

Standards and Practices
Over Head Electric Equipments

by

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ELECTRIFICATION SCENARIO AT A GLANCE

- 1st Electric Train started on 3rd February, 1925 on ex-Great Indian Peninsula **Railway (GIP Railway)**, (now Central Railway) from Bombay VT(now CSTM) to Kurla via Harbor line, about **15.00 Km** long.
- Now, as on **31-03-06**, the electrified route is **17,450 Km** which is about **27.7%** of Indian Railways route of about **63,000 Km**.

ELECTRIFICATION SCENARIO AT A GLANCE

- Passenger Traffic carried out on Electrified route is about 50%.
- Goods Traffic carried out on Electrified route is 67%.

TRACTION VOLTAGE SYSTEM

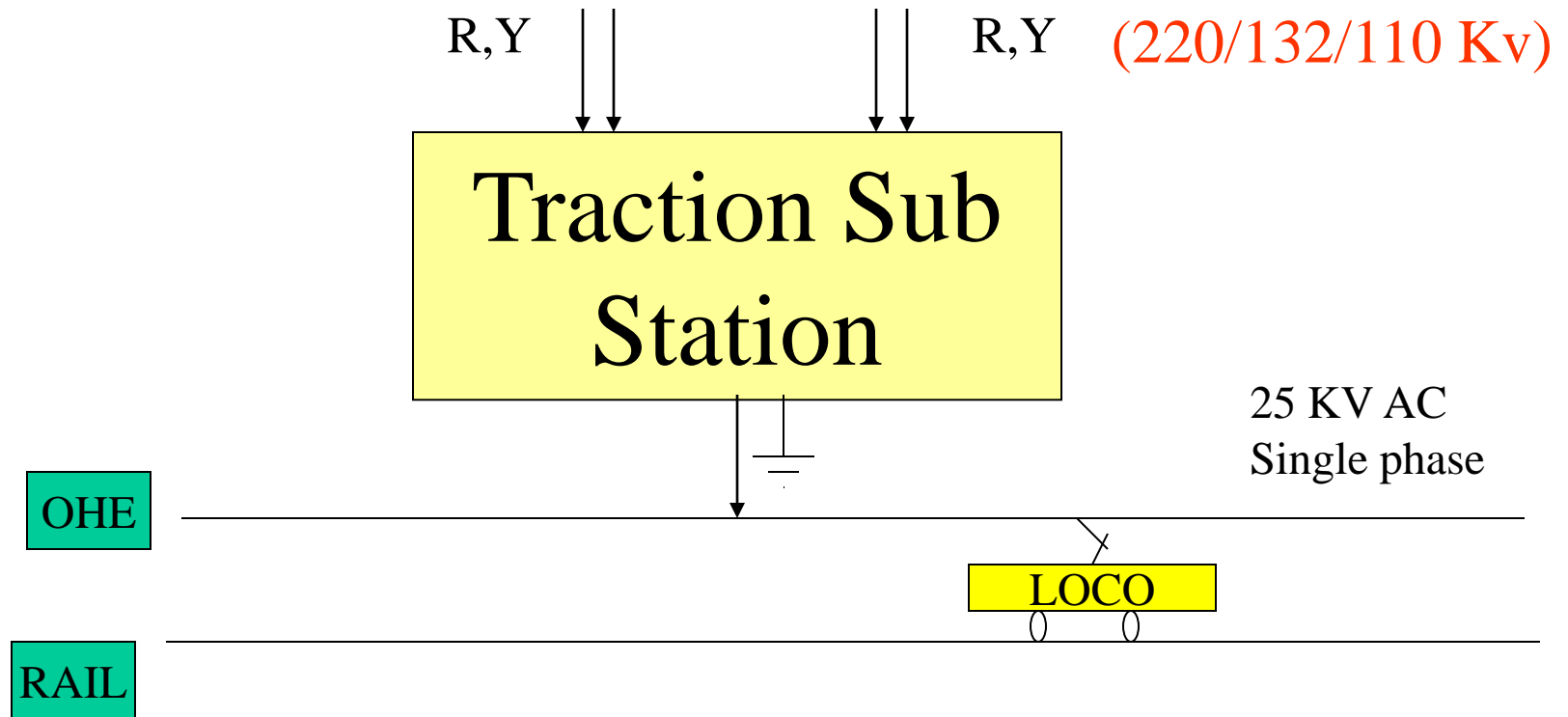
- Electric Traction introduced in **Mumbai area** on **1500 volt DC traction** in **1925**.
- **25 KV AC Traction** introduced in **1960** which is now universally adopted in Indian Railways.
- **1500 volt DC** – 400 route Km.(which is also under conversion to 25 KV AC).
- **25 KV AC**, single phase 50 Hz – 17,050 route Km

Traction Distribution (TRD)

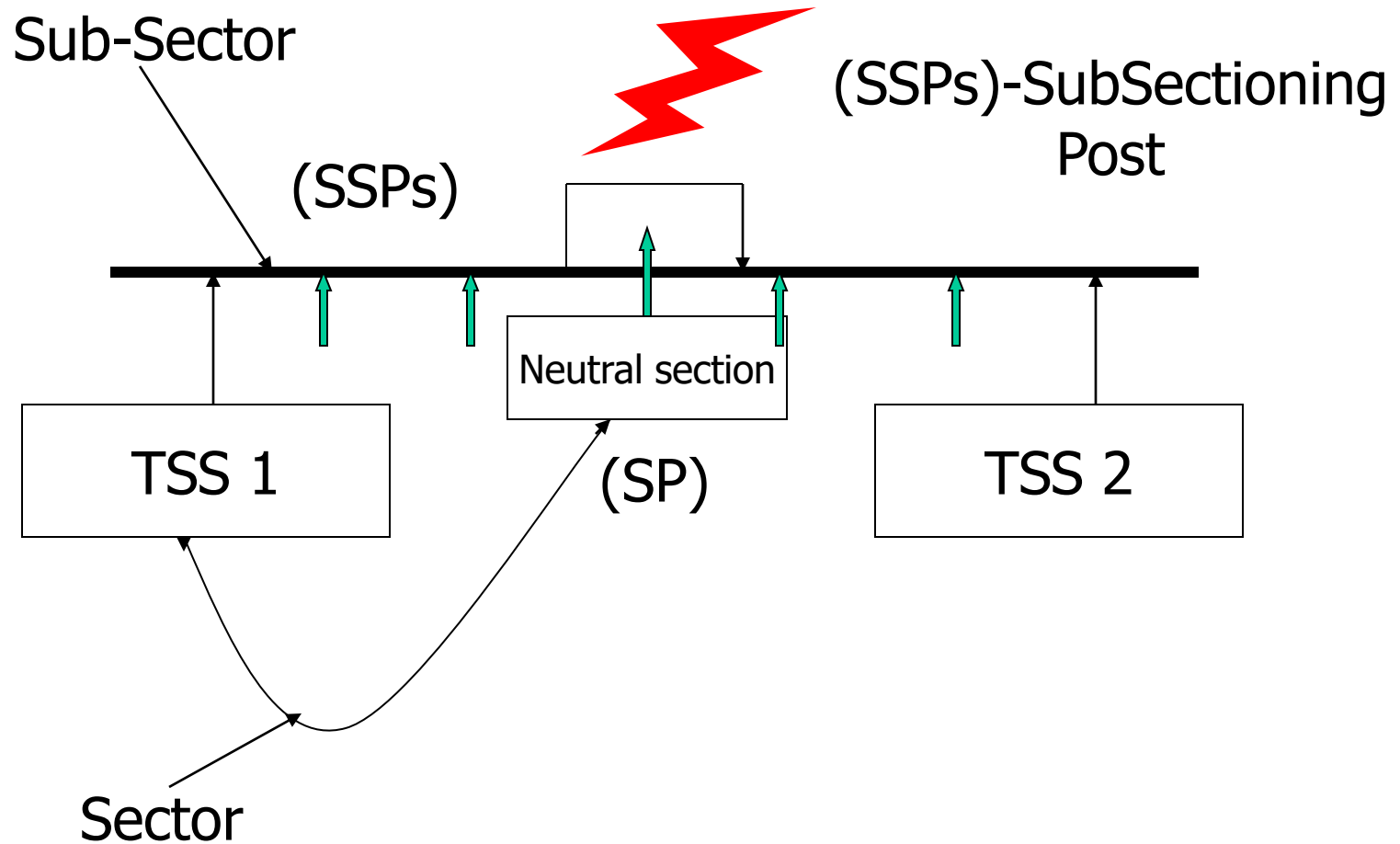
- Power Supply Installation (PSI)
- Overhead Equipment (OHE)
- Remote Control equipment
 - RCC [Remote Control Center]
 - SCADA- [Supervisory Control and Data Acquisition system]



SCHEMATIC DIAGRAM OF TRACTION SUB STATION



SCHEMATIC DIAGRAM



PTFE SHORT NEUTRAL SECTION

NEUTRAL SECTION

Y PHASE

R PHASE

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Neutral Section

A short section of insulated dead overhead equipment which separates the sectors fed by two adjacent substations which are normally connected to different phases.

- Warning Boards for Driver

OHE Arrangement



DROPPERS & BONDS

- DROPPERS

- A fitting used in overhead equipment construction for supporting contact wire from catenary

- BONDS

- An electrical connection across a joint in or between adjacent lengths of rail

(structure bond, continuity bond, cross bond etc.)

Auto Tensioning Device (ATD)

- Auto tensioning device
 - A device for maintaining the tension of OHE conductors constant under all ambient temperature conditions.
 - Such OHE is called regulated OHE.

CONTACT & CATENARY WIRE

- Contact wire –
 - cross sectional area - 107 sq.mm.
 - diameter - 12.24 mm
 - normal tension – 1000 kg
 - breaking load – 3905 kg

- Catenary wire –
 - cross sectional area - 65 sq.mm.
 - diameter – 10.50 mm
 - Normal tension – 1000 kg
 - breaking load – 3920 kg

Electrical Clearance

- The minimum electrical clearances (**vertical and horizontal**) to be maintained under the worst condition of temperature, wind, etc. between any live part of the overhead equipment or pantograph and parts of any fixed structures (earthed or otherwise) or moving loads:

i) long durations 250 mm

ii) short durations 200 mm

Working Clearance

- Minimum clearance between live conductor/equipments and such earthed structure/live parts of different elementary sections where men are required to work shall be 2 m.
- Where the clearance is not obtained the structure shall be protected by earthed metallic screens or prescribed warning boards.

IMPLANTATION

- The horizontal distance from the nearest face of traction mast to the centre line of track
- The nominal IMPLANTATION of mast is **2.5 m.**
- Can be lowered to **2.36 m** (with the approval of EIG)

Height of the Contact Wire

- Minimum 4.80m (above rail level)
- maximum 5.80m
- On level crossing 5.50m. (Provision of Height Gauge at LC Gates)

OHE Inspection Car (Tower Wagon)

- Used for maintenance of OHE and for attending to break downs.
- Carries necessary tools for maintenance and break downs such as tackles, straining screws, clamps, ropes, ladders, adequate stock of insulators, length of contact and catenary wires and other OHE fittings.
- Types of Tower wagon –
 - Four Wheeler (speed potential upto 75 KMPH)
 - Eight Wheeler (speed potential upto 110 KMPH)

4 Wheeler Tower Wagon



8 Wheeler Tower Wagon



Environmental Effect on OHE

- Pollution causes large number of insulator – flash over.
- Pollutants provide creepage path resulting into flash over of insulators and consequent creeping of circuit breakers.
- Types of pollution
 - Saline pollution – caused by salt deposits in coastal areas.
 - Chemical and industrial pollution - caused by waste from industries like hydrochloric acid, Sulphuric acid, particles of urea, cement etc.

Maintenance Schedules for OHE

- **Foot Patrolling** – For visual inspection of every part of OHE.
- **Trolley Inspection** – To observe closely the OHE during day time.
- **Current Collection Tests** – To detect points at which contact between the contact wire and pantograph is unsatisfactory resulting in sparking. These tests are performed at night.
- **Special Checks** – More frequent attentions on items such as Insulators , section insulators, Isolating switches, earth connections, Bird nest etc.

Maintenance Schedules for OHE – contd.

- **Annual Maintenance and OHE Inspection Car Check** – Replacement of defective fittings, checking and correction of clearances, heights, staggers, Checking of Masts, portals, contact wire and catenary wire, insulators, neutral sections, regulating equipments, clamps etc.
- **Periodical Overhaul** – At the interval of four years.
- **Re-tensioning of Unregulated OHE** – At every six months.

Power Supply Installations

- Traction Substation (TSS)
- Switching Stations

132 KV DOUBLE POLE ISOLATOR



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132 KV SF 6 CIRCUIT BREAKER

LA

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HV BUSHING

BUCHHLOZ RELAY

RADIATORS

TAP CHANGER

MARSHALLING BOX

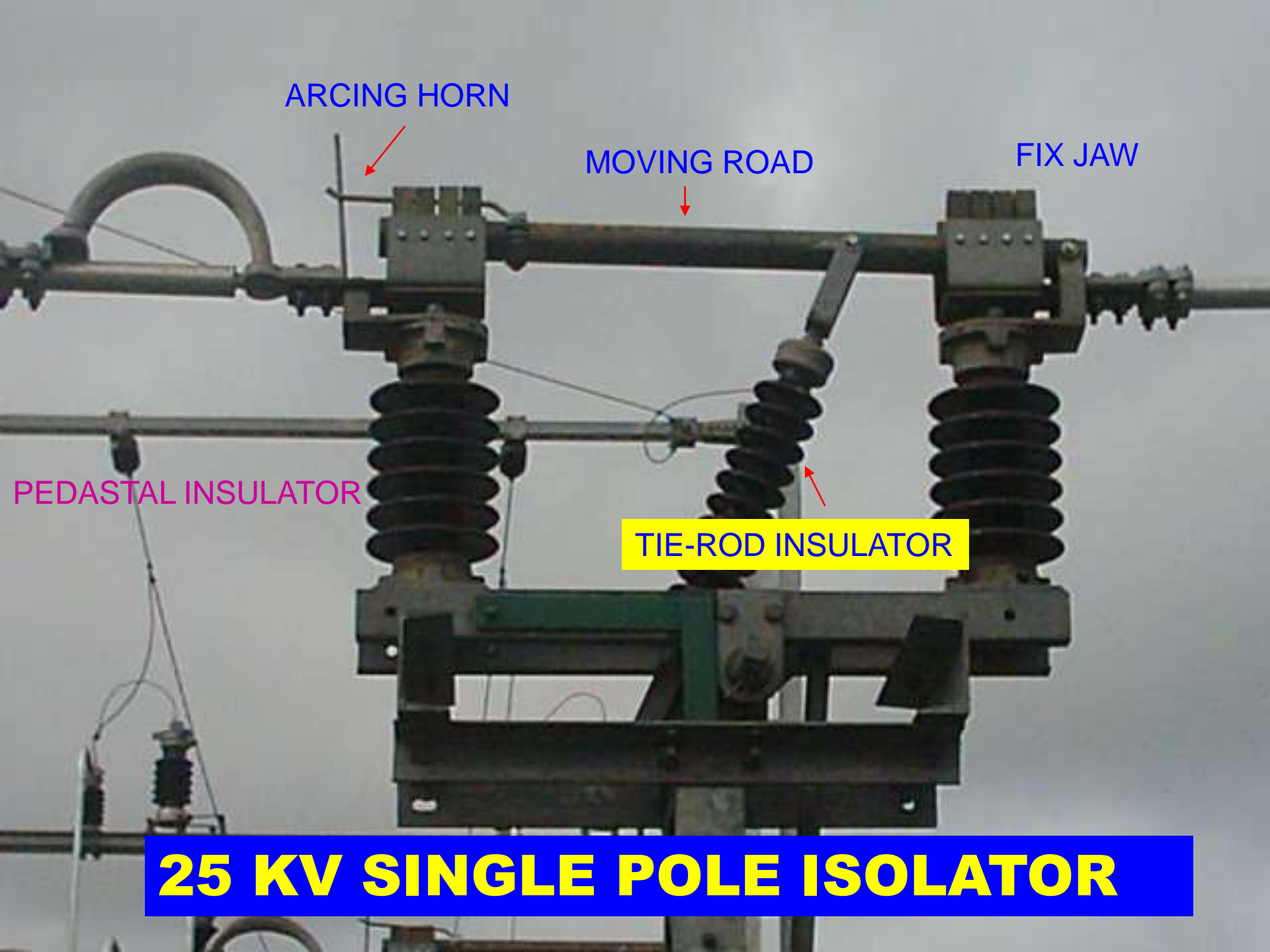
132/25 KV TRANSFORMER

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CURRENT TRANSFORMER





ARACING HORN

MOVING ROAD

FIX JAW

PEDASTAL INSULATOR

TIE-ROD INSULATOR

25 KV SINGLE POLE ISOLATOR

SUB SECTIONONG AND PARRALING POST DC SECTION



LA

BUS BAR

CT

PT

CB

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Maintenance Schedules of Traction sub-stations

- **Fortnightly maintenance** -
 - Going around the whole area of sub stations,
 - inspect for general cleanliness, proper drainage, road and rail axis.
 - Checking of batteries.
- **Monthly maintenance** —
 - Bonding and earthing
 - Oil level in transformers, circuit breakers etc.
 - Insulators
 - Traction transformer
 - Operating mechanism of circuit breakers and interrupters.

Maintenance Schedules of Traction sub-stations-- Contd

- **Quarterly maintenance**
 - Inspection of batteries and battery charges.
 - PTs and CTs.
 - Auxillary transformers.
- **Half yearly maintenance**
 - Traction transformers – Testing of oil sample for acidity and BDV.
 - Control and Relay panel
 - Traction transformers.

Maintenance Schedules of Traction sub-stations-- Contd

- Yearly maintenance
 - Inspection of fence all around the sub station and bonding between metal fencing panels and to earth.
 - Lightning arresters.
 - Bonding and Earthing
 - Traction transformers.
 - Control and Relay panel
 - Batteries and battery charges.

Cost of Electrification

Double track /Route Km = Rs. 6 to 6.5 million

Single track/Route Km = Rs. 4 million

Yearly Energy consumption for traction purpose on IR =
10,157 million kwh

Yearly Energy bill of IR = about Rs.40000 million

THANK YOU