



Your Touchstone Energy<sup>®</sup> Cooperative 

# Electric Service Manual

## Section 3 – Electric Metering



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## Section 3 – Electric Metering

### 3.1 General

This section contains methods and requirements for metering electrical usage on services supplied by Dakota Electric Association. While these requirements are applicable for the majority of the interconnections, there are always unique installations which may require deviations from these standards. Dakota Electric reserves the right to deviate from this standard for any reason, including economics, aesthetics, equipment, and safety. Deviation from this standard must be reviewed and approved in writing by the Engineering Department prior to implementation.



#### 3.1.1 Meter Location and Accessibility

The meter socket must be mounted in a location that meets the following conditions.

- The center of the meter shall be located at a height between 4 to 6 feet above the ground
  - There are some exceptions to this for multi-family, and commercial buildings that will be discussed in those sections.
- Location and path to the meter(s) must be clear and free of hazards for anyone accessing the meter
- Accessible by Dakota Electric Association 24/7, with open walkway to/from the meter, that is clear of shrubs, bushes etc.
- Solidly mounted on a permanent structure, not on a fence or other semi-permanent structure, so that they maintain a vertical position
- Free from interference with traffic on sidewalks or driveways
- Located so that it is not subject to damage from excessive moisture or vibrations, snow plows, falling ice from roofs or ice flows etc.
- No metering shall be attached to Association owned poles or equipment
- Where meters, originally installed in accessible locations, satisfactory to Dakota Electric, are rendered inaccessible by virtue of alternations or new construction, such meters shall be reinstalled at a new fully accessible location, reviewed and approved by Dakota Electric. The cost for moving the metering to the new accessible location will be the expense of the member or property owner.

Dakota Electric recommends the meter socket is installed on the side of the building which is closest to the [Utility Connection Point](#).

Contact Dakota Electric to determine which side of the lot has the Utility Connection Point. Typically, a residential lot has only one Utility Connection Point.

Mounting the meter socket on the wrong side of the building will result in longer secondary runs, greater voltage drop, increased installation costs and reduced power quality for the building.

### 3.1.2 Meter Socket Requirements

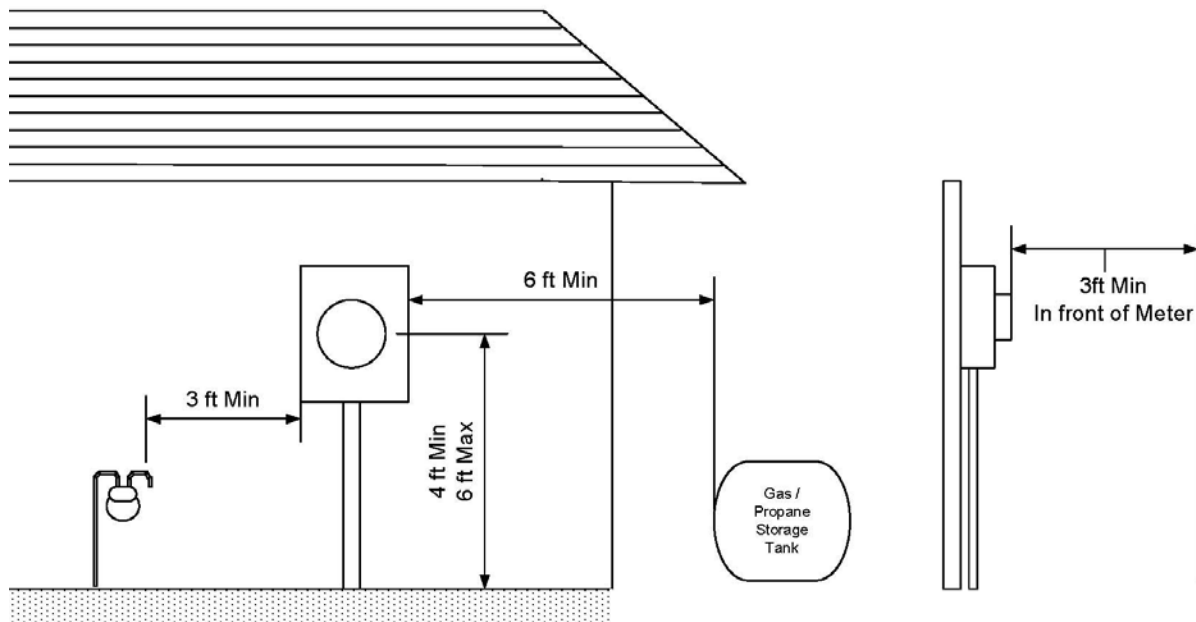
The member or their contractor is responsible for purchasing and installing a meter socket that meets the following requirements.

- Must be UL (Underwriters Laboratories) or ARL (Applied Research Laboratories) approved
- All self-contained meter sockets, whether transformer rated, sub-meter, or main service; must use a lever actuated jaw clamping positive by-pass mechanism.
- All meter sockets for transformer rated installations using CT's, must use an automatic by-pass to short the CT's and maintain electrical service upon removal of the meter.
- Ring-less style
- Equipped with a track resistant polycarbonate insulating safety shield.
- Have wire terminals rated for conductors from #6 to 350 MCM for non-transformer rated installations
- Wire terminals rated for both copper and aluminum conductors

### 3.2 Residential Metering

All residential meter socket installations must adhere to the above requirements set in [Section 3.1.1](#) Meter Access, and [Section 3.1.2](#) Meter Socket Requirements. Additionally there are requirements specific to residential meter sockets below.

- Meters must have unobstructed space at least 3 feet in front and 1 foot to each side.
- Center of meter to be located at a height between 4 to 6 feet above the ground.
- Meter sockets shall not be located above or below decks, along driveways or walkways where they are subject to damage or create a safety hazard.
- It is recommended that residential meter sockets are not mounted on the back of the structure to help avoid future conflicts with decks and other additions.
- Meters must be a minimum of 3 feet away from a gas meter, and 6 feet away from combustible storage. See figure below.



Meter Socket Clearances

### 3.3 Multi-Family Dwelling Metering

All Multi-Family Dwelling meter socket installations must adhere to the requirements specified in [Section 3.1.1](#) Meter Access, and [Section 3.1.2](#) Meter Socket Requirements. Additionally, there are requirements specific to multi-family dwelling metering below.

- The meter socket(s) shall be mounted on the outside of the building and shall be accessible to Dakota Electric Personnel at all times.
- Installations with voltage greater than 240V, shall use a transformer rated meter with a CT and VT. See the Transformer Rated Metering section below in the Commercial Metering section.
- Single Phase 400 amp rated services (320 amp continuous), with voltages not exceeding 240 volts, may use a Dakota Electric approved 320-amp meter socket and a self-contained meter.
- For apartment complex or condos, each meter socket must be permanently labeled with the apartment number or the street address. This labeling must be done by the electrician or building owner prior to energization of the service by Dakota Electric.
- Apartment or unit numbers and street addresses must be provided to Dakota Electric before service connections can be completed.
- Below are meter height requirements for banked meter sockets, used for multi-family dwelling meters
  - Mounting Heights – The mounting heights of the meters above the final floor (inside) or final grade (outside) are as follows:



Type of Installation	Minimum Meter Height *	Maximum Meter Height *
Single Meter Socket	4'	6'
Inside with multiple stacked meter sockets	2'	6'
Outside with multiple stacked meter sockets	3'	6'
Potential (VT) & Current Transformer (CT) Metering Cabinet	4'	5'

\*The height is measured to the center of the meter from the floor or final grade.

### 3.4 Commercial Metering

All Commercial meter socket installations must adhere to the above requirements set in [Section 3.1.1](#) Meter Access, and [Section 3.1.2](#) Meter Socket Requirements. Additionally, there are requirements specific to commercial metering below.

- The meter socket(s) shall be mounted on the outside of the building and shall be accessible to Dakota Electric Personnel at all times. Facilities with a large number of meters (i.e. apartments) may have the meters installed inside the building. if the following requirements are met:
  - Dakota Electric has reviewed and provided written approval for the installation of the meters inside the building.
  - All meters for the facility shall be located within a single room.
  - The meter room shall be located along an outside wall of the building.
  - A door into the room shall provide direct access from the outside of the building and shall be accessible by DEA personnel 24 hours a day.
  - Apartment buildings may locate the metering room, so that it is directly accessible through the main apartment entrance. Dakota Electric shall be given a key for the main entrance door and all the doors required for entrance to the meter room. The room shall be located along an outside wall.
  - If the door has a lock installed, DEA shall be provided a key to keep in its possession or another method of access, approved by Dakota Electric, shall be provided. An agreement is also required, between Dakota Electric and the building owner, requiring the owner or maintenance to provide keys or other form of access to the room with the meters, now and in the future.

- The room shall not be used for storage.
- The minimum working space at the front of each meter socket shall be a minimum of three feet, to allow the installation or removal of the meter from the socket.
- The metering shall be installed such that all doors or hinged panels are able to be fully opened.
- Facilities supplied by multiple Dakota Electric-owned distribution transformers are required to have a separately metered service for each utility transformer. This allows for monitoring of the transformer loading and to provide accurate billing, considering distribution transformer and other system losses. Single-phase transformers connected to provide multi-phase power are considered as one transformer unit or "bank of transformers".
  - Specific low usage, and street or security light services may be installed as un-metered service.
- Single phase services with voltages 240 volts and below and with service ratings of 200 amps or less will typically use self-contained meters.
- Single phase 400 amp rated services (320 amp continuous), with voltages not exceeding 240 volts, may use a Dakota Electric approved 400 amp meter socket and self-contained metering.
- Single phase installations with voltage greater than 240V or greater than 320A shall use a transformer rated meter with a CT and VT. See Transformer Rated Metering, [Section 3.4.1](#) below.
- Three phase services rated for 200 amps or below shall use self-contained metering.
- Three phase services above 200 amps shall use a transformer rated meter with a CT and VT. See Transformer Rated Metering, [Section 3.4.1](#) below.
  - An exception can be made allowing the installation of self-contained metering for 480V metering, if all of the following conditions are met. You must contact Dakota Electric and receive written approval to use this exception.
    - The service load does not exceed 200 amps for multiphase services, or the load does not exceed 400 amps for single phase services.
    - The metering is cold sequenced. Cold sequenced means a full load interrupting rated disconnect switch capable of being locked in the open



and closed position, is mounted ahead of the metering. This switch is used to de-energize the service along with the metering for working on the metering.

- The service can be routinely and easily shut off during normal business hours. A good example of this would be a crop irrigation pump.

### 3.4.1 Transformer Rated Metering

Transformer rated metering, is required to be used when the current level or voltage level exceeds the rating of a self-contained meter. Dakota Electric requires the use of transformer rated metering under the following conditions:

- Single-phase services over 400 amps (320 amps of load)
- Three-phase services over 200 amps
- Single-phase & three-phase services with voltages greater than 240 volts (see exception in [section 3.4.2](#) Cold Sequenced Metering)

Below are the requirements for the installation of the metering.

- The current transformers (CT) and voltage transformers (VT) will be provided by Dakota Electric and installed by the Member or contractor.
- No Member wiring (other than the service conductors) shall be installed in the metering transformer cabinet, meter socket, or conduits dedicated for metering wires. Also, to ensure metering accuracy, no Member wiring shall be permitted to be connected to the Association's metering secondary wiring.
- The current transformers and voltage transformers shall not be installed on the Member's side of the service disconnect.
- Metering Transformer Cabinet for CTs and VTs
  - The Member is required to supply a UL or ARL approved cabinet to house the current transformers and voltage transformers. Metering transformer cabinets mounted outside shall be approved for that purpose.
  - All Metering transformer cabinets shall have hinged doors and latching mechanisms whereby Dakota Electric can install a padlock.
  - Metering transformer cabinets shall include provisions for grounding and the cabinet shall be bonded to the grounded service conductor, per NEC.
  - Dakota Electric distribution transformers shall not be used for metering.
    - a. No current transformers or voltage transformers shall be mounted within the Dakota Electric distribution transformer.
    - b. No holes shall be drilled or cut into the side of a Dakota Electric distribution transformer cabinet.

- c. No metering sockets or metering transformer cabinets shall be mounted on the Dakota Electric distribution transformer.
- The metering transformer cabinet shall not be used as a junction box or buss gutter.
- For services rated 400 amps and above, the metering transformer cabinets shall have provisions for mounting bar-type current transformers.
- For services rated over 400 amps, Dakota Electric will supply window type CT's.
- Minimum dimensions for Metering Transformer Cabinets are as follows:
  - a. CTs only (no VTs) 24 X 24 X 12 inches
  - b. CTs and VTs 36 X 36 X 12 inches
  - c. For services over 800 amps, switchgear metering is required.

o Conduit and Meter Transformer Cabinet Mounting Requirements

- For all services, the conduit from the metering transformer cabinet to the meter is to be at least 1 inch in diameter and provided and installed by the Member or Member's contractor.
- The wiring between the meter socket and the CTs and VTs will be provided and installed by Dakota Electric personnel.
- The recommended distance between the metering transformer cabinet and the meter is less than 25 feet. The maximum distance shall not be longer than 50 feet.
- The metering transformer cabinet shall be mounted so that;
  - a. The top of the cabinet is no higher than 8 feet from the floor or ground level
  - b. The bottom of the cabinet is no lower than 4 feet from the floor or ground level.

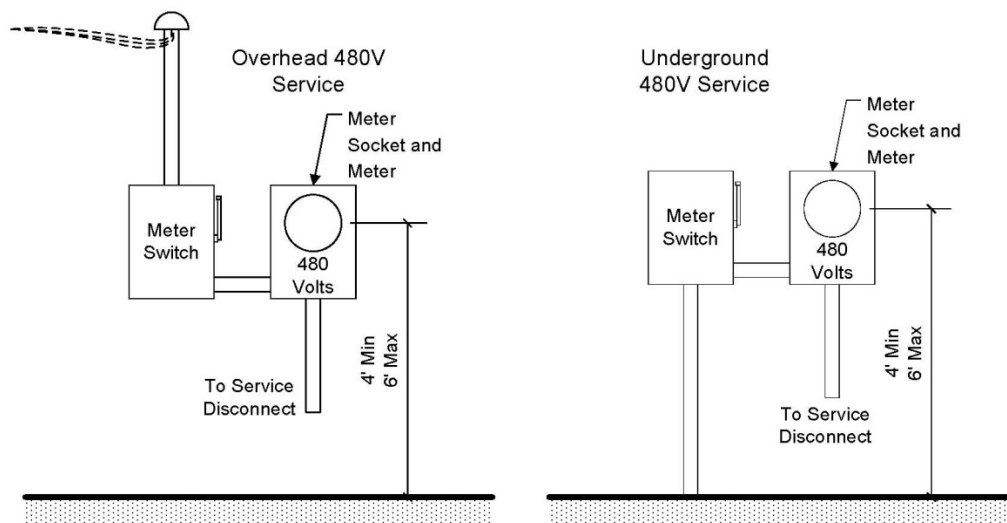
**3.4.2 Cold Sequenced Metering**

Single-phase services above 320 amps & three-phase services above 200 amps, with voltages greater than 240 volts require transformer rated metering. This is to reduce the risk of arc-flash events when changing meters or working on the meter socket. However, if the entire electrical service can be de-energized at any time and meets the following requirements, self-contained, cold sequenced metering may be used. Cold sequenced meters have a disconnect, rated for full load interruption, installed on the utility side of the metering. This allows Dakota Electric personal to de-energize the service and metering before removing the meter.

To utilize this option the service must meet the following requirements:

- Single-phase or three-phase with a service size of 200 amps or below, where the load does not exceed 200 amps for a 200-amp meter installation.
- The metering must be cold sequenced. Cold sequenced means a full load interrupting rated disconnect switch capable of being locked in the open and closed position, mounted ahead of the metering, this switch is used to de-energize the service along with the metering to allow safe conditions for working on the metering.
- The service can be routinely and easily shut off during Dakota Electric's normal business hours and during non-business hours as required. 480V services, which in Dakota Electric's view, are not easily de-energized during normal business hours, will not be allowed as cold sequenced self-contained metering. A service to an irrigation pump is a good example of a service which can be easily shut off during the member's normal business hours.
- This exception must be approved in writing by Dakota Electric and the member must agree in writing to allow Dakota Electric the ability to de-energize the service by using the disconnect (Cold Sequence Meter Switch), without notice, at any time. With this agreement, the member shall release Dakota Electric from any liability for operating this disconnect.

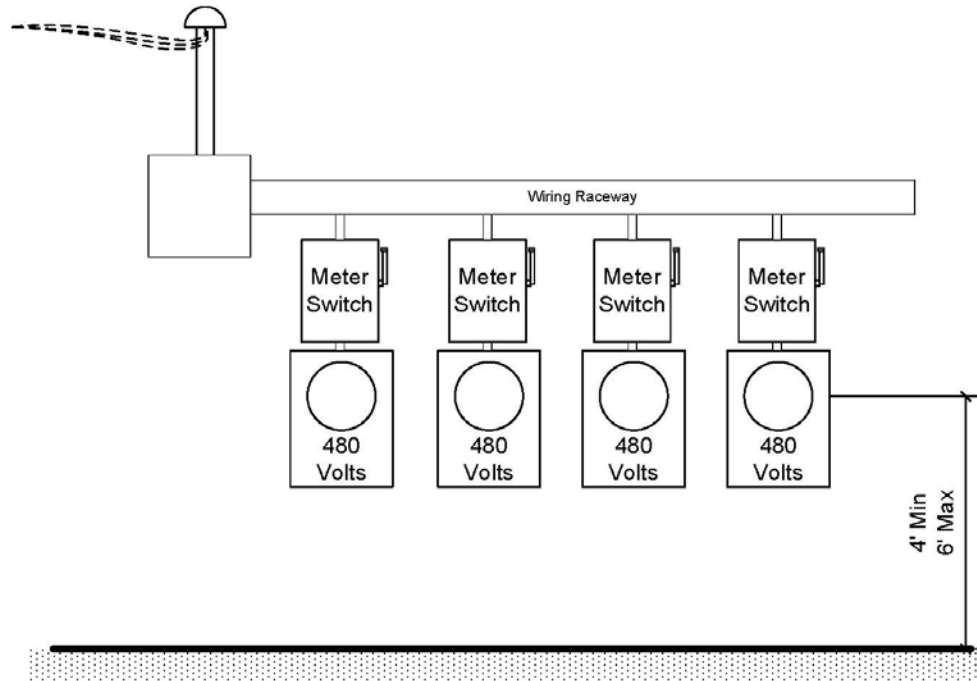
#### Single Phase Service with Cold Sequence Switch



- Cold Sequence Meter Switch shall be non-fused and lockable in both open and closed position.
- Cold Sequence Meter Switch shall only de-energize a single service.

- Cold Sequence Meter Switch and meter socket shall be bonded to the system grounding conductor.
- Cold Sequence Meter Switch must be in the open position when installing or removing the meter.
- Cold Sequence Meter Switch and meter socket may be housed within a single box. Cold Sequence Meter Switch must be able to be operated without opening cover and there must be separate covers for switch area and meter area.
- Cold Sequence Meter Switch shall be lockable by Dakota Electric

Three Phase Service with Cold Sequence Switch



- Wiring raceway and all boxes upstream of the meter shall be lockable by Dakota Electric and shall be weatherproof when installed outdoors.
- Raceway shall contain no splices in the wires.

### 3.4.3 Group Billing/ Master Metering

- Group Billing is where the Dakota Electric billing system provides a single bill for multiple meters on multiple services. There is no change in energy cost using this

method as each service is metered at its normal rate. This allows members to pay for the electric usage of multiple properties with one bill

- Master Metering is done on the secondary side of the transformer, where the facility owner requests the distribution facilities are connected to an individual meter, to sum the loads within the building and then distribute the energy to the individual tenets.
  - Master metering is only available for new installations. Existing buildings, which are physically converted from residential to commercial use may qualify, but any remaining residential units must maintain individual Dakota Electric metering.
  - All extra costs for these installations are the responsibility of the facility owner.
  - The facility must own all wiring and facilities downstream of the distribution transformer, except for the metering current and voltage transformers.

#### 3.4.4 Primary Metering

Depending upon the configuration of the DEA primary system, the Member may have the option of installing primary metering on the 12.5kV system. There is a special Dakota Electric energy & demand rate for primary metered facilities. Many times this option is not available without the installation of additional 12.5kV primary facilities. This additional equipment is typically required to allow for proper metering and to not negatively impact the reliability of other Dakota Electric Member's loads connected to the system.

- The Member is responsible for all integration and installation costs for the primary metering system.
- Primary metering is only available for individual members.
- Primary metering is only available for new installations.
- All of the electrical facilities downstream of the metering point are owned, operated and maintained by the member. The Member is responsible for purchasing all existing electrical facilities on the Member's side of the primary metering installation(s). Existing facilities required by Dakota Electric to supply other members are not eligible for purchase.
- The Member is responsible for routine and emergency maintenance of those member owned primary facilities, which includes emergency transformer

replacement and emergency primary facility repair or replacement. It is recommended that the facility owner contract for these emergency repair / replacement services.

- Primary Metering is required for all primary wires feeding the facilities/complex. In most underground cable installations, there will be a need to install primary metering on both the normal source feed and the alternative maintenance (backup) source feed. Without this alternate maintenance feed, any problems or any routine maintenance of equipment supporting the primary electrical supply will require an electrical outage to the facilities for the repair or maintenance.
- All labor costs for work required on the Members system are the responsibility of the Member. Also, any additional costs incurred by Dakota Electric for switching on the Dakota Electric distribution system occurring outside of normal working hours will be the responsibility of the Member.
- All primary facilities interconnected with the Dakota Electric system shall obtain design review and prior written approval, from Dakota Electric's engineering department, before any installation or modifications.
- Dakota Electric, the NEC, or both may require special protection for the Member's primary system. The Member is required to provide and maintain all necessary protection. This protection shall coordinate with DEA's distribution system's protection.

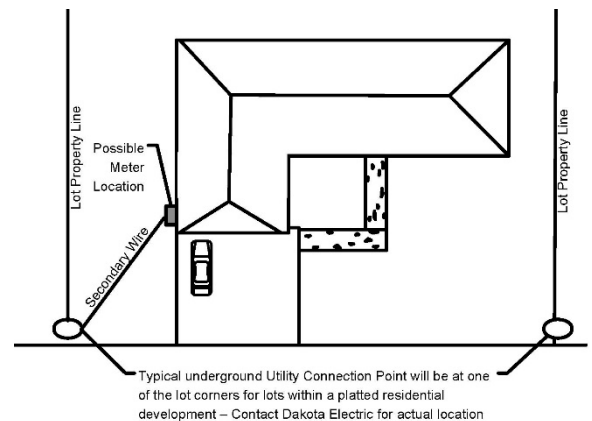
The primary metering system includes:

- 7.2/12.5kV voltage transformers and current transformers. These will be supplied and owned by Dakota Electric
- Transformer rated meter, provided by Dakota Electric
- Metering Socket provided by member and approved by Dakota Electric.
  - If installation is supplied underground, the Member is required to supply a metering enclosure to house the potential and current transformers. The enclosure design shall be reviewed and approved by Dakota Electric Association. The primary metering enclosure shall be supplied by the Member per the applicable Dakota Electric equipment specifications. If installation is from overhead facilities, Dakota Electric will supply all metering equipment for primary overhead metering installations.

## 3.5 Technical Information

### 3.5.1 Glossary

- **Cold Sequence Metering** – Self-contained metering using a fully rated disconnect (Cold Sequence Meter Switch) installed on the utility side of the metering to allow the metering to be de-energized to allow metering work to be safely completed.
- **Cold Sequence Meter Switch** - This switch is used to interrupt power to a meter and the load. This switch is also used to de-energize a meter to allow it to be safely removed or installed. This is referred to as cold sequencing a meter.
- **Current Transformer** - A current transformer (CT) provides a current on its secondary terminals that is proportional to the current in the primary circuit. Current transformers are used in metering and protective circuits to step down the current to levels which can be easily utilized.
- **Member** – Dakota Electric Association “customer”, as a not for profit cooperative everyone who received electric service from Dakota Electric is a member of the Dakota Electric Association.
- **Self-Contained Meter** - A self-contained meter is designed to carry the full rated current of the circuit being metered and being energized at the line voltage. It does not require auxiliary instrument transformers to step down line current or voltage.
- **Transformer Rated Meter** - When the electrical supply needs of the load exceed the rating of a self-contained meter, instrument transformers are used. Current and voltage transformers are used to step down the current and voltage of the circuit to levels which then can be measured by the meter.
- **Utility Connection Point** - This is the point where the Dakota Electric owned facilities are connected to the Member owned facilities. For residential this is typically in a transformer or pedestal; for underground commercial service this is typically in the Dakota Electric distribution transformer.
- **Voltage Transformer** - A voltage transformer (VT) also known as a potential transformer (PT), provides a voltage on its secondary terminals that is in proportion to the voltage of the circuit. Voltage transformers are used in metering and protective circuits to step down the voltage to levels which can be easily utilized.



### 3.5.2 Codes and References

The following is a brief list of applicable codes and other references which are used in the electric service handbook. *Note - Many links on this page link to web sites that are external to Dakota Electric and thus Dakota Electric does not control the content of these sites.*

- EMF - Electric and Magnetic Fields - are invisible lines of force associated with the production, transmission and use of electric power. For more information on the health aspects of EMF we recommend you go the National Institute of Environmental Health Science - National Institute of Health web site.
- IEEE - Institute of Electrical and Electronics Engineers (IEEE), the world's largest professional association who's core purpose, is to foster technological innovation and excellence. IEEE hosts various standards committees and publishes and maintains those standards.
- National Electrical Code (NEC) - Published by the National Fire Protection Association (NFPA), the National Electrical Code covers the installation of electrical facilities in public and private structures, commercial and industrial facilities.
- National Electrical Safety Code (NESC) - Published by the IEEE, the National Electrical Safety Code sets the ground rules for practical safeguarding of persons during the installation, operation, or maintenance of electrical supply and communication lines and associated equipment.

### 3.5.3 Diagrams

3.5.3.1 [Single Phase 120/240V Meter Connection Diagram - 2S](#)

3.5.3.2 [Single Phase 120 /208V Meter Connection Diagram - 12S](#)

3.5.3.3 [Three Phase 120/208 Meter Connection Diagram - 9S](#)

3.5.3.4 [Three Phase 277/480 Meter Connection Diagram - 9S](#)