सवारी डिब्बा कारखाना
(रेल मंत्रालय की उत्पादन इकाई)
चेन्नै - 600038

आज़ादी का अमृत महोत्सव

TRAIN SET

SALIENT FEATURES OF TRAINSET 44

- 50% Powering And High Acceleration And Deceleration
- Regenerative And EP Brake System (Dedicated BECU) With Blending
- Fully Suspended Traction Motor
- Led Light Fittings (Diffused Lighting)
- Led Destination Board
- GPS Based Passenger Information System
- CCTV
- Centralised Automatic Plug Door For Coach Entry
- On Board Infotainment System (2 Nos Of Infotainment Monitor)

SALIENT FEATURES OF TRAINSET 44

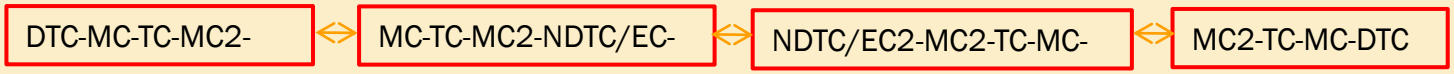
- Disaster Management Light
- Provision For Train Protection Warning System(TPWS) / Automatic Train Protection(ATP)/ Communication Based Train Control(CBTC)/ Train Collision Avoidance System(TCAS)
- Fitted With Ambience Noise Measurement (ANM), Emergency Talk Back Unit (ETBU), Centralised Coach Monitoring System (CCMS)
- Signal Exchange Light
- Door Indication Lamps
- CCMS and Tip Up Seats For Technical Crew

SALIENT FEATURES OF TRAINSET 44

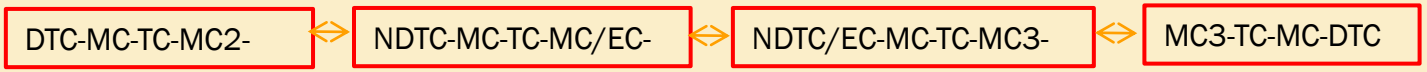
- 415v Synchronised Bus System
- 684AH Lithium Iron-phosphate Battery
- RMPU With VVVF Control For One Compressor
- 3 Hours Emergency Load Back Up In Case Of OHE Failure

RAKE COMPOSITION- COMPARE WITH TRAIN 18

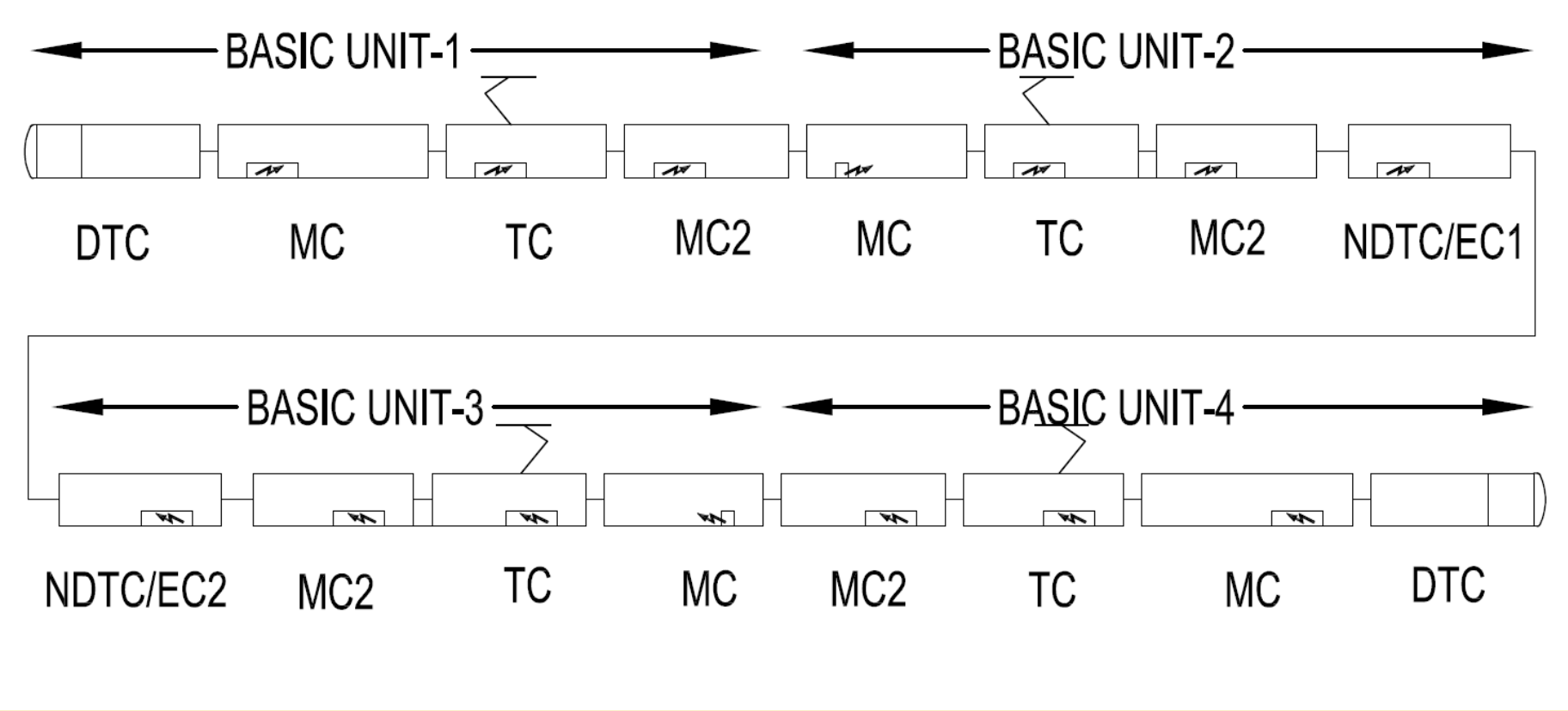
VB TRAINSET RAKE CONFIGURATION



TRAIN-18 RAKE CONFIGURATION



RAKE FORMATION WITH 4 BASIC UNITS



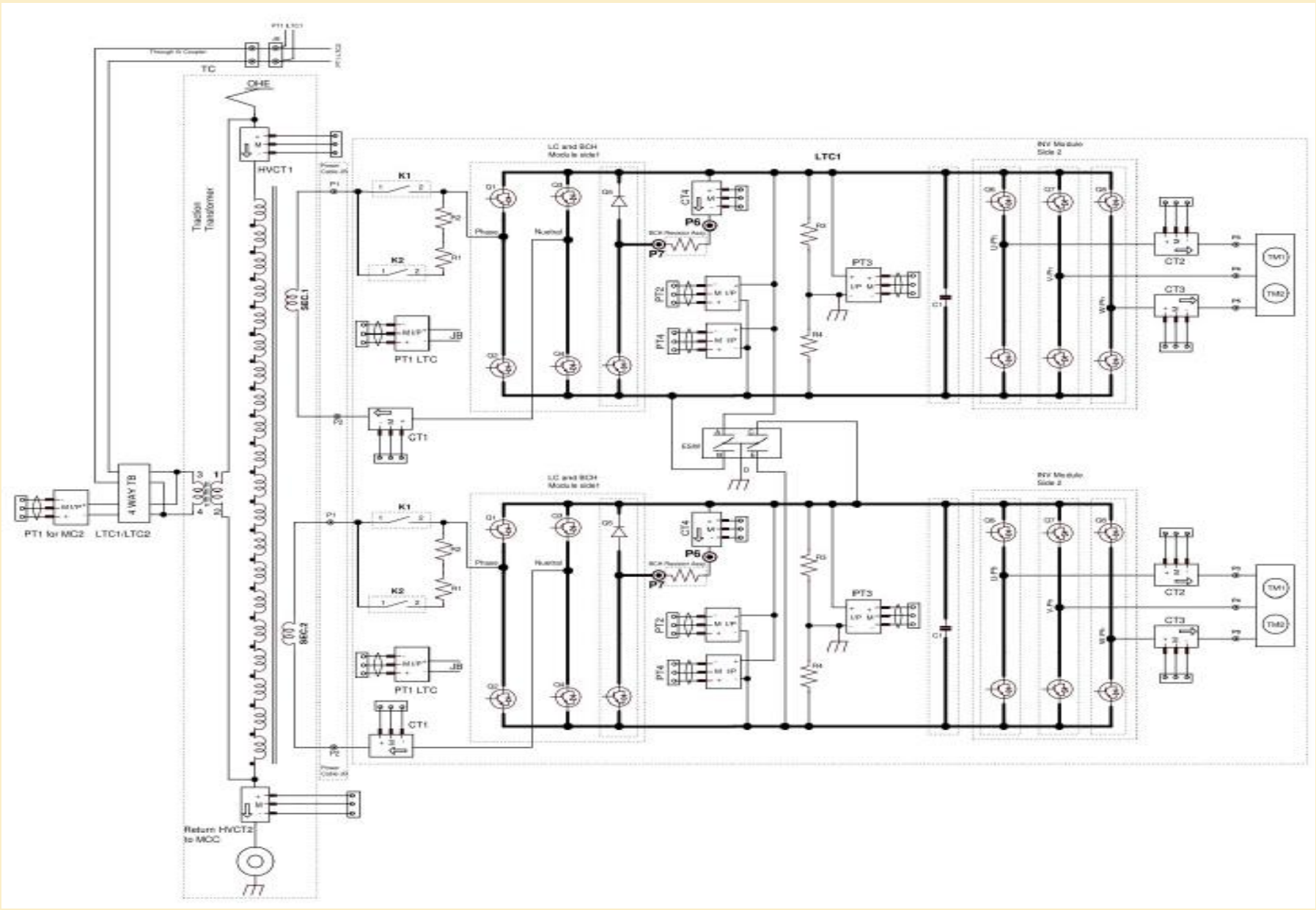
SAFETY FEATURES ADOPTED IN TRAINSET COACHES

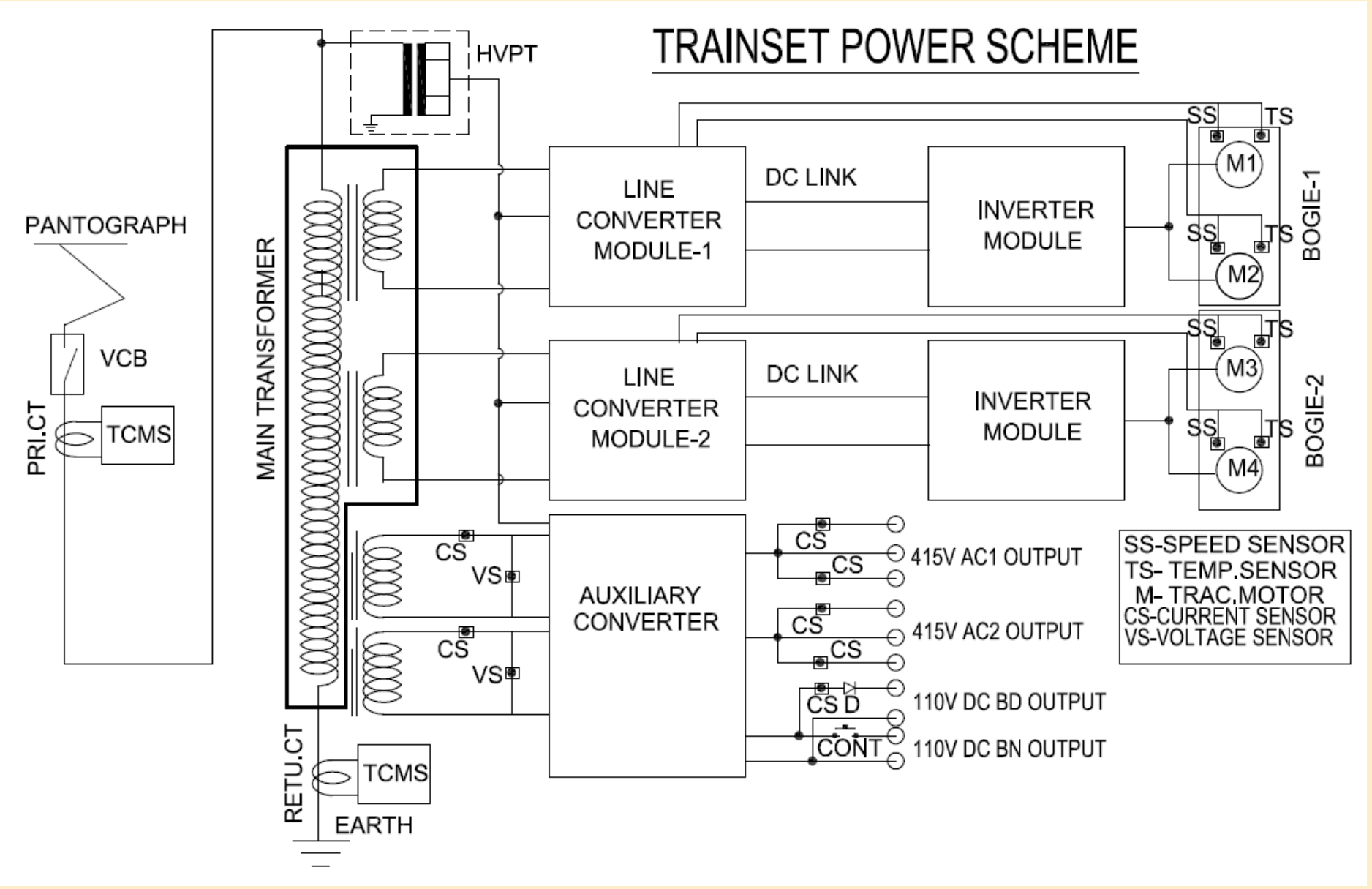
- Additional CT is provided in HT cable to adjacent coach 25kv supply
- Additional VCB is provided over the roof in order to trip the HT line over roof in case of fault
- Mechanical protection is provided for HT cables laid over the roof
- All cubicles are made with Fire Barrier tested
- Fire survival cables are used in PA PIS system, Emergency Tack Back system, Door control system , Fire detection system etc
- CCTV cameras
- Emergency Talk Back Unit (ETBU)

SAFETY FEATURES ADOPTED IN TRAINSET COACHES

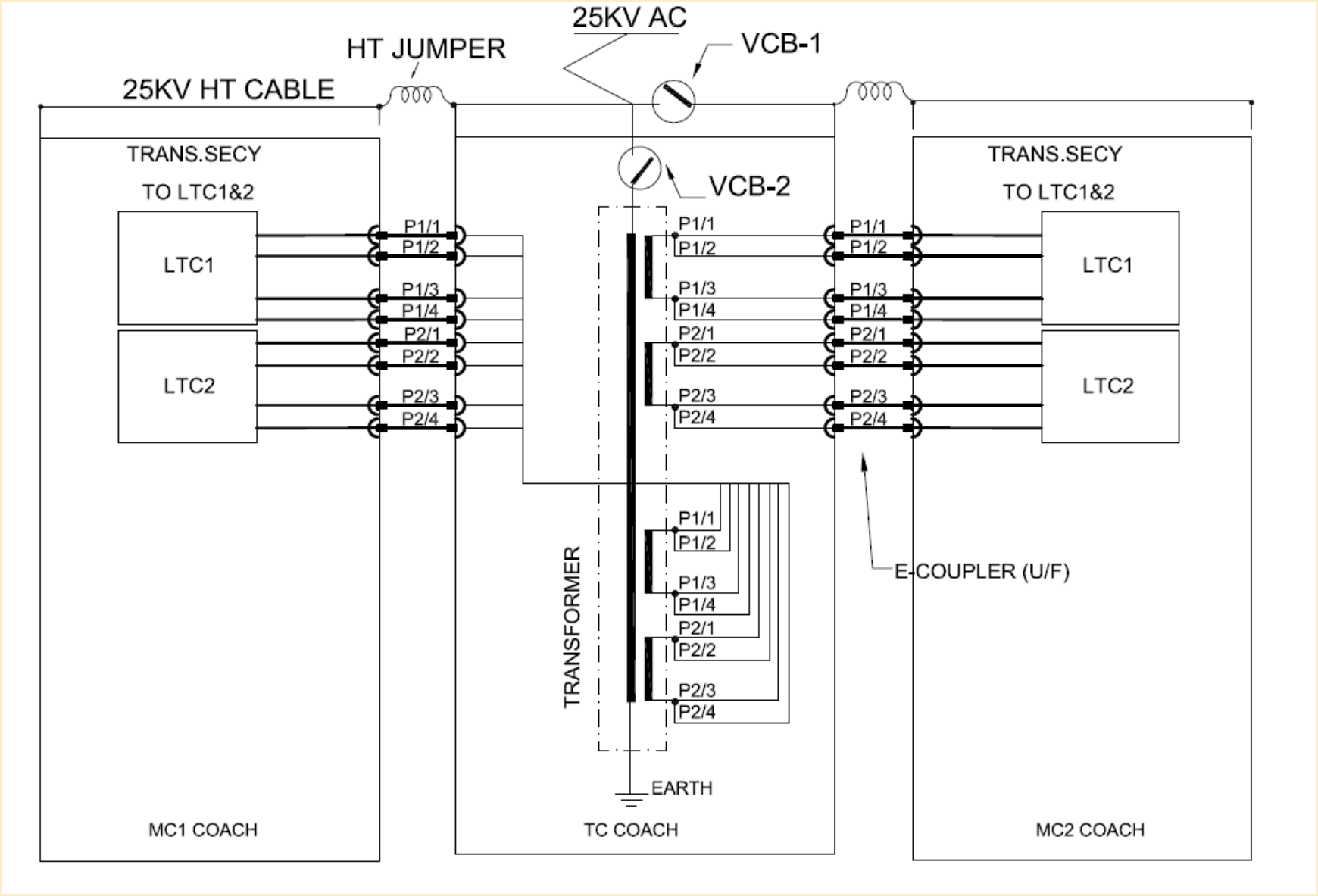
- Disaster Management light
- Fire detection and alarm system is introduced in all the coaches
- Passenger Alarm Chain Pulling with electrically operated Push Button
- Cab recording
- Centralised Coach Monitoring System (Air conditioning system)
- Vigilance Control Device
- Event recorder
- APC for Panto down during neutral section negotiating
- Provision for introduction of TCAS

POWER SCHEMATIC DIAGRAM

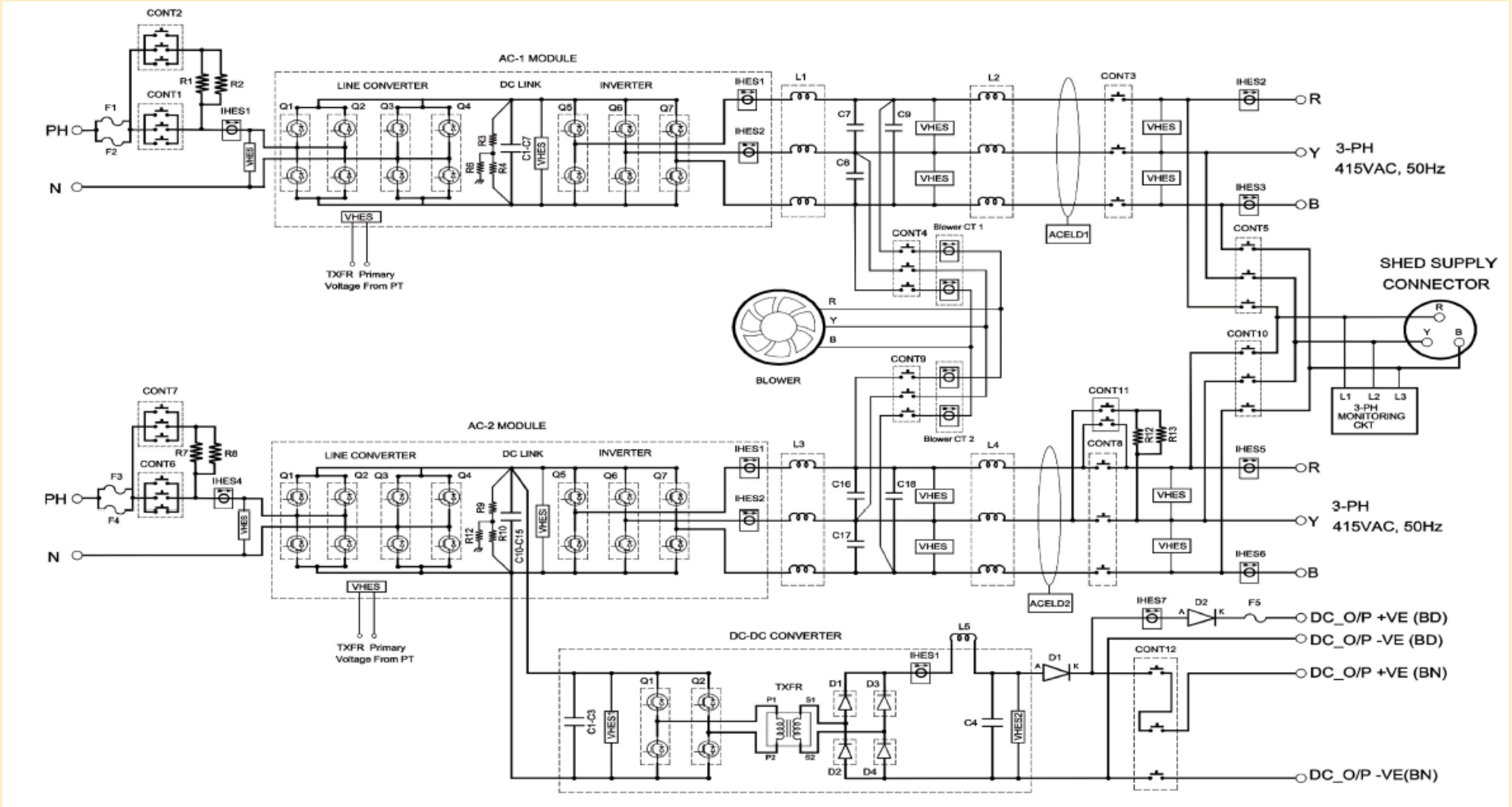



TRAINSET POWER SCHEME
HVPT
PANTOGRAPH
VCB
PRI.CT
TCMS
MAIN TRANSFORMER
LINE CONVERTER MODULE-1
DC LINK
INVERTER MODULE
SS
TS
M1
M2
BOGIE-1
LINE CONVERTER MODULE-2
DC LINK
INVERTER MODULE
M3
M4
BOGIE-2
CS
VS
AUXILIARY CONVERTER
415V AC1 OUTPUT
415V AC2 OUTPUT
CS D
110V DC BD OUTPUT
CONT
110V DC BN OUTPUT
SS-SPEED SENSOR
TS- TEMP.SENSOR
M- TRAC.MOTOR
CS-CURRENT SENSOR
VS-VOLTAGE SENSOR
RETU.CT
TCMS
EARTH

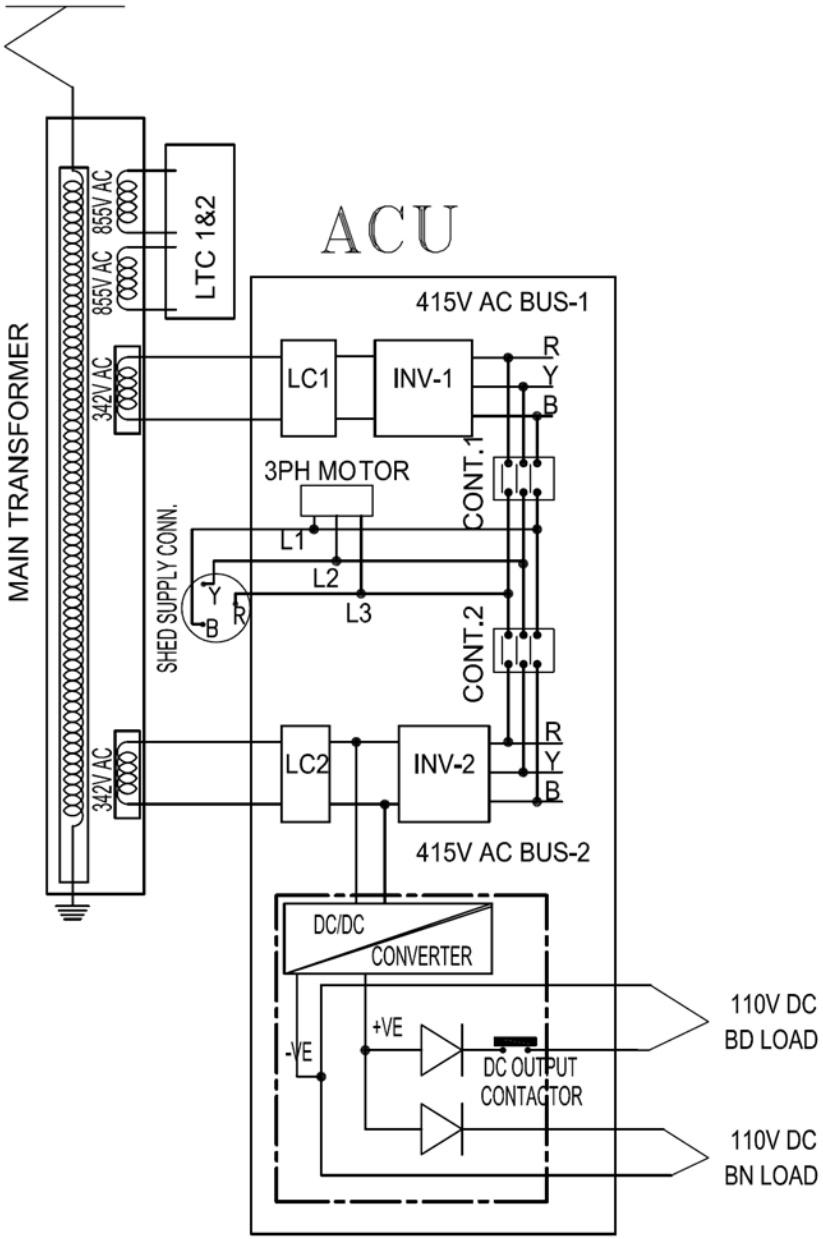
TRACTION POWER DISTRIBUTION TO MOTOR COACHES THROUGH POWER COUPLERS



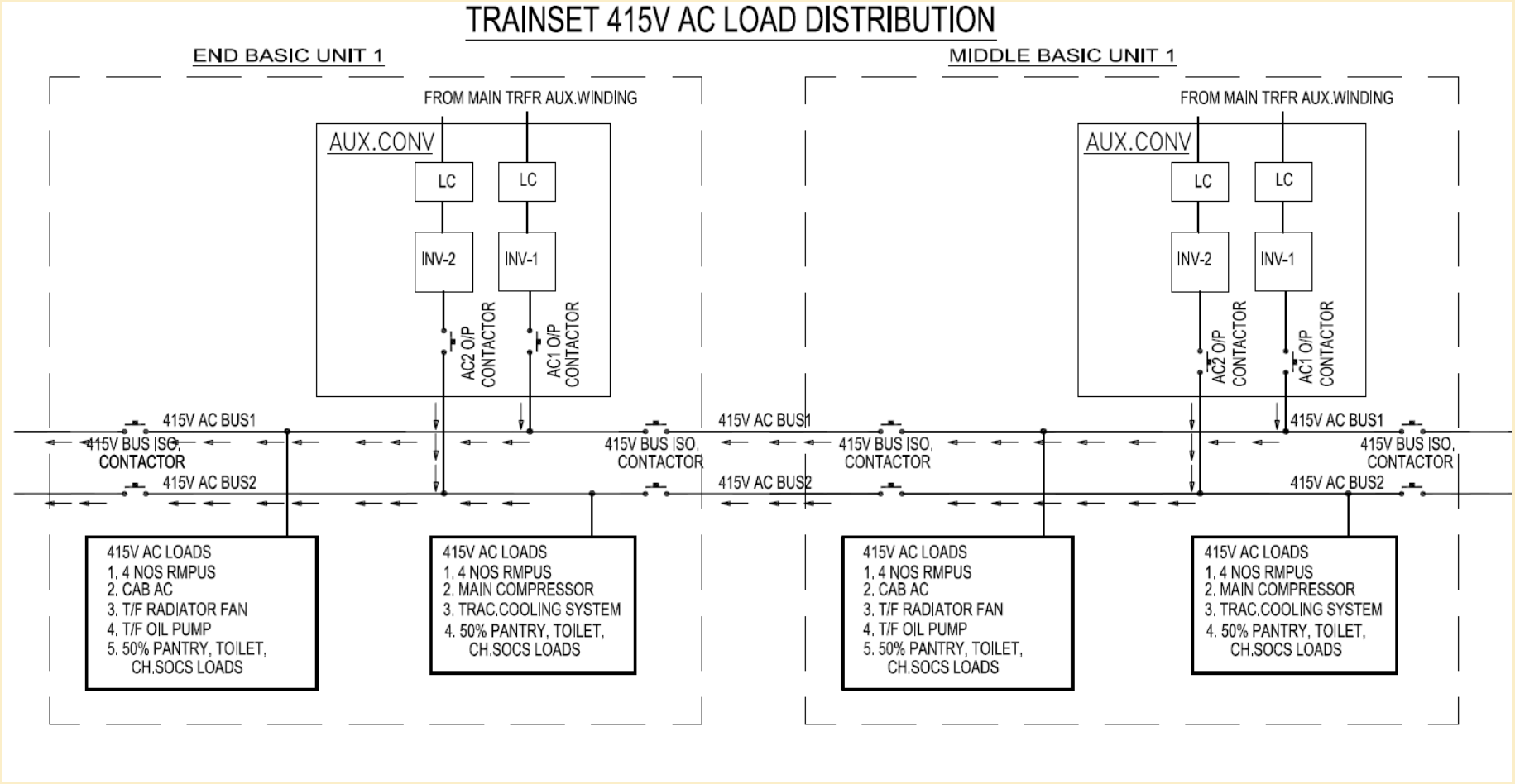
POWER SCHEMATIC OF AUXILIARY CONVERTER UNIT



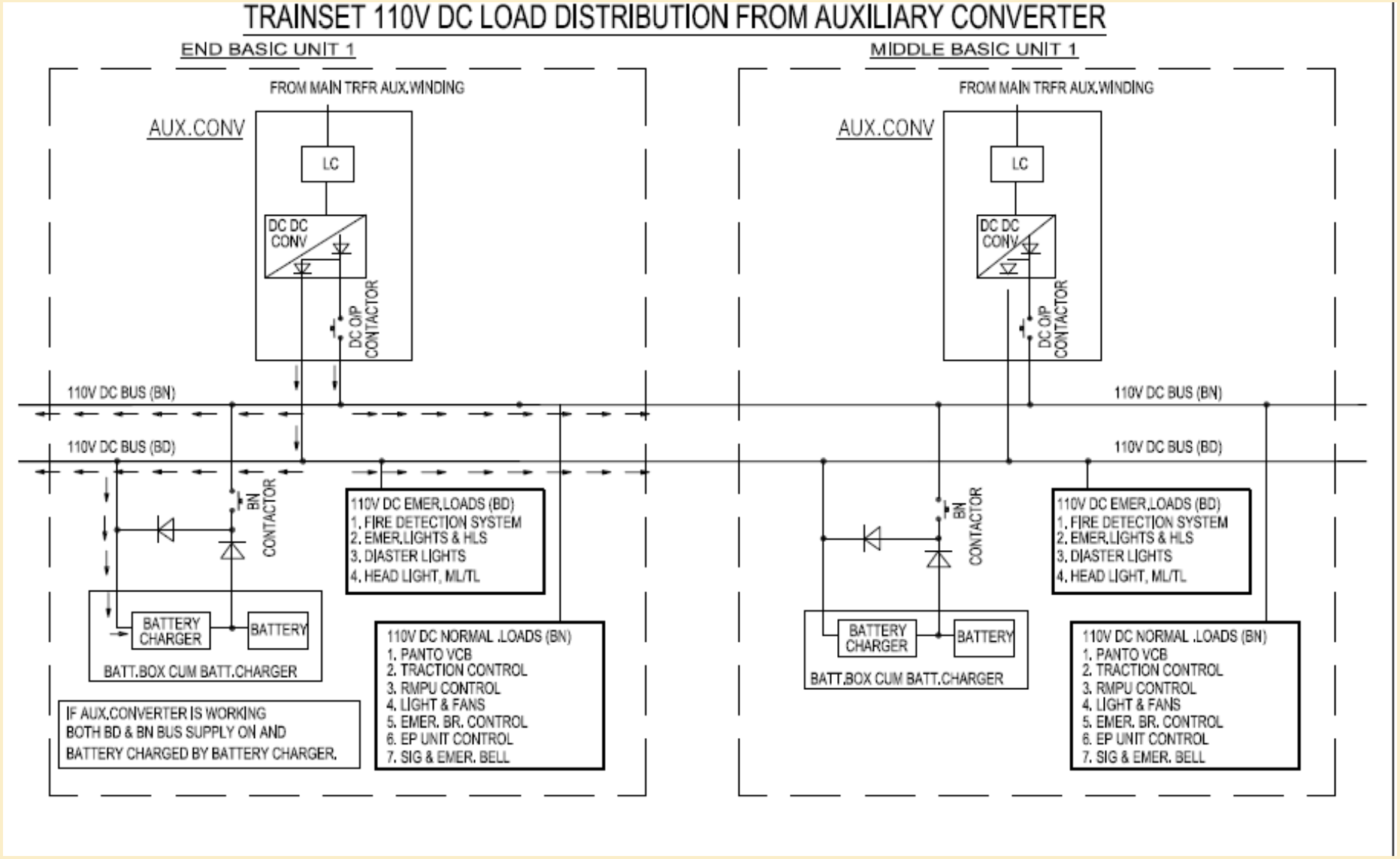
AUXILIARY CONVERTER



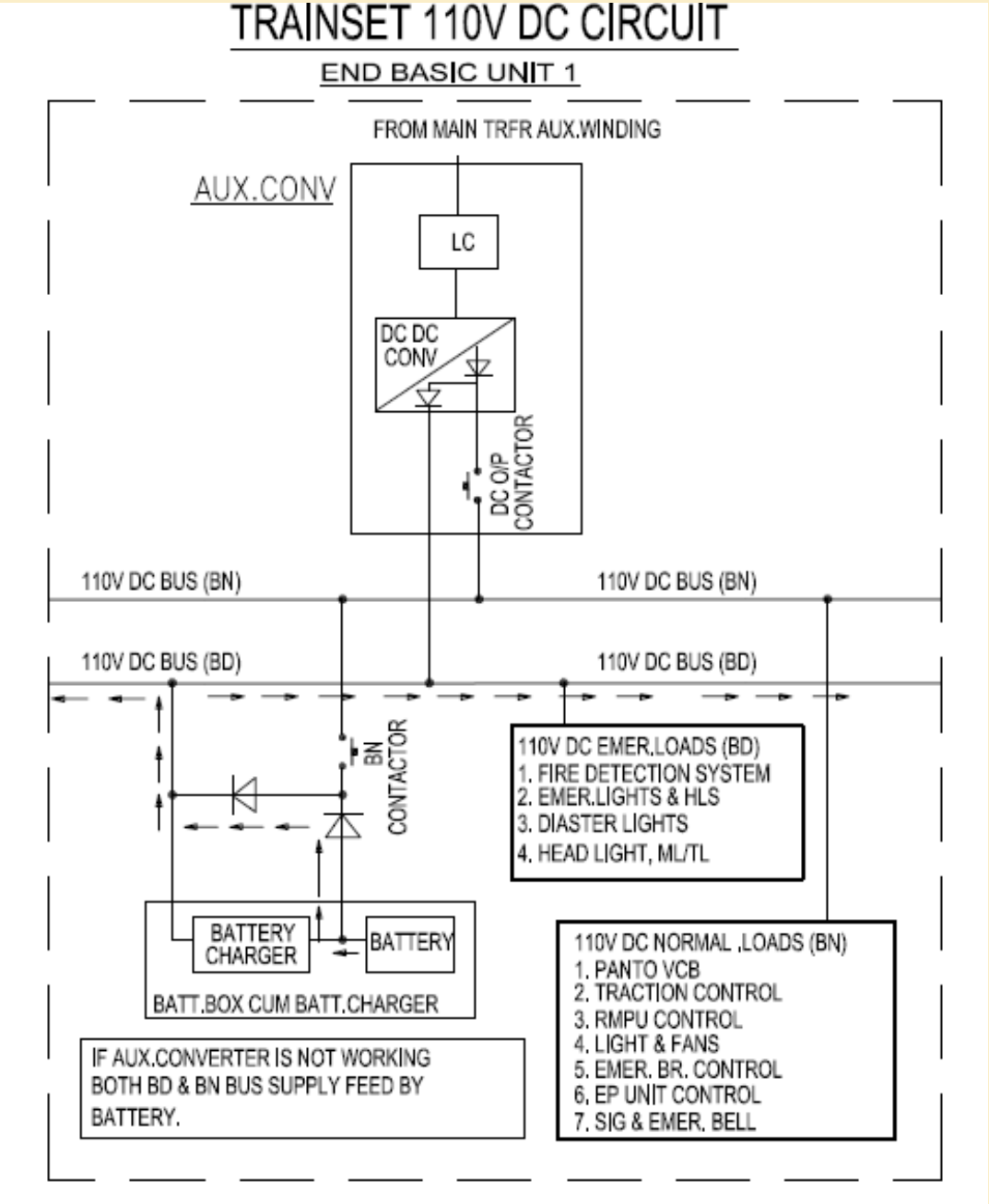
AUX CONVERTER 415V AC DISTRIBUTION



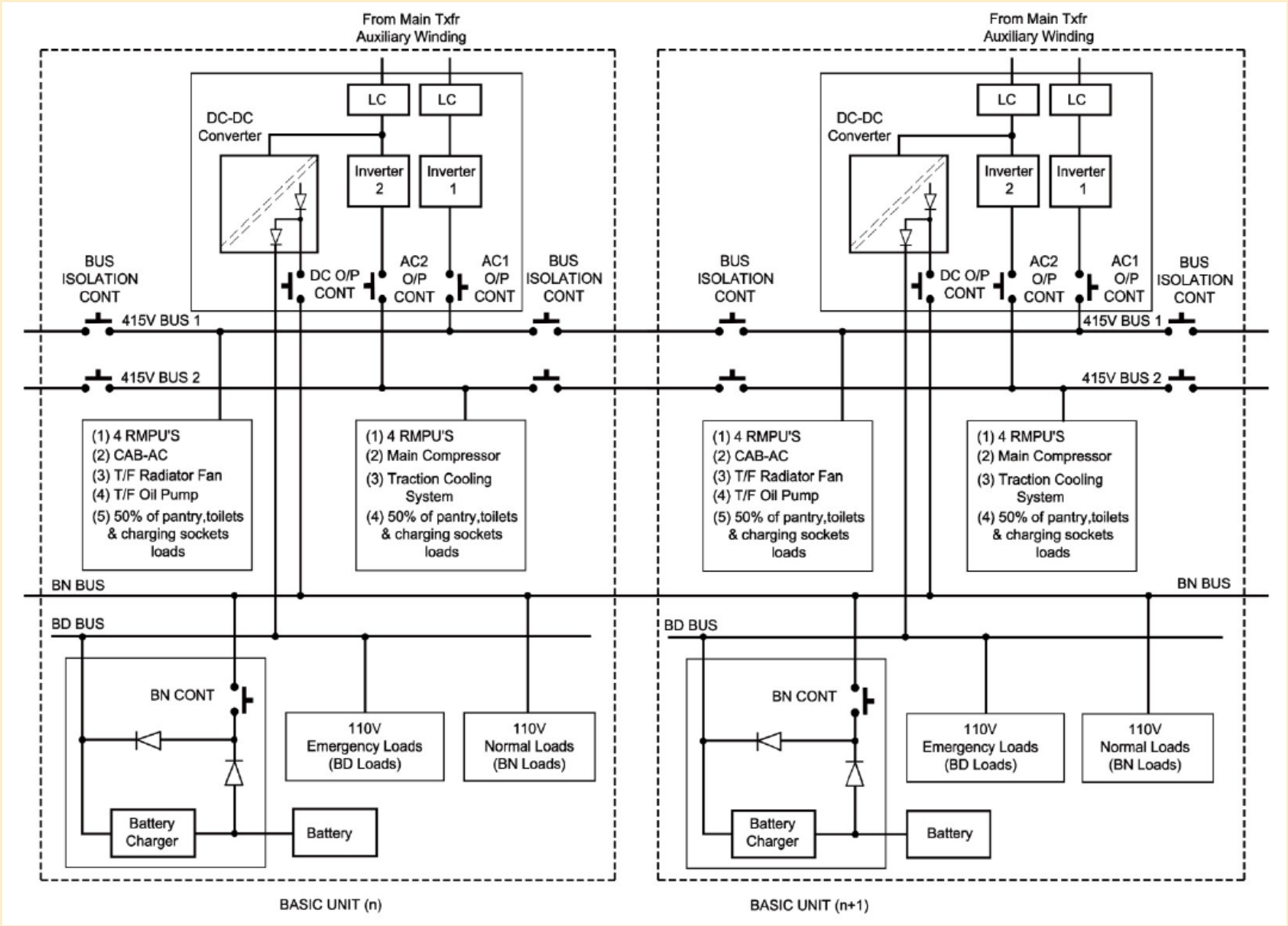
BATTERY CHARGING FROM AUXILIARY CONVERTER



BATTERY DIRECT SUPPLY WHEN AUX CONVERTER IS OFF



REDUNDANCY SCHEME OF 415V AC AND 110V DC SUPPLY



REDUNDANCY COMPARISION BETWEEN TRAINSET AND TRAIN 18

1) RMPU redundancy

Failure of Aux converter of BU	Redundancy level of RMPUs supply availability of Trainset					Redundancy level of RMPUs supply availability of Train 18				
	BU1	BU2	Bu3	Bu4	Emergency loads	BU1	BU2	BU3	BU4	Emergency loads
BU1 only	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%
BU1 & BU2	50%	50%	100%	100%	100%	50%	50%	50%	100%	100%
BU1,BU2 &Bu3	X	X	X	X	100%	X	X	X	X	100%

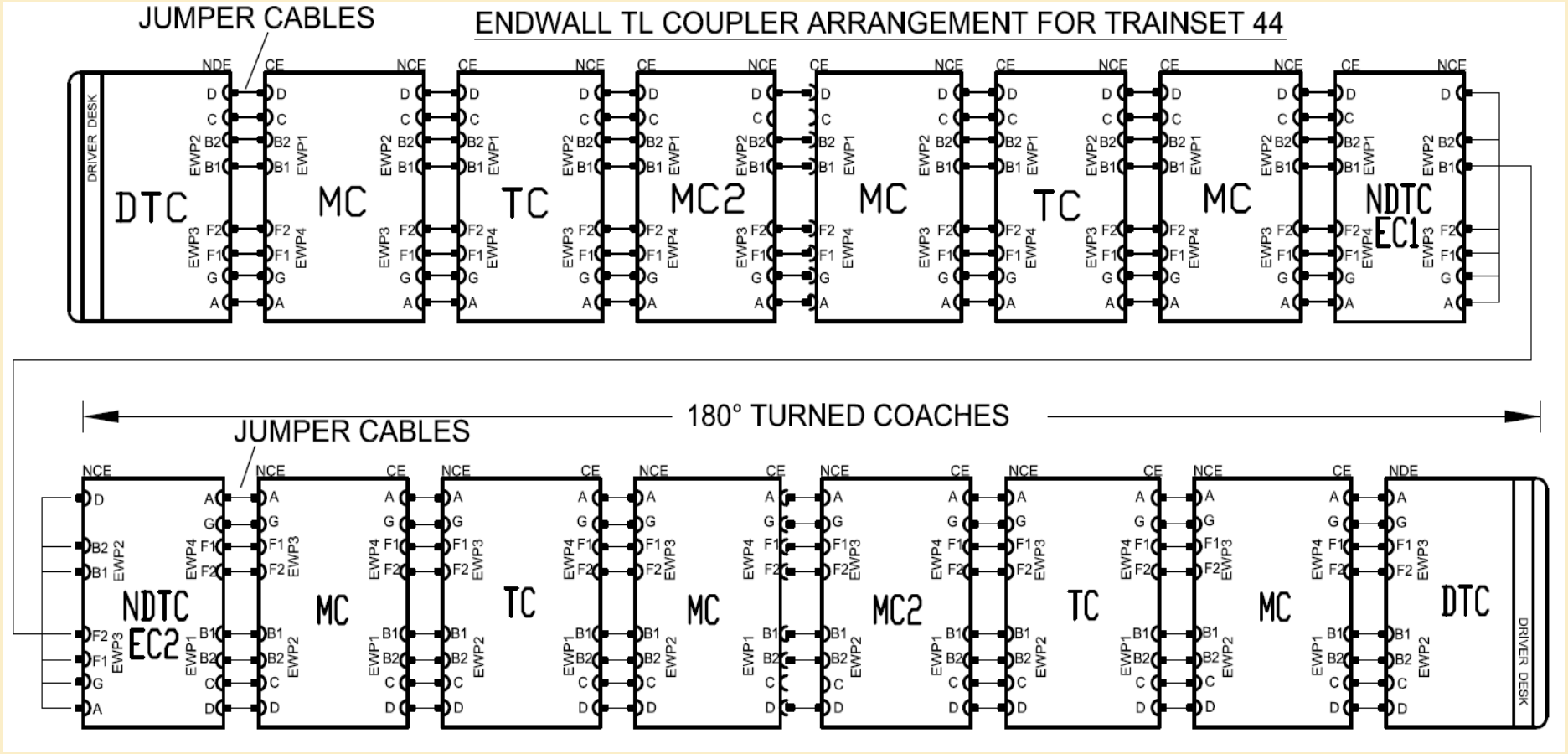
REDUNDANCY COMPARISION BETWEEN TRAINSET AND TRAIN 18

2) DC system redundancy

Failure of Aux converter of BU	Redundancy level of DC load availability of Trainset					Redundancy level of DC load availability of Train 18				
	Normal load- lights, PIS, infotainment				Emergency loads- Traction, TCMs, Door, PAS	Normal load- lights, PIS, infotainment				Emergency loads
	BU1	BU2	Bu3	Bu4		BU1	BU2	BU3	BU4	
BU1 only	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
BU1 & BU2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
BU1,BU2 &Bu3	X	X	X	X	100%	X	X	x	x	100%

3) Battery backup for RMPU blower: Train18 – 1 hour, Trainset - 3 hours

IV COUPLER ARRANGEMENT



A = DATA BUS - ETB-M, ECN-M, AUDIO, ETHERNET, CAN COMMN., CCTV COMMN. ETC.

G = DATA BUS - ETB-R, ECN-R, AUDIO, ETHERNET, CAN COMMN., CCTV COMMN. ETC.

F1 = 46 TRAIN LINES

F2 = 46 TRAIN LINES

B1 = 415V AC BUS

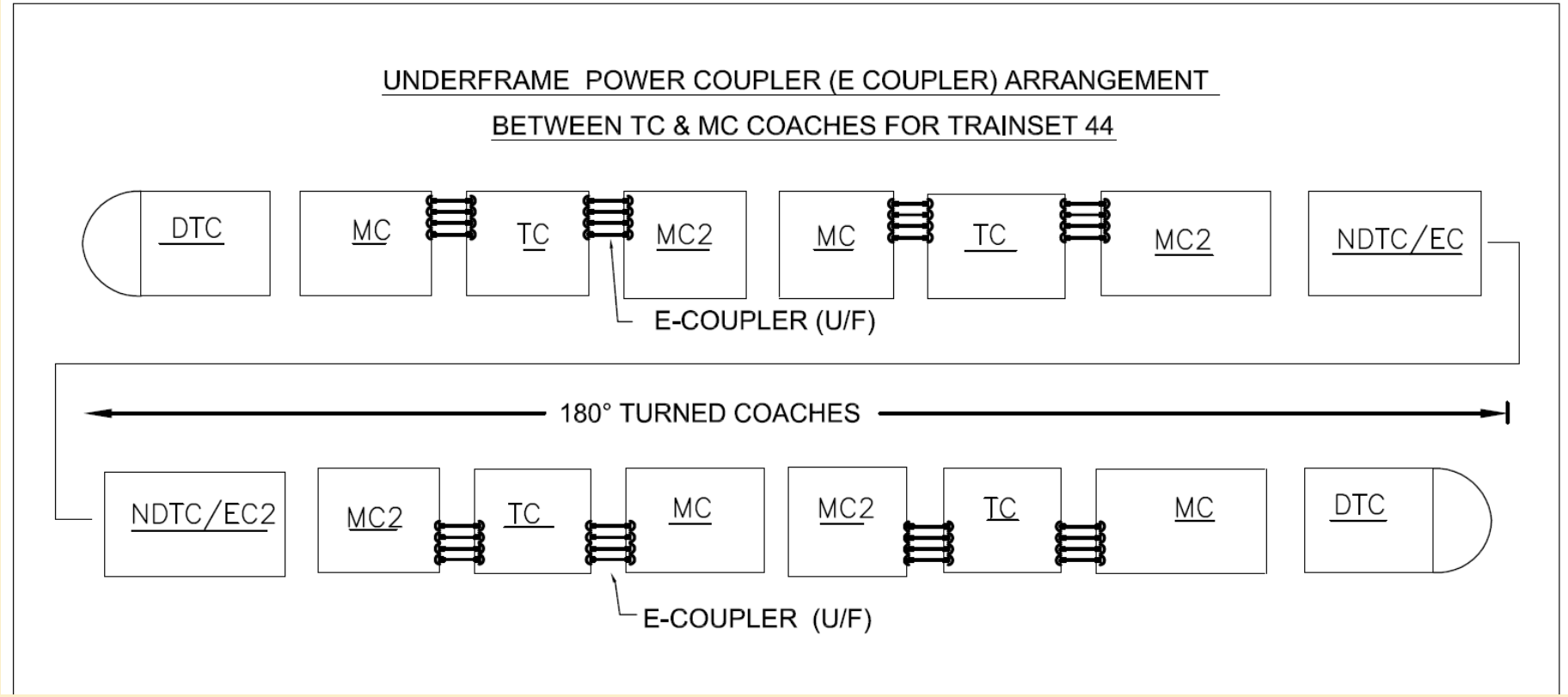
B2 = 415V AC BUS

C = 110N DC BD TRAIN LINE (DIRECT)

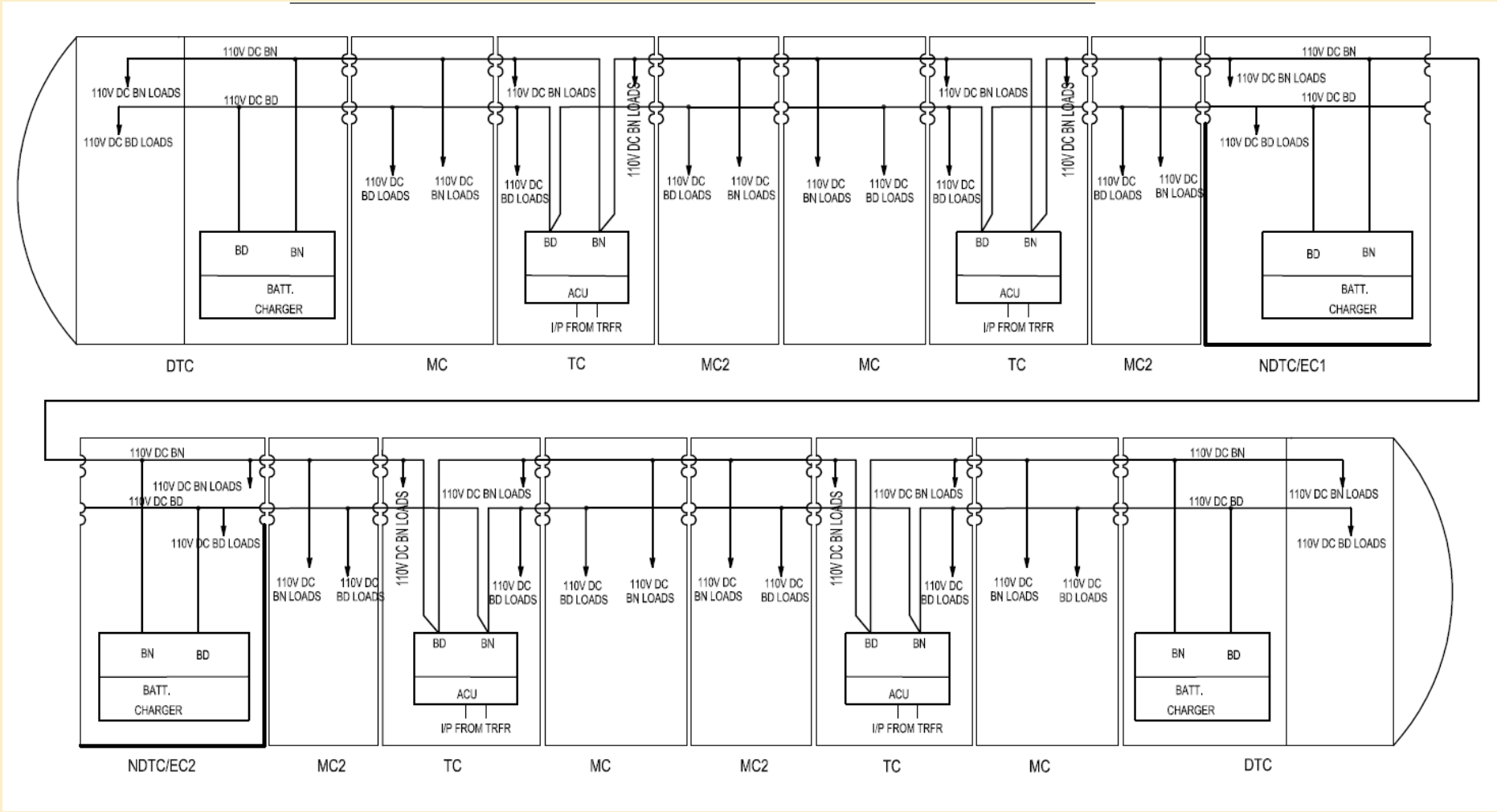
D = 110V DC BN1&2 TRAIN LINE (NORMAL)

E = TRANSFORMER SECONDARY LINE

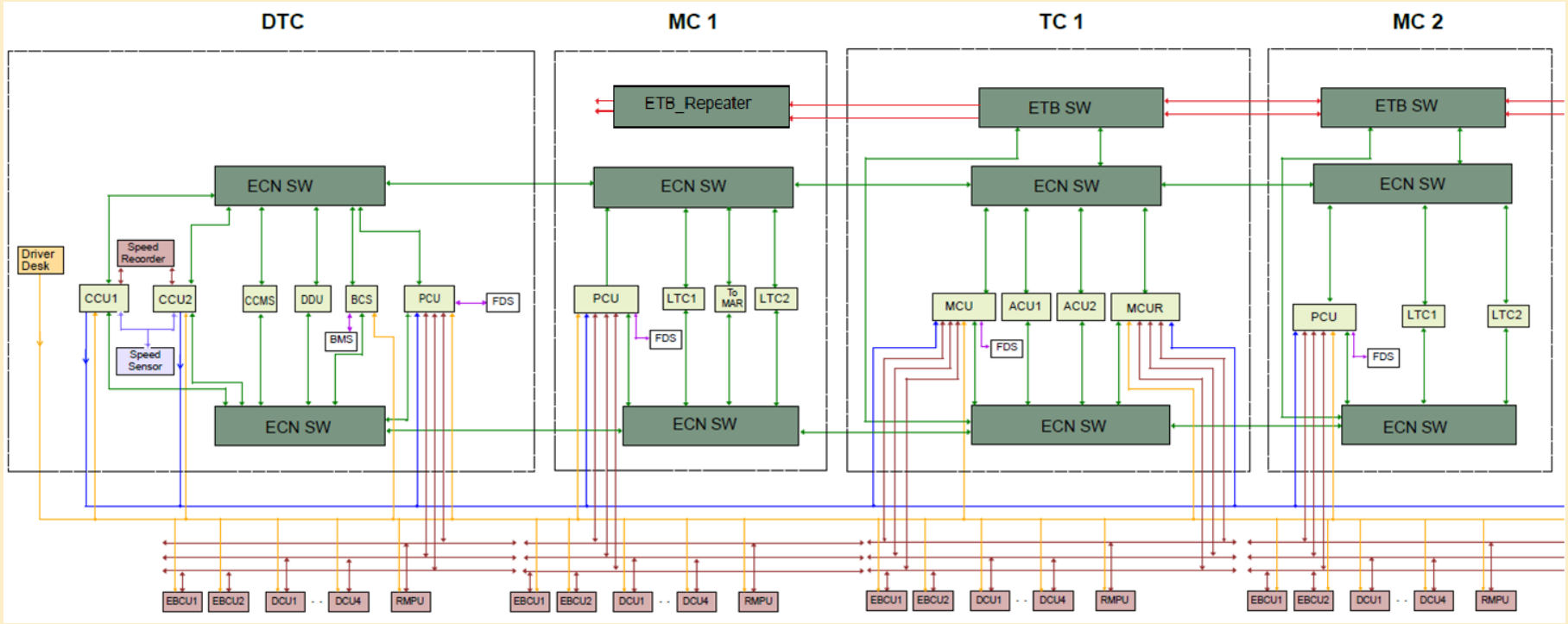
POWER COUPLER ARRANGEMENT IN RAKE FORMATION



110 V DC BD AND BN IN RAKE FORMATION



TCMS - END BASIC UNIT



Ethernet Consist Network

CAN Communication

Speed Sensor Interface

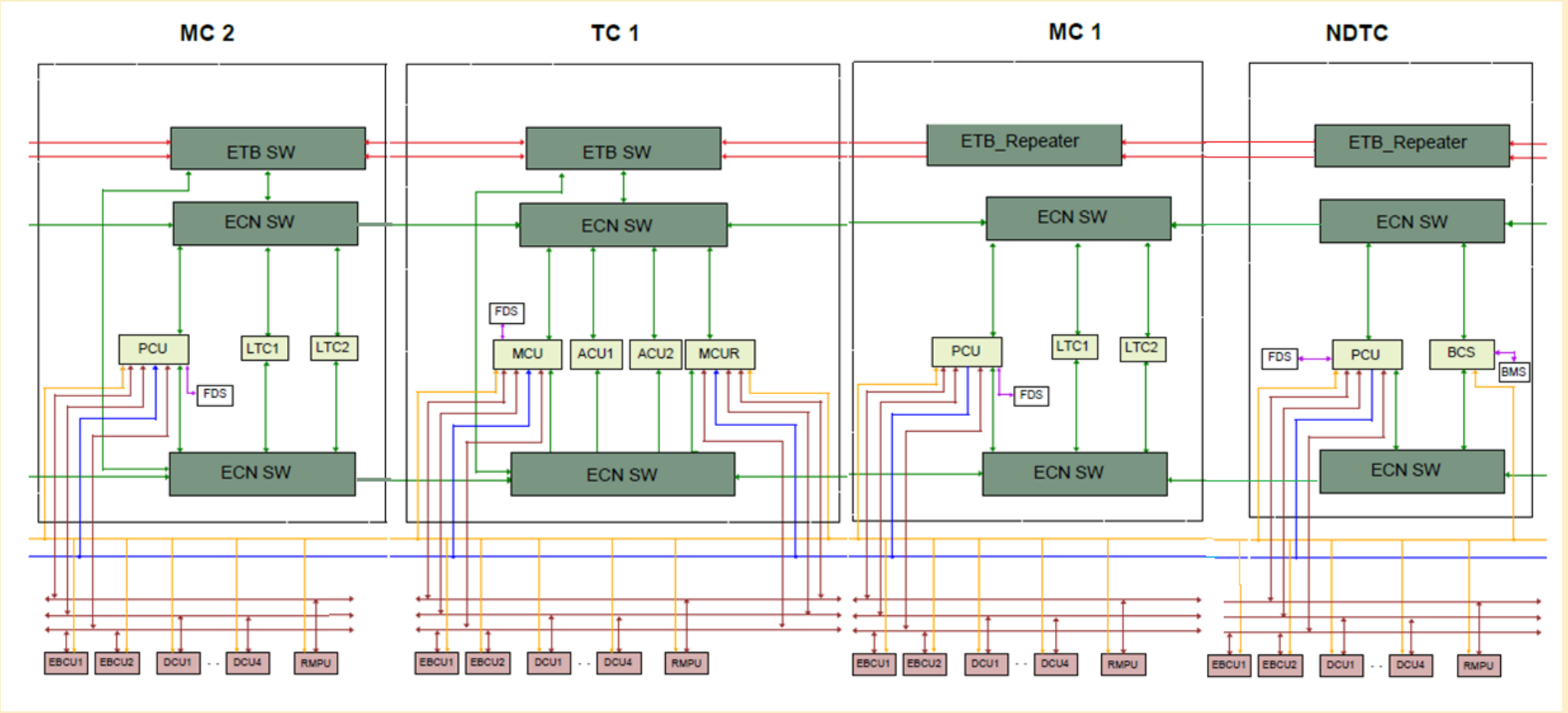
Train Line

RS485 Network

ETB

Frequency Generator Signal

TCMS - MIDDLE BASIC UNIT



Ethernet Consist Network
CAN Communication
Speed Sensor Interface
Train Line
RS485 Network
ETB
Frequency Generator Signal

Central Control Unit (CCU)

- Central Control Unit (CCU) is part of integrated control system provided for Trainset and is located in DTC
- CCU will be used as complete control master for entire train formation
- There will be two CCUs in each Driving Trailer Coach one as a Master and other as standby.
- CCU will be interfaced with different inputs and outputs
- CCU will do centralised control calculations & distribute the commands to MCU & PCU

Main control Unit (MCU)

- Main control Unit (MCU) is part of integrated control system provided for Trainset.
- This is available in Trailer Coach (TC) of each basic unit.
- MCU will be used as interface for motor coaches for Line and Traction converter interface.
- MCU will do all control related calculations of data received from PCU & data read through digital inputs & analog inputs for that particular basic unit motor coaches.
- used as redundancy to MCUR for EP brake control, Door control, RMPU control and light control in each Trailer coach
- MCUR will take over control function only when MCU is not healthy or unable to do braking function.

Passenger Comfort Control Unit (PCU)

- Passenger Comfort Control Unit (PCU) is part of integrated control system provided for Trainset
- located in DTC, NDTC and MC.
- PCU of DTC,MC and NDTC controls lights, interface with RMPU,EBCU,FDS and door based on command received from CCU.
- It also controls compressor(in DTC/NDTC) and parking brake.
- PCU communicates with RMPU through RS-485 communication and gets the status data and fault data to show on DDU.
- PCU communicates with DCUs through RS-485 communication and gets the status data and fault data to show on DDU.
- PCU communicates with EBCUs through RS-485 communication to provide brake related
- commands to EBCU and gets the status data and fault data to show on DDU.

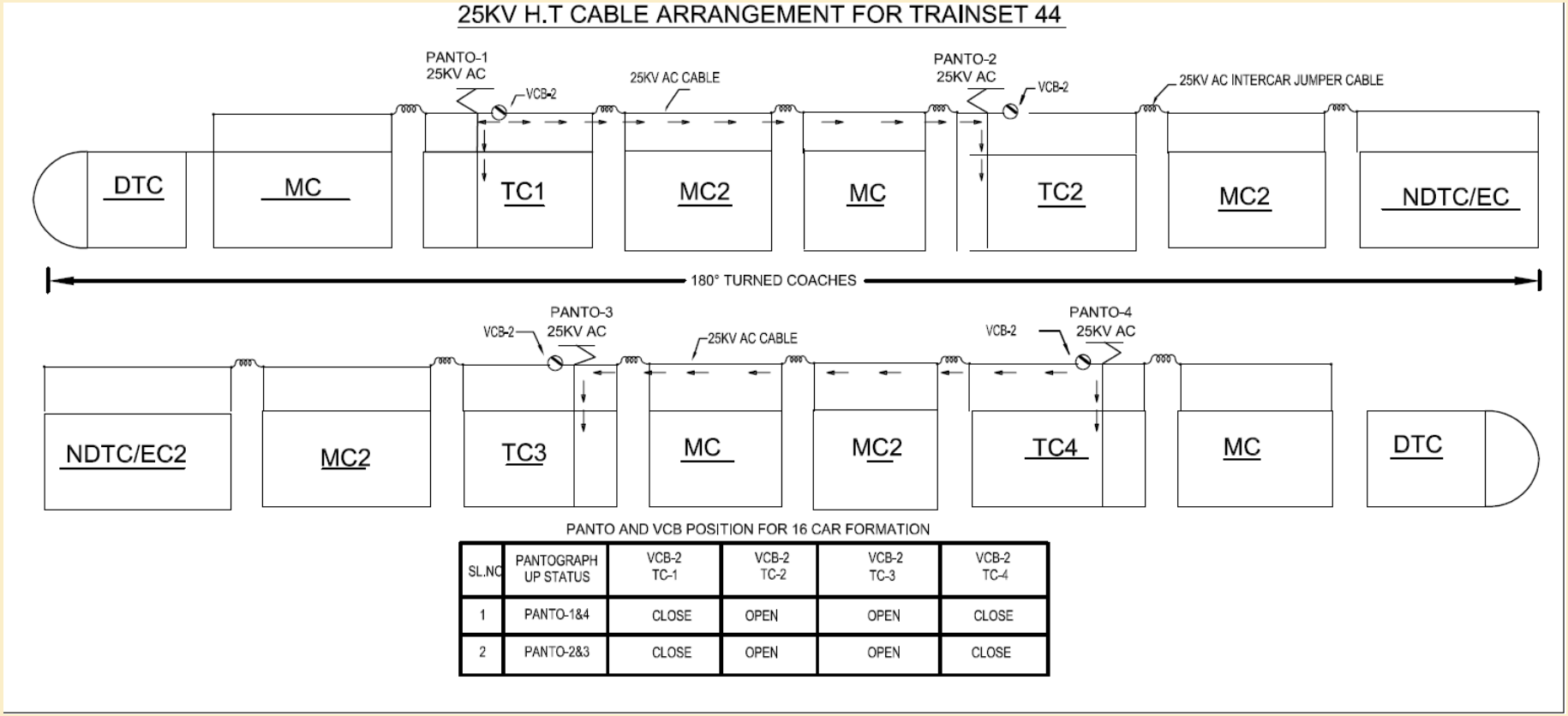
ECN NETWORK

- Each coach has two ECN switches, one is main and another one is redundant
- ECN communication is limited to Basic unit level
- Each ECN switch communicates with CCU1,CCU2, PCU, MCU, MCUR, CCMS, DDU, LTC, ACU
- ECN switches of main and redundant of one coach is linked to another coach by network

ETB NETWORK

- Each basic unit has two numbers of Two channel ETB switches one in TC coach and another in MC2 coach
- Normally ETB switch in TC will act as master and in MC2 will act as slave. If ETB switch of TC fails, then MC2 will take over.
- ETB repeater is available in NDTC and MC1 coach

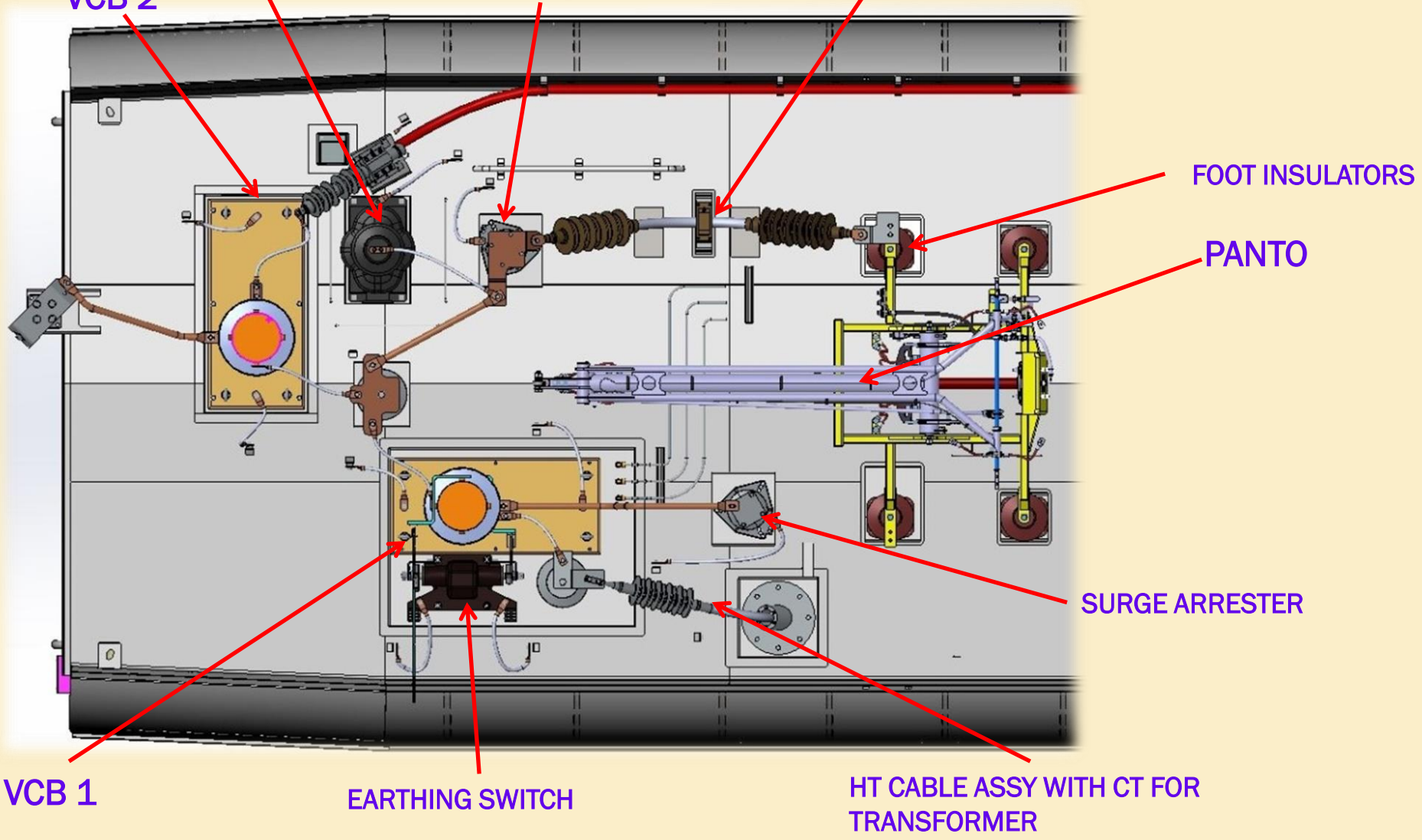
25KV HT CABLE ARRANGEMENT OVER THE ROOF OF THE TRAIN



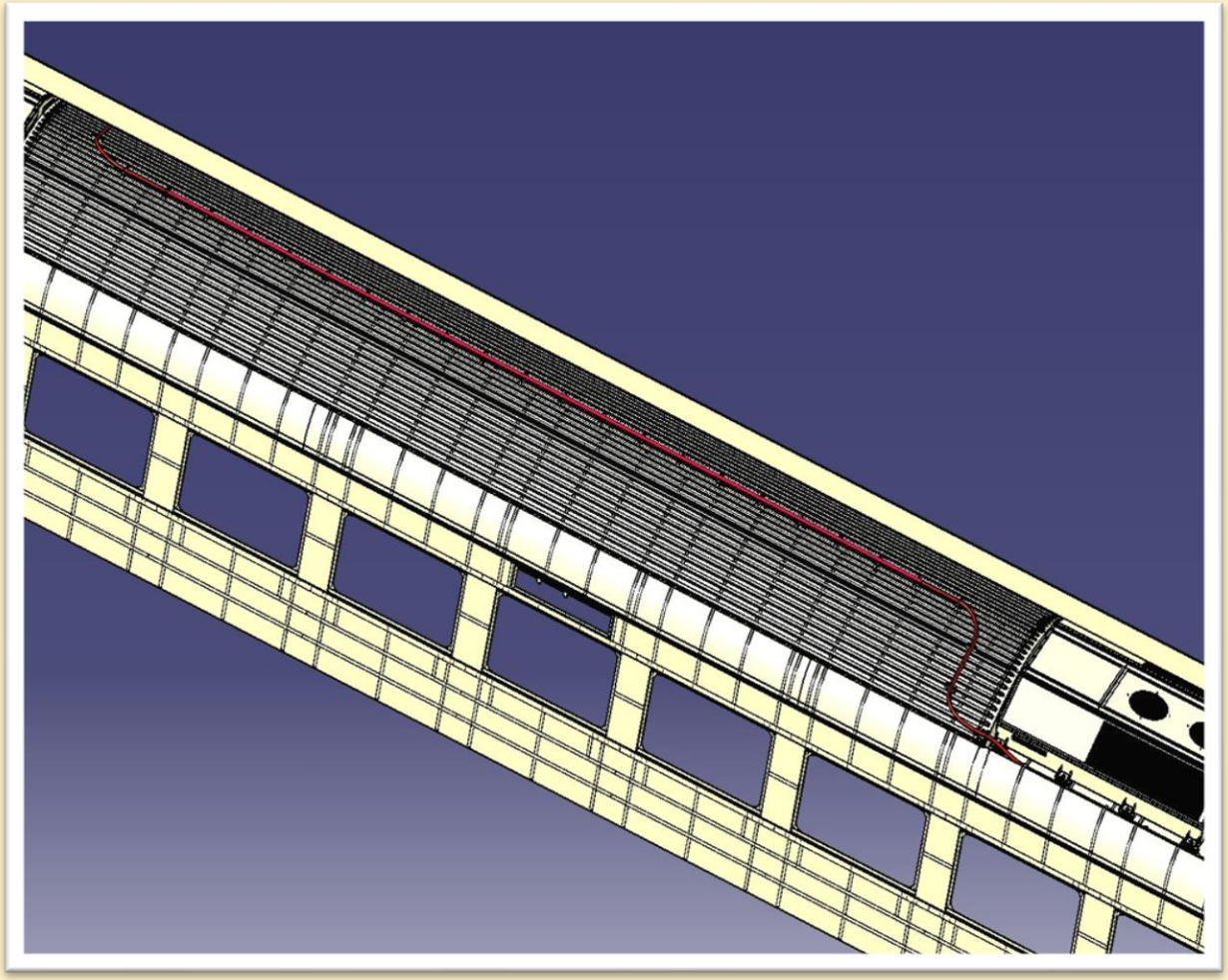
PANTO AND VCB POSITION FOR 16 CAR FORMATION

SL.NO	PANTOGRAPH UP STATUS	VCB-2 TC-1	VCB-2 TC-2	VCB-2 TC-3	VCB-2 TC-4
1	PANTO-1&4	CLOSE	OPEN	OPEN	CLOSE
2	PANTO-2&3	CLOSE	OPEN	OPEN	CLOSE

ABOVE ROOF EQUIPMENTS

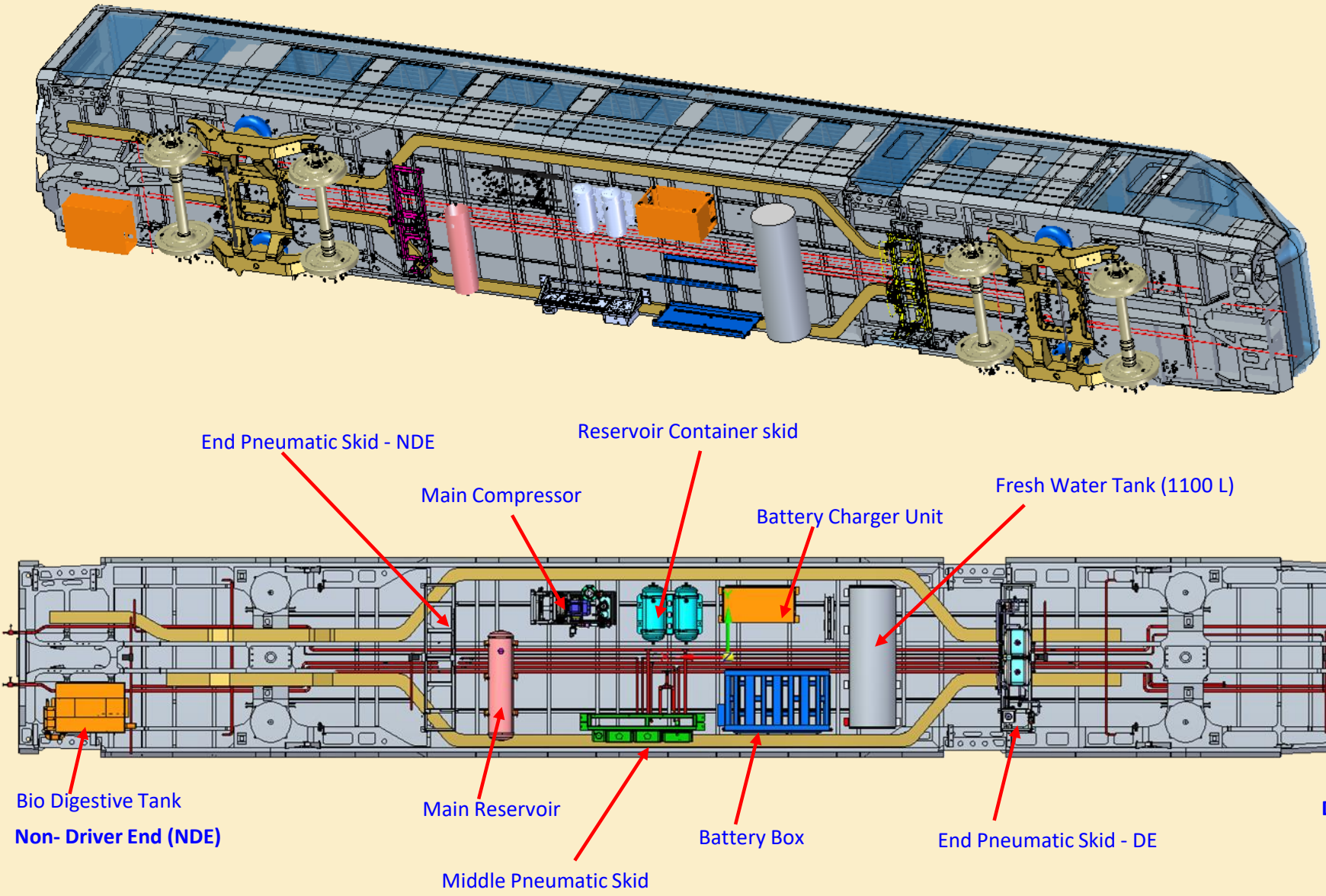


ROOF THROUGH HT CABLE ARRANGMENT



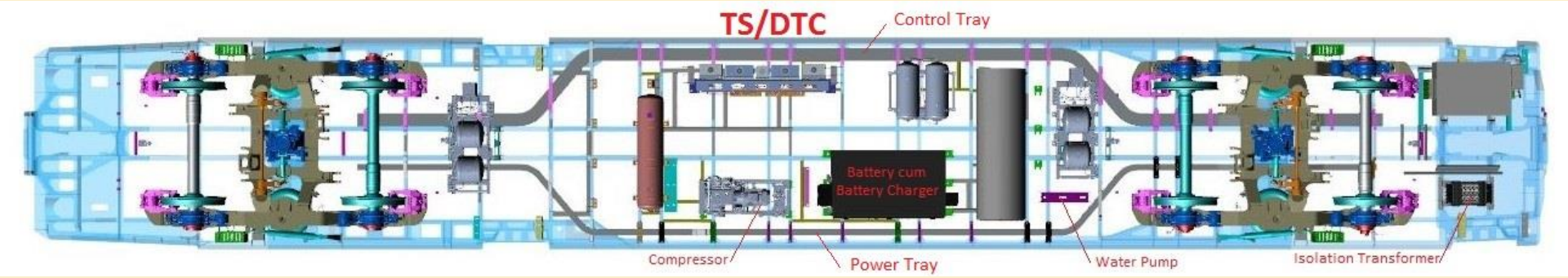
25 KV HT CABLE WITH MECHANICAL PROTECTION RUNNING THROUGH OUT THE ROOF SUPPLIED BY M/s.TE CONNECTIVITY

DTC - UNDERFRAME EQUIPMENTS



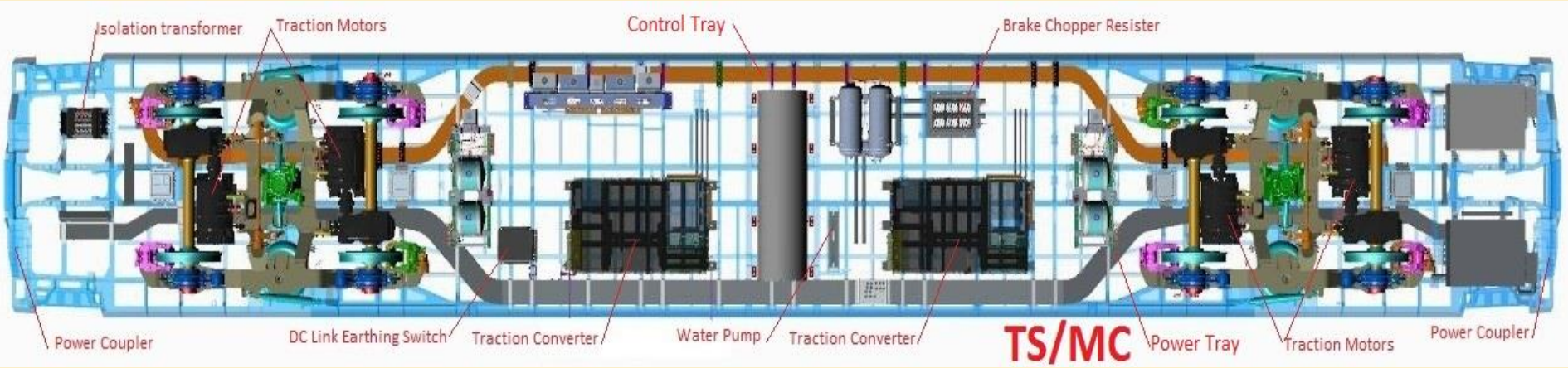
DTC - Bottom View - Equipments

DTC- UNDERFRAME EQUIPMENT LAYOUT

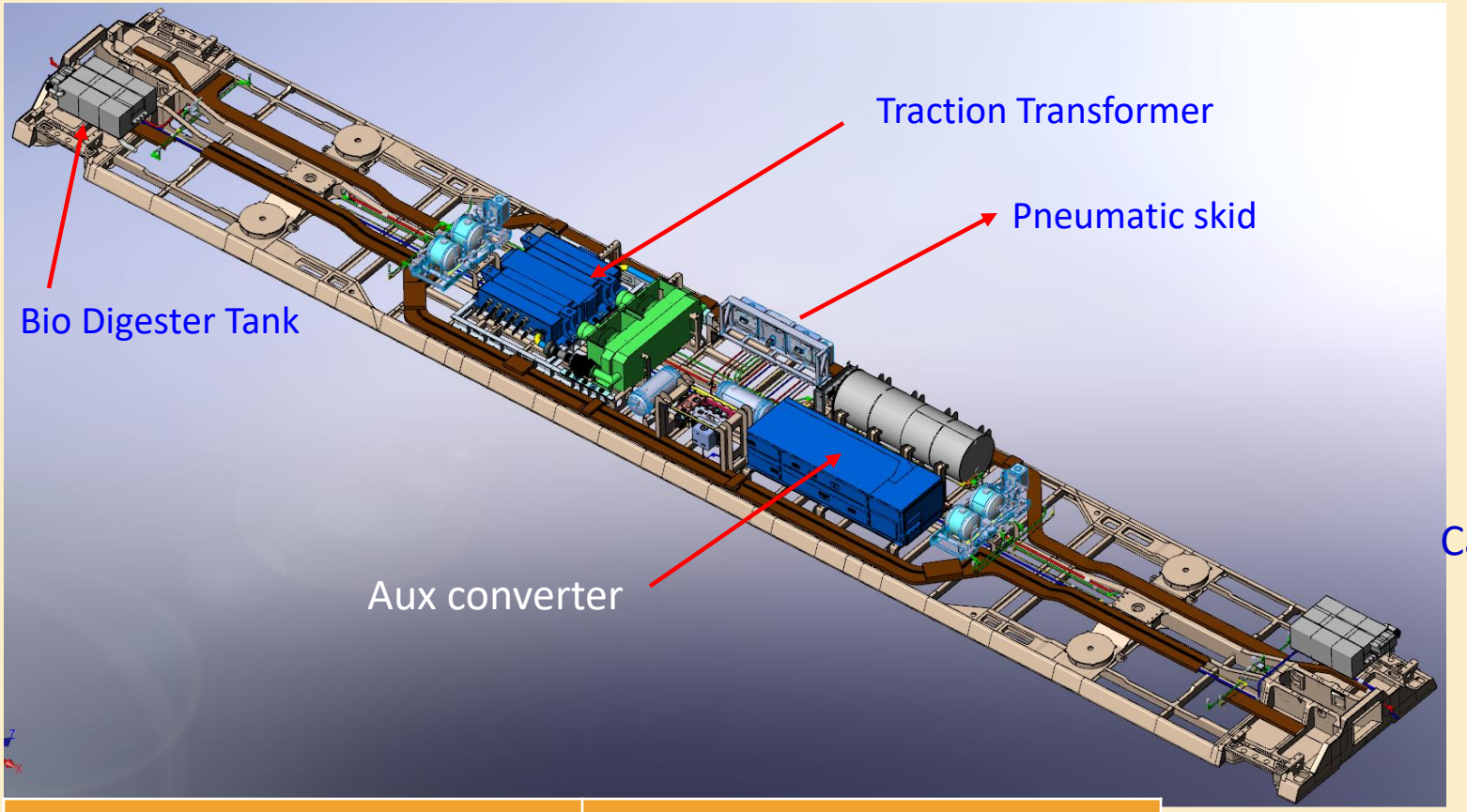


DTC/NDTC UNDERFRAME EQUIPMENTS	QTY
BATTERY BOX cum BATTERY CHARGER	1
ISOLATION TRANSFORMER	1
WATER PUMP	1

MC – UNDERFRAME EQUIPMENTS

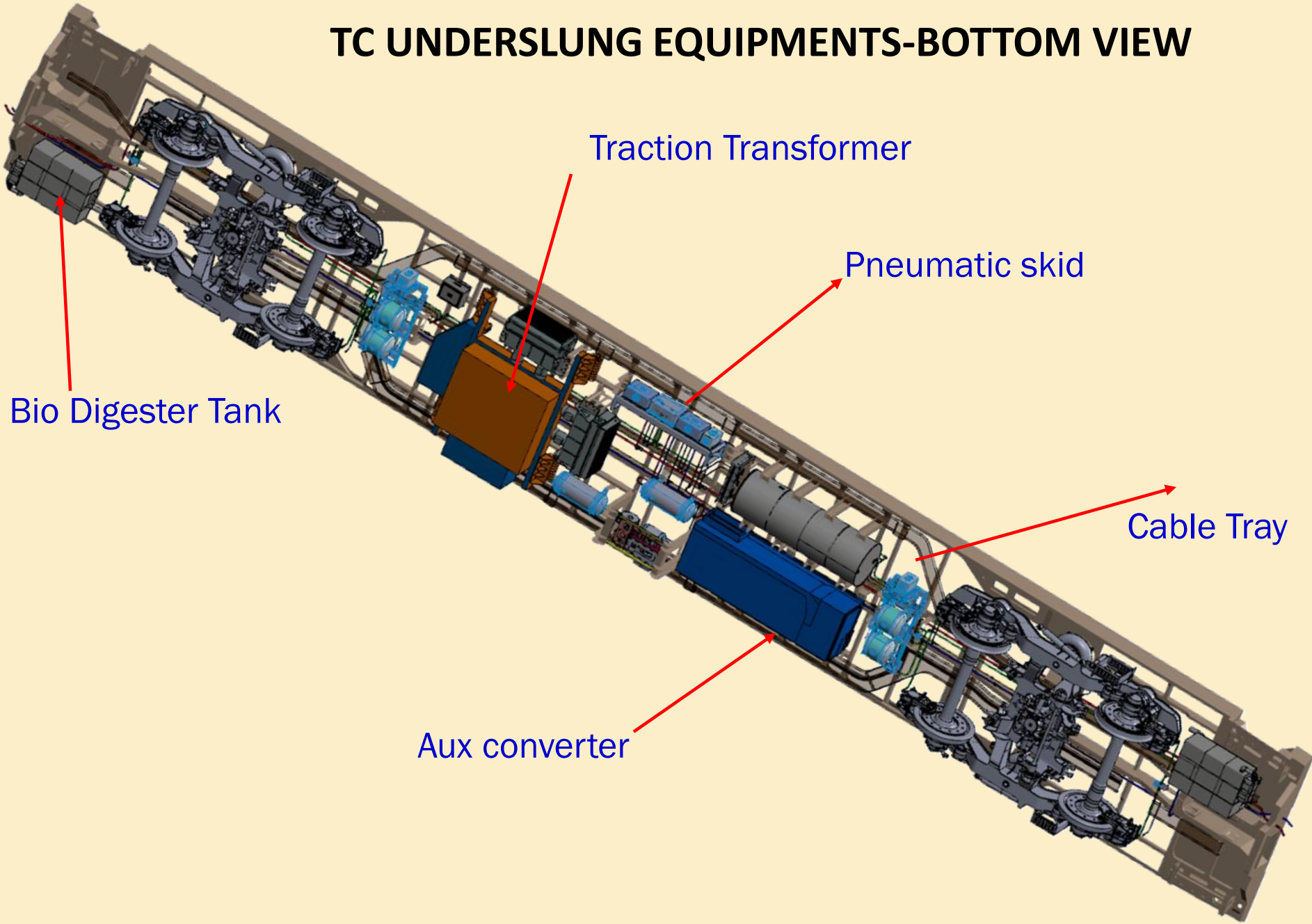


TC UNDERSLUNG EQUIPMENTS

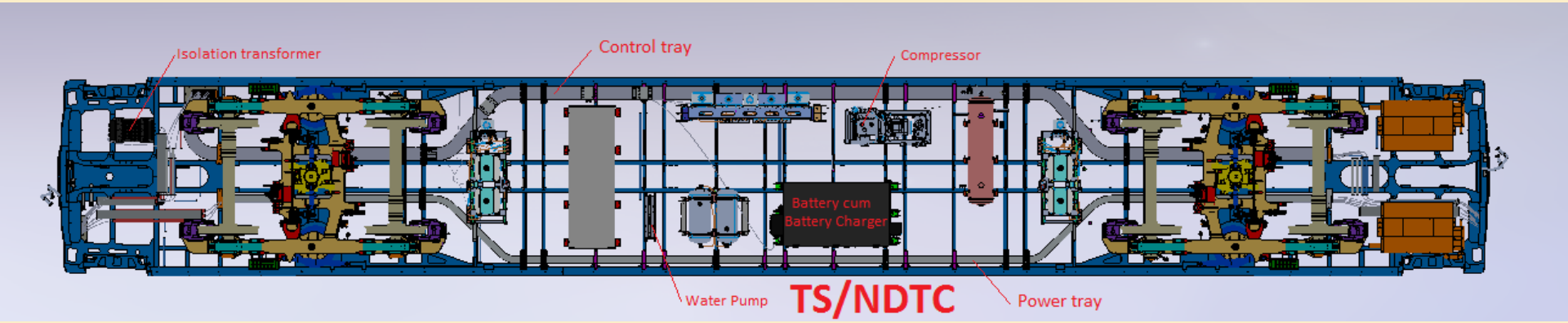


MC UNDERFRAME EQUIPMENTS	QTY
TRACTION CONVERTER	2 NOS
TRACTION MOTOR JUNCTION BOX	4 NOS
BRAKE CHOPPER RESISTANCE	1 NO
WATER PUMP	1 NO
EARTHING SWITCH	1 NO
ISOLATION TRANSFORMER	1 NO

TC UNDERSLUNG EQUIPMENTS-BOTTOM VIEW

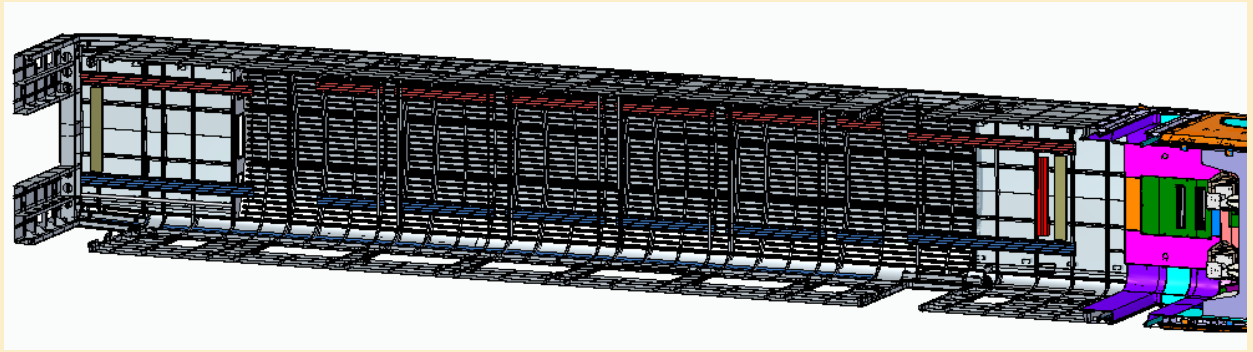


UNDERFRAME EQUIPMENT LAYOUT- NDTC

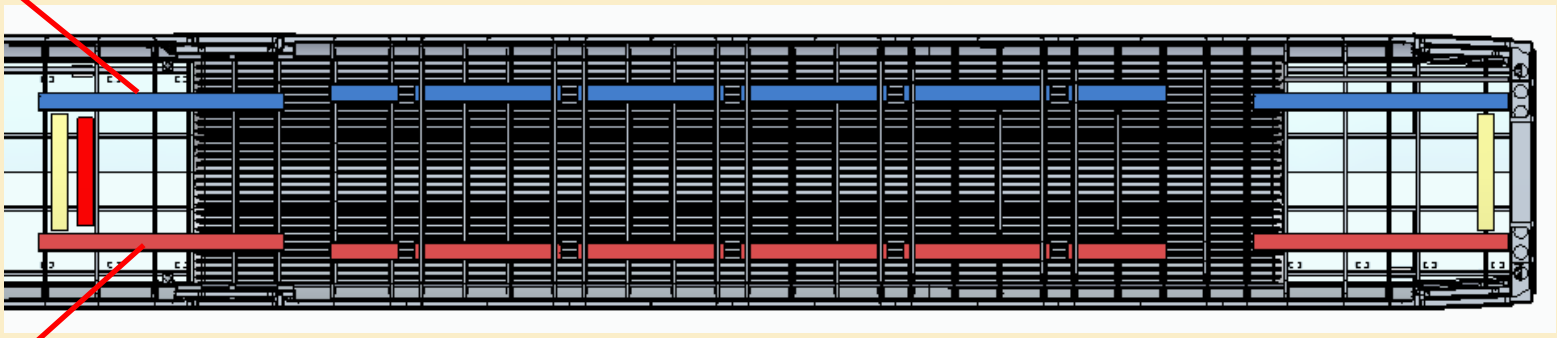


DTC/NDTC UNDERFRAME EQUIPMENTS	QTY
BATTERY BOX cum BATTERY CHARGER	1
ISOLATION TRANSFORMER	1
WATER PUMP	1

ROOF ARRANGEMENT



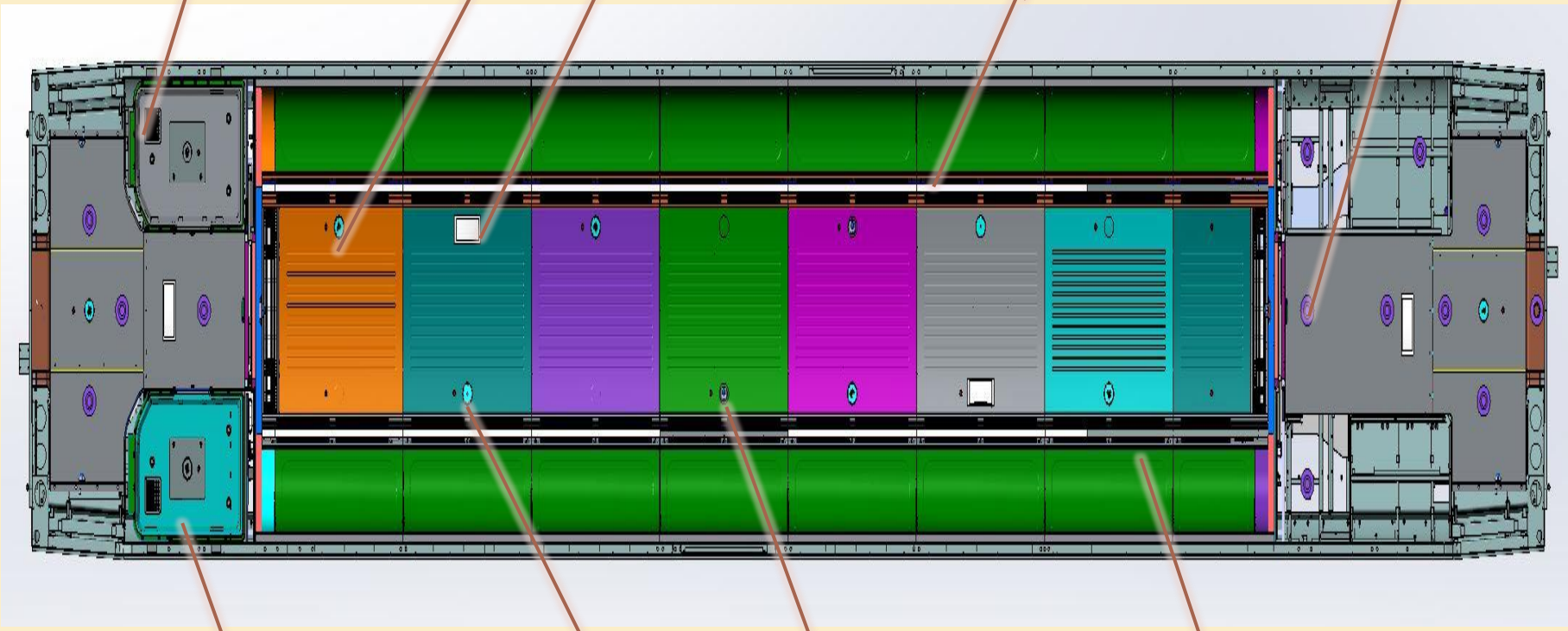
CABLE TRAY



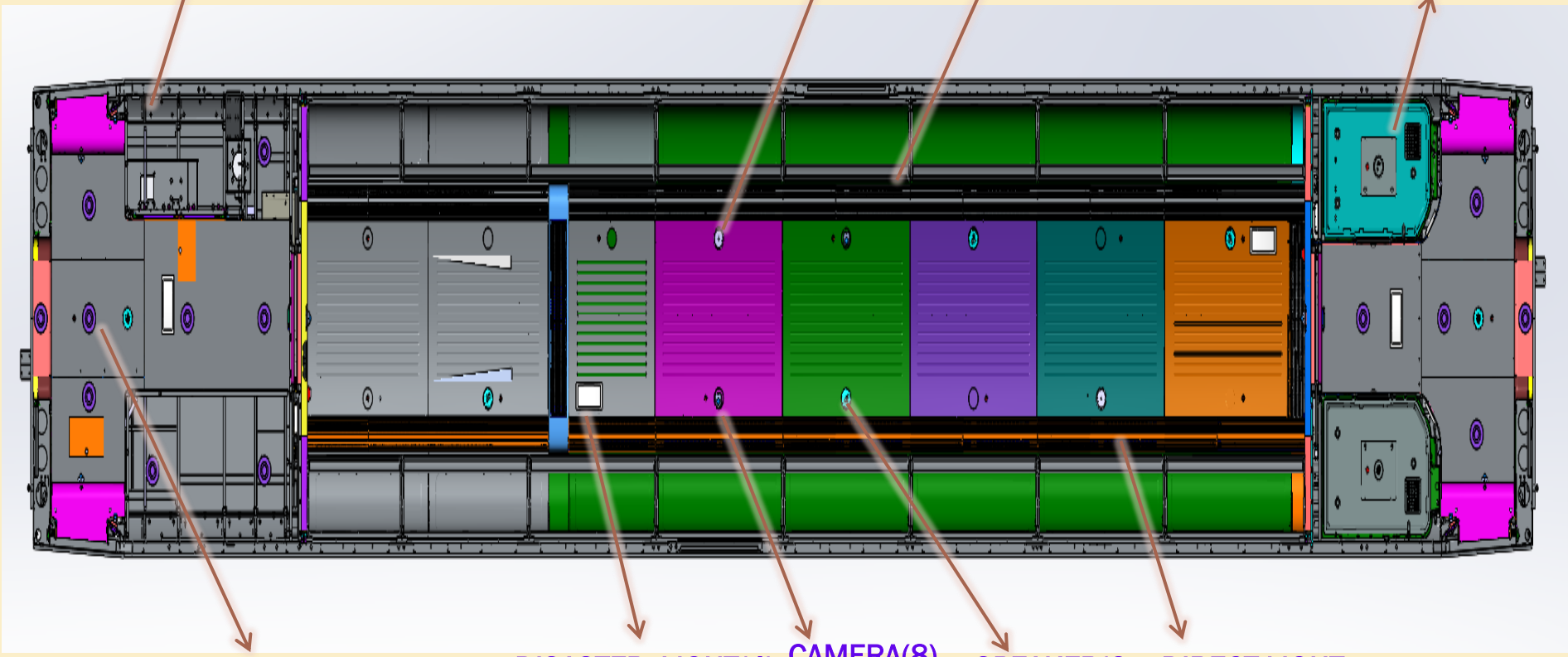
CABLE TRAY

- INSIDE ROOF TRAYS AND CONDUITS ARE PROVIDED FOR CABLE ROUTING.
- CONDUITS ARE PROVIDED TOWARDS THE SIDES OF CARLINE FOR TRAIN LINE CABELS AND RMPU CABLES

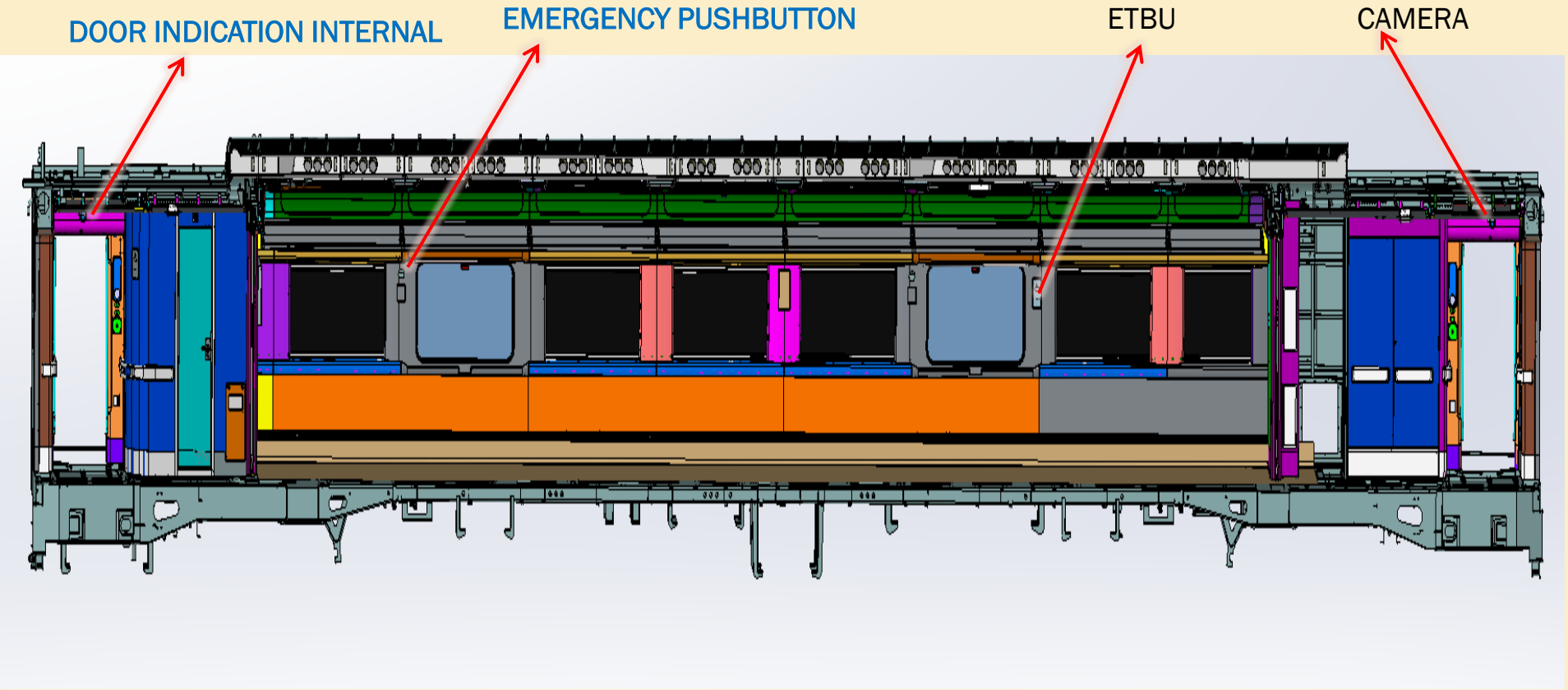
ROOF EQUIPMENTS-MC/NDTC COACH



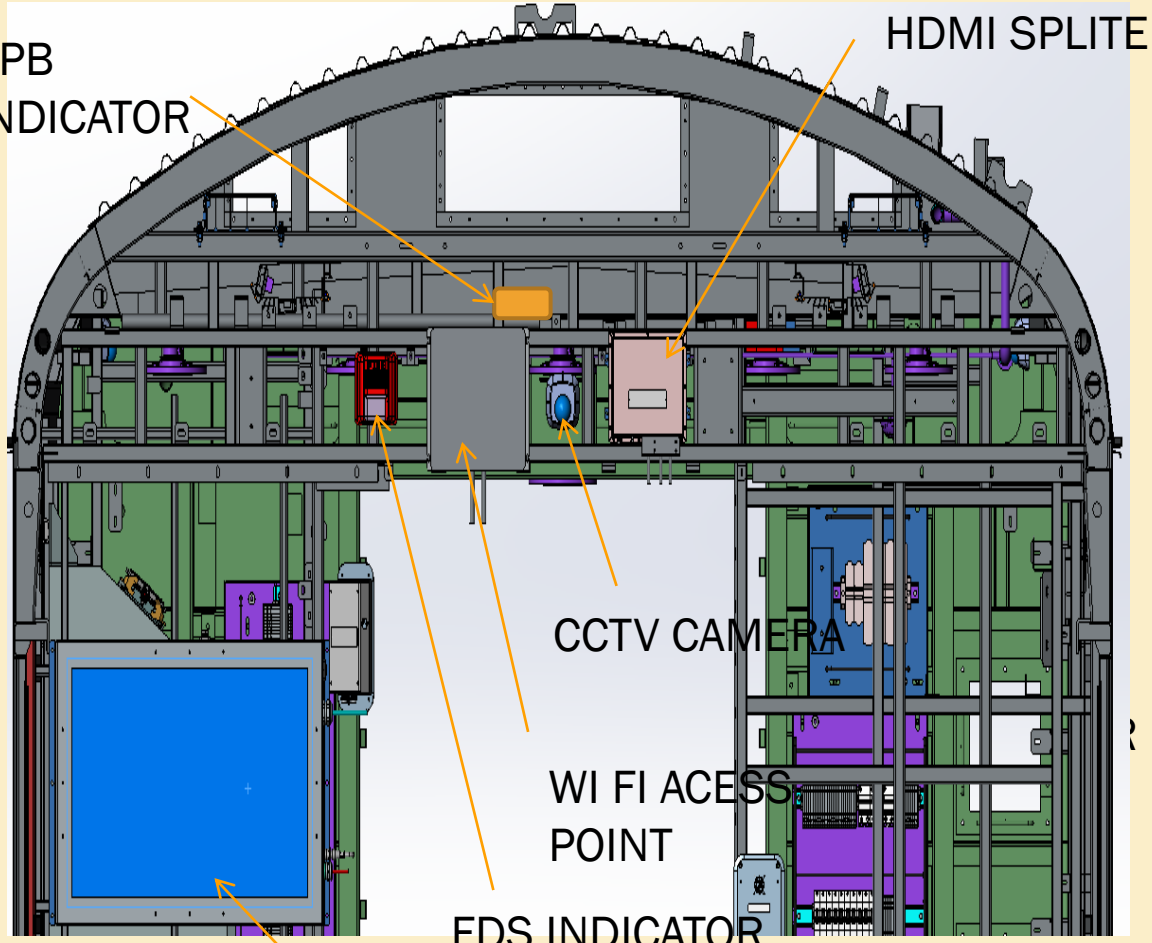
ROOF EQUIPMENTS-TC COACH



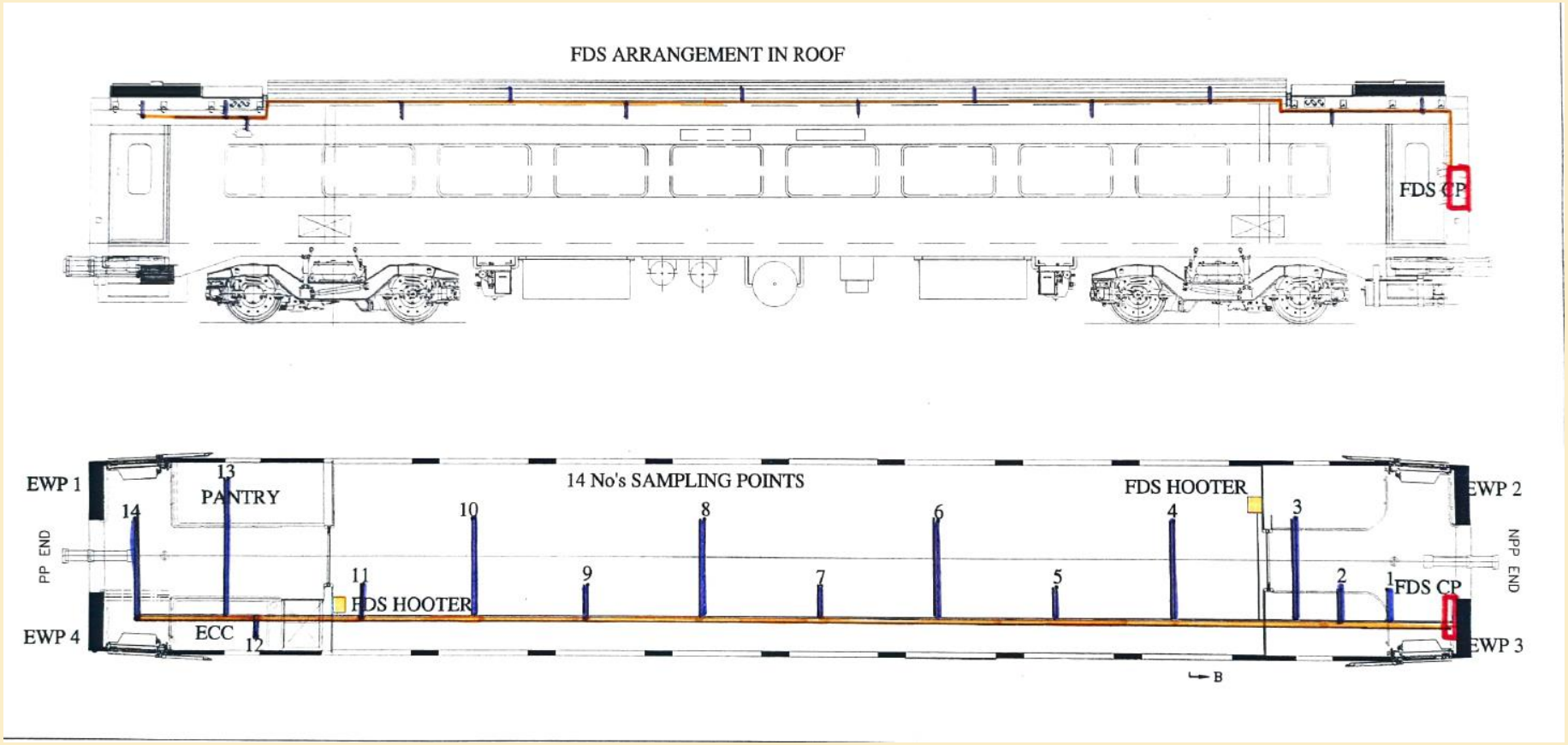
INNER COACH SIDE WALL EQUIPMENTS



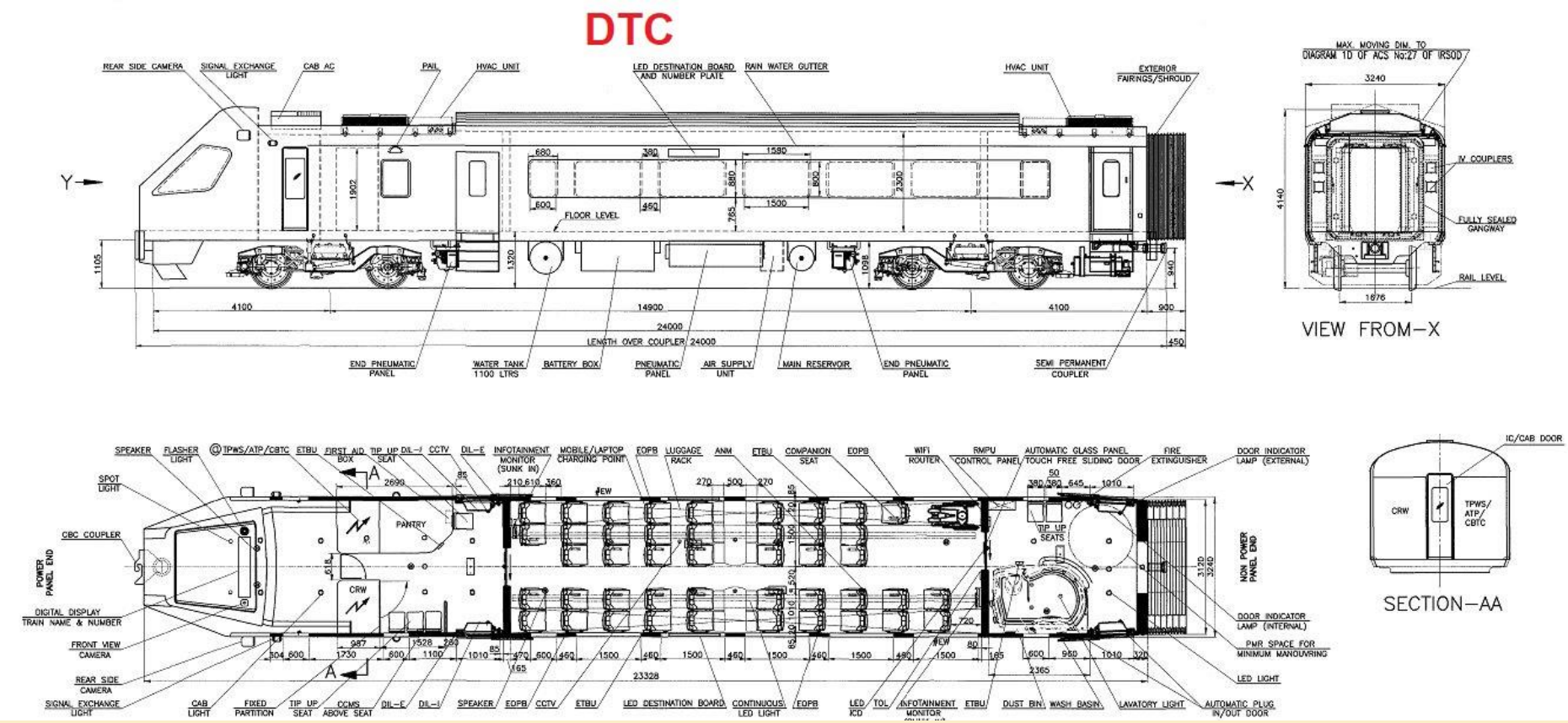
ABOVE IC DOOR PANEL & PARTITION PANEL EQUIPMENTS



FIRE DETECTION SYSTEM



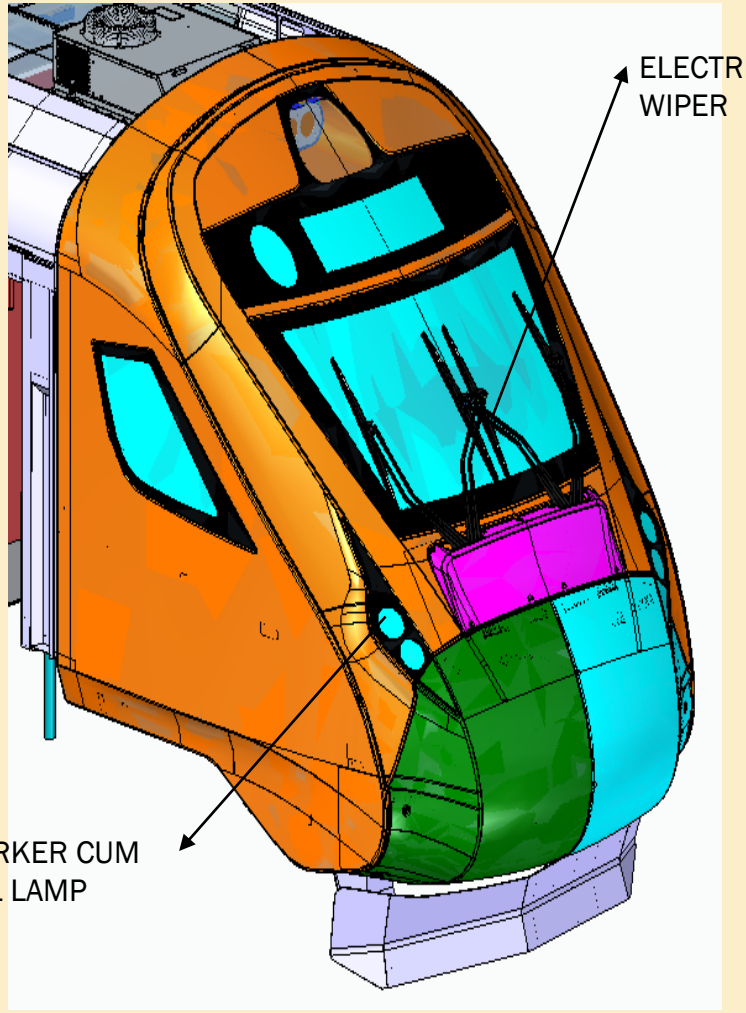
COACH INTERIOR - EQUIPMENT LAYOUT



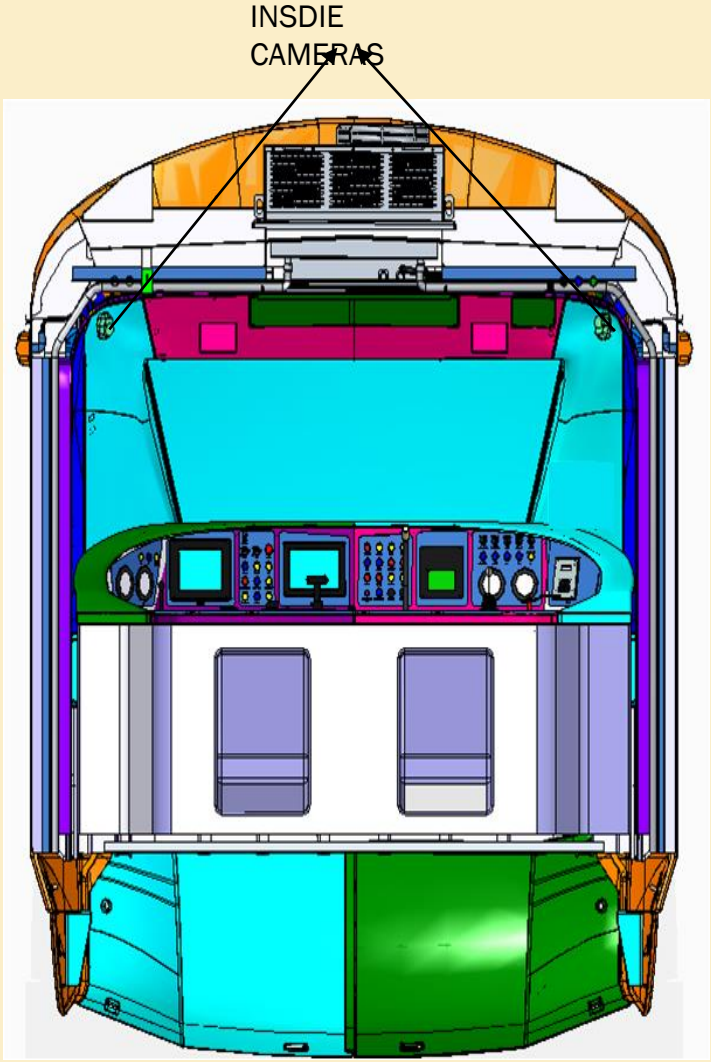
DTC LAYOUT

SEATING CAPACITY : 44

NOSE CONE ARRANGEMENT

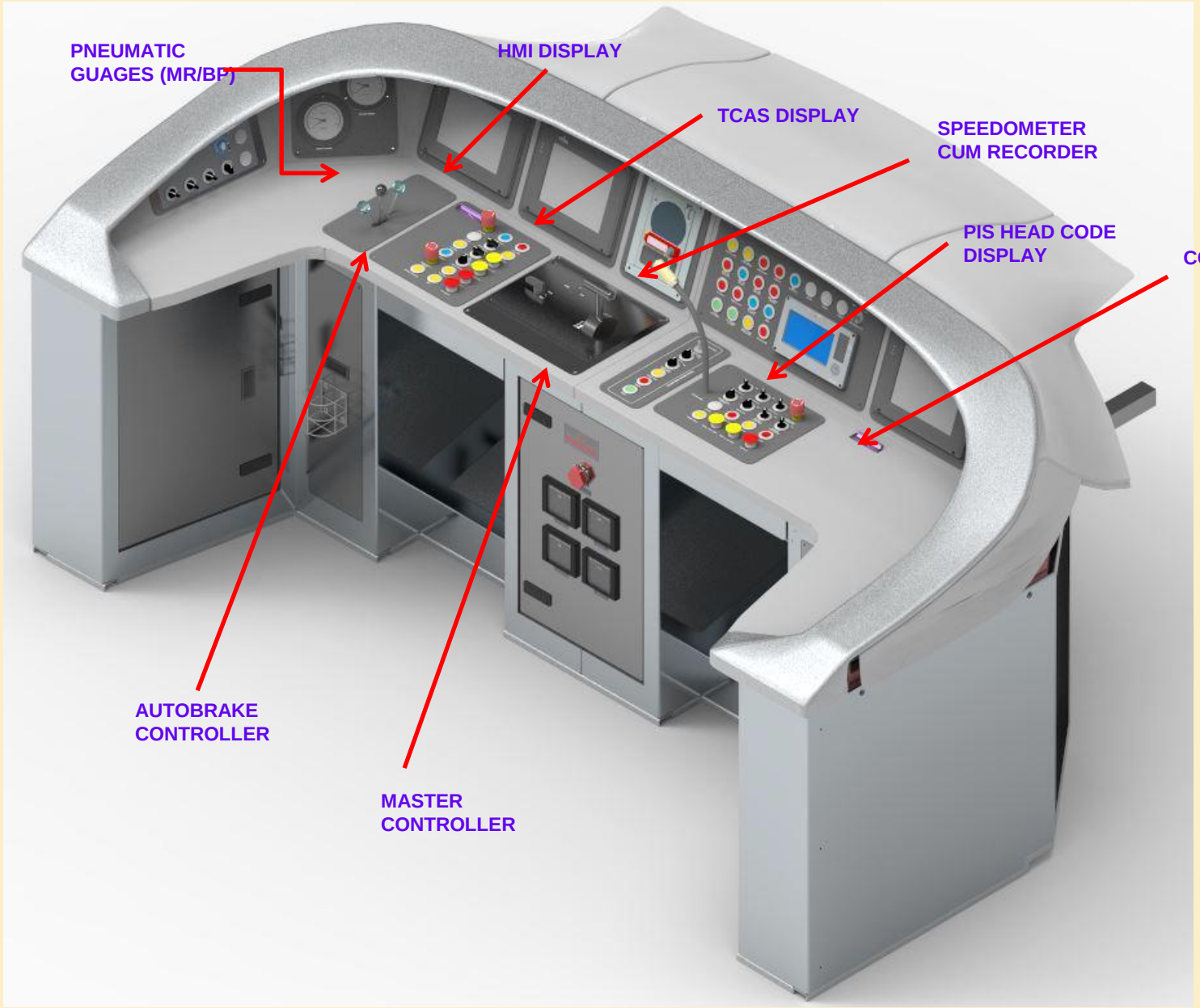


AERODYNAMIC NOSE CONE

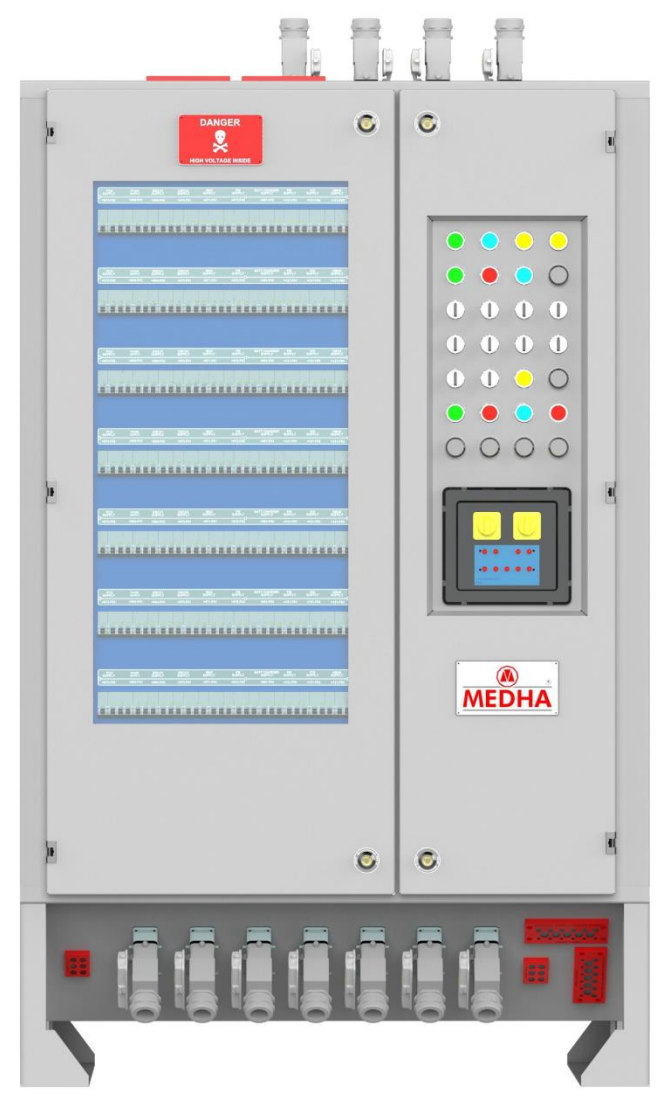


DRIVER DESK ARRANGEMENT INSIDE CAB

EQUIPMENT LAYOUT - DRIVERS DESK



DRIVERS CAB REAR WALL (CRW) PANEL



IMPROVEMENTS MADE

COMPARISION BETWEEN TRAIN 18 & NEW VB TRAINSET RAKE

S/N	Parameter		Train 18	Trainset
1	Time to reach 160 kmph		145s	140s
2	Redundancy for Auxiliary Converter		50% RMPU functioning in case of basic unit failure	100% RMPU functioning in case of basic unit failure
3	HT cable protection	Elec	By CT	By CT & VCB without earthing switch
		Mech	No	Yes
4	Disaster light		No	Yes (4 nos./coach)
5	Platform side camera		2Nos/DTC (Only EBU)	2Nos/DTC + 2Nos/NDTC (DTC/EBU + NDTC/MBU)

COMPARISION BETWEEN TRAIN 18 & NEW VB TRAINSET RAKE

S/N	Parameter	Train 18	Trainset
6	Synchronized 415 v bus	Not available	Available
7	Battery	300 AH VRLA battery	Explosion proof lithium-iron-phosphate batteries 684Ah combined with battery charger
8	HVAC	Direct switch on control	VVVF control for higher efficiency (for one compressor)
9	SIL certification of TCMS	nil	SIL 2 (safety integration level)
10	Ventilation duct for TM	No. Part of TM itself	Yes. Provided on sidewall
11	Signal exchange light	No	Yes (2 nos/DTC)

COMPARISION BETWEEN TRAIN 18 & NEW VB TRAINSET RAKE

S/N	Parameter	Train 18	Train set
12	Fire detection system	Smoke detection only in RMPU unit.	FIRE DETECTION SYSTEM in all coaches
13	Fire survival cable	Available for plug door	For PA/PIS, ETB circuit, Passenger Alarm, Fire detection system and Door system.
14	Traction motor connection	By Junction box	By plug and socket assembly
15	Display unit for passengers	For PIS above IC door - 2 nos/C. For infotainment system (24”) – 4 nos.	For PIS above IC door- 2 nos/C. For PIS & Infotainment system (32”) – 2 nos.
16	CCMS	NO	YES (for air conditioning monitoring & control and communicating information/alert to control centre/maintenance staff through GSM/GPRS)

EQUIPMENT RATINGS

RATINGS OF MAJOR EQUIPMENTS

Sl.No	Description of Major Equipments	Rating
1	MAIN TRANSFORMER	PRIMARY-2556KVA 22.5KV /114A
		TRAC.SECONDARY (4 windings) 855V AC at 22.5KV for Traction
		Secondary(2 windings)342V AC At 22.5KV for Aux
		ClASS-A INSULATION
2	OUTPUT CT	250A/1A
3	TRACTION CONVERTER	2X532KVA I/P-627V RMS-1140V RMS
		O/P- 3PHASE 1430 V RMS, : 2 X 120A,0-175HZ
4	TRACTION MOTOR	CONTINUOUS RATING :210KW,1375V,120A,111.1Hz ONE HOUR RATING: 230KW,1375V,130A
5	TRACTION MOTOR GEAR RATIO	5 : 158
6	AUXILIARY CONVERTER	INPUT 1- 285-415V SINGLE PHASE 50HZ INPUT 2- 285-415V SINGLE PHASE 50HZ
		Inverter Module1 output: 415AC 3 Phase 50Hz, 200KVA(As per Name Plate): 264KVA(Calculated)
		Inverter Module-2 output: 415AC 3 Phase 50Hz, 200KVA(As per Name Plate): 264KVA(Calculated)
		Output-3 DC Output(BN,BD): 110VDC,30KW

RATINGS OF MAJOR EQUIPMENTS

Sl.No	Description of Major Equipments	Rating
7	PANTO GRAPH	1.5 KV TO 25 KV 400A
8	AC SURGE ARRESTOR (MAIN)	40KV AC
9	LINE VOLTAGE Transformer	25KV/200V
10	VCB	25KV AC,50Hz,I=1KA 25KV AC,50Hz,I=1KA
11	AC EARTHING SWITCH	
12	HT CABLE	25KV AC
13	INPUT CURRENT TRANSFORMER	250A / 1A
14	BRAKE CHOPPER RESISTOR	3.42Ohm – 4.85 Ohm

CARE TAKEN DURING MANUFACTURING

- ✓ Stage wise inspection is being carried out
- ✓ Regular meetings are being carried out to resolve the teething issues
- ✓ Torque value is being ensured for mechanical tightness of equipment as well as electrical termination
- ✓ Ensure proper cable laying with respect to voltage segregation, protection against sharp edges etc.,

COMMISSIONING PLAN

A) STAGE INSPECTION

- ✓ UNDERFRAME CABLE HARNESS INPECTION
- ✓ ROOF CABLE HARNESS INSPECTION
- ✓ UNDERFRAME TRAY CABLING ARRANGEMENT INSPECTION
- ✓ CABLE ROUTING AND CLAMPING INSPECTION
- ✓ EARTHING ARRANGEMENT INSPECTION
- ✓ EQUIPMENT MOUNTING INSPECTION
- ✓ CONTROL AND POWER CABLE CONTINUITY CHECK
- ✓ CABLING INSULATION AND HIGH VOLTAGE TEST

COMMISSIONING PLAN

A) STATIC COMMISSIONING (BASIC UNIT LEVEL)

- ✓ BATTERY SUPPLY AND CHARGING
- ✓ ERCU VALIDATION
- ✓ CAB ACTIVATION
- ✓ BASIC UNIT CONFIGURATION
- ✓ NETWORK ESTABLISHMENT (ECN)
- ✓ PANTO, VCB PROTOCOL VALIDATION
- ✓ TRAIN LINE PROTOCOL CHECKING
- ✓ 415v MAIN AIR COMPRESSOR PROTOCOL
- ✓ AUTO AND EP BRAKE TESTING
- ✓ RMPU TESTING AND AIRCONDITIONING PERFORMANCE
- ✓ DOOR PERFORMANCE AND INTERLOCK
- ✓ ALL SENSORS VALIDATION
- ✓ AUX CONVERTER ENERGISING WITH OHE AND ITS PERFORMANCE
- ✓ TRACTION INVERTER ENERGISING AND MOVEMENT

COMMISSIONING PLAN

B) STATIC COMMISSIONING (RAKE LEVEL)

- ✓ BATTERY SUPPLY AND CHARGING
- ✓ CAB ACTIVATION FROM BOTH ENDS
- ✓ NETWORK ESTABLISHMENT (ECN &ETB)
- ✓ TRAIN LINE PROTOCOL CHECKING
- ✓ OHE ENERGISING AND AUXILIARY CONVERTER PERFORMANCE
- ✓ COMPRESSOR MANAGEMENT VALIDATION
- ✓ 110V AND 415 V REDUNDANCY CHECK
- ✓ DOOR INTERLOCKS WITH TRACTION VALIDATION
- ✓ CCTV PROTOCOL
- ✓ PASSENGER SURVILIANCE SYSTEM PROTOCOL
- ✓ BRAKE PROTOCOL VALIDATION
- ✓ TRACTION INVERTER ENERGISING AND MOVEMENT

COMMISSIONING PLAN

C) DYNAMIC COMMISSIONING (RAKE LEVEL)

- ✓ CAB ACTIVATION FROM BOTH ENDS
- ✓ OHE ENERGISING AND AUXILIARY CONVERTER PERFORMANCE
- ✓ REDUNDACNY CHECK
- ✓ DOOR INTERLOCKS WITH TRACTION VALIDATION
- ✓ CCTV PROTOCOL
- ✓ PASSENGER SURVILIANCE SYSTEM PROTOCOL
- ✓ TRACTION INVERTER ENERGISING AND MOVEMENT
- ✓ TRACTION WITH DIFFERENT MODES
- ✓ BASIC UNIT ISOLATION PERFORMANCE

Thank you