Diesel Electric Locomotive 2700 HP – Modernised

The Diesel electric 2700 HP modernized locomotive, brings back first of all, the innovative technology tested on Carpathia 2300 DE-M locomotive.

In order to achieve this project we used the platform of a 2100 HP old locomotive, brought into the workshop from operation for repair works.

In its modernization we used a more powerful diesel engine, from the range of products of the German producer MTU, so we succeeded to create a high performance and balanced product, built exactly according to the requirements of the client.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel arrangement</td>
<td>Co’Co’</td>
</tr>
<tr>
<td>Maximum power output</td>
<td>2700 HP</td>
</tr>
<tr>
<td>Top speed</td>
<td>100 km/h</td>
</tr>
<tr>
<td>Fully loaded weight</td>
<td>115 t</td>
</tr>
<tr>
<td>Maximum axle load</td>
<td>19 t</td>
</tr>
<tr>
<td>Starting tractive effort</td>
<td>350 kN</td>
</tr>
<tr>
<td>Wheel radius</td>
<td>1100 mm</td>
</tr>
<tr>
<td>Wheelbase (between bogie pivots)</td>
<td>9000 mm</td>
</tr>
<tr>
<td>Length</td>
<td>17000 mm</td>
</tr>
<tr>
<td>Width</td>
<td>3000 mm</td>
</tr>
<tr>
<td>Height (measured from the rail top)</td>
<td>4475 mm</td>
</tr>
<tr>
<td>Minimum curve radius</td>
<td>275 m - line service</td>
</tr>
</tbody>
</table>
Design concept

Drive concept

The voltage from the main generator is rectified by a three-phase rectifier and applied to a converter which in turn feeds independently each traction motor using six PWM traction inverters. Two choppers deal with the rheostatic braking. This equipment is assembled into two identical and independent groups supply the driving trains. Each group consists of an chopper for braking and three traction motors which drive the wheels of each bogie. If a fault is signaled by one of the six sensors installed in each traction motor or by a protection device inside the power semiconductor inverters, the locomotive can continue it’s service at a traction rating proportional with the faulty sections that can be independently isolated.

For feeding the auxiliary services, an IGBT static converter is used. This converter consists of an chopper for the braking circuit and four inverters for the asynchronous motors of the compressor, forced ventilation motors for the traction motors and rheostatic braking blocks.

Control concept

A command, protection, diagnose and signaling computer collects various data types and continuously monitors the regimes in which the locomotive is operating. This computer is built-up in a modular design and keeps track of 160 digital signals, 60 analog signals, and commands 64 power outputs.

Also, a traction-braking computer controls and monitors the six traction inverters of the six traction motors. Using the built-in braking choppers energy is recovered. Advanced software algorithms implemented in this computer prevents wheel slip and ensures the optimum system operation.

Mechanical concept

The Diesel electric 2700 HP modernized locomotive is a box-frame locomotive with crew cabs at the ends. The machinery room is split into three distinct compartments, electric, diesel engine, pneumatic and hydraulic. For easy installation of equipment or maintenance, the top of the machinery room is open. Roof sections can be removed for this purpose.
### Diesel engine
- **MTU - 16V4000R43R**
  - UIC nominal power rating: 2000 bkW
  - Rated speed: 1800 rpm
  - Idle speed: 600 rpm
  - Engine torque: 9019 Nm
  - No load, idle fuel consumption: 5.7 kg/h
  - Engine arrangement: V16
  - Engine displacement: 76.3 liters
  - Bore / stroke: 170 / 210 mm
  - Emissions regulation: Stage III A

### Generator
- **GFP 560 M8**
  - Power rating: 2000 kVA
  - Rated speed: 1800 rpm
  - Voltage: 1400 V
  - Frequency: 120 Hz
  - Current: 825 A
  - Efficiency: 0.95
  - Protection class: IP 21
  - Operating class: S1
  - Isolation class: H (VPI)

### Traction motors
- **GDTM 533 F**
  - Power rating: 475 kVA
  - Rated speed: 2380 rpm
  - Voltage: 1400 V
  - Frequency: 48 Hz
  - Current: 238 A
  - Efficiency: 0.947
  - Protection class: IP 21
  - Operating class: S1
  - Isolation class: H (VPI)

### Compressor
- **Almig TrackAir TA22E**
  - Type of compressor: screw
  - Air flow: 2770 l/min
  - Pressure rating: 10 Bar
  - Driving motor power: 22 kW
  - Driving motor type: async
  - Driving motor rated speed: 3000 rpm
  - Other installed features: air dryer, cooling fan, oil heater
### Command block
- **Command, protection, diagnose**
  - Measures fuel levels in main fuel tank
  - Measures in kilograms fuel consumption rates
  - Measures fuel temperature
  - Measures engine RPM
  - Manages data using the cabin HMI's
  - Stores and tracks the state of all system inputs
  - Sends data to the speed measuring devices
  - Stores non-authorized system entry's
  - Vocal and graphic signaling of system status

### Inverter block
- **Traction-braking inverters**
  - Uses DSP micro-controller technology
  - Independent inverters, one for each traction motor
  - Long life-expectancy (no moving parts)
  - Constant power or constant torque regimes
  - Energy recovery using built-in choppers
  - Dynamic software controlled traction motor outputs
  - Software wheel-slip prevention algorithms
  - Modular design, with separate function blocks
  - Built-in communication modules

### Cab equipment
- **Improved crew conditions**
  - Air cooling unit
  - Joystick-type train commands
  - HMI display with touchscreen
  - Ergonomic seats
  - High power cabin heating units
  - Adjustable heated rear-view mirrors
  - Controls for shunting operation