

Section 6 – Electric Service - General

6-1 Number of Services and Voltages / Meter 2
6-2 Energy Conversion Factors..... 7
6-3 Lightning Protection 8
6-4 State Regulatory Agencies 10

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

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

One service lateral (drop).

Each premise qualifies for a service. One service to a group of buildings used in the same business is encouraged. 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. Unless approved by the company, any second service and/or meter shall be billed as a separate customer. An exception may be made for services that are less than 50 feet apart with a combined size larger than the available service sizes listed under paragraph 4.A-H. In this case the metering may be electronically combined.

Examples for this rule are:

1. A property with two separate residences would qualify for one service to each residence.
2. A property with a residence and a second building or facility used for domestic purposes would qualify for one service unless the second building is greater than 150 feet from the residence at their closest point. The second building is assigned a residential rate when used for domestic purposes only.
3. A property containing a residence and another building used for commercial purposes would qualify for one service to each building.
4. A property containing multiple commercial buildings used for the same business, qualifies for one service. The intent is that electricians should weigh the cost of the Company providing the feeds to other buildings (using special facility charges) with the cost of doing it themselves. Note that it is not acceptable to provide additional services just to circumvent the intent of a rate design.
5. A property containing two commercial buildings engaged in two separate businesses would qualify for one service to each building.
6. Multiple conductors originating from the same transformer, following the same route to the building, and hitting multiple side-by-side disconnects, are considered by code to be one service. (NEC 230.2)).

Exceptions to this rule are shown in Paragraph 3.D. These exceptions deal with the large loads and voltage drop issues.

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 paragraph 4 for available service voltages and capacity limitations for new services.

A customer is allowed one class of service per premise.

Enlargements

- a) Existing 120/240 single-phase customers would not qualify for an additional three-phase service.
- b) Customers with an existing three-phase service do not qualify for an additional single-phase service.
- c) 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 paragraph 3.D.

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 paragraph 3.D.

6-1 Number of Services and Voltages / Meter (Cont'd)**3.D. Exceptions**

Exceptions to this rule may include:

"This rule" refers to paragraphs 3a, 3b, and 3c.

- a. Multiple Metering. Where more than one point of metering is necessary because of interruptible service rate, governmental requirements or regulatory rules.
Examples:
 1. House meters or common area meters for multi residential occupancy buildings, as required by NEC 210.25.
 2. Some parallel generation buy back rates.
- b. Large Loads. Where large or unusual loads requiring additional services or a different class of service in accordance with these "character of service" rules. Class of service is defined by the voltage and number of phases. These cases must also meet the electrical code requirements, including inspector approval.
Examples:
 1. Load additions that push the customer's load requirements above the upper demand limits in paragraph 4.A-H for the customer's existing service. The Company may refuse to supply two separate services on large electrical service entrances where there is no indication of sufficient load.
 2. Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants. This case requires inspector approval. This case is very rare. NEC 230.2(B).
- c. Voltage Drop. Where more than one point of delivery (service) for cases where, in the judgment of the Company, voltage regulation would be unreasonable due to load size and distance between loads. These cases must also meet the electrical code requirements. General rule is 150 foot separation. See NEC 230(1).
- d. Fire Walls. Where a structure is divided into more than one building, as defined by State Law, and therefore qualifies for one service per building. The buildings must be separated by a substantial firewall throughout the structure up to the roof that is in accordance with state codes. MI requires a 2 hour fire wall per the MI Building Code definition. Note 3.A. limitations to one service per premise.
- e. Fire Pumps and Misc. Fire pumps, other emergency electrical systems, parallel power production systems, or multiple sources of supply for purposes of enhanced reliability, that require a separate service (special facilities charge).
(See Service Manual subsection 8.4 on fire pumps.)

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.

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

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 voltage.

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

Closed to new customers.

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 wye

This service is available to customers where the demand will not exceed 2000 amp (750 KVA).

The upper limit of 750 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.

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

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

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

4.G. 1- & 3-Phase, 14,000/24,940 Volt, 4-Wire Wye

Combination single-phase and three-phase, 7,200/12,470 volt, four-wire wye

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

5. URD Services from a Pole Transformer

Underground services

From pole 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.

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 three-phase services.

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Section 6 ELECTRIC SERVICE - GENERAL

Page 7 of 10

6-2 Energy Conversion Factors

Fuel	Energy Content	Unit Price	Heat Conversion Efficiency	Cost Per Million BTU	Break Even Cost
Natural Gas	100,000 BTU/therm	\$.76/therm	90%	\$8.44	\$.76/therm
Propane	91,600 BTU/gallon	\$1.25/gallon	90%	\$15.16	\$.70/gallon
#2 Fuel Oil	139,400 BTU/gallon	\$2.50/gallon	80%	\$22.42	\$.94/gallon
#6 Fuel Oil	150,000 BTU/gallon	\$3.00/gallon	80%	\$25.00	\$1.01/gallon
Kerosene	135,000 BTU/gallon	\$3.00/gallon	85%	\$26.14	\$.97/gallon
Electric Resistance	3,412 BTU/KWH	\$.13/KWH	100%	\$38.10	\$.029/KWH
Electric Heat Pump	3,412 BTU/KWH	\$.13/KWH	200%	\$19.05	\$.058/KWH
Wood, Hardwood	24,000,000 BTU/cord	\$200.00/cord	60%	\$13.89	\$122/cord
Wood Pellets	8,000 BTU/lb	\$200.00/ton	80%	\$15.63	\$108/ton
Shelled corn	6,970 BTU/lb	\$4.00/50 lbs	75%	\$15.30	\$2.21/50 lbs
Coal	13,100 BTU/lb	\$200.00/ton	75%	\$10.18	\$166/ton

Energy Conversion Factors

1 CF (Cubic Foot)	= Approx. 1,000 BTU
1 CCF	= 100 CF = 1 Therm
1 MCF	= 1,000 CF
1 Therm	= 100,000 BTU
1 MBH	= 1,000 BTU/HR
1 Boiler HP	= 42 CFH
1 HP	= 746 Watts
1 Dekatherm	= 10 Therms = 1000 CF

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.

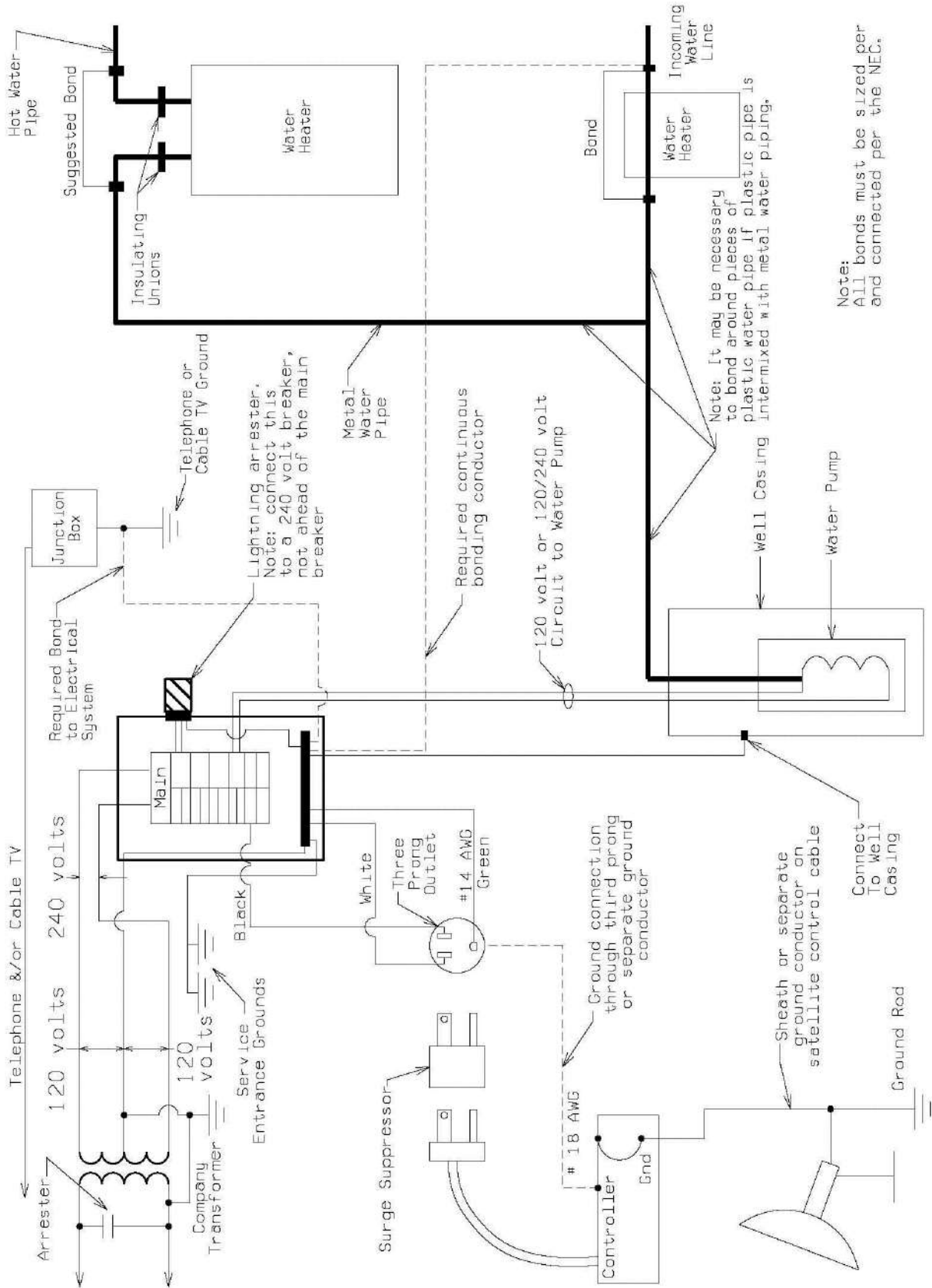
Because of poor grounding conditions, it is critical to bond all metallic systems. The theory is that by bonding everything, there will be little or no difference in potential between metallic systems (therefore minimizing damage). Bonding is also done for safety and code reasons. If you are correcting 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.

Surge suppressors can also help. 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. 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.

6-3 Lightning Protection (Cont'd)



6-4 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:

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:

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)