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सत्यमेव जयते

भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - 226 011
Government of India-Ministry of Railways
Research Designs & Standards Organisation
Lucknow - 226 011

AN ISO 9001 CERTIFIED ORGANISATION

No.SD.Genl.3
एसडी.जनरल.3

Date.27.09.2016

Chief Motive Power Engineer/Diesel,

1. Central Railway, CST, Mumbai - 400 001(MH)
2. Eastern Railway, Fairlie Place, Calcutta -700 001 (W.B.)
3. Northern Railway, Baroda House, New Delhi -110 001
4. N.E.Railway, Gorakhpur-273 001 (UP)
5. N.F.Railway, Maligaon, Guwahati -781 011 (Asam)
6. Southern Railway, Park Town, Chennai -600003 (TN)
7. S.C.Railway, Rail Nilayam, Secunderabad -500 371 (AP)
8. S.E.Railway, Garden Reach, Calcutta -700 043 (W. B)
9. Western Railway, Church gate, Mumbai -440 020 (MH)
10. North Western Railway, Jaipur-302006 (Rajsthan)
11. East Central Railway, Hajipur-844101 (Bihar)
12. East Coast Railway, Bhubaneshwar -751017(Odisha)
13. North Central Railway, Allahabad-211001 (UP)
14. West Central Railway, Jabalpur - 482001 (MP)
15. South Western Railway, Hubli - 580023 (Karnataka)
16. South East Central Railway, Bilaspur - 495004 (Chhatishgarh)

**विषय**: Diagram book of WDP4D (4500 HP) locomotive.

Newly prepared diagram book for WDP4D (4500 HP) Dual cab locomotive for Passenger service is issued as details given below:

Diagram Book of WDP4D (4500 HP) Dual cab AC – AC traction locomotive report no. MP.MISC – 316 (Rev 0.00) September' 2016.

DA : As above

(सी.मधुसुदन राव)
(C. Madhusudana Rao)
कार्यकारी निदेशक/चा.श.
EDSMP

**GOVERNMENT OF INDIA**
MINISTRY OF RAILWAYS
भारत सरकार - रेल मंत्रालय

# डब्ल्यूडीपी4डी(4500एच.पी.) डुअल कैब एसी–एसी कर्षण डीजल इलेक्ट्रिक लोकोमोटिव की रेखाचित्र पुस्तिका

# DIAGRAM BOOK OF WDP4D (4500 HP) DUAL CAB AC – AC TRACTION DIESEL ELECTRIC LOCOMOTIVE

रिपोर्ट सं.एमपी.मिस्ले- 316(संशो.– 0.00),सितम्बर'2016
Report No.MP.MISC- 316 (REV. – 0.00),September'2016

**MOTIVE POWER DIRECTORATE**
चालन शक्ति निदेशालय

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| Signature | 27/9/16 | 27/9/16 | 28/9/2016 |
| Name & Designation | Sudhakar Kumar SSE(D)/MP | Pankaj Saxena Dy.Director/MP | C. Madhusudana Rao EDSMP |
| | Prepared by | Checked by | Approved by |

# WDP4D (4500 HP) DUAL CAB 3-PHASE AC-AC TRACTION CO-CO DIESEL ELECTRIC LOCOMOTIVE

## BRIEF DESCRIPTION OF THE LOCOMOTIVE

## GENERAL

The WDP4D dual cab locomotive is equipped with a turbocharged 16-cylinder 2-stroke 710 G3B diesel engine. This engine has high fuel efficiency and requires low maintenance. The fuel efficiency of this locomotive is better than the existing locomotives. This engine has many modern features like, laser hardened cylinder liners, unit fuel injectors which eliminate the problematic HP tube, Inconel valves, hydraulic valve adjuster, durable crankcase and piston structure. The diesel engine drives the main alternator.

***Feature of dual cab has sufficiently improved the visibility for crew***. The length of locomotive is 23002 mm over buffer to buffer where as, length of both cab is not same. The CAB-1 & CAB-2 length are 2377 and 2232 mm respectively.

This locomotive has been designed to run up to maximum operating speed of 140 Km/h on BG routes of Indian Railways for passenger service. The tractive effort limiting switch has been provided in the driver cab of the locomotive & may be operated by the crew at the time of requirement.

## ELECTRICAL MACHINES

### (A) Traction & Companion Alternator (TA 17)

1. **The main alternator TA17 is a 3-phase, 10 pole, 90 slots machine** equipped with two independent and interwoven sets of stator winding. The main alternator construction is such that there are basically two alternators in one - two sets of stator windings, permanently connected in series, work with a rotating field common to both the windings in order to provide higher alternator output voltage, which is a basic requirement of a low current high voltage alternator used on AC-AC locomotives. The main alternator converts the mechanical power of diesel engine into 3-Phase Electrical Power alternating current. The internal rectifier bank of the main alternator converts 3 Phase AC Power into DC Power (alternating current into direct current) there by providing a DC power output. The DC voltage output from the main alternator is called the DC link voltage and is applied to the traction inverters. DC link voltage varies with the throttle position from 600 V DC at Throttle - 1 to 2600 V DC at Throttle - 8. The inverter changes DC power into variable frequency variable voltage 3 phase AC power for traction requirement as per the feedback control signals received from LCC & TCC. **WDG4D locomotive is provided with self load test feature, capable of testing full output of the engine.** There are three variants of traction alternator in this locomotive i.e M/s EMD, M/s BHEL and M/s Yongji at present.

2. **Companion alternator** (**CA 6B)**

   This is a three phase AC steady state alternator of 250 kVA rating, which is physically connected but electrically independent of the main alternator. The companion alternator rotor

field is excited directly by auxiliary supply of the locomotive (74± 4 V DC). It receives the excitation current from the auxiliary alternator through a pair of slip rings which are located adjacent to the slip rings of the main alternator. The companion alternator develops power whenever the diesel engine is running. The output voltage is directly proportional to the speed of rotation but varies to some extent with change in alternator temperature and load. It is used for excitation of the main alternator as well as for supply to Inertial (dustbin) blower, TCC1 and TCC2 blower motor, TCC electronic blower, 55-220V AC for radiator fans and various control circuits. An AC auxiliary alternator of 18 kW rating is used for meeting the auxiliary and control system load

**3. Traction Alternator Blower**

The Main Alternator Blower and traction motor blower share a common housing mounted on the front side of the auxiliary generator. Although both the blowers are mounted on the auxiliary generator shaft an internal partition separates the two blower portions. Air is drawn from the central air compartment into the alternator blower close to the auxiliary generator and passes through a duct to the main alternator air box. Air from alternator blower first cools the main alternator rectifier banks then passes internally through the alternator and companion alternator to the engine room. This creates a slight positive pressure to keep the dirt from entering the engine room

**(B)Traction Motor**

1. **The traction motor** is a three phase, asynchronous type 4 poles force cooled electrical machine. Its stator winding is star connected. The motor converts electrical power into mechanical power to the shaft. It has very simple & extremely rugged, almost unbreakable construction i.e. squirrel cage rotor. Use of AC traction motor in AC-AC transmission has the advantage of high adhesion and high tractive effort, maintenance free, high reliability & availability and higher energy efficiency. In dynamic braking mode, the three-phase motors act as generators and power is fed back to the DC link via the two inverters and gets dissipated in BDR grids.

   There are five variants of traction motor in this locomotive i.e M/s Siemens, M/s EMD, M/s Yongji, M/s Medha & M/s BHEL at present. The technical details are incorporated in RDSO specification no. MP.0.2400.52 (Rev.02) July'2013.

**2. Traction Motor Blower**

It mounted on the auxiliary generator, supplies air for traction motor cooling, generator pit aspirator operation, main electrical cabinet pressurization and traction computer cooling. Air is drawn through a movable inlet guide vane through the blower, and delivered into a duct to the traction motors. A portion of this air is diverted through a set of filters for delivery to the computer module portion of traction inverter cabinets for module cooling. Another set of filters cleans the air used to pressurize the main electrical cabinet.

**C).Other Electrical Machines**

**1. Dynamic Brake Grid Blower**

Each unit of the Dynamic Brake Grid Blower Assembly consists of fan assembly powered by a 36 HP series wound DC motor. During dynamic braking, a portion of the current (rectified DC) from the traction motors is shunted around one of the resistor grids and used to power the grid blower motor. Air driven by the grid blower drives grid heat to atmosphere.

**2. Inertial / Dustbin Blower**

Outside air is cleaned by Inertial (dustbin) blower, before it enters central air cabinet. In the Inertial blower there are two inertial filter panels, one mounted on either side of the locomotive. Outside air is drawn rapidly through the tubes which contains specially designed vanes that induce a spinning motion to the contaminated incoming air. Dirt and dust particles, because they are heavier than air are thrown to the outer wall of the tube and carried to the bleed duct where it is removed by the scavenging action of the Inertial blower and expelled through the roof of the locomotive. The resulting clean air continues on through the smaller diameter portion of the tube where the air is again caused to swirl by internal vanes. The particles are carried to the bleed duct and the resulting clean air enters the central air compartment.

**3. Radiator Cooling Fan Motors**

Radiator Cooling Fan Motors are of the inverted squirrel cage induction motor type and are integral part of the cooling fan assembly. Each cooling fan (total two per locomotive) is driven by a two-speed AC motor, which in turn is powered by the companion alternator. Cooling fans are powered through contactors, which are controlled by the locomotive control system. Each fan motor circuit consists of one slow-speed and two fast-speed contactors that are located in the AC cabinet.

## AC –AC TRANSMISSION SYSTEM

There are three types of AC-AC transmission systems of M/s EMD, M/s Siemens & M/s Medha in this variant of locomotive. ***In EMD and Siemens AC-AC traction/transmission systems***, the locomotive has two traction inverters TCC1 and TCC2 (one inverter per 3 traction motors of a bogie) whereas in ***Medha traction systems*** it has 6 traction inverters (one inverter per traction motor). The output of inverters (pulse width modulated PWM output voltage) is responsible for providing the variable frequency and the variable terminal voltage for the three-phase motors. The main alternator feeds electrical power to the DC link via two series connected diode rectifiers. The TCC blowers diffuse heat produced by losses generated in TCCs.

The WDP4D locomotive is equipped with a microprocessor based computer control system. It provides fault detection of components and systems, it contains 'self tests' to aid in trouble shooting locomotive faults. It has basic features like, significant reduction in number of control modules, better fault detection of components, memory archive and data snap shot. This system is equipped with a diagnostic display system in the cab to provide an interface between the maintenance personnel and the computer. The computer is programmed to monitor and control locomotive traction power, record and indicate faults that have been incorporated in control system. **One of the special features of the locomotive is that, it is provided with event recorder, which downloads various parameters in control system for later use.**

## ELECTRICAL CONTROL SYSTEM

WDP4D locomotive electrical control items are as under:

- **Power & Control Cables**
  All power cables are Electron Beam cables as per EDPS-304 and control cables are as per EDPS-179. Circuit breakers and associated electrics are as per RDSO spec no. MP.0.2400.67
- **Loco Computer Control (LCC**)
  LCC has been fitted in the locomotive. LCC drives the Load Ammeter, Vigilance Control Device (VCD) or Alerter and Speedometer mounted on the Driver's control Desk. These outputs are electrically isolated from the Central Processing Unit (CPU) and have short circuit protection.
- **Wheel Slip Control Device**
  Wheel slip control device maximizes the adhesion performance and creep control philosophy is used. Speed sensors mounted on the Traction Motors provide the speed signals. Wheel diameter calibration gets done periodically, whenever loco is under coasting in a specified band of speed range and dynamic brake/pneumatic brake has not been applied. Sanding is operated automatically. During dynamic braking, controlled creep is used for wheel slide control.
- **Tractive Effort Limiting (TELM) Switch**
  Tractive effort limiting switch has been provided on Engine Control Panel to enable limiting of the tractive effort while working on Weak/Lengthy bridges.
- **Automatic Flasher Feature**
  Automatic flasher feature puts on flasher light automatically when brake pipe pressure drops to 2.8 kg/cm$^2$ due to extraneous reasons like train parting.
- **Manual Flasher Light Switches**
  These switches are provided in both the cabs. In each cab, two switches are provided on Control Console. From any cab, Flasher Lights can be put ON.
- **BL Key for Cab Selection**
  This BL Key is provided in both the Cabs. BL Key is a master handle for Cab selection in dual cab locomotive. BL Key is a ten pole switch. It is mounted on the ECC# 1 in Cab-1 and ECC# 4 in Cab-2 on the Engine Control panel. BL Key is having two positions OFF and ON. BL Key handle can be inserted or removed in OFF position only. The cab in which BL Key is Inserted and kept in ON position, is called Active Cab. If the BL Key is removed in both Cabs the locomotive is treated as Isolated. If BL Key is inserted and turned ON in both the Cabs, then also the locomotive is treated as Isolated. The BL Key interlock is provided in the following Circuits. Therefore without BL Key in ON position, the following operations are not possible:
  - Alerter Reset push button Input
  - RAPB/AEB switch enable Input
  - TE limit switch enable Input
  - Horn Push button Input (for event recorded data)

- Throttle and reverser handle Inputs
- Manual sand switch Input

- **Battery Ammeter**
  This Analog Meter indicates the locomotive Battery Charging/Discharging rate. This Battery Ammeter is provided in Cab-1 only.
- **Classification Lights Switch**
  This Rotary switch has three settings LONG HOOD FORWARD, OFF and CAB END FORWARD. In Dual Cab Locomotives it is provided in both the Cabs. In Cab-1 if this switch is kept in Cab End Forward (cab-1 end) position Cab-1 side white lights and Cab-2 side red lights become ON. If in Cab-2 this switch is kept in Cab End Forward (Cab-2 end) position, the Cab-2 side White lights and Cab-1 side Red lights become ON.
- **Alerter Light**
  It is provided in both the Cabs. Whenever T0 Cycle (60 sec.) is completed, computer drives a Digital output to the Alerter light to alert the operator. Both Cab Alerter lights blink at a time, but Alerter Reset is possible from Active Cab only.
- **Alerter Alarm**
  The Alerter Alarm sounds, if the driver has not acknowledged the flashing of the console Alerter indicator lights for 8 seconds. When the Alerter sounds the driver must acknowledge it within the next 8 seconds to avoid a penalty Brake application.
- **Speedometer**
  An analog speedometer mounts to the right handle side of the air flow indicator. The speedometer scale is 0 to 120 kilometers per hour (km/h).
- **Event Recorder**
  This is as per RDSO specification No. MP.0.3700.12 (Rev.00) Jan'2009. The system shall be able to record the following events in a separate (take out type) memory unit:
  - Train Brake pipe pressure (kg/cm$^2$)
  - Loco Brake Cylinder Pressure (kg/cm$^2$)
  - Status of penalty application (through PCS)
  - Notch position (idle, 1$^{st}$ to 8$^{th}$)
  - Status of power application (motoring/braking)
  - Direction of movement of loco (Forward/Reverse)
  - Locomotive speed (Kmph)
  - Status (ON/OFF & Dim/Bright) of headlight
  - Status (ON/OFF) of flasher light
  - TE limit switch ON/OFF
- **Emergency Fuel Cut-off (EFCO) & Engine Stop Switch**
  When this switch is pressed for approximately 0.5 seconds, this Red push button switch requests the Locomotive Computer to stop the Diesel Engine. The push button need not be held until the engine stops. However, pushing the button for 0.5 second ensures that the Computer recognizes the switch actuation as a proper shutdown request. One more additional EFCO/Eng. Stop switch is provided.

- **Head Light Switches**
  In dual CAB loco, in each CAB there are two rotary switches to select CAB end / hood end headlights.
- **Memory Freeze Switch**
  It is provided in both the CABs in parallel. In any CAB, if it is ON then LCC will get Memory Freeze digital input. Suitable type of switch is provided for memory freeze operation which is used for freezing the event recorder data as and when required specially in accident case. Normally this switch is sealed.

## BOGIE & UNDERFRAME

The WDP4D locomotive is equipped with high adhesion HTSC (High Tensile Steel Cast) truck or bogie. The bogie assembly supports the weight of the locomotive and provides the means for transmission of power to the rails. The HTSC bogie is designed as a powered 'bolsterless unit'. Although the bogie or truck 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 truck or bogie to the locomotive underframe through the carbody pivot pin assembly. Each bogie is equipped with three unidirectional AC traction motors for better adhesion characteristics. The motors are geared to the driving axles, which in turn apply rotational force to the rails through the wheels. The driving force is transmitted to the bogie through traction link attached to the journal-bearing adapter and the bogie frame. From the truck/ bogie frame the driving force is transmitted to the locomotive carbody through the carbody pivot pin.

Each locomotive is an independent power source. Several units may be combined for multiple operations to increase the load capacity.

The WDP4D locomotive has been designed on the 'platform' concept which means that the layout and the mounting of equipment is arranged in such a manner that retrofitment of equipment developed in future on existing locomotives as well as equipment changes/upgradation of the existing design of the locomotive can be implemented without any major change in the underframe, structure and even layout.

Coupler and Buffer: H-type couplers to DLW Pt. No. 11535945 & Long life side Buffers to DLW Pt. No. 11982100 are fitted in the locomotive. Cattle Guards have been fitted on both ends of locomotive as per DLW Pt. No. 17032969.

## BRAKING SYSTEM

The locomotive is equipped with computer controlled braking system as per RDSO specification no. MP.0.01.00.20 (Rev.02) April'2010 or MP.0.01.00.24 (Rev.01) Jan'2010. This system is an electro-pneumatic microprocessor based system. The overall purpose of using a computer (microprocessor) to control the air brake system is to eliminate as many of the electrical and mechanical devices as possible, thereby reducing periodic maintenance, simplifying trouble shooting, fault diagnostics etc. It allows greater reliability and flexibility for future system upgrade.

The CCB system conforming to UIC requirements and during operation and diagnoses any fault and communicates to the system for logging and display.

The complete information related to brake system is as under

- Brake rigging and brake ratio are as per drawing no. SK.VL-756
- Single brake block system which utilizes one composition brake block at each wheel.
- Parking brakes have been provided in rear bogie.
- Dynamic brake has been provided in the locomotive.
- Automatic Emergency Brake (AEB) and Restricted Air Penalty brake Switch (RAPB): AEB restricts the speed of locomotive to a preset value, which is useful in ghat sections. RAPB switch is provided in the cab to enable AEB feature.

## SPEED POTENTIAL

In order to establish the speed potential of WDP4D (dual cab) locomotive on track maintained to C&M-I, Vol.-I standard, detailed oscillation trials have been conducted on BAD – AGC section of North Central Railway up to a maximum speed of 150 Km/h on tangent track and station yard. The test results are contained in RDSO report no. MT-1097/F (Rev.0) dated 11-04-2011, which indicate that the WDP4D locomotive has exhibited satisfactory riding characteristics up to a maximum test speed of 150 km/h on tangent track, station yard.

Oscillation trials on 2° degree curve up to a maximum speed of 120 Km/h have also been conducted over BZL- DKAE section of Howrah – Dhanbad route of Eastern Railway on track maintained to C&M-I, Vol.-I standard. The test results as contained in RDSO report no. MT-1146/F (Rev.0) dated 19-12-2011, indicate that the WDP4D locomotive has exhibited satisfactory riding characteristics up to a maximum test speed of 120 km/h on 2° degree curve.

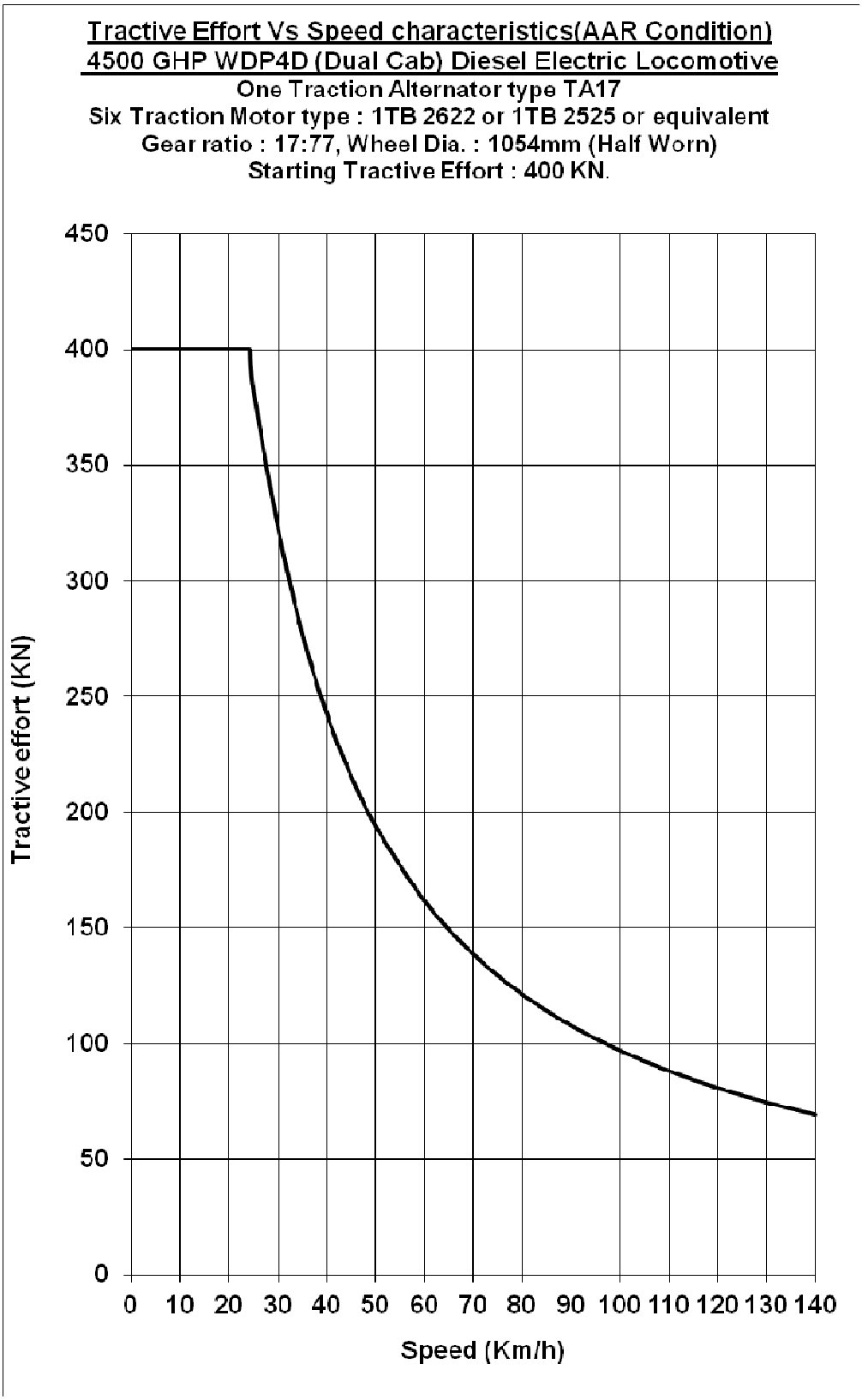
Based on the satisfactory trial results, it is certified that single/double headed WDP4D (Dual cab) class of locomotives has been ***permitted to run up to a maximum speed of 135 km/h on track maintained to C&M-I, Vol.- I standard & 105 Km/h on track maintained to other than C&M-I, Vol.- I standard*** of Indian Railways.

## HAULING CAPACITY, BALANCING SPEED & ACCELERATION CHARACTERISTICS

### Load chart for passenger services

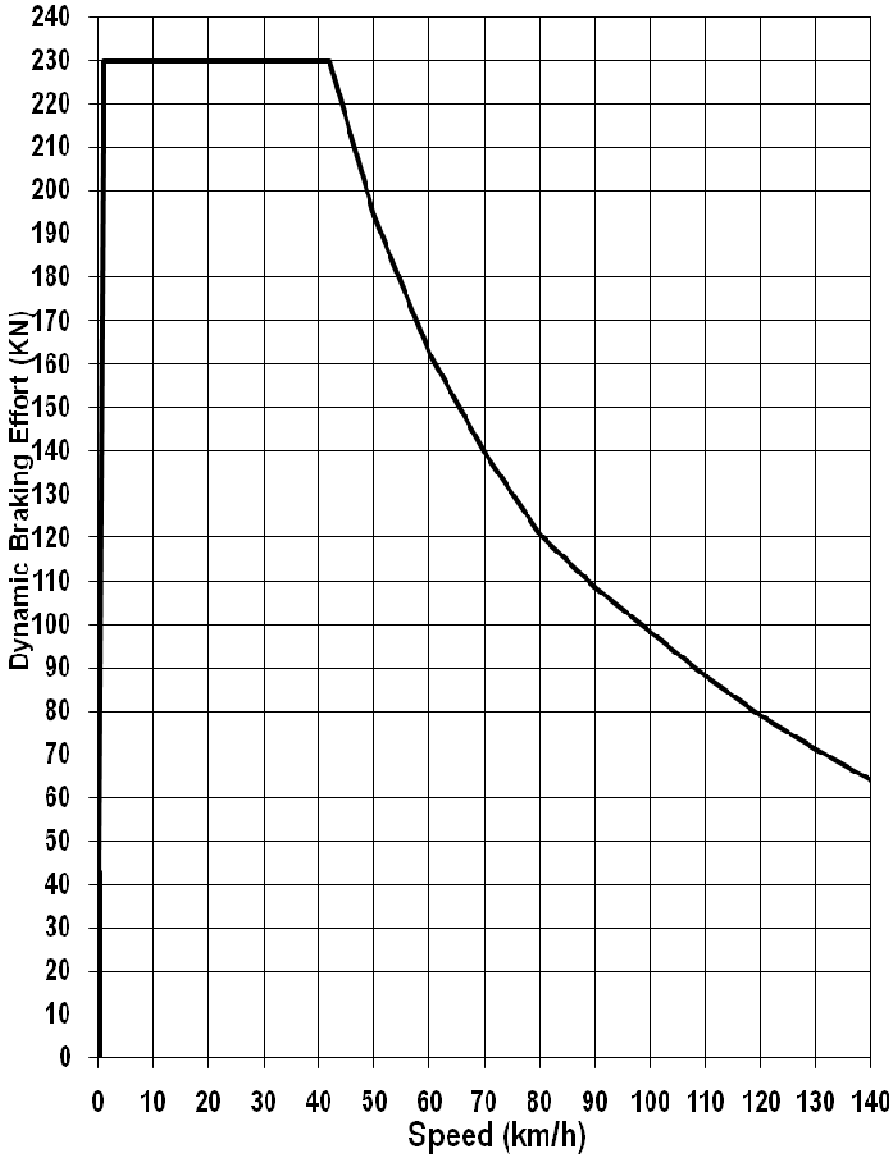
- The load charts are drawn considering the which is the current limitation imposed by loop length.
- Values of trailing tonnages given in the chart are the maximum permissible values. Values are applicable for straight track only.
- On a curved section actual permissible load will be less than the values specified above. Actual permissible loads should be fixed based on load trial.
- Trailing loads fixed by load trial should be confirmed by load factor trial also.

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Tractive Effort Vs Speed characteristics(AAR Condition)
4500 GHP WDP4D (Dual Cab) Diesel Electric Locomotive
One Traction Alternator type TA17
Six Traction Motor type : 1TB 2622 or 1TB 2525 or equivalent
Gear ratio : 17:77, Wheel Dia. : 1054mm (Half Worn)
Starting Tractive Effort : 400 KN.
Tractive effort (KN)
450
400
350
300
250
200
150
100
50
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
Speed (Km/h)

## Dynamic Braking Charactristics of 4500 GHP WDP4D (Dual cab) Diesel Electric Locomotive

One Traction Alternator: TA17
Six Traction Motor: 1TB 2622 or 1TB 2525 or Equivalent
Gear Ratio: 17:77, Wheel Dia: 1054 mm (Half Worn)




**Note**: The maximum dynamic braking effort estimated in the chart is based on electrical parameters of the loco. Actual effort may vary slightly depending upon the adhesion.

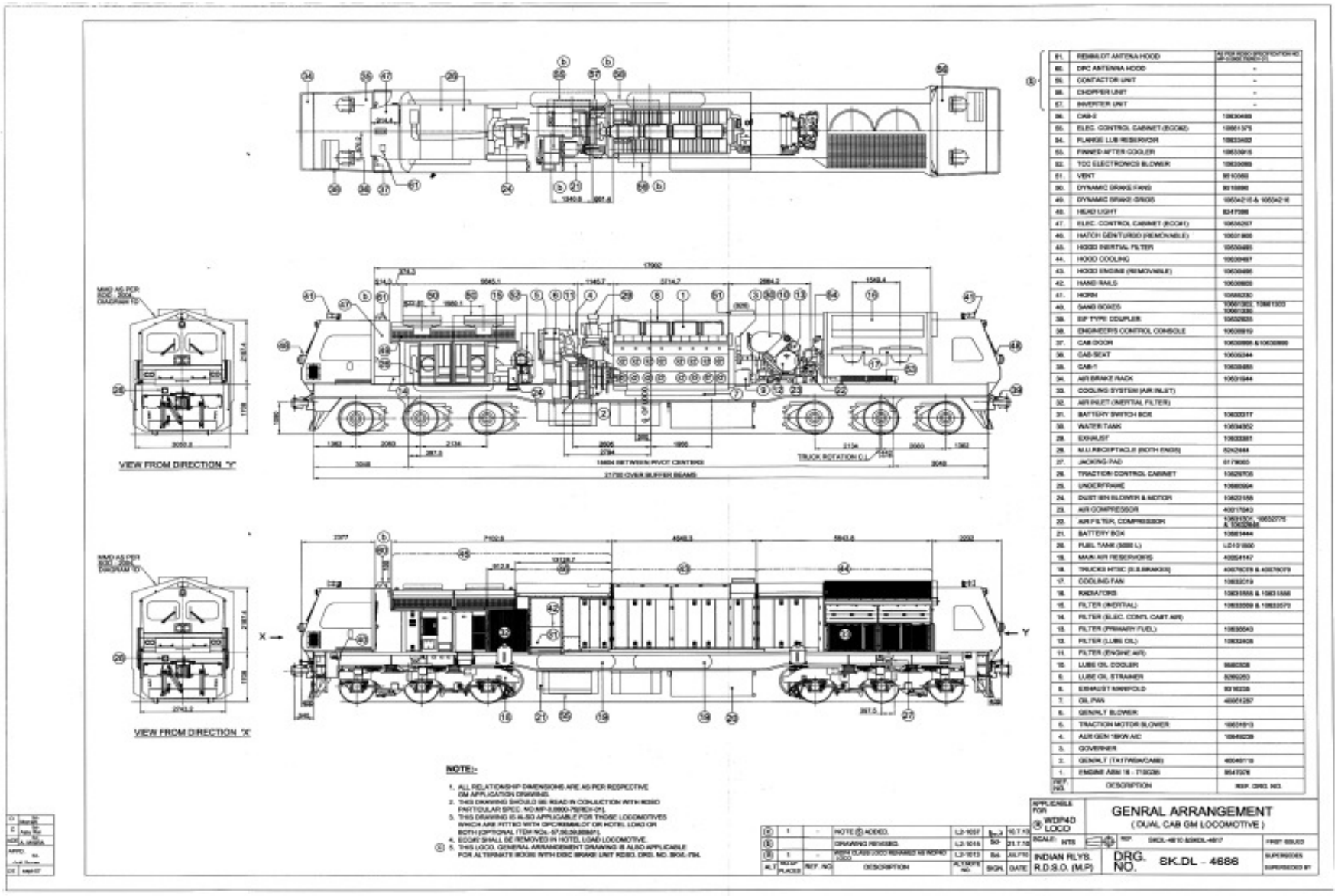
## MAIN PARTICULARS OF WDP4D (Dual Cab) LOCOMOTIVE

| **GENERAL** | | **Injection System** | | |
|---|---|---|---|---|
| Weight of loco in Working Order (T) | 123 | Type | Direct unit injector | |
| Adhesive weight in Working Order (T) | 123 | Displacement / cyl. | 11635 cm² | |
| Axle load (T) | 20.5 | **Turbo Supercharger** | | |
| Wheel dia (new) Driving mm. | 1092 | Make and type | EMD Model G | |
| Tractive effort (Kg.), Maximum | 400 KN | Weight of turbocharger | 953 Kg. | |
| Speed (Km/h) . Maximum | 140 | **TRANSMISSION (ELECTRICAL)** | | |
| Transmission | AC – AC traction | **Traction Alternator** | **EMD** | **BHEL** |
| **ENGINE** | | Make and type | EMD TA-17 | BHEL TA 9901 |
| Make and type | 710 G3B | Number per locomotive | One | one |
| No./Loco | One | Maximum speed | 954 rpm | 954 |
| Governor | Woodward | Max. Voltage | 2600 V DC | 2600 V DC |
| Weight of engine (dry) | 17963 Kg. | Max. continuous current | 1250 A DC | 1250 A DC |
| Number of cylinders | 16 | **Companion Alternator** | | |
| Cylinder formation | 45 degree V type | Make and type | CA 6B | **AA 9201** |
| Bore and stroke in mm | 230.19 x 279.4 | Max. Voltage | 230 V AC | 230 V AC |
| Mean piston speed m/sec | 8.38 | Frequency at 954 rpm | 127 Hz | 127 Hz |
| BMEP at rated output | 11.23 | Max. power | 250 KVA | 250 KVA |
| Compression ratio | 16 : 1 | Unit weight (TA & Comp. alternator assly.) | 8709 Kg (Appr.) | 7400 Kg (Appr.) |
| Lube oil sump capacity | 1073 Litre | **Traction Motor** | | |
| Lube oil pan, from bottom to top dip stick | 371 Litre | **Make** | **Siemens** | **EMD** |
| **Horse Power** | | Type | 1TB2525 – 0TA02 | A 2916-8 |
| AAR condition | 4500 hp | Number per locomotive | 6 | 6 |
| At site (47°C – 600m) | 4400 hp | Continuous voltage/Current/ Nominal rating | 1520V / 202A / 485 KW | 1550V / 265A / 435 KW |
| Input to traction | 4150 hp | Maximum Power (KW) / speed (RPM) | 630 / 3320 | 630 / 3200 |
| **RPM** | | Gear ratio | 17:77 | 17:77 |
| Rated | 954 | Suspension | Axle hung | Axle hung |
| Idle / Low idle | 269 / 200 | Motor, Complete weight | 2120 Kg | 2061.58 Kg |

| **Cooling system** | | **AUXILIARIES** | |
|---|---|---|---|
| Water Pump type | Centrifugal | **Auxiliary Generator** | |
| Water pump capacity | 3411 l/m at 900rpm | Make and type | GM, 5A – 8147 |
| No. of radiator fans | Two | HP absorbed | 18 kW |
| Fan drive | AC motor | Rating | 74 V DC, 904 rpm |
| Fan power | 113.4HP | **COMPRESSOR** | |
| **BATTERIES** | | Make | GARDENER DENVER (GD) & ELGI |
| Make and type | SURRETTE, 16 CH-25 Unitized | Type | Water – cooled, two stage, 3 cylinder (Model – WLNA 9BB & RR66101 W |
| Number of cells | 10 | Free Air Delivery (FAD) | GD make – 170 SCFM at 900 rpm & 35 CFM at 200 rpm<br>ELGI make – 200 CFM at 950 rpm & 35 CFM at 200 rpm |
| Arrangement | 2 series connected<br>5 cell Ni-Cadmium Shaft-Nife SRX1500P batteries | Lube oil capacity | GD: Maximum -11.63 lit<br>ELGI: Maximum 12 lit & 6 lit minimum. |
| Voltage | 72.5 VDC | Weight | 1043 Kg |
| Capacity | 150 AH | **CONTROL SUPPLIES** | |
| Head light | 200W,30V PAR- 56Standard bulb | **Fuel tank (Detachable)** | |
| | | Number per locomotive | One |
| **BRAKES** | | Total capacity | 5000 litres |
| Locomotive | Air, Hand, Dynamic Brakes fully Blended with Automatic Brakes. | **Sand** | |
| Train | Pure air brake system. | Number of sand boxes / Locomotive | **8** |
| System | KNORR/NYAB CCB equipment. | Total capacity | 0.028$m^3$ Box (1.0 cubic ft. / box) |

## Comparative study of TCC's of different make on WDP4D (Dual Cab) locomotive

| Features | MEDHA | SIEMENS | EMD |
|---|---|---|---|
| **Type of control** | Individual motor control<br>Six traction invertors for each traction motor | Individual bogie control<br>Two traction invertors one for each bogie, PWM Invertor, 3KV, 900Amps | Individual bogie control<br>Two traction invertors for each bogie |
| **IGBT Devices** | ABB make, 5SNA 0600G650100, VCES =6.5 KV, IC=600Amps.<br>2 devices/phase module | ABB make, 5SNA1200G450300, VCES =4.5 KV, IC= 1200 Amps.<br>6 devices /phase module | Mitsubishi make, SD70 Ace, VCES =4.5 K V, IC=1200Amps,<br>4 devices /phase module |
| | | | |
| **Device Cooling** | Primary: Through heat pipe liquid circulation<br>Secondary: Air cooling by TCC Blower | Air cooling by TCC Blower | Air cooling by TCC Blower |
| **TCC Blower** | 6 | 2 | 2 |
| **DC Link isolation** | DC link isolator within TCC | DC link disconnector is within TCC Q8,Q9 (2 Nos) | DC link CB is in ECC#1 |
| **LCC** | Loco Control Computer is in **ECC#1** (MLC- 691)<br>Traction Control Computer is in **TCC** (MTCC) | Loco Control Computer H/w (SIBAS 32S) & S/w and<br>Traction Control Computer H/w & S/w – **both are in TCC** | Loco Control Computer EM2000 Traction Control Computer (MPU) **both are in ECC#1** |
| **DC Link Capacitors** | 6 | 4 (C1,C2,C3,C4)-1.75 mf | 8 ( each 550 µF) |
| **Hotel Load Invertor** | Underslung, if provided | In TCC | - |
| **Crow bar protection** | Brake Chopper | Yes | Yes |
| **Display Unit** | VFD | Graphical Display Unit with TFT Screen. | VFD |


VIEW FROM DIRECTION "X"
VIEW FROM DIRECTION "X"
TRUCK ROTATION C.L
1568X BETWEEN PIVOT CENTERS
21700 OVER BUFFER BEAMS
NOTE:-
1. ALL RELATIONSHIP DIMENSIONS ARE AS PER RESPECTIVE GM APPLICATION DRAWING.
2. THIS DRAWING SHOULD BE READ IN CONJUCTION WITH RDSO PARTICULAR SPEC. NO:MP-0.0000-75(REV-01).
3. THIS DRAWING IS ALSO APPLICABLE FOR THOSE LOCOMOTIVES WHICH ARE FITTED WITH DFC/REMBLOT OR HOTEL LOAD OR BOTH (OPTIONAL ITEM NOs.-57,58,59,60).
4. EQUIP SHALL BE REMOVED IN HOTEL LOAD LOCOMOTIVE.
5. THIS LOCO. GENERAL ARRANGEMENT DRAWING IS ALSO APPLICABLE FOR ALTERNATE BOGIES WITH DISC BRAKE UNIT REFER. DRG. NO. 8K.DL-194.
61. REMBLOT ANTENA HOOD
60. DFC ANTENNA HOOD
59. CONTACTOR UNIT
58. CHOPPER UNIT
57. INVERTER UNIT
56. CAB-2
55. ELEC. CONTROL CABINET (ECC&E)
54. FLANGE LUB RESERVOIR
53. FINNED AFTER COOLER
52. TDC ELECTRONICS BLOWER
51. VENT
50. DYNAMIC BRAKE FANS
49. DYNAMIC BRAKE GRIDS
48. HEAD LIGHT
47. ELEC. CONTROL CABINET (ECC&T)
46. HATCH GENTURDO (REMOVABLE)
45. HOOD INERTIAL FILTER
44. HOOD COOLING
43. HOOD ENGINE (REMOVABLE)
42. HAND RAILS
41. HORN
40. SAND BOXES
39. BP TYPE COUPLER
38. ENGINEER'S CONTROL CONSOLE
37. CAB DOOR
36. CAB SEAT
35. CAB-1
34. AIR BRAKE RACK
33. COOLING SYSTEM (AIR INLET)
32. AIR INLET (INERTIAL FILTER)
31. BATTERY SWITCH BOX
30. WATER TANK
29. EXHAUST
28. M.U.RECEPTIVACLE (BOTH ENDS)
27. JACKING PAD
26. TRACTION CONTROL CABINET
25. UNDERFRAME
24. DUST IEH BLOWER & MOTOR
23. AIR COMPRESSOR
22. AIR FILTER, COMPRESSOR
21. BATTERY BOX
20. FUEL TANK (5000 L)
19. MAIN AIR RESERVOIRS
18. TRUCKS HTSC (D.B.BRAKES)
17. COOLING FAN
16. RADIATORS
15. FILTER (INERTIAL)
14. FILTER (ELEC. CONTL CABT. AIR)
13. FILTER (PRIMARY FUEL)
12. FILTER (LUBE OIL)
11. FILTER (ENGINE AIR)
10. LUBE OIL COOLER
9. LUBE OIL STRAINER
8. EXHAUST MANIFOLD
7. OIL PAN
6. GENRLT BLOWER
5. TRACTION MOTOR BLOWER
4. AUX GEN 15KW A/C
3. GOVERNER
2. GENRLT (TA17A69A/CA8E)
1. ENGINE ABM 16 - 710G3B
SEQT NO. DESCRIPTION REFR. DRG. NO.
APPLICABLE FOR WDP4D LOCO
GENRAL ARRANGEMENT
( DUAL CAB GM LOCOMOTIVE )
SCALE: NTS
INDIAN RLYS. R.D.S.O. (M.P)
DRG. NO. 8K.DL – 4886
D 1 – NOTE (5) ADDED. L2-1057 16.7.15
B – DRAWING REVISED. L2-1015 21.7.15
A 1 – WDM3 CLASS LOCO RENAMED AS WDP4D LOCO L2-1013
ALT. NO OF PLACES REF. NO. DESCRIPTION ACTIVITY NO. SIGN. DATE

| HAULAGE CAPACITY (PASSENGER) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LOCO: WDP4D (4500 HP)** | | | | | **Track condition: Dry Rail** | | | | **WT OF LOCO : 123 t** | | | | |
| **Trailing load in ones at Km/h on tangent track, ICF stock ( With 0.005m/sec² acceleration reserve)** | | | | | | | | | | | | | |
| **GRADE** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** |
| **LEVEL** | 22920 | 16065 | 10515 | 7390 | 5445 | 4140 | 3230 | 2560 | 2060 | 1675 | 1375 | 1135 | 940 |
| **500** | 10385 | 7825 | 5445 | 4040 | 3115 | 2470 | 1995 | 1635 | 1350 | 1125 | 945 | 795 | 665 |
| **400** | 9125 | 6925 | 4855 | 3620 | 2810 | 2240 | 1815 | 1495 | 1240 | 1040 | 870 | 735 | 620 |
| **200** | 5665 | 4385 | 3125 | 2370 | 1870 | 1510 | 1245 | 1035 | 870 | 735 | 620 | 530 | 445 |
| **150** | 4505 | 3510 | 2515 | 1915 | 1515 | 1230 | 1015 | 850 | 715 | 605 | 515 | 440 | 370 |
| **100** | 3185 | 2495 | 1795 | 1375 | 1090 | 890 | 735 | 615 | 520 | 440 | 375 | 315 | 265 |
| **50** | 1660 | 1300 | 930 | 710 | 560 | 450 | 370 | 305 | 255 | 210 | 175 | 145 | 115 |

**Note:**

The above values are derived through theoretical computer simulation and may be used as a guideline & load may be fixed after conducting actual field trials.

## Balancing speed (Km/h) & acceleration characteristics of WDP4D locomotive on level track

| Locomotive | Balancing speed (Km/h) | | |
|---|---|---|---|
| | **18 ICF Coaches (920 T) (15 SL+ 2 III AC +1 II AC)** | **21 ICF Coaches (1075 T) (17 SL+ 3 III AC +1 II AC)** | **24 ICF Coaches (1230T) (18 SL+ 3 III AC+2 II AC +1 II AC)** |
| WDP4D | 143 | 135 | 126 |

## Acceleration characteristics

| Speed (km/h) | **18 ICF Coaches (15 SL+ 2 III AC +1 II AC)** | | **21 ICF Coaches (17 SL+ 3 III AC +1 II AC)** | | **24 ICF Coaches (18 SL+ 3 III AC+2 II AC +1 I AC)** | |
|---|---|---|---|---|---|---|
| | **Time (Minutes)** | **Distance (Km)** | **Time (Minutes)** | **Distance (Km)** | **Time (Minutes)** | **Distance (Km)** |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 – 10 | 0.13 | 0.01 | 0.15 | 0.12 | 0.18 | 0.01 |
| 0 – 20 | 0.26 | 0.04 | 0.30 | 0.04 | 0.34 | 0.06 |
| 0 – 30 | 0.41 | 0.10 | 0.47 | 0.12 | 0.54 | 0.14 |
| 0 – 40 | 0.81 | 0.21 | 0.93 | 0.24 | 1.02 | 0.29 |
| 0 – 50 | 1.13 | 0.42 | 1.32 | 0.50 | 1.43 | 0.66 |
| 0 – 60 | 1.52 | 0.71 | 1.74 | 0.92 | 2.04 | 1.13 |
| 0 – 70 | 1.91 | 1.28 | 2.37 | 1.56 | 2.71 | 1.84 |
| 0 – 80 | 2.56 | 1.95 | 2.94 | 2.40 | 3.62 | 2.97 |
| 0 – 90 | 3.24 | 2.93 | 3.92 | 3.71 | 4.83 | 4.62 |
| 0 – 100 | 4.16 | 4.34 | 5.08 | 5.56 | 6.32 | 7.12 |
| 0 – 110 | 5.23 | 6.46 | 6.61 | 8.32 | 8.85 | 11.30 |
| 0 – 120 | 6.84 | 9.52 | 9.05 | 13.05 | 13.31 | 17.31 |
| 0 - 130 | 9.32 | 14.71 | 14.00 | 20.08 | | |
| 0 - 140 | | | | | | |

**Note**: The above values are derived through theoretical computer simulation and may be used as a guideline & actual time& distance may be fixed after conducting actual field trials.