

STC

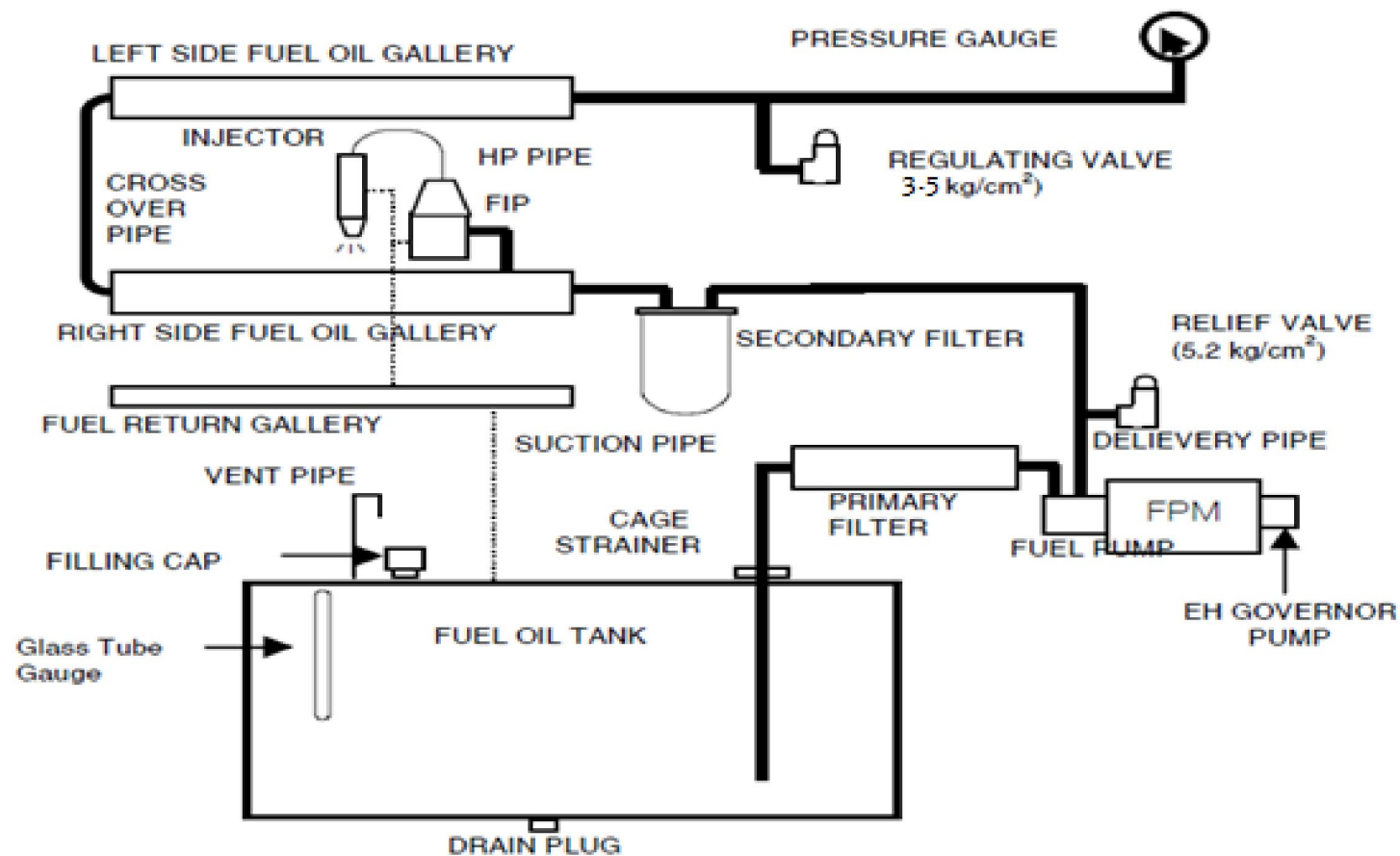
Charbagh, Lucknow



Fuel Oil System

All locomotive units have individual fuel oil system. The fuel oil system is designed to introduce fuel oil into the engine cylinders at the correct time, at correct pressure, at correct quantity and correctly atomised. The system injects into the cylinder correctly metered amount of fuel in highly atomised form. High pressure of fuel is required to lift the nozzle valve and for better penetration of fuel into the combustion chamber. High pressure also helps in proper atomisation so that the small droplets come in better contact with the fresh air in the combustion chamber, resulting in better combustion. Metering of fuel quantity is important because the locomotive engine is a variable speed and variable load engine with variable requirement of fuel. Time of fuel injection is also important for better combustion.

Fuel Oil System



Fuel Feed System And Its Associate Components

Fuel oil tank

A fuel oil tank of required capacity (normally 5000ltrs), is fabricated under the superstructure of the locomotive and located in between the two bogies. Baffle walls are used inside it to arrest surge of oil when the locomotive is moving. A strainer filter at the filling plug, an indirect vent, drain plug, and glow rod type level indicators are also provided.

Fuel Feed System And Its Associate Components

Fuel primary filter

A filter is provided on the suction side of the fuel transfer pump to allow only filtered oil into the pump. This enhances the working life of the fuel transfer pump. This filter was initially a renewable bleached cotton waste packed filter, commonly known as socks type filter element. These socks type filters are coarse filters and have a greater ability to absorb moisture, and are economical. However, in most places, it has been replaced by paper type filter, which have longer service life

Fuel Feed System And Its Associate Components

Fuel transfer pump or booster pump

The fuel feed system has a transfer pump to lift the fuel from the tank. The gear type pump is driven by a dc motor, which is run by storage batteries through a suitable circuit. Currently it has been replaced with AC fuel pump motor with built in inverter.

Fuel Feed System And Its Associate Components

Fuel relief valve

The spring- loaded relief valve is meant for by passing excess oil back to the fuel tank, thus releasing excess load on the pump and on the motor, to ensure their safety. It is adjusted to a required pressure (normally 5.2 kg/cm²), and it by- passes the excess fuel back to the oil tank. It also ensures the safety of the secondary filter and the pipe lines.

Fuel Feed System And Its Associate Components

Fuel secondary filter

The fuel secondary filter is located after the booster pump in the fuel feed system. The filter used is a paper type filter, cartridge of finer quality, renewable at regular intervals. This filter arrests the finer dirt particles left over by the primary filter and ensures longer life of the fuel injection equipments.

Fuel Feed System And Its Associate Components

Fuel regulating valve

The fuel-regulating valve is spring-loaded valve of similar design as the fuel relief valve. It is located after the secondary filter in the fuel feed system. This valve is adjusted to the required pressure (3.5 kg/cm²), and always maintains the same pressure in the fuel feed system by releasing the excess oil to the fuel oil tank. There is no by-passing of oil if the pressure is less than the adjusted level.

Fuel injection system and Its Components

Fuel Injection pump

It is a constant stroke plunger type pump with variable quantity of fuel delivery to suit the demands of the engine. The fuel cam controls the pumping stroke of the plunger. The length of the stroke of the plunger and the time of the stroke is dependent on the cam angle and cam profile, and the plunger spring controls the return stroke of the plunger.

Fuel injection system and Its Components

The plunger moves inside the barrel, which has very close tolerances with the plunger. When the plunger reaches to the BDC, spill ports in the barrel, which are connected to the fuel feed system, open up. Oil then fills up the empty space inside the barrel. At the correct time in the diesel cycle, the fuel cam pushes the plunger forward, and the moving plunger covers the spill ports. Thus, the oil trapped in the barrel is forced out through the delivery valve to be injected into the combustion chamber through the injection nozzle

Fuel injection system and Its Components

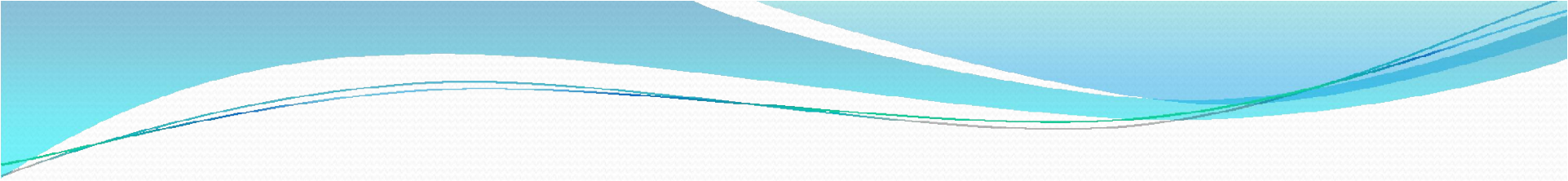
Fuel injection nozzle

The fuel injection nozzle or the fuel injector is fitted in the cylinder head with its tip projected inside the combustion chamber. It remains connected to the respective fuel injection pump with a steel tube known as fuel high pressure line. The fuel injection nozzle is of multi-hole needle valve type operating against spring tension. The needle valve closes the oil holes by blocking the oil holes due to spring pressure. Proper angle on the valve and the valve seat, and perfect bearing ensures proper closing of the valve.

Orifice Test

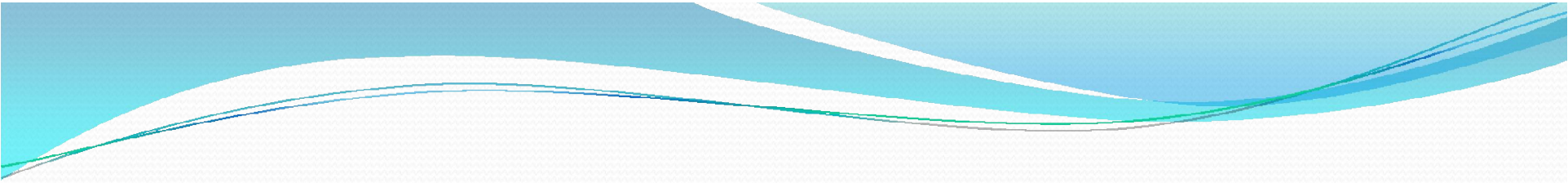
This test is a rough and ready method to ascertain the efficiency of the fuel feed system under full load condition. The procedure of testing is as under:

1. An orifice plate of $\frac{1}{8}$ inch is fitted in the system before the regulating valve.
2. A container to be placed under the orifice to collect the oil that would leak through it during the test.
3. The fuel booster pump to be switched on for 60 seconds. The rate of leakage should be about 9 lt. of fuel per minute through the orifice. The system should be able to maintain 3 kg /cm.sq pressure with this rate of leakage.



Lube oil system

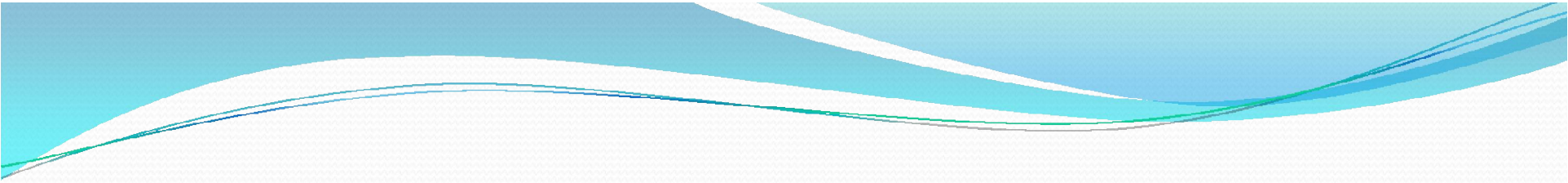
- Introduction
- Components of Lube oil system
- Working
- Problem related to lube oil system



Lube oil system

The lubricating system in a diesel engine is of vital importance. The lubricating oil provides a film of soft slippery oil in between two frictional surfaces to reduce friction and wear. It also serves the following purposes.

- Cooling of bearing, pistons etc.
- Protection of metal surfaces from corrosion, rust, surface damages and wear
- Keep the components clean and free from carbon, lacquer deposits and prevent damage due to deposits.

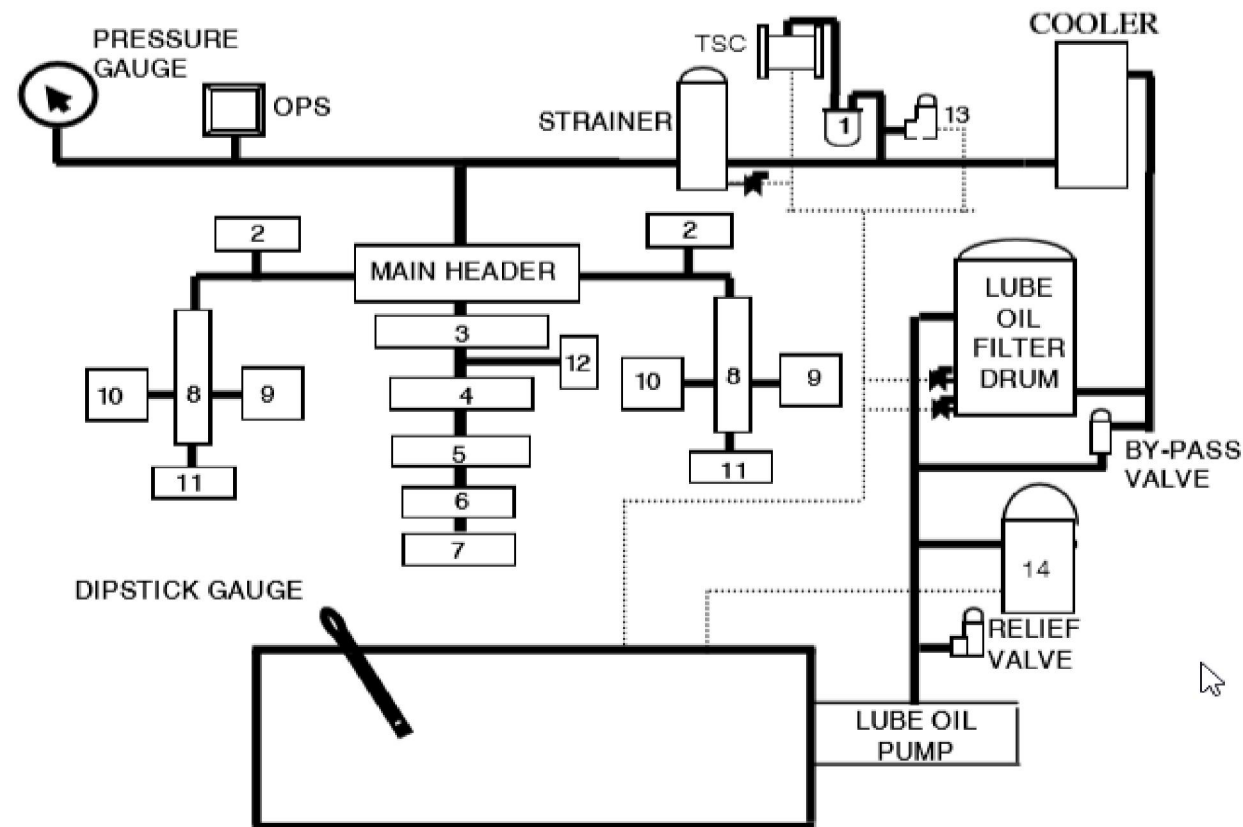


lube oil system of WDM2 loco

The system essentially consists of the following components.

1. Gear type lube oil pump
2. Spring loaded relief valve
3. Lube oil filter tank
4. Differential bypass valve
5. Lube oil cooler
6. Regulating valve
7. Lube oil strainer
8. Oil pressure switch
9. Oil pressure gauge
10. Oil sump capacity 1270 lt.

lube oil system of WDM₂ loco



1-MICRO FILTER
2- CAM SHAFT BEARINGS
3-MAIN BEARINGS
4- CRANK PIN
5-PISTON PIN

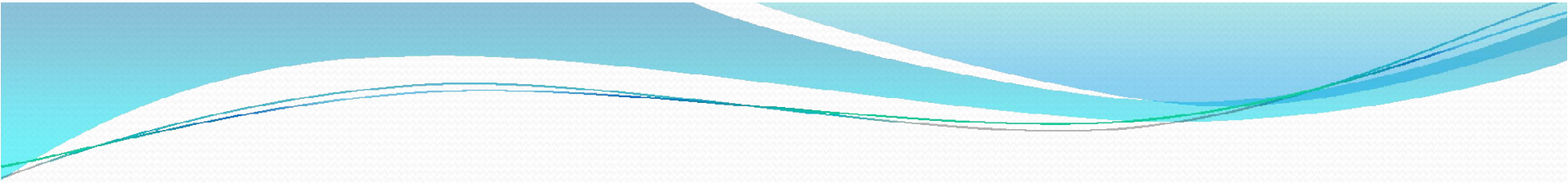
6-PISTON CROWN
7-CYLINDER LINER
8.SUB HEADER
9. ROCKER ARM ASSEMBLY
10. FIP LIFTER

11-SPRAY NOZZLE
12- VIBRATION DEMPER
13- RELUGULATING VALVE
14- CENTRIFUGAL FILTER

lube oil system of WDM₂ loco

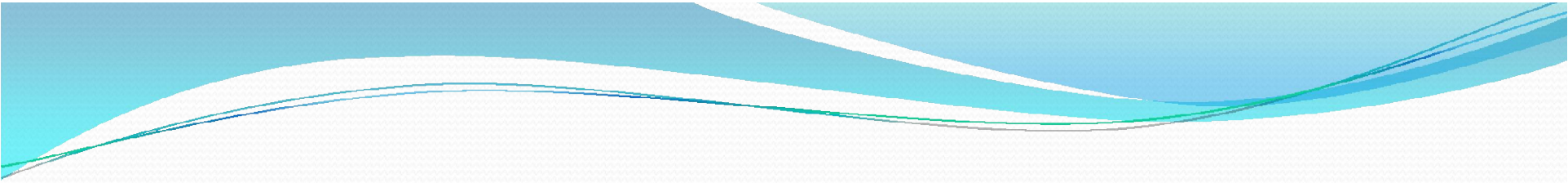
Forced lubrication system is used in diesel locomotive, detail of system is as -

Lower portion of engine crank case, it termed as lube oil sump, its capacity is 1270 liters. To fill the lube oil filling cap is provided on free end engine right side. Dipstick gauge is provided near R5 cylinder for measuring lube oil level. While checking lube oil level engine should be on idle condition and crank case exhaustor motor should be in ON position.



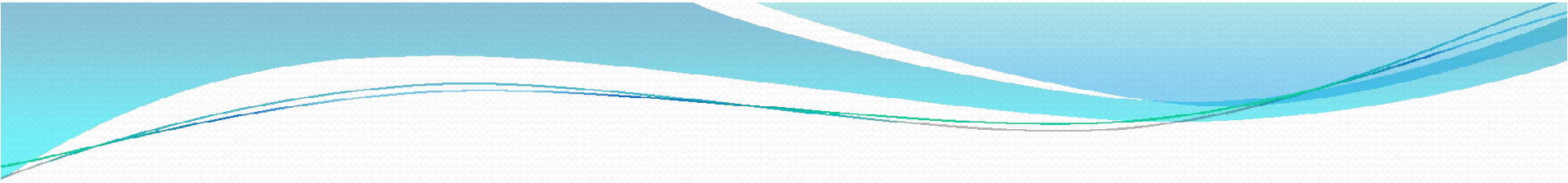
lube oil system of WDM₂ loco

Lube oil pump is "Positive displacement type" and located in engine room right side free end. It gets drive from main crank shaft extension shaft no. 1 gear. When diesel engine starts, lube oil pump also starts working; it sucks oil from the sump and sends to delivery pipe, on delivery pipe relief valve (setting 9.5 kg/cm²) is provided. Oil from delivery pipe goes to filter drum & centrifugal filter.



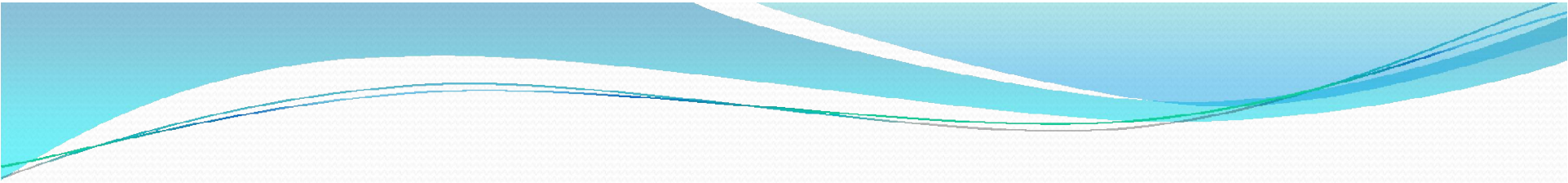
lube oil system of WDM₂ loco

Filtered oil from lube oil filter drum goes to lube oil cooler, it is located in radiator room here oil gets cool with water tubes. After that a connection given to TSC through micro filter to lubricate bearing in intermediate casing. The oil coming from lube cooler goes to lube oil strainer ,strainer has one drain cock it should be tied and sealed. From strainer filtered oil goes to main header.



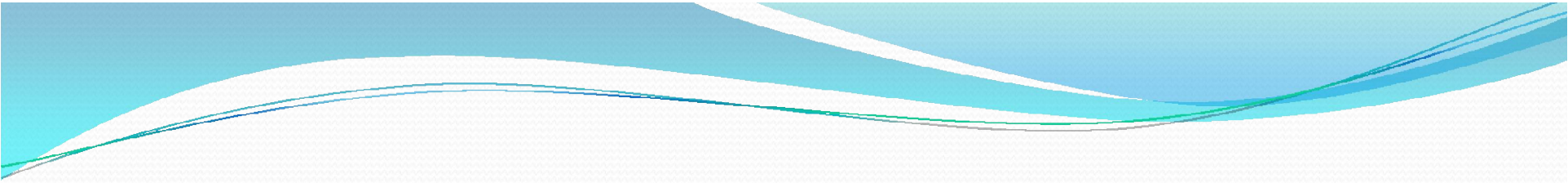
lube oil system of WDM₂ loco

Main header having 9 S-type jumper pipes and each pipe is connected to main bearing. After lubricating main bearing oil goes to crank pin and lubricates connecting rod bearing. Through connecting rod oil goes to piston pin and lubricated it and also cools the piston crown, further oil dropped in the sump through return passage, while dropping oil splash and lubricate the cylinder liners



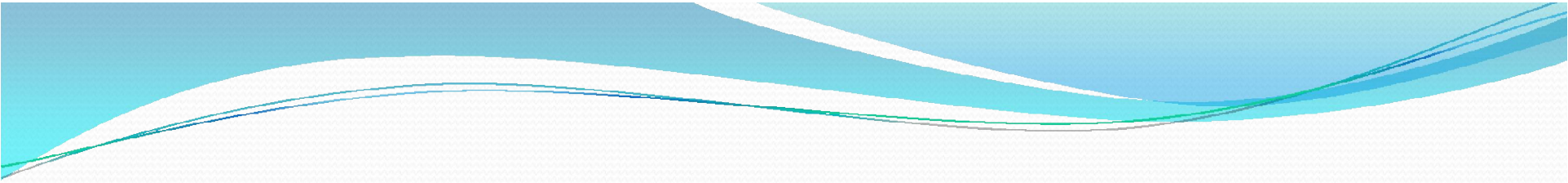
lube oil system of WDM₂ loco

Two pipe connections were given from main header to sub header and one 'T' joint on each pipe given for cam shaft, which helps in lubricating cam shaft bearings. From both sub header two pipe connections are provided for each cylinder to lubricate rocker arm assembly and fuel pump lifter. At the end of both sub header on power take off end one nozzle is provided to lubricate cam shaft gear as well as split gear in spray form.



Crank case exhaustor motor

It is located on engine left side power take off end. Initially it starts on battery further it work on auxiliary generator out put. A blower is fitted on its shaft which creates partial vacuum and evacuated gasses from crank case sump. Working of motor is confirmed from its indication lamp provided on both control desks



Crank case explosion door

Due to any reason if pressure of the gasses inside the engine block is increased which leads to damage engine block. To avoid the damage crank case explosion doors are provided. When pressure increased more than prescribed level explosion door gets burst and safe guard the engine block. On each side of crank case one spring loaded type explosion door is provided in place of crank case cover



problems related to lube oil system

Lube oil pressure in not building up

Causes:

Low oil level in the sump

Drain cock of filter drum/strainer open

Pressure relief/ regulating valve stuck up.

High temperature of engine

Leakage in lube oil system

Water mixing in lube oil

Fuel oil mixing in lube oil



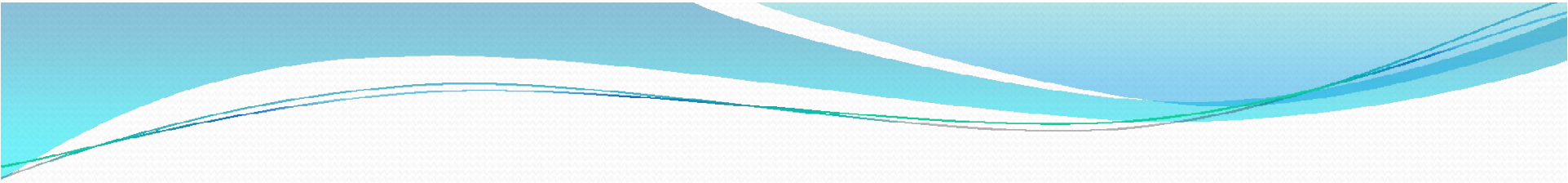
problems related to lube oil system

Lube oil level increasing in lube oil sump

Causes:

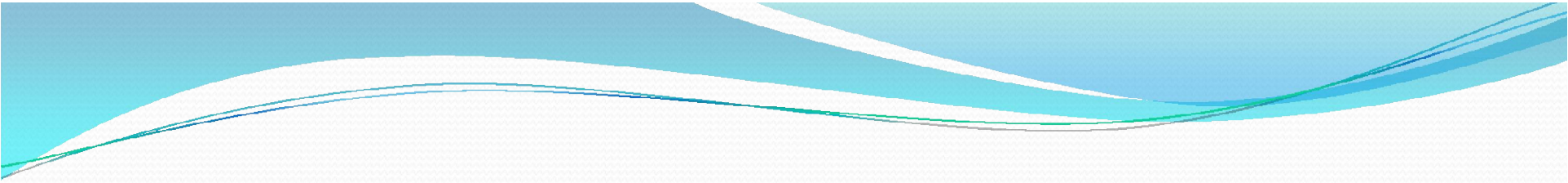
Water is mixing in lube oil

Fuel oil mixing in lube oil



Supercharging system

- Introduction
- Benefits and method of supercharging
- Construction and working of supercharger
- Problem related to supercharging



Supercharging system

The process of increase air pressure more than atmospheric pressure and deliver in cylinder for fuel combustion is called supercharging. The IC engine in which air for combustion enters at atmospheric pressure is called normally aspirated engine, and in which it enters at an increased pressure is called charged engine.



Benefits and method of supercharging

It increases the efficiency of the engine up to 50% with same engine dimension.

It increases better cooling of engine components like valves, head etc.

It helps in maintaining the components carbon free.

It helps in reducing the thermal stress due to scavenging action of air.



Benefits and method of supercharging

By using reciprocating compressor : this method is not suitable for railway purpose as it requires more space and load on the loco will also get increased.

By using roots blowers: In this method charging of air is done by blowers driven by engine gears. This method is less efficient for railway purpose.

Blowers driven by exhaust gases: In this method waste gases are used for driving a turbine, which in turn rotates a diffuser and charge air is created. It is best suited method for locomotives.

Construction of supercharger

TSC having four casing

1. Gas inlet casing
2. Turbine casing
3. Intermediate casing
4. Blower casing

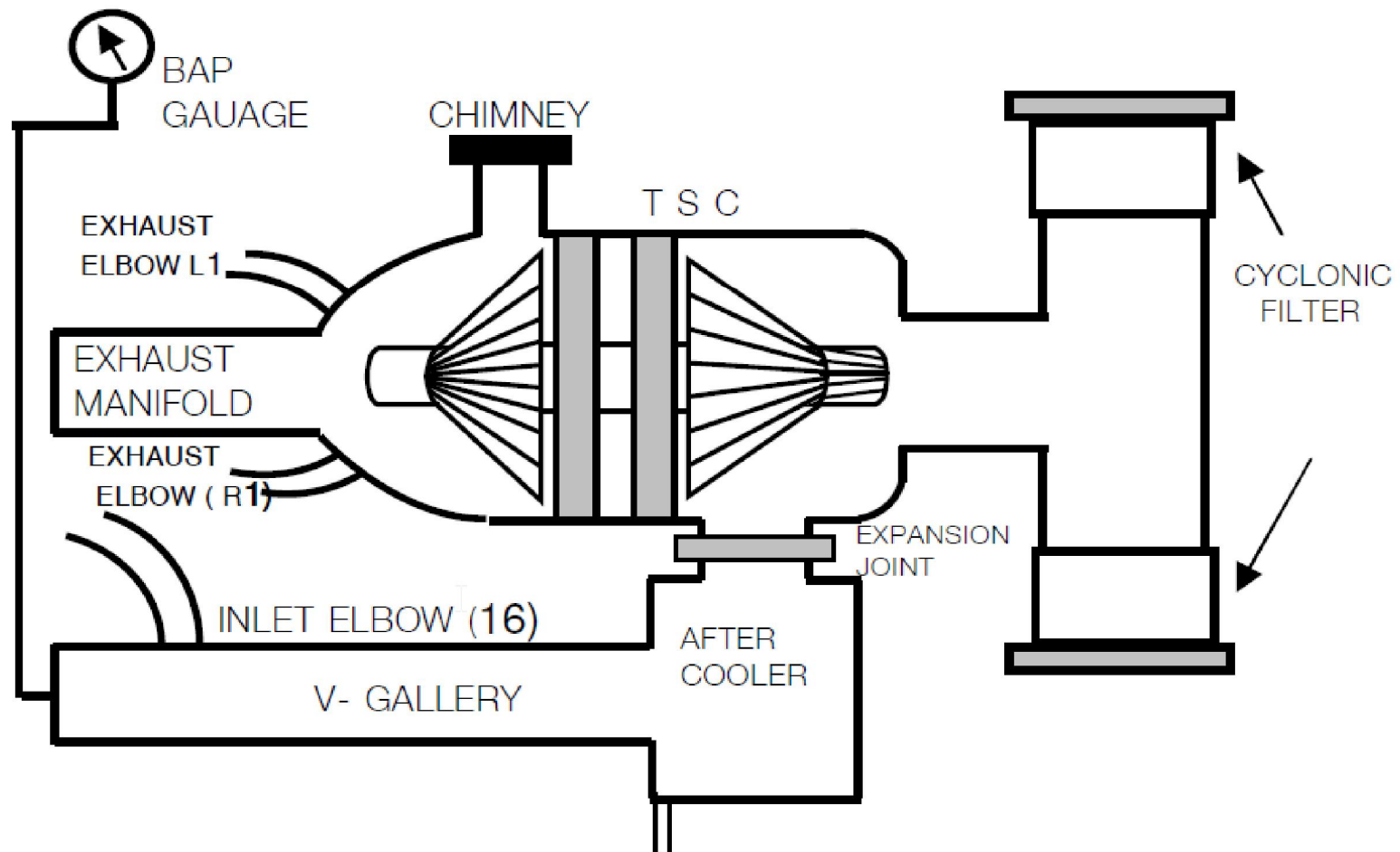
Gas inlet casing is connected with exhaust manifold. One dome is provided in this casing. Rotor shaft is fitted in intermediate casing; turbine and blower are fitted on this shaft. Turbine is fitted in turbine casing and blower in blower casing. Gas inlet casing is connected to turbine casing through nozzle ring. One side of blower casing connected with cyclonic filter and other with expansion joint to after cooler. There is provision for cooling of TSC also, now a days it is done through lube oil. Rotor shaft bearing is lubricated by engine lube oil system.



working of supercharger

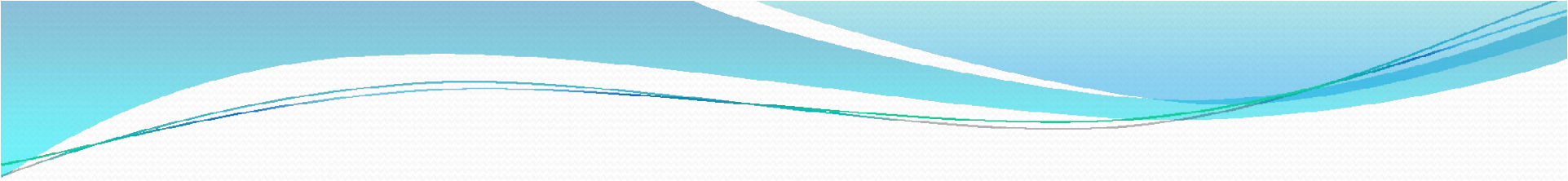
Working - Exhaust gases discharged by engine goes to gas inlet casing of TSC through exhaust manifold. In this casing gasses gets the direction with the help of dome and nozzle ring and hit the turbine blades and goes off to atmosphere through chimney. When turbine starts rotating same time blower also starts rotating since fitted on the common shaft. Partial vacuum is creating in blower casing hence atmospheric air flow from cyclonic filter. Blower compress the air into after cooler, where it cools with water hence its density is increased. The other end of after cooler is connected to 'V' gallery where the pressurized air is collected and collected air pressure is called Booster Air Pressure.

Working of supercharger



Booster air pressure not building up

Cause	Remedies
Insufficient FOP	Check relevant cause
Governor linkage jam	Operate 2 – 3 times manually
Leakage in exhaust elbow/manifold	Try to arrest.
Leakage from inlet elbows.	Try to arrest
Parallel transition not coming	Take manual transition
Defect in TSC	Confirm the free rotation



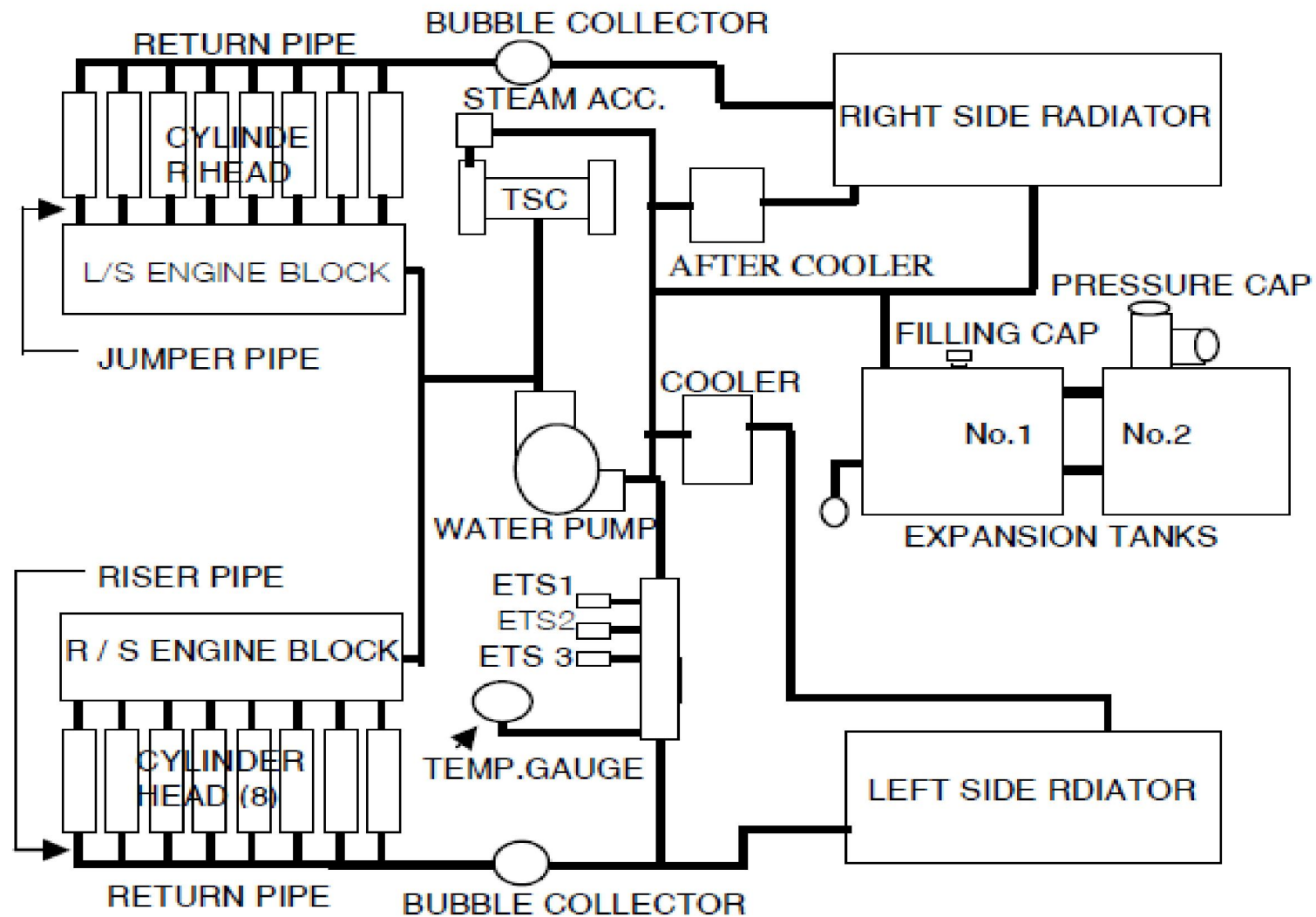
Cooling Water system

- System description
- Diagram
- Modifications related to cooling water system

System description

Chemical treated water is filled in the system to avoid corrosion, scaling forming and leakages will visible easily. On Alco loco pressurized water cooling system is provided. Centrifugal water pump is provided on left side free end of the engine, which gets drive from extension shaft gear. System capacity is 1210 liters. Filling cap provided on expansion tank. When diesel engine starts, water pump sucks water from four places viz. expansion tank, TSC water return pipe, right side radiator core via after cooler, and left side radiator core via lube oil cooler. Water is pumped at three places viz. right side engine block, left side engine block and TSC.

Diagram



System description

Right/Left side engine block -The water in right and left side engine block, cools the cylinder liner and afterwards rises through jumper pipe to cylinder head to cool it and rises through riser pipe to the water return pipe.

Through right side water return pipe water goes to the left side radiator core via bubble collector and left side water return pipe goes to right side radiator core through bubble collector. In the radiator core water is cooled by radiator fan.

System description

Turbo supercharger- Here water cools the intermediate and turbine casing, further it will go to suction side of pump through steam accumulator. Now cooling of TSC is done through lube oil only.

Radiator fan working –Radiator fan works according to the water temperature. Temperature is measured by thermostatic switches viz. ETS₁, ETS₂,ETS₃ provided in expresser room on water junction box.



modifications pertaining to cooling water system

Louvred fin radiator

High efficiency turbochargers

Large after cooler & water connection

Revision of ETS setting

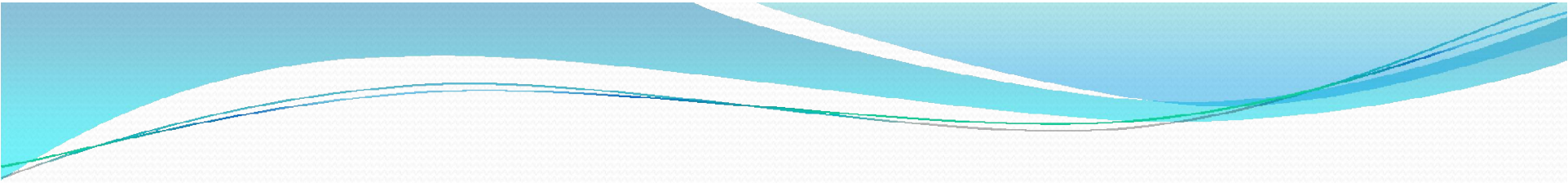
Pressurization of cooling water system

Flexible water inlet elbow

Digital water temperature indicator

Electronic water level indicator

Improved type pipe joints



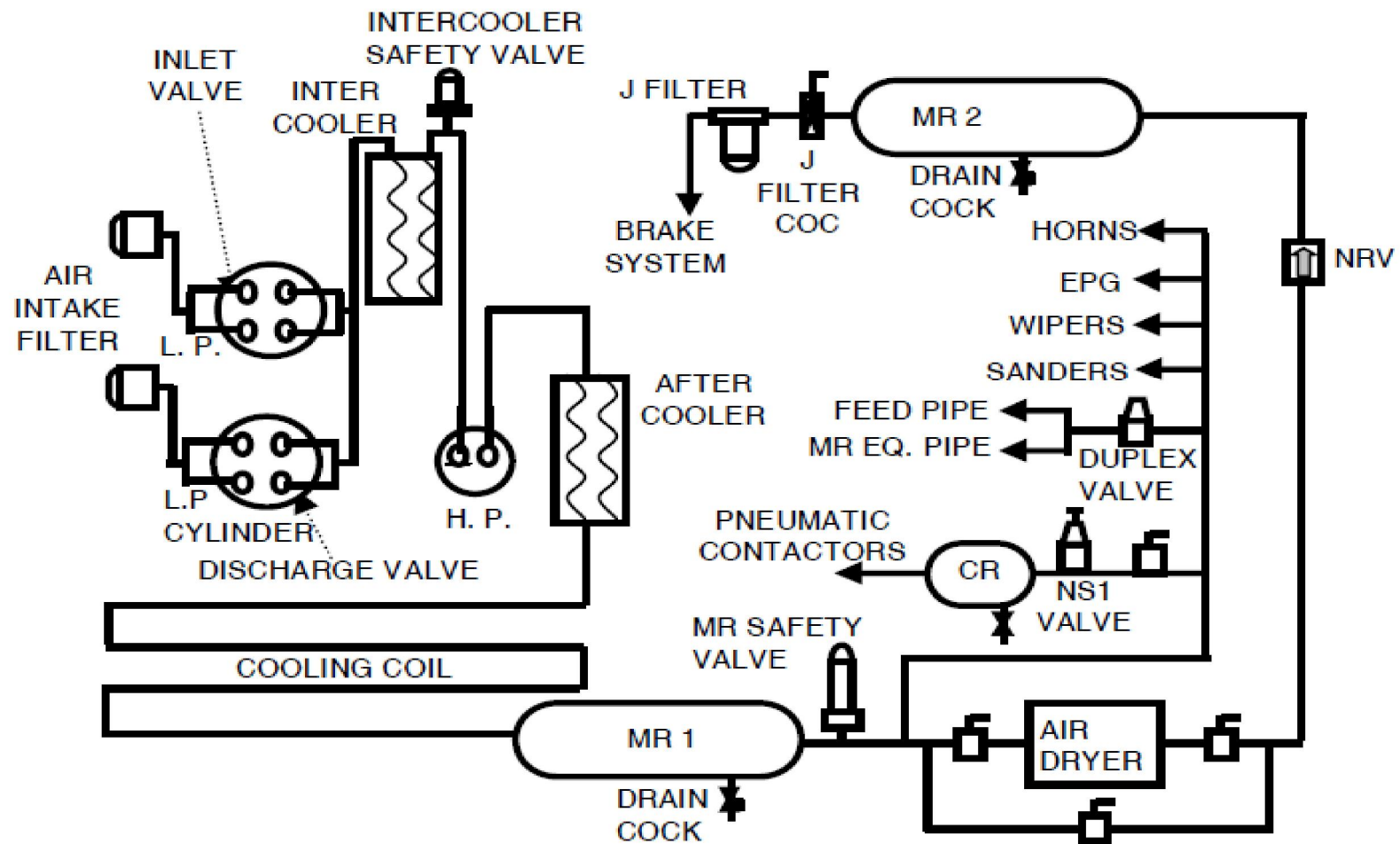
Compressor

- System description
- Diagram
- Working of compressor
- Common problems and remedies

Compressor

In IRAB₁ brake system fitted loco have only compressor. It is provided in the compressor room. The main function of compressor is to provide compress air for various purposes. It has one crankshaft and two bearings. One end of crank shaft is connected to engine main crankshaft with fast coupling and other end to with flexible coupling. It has 03 cylinders, 02 low pressure cylinders in 'V' shape and 01 high pressure cylinder in vertical position. Breather valve is provided in the sump to avoid pressurization of sump. 20 liter lube oil filled in compressor sump for lubrication. For circulation of lube oil one chain and sprocket driven pump is provided in sump. Filling cap is provided for lube oil filling and dipstick gauge for checking of oil level.

Compressor



Compressor

MR Charging:-

Compressor charges the main reservoir with pressurized air. Each cylinder have inlet and discharge valve working on principle of differential pressure. It's working to charge main reservoir with pressurized air, has 03 cylinders, two big cylinders are called low pressure cylinders and small is called high pressure cylinder. Low pressure cylinders having 02 inlets and 02 discharge valves, inlet valve is connected to air intake filter and discharge valve to intercooler.

Compressor

High pressure cylinder having 01 inlet and 01 discharge valves, inlet valve is connected to inter cooler and discharge valve to cooling coil through after cooler. Inlet valves have un-loader assembly, its connection given to EPG. When piston travel from TDC to BDC in low pressure cylinder inlet valve opened and filtered atmospheric air entered in cylinder. When piston travel from BDC to TDC inlet valves close and pressure is increased in cylinder hence discharge valve gets open and air goes in intercooler where it cools by air. Safety valve (setting 4.2 kg/cm²) is provided on inter cooler to safeguard it.

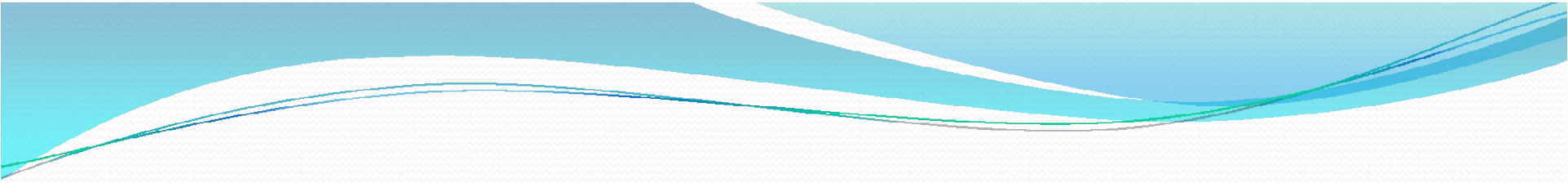
Compressor

When piston travel from TDC to BDC in high pressure cylinder inlet valve open hence air from inter cooler entered in cylinder. When piston travel from BDC to TDC inlet valves close and pressure is increased in cylinder hence discharge valve gets open and air goes in cooling coil through after cooler where it gets cool by air and charged MR₁. Safety valve (setting 10.5 kg/cm²) is provided on outlet pipe of MR₁, it discharge over pressure and safe guard the MR tank. From MR₁ air goes to MR₂ through air dryer and NRV. MR₁ is provided in undertruck between fuel tank and rear truck and MR₂ between fuel tank and front truck.

Common problems and remedies

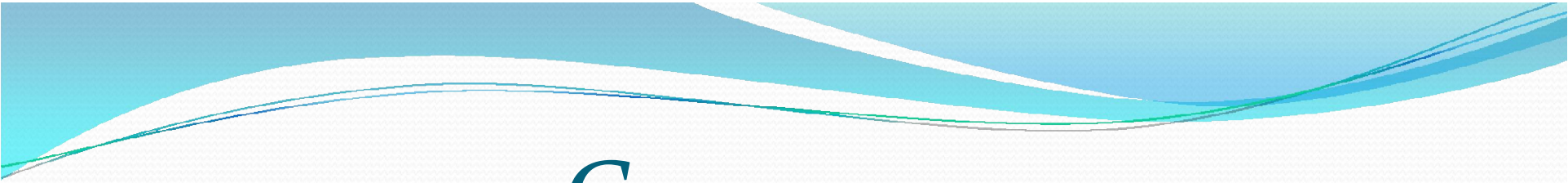
MR pressure not buildup

Causes	Remedies
Inter cooler safety valve blowing continuously	Tap it.
MR safety valve blowing continuously	Tap it.
Auto drain valve blowing continuously.	Tap / isolate it.
Leakage from MR/BC equalizing COC or BP/FP angle cock.	Close it properly.
Air dryer unit defective	By pass it.



Governor

- Introduction
- Main parts
- working



Governor

It is located on engine right side at power take off end. Its main work is to keep engine RPM stable as per throttle notch position irrespective of load and road. It also work the following-

1. Controls fuel oil supply
2. Co-ordinate between main generator and diesel engine HP.
3. Brought engine speed to idle or shut down when any safety device operates.
4. Helps in engine starting and stopping

Three types of governor are used in Diesel locomotive.

1. Electro Hydraulic Governor (EH)
2. Wood Ward Governor (WW)
3. Microprocessor Control Based Governor (MCBG)

Wood Ward Governor

Main parts of WW governor

- Drive shaft
- Pump
- Fly weight
- Main rotating bush
- Speeder spring
- Main pilot valve plunger
- Buffer piston
- Speed setting valve plunger
- Power piston
- rotating bushing

Wood Ward Governor

Main parts of WW governor

- Speed setting piston
- Triangular plate
- Oil sump
- A, B, C, D solenoid
- vain servo motor
- Load control potentiometer
- shut down plunger assembly



Wood Ward Governor

Its sump capacity is 2.5 liters. A glass tube is provided to check the oil level. Governor pump is fitted inside the governor body. It maintains the oil pressure at 100psi in the system. The pump and rotating bushing get drive by right side camshaft. Fuel rack control shaft is connected to power piston through linkage and all 16 cylinder fuel rack is controlled by control shaft. Engine fuel rack opens when power piston lifts up. Speed setting valve plunger is provided in governor speeder section, it controlled by triangular plate. A, B, C, D solenoids valve are fitted on triangular plate, according to notches these solenoids valves are picked up and press triangular plate and speed setting valve plunger downward it is called increment.



Wood Ward Governor

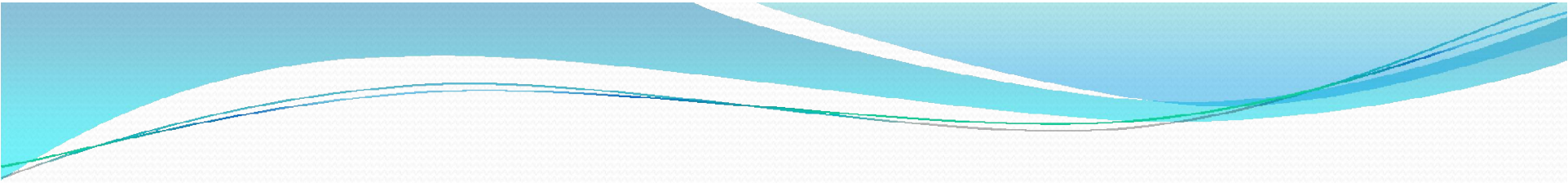
Opening of fuel rakes are proportionate to increment and engine speed increases.

Engine starting – When engine starts governor pump also starts working hence rotating bushing starts rotating with the help of drive shaft and oil passage open for buffer piston. Oil pressure is increased between buffer piston and power piston hence power piston lifts up and due to lifting of power piston fuel rakes opened, fuel supply starts in engine cylinder.



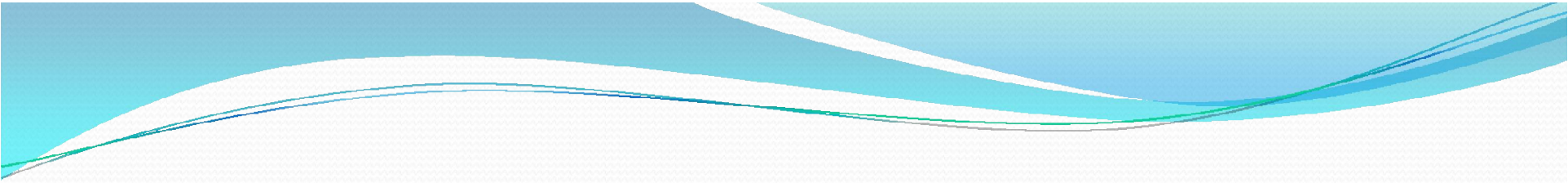
Wood Ward Governor

Increasing/Decreasing of engine speed –
According to throttle notches A, B, C, D solenoids pick up sequentially and pressed the triangular plate, Speed setting valve plunger comes downward and pressure mounted on speed setting piston results in compression in speeder spring, fly weights bend inside hence main pilot valve plunger goes downward. Oil passage open for buffer piston and power piston lifts up, fuel rake opening increased and engine rpm increased. Fly weight comes in balanced position, again engine speed stabled as per notch position and fuel rakes also stabled.



Air Brake System

- **Introduction**
- **Features of IRAB₁ brake system**
- **Main valves of the brake system**
- **Application of independent brake valve**
- **Application of Automatic brake valve**



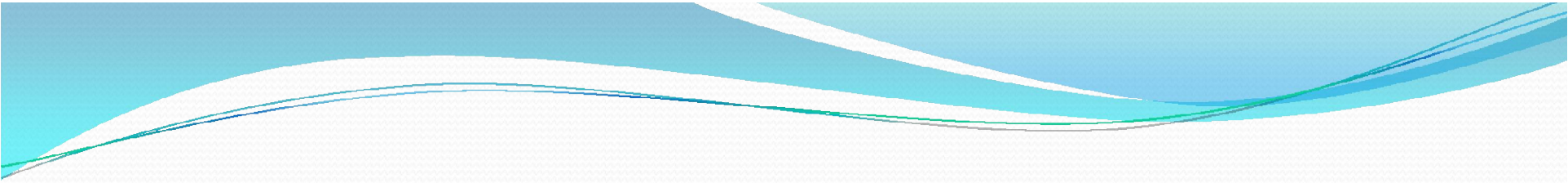
Air Brake System

IRAB – 1 brake system has been designed by RDSO and fitted with New Generation ALCO locomotives. This is a complete air brake version, in which only compressor unit is used instead of Expressor for creating air pressure in the brake system and all the brake valves are panel mounted.

Features :-

Locomotives Brakes can be applied and released through independent brake valve SA9, independently.

Formation brakes can be applied & released through Automatic brake valve A9



Air Brake System

Features :-

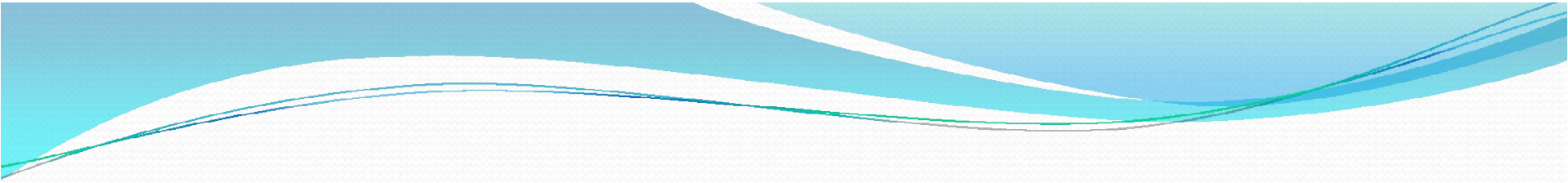
Locomotive brakes are applied automatically when formation brakes are applied.

Suitable for MU operation also, with which the brakes of trailing units are controlled from leading unit.

Brakes in the rear loco are synchronized with lead loco brakes.

Emergency brake application is available to have minimum possible braking distance, from any control stand and any loco.

Safety devices are incorporated to bring the engine to idle in case of emergency brake application and train parting.



Air Brake System

Features :-

In case of train parting between the locos, both the locos will have automatic brake application.

Automatic brake and Dynamic brakes are inter locked. So that, Auto Brake will be released automatically when the DB is applied.

The system can work either with single pipe / dual pipe.

Air Brake System valves

Description	Purpose
A9 Automatic Valve	Brake application for Loco as well as formations.
SA 9 Independent Brake Valve	Brake Application for Loco alone
MU – 2B	M.U. Operation, used as gate valve
F 1 – Selector	M.U. Operation, used as gate valve
C2W or Additional C2. Valve	Feeding B. P. Pressure to the formation
24 A Double Check Valve	This will allow only one operation at a time.
C3W Distributor Valve	Proportionate Brake valve application during A9 application.

Air Brake System valves

Description	Purpose
C2 Relay Valve	For Locomotive Brake.
Pressure Switch	Loco will be brought to idle during A9 emergency application.
D1 Emergency Valve	For Emergency brake application.
D1 Pilot air valve	During Dynamic brake Loco brake will be released.
Pressure Limiting Valve	Pilot air to C2 Relay valve for synchronized brake application is Limited to 2.5 kg / Cm ²
M. R. Safety Valve	release excess pressure from MR

Independent brake application and release

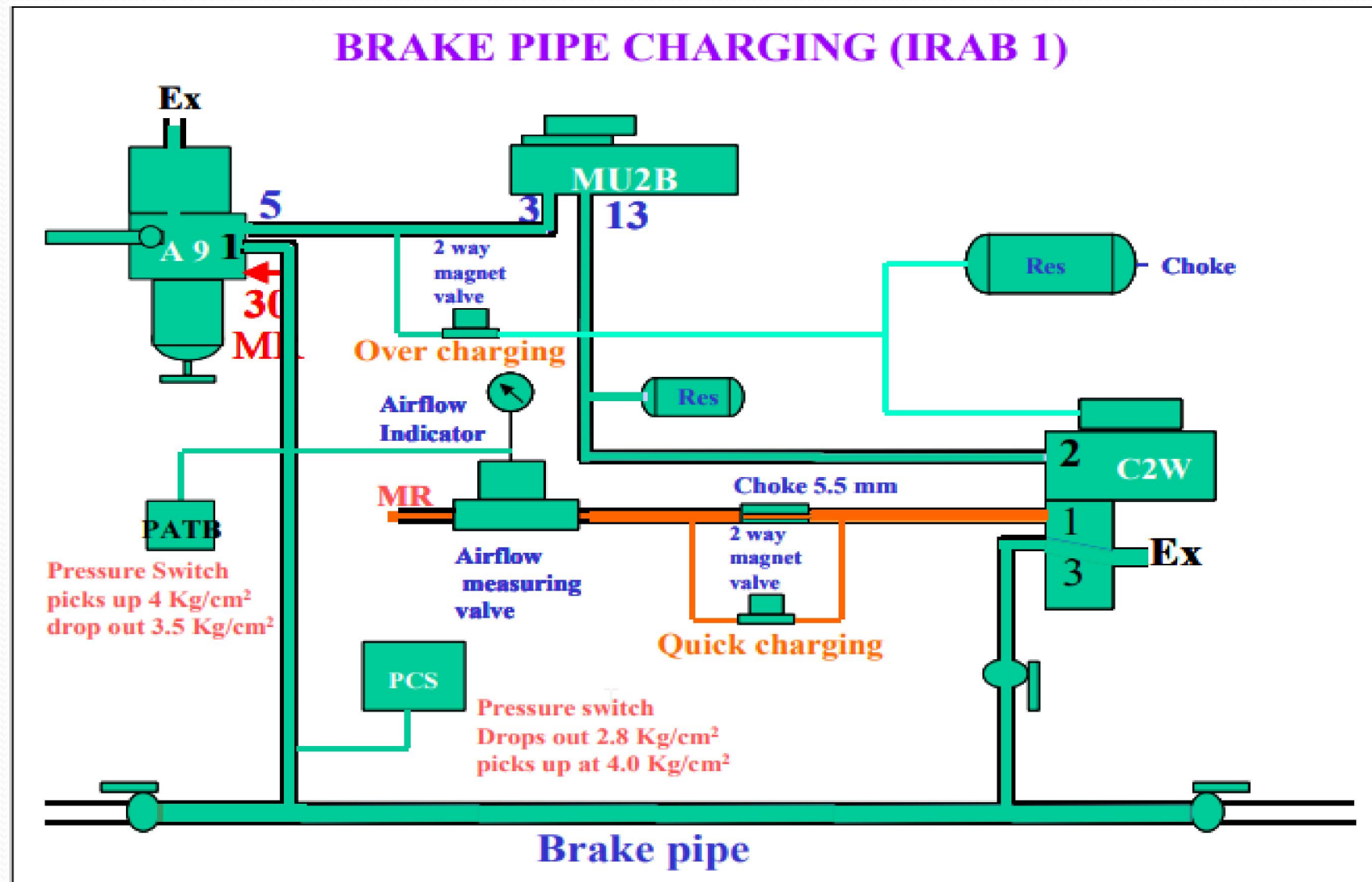
When SA9 handle is kept in released position, Brakes are in released condition. When SA9 handle is moved to application zone, it supplies pilot air to C2 relay. In lead loco or single unit loco MU2B is kept in lead position. In this, condition air from MU2B will come out and this air acts as Pilot air for C2 relay valve, entering through a double check valve. This pressure acts at the top of main diaphragm of C2 relay valve. C2 relay valve in turn will supply air to the Brake Cylinder. If the SA9 handle is moved to release position, the pilot air supplied to C2 relay port 2 will be withdrawn and exhausted through SA9 exhaust port.

Automatic brake application and release

BP charging:

When the A9 handle is kept in release position, it supplies pilot air at 5 Kg/Cm² to C2W relay air valve through MU2B. A volume reservoir is also connected at this line to dampen fluctuation of pressure. C2W valve thus charges the BP equal to the pilot pressure. At the outlet of C2W valve, a 3/4" COC is fitted which should be open in single unit / lead unit and closed in trailing unit.

Automatic brake application and release



Automatic brake application and release

Monitoring of BP charging :

While starting a train after coupling and charging the Brake pipe, the driver should check the indicator reading. It should be less than the number of vehicles in that train. (The graduations are in 'No of wagons') and turn Red needle and align with the white needle. While working, if BP starts leaking, the white needle will overshoot the red needle. This is the indication of a problem / leakage in Brake pipe. On getting this indication, the driver should stop, investigate the reason for BP leakage and rectify.

Automatic brake application and release

Automatic / conjunction brake in locomotives:

When there is a reduction in brake pipe, C₃W valve senses it and supply air pressure proportional to the reduction in BP for the brake cylinder. This air passes through the limiting valve and then to F₁ selector valve. If the MU₂B and also F₁ selector are in lead, this pressure flows to the C₂ relay valve through the double check valve and applies the loco brakes. When the BP is recharged, C₃W valve will withdraw the air and exhaust it causing the C₂ relay to release the brakes in the loco.

Automatic brake application and release

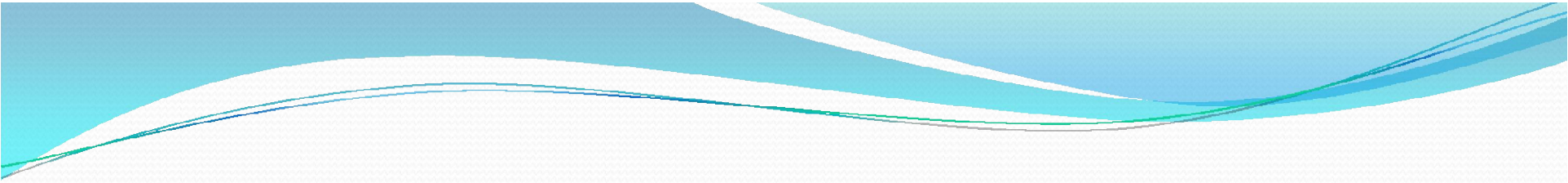
Action on dynamic brake application:

If dynamic brakes are applied, (while the Automatic brake is also ON) D1 pilot air valve fitted in between limiting valve and F1 selector will be energized causing the normal passage to cut off and air applied to C2 relay through F1 selector to be exhausted. This causes the loco brakes to release

Automatic brake application and release

Over charging function:

Generally, if there is brake binding in any of the vehicle in formation, the crew has to reach the particular vehicle and release the brakes manually. It will take several minutes. To avoid delay due to brake binding, the brake pipe is charged more than 5 Kg/Cm². For overcharging, the crew should press overcharging button, in certain cases switch. This switch energizes the 2-way magnet valve, supplying BP pilot air to C2W relay valve. This pressure increases the setting of C2W valve to 5.4 Kg/Cm². The switch should be released as soon as the BP rises to 5.2 Kg/Cm²



Bogie

- **Tri-mount bogie**
- **Parts of under carriage**
- **Safety fitting in tri-mount bogie**
- **High adhesion bogie**
- **HTSC bogie**



Trimount Bogie

The tri-mounts bogie consists of a single piece cast steel frame, which has a conventional bogie pivot carried in the cross member located between the leading and middle axles and two load bearers which are carried in cross member of the frame between the middle and trailing axles. The weight of the locomotive body is transferred to the bogie at the pivot and at the two load bearers to form a three-point support. The pivot carries approximately 60% of the vertical load and also receives and transmits traction and braking forces while the two load bearers share the remaining 40% of the vertical load.



Trimount Bogie

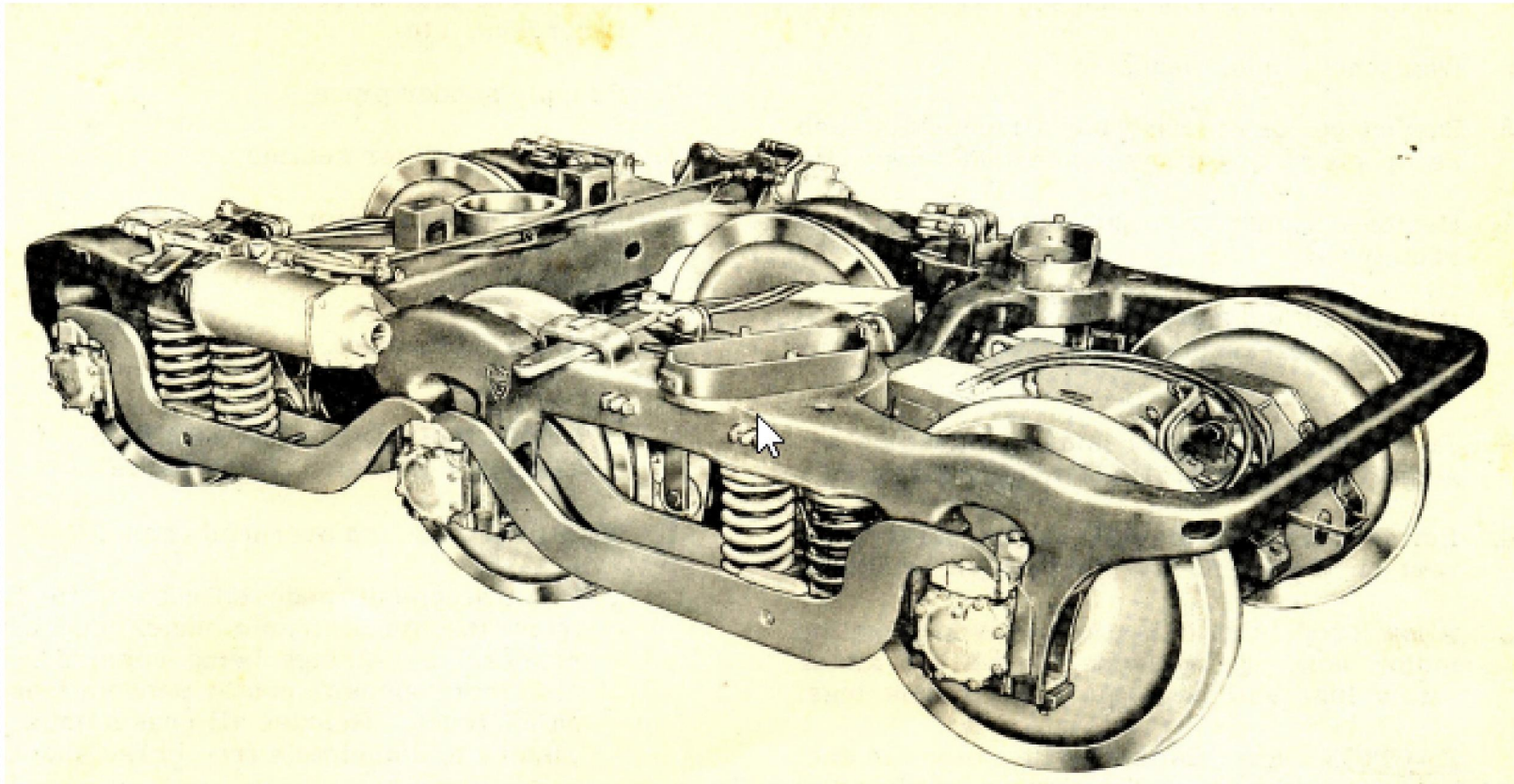
The load bearers are not designed to transmit any traction or braking forces. The effect of the off centre pivot and the concentric loading pads is virtually that a large diameter pivot. This tends to minimize weight transfer due to tractive effort or braking force and maintain a higher factor of adhesion in service.



Trimount Bogie

The cylindrical pivot liner which transmits traction and braking forces and the circular liner which receives the vertical load, are of medium carbon steel, the pivot bowl and loading pad oil pans are fitted with oil for lubrication of these liners. The oil pans are provided with dust shields. Resilient liners are provided between the foot of the loading pad and the bearing shoe. The lateral spacing of the pads affords stability against the tipping forces of the locomotive and the frictional resistance of the pads prevents nosing. Single stage suspension is used, consisting of long deflection helical springs, friction snubbers are fitted inside one nest of each group of springs.

Trimount Bogie

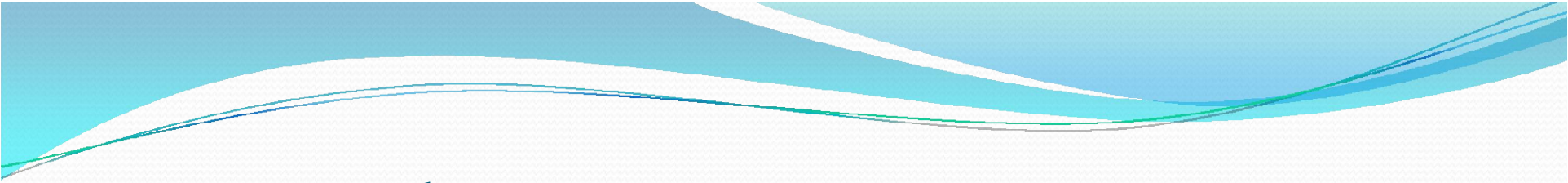


Tri-Mount Bogie



Trimount Bogie

Full equalisation between adjacent wheels is obtained by suitably positioning the springs on the equaliser and controlling their working heights. Movable axle journal boxes are mounted in pedestals cast integral with the frame. Movement of the boxes in the pedestals obtains the lateral play for negotiating passage over curves and turnouts. Clasp brakes are provided on the broad gauge locomotives while single shoe brakes are provided on the meter gauge locomotives.



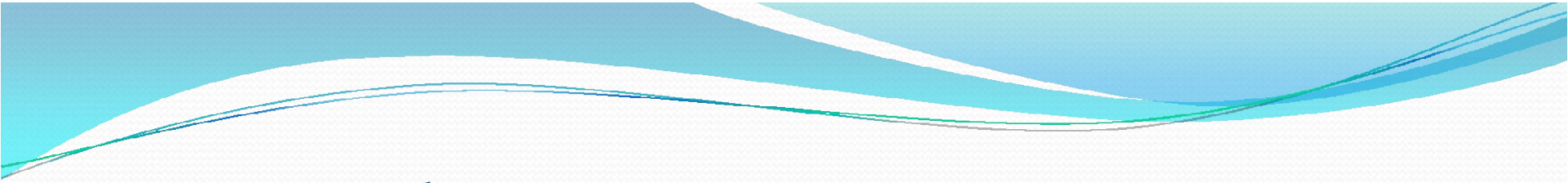
Under-Carriage Major Divisions

A - Main parts of the buffer beam

1. Both side Buffers.
2. C.B.C.(Centre Buffer Coupling)
3. Cattle Guards.
4. Foot Steps

B - Main parts of the Chassis

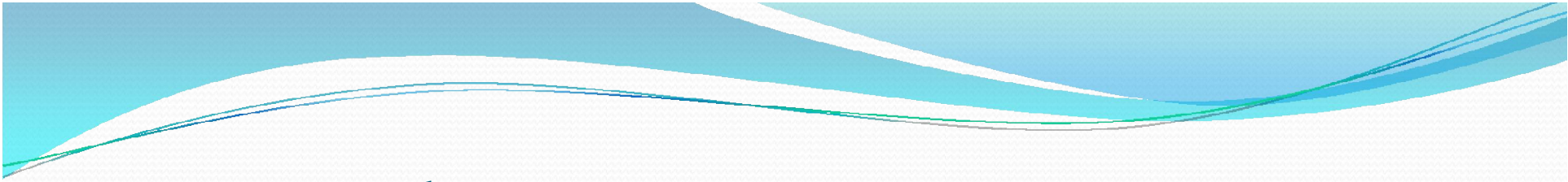
1. Fuel oil tank
2. Pivot Pin.
3. Side bearer
4. Bolster Pin Clamps



Under-Carriage Major Divisions

Main parts of the Chassis

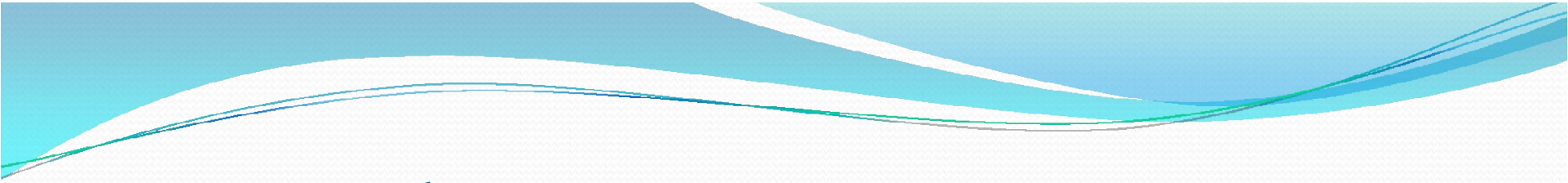
5. Air duct boot base
6. Both sides fuel oil-filling cap.
7. Both sides buffer beam.
8. Both sides stay rod-fitting
9. Main reservoir
10. Air cut out cock



Under-Carriage Major Divisions

C - Main parts fitted on bogie frame

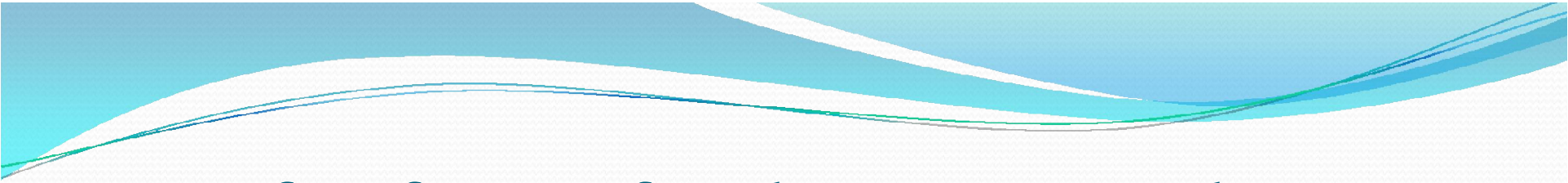
1. Three pair wheel fitted in each bogie
2. Gear case, three pair in each bogie.
3. Traction Motors
4. 8 no. Equalizing beam each bogie
5. Tie bar in each bogie 02 no.
6. Coil springs –
 - i. Outer coil spring
 - ii. Inner coil spring
 - iii. Snubber coil spring



Under-Carriage Major Divisions

Main parts fitted on bogie frame

- 7. Brake cylinder base
- 8. Break cylinder Air pipe cut-out cock
- 9. Side brake Hanger
- 10. Pull Rod "L" clamp



Safety fittings fitted in Tri-mount bogie

1. Dust guard
2. Buffer.
3. Cattle Guard.
4. Rail Guard.
5. Safety bracket for MR.
6. "U" bracket for C B C.
7. Buffer lamp box.
8. Hand Brake Chain.
9. Tie Rod Safety Chain.
10. Equalizer beam safety bracket.
11. Pull Rod "L" clamp.
12. Gear case "L" clamp
13. Gear case "C" clamp.
14. Safety clamp for Air pipe.
15. Bolster pin
16. "U" Safety bracket (chassis & Bogies cross beam).
17. Sealing of felt wick's carrier plate bolt / screw.
18. Sealing of T / M cap's dummy.

High adhesion, fabricated box type, Two stage suspension, co-co type bogie

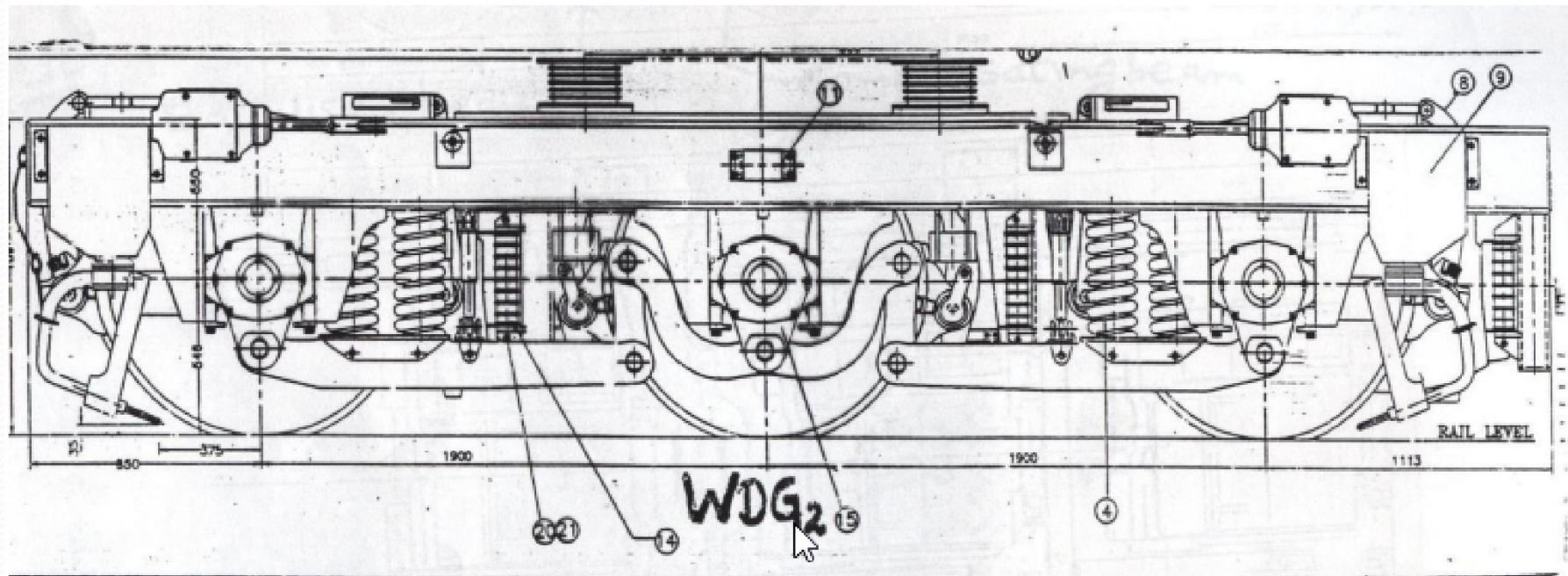
This is a 3-axle type bolster-less bogie with two-stage suspension, floating pivot and Uni-Directional arrangement of axle huge nose suspended traction motors. Bogie frame is of straight and fabricated box type construction with three transoms to carry nose suspension. The locomotive body weight is supported on bogie frame through four rubber side-bearers directly mounted on bogie side bears. Shims have been provided below outer side-bearers to distribute load on side bearers in a 60:40 ratio, 60% of the load being supported on side bearers adjacent to centre pivot and 40% of load at remaining two side bearers. Centre pivot does not take any vertical load and is used only for transfer of traction and braking forces.



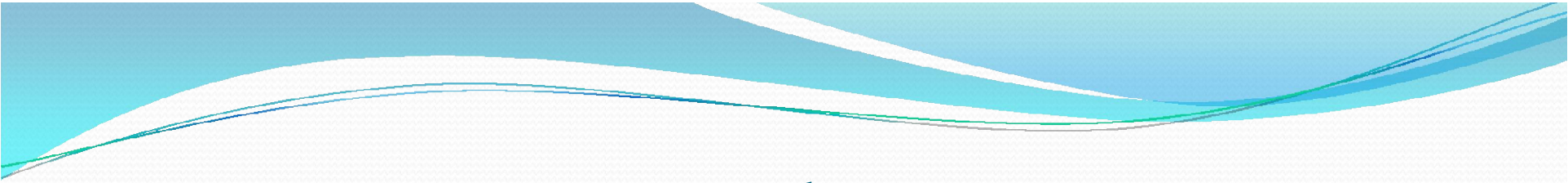
High adhesion, faricated box type, Two stage suspension, co-co type bogie

The bogie frame in turn is supported on axles through helical coil spring mounted on equalizer beams. The equalizing mechanism consists of equalizers hung directly on end axle boxes and supported on middle axle box through a link and compensating beam arrangement. The equalizing mechanism enables achievement of equal axle loads on uneven track and reduces weight transfer at start.

High adhesion, faricated box type,
Two stage suspension, co-co type bogie

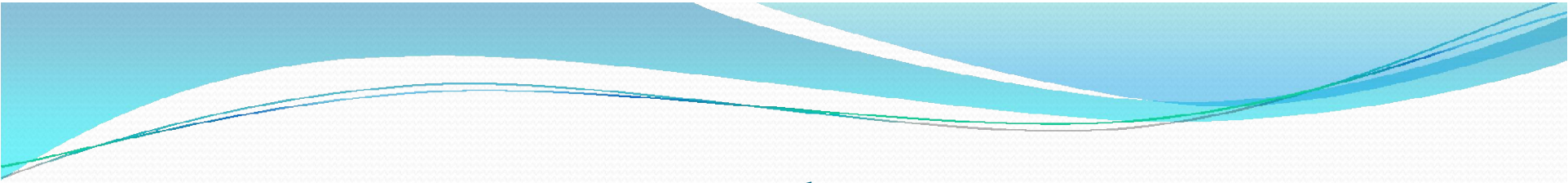


Bogie of WDG2 Locomotive



HTSC bogie

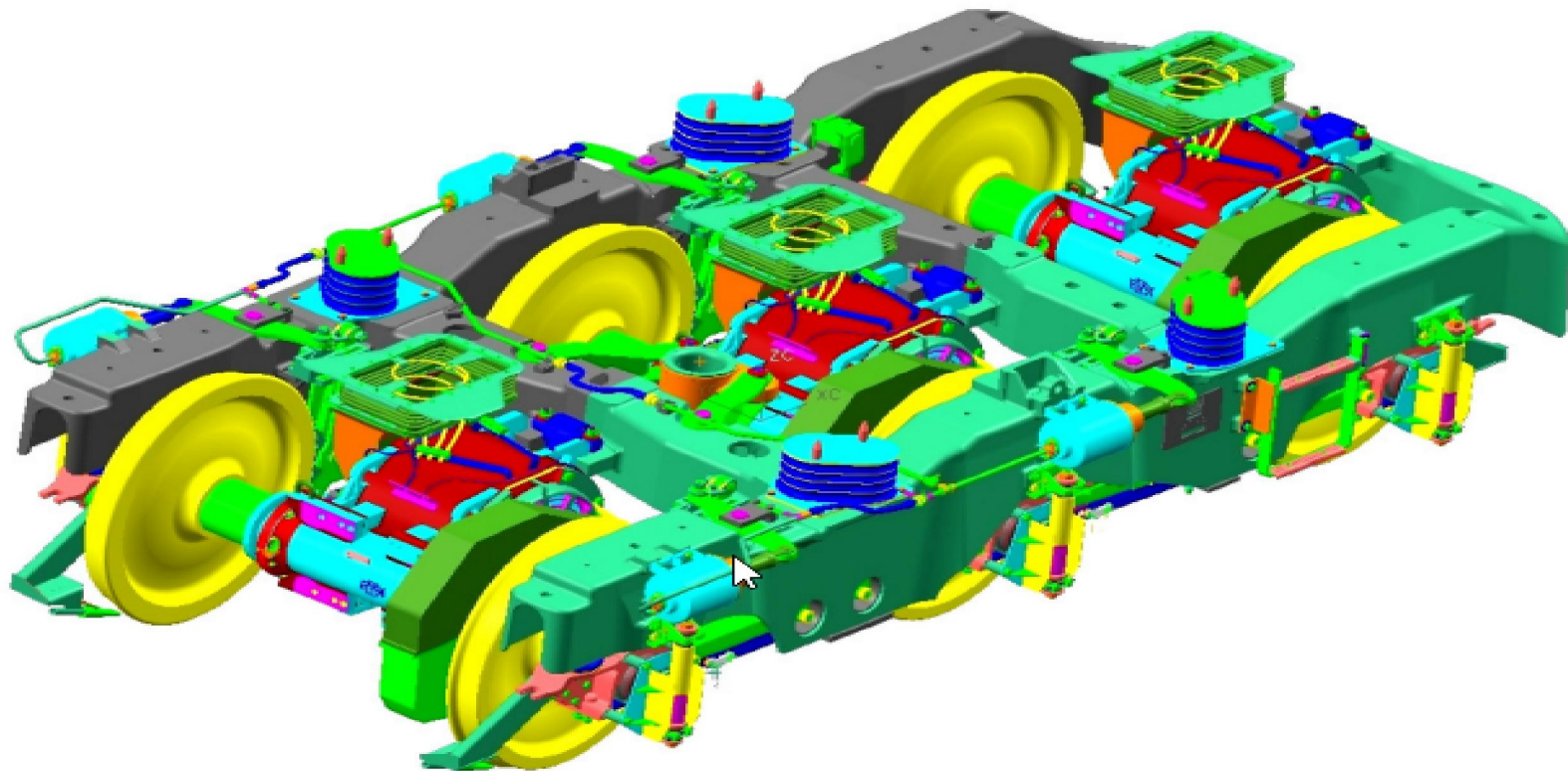
The GT46 PAC locomotive is equipped with a modified HTSC (High Tensile Steel Cast) means for transmission of power to the rails. This bogie assembly supports the weight of the locomotive and provides the means for transmission of power to the rails. Unlike conventional rigid bogies, in which axles are held in parallel with each other, the HTSC bogie is designed as a powered “bolster less” unit. Although the bogie frame itself is rigid, the design allows the end axles to move or “Yaw” within the frame. This movement will allow the wheels to position themselves tangent to the rails on curves for reduced wheel and rail wear. Traction loads are transmitted from the bogie to the locomotive under frame through the carbody pivot pin assembly.



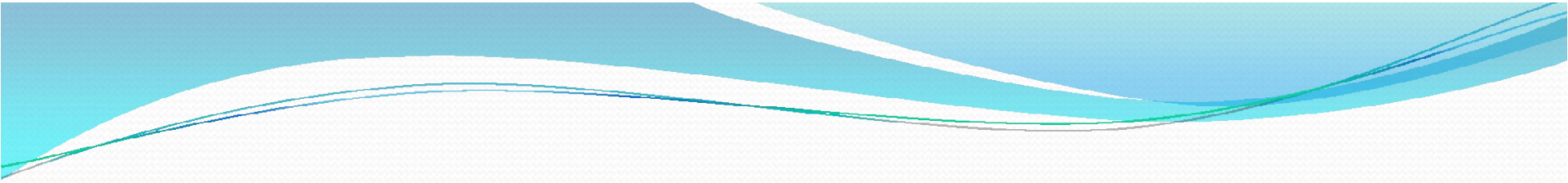
HTSC bogie

The bogie is designed for extended maintenance intervals with lateral thrust pads and plates at the journal bearings and brake rigging being the only friction wearing components on the bogie requiring periodic replacement. The bogie is equipped with three AC power traction motors. The traditional rubber suspension spring “nose packs” on the motors is replaced with nose link assemblies that increase ease of disassembly and lowering of traction motor/wheel srts for maintenance.

HTSC bogie



G/M Locomotive Bogie



Load box test

- **Introduction**
- **Type of load box test**
- **When to conduct**
- **Pre-load box test check**
- **Parameters to be recorded**



Introduction

This is a test to check the capability and performance of the engine by simulating the actual working condition of the locomotive at rated output, in static condition. During load box test, the output of the engine is measured in terms of electrical parameter. In this, the output of the generator is connected across a set of resistance instead of connecting it with the Traction Motors. The output of the engine is dissipated in terms of heat across the resistance during Load Box test



Type of load box test

They are of two types, based on the type of load resistance connected:

- 1) Grid Resistance Load Box
- 2) Water Resistance Load Box

Comparison of water and grid load box test

WATER RESISTANCE	GRID RESISTANCE
Load resistance can be varied at infinite stages; hence a continuous HP curve can be plotted through this	Load Resistance can be changed only at limited stages
Load resistance can be changed during loaded condition	To change the load resistance in grid type, the locomotive requires to be stepped down
Water load box can be conducted for a longer duration	Grid resistance load box can not be conducted for longer duration
Requires permanent establishment to setup water load box	Comparatively handy and can be shifted with lesser effort



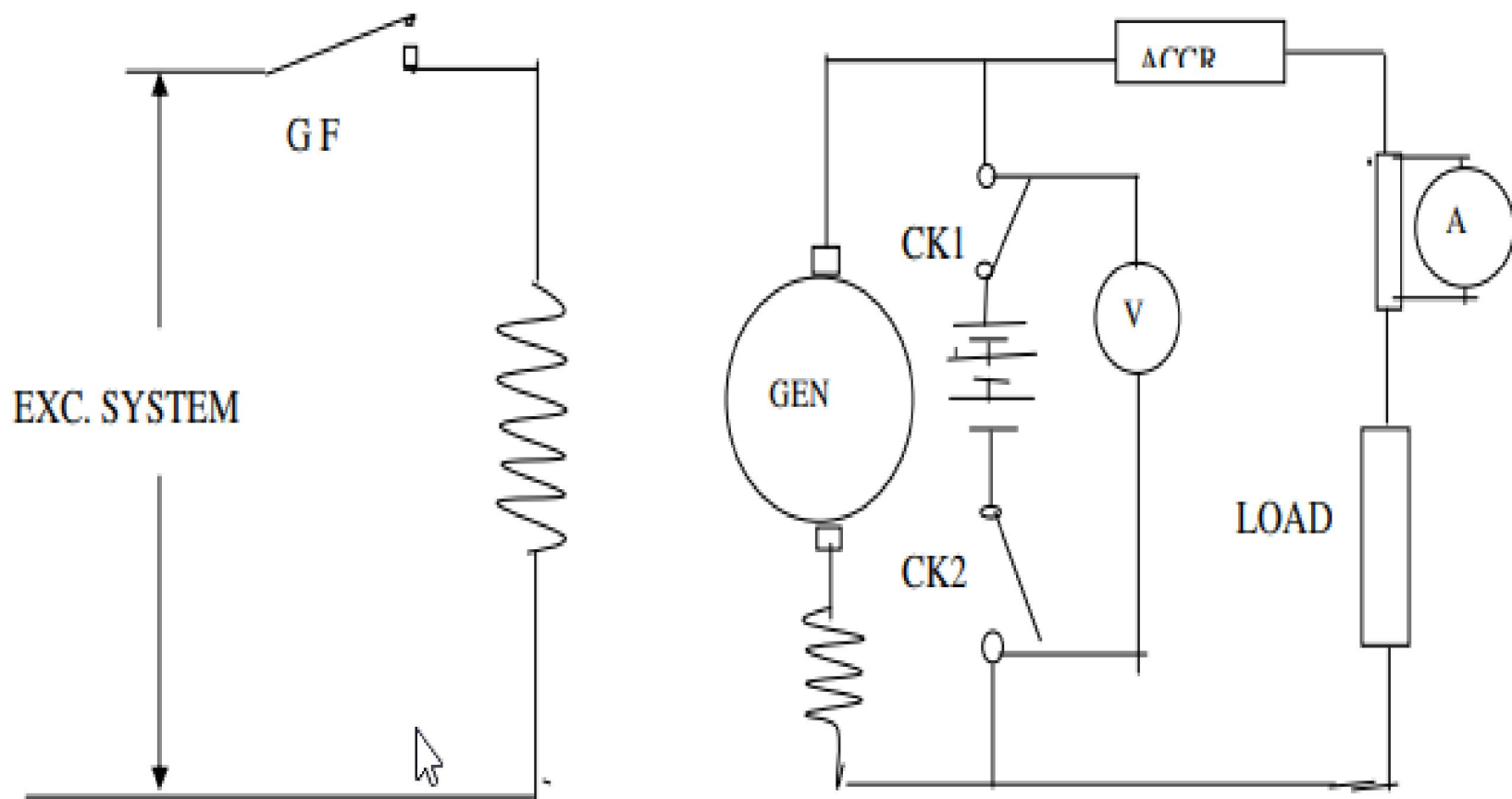
When to conduct load box test

- 1) After new manufacturing
- 2) Before and after major repairs
- 3) Before and after major schedule
- 4) To diagnose any specific problem

Pre-load box test check

- 1) Check level of fuel oil, lube oil and coolant
- 2) Check for abnormal sound
- 3) Check bearing temperature (if applicable)
- 4) Check for any leakages
- 5) Check IR value of electrical circuit
- 6) Check notch wise engine rpm
- 7) Check operation of safety devices

load box test



Parameters to be recorded

[illegible]

Parameters to be recorded

Cyl. No	Compression Pressure	Firing Pressure	Exhaust Gas Temp	Cyl. No	Compression Pressure	Firing Pressure	Exhaust Gas Temp
1R				1L			
2R				2L			
3R				3L			
4R				4L			
5R				5L			
6R				6L			
7R				7L			
8R				8L			

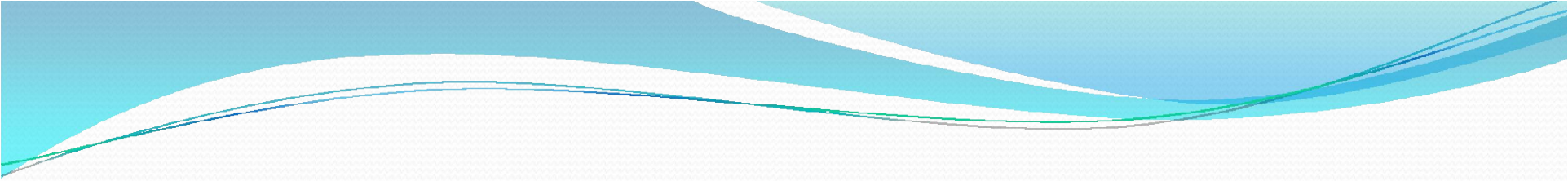


Parameters to be recorded

- Exhaust gas temperature
- Lubricating Oil temperature
before and after AC
- Lubricating Oil Pressure
before and after filter tank
- Cooling Water Pressure

Summary

Load Box test is conducted to check and verify the capability and performance of the diesel engine by simulating the actual working condition in static condition of the locomotive. This is also used as a diagnostic tool to identify problems related to any system or component. During load box test, the output of the generator is connected across a set of resistance instead of connecting it with the Traction Motors. The output of engine is measured in terms of electrical parameters i.e. volt and ampere, across the resistances connected in load box. Several other mechanical and electrical parameters are also recorded to diagnose problems related to engine performance, based on the observations made during load box test.



Comparison of Alco and EMD locomotives

Comparison

Alco	EMD
The power assemblies used are working on 04 stroke cycle.	The power assemblies used are working on 02 stroke cycle.
In fuel oil system fuel injection pump & injectors are fitted as separate units.	Injector and FIP are designed and fitted as single unit known as MUI(Mechanical unit injector)

Comparison

Alco	EMD
The Lube oil system is having a single lube oil pump.	It has three lube oil pumps fitted in two housing:- Main lube oil pump Scavenging oil pump Piston cooling pump

Comparison

Alco	EMD
Crank case vacuum is created through crank case exhauster motor.	Sump vacuum is created by provision of eductor assembly.
One centrifugal type water pump is provided for circulation of coolant.	Two water pumps are fitted (one for each bank)

Comparison

Alco	EMD
Radiator cores are vertically mounted, one mechanically driven radiator fan is provided .	Radiator cores are fitted at slant angle. Two 3 phase AC fans are working as radiator fans.
During rotation of radiator fan flow of air is inwards at radiator cores.	During rotation of radiator fan flow of air is outwards at radiator cores.

Comparison

Alco	EMD
TSC rotates at higher notches only through exhaust gases.	TSC rotates through gear drive up to 6 th notch and above it exhaust driven.
Commonly MCBG governor is fitted.	Woodward governor is provided.

Comparison

Alco	EMD
IRAB ₁ brake system is provided.	CCB (computer controlled brake) system is fitted.
Compressor is air cooled.	Compressor is water cooled.

Comparison

Alco	EMD
MEP-660 microprocessor based controlled system is fitted.	EM-2000, MEDHA/Siemens control system is fitted
Safety devices ETS, water level sensor, GR etc. are fitted	EPD (engine protection device) & HOD (hot oil detector) are provided

Comparison

Alco	EMD
Casted/ fabricated bogie frame is provided.	HTSC(high tensile steel cast) bogie frame is provided.
Cardium compound is to be filled in Traction motor gear case.	Oil RR-460 is filled in traction motor gear case.

Blow by, Holding time &
orifice tests of
Alco locomotives

Blow-by test

It can be performed insitu position on the locomotive. There are chances of leakage from valve seat due to bending, pitting and overheating of valve. Blow by test is performed to check leakage of combustion chamber. It works on principle that pressure drop across choke depends on flow rate through choke. The fixture is attached to Cylinder head after removal of decompression plug. Air pressure of 5 Kg/cm² is fed before the choke. The particular piston is kept at TDC position. The sustained pressure by compression chamber depends on leakage through seat and piston ring.

Blow-by test

If the blow by reading is less. The probable causes may be :-

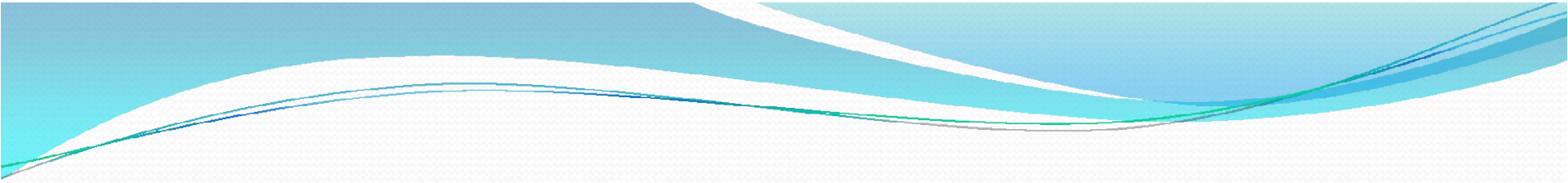
- leakage from valve seat
- wear of piston ring
- wear of liner inner surface
- alignment of ring gaps

Holding time test

It is performed in sub-assembly section before and after overhauling of cylinder head. In this test face of head forming combustion chamber is closed using a plate. Injector opening is also closed by putting an injector in it. Now air pressure is applied through centre hole of dummy plate at a pressure of 5 Kg/cm^2 . After that cut out cock of inlet passage is closed. Time duration for the pressure to reduce till zero is recorded, if holding time is less than 40 second then there may be leakage from valve seat.

Orifice test

It is performed to ensure sufficient fuel oil pressure in fuel oil system. To perform the test orifice plate of 1/8 inch is attached before regulating valve. A container is placed below the opening of orifice and the oil coming out is collected. Fuel booster pump is kept ON for 60 second, in shut down condition of the engine the quantity of fuel should be minimum 9 litres and system should be able to maintain a pressure of 3 Kg/cm² also.



Thanks