

# **Electric Service Vault Manual**



6/27/2019



# Electric Service Vault Manual

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## Preface

### 00.0) Purpose

The purpose of a vault is to provide a space physically within a building footprint that can be considered outside of the building from a code compliance perspective. This creates a space that utility equipment can exist without restraint from the NEC and other codes typically applicable to a building. The Wisconsin Administrative Code, section PSC 114, governs the equipment installation within the vault and compliance is self-enforced by the utility.

### 00.1) Scope

These requirements are applicable to all customer owned structures and/or facilities in which We Energies owned equipment and/or cables are installed. Two types of installations are covered by this manual, differing primarily based on who the space is accessible to. They are:

#### **Vault**

- Located within a building footprint or underground
- Accessible only to qualified utility personnel and fully secured with utility owned locks
- Cables and terminations typically exposed
- Customer owned service equipment is not permitted

#### **Alcove**

- Located within a building footprint (at grade only)
- Access not limited to utility personnel (unsecured)
- All cables protected by conduits and/or equipment enclosures
- Limited to pad mount utility equipment
- Customer owned service equipment is allowable



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## Part 1: Design & Construction Process

### 10) Design Requirements

#### 10.1) Engineering Review & Acceptance

**10.1.10)** We Energies, in its review and inspection, may specify additional requirements relative to equipment utilized and general design.

**10.1.20)** For questions of requirement intent, a We Energies Application Engineer will provide an interpretation/clarification and shall be solely responsible for final determination of compliance.

#### 10.2) Customer Design

WI administrative code prevents a regulated utility from engaging in direct competition with non-regulated entities such as contractors and consultants. The customer is therefore responsible for the design and all associated costs for any structure or equipment owned by the customer. We Energies shall, at its discretion, provide feedback, suggestions, or guidance for the customer and their consultants/contractors.

**10.2.10)** The customer shall provide drawings for We Energies' review and acceptance detailing all structure and equipment within and related to the vault or alcove. Prior to making changes during construction, drawings shall be updated and re-submitted to We Energies for review and acceptance.

**10.2.20)** The customer's design shall consider both the present and future equipment placement needs of We Energies.

**10.2.30)** The customer's design shall accommodate the placement and connection of a grounding grid and ground rods which shall be designed and installed by We Energies. A reasonable separation/isolation of customer grounding shall be maintained (typically 10' for ground rods) from utility grounding.

**10.2.40)** Each vault/alcove will require equipment and conduit placement unique to the project. Customer owned equipment such as fans, ventilation, and lighting will also require coordination. Consult a We Energies' Application Engineer for specific constraints/requirements.



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## Part 1: Design & Construction Process

### 11) Construction Process

#### 11.1) Construction Coordination

**11.1.10)** We Energies must install ground rods and a grounding grid at specific stages in the construction process prior to completion of the customer's construction. The customer shall coordinate these installations with We Energies and shall provide a minimum of 2 weeks' notice prior to the desired installation date (one months' notice is preferable to ensure crew availability).

a) Ground rods need to be driven into unexcavated earth and shall be installed prior to backfilling.

b) Ground grid/mat is required to be installed into the final floor slab and shall be installed directly into the slab after installation of stone underlayment and/or moisture barrier materials.

**11.1.20)** The customer shall be responsible for maintaining a secure worksite and protecting installed grounding from theft and shall be responsible for all costs associated with repair or replacement of installed grounding.

**11.1.30)** Installation of ground bus and/or other We Energies' equipment shall commence only after the vault/alcove is fully secured and lockable. Additional customer construction shall be permissible only by exception under limited circumstances and shall require a We Energies escort. Costs associated with a We Energies escort for this purpose shall be chargeable to the customer/contractor.



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## Part 1: Design & Construction Process

### 11.2) Example Sequence of Events

The following typical sequence of events is intended for use as a reference and is likely to vary depending on the specifics of a particular project.

- Customer applies for service and provides load calculations.
- Initial meeting to discuss viable options, location, and rough size requirements.
- Customer selects proposed location and We Energies develops initial equipment layout.
- Follow up meetings refine customer design and We Energies equipment layout.
- We Energies Application Engineer reviews customer drawings and provides feedback.
- We Energies Application Engineer provides acceptance of customer drawings for release to construction.
- Customer begins construction of vault/alcove with site prep and excavation.
- Footings, below grade electrical conduits, pipes, structural steel/concrete, and some masonry walls are installed.
- We Energies installs ground rods.
- Stone backfill, compacting, and installation of waterproofing membrane and sealing of penetrations occurs.
- We Energies installs ground grid during/following placement of rebar for the floor slab
- Floor slab is poured.
- Vault/alcove structure is completed and installation of ventilation and doors occurs
- Electrical and lighting is installed and penetrations/conduit for service conductors are installed through the wall.
- Fireproofing and sealing of all penetrations occurs.
- Door hardware and any other remaining items are finished.
- Inspection by a We Energies Application Engineer occurs. Acceptance is provided and We Energies installs a lock cylinder.
- Customer switchgear is installed.
- We Energies installs ground bus, a transformer, and primary cabling.
- Customer switchgear is inspected by the municipality and We Energies metering group
- We Energies installs secondary cables and meters.
- Service is energized.



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## Part 2: Physical Requirements

### 20) Vaults

#### 20.1) General

Electric service vault requirements apply to a room in the customer's facility in which We Energies will build and own an electrical distribution substation. The customer is responsible for the structure and the environment. We Energies is responsible for its electrical distribution equipment.

**20.1.10)** Each aisle or work space about equipment shall have a suitable means of exit which shall be kept clear of all obstructions. If the character and arrangement of equipment in the vault are such that an accident would close or render a single exit inaccessible, a second exit shall be provided.

**20.1.20)** All personnel doors shall swing out and be equipped with full width panic bars that are normally latched but open under simple pressure for quick escape in the event of trouble. Von Duprin catalog number 99NL-F or functional equivalent shall be used.

**20.1.30)** The customer shall furnish and install sufficient lighting fixtures to provide a minimum illumination intensity of 10 foot candles. If the room temperature is to be maintained above 40°F, fluorescent light fixtures may be used. The lighting fixtures shall be arranged so that persons changing lamps or making repairs on the lighting system will not be endangered by live parts or other equipment. The lighting circuit shall be supplied from a back-up generation source, if present.

**20.1.40)** A We Energies supplied lock box containing any required keys to access the vault via the customer's facility shall be installed in a location readily accessible to We Energies unless compliance with 31.1(b) is maintained at all times.

**20.1.50)** The vault shall be constructed according to the requirements of the Wisconsin State Administrative Code, sections PSC 114 & SPS 316, and meet the requirements of all local ordinances.

#### 20.2) Vault Structure

**20.2.10)** Indoor vaults shall be located so as to be easily accessible by Company personnel to facilitate moving and operation of utility electrical distribution equipment. The customer must provide floors, doorways, passageways and/or elevators having structural strength and clearances adequate for the transportation, installation and replacement of transformers and associated equipment. These clearances shall take into consideration the ultimate transformer size needed for the installation. It is highly desirable that a hatchway or doorway on an



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outside wall or ceiling of the vault will be provided such that the equipment can be installed directly from the outdoors.

**20.2.20)** The size and shape of the vault in which We Energies equipment is to be installed must be sufficient to safely operate the installed equipment, perform maintenance on such equipment, and remove and replace such equipment should that become necessary. The minimum vault size and shape will be specified by the We Energies Application Engineer.

**20.2.30)** The vault will be secured with a We Energies provided and installed high security lock cylinder in each door. The cylinder may be either a rim or mortise type.

**20.2.40)** The walls and roofs of vaults shall be constructed of masonry materials which have adequate structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with earth shall be concrete not less than 4 inches thick, but when the vault is constructed with a vacant space or other rooms below it, the floor shall have adequate structural strength for the ultimate load and a minimum fire resistance of 3 hours.

**20.2.41)** The use of materials which are subject to rot and/or mold growth in the presence of moisture or which are readily flammable are not acceptable for use inside or as part of the vault structure. Such materials include, but are not limited to: wood, drywall, foam insulation, and plastics. PVC conduit, insulated wiring such as THHN, and plastic equipment housings are acceptable when used as part of a system required by this manual.

**20.2.42)** Windows, glass panels, or glass blocks are not permissible.

**20.2.50)** The customer shall provide non-combustible exterior doors and fireproof interior doors suitable for the required size of the doorway. All doors shall swing out of the vault. The We Energies Application Engineer will specify required doorway size(s) and location(s).

**20.2.51)** Where a doorway connects the building and vault, the fire resistance rating of the door shall be a minimum of 3 hours. A minimum 3.5" concrete sill or curb shall be provided under each vault interior doorway to contain within the vault the oil from the largest transformer unless the floor of the transformer vault is at least 4" inches below the adjacent area.

**20.2.60)** The customer shall provide drainage to carry off any accumulation of water via one of the two methods below.

**a) Floor drain(s):** The entire floor shall be pitched to the drain(s) at a slope of 1-2%. Sump crocks and pumps associated with transformer vault floor drains shall be located outside of the vault so they can be maintained without entry to the vault. The customer shall consult with local sewerage district to determine what if any provisions are required to prevent





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transformer oil entry into the local sewer system in the event of a transformer case leak. The customer is responsible to install any required oil stop provisions.

b) Gravity directly to the outside of the building: The entire floor shall be pitched to the exterior doorway(s) at a slope of 1-2%. A small gap of ¼ to ½ inch shall be provided in place of a door sill. The drainage path shall be free of curbs or other obstructions. Vault floor elevation must be above adjacent grade.

**20.2.70)** The customer shall provide electrical conduits and penetrations as required for We Energies' primary and secondary cables. The locations, sizes, arrangement will be specified by the We Energies Application Engineer.

**20.2.80)** Pipe, duct, or conduit systems foreign to the electrical installation shall not enter, pass through, or be installed in earth below a transformer vault except by written permission from a We Energies Application Engineer. No system will be accepted if it contains appurtenances that require maintenance.

### 20.3) Ventilation

The customer shall provide ventilation adequate to dispose of transformer full-load losses without creating an excessive ambient temperature above 40 °C (105 °F). One of the two methods below shall be utilized.

a) For a vault ventilated by **natural air circulation**, the combined net area of all ventilating openings shall not be less than 3 square inches per kVA of ultimate transformer capacity. Roughly half of the total area of openings required for ventilation shall be in one or more openings near the floor and the remainder in one or more openings in the roof or side walls near the roof. Intake and exhaust vents should be located at opposite ends of the vault to promote good air circulation.

b) For a vault ventilated by **forced air circulation**, the forced air system shall provide a minimum ventilation capacity of 1.5 CFM per kVA of ultimate transformer capacity. Fan or blower units shall be located outside of the transformer vault so that they can be maintained without entry to the transformer vault.

**20.3.10)** Vaults shall be ventilated directly to the outside without using flues or ducts unless written variance is granted by the State of Wisconsin Electrical Inspector.

**20.3.20)** When written variance is granted by the State of Wisconsin Electrical Inspector flues and/or ducts may be used if the ducts are of a fire resistive construction.



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**20.3.30)** When written variance is granted by the State of Wisconsin Electrical Inspector to ventilate the transformer vault to the indoors ventilation openings shall be fitted with automatic closing fire dampers that operate in response to a vault fire. These dampers shall possess a standard fire rating of not less than 3 hours.

**20.3.40)** Forced air systems shall be thermostat controlled with a turn-on temperature of 85° F. Use of thermostat(s) other than simple switched line-voltage units or integration with a building automation system requires review and acceptance by a We Energies Application Engineer. For installations with multiple stages or variable-speed fans full rate of flow shall be reached by 105° F.

**20.3.50)** Ventilation openings shall be covered with durable grating and screens or louvers in order to avoid unsafe conditions and to restrict entrance of snow and rain. Gratings shall be ¼ to ½” mesh and made of cooper, stainless steel, or heavy gauge galvanized steel.

### 20.4) Ancillary Equipment

**20.4.10)** In addition to the lighting circuit, the customer is required to furnish and install one 20 ampere, 120 volt circuit in the transformer vault. This circuit shall be supplied from a back-up generation source, if present.

**20.4.20)** The customer shall only provide a fire suppression system (automatic sprinkler) if required by local ordinances. The fire suppression system shall be a type that is not damaged or activated by freezing temperatures. Heads and associated piping shall not obstruct replacement of transformers or other equipment.

**20.5)** Secondary Service Termination shall comply with one of the following methods.

**a)** If the customer installs a We Energies approved service termination enclosure We Energies will extend secondary conductors within customer installed conduits from the transformer vault to the termination enclosure. We Energies will extend conductors no greater than 8 feet outside the vault.

**b)** If the customer installs a termination enclosure that is not approved by We Energies or the customer wishes to extend conductors greater than 8 feet outside the vault the customer must extend secondary conductors from the termination enclosure to the terminals of the We Energies owned transformer(s) in the vault. Review & acceptance of materials and method by a We Energies Application Engineer is required prior to construction.



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## Part 2: Physical Requirements

**20.5.10)** Secondary services shall be metered per the We Energies “Electric Service and Metering Manual Books 1 and 2.



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## Part 2: Physical Requirements

### 21) Alcoves

#### 21.1) General

Electric service alcove requirements apply to a space accessible to the customer and within the customer's facility's foundation in which We Energies will install and own electrical distribution equipment. The customer is responsible for the structure. We Energies is responsible for the electrical distribution equipment.

**21.1.10)** Each aisle or work space about equipment shall have a suitable means of exit which shall be kept clear of all obstructions. If the character and arrangement of equipment in the alcove are such that an accident would close or render a single exit inaccessible, a second exit shall be provided. Operating clearances and egress required by SPS 316 and the NEC shall be maintained for all equipment in the alcove.

**21.1.20)** All personnel doors shall swing out and be equipped with full width panic bars that are normally latched but open under simple pressure for quick escape in the event of trouble. Von Duprin catalog number 99NL-F or functional equivalent shall be used.

**21.1.30)** The customer shall furnish and install sufficient lighting fixtures to provide a minimum illumination intensity of 10 foot candles. Fluorescent light fixtures shall not be used. The lighting circuit shall be supplied from a back-up generation source, if present.

**21.1.40)** Only metal-enclosed utility equipment shall be allowed in areas accessible to unqualified persons. Un-protected live parts require use of a secured vault.

**21.1.50)** The alcove shall be constructed according to the requirements of the Wisconsin State Administrative Code, sections PSC 114 & SPS 316, and meet the requirements of all local ordinances.

**21.1.60)** Transformers and other equipment installed in an alcove will require specific conduit placements and minimum bend radii. The customer shall provide drawings detailing this information for review and acceptance by a We Energies Application Engineer prior to construction.

#### 21.2) Alcove Structure

**21.2.10)** Alcoves shall be located at grade level and so as to be easily accessible by Company personnel to facilitate moving and operation of utility electrical distribution equipment. The customer must provide floors, doorways and/or passageways having structural strength and clearances adequate for the transportation, installation and replacement of transformers and



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## Part 2: Physical Requirements

associated equipment. These clearances shall take into consideration the ultimate transformer size needed for the installation.

**21.2.20)** The size and shape of the alcove in which We Energies equipment is to be installed must be sufficient to safely operate the installed equipment, perform maintenance on such equipment, and remove and replace such equipment should that become necessary. The minimum alcove size and shape will be specified by the We Energies Application Engineer.

**21.2.30)** The walls and roofs of alcoves shall be constructed of masonry materials which have adequate structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of alcoves in contact with earth shall be concrete not less than 4 inches thick, but when the alcove is constructed with a vacant space or other rooms below it, the floor shall have adequate structural strength for the ultimate load and a minimum fire resistance of 3 hours.

**21.2.31)** The use of materials which are subject to rot and/or mold growth in the presence of moisture or which are readily flammable are not acceptable for use inside or as part of the alcove structure. Such materials include, but are not limited to: wood, drywall, foam insulation, and plastics. The use of wood, plastics, and glass (breakable) is acceptable only when used as a non-structural screening material on the exterior of the alcove. PVC conduit, insulated wiring such as THHN, and plastic equipment housings are acceptable within an alcove.

**21.2.40)** The customer shall provide drainage to carry off any accumulation of water. The entire floor shall be pitched to the exterior at a slope of 1-2%. The drainage path shall be free of curbs or other obstructions. Alcove floor elevation must be above adjacent grade.

**21.2.50)** The customer shall provide electrical conduits and penetrations as required for We Energies' primary and secondary cables. The locations, sizes, arrangement will be specified by the We Energies Application Engineer.

### 21.3) Ventilation

The customer shall provide ventilation adequate to dispose of transformer full-load losses without creating an excessive ambient temperature above 40 °C (105 °F). The combined net area of all ventilating openings shall not be less than 3 square inches per kVA of ultimate transformer capacity. Roughly half of the total area of openings required for ventilation shall be in one or more openings near the floor and the remainder in one or more openings in the roof or side walls near the roof. Where possible intake and exhaust vents should be located at opposite ends of the alcove to promote good air circulation. Alcoves shall be ventilated directly to the outside without using flues or ducts.



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**21.4)** Secondary Service Termination shall comply with one of the following methods.

**a)** If the customer installs a We Energies approved service termination enclosure We Energies will extend secondary conductors within customer installed conduits from the transformer alcove to the termination enclosure. We Energies will extend conductors no greater than 8 feet outside the alcove.

**b)** If the customer installs a termination enclosure that is not approved by We Energies or the customer wishes to extend conductors greater than 8 feet outside the alcove the customer must extend secondary conductors from the termination enclosure to the terminals of the We Energies owned transformer(s) in the alcove. Review & acceptance of materials and method by a We Energies Application Engineer is required prior to construction.

**21.4.10)** Secondary services shall be metered per the We Energies “Electric Service and Metering Manual Books 1 and 2.



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## Part 3: Maintenance & Access Requirements

### 30) Documentation

#### 30.1) Vault Agreement

Prior to energizing any services from the vault or alcove the customer shall sign a vault agreement stipulating to compliance with all items in parts 2 and 3 of this document.

**30.1.10)** For transformer vaults that are ventilated to the indoors the customer shall hold We Energies harmless for any damage that results from smoke or fire entry into the building associated with a transformer vault fire.

### 31) Access

**31.1)** The customer shall provide We Energies personnel 24-hour per day access to vaults for the purpose of switching and maintenance via one or both of the following methods.

- a) A We Energies supplied lock box containing any required keys to access the vault via the customer's facility. Arrangements must be made to supply replacement key(s) prior to re-keying of customer lock(s).
- b) 24-hour per day on-site security or maintenance personnel capable of providing prompt escort to the vault via the customer's facility. Call out of off-site personnel is not acceptable.

### 32) Maintenance

**32.1)** The customer shall be responsible for all maintenance to the:

- a) Vault/Alcove Structure – Walls, floors, ceiling, doors, fire proofing materials, and any conduits that penetrate the structure.
- b) Ventilation System – Louvers, screening, duct work, fans, motors, motor controllers, thermostats, etc.
- c) Drainage System – Drains, piping, sumps, pumps, etc.
- d) Lighting System – Bulbs, fixtures, switches, outlets, conduit and wire.
- e) Fire Suppression System – Sprinkler heads, piping, etc.



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## Part 3: Maintenance & Access Requirements

**32.2.10)** The Wisconsin State Administrative Code, PSC 114, and We Energies policy does not allow customers access to vaults containing We Energies equipment. We Energies will inform the customer of any required maintenance, or at the request of the customer will escort the customer through the vault for the purpose of inspection.

**32.2.20)** Any required maintenance will be performed by the customer or his contractor in the presence of a We Energies inspector/escort. Costs associated with a We Energies inspector/escort for this purpose shall be chargeable to the customer.

**32.2.30)** The customer may be held liable for any and all costs associated with repair or replacement of We Energies equipment resulting from failure to perform required maintenance for which they have been notified. This includes but is not limited to damage from flooding due to clogged drains or failed sump pumps and transformer failure due to overheating from a lack of functional ventilation.

**32.3)** We Energies shall be responsible for all maintenance to the We Energies owned electrical distribution equipment. We Energies will, except in the case of emergencies, make arrangements with the customer for any service outages or replacement of equipment requiring disruptions to the customer.





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## Appendix: Recommendations

**A.1)** Ask questions even if you are fairly sure. The consequences of making assumptions can be significant and our experience is that almost every question asked was well worth the time and effort.

**A.2)** On drawings include even minor details in equipment placements such as light switches and fan controls so we can verify they don't conflict with utility equipment or cable routing.

**A.3)** Utilize end bells for all conduits entering a vault or terminating into the bottom of pad mount utility equipment in an alcove. This is a short coupler with a 90 degree radius on the end to prevent chafing of wires

**A.4)** For a vault with a floor drain: unless specified otherwise, conduits entering through a floor should be stubbed 4-6" above the floor height to eliminate the potential for water or oil entering the duct. Taller duct stubs can potentially make cable routing difficult.

**A.5)** For floors drained directly to the outside and all walls: unless specified otherwise, conduits should be stubbed as close as possible (1-2") to the surface.

**A.6)** Prior to handing a vault over to We Energies for final construction rinse the floor down with water. This will help remove dust accumulation and also serve to prime the trap in the floor drain.