VANDE BHARAT EXPRESS TRAINSET (V2.0)
MAINTENANCE MANUAL

Volume 2 – System Documentation

IRCAMTECH/GWL/2022-23/T-18/MM/2.0
SEPTEMBER, 2022
The correction slips to be issued in future for this report will be numbered as follows:

IRCAMTECH/GWL/2022-23/T-18/MM/2.0# XX date .......

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

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<th>Date</th>
<th>Corrections</th>
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<td>August 2020</td>
<td>First Release</td>
<td>For first and second rake of VBE trainset manufactured by ICF in 2018</td>
</tr>
<tr>
<td>2.0</td>
<td>September 2022</td>
<td>Second Release</td>
<td>For 44 rakes of VBE trainset (Third rake onwards)</td>
</tr>
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1.1. INTRODUCTION

Vande Bharat Express (trainset) is India’s first successful attempt of adaptation of Trainset technology against conventional system of passenger coaches hauled by separate locomotives. Trainset configuration though complex than conventional train arrangement is faster, easier to maintain, consume less energy, and have greater flexibility in train operation.

The Maintenance Manual for first two rakes of Vande Bharat Express trainset (T-18) manufactured by ICF was published by CAMTECH in August'2020. These two rakes are based at SSB depot NR.

Subsequently 44 rakes as per revised specifications are planned to be manufactured at ICF. First rake of this batch has already turned out by ICF in August'2022.

Maintenance Manual for the second batch of 44 Vande Bharat rakes has been prepared incorporating design changes introduced by ICF.

1.1.1. TRAIN FORMATION

Rake formation of semi high speed trainset consists of 16 coaches with two non Driving Trailer Car (DTC) at both end of rake with driver controls, TCMS and aerodynamically designed nose cone. 8 Motor Cars (MC) with traction motors and traction converters, 4 Trailer Cars(TC) with pantograph mounted on the roof and two Non Driving Trailer cars (NDTC).

![Train Formation Diagram]

1.1.2. SPECIFICATIONS

| Number of Coaches in Basic Unit | 4 car per BU  
| DTC-MC-TC-MC2 (End BU)  
| NDTC-MC2-TC-MC (Middle BU) |
| Train formation 16 coaches | 4 BU per Train |
| % Motoring | 50% |
| Maximum Service Speed | 160 Kmph |
| Average Acceleration from 0 to 40 Kmph | 0.8 m/sec² |
| Deceleration | 1 m/sec² |
### 1.1.3. DIFFERENCE FROM THE PREVIOUS VERSION

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TRAIN-18 VBE</th>
<th>TRAINSET VBE (2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16 CAR Rake formation (Totally 8 Variants)</td>
<td>16 CAR Rake formation (Totally 6 Variants)</td>
</tr>
<tr>
<td>2</td>
<td>Layout Drawings:</td>
<td>Layout Drawings:</td>
</tr>
<tr>
<td></td>
<td>Traction Motor Duct not provided</td>
<td>Traction Motor Duct / Filter introduced in MC Coach</td>
</tr>
<tr>
<td></td>
<td>Traction transformer rating : 2880 kVA (JST Make)</td>
<td>Traction transformer rating : 2556 kVA (JST Make)</td>
</tr>
<tr>
<td></td>
<td>Traction Motor Continuous Rating : 254 kW, 1375V, 121A</td>
<td>Traction Motor Continuous Rating : 210 kW, 1184V, 120A</td>
</tr>
<tr>
<td></td>
<td>TCMS is provided in DTC.</td>
<td>CCMS Provided in DTC Coach.</td>
</tr>
<tr>
<td>5</td>
<td>No provision for Signal Exchange Light</td>
<td>Signal Exchange Light provided in DTC.</td>
</tr>
<tr>
<td>8</td>
<td>Passenger Emergency Communication Unit (PECU)</td>
<td>Emergency Talk Back Unit (ETBU)</td>
</tr>
<tr>
<td>10</td>
<td>Speaker : 9 Nos.</td>
<td>Speaker : 6 Nos.</td>
</tr>
<tr>
<td>11</td>
<td>No Disaster Management Lights</td>
<td>Disaster Management Light : 4 Nos.</td>
</tr>
<tr>
<td>12</td>
<td>CCTV : 6 Nos.</td>
<td>CCTV : 8 Nos.</td>
</tr>
<tr>
<td>C</td>
<td>Bogie</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Side frame is common with MC.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Weight of CP pin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 129 kg</td>
<td>Weight of CP pin</td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 113 kg</td>
<td>Weight - approx. 113 kg</td>
</tr>
<tr>
<td>3</td>
<td>Weight of traction centre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 78 kg</td>
<td>Weight of traction centre</td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 70 kg</td>
<td>Weight - approx. 70 kg</td>
</tr>
<tr>
<td>4</td>
<td>Weight of control arm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 73 kg</td>
<td>Weight of control arm</td>
</tr>
<tr>
<td></td>
<td>Weight - approx. 55 kg</td>
<td>Weight - approx. 55 kg</td>
</tr>
</tbody>
</table>

**Bogie Frame thickness**
## 1. Introduction

### Side frame – middle

<table>
<thead>
<tr>
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<th>TRAIN-18 VBE</th>
<th>TRAINSET VBE (2022)</th>
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<tbody>
<tr>
<td>1</td>
<td>Top plate</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Bottom plate</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Outer web</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Inner web</td>
<td>20</td>
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### Side frame - Ends

<p>| | | |</p>
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<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bottom plate</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>Top plate</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Webs</td>
<td>16</td>
</tr>
</tbody>
</table>

### Transom

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Top plate</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Bottom plate</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Webs</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Stiffeners in side frame, transom</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Estimated weight (approx) in t</td>
<td>2.357</td>
</tr>
</tbody>
</table>

### Wheel & Axle

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wheel seat dia. in mm</td>
<td>Ø222 H7/v6 for both MC &amp; TC</td>
</tr>
<tr>
<td>2</td>
<td>Overall axle length in mm</td>
<td>2440</td>
</tr>
<tr>
<td>3</td>
<td>Between shoulders in mm</td>
<td>2060</td>
</tr>
<tr>
<td>4</td>
<td>Axle body dia. in mm</td>
<td>Ø188 for both MC &amp; TC</td>
</tr>
<tr>
<td>5</td>
<td>Wheel hub dia. in mm</td>
<td>Ø286</td>
</tr>
<tr>
<td>6</td>
<td>Axle capacity / load</td>
<td>Axle capacity – 21 t (standardized bogie for EMU-US / MEMU-US)</td>
</tr>
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</table>

### Furnishing & Amenities

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>1</td>
<td>Emergency open able windows in each coach</td>
</tr>
<tr>
<td>2</td>
<td>Larger pantry car area than existing</td>
</tr>
<tr>
<td>3</td>
<td>Tip up seats unavailable</td>
</tr>
<tr>
<td>4</td>
<td>Automatic Retractable Foot Plate (Doorway)</td>
</tr>
</tbody>
</table>
1.2. TECHNICAL DESCRIPTION

1.2.1. GENERAL
New air conditioned light weight coach for service up to 160 km / h on special high speed lines of Indian Railways.

1.2.2. COACH DESCRIPTION

DRIVING TRAILER COACH (DTC)
DTC is a non-powered vehicle with a driver cab at one end. The driver cab is furnished with a pre-fabricated driver desk. All driving operations are possible from this driver desk. Feedback from the system in all the coaches/basic units is available for viewing by motor man on the driver desk. In this regard, CCU aggregates the information from all the coaches and a TFT driver display screen provides information to motor man. Further an illuminated indication panel is provided for important driving related information for quick viewing by motor man. Various gauges are also provided for viewing MR, BP, BC pressure. Motor man can also control the passenger information system from the driver desk DTC. Apart from the driver cab is called as passenger saloon area. Passenger saloon area is similar to trailer coach, except the space occupied by driver cab.

DTC also consists of battery box, battery charger, compressor, water tank, main reservoir, air supply unit, end pneumatic panel which are mounted under-slung. Rest of the DTC apart from the driver cab is passenger saloon area which consists of pantry, RMPU control unit, mono block pump controller, CRW, GCRW panel and various end wall panels. It is an air-conditioned coach. All passenger comfort related load is controlled by driver from driver cab.

TRAILER COACH (TC)
TC is a non-powered vehicle with only a passenger saloon area. The passenger saloon area includes lights, emergency lights, air handling unit (for ventilation), and passenger information system consisting of LED displays and speakers (for announcements). TC consists of a pantograph, vacuum circuit breaker and HV isolator on roof. It also consists of auxiliary converter unit and power transformer mounted under-slung. Power to LTC units of both motor coaches is distributed from same power transformer.

NON DRIVING TRAILER COACH (NDTC)
NDTC consists of passenger saloon area, pantry, RMPU, mono block pump controller, electrical cabinet and various End wall panels. It is an air-conditioned coach. Non Driving Trailer Coach (NDTC) is similar to DTC except driver related interface. It also consists of battery box, battery charger and compressor mounted under-slung. It also consists of passenger saloon area which consists of pantry, RMPU control unit, mono block pump controller, and various end wall panels.

MOTOR COACH (MC)
MC is a powered vehicle with one traction motor driving each axle. The motor coach consists Line and Traction Converter Unit (LTC) for each Bogie mounted under-slung. Also Brake chopper resister is mounted under-slung. Transformer secondary cable for both LTC unit from power transformer come from Trailer Coach through under-frame mounted Power Coupler. It also consists of passenger saloon area, pantry, RMPU, mono block pump controller, electrical cabinet and various end wall panels. It is air-conditioned coach. The passenger saloon area is similar to trailer
Note: MC with electrical change over switch is named as MC2

1.2.3. TECHNICAL DATA

<table>
<thead>
<tr>
<th>Designation</th>
<th>Value</th>
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<tbody>
<tr>
<td>Track gauge</td>
<td>1,676 mm</td>
</tr>
<tr>
<td>Speed</td>
<td>Max. 160 km/h</td>
</tr>
<tr>
<td>Length of car-body (Over Coupler)</td>
<td>24000 mm</td>
</tr>
<tr>
<td>Width of car-body</td>
<td>3240 mm</td>
</tr>
<tr>
<td>Car height above top of rail</td>
<td>4140 mm</td>
</tr>
<tr>
<td>Wheels</td>
<td>952 mm dia.</td>
</tr>
<tr>
<td>Distance between center pivots</td>
<td>14900 mm</td>
</tr>
</tbody>
</table>

1.2.4. SEATING ARRANGEMENT

<table>
<thead>
<tr>
<th>Designation</th>
<th>No's</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Trailer Coach (DTC)</td>
<td>Passenger – 44</td>
</tr>
<tr>
<td></td>
<td>Loco Pilot – 02</td>
</tr>
<tr>
<td></td>
<td>Technical Crew – 03</td>
</tr>
<tr>
<td></td>
<td>Pantry Crew - 02</td>
</tr>
<tr>
<td>Trailer Coach (TC)</td>
<td>Passenger – 78</td>
</tr>
<tr>
<td>Non Driving Trailer Coach (NDTC / EC)</td>
<td>Passenger – 52</td>
</tr>
<tr>
<td>Non Driving Trailer Coach (NDTC / EC2)</td>
<td>Passenger – 52</td>
</tr>
<tr>
<td></td>
<td>Pantry Crew - 02</td>
</tr>
<tr>
<td>Motor Coach (MC)</td>
<td>Passenger – 78</td>
</tr>
<tr>
<td></td>
<td>Pantry Crew - 02</td>
</tr>
<tr>
<td>Motor Coach (MC2)</td>
<td>Passenger – 78</td>
</tr>
<tr>
<td></td>
<td>Pantry Crew - 02</td>
</tr>
</tbody>
</table>

1.2.5. CARBODY PART

1.2.5.1. UNDER FRAME
IRS M41 Corten steel under frame with centre sill design and no trough floor is having 2mm thick SS cover sheets on under frame instead of trough floor. To mount gangway at the same height of coach, provision for coupler on head stock is lowered. Provision to fix under slung pipes, conduits, equipments and bogie are provided on under frame. Body bolster will have non removable spigot for air supply to air spring.

1.2.5.2. SIDE WALL
Side wall consists Ferritic stainless Steel (SS409) framework and sheet (thickness=3mm) which welded together with help of robotic and manual welding an welding fixtures. Cut out for windows & LED destination display and brackets for fixing furnishing and electrical items are provided on sidewall. Ventilation duct for traction motor is provided on side wall of motor car coaches of trainset.

1.2.5.3. END WALL
Ferritic Stainless Steel (SS409) sheets are used to manufacture End wall of semi
1.2.5.4. **ROOF**
Semi high speed trainset roof consists Ferritic Stainless Steel (SS409) Roof frame and Corrugated Roof sheet made of Austenitic Stainless Steel (SS304) of thickness 1.7mm and 1.25mm. Flat roofs for fixing RMPU units are provided in roofs of all coaches and provision to fix Pantograph is provided in Trailer Cars. Brackets and cut away for furnishing and electrical items will be provided on the roof.

1.2.5.5. **BODY SHELL**
Under frame, End construction, Side all, Door frame, curved middle roof and flat roofs are welded together in body shell assembly JIG specially designed for trainset. Body shell items such as partition frame, Brackets to fix Decoupling rubbers & seats and rain water gutters are Welded on to body shell.

1.2.5.6. **DRAW AND BUFFER GEAR**
Tight lock center buffer coupler type AAR - H. Provided on driver cabin side of coach.

1.2.5.7. **SEMI PERMANENT COUPLER**
The Front Driving Coaches (DTCs) has CBC couplers and the in between coaches are permanently coupled with Semi-permanent couplers.

1.2.5.8. **PLUG DOORS (ENTRY DOORS)**
Automatic plug door (with sliding footstep) includes locking and opening mechanism is a sophisticated system in which the coach doors shall remain closed whenever the train starts from Railway station. Similarly, these doors remain closed till the train stops at the next station and eliminate chances of passengers detraining from the moving train.
1.2.5.9. SLIDING DOORS (TRANSIT DOORS)
Interior sliding doors serve to separate the boarding area of the carriage from the seating area with advantages of the solution: reliability and comfort of operation. The interior door can be controlled either by a radar signal when the person approaches or by pressing a button on the door. In case of power failure, the doors are freely movable manually or in case of emergency, the door is disconnected from the power supply when emergency button is pressed and is freely movable manually.

1.2.5.10. GANGWAYS
The gangway is the flexible part of the train, allowing the relative movements between the Coaches and offering passengers a secure and comfortable passageway.
1.2.6. WINDOWS
Continuous sealed windows with the provision of emergency exit.

1.2.7. INTERIOR EQUIPMENT

1.2.7.1. INTERIOR FITTING
Saloon passenger area in the coach center, 2 plus 3 arrangement for the chair car class and 2 plus 2 arrangement for executive class separated via sliding doors from the entrance area. Seats designed in light weight construction especially for the new coach type. Continuous luggage rack above the seats. Pantry compartment for storing, preparing and serving of precooked meals.
1.2.7.2. INTERIOR PANELLING
Side walls and ceilings in the passenger area made of modular FRP. Corrugated FRP roof panel is provided to improve the aesthetics.

The floor is made of sound absorbing multiplex plates on special noise damping rubber profiles.

1.2.8. LIGHTING
Indirect LED lighting for a calmer aircraft like experience.

1.2.9. PASSENGER SAFETY EQUIPMENT

1.2.9.1. EMERGENCY OPERATABLE PUSH BUTTON (EOPB)
1.2.9.2. EMERGENCY TALK BACK UNIT (ETBU)

1.2.9.3. FIRE DETECTION AND SUPPRESSION SYSTEM

1.2.9.4. EMERGENCY LIGHTS
1.2.10. TOILETS
FRP modular toilet module at the coach end. Trainset contains vacuum assisted bio-toilet system. Water tank (1100 liters) is provided under-slung.

1.2.11. BRAKE
Pneumatic disc brake type, anti-skid device, electro-pneumatic control system and regenerative braking.

1.2.12. ELECTRICAL EQUIPMENT
All power components such as Line & Traction converters, Auxiliary converter, Air Compressor, Battery box, Battery charger, Brake chopper resister are mounted under the frame.

Electrical Equipment is distributed across all the coaches.

1.2.12.1. Line and Traction Converter
- Each Basic unit has 2 Motor coach
- Each Motor Coach has 2 Nos of Line and Traction converter and each control two motors of a bogie
- Input power to Line converter comes from Transformer kept in-adjacent TC
- Line and Traction converters are water cooled.

1.2.12.2. Line Converter
- Line Converter consists of Input Pre-charging Circuit and Line Contactor
- It consists of output DC Link capacitor.

1.2.12.3. Auxiliary Power Supply (APS)
In trainset all coaches are proposed to work on two different voltages. A Converter unit is required to generate 2 different type of voltages to serve these loads. Those are
  - 415V AC, 3phase, 50Hz
  - 110V DC.

Load on 415V AC, 3-phase, 50Hz loads:
• RMPU
• Ventilation Blower
• CAB AC
• Main Compressor
• Traction Converter Cooling system
• Transformer Radiator Fan
• Transformer Oil Pump
• Mobile, Laptop, Pantry, luggage rack reading lights & Toilet loads
• Water Pump for Toilet Tank
• Aux converter Cooling blower.

Loads on 110V DC loads:
• Battery Charging
• Coach, Vestibules and Driver Cabin normal lights
• Coach and Driver Cabin Emergency lights
• Twin Beam/Auxiliary Head light, Marker Light, Tail Light, Flasher light, Spot Lights, Passenger Alarm Indication Light, Electronic signal bell
• Control Electronics Loads: PIS, CCTV, Relays, Contactors, Driver desk, Brake systems and all other control units
• Auxiliary compressor for Pantograph
• Emergency Ventilation Blowers
• 110V dc Toilet Loads, Seat Lights & Doors.

The APS get power directly from 2 nos of secondary windings of Transformer
• Transformer and Auxiliary converter are mounted in TC coach
• It is mounted under slung and forced cooled system

Auxiliary Power supply consists of two Cubicles

Auxiliary Converter Unit (ACU)
ACU consists of below modules
  o AC1 Module
  o AC2 Module
  o DC Converter Module

ACU is mounted at under frame of TC coach

Battery Charging System (BCS)
BC is mounted at under frame of DTC/NDTC coach inside battery box, to charge the battery.

1.2.12.4. CRW Panel
• One Electrical Cubicle is provided at rear side of driver cab
• It houses all electrical & electronics components required for rake & coach level control
• Below mentioned are the major equipments housed inside CRW Panel
• CCU 1&2, PCU
• IFTCU, NVR, PIS CC, Ethernet switches
• CAB AC CU, Smoke Sensor
• EBCU 1&2
• TPWS
• MCB's
• Selection switches
- Relays & Contactors for various application.

1.2.12.5. RMPU Panel
- One Electrical panel is provided at opposite to driver cab in DTC
- It houses all electrical & electronics components required for coach level RMPU control
- Below mentioned are the major equipments housed inside RMPU Panel
  o RMPU Control Unit
  o MCB's
  o Smoke sensor
  o Terminal Block
  o Relays & contactors.

1.2.12.6. TC ECC Panel
- One Electrical Cubicle is provided in front of pantry car in each coach
- It houses all electrical & electronics components required for Basic Unit level control
- Below mentioned are the major equipments housed inside ECC Panel
  - MCU 1&2
  - RMPU Control Unit,
  - IFTCU, NVR, PIS CC
  - Ethernet switches, Smoke Sensor
  - EBCU 1&2
  - MCB's
  - Selection switches
  - Relays &
  - Contactors for various application.

1.2.12.7. MC ECC Panel
- One Electrical Cubicle is provided in front of pantry car in each coach
- It houses all electrical & electronics components required for coach level control
- Below mentioned are the major equipments housed inside ECC Panel
  - PCU
  - RMPU Control Unit,
  - IFTCU, PIS CC
  - Ethernet switches, Smoke Sensor
  - EBCU 1&2
  - MCB's
  - Selection switches
  - Relays &
  - Contactors for various application.

1.2.12.8. NDTC ECC Panel
- One Electrical Cubicle is provided in front of pantry car in each coach
- It houses all electrical & electronics components required for coach level control
- Below mentioned are the major equipments housed inside ECC Panel
  - PCU
  - RMPU Control Unit,
  - IFTCU, NVR, PIS CC
  - MAR, CHMM
1.2.12.9. TCAS
TCAS is a supporting system to loco pilot and the system interferes only when loco pilot is not able to react to unsafe situations. Even though the locomotive is fitted and running with TCAS, loco pilot is only responsible for running the train. Loco pilot shall continue to follow the existing operational procedures, general and subsidiary rules of Railway by obeying the line side signals and all temporary and permanent speed restrictions.

Features
- Supervising current speed to the Maximum Permitted Speed (MPS).
- Automatic visual and audio warnings during over speeds.
- Application of brake, if current speed exceeds the MPS by more than 5 kmph.
- Rollaway/ Rollback protection – In case train rolls back on its own or drawn by loco pilot for more than the configurable small distance in reverse direction in normal mode, brakes shall be applied to stop the train. Brake shall be released as soon as train is stopped.
- Prevention of Signal Passing at Danger (SPAD).
- Prevention of side collision in block section.
- Prevention of head-on and rear end collisions.
- SOS generation and cancellation.
- Automatic loop line speed control.
- Automatic speed regulation for Temporary Speed Restriction (TSR) and Permanent Speed Restriction (PSR).
- Automatic computation of train length.
- Automatic blowing of horn at level crossings.

1.2.12.10. APC
The Automatic Power Control system cuts the incoming power supply to a traction unit for short periods. This is required where power supplied from one part of a power distribution system in separated from another by a neutral section. Its fitment prevents damage to the power distribution system or the vehicle. The system detects a track magnet positioned shortly before the beginning of the neutral section and sends a signal to the incoming power circuit breaker controller to open the circuit breaker. Once the system detects a second magnet positioned after the neutral section a second signal is sent to close the circuit breaker. The APC Receiver is a very robust unit and can be mounted on the vehicle main underbody or a bogie.

APC Receiver
The APC Receiver comprises a single Line Replaceable Unit assembly with flying lead. The APC Receiver is located externally beneath the train to detect the magnetic flux emanating from the trackside magnet placed shortly before the beginning of the neutral section break and sends a signal to the incoming power circuit breaker controller to open the circuit breaker.
1.2.12.11. PASSENGER INFORMATION SYSTEM

The Passenger Information System for Train-18 shall give required information to the passengers in a train throughout the journey in both visual and audio information.

System shall have provision for public announcement where Driver/Guard can address all the passengers in the train, Inter Communication (IC) between Driver and Guard communication.

The main aim of this system shall be to provide convenience to the passengers by providing the station information and other required information.

- **Main Communication Panel (MCP)** is the master for the entire PIS system. The communication between the MCP and all the devices in PIS network will communicate through Ethernet.
- The MCP in the trailing coach will behave as Global Master based on direction of the journey and other MCP becomes Slave.
- The leading and trailing Coaches consists of Main Communication Panel (MCP) with GPS Antenna, One Head Code, One Car Control (CC) with built in audio amplifier unit, Two Side Destination Board Displays (SDBD), Two ANMs, One cab speaker, Four Emergency Talk Back Units (ETBU), Two LCD displays (common for PIS and infotainment), Six Saloon Loud Speakers and One microphone.
- All other coaches other than leading and trailing coaches, will have Side Destination Board Displays (SDBD), One Car Control (CC) with built in audio amplifier unit, Four Emergency Talk Back Units (ETBU), Two LCD displays (common for PIS and infotainment), Two Ambient Noise Measurement Module (ANM) and six Saloon Loud Speakers.
- Speaker of 6 watt r.m.s. rating of reputed make Ahuja/Philips/Boston is provided.
- Public address system and Inter coach communication provided through Ethernet.

**Main Communication Panel (MCP)**

- MCP has 7 Inch touch screen based TFT LCD Display for user interface.
- This module is mainly used for configuration and displaying the menu options, system status and route information to user (Driver / Guard).
- This Module is mounted on the driver desk.
- Complete PIS structure health shall be displayed on driver display.
- User can enable the PA, IC, TR, ETBU communication by using the touch keys provided on the LCD screen.
- MCP has GPS interface to have real time GPS co-ordinates.
- MCP takes care of all operations such as train route simulation using GPS, Fault Diagnostic of the complete PIS system.
- Train route database of the PIS system is stored in MCP.
- MCP has Ethernet interface with CCTV Display through Ethernet switch for displaying near by cameras when ETBU is operated and to show the rear View camera when station is arrived.
- MCP shall have RS422 interface with Train Radio for future purpose.
- MCP shall have an interface with Microphone to enable the PA, IC and ETB feature.
- MCP shall record the conversation of ETBU call with GPS time stamp and send the data to MAR system to store the data.

**Car Control Unit (CC)**

- The Car control unit acts as an amplifier for driving the Saloon loud speakers.
which are placed in each car of the train
- It will get the information to be announced from MCP
- CC shall have interface with two ANM's to capture the ambient noise level in the coach. Based on the ambient noise level in the coach volume in the coach will be adjusted automatically
- Speakers are routed from CC in each coach by 50% audio sharing from next coach.

### Head Code Display (HCD)
- The Head Code Display comprises of LED boards
- Head Code will be provided at the front end of the driving coach (leading and trailing) above the lookout glass. LED Matrix size: 16x128
- Head code is placed at the front each end of the Driving Coach (Leading and Trailing).
  - It will displays following in Hindi, English and regional languages
  - Train Name, Train No., Originating Station and destination station
  - In case of communication failure to Head Code, Destination can be selected from TCMS display.

### Side Destination Board Display (SDBD)
- Side Destination Board Display System will be provided at each side of the coach
- The Side Destination Board Display System will display information in two windows; in one window Coach number and Train number, in second window Train name and Source to Destination in English, Hindi and Regional language
- LED Matrix size: 16x128

### Single Side Display (SSD)
- The In-Coch LED Display unit comprises of 16x144 matrix Multi Colour LED boards
- SSD will display the route related information like present station and next station to the passengers throughout the journey
- In addition to the route related data, the SSD will Coach ID, Speed of the train
- SSD will receive the journey information from MCP.

### In coach LCD Display
The In Coach Displays are 32 inch LCD displays used to display the following information to the passengers sitting inside the coach. The In Coach LCD Displays are interfaced to IFTCU unit through HDMI interface.
- Default Welcome and farewell messages
- Originating and destination station
- Current Date & Time
- Current location of the train
- Name of approaching station
- Current and next Halting Station
- Time to next stations
- Next interchange point
- Running speed
- Platform side
- Advertisements
- Safety Messages
- Dynamic Route Map
• Late running status
• Onboard facilities
• Approximate distance to next station
• Train Arrival & departure time with route map.

**Emergency Talk Back Unit (ETBU)**
- The purpose of Emergency Talk Back Unit is to provide the emergency communication between Driver / Guard and Passengers
- When a Emergency Talk Back Unit is operated by passenger in any particular coach, an indication of the location of the operated device will be given to on MCP
- The Driver / Guard will acknowledge the ETBU request by pressing ‘Accept’ icon in MCP to enable the communication with passenger
- When ETBU request is received to MCP, MCP will give the information to CCTV display to enable the nearby cameras of the ETBU.

**Ambient Noise Measurement Module (ANM)**
- ANM is basically a noise measurement module to adjust the announcements volume level in passenger area based on the surrounding noise with comprised microphone
- It will detect the background noise, measures the noise level and sends the same to CC
- The CC will adjust the volume level based on the background noise received from ANM
- It will be operated at 110V DC supply.

**Saloon and Cab Loudspeakers**
- Speaker of 6 watts r.m.s. rating of reputed make Ahuja is provided
- 50% of sharing is provided for the speakers between coaches in case of single power amplifier failure; at least half of the speakers are still operative in the coach
- Speakers are distributed in equal distance diagonally for even coverage of the sound in the coach.

**Microphone**
- Microphone is a professional high quality goose neck microphone are suitable for various PA applications
- Microphone is interfaced to MCP for PA, IC, ETBU operations
- Driver can talk through the microphone.

**GPS Module**
- A rugged GPS module with inbuilt antenna is located on the roof of DTC
- GPS module has RS485 communication with MCP unit for acquiring latitude, longitude, Date & time information.

**1.2.12.12.CCTV**
CCTV System is used to capture and record the live view from IP cameras which are located in passenger area or in external environment
CCTV System in all passenger coaches is for public security and to monitor unforeseen movements of people to prevent incidental losses

Asst. Driver / guard monitors the live views displaying in monitor which is located in driver's cabin
- CCTV System consists of
  - CCTV Recorder (NVR)
  - IP Indoor Cameras
  - IP Outdoor Cameras
  - Ethernet Switches
  - Guard / CCTV Display Unit.

1.2.12.13. DIVER CONSOLE
The driver cab is furnished with a pre-fabricated driver console. All driving operations are possible from this console. Feedback from the system in all the coaches/basic units is available for viewing by motor man. An illuminated indication panel is provided for important driving related information for quick viewing by motor man. Various gauges are also provided for viewing MR, BP, BC pressure. Motor man can also control the passenger information system from the driver desk.
1.2.13. AIR CONDITIONING SYSTEM

1.2.13.1. AIR CONDITIONING UNITS
Two microprocessor-controlled roof-mounted package units. Special air conditioning ducts for silent and equal distribution of conditioned air.

Separate Cab air conditioning unit for driver cabin.

1.2.14. BOGIES
Bolster-less bogie for semi high speed operation.

In Motor Coaches (MC/MC2), fully suspended traction motors and drive gear unit.
Layout of Air Conditioned DTC
Layout of Air Conditioned MC

16 COACH FORMATION

FEATURES:

1. HEADBOARD HANGS WITH CONSUMER POCKET WITH EXTRACTION FAN.
2. LED LIGHT FITTED CONTINUOUS LIGHTING AND LED ILLUMINATION BOARD.
3. OPG HANGS PASSANGER INFORMATION SYSTEM.
4. CCTV.
5. AIR CONDITIONER DOORS FASTENED.
6. AUTOMATIC GLASS PANES.
7. TOILET FitTED WITH GLASS DOOR.
8. CENTRALIZED AUTOMATIC PLUG DOOR FOR COACH DOORS.
9. PPE MODULAR TOWEL.
10. FASTENED VENTS.
11. VACUUM WASTE RED DURAT.
12. THE HANDS liebehler SYSTEM.
13. MINIMUM SPEED 100 KM.
14. REFRIGERATIVE AND E.F. DRIVE SYSTEM (BELOW CONTROLLED).

NOTE:

1. WASHING CLOTHES
2. FACILITIES:
3. WC WITH ELECTRICALLY OPERATED DOORS IS HUNG AS MC.
4. WASTE DRAIN.
5. PPE - INSTRUCTION LABELS.
6. MODELS FOR INSTRUCTION LABELS.
7. OBDs DURING EMERGENCIES.
8. POCKET FOR MOBILE / LAPTOP

LAYOUT OF AIR CONDITIONED MOTOR CAR FOR SEMI HIGH SPEED TRAIN SET INDIAN RAILWAY STANDARDS
1. Introduction

Layout of Air Conditioned TC

FEATURES:
1. Interior panels with concealed boxes with streamlined finish
2. LED signage for lights, lighting, and LED destination boards
3. GPS-based passenger information system
4. CCTV
5. Avee shape exterior framing
6. Automatic glass panel train first to second door
7. Centralised automatic plug door for coach entry
8. 9ft minimum table
9. Wd filler
10. Vacuum assisted full toilet
11. On-board entertainment system (2 HD of accommodation monitor)
12. Emergency speed limit 100 kmph
13. Air conditioning with EB in multiple sides
14. Right-hand drive with EB in multiple sides
15. Right-hand drive with EB in multiple sides
16. Right-hand drive with EB in multiple sides
17. Right-hand drive with EB in multiple sides
18. Door armature lamp

NOTE:
1. Seating capacity
2. No. of lavatories
3. Mtr. with electrical change direction switch (which acts as MGT)
4. Brake drill, Mtr. 3-4-5-6-12-13-14-15-16
5. Various fuel quantities for various coaches, door opening and closing functions
6. Various passenger emergency alarm push button (ESP) and emergency alarm button

16 COACH FORMATION

NOTE:
- Toilet Occupies Light
- Window
- Exits 4 to 6 (location to be finalized)
- Exit - 4
- Electrified operated push button (ESRB) - 4
- Door inspection lamp (EB/LTR): DLR-4 - 4
- Emergency armature lamp - 4
- LED based destination boards - 4

LAYOUT OF AIR CONDITIONED TRAILER CAR FOR SEMI-HIGH SPEED TRAIN SET

IRCAMTECH/GWL/2022-23/T-18/MM/2.0
Layout of Air Conditioned MC2
1. Introduction

**Layout of Air Conditioned NDTC/EC**

**FEATURES:**
1. Alexander Planked New Coreless Scaffolding with Sandwiched Paper
2. LED Low Form Extended Lighting and LED Declaration Board
3. UPS Based Power Backup System
4. Air Conditioner Exterior Painting
5. Automatic Sliding Trolley Doors in Sliding Doors
6. Centralized Automatic Plum Door for Coach Entry
7. Fumigation Valet
8. Fumigation Valet
9. FUM DECOR
10. Sliding Sliding Sliding Sliding
11. ON BOARD ENTRANCE SYSTEM (OHA OF ENTRANCE SYSTEM)
12. Manual Speed with Car Wash
13. Fully Automatic Train Wash in Multi-later Mode
14. RESEVATIVE AND T.P. BRIDGE SYSTEM (WEIGHT BALANCE)
15. PRESENTATION FOR TRAIN PROTECTION SIGNAL SYSTEM (TPPS)
17. Centralized Coach Monitoring System (CCMS)

**NOTE:**
1. MAXIMUM CAPACITY — 32
2. NO. OF LOAFS — 2
3. WINDING PLUMB — G-WINDING
4. HYDRAULIC HEAT EXTRACTOR (HHE) — 3 HEE
5. 4 - 4 He
6. 20 - 4 He
7. ELECTRICALLY OPERATED PUSH BUTTON (EOPB) — 4 He.
8. Dloor Lumberboard Unit (SLU) — 4 He.
9. Dloor Diameter Unit (DDU) — 4 He.
10. Fumigation Valet — 4 He.
11. LED Based Declaration Board — 3 He.
Layout of Executive Air Conditioned NDTC/EC2

FEATURES:
1. INTERIOR FINISH WITH CONCEALED INTERIOR WITH DURABLE MATERIALS
2. LED LIGHT FITTINGS ENSURE LIGHTING AND LED ILLUMINATION DONE.
3. EYE LEVEL PASSAGEWAY INFORMATION DISPLAY.
4. LCN.
5. ALUMINUM EXTERNAL PANEL.
6. AUTOMATIC GLASS PANELS. TOUCH FREE IC SWING DOORS.
7. CENTRALIZED AUTOMATIC FUSE DOORS FOR EASY ENTRY.
8.wig Manually To Element.
9. LED LIGHT.
10. TOUCH PANEL EYES VISIBLE.
11. ON BOARD MONITOR SYSTEM (2 INCH OF INFORMATION MONITOR)
12. AIR CONDITIONING SYSTEM (N2 unit), HEADWIND INLET SYSTEM.
13. FULLY SUSPENDED SUSPENSION WHICH IS BLIGHTED IN SILENCE.
14. EYE LEVEL PASSAGEWAY INFORMATION DISPLAY.
15. SUPERIOR SOUND SYSTEM (N2 unit), HEADWIND INLET SYSTEM.
16. PROVIDER FOR TRAIN PROTECTION WARNING SYSTEM (TYPE).
17. LAYOUT OF NON DRIVING AIR CONDITIONED TRAILER CAR 2 FOR SEMI HIGH SPEED TRAIN SET (EXECUTIVE CLASS).
18. DOOR INDICATION LAMPS.

NOTE:
1. ENTRY DEPARTMENT
   - 2
2. NO. OF LAVATORIES - 02
3. NO. OF SEATS / 24
4. DOOR INDICATION LAMPS (INTERNAL) (2x4) - 4 max.
5. DOOR INDICATION LAMPS (EXTERNAL) (2x4) - 4 max.
6. DOOR INDICATION LAMPS (EXTERNAL) (2x4) - 4 max.
7. EXTRANEOUS OPENABLE WINDOW - 4 max.
8. LED ILLUMINATION BUTTON - 2 nos.

NDTC/EC2

16 COACH FORMATION