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भारत सरकार  
रेल मंत्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

**PARTICULAR SPECIFICATION  
FOR  
DIESEL ELECTRIC MULTIPLE UNIT  
(MG)**

Spec. No. MP – 0.08.00.42 (Rev – 0.01)  
विशिष्ट संख्या चा०श० – 0.08.00.42 (संशोधित 0.01 )

**NOVEMBER- 2000**

**Issued by**  
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मानक नगर, लखनऊ . २२६ ०११  
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## **PARTICULAR SPECIFICATION FOR DIESEL ELECTRIC MULTIPLE UNIT ( MG )**

### **1. SCOPE**

- 1.1 This Specification supersedes Particular Specification for Diesel Electric Multiple Unit (MG), Spec. No. MP-0.08.00.42 (Rev.0.00), August'2000.
- 1.2 This specification covers the particular requirements of design, construction, supply and commissioning into service of fully furnished and finished Metre gauge Diesel Electric Multiple Units (MG DEMU).
- 1.3 The standard consist of each unit shall be of three coaches - one driving power car (DPC), one trailer car (TC) and one driving trailer car (DTC).
- 1.4 The DPC shall be in accordance with RDSO Sketch No. SK – 98109.
- 1.5 The TC shall be in accordance with RDSO Sketch No. SK – 98110.
- 1.6 The DTC shall be in accordance with RDSO Sketch No. SK – 98113.
- 1.7 This specification consists of three parts as follows :
  - Part I : Coach Structure and Design
  - Part II : Traction Equipment
  - Part III : Coach lighting
- 1.8 This specification read with IRS Specification No. R-35-75 for coaching stock is intended to include everything requisite to the construction of these coaches, notwithstanding that everything required may not be mentioned herein.

**PART I**

**COACH STRUCTURE and DESIGN**

1. **CONTRACT DRAWING**

1.1 A list of drawings generally applicable for the construction of these coaches is given in Annexure I.

2. **LEADING PARTICULARS**

2.1 The leading particulars of the DPC, TC & DTC shall be as follows :

(i)	Gauge	1000 mm	
(ii)	Length over body	19500 mm	
(iii)	Length over centre buffer couplers	20184 mm	
(iv)	Width over body	2740 mm	
(v)	Height of centre buffer coupler from rail level under tare	585 mm	
(vi)	Overall height of the coach from rail level to centre of roof under tare	3355 mm	
(vii)	Height of floor from rail level under tare		
	DPC	1036 mm	
	TC & DTC	965 mm	
(viii)	Distance between bogie centres	13715 mm	
(ix)	Bogie wheel base	DPC - 2300 mm DTC/TC - 1980 mm	
(x)	Maximum load per axle		
	DPC	12.0 t	
	TC & DTC	10.16 t	
(xi)	Wheel Diameter	DPC	DTC & TC
	New	838 mm	725 mm
	Fully worn	768 mm	655 mm
(xii)	Braking	Twin pipe graduated release air brake system	

### 3. **MAXIMUM MOVING DIMENSIONS**

- 3.1 The coaches shall conform to maximum moving dimensions as shown in RDSO Drg. No. CSC-849.

### 4. **BOGIE**

- 4.1 The general arrangement of DPC bogie shall be as per ICF drawing No. MG/EMU/M-0-0-001. However, the springs shall be redesigned to suit the loading conditions of DMU.
- 4.2 The TC & DTC bogies shall be as per ICF Drg. No. MG/T-0-0-002.
- 4.3 The axle box and bolster springs shall be suitably designed for the loads encountered in service and shall conform to RDSO Technical Specification No. WD-01-HLS-94 (Rev. 1, May '95).
- 4.4 The bogie side frame shall be fabricated as a single piece. It shall not be fabricated out of shorter lengths welded together. The guide and guide cap of bogie frame shall have 2 mm pitch fine threads and guide shall have two 4 mm dia holes drilled opposite at the appropriate location. The guide bush shall be of acetal resin to RDSO Schedule of Technical Requirements No. C-8215 (Rev. 2).
- 4.5 Roller bearings of approved type shall be used for axle box bearings and shall be housed in cast steel axle boxes effectively sealed against ingress of dust and water.

### 5. **BODY SHELL**

#### 5.1 **SHELL STRUCTURE**

- 5.1.1 The shell shall be of integral, welded light weight construction, generally as per the layouts shown in paras 1.3 to 1.5. The weight of the coaches shall be as low as possible consistent with adequate strength. The underframe of the DPC shall be suitably designed to withstand the load of power pack and other accessories, in addition to the passenger load.
- 5.1.2 The roof of the DPC shall have an opening for lowering the power pack from top with the help of a crane. The opening shall be provided with a water tight cover. Since the engine room area shall have a few large openings, an underframe heavy design may be considered, while maintaining the essential features of a tubular girder.
- 5.1.3 The main structural members of the coach shell shall be either of rolled steel sections or of pressed steel plates and sheets conforming to approved specifications, assembled and welded together in suitably designed jigs.

- 5.1.4 The coach shell shall be designed to meet the following loads :
- (i) A vertical load of 1.845 t/m uniformly distributed for passenger area. The weight of the various equipment mounted in the DPC (power pack, main generator, auxiliary generator, compressor, radiator etc.) shall be considered as concentrated loads and shall be simulated as such during load/strain gauge testing.
  - (ii) A horizontal squeeze load of 122 t applied at the centre line of the CBC.
  - (iii) A combination of loads specified at (i) & (ii).
- 5.1.5 The stresses estimated by an approved method shall not exceed 14.2 kg/sq.mm for members made of steel to IS:2062-1984 Fe 410 Cu W and 22.6 kg/sq.mm for members made of corten steel to IRS:M-41 for the vertical load described above. For the squeeze and combined loads referred above, the stresses should not exceed 90% of the lower yield point or proportional limit of the material in the load carrying members of the shell.
- 5.1.6 FRP tissues shall be laid over entire trough floor, outside the solebar, bodypillars, sidewall upto waist rail, and tubular frame below doorway etc. as shown in ICF Drg. No. ICF/Sk-9-0-898.
- 5.1.7 Each completed shell shall be tested for leakage through roof, body sides and ends at the works of the contractor, who shall provide a test rig to the satisfaction of the inspecting officer.
- 5.1.8 Manufacturer shall furnish all the sub-assembly drawings along with actual balancing calculation, maximum axle load of DPC/TC/DTC, brake power calculation and stress calculation of shell etc. for approval of RDSO before manufacturing.
- 5.2 FLOORING
- 5.2.1 Compartment, Doorway and Vestibule Gangway
- .1 Floor construction arrangement shall consist of 2 mm thick PVC sheet to Schedule of Technical Requirements for flexible vinyl flooring for use in coaching stock No. C-8515 (Rev. 1) with upto date amendment slips, laid over 12 mm impregnated compressed laminates to RDSO Specification No. C-9407. In addition to this, 3 mm aluminium chequered plate to IS:737 HS 20W shall be laid over PVC sheet in the doorway passages. Skirting of 150 mm height shall be finished with PVC sheets and properly anchored to the compreg board. The finished floor shall be free from bulges, depression and cracks. All joints in PVC sheet shall be hot air welded.

## 5.2.2 Engine Room of DPC

- .1 The floor of the engine room shall consist of galvanised chequered steel plates of approved quality laid directly on the steel supports secured to the corrugated steel floor sheets. The steel chequered plates shall be directly secured to the steel support frame. No timber or any other inflammable material shall be used for flooring of engine room.

## 5.3 DOORS

- 5.3.1 All body side doors shall be provided with internal safety catches at top and bottom with padlocking arrangement at top only. One door on either side of the coach diagonally opposite shall be provided with staples for padlocking from outside.
- 5.3.2 The body side doors shall also be provided with carriage door lock suitable for locking/unlocking with standard square key both from inside and outside.

### 5.3.3 Engine Room

- .1 A removable hatched type door shall be provided on each side of engine room of DPC. The door shall be water tight and shall blend with coach profile. The removable hatched type doors shall be secured by bolts so that they can be opened only by the railway staff from the interior of the engine room.
- .2 A single hinged swing door leading from the driver's compartment for staff use shall be provided. It shall be located on the partition to suit the arrangement of the engine room and secured by a slam type lock which can be opened by railway staff from the driver's cab.

## 5.4 WINDOWS

- 5.4.1 FRP windows shall be provided.
- 5.4.2 Glass shutters of all bodyside and door windows shall be provided with spring loaded balancing device.
- 5.4.3 Window sill arrangement shall be made leak proof against the ingress of water as a means to prevent corrosion of side wall and other parts of the shell.
- 5.4.4 All body side windows other than door windows shall be provided with 4 protection bars each.
- 5.4.5 All body side door windows shall be provided with 8 protection bars with a centre stiffener flat to RDSO Sketch 84162, alt 1.
- 5.4.6 Driver's Compartment
  - .1 Two fixed lookout glasses of uniform size shall be provided in the end wall of each driver's compartment and these shall be of glazed, clear, colourless safety glass 6.3 mm thick.

- .2 Fixed sun-visors of approved design shall be provided outside the glazed windows and a pneumatic type wind screen wiper with a long handle for manual operation shall be provided on each of the two lookout windows.

#### 5.5 DOOR WAY AREA

- 5.5.1 Stainless steel trough floor with adequate support shall be incorporated in the underframe at locations below the end doorways.

#### 5.6 WATER WRIGGLES

- 5.6.1 Continuous water wriggles shall be provided from one end of the coach to the other, formed by upsetting the sides of the roof's sheets. Gutters of suitable design of pressed shape shall be welded directly to the roof skin over the doorways.

#### 5.7 ROOF VENTILATORS

- 5.7.1 Roof ventilators to ICF Drg. No. WLRRM4-7-3-402, latest alteration, shall be provided as shown in the layout drawings mentioned in paras 1.3 to 1.5.

#### 5.8 INSULATION

- 5.8.1 The inside of the roof shall be provided with 25 mm thick bonded mineral/glass wool thermal insulation and shall comply with schedule of requirements as detailed in Annexure II.
- 5.8.2 Bonded glass/mineral wool shall be applied with 'CRPX' compound or other approved adhesive which should not have exceeded its recommended shelf life at the time of application.
- 5.8.3 The partition walls of engine room shall be insulated to eliminate transmission of heat and noise of engine to the driver's compartment and passenger compartments.

#### 5.9 VESTIBULES

- 5.9.1 The non-driving ends of DPC and DTC and both ends of TC shall be provided with UIC type of vestibules and sliding doors with approved locking arrangement.

#### 5.10 LIFTING PADS

- 5.10.1 The body shall be subjected to repeated lifting by overhead cranes or jacks. Suitable lifting brackets or pads shall be provided for this purpose, which shall not damage the coach body. They shall be provided on DPC, TC & DTC and shall be marked in a readily distinguishable manner.

## 5.11 TRAP DOORS

- 5.11.1 Suitable trap doors shall be provided on the flooring for inspection of underslung equipment, which need attention during service. The design of trap door shall be such that it can be conveniently lifted when attention to equipment is required but strong enough to withstand normal passenger loading. The trap door shall remain in level to the floor of the coach.

## 6. CENTRE BUFFER COUPLER

- 6.1 Enhanced centre buffer couplers to RDSO Sketch-80086, alt.2 and 80087, alt. 4 shall be provided.

## 7. BRAKE SYSTEM

- 7.1 The MG DEMU shall be provided with twin pipe graduated release air braked system. The brake system should be of WABCO design meeting UIC requirements. The brake system should be capable to upgraded to electro-pneumatic system, if required so at a later stage. The brake valves / equipment to be fitted on the brake system should be from RDSO's approved sources.

- 7.2 Driver's brake valves are to be provided on both DPC and DTC control stands/cabs. Arrangement should be there to make brake valves inoperative on DPC/DTC control stand which is not being used to control brake system. However, it should be possible to apply emergency brakes from the control stand which is not being used.

### 7.3 **Driver's brake valve**

- 7.3.1 Independent brake valve:- The locomotive brake system should be provided with self lapping type independently operated brake valve of WABCO design (SA-9 valve WABCO PC. No. 564141) on both DPC and DTC. The brake valve should have two positions namely 'Release' and 'Application'. In between Release and Application position, the brake cylinder pressure built up should be in proportion to the handle movement.

### 7.3.2 Automatic brake valve

- 7.3.2.1 Automatic brake valve shall be self lapping type valve of WABCO design (A-9 valve WABCO PC No. 564140 )

- 7.3.2.2 In emergency position of brake valve handle, the brake pipe shall be vented to atmosphere through a sufficiently large diameter opening in such a way that the BP pressure comes to atmosphere level in 1 to 2 seconds maximum when the DPC/DTC is tested separately. The emergency position in driver's brake valve should be independent of normal brake control system and should be available for use at all times on both DPC and DTC.



### 7.3.3 Assistant Driver's Emergency Brake Valve:-

In addition to the emergency brake application position on automatic brake valve, one Assistant Driver/Guard's emergency brake valve shall be provided for direct venting of brake pipe. Venting shall be through a sufficiently large diameter opening in such a way that the Brake pipe pressure comes to atmosphere level in 1 to 2 seconds when DPC/DTC is tested separately. During emergency brake application by emergency brake valve or through driver's automatic brake valve, automatic power cut off should take place.

### 7.4 **Distributor valve**

Distributor valve should be of approved designs given in Spec. 02-ABR-94. Distributor valve should be simple, compact and sturdy in construction. It should include control reservoir, isolating cock and strainer. It should be suitable for single pipe as well as twin pipe system. It should give maximum brake cylinder pressure depending on the brake pipe regime pressure. It should have manual operating lever to release the brakes manually. The distributor valve shall be suitable for use with cast iron brake blocks. However it shall also be suitable for use with composition brake block. The distributor valve shall be suitable to function with electro-pneumatic system, if so required at a later date. This shall be possible without any major modification to the proposed distributor valve.

### 7.5 **Hand brake**

7.5.1 Suitable hand brake arrangement should be provided on DTC, which shall be adequate to hold the 3-car unit under crush load condition, stationary, on 1 in 100 gradient assuming mechanical efficiency of 50% and shall be equalised. The hand brake wheel shall be fitted with safety loop or catch to retain the brake in the 'off' position and an indicator showing the direction in which the wheel must be rotated to apply the brakes 'on' or 'off'.

### 7.6 **Brake system pressure / vacuum and brake application / release timings.**

The brake system should be capable to maintain following pressure and brake release / application timings on DPC and DTC. Where timings are not given UIC standard timings can be taken to design brake system.

#### 7.6.1 Pressure specification:

<b>Pressure/ vacuum</b>	<b>Values</b>
Brake pipe pressure	5 $\pm$ 0.1 kg/cm <sup>2</sup>
Feed pipe pressure	6 $\pm$ 0.1 kg/cm <sup>2</sup>
Full service reduction	1.6 to 1.8 kg/cm <sup>2</sup>
Minimum service reduction	0.3 to 0.5 kg/cm <sup>2</sup>
Maximum independent BC pressure	3.5 kg/cm <sup>2</sup>
Maximum auto brake cylinder pressure	3.5 kg/cm <sup>2</sup>

7.6.2 **Standard timings :**

.1 Application and release timings on DPC/DTC with automatic brake valve:

S.No	Description	Condition	
1.	Full service brake application	Brake Application (time for BC pressure to build up to 95% of maximum BC pressure	9 to 12 seconds
		Release after application (time for BC pressure drop from max. to 0.4 kg/cm <sup>2</sup>	10 to 15 seconds
2.	Emergency brake application	Brake Application time for BC pressure to build up to 95% of maximum BC pressure	7 to 10 seconds
		Release after application (time for BC pressure drop from max. to 0.4 kg/cm <sup>2</sup>	15 to 20 seconds
3.	Independent brake valve	Brake Application time for BC pressure to build up to 95% of maximum BC pressure	4 to 6 seconds
		Release after application (time for BC pressure drop from max. to 0.4 kg/cm <sup>2</sup>	20 to 25 seconds

7.7 **Pressure and vacuum gauges**

7.7.1 Gauges should be self illuminated with L.E.D with flush mounting.

7.7.2 All the pneumatic gauges shall be calibrated in 0.1 kg/cm<sup>2</sup> pressure and least count should be 0.1 kg/cm<sup>2</sup>.

7.7.3 Following gauges shall be provided in the cab to indicate to the driver regarding air pressure level in various parts of the system.

- .1 MR pressure gauge
- .2 Feed pipe pressure gauge
- .3 Brake pipe pressure gauge
- .4 Auxiliary reservoir gauge
- .5 Brake cylinder pressure gauge
- .6 Any other gauge which is required as per the system offered.

Brake pipe pressure gauge and vacuum train pipe pressure gauge should preferably be of 6" diameter. Other gauges should also be of at least 4" diameter. Gauges should be provided as per RDSO's approved drawing Nos. SK.DP-3521 to 3530 and SK.DP-3533.

7.8 The brake system/rigging shall be underframe mounted and shall be provided with clasp type brakes with cast iron brake blocks.

7.9 The MG DEMU shall be provided with deadman's device in each driving cab.

7.10 Application of any type of brake shall result in simultaneous cutting off of the power to the driving axles.

7.11 Adequate safety straps shall be provided below the moving components of the brake rigging and other components to prevent falling on the track in the event of failure of any component. All the brake rigging pins/joints shall be provided with bulb type cotters.

7.12 The pneumatic pipes shall be given suitable anti rust treatment for protection against corrosion.

7.13 The brake gear shall be as per RDSO Schedule of Technical Requirements for Brake Gear for Mainline Coaches No.C-8107.

7.14 Literature And Drawings

7.14.1 The supplier shall submit brake schematic diagram along with description of the complete system with the offer. Pamphlets covering schematic diagram, installation drawing of individual assembly shall be submitted along with the offer for proper appreciation of the system offered by the supplier.

7.14.2 The supplier shall submit testing procedure, specification etc. for different valves and brake system as a whole. The supplier shall also indicate the maintenance facilities required for proper upkeep of the equipment. Offer should also include requirements of spares for a period of 3 years. The cost of spares will also be given in the offer.

7.14.3 After the system is finalised, the supplier shall submit copies of the instructional, maintenance and test specifications at the rate of one copy per five DEMUs covering the following:

- .1 Assembly drawings of various components and schematic diagram with description of individual item and system as a whole.
- .2 Assembly and disassembly instructions
- .3 Trouble shooting instructions
- .4 Testing procedure / specification of individual item
- .5 Wearing limits of wearing components
- .6 Rubber kit and spring details
- .7 Overall dimensions and mounting details of individual items
- .8 Particulars of cable entry, if any.
- .9 Weight of various components
- .10 Lubrication chart (equivalent indigenous lubricant may be indicated).

#### 7.15 Inspection and Testing

7.15.1 Before manufacturing of prototype, the supplier will submit the drawings of brake system for approval of RDSO. The drawings will be submitted along with technical details of brake valves / equipment used on brake system. The drawings will be evaluated and if found suitable prototype manufacturing will be started by the manufacturer. Manufacturer will be in constant touch with RDSO for design review and prototype development. After manufacturing of the prototype it will be taken up for inspection.

Prototype inspection will be carried out by RDSO. In general the inspection will be carried out according to UIC/RDSO specifications. However, detailed type tests inspection scheme will be submitted by the supplier. The test scheme should include testing of complete system as well as testing of individual brake valve/equipment. Supplier should get prior approval of test scheme from RDSO before actually conducting prototype inspection.

7.15.2 Inspection of fitment of the brake system on DEMU.

The installation of first system on DEMU shall be the responsibility of the supplier. Assistance with regard to labour and other facilities which are available in the production unit/work shop of Indian Railways would however, be provided to the supplier during prototype installation. Supplier will provide all necessary guidance and technology including any special tooling or wiring etc. required for satisfactory installation of the system on the locomotive.

The fitment aspect of the system will be checked on the DEMU by the representative of RDSO and purchaser in presence of the supplier. The prototype should give satisfactory results on DEMU.

#### 7.16 Performance Guarantee

The equipment supplied by the supplier shall guarantee the equipment against design and manufacturing defects for a period of two years from the date of commissioning. Notwithstanding anything that may be specified in this

specification, the final responsibility for suitability of the design shall lie with the supplier who shall undertake to carry out all modifications and alterations to equipment supplied by them for satisfactory functioning in accordance with this specification as may be necessary during guarantee period. Such modification shall be carried out on all units by the supplier free of cost.

Any damage or unsatisfactory performance of any equipment noticed during the guarantee period shall be rectified or replaced free of cost. The replaced components shall further be under guarantee for two years from the date of their fitment. If replaced component gives unsatisfactory performance in service, it shall be replaced by modified and improved component by the supplier free of cost.

## 8. **PASSENGER EMERGENCY ALARM COMMUNICATION**

- 8.1 The passenger emergency alarm communication shall be independent of the brake gear and shall consist of trambler type bells operated electrically by pulling alarm handles provided in each passenger compartment. The bells should sound simultaneously in all driver's compartments in the train and shall be sufficiently loud to be heard above the prevalent noise and shall ring continuously till switched off. The arrangement of the alarm bells shall be generally to Sketch-62228.
- 8.2 The alarm handles shall be of steel and shall be connected to the alarm apparatus by 3.2 mm galvanised steel wire rope or chain enclosed in steel conduits.
- 8.3 The alarm system shall also provide external indicators on one end of each coach, which shall give a visible indication of the coach from which the alarm handle has been pulled and shall operate an electrical switch of the design shown in Sketch-62251. The switch shall stop the alarm bell ringing when the indicator is reset to its normal position. The supply to the passenger emergency alarm communication system shall be through the driver's control key switch.

## 9. **WARNING HORN**

- 9.1 Two pneumatic horns shall be mounted vertically in front of the driver's compartment and these shall be operated by two robust foot operated valves located on either side of the driver's control desk.

## 10. **ANTI-PILFERAGE MEASURES**

- 10.1 While securing compartment fittings, anti-pilferage measures shall be incorporated generally in accordance with RDSO Sketch-71200.

## 11. **SIGNAL BELLS**

- 11.1 An electric signal bell system shall be provided between driver's compartment and shall consist of single stroke bell and two switches (one for each doorway) in each driving cab. The bells shall be operated from the battery circuit.

12 **CATTLE GUARD**

12.1 Cattle guard of suitable design shall be provided at the driving end of the DPC and DTC.

13. **FIRE PREVENTION MEASURES**

13.1 Fire prevention measures shall be in accordance with 'Code of Practice for Prevention of Fires on EMU Stock', October '91 (first revision).

14. **INTERIOR FURNISHING**

14.1 The interior finish and furnishing must be to the best standards of coach work, and shall combine a good and clean appearance with durability and serviceability. The interior surfaces, such as walls, partitions, bulkheads etc. shall be rounded and joints shall be avoided. All surfaces liable to frequent handling shall be finished with materials suitable for periodical washing or cleaning, and shall be of a colour which will not show up stains.

14.2 The materials used for finishing and furnishing shall be suitable for use under all climatic conditions and shall, as far as possible, be fire proof, non-hygroscopic and vermin and rot proof.

14.3 **CEILING**

14.3.1 The ceiling in passenger compartments shall be of 2 mm thick asbestos sheet to RDSO Schedule of Technical Requirements for asbestos sheets -Interior paneling for Railway Passenger Coaches (Tentative) No. C-8105.

14.3.2 The ceiling of engine room shall be of 1 mm thick Mild Steel Sheet.

14.4 **PANELLING**

14.4.1 The interior paneling in the compartment shall consist of 3 mm thick resin bonded thermo-setting laminated plastic sheets of approved shades. The laminated plastic sheets shall conform to RDSO Schedule of Technical Requirements for decorative thermo-setting Synthetic Resin Bonded Laminated Sheets No. C-8623.

14.4.2 Side wall and partitions of engine room shall be 1 mm thick MS sheets.

14.5 **SEATS AND SEAT FRAMES**

14.5.1 The seats shall be designed to combine comfort and pleasing appearance and shall permit easy cleaning, both of the seat and the backrest. The seats shall be firmly fixed to the frame, which shall be robust enough to stand overload and shall provide easy access to the floor below the seat for cleaning and washing.

14.5.2 All seats shall be cushioned, properly vented and upholstered with vinyl coated fabric to Gr. 1 Class 'A' of IS:1259-1984 (Third Revision). In addition to the

marking given under Clause 6.3 of IS:1259-1984 (Third Revision), the upholster/cloth shall be moulded on the facing side and stamped on back side with Indian Railways crest to RDSO Sketch-68060, alt. 2.

#### 14.5.3 Seats for Driver's Compartment

- .1 Two seats shall be provided in each driver's compartment, one for the driver behind the controls, and the other for the guard behind the other glazed window. The driver's seat shall be of swiveling type without folding to permit the driver to manipulate the controls either while sitting or standing. The seat frame or swivelling arrangement shall be of robust design, easy to operate and hold in any desired position. The seat shall consist of an upholstered latex foam cushion secured firmly to the frame in pilfer proof manner and shall have a light backrest.
- .2 The guard's seat shall be of the folding type, fixed to a rigid frame which will not obstruct movement in the compartment when the seat is not in use. The seat shall be upholstered similar to the driver's seats. The guard's and driver's seats in the driving cab shall be without springs but with latches so that they can be latched when folded. A foot rest shall be provided in front of the driver's seat.

#### 14.6 LUGGAGE RACKS

- 14.6.1 Chromium plated or light alloy luggage racks shall be provided in the passenger compartments. These racks shall be capable of taking a load of 74.4 kg/m in service and 131 kg/m in static tests.

#### 14.7 INTERIOR COLOUR SCHEME

- 14.7.1 The interior colour scheme shall be as follows :

Floor to cant rail in compartments, doorway passages and outside of lavatories	Laminated plastic sheet (3 mm thick) Conforming to RDSO spec. No. C-9602 of Stardust GreyA.661 of Bakelite HYLAM (or) 521 of Wood Polymer (or) CF-682 of Caprihans (or) M-333 of Formica (or) similar.
Flooring of compartments	2mm thick PVC flooring sheet of spectrum blue confirming to RDSO/Spec. C-8515 (Rev. 2 with Amendment Slip No.2.
Ceiling	White Paint
Upholstery	Haze Imperial 103/1306 to IS:1259, Grade 1, Class 'A' of Bhor or similar
Luggage Racks	Smoke Grey (ISC-692)

#### 15. EXTERNAL FITTINGS & FURNISHINGS

- 15.1 Footsteps shall be provided at all body side doors.
- 15.2 Steel step iron shall be provided below the entrance to the driver's compartment and shall be so located as to provide a convenient foot-hold without infringement of the maximum moving dimensions.
- 15.3 Destination boards and number plates with mounting brackets shall be provided on both sides of the coach.
- 15.4 Suitable tail lights and flasher lights shall be provided on all end walls.
- 15.5 A tail board of approved design, such as could be operated from inside the driving cab shall be provided on the DPC & DTC at an approved location.
- 15.6 An under slung fuel tank of 1200 litres capacity shall be provided on the DPC.

16. **EXTERIOR COLOUR SCHEME**

- 16.1 The exterior colour scheme shall be notified at the time of placement of order.

17. **MARKING**

- 17.1 Coaches shall be marked generally to drawing No. CSC-876, alt. 32. Particulars of allottee Railways and coach number shall be intimated later.

18. **NOTICES**

- 18.1 The notices shown in Sketch-59335 shall be fixed in each compartment at approved locations. The notices shall be printed in black letters on a white background, on vitreous enamel plates secured to the walls by pop rivets.

19. **TESTS ON MECHANICAL PARTS**

- 19.1 The following tests shall be conducted on mechanical parts on prototype driving car :
  - (i) Squeeze load test under load conditions as specified in para 5.1.4.
  - (ii) Tests on brake equipment (on individual coaches as well as on complete unit)
  - (iii) Tests on hand brake arrangement.
- 19.2 The test scheme for above tests shall be finalised after completion of prototype, in consultation with the manufacturer.



20. **CLEARANCES**

20.1 The first unit to be completed shall be placed on level straight track and the buffer and coupler height, spring height, bogie clearances and other clearances shall be checked under tare, normal load and crush load conditions. The unit shall, under these conditions, be passed through a structure representing the maximum moving dimensions as per RDSO drawing No. CSC-849. The DMU shall also meet the requirements of Schedule of Dimensions-1963.

21. **TARE WEIGHT**

21.1 The tare weight of prototype DPC, TC and DTC shall be taken by using load cells, approved by the inspecting officer.

22. **RUNNING TESTS**

22.1 The following running tests shall be conducted on the rake to assess its speed potential and brake capabilities :

- (i) Oscillation trials on prototype unit to assess the riding quality at a speed 10% higher than the designed operating speed.
- (ii) Braking distance trials from the maximum operating speed.

22.2 The test scheme for the above trials shall be finalised before conducting the trials in consultation with the manufacturer.

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**PART II**

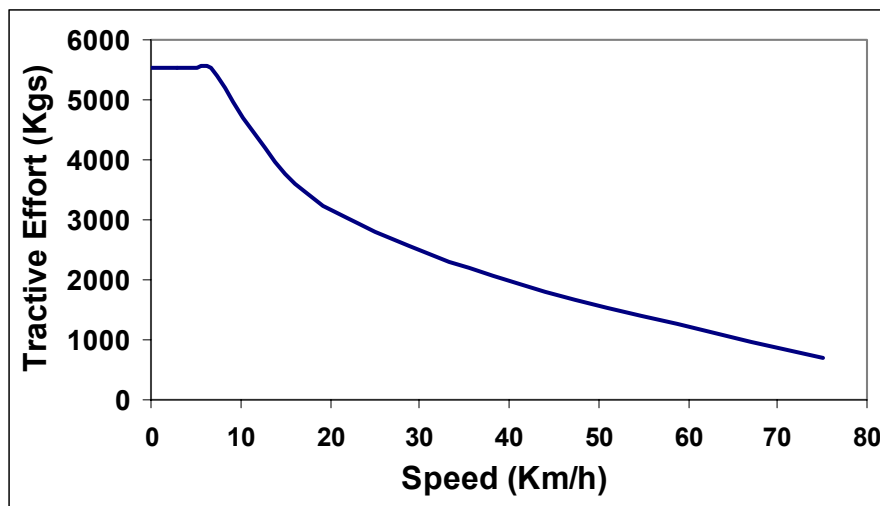
**TRACTION EQUIPMENT**

1.0 Metre Gauge, diesel-electric multiple unit Power car with maximum axle load of 12 t and fitted with a 350 hp fuel efficient diesel engine and DC/DC transmission, complete in all respects, shall be assembled, inter alia, with :-

- One Cummins' NTA - 855L fuel efficient diesel engine capable of producing 350 hp under standard conditions along with either GAC or PG Woodward actuator (to be supplied by the engine manufacturer) and excitation control & speed governing ELCM system of M/s BHEL. (The specification of ELCM to be employed on DEMUs is under revision by BHEL, based on discussions with RDSO/ICF).
- One BHEL Make traction generator model TG 4302 AZ.
- Four BHEL Make TM 3801 AZ model traction motors.
- One Kerala Electrics make Auxiliary generator with voltage regulator.
- One complete set of BHEL make propulsion control equipment.

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

Maximum operating speed	75 km/h
Gear ratio	15:53
Motor Grouping	4P
Continuous speed	44 km/h
Maximum tractive effort at start	5520 Kg.
Continuous rating tractive effort	1800 kg
Installed power (standard)	Approx. 350 hp
Power input to traction (site)	298 hp
Speed Vs TE characteristics	As per Figure-1
Dynamic brake	Not provided



**Speed Vs TE characteristics  
Figure--1**

### 3.0 CLIMATIC CONDITIONS

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

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

### 4.0 MULTIPLE OPERATION

The DEMU shall be usually deployed for operation upto a maximum of four Power cars in a formation of twelve coaches.

### 5.0 DIESEL ENGINE AND ITS COOLING SYSTEM

The Power car shall be powered by Cummins' NTA - 855L fuel efficient diesel engine capable of producing approx 350 hp at 2100 rpm under standard conditions. The engine shall be adjusted to deliver 298 hp to the generator under site conditions.

Side mounted radiator and fan assembly, with panels for the proposed NTA - 855L Power-packs shall be provided. For ventilation of engine room, fan of adequate capacity driven hydraulically shall be provided. Hydraulic circuit with supporting calculation shall be submitted by the tenderer for assessment of adequacy of the offered system.

### 6.0 TRANSMISSION

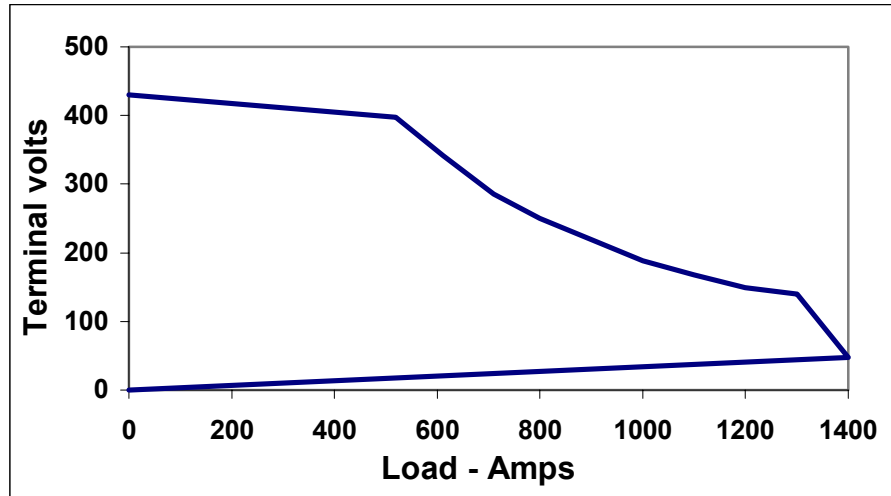
Transmission of power from the engine shall be done by means of a directly coupled self ventilated BHEL make TG 4302 AZ model traction generator, four axle hung nose suspended BHEL model TM 3801 AZ traction motors. A 12.5 KW Kerala Electrical auxiliary generator shall be provided. BHEL make propulsion control equipment shall also 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 GENERATOR

Make and Type	BHEL model TG 4302 AZ
No. per DPC	One
Low voltage rating (DC)	Application rating to be based on the system
High voltage rating (DC)	-do-
Temperature rise limit	T1a-70°C for stator & T1f-70°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	BHEL make ELCM capable of working with GAC or Woodward actuator and suitable for BHEL generator control model TG 4302 AZ.
Generator Characteristics	As per Figure-2



V-I characteristics of Traction Generator 4302AZ  
Figure-2

## 8.0 TRACTION MOTOR

Make and Type	BHEL make TM 3801 AZ
No. per DPC	Four
Insulation – Armature & field	Class H
Ventilation	Self-ventilated

## 9.0 AUXILIARY GENERATOR/EXCITER

The auxiliary generator provided shall be suitable for catering to the lighting and fan requirement of three coaches, including one DTC.

Make & Type	Kerala Electricals
Number per DPC	One
Continuous rating	12.5 KW
Insulation - Armature & field	Class H
Drive	Belt-driven-drive taken from main generator 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
- Battery discharge indication.
- Aux. Gen. failure indication.
- Low idle rpm indication.
- Power ground.
- Cranking contactor welding indication
- Traction control supply ON
- Engine trip
- Motor overload failure
- Motor earth fault
- 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
- Sanding

Safety interlock shall be provided to prevent Power cars in MU operation from being moved when all the Power cars are not set for propulsion in the same direction. The DPC & DTC shall be provided with speed indicating and recording system of approved make and shall conform 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 conform 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.

## 13.0 COMPRESSOR

One belt-driven air compressor type TRC 1000 B of ELGI make or equivalent, similar to the one used on the existing 700 HP BG DEMUs, shall be provided.

## 14.0 PIPING

All pipe joints will be as per ICF standard practice. Schematic piping to suit the engine shall be to the relevant ICF drawings. Flexible pipes shall be provided at the locations prone to vibrations.

## 15.0 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.

## 16.0 FIRE EXTINGUISHER

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

### **PART III**

#### **COACH LIGHTING**

1. This covers the requirements of lighting equipment to be installed in the DEMU. Lights and fans shall be as per layouts mentioned in paras 1.3 to 1.5.
2. The power supply for the coach lights of the DEMU shall be met by the auxiliary generator provided on the power car.
3. All the coaches of the DEMU shall be provided with an emergency electrical connection for lighting load only. The lighting load will be worked by the battery provided on power car in case of auxiliary generator failure.

#### **4. WIRING**

- 4.1 The code of practice for wiring as per EL/TL/48 shall be generally followed. Each driving cab shall be provided with a control panel with controlling switches for lighting and fan circuits. Suitable indication lamps shall be provided to indicate the working of the generator and ON/OFF positions of various feeders. The configuration of coupler wires shall be such as to meet the above requirements. The control of lights and fans shall be possible from any of the driving cabs.

#### **5. INTER CAR COUPLERS**

- 5.1 Power and trailer coaches shall be connected to each other by means of suitable electrical power couplers and socket arrangements so that the control of lights and fans in all the coaches of the unit is possible from any driving cab. Each end wall of the coach shall have a socket on one side and coupler plug on other side so as to permit flexibility in operation.

#### **6. DISTRIBUTION FUSE BOARDS**

- 6.1 Distribution fuse boards for the entire coach shall be located uniformly along the length of the coach. Each board shall be accessible through a separate hinged cover. The cover shall be provided with a suitable locking device that could be opened by the same key as for the junction box. A suitable key shall also be provided for keeping the cover in open position.

#### **7. FANS**

- 7.1 Fixed type of fans of 400 mm sweep conforming to IS:6680-1972 shall be provided. Each fan shall be controlled by its own switch. The fan base shall be insulated from the coach body and the coach wiring shall be terminated to 2-way connectors supplied with the fan and fixed on the ceiling.

## 8. **LIGHTS**

8.1 Interior: Fluorescent fittings shall be used for lighting the compartment as shown in layouts indicated in paras 1.3 to 1.5.

8.2 Exterior: External light fittings with 32 V, 15 W incandescent lamps to IS:897 shall be fitted at locations as shown in the coach layouts (paras 1.3 to 1.5). The coach wiring shall be terminated on 2-way connectors to IRS Drg.No. E101/M/B and the connection to the light fitting shall be given from 2-way connectors using flexible wires.

8.3 All the lights shall be grouped into L-I and L-II circuits which shall consist of essential and non-essential lights respectively. 50% of the compartment lights and doorway lights shall be wired as essential lights and all the other lights as non-essential lights.

8.4 One electrical socket on either side of the power car shall be provided to facilitate the use of portable inspection lamp for the examination of underframe equipment.

## 9. **SWITCHES**

9.1 Heavy duty toggle switches for the control of compartment fans shall be located on the body side wall pillars between windows in the respective bays. All light points shall be wired without individual switch. A separate switch shall be provided in the driver's cab for control of headlights.

## 10. **TEST CERTIFICATES**

10.1 Electrical test shall be carried out on each coach in accordance with EL/TL/48. One copy of test certificate after counter signature by Inspecting Engineer shall be made available to the Railway to which the coach is allotted.

## 11. **MARKINGS**

11.1 At either end panel underneath the emergency coupler socket, following shall be stencilled.

“Junction box provided inside.”

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**LIST OF DRAWINGS GENERALLY APPLICABLE**  
**IN THE CONSTRUCTION OF MG COACHES**

	Description	Drawing No.
1.	Layout	
	DPC	SK-98109
	TC	SK-98110
	DTC	SK-98113
2.	Body Details	
	i) Max. Moving Dimensions	CSC-849
	ii) Roof Ventilator	WLRRM4-73-402
3.	Compartment Fittings	
	i) Ash Tray	CA/CF-1514
	i) Coat Hook	C/CF-55
4.	Door Fittings	
	i) Door Lock	CA/DW-1031
	ii) Step Rail	T-4-1-501
	iii) Safety Catch (on top of bodyside door)	CA/DW-2237
	iv) Safety Catch (on bottom of bodyside door)	CA/DW-2242

**SCHEDULE OF REQUIREMENTS FOR BONDED MINERAL/GLASS WOOL INSULATION  
FOR INTEGRAL COACHES**

The material shall have a nominal thickness of 25mm or as specified by the purchaser and shall generally conform to requirements of Group 1 of IS Specification 8183-1976 (Specification for bonded mineral wool for thermal insulation) and the following additional requirements :-

1. a) **Bonded Mineral wool :**

The bulk density of the material shall be 48 Kg/cu m or 40 Kg/cu m or as specified by the purchaser and shall not vary by more than  $\pm 15\%$  of the value specified when tested as per Clause 3.2.1 of IS:8183-1976. The material with upper limit of bulk density of 48 Kg/m<sup>3</sup> + 15% (i.e. 55 Kg/m<sup>3</sup>) shall be considered to lie within Group 1 also.

b) **Bonded Glass Wool :**

The bulk density of the material shall either be 24 Kg/cu m or 16 Kg/cu m or as specified by the purchaser and shall not vary by more than  $\pm 15\%$  of the specified value when tested as per clause 3.2.1 of IS:8183-1976.

2. The thermal conductivity of the material ( K-value) shall not exceed 0.49 mW/cm/degree C (0.04K.Cal/m/h/degree C) for a mean temperature of 50 degree C.

3. It must be suitable for application on steel sheets or other surface with suitable adhesive and shall firmly adhere to the surface on which it is applied.

4. The insulation must be guaranteed for the above performance for a minimum period of one year from the date of putting the coach into service.

5. The material shall satisfy all optional requirements given under Clause 3.10.1 to 3.10.7 of IS Specification No.8183-1976.

6. The material shall in addition pass the jolting test described below :-

6.1 **Apparatus for jolting test:**

The apparatus consists of a steel frame with a slot to accommodate the test panel of size 41 x 32 cm. Provision is made for raising the frame work through a height of 25mm and dropping freely on to two rubber blocks with an approximate frequency of 4 cycles per second. The shape of the cam shall be such that it supports the frame with the panel right through. In the last 2mm stroke, a mild shock is given to the panel by making the panel compress against the rubber blocks.

6.2 **Test procedure :**

300 x 300mm square pieces of sample from the supply are to be pasted on the panel plate on which the entire system of painting for the roof has already been painted. For bonding for the insulation material, 'CPRX' compound or any other approved adhesive may be used. Sufficient flash time may be given after the application of the adhesive before the insulation material is pasted on. The test panel shall not show any lamination and should withstand one lakh jolts in the jolting machine. The material should also not exhibit friability.

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Note:

The Sketch No. 98109, 98110 & 98113 are not available in digitised form. Blue print may be collected from RDSO.