LATEST DESIGN IMPROVEMENTS FOR ALCO LOCO

PRIME OBJECTIVES OF MODIFICATIONS:

1. IMPROVEMENT IN FUEL EFFICIENCY.
2. POWER UPGRADATION.
2. IMPROVEMENT IN RELIABILITY (REDUCTION OF FAILURES).
3. REDUCTION OF MAINTENANCE COST AND DOWN TIME.

Phases of Upgradations :-

S. No	Upgradation(HP)	Improve in Fuel Efficiency	Reduction in LOC	SFC (gm/bhp/ hr)
1	2600 ⟶ 2600 FE	6%	15%	166 to 156
2	2600FE ⟶ 3100	8%	25%	156 to 153
3	3100 ⟶ 3300	9.6%	33%	153 to150

Stage-1 : 2600 ⟶ 2600 FE Fitment of fuel-efficient kit.

a. Large after cooler
b. High efficiency turbochargers(Napier & VTC304)
c. Modified water connections to after cooler
d. 17mm fuel injection pump
e. 12.5 CR Steel capped pistons
f. Modified cam shaft with 140 degrees overlap.

Stage-2 : 2600FE ⟶ 3100 HP

a. Engine RPM raised to 1050

b. High efficiency turbochargers(GE Twin discharge & VTC304)

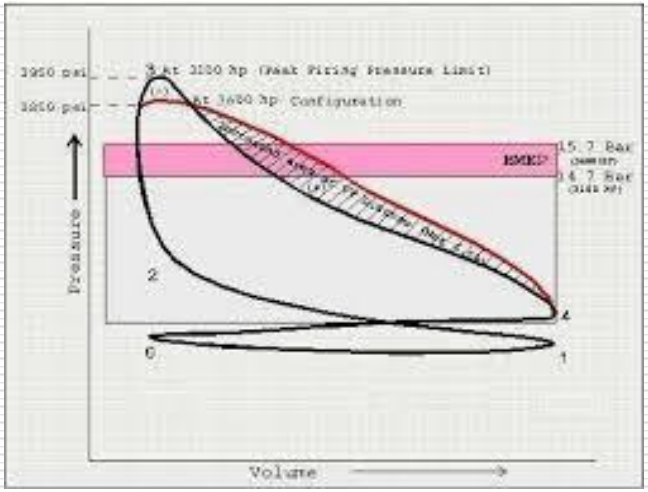
c. Fuel efficient piston ring

d. Use of Multigrade Lube oil.

Stage-3 :3100HP ⟶ 3300/3600 HP

Increased the Area of PV Diagram

a. **New generation Turbosuperchargers(TPR-61)**
b. **Stiffer unit Camshaft**
c. **251+ Cylinder head**
d. **11.75 CR super bowl steel cap piston**
e. **17 mm FIP with fuel rack of 35 division**
f. **HP tube for 1200 bar rating**



Other Relevant improvements

- **Longer life Fuel Oil filters (120 days sch.)**

  Earlier primary fuel oil filter – 30 days life, and secondary fuel oil filter – 60 days life. For use of long life filters both primary and secondary filters can give 120 days life

- **Longer life Lube Oil filters (240 days sch.)**

  Earlier conventional type lube oil filter – 120 days life.

  For use of long life lube oil filters can give 240 days life

Plate type Lube oil cooler:

Diesel electric locomotives 2600 HP were provided with shell and tube type lube oil cooler. Upgradation to 3100 HP and more necessitates the enhancement of cooling arrangements for vital combustion chamber components. Due to space constraints the shell and tube type design could not meet the enhanced requirement. A new design plate type lube oil cooler was developed and fitted on the 3100 HP locomotives which is smaller in size and has a higher heat transfer capacity.

Mechanically-bonded radiators

For improved reliability and longer life, mechanically bonded radiators are planned for use on WDG2 &WDM3D locomotives. Mechanically bonded radiators use seamless tubes, which are mechanically bonded with header, whereas in conventional radiators, rolled and soldered tubes are soldered with the header, which is less reliable as compared to mechanical expansion.

Thermal insulation for exhaust manifold

Thermal Insulation for Exhaust Manifold was 1st used on 3100 hp, full-width, dual cab, WDP2 locomotive primarily with the purpose of reducing temperatures in the engine room thus making the locomotive more user-friendly. A study undertaken by RDSO shows drastic reduction in manifold temperature by more than 250^{o}C along with reduction in fuel consumption by around 0.4%.

Moatti type Lube Oil filter

These filters do not employee any replaceable elements and therefore do not require much maintenance. In addition, the filtration efficiency is considerably higher and the use of a separate centrifuge also can be discontinued.

Open grain cylinder liners

It helps in forming thin lubricating film between piston and liner. It was introduced to reduce lube oil consumption and enhance service life.

Improvements in cylinder heads components

- **Improved valve guide with harder material, closer bore tolerance.**
- **Swivel type water jumpers instead of the gray cast iron flexible or rigid type jumpers**

L – Type composite brake blocks:

The non-asbestos L-Type composite brake blocks replaced Cast-iron brake blocks which was in use on various locomotives.

The advantages of L-type composite brake blocks:

- **Better Braking characteristics**
- **less Wear and more service life of blocks.**
- **less Wear on the running surface of the wheels**

Nylatron bushings and liners for bogies

Nylatron is a thermoplastic material used extensively on EMD locomotives in the bushings and liners of bogies as it is strong & wear-resistant. Its use is likely to help in increasing periodicity of bogie maintenance. It has been extend this concept on WDG2/WDM3D bogies also.

Modified bogie for WDM3D/WDG3 series without weight compensation arrangement

- **Elimination of equalizing/compensating beams.**
- **The loss in adhesion would be made up due to superior wheel slip control.**
- **Another feature planned for this design is provision of CRU instead of conventional cyl. roller bearings on journals for improved reliability & reduced maintenance.**

Driver’s friendly cab designed with suitable amenities.

Some of the important features are improved cab structure with noise proofing, redesigned partition door, improved locks, superior lights, superior gauges, amenities etc.

Roller suspension Bearing:

- **Roller bearing equipped motor suspension unit offers a significant increase in bearing life. It has 06 years overhauling period.**
- **RSB require little maintenance compare to plain suspension bearing.**
- **The roller Bearing MSU also offers an improved lubrication design because it is grease lubricated, oil levels do not have to be maintained, contamination and sealing concerns are minimized, oil wick inspection and replacement are eliminated.**
- **As these offer reduced radial clearance, it will result in reduced gear teeth wear, reduced gear case and motor support bearing problems and reduced motor vibrations.**

Air dryer :

Compressed air is used on Diesel electric and electric locomotives, EMU/MEMU and DEMU for brake system and operation of other auxiliary devices. The compression cycle of ambient air includes compression in locomotive compressor and then cooing in after cooler. During compression, pressure and temperature of ambient air increases but its relative humidity decreases. However absolute amount of the moisture present in the air remains the same. After compression when the air is cooled in after cooler, it becomes saturated and condensation takes place. This condensed moisture is drained out from main reservoirs. A major portion of moisture is remove in this process, but water still remains present in the form of vapor in the compressed air. This water vapor condenses in air brake equipment/valves, air pipes and auxiliaries during train operation. Eliminating those problems Airdryer is provided.

Development of high-efficiency RTMBs and FTTMBs

Higher efficiency RTTMBs and FTTMBs for better cooling of Traction motors have been developed with modified blades and sealed bearings.

AC motor for fuel pump & crankcase

In view of the inherent problems of brush holder & commutator in DC motors, AC fuel pump and Crankcase motor(s) with built-in invertor was developed. It is Maintenance free motor.

AC dust exhauster blower motor for engine filtration system

In view of the inherent problems of brush holder & commutator in DC motors, it has been decided to develop AC Dust Exhauster blower motor with built-in invertor. It is Maintenance free motor.

LED type flasher light

RDSO has conducted a comparative study of conventional, Xenon and LED type flasher lights and concluded that the LED type light is the best suited for our application.

Micro-processor based control system

The E-type excitation control system of ALCO class locomotive were replaced with microprocessor control system, due to various advantages and latest technology.

The microprocessor based locomotive control system receives various digital input signals either from driver control desk, MU wires of other loco, feed back signals from individual output devices like relays, contactors etc. indicating their status, energized or not.

Micro-controller based engine governor

Apart from fuel saving, have given an excellent performance.

All the analog parameters like voltages, currents, pressures and temperatures are sensed through various sensors and are connected to the system.

Thank you

Stiffer unit camshaft

Larger dia. cam lobes can withstand higher stresses thereby resulting in higher camshaft life. In this design, one cam segment is meant for one cylinder and can be attended separately. Each segment, therefore, can be removed and replaced easily by simply removing the fuel pump support of that location. Valve timing adjustments of the adjacent cylinders are not disturbed. In conventional design, whole camshaft assembly has to be necessarily removed from the free end which takes too much time. Expected life of the camshaft is more than six years.