
UNIT 7 SAFETY DEVICES

OBJECTIVES

After completion of this unit, you should be able to:

- Appreciate the functioning of low lube oil switch
- Appreciate the functioning of hot engine alarm
- Appreciate the function of low water level switch
- Appreciate the ground fault detection devices
- Appreciate wheel slip protection device
- Appreciate function of pneumatic control switch

STRUCTURE

1. Low lube oil switch
2. Hot engine alarm
3. Low water level safety
4. Ground in power circuit
5. Safety auxiliary relay
6. Wheel slip protection
7. MU stop button
8. Pneumatic control switch
9. Safety devices of YDM4/WDS6
10. Summary
11. Self-assessment exercises

1. LOW LUBE OIL SWITCH

This safety device is provided to protect the engine against low lubricating oil pressure. When the lubricating oil pressure falls below 30 psi (2.1 kg/cm²) the oil pressure switch is repositioned. The Governor clutch coil is de-energised. The Governor arms A & B are separated by bias spring; also the Governor stabilising coil is energised. The Governor shuts down the engine. The engine start light comes on; low lubricating oil pressure indicating light (green) comes on.

2. HOT ENGINE ALARM

(a) Variable speed drive for radiator fan

This device is used to keep the cooling water temperature within permissible limits. At predetermined temperature it starts first the radiator fan to run at medium speed, then at faster speeds, and finally brings the engine to idle if the radiator fan can not control the temperature.

(b) Hot engine safety circuit

Engine temperature sensitive switch, ETS, closes when the cooling water temperature rises above 84°C (185°F). The hot engine indication light (red) comes on. Signal relay SR is energised through ETS. Engine temperature relay ETR is also energised. The Governor speed coil is set for idle speed, also the alarm gong comes on.

3. LOW WATER LEVEL SAFETY (Fig.1&2)

This safety device is provided against low cooling water level. If the cooling water level drops to a predetermined level the alarm sounds and the engine shuts down. The LWS contact opens in clutch coil circuit. The Governor clutch coil is de-energised. The Engine is shut down through the governor circuit. LWS also energises wire 5B thereby the hot engine light comes on. The signal relay is energised (SR) and the alarm gong rings.

4. GROUND IN POWER CIRCUIT

The ground relay, GR, is energised whenever insulation resistance between main generator circuit and ground goes down. The reset knob of GR comes out. The ground relay contact GR opens and generator field contactor GF is de-energised. The Generator Field contact opens the generator field circuit, and power to motors is cut off. The Governor speed coil is set up for the idle speed when the GR contact closes in the Governor speed coil circuit. The ground relay light (white) comes on. The signal relay is energised, resulting in alarm gong sounding

5. SAFETY AUXILIARY RELAY

Whenever the governor speed coil starts getting the reference current, the safety auxiliary relay SAR operating coil is energised and its contact picks up. This safety device is provided to prevent the Diesel Engine from over speeding in case any open circuit takes place in the speed coil circuit. If this condition arises SAR operating coil will be de-energised, resulting in de-energisation of the clutch coil. The Governor arms A and B are separated by bias spring and the engine comes to stop.

In addition to this a mechanical device is also provided to prevent the engine from over-speeding (over speed trip mechanism) when the Diesel engine speed goes to more than 1120 RPM this device trips the engine to shut mechanically by moving the fuel racks to no fuel position.

6. WHEEL SLIP PROTECTION

Whenever wheel slip relay WSR1 or WSR2 or WSR3 is energised wheels slip buzzer sounds by wire 10 through wire 13. Wheel slip light comes on. By closing WSR1 or WSR2 or WSR3 interlocks the PWM main turn off winding in the excitation system is connected across battery source and the generator power is reduced.

7. M.U.STOP BUTTON / SWITCH

When it is desired to stop all engines working in multiple unit operation, this emergency stop button is pushed.

8. PNEUMATIC CONTROL SWITCH

This switch (PCS) trips during emergency brake application, train partition, vigilance control device being not minded by the driver at the specified time etc. When PCS trips, engine speed and power returns to notch one through the governor speed circuit.

9. SAFETY DEVICES - YDM4/WDS6

9.1 LOW LUBRICATING OIL PRESSURE

This safety device is provided to protect the engine against low lubricating oil pressure. As soon as the lubricating oil pressure falls below safe minimum the engine through the governor shuts down giving an alarm signal

9.2 HOT ENGINE ALARM

(a) Variable speed drive radiator fan

This device used to keep the cooling water temperature within permissible limits. Reaction is similar to that in the WDM2 locomotive.

(b) Hot engine safety circuit

If engine water temperature exceeds the set value of temperature switch (ETS1) a contact closes and energises signal relay (SR). The warning light comes on and alarm gong sounds. If the temperature continues to rise above the set value to temperature switch (ETS2) if used, a contact opens and de-energises the engine run relay (ERR) when ERR drops out the engine speed returns to idle.

9.3 LOW WATER LEVEL SAFETY (Fig.9)

This safety device is provided against low cooling water level. If cooling water level drops to predetermined level in the expansion tank the alarm sounds and the engine shuts down.

9.4 GROUND RELAY

If a ground occurs in the power or control circuits, ground relay (GR) will operate. A normally closed contact drops out the generator field contactor (GF) thus the generator excitation is removed. GF interlock also opens in the separate excitation circuit to remove exciter excitation. Engine run relays are energized; all the governor speed solenoids drop out forcing the engine to return to idle speed.

9.5 WHEEL SLIP PROTECTION

Wheel Slip relays (WSR) are connected between points of equal potential in the traction motor circuits. If a motor slips during operation, a difference of potential will exist across the relay coil and the relay picks up. When the relay is energized, its contacts will light a lamp and sound the warning buzzer.

Also a contact on the wheel slip relay, in series with the governor over-ride solenoid will close. This action will reduce main generator output to the traction motors; automatically correcting wheel slip and then re-applying power when wheel slipping has stopped. The throttle handle does not have to be moved back unless slipping is corrected.

9.6 ENGINE OVERSPEED

If the engine exceeds a set value of engine speed, the over-speed mechanism operates the engine over speed switch (EOS de-energises ERR, and the engine shuts down. In this case alarm gong will not operate.

9.7 PNEUMATIC CONTROL SWITCH

This switch (PCS) trips during emergency brake application, train partition on vigilance control device operation (if used). When the PCS trips, the resulting circuit operation causes the engine speed and power return to notch 1.

9.8 ENGINE SHUT DOWN

Normal shutdown or stopping of the engine is accomplished by moving the engine control switch (ECS) to “SU STOP” position. If the locomotive is being operated in multiple, or if engine must be shut down in emergency, the ECS switch should be moved to “MU STOP” position.

10. SUMMARY

Safety devices play a very important role in the diesel locomotive to avoid extensive damage of engine components as well as transmission components. Among the safety devices, some are to ensure safety of the engine components and the diesel engine and rests are for safety of the transmission. There are minor differences between the safety devices of WDM2 and YDM4 locomotives. The over speed safety of WDM2 is a mechanical device and that of YDM4 is electrical. The wheel slip protection system of WDM2 reduces excitation during the occurrence of wheel slip and over-ride solenoid comes in operation in YDM4 in order to have load control.

11. SELF-ASSESSMENT EXERCISES

1. What does happen if the lube oil pressure of diesel engine falls below pre-set value?
2. Which device senses the cooling water level in expansion tank and what does it do in such occurrence?
3. What does the ground relay do?
4. How do the wheel slip relays sense traction motor faults and what happens in such situation?
5. How does the over-speed safety device shuts down the engine in YDM4 loco?