

SECTION 7

CODE INFORMATION

7.1 State of Wisconsin Codes

In general, the rules and codes applicable to electric service are contained in:

- National Electric Safety Code (NESC)
- National Electrical Code (NEC)
- Wisconsin Administrative Code
- Marshfield Utilities Rates and Rules

Various other definitions are also utilized. These are discussed below.

Wisconsin Administrative Code SPS 316.100 (2)(a) Definition of Building

"Building" means a structure that stands alone or is separated from adjoining structures by fire walls having not less than a 3-hour fire resistive rating with all openings in the wall protected with 3-hour fire-rated door assemblies.

7.2 NEC 230.2 Number of Services

A building or other structure served shall be supplied by only one service. (MU will normally provide only one service to a customer site).

Exceptions:

1. For fire pumps where a separate service is required.
2. For emergency, legally required standby, optional standby or parallel power production systems where a separate service is required.
3. By special permission¹ buildings where there is no available space for service equipment accessible to all occupants; or a single building or other structure sufficiently large to make two or more services necessary.
4. Capacity Requirements - Additional services shall be permitted:
 - a. Where the capacity requirements are in excess of 2000 amperes at a supply voltage of 600 volts or less.
 - b. Where the load requirements of a single-phase installation are greater than the serving agency normally supplies through one service.
5. Additional services shall be permitted for different voltages, frequencies, phases or different cases such as different rate schedules.
6. Two or more service drops or laterals may be installed for the same class of service if located more than 150 feet apart, measured in a straight line, and provided that all

¹ "Special permission" per SPS 316.100 (2)(b) means a petition for variance in accordance with s. SPS 316.005.

electrical wiring supplied by each service has no common raceway or connection with any other service. This will only be allowed by special permission in advance by MU.

7. Underground sets of conductors, size 1/0 and larger, running to the same location and connected together at their load end shall be considered to be one service lateral.
8. For row house construction, per SPS 316.230 (1)(c), a separate service drop or lateral shall be permitted for each 2 attached units.

7.3 Wisconsin Administrative Code Modifications to the NEC

SPS 316.230 Services:

(1) NUMBER OF SERVICES.

SPS 316.230(1)(a)(a) These are department informational notes to be used under NEC 230.2 (intro.):

Note: See definition of building in s. SPS 316.100 (2) (a). (listed above in section 7.1)

Note: It is recommended that the electric utility or cooperative supplying electric current be contacted prior to service equipment installations for any special requirements.

- (b)** Substitute the following wording for NEC 230.2 (B) (2): Two or more service drops or laterals for the same class of service if located more than 150 feet apart, measured in a straight line, and provided that all electrical wiring supplied by each service has no common raceway or connection with any other service.
 - (c)** This is a department rule in addition to the requirements of NEC 230.2 (B): For a building which is not more than 3 stories in height and which contains only 3 or more attached, vertically separated, side-by-side or back-to-back dwelling units, with each dwelling unit served by an individual exterior exit within 6 feet of the exit discharge grade, a separate service drop or lateral shall be permitted for each 2 attached units.
- (2) NUMBER OF SERVICE-ENTRANCE CONDUCTOR SETS.** The requirements specified in NEC 230.40 Exception No. 3 are not included as part of this chapter.
- (3) SERVICE EQUIPMENT — DISCONNECTING MEANS.**
- (a) General.** This is a department rule in addition to the requirements of NEC 230.70: Disconnecting means shall be provided to disconnect the utility wiring from the premises wiring at any point where utility wiring terminates and premises wiring extends overhead or underground to more than one building or structure.
 - (b) Location.** This is a department rule in addition to the requirements of NEC 230.70 (A): Raceways containing service conductors or cables, or service entrance cable not contained within a raceway, may not extend longer than 8 feet into a building to the service disconnect or the first service disconnect of a group of disconnects as permitted by NEC 230.71. The raceways or conductors shall be considered to have entered the building at the point where they pass through the outer surface of the building exterior, except as permitted by NEC 230.6.
- (4) RATING OF SERVICE DISCONNECTING MEANS.** This is a department rule in addition to the requirements of NEC 230.79:
- (a) Two- or multi-family dwellings.** Except as provided in par. **(b)**, for 2-family or multi-family dwellings, the service equipment shall have a rating of not less than 150

amperes, 3-wire or 4-wire. Where the combined rating of all service disconnecting means is 150 amperes or larger, the service or feeder equipment rating for each dwelling unit shall have a rating of not less than 60 amperes.

(b) Exception. Service equipment having a rating of not less than 100 amperes, 3-wire or 4-wire, may be installed in an existing 2-family dwelling only where both of the following conditions are complied with:

1. The load computed in accordance with NEC 220 does not exceed 80 amperes.
2. Specific written approval is granted by the municipal inspection department having jurisdiction.

Underground service conductors shall enter the customer's building aboveground to prevent water or seepage entry due to soil or ground water conditions. The Utility is not responsible for any damage caused by water entry through the customer's raceway or conduit.

MU requires all energy to be metered. Jumpers are not to be placed in meter sockets, and service to billboards, signs, traffic signals, cable TV amplifiers, telephone equipment, railroad signals, etc. will be metered.

7.4 Grounding Electrode System Addition to NEC 250.53 (SPS 316.250)

(A) Rod, Pipe, and Plate Electrodes. Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3). Per WI Administrative code SPS 316.250 (1) The exception in NEC 250.53 (A) (2) is not included.

(1) Below Permanent Moisture Level. If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

(2) Supplemental Electrode Required. A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(4) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:

- (1) Rod, pipe, or plate electrode
- (2) Grounding electrode conductor
- (3) Grounded service-entrance conductor
- (4) Nonflexible grounded service raceway
- (5) Any grounded service enclosure

(3) Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart. SPS 316.250 (2) Supplemental Electrode. This is a department rule in addition to the requirements in NEC 250.53 (A) (3): A single electrode consisting of a rod, pipe or plate shall be augmented by one additional electrode of any of the types in NEC 250.52 (A) (4) to (A) (8).

Informational Note: The paralleling efficiency of rods is increased by spacing them twice the length of the longest rod.

(B) **Electrode Spacing.** Where more than one of the electrodes of the type specified in 250.52(A)(5) or (A)(7) are used, each electrode of one grounding system (including that used for strike termination devices) shall not be less than 1.83 m (6 ft) from any other electrode of another grounding system. Two or more grounding electrodes that are bonded together shall be considered a single grounding electrode system.

(C) **Bonding Jumper.** The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B) and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.77.

(D) **Metal Underground Water Pipe.** If used as a grounding electrode, metal underground water pipe shall meet the requirements of 250.53(D)(1) and (D)(2).

(1) **Continuity.** Continuity of the grounding path or the bonding connection to interior piping shall not rely on water meters or filtering devices and similar equipment.

(2) **Supplemental Electrode Required.** A metal underground water pipe shall be supplemented by an additional electrode of a type specified in 250.52(A)(4) through (A)(8). If the supplemental electrode is of the rod, pipe, or plate type, it shall comply with 250.53(A). The supplemental electrode shall be bonded to one of the following:

- (1) Grounding electrode conductor
- (2) Ground service-entrance conductor
- (3) Nonflexible grounded service raceway
- (4) Any grounded service enclosure
- (5) As provided by 250.32(B)

Exception: The supplemental electrode shall be permitted to be bonded to the interior metal water piping at any convenient point as specified in 250.68©(1), Exception.

(E) **Supplemental Electrode Bonding Connection Size.** Where the supplemental electrode is a rod, pipe, or plate electrode, that portion of the bonding jumper that is the sole connection to the supplemental grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire.

(F) **Ground Ring.** The ground ring shall be buried at a depth below the earth's surface not less than 750 mm (30 in.).

(G) **Rod and Pipe electrodes.** The electrode shall be installed such that at least 2.44 m (8 ft) of length is in contact with the soil. It shall be driven to a depth of not less than 2.44 m (8 ft) except that, where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or, where rock bottom is encountered at an angle up to 45 degrees, the electrode shall be permitted to be buried in a trench that is at least 750 mm (30 in.) deep. The upper end of the electrode shall be flush with or below ground level unless the aboveground end and the grounding electrode conductor attachment are protected against physical damage as specified in 250.10

(H) **Plate Electrode.** Plate electrodes shall be installed not less than 750 mm (30 in.) below the surface of the earth.

7.5 Wisconsin Administrative Code PSC 113

Wisconsin has recently updated the Wisconsin Administrative Code PSC 113. Listed below are code sections, which pertain to service requirements and voltage standards.

Definitions - PSC 113.0701

- (1) "Flicker" or "voltage flicker" means a variation of input voltage sufficient in duration to allow visual observation of a change in electric light intensity.
- (2) "Harmonic distortion" means the mathematical representation of the distortion of the pure sine waveform. Distortion of the pure sine waveform is typically caused by loads that draw current discontinuously or whose impedance varies during the cycle of the input AC voltage waveform.
- (3) "Point of service" means the connection point between the customer electrical system and the utility electrical system.
- (4) "Power quality" means the concept of powering and grounding sensitive electronic equipment in a manner that is suitable to the operation of that equipment.
- (5) "Retail power service" means service furnished principally for electromotive or industrial purposes and may include service for lighting incidental thereto as defined in the utility's rates and rules.
- (6) "Sag" means an RMS reduction in the AC voltage, at the power frequency, for durations from a half-cycle to a few seconds.
- (7) "Swell" means an RMS increase in the AC voltage, at the power frequency, for durations from a half-cycle to a few seconds.
- (8) "Transient" means a sub cycle disturbance in the AC waveform that is evidenced by a sharp but brief discontinuity of the waveform. May be of either polarity and may be additive to or subtractive from the nominal waveform.

Note: The definitions used in subsections (1), (2), (4), (7), and (8) are based on the definitions in Authoritative Dictionary of IEEE Standards Terms-7th Ed.
- (9) "Steady state voltage" means the RMS voltage after all sags, swells and transients have decayed to a negligible value.
- (10) "Service voltage," means the steady state voltage at the point of service.

7.6 Harmonics of 60 Hertz Voltage Waves PSC 113.0704

Utilities shall make reasonable efforts to investigate equipment-operating problems suspected to be associated with harmonic distortion of the 60 Hz voltage sinewave at the point of service. When the source of the harmonic distortion is determined to be equipment operated by a specific customer, the utility shall notify the customer and it shall be the customer's responsibility to correct the problem. When corrective action is necessary, the guideline to be used is the 1992 IEEE Standard 519.

7.7 Radio and Television Interference PSC 113.0707

- (1) Each utility shall own or otherwise arrange to have available when needed, suitable monitoring equipment for surveying its lines and equipment for possible radio and/or television interference.
- (2) Each utility shall establish and routinely utilize in the course of regular operation, means whereby the presence of radio and/or television interference may be detected.
- (3) Each utility shall, upon notification or detection of the presence of radio and/or television interference, survey its lines and equipment for possible sources of radio and television interference. When significant interference is found, reasonable measures shall be taken to locate the source and, if on the utility's system, to mitigate the interference. Where the magnitude and nature of the interference is found to be so small, intermittent or insignificant that it affects only a few customers or a particular, unique piece of customer equipment that may have limited capabilities to receive weak signals, it may be necessary to limit the utility's responsibility for mitigation to reasonable, cost-effective measures.

Note: In some cases, some interference from the utility's system may be detected, but found to be insignificant and inconsequential for the majority of customers. Its elimination or mitigation may still not result in adequate reception of some signals. In many areas, radio or television reception of some transmissions is normally inadequate due to frequency; weak signal strength, high ambient noise, and distance from the source, terrain or other obstacles beyond the utility's control. The capabilities and limitations of the customer's receiver should also be evaluated and considered in determining the nature, extent and cost of the utility's mitigation activities. Also, other options may be available and more feasible, for example, applying the mitigation to the customer's equipment or substitution of cable television (CATV) or digital satellite service for local antenna systems.

- (4) Where the source of interference is determined to be equipment owned by a specific customer, the customer shall be so advised and informed of his or her responsibility to correct the problem (see s. PSC 113.0201).

7.8 Measuring Customer Service PSC 113.0802

- (1) Except as provided in sub. (2), all energy sold to customers shall be measured by commercially acceptable measuring devices owned and maintained by the utility. All other electrical quantities, which the rates or utility's rules indicate, are to be metered shall be metered by commercially acceptable instruments owned and maintained by the utility.
- (2) For temporary or special installations where it is impractical to meter loads, such as certain highway or area lighting which may be billed at a flat rate based on lamp rating and use, the consumption may be calculated.
- (3) The metering and wiring in non-transient, multi-dwelling-unit residential buildings, mobile home parks and commercial establishments where individual unit metering is provided, or required under the provisions of s. PSC 113.0803, shall be so installed or arranged so that each customer or tenant is metered for his or her own consumption

only. Energy used by common area loads, for example, hallway lighting and heating, shall be separately metered and billed as appropriate under the utility's filed tariff.

- (4) Utilities shall inspect existing properties for jointly metered service where a tenant reasonably suspects that he or she is being billed for significant usage (e.g., furnace, water heater, etc.) that is service more than one rental dwelling unit. The utility may bill the property owner for such an inspection. See s.196.643, Statutes.

Individual Electric Meters Required for Non-transient Multi-dwelling Unit Residential Buildings, Mobile Home Parks and for Commercial Establishments PSC 113.0803. The requirements for individual metering that follow also apply to upgrades or any change to the electrical equipment due to age, size, damage, and etc. regardless of the date the building was constructed.

- 1) Each dwelling in a multi-dwelling unit residential building and mobile home park constructed after March 1, 1980 shall have installed a separate electric meter for each such dwelling unit. Dwelling unit means a structure or that part of a structure which is used to or intended to be used as a home, residence or a sleeping place by one or more persons maintaining a common household, and shall exclude transient multi-dwelling buildings and mobile home parks, for example: hotels, motels, camp grounds, hospitals, community-based residential facilities, residential care apartments or similar facilities, nursing homes, college dormitories, fraternities and sororities.
- 2) Each tenant space in a commercial building constructed after March 1, 1980 shall have installed a separate electric meter.
- 3) Any existing building, which undergoes alterations involving a change in type of occupancy or substantial remodeling, shall have installed a separate electric meter for each separate tenant space.
- 4) For the purpose of carrying out the provisions of sub. (1), individual unit metering will not be required:
 - a) In commercial buildings where the commercial unit space requirements are subject to alteration, as evidenced by temporary versus permanent type of wall construction separating the commercial unit spaces. Examples of temporary wall construction are partition walls, which do not extend through the ceiling and walls, which do not constitute a code-required fire separation.
 - b) For electricity used in central heating, ventilating and air-conditioning systems.
 - c) For electric back-up service to storage heating and cooling systems or when alternative renewable energy resources are utilized in connection with central heating ventilating and air conditioning systems.
- 5) For reasonable cause shown, the commission may grant waivers of this rule on a case-by-case basis. Applications for a waiver must be submitted to the commission in writing and set forth the facts or reasons applicant believes justify a waiver. In cases involving multi-dwelling unit residential buildings, the applicant must show that the electric equipment under tenant control is substantially more efficient than required by applicable codes and

that the overall electric usage under tenant control is minimal. Example cases, which would not qualify for waiver, are buildings, which are electrically heated, or buildings, which have individual unit electric water heaters.