Traction system and Rolling Stock in Metro Railways

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UTHS/RDSO

Traction Distribution

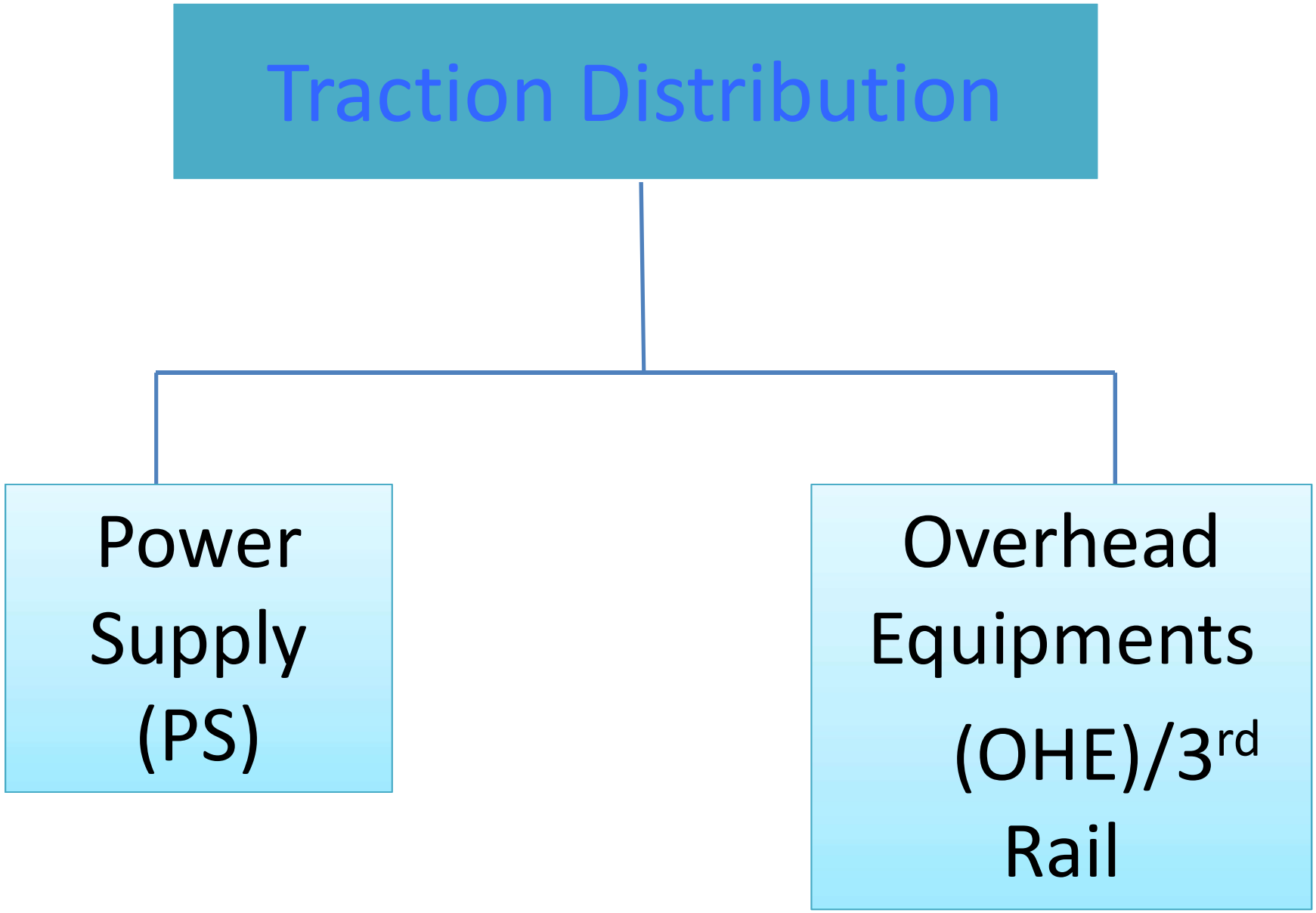
Two types of traction supplies are used in Metro Railways.

A. Conventional 25KV AC Overhead supply

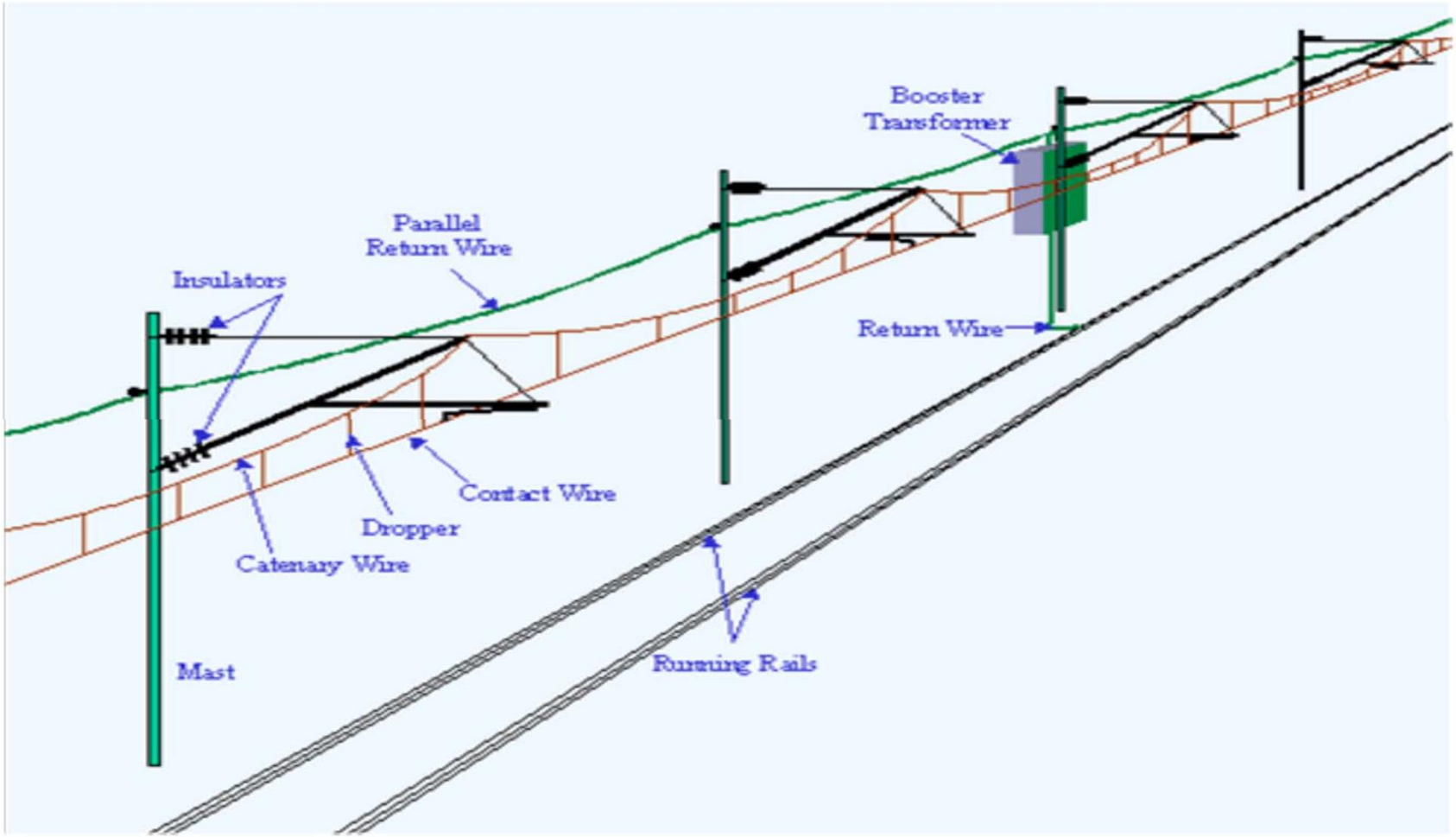
The traction supply is made through conventional overhead catenary system, though some design design features are different from Indian Railways system.

B. Third Rail system with DC supply

Traction power supply is made through 750V DC system through a conductor rail laid parallel to the track (called third rail)

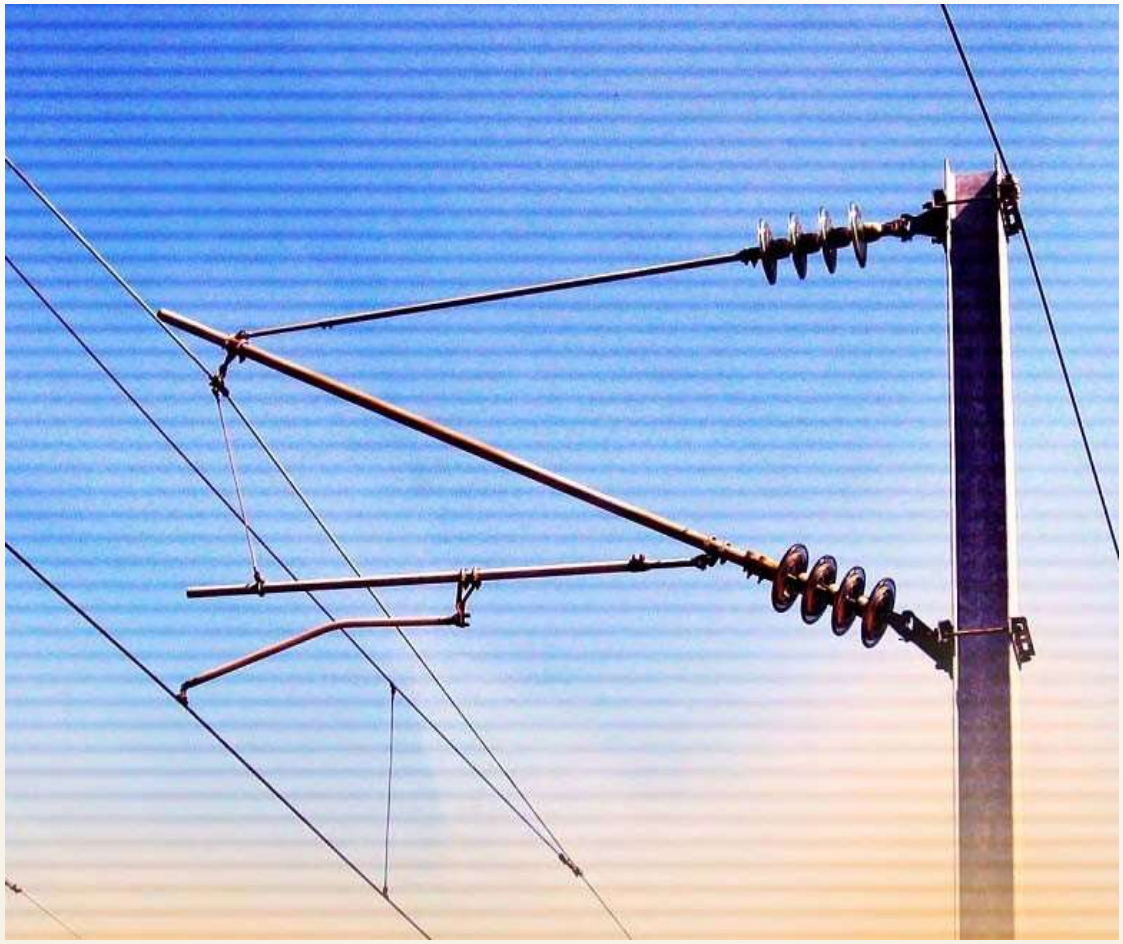

Traction Distribution
Power Supply (PS)
Overhead Equipments (OHE)/3rd Rail

Overhead Catenary System (OCS)



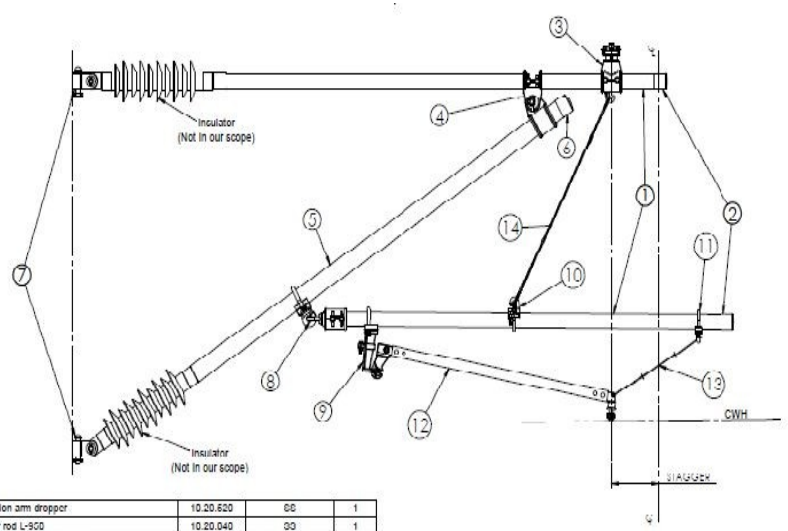
AC Electrification System : Overhead Contact Line (OCL) or Overhead Catenary System (OCS).

Supporting structure: Poles, beams and other structures used to install the various lines and wires over the permanent way.



Modular Cantilever

Pull Off Type MCS (with 1.2 m encumbrance)

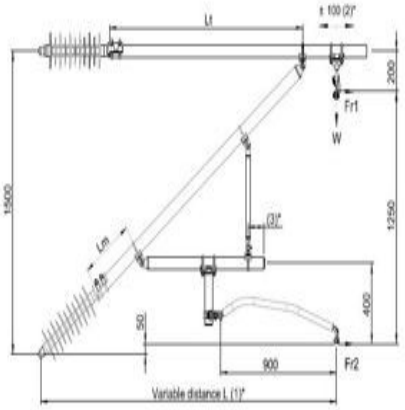


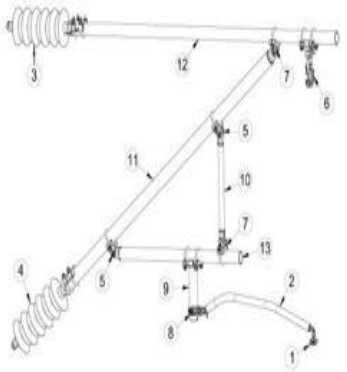
Sr. No.	Description of Items	Part No.	Material	Qty.
14	Registration arm dropper	10.20.620	SS	1
13	Windstay rod L-900	10.20.040	SS	1
12	Steady arm straight assembly	10.20.502	Al Alloy & SS	1
11	Eye clamp for windstay D-55	10.20.532	Al Alloy & SS	1
10	Hook clip D-55 assembly	10.20.519	Al Alloy & SS	1
9	Steady arm bracket-A D-55 assembly	10.20.530	Al Alloy & SS	1
8	Hook and eye clamp assembly	10.20.572	Al Alloy & SS	1
7	Ball and Socket assembly	10.20.524	Al Alloy & SS	2
6	PVC tube cap 70	10.20.075	PVC	1
5	Cantilever tube 70mm	10.20.072	Al Alloy	1
4	Double tube holder 55-70 assembly	10.20.509	Al Alloy & SS	1
3	Catenary wire support with bimatallic sleeve	10.20.517	Al Alloy & SS	1
2	PVC tube cap 55	10.20.074	PVC	2
1	Cantilever tube 55mm	10.20.071	Al Alloy	2

Note.- Exact length of pipe shall be calculated as per site LOP

PUNE METRO RAIL PROJECT

Pull Off Type MCS (with 1.25 m encumbrance)



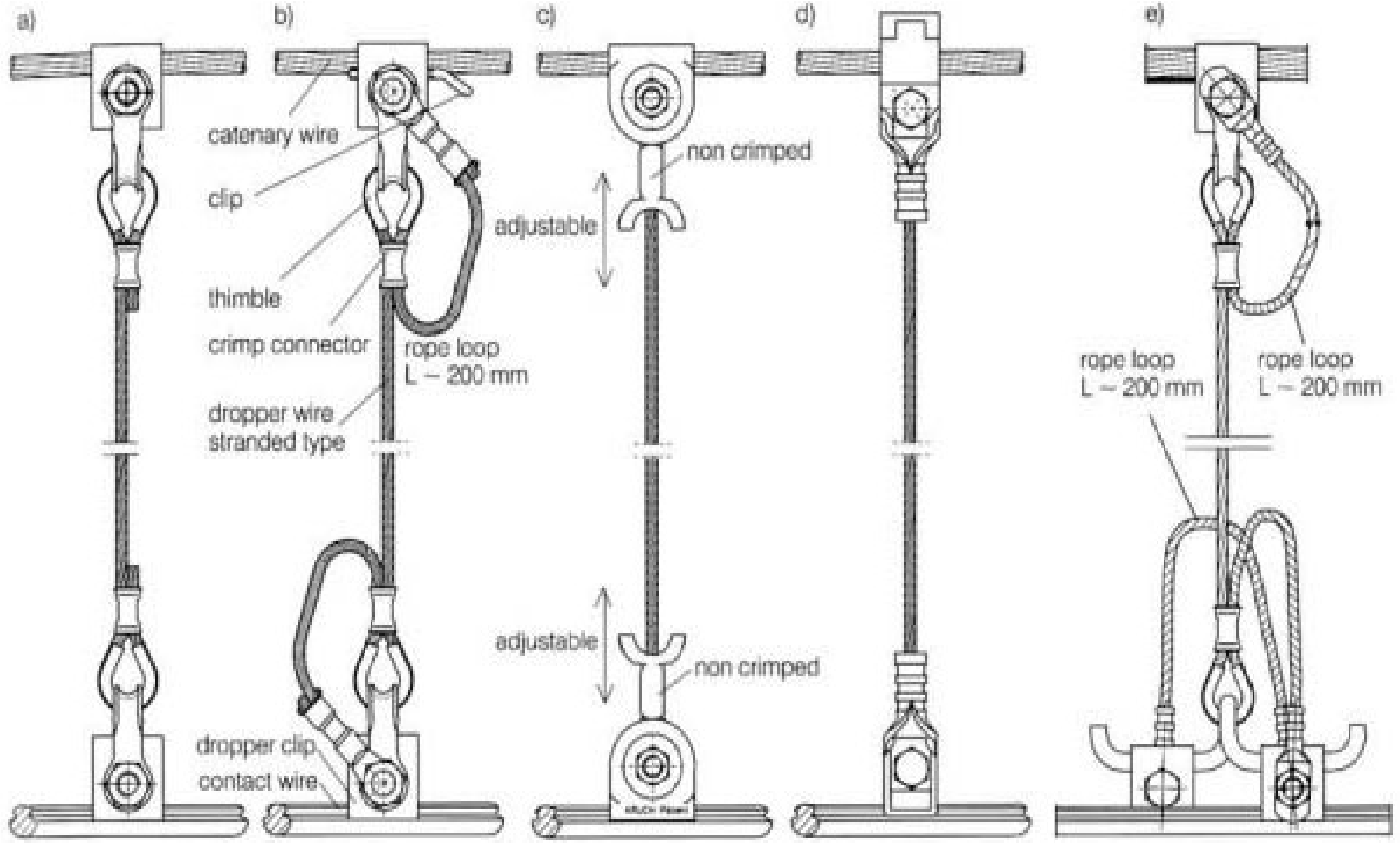


N°	Designation	Reference	Qty
1	Single contact wire bolted clamp	37207/B	1
2	Aluminium bent steady arm 900	PE-231	1
3	25 kV insulateur for tube Ø60 (1600 creepage)	74432/A	1
4	25 kV Insulator for tube Ø70 (1600 creepage)	74433/A	1
5	Tube Ø70 attachment	56336/B	2
6	Messenger suspension under tube Ø60	56337/A	1
7	Tube Ø60 attachment	56335/B	2
8	Tube Ø60 horizontal swivel attachment	56333/D	1
9	Lowering bracket tube under tube Ø60	64184-TYPE 0	1
10	Aluminium reinforcement tube Ø38	56367-ITEM 5	1
11	Aluminium tube with Ø13 eye - Tube Ø70x5	56381	1
12	Aluminium tube with cap - Tube Ø60x4	73286	1
13	Aluminium tube with Ø13 eye and cap - Tube Ø60x4	64182	1

Tubular Portal Structures on Mainline:-

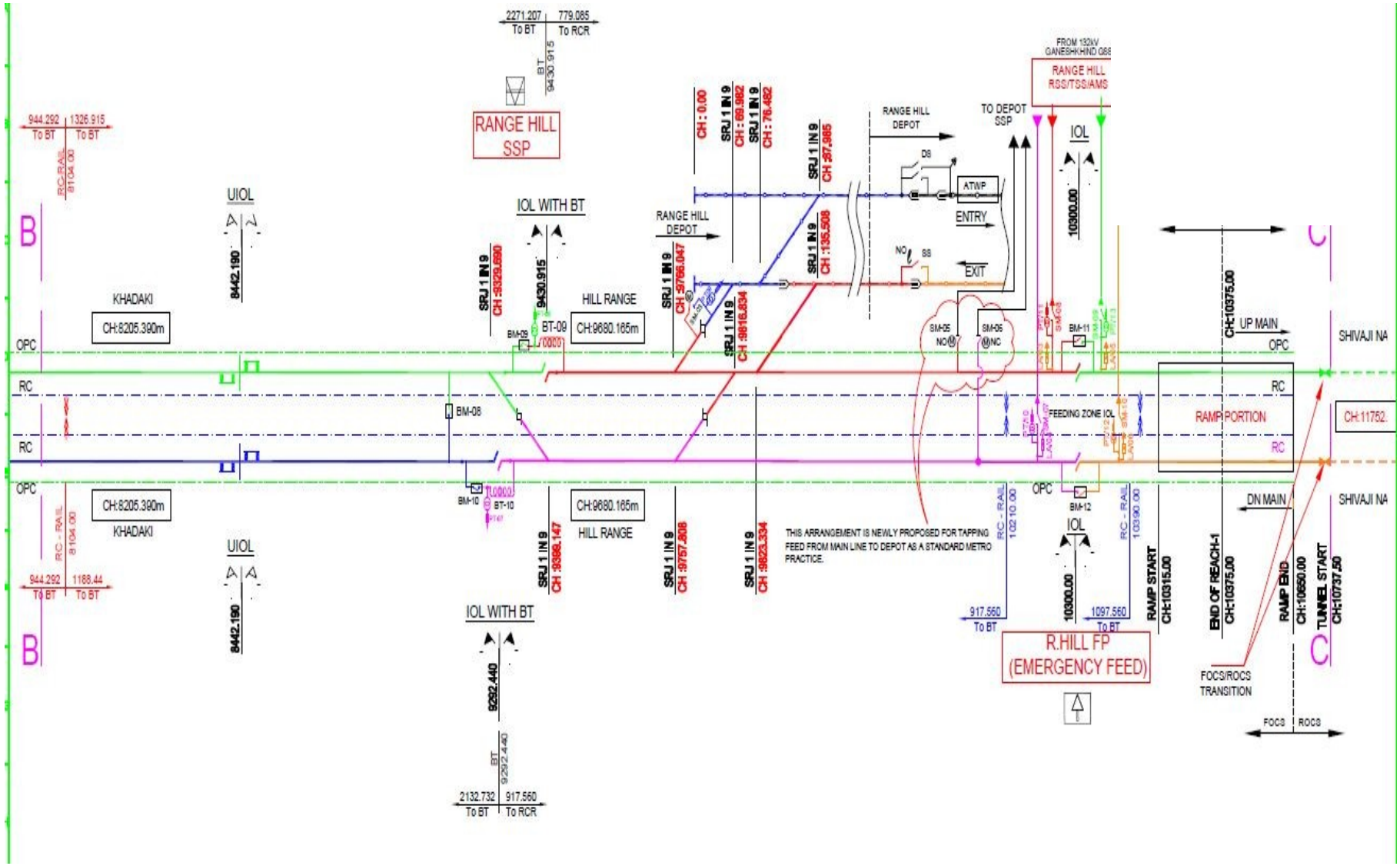
- Used on elevated viaduct section
- Three part structure comprising two upright poles and one curved boom
- Good aesthetic look to the metro corridor

Dropper wire : Traditionally provide physical support of the contact wire with or without joining the catenary and contact wires electrically.

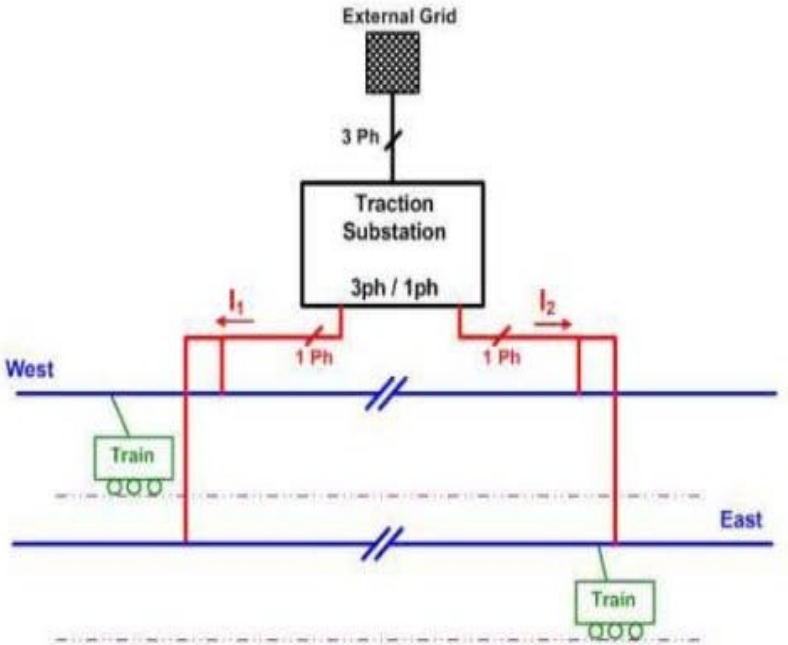


a) non-current carrying dropper, b) current carrying droppers, c) adjustable current carrying dropper, d) current carrying dropper, e) current carrying droppers for twin contact wire

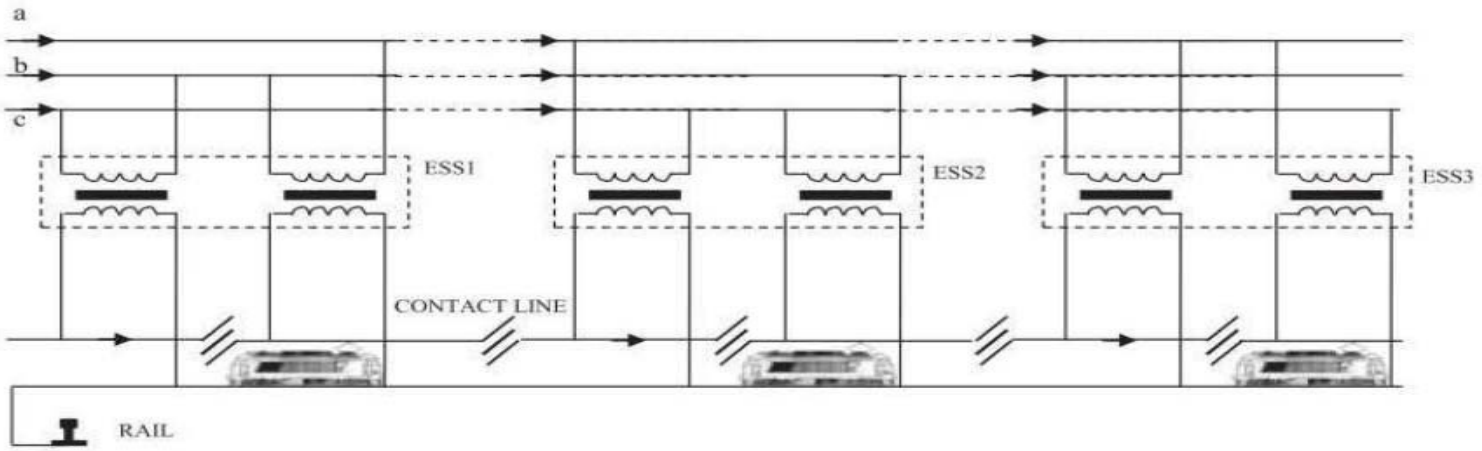
Sectioning Diagram



AC Electrification System :Neutral Zone

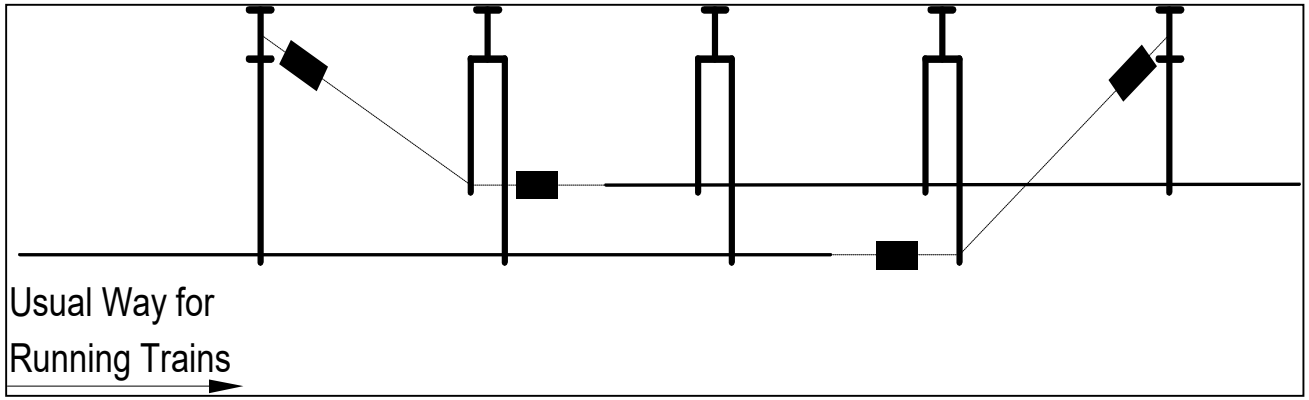


Neutral zone or **Neural section** is in distance (meter) where there is no electricity due to separation of two different line-line voltages for sharing electricity supply on each phase.



Insulated Overlaps

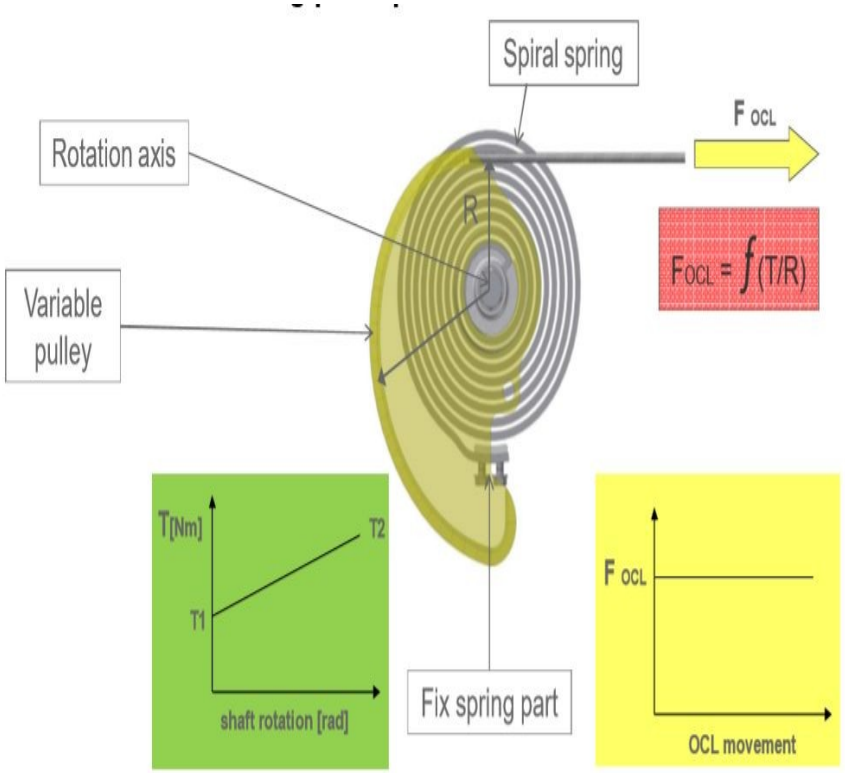
- The General arrangement of OHE, in 4 span insulated overlaps, is shown in figure below. The insulated overlap is made up of 4 spans. Viewed in the normal direction of traffic, the OHE located on the left-hand side, directly gets anchored later while the one located on the right-hand side crosses first the left-hand equipment and gets anchored. This arrangement is called a Normal overlap with 4 spans.
-
-



Normal Insulated Overlap with 4 spans

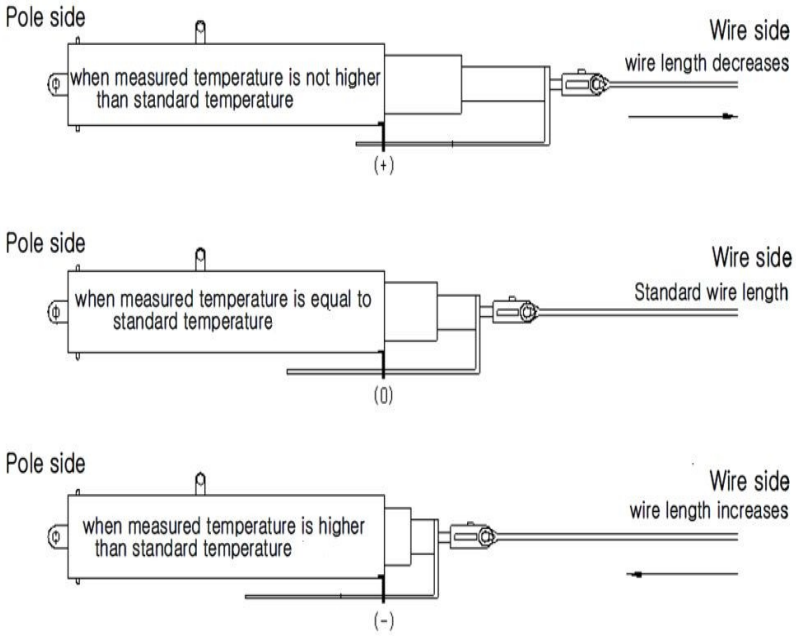
Types of Spring Type ATD

Spiral Type ATD

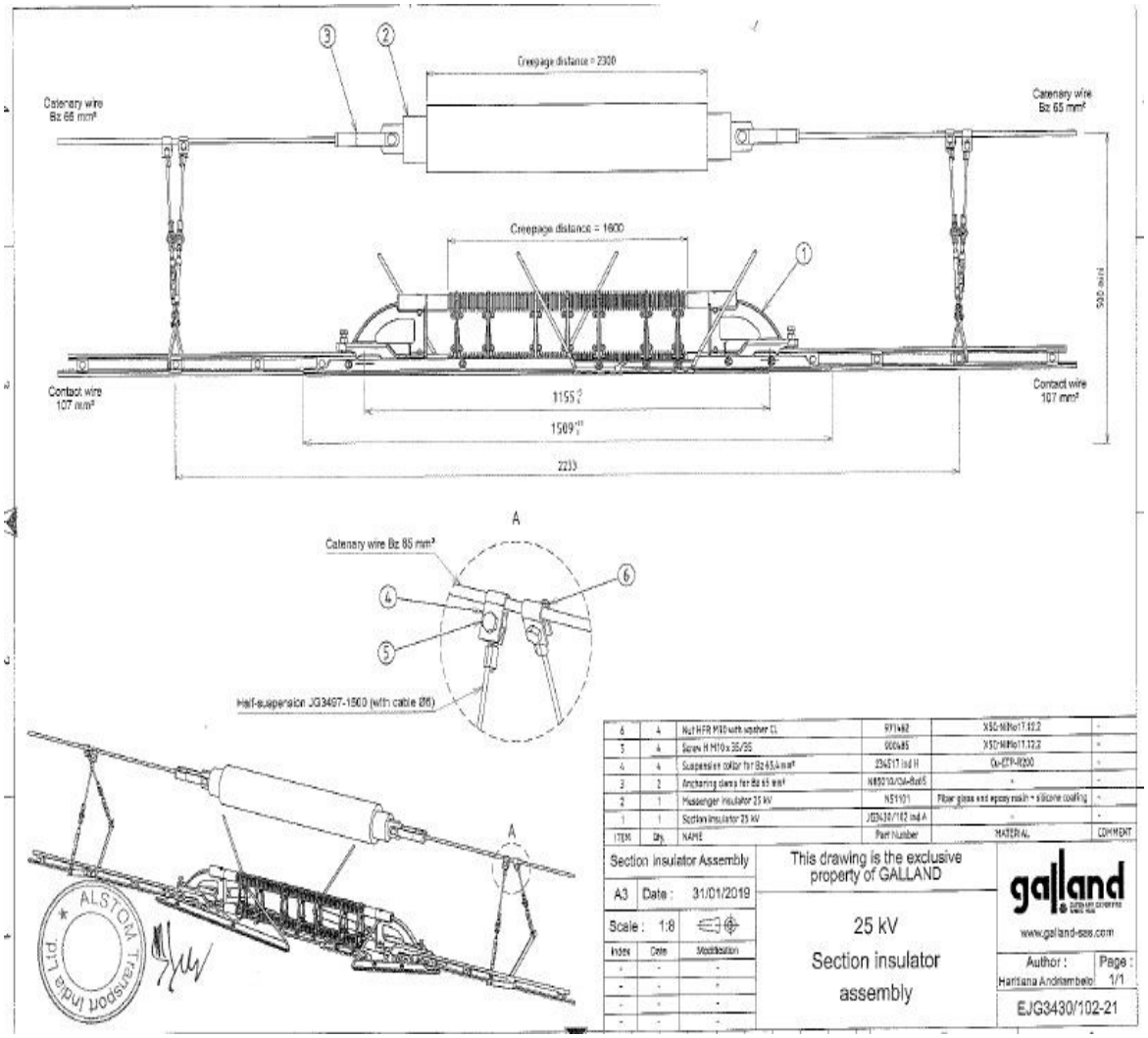


Types of Spring Type ATD

Helical coil Type ATD



Section Insulator



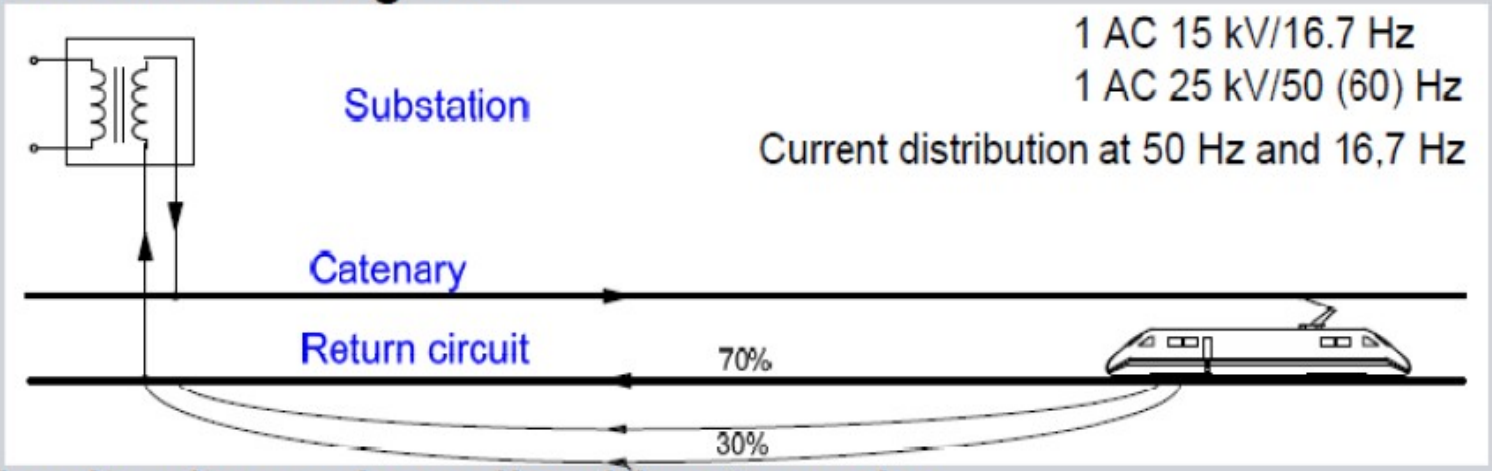
ITEM	Qty.	NAME	Part Number	MATERIAL	COMMENT
6	4	Nut HFR M10 with washer CL	971482	X5CrNiMo17-12-2	-
5	4	Screw H M10 x 35/35	900485	X5CrNiMo17-12-2	-
4	4	Suspension collar for Bz 65,4 mm²	254517 ind H	Cu-ETP-R200	-
3	2	Anchoring clamp for Bz 65 mm²	N99210/CU-Bz65	-	-
2	1	Messenger insulator 25 kV	N51101	Fiber glass and epoxy resin + silicone coating	-
1	1	Section insulator 25 kV	JEG430/102 ind A	-	-

Section insulator Assembly		This drawing is the exclusive property of GALLAND	galland
A3	Date : 31/01/2019		
Scale : 1:8		25 kV Section insulator assembly	www.galland-sas.com
Index / Date / Modification			Author : Hantsana Andriambelo / Page : 1/1
- / - / -			EJG3430/102-21

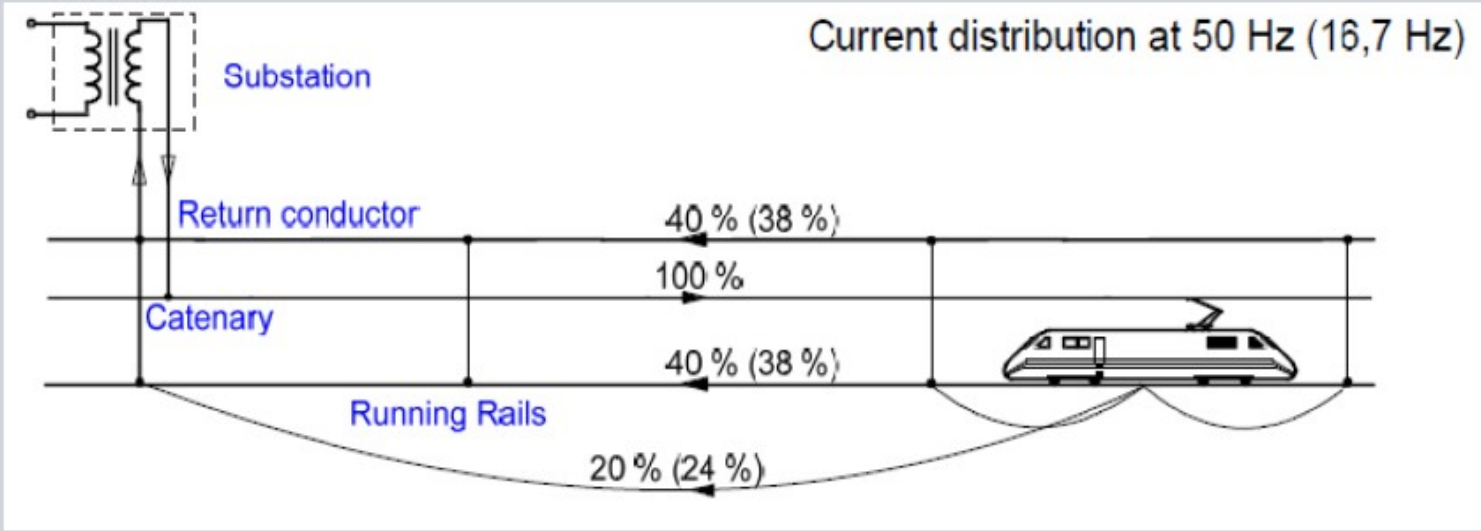
AC Electrification System :Feeding Systems

Direct-fed System

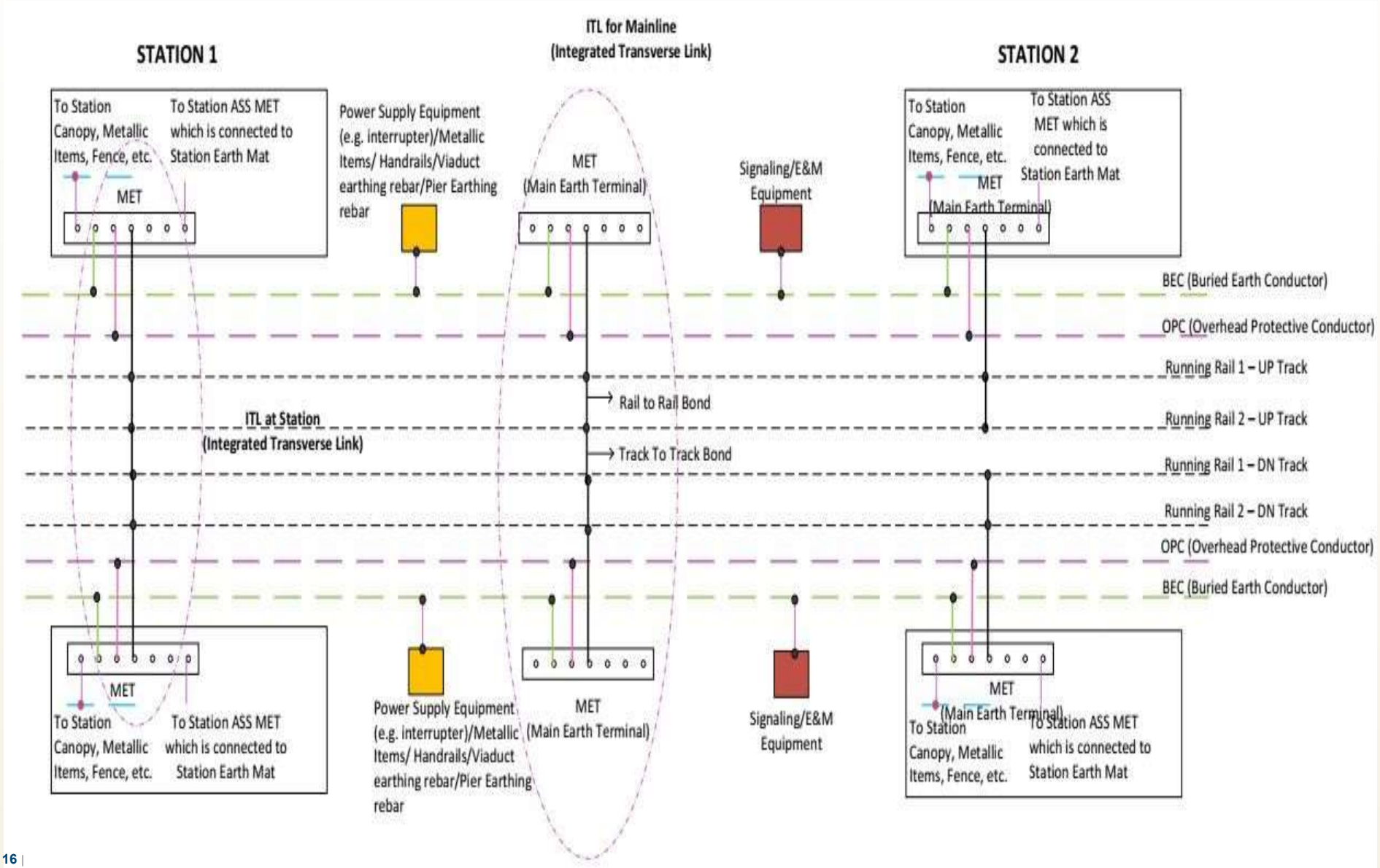
Return circuit via running rails



Return circuits via running rails with return wire

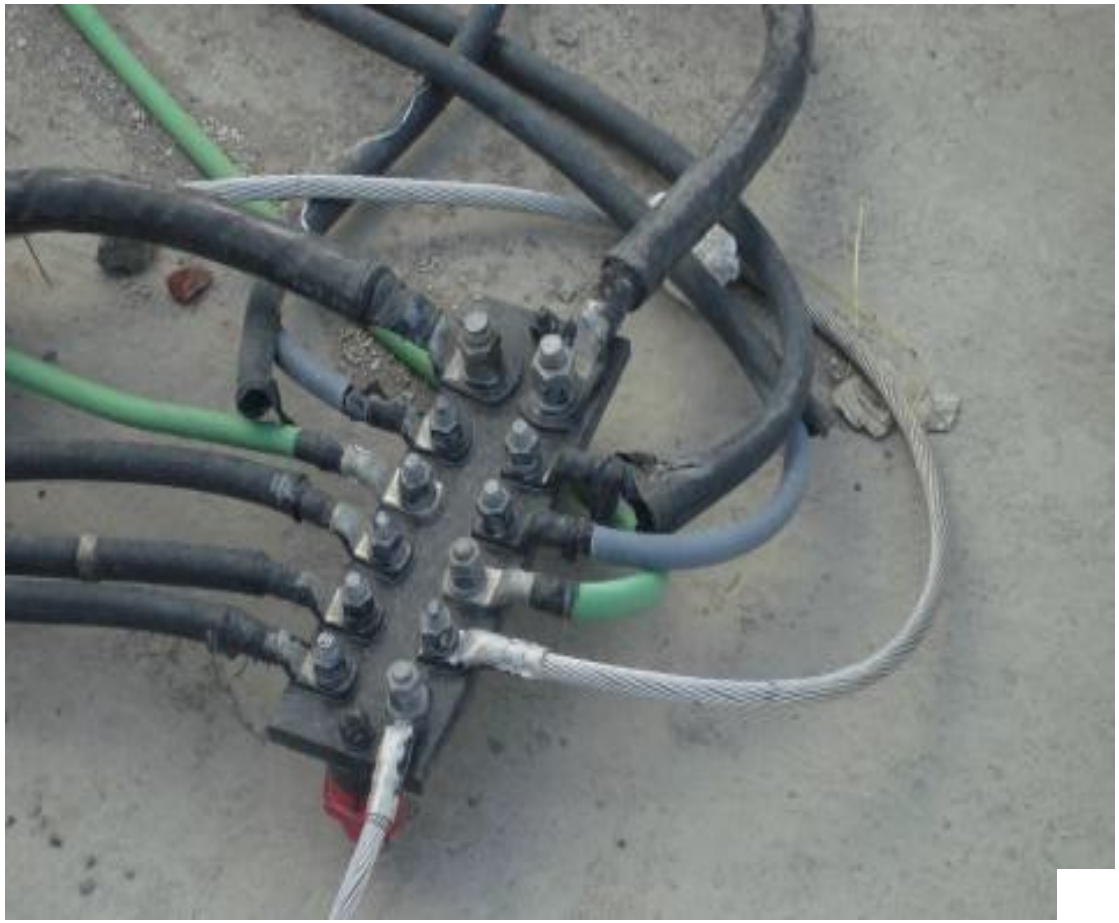


Typical Earthing Scheme in Mainline

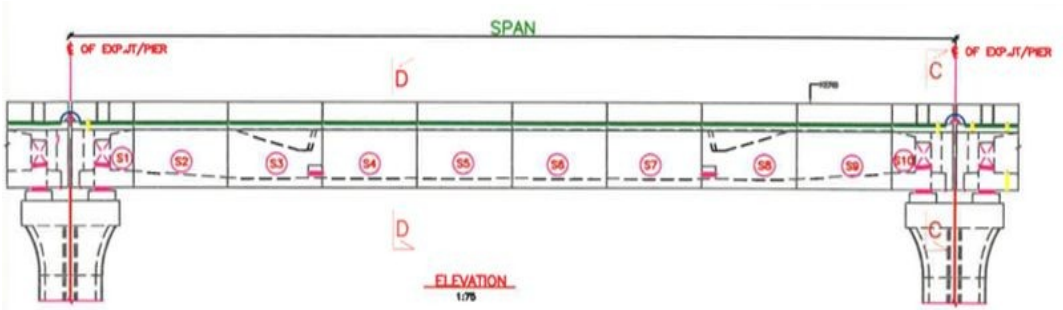


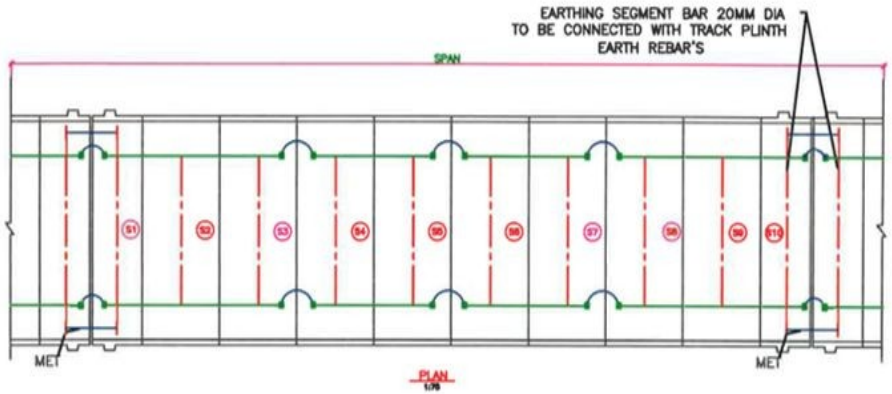
3. Earthing Scheme

- "**Integral Transverse Link" (ITL)** It is interconnection of Down line OPC, BEC and Up line OPC, BEC. This shall be provided at an interval of 1 Km and less.

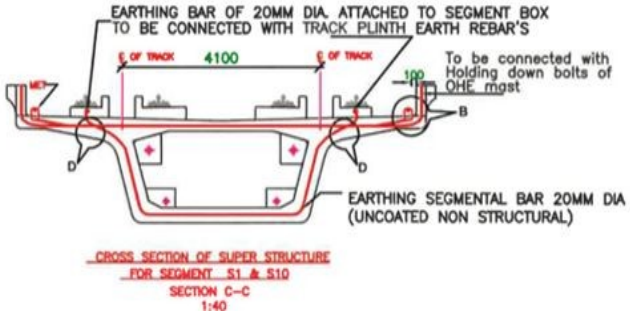


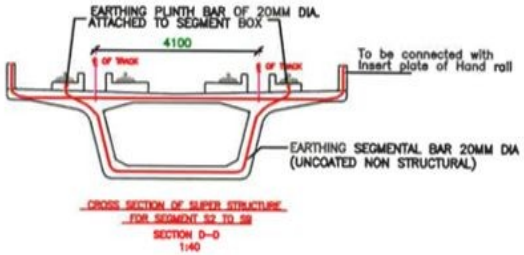
3.2 Typical Earthing Arrangement at Viaduct



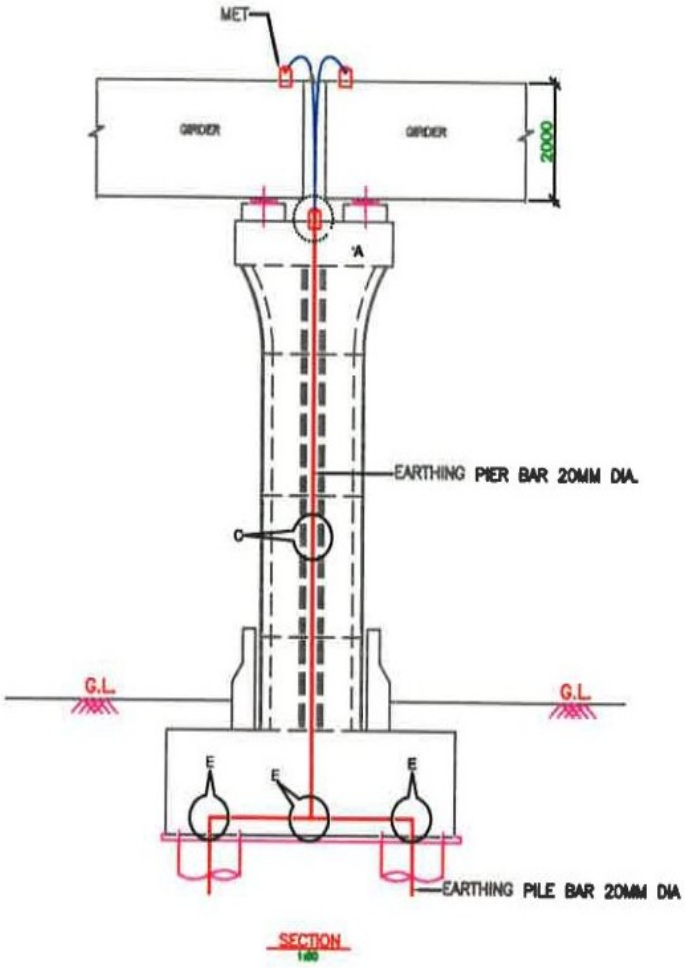


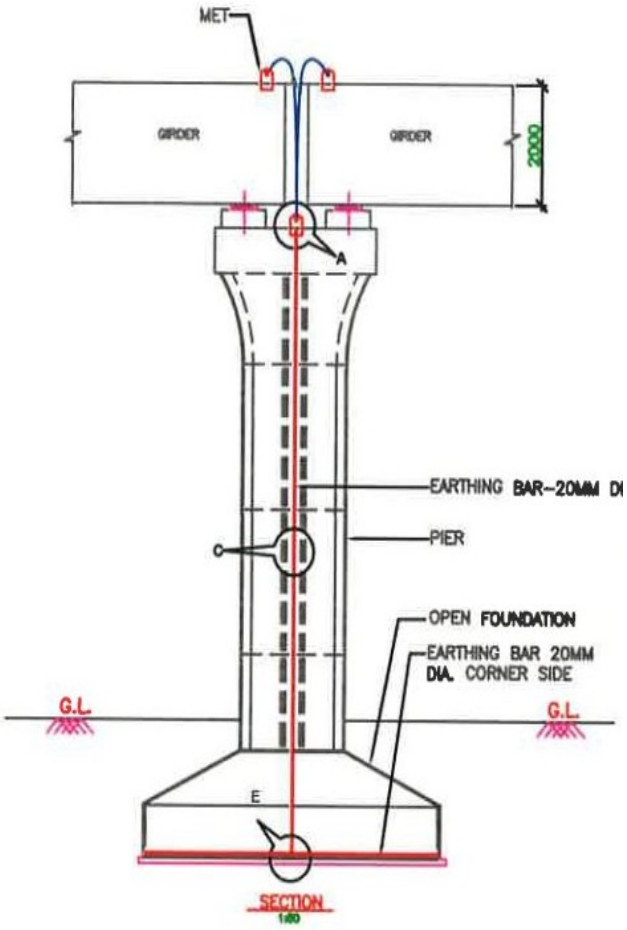
Track Plinth Earthing & Bonding



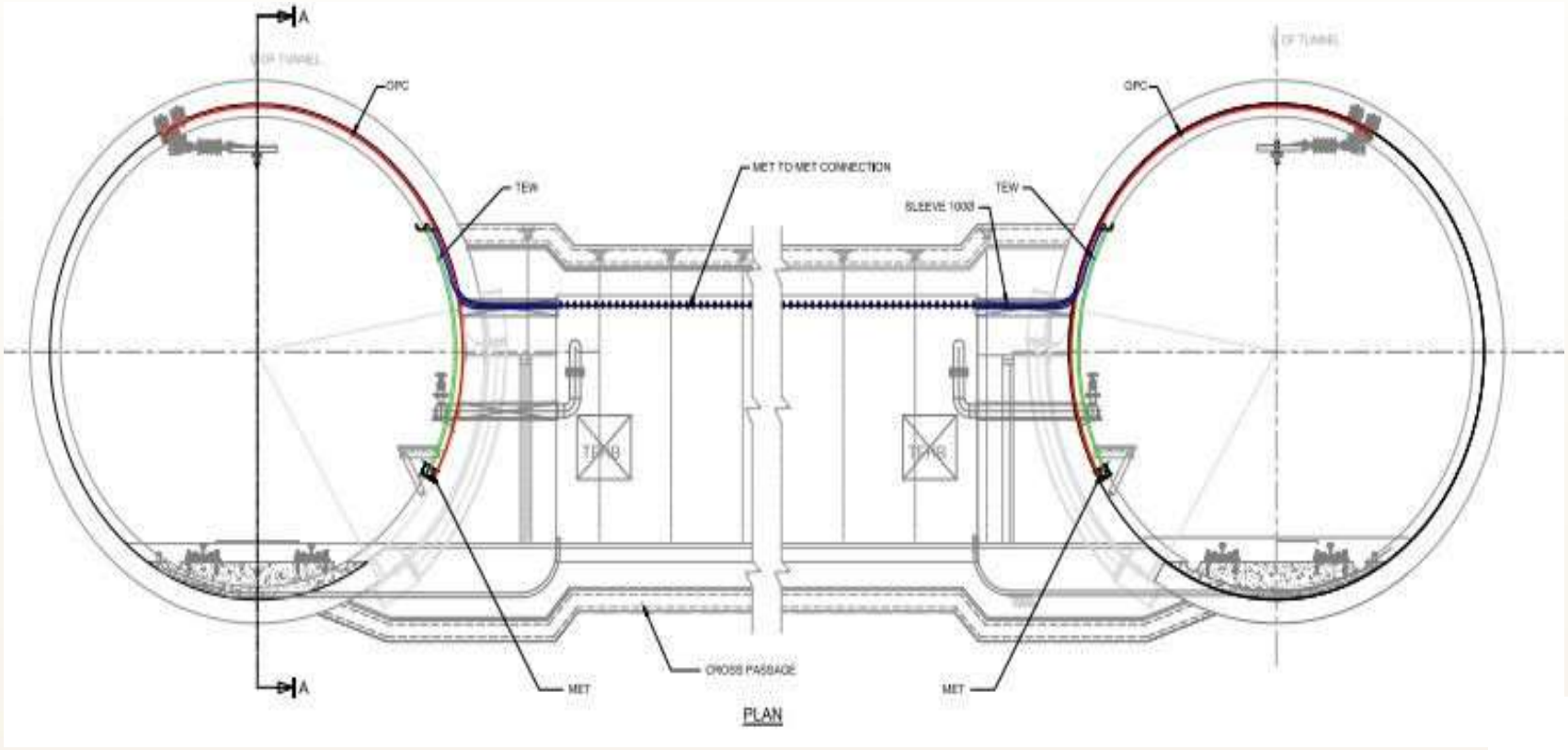


Typical Earthing Arrangement at Piers

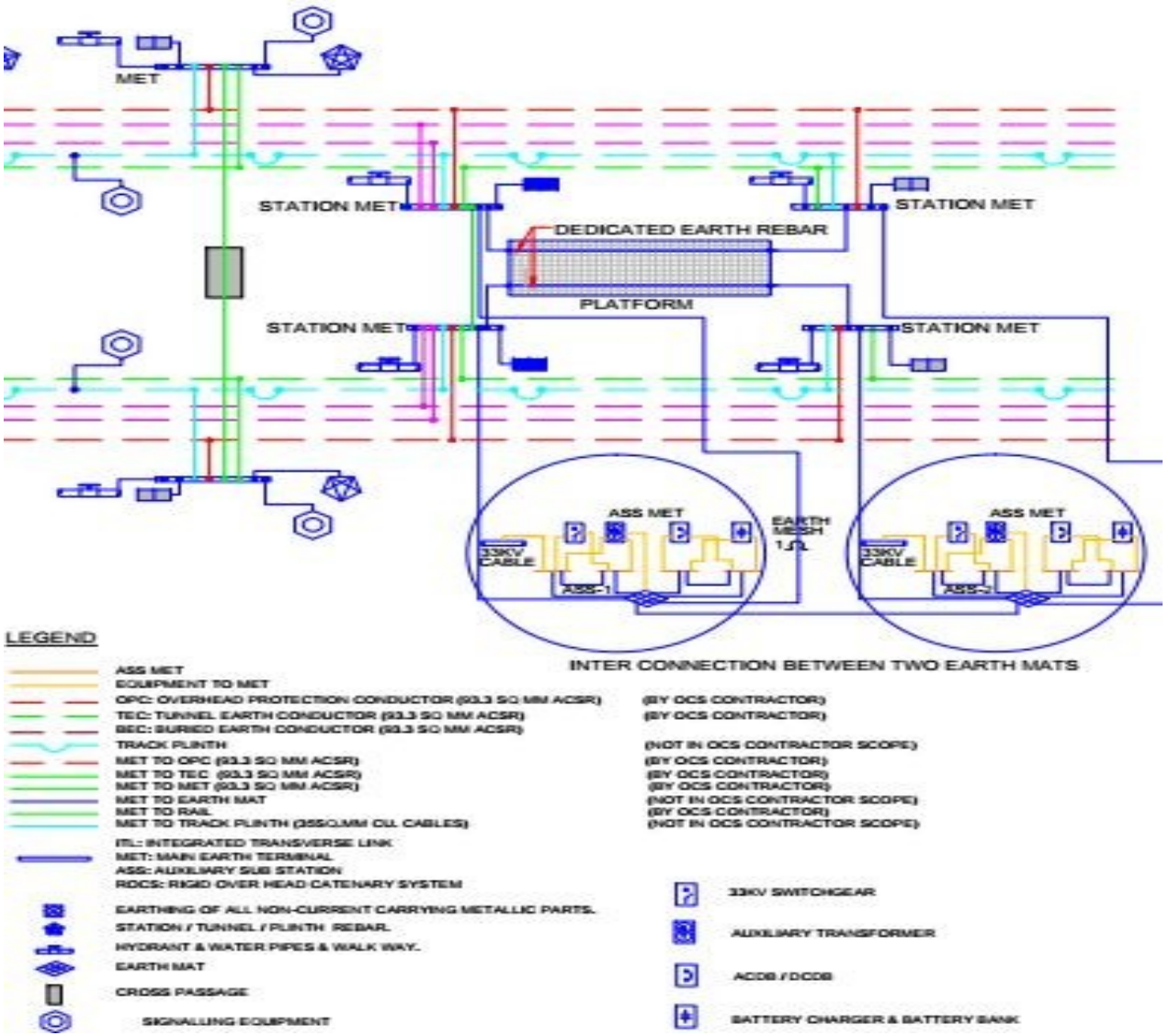




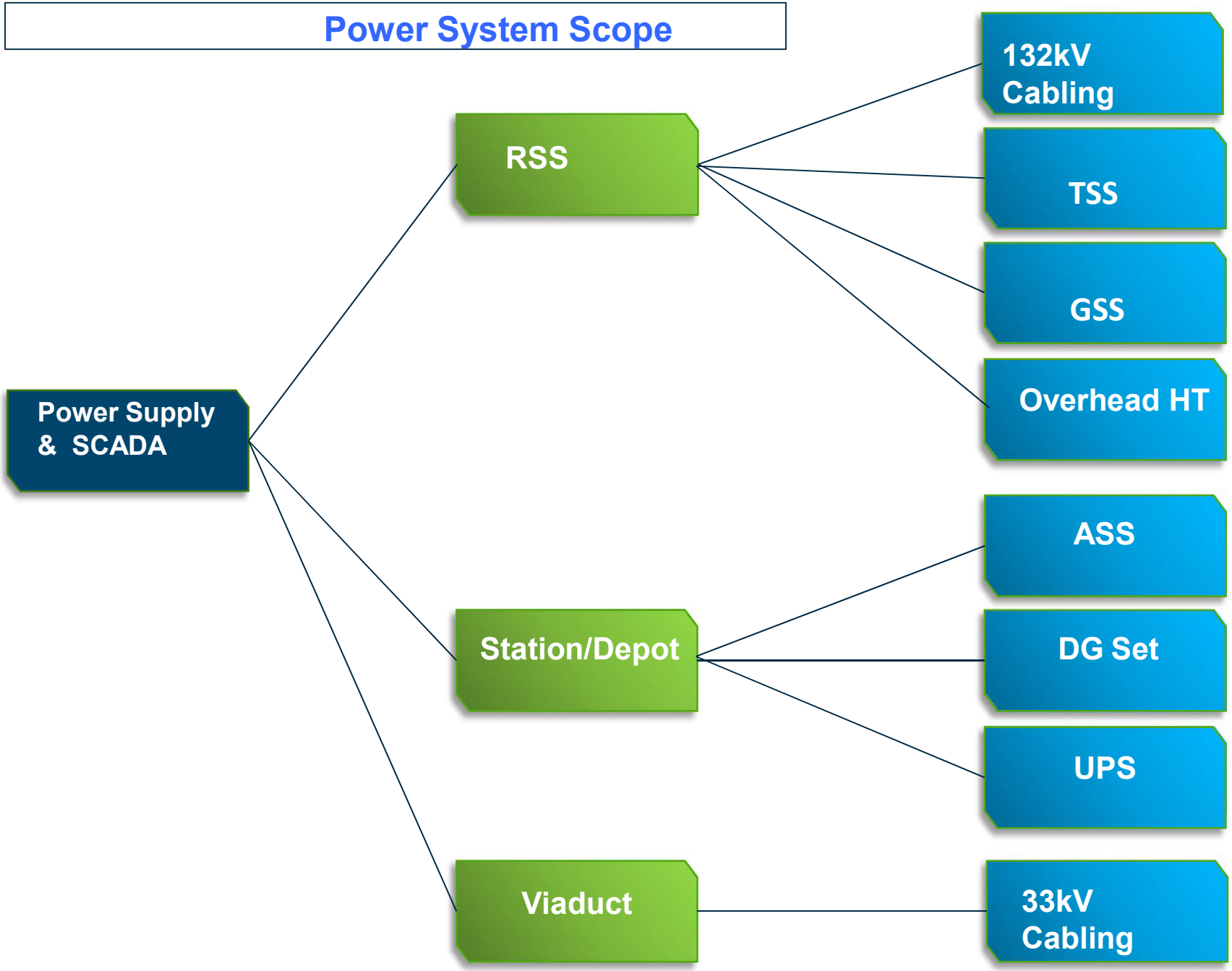
Typical Earthing at Tunnels



Typical Earthing Arrangement at UG stations



Power System Scope

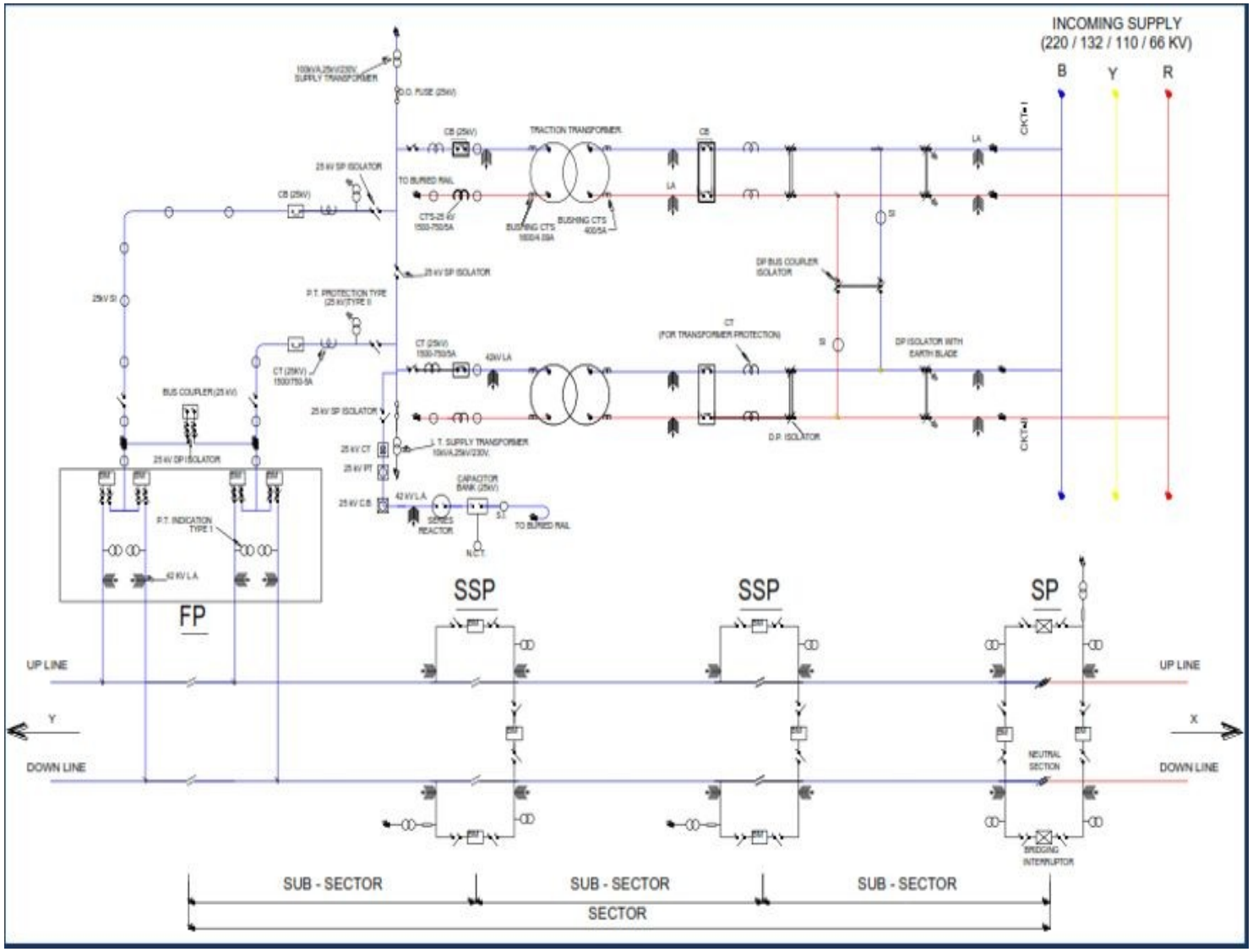


Gas Insulated Sub stations

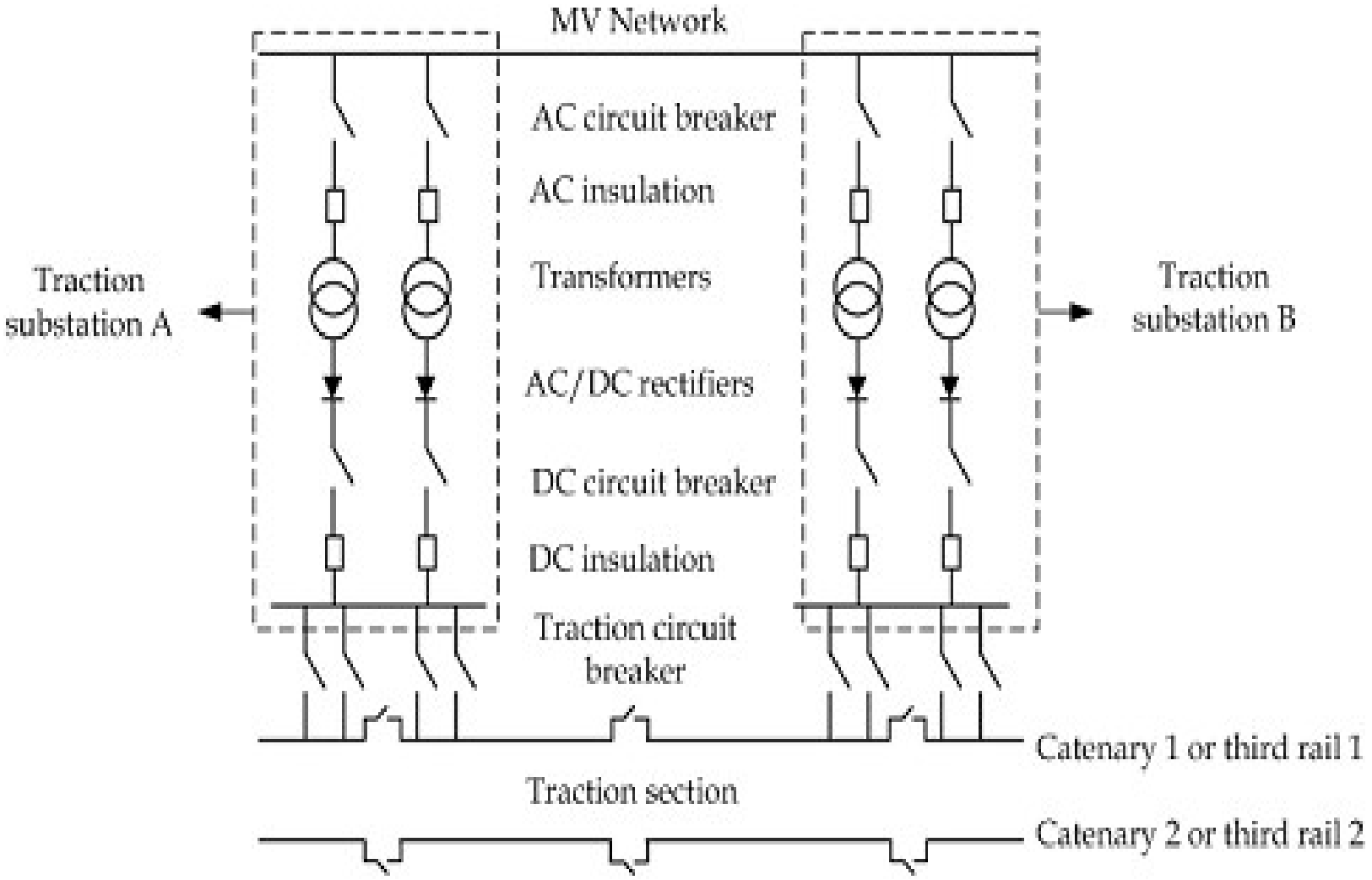
GIS Front view

GIS Top view

Typical Feeding arrangement from Traction Substation



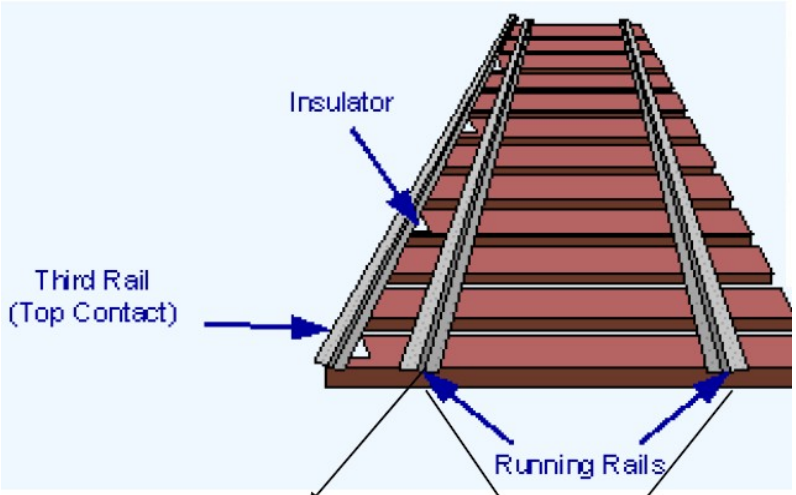
DC Electrification System



Running Rails

3rd rail

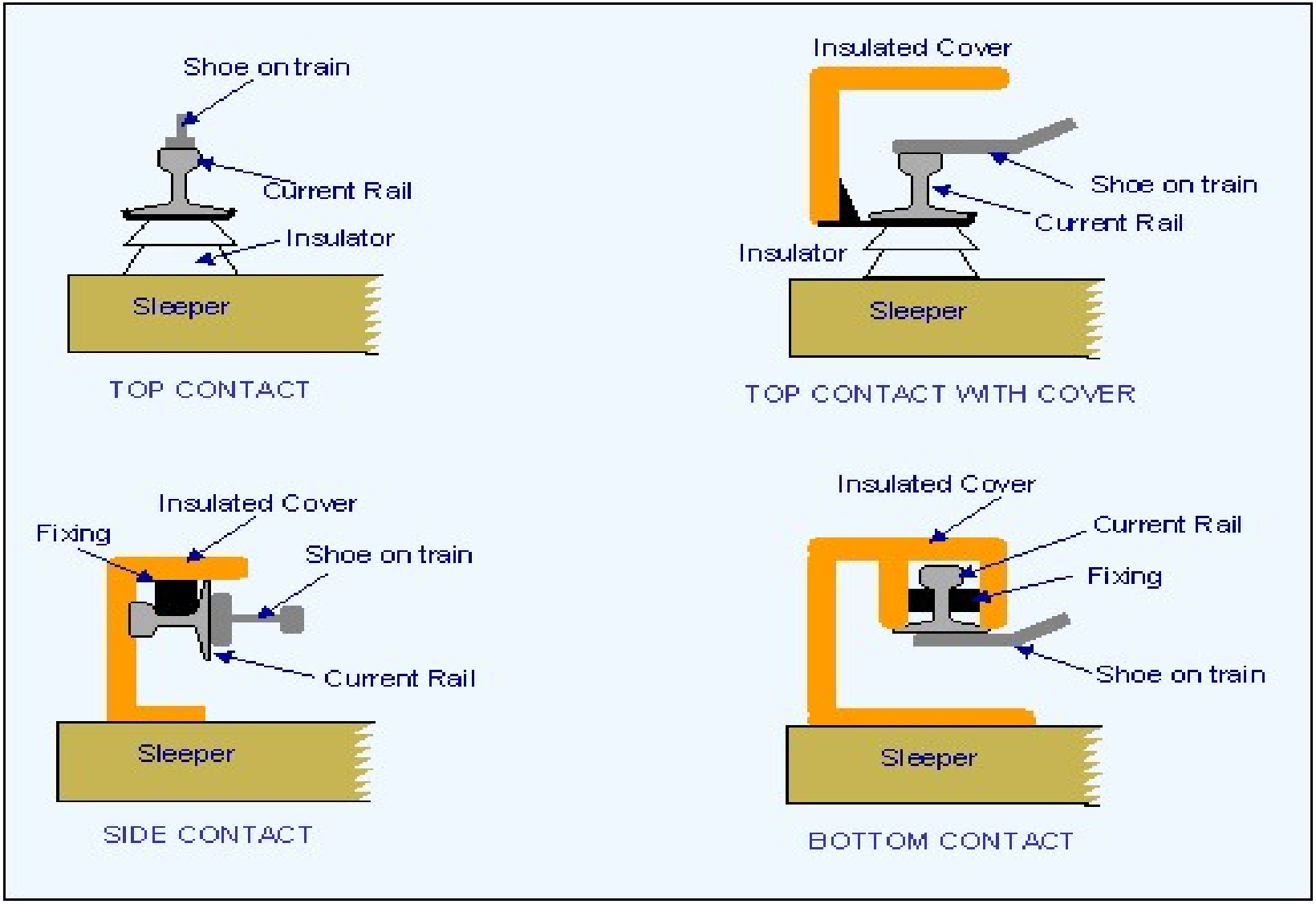
Running rails = Track



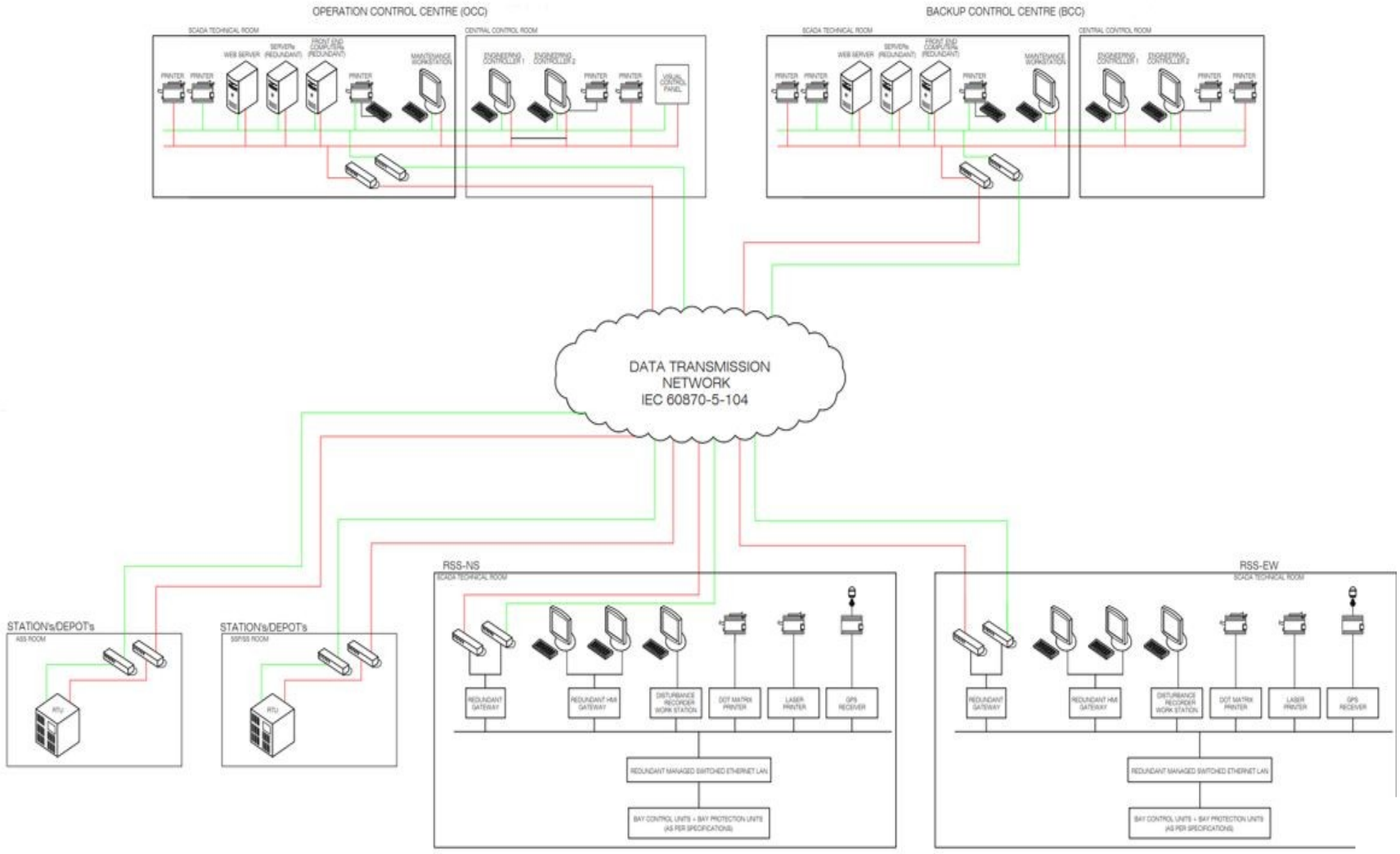
Rail

Two Rails = 1 track

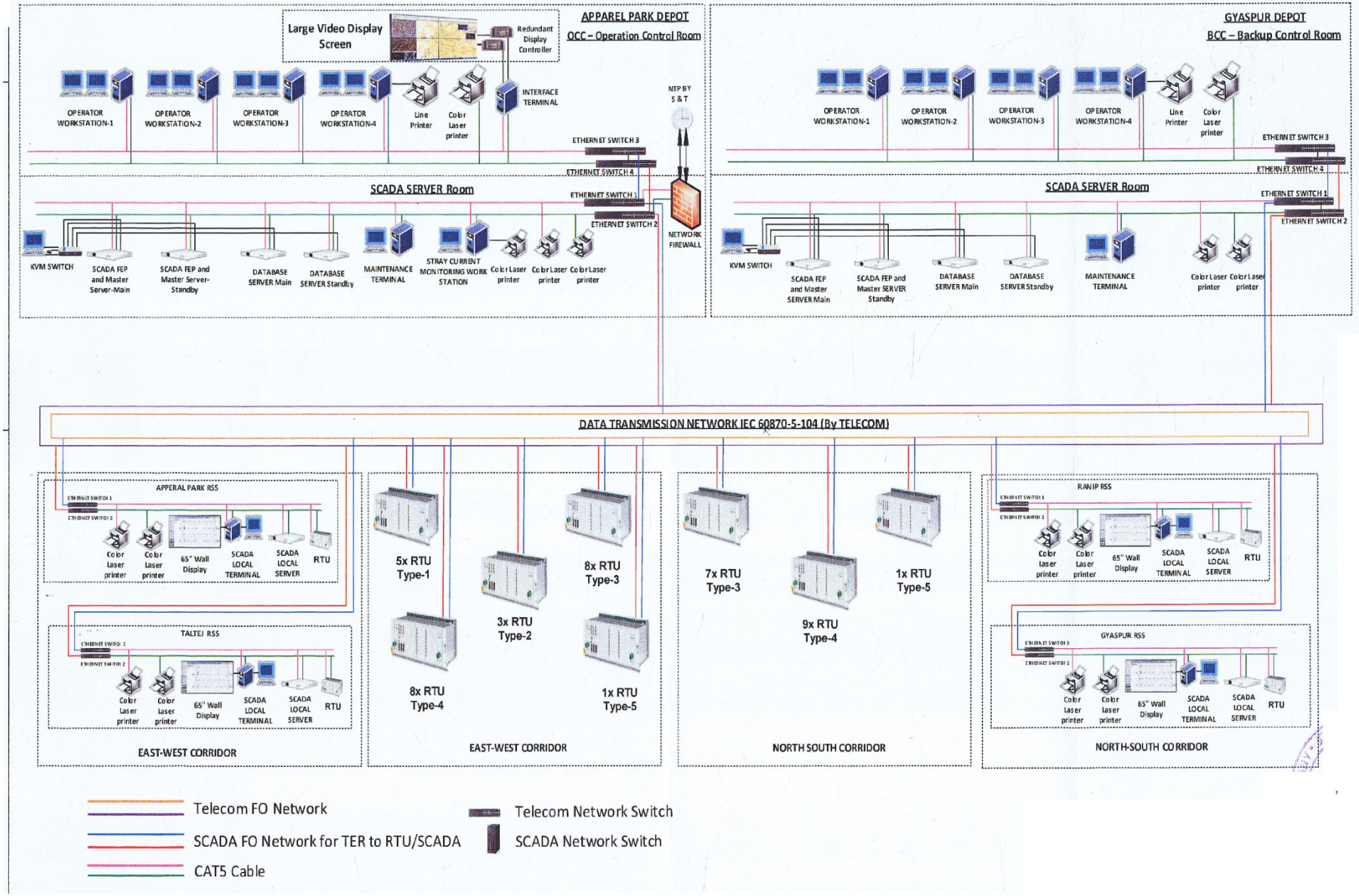
DC Traction


Shoe on train
Current Rail
Insulator
Sleeper
TOP CONTACT
Insulated Cover
Shoe on train
Current Rail
Insulator
Sleeper
TOP CONTACT WITH COVER
Insulated Cover
Fixing
Shoe on train
Current Rail
Sleeper
SIDE CONTACT
Insulated Cover
Current Rail
Fixing
Shoe on train
Sleeper
BOTTOM CONTACT

SCADA Schematic Diagram



SCADA ARCHITECTURE



OVERVIEW OF ROLLING STOCK IN METROs

Salient Features

1. Variable voltage variable frequency control
2. CAB signaling
3. Automatic train operation (ATO) system
4. Intelligent TCMS(Train control and Management system)
5. Light weight
6. Regenerative braking

----- Continued

8. Modern communication system
9. Front/side evacuation in case of emergency
10. Stainless steel body and modern look.
11. Passenger communication to driver in case of emergency
12. Direct communication with driver and passenger from control room is possible.

13.Fully Air-conditioned

14. IGBT Based converter/inverter including Auxiliary converter

15. Automatic Door Operation

16. Special Fire Protection using material confirming to international norms.

17. Automatic Train operation using ATP/ATO/DTO

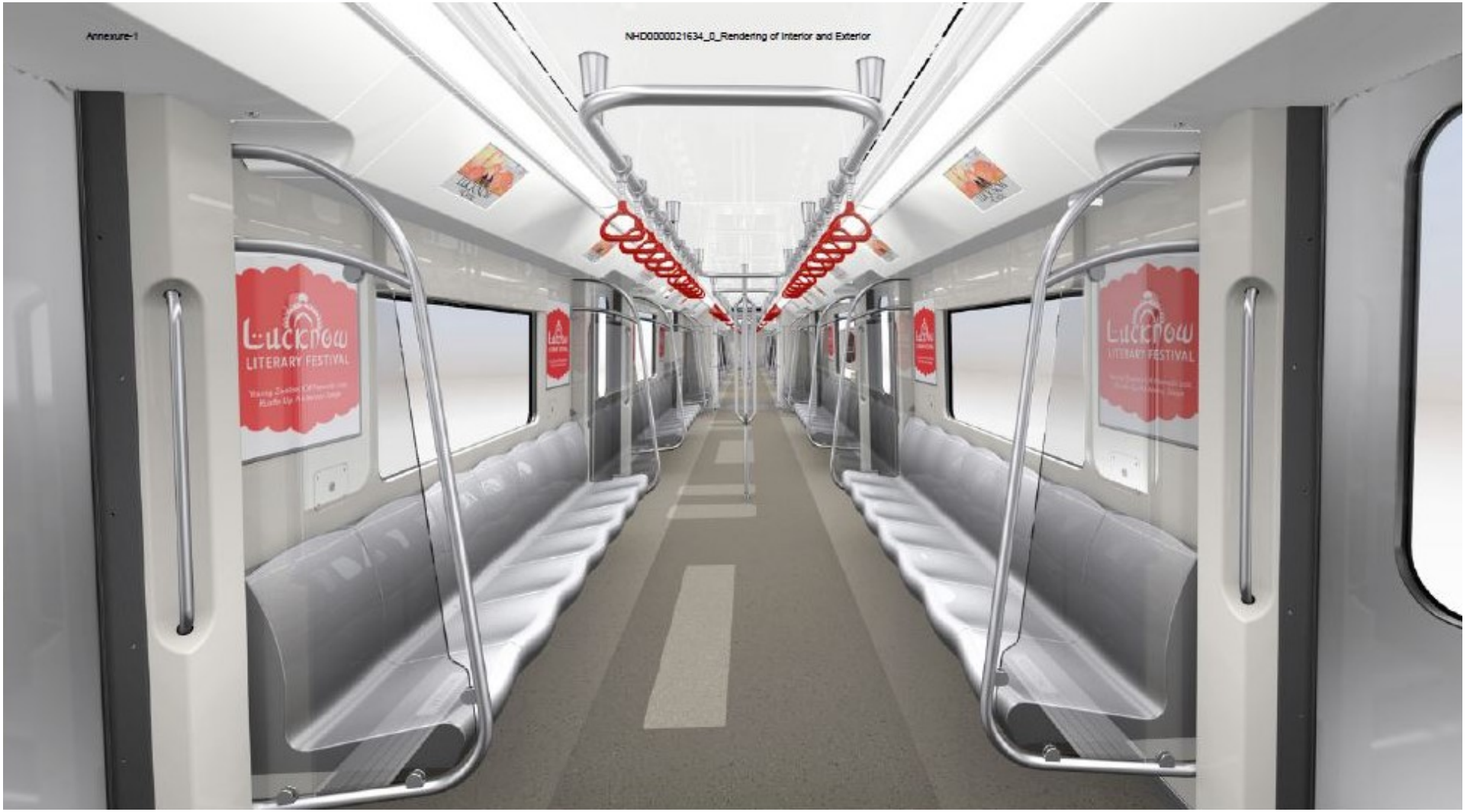
18. Wide intercar gangway

19. Noise level to international standard

Modern Rolling Stock

Annexure-I

NHD0000021634_0_Rendering of Interior and Exterior

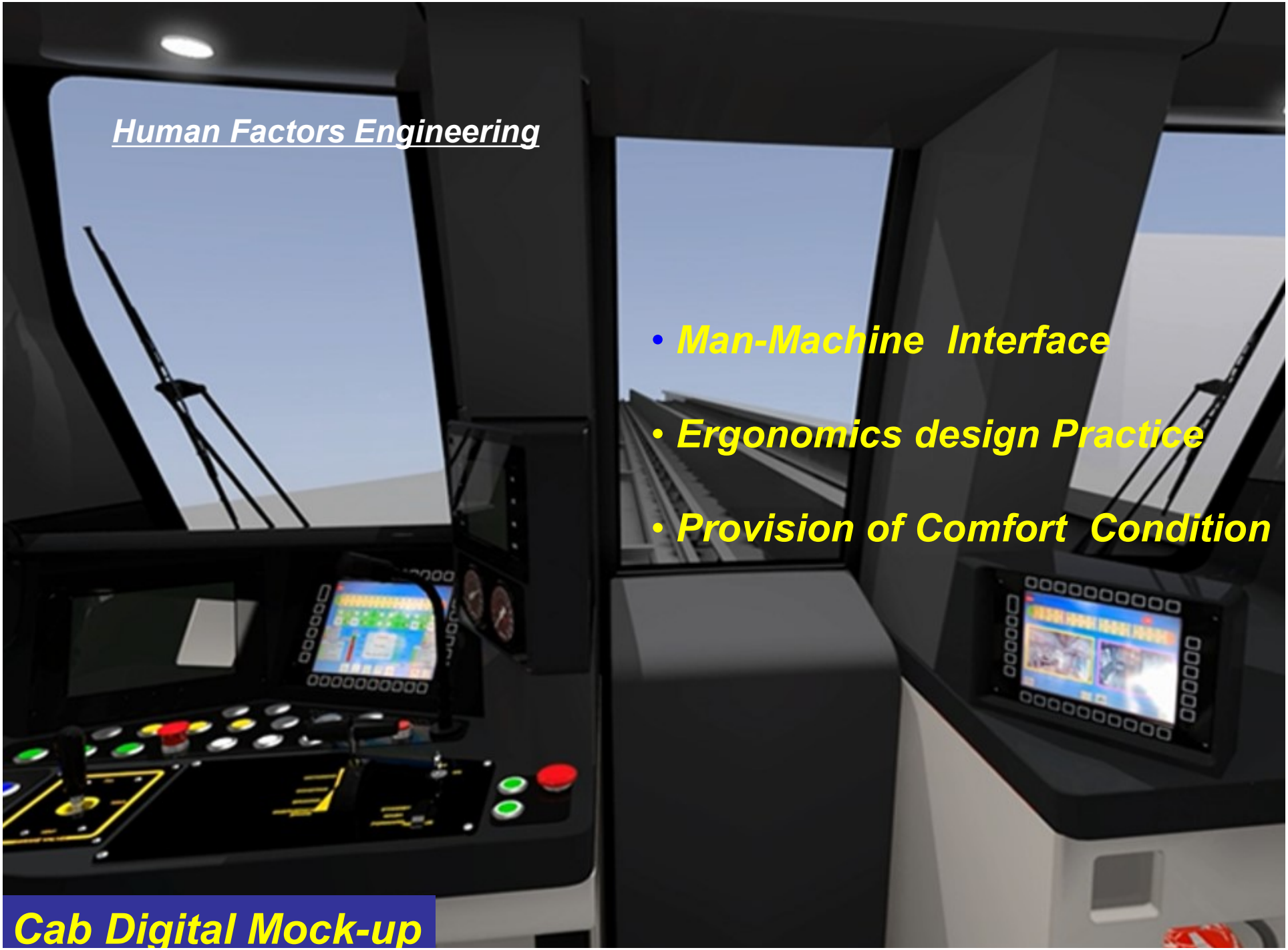


Vehicle Exterior View

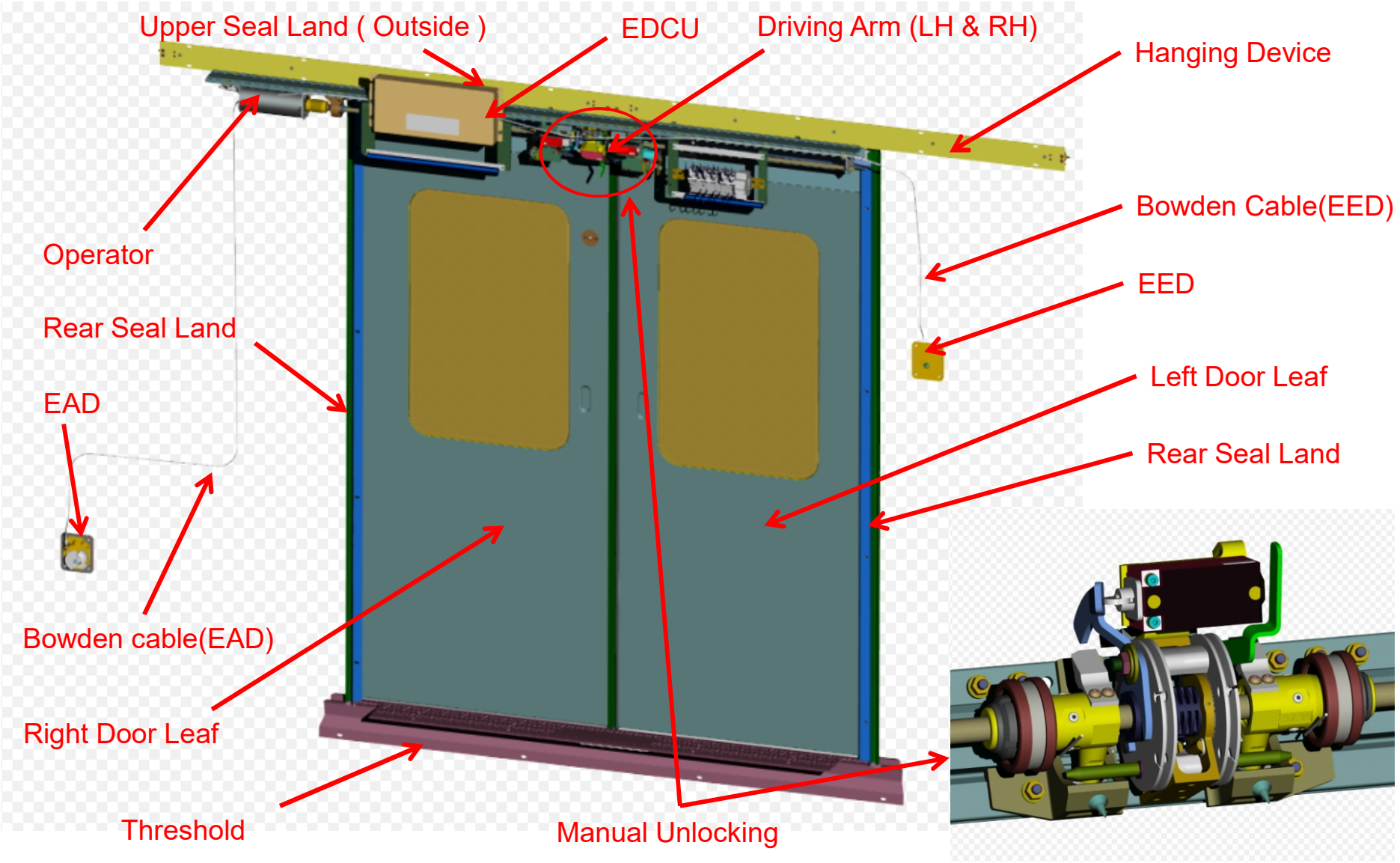
- ***Aero dynamic cab styling***
- ***Modernized car body contour***
- ***Exterior panels and wide windows***
- Austenitic ***stainless steel without paint***
- ***4 wide doors on each side***

- ***Accommodation of standee***
- ***Wide gangway between coaches***
- ***Provision of Comfort at all location***
- ***Permission of Easy Passage***

Wide-opening gangway

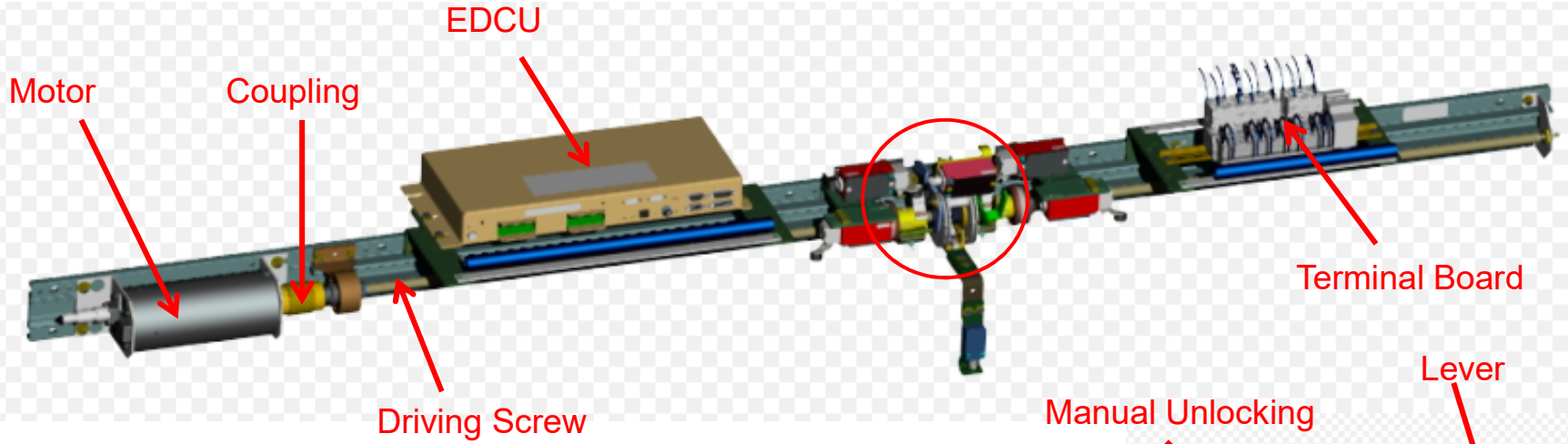

Human Factors Engineering
• Man-Machine Interface
• Ergonomics design Practice
• Provision of Comfort Condition
Cab Digital Mock-up

DooR Main Component



ALSTOM

Operator



Operator Composition:

→ Motor

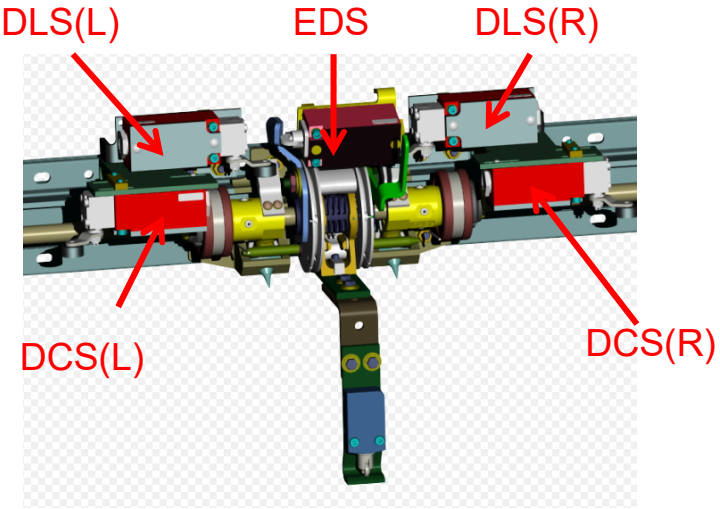
→ Coupling

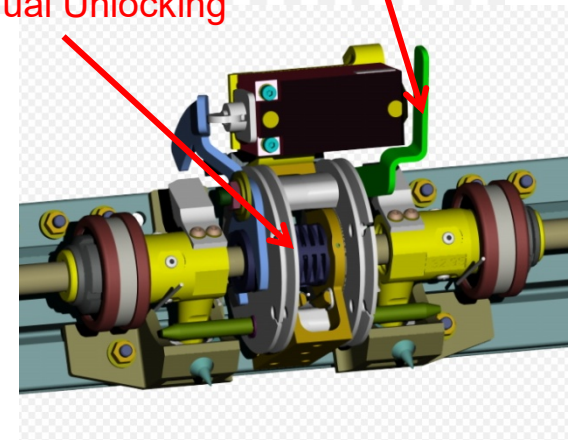
→ Driving screw

→ Locking device

→ Manual unlocking

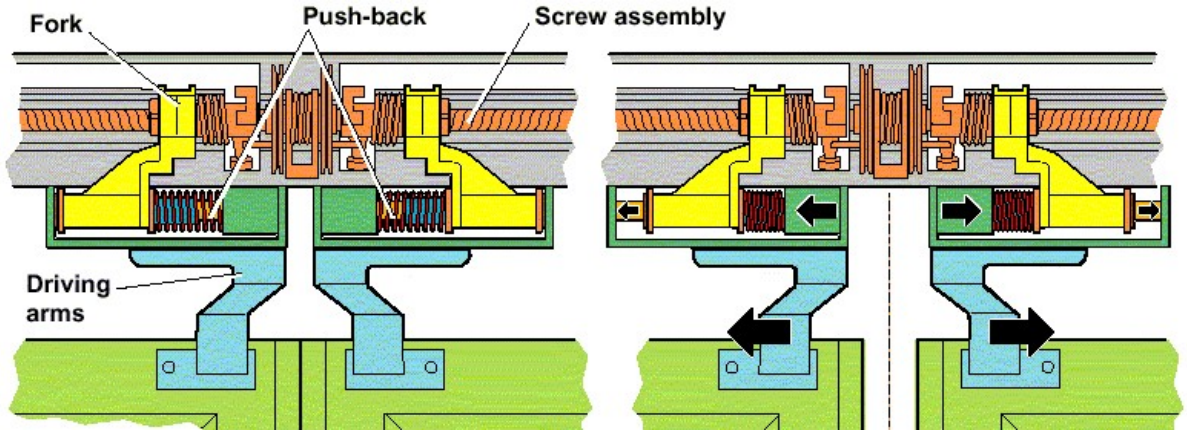
→ Switches





ALSTOM

Push Back Device



This push back allows to reopen each door leaf by 10mm~15 mm total gaping. The push-back is equally operational throughout the whole door opening and closing cycle.

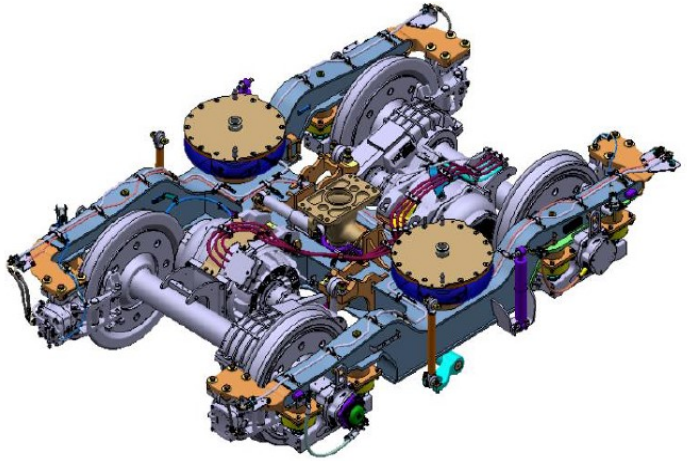
The locking device prevents the translation of the fork (driving nuts) fitted on the driving screw. The push-back device is incorporated in the linkage between the “driving nut” and driving arms, so that a “locked” door panel can still be pushed-back.

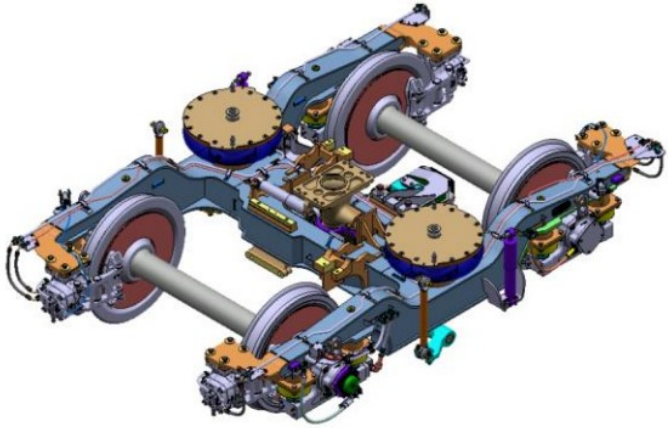
The push-back device includes two Door Closed Switches (DCS). One switch is activated if one door leaves is moved. The safety loop shall include the push-back switches and the Door Locked Switches.

When one switch is activated, the EDCU is informed and send a message through the network.

GENERAL DESCRIPTION – BOGIE CHARECTERISTICS

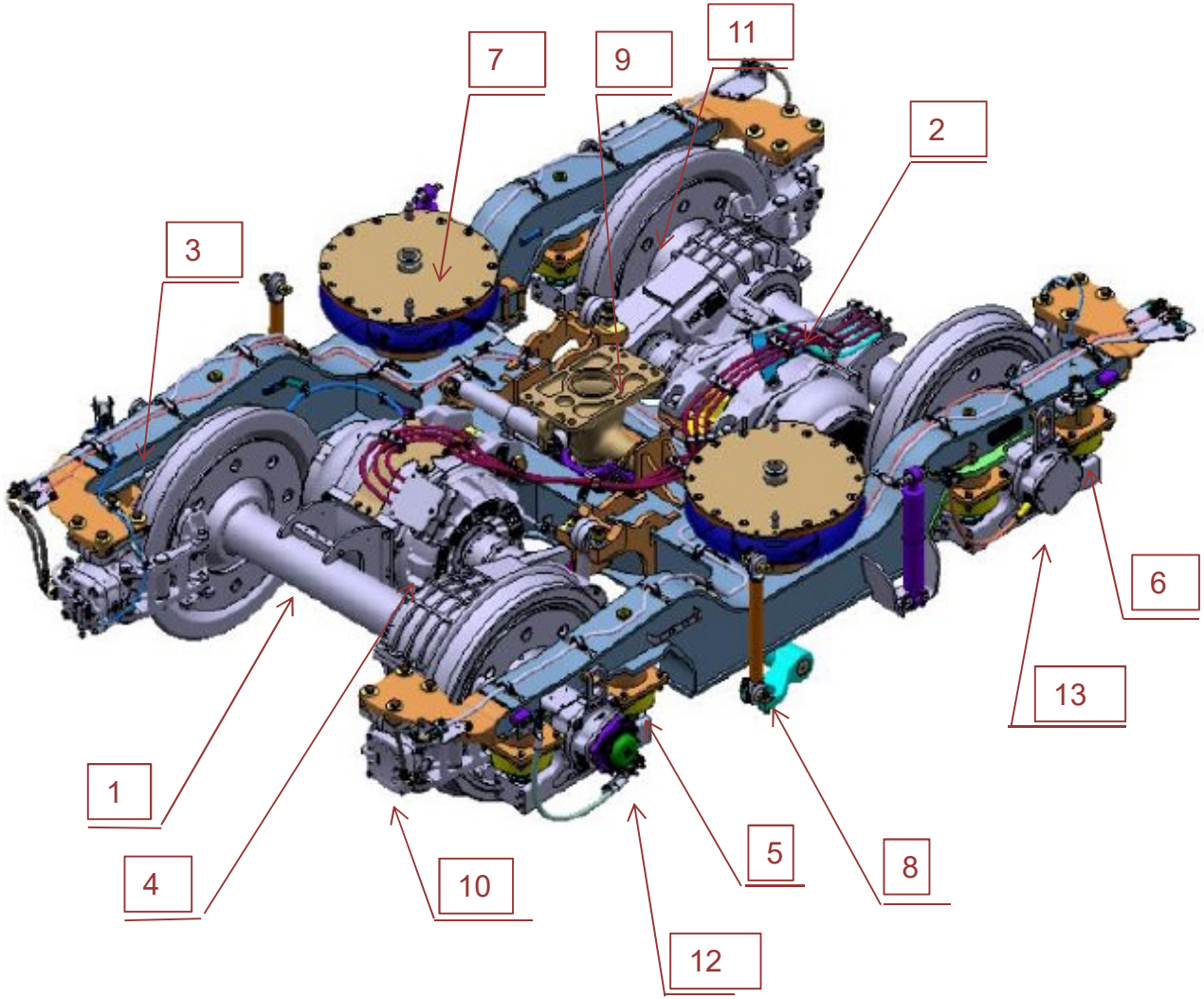
- Maximum service speed : 80km/h
- Maximum design speed : 90 km/h
- Axle load : 16 t
- Bogie wheelbase: 2300 mm
- Gear Box: ratio 6.19
- Wheel diameter : 860 mm / 780 mm
- 4 Wheel Disc brake per bogie (No brakes units on extreme axle)
- Minimum curve capability:
  - 120 m in depot with maximum speed of 30 kmph
  - 140 m in mainline with maximum speed of 40 kmph
- Vehicle Dynamic Analysis of Bogie is carried out by multi-body simulation techniques.The bogie stability is verified according to UIC 518 and EN14363





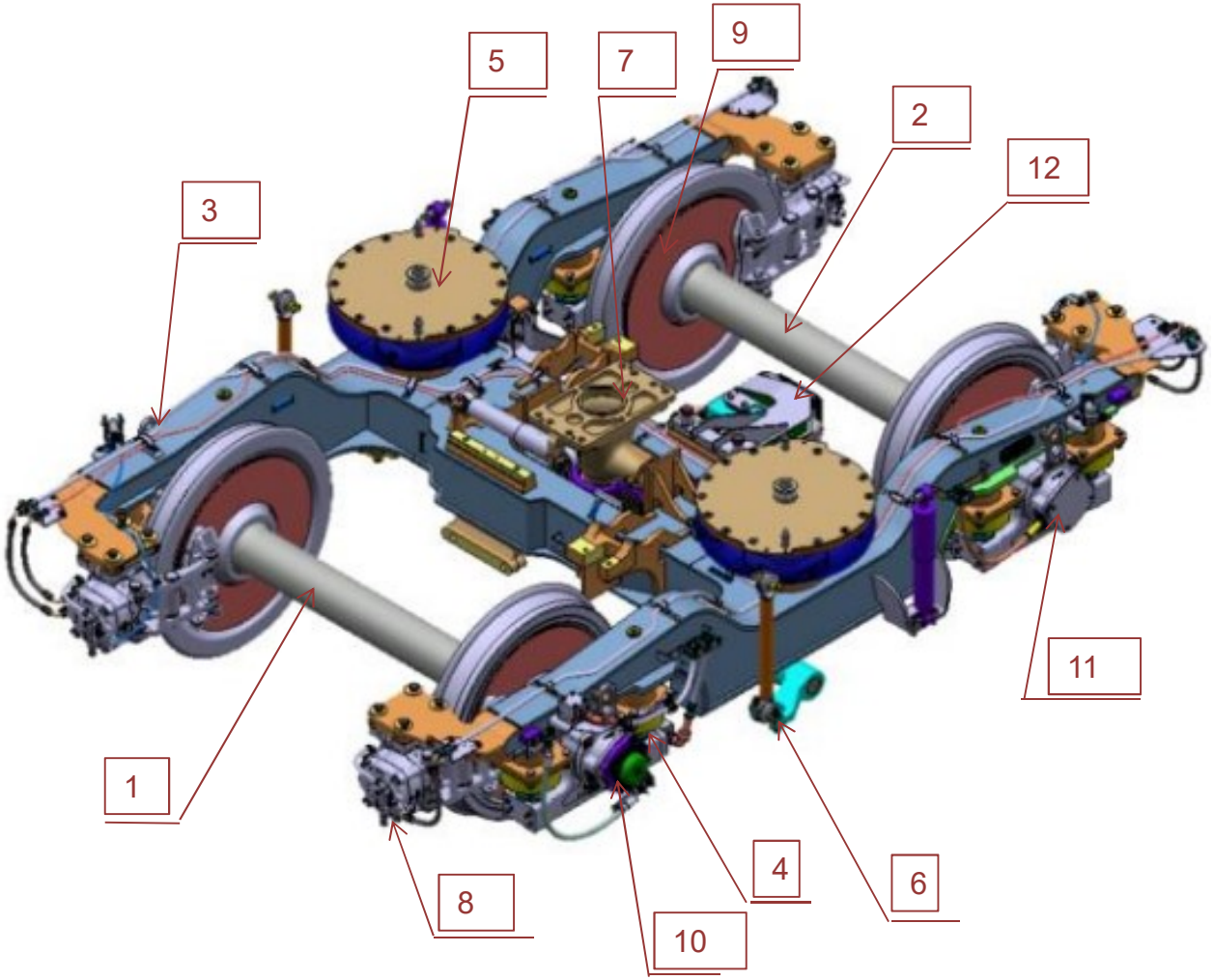
Pictures are for reference only

BOGIE SUB-ASSEMBLIES – MOTOR BOGIE



Item No	Description
1	Motor Wheel Set Assembly with Axle Box (Front)
2	Motor Wheel Set Assembly with Axle Box (Rear)
3	Frame Assembly
4	Transmission Assembly
5	Primary Suspension Assembly (Gear Box Side)
6	Primary Suspension Assembly (Motor Side)
7	Secondary Suspension Assembly
8	Anti-Roll Bar Assembly
9	Bogie to Car body Connection
10	Brake Caliper Assembly
11	Brake Disc Assembly
12	Current Return Assembly
13	Speed Sensor Assembly (WSP)

BOGIE SUB-ASSEMBLIES – TRAILER BOGIE



Item No	Description
1	Trailer Wheel Set Assembly with Axle Box (Front)
2	Trailer Wheel Set Assembly with Axle Box (Rear)
3	Frame Assembly
4	Primary Suspension Assembly
5	Secondary Suspension Assembly
6	Anti-Roll Bar Assembly
7	Bogie to Car body Connection
8	Brake Caliper Assembly
9	Brake Disc Assembly
10	Current Return Assembly
11	Speed Sensor Assembly (WSP)
12	STF-DL Antenna

BOGIE SUB-ASSEMBLY OVERVIEW – SECONDARY SUSPENSION

Anti- Roll bar system

- Anti-roll system consists of a steel torsion bar with rotational freedom in two bearings bolted on the bogie transom. A forged steel lever is fitted on each end of the bar.
- The end of each lever is linked to the carbody by a rod whose ends are equipped with self-lubricating bearings, which allow the lateral and angular displacements between the carbody and the bogie frame.
- The anti-roll bar limits the tilting of the carbody in cant unbalance situations according to the roll coefficient requirements.
- Rubber bearings maintaining anti-roll-bar will reduce noise and vibrations transmitted to carbody.

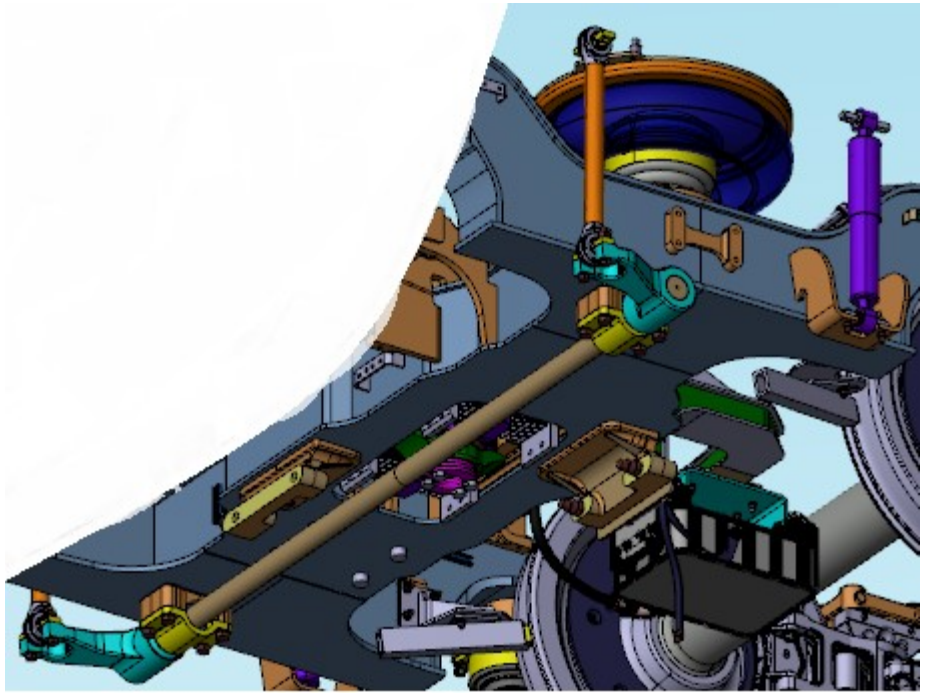


Fig.: Anti Roll Bar

Pictures are for reference only

Brakes

- Electro-pneumatic (EP) service friction brake
- Electric regenerative service brake
- Continuous blending of EP & regenerative braking
- Emergency friction brake
- High integrity fast response closed loop digital microprocessor based brake control system
- Load weighing signal to control brake effort.
- Spring applied air release parking brake on 50% axles - no chances of rolling even on grade in the event of failure of air supply
- Digital wheel slide protection with gradual slide correction

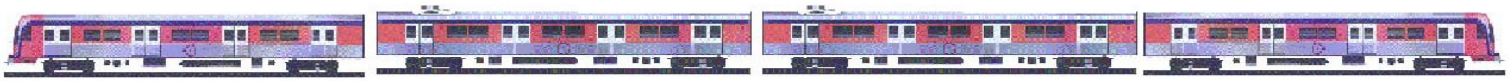
BRAKE SYSTEM

- **Microprocessor controlled brake system**
- **Service brake with blending of EP and electric brake over entire speed range**

ADVANTAGES OF REGENERATIVE BRAKING

- **25% to 35% traction energy regenerated**
- **Less consumption of brake blocks**
- **Increased wheel life**
- **Reduced maintenance**
- **Heat dissipation reduced in tunnel**
- **Less energy consumption for VAC system**

Types of train configurations



DM - T - T - DM

4 car train

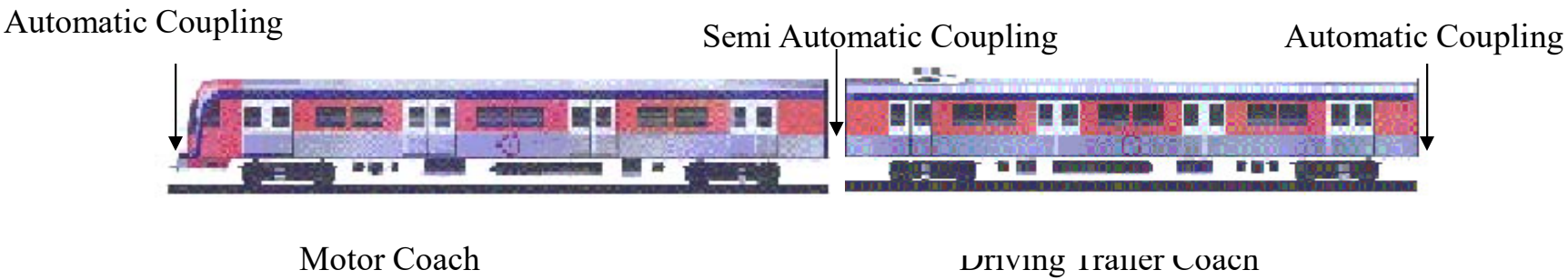
DM - T - T - M - T - DM

6 car train

50% Motoring

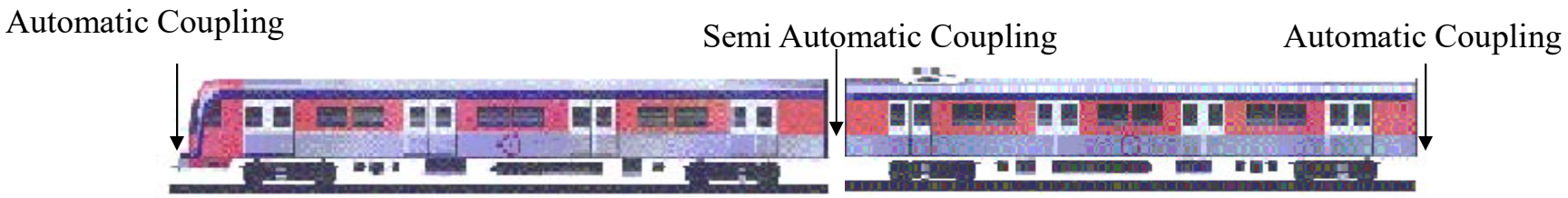
* In case of 66% motoring, 2 motor coaches and one trailor coach for a 3 unit train

Typical dimension of Car



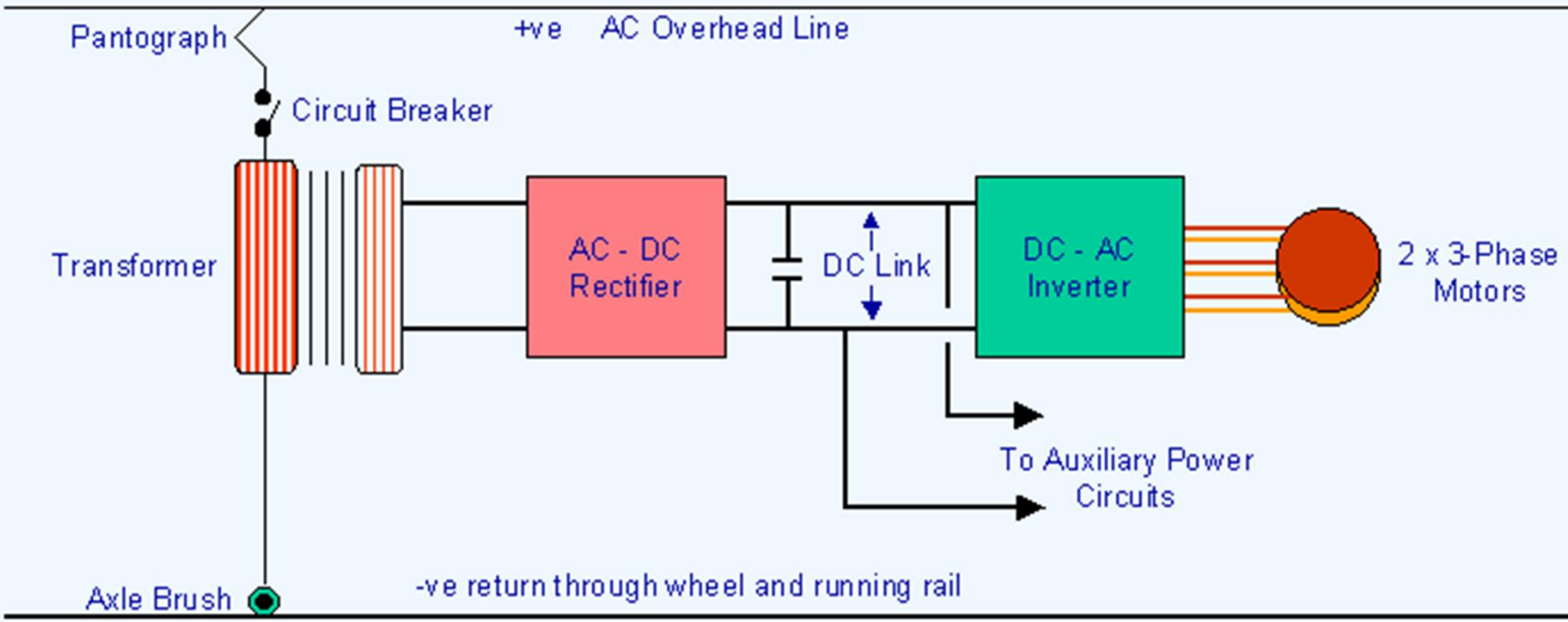
Notional length over body	22550 mm
Maximum Width over body	2900 mm
Approximate bogie wheel base	2300 mm
Wheel diameter new/fully worn	860/780 mm
Minimum passenger saloon headroom	2050 mm
Passanger Capacity DMC/TC (AW3)	342/317
Weight of DMC	41 tonnes
Weight of TC	42 tonnes

Basic parameters of Car



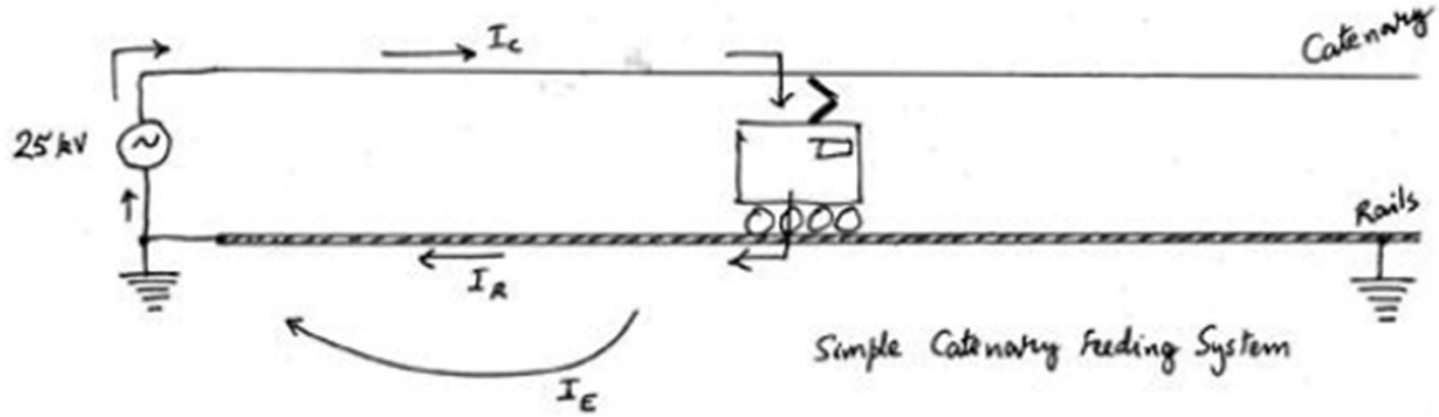
Maximum design speed	90 km/h
Maximum operational speed	80 km/h
Round trip schedule speed	32/35 km/h
Acceleration	0.82/0.78 m/s/s $\pm$ 5%
Service braking rate	1.0 m/s/s $\pm$ 5%
Emergency braking rate	1.3 m/s/s
Jerk rate	0.70 m/s/s/s $\pm$ 5%

Traction Power Circuit Layout:

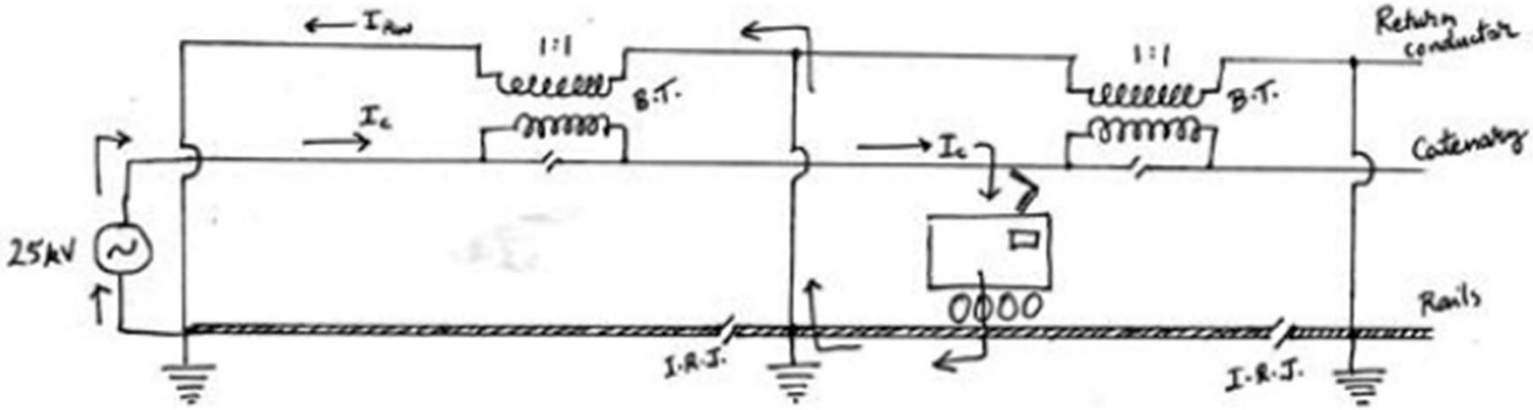


Schematic of single phase AC supply powering 3-phase AC motors

Traction Power Circuit – return current :



Simple Catenary Feeding System



Booster Transformer Feeding System
with Return Conductor and Insulated Rail Joints

Electrical systems- 25 kV ac

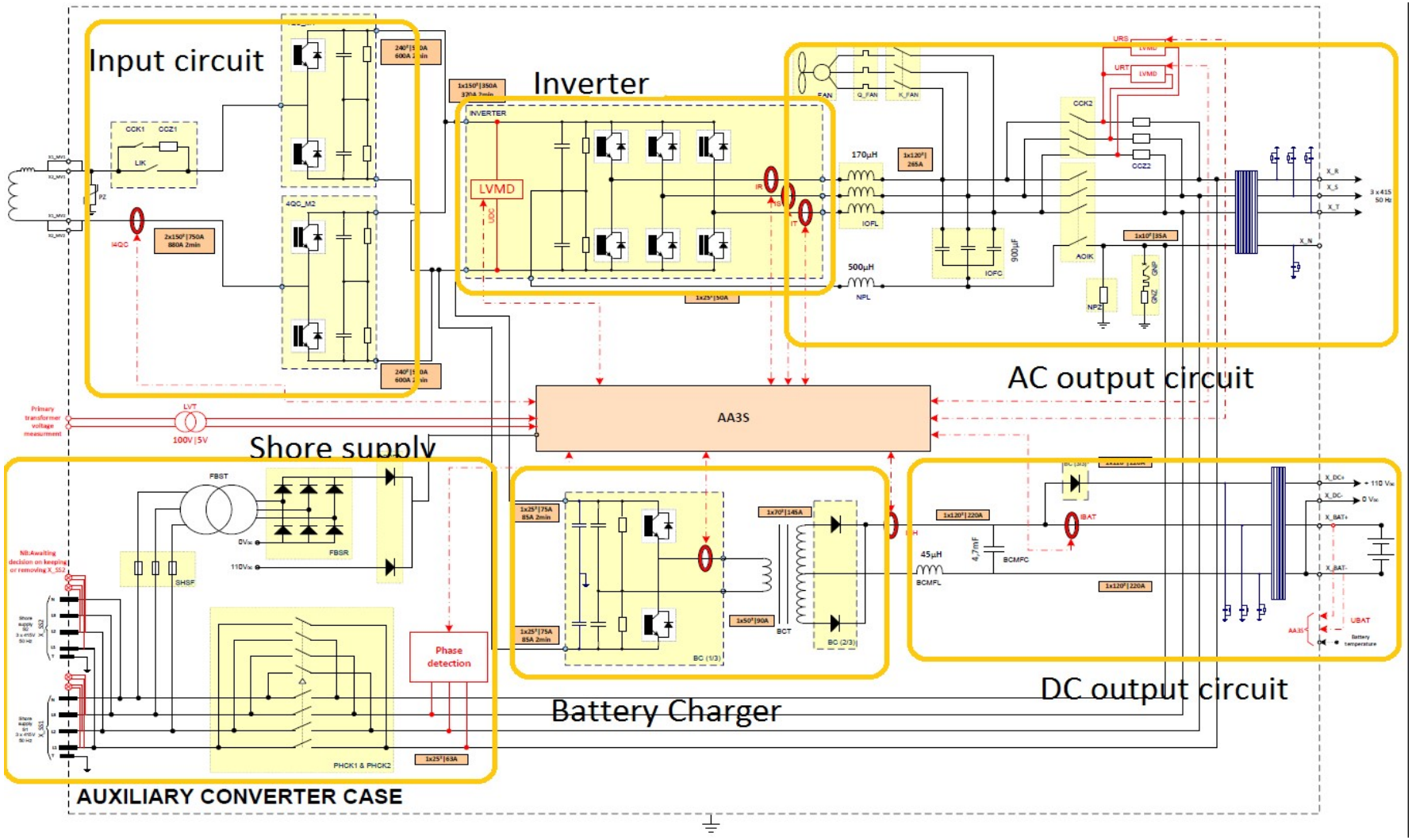
- **One converter-inverter per bogie in each motor car.**
- **Power converter- inverter shall be four quadrant IGBT based with pulse width modulation control.**
- **Power converter- inverter shall be Natural/ forced air cooled.**
- **3 phase asynchronous Traction motor drive with VVVF control**
- **Mounting of Traction motor on the bogie frame via flexible coupling and gear unit**
- **Microprocessor based control to cover control, protection, fault diagnostic display and data acquisition requirements.**
- **Fault data reading system shall be connected to the TCMS via the Car Data Bus and Inter Car Data Bus**
- **Display of Fault data on VDU in the "live" driving console**
- **Back-up batteries to supply emergency loads for 60 minutes**

Auxiliary Converter: Main output data

Ouput characteristics:

- 415V 3ph – 50Hz
  - Permanent Nominal power (1SIV) :185kVA, pf 0.85
  - Transient power (1 SIV) :295kVA during 5s, pf 0.67
  - Output voltage regulation tolerance :± 5 %
  - Frequency tolerance :± 2 %
  - Unbalance voltage :≤ 1 %, (max unbalance load, 8kVA, pf 0,85)
- 230V 1ph – 50Hz
  - Permanent nominal power rating :8kVA, pf 0.85
  - Output voltage tolerance :- 5 % / +10%
  - Frequency tolerance :± 2 %
- 110Vdc
  - Continuous output power rating : 25kW @ 123,5V (20°C)
  - Ripple voltage :1% Unom Vrms
  - Temperature correction :Yes

Auxiliary Converter- Power circuit



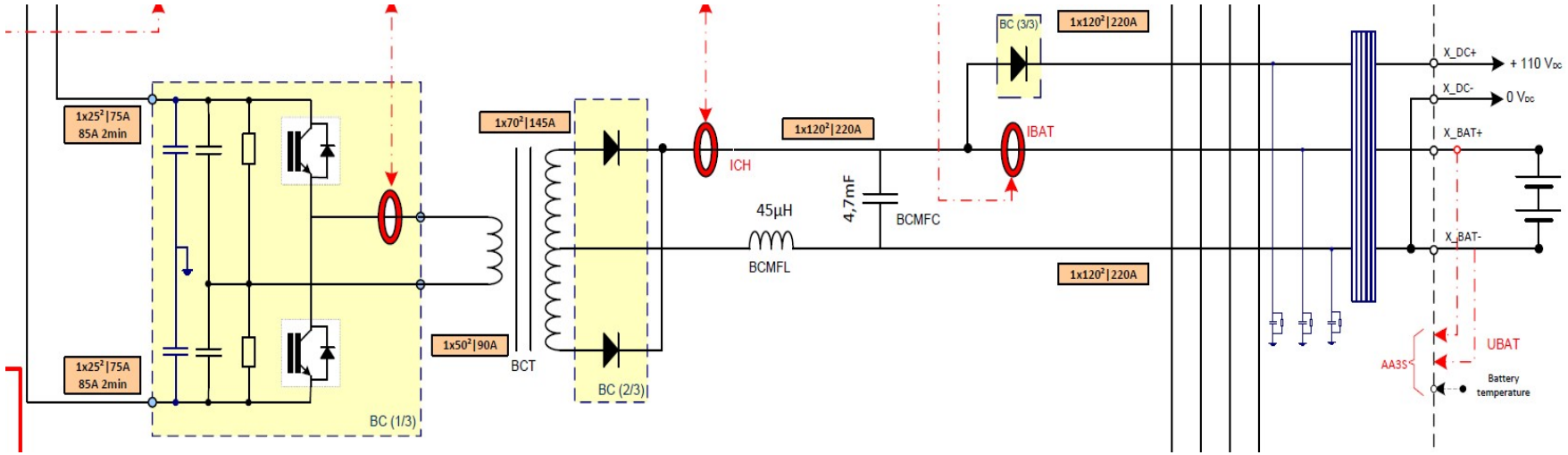
Auxiliary Converter: Battery charger & DC output circuit

Battery Charger :

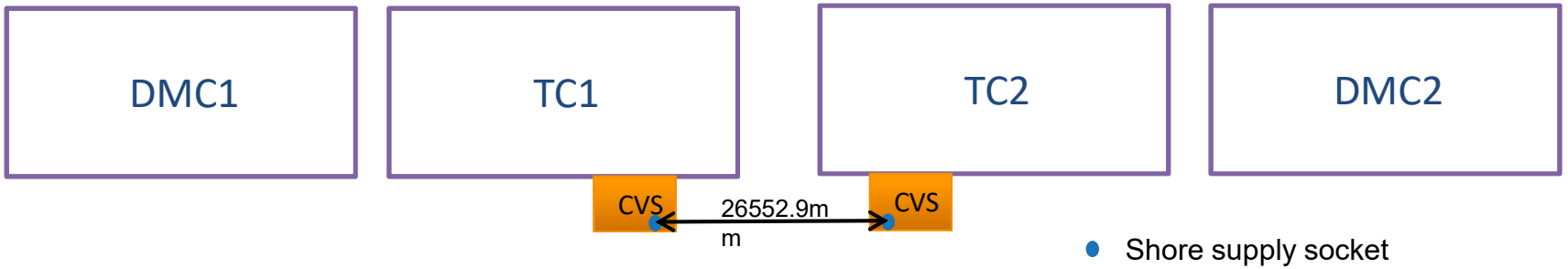
The battery charger consists of :

- a single phase half bridge that supply the primary of a medium frequency transformer.
- transformer makes the galvanic isolation between the battery voltage and the primary voltage.
- a diode rectifier and an output filter in order to provide a DC voltage to feed batteries and 110 V loads.
- an output diode for connection of batteries in parallel

.



Auxiliary Converter: Shore supply

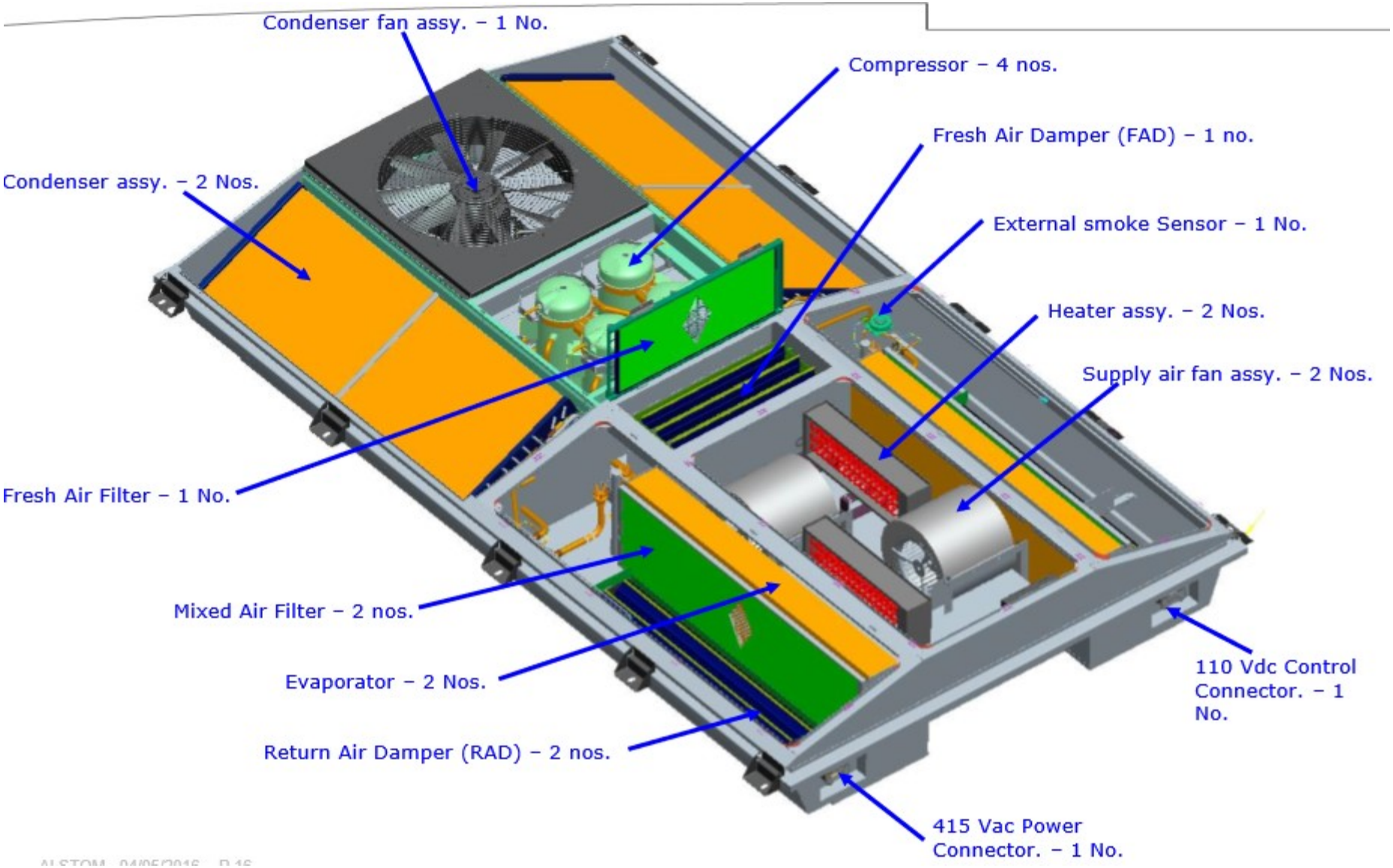


Distance between two sockets of same CVS: 2034mm

Air conditioning & Ventilation

- Two roof mounted AC units provided on all cars of RC/ MC to meet the provisions of Fixed Guideway Vehicles in accordance with ASHRAE
- Automatic control of temperature and Relative humidity - 25 degree Centigrade and 65% RH
- Provision of emergency ventilation from battery supply to maintain required oxygen level in the event of failure of AC units, traction power or auxiliary converter.
- Driving cab equipped with independent AC unit

Lucknow Air Conditioning System



Automatic train operation

- ATP
  - ATP dictated parameters
  - operation by driver
  - Automatic application of brakes in case driver violates command issued by ATP.
- ATO
  - automatic starting/stopping and operation of train
  - automatic opening/closing of doors etc.
- UTO/DTO- All the functions are automatic. The starting, stopping, running are all automatic without mannual intervention.

TCMS

Train Control Management System

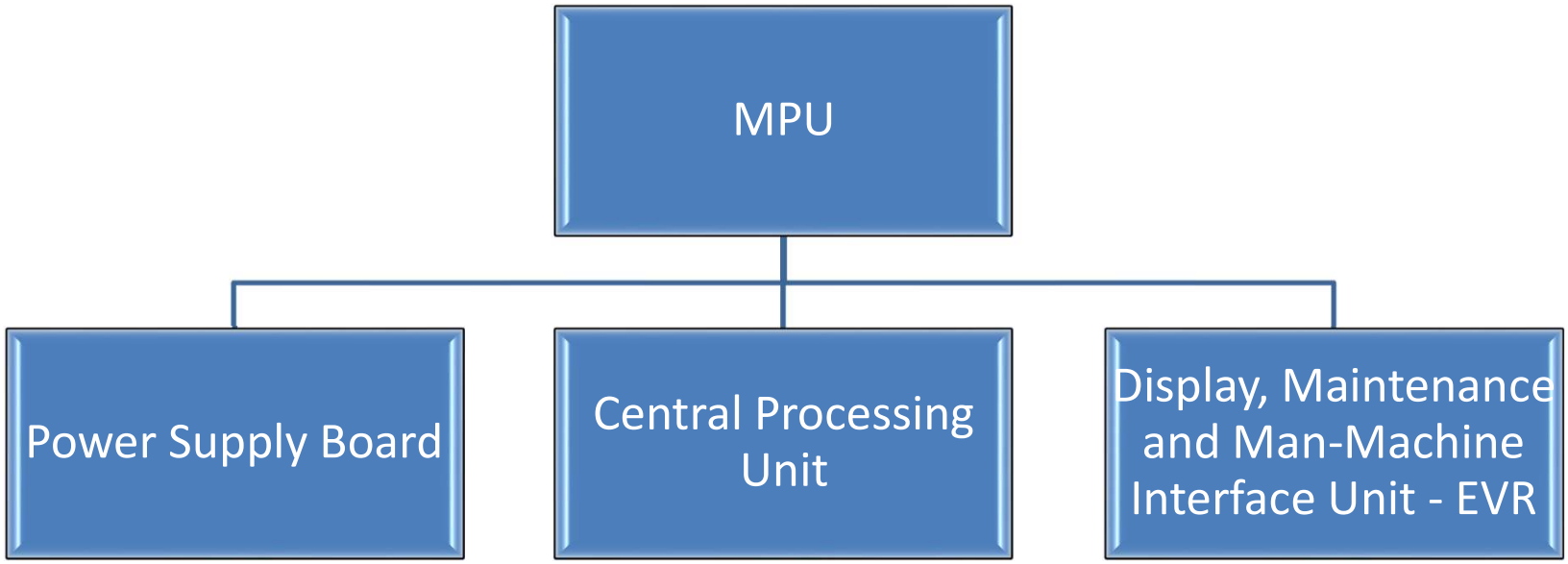
Requirement of TCMS

- Centralised monitoring
- Interface with signalling system
- Monitor different functions of train
- Communicate with different systems
- Control the systems as per user requirement

Components

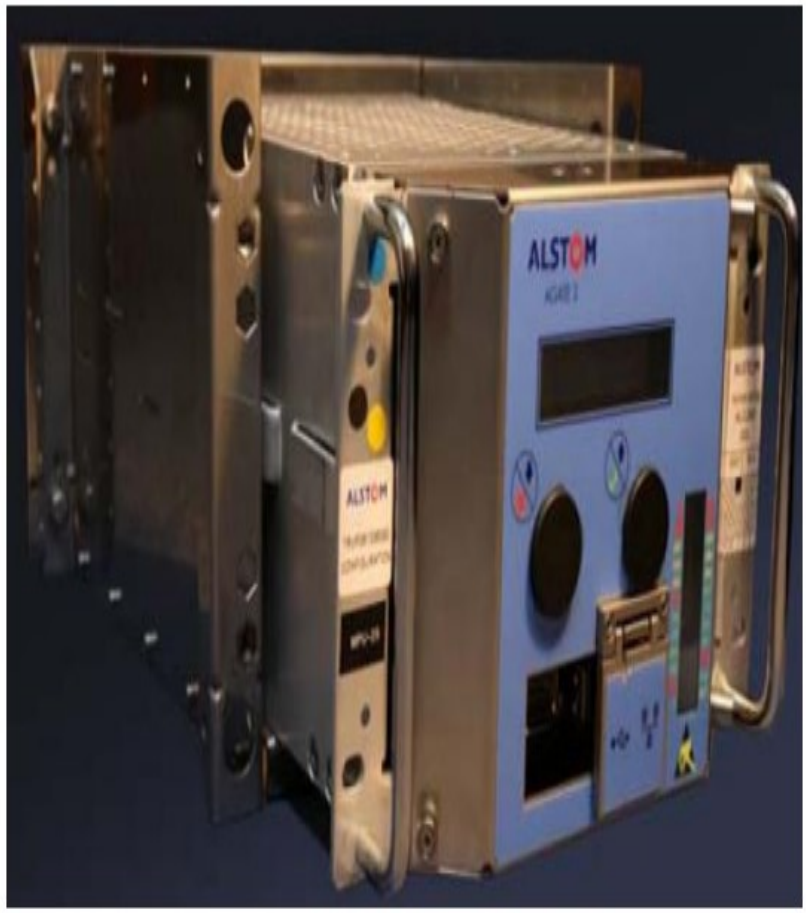
- TCMS consists following components:
  - Main Processing Unit (MPU)
  - Driver Display Unit (DDU)
  - Basic Remote Input Output Unit (BRIOM)

Main Processing Unit (MPU)



Main Processing Unit (MPU)

- Power Supply: 110V DC
- Central processing unit
  - Intel Atom 1.3 GHz
    1. 1GB Flash
    2. 512MB RAM
    3. Operating System - Linux
- In operation mode, the MMI is managed by one board. It is composed of 24 LEDs, which shows the state of power supplies and other functions of the MPU. It also includes a VFD display (2 lines of 20 characters) and two push buttons for menus interface.



Main Processing Unit (MPU)

- Two MPU in both Cab's
- One is Master and another Slave
- In normal operation each MPU executes its application software, which is identical on both MPU, only the Master MPU activate the Output.
- Both MPU exchanges mutual control data through network.
- In case of failure of the Master MPU, Slave MPU becomes new Master.

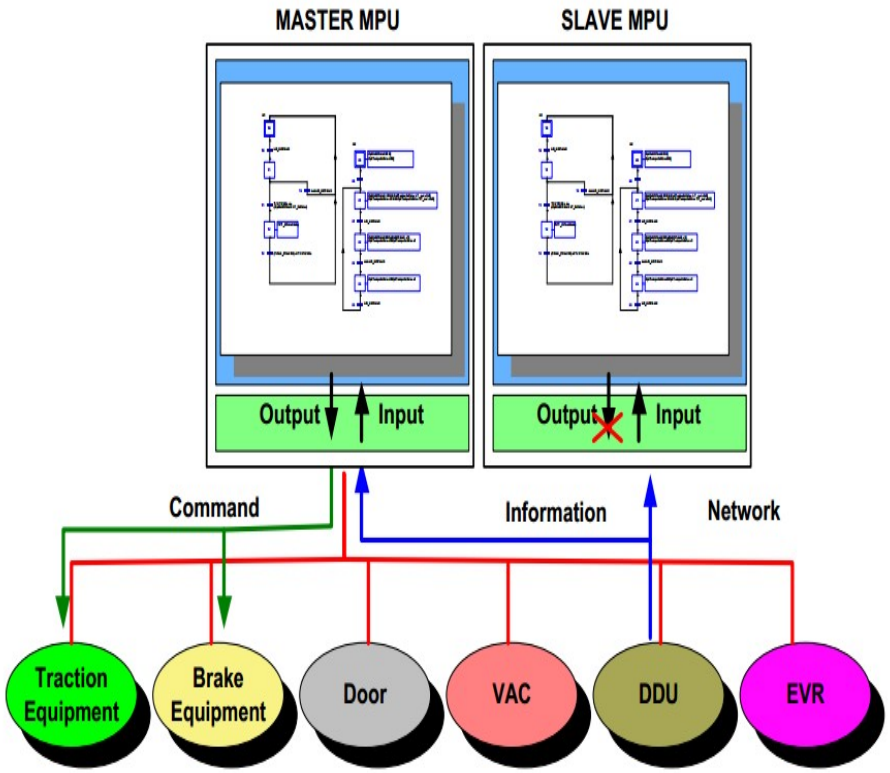


Figure 2 – MPU Redundancy Management

Driver Display Unit (DDU)

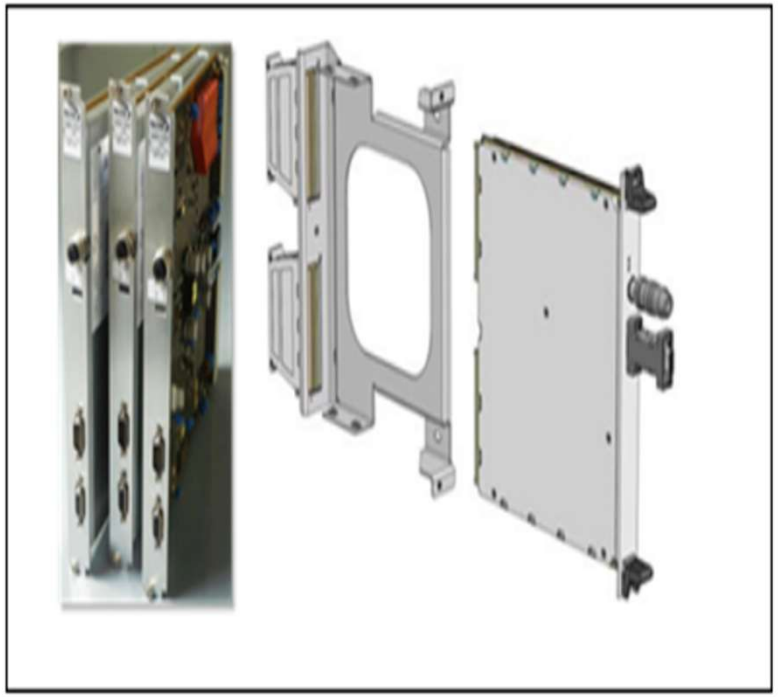
- The DDU provides the interface between operators and the TCMS through the vehicle network.
- DDU used is a compact one with its CPU and display unit are in a single unit.
- CPU Characteristics
  - Processor Type : ARM CORTEX A9 FRS iMX6 Dual Core 800MHz
  - Cache Memory : 1MB
  - Memory bus : 64 bits
  - RAM capacity : 1GB
  - Flash Disk : 4GB

Driver Display Unit (DDU)

- Display characteristics
  - Size : 10.4"
  - Resolution : VGA (640x480)
  - Touchscreen : Capacitive
  - Screen type : LED
  - Peripheral keys : 32
  - Sensors : Ambient noise and brightness
  - Colour : 24 bits
  - Brightness : >1000 Cd/m2 (with touchscreen)
  - Viewing Angle : ± 70° horizontal / ± 60° vertical

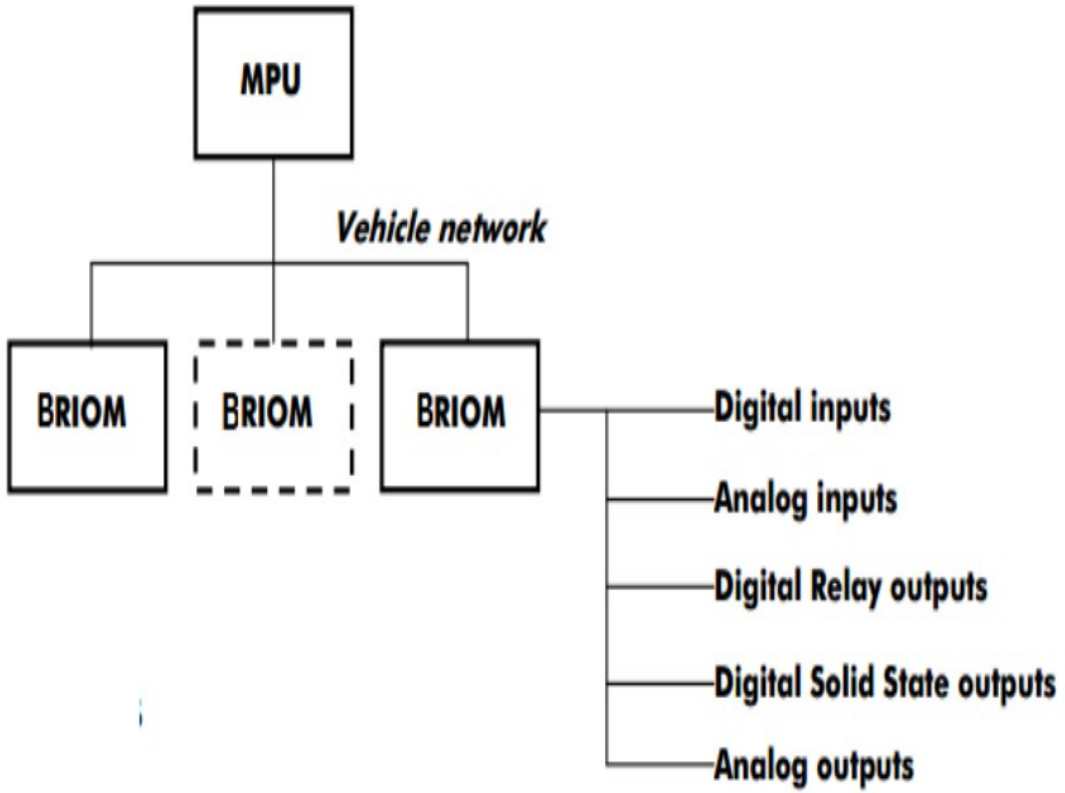
Basic Remote Input Output Module (BRIOM)

- All digital inputs/outputs to and from train sub-systems (Traction, brake, Doors, Air Conditioning, Air compressor, Auxiliaries etc.) are connected to the Basic Remote Input Output Module (BRIOM).



Basic Remote Input Output Module (BRIOM)

- Function of BRIOM
  - To acquire and test the digital and analogue input
  - To set and test digital or analogue outputs



Basic Remote Input Output Module (BRIOM)

- Two types of BRIOM configurations have been used, which are described below
  - BRIOM1 with 40 digital inputs, 10 digital outputs
  - BRIOM2 with 40 digital inputs, 10 digital outputs, 4 Analogue inputs and 1 Analogue outputs
- Each BRIOM is based on 2 types of boards:
  - One Processing & communication board.
  - One board of Power supply, digital inputs, relay outputs, analogue inputs & analogue outputs.

EQUIPMENT LOCATION OF THE TCMS DEVICES

TCMS Device Description		DMC	TC	TC	DMC
MPU	Main Processing Unit	1	0	0	1
DDU	Driver Display Unit	2	0	0	2
BRIOM	BRIOM1 - 40DI/10DO on 72V/110V	1	1	1	1
	BRIOM2 - 40DI/10DO/4AI/1AO on 72V/110V	3	2	2	3
CRS	Consist Ring Ethernet Switch	11	8	8	11
Dataplug	For MPU	1	0	0	1
	For CRS	11	8	8	11

Data Exchange

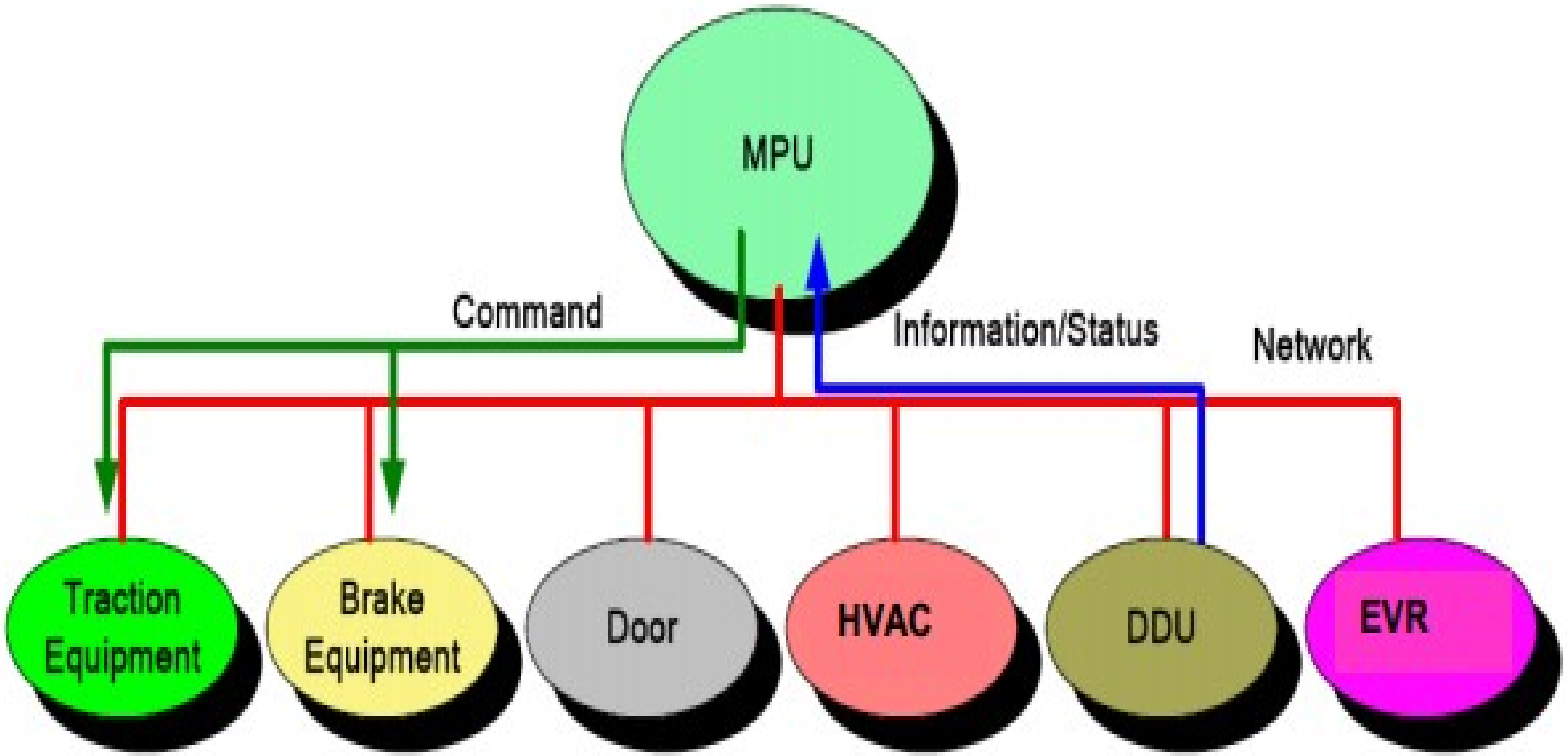
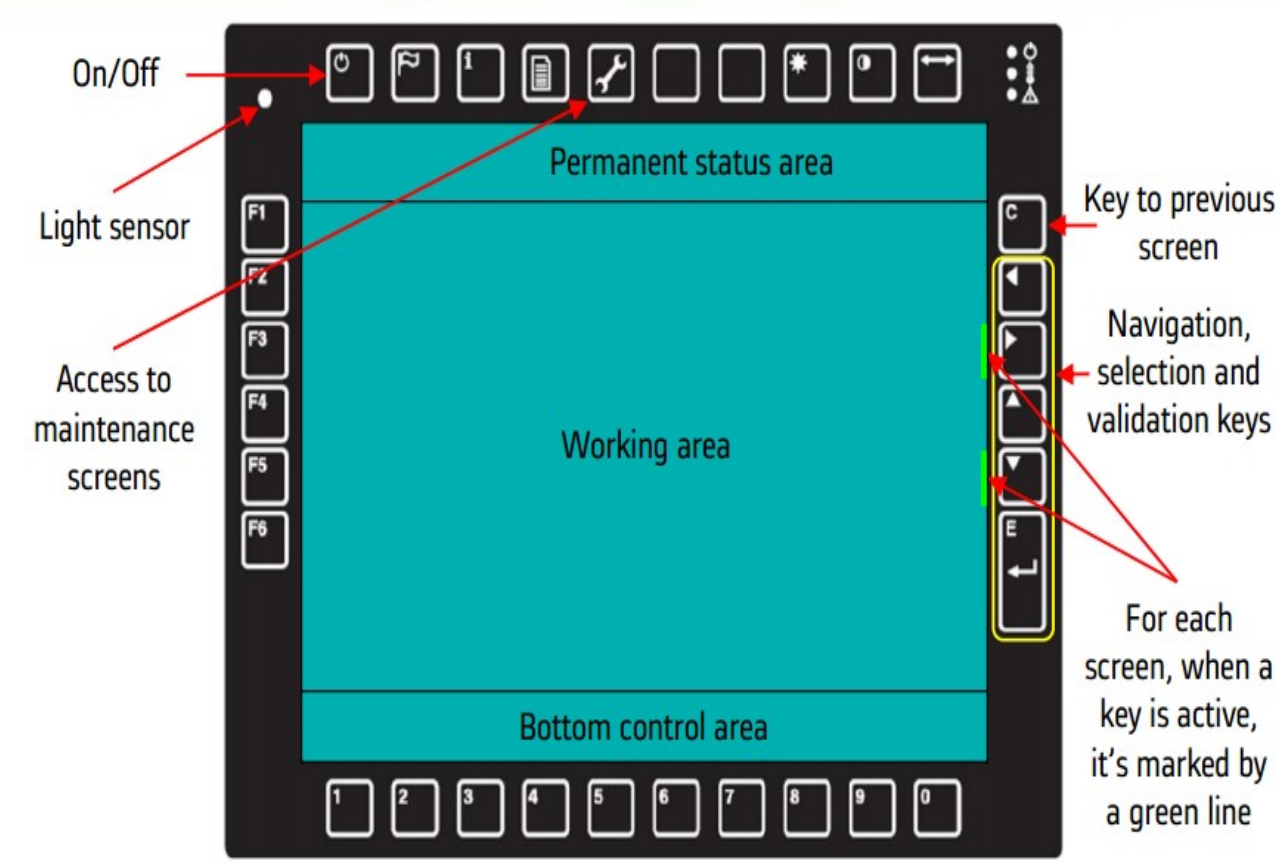


Figure 2 – Data Exchange with MPU

Main Console

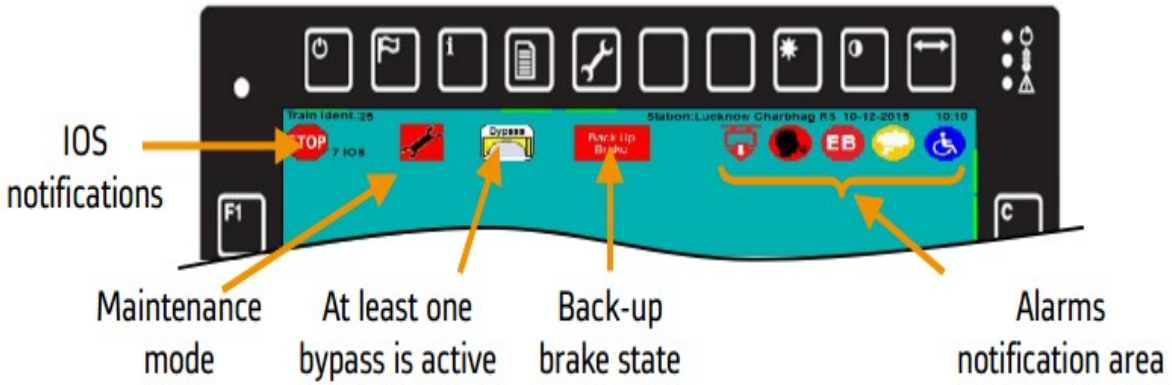
- General Information
- Driving Screens
  - Main Driving Screen
  - IOS and alarm screen
- Maintenance Screen
  - Maintenance screens with real time information
  - Maintenance screens with recorded information

Main Console - General Information



Permanent Status Area

Permanent status area at the top of the screen is the same for all screens. It allows to alert driver that an alarm or an IOS appears.



An acknowledgement system is associated with IOS and some alarms (Passenger Emergency Intercom, Emergency Egress Device, Mechanical crew switch, Emergency Brake and smoke detection).

When a new IOS appears, related icons blink and a sound is emitted by console until driver acknowledges IOS. When IOS is acknowledged, related icons stop to blink and console stops emitting sound.

Permanent Status Area

IOS details

High level: rescue or detrain


Medium level: end of line


Low level: end of day

Alarms details


Passenger Emergency Intercom


Emergency Egress Device

Emergency Brake


Smoke detection


Wheelchair access request

Mechanical crew switch

Other information


Maintenance mode

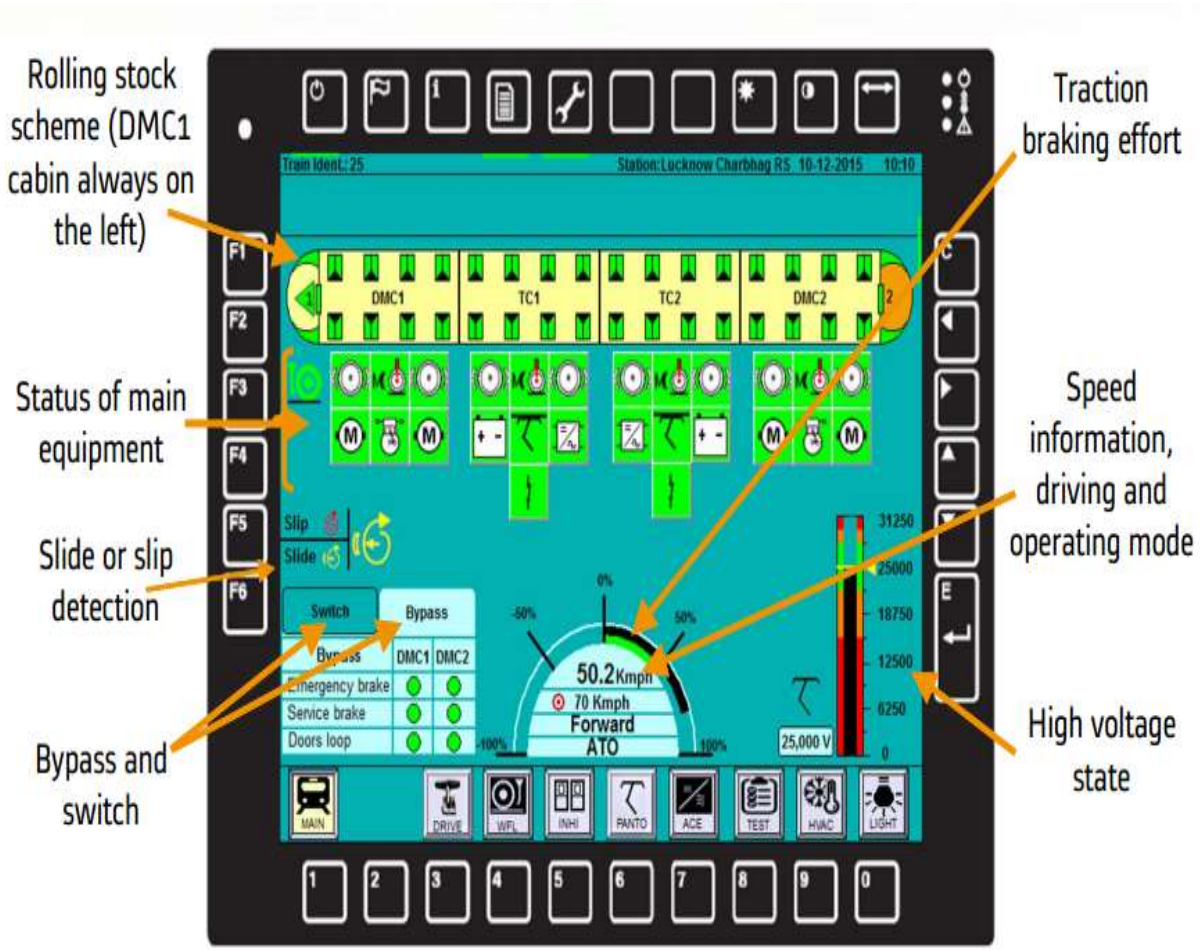

Maintenance mode with
Train Tracer forcing allowed

At least on bypass activated

Back-up brake activated

Back-up brake isolated

Main Driving Screen

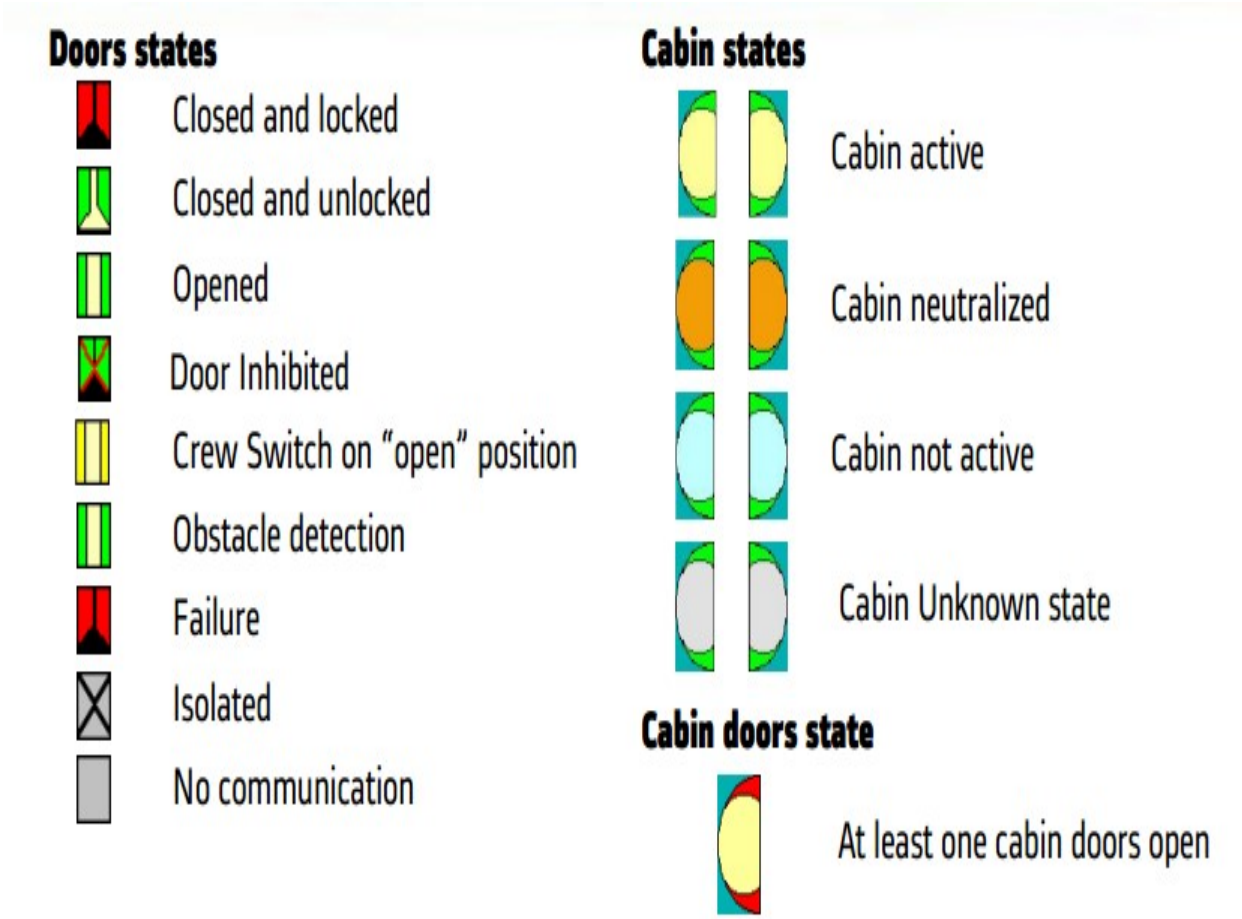


Main Driving Screen

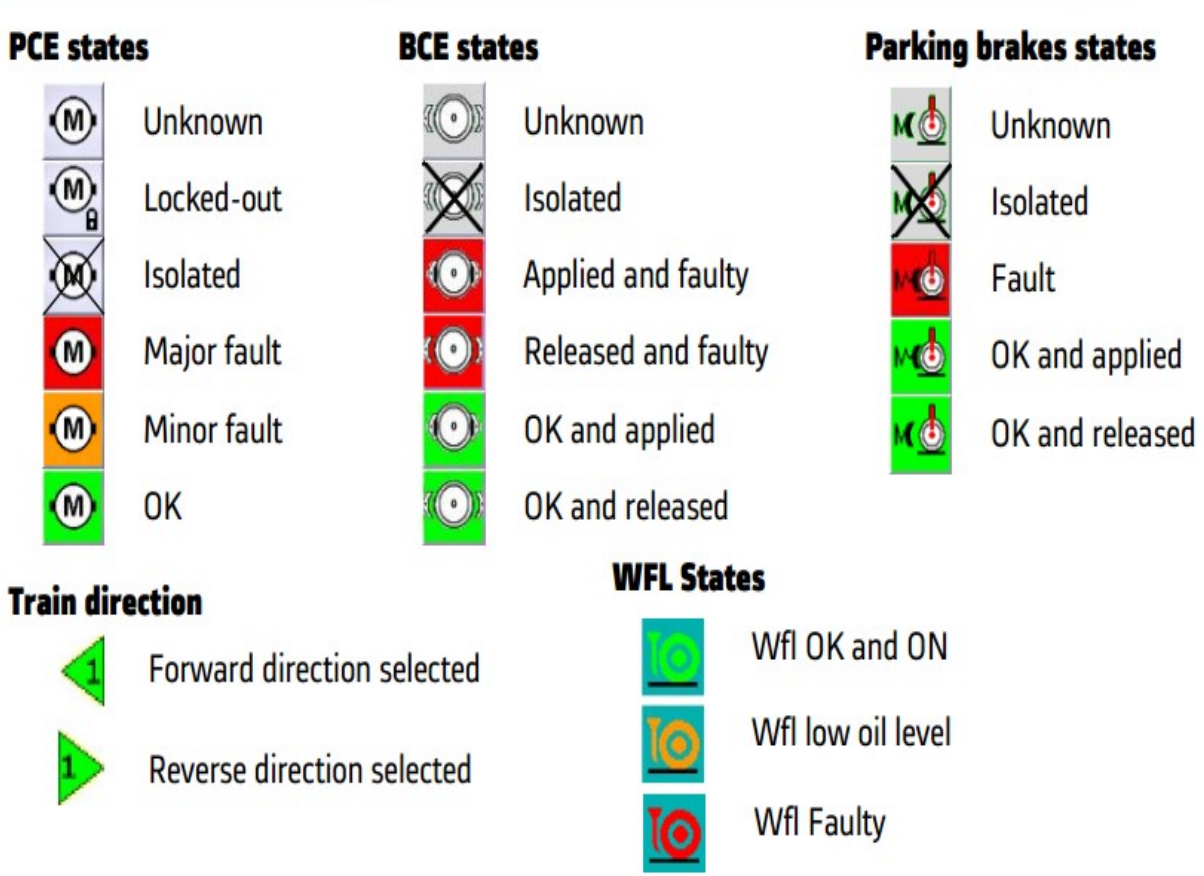
The colors code used on the main driving screens is set as following.

Colour	Description
Bondi Blue	Screen background
Gray	Unknown state, loss of communication
Green	No alarm, normal operation
Yellow	Warning, low criticity event
Orange	Pre-alarm, medium criticity event
Red	Alarm, high criticity event
Black	Text

Main Driving Screen - Icons



Main Driving Screen - Icons



Main Driving Screen - Icons

Panto states

Unknown

Up

Down

Failure going down

Failure going up

Battery states

Battery Ok

Battery level low

Battery level critically low
Or faulty

VCB states

Unknown

Fault (abnormally opened)

Fault (abnormally closed)

Normally opened

Normally closed

Compressor states

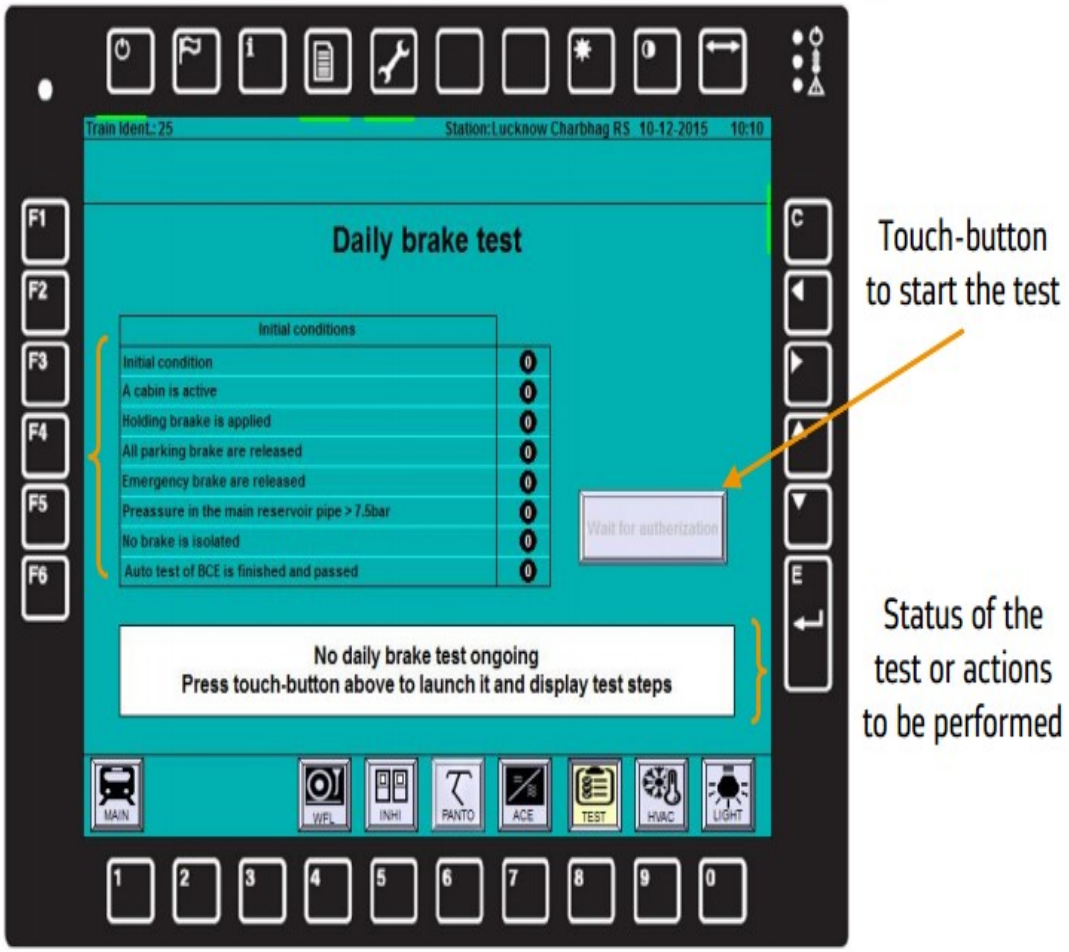
Unknown

Fault

OK and stopped

OK and running

Daily Brake Test

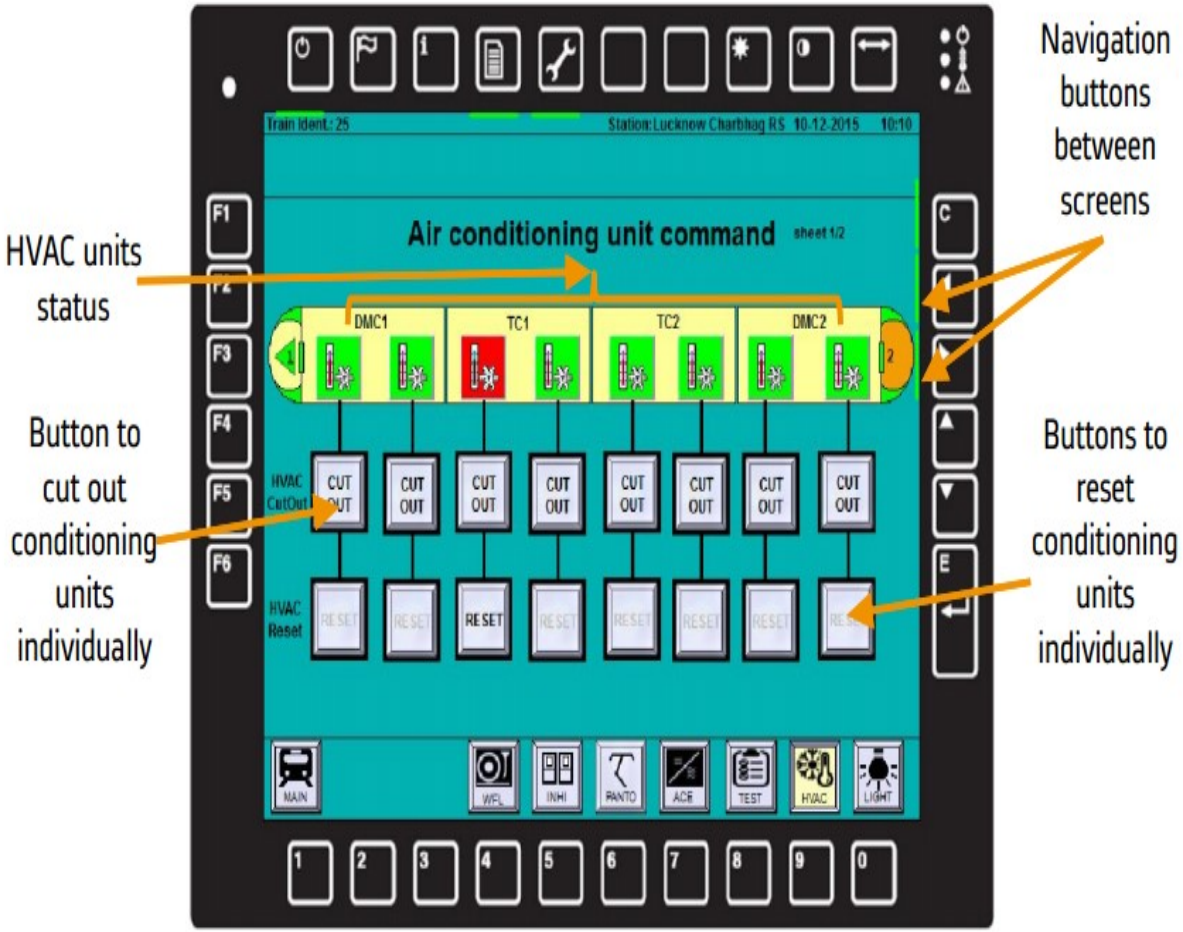


State of the conditions to state a daily brake test

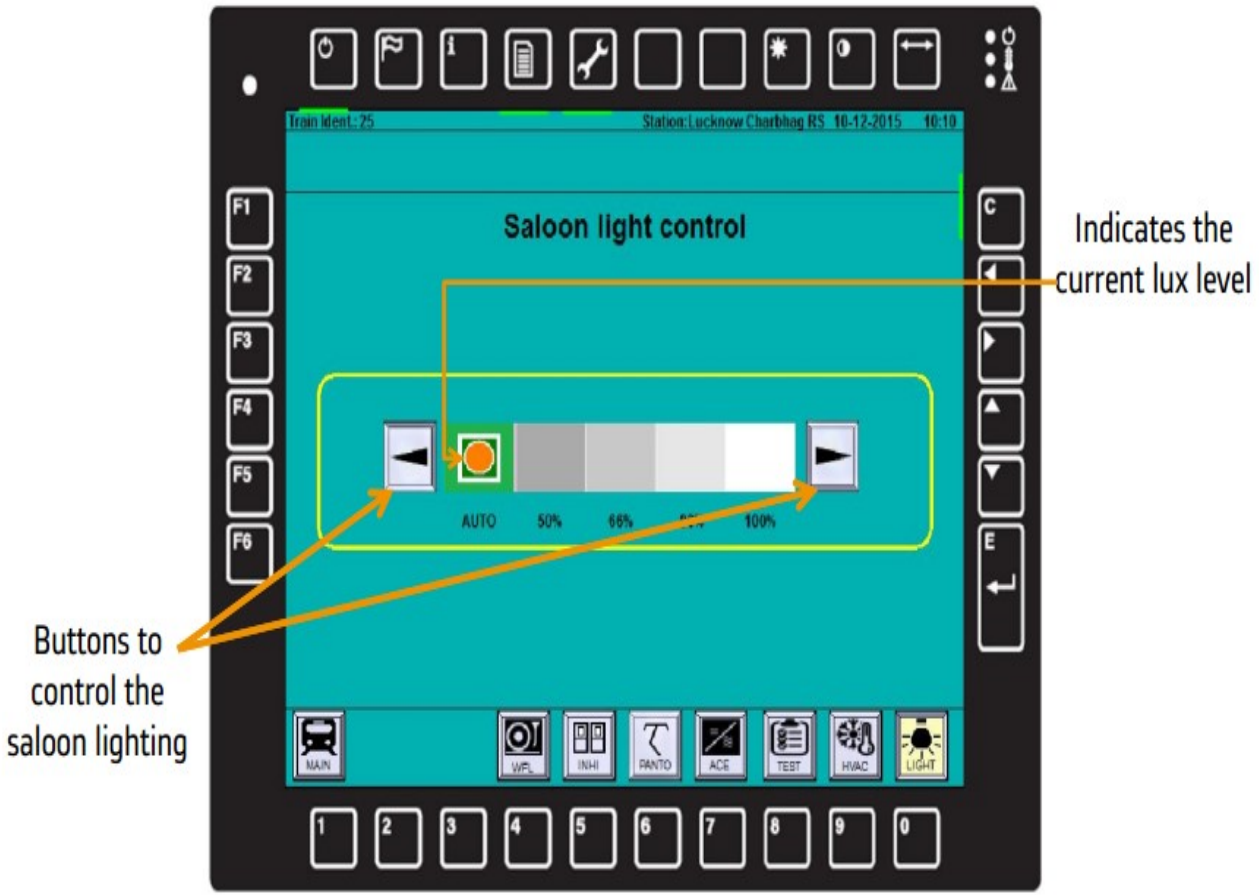
Touch-button to start the test

Status of the test or actions to be performed

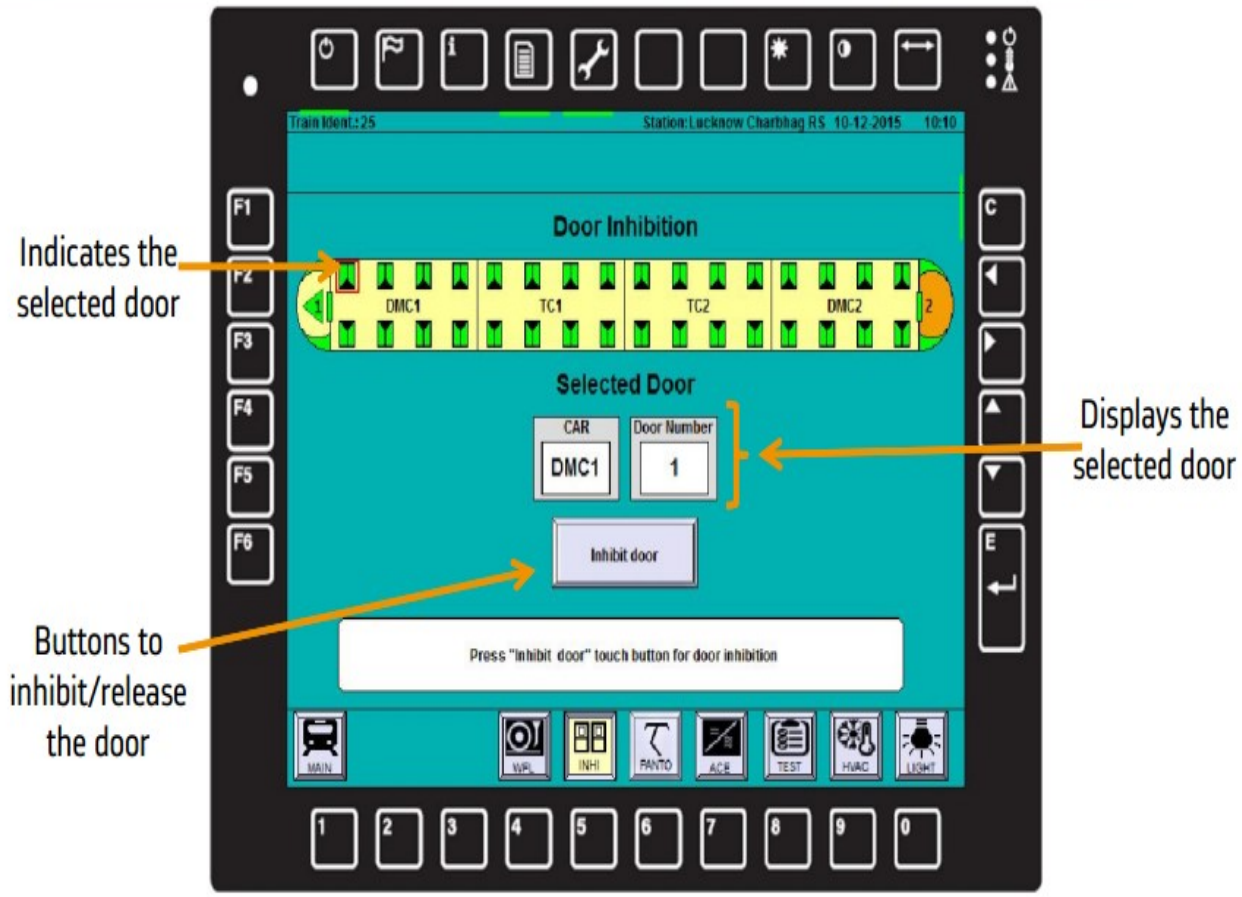
Air Conditioning Screen - 1



Saloon Lighting Control Screen

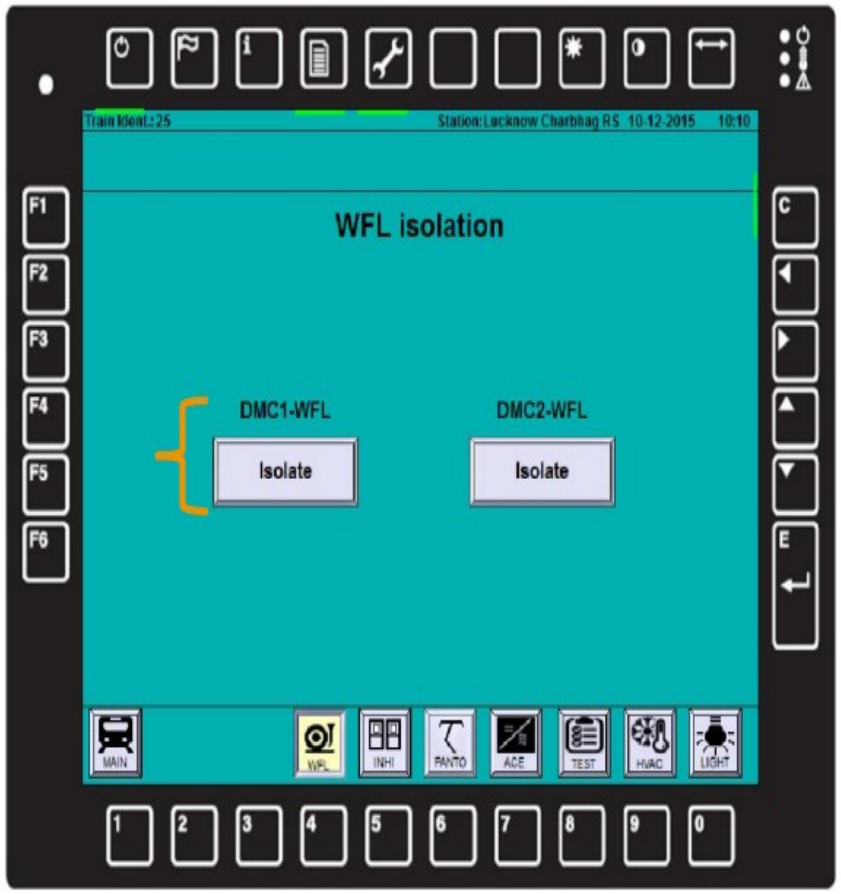


Door Inhibition Screen

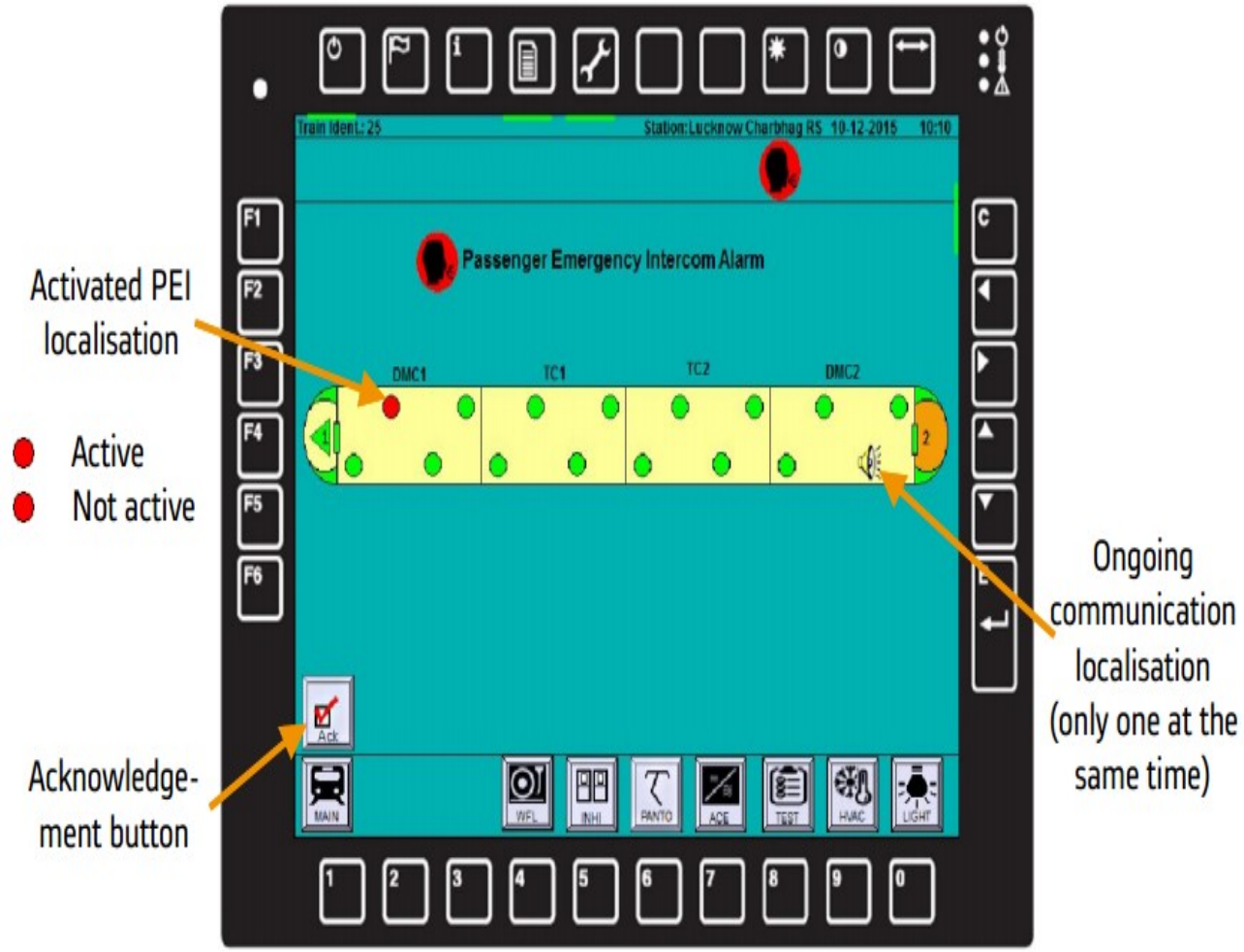


WFL Isolation Screen

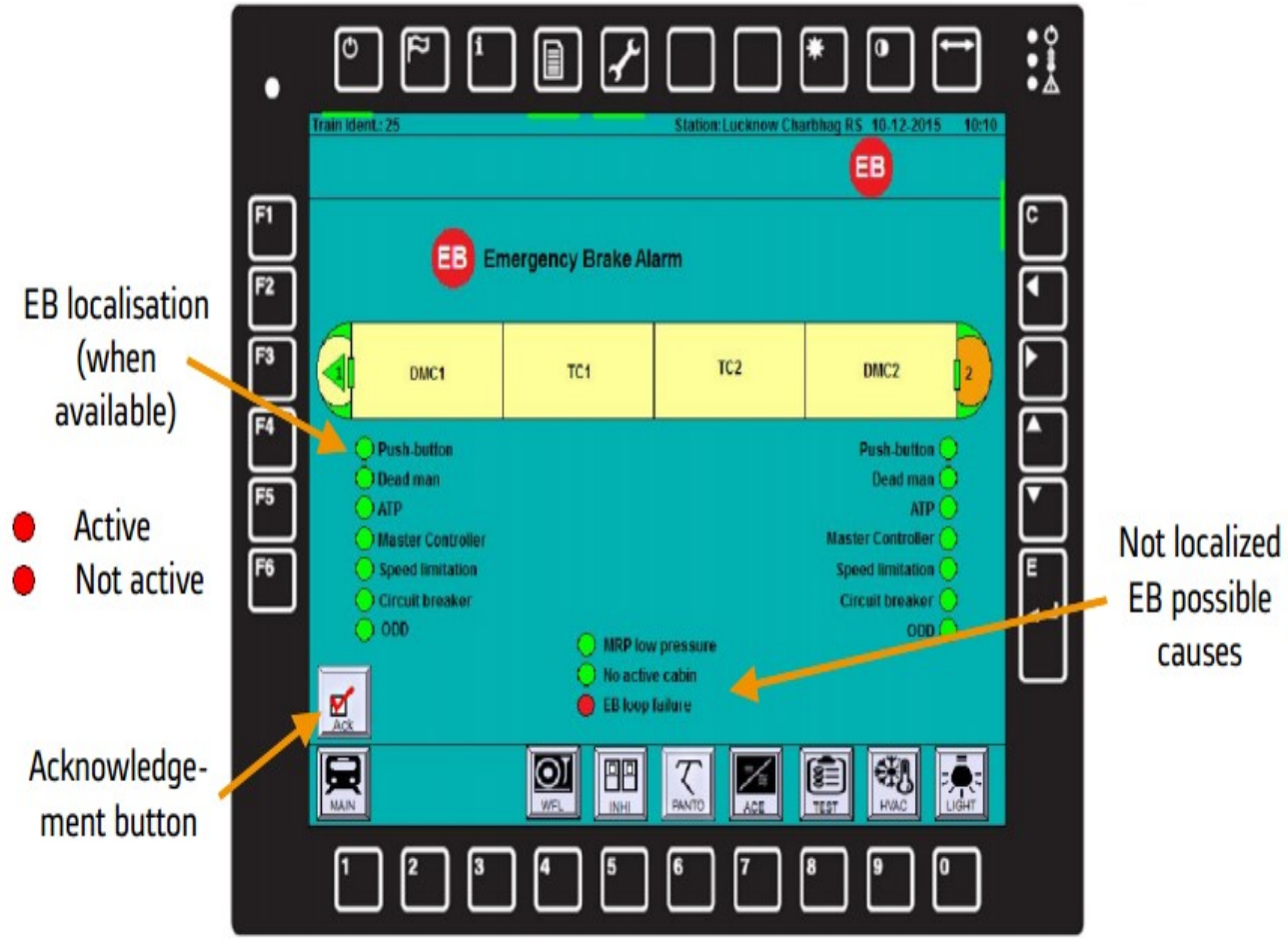
Buttons to Isolate/Release the wfl



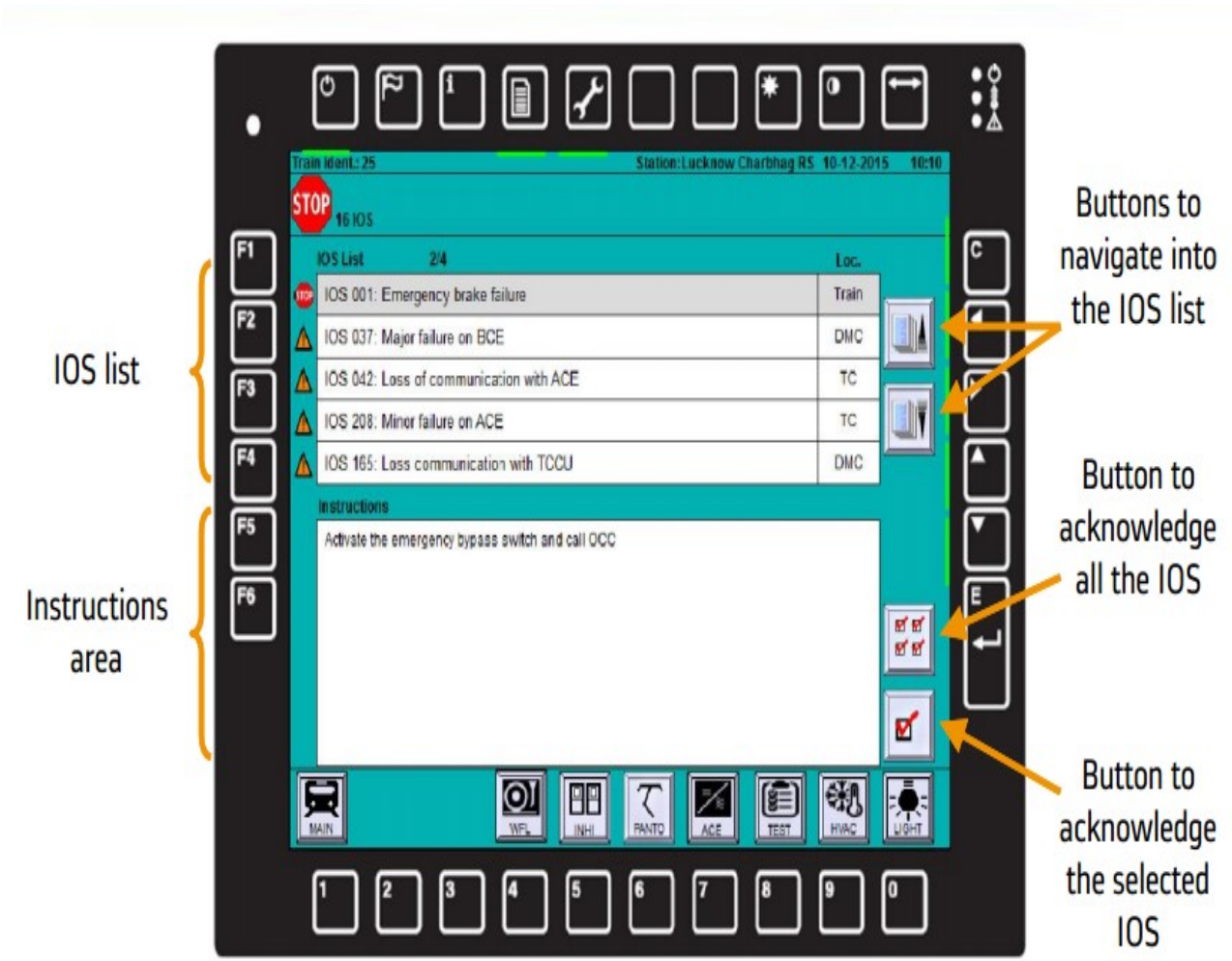
Passenger Emergency Intercom Alarm Screen



Emergency Brake Alarm Screen



IOS Screen


IOS list
Instructions area
Buttons to navigate into the IOS list
Button to acknowledge all the IOS
Button to acknowledge the selected IOS
Train Ident.: 25
Station: Lucknow Charbhag RS 10-12-2015 10:10
STOP
16 IOS
IOS List 2/4
Loc.
IOS 001: Emergency brake failure
Train
IOS 037: Major failure on BCE
DMC
IOS 042: Loss of communication with ACE
TC
IOS 208: Minor failure on ACE
TC
IOS 165: Loss communication with TCCU
DMC
Instructions
Activate the emergency bypass switch and call OCC
F1
F2
F3
F4
F5
F6
C
E
MAIN
WSL
INHI
PANTO
ACE
TEST
HVAC
LIGHT
1
2
3
4
5
6
7
8
9
0

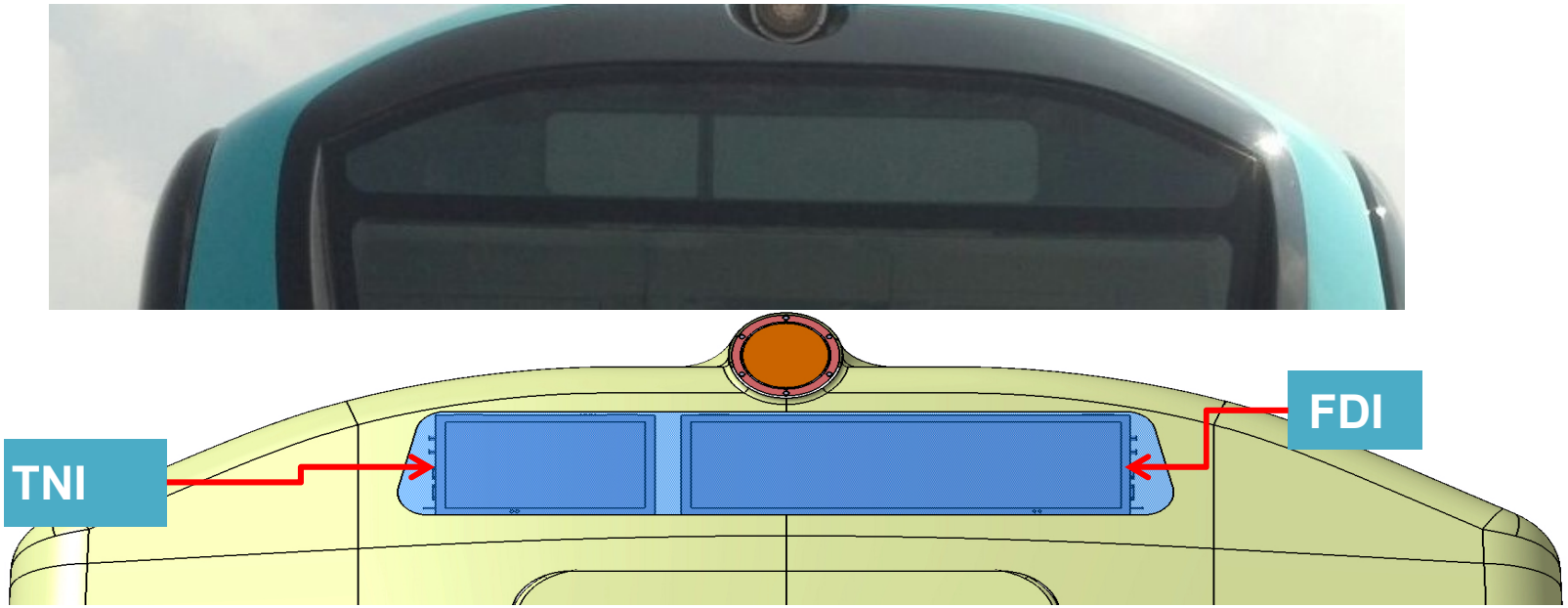
- The major substsytems like conereter, Aux. converter, HVAC, Brake system, PAPIS have their own softwares.
- TCMS has overall control and monitoring of all major subsystems with interface with signalling side.
- PAPIS has its own storage and software with interface to TCMS.

PAPIS

PAPIS stands for Passenger Announcement and Passenger Information System

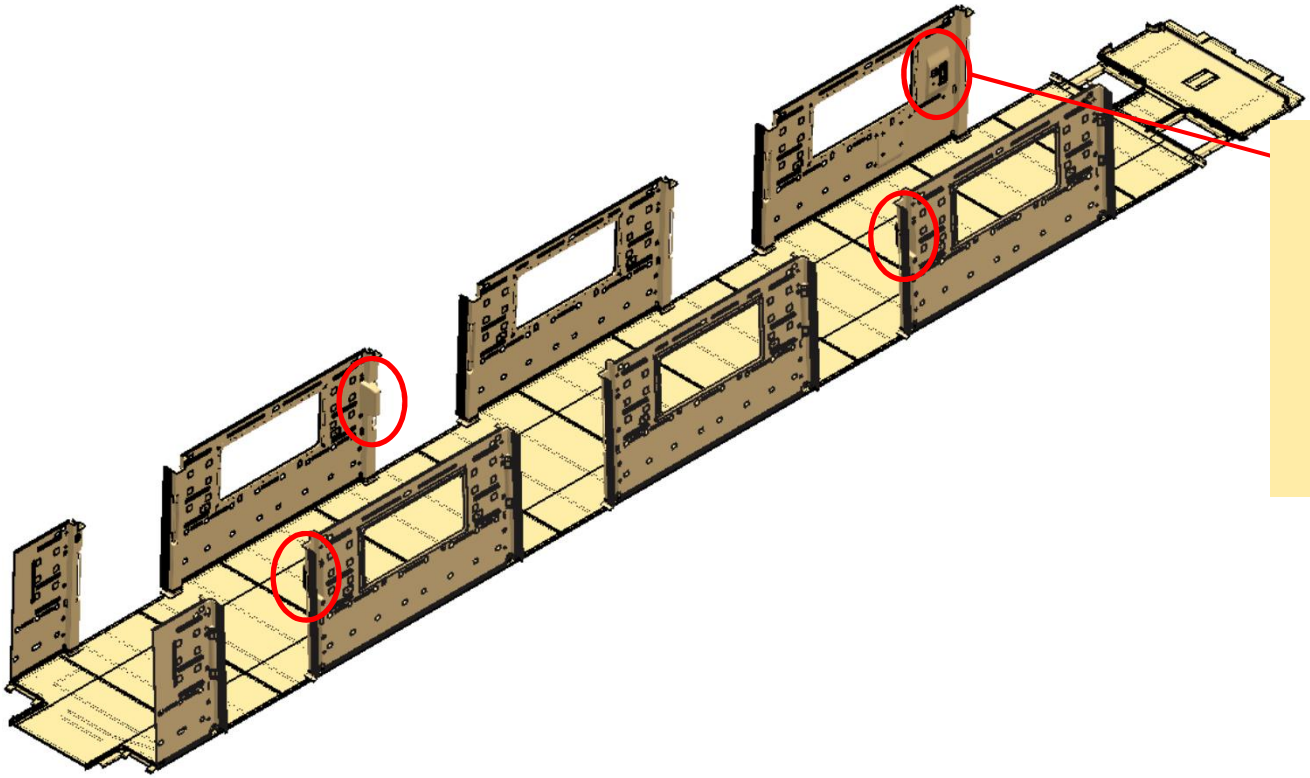
It provides all information to public like TNI, FDI, DRM(Dynamic route mapping), Announcements, digital advertisements. The passenger is also able to communicate to the driver through PEI (Passenger Emergency Information).

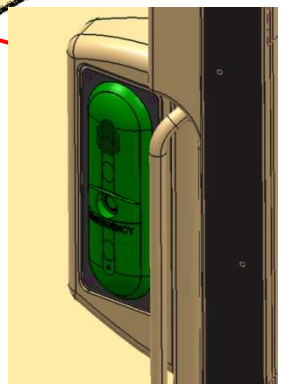
FDI, TNI Location



	FDI	TNI
Dimension (H x W x D) mm	222 x 752 x 64	222 x 368 x 64
Angle of View	+/- 60 (H), +/-60 (V)	+/- 60 (H), +/-60 (V)
Viewing Distance	30 meters	30 meters
Operating Temp	-20~ +65degC	-20~ +65degC
IP Rating	IP 54 (Front)	IP 54 (Front)

PEI BOX INSTALLATION- DMC

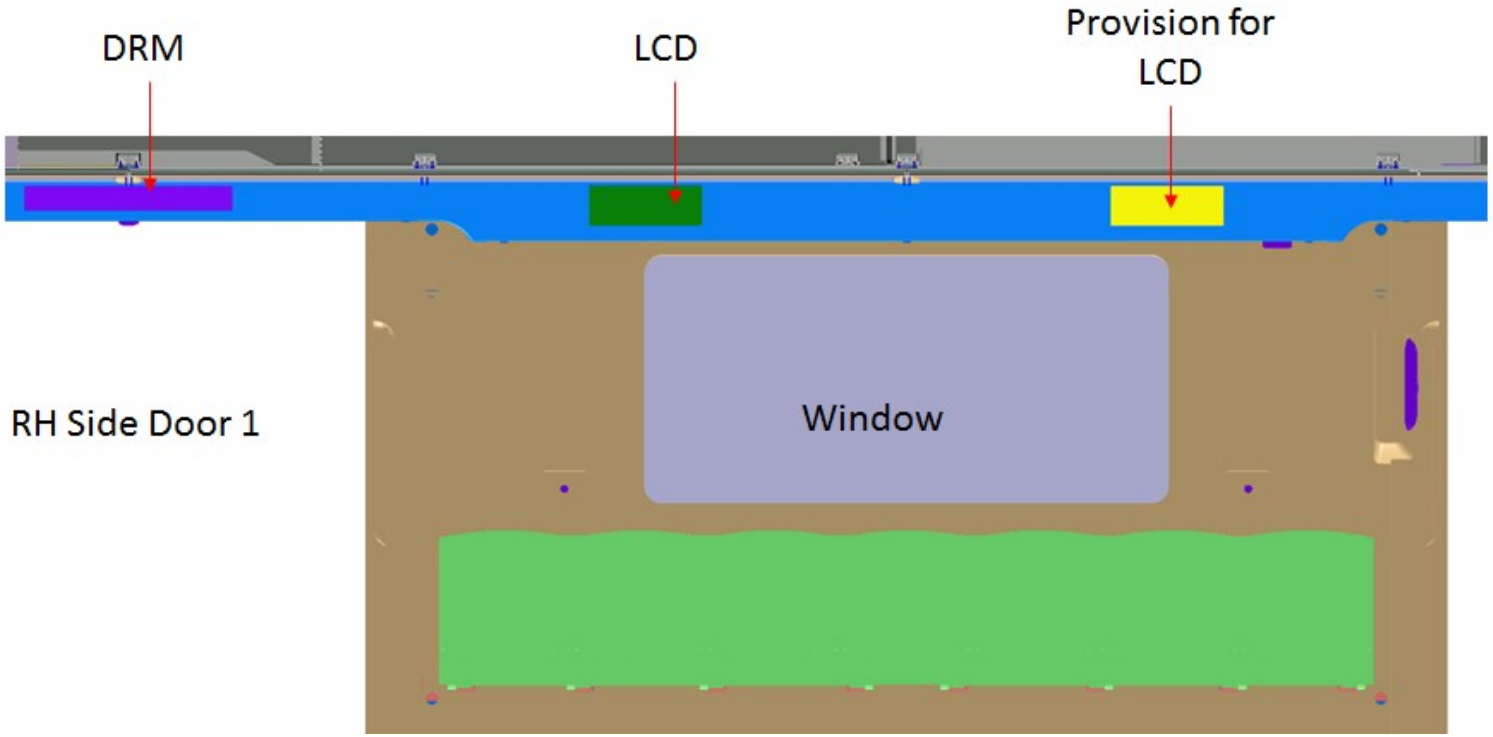




TOTAL : 4 NOS

INTERNAL LCD DISPLAY-Provision

TOTAL :6 NOS



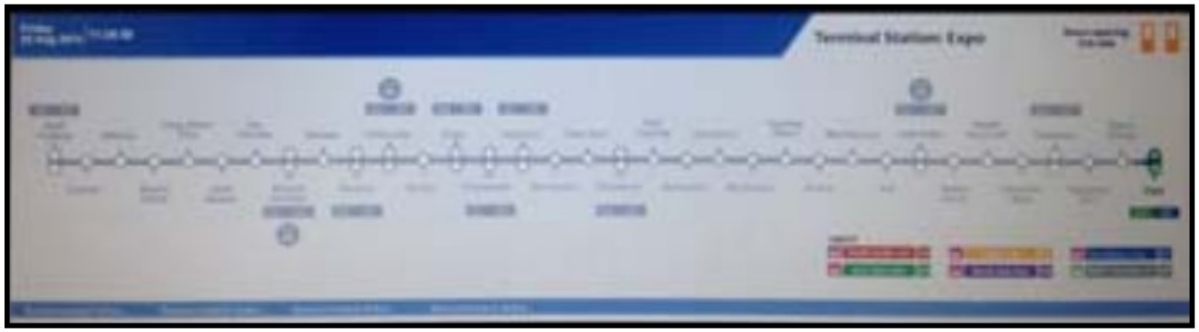
DRM -Location

TOTAL : 8 NOS

DRM Sample Pictures

LCD-DRM

LED-DRM



THANK YOU