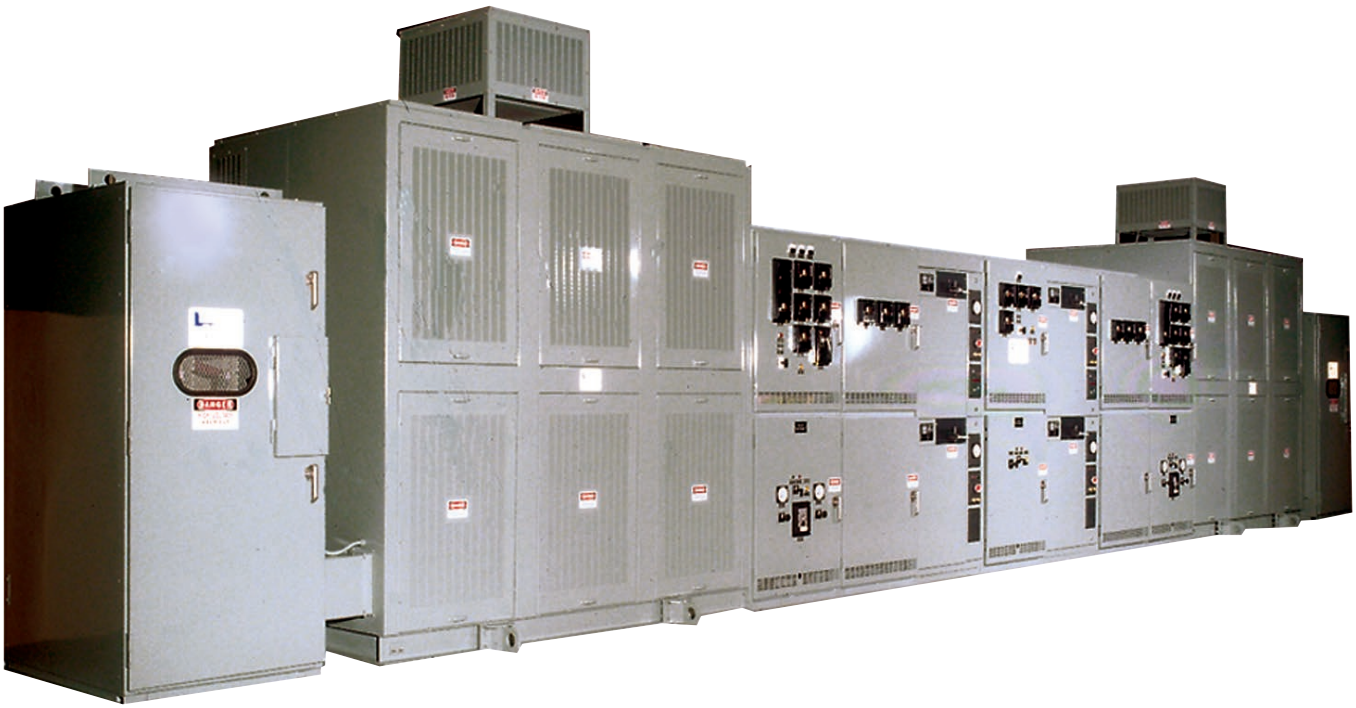
UNIT SUBSTATIONS

More than 30 Years Experience Designing & Building Transformers . . .



Advantages of Federal Pacific Unit Substations:

- Single responsibility
- Complete coordination - both mechanical and electrical
- Maximum flexibility with a wide choice of components and ratings to meet exact application requirements
- Optimum security to operators
- Modern design
- Meets all ANSI, IEEE, and NEMA Standards
- Indoor or outdoor construction
- Dry or liquid-filled transformers
- Primary voltages up to 38,000 volts
- Secondary voltages 5,000 volts or less
- Load ratings up to 10 MVA (Dry)

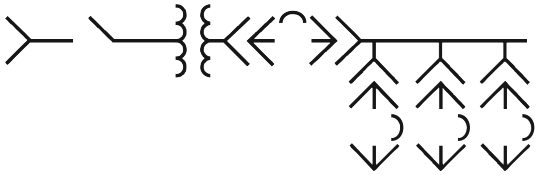
Planning modern, industrial, commercial, and institutional electrical systems demands serious consideration of primary voltage power distribution systems. The Federal Pacific Unit Substation is a coordinated piece of equipment designed to receive electrical power at voltages up to 38,000 volts, transform it to voltages of 5000 volts or less, and control its distribution to load areas. Federal Pacific Unit Substations follow the modern system concept of locating transformers as close as possible to areas of load concentration at utilization voltages, thus minimizing the lengths of secondary distribution cables and buses. This concept provides several basic advantages, such as:

- Reduced power losses
- Improved voltage regulation
- Improved service continuity
- Reduced likelihood of faults
- Increased flexibility
- Minimized installation expenses
- Efficient space utilization

Unit Substations, as defined herein, fall within the category of "Secondary Unit Substations," as defined in NEMA Standards.

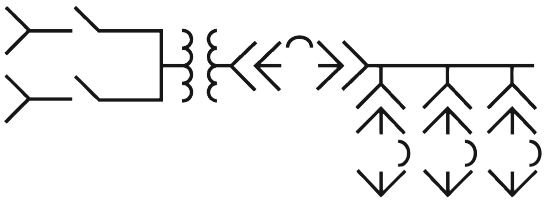
A. Simple Radial

- Simplest and least costly
- Easy to coordinate
- No idle sections



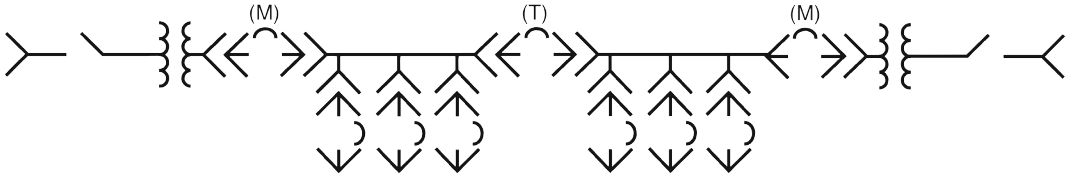
B. Primary Selective Radial

Similar to simple radial, with the added advantage of spare primary incoming cable circuit. By providing a spare circuit, duration of outage due to any problem on one primary circuit, such as a cable failure, is limited.



C. Secondary Selective

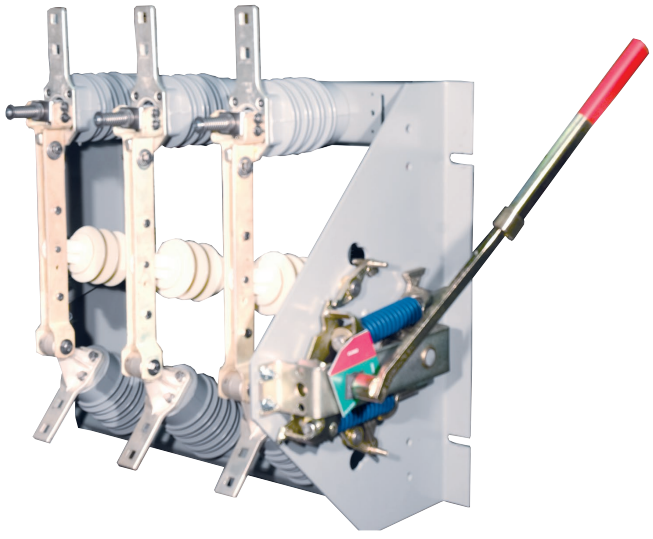
Normally operates as two electrically independent unit substations with bus-tie breaker (T) open and with approximately half of total load on each bus. In case of a failure on either primary incoming circuit, only one bus is affected, and service can be promptly restored by opening main breaker (M) on dead bus and closing tie breaker (T). This operation can be made automatic, with duration of outage on either bus limited to a few seconds. Since the transformers are not continuously paralleled, secondary fault currents and breaker application are similar to those on radial unit substations. Either transformer can be removed from service and isolated with no interruption of service on either bus by first closing the tie breaker and then opening the associated main breaker. Service continuity and substation capacity can be further improved by substituting selector type primary switches, as in B.



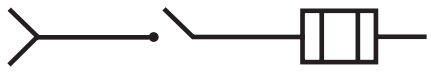
Primary or Incoming Line Section

Federal Pacific Unit Substations are supplied with Auto-jet® II switches with the following features:

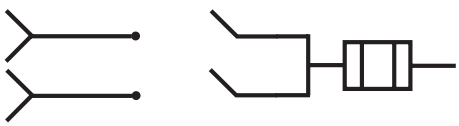
- 600 amp continuous and interrupting
- Single and three-phase
- Front chain drive
- Side-operated direct drive
- Motor operated
- Up to 61 ka asymmetrical momentary and one-time fault -closing
- Up to 40 ka asymmetrical 3-time fault-closing
- 1200 amp continuous and interrupting, most ratings
- UL® listed designs available at 5kV and 15kV



Configurations available:



Single Incoming - Radial



Dual Incoming - Loop

Transformer Section

Primary Voltages to 34.5 kV

- Dry-Type Transformers
- Liquid Transformers

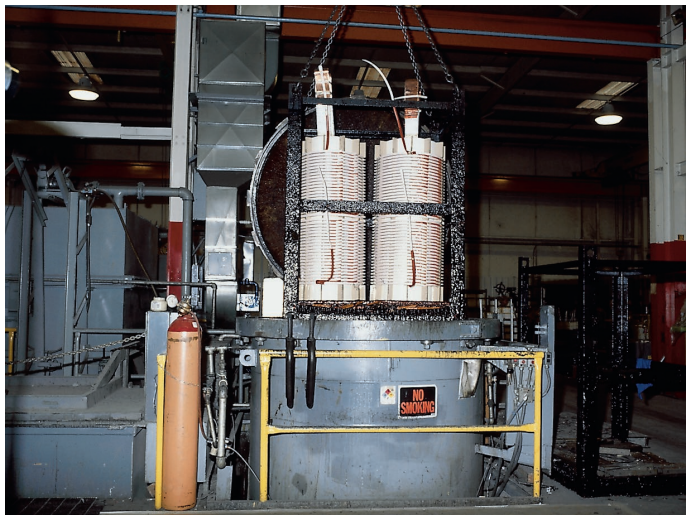
Dry-Type Transformer Features:

- 112.5 KVA through 10 MVA and above
- 2.4 kV through 35 kV class
- Standard or custom designs
- Ventilated indoor or outdoor enclosures
- 80° C, 115° C, or 150° C temperature rise
- Copper or aluminum windings
- Wide variety of options and accessories
- UL® listed designs available at 5kV and 15kV

Vacuum Pressure Impregnated (VPI) and VPI/Epoxy Shielded Transformers feature polyester coil encapsulation process plus an optional epoxy shield.

Advantages over cast-coil:

- Outstanding environmental protection
- Higher thermal overload capabilities
- Significantly lower initial cost (2/3 of cast coil)
- Reduced operational cost due to elimination of epoxy cracking
- Less weight, smaller size (25% less on a typical 1000 KVA)
- Maximum design flexibility
- Greater dielectric strength
- Short delivery due to less manufacturing process time



Federal Pacific offers the option of dry-type or liquid-filled transformers from nationally and internationally recognized manufacturers.

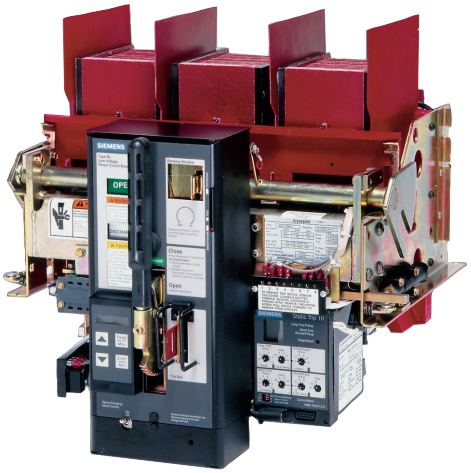
Low-Voltage Section

Federal Pacific Power Circuit Breaker Drawout Switchgear

- UL ratings on major components, such as switches, dry-type transformers and power circuit breakers
- Secondaries from 240 VAC including:
  600 volt power circuit breakers
  5kV - 15kV metal-clad switchgear
  5kV motor control centers
- Custom configurations to meet specific electrical and mechanical criteria

Accessories

Standard accessories that are easily provided are: secondary metering, including transformers, feeder metering, electrical, mechanical and key interlocking, breaker element lifting device, and an array of tripping and auxiliary functions available on the breaker elements.



- Metal-enclosed drawout construction
- Stored energy breaker mechanism manually or electrically operated
- 800; 1,600; 2,000; 3,200; and 4,000 A. frames
- Adjustable solid state trip devices
- Interrupting ratings to 85,000 A. Sym.
- Integrally-mounted current limiters for 200,000 A. interrupting capacity

Construction

The low-voltage distribution section of many Federal Pacific Unit Substations consists of low-voltage power circuit breaker drawout switchgear that provides a combination of the most modern circuit breaker devices and flexible structure design to offer the maximum in system protection to most low-voltage distribution requirements. The self-powered, fully-adjustable solid state trip devices utilized in the circuit breaker elements provide completely coordinated overcurrent and short-circuit protection with the availability of narrow trip bands, selective tripping, and integrally-mounted ground fault protection.

The structure is completely compartmentalized to isolate each circuit breaker in its own cell. A full-height load-side rear cable compartment eliminates the need for pull boxes and may be optionally isolated from the associated front bus compartment. Standardized busing arrangements are utilized and future extension is provided. Cable or busway connections are easily made out the top, bottom, or other locations as required.