

# Report on Ichchhapore substation Substation:



## Substation Equipment:

### 1] Power Transformer:

A static electrical machine used for transforming power from one circuit to another circuit without changing frequency is termed as Power transformer. The transformers are generally used to step down or step up the voltage level of a system for transmission and generation purpose. These transformers are classified into different types based on their design, utilization purpose, installation methods, and so on.

### 2] Instrument Transformer

The current and voltage transformers are together called as the Instrument transformers. Current transformer is used for the measurement of the alternating current by taking samples of the higher currents of the system. These reduced samples are in accurate proportions with the actual high currents of the system. These are used for installation and maintenance of the current relays in substations for protection purpose which are normally have low-current ratings for their operation. Potential transformer is quite similar to the current transformer, but it is used for taking samples of high voltages of a system for providing low-voltage to the relays of protection system and also to the low-rating meters for voltage

measurement. From this low-voltage measurement, the actual system's high voltage can be calculated without measuring high voltages directly to avoid the cost of the measurement system.

### 3] Conductors

The material or object that obeys the electrical property conductance (mostly made of metals such as aluminum and copper) and that allows the flow of electric charge is called a conductor. Conductors permit free movement of the flow of electrons through them. These are used for the transmission of power or electrical energy from one place (generating station) to another place (consumer point where power is consumed by the loads) through substations. Conductors are of different types and mostly aluminium conductors are preferred in practical power systems.

### 4] Insulators

The material which does not allow free movement of electrons or electric charge is called an insulator. Hence, insulators resist electricity with their high resisting property. There are different types of insulators such as suspension type, strain type, stay type, shackle, pin type and so on. A few types of insulators are shown in the above figure. Insulators are used for insulation purpose while erecting electric poles with conductors to avoid short circuit and for other insulation requirements.

### 5] Isolators

Isolator is a manually operated mechanical switch that isolates the faulty section or this section of a conductor or a part of a circuit of a substation meant for repair from a healthy section in order to avoid occurrence of more severe faults. Hence, it is also called a disconnector or disconnecting switch. There are different types of isolators used for different applications such as single-break isolator, double-break isolator, bus isolator, line isolator, etc.

### 6] Bus Bars

The conductor carrying current and having multiple numbers of incoming and outgoing line connections can be called a busbar, which is commonly used in substations. These are classified into different types like single bus, double bus and ring bus.

### 7] Lightning Arrester

The substation equipments such as conductors, transformers, etc., are always erected outdoor. Whenever light surges occur then, a high-voltage pass through these electrical components causing damage to them (either temporary or permanent damage based on the amount of voltage surge). Therefore, to avoid this difficulty, lightning arresters are placed to pass the entire lightning surge to earth. There are other arresters which are used to ground the switching surges called as surge arresters.

### 8] Circuit Breakers

For the protection of substation and its components from the overcurrents or over load due to short circuit or any other fault the faulty section is disconnected from the healthy section either manually or automatically. If once the fault is rectified, then again the original circuit can be rebuilt by manually or automatically. Different types of circuit breakers are designed based on different criteria and usage. But in general mostly used circuit breakers are Oil circuit breaker, Air circuit breaker, SF<sub>6</sub> circuit breaker, Vacuum Circuit Breaker, and soon.

### 9] Relays

Relays are used for disconnecting the circuits by manual or automatic operation.

Relay consists of the coil which is excited or energized and such that making the contacts of relay closed activates the relay to break or make the circuit connection. There are different types of relays such as overcurrent relays, definite time over current relays, voltage relays, auxiliary relays, reclosing relays, solid state relays, directional relays, inverse time overcurrent relays, microcontroller relays, etc. The above figure shows some basic relays and their operation.

### 10] Capacitor Bank

A Capacitor bank is a set of many identical capacitors connected in series or parallel within an enclosure and is used for the power factor correction and basic protection of substation. These capacitor banks act as a source of reactive power, and thus, the phase difference between voltage and current can be reduced by the capacitor banks. They will increase the ripple current capacity of the supply. It avoids undesirable characteristics in the power system. It is the most economical method for maintaining power factor and of correction of the power lag problems.

### Distribution Transformers



A **distribution**

**transformer or service transformer** is a transformer that provides the final voltage transformation in the electric power distribution system, stepping down the voltage

used in the distribution line to the level used by the customer. The invention of a practical efficient transformer made AC power distribution feasible.

Distribution transformers normally have ratings less than 200 kVA, although some national standards can allow for units up to 5000 kVA to be described as distribution transformers. Since distribution transformers are energized for 24 hours a day (even when they don't carry any load), reducing iron losses has an important role in their design. As they usually don't operate at full load, they are redesigned to have maximum efficiency at lower loads.

## Electricity Meter



An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

Electric utilities use electric meters installed at customers' premises for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (kWh). They are usually read once each billing period.

When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response load shedding during peak load periods.

# SINGLE LINE DIAGRAM OF 66 KV ICHHAPUR

DawofCommilaalon:23/411  
FaultLaval:12.805 KA  
1475MVA







