ECET 4520

Industrial Distribution Systems, Illumination, and the NEC

Distribution System Components

Distribution System Components

An <u>Industrial (Electric) Distribution System</u> is a network of electrical devices that receives electric power from a local provider (utility) and distributes it to the utilization equipment within an industrial facility.

This presentation introduces and defines many of the different components found within an industrial distribution system.

Note – in order to maintain consistency throughout the course, the provided definitions are taken from Article 100 of the NEC whenever possible.

Service

Service – The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

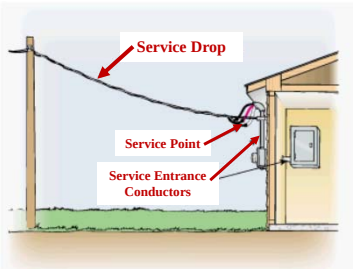
Note – The term "service" includes all the materials and equipment involved with the transfer of electric power from the serving utility, as governed by the NESC (National Electrical Safety Code), to the electrical wiring system of the premises being supplied, as governed by the NEC (National Electric Code).

Service Point – The point of connection between the facilities of the serving utility and the premises wiring.

Service – Utility Side

Service Drop – The (utility-owned) overhead conductors between the utility electric supply system and the Service Point.

If the Service Point is located at the utility pole, then the conductors shown in the figure would be considered Overhead Service Conductors



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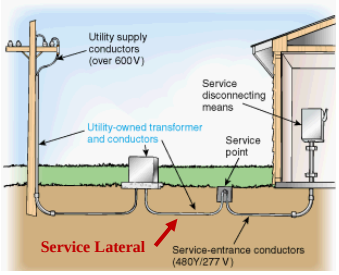
Service – Utility Side

Service Lateral – **The (utility-owned) underground conductors between the utility electric supply system and the Service Point.**



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Service – Premises Side

Disconnecting Means – **A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of (electric) supply.**

Service Conductors – **The conductors from the Service Point to the Service Disconnecting Means.**

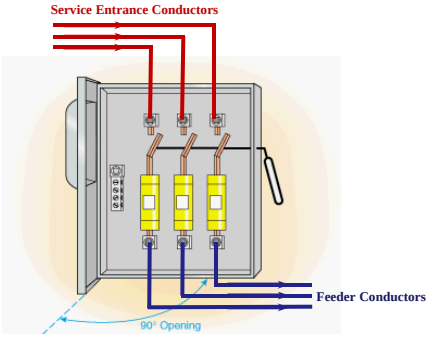
Note – The term Service Conductors is a general term that describes the conductors between the Service Point and the Service Disconnecting Means. These conductors are further classified as Overhead or Underground Service Conductors, and/or Overhead or Underground System Service-Entrance Conductors.

Service – Premises Side

Service Equipment – **The necessary equipment, usually consisting of a circuit breakers or switches and fuses and their accessories, connected to the load end of Service Conductors … and intended to constitute the main control and cutoff of the supply.**

For example:

A gang-operated, three-pole switch (disconnecting means) connected in series with a set of fuses allows for both manual and automatic operation.



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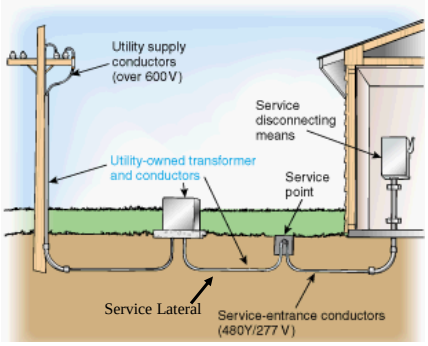
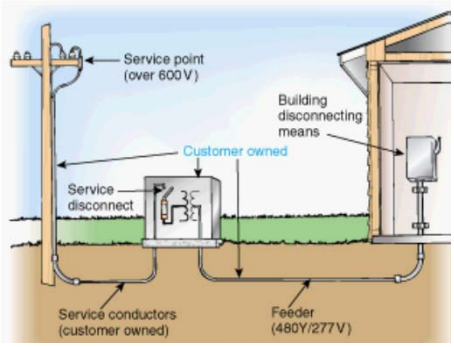
Service Example Comparison

Service Supplying Customer-Owned Transformer

Note that, in the 2nd case, the conductors on "load" side of transformer are not considered Service Conductors" due to the location of the Service Disconnecting Means.





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Electric Distribution Systems

Premises Wiring (System) – Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point.

Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar (utilization) equipment.

Distribution System Components

Device – A unit of an electrical system, other than a conductor, that is intended to carry or control but not utilize electric energy.

Utilization Equipment – Equipment that utilizes electric energy for electromechanical, electronic, heating, lighting, or similar purpose. (I.e. – "Loads")

Switchboards

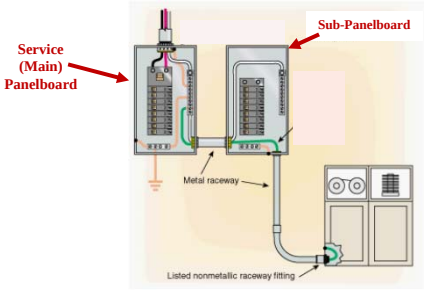
Switchboard – **A large single panel, frame, or assembly of panels on which are mounted… switches, overcurrent and other protective devices, buses, and instruments.**

Switchboards are generally accessible from the rear as well as from the front, and are not intended to be installed in cabinets.

Panelboards

Panelboard – **A single panel or a group of panel units in the form of a single panel, including buses and automatic overcurrent devices, equipped with or without switches for the control of light, heat, or power circuits.**

Panelboards are designed to be placed in a cabinet or cutout box that is placed in or against a wall and are only accessible from the front.



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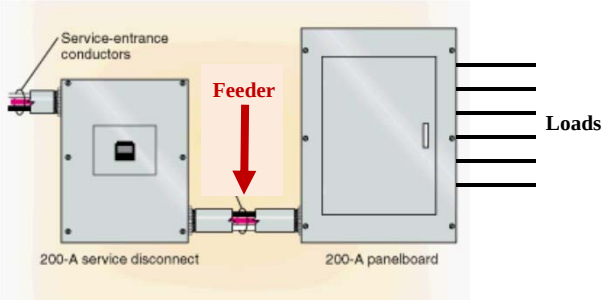
Feeders

Feeder – All circuit conductors between the service equipment or other power supply source and the final branch-circuit overcurrent device.



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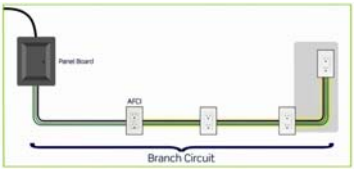
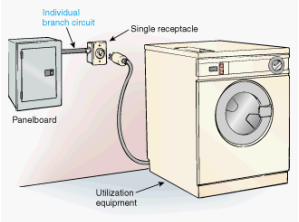
Branch Circuits

Branch Circuit – The circuit conductors between the final overcurrent device protecting the circuit and the outlets.



Individual Branch Circuit – A branch circuit that serves a single dedicated load.

Also called a *Dedicated Circuit* or a *Special Purpose Circuit.*



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Outlets

Outlet – A point on the wiring system at which current is taken to supply utilization equipment.

Note that this term is frequently misunderstood to only apply to a specific device within the distribution system from which current is taken, such as a box or a receptacle.

But, based on the actual definition, the terminal housing of a hard-wired motor is the outlet at the end of the branch circuit that is supplying the motor.

Outlets

Lighting Outlet – An outlet intended for the direct connection of a lampholder, a luminaire (lighting fixture) or a pendant cord terminating in a lampholder.

Luminaire – A complete lighting unit consisting of lamps together with the parts designed to distribute the light, to position and protect the lamps and ballast (where applicable), and to connect the lamps to the power supply.

Outlets

Appliance Outlet – **An outlet intended for the direct connection of Utilization Equipment, generally other than industrial, that is installed or connected as a unit to perform one or more functions.**

Appliance – **Utilization equipment, generally other than industrial, that is installed or connected as a unit to perform one or more functions such as clothes washing, air conditioning, deep frying, and so forth.**

Outlets

Receptacle Outlet – **An outlet where one or more receptacles are installed.**

Receptacle – **A contact device installed at an outlet for the connection of an attachment plug.**

Attachment Plug – **A device that, by insertion in a receptacle, establishes a connection between a flexible cord's conductors and the conductors connected permanently to the receptacle.**

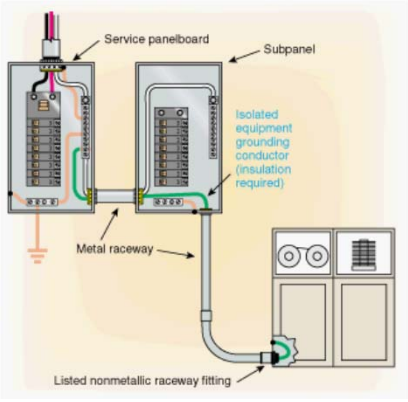
Raceways

Raceway – An enclosed channel that is designed for holding wires, cables or busbars.

- **Rigid Metal Conduit – Heavy galvanized steel or aluminum tube with threaded ends.**
- **Electrical Metallic Tubing (EMT) – thin-walled galvanized steel or aluminum tube with compression couplings.**

Distribution System Example

System with Service Panelboard and Subpanel



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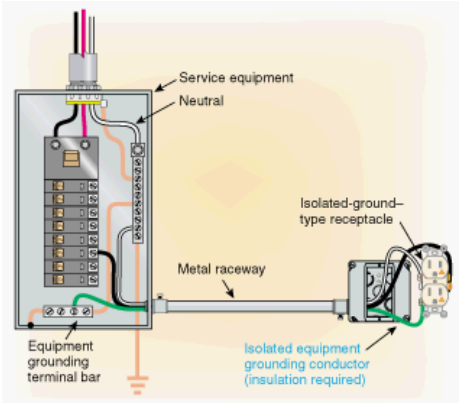
Distribution System Example

Service Panelboard and Branch Circuit



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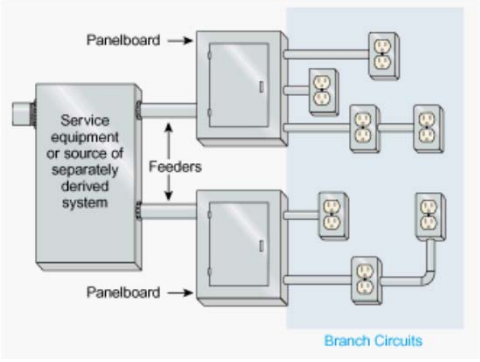
Distribution System Example

Feeder and Branch Circuit Example



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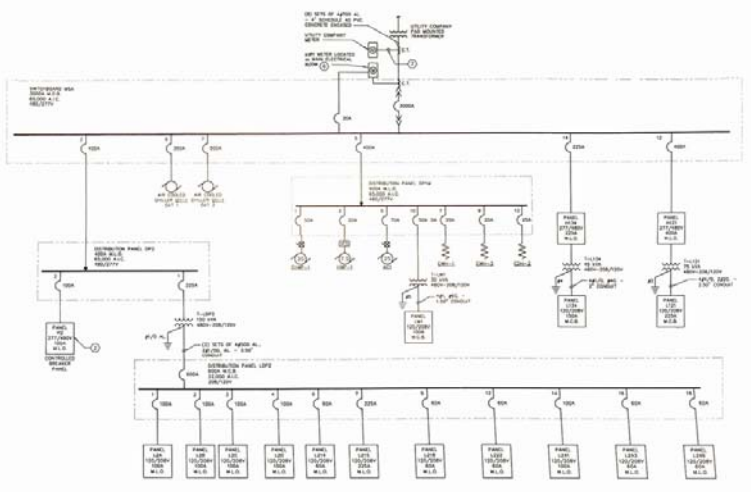
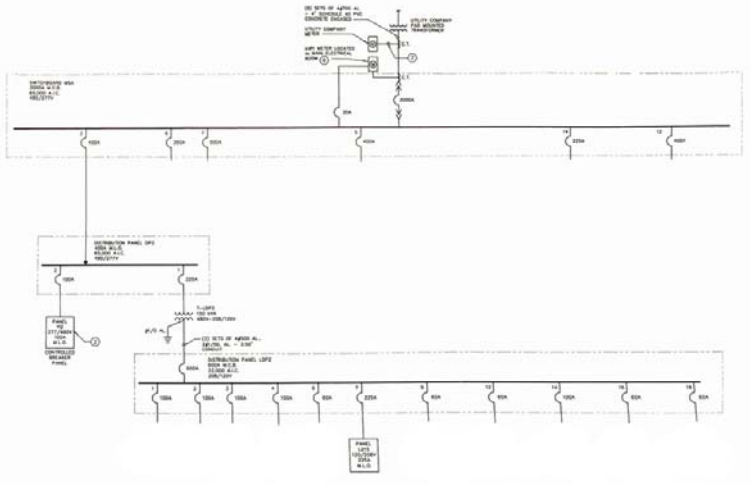
Q-Building Electric Distribution System

Partial One-Line Electrical Diagram



Q-Building Electric Distribution System

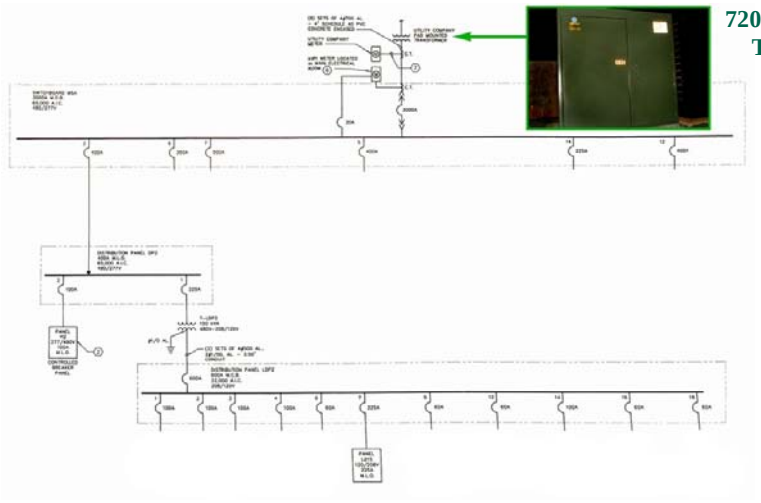
Path from Service Transformer to Q-215 Lab



Q-Building Electric Distribution System

Utility-Owned Transformer

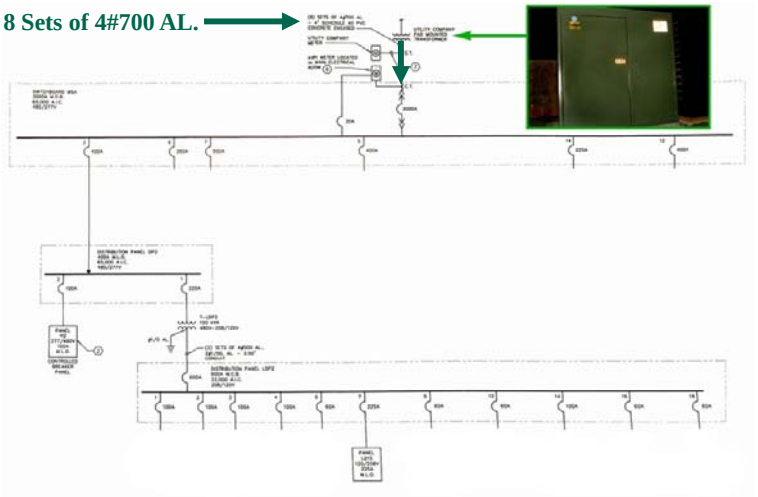
1500kVA
7200V – 480/277V
Transformer



Q-Building Electric Distribution System

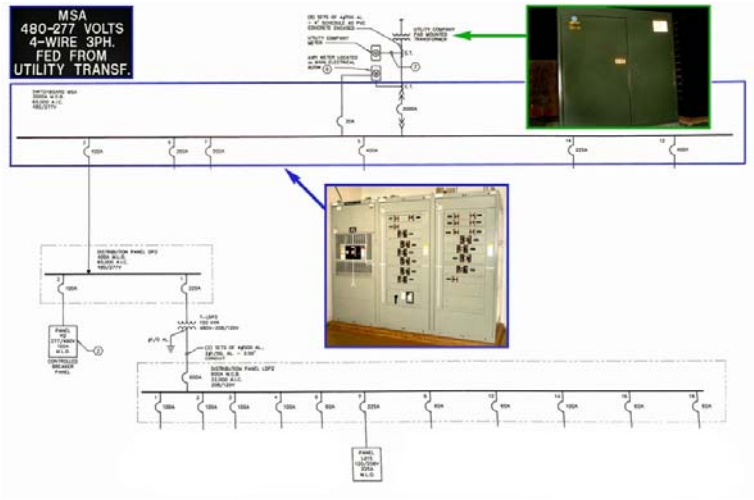
Service Entrance Conductors

8 Sets of 4#700 AL.



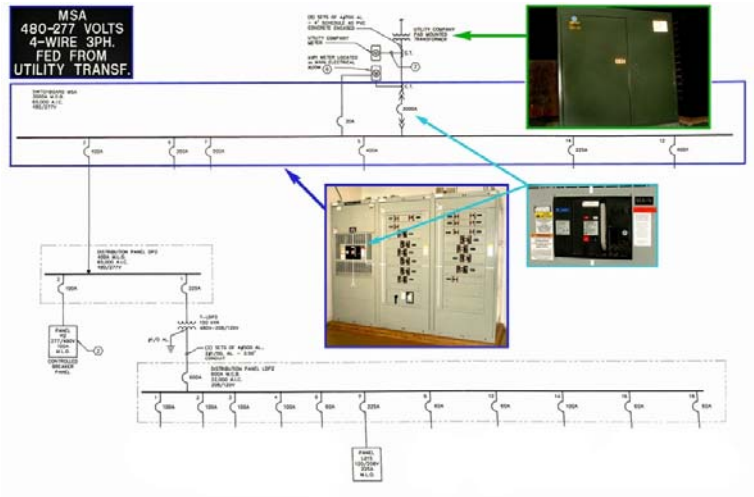
Q-Building Electric Distribution System

Main Switchboard – MSA



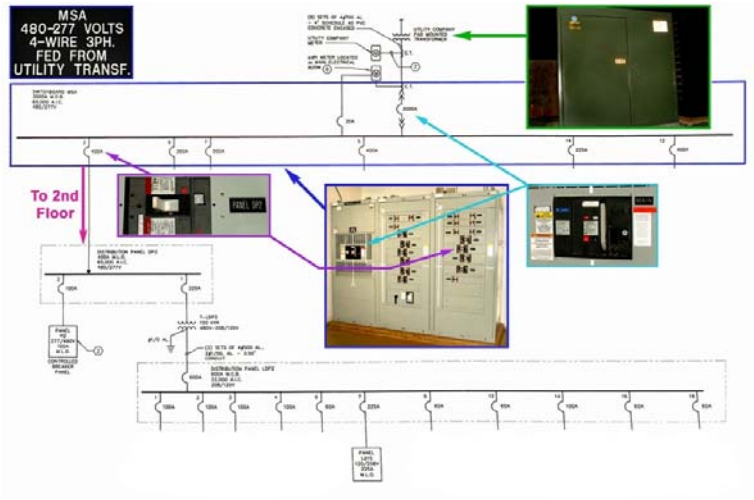
Q-Building Electric Distribution System

Disconnecting Means – 3000A Circuit Breaker



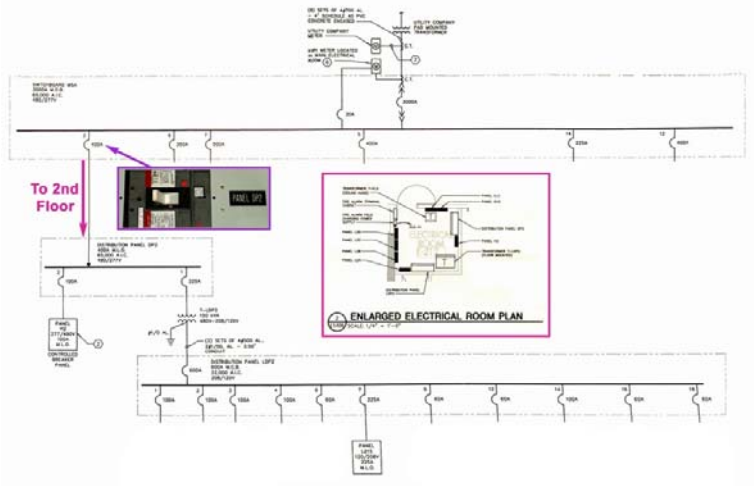
Q-Building Electric Distribution System

400A Circuit Breaker Protecting Feeder to 2nd Floor



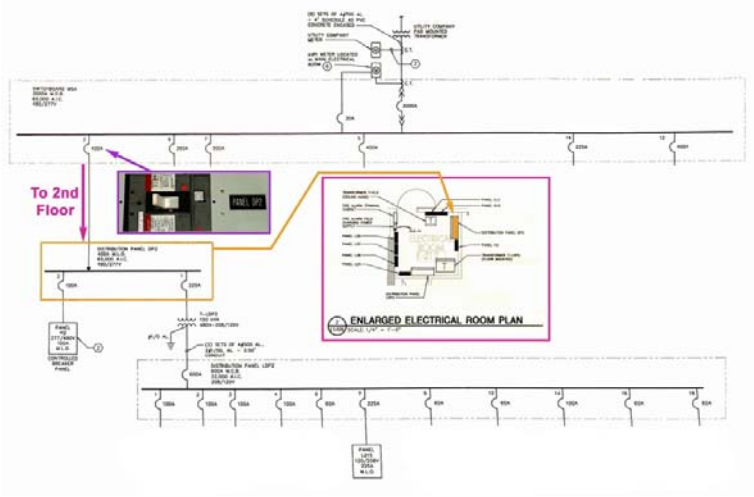
Q-Building Electric Distribution System

400A Feeder to Panel DP2 in 2nd Floor Electrical Room



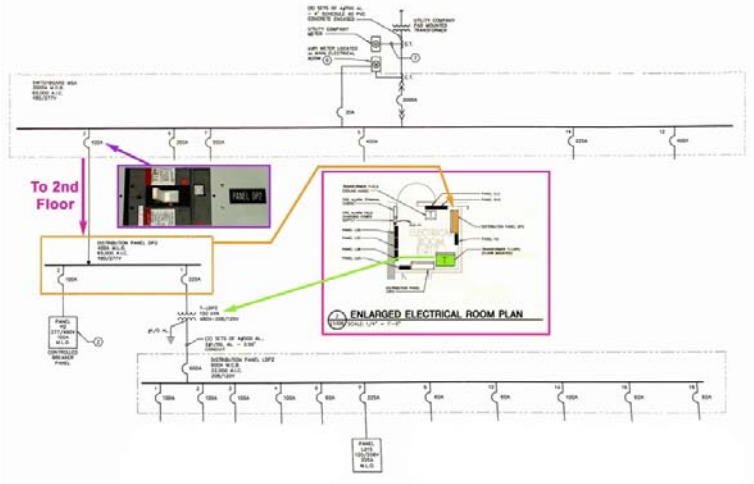
Q-Building Electric Distribution System

Distribution Panel DP2



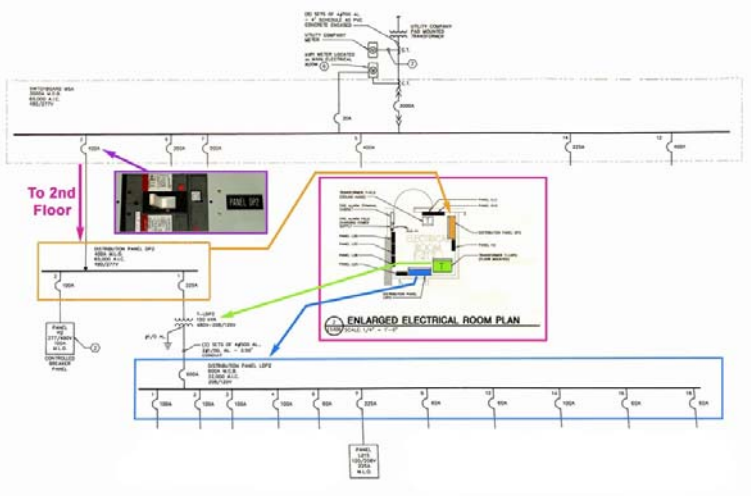
Q-Building Electric Distribution System

150kVA, 480V – 208Y/120V Step-down Transformer



Q-Building Electric Distribution System

Low-Voltage Distribution Panel LDP-2



Q-Building Electric Distribution System

225A Feeder to Panel L-215