## Section 6 – Electric Service – General

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# 6-1 Number of Services and Voltages / Meter

## Available Service Voltage Rules

**1. Alternating Current Type**

The Company furnishes 60 hertz alternating current, single- and three-phase, at various voltages, but not all types of service are available at every location.

**2. Service Availability Notification**

The Company should be consulted as to the type of service available in any area before wiring layouts are made, equipment is purchased, or when extensive wiring changes are contemplated.

**3.A. One Service Lateral**

In general, the NEC allows for a single service to a building or structure. The Company will supply:

One service lateral (drop).

In general, the NEC allows for single service to a building or structure. One reason for this requirement is for first responders to have a single point to disconnect electricity to a building in the event of an emergency. All buildings that have multiple services must have an identification plaque that denotes other services to the building (NEC 230.2(E)). The Company reserves the right to specify service location and service voltage. Any additional services, meters, or transformers requested by a customer that do not meet the rules below will be treated as **special facilities**.

In no case will a customer be allowed additional services or meters to circumvent the intent of the rate design. However, in some situations, the Company will allow a second service; these situations are reviewed on a case by case basis and may be billable as special facilities. In other situations, a second service is required and as such will be treated as any other new service. Listed below are exceptions of each.

Please consult the Company for clarification on any of the following exceptions or to confirm if any of the following exceptions apply:

1. Special conditions (fire pumps, emergency systems, standby systems, parallel power systems, systems designed specifically for enhanced reliability). NEC 230.2(A)

2. Special occupancies (multi-occupancy buildings with space restrictions, a very large building where engineering reasons require two services). NEC 230.2(B)

3. Single customers on one premise with multiple buildings (residential). A residential home with separate garage/barn may be granted a second service if the buildings are a minimum of 150’ from one another.

4. Properties with multiple buildings (commercial/industrial).

5. Capacity requirements (related to service size and our equipment limitations). NEC 230.2(C)

6. Different characteristics (different voltages or rate schedules). NEC 230.2(D)

7. Parallel service conductors in the same trench. NEC 230.2

8. Scenarios exist where only one service will be provided per building however multiple meters are allowed.

9. There may be other circumstances or situations that are not addressed here.

## 6-1 Number of Services and Voltages / Meter (Cont'd)

### 3.B. One Class of Service

The Company will normally supply to each customer's premise:

One class of service.

See section 6-1(4) for available service voltages and capacity limitations for new services.

A customer is allowed one class of service per premise.

Enlargements

1. Existing 120/240 single-phase customers would not qualify for an additional three-phase service.

2. Customers with an existing three-phase service do not qualify for an additional single-phase service.

3. Customers with an existing three-phase service would not qualify for a second three-phase service of a different voltage unless approved by the Company.

   If not approved by the Company, the customer shall pay in advance for the second service as special facilities; however, the customer shall be given the option of a written agreement to receive a refund of the special facilities payment if its entire load is converted to the new service within a five- (5) year period. The Company reserves the right to deny all special facilities.

Exceptions to this rule are shown in section 6-1 (3.A.)

### 3.C. One Meter

The Company will normally supply to each customer's premises:

One meter.

A customer is allowed one meter per premise. Rate orders and administrative law require that all customer load be metered through one meter point. This requirement is to avoid circumventing the intent of a rate and to minimize utility investment. MI R460.3605(5) states "Every reasonable effort shall be made to measure at 1 point all the electrical quantities necessary for billing a customer under a given rate."

Exceptions to this rule are shown in section 6-1(3.A.)

### 4. Service and Nominal Voltages Furnished

The types of service and nominal voltages furnished are listed below.

### 4.A. Single-Phase, 120/240 Volt, 3 - Wire

Single-phase, 120/240 volt, three-wire

This service is available to customers whose demand will not exceed 800 amp (200 KVA). This service is not available in areas designated as "120/208 volt areas" or where the customer has an existing service.

### 4.B. Single-Phase, 120/208 Volt, 3 - Wire

Single-phase, 120/208 volt, three-wire

This service is available in areas designated as "120/208 volt areas" and where the demand will be 200 amp (50 KVA) or less. This service is not available where customer has an existing service.

## 6-1 Number of Services and Voltages / Meter (Cont'd)

The upper demand limitation of 50 KVA is in place for two reasons.
1. High secondary neutral currents and the associated voltage drop issues.
2. Severe phase imbalance problems on the three-phase transformer bank feeding this service.

**4.C. Three-Phase, 480 Volt, 3 – Wire**

Three-phase, 480 volt, three-wire

Closed to new customers.

Existing customers with this service voltage will be allowed to increase their demand at this voltage at the existing location up to the existing main switch rating, not to exceed 2500 KVA.

**4.D. 1- & 3-Phase, 120/240 Volt, 4 - Wire Delta**

Combination single-phase and three-phase, 120/240 volt, four-wire delta

Closed to new customers.

Existing customers with this voltage or 240 volt, 3-phase, 3-wire delta will be allowed to increase their demand at this voltage at the existing location up to the existing main switch rating, not to exceed 1500 KVA.

**4.E. 1- & 3-Phase, 120/208 Volt, 4 - Wire Wye**

Combination single-phase and three-phase, 120/208 volt, four-wire grounded wye

This service is available to customers where the demand will not exceed 3000 amp (1000 KVA).

The upper limit of 1000 KVA is intended to prevent overly large services and the resulting congestion at the transformer setting and customer service entrance. This is also the largest size transformer that the company stocks for 120/208 volts.

**4.F. 1- & 3-Phase, 277/480 Volt, 4 - Wire Wye**

Combination single-phase and three-phase, 277/480 volt, four-wire grounded wye

This service is available to customers where the demand will not exceed 3000 amp (2500 KVA).

The upper demand limit is intended to prevent overly large services and the resulting congestion at the transformer setting and customer service entrance. This is also the largest size transformer that the company stocks for 277/480 volts.

**4.G. 1- & 3-Phase, 2400/4160 Volt, 4 - Wire Wye**

Combination single-phase and three-phase, 2400/4160 volt, four-wire wye

This service is closed to new customers.

**4.H. 1- & 3-Phase, 14,400/24,940 Volt, 4-Wire Wye**

Combination single-phase and three-phase, 14,400/24,940 volt, four-wire wye

This service is available to customers where the demand will exceed 1000 KVA.

## 6-1 Number of Services and Voltages / Meter (Cont'd)

In some cases this may result in a step-up setting until the area is converted to 14.4/24.9 KV.

The primary voltage 7.2/12.5 KV Wye was omitted since it will very likely result in a permanent future step-down transformer setting to install and maintain when the Company converts to 14.4/24.9 KV.

**5. Underground Services from a Pole-Mounted Transformer**

Underground services

From pole-mounted transformer setting

The voltages specified in section 4.A. through 4.G. are available to customers whose demand will not exceed 800 amp and are subject to the limitations set forth in those rules. Customer to consult with the Company for approval of services more than 400A.

**6. Additional Services/Special Facilities**

Customer request for additional services or service which does not conform to these rules shall be treated as "special facilities" for which the customer is obligated in accordance with extension rules for any added costs involved. The company reserves the right to deny special facilities.

**7. Other Exceptions**

Exceptions to the above rules may be made when clearly warranted due to unusual engineering or economic circumstances.

**8. Impedance Grounded Services**

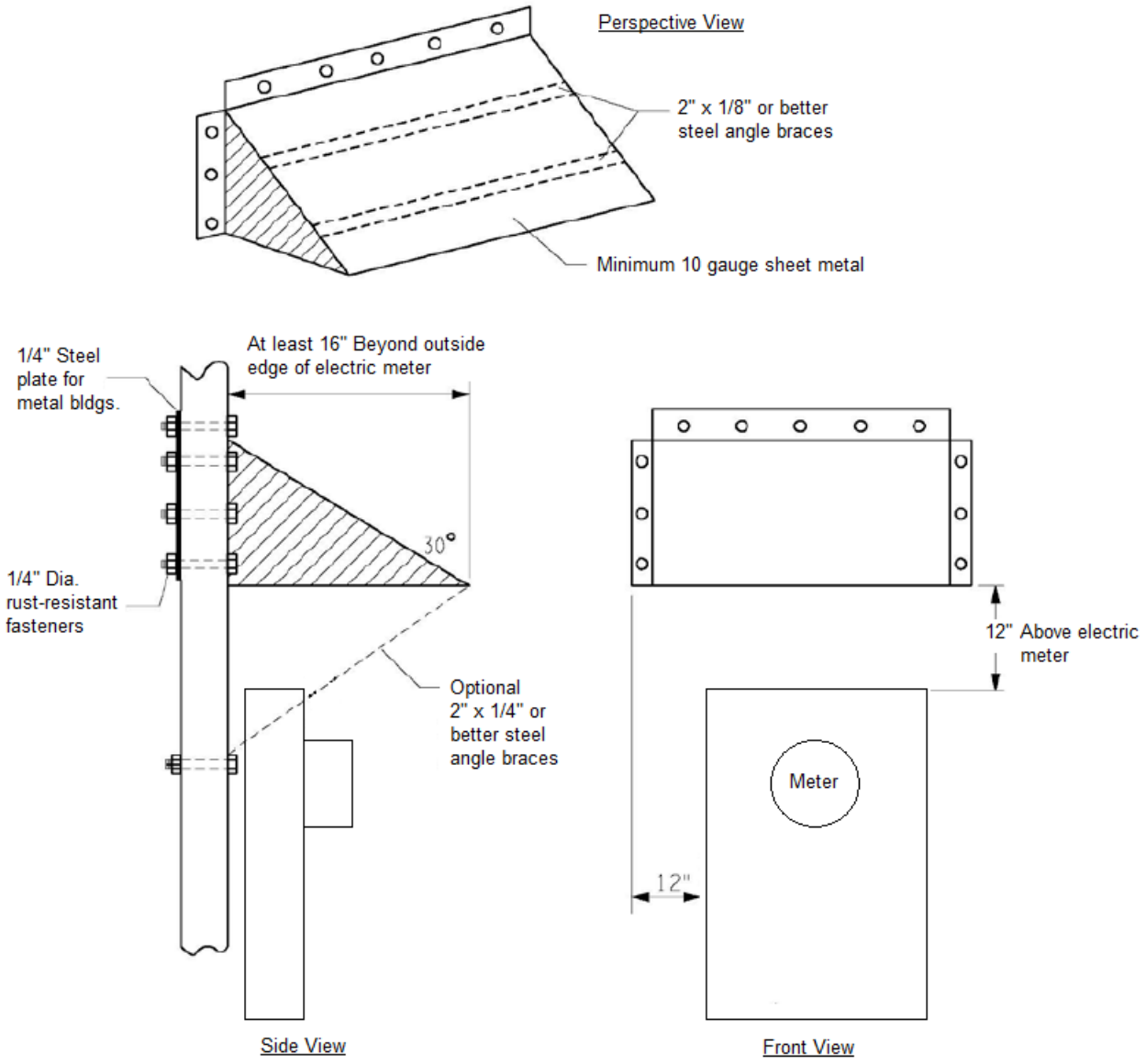
No impedance grounded services are allowed - only solidly grounded wye services for new or upgraded three-phase services.

# 6-2 Meter Protection from Snow and Ice

The customer is responsible to provide a safe location for the gas and electric meters to protect them from damage. Customers may be billed for damage to metering equipment caused by falling snow and ice in the absence of a snow and ice shield.

**A snow and ice shield is mandatory on the pitched side of metal roofs (provided by the customer)**. A shield is highly recommended for other areas.

A typical snow and ice protective shield is shown below, but other methods may be used per the guidelines listed in the notes below the picture.




Notes:

1. The shield must be constructed to handle the force of falling ice/snow from a given height.
2. A metal shield should be constructed, primed, and painted with a minimum of 10 gauge metal.
3. The protective shield does not have to be constructed using metal but must be constructed using good engineering and construction practices to complete #1 above.

# 6-3 Lightning Protection

Lightning damage due to induced electrical surges from nearby lightning strikes is a common problem. Part of the problem is due to poor grounding conditions. Glaciated sand or gravel soil is very poor for grounding. Average soil resistivities in the area of 250,000 ohm - cm or more are typical. Per IEEE 142-1982 (the Green book on grounding) and based on actual field results, the following are typical:

A. One rod: 800 ohms or more.
B. Ten-rod deep ground: 150 ohms or more.
C. Six-inch drilled well 100 feet deep: 85 ohms or more.

Because of poor grounding conditions, it is critical to bond all metallic systems. The theory is that by bonding everything, there will be little or no difference in potential between metallic systems (therefore minimizing damage). Bonding is also done for safety and code reasons. If you are correcting bonding problems, it is important to bond everything. Partial bonding could actually aggravate problems. Bonding should be done to the grounding electrode system in the following cases:

1. Drilled well casings - Code requires the equipment ground to be bonded to the well casing and the case of the water pump. In residential cases, this is often only a #12 copper. The drilled well is the best ground in the area. Consequently, the Company recommends at least a # 6 copper bond. This bond will minimize lightning damage to submersible pumps. This bond can be done by drilling the well casing 12 inches above grade and using a self-tapping bolt. It can also be attached to the grounding bolt on newer well casing caps.

2. Metallic water piping and hydronic heating systems.

3. Natural gas or LP gas piping if built with black iron pipe. Bonds are desirable on other piping systems, but there are potential problems with bonds damaging the pipe.

4. TV antenna systems - Code requires these to be grounded to a rod by the most direct path possible. It is also important to bond this to the electrical system.

5. Satellite dishes - There should be a ground rod at the dish and a bond to the electrical system. See NEC 810.21 for information. Also, a three-prong outlet and surge suppressor is helpful at the controller. Note that the newer small dishes are not metallic and so avoid many of the bonding issues.

6. Lightning rod systems - It is important to bond this to the electrical system.

7. Structural Steel.

8. Cable TV and telephone grounds where they enter the building.

Consult with the local electrical inspector for any questions related to premise wiring grounding and bonding

Surge suppressors can also help mitigate lightning-related damage. It is important, however, that all bonding be completed first. Note that plug-in type surge suppressors will only work on properly installed three-prong outlets. Surge suppressors (lightning arrestors) that are installed at the main disconnect must be installed on the load side of a breaker or fuse. Surge Suppressors cannot be installed in the meter socket/pedestal or upstream of the metering point. Note that a lightning surge will be over before the breaker can trip. Also, note that these devices do fail and the breaker protection will take the arrester off line. If the arrester is wired ahead of the main, arcing can continue, causing a fire.

"Isolated grounds" on electrical wiring refer to insulated and isolated equipment grounds going back to the bond at the main electrical disconnect. Totally isolated grounding systems are potentially very dangerous and, in almost all cases, do not comply with electrical codes.

## 6-4 Stray Voltage

Definition: Stray voltage is low-level AC voltage on the grounded conductors and bonded metal objects of a farm. This voltage exists as a normal and unavoidable consequence of operating electrical equipment. It is termed "Stray Voltage" when voltage can be measured between two points which can be simultaneously contacted by livestock.

If you have concerns or questions regarding stray voltage on farms, call the local Company and ask to speak to an Agricultural Consultant. At the request of the customer, these experts can perform an in-depth investigation to evaluate if voltages are of a level to affect animal behavior as established by the PSCW. Visit https://www.wisconsinpublicservice.com/partners/agriculture/ for more info.

Recommendations: The Company system design is such to maintain the best level of service voltage regulation possible on farms. Placement of the utility transformer as close as possible to the major load centers is recognized as a critical step in reducing potential stray voltage problems. This will also reduce the large voltage drops from long on-farm service runs.

The installation of a true four-wire system on farms can further reduce the impact of neutral voltage on bonded metal objects. Note the wording in NEC 547.9 and 250.32 for more detail.

An equipotential plane is a very effective way to prevent stray voltage problems with cattle. In accordance with NEC 547.10, the Company strongly recommends the installation of an equipotential plane in any new or remodeled livestock facility.

Additional information and guidelines on any of these recommendations may be obtained by contacting the Company.

# 6-5 EMF Guidelines

**Purpose**

This Electro-Magnetic Field (EMF) Guide is designed to aid those who plan, design and build electric distribution facilities. This guide addresses the typical equipment being installed on the distribution system, including primaries, secondaries, services, transformers and service entrance equipment.

When planning distribution line projects, the Company takes into consideration the number of persons who could be exposed to EMF along the routes, the intensity of exposure and the duration of exposure.

These guidelines will address customer concerns regarding building of electric distribution systems. The guidelines do not necessarily lessen the public's risk because the science is uncertain. (Source is PSCW Advanced Plan 6 Order.)

**General**

Our customers are most concerned about the location of facilities where they spend a great deal of time - such as offices, classrooms, playgrounds (both schools and daycare centers) and residences.

Generally, magnetic fields can be reduced on facilities by the following methods:

- Higher service voltage which will reduce the current.
- Closer spacing of conductors, which cancels magnetic fields.
- Increased distance; generally the magnetic field is inversely proportional to the square of the distance (except transformers which are cubed of the distance).
- Minimizing load current; magnetic fields are directly proportional to load current.
- Proper phasing of double circuit lines, including transmission underbuilds (overhead utility lines).
- Balancing loads.

Good judgment should be used when locating our facilities. A number of issues need to be addressed when spotting electric distribution facilities. EMF should be one of these issues when spotting the following types of facilities:

**Transformers**

Transformer vaults generally have higher magnetic fields because of the secondary bus arrangements. If vaults are necessary, try to keep them away from areas where people may spend time, such as classrooms and offices.

Try not to locate transformers in school or daycare playgrounds or within 20 feet of offices, classrooms or residences.

**Services**

Use triplex and quadruplex service and secondaries whenever possible because the close spacing between the phases cancels magnetic fields.

**Underground Primary and Secondary**

Underground can have higher magnetic fields than overhead because the cables are closer. Try to keep underground primary and secondary 20 feet from classrooms, offices and playgrounds.

## 6-5 EMF Guidelines (Cont'd)

**Route Selection**

Where practical, avoid routing new facilities close to populated areas.

**Overhead Major Primary Feeders Within 20 Feet of Offices, Schools and Residences (Utility Only)**

Use multi-phase versus single-phase where possible. If a major feeder needs to be routed near a playground, consider using five-foot higher or ten-foot higher poles.

**Meter Bases and Service Entrance Equipment**

Whenever possible, locate metering and service entrance equipment near unoccupied locations in homes or businesses. Avoid classroom areas in schools.

## 6-6 State Regulatory Agencies

The Company will not interpret the electrical code. Questions concerning code interpretations should be referred to your local inspector's office, or you may contact your state electrical inspector at the address and phone number listed below:

State of Wisconsin (Department of Safety and Professional Services (SPS))
Electrical Program
1400 East Washington Avenue
Madison, WI 53703
Electrictech@wi.gov

Department of Licensing and Regulatory Affairs,
Bureau of Construction Codes, Electrical Division
P.O. Box 30254
Lansing, MI 48909
Phone: (517) 241-9320

For utility-related issues, please call the Company or the following state regulatory agency:

Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854
Phone (608) 266-5481

Michigan Public Service Commission
P.O. Box 30221
Lansing, MI 48909
Phone: (800) 292-9555 (Consumer Inquiry and Complaint)
Phone: (517) 241-6180 (Outside of MI)