

SIEMENS ACDC EMU

# EMU

```
graph TD; EMU[EMU] --> Box[ ]; Box --> AC[AC EMU]; Box --> DC[DC EMU]; Box --> MEMU[MEMU]; Box --> ACDC[AC/DC EMU]; Box --> METRO[METRO];
```

The diagram illustrates a hierarchical structure starting with 'EMU' at the top. A large black arrow points down from 'EMU' to a wide, empty rectangular box. From the bottom of this box, five separate black arrows point down to five distinct categories: 'AC EMU', 'DC EMU', 'MEMU', 'AC/DC EMU', and 'METRO'. Each category is enclosed in its own rectangular box.

**AC  
EMU**

**DC  
EMU**

**MEMU**

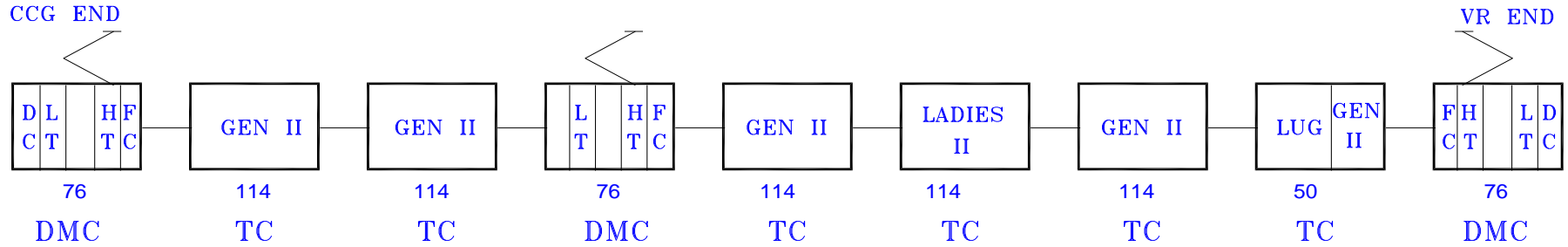
**AC/DC  
EMU**

**METRO**

# ADVANTAGES OF EMU TRAIN SETS

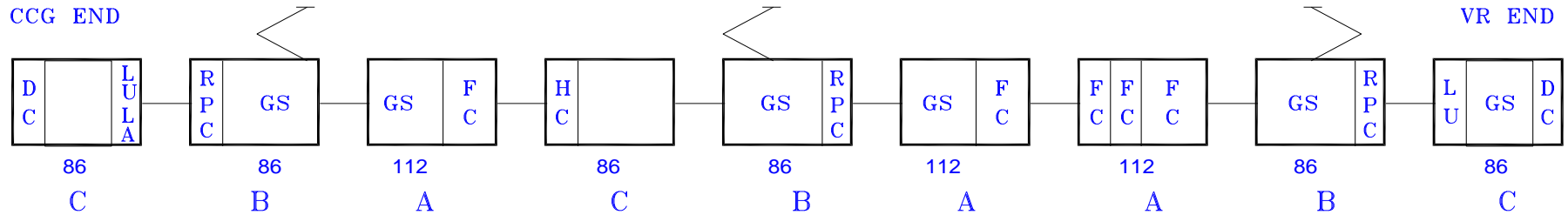
- **Higher reliability – due to distributed power units.**
- **Lower and distributed axle load-reduces track bridge maintenance and increases assets life.**
- **Higher acceleration and deceleration –due to distributed power distribution.**
- **Higher floor area- due to elimination of loco.**
- **Elimination of reversal of train- increases operational efficiency.**
- **Noiseless and environment friendly –due to absence of power cars.**
- **Reduced maintenance ,long life of wheels and brake equipments- due to regenerative braking.**
- **Reduced coupler forces- increases safety.**
- **Due to higher acceleration and deceleration-less time in negotiating speed restrictions and achieving max speed.**
- **(It is possible to reduce the run time by 3 hrs by operating train at 130 kmph without any additional expenditure on track and other infrastructure.)**

### 9 CAR AC EMU FORMATION



TOTAL SEATING  
CAPACITY = 848

### 9 CAR DC EMU FORMATION



TOTAL SEATING  
CAPACITY = 852

# SIEMENS EMU



## Passenger carrying capacity( 12 car)

Type of load	No. of passenger	remarks
Normal load	1255	All in sitting condition
Crush load	2510	1255-in sitting condition 1255- in standing condition
Dense crush	3765	1255-in sitting condition 2510- in standing condition
Super dense Crush	4290	1255-in sitting condition 3035- in standing condition
Practical Dense Crush Load	5000	1255- In sitting condition 3745- In standing condition.

# ADVANTAGES OF 3-PHASE DRIVE

- Energy efficient.
- Passenger comfort due to step-less control.
- Better adhesion due to smooth control.
- Flexible operation , wide range of diagnostic features and very compact size of equipment due to adaptability to digital control.
- Robustness and reliability with low maintenance.
- High power/weight ratio.
- Inherent regenerative braking capability.
- Unity power factor in AC traction.

# THE ADVANTAGES OF 3 PHASE EMU

1. It enables energy efficiency.
2. It provides step less control thereby increasing passenger comfort.
3. Better adhesion between wheel and rail due to smooth control.
4. Due to digital electronic control, the flexible operation, wide range of diagnostic features and very compact size of equipment.



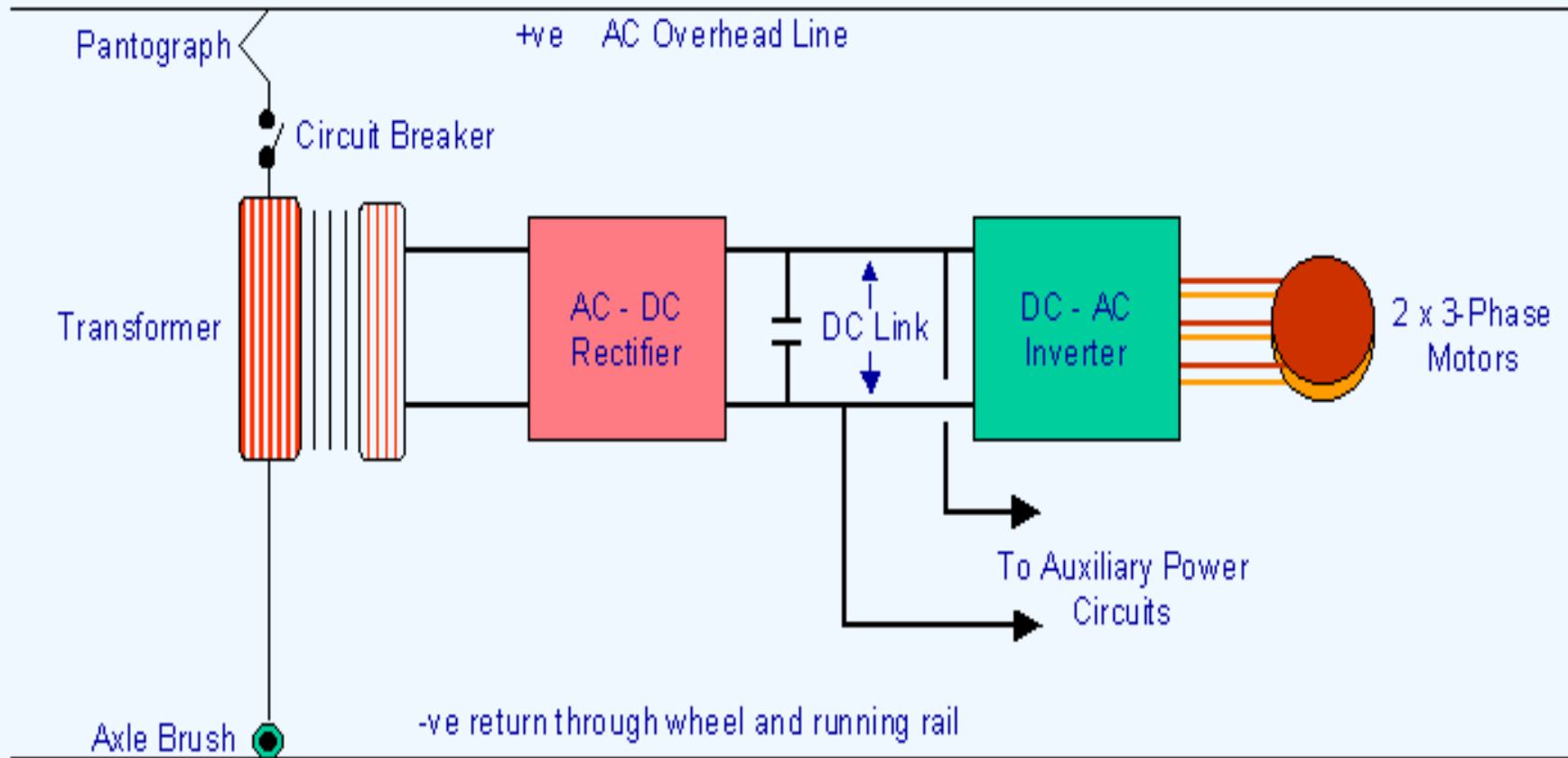
5. Robustness and reliability with a low maintenance requirement.
6. High power to weight ratio.
7. High voltage, low current operation.
8. Inherent regenerative braking capability.
9. Unity power factor in AC traction.
10. Roller bearings axle suspension reduces maintenance.

# LIST OF ABBREVIATIONS

- 4QC Four Quadrant Converter
- ACU Auxiliary Converter Unit
- BCU Brake Control Unit
- DTC Driving Trailer Car
  
- EP Electro-Pneumatic
  
- HSCB High Speed Circuit Breaker
  
- HTC High Tension Compartment
- IGBT Insulated Gate Bipolar Transistor

- KLIP Intelligent terminal for peripheral interfacing.
- MVB Multifunction Vehicle Bus.
- NDTC Non Driving Trailer Car
- SIBAS Siemens Bahn Automation System
- TCC Traction Converter Container
- TCU Traction Control Unit
- VCB Vacuum Circuit Breaker

# POWER CIRCUIT



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

# TRACTION EQUIPMENTS

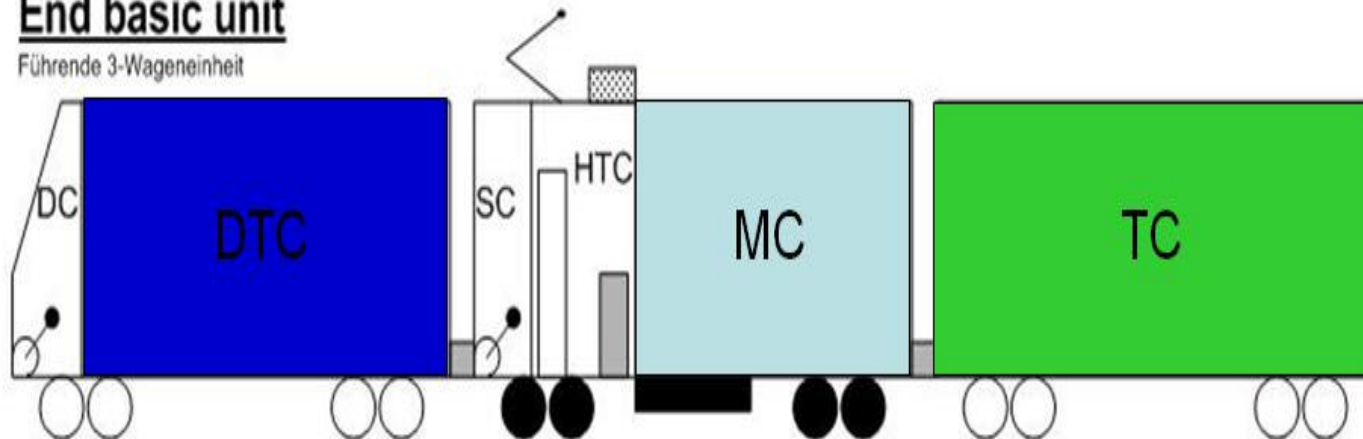
- PANTO GRAPH
- VCB/ABB
- MAIN TRANSFORMER
- 4QC CONVERTER
- DC LINK
- VVVF INVERTER
- TRACTION MOTORS

# AUXILIARY EQUIPMENTS

- AUXILIARY CONVERTER UNIT
- TRANSFORMER OIL PUMP
- RADIATOR FAN MOTORS
- TCC COOLING FAN MOTOR
- SIMPLIFIED BATTERY CHARGER
- MAIN COMPRESSOR
- AUXILIARY COMPRESSOR

## End basic unit

Führende 3-Wageneinheit

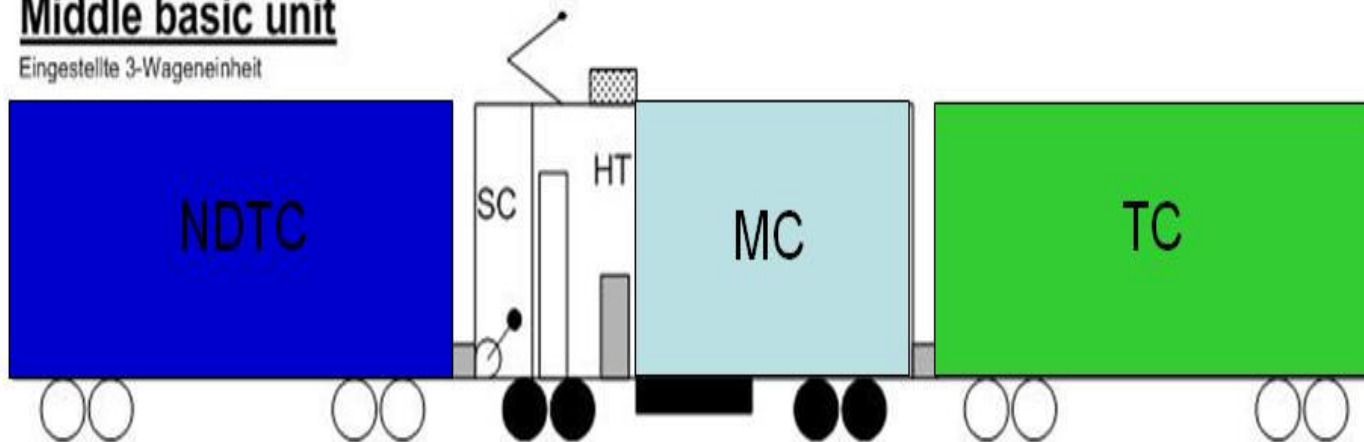


## Legend:

- DTC Driving Trailer Car
- MC Motor Car
- NDTC Non Driving Trailer Car
- TC Trailer Car
- HTC High Tension Comp.
- DC Driving Cab
- SC Shunting Cab
- Power axle
- Trailer axle
- Transformer
- ▨ Brake resistor
- Traction converter
- Auxiliary converter
- ⊙ Master controller
- < Pantograph

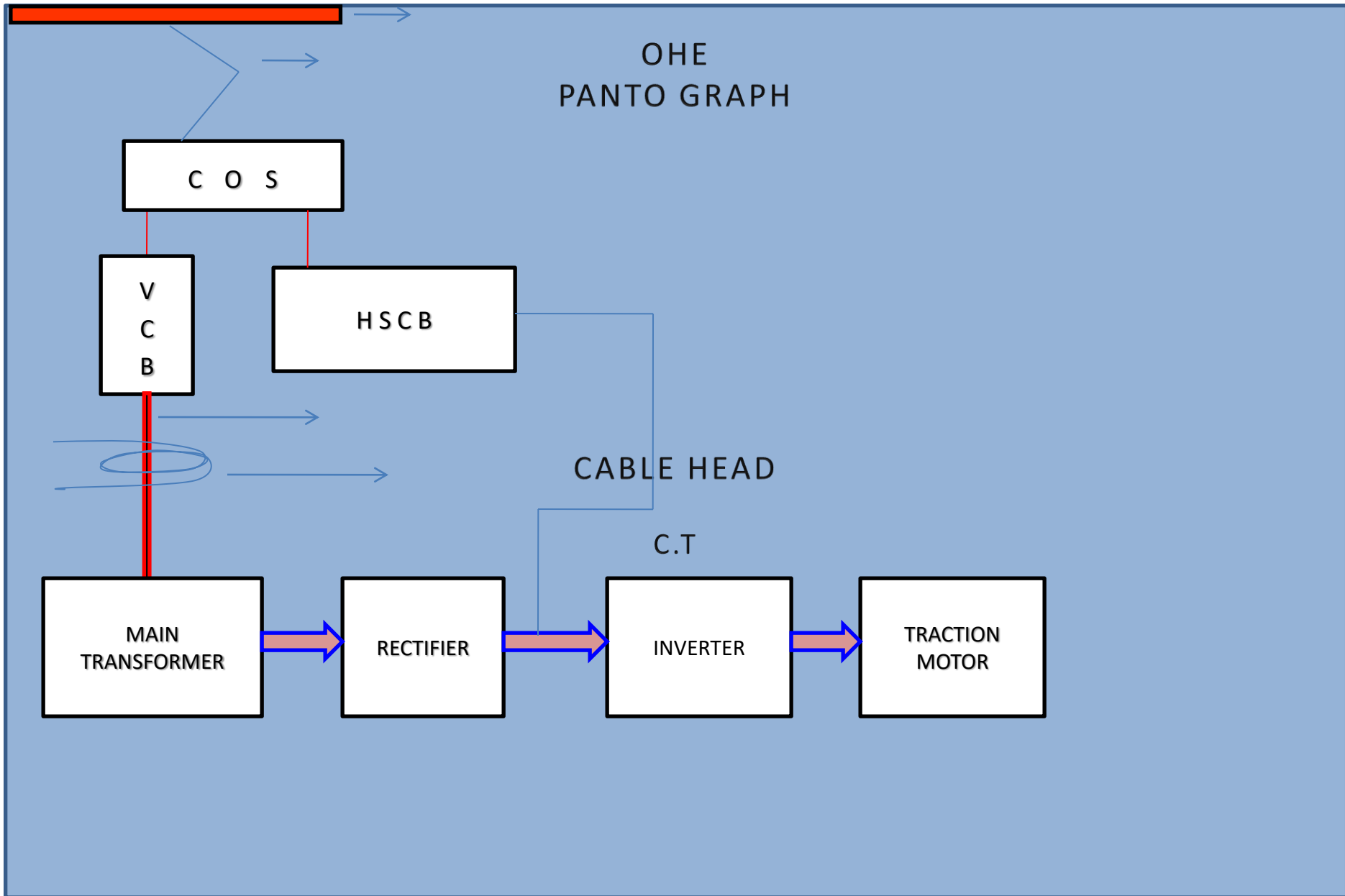
## Middle basic unit

Eingestellte 3-Wageneinheit



# AC/DC EMU POWER FLOW DIAGRAM

(Only major equipments are shown)



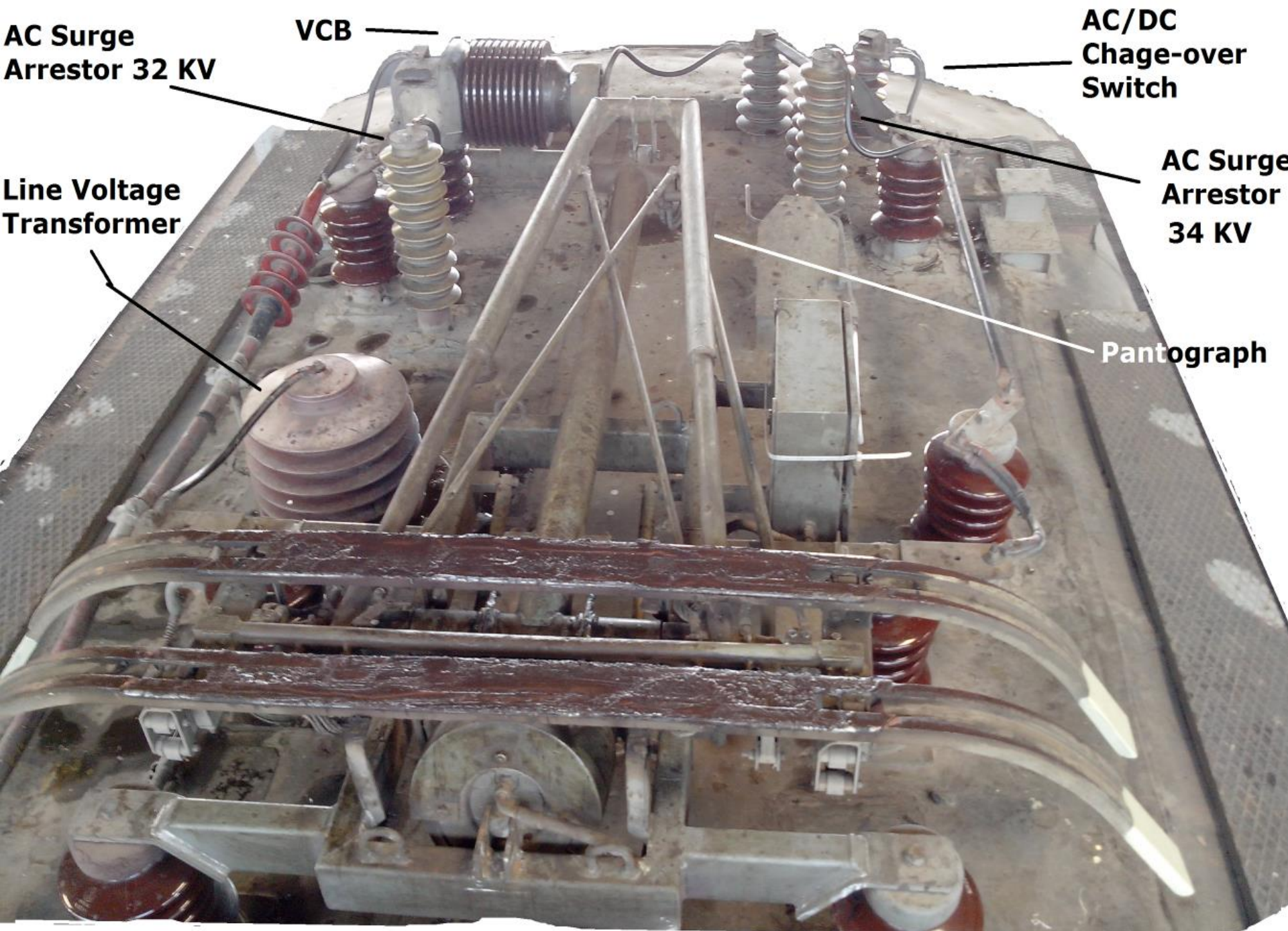


# *ROOF EQUIPMENTS*

- PANTOGRAPH
- AC SURGE ARRESTER
- AC SURGE ARRESTER
- DC SURGE ARRESTER
- CURRENT TRANSFORMER
- LINE VOLTAGE TRANSFORMER PT

# *ROOF EQUIPMENTS*

- AC/DC CHANGEOVER SWITCH (COS)
- VACCUM CIRCUIT BRAKER (VCB)
- AC EARTHING SWITCH
- BRAKING RESISTER



AC Surge  
Arrestor 32 KV

VCB

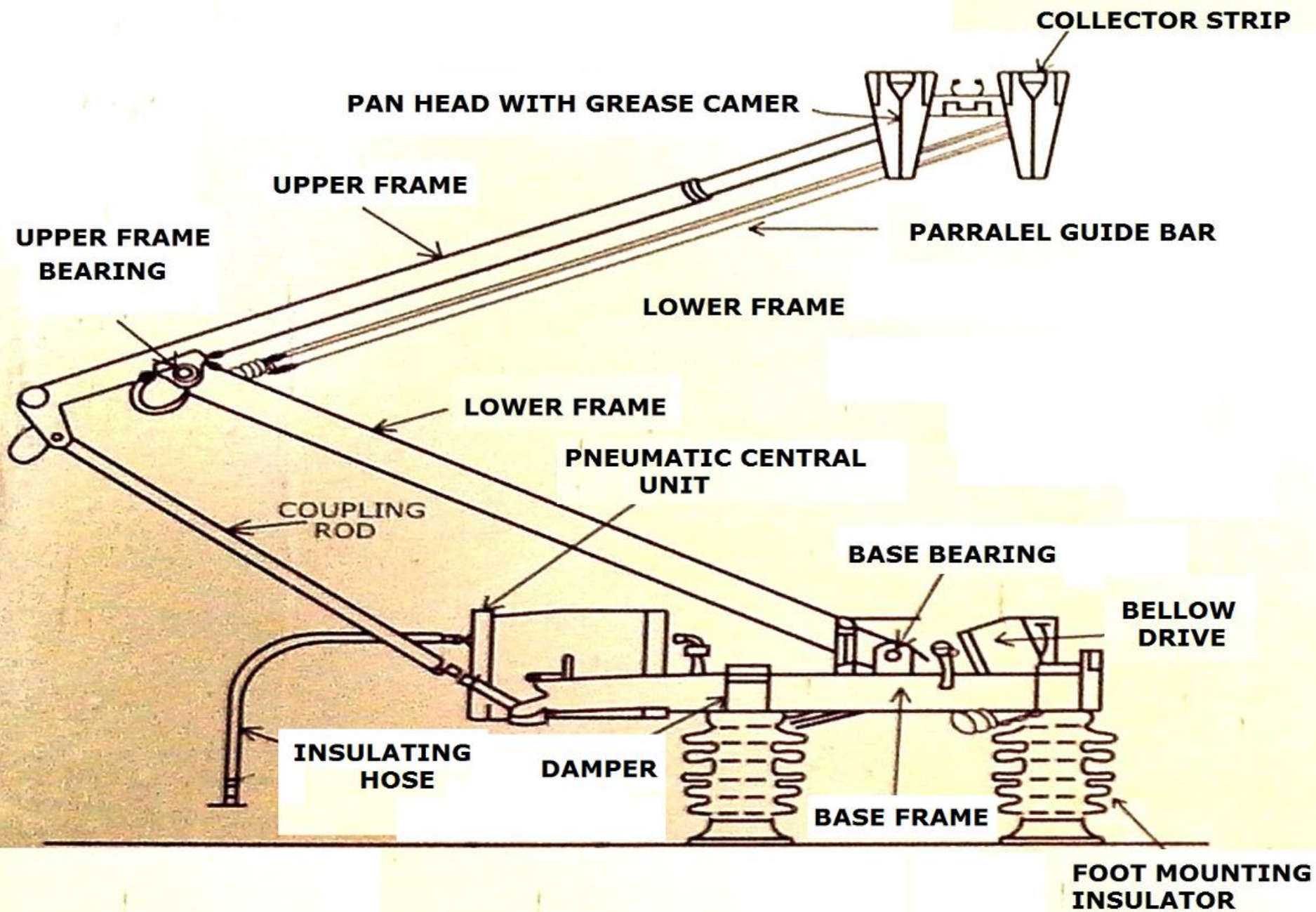
AC/DC  
Charge-over  
Switch

Line Voltage  
Transformer

AC Surge  
Arrestor  
34 KV

Pantograph





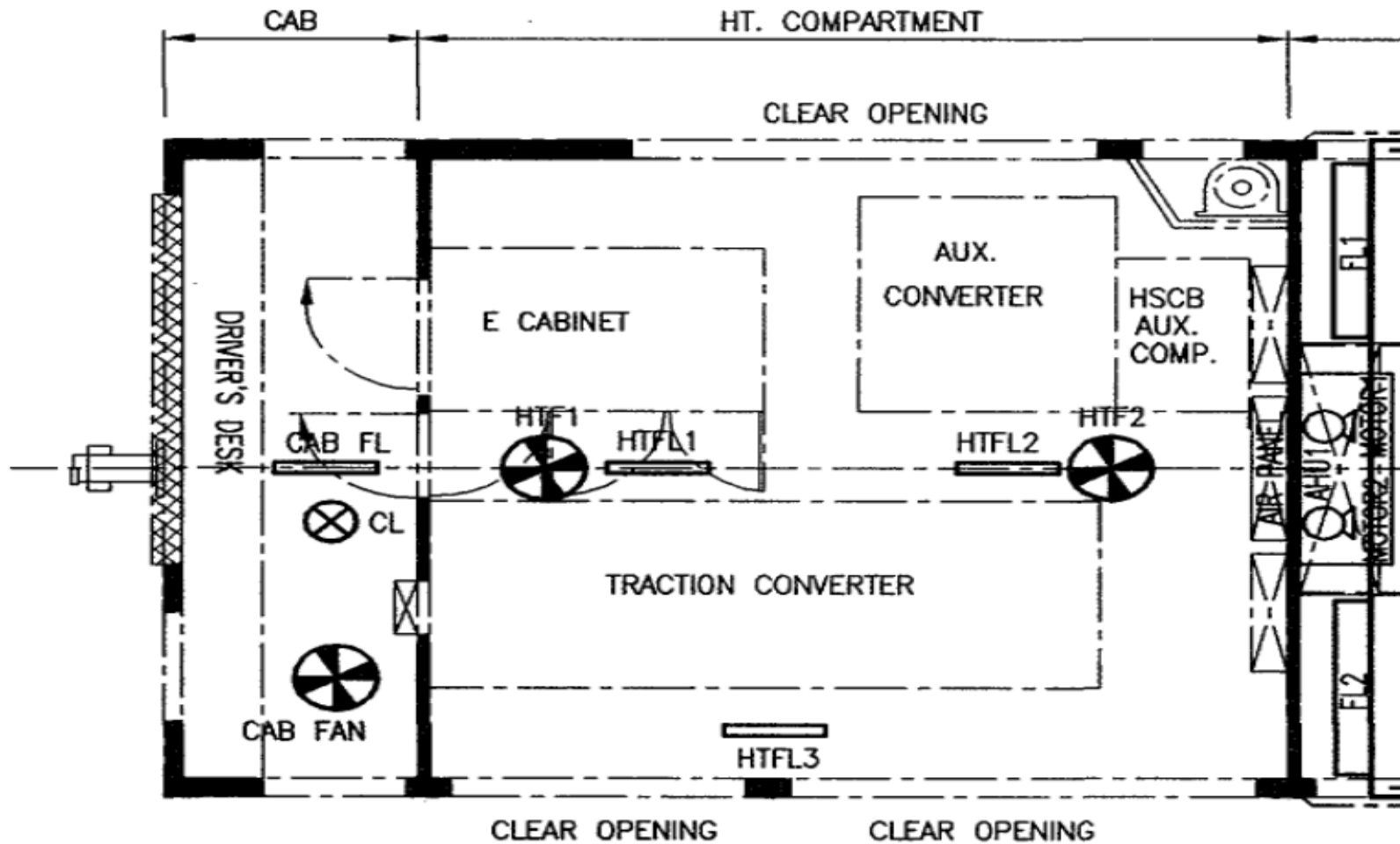
## *UNDER FRAME EQUIPMENTS*

- MAIN TRANSFORMER 25 KVAC/950VAC.
- BATTERY SET.
- MAIN COMPRESSOR.
- BRAKE UNIT.
- BRAKE CYLINDERS.
- TRACTION MOTORS (240 KW).
- AIR SUSPENSION SYSTEM.
- BRAKE CYLINDER PRESSURE SENSOR.

## **HTC EQUIPMENTS**

1. DC main circuit-breaker HSCB (Only In DC-AC EMU)
2. Current converter with integrated TCU
3. Auxiliary converter unit ACU
4. Brake control unit, BCU
5. Pantograph control
6. Measuring equipments
7. Voltage sensing device VSD
8. Auxiliary air compressor
9. Fire detection system
10. E-cabinet Electronic
11. SIBAS Klip station (SKS 22).

## Layout of HT Compartment



# BRAKE SYSTEM

On EMU rakes following type of brakes are provided.

- EP Brake
- Auto Brake
- Emergency Brake
- Guard's emergency brake
- Dead man's handle.,Regenerative brake,Parking brakes.



# DC Earthing switch



# Driver's desk





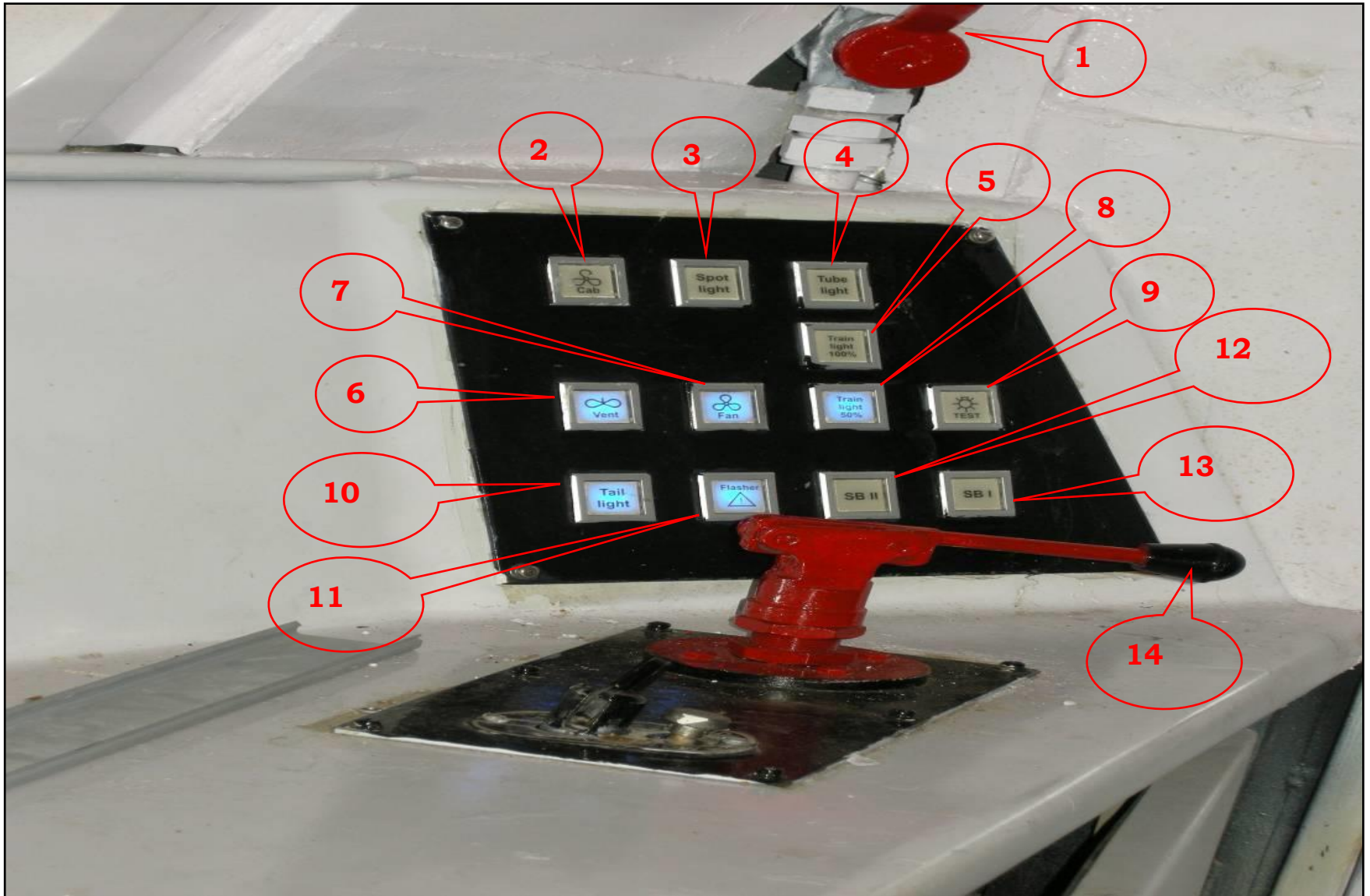
13

RDM 0 ON

2 FWD 0 REV

Braking Driving

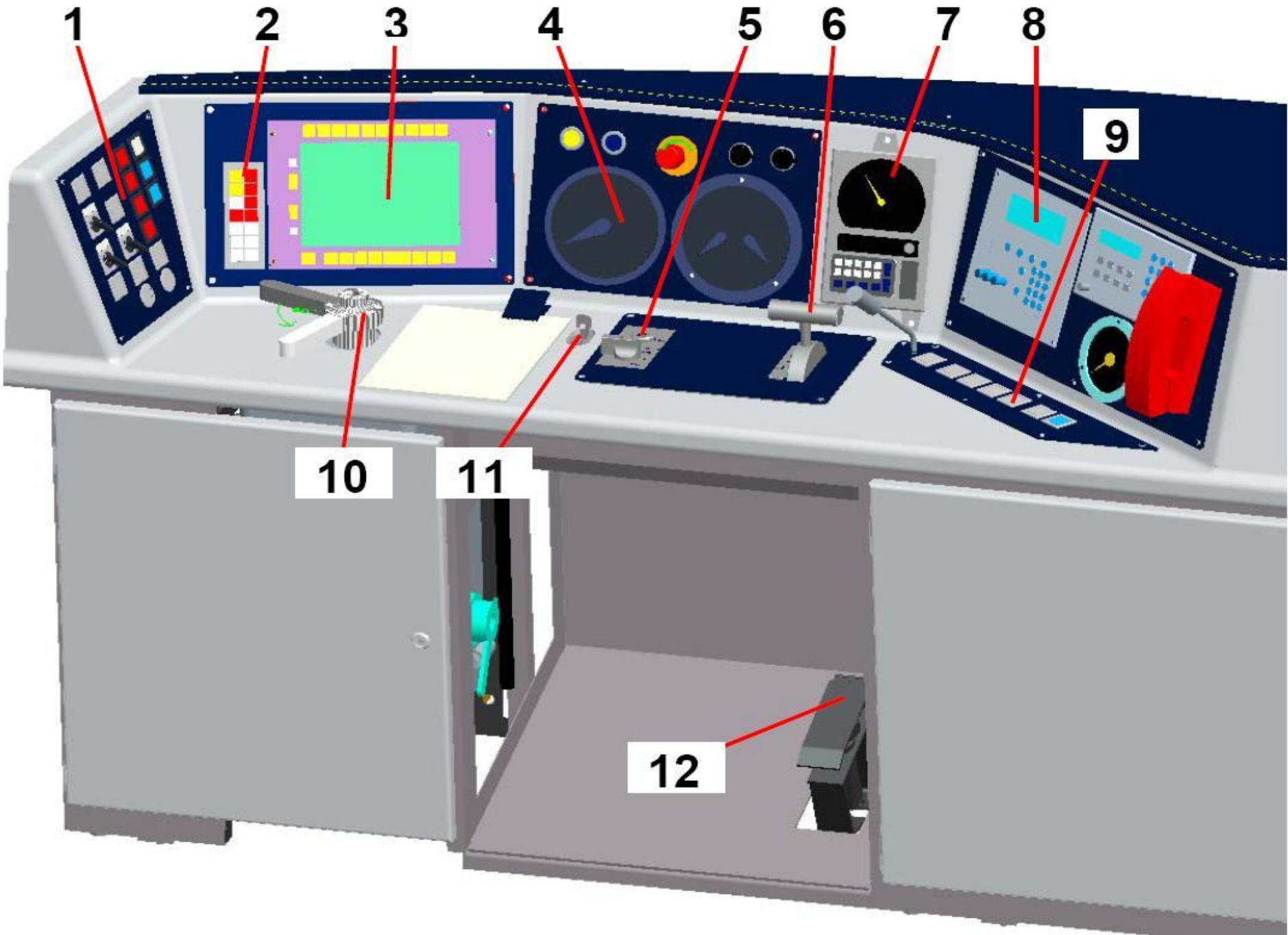
# Guard side panel





# MMI

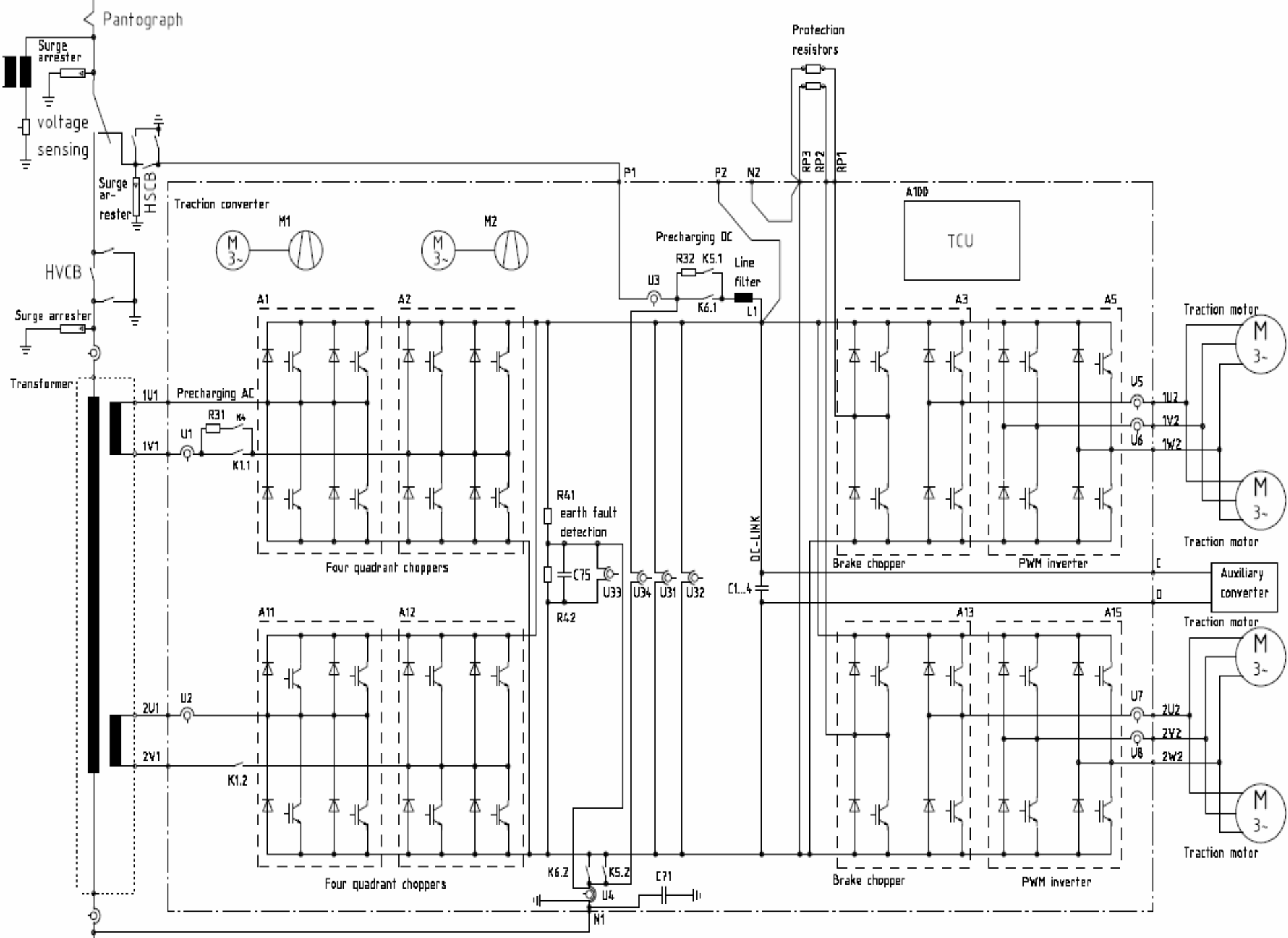




# Under-frame Equipment DTC

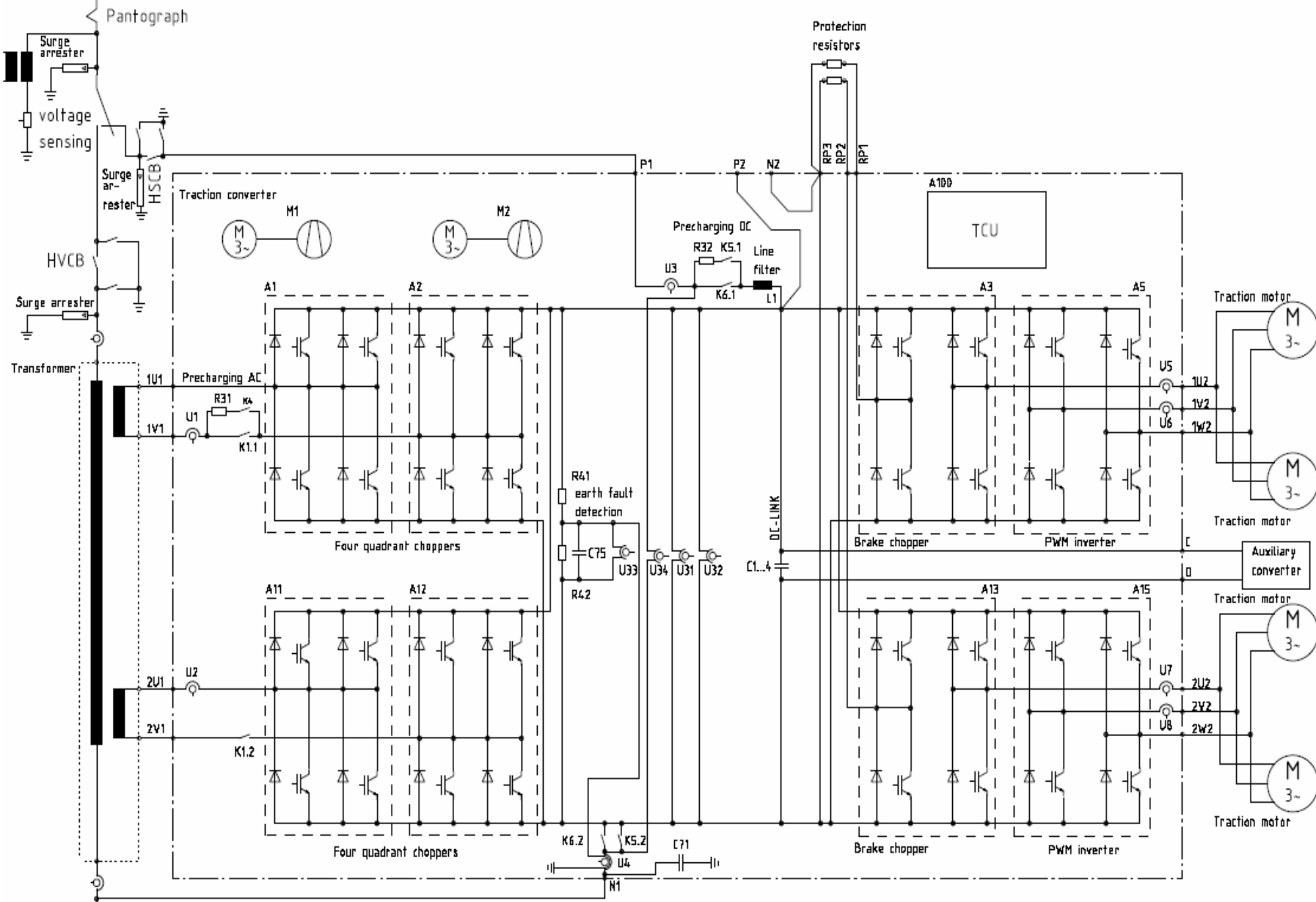
- Main compressor
- Battery box
- Different reservoirs
- Combined brake unit
- Parking brake equipments
- Air suspension equipments
- Mechanical weight transfer equipment

AC 25KV 50 Hz; DC 1500 V





AC 25KV 50 Hz; DC 1500 V



# **Technical Details of Siemens AC/DC EMU Rake**

# Technical details

Catenary voltage	25 kV AC 50 Hz and 1.5 kV DC
Maximum speed	100 km/h
Nominal rating (basic unit)	1100 kW
Wheel arrangement	2' 2' + Bo'Bo' + 2' 2'
Starting effort max.	135 kN (basic unit)
Vehicle weight	113.6 t (basic unit) 31.55t – 51.2t – 30.88t
Length (basic unit)	63 metres
Drive	Integrated nose-suspended drive
Brake	Compressed-air brake / electronic brake unit
Stop brake (basic unit)	Spring-loaded brake 4 cylinder
Dynamic brake	Catenary voltage-dependent network and dynamic brake
Electric brake force max. (basic unit)	125 kN
Brake force max. (basic unit)	185 kN

# Technical details

Track Gauge	1676 mm
Coach length over body	20726 mm(21521 mm over couplers)
Max. Width over body	3660 mm
Height of centre line of the Coupler	1035 mm from rail level under tare condition
Distance between buffer centers	1956 mm
Acceleration (average from 0 to 40 km/h)	0.54m/s/s
Deceleration	
Average from booked speed to 50 Kmph	0.76m/s/s
Average from 50kmph to stop	0.84m/s/s
Max Rolling stock operational Speed	100Kmph
Max. Rolling stock test speed	110 Kmph

SN	Item	Type	Rating	Make	Weight (kgs)	Qty
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1	Pantograph (AC-DC)	AM 18-B2	1.5 KV TO 25 KV	STONE INDIA (PROTO TYPE)	290	1
			1100A / 1.5 KV			
			400A / 25 KV			
		WBL 23.03	1.5 KV TO 25 KV	SCHUNK	150	1
			1100A / 1.5 KV			
			60A / 25 KV			
2	AC Surge Arrestor (Main)	POLIM S 34N	34 KV	ABB	12.6	1

3	AC-DC Supply Change Over Switch	RS 25.10	25 KVAC / 1500 V DC	SECHERON	57	1
4	AC Surge arrestor	POLIM S 32N	32 KV	ABB	12.5	1
5	DC Surge arrestor	POLIM H 2.0 SD	2 KV, 1 KA	ABB	4.5	1
6	VCB	BVAC 25.10	25 KV, 50 Hz 1=1KA	UTO Meters LT	155	1
7	Current Transformer (Input / Roof)	TYPE - 1910	75/1A, 3VA	RITZ	7	1
8	Line Voltage Transformer	GSEFBG25 .F GR.2	25 KV / 150V - 5 VA 1.5 KV / 150V - 5 VA	RITZ	95	1

9	Battery set	Low Maintenance	110 V / 90 AH	JUMBO	50 kg	1 set
10	Main Compressor	VV 120	6.7 KW	KBIL	158	1
11	Air handling unit	-	7300 m³ / hr	SIDWAL	100 kg	1
12	Auxiliary Converter	560333 19/1.00	115 KVA	SIEMENS	1200	1
13	Braking Resistors	BWD 73	2x3 OHMS, 1600 KW FOR 1 SEC	HEINE	85	1



14	Earth brush (Traction Motor)	POLYRAD	520A	SCHUNK METAL	--	4
15	25 Kilo OHM Resistance	KRAH	25 KILO OHMS, 60 W	BIRKHOLZ	1.3	1
16	AC Earthling Switch	PCE VES 25.4	25 KV, 400A	PATRA & CHAND	26	1
17	HSCB (High Speed Circuit Breaker)	HSCB UR6-32S	1500 V DC	SECHERON	37	1
18	DC Earthling Switch	BTE 03.04	3 KV, 400 A	SECHERON	13	1

# **TRACTION TRANSFORMER SIEMENS AC/DC RAKES**

**TYPE** **LOT 1250(ABB)**

**PRIMARY** **1250KVA, 22500V, 5505A, 50Hz**

**SECONDARY** **2X625KVA, 2X855V, 2X731A**

# TRACTION CONVERTER CUBICAL

## The technical details:

- Nominal input voltage      2 x 950 V AC, 50 Hz  
1500V DC
- Input voltage range in AC mode  
627 V – 1083 V AC  
Which is related to a line voltage from  
16.5 – 28.5 kV
- Input frequency range in AC mode  
46Hz – 54 Hz

# TRACTION CONVERTER CUBICAL

- Input voltage range in DC mode

800 V – 1800 V DC

- Nominal DC link circuit voltage traction operation

AC Mode 1800 V

DC Mode 1500 V

- Power factor in AC at different loads and line voltages approx. unity

# 4QC CONVERTER

- Number of 4 QC per Traction Converter Cubical (TCC) - 2
- Semiconductor - IGBT
- Type of phase module- SIBAC® BB S P 1500 FL
- Pulse frequency - 750 Hz

# PWM INVERTER

- **Number of PWMI per TCC -** 2
- **Number of traction motors per PWMI -** 2
- **Semiconductor-** IGBT
- **Type of phase module-**  
SIBAC® BB S P 1500 FL
- **Pulse frequency-** Variable, up to 800Hz

# BRAKE CHOPPER

- Number per TCC 2
- Semiconductor IGBT
- Type of phase module  
SIBAC® BB S P 1500 FL
- Pulse frequency- 250 Hz

# DC LINK

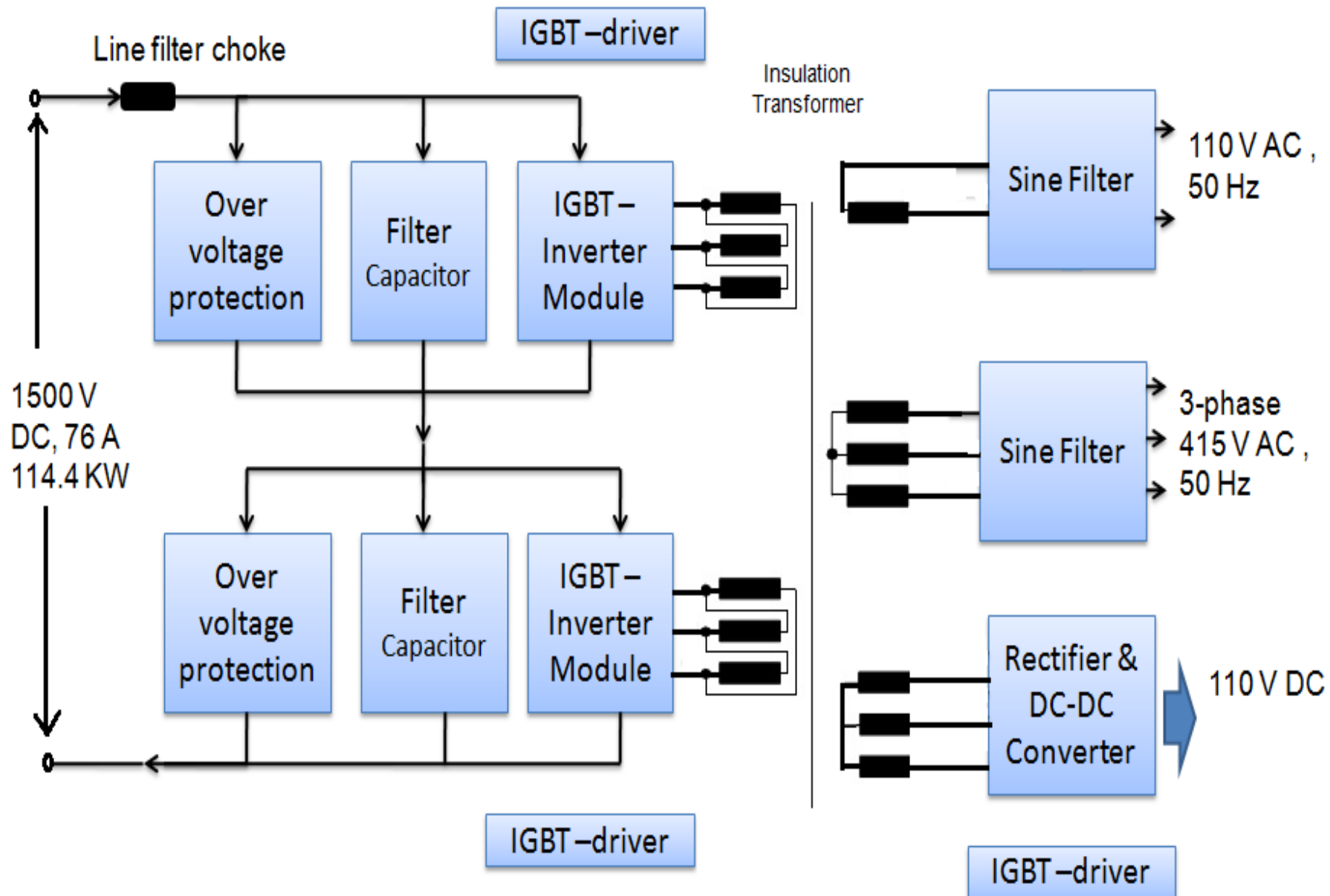
- **Capacity of DC link circuit** 12 mF -0 % +10 %
- **Inductance of line reactor** 6 mH -0 % to+10 %
- **Control Voltage**
- **Control voltage range** Max operating current at nominal voltage 110 V DC 77 V to 137.5 V DC, 10 Amp.
- **Auxiliary supply voltage** Continuous power demand 3AC, 415V, 50Hz 6.2kw



# TRACTION MOTORS

SPECIFICATION	IEC60349-2
RATED VOLTAGE	932V
RATED CURRENT	200A
RATED POWER	240KW
RATED SPEED	2000rpm
RATED FREQUENCY	101.5Hz
THERMAL CLASS	200

## AUXILIARY CONVERTER UNIT



<p>➤ <b>3 AC 415 V, 50 Hz, 87 kVA</b></p>	<p>The 3 phase AC output supplies traction ventilation fan motors &amp; air compressor.</p>
<p>➤ <b>1 110 Volt AC, 50 Hz, 20 kVA</b></p>	<p>The 1 phase AC output (1 AC 110 V, 50 Hz) supplies for passenger compartment fans and lighting etc</p>
<p>➤ <b>110 Volt DC, 9 kW</b></p>	<p>The DC output provides DC 110 V for low voltage power supply (contactors etc.) and battery charging. It is produced by the ACU's internal battery charger.</p>

## COMPRESSOR

MAKE AND TYPE

KNORR'S VV120

AIR DELIVERY

920 LPM

MAX PRESSURE

10 KG/CM2

RATED SPEED

1455 RPM

SHAFT POWER

6.7 KW

MOTOR RATING

415V,12.7A, 9.2KVA, PF .8

**THANKS**

**Thanking You All**

