIP and injector , which supplies pressurized fuel oil in the form of spray . There are 10 injector assemblies , one for each cylinder.



DESCRIPTION :-

The fuel oil system is designed to introduce fuel oil into the engine cylinders at the correct time, at the correct pressure, at correct quantity and correctly atomised. The system injects metered amount of fuel into the engine cylinder correctly in highly atomised form at a stipulated time in the four stroke cycle operation of the engine. Metering the fuel to correct required quantity is important because the engine has to work in a variable speed and with variable load .Timing the injection of fuel is also important to enable fuel to burn completely for maximum benefit out of it.

This system consists of a fuel tank of capacity 3000 Lts. Oil is drawn from the tank by gear pump via a fuel filter. The gear pump is driven by the accessory drive gear shaft and rotates at engine speed. To eliminate turbulence of the liquid fuel, pulsation damper is provided in pump outlet. Fuel then flows through the filter screen to pressure regulating valve, from regulating valve fuel is supplied to the fuel injector equipment as per throttle position through engine governor. Fuel injector equipment consists unit type FIP & injector. Shut down valve is provided in injector inlet line which has final control of fuel oil from the pump to injector. Timing the injection of fuel is carried out by cam mechanism. Fuel return line from the injector unit is connected to tank.

How Auto Governor controls engine speed :-

During cranking of an engine the engine speed should reach 190 to 250 RPM. At 150 RPM, a good gear pump will be able to pick up fuel, at these speeds, the idle spring and weight assist spring will hold the governor plunger and idler plunger together, but fuel pressure is not height.

As engine fires and speed increases, gear pump delivery also increases. But governor weight force also increases. Fuel pressure continues to rise and increase fuel flow to the engine.

As engine speed reaches 800 to 1000 RPM approximately, resistance to governor weight force increases, as idle spring and torque spring start getting compressed.

The high resistance presented by these two springs keeps the plunger surfaces very close together and continually increases fuel to engine- raising engine speed or torque.

Fuel flow continues to increase, as the throttle comes to full open, until the high speed governor spring is compressed enough that its resistance will balance the force exerted on the governor plunger.

At this point the engine's governor cut off speed has been reached, and unless position is changed to reduce it, fuel flow will continue at this 'governed' rate.

A wide open throttle will soon allow engine speed to increase beyond a safe speed in order to save the engine from such a damaging high speed and consequent failure (particularly valve and injector train damage, governor plunger is provided with small four holes through which fuel is dumped and speed decreases.

As the throttle is closed, the engine speed reduces to idle speed. Reduced governor weight speed moves the plunger back until it aligns idle port.

3 LUBRICATING OIL SYSTEM

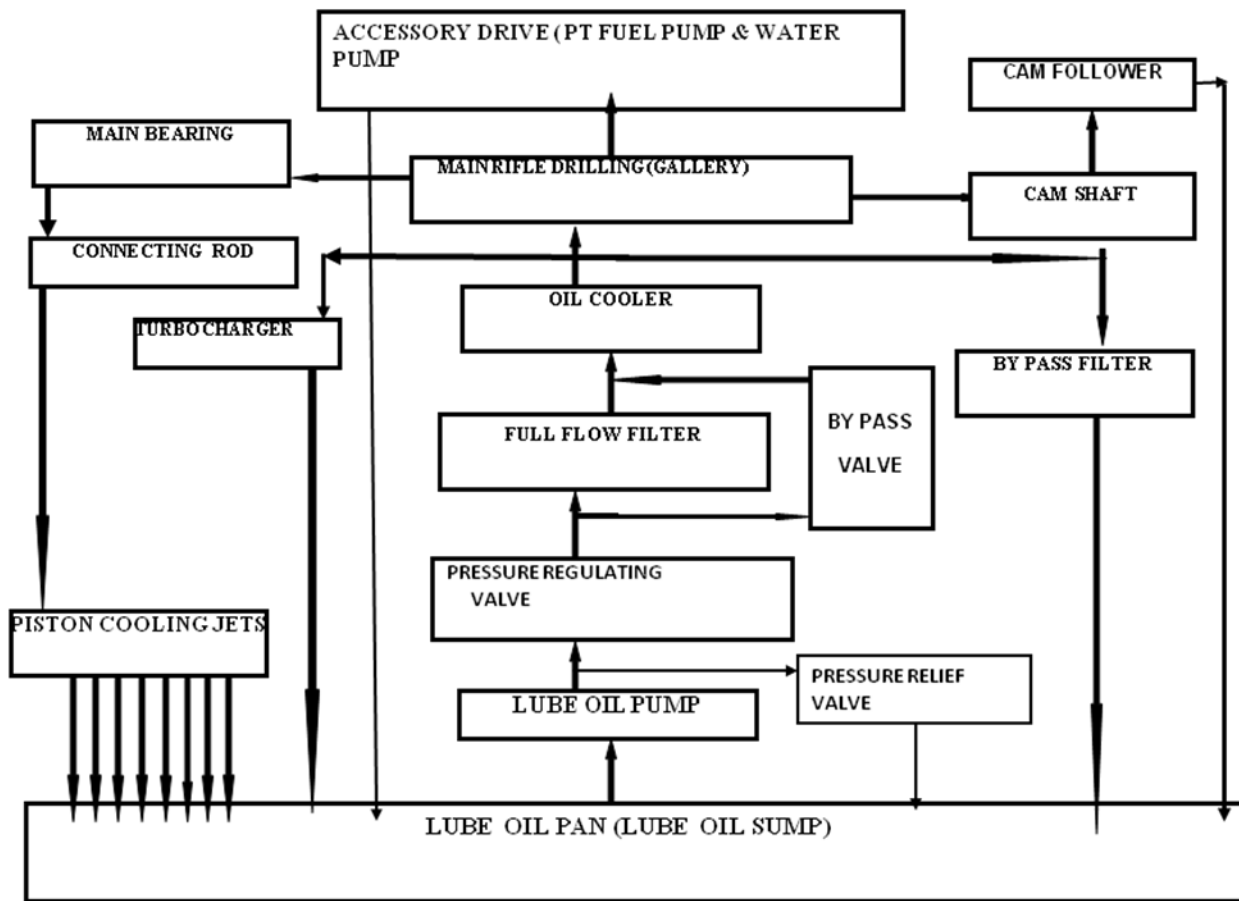
Diesel engine is fitted with force-feed lubricating oil system with low lube oil protection device.

The lube oil system has the following characteristics:-

1. To lubricate all the moving parts of the engine.
2. To help in sealing the combustion chamber from the crankcase.
3. To clean the engine by picking up foreign particles.
4. To cool the parts that it contacts.

The main components of the lube oil system are : -

- i. **Lube oil sump** :- It is a storage tank having capacity of 151 Lts .
- ii. **Lubricating oil Pump** :- It is a gear type positive displacement pump which supplies lube oil to the system.
- iii. **Lube oil Full Flow Filters** :- The purpose of lube oil filter is to remove foreign particles suspended in the oil, so that it cannot harm the engine.
- iv. **Bypass Filter** :- The function of by-pass filter is to assist the full flow filter by trapping the finer dirt particles that get through the full flow filter.
- v. **Lube Oil Cooler** :- The purpose of lube oil cooler is to cool the lube oil so that it can again absorb heat while lubricating the parts.
- vi. **Pressure regulating valve** :- It maintains lube oil pressure in the system between 3.4 to 6.2 kg/cm².
- vii. **Pressure relief valve** :- It is fitted at the discharge side of the pump which protects the pump from high pressure and controls the discharge pressure by passing a portion of the oil back to the sump.
- viii. **By pass valve** :- It is a differential pressure valve to hold a relatively constant pressure across the filter.



DESCRIPTION :-

The lubricating oil pump, mounted on the free end side of the engine sump, draws the lubricating oil from the engine sump and feed it into the system. A relief valve fitted at the discharge side of the pump which protects the pump from high pressure and controls the discharge pressure by passing a portion of the oil back to the sump. The remainder of the oil flows through the regulating valve and then passes through full flow filter, which is equipped with a differential pressure by-pass valve to hold a relatively constant pressure across the filter. From the filter the oil flows through the lube oil cooler and then into the main lubricating oil header of the engine to provide pressure lubrication to the bearing surfaces. A pipe connection from lube oil cooler goes to the both turbo super charger for cooling and lubricating the TSC and drain in the sump. A branch line of the lube oil goes for by pass filter for filtration of lubricating oil. Branch lines leading from the main header supply lubricating oil to the main bearings, connecting rods, cylinder heads, piston cooling jets and return to the sump. Another branch feeds the oil to camshaft bearings & cam follower. Sub header supplies oil to accessory drive like fuel pump & water pump etc. A small line leads to the pressure gauge and the low lube oil pressure switch for engine safety. The normal lube oil pressure of the engine is 3.4 Kg/cm² to 6.2-kg/cm² at the rated speed and normal temperature.

Checking of Lube Oil level by dipstick.

Oil gauge dipstick is located on the engine. For accurate readings, oil level should not be checked for approximately 15 minutes after engine shutdown.

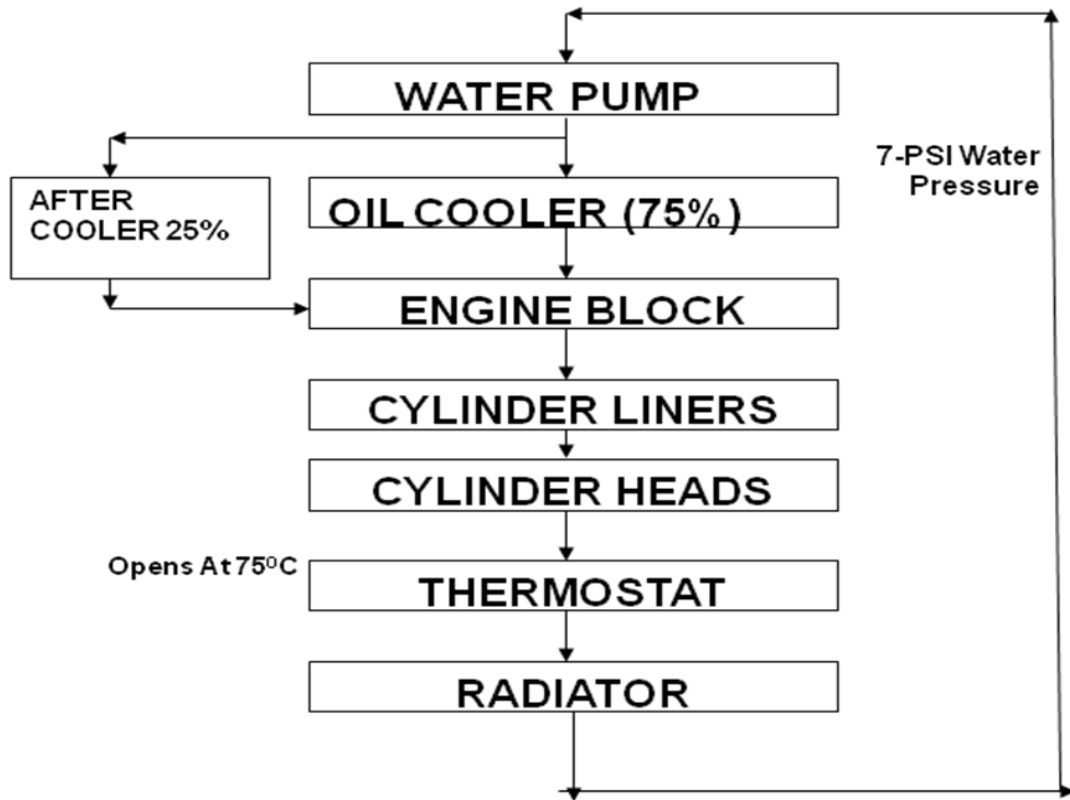
Dipstick should be kept with the pan with which it was originally fitted. Keep oil level as near "H" (high) mark as possible.

4. COOLING WATER SYSTEM

The main components of the cooling water system are :-

- i. Expansion tank :-** The capacity of expansion tank is 85 liters. It collects vent out air from engine and radiators.
- ii. Water pump :-** Water pump is the main part of water cooling system. It is used to circulate the cooling water in the system .
- iii. Radiators :-** Four radiators (two on each side) are provided in radiator compartment . The water is cooled while passing through the radiator.
- iv. Hydraulic oil coolers :-**Hydraulic oil cooler is located in the radiator compartment . It is situated at the right hand side of the engine . before the RHS radiator , it receives cold air first for cooling the hydraulic oil.
- v. Radiator Fans:-** Two nos. of radiator fans are located on top at the centre of the radiator compartment . The fans are driven by hydraulic motors. Radiator fans suck relatively cold air from atmosphere through the radiators and throw out the hot air to the atmosphere.
- vi. Ventilation fan :-**Ventilation fan is located on top of the engine compartment .Like radiator fan it is also driven by hydraulic motor. As the engine is mounted in closed compartment , ventilation is required to keep the compartment cool.





DESCRIPTION :-

After combustion of fuel in the engine, a portion of heat produced inside the cylinder is absorbed by the components surrounding the combustion chamber i.e. Piston, Cylinder, Cylinder head etc. Unless the heat is taken away from them and dispersed elsewhere, the components are likely to fail. All internal combustion engines are provided with a cooling system designed to cool the excessively hot components, distribute the heat to other surrounding components to maintain uniform temperature through out the engine and finally dissipate the excess heat to atmosphere to keep the engine temperature within suitable limit. The engine of DEMU (provided in DPC) is also provided with closed circuit pressurised water cooling system .

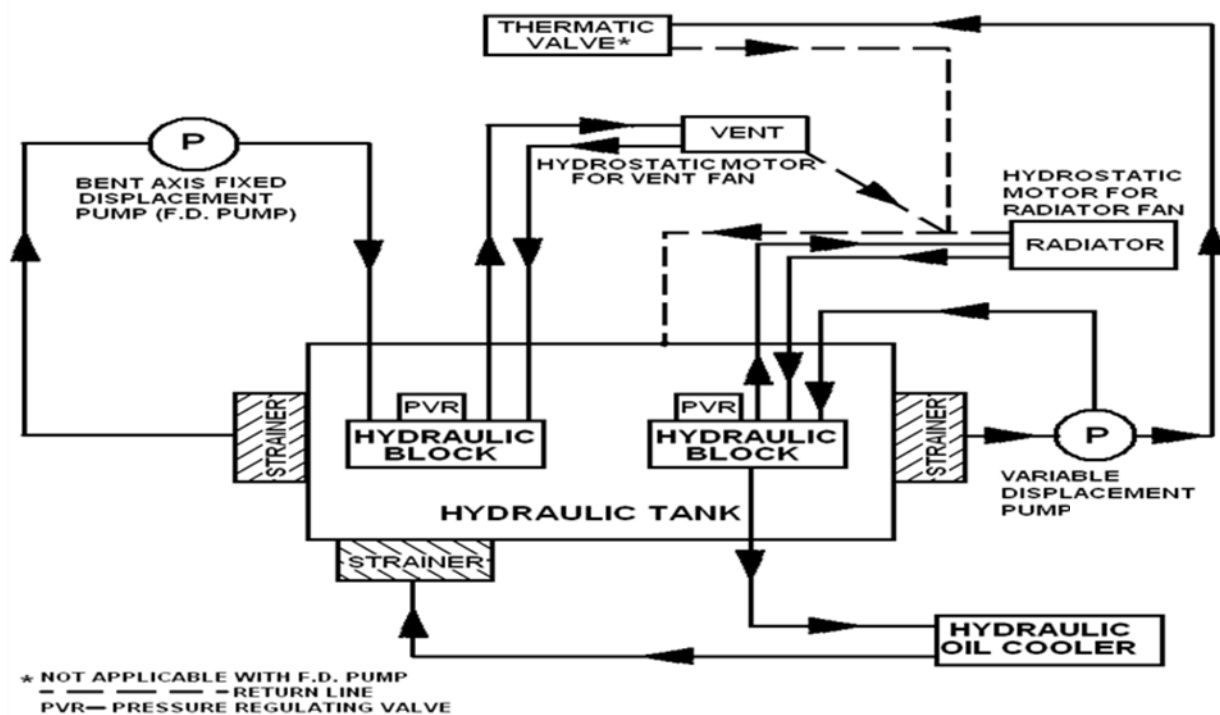
A centrifugal pump driven by the engine crank shaft through a gear, draws water from the system and delivers through the outlet under pressure. From the outlet about 25% is utilised for cooling after cooler & rest is utilised for cooling oil cooler. Both the water outlet is connected to engine block , where it cool down cylinder liner & cylinder head & then the hot water get inside the radiator core for further cooling by radiator fan & the same water is recirculated by the water pump.

5. HYDRAULIC OIL SYSTEM

The purpose of hydraulic system is to transfer the required power from engine to radiator and ventilation fans.

The main components of hydraulic system are :-

- Hydraulic tank
- Hydraulic pump
- Hydraulic Motor
- Hydraulic oil cooler
- Manifold block
- Pressure relief valve
- Thermatic valve
- Return line filter
- Return block
- Hydraulic oil level indicator
- Remote Pressure Regulating Valve
- Shut-off valve
- Hydraulic pressure gauge
- Hydraulic temp gauge



HYDRAULIC OIL SYSTEM (KCL)

DESCRIPTION :-

The purpose of hydraulic system is to transfer the required power from engine to radiator and ventilation fans.

Variable displacement pump is mounted on the engine. It is directly driven by engine gear drive with 1: 1: 1 drive ratio and is used to drive the radiator fan . The hydraulic pump which is used to drive ventilation fan is of fixed displacement type. It is mounted on engine and driven by belts from left accessory drive of the engine. Both the pumps run simultaneously to draw hydraulic oil from the hydraulic tank after passing through the strainer.

The hydraulic oil is then delivered to individual hydraulic block for running the radiator fan hydraulic motor as well as ventilation fan motor .The excess hydraulic oil is vent back to hydraulic tank .The hot hydraulic oil from the tank is allowed to pass to hydraulic oil cooler for cooling and after filtration through strainer the hydraulic oil is then recirculated in the system .

Hydraulic System Maintenance:

Hydraulic Oil for hydraulic system is expected to give a very long life, if maintained properly. One should be careful to monitor these factors, which are detrimental to oil life.

- Hydraulic oil temperature should be within the best operating. range i.e. 20°C to 60°C.
- A variation of 10° below or above this range reduces the oil life to half of the recommended period.
- Dirt entry into the system because of poor handling, transportation gasket leakage etc. is not desired.
- Viscosity of the oil should not be outside the range (74.5 to 167 mm²/second) measured within 20° C to 80 °C temperature range.
- Avoid mixing of water with the oil, which may occur during rainy season.
- Check presence of water during every 300 hours of engine maintenance by draining the bottom plug.
- Check if cloudiness is observed in the oil. Presence of water will destroy the lubricating properties of oil and cause fast wear.
- Avoid foaming of the oil, which normally occurs due to heavy churning of oil or suction of air by hydraulic pump.

Hydraulic System Do's & Don'ts:

Do's	Don'ts
Change oil after every 2000 hours of operation.	Do not exceed oil change interval more than one year or 2000 hours, whichever is earlier.
Filter Element should be changed immediately after restriction indicator shows "RED" mark.	Do not clean and re-use filter element
Replace Hoses & 'O' rings after every 6000 hours of operation or 2 years, whichever is earlier.	Do not re-use any "O" ring or Dowty washers during re-assembly.
Oil contamination level should be checked every month.	Do not use oil with contamination level exceed the limits.
Do check the thermatic valve in hot water temp bath. It should close hydraulic flow at 90 Deg. C.	Do not repair the thermatic valve. Do not reuse the thermatic valve in case flow does not seize at 90 Deg. C.
During re-fitting carefully align and route the hoses.	Do not apply force or twist the hoses for alignment and tightening.

Important Trouble Shooting for 1400 HP DEMU

S.No	Problem	Cause	Remedy
1	Engine not cranking.	<ul style="list-style-type: none"> • 24 V knife switch in OFF position. • Starting panel MCB in OFF position. • Selector switch knob not set in correct position. 	<p>- Put it ON.</p> <p>- Put it ON.</p> <p>- Put selector switch in correct position if:-</p> <ol style="list-style-type: none"> 1. Engine start by control panel, put knob on No. 1 (In this method only local engine will start) 2. Engine start by Driver cabin, put knob on No. 2 (In this method all engines will start at time)
2.	Engine cranking but not starting	Any shutdown safety device in operative position-	<p>Check all safety devices (L.H.O.L, L.C.W.L, Over speed trip, H.O.F.F etc.) if any safety device found in operative condition put it right as follows-</p> <p>Check water tank level, if any leakage found tries to stop it and reset the L.C.W.L then start the engine.</p> <p>Check lube oil level and O.P.S. connections if found lube oil in correct level. Reset the O.P.S then start the engine and record the LOP.</p> <p>Check hydraulic oil level if found necessary top up it. Check hydraulic oil tank cutout cock it should be in fully open position. If hydraulic oil level is correct reset the L.H.O.L and start the engine.</p> <p>Reset it on ECP by reset switch.</p>
		1. L.C.W.L in operative condition.	
		2. O.P.S. in operative condition.	
		3. L.H.O.L sound with indication on ECP and L.H.O.L in operative condition.	
4. Over speed indication on ECP.	Reset it on ECP by reset switch.		
		Governor MCB in OFF position	Put it ON
		Air lock in Fuel oil system.	Remove air lock in the system
3.	Engine cranking but suddenly stopped	Empty fuel tank.	Top up fuel in tank.
		Obstruction in fuel supply or main cutout cock close.	Put it ON and check priming pump cutout cocks both should be in close position.
		Air lock in Fuel oil system.	Remove air lock in the system
		Any rubber pipe crack	Replace defective pipe.

		<p>Actuator linkage in maximum position.</p> <p>Governor MCB in OFF position.</p> <p>Any shutdown safety device in operative position-</p>	<p>Check actuator position and correct it.</p> <p>Put it ON</p> <p>Check and correct as describe in S.No. 1 & 2</p>
4.	Engine not responding according to throttle.	<p>D.I.R not picking up.</p> <p>Driver's key not properly fitted.</p> <p>ECS in OFF position.</p> <p>Master controller not works properly.</p>	<p>Manually operate DIR relay.</p> <p>Driver's key fit properly.</p> <p>Put it ON.</p> <p>Check interlocks.</p>
5.	Engine over speed during start.	<p>Actuator linkage at maximum level.</p>	<p>Check actuator linkage if stick up, put it in right position.</p> <p>Check Magnetic pickup coupler for open if open then tight properly</p>
6.	Engine shut down and not starts again.	<p>Any shut down safety device in operate position.</p> <p>Over speed trip.</p> <p>LCWL operate.</p> <p>LHOL operate.</p> <p>Fuel tank empty.</p> <p>Restrict fuel supply or COC closed.</p>	<p>Set shut down device on ECS and- Check lube oil level and OPS. If engine not cranking, smoothly strike on OPS by wooden piece.</p> <p>Set over speed trip</p> <p>Check water level in the tank, top up if require.</p> <p>Check Hydraulic oil level and inspect hose pipes. Check Hydraulic tank COC they are in OPEN position and micro switch not loose.</p> <p>Top up Fuel in fuel tank.</p> <p>Check main suction line and manually fuel priming pump. Check and correct as describe in S.No. 3</p>
7.	Engine Hunting	<p>Engine not notch up properly.</p> <p>Restrict fuel supply</p> <p>Any idling device in operate condition.</p>	<p>Engine notch up properly and wait for RPM setup.</p> <p>Check for air locks and leakage, if found put it right.</p> <p>Re set operate device.</p>

8	Alarming Hot Engine	<p>Water temperature above 96^o C.</p> <p>Water pump not working properly.</p> <p>Radiator fan not working properly.</p> <p>Hydraulic pressure less.</p> <p>ETS defective.</p>	<p>Check water leakage from water pump, radiator room and engine block. Get fast pumping by put GF off for reducing temp. Check temp. of suction & outlet by hand, if temp. deference observes then water pump may not be work. Observe water pressure through vent valve.</p> <p>Ensure radiator proper fan RPM and radiator room door in closed.</p> <p>Check pressure in Hyd. Pressure gauge if found less , adjust it by pressure adjusting knob.</p> <p>Check temp. in temp. gauge and check manually water level. Remove load and get fast pumping by put GF off for reducing temp.</p>
9	Engine shutting down with LCWL signal.	<p>Low water level.</p> <p>Water leakage from SMR radiator.</p>	<p>Check water level if found less fill water. If water level is correct then disconnect LCWL connection.</p> <p>Check water level if found less fill water.</p>
10	Wheel skid / Wheel jam	<p>Brake jam</p> <p>Traction motor Bearing seized.</p> <p>Smoke coming form Traction motor.</p> <p>Defective Axle box bearing.</p> <p>DPC Traction motor pinion jam.</p>	<p>Check brakes for proper opening. Release brake by Distributor valve, close brake cylinder pipe COC.</p> <p>Isolate seized motor.</p> <p>Use fire extinguishers, Isolate seized motor.</p> <p>Check axle box bearing for over heating.</p> <p>Release brakes. Check wheel movement in reverse & forward direction.</p>
11	Air spring D- flat	<p>Air spring air hose cracked or brushed.</p> <p>Broken Air spring.</p>	<p>Isolate defective air spring.</p> <p>Check for hanging parts, if not then Isolate defective air spring.</p>
12	MR pressure not building up or MR pressure zero.	<p>Air compressor defective</p> <p>Unloader valve defective.</p>	<p>Check air compressor – Check Oil level Check V belts for broken Crack compressor pipes Check compressor pipe seat</p> <p>Close isolating valve. Check pressure switch and off MCB if required.</p>

		<p>ABD valve defective.</p> <p>Any flexible pipes crack or brushed.</p>	<p>Tapping ABD valve. Close all drain cocks and isolate ABD valve.</p> <p>Check all flexible pipes for leakage and repair it.</p>
13	Feed pipe pressure not building up	<p>MR pressure not charges properly.</p> <p>Leakage from Feed pipe</p>	<p>Prevent air leakages and charge MR pressure upto 8 kg/cm²</p> <p>Prevent air leakages from Feed pipe.</p>
14	Brake pipe pressure/ Feed pipe pressure not building up or zero.	<p>Compressor defective</p> <p>BP/FP angle cocks in wrong position.</p> <p>Any drain cocks in open condition</p> <p>BP/FP pipes palm end in open condition</p>	<p>Check air compressor – Check Oil level Check V belts for broken Crack compressor pipes Check compressor pipe seat Check intercooler for leakages.</p> <p>Put it right in position.</p> <p>Put it close position.</p> <p>Refit with new rubber washers.</p>

RECIPROCATING AIR COMPRESSOR
(MODEL –TRC 2507 OF M/S . ELGI)

TECHNICAL SPECIFICATION

MODEL	TRC 2507
Type	Reciprocating, Air cooled, Splash lubricated
Displacement	3292 Lit./min (116.252 cft/min) (3.292 M ³ /min)
Free air delivery	2600. Lit./min (91.818 cft/min) (2.600 M ³ /min)
Working pressure	7 Kgf/cm ²
Type of configuration	‘V’
Compression stage	2 stage
Cylinders	2 No. (1 LP & 1 HP)
Cylinder size (dia) & stroke	LP-197 mm, HP-127 mm, stroke - 90 mm
Type of valve (Suction & Delivery)	Individual Disc valves LP & HP
Volumetric Efficiency	79%
Compressor speed	1200 rpm
Type of lubrication	Splash
Type of cooling	Air cooled
Type of fan	Forced draught
Oil fill capacity	Max. 3000 ml. Min 2500 ml
Grade of oil	Servo Press 150
Direction of rotation	Clockwise - viewed from non driving end
Inter cooler Safety valve set pressure	5 kgf/cm ²
Overall dimensions L x B x H	670 mm x 820 mm x 855 mm
Net Weight	650 kg
Type of drive	V belt

INTRODUCTION :-

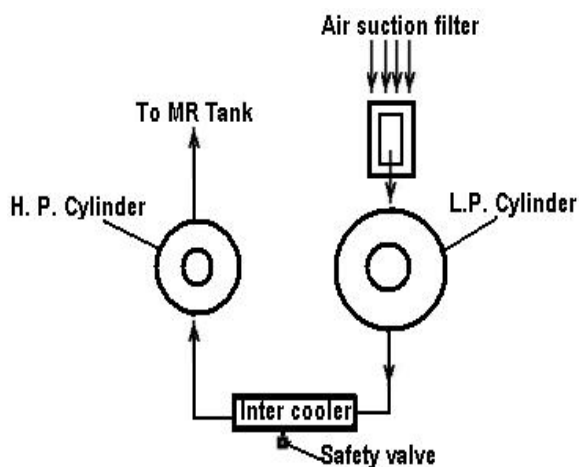
Compressed air is required for Braking system , operation of Electro pneumatic contactors, Air suspension, operation of Wind shield wipers & Horns. To get constant supply of compressed air at required pressure, a belt driven compressor at the free end of the engine is provided to supply compressed air at a required rate of 8 kg/cm² at idling speed of the engine.

The air compressor is a reciprocating type two stage, two-cylinder compressor. The compressor has splash type lubricating oil system and its cooling is done by air. The compressor consists of two cylinders arranged in a 'V' form on a crankcase, with the low pressure (LP) cylinder at the one side and the high pressure (HP) cylinder on the other side of the crankcase.

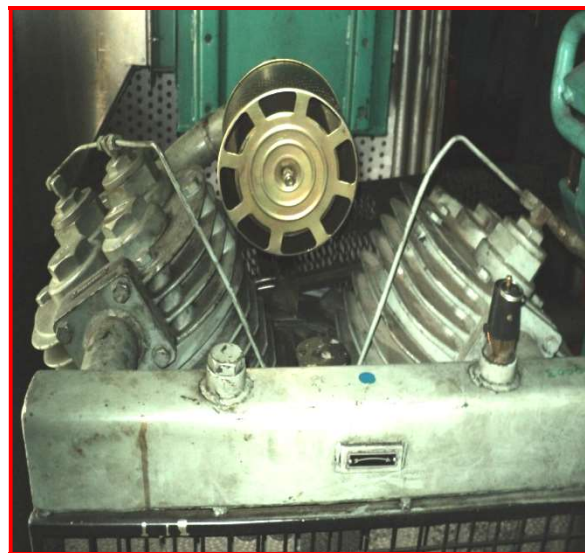
RECIPROCATING AIR COMPRESSOR

The main components of air compression system are :-

- i. **Air suction filter** :- It is a dry type air filter and fitted at the suction side of the LP (Low Pressure) cylinder . While passing through the filter element , all dust particles in the air will be absorbed by the filter . So the suction air will be dust free.
- ii. **Low pressure (LP) cylinder** :- Atmospheric air is initially compressed at low pressure inside this cylinder
- iii. **Inter cooler** :- An inter cooler is provided to cool the low pressure compressed air which will be compressed further in high pressure cylinder.
- iv. **Inter cooler safety valve** :- A safety valve is fitted in the intercooler for protection of the inter cooler and low pressure cylinder.
- v. **High pressure (HP) cylinder** :- After cooling in the intercooler , the air is further compressed at high pressure inside this cylinder.
- vi. **Crank case** :- The crankcase houses the crankshaft assembly . It also acts as the sump for the lubricating oil and is provided with an oil level indicator , a draining plug and a breather valve.
- vii. **Main air reservoir (MAR)** :- it is mounted in the under frame of DPC . High pressure compressed air is accumulated inside this reservoir. One drain cock is provided in MAR which is used for draining out of moisture from the compressed air when required.



SCHEMATIC DIAGRAM FOR COMPRESSOR



RECIPROCATING AIR COMPRESSOR

DESCRIPTION :-

Atmospheric air initially enters through air suction filter to low pressure cylinder and get compressed at low pressure. The compressed air from low-pressure cylinder manifold enters into the inter cooler manifold and passed through the inter cooler tubes. The inter cooler is of radiator type consisting tubes with fins which cools the low-pressure compressed air before compression in the high-pressure cylinder. In the high pressure cylinder, it is further compressed to attain the specified pressure. The discharge side of high-pressure cylinder is connected to the main air reservoir.

TROUBLE SHOOTING CHART FOR COMPRESSOR

Sl. No.	DEFECT	LIKELY CAUSES	REMEDIES
1	Compressor over heats	<ul style="list-style-type: none"> ● Dirty oil ● Oil level low ● Cylinder and inter cooler tube fins dirty ● Breather valve not working ● Wrong direction of rotation 	<ul style="list-style-type: none"> ● Change oil. ● Fill correct grade of oil up to maximum level in the dipstick. ● Blow with compressed air or clean manually. ● Open, clean and refit after checking. ● Interchange correct direction
2	Compressor dose not unload	<ul style="list-style-type: none"> ● Blocked unloader pipes ● Defective suction unloader 	<ul style="list-style-type: none"> ● Open and clean pipes ● Remove the suction unloader, clean and refit
3	Oil carryover in Compressed air	<ul style="list-style-type: none"> ● Chocked air filter. ● Oil level high ● Oil viscosity too low ● Breather not working ● Piston rings stuck in grooves or broken. ● Piston to cylinder clearance excessive 	<ul style="list-style-type: none"> ● Clean or renew the air filter element. ● Drain to correct level ● Change to recommended grade ● Open, clean and refit after checking ● Loosen the piston rings, if broken, change the rings as a set. Check all related parts for wear before fitting. ● Check and change as required
4	Unusual wear of cylinder, piston and piston ring	<ul style="list-style-type: none"> ● Inadequate air filter maintenance ● Oil change frequency insufficient ● Incorrect grade of oil 	<ul style="list-style-type: none"> ● Increase frequency of cleaning ● Increase frequency with more periodic check of oil ● Change to correct grade as given in recommended lubricants chart.
5	Water or rust formation in crankcase	<ul style="list-style-type: none"> ● Faulty breather valve. 	<ul style="list-style-type: none"> ● Check and replace the breather valve if necessary.
6	Oil leak through breather valve	<ul style="list-style-type: none"> ● Breather valve is not working. ● Piston rings stuck in Grooves or broken. ● Piston to cylinder clearance excessive. 	<ul style="list-style-type: none"> ● Open and refit the breather. ● Loosen the piston rings. If broken. Change the rings as a set. Check all related parts for wear before fitting. ● Check and change as required.
7	Abnormal noise and Compressor Knocking	<ul style="list-style-type: none"> ● Loose compressor pulley and key. ● Worn out piston, cylinder, crankshaft and connecting rod bearings. 	<ul style="list-style-type: none"> ● Remove pulley and examine keyway and key for wear, Change the key / pulley as required ● Overhaul compressor unit. Replace the related components.

-contd-

Sl. No.	DEFECT	LIKELY CAUSES	REMEDIES
8	Pressure built up time excessive	<ul style="list-style-type: none"> ● Chocked air filter. ● Loosen belts. ● Leak joints in pressure lines. ● Defective seating of inlet and delivery valve plates. ● Worn out piston rings. 	<ul style="list-style-type: none"> ● Renew new one. ● Adjuster or replace, if elongated. ● Open and re-tighten with Teflon tape or jute and shellac. ● Open, clean and refit after careful check. ● Replace after checking the related components.
9	Excessive belt wear	<ul style="list-style-type: none"> ● Incorrect engine and compressor pulley alignment. ● Incorrect belt tension 	<ul style="list-style-type: none"> ● Check and adjuster using a straight edge or string across the diameter of bolt the pulleys. ● Check belt adjustments frequently.
10	Compressor package vibration	<ul style="list-style-type: none"> ● Uneven surface level. ● Mounting bolts and nuts loose. 	<ul style="list-style-type: none"> ● Check the surface with spirit level and correct the surface level. ● Tighten bolts and nuts.

SCHEDULE OF STANDARD EXAMINATION OF 1400 hp BG HHPDMU

Periodicity of maintenance of CIL engine, Electrics & Controls, Brake equipments:

- i) Trip Schedule. - At end of each trip (maximum 7 days)
- ii) Monthly Schedule. - 1 month \pm 3 days
- iii) Quarterly Schedule. - 3 months \pm 3 days.
- iv) Half-yearly Schedule. - 6 months \pm 5 days.
- v) Eighteen monthly Schedule. - 18 months \pm 7 days.

Type and periodicity of schedules of Coach body, Under frame, Bogie assembly, Brake rigging:

- i) Primary . - Daily
- ii) Schedule 'A' - 1 month \pm 3 days
- iii) Schedule 'B' - 3 months \pm 7 days.
- iv) Schedule 'C' - 6 months \pm 15 days.
- v) POH - 18 months \pm 15 days.

Schedules of Periodical Overhauling(POH) of Major Items :

- i) CIL Engine : After 18,000 hrs based upon performance parameters.
- ii) Traction motors : 18 months.
- iii) Traction Alternators : 36 months.
- iv) Compressor : 18 months.
- v) Coach body & Under-gear : 18 months.

Schedule for Engine, Brake Power, Compressor etc.

SCHEDULE OF STANDARD EXAMINATION OF 1400 hp BG HHPDEMU
SCHEDULE OF STANDARD EXAMINATION OF 1400 HP BG HHPDEMU
(CIL Engine, Brake power, Compressor etc.)

TRIP SCHEDULE

DPC/DTC No: Cumulative km.

Date : Cumulative hrs.

S.No	Details of work to be carried out	Condition/action	Remarks
A. CONDITION: DIESEL ENGINE STOPPED			
1.	<u>Oil & Water filling</u> Check and top-up if necessary: a) Lube oil b) Fuel oil c) Coolant d) Hydraulic oil e) Compressor oil		
2.	Drain residue from : i) Air reservoirs. ii) Intercooler of compressor. iii) After cooler of pneumatic circuit.		
3.	<u>Engine fuel system</u> Drain sediments from water separator.		
4.	Check and clean fuel tank level gauge.		
5.	<u>V-Belts</u> Check the belts for correct tension and serviceability: a) Compressor b) Water pump. c) Hydraulic ventilation fan pump drive		

6.	<p><u>Engine air intake system</u></p> <p>a) Remove and clean dust pan.</p> <p>b) Check for complete red band on vacuum indicator. Clean outer element only with dry compressed air from inside to outside.</p> <p>Note: Replace outer element after 4/5 cleanings or as soon as red band appears immediately even after cleaning.</p>		
7.	<p>Clean the following items with dry compressed air.</p> <p>a) Panel filter (engine room).</p> <p>c) Outer body of engine air intake filters.</p>		
8.	<p>Check for red indication on return line filter on hydraulic tank. If red, change the filter.</p>		
9.	<p>Check and ensure proper fitment of hose securing clamp and hose end fittings.</p>		

B. CONDITION : DIESEL ENGINE RUNNING			
10.	<u>Mechanical (General examination)</u> a) General visual checking to be made to detect loose, defective, missing or leaky parts in the following systems: i) Cooling water ii) Lube oil iii) Fuel oil iv) Air intake & exhaust v) Hydraulic vi) Pneumatic b) Ensure proper working of all gauges. (DPC & DTC)		
11.	Check and ensure that hydraulic valve is fully open.		
12.	Check radiator fan Hydraulic oil pressure & temperature	Pressure	Temp.
Pressure : 150- 180 bar			
Temperature : Not more than 70°C			
13.	Check operation of compressor to ensure that there is no noise and vibration.		
14.	Check and record:	Idle	1800 rpm
Engine lube oil pressure: Permissible values;			
*1-2 kg/ cm. ² for idle			
*3-7 kg/ cm. ² for 1800rpm			
Lube oil temp: Should lie between 75°C - 105°C .			
Cooling water temp : Not more than 95°C			

SCHEDULE OF STANDARD EXAMINATION OF 1400 hp BG HHPDEMU

S.No	Details of work to be carried out	Condition/action	Remarks
15.	<p><u>Pneumatic system</u> (DPC ,DTC)</p> <p>a) Time for charging the main air reservoir from 0 to 7 kg/cm². 10 min.</p> <p>b) MR cut in pressure. 6 ± 0.1 kg/cm²</p> <p>c) MR cut out pressure. 7 ± 0.1 kg/cm²</p> <p>d) MR safety valve starts blowing off at. 7.75 kg/cm²</p>		
16.	<p>Check and record the following :</p> <p>a) Brake Cylinder Pressure.</p> <p>DPC – 1.6 kg./cm.²</p> <p>DTC – 3.5 kg./cm.²</p> <p>b) BP pressure : 5.0 kg./ cm.²</p> <p>c) Feed .Pipe Pressure 6.0 kg./ cm.²</p> <p>d) Parking Brake pressure 3.5 kg./ cm.²</p>		
17.	<p><u>Functional Test : (DPC & DTC)</u></p> <p>a) A9 valve : Apply & Release</p> <p>Satisfactory</p> <p>b) SA9 valve : ---do----</p> <p>c) Guard's valve : ---do---</p> <p>d) Deadman's device : ---do----</p>		
18.	Check working of wiper		
19.	Check working of horn.		
	<i>Repairs booked by driver</i>		
	1.		
	2.		
	SSE (DEMU) Name & Sign	SUP Name & Sign	

EXAMINATION OF 1400 hp BG HHPDEMU
SCHEDULE OF STANDARD EXAMINATION OF 1400 HP BG HHPDEMU
(CIL Engine, Brake power, Compressor etc.)

MONTHLY SCHEDULE

DPC/DTC No.: Cumulative km.

Date : Cumulative hrs.

Repeat all checks of Trip Schedule

S.No	Details of work to be carried out	Condition/action	Remarks
A. CONDITION : DIESEL ENGINE STOPPED			
1.	<u>General check :</u> Check tightness of foundation/ mounting bolts of the following : a) Engine, b) Radiators, c) Compressor d) Radiator & Ventilation fan . e) Inlet & Exhaust manifolds.		
2.	<u>Change the following filters (after 300 hrs / monthly, whichever is earlier) :</u> a) Engine lube oil system :- i) Full flow filter ii) By-pass filter b) Engine fuel filter		
3.	Change Engine Oil (<u>after 300 hrs / monthly, whichever is earlier</u>) .		
4.	<u>Fuel inlet connection screens :</u> Check and clean magnetic filter screens in fuel system.		
5.	Check throttle linkages with hand for freeness.		

6.	<p>Clean and inspect. Replace if damaged.</p> <p>a) Crank case breather, b) Compressor breather, c) Fuel Tank breather, d) Hyd. Tank breather.</p>		
7.	<p>Coolant :</p> <p>Engines provided with Borate base coolant(i.e. Coolant Additive Concentrate-CAC)</p> <p>- Check coolant for CAC with Test strip.</p> <p>- Add CAC if value per litre < 0.6.</p> <p>- If coolant colour is pink, pH is within limit (8.5to 10.0).</p> <p>- If colourless, add CAC to maintain concentration.</p>		
8.	<p>i) Hydraulic oil to be checked for water contamination by draining sample from the bottom plug and see if cloudiness is observed in the oil.</p> <p>ii) Hydraulic oil & filter to be changed <u>(only during first monthly and then during Half-Yearly schedule)</u></p>		
9.	<p><u>Compressors;</u></p> <p>i) Remove and clean the oil bath air filter.</p> <p>ii) Change oil in oil bath air filter.</p> <p>iii) Change crank case oil.</p>		

EXAMINATION OF 1400 hp BG HHPDEMU

S.No	Details of work to be carried out	Condition/action	Remarks
10.	Check air piping. Visually inspect hoses, pipes for damages/cracks and clamps for looseness.		
11.	Test and refill the fire extinguishers if necessary.		
B. CONDITION : DIESEL ENGINE RUNNING			
12	<u>Cooling water system</u> Check that vent pipes in the system are open.		
13.	<u>Check working of radiator fan:</u> Radiator fan RPM should be measured by inserting tachometer at fan shaft. Side mounted Min. : 750 Radiator Max. : 1600 Vent Fan Max. : 1200		
14.	Check safety valve operation of compressor. (9.0 kg/cm ²)		
	<i>Repairs booked by driver</i>		
	1.		
	2.		
	SSE (DEMU) Name & Sign	SUP Name & Sign	

SCHEDULE OF STANDARD EXAMINATION OF 1400 HP BG HHPDEMU
(CIL Engine, Brake power, Compressor etc)
QUARTERLY SCHEDULE

DPC/DTC No.: Cumulative km.

Date : Cumulative hrs.

Repeat all checks of Trip & Monthly Schedule

S.No	Details of work to be carried out	Condition/action	Remarks
CONDITION : DIESEL ENGINE STOPPED			
1.	<u>Compressors</u> a) Open crankcase door and check all connecting rod nuts and bolts. b) Remove, dismantle and clean the disc valves. Assemble with new packings. c) Clean the intercooler.		
2.	<u>A-9 & SA-9 brake valves for DPC & DTC.</u> Lubricate brake valve cams.		
3.	<u>Pneumatic System :</u> i) Clean aftercooler externally by blowing compressed air. ii) Blow down air reservoirs with compressed air and clean.		
4.	<u>Fuel injectors and valves (only during first quarter and then during POH)</u> a. Adjust fuel injectors. b) Check and ensure valve clearance as : - Inlet : 0.36 mm - Exhaust : 0.69 mm. Replace Rocker cover gasket & tighten the cover capscrew to 45 Nm.		
5.	Check water pump for free rotation.		
A. <u>CONDITION: DIESEL ENGINE RUNNING</u>			
5.	Check for leakages in all the systems.		
	<i>Repairs booked by driver</i>		
	1.		
	2.		
	SSE (DEMU) Name & Sign	SUP Name & Sign	

SCHEDULE OF STANDARD EXAMINATION OF 1400 HP BG HHPDEMU
(CIL Engine, Brake, Compressor etc.)
HALF-YEARLY SCHEDULE

DPC/DTC No.: Cumulative km.

Date : Cumulative hrs.

Repeat all checks of Trip, Monthly & Quarterly Schedule

S.No	Details of work to be carried out	Condition/action	Remarks
CONDITION : DIESEL ENGINE STOPPED			
1.	Hydraulic system		
A.	Change oil.		
B.	Change return line filter element.		
C.	Clean and check strainer for external damage. Change if necessary.		
CONDITION : DIESEL ENGINE RUNNING			
2.	Check for leak-offs from pumps in the hydraulic systems. Remove leak-off hose and collect oil in measuring jar for one minute. i) Radiator pump leak-off : Variable Displacement < 6.300 litres/min. Fixed Displacement < 5.600 litres/min. ii) Vent pump leak-Off < 1.900 litres/min.		
3.	Check for leakages in the system.		
	REPAIRS BOOKED BY DRIVER AND REPEATED BOOKING		
	1		
	2		
	3		
	SSE (DMU)'s SIGN.	SUP.	SIGN
	NAME	NAME	

STANDARD SCHEDULE EXAMINATION OF 1400 HP HHPDEMU

(CIL Engine, Brake , Compressor etc.)

EIGHTEEN MONTHLY SCHEDULE

DPC/DTC No.: Cumulative km.

Date : Cumulative hrs.

Repeat all checks of Trip, Monthly, Quarterly & Half-yearly Schedule

S.No	Details of work to be carried out	Condition/action	Remarks
Air Intake & Exhaust System			
1.	<u>Turbocharger</u> i) Check oil leakages through intake & exhaust seals. ii) Check turbocharger shaft end clearance with a dial depth gauge (value: 0.05mm to 0.13 mm). iii) Repair the turbo with repair kit.		
2.	Check for leakage in air intake system, if any, rectify the same with necessary parts.		
3.	Replace air cleaner inner & outer filter elements		
4.	Check vacuum indicators for functioning of reset button & external damages and replace if necessary		
5.	Check for leakage from exhaust system, if any, rectify the same with necessary parts.		
6.	Check & replace hoses & clamps of air intake pipings on condition basis.		
7.	Check air intake and exhaust piping supports. Take corrective action accordingly.		
8.	Clean the engine room panel filters by dry compressed air and replace if necessary.		
Fuel System			
1.	Clean water separator assembly.		
2.	Replace fuel filter element.		
3.	Replace all fuel line hoses.		
4.	Calibrate the injectors after replacing the cups and O-rings.		
5.	Calibrate the PT pump by replacing the necessary parts need to be changed for calibration (magnetic filter, gasket set, etc.)		

S.No	Details of work to be carried out	Condition/action	Remarks
6.	Adjust valve. Check the conditions of push rods, adjusting nut & screws, if necessary replace.		
7	Check fuel lines & connections for leakage.		
8	Check fuel pump linkages.		
9	Check actuator functioning.		
10.	Clean thoroughly fuel tank with steam and detergents and dry the tank with air blast.		
Lubricating Oil System			
1.	Replace engine oil.		
2.	Replace full flow & bypass filter elements.		
3.	Replace all oil line hoses & clamps.		
4.	Check external oil leakage from head gasket/rocker housing gasket, seals, etc. If necessary, replace the same.		
Cooling System			
1.	Flush cooling water tank. Replenish with CAC and water . Replace CR element of system with CAC for DPCs having CR element. Check for concentration.		
2.	Replace water pump drive belts.		
3.	Replace all hoses, clamps & coupling O-Rings of cooling system pipe lines and radiator assembly.		
4.	Remove radiator assembly (RMR) from the mounting & clean the radiator assembly.		
5.	Check all radiator Anti Vibration Mountings and replace if necessary.		

Hydraulic System			
1.	Replace hydraulic oil. Ensure that oil cleanliness level is of NAS1638 Class 9 or better		
2.	Replace hydraulic oil return line filter.		
3.	Replace vent pump belts.		
4.	Clean hydraulic system strainer. Check for external damage, replace if necessary.		
5.	Check thermatic valve operation.		
6.	Externally clean & check leak-offs from main hydraulic & ventilation pump at rated speed. Radiator fan pump : Variable Displacement < 6.300 litres/min. Fixed Displacement < 5.600 litres/min. Vent fan pump : < 1.900 litres/min		
	Externally clean & check leak-offs from main hydraulic & ventilation motor at rated speed. Radiator fan motor : < 2.550 litres/min. Vent fan motor : < 0. 8 litres/min		
7.	Externally clean & check radiator fan operation		
8.	Externally clean & check vent fan operation		
9.	Hoses: i) Replace all hydraulic pressure line hoses. ii) Replace all hydraulic leak-off & return line hoses on condition basis.		
10.	Clean hydraulic oil cooler externally.		
11.	Check & set hydraulic system pressure at 170 bar		
12.	Compressor : i) Dismantle and overhaul ii) Replace worn out parts. iii) Replace all 'O' rings, gaskets, oil seals. iv) Assemble and run the compressor to evaluate its performance.		

13.	Brake valves : i) Dismantle and overhaul all brake valves. ii) Replace all 'O' rings seals and gaskets. iii) Assemble and test to evaluate their performance.		
14.	Check Vibration damper, replace if necessary.		
15.	Carry out repairs advised by Shed in Pre-Shopping report.		
CONDITION : DIESEL ENGINE RUNNING			
16.	Carry out the load box test to check the performance of engine.		
17.	Check for the leakages in various systems.		

