

GP 16-06-01	Substation Layout	August 2003
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Substation Layout

GP 16-06-01

Scope

- 1) [I] This Global Practice (GP) covers substation layout.
 - 2) [I] Outdoor switchyards and switch racks are covered only with regard to space from other equipment. The layout of the switchyard or switchrack itself is not covered by this Practice.
 - 3) [I] An asterisk (*) indicates that additional information is required. If a job is contracted, this additional information shall be furnished in the Job Specification.
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1. Required References

[I] This Section lists Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. ASTM–American Society for Testing and Materials

ASTM D 448	Standard Classification for Sizes of Aggregate for Road and Bridge Construction
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1.2. IEEE–Institute of Electrical and Electronic Engineers

IEEE C2	National Electrical Safety Code (ANSI/IEEE)
IEEE C37.30	Standard Requirements for High-Voltage Switches (ANSI/IEEE)

1.3. NEMA–National Electrical Manufacturers Association

NEMA Z535.5	Accident Prevention Tags (for Temporary Hazards)
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1.4. NFPA–National Fire Protection Association

NFPA 70	National Electrical Code
NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment (National Fire Codes, vol. 7)
NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas Revised and Redesignated from NFPA 497A-1992 and Part of NFPA 497M-1991 (National Fire Codes, vol. 11)

2. Additional Requirements

- [I] The following GPs shall be used with this Practice as specified by the Owner's Engineer.
- * [I] Appropriate regional or national standards applicable to the specific location shall be used with this GP as specified.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 04-03-01	Plant Buildings for Operation and Storage
GP 04-03-02	Blast Resistant Buildings

3. Definitions

Term	[I] Description
acceptable and preferred practices	* Where this GP lists more than one type of equipment or method as acceptable or preferred, the Contractor shall make the selection based on Owner's optimum cost benefits. Optimum cost benefits may be achieved by reducing maintenance and operating expense through initial added investment. Economic basis for calculating optimum cost benefits shall be specified in the design documents.
captive transformer	A transformer which supplies a single utilization device, usually a large motor. The transformer may be located either at a substation or close to the device it supplies.
critical facility	* A facility which represents or is needed for 20 percent or more of plant production or throughput. The facilities may be process units, loading or unloading facilities, utilities, and similar major elements of a plant. Facilities not meeting the 20 percent rule may also be designated as critical for safety, environmental or commercial reasons.
flash protection boundary	An approach limit at a distance from live parts that are uninsulated or exposed within which a person could receive a second-degree burn.
independent facility	One facility is defined as independent of another facility if the first mentioned facility can operate without the other facility
indoor substation	A substation within a field-constructed or prefabricated building.
main substation	A substation or switchyard which supplies all or a major part of the power to the individual substations supplying the onsite and offsite facilities of a complete plant.
outdoor substation	Defined by construction type as one of the following: a. Standard outdoor construction is metal-clad equipment protected by a weatherproof enclosure. b. Protected-aisle outdoor construction is metal-clad equipment within a factory-assembled building-like enclosure.
substation	An assembly of switchgear or control center equipment supplied directly by feeders or by adjacent transformers.
substation at grade	Having the finished floor level 8 in. (200 mm) above the adjoining grade.
substation building elevated to accommodate underground cable entry	At least 5 ft (1.5 m) above grade
substation building with floor above grade to meet area classification	At least 2 ft (600 mm) above surrounding grade.



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4. Documentation

- 1) [M] Substation equipment layout drawings of all indoor and main outdoor substations shall be prepared. Such drawings shall show building doors, equipment positions, and the extent of breakers when in withdrawn position with equipment doors open. These shall be dimensioned with clearances and aisles detailed.
- 2) [O] The position of maintenance items (i.e., breaker trucks) stored in the substations shall also be shown.
- 3) * [S] When specified or required by national standards, the flash protection boundary shall be calculated and documented for each piece of switchgear and motor control at 208V and greater. The calculation method shall be approved by the Owner's Engineer.

5. Location and Protection

- 1) [S] For switchgear and motor controllers, minimum spacing from flammable release sources shall be as shown on the area classification drawings and as follows:
 - a) Spacing for main substations shall be at least 150 ft (45 m).
 - b) * Spacing of less than 150 ft shall be approved by the Owner's Engineer.
 - c) Spacing requirements for other than main substations are given in Table 1. These are listed for the indicated type of equipment, flammable release source location, and operation.
- 2) [S] Indoor and protected-aisle outdoor substations located in a 2 ft (600 mm) high Division 2 area, and within 50–100 ft (15–30 m) from a heavier-than-air release source, shall have elevated floor levels as follows.
 - a) Floor levels shall be elevated 2 ft or more above surrounding grade.
 - b) Ventilation shall not be used to make the substation unclassified.
 - c) When a substation is raised 2 ft (600 mm), the space under indoor substations or protected-aisle outdoor substation shall be enclosed on all four sides and solidly filled from grade to floor level.

[R] Main substations shall be located in non-classified locations that are free of cooling tower spray and other gases or vapors that could contribute to insulation and equipment failures. These substations shall also be sufficiently removed from heat sources that could affect equipment capabilities.
- 4) * [M], [R] Unless otherwise specified, substation buildings in classified locations, or in any location with a corrosive or extremely dusty atmosphere, shall be pressurized.

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