



# SWITCHYARD OF FGPP

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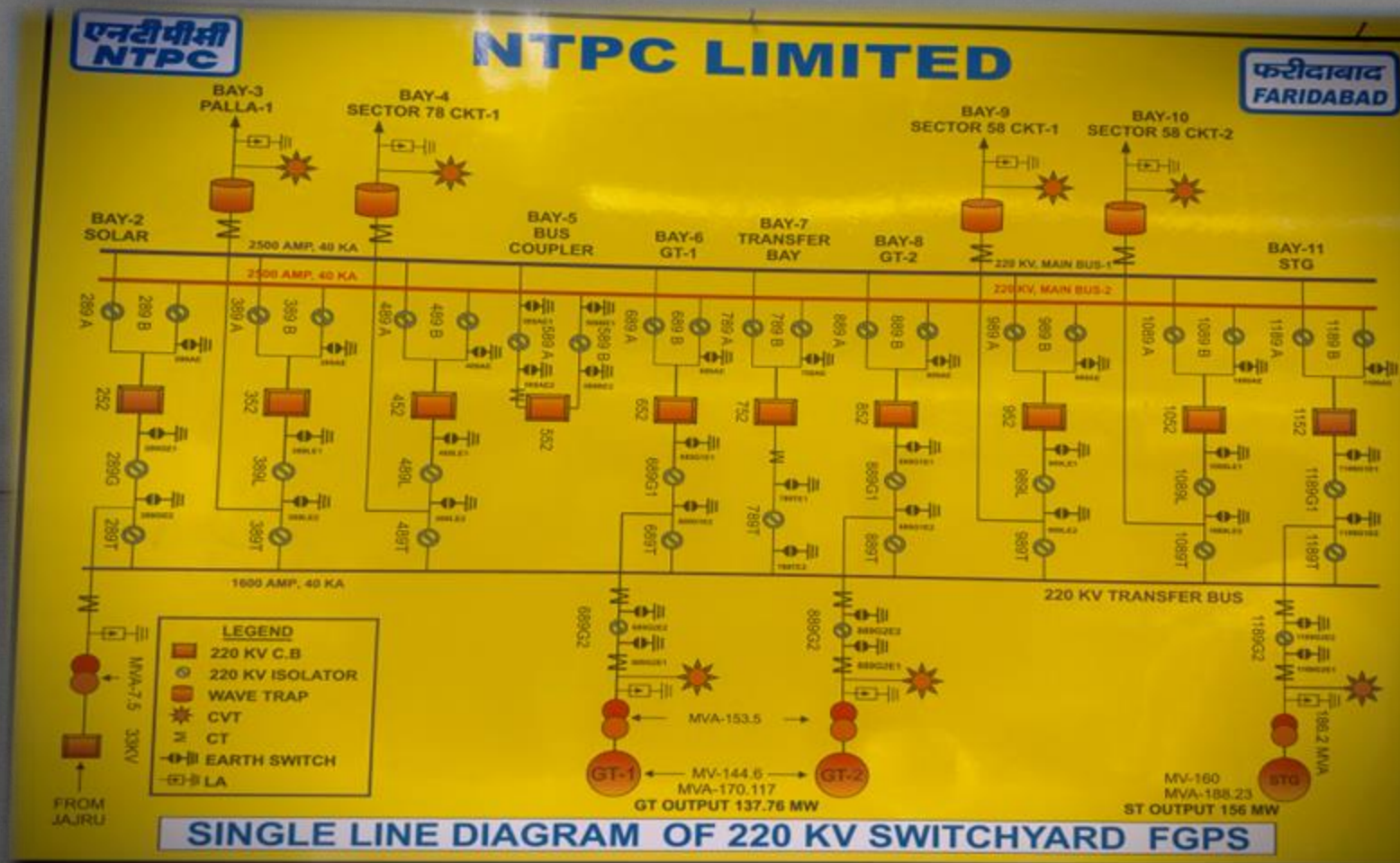
# Introduction to Switchyard

FGPP has a **220 kV switchyard** & It is an integral part of any power plant, as it **connects the electrical output of the plant to the external transmission grid**. It helps in **routing power**, ensuring **control**, and providing **protection** for the entire system. A structured **switchyard** guarantees **safe, reliable, and efficient** delivery of electricity, making it a crucial element in maintaining uninterrupted power supply.





# SINGLE LINE DIAGRAM OF SWITCHYARD FGPP



- Code 89 - ISOLATOR
- Code 52 - CIRCUIT BREAKER

# 220 kV Switchyard – FGPP

- Power Generation Sources
  - **GT-1** (137.76 MW), **GT-2** (137.76 MW) – Gas Turbine Units
  - **STG** (156 MW) – Steam Turbine Generator
  - Inputs from **33 kV JAJRU (solar plant) line**.
- Bus Bar System
  - FGPP switchyard has **Double Bus Bar with Transfer Bus** arrangement.
  - **Main Bus-1 & Main Bus-2**: Primary paths for power flow.
  - **Transfer Bus**: Ensures continuous supply during faults/maintenance.
  - **Bus Coupler** (Bay-5): Connects buses for operational flexibility.

# 220 kV Switchyard – FGPP

- Bay-wise Distribution
  - **Bay-2:** Solar input.
  - **Bay-6:** GT-I output connection.
  - **Bay-8:** GT-II output connection.
  - **Bay-7:** Transfer Bay.
  - **Bay-11:** STG output connection.
  - **Bay-3 & Bay-4:** Feeders to **Palla-1** & **Sector 78 (ckt-1)**.
  - **Bay-5:** Bus Coupler.
  - **Bay-9 & 10:** Feeders to **Sector 58 (ckt-1) & (ckt-2)**.



- Switchyard Equipment Overview

## 1. Power Transformers

Power transformers step up or step down voltage levels for efficient transmission. They consist of primary and secondary windings on a magnetic core. These transformers help reduce power losses and maintain voltage stability over long distances.

## 2. Circuit Breakers

Circuit breakers interrupt fault currents automatically or manually. They isolate faulty sections during short circuits or overloads to protect the system. Their fast operation prevents equipment damage and ensures system safety.

Types of C.B:-

- SF<sub>6</sub> circuit breakers
- Vacuum circuit breaker

## 3. Isolators / Disconnectors

Isolators physically disconnect parts of the switchyard for safe maintenance. They operate only under no-load conditions to ensure safe isolation. They provide a visible gap to confirm that the circuit is safely de-energized.

## 4. Busbars

Busbars are conductors that connect various circuits within the switchyard. They ensure reliable power distribution and easy connection between equipment. Their design allows flexibility in power flow.

## 5. Current Transformers (CTs)

CT reduce high currents to safe, measurable levels. They provide inputs to protective relays and metering equipment. CTs are essential for accurate current measurement and system protection.

## 6. Voltage Transformers (VTs)

VTs, also called Potential Transformers (PTs), step down high voltages for metering and protection. They ensure accurate voltage measurements for relays and meters, preventing damage to equipment. VTs maintain system control and stability.

Types of V.T:-

- Electromagnetic VTs
- Capacitive VTs

## 7. Lightning Arresters

Lightning arresters protect equipment from overvoltages due to lightning or surge arresters. They safely divert surge currents to the ground, preventing insulation failure and equipment damage. Arresters are critical for system reliability. It has a round metal cap type structure on the top called CORONA RING, meant for providing corona losses.

### Types of L.A :-

- Metal oxide arresters
- No gapped line arresters (NGLA)
- Externally gapped line arresters (EGLA)

## 8. Wave Traps / Line Traps

Wave traps block high-frequency carrier communication signals on power lines. They allow normal power frequency (50/60 Hz) to pass through without interference. This ensures clear communication for system monitoring and control.

## 9. Control and Relay Panels

These panels house protective relays, control switches, and indicators. They facilitate monitoring, controlling, and protecting switchyard equipment. Their role is crucial in detecting faults and initiating corrective actions quickly.



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## Notes :

- **Bus Coupler** connects Main Bus-1 and Main Bus-2, allowing power transfer between them for load sharing and redundancy.
- **Transfer Bay** connects equipment temporarily to the **Transfer Bus** during maintenance or fault, ensuring uninterrupted power flow.
- They allow seamless shifting of loads between buses during maintenance or faults, ensuring continuous power flow. This setup reduces outage risks and simplifies routine operations without disrupting supply.
- The lightning arrester is the initial switchyard device installed in a power plant, serving as the primary protection against voltage surges.
- **Sequence of operation in Isolators**
  - While opening: open circuit breaker → open isolator → close earthing switch (if any)
  - While closing: ensure circuit breaker is open → close isolator → open earthing switch → close circuit breaker.

## Field Observation – Power Plant Visit.



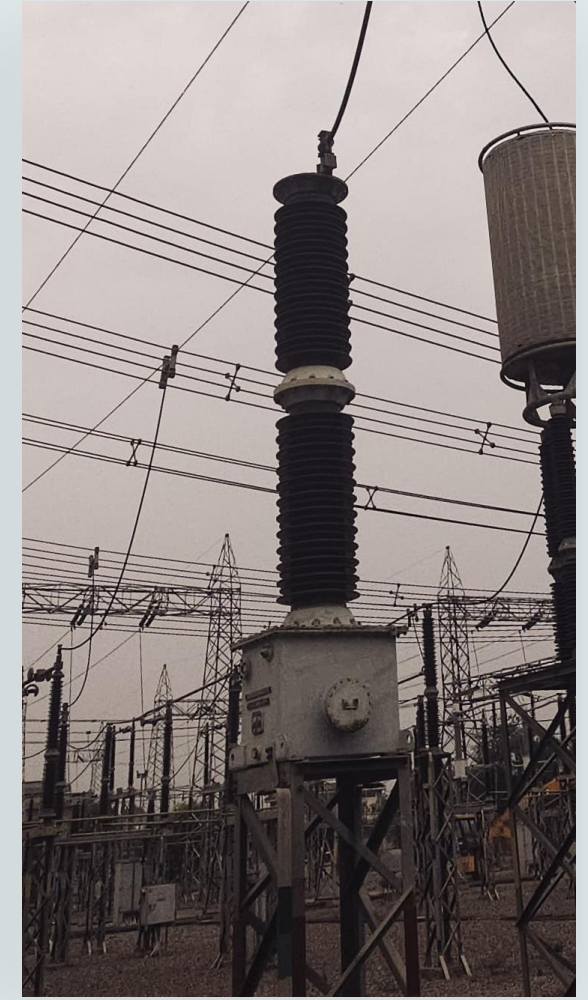
Wave trap / Line trap



Circuit breaker



Isolator



Capacitive Voltage transformer



## Field Observation – Power Plant Visit.



Lightning Arrester



Bus Bar



Current transformer





THANK YOU

Sincere thanks to -  
AGM – S.S Narula Sir  
&  
Sir Kaushal