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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.11.01.2016

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 WDG4D (4500 HP) locomotive.

Newly prepared diagram book for WDG4D (4500 HP) Dual cab locomotive for freight service is issued as details given below:

Diagram Book of WDG4D (4500 HP) Dual cab AC – AC traction locomotive report no. MP.MISC - 312 (Rev 0.00) January' 2016.

DA : As above

(सुधांशु पँवार)
(Sudhansu Panwar)
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for Director General/Motive Power

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
भारत सरकार - रेल मंत्रालय

डब्ल्यूडीजी4डी(4500) डुअल कैब एसी–एसी कर्षण लोकोमोटिव की रेखाचित्र पुस्तिका

DIAGRAM BOOK OF WDG4D (DUAL CAB) (4500 HP) AC – AC TRACTION LOCOMOTIVE

रिपोर्ट सं.एमपी.मिस्ले. 312(संशो.– 0.00),जनवरी'2016
Report No.MP.MISC-312 (REV. – 0.00), January'2016

MOTIVE POWER DIRECTORATE
चालन शक्ति निदेशालय

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WDG4D (4500 HP) DUAL CAB 3-PHASE AC-AC TRACTION CO-CO DIESEL ELECTRIC LOCOMOTIVE

BRIEF DESCRIPTION OF THE LOCOMOTIVE

GENERAL

The WDG4D 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 is 2377 and 2232 mm respectively.

This locomotive has been designed to run up to maximum operating speed of 105 Km/h on BG routes of Indian Railways. 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 it is 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 four variants of traction motor in this locomotive i.e M/s Siemens, M/s EMD, M/s Yongji & M/s Medha 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 WDG4D 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

WDG4D 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, 1st to 8th)
  - 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 WDG4D locomotive is equipped with a fabricated 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. Axles 1 and 3 can move or kink a little bit to negotiate a curve from 0-8 degree deflection, increases the tractive effort and improves the rolling resistance. 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 tractive rod attached to the journal-bearing adapter in the 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 WDG4D 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: E-type couplers to DLW drawing no. 17451103 & Long life side Buffers to RDSO Drg. no. SK.DL 4748 have been fitted in the locomotive.
Cattle Guards have been fitted on both ends of locomotive as per RDSO Drg. no. 1032969.

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.

Computer simulation of EBD has been carried out and simulated EBD for (light) single WDG4D locomotive at 105 Km/h on level section is 477 m with full independent brake application (5.1 kg/cm² BC pressure).

SPEED POTENTIAL

In order to establish the speed potential of WDG4D (dual cab) locomotive on track maintained to other than C&M-I, Vol.-I standard, detailed oscillation trials have been conducted on BE – MB section of Northern Railway on tangent track, station yard and curved track. The test results are contained in RDSO report no. MT-1262/F dated 18-07-2013, which indicate that the WDG4D locomotive has exhibited satisfactory riding quality and stability characteristics up to a maximum test speed of 115 km/h on tangent track, station yard & curved track.

Based on the satisfactory trial results, it is certified that single/double headed WDG4D (Dual cab) class of locomotives may be permitted to run up to a maximum speed of 105 km/h on BG routes of Indian Railways.

HAULING CACACITY

Load chart for freight services

The load charts are drawn considering the standard 59 loaded BOXN wagons having capacity (CC+8+2t) i.e. 5400 tonnes which is the current limitation imposed by loop length.

To assist Railways to decide loads under adverse conditions also, it has now been decided to include two sets of load charts for diesel-electric locomotives for freight services i.e. one based on the dry rail condition (standard conditions) and the other for adverse conditions taking into consideration the wet rail condition.

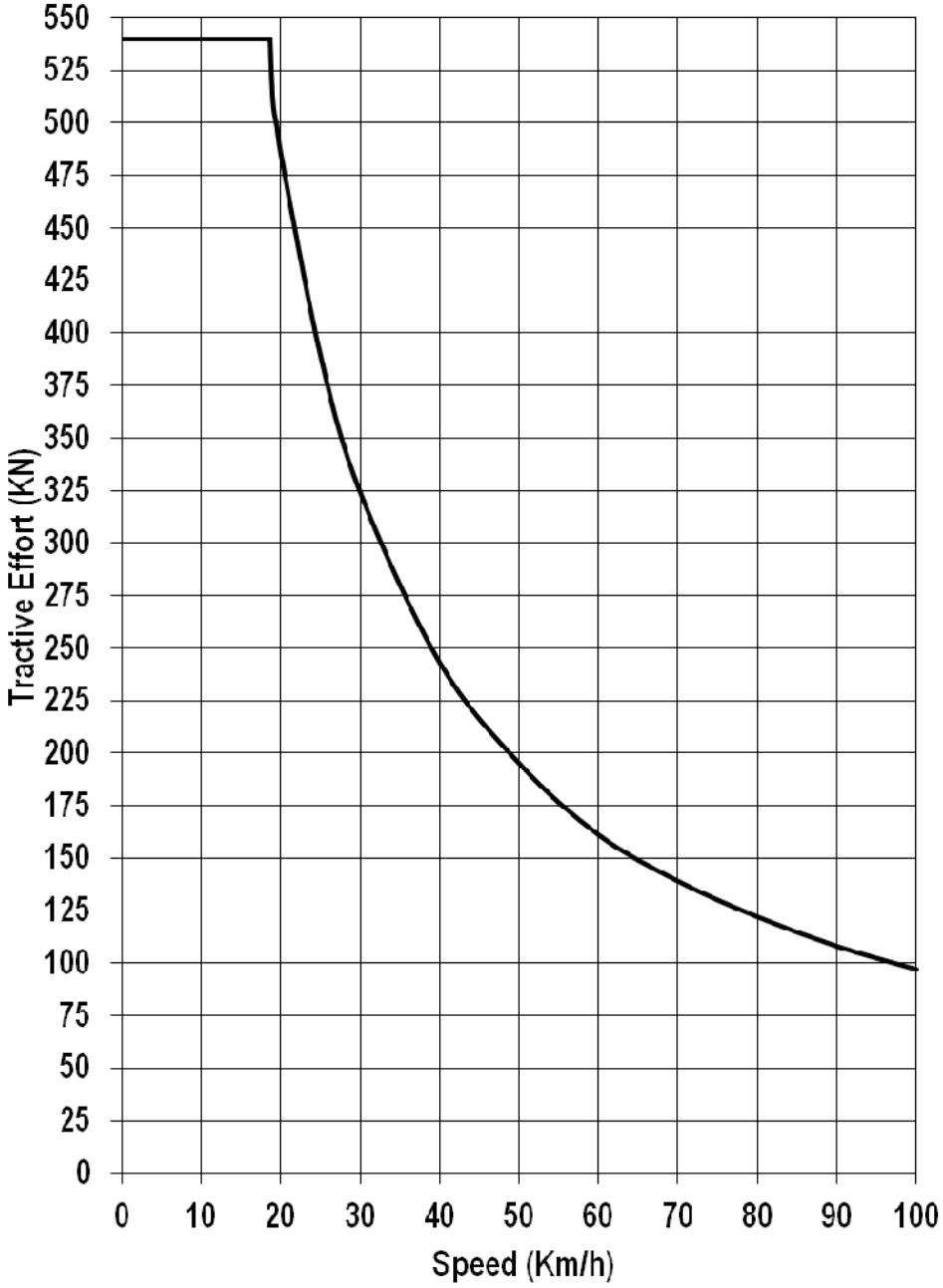
Assumptions for haulage capacity:

The following assumptions have been considered while computing / calculating haulage capacity of diesel electric locomotives for goods services:

- The load charts are applicable for dry rail conditions as well as wet rail conditions with different gradients.
- The load charts are based on designed value of adhesion on dry rail conditions. The adhesion values in case of wet rail condition is likely to drop maximum by 20% as compared to dry un-sanded condition as per RDSO Report no. TFC - 77, January '2002.
- The Load chart has been calculated on the basis of 5% ageing factor & no acceleration reserve.
- No de-rating factor has been considered in computing haulage capacity.
- Specific starting resistance of loaded BOXN / BCN wagon has been taken as 4 kg/t on main line service.

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Tractive Effort Vs Speed characteristics (AAR condition)
4500 GHP WDG4D (Dual Cab) Diesel Electric Locomotive
One Traction Alternator : TA17
Six Traction Motor : 1TB 2622 or 1TB 2525 or equivalent
Gear ratio : 17:90, Wheel Dia. : 1054mm (Half Worn)
Starting Tractive Effort : 540 KN

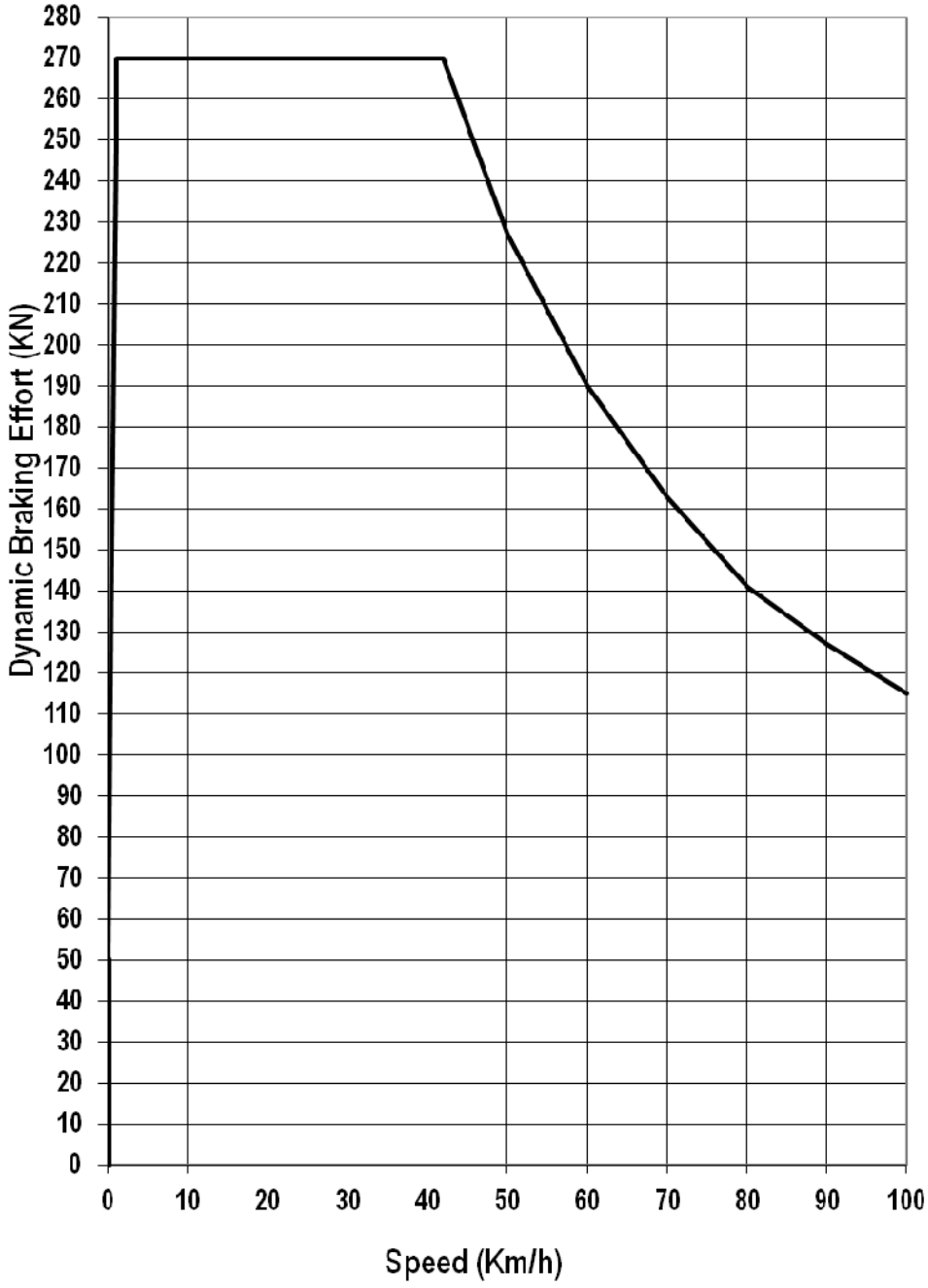


Dynamic Braking Characteristics of
4500 GHP WDG4D (Dual cab) Diesel Electric Locomotive

Traction Alternator: TA17

Traction Motor: 1TB 2622 or 1TB 2525 or Equivalent

Gear Ratio: 17:90, Wheel Dia: 1055 mm (HW)



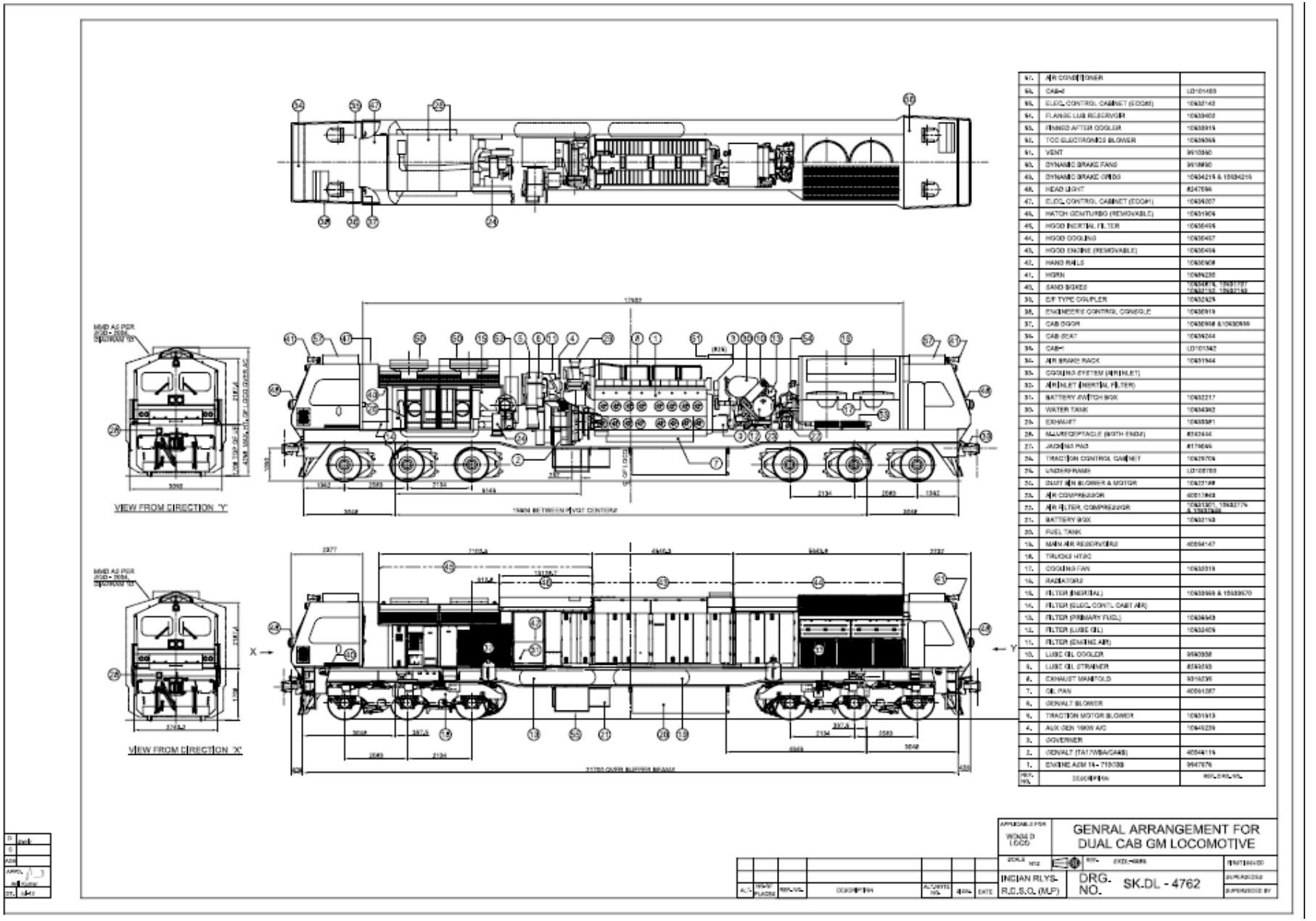
MAIN PARTICULARS OF WDG4D (Dual Cab) LOCOMOTIVE

GENERAL		Injection System		
Weight of loco in Working Order (T)	130.2	Type	Direct unit injector	
Adhesive weight in Working Order (T)	130.2	Displacement / cyl.	11635 cm²	
Axle load (T)	21.7	Turbo Supercharger		
Wheel dia (new) Driving mm.	1092	Make and type	EMD Model G	
Tractive effort (Kg.), Maximum	540 KN	Weight of turbocharger	953 Kg.	
Speed (Km/h) . Maximum	105	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	17:90	17:90
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 ELGI make – 200 CFM at 950 rpm & 35 CFM at 200 rpm
Arrangement	2 series connected 5 cell Ni-Cadmium Shaft-Nife SRX1500P batteries	Lube oil capacity	GD: Maximum -11.63 lit 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	6000 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	0.028m^3 Box (1.0 cubic ft. / box)

Comparative study of TCC's of different make on WDG4D (Dual Cab) locomotive

Features	MEDHA	SIEMENS	EMD
Type of control	Individual motor control Six traction invertors for each traction motor	Individual bogie control Two traction invertors one for each bogie, PWM Invertor, 3KV, 900Amps	Individual bogie control Two traction invertors for each bogie
IGBT Devices	ABB make, 5SNA 0600G650100, VCES =6.5 KV, IC=600Amps. 2 devices/phase module	ABB make, 5SNA1200G450300, VCES =4.5 KV, IC= 1200 Amps. 6 devices /phase module	Mitsubishi make, SD70 Ace, VCES =4.5 K V, IC=1200Amps, 4 devices /phase module
Device Cooling	Primary: Through heat pipe liquid circulation 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) Traction Control Computer is in TCC (MTCC)	Loco Control Computer H/w (SIBAS 32S) & S/w and 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



97.	AIR CONDITIONER	
96.	CAB-II	LD1010403
95.	ELECL CONTROL CABINET (ECGCIII)	10633142
94.	FLANGE LUB RESERVOIR	10633402
93.	FINNED AFTER COOLER	10633919
92.	TCC ELECTRONICS BLOWER	10633694
91.	VENT	9610360
90.	DYNAMIC BRAKE FANS	9618890
89.	DYNAMIC BRAKE GRIDS	10634215 & 10634216
88.	HEAD LIGHT	8247596
87.	ELECL CONTROL CABINET (ECGPI)	10634207
86.	HATCH GENITURBO (REMOVABLE)	10631904
85.	HOOD INERTIAL FILTER	10630494
84.	HOOD COOLING	10630497
83.	HOOD ENGINE (REMOVABLE)	10630498
82.	HAND RAILS	10630908
81.	HORN	10689230
80.	SAND BOXES	10634875L, 10631197, 10631197, 10631198
39.	D/F TYPE COUPLER	10632424
38.	ENGINEERS CONTROL CONSOLE	10630919
37.	CAB DOOR	10630898 & 10630899
36.	CAB SEAT	10634244
35.	CAB-I	LD1010402
34.	AIR BRAKE RACK	10631944
33.	COOLING SYSTEM (AIR INLET)	
32.	AIR INLET (INERTIAL FILTER)	
31.	BATTERY SWITCH BOX	10632217
30.	WATER TANK	10634382
29.	EXHAUST	10633981
28.	MAU/RECEPTACLE (BOTH ENDS)	8242446
27.	JACKING PAD	8178696
26.	TRACTION CONTROL CABINET	10637674
25.	UNDERFRAME	LD1007703
24.	DUST SEN BLOWER & MOTOR	10632198
23.	AIR COMPRESSOR	40611948
22.	AIR FILTER, COMPRESSOR	10632301, 10632776 & 10632302
21.	BATTERY BOX	10632163
20.	FUEL TANK	
19.	MAIN AIR RESERVOIRS	40694147
18.	TRUCKS HTSC	
17.	COOLING FAN	10633519
16.	RADIATORS	
15.	FILTER (INERTIAL)	10633569 & 10633570
14.	FILTER (ELECL CONTL CABT AIR)	
13.	FILTER (PRIMARY FUEL)	10636949
12.	FILTER (LUBE OIL)	10632409
11.	FILTER (ENGINE AIR)	
10.	LUBE OIL COOLER	9949358
9.	LUBE OIL STRAINER	8249193
8.	EXHAUST MANIFOLD	9916295
7.	OIL PAN	40691287
6.	GENALT BLOWER	
5.	TRACTION MOTOR BLOWER	10631913
4.	AUX GEN 190KW A/C	10646239
3.	GOVERNER	
2.	GENALT (TA17/BA/CA48)	40644719
1.	ENGINE ASM 16- 710G3B	9947876
REV. NO.	DESCRIPTION	REF. DWG. NO.

HAULAGE CAPACITY (FRIEGHT)										
Loco: WDG4D (4500)			Track condition : Dry Rail				Weight of loco : 130.2 T			
Trailing load in tonnes at Km/h on tangent track										
BOXN/BCN Wagons and other casnub bogie air brake stocks										
GRADE	START	20	30	40	50	60	70	80	90	100
LEVEL	5400	5400	5400	5400	5400	5400	5400	5400	4515	3570
1/500	5400	5400	5400	5400	5400	4255	3420	2750	2290	1895
1/400	5400	5400	5400	5400	4760	3715	3005	2430	2035	1690
1/200	5400	5400	5085	3660	2835	2245	1840	1510	1280	1080
1/150	4990	4990	3950	2855	2215	1760	1450	1190	1015	855
1/100	3775	3775	2720	1965	1530	1215	1000	820	700	590
1/50	2145	2090	1365	975	750	590	480	390	325	270

HAULAGE CAPACITY (FRIEGHT)										
Loco: WDG4D (4500)			Track condition : Wet Rail				Weight of loco : 130.2 T			
Trailing load in tonnes at Km/h on tangent track										
BOXN/BCN Wagons and other casnub bogie air brake stocks										
GRADE	START	20	30	40	50	60	70	80	90	100
LEVEL	5400	5400	5400	5400	5400	5400	5400	5400	4515	3570
1/500	5400	5400	5400	5400	5400	4255	3420	2750	2290	1895
1/400	5400	5400	5400	5400	4760	3715	3005	2430	2035	1690
1/200	4725	4725	4725	3660	2835	2245	1840	1510	1280	1080
1/150	3965	3965	3950	2855	2215	1760	1450	1190	1015	855
1/100	2990	2990	2720	1965	1530	1215	1000	820	700	590
1/50	1690	1690	1365	975	750	590	480	390	325	270