

Safety Devices in GM/HHP loco

Lecturer(Diesel)/IRIMEE

GOVERNOR (LOPS)

- When oil pressure in the line drop below the speed setting oil pressure , the system (LOPS) will take action to shut down the engine.

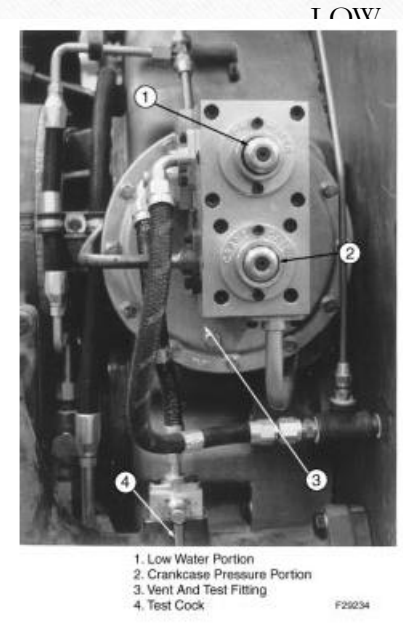


LOPS-cont---

- The governor reacts by moving the lay shaft and racks to the no fuel position. A plunger stand out from the side of the governor exposing a red band .
- The engine cannot be restarted until this plunger is reset.

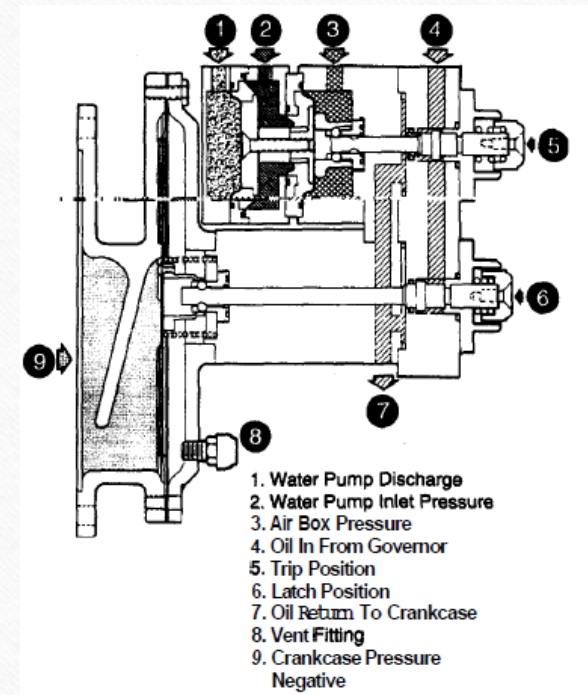
Low Water Pressure Detector

- A low water safety device balances water pressure against Air box pressure.
- When water pressure falls , the device dumps oils from the Governor supply line ,causing engine shut down.



Low Water Pressure Detector cont..

- The low water safety device is a spring loaded, normally open, two way valve piloted by a latching mechanism on a diaphragm stack. There are two diaphragm in this stack , on sensing water pressure into the engine and the other sensing engine Air box pressure.



Low Water Pressure Detector

cont..

- Under normal operating condition water pressure exceeds Air box pressure.
- The following condition will cause the device to trip.
 - Loss of water level.
 - Pump cavitation due to air entrainment (during starting)
 - Pump cavitation due to water temperature.
 - Excessive Air box pressure due to **Turbine surging** at low throttle speeds.
 - Over filling of water tank can cause low water shut down.

Low Water Pressure Detector cont..

- Testing of Low Water Safety Devices
 - With the engine running at idle speed, placing the test cock in the horizontal position, and obtaining a free flow of water from the orifice, should trip the device on the first or second try .
 - If the device does not trip , the device should be taken off and checked on a test panel to determine the cause of malfunction. It is recommended that the operation of the device be checked monthly.

CRANKCASE PRESSURE DETECTOR

- Negative pressure is normally maintained in crankcase by Ejector arrangement.
- When Crankcase pressure detector senses a positive crank case pressure, it trips and dumps oils from the Governor supply line ,causing engine shut down.



CRANKCASE PRESSURE DETECTOR, cont....

- The following conditions may causes the detector to trip-
 - Blockage of oil seperator
 - Cylinder compression leak into oil pan or top deck.
 - (cracked Cyl hd, cracked piston, loose injector ,broken v/v)
 - Pressurised air from air box leaking to oil pan
 - (broken liner seal,broken crab bolt, loose crab bolt retainer, Extreme cyl.scoring)
 - Overheated part in crankcase igniting oil vapour.

CRANKCASE PRESSURE DETECTOR, cont....

- The detector should be tested periodically to ensure proper operation-
 - Without starting the engine, remove the cap from the vent on top of the detector.
 - Using a Hydrometer bulb, create a suction on the vent tube .
 - This should trip the reset stem as it simulates a positive pressure being applied to the opposite side of the diaphragm.
 - If the detector not trip, replace the detector.

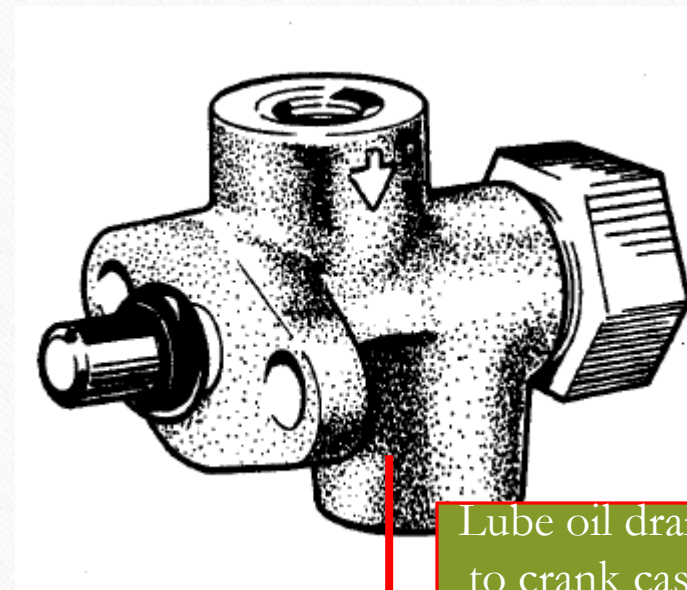
HOT OIL Detector –Thermostatic Valve

- Hot oil detector is mechanical safety device located in the discharge elbow of the main lube oil pump.
- It consists of thermostatic valve and associated piping.



Hot oil detector –Thermostatic valve---cont

- When oil temperature rises to 121°-126°C, the thermostatic valve will open and the pressure oil is allowed to pass through the valve and drain into the Governor drive housing (it is open to Crankcase sump). The Governor senses the resultant low oil pressure and initiates an engine shutdown.
- It will reset automatically when oil temp falls. The engine may then be restarted when the governor low oil plunger is reset.
- Inadequate cooling water supply may be the reason of its trip.

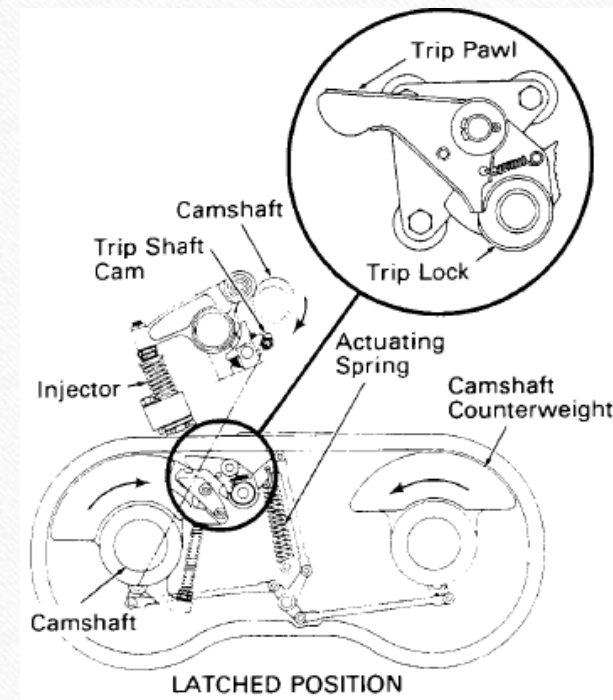


Lube oil coming
from Governor

Lube oil drain
to crank case
when oil
temp raise to
124°c & v/v
open.

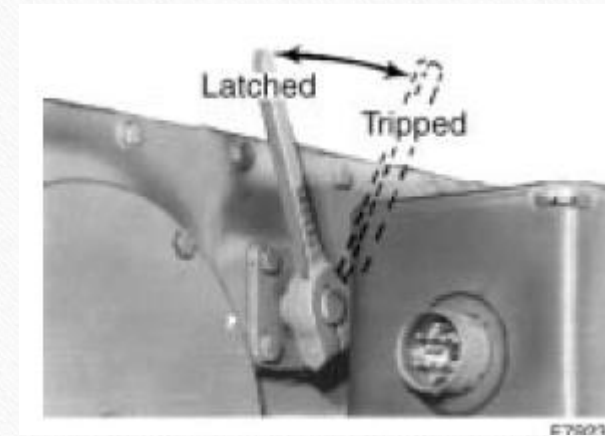
Over Speed Trip assembly

- The engine overspeed trip is a mechanical safety device to stop fuel injection if engine speed exceeds specific limit.
- A flyweight mounted on counterweight at part of right bank camshaft activates the trip.
- If centrifugal force exceeds adjustable spring tension fly weight moves out. When the fly weight moves out ,it contacts the trip pawl.



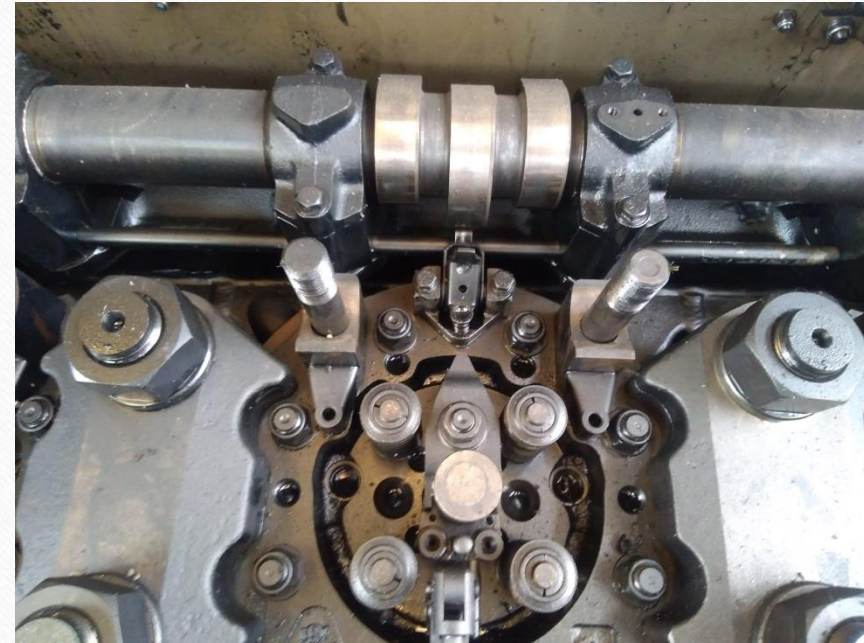
OST

- OST Tripping Range for –
 - WDG4/WDP4- (1035 – 1050 RPM)
 - WDP4B/WDP4D- (1085 -1100 RPM)



OST

- Further, the trip pawl rotates a trip shaft on each bank of engine.
- When the trip can rotates upward ,it raise a pawl under the rocker arm to prevent further activation of the fuel injector.



VCD-VIGILANCE CONTROL DEVICE

- The vigilance function is performed by EM2000. When the locomotive brakes are released, the computer requests an acknowledgment from the locomotive operator from time to time (Vigilance cycle reset button pressed, Change of throttle handle position, Application of dynamic brakes, Operation of horns, Operations of sanders, Application of brakes etc)
- If acknowledgment is not sensed by EM2000 upto 60 secs, following activity will be done:
 - Alerter lights flashing (yellow) for 08 seconds, then
 - ALERTER ALARM sounds for 08 seconds (Lights continue flashing)
 - After that engine idling & Penalty brake applied.
 - After penalty brake reset only by Vigilance Reset Switch.

VCD in console

Alerter Indication



Alerter
Reset
switch

SPEED UP OF COLD ENGINE

- Raising of engine rpm on TH2 for rising the water temperature above 52°C/125°F (If temp is below 46°C/115°F).
- Above 52°C/125°F engine return to idle.
- Engine water inlet temperature should be allowed to reach 49°C (120°F) at idle before moving the throttle handle above TH2 position.

LOW IDLE

- When the locomotive is in IDLE for more than 10 minutes, The EM2000 give commands to Governor for reducing the engine RPM is to 200 rpm by energizing AV and DV for reducing the fuel oil consumption. This is possible only with governors having this option.
 - Full Speed (at 8th notch) : 954 RPM
 - Normal Idle Speed: 269 RPM
 - Low Idle Speed: 200 RPM

HOT ENGINE CONDITION

- The engine cooling water temperature is sensed at the water pump inlet.
- When the temperature becomes excessively high (101°C), the computer will display the “HOT ENGINE - THROTTLE 6 LIMIT” message & limit engine loading when operating in throttle position 7 or 8.
- This condition will remain in effect until the temperature returns to a safe limit (79°C to 87°C).
- If operating in throttle position 6 or lower, engine load will not be reduced during a hot engine condition. However, the return to full power can only be accomplished by reducing cooling water system temperature to normal.

FVS- Filter Vacuum Switch :

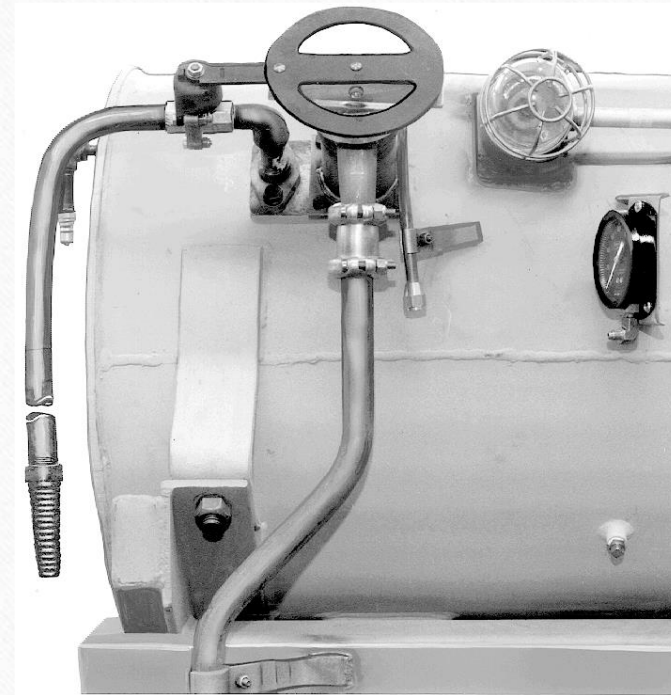
- The engine Air filter assembly is equipped with pressure switches to sense the differential between Ambient pressure and pressure at the Turbocharger inlet.
- Differential between the filter housing and ambient reaches > 356 mm (14" H₂O) ,The EM2000 display message FILTER VACUUM SWITCH TRIPPED
- Differential between the filter housing and ambient reaches > 610 mm (24" H₂O) ,The EM2000 display message ENGINE AIR FILTERS DIRTY.
- If throttle is above 6, the display shows “ENGINE AIR FILTERS ARE DIRTY CHANGE OUT REQUIRED, POWER MAY BE LIMITED TO TH6. Engine speed will be reduced to 730 RPM (TH6) and loading will be reduced to a maximum of 1820kw (turbo off gear train) or 1550kw (turbo on gear train.)1500 HP (1120 KW).

EVENT RECORDER

- The system shall be able to record the following events in a separate (take out type) memory unit or filter mode to separate these data from the continuously recorded other data of the locomotive:
 - Train Brake pipe pressure Kg/cm²
 - Loco Brake Cylinder pressure Kg/cm²
 - Operation of VCD - Status of penalty brake application (T2 cycle)
 - VCD Acknowledgement/ Reset switch
 - VCD fail
 - Vigilance control system Isolated
 - Notch position (idle, 1st to 8th)
 - Status of power application (motoring/braking)
 - Direction of movement of loco (FOR/REV)
 - Locomotive speed (Kmph)
 - Status (ON/OFF and Dim/Bright) of headlight
 - Status (ON/OFF) of flasher light
 - TE limit switch ON/OFF
 - Shed name
 - Loco No.
 - Distance in Km.
 - Date
 - Real time in hours, minutes and seconds
 - TE limit current

Pressure Cap in the water tank

- A Pressure cap, which is located on the water tank filler pipe, opens at approximately 20 PSI/1.40 Kgf/cm². By relieving excessive pressure, this prevents damage to cooling system components.



THANK YOU