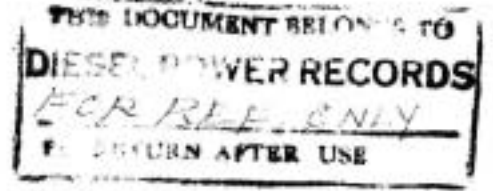


(for official use only)  
(अधिकार प्रयोग के लिए मात्र)



भारत सरकार  
रेल मंत्रालय

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS



१४०० अश्वशक्ति के डीजल गणक एकक हेतु  
उपकरण विशिष्टिकरण  
( आदिरूप विकास हेतु )

**Equipment Specification  
For  
1400 hp Diesel Multiple Unit  
(For Prototype Development)**

विशिष्टिकरण संख्या चा०श०. ०.२४.००.१८  
जनवरी १९९९  
(संशोधन - ००)

SPECIFICATION No. MP-0.24.00.18  
JANUARY 1999  
(REVISION -00)

अनुसंधान अभिकल्प एवं मानक संगठन  
मानक नगर, लखनऊ - २२६ ०११  
RESEARCH DESIGNS & STANDARDS ORGANISATION  
MANAK NAGAR, LUCKNOW-226 011

**EQUIPMENT SPECIFICATION OF 1400 HP DEMU**

1.0 1400 hp, Broad Gauge, diesel-electric multiple unit Power car with nominal axle load of 20 t and fitted with Cummins' KTA 3067 L fuel efficient diesel engine and AC/DC transmission, complete in all respects, shall be assembled, inter alia, with:-

- One Cummins' KTA 3067 L fuel efficient diesel engine capable of producing 1400 hp under standard conditions along with accessories and excitation control & speed governing LCC system.
- One BHEL Make traction alternator model TA 7003 AZ
- One BHEL make three phase bridge type rectifier
- Four BHEL Make 4303 AZ model traction motors.
- One Kerala Electrics Make Auxiliary alternator with voltage regulator.
- One complete set of BHEL make propulsion control equipment

2.0 **OPERATING REQUIREMENTS (half worn wheels)**

Maximum operating speed	100 km/h
Gear ratio	20:91
Motor Grouping	4P permanent
Continuous speed	42.9 km/h
Maximum tractive effort at start	15,000 Kg.
Continuous rating tractive effort	7100 kg
Installed power(standard conditions)	1400 hp
Installed power(site)	1370 hp
Power input to traction (site)	1250 hp
Speed Vs TE characteristics	RDSO Graph No. GDP- 1095
Dynamic brake	Not provided

3.0 **CLIMATIC CONDITIONS**

The DEMU power equipment shall be in continuous operation under the following atmospheric and climatic conditions :-

Ambient temperature	45 deg.C (occasional peak value of 50 deg.C)
Altitude	Sea level to 600 m
Humidity	40% - 100%
Maximum temperature	55 deg.C

4.0 **MULTIPLE OPERATION**

The DEMU shall be suitable for multiple operation upto a maximum of four Power cars in a formation of sixteen coaches. Multiple operation shall also be possible with all the types of existing 700 hp DEMUs manufactured by ICF.

5.0 **DIESEL ENGINE**

The Power car shall be powered by Cummins' KTA-3067-L fuel efficient diesel engine capable of producing 1400 hp at 1800 rpm under standard conditions. The engine shall be adjusted to deliver 1370 hp (site) for the present application. The engine shall deliver 1250 hp to the alternator under site conditions indicated above. The engine shall be fitted on the prototype only after type approval by RDSO.

6.0 **TRANSMISSION**

Transmission of power from the engine shall be done by means of a directly coupled self ventilated BHEL make TA 7003 model traction alternator, with BHEL make separately-mounted rectifier, driving 4 axle hung nose suspended BHEL model 4303 AZ traction motors. A 18.5 kW Kerala Electrical auxiliary alternator shall be provided. BHEL make propulsion control equipment shall be provided.

All electrical machines and control equipment shall generally conform to relevant IEC Publications and shall be type and routine tested as per RDSO approved test programme. Type testing of equipment shall be carried out by RDSO unless specifically waived by RDSO in case of proven equipment. The temperature rise limits given in the IEC Publication shall be reduced suitably to work out the applicable limits for alternator, traction motor and other machines to account for higher ambient temperatures in India.

#### 7.0 TRACTION ALTERNATOR

Make and Type	BHEL model TA 7003*
No. per DPC	One
Low voltage rating (DC)	3000A & 315 V
High voltage rating (DC)	1000 A & 900 V
Temperature rise limit	T1a-70 deg.C. for stator & T1f-70 deg.C. for field where T1a and T1f are the established temperature indices for armature and field insulation respectively.
Insulation	Class H
Ventilation	Self-ventilated
Excitation	LCC supplied with the engine suitable for BHEL alternator control model TA 7003
Alternator Characteristics	RDSO curve No. GDP - 1096

\* - The equipment shall be fitted on the prototype only after type approval by RDSO.

#### 8.0 TRACTION MOTOR

Make and Type	BHEL make 4303 AZ*
No. per DPC	Four
Low voltage continuous rating	425 amps, 530 V (IEC-20 deg.C)
Max. permissible speed	2772 rpm
Max. permissible current	750 amps
Insulation - Armature & field	Class H
Ventilation	Self-ventilated - air flow at 1170 rpm is 15 cub. m/min.
Traction Motor characteristics	BHEL curve No. TME/401188

\* - The equipment shall be fitted on the prototype only after type approval by RDSO.

#### 9.0 TRACTION RECTIFIER

Make & Type	BHEL make.
Number per DPC	One cubicle per Power car
Short time duty rating (DC)	3000 amps
Continuous rating (DC)	1800 amps, 530 V
Ventilation	Self-ventilated
Type of device	BHD R62-32
No. of bridges per cubicle	3
Device arrangement per bridge	1X1X6

**10.0 AUXILIARY GENERATOR**

Make & Type	Kerala Electricals or equivalent.
Number per DPC	One
Continuous rating	25 kW
Insulation - Armature & field	Class H
Drive	Belt-driven - drive taken from main alternator end
Ventilation	Self-ventilated

**11.0 CONTROLS AND GAUGES**

Adequate control equipment including gauges, instruments and cab safety devices shall be provided for safe and satisfactory operation of the Power car and the Driving trailer car. The controls shall be so arranged in the cab that it will be within easy reach of the driver from all driving positions. All gauges shall be of proven and reliable design. Graduations of all gauges shall be in metric units. Following gauges shall be provided in the cab :-

- Diesel engine lube oil pressure gauge.
- Cooling water temperature gauge (Electronic).
- Fuel oil pressure gauge.
- Boost pressure gauge.
- Traction motor load Ammeter.
- Air brake gauges
- Battery charge and discharge ammeter.
- Water level indicator (Electronic)
- Speedometer

The following audio-visual signals or reference panel lights shall be provided in the cab for single and multiple operation of the Power cars :

- Low lubricating oil pressure.
- Radiator water temperature too high.
- Engine shut-down
- Wheel slip indication.
- Battery discharge indication.
- Aux. Gen. failure indication.
- Low idle rpm indication.
- Power ground.
- Cranking contactor welding indication
- Traction control supply ON
- Alternator overload
- Alternator winding temp.
- Alternator bearing temp.
- Engine trip
- Rectifier fuse failure
- Rectifier cooling fan failure
- Aux. Alternator failure
- Motor overload failure
- Motor earth fault
- Parking brake applied
- Drive function released
- Common annunciation
- Train parting indication
- Multiple operation status

The following safety devices, inter alia, shall be provided :

- Water temperature too high - Transmission cut-off and engine returned to idle.
- Low water in radiator - Power to transmission cut-off and engine shut down.
- Low lube oil pressure - Power to transmission cut-off and engine shut down.
- Engine speed too high (Over speed trip) - Power to transmission cut-off and engine shut down

Adequate protection of an approved design shall be provided against electrical overloads and grounding.

The following minimum operating controls for multiple unit operation of all Power cars from any cab of Power or Driving trailing unit shall be provided :-

- Notch control
- Brakes
- Forward and reverse movement control

Safety interlock shall be provided to prevent Power cars in multiple unit operation from being moved when all the Power cars are not set for propulsion in the same direction. The Power car shall be provided with speed indicating and recording system of approved Make and shall confirm to RDSO Specification No. MP.0.3700-01.5.

## **12.0 CABLES & OTHER ELECTRICAL FITTINGS**

Power & control cables of standard metric sizes shall be provided as per RDSO Specification No. SPEC/E-14/01(Part II)-REV-II:1993 (Table 1). Terminal ends for control cables and wire shall confirm to RDSO Specification No.MP- 0.5200.04.

The Power car shall be equipped at both ends with standard headlights to RDSO specification no. EL/TL/41. Aspect lights, cab lights/ conduits etc. shall be of type available indigenously. The Power car shall be provided with flasher lights to RDSO Spec. No. SPEC/E-14/6/02-A of Aug '87 with Amendment dt. 4-4-90.5.8.3.

## **13.0 COMPRESSOR**

Air compressor shall be ELGI make TRC 1000 B or similar, delivering a minimum of 20 cfm at 8 kg/sq. cm at engine idling speed.

## **14.0 LUBRICATION**

Grease nipples shall conform to IS specification No. 4009. All the grease nipples & adapters, where used, shall be tack welded to prevent them from unscrewing and falling off in service.

## **15.0 ROLLER BEARINGS**

Roller bearings used on the Power car at various locations shall be such which can be inspected easily. Pre-packed bearings are not preferred for auxiliary equipment.

## **16.0 FIRE EXTINGUISHER**

Three Halon 1211 type fire extinguishers shall be provided, one in the engine compartment and the others in the cabs.

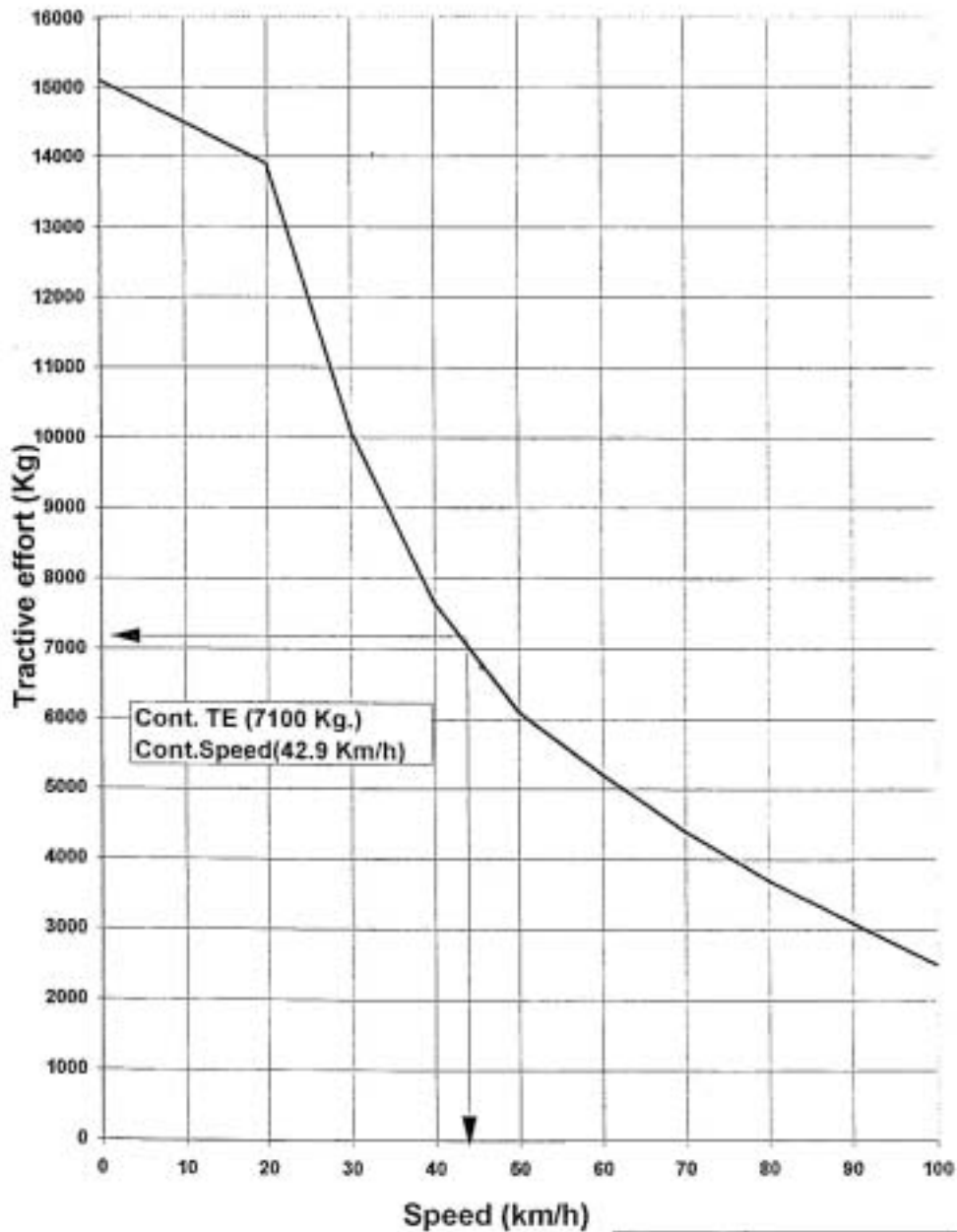
## Performance of 1400 hp DEMU

Diesel engine - KTA-3067-L

Traction alternator - BHELTA 7003 (1800 rpm on top notch).

Traction motor(4) - BHEL TM 4303 AZ (4P combination)

Gear ratio-20:91 & Wheel dia-915 mm(half worn).

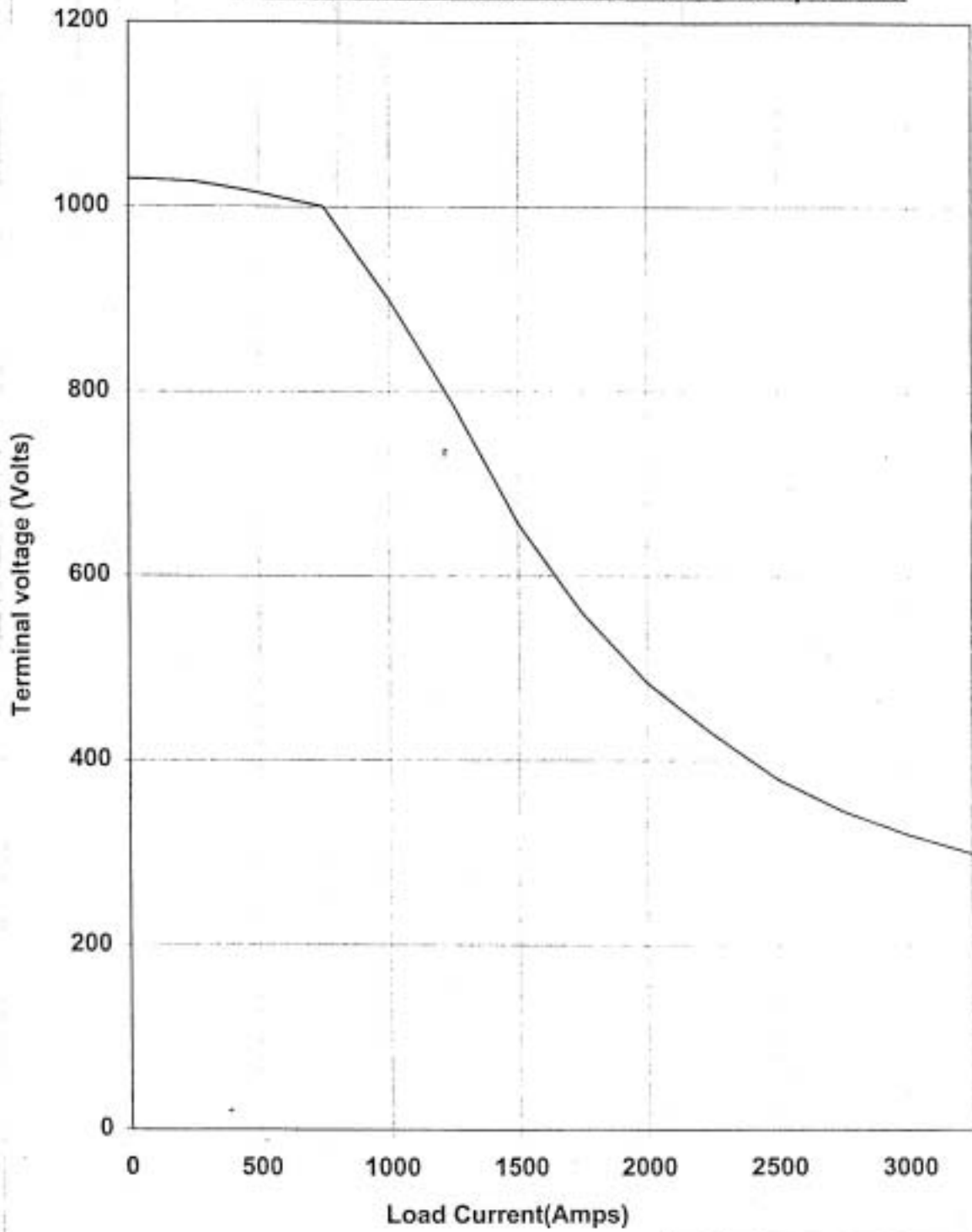


RDSO  
(MP)

REF. - NIL

GDP -1095

**V-I Characteristics of TA 7003 for 1400 hp DEMU**



RDSO (MP)	REF : NIL
	GDP - 1096

**BHARAT HEAVY ELECTRICALS LTD. BHOPAL**  
**TRACTION MACHINES ENGG. DIVN**

CURVE NO  
 TME/40116

**TM 4303 A2 TRACTION MOTOR PERFORMANCE CHARACTERISTICS**  
**FOR 1400 HP DIESEL ELECTRIC MULTIPLE UNIT**

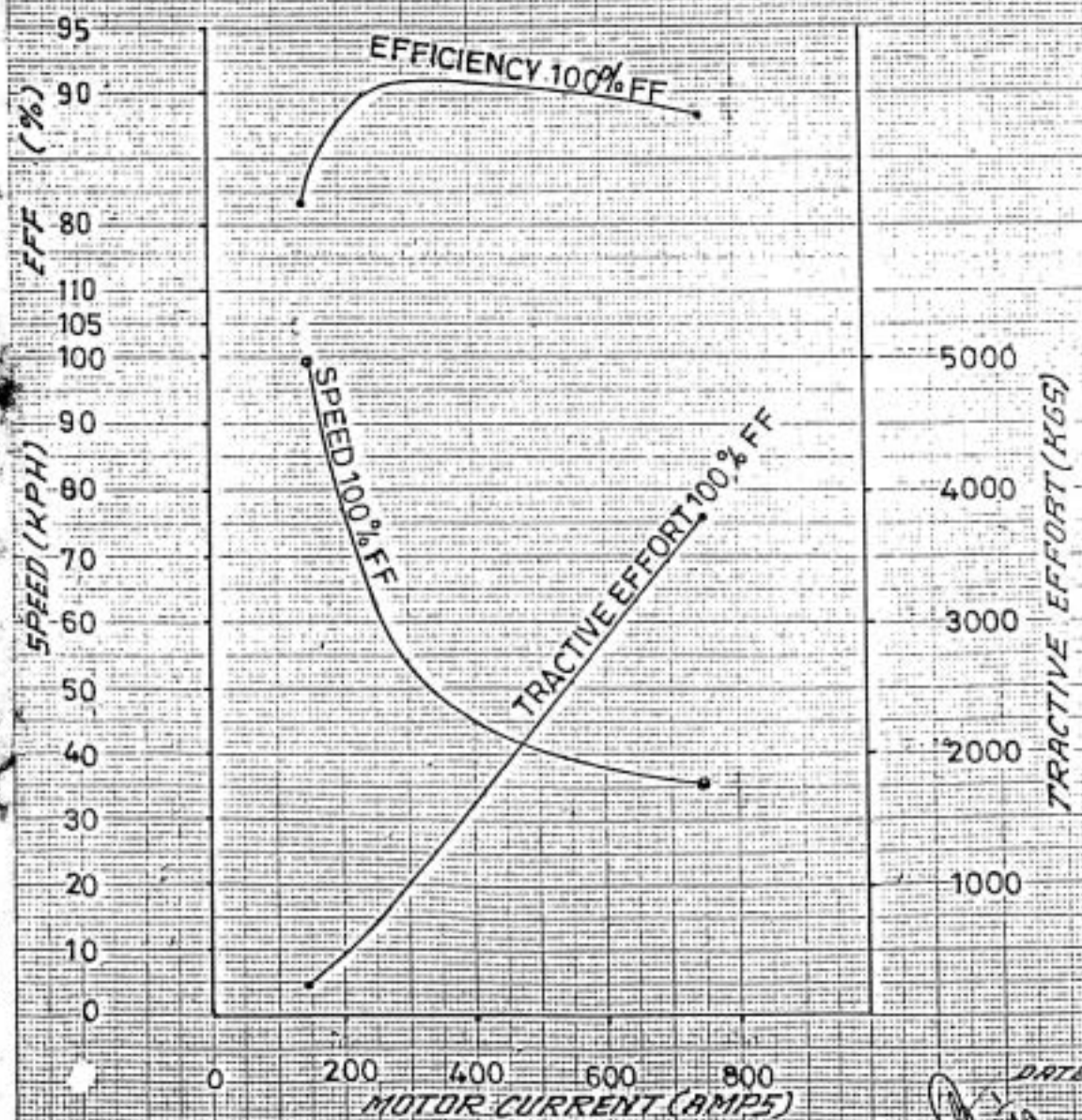
RESISTANCE AT 115 DEG C	OHMS
ARMATURE	0.0158
SERIES FULL FIELD	0.0171
INTER-POLE	0.0112

PROVISIONAL

GR 20:91

**RATINGS AT IEC REDUCED BY 20 DEG C**

	AMPS	VOLTS	KM	RPM	PERFORMANCE AT 550 VOLTS
CONTINUOUS	415	550	207	1200	WHEEL DIA = 915
ONE HOUR	455	550	227	1060	RPM = KPH X 26.382



DATE: 11-01-99

CURVE NO  
 TME/40118

DRN BY: SANTOSH    CHD BY: N.N. NAGAR    APPD BY: R.N. PAUL