

Distribution

The purpose of the **Distribution** system is to deliver power to the customers after the voltage has been stepped-down to a “distribution” voltage. As the power gets closer to the customers, it is generally more economical to move the power at these lower voltages.



Distribution

Typical **Primary** distribution voltages include:



⚡ 19.9 kV

⚡ 12.7 kV

⚡ 7.6 kV

⚡ 7.2 kV

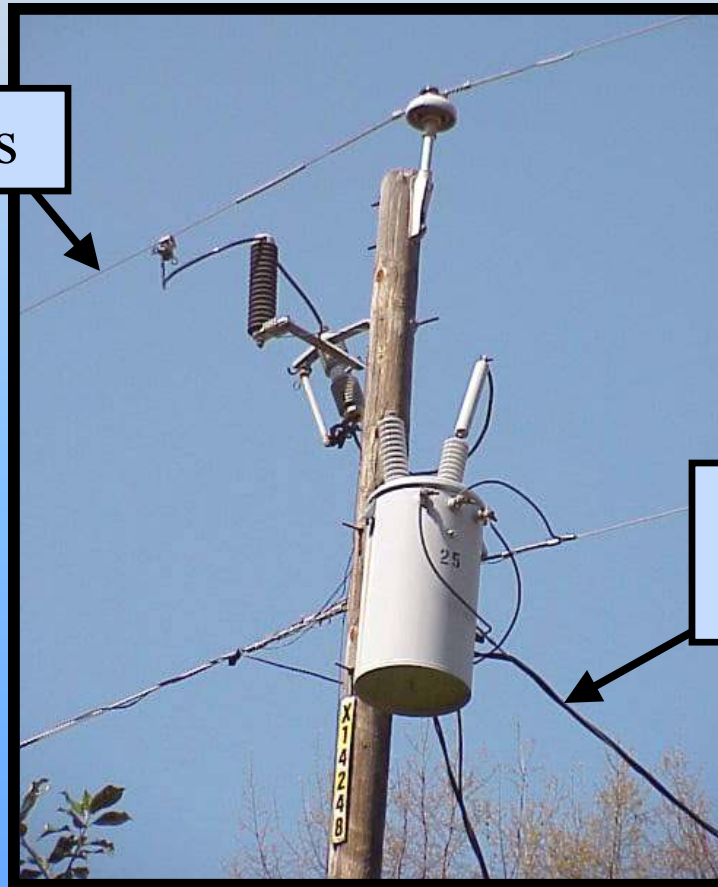
⚡ 2.4 kV

Note: Phase to Ground voltages

Distribution

Before the power gets to the customer, a **transformer** may lower the “primary” voltage to a “secondary” voltage of 120/240 volts.

Primary: 19,900 volts



Secondary:
120/240 volt service

Distribution

The distribution circuits may be **overhead** or **underground**. This will depend on the load density and the physical conditions of the particular area to be served.



*Overhead Transformer
Bank & Service*



*Padmount Transformer
for Underground System*

Distribution

Typical distribution equipment are listed below:

-  Capacitors
-  Fuses
-  Circuit Reclosers
-  Regulators
-  Poles
-  Switches & sectionalizers
-  Transformers - Overhead
-  Underground Equipment

Distribution - Underground Equipment



A **riser** or **riser pole** is used to connect underground cables to an overhead primary line.

Riser Pole

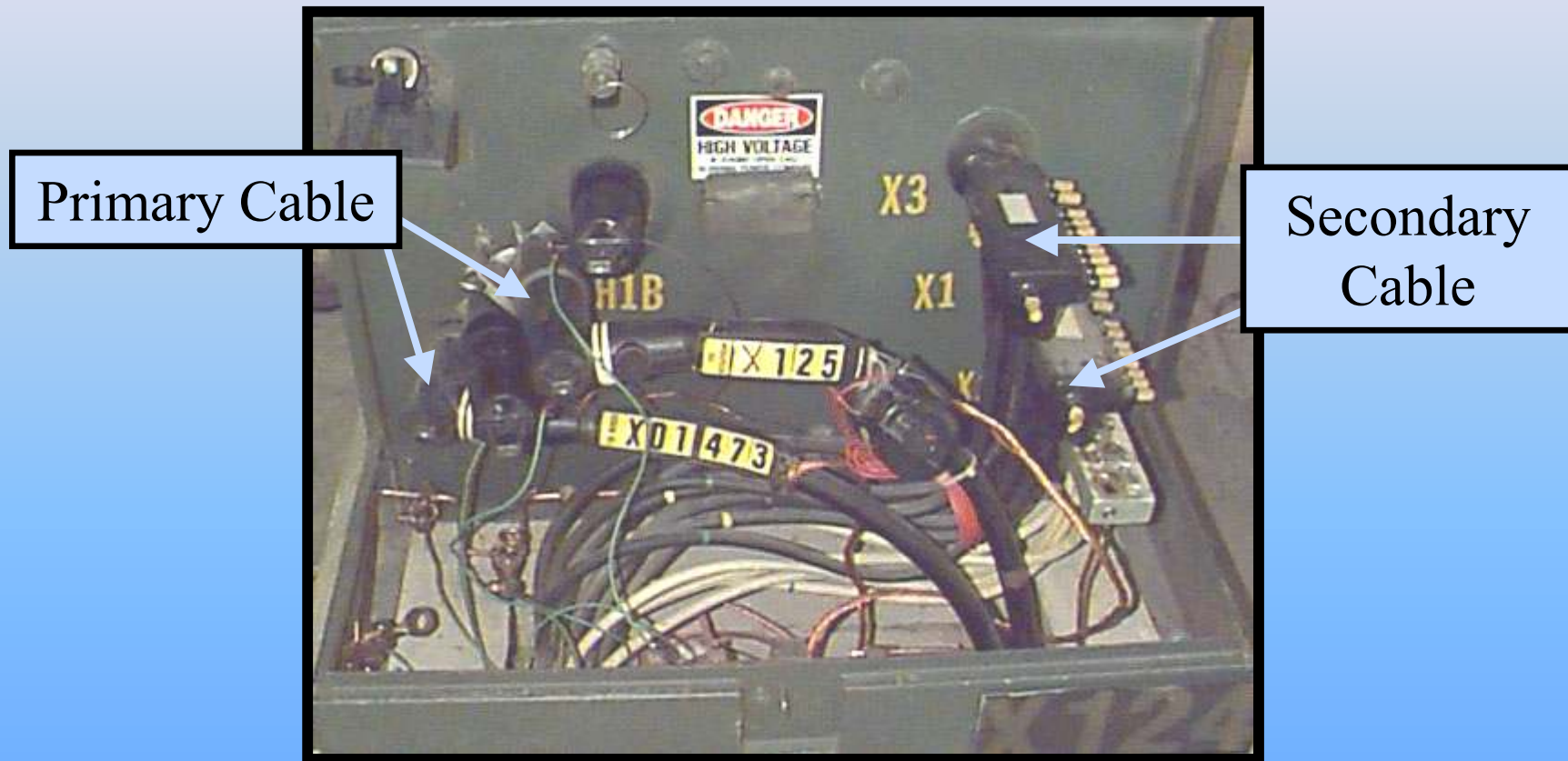
Distribution - Underground Equipment

Padmount transformers perform the same function as overhead transformers. Padmounts step down the “primary” voltage to “secondary” voltage - usually 120/240 volts.



Single Phase Pad Mounted Transformer

Distribution - Underground Equipment



Single Phase Pad Mounted Transformer

Distribution - Underground Equipment

Three phase underground distribution systems provide underground service to large customers.



Three Phase Pad Mounted Transformer

Distribution - Underground Equipment

Outdoor **metal clad switchgear** provides a weather proof housing for circuit breakers, protective relays, meters, current transformers, potential transformers, bus conductors, and other items necessary to provide electric system requirements.



Switchgear

Sectionalizers

A sectionalizer is designed to isolate faults on circuits in conjunction with reclosers. A sectionalizer does not interrupt fault current. It waits until the recloser de-energizes the line. After a pre-determined number of operations by the recloser, the sectionalizer opens to isolate the section of faulty line. This allows the recloser to re-energize the line up

to the open sectionalizer.



Distribution Regulators/Autoboosters



Voltage regulators are devices that maintain distribution voltage within a specified range of values. They are used by power companies to minimize voltage drop and to ensure that the proper voltage is supplied to customers.

Distribution Regulators/Autoboosters

Most **Voltage Regulators** are capable of raising or lowering the voltage by 10%.



Controls



*Position
Indicator*

Distribution Regulators/Autoboosters

Most **Voltage Regulators** have **16 taps or steps** in the raise and lower position.



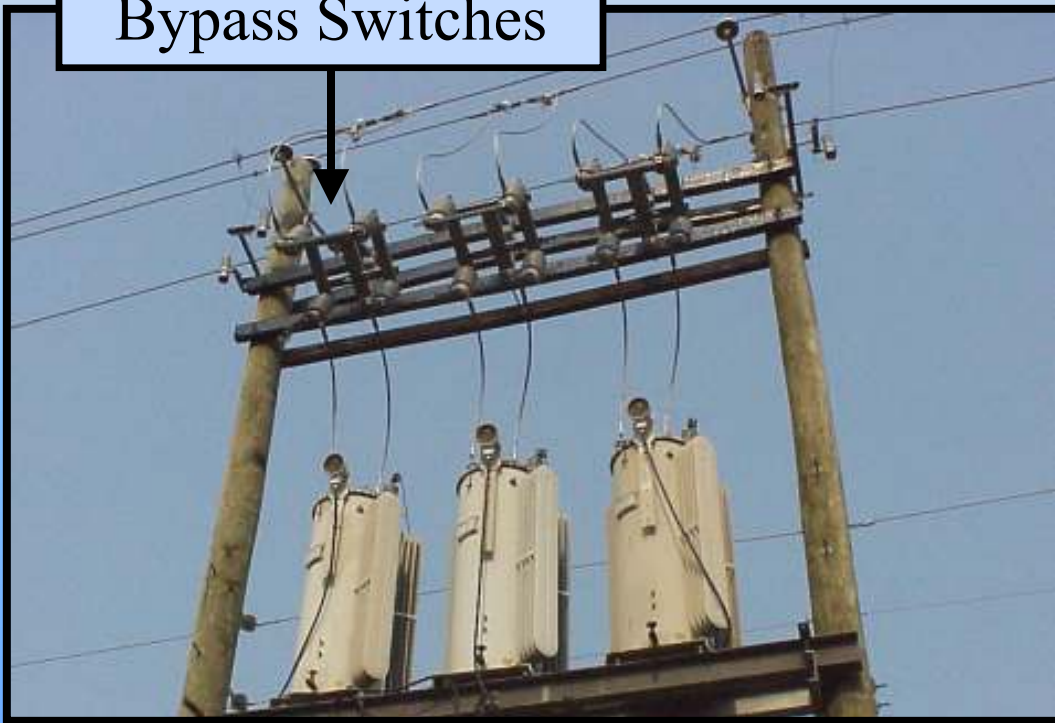
The position indicator shown here has 16 “steps” in the lower position, 16 steps in the raise position, and a Neutral position.

Each step can raise or lower the voltage by 5/8%. At Step 16-Raise, the voltage is raised by 10%. Likewise, in Step 16-Lower, the voltage is lowered by 10%.

Distribution Regulators/Autoboosters

If a voltage regulator needs to be **bypassed**, it is import to have the regulator in the **Neutral** position.

Bypass Switches



Position Indicator

Distribution Regulators/Autoboosters

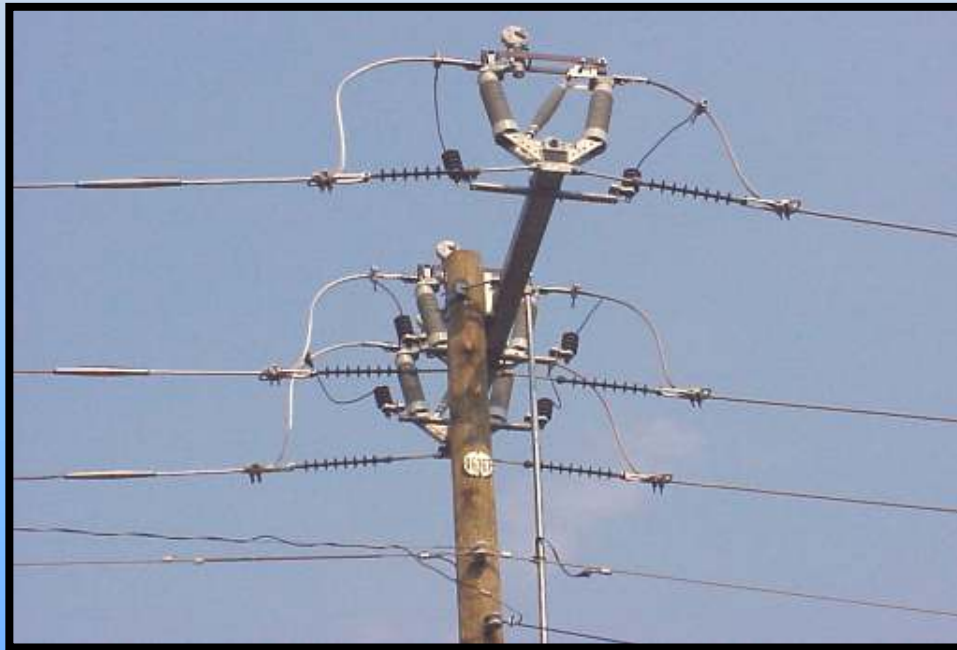
Autoboosters are very similar to voltage regulators. The difference is that autoboosters can only increase voltage.



Autoboosters

Distribution - Switches

Switches are used to disconnect or close circuits that may be energized.



Gang Operated Switch



Switch Control Handle

Distribution - Switches

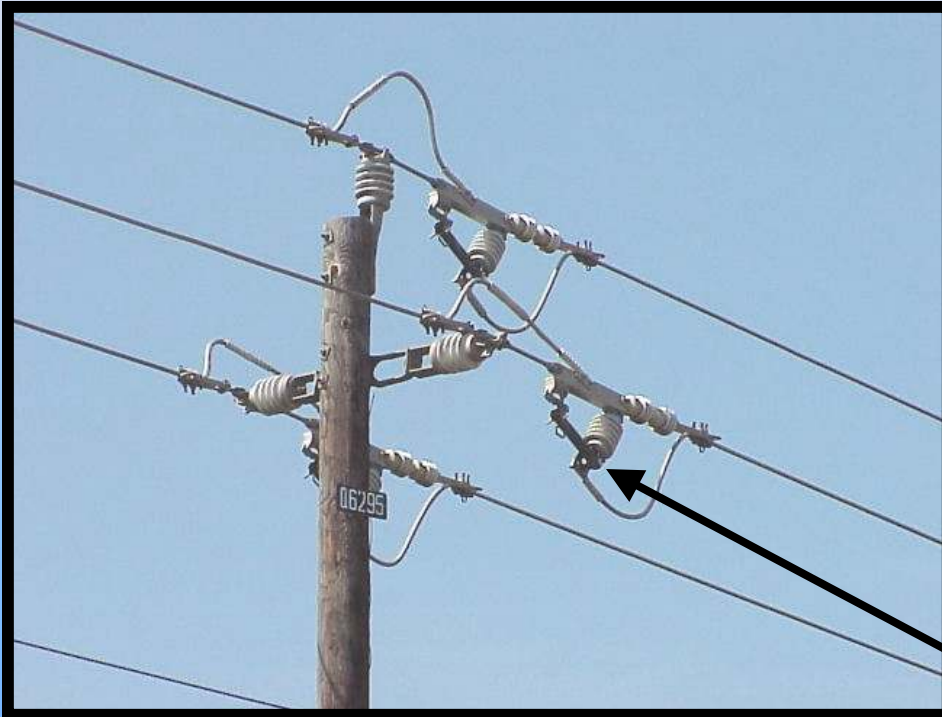
Some switches are equipped with **motor controls** and supervisory control so that switches may be operated remotely



*Gang Operated Switch
with Motor Controls*

Distribution - Switches

The picture below shows a **Solid Blade “In-Line” Disconnect** switch that is operating using a switch stick.



Solid Blade Disconnect Switch



Distribution Transformers - Overhead

Transformers are designed to reduce the voltage of the primary circuit to the voltage required to supply the customer.



Distribution Transformers - Overhead

Transformer banks are used to provide customers with 3-phase power.



3-Pot Transformer Bank

Distribution Transformers - Overhead

Depending on the customer's needs, transformer banks are connected in different configurations.



2-Pot Transformer Bank

Distribution Operation Center

A distribution system is divided into several regions or divisions within each operating company. These regions or divisions have distribution control centers sometimes referred to as **Distribution Operation Centers or DOC's**.



Distribution Control Center

The Distribution Operation Centers are responsible for all distribution lines and equipment within their area of control.



Distribution Control Center

Whenever switching is performed on their system, it is coordinated through the **DOC**.



Distribution Control Center



Operators track the status of lines and equipment using various **tags**.

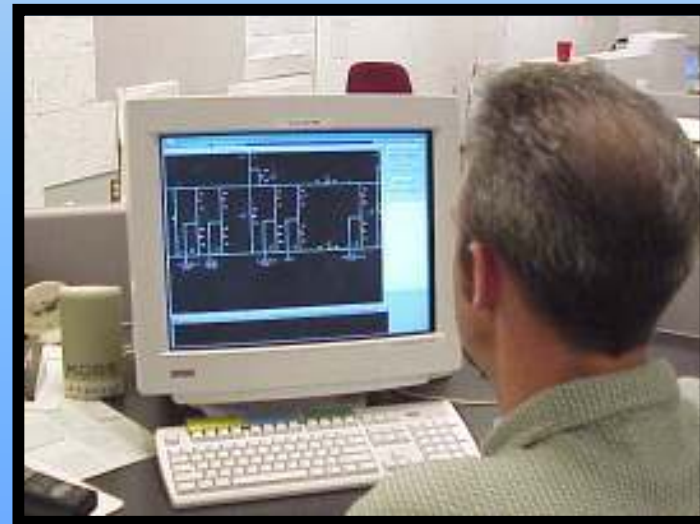


Distribution Control Center



SCADA stands for
Supervisory Control and
Data Acquisition.

An automated control system called SCADA allows operators to monitor and control substation and line equipment remotely.



Distribution Control Center



Customer Service Representatives deal directly with the customers. They relay information about system outages to the control center operators.

