



Upper Peninsula Power Company

Electric Service Manual

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1-1 Purpose

This Service Manual is published by Upper Peninsula Power Company (UPPCO), hereinafter referred to as "the Company", for the convenience of the Company's customers and their architects and contractors. The information contained in the manual is in addition to the various municipal electrical codes, the Michigan Administrative Code, and any other regulations which may apply. The Company reserves the right to make revisions in these rules whenever changes in the art, legal requirements, or other circumstances make it advisable. These rules are intended for standard equipment installations. When, because of physical limitations of the premises, it is impractical to follow them, the Company shall be consulted for permissible modifications. The information contained herein does not cover in detail the requirements of the Company's rate schedules, extension rules, or general rules; the Company should be consulted for specific information concerning these matters.

The Company may refuse or discontinue service if a customer does not comply with these rules; however, the customer will first be notified and afforded reasonable opportunity to comply. Service may be discontinued without prior notice when a dangerous condition exists on customer's premises.

The following is a listing of abbreviations that may be present in this document:

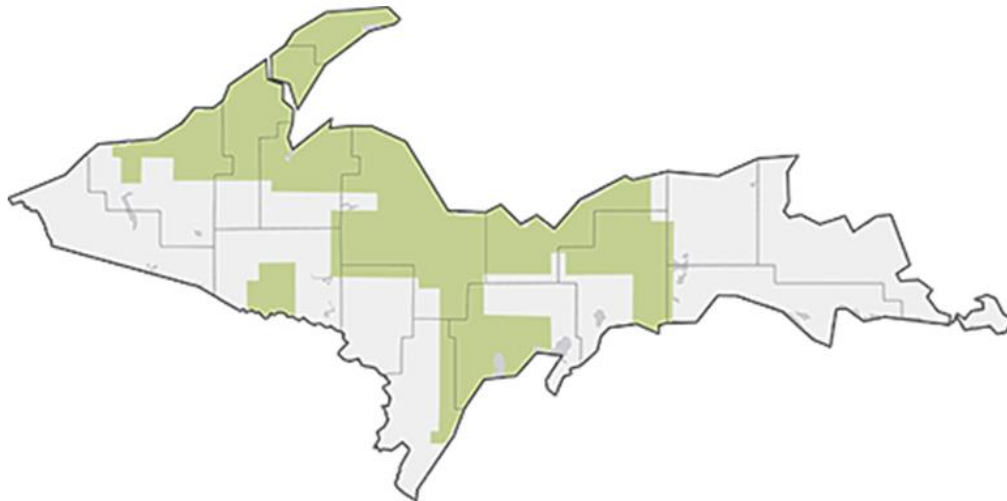
UPPCO	Upper Peninsula Power Company
NEC	National Electric Code
NESC	National Electric Safety Code (rules governing utilities)
MPSC	Michigan Public Service Commission (regulatory & rule making policy)

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1-2 Territory Maps



Upper Peninsula Power Company



1-3 Contact Information

Michigan law requires anyone excavating to provide notice at least 72 hours, but not more than 14 days, before the start of any blasting or excavation. Emergency service is available.

Miss Dig 811

Phone: **811** (or 248-370-6400 or 800-482-7171)

Request service online with e-Locate service

Website:

<http://www.missdig.org/>

Michigan Compiled Laws § 460.723 Sec. 3. (n) "Excavator" means any person performing excavation or blasting.

From Michigan Compiled laws § 460.725 Sec. 5. (1) It requires that "An excavator shall provide a dig notice to the notification system at least 72 hours, but not more than 14 calendar days, before the start of any blasting or excavation."

State of Michigan Miss Dig information public act information 174:

<https://www.missdig.org/education/public-act-174.html>

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1-3 Contact Information

Upper Peninsula Power Company

Website:

<http://www.uppco.com/>

24-hour Emergency Service

Phone: 906-449-2011 (800-562-7809)

Residential Customer Service

Phone: 906-449-2013 (800-562-7680)

Fax: 906-485-2431

Email: customerservice@uppco.com

Commercial Customer Service

Phone: 906-449-2014 (800-337-8445)

Fax: 906-485-2431

Email: customerservice@uppco.com

UPPCO Local Offices (not open to local business)

Mailing Address:

Delta Service Center
2800 29th Avenue North
Escanaba, MI 49829

Iron River Service Center
3313 US Hwy 2 East
Iron River, MI 49935

Ishpeming Service Center North
500 North Washington Street
Ishpeming, MI 49849

Ishpeming Service Center South
800 Greenwood St.
Ishpeming, MI 49849

Munising Service Center
225 East Munising Avenue
Munising, MI 49862

Ontonagon Service Center
680 Greenland Road
Ontonagon, MI 49953

West Houghton Service Center
18494 Houghton Canal Road
Houghton, MI 49931

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2-1 Basic Electric Clearances - Services

2-1.1 Clearances for Electric Overhead Services

Not for primary or secondary (non-service) clearances.

UPPCO will exercise Stop Work Authority in the event that an unsafe condition or behavior violates these clearances.

Clearances per NESC Table 232-1 and Table 234-1.

Note that the following are the minimum required clearances. Additional clearances must be added to account for thermal loading, ice loading, and snow depth when looking at vertical clearances. All clearances are for services under 750 volts unless otherwise indicated.

Triplex & Quadruplex Cables (most common)
Open Wire Poly Insulated Cables

Type A
Type B

Rule 230C3

<u>Vertical Clearances</u>	A	B
Roads, Streets, Driveways, Parking Lots, Alleys, Cultivated Land, Grazing Forest, Orchards, etc.	16.0'	16.5'
If the height of the building to which the service is attached does not permit and there is only a residential driveway (no chance of trucks), under 150 volts to ground, and insulated.	12.0'	12.5'
Drip Loop	10.0'	10.5'
Spaces & ways subject to pedestrian or restricted traffic only (no horse riding or vehicles over eight feet).	12.0'	12.5'
Spaces & ways subject to pedestrian or restricted traffic only (no horse riding or vehicles over eight feet), the building height does not permit, under 150 volts to ground, and insulated.	10.0'	10.5'
Drip Loop	10.0'	10.5'
If along roads in rural districts where it is unlikely that vehicles will be crossing under the line (must consider blow out to embankments, etc.)	14.0'	14.5'
If along rural roads and located relative to fences, ditches, embankments, etc., so that ground under the line would not be expected to be traveled except by pedestrians, may be reduced to the following: The service must be under 150 volts to ground and insulated.	9.5'	12.5'

2-1.1 Basic Electric Clearances – Services (Cont'd)

<u>Vertical Clearances</u>	A	B
DOT minimum clearances over roadway (only State and Federal Highways) (use NESC if greater than this) (under worst case conditions) (MI DOT Annual Permit Form).	MI: 18.0'	MI: 18.0'
Over or under roofs or projections <u>not readily accessible</u> (no permanent stairs, ladders, doorways, ramps, windows, etc. to the roof; no vehicles) and the service is NOT ATTACHED to that structure. (This clearance also applies above railings, walls, or parapets around balconies or roofs).	3.5'	10.5'
Over or under balconies & roofs <u>readily accessible</u> to pedestrians (as part of structure to which <u>service is NOT ATTACHED to that structure</u> (casually accessed through a doorway, ramp, window, stairway, or permanently mounted ladder etc.) (NESC Table 234-1 row 1(b)(2) columns 3 & 5.)	11.0'	11.5'
Over roofs, balconies, porches, or attached decks over which they pass and the <u>service is ATTACHED to that structure</u> (NESC 234C(3)(d)).		
<u>Accessible</u>	10.0'	10.0'
<u>Not Readily Accessible</u> to pedestrians (including drip loops)		
MI: Under 750 volts phase to phase	3.0'	10.0'
MI: Under 300 volts phase to phase	3.0'	3.0'
Over or under catwalks & other surfaces upon which personnel walk	11.0'	11.5'
Other vertical clearances to signs, chimneys, billboards, radio & TV antennas, tanks, and other installations not classified as buildings or bridges.	3.5'	6.0'

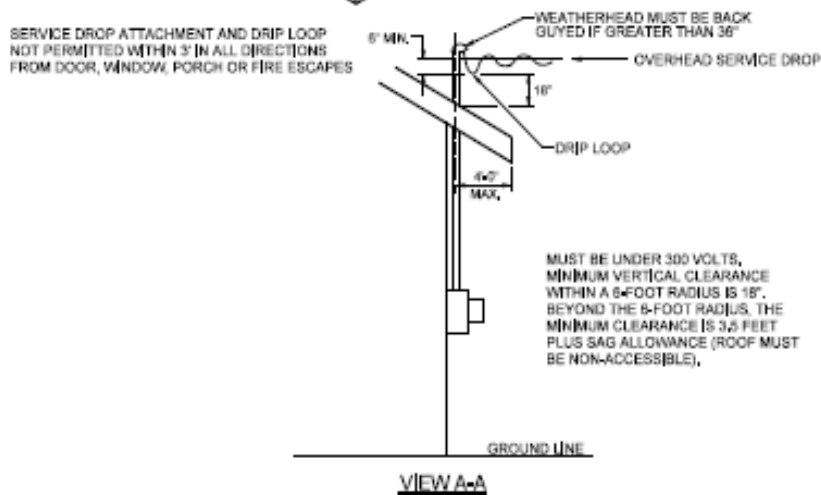
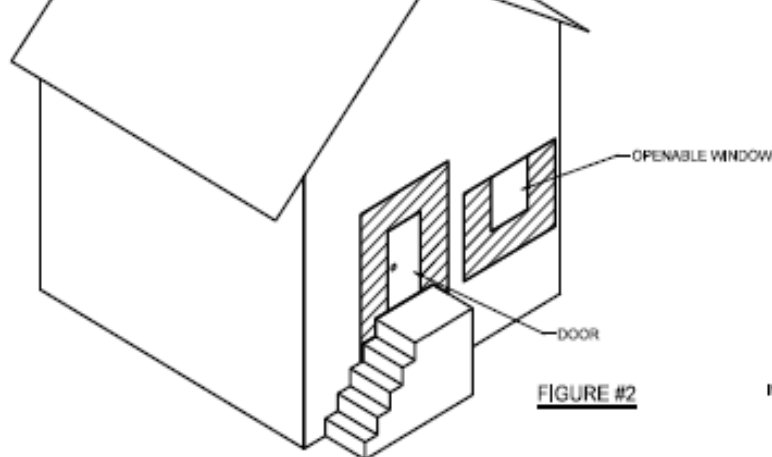
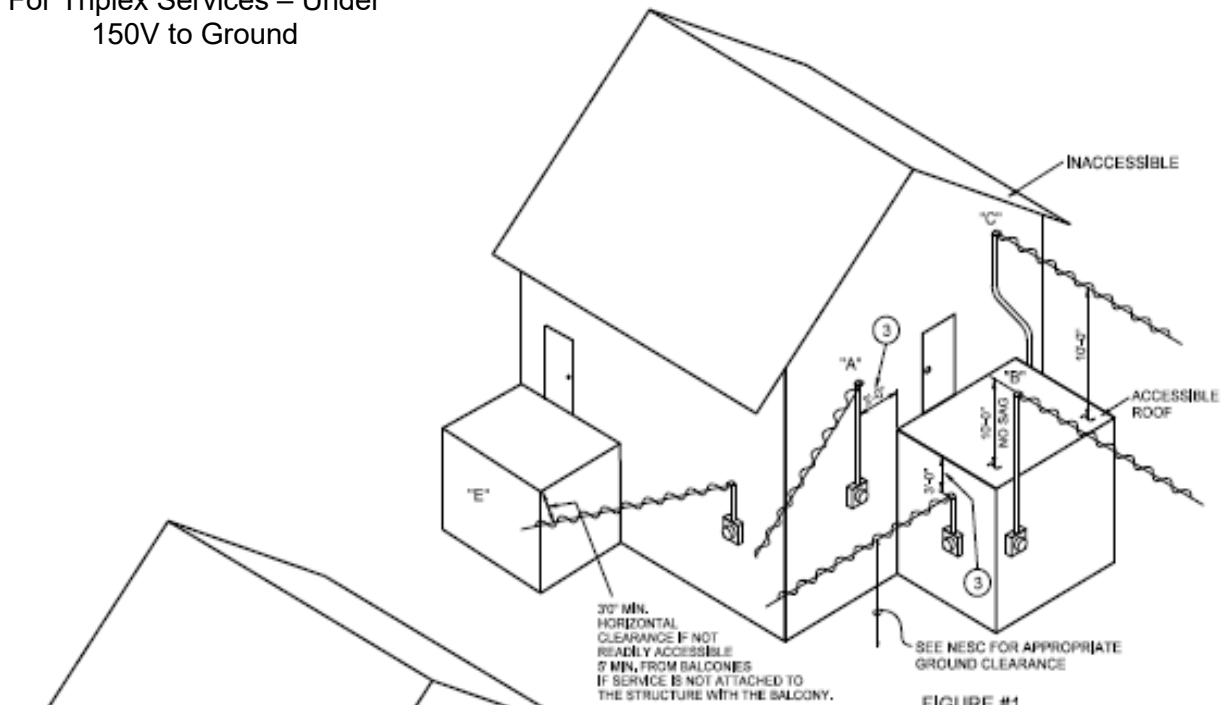
<u>Horizontal Clearances</u>	A	B
Horizontal clearance, at rest (no wind) to walls, projections, windows, balconies, and areas readily accessible to pedestrians.	5.0'	5.5'
Horizontal clearances to signs, chimneys, billboards, radio & TV antennas, tanks, flagpoles poles and flags, banners and other installations not classified as buildings or bridges.		
Accessible	5.0'	5.5'
Non-Accessible	3.5'	5.5'

Notes:

1. Where these clearances cannot be obtained, the conductors and rigid live parts shall be guarded. (NESC 234C2)
2. Code requires a clearance to any part of an overhead service to be three feet in any direction from windows (unless window is not designed to open) (above windows is acceptable if triplex or quadruplex), doors, porches, and fire escapes if the service drop is attached to the building and not readily accessible. This clearance also applies to the drip loop. See Figure #2 (NESC 234C3d (2)).
3. See figure #3 for an exception to roof clearance when using a periscope (through the roof raceway) and non-accessible roof or balcony and with voltages less than 300 volts to ground (NESC 234C3d (1)).

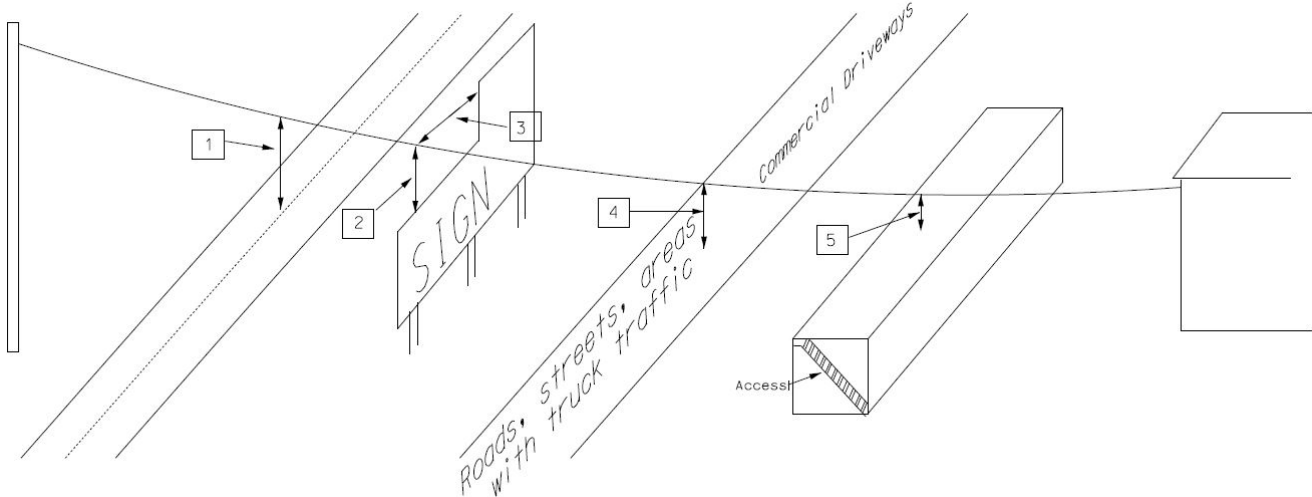
2-1 Basic Electric Clearances – Services (Cont'd)

For Triplex Services – Under
150V to Ground

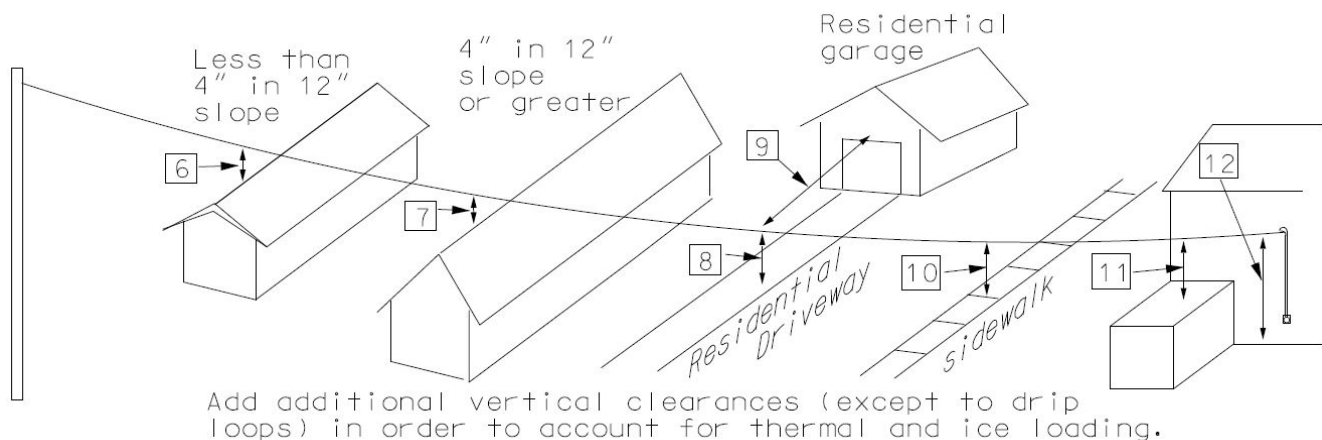


2-1 Basic Electric Clearances – Services (Cont'd)**Triplex Services Under 150 Volts to Ground**

1. 18'0" under worst case in Michigan, State and Federal roads.
2. 3'6" vertical clearance to signs, chimneys and other structures (not readily accessible).
3. 3'6" horizontal clearance to signs, chimneys, and other structures (not readily accessible).
4. 16'0" vertical clearance to roads and areas subject to truck traffic.
5. 11'0" over accessible roofs or balconies not attached to the building being served by the service drop.



6. 3'6" in Michigan if low sloped roof and inaccessible.
7. 3'6" in Michigan if steep roof and inaccessible.
8. 12'0" to residential driveways where higher attachment points can't be obtained. If there is a reasonable chance of truck traffic, this clearance does not apply.
9. 5'0" horizontal clearance to building.
10. 12'0" over sidewalks and pedestrian-only areas. This does not apply if vehicles can reasonably be driven here or horses ridden here. 10'0" if can't get height, due to building height attachment limits.
11. 10'0" over accessible, attached roofs and balconies. In Michigan this is 3'0" if not readily accessible.
12. Adjacent line clearance for the lines applies. In this example it would be 12'0" (note 10).



2-2 Miscellaneous Clearances

2-2.1 Wells

Underground 5 feet for electric or gas. May be reduced to one foot with special permission and with special precautions for lightning damage (Company Design Rule).

Overhead Horizontal clearance must be considered for well maintenance. MIOSHA requires at least 10' working clearance.

2-2.2 Private Septic Systems

Clearance to holding tanks, collector tanks, drain fields, and mound systems (Company design policy): 10 feet

2-2.3 Stored Materials

Overhead Overhead lines shall not be run over areas designated for material storage where cranes or other types of tall machinery are used unless adequate clearance can be provided for full use of the equipment (Company design rule).

2-2.4 Working Clearances

Following are the MIOSHA Rule 408.14005(4) rules.

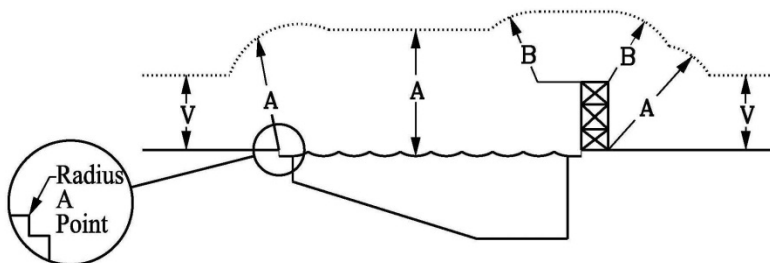
Voltage	Minimum personnel clearance, To any part of crane, or to the load in feet
69 kv and below	10
115 kv and 138 kv	11
345 kv	15

2-2.5 Swimming Pools / Hot Tubs

Underground 5 feet of pool / hot tub or auxiliary equipment (horizontally) (NESC 351C1)

Overhead Shall be avoided by a minimum of 10 feet horizontally from the edge of the pool, diving platform, diving tower, water slide, or other fixed, pool-related structures. The following are clearances for utility triplex service drops (under 750 volts). Conductor thermal and ice loading must be considered also.

A=22.5 feet, B=14.5 feet, V=normal ground clearance

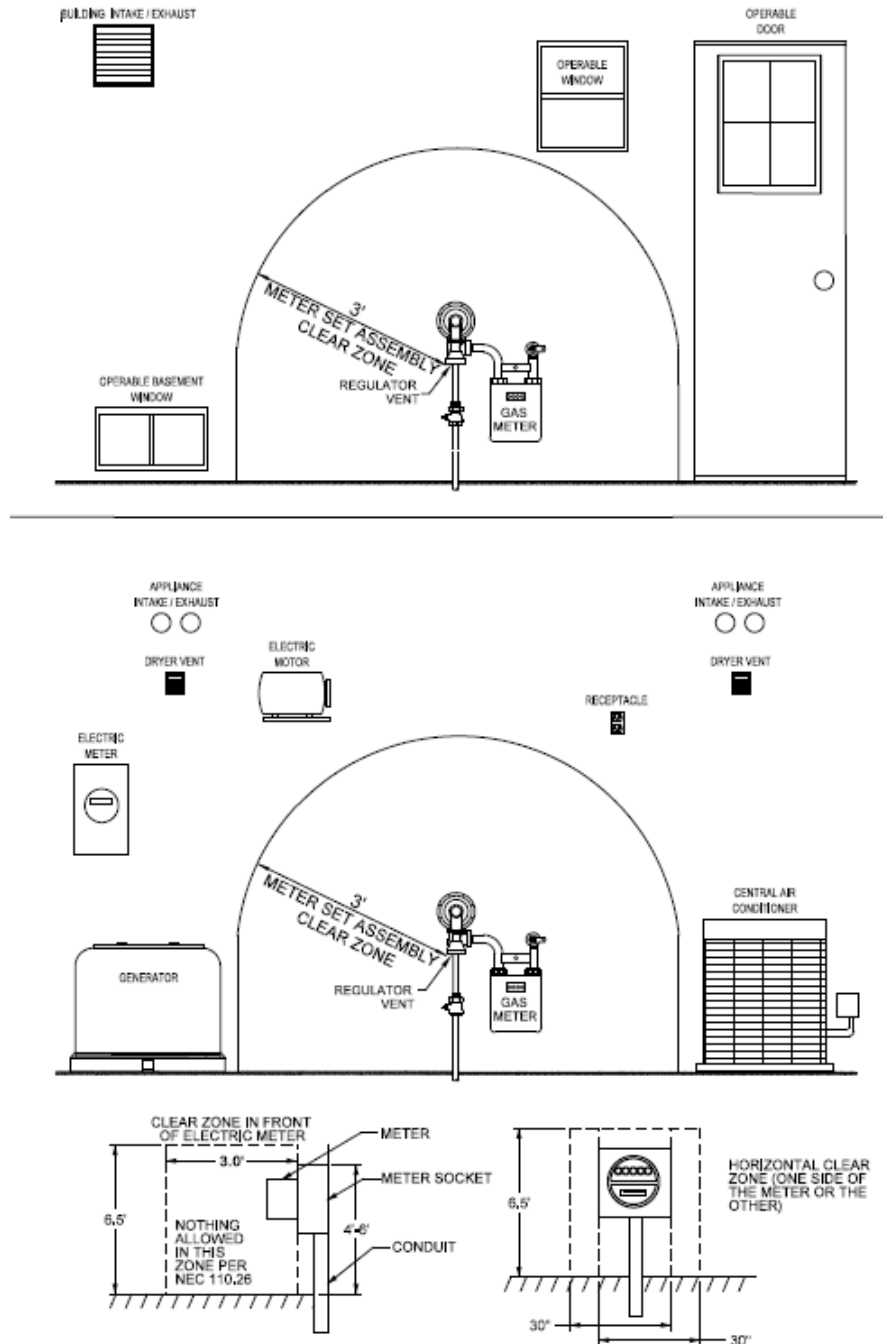


2-2 Miscellaneous Clearances (Cont'd)

2-2.6 Natural Gas Lines

Basic underground clearance from gas lines to all other utilities or below-ground structures is one foot.

2-2.7 Natural Gas and LP and Meters



Notes:

1. The National Electric Code 110.26 requires 3'-0" in front of electrical equipment including the electric meter socket. This clearance zone applies from the ground up to 6.5 feet.
2. The 3-foot radius clearance applies to clearances between the electric meter and the vents on LP and Natural Gas regulators.

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2-2.8 Fuel Tanks

- Overhead An above-ground LP Gas container or other fuel storage and any of its parts shall not be located within 15 feet of a vertical plane beneath overhead electric power lines. (Company policy superseding LP Gas Code Handbook 6.4.5.12)
- Underground Underground cables shall not go under fuel tanks. They shall not come within 10 feet of above or below-ground tanks. Electric cables can come closer if installed in approved conduit. (Call Customer Service on contamination and maintenance issues.)

2-2.9 Class I Hazardous Locations

Buried electric lines, meter sockets, CT cabinets, or termination enclosures must observe the following minimum horizontal clearances from the flammable fuel system components listed below:

Under fuel storage tanks (above or below ground)	0 feet (not allowed under the fuel tank)
Fill Pipe	10 feet
Dispensing device	20 feet
Remote pump	10 feet
Vents	5 feet

Consult the Company for other Class I hazardous locations. (NESC 127, NEC Article 514 and NEC Article 515).

2-2.10 Buildings

Underground electric lines should not be installed under buildings nor may buildings be built over underground electric lines of any voltage. (NESC 351C2 and 350.H.) (See also NEC 300-5c.)

2-2.11 Billboards

The overhead service attachment and drip loop must have the following clearances from any access platform, assuming that the access platform is not accessible (no fixed access ladder or a ladder that is at least 8 feet short of the ground). The normal attachment should be on a corner of the sign. The service should not go across the face of the sign, where it might block access. NESC 234C.3.d.

3 feet below the platform (and at least 3 feet in all directions from an access ladder).

3 feet above the platform (or 3 feet out from the platform).

2-2.12 Special Cases

See the Company for additional clearance requirements not listed above. Some of the items which require special clearances include the following:

Railroads	Sailboat Areas
Light Poles (standards)	Boat Landings
Grain Bins	Airport Approaches
Bridges	Electric Transmission / Distribution Lines
Catwalks	Ladders Mounted to Tall Buildings (Over 50 ft.)
Windmills/turbines	

2-3 Antenna Clearances

Location of Outdoor Antennas

Outdoor antennas and satellite dishes (receiving stations) and supporting structures, at or on residences, shall have a horizontal clearance from Company electric lines, greater than its total height. Lead-in conductors

attached to buildings shall be installed so they cannot swing closer than 10 feet to or pass over the electric supply conductors.

Exception: Service drops of 150 volts or less to ground shall have a minimum clearance of 4 feet from the antenna and supporting structure and a minimum clearance of 2 feet from the lead-in conductors.

Consult the Company when these clearances cannot be met.

Also note: NESC 234 Table 234-1
NEC 810.18(A) and 810.13

2-4 Location of Padmount Transformers Near Buildings

See Subsection 5-11 on how to reference the window in the concrete pad. This is critical for access, switching and conduit training.

Pad mount transformers cannot be located UNDER any portion of a combustible or non-combustible building or structure.

Non-combustible vs. Combustible Walls Definition

For the purposes of this Section, combustible walls are walls of Type No. V buildings as determined by Michigan Building Code (Construction Classification IBC Chapter 6). All other walls are considered to be non-combustible.

The following is not part of code but is intended to help clarify the combustible wall definition:

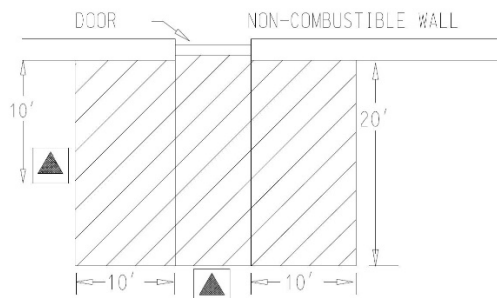
Combustible	Non-combustible
<ul style="list-style-type: none"> - Wood frame - Wood frame with a brick veneer, stucco, thin layer of stone, etc. - Metal clad over a wood frame (typical pole shed) 	<ul style="list-style-type: none"> - Masonry structures (generally a minimum of 4" thick) - Metal sheds (metal walls, metal roof, concrete floor) (can't have wood framing for the flooring, walls, or roof) - Poured concrete walls sandwiched between Styrofoam layers (Type IB) - Heavy timber construction (non-combustible material Between timbers) (see definitions of heavy timber construction)

1. Non-combustible Walls

Pad mount oil insulated transformers shall not be located closer than 10 feet to non-combustible walls. (Company policy)

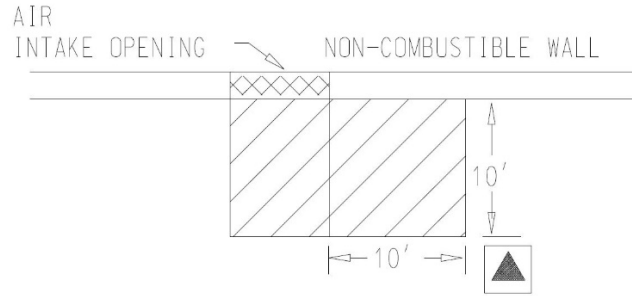
A. Doors

Pad mount oil insulated transformers shall not be located within a zone extending 20 ft. outward and 10 ft. to either side of a building door.



B. Air Intake Openings

Pad mount oil insulated transformers shall not be located within a zone extending 10 ft. outward and 10 ft. to either side of an air intake opening. Such transformers may be located within said zone beneath an air intake opening provided there is not less than 25 ft. diagonal between the transformer and said opening.



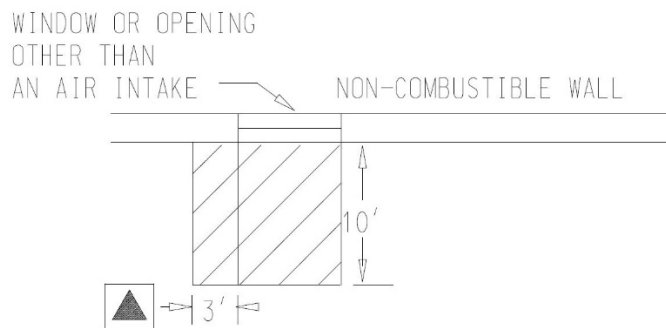
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2-4 Location of Pad mount Transformers Near Buildings (Cont'd)

C. Windows or Openings (Other Than Air Intake)

First Story

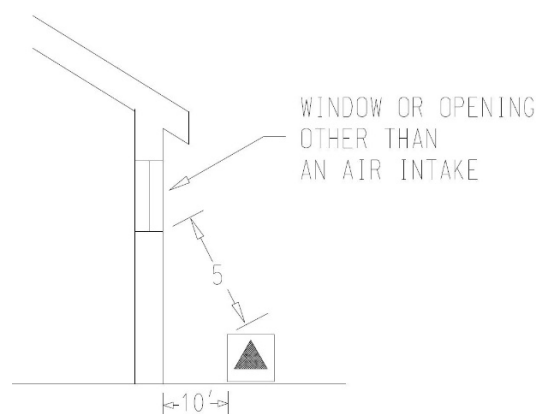
Pad mount oil insulated transformers shall not be located within a zone extending 10 ft. outward and 3 ft. to either side of a building window or opening other than an air intake.



D. Windows or Openings (Other Than Air Intake)

Second Story

Padmount oil insulated transformers shall not be located less than 5 ft. from any part of a second story window or opening other than an air intake.



EXCEPTION - These window clearances do not apply to glass block or fire windows meeting the requirements of the MI Commercial Building Code (Fire Window, IBC Chapter 7, Section 714.3).

2. Combustible Walls

- A. Pad mount oil insulated transformers in sizes up to and including 100 kVA shall be located according to the provisions set forth for non-combustible walls.

Note: Installations with 75 kVA three phase pad mounts should be designed with upgrades to 150 kVA in mind.

- B. Pad mount oil insulated transformers in sizes above 100 KVA shall be located a minimum of 10' from the building wall, in addition to the clearances from building doors, windows and other openings set forth for non-combustible walls. Also, a sump shall be installed for transformers in sizes exceeding 500 kVA if the immediate terrain is pitched toward the building. Contact Electric Distribution Engineering Department for sump specifications.

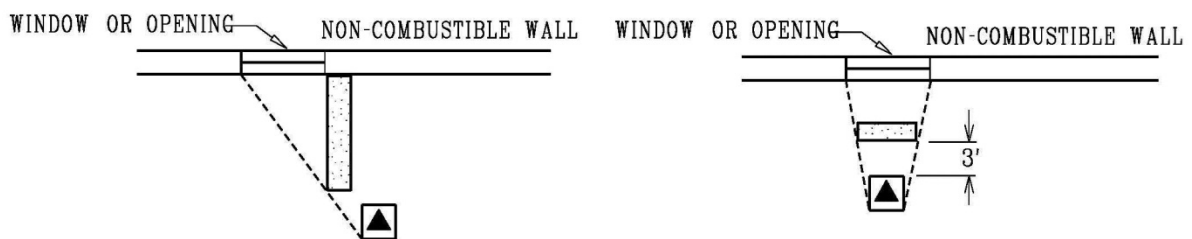
2-4 Location of Pad mount Transformers Near Buildings (Cont'd)

3. Barriers

If the clearances specified above cannot be obtained, a fire-resistant barrier may be constructed in lieu of the separation. Based on the State Building Code, a fire-rated barrier would have to be a minimum of a 4-inch solid masonry wall or a 12-inch hollow masonry wall. If a non-combustible barrier is part of the building exterior wall, consider the impact on the eave and the potential of fire access to the roof trusses. The following methods of construction are acceptable:

A. **Non-Combustible Walls**

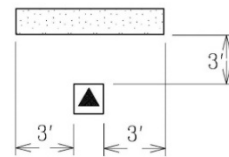
The barrier shall extend to a projection line from the corner of the pad mount transformer to the farthest corner of the window, door or opening in question. The height of the barrier shall be 1' above the top of the pad mount transformer.



B. **Combustible Walls**

The barrier shall extend 3' beyond each side of the pad mount transformer. The height of the barrier shall be 1' above the top of the pad mount transformer.

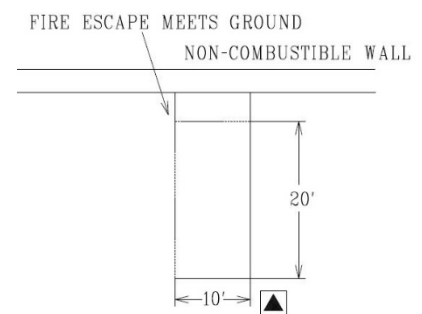
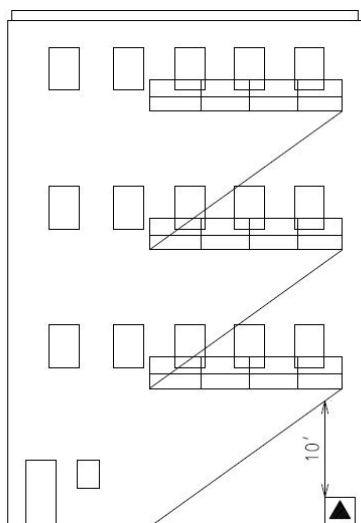
(SOLID OR WITH WINDOW OR OPENING) COMBUSTIBLE WALL



4. Fire Escapes

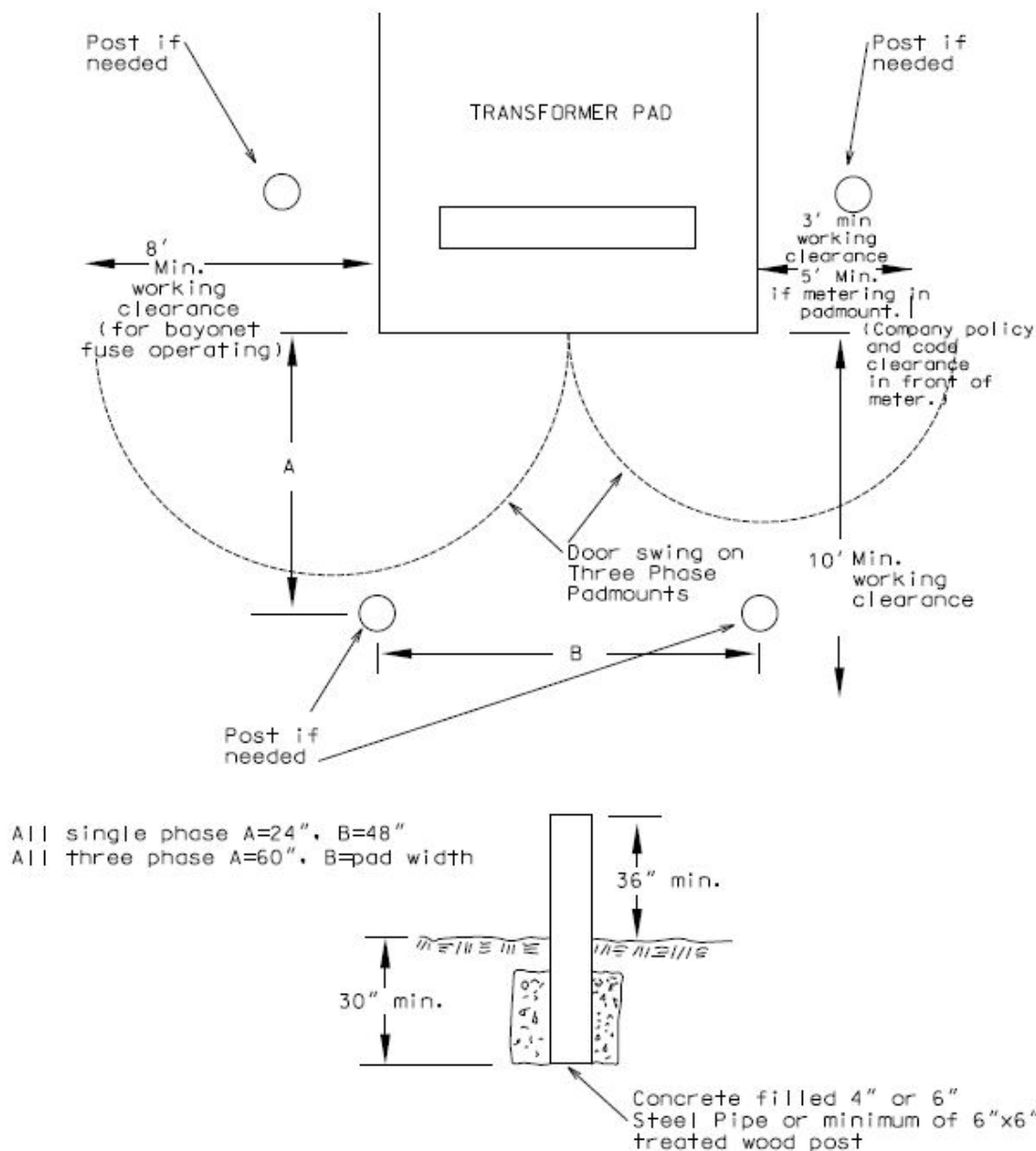
Pad mount oil insulated transformers shall not be located within a zone extending 20 feet outward and 10' on either side of the point where a fire escape meets the ground.

Pad mount oil-insulated transformers located beneath fire escapes shall have a vertical clearance of not less than 10 feet from the top of the transformer to the bottom of the fire escape.



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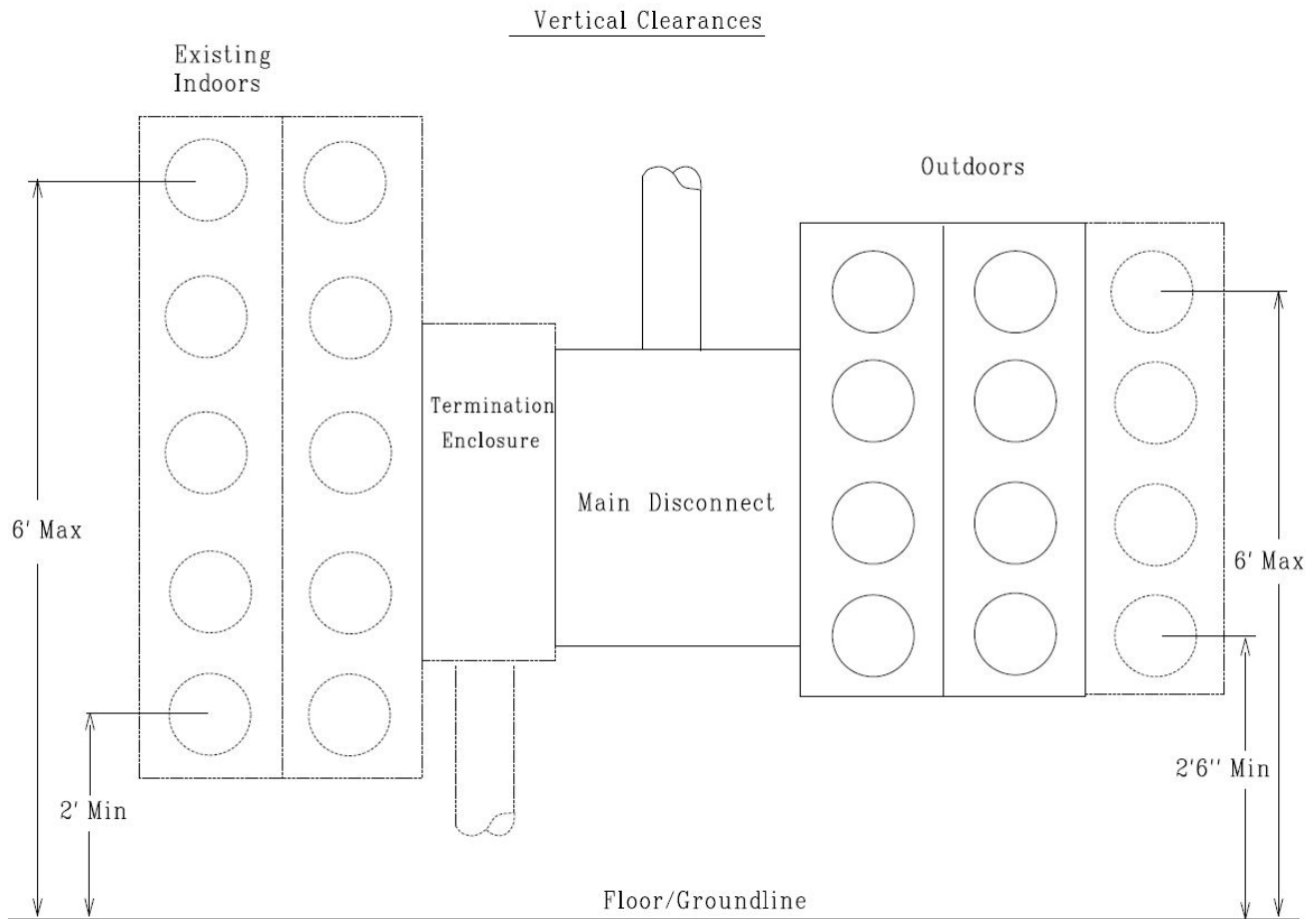
2-5 Working Clearances / Protective Posts for Padmount Transformers



Notes:

1. The minimum working clearance around pad mount transformers is 8 feet to the left, 10 feet in front, and 3 feet behind and to the right side of the pad mount transformer. If metering is inside the pad mount transformer, the minimum clearance to the right side is 5 feet. See the above diagram. These working clearances apply with or without protective posts. This working clearance includes fences, shrubs, gas risers or equipment, etc.
2. Pad mount transformers cannot be located UNDER any portion of a building or structure.
3. See Subsection 2-4 for code clearances to combustible walls, doors, windows, intakes, etc.
4. Protective posts are **required** where the transformer is subject to vehicular traffic. Installation and cost of this protection is the responsibility of the customer. If the Company has to install this protection, appropriate charges will be billed to the customer.
5. The customer or damaging party is liable for damage to the Company's equipment with or without protective posts.

2-6 Multiple Metering

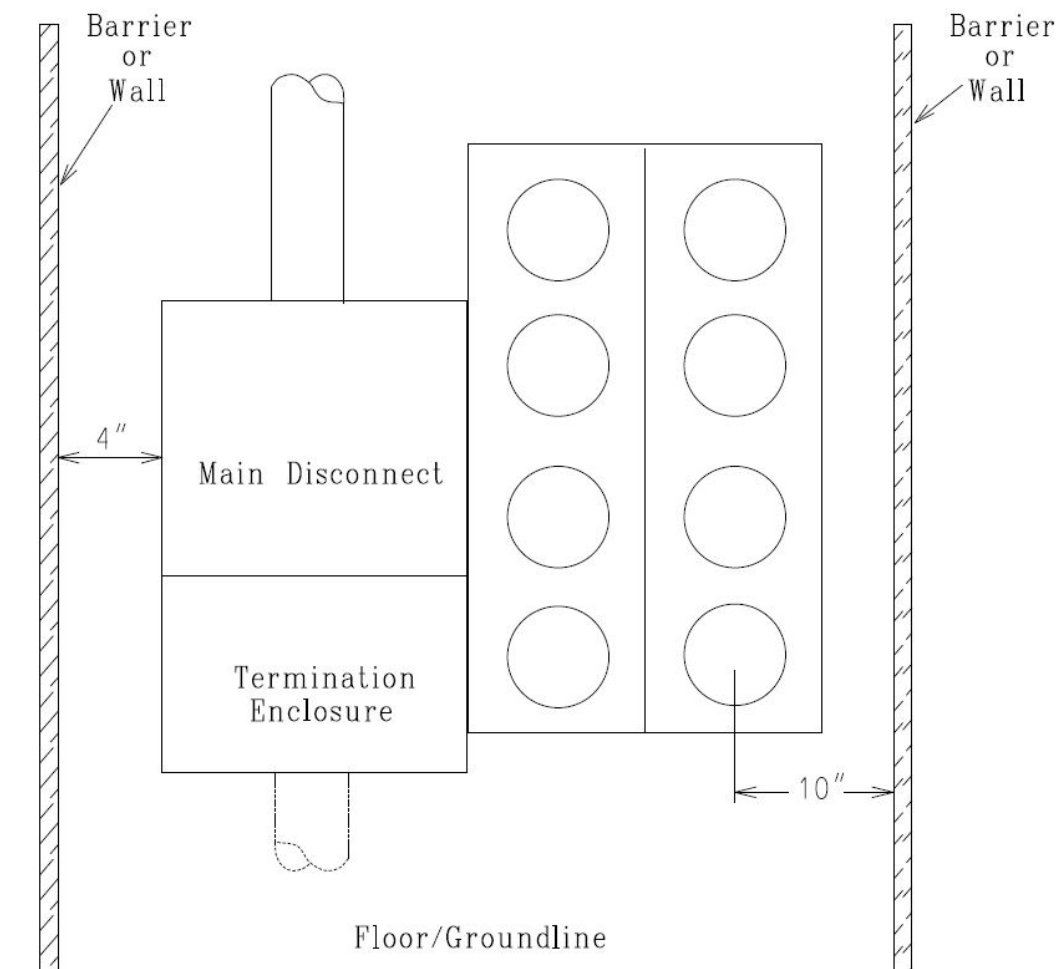


Notes:

1. **Metering shall be outside.**
2. A minimum of 3 feet must be provided in front of all metering installations. See NEC 110.26(A).
3. 6'6" overhead headroom working space required per NEC 110.26(A).

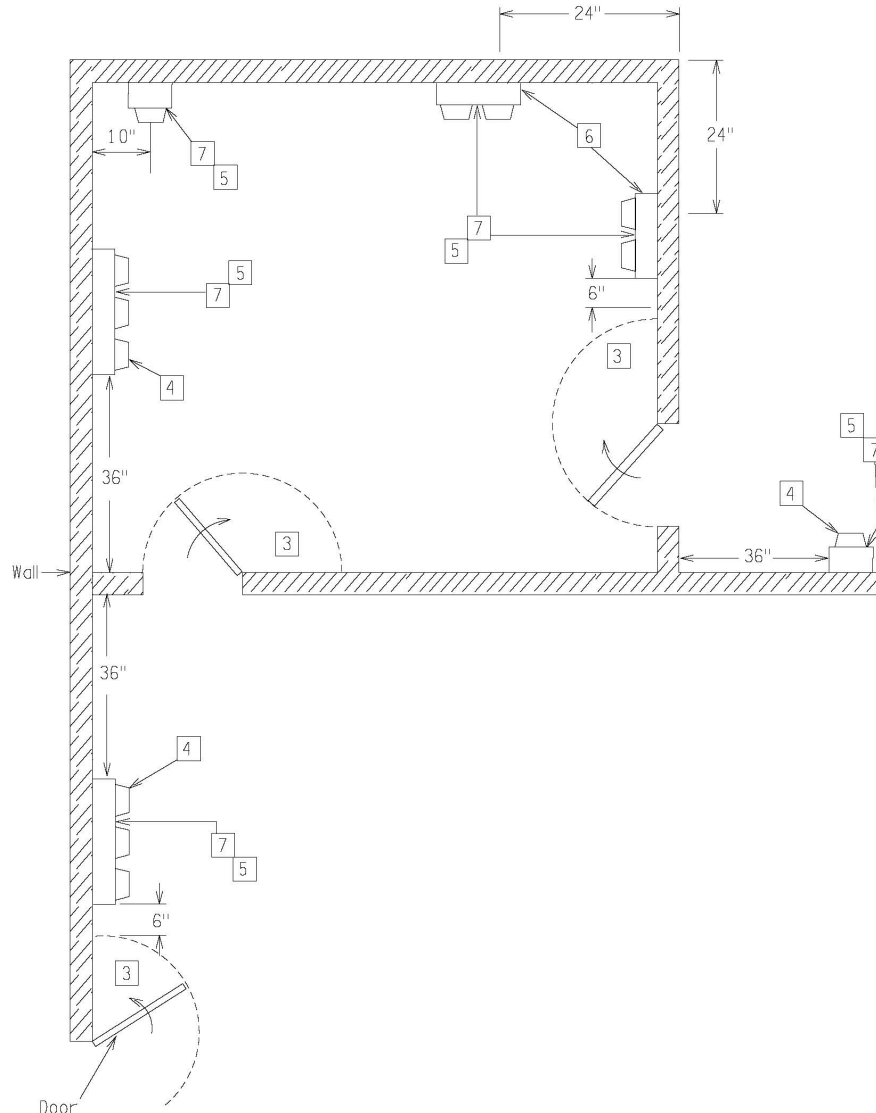
2-6 Multiple Metering - Clearances (Cont'd)

Horizontal Clearances



Notes:

1. **Metering shall be outside.**
2. A minimum of 3 feet must be provided in front of all metering installations. See NEC 110.26

2-6 Multiple Metering –Clearances (Cont'd)**Swinging Door, Frontal & Side Clearances for Indoor Multiple Metering****Notes:**

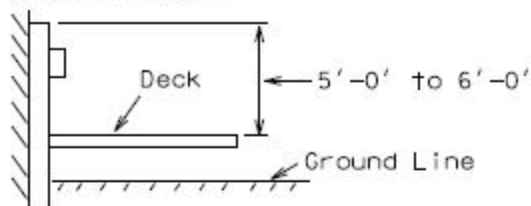
1. **All new metering installations shall be outside.**
2. All dimensions shown are minimum dimensions.
3. Meters are not to be installed on walls where they will be behind an open swinging door.
4. Meters may require protective barriers if traffic through doorway could cause meter damage. A minimum clearance of 12 in. is required from the center line of the meter-connection device to the barrier.
5. Location of electric meters must comply with dimensions shown on this sketch and meter mounting height dimensions shown in Subsection 2-6.
6. A minimum of 24 inches applies when meter stacks are mounted on adjacent corner walls.
7. A minimum clearance of 3 feet must be provided in front of all metering installations. See NEC 110.26(A).
8. The Company shall be consulted concerning the location of metering equipment before metering equipment is installed.

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2-7 Residential Deck / Other

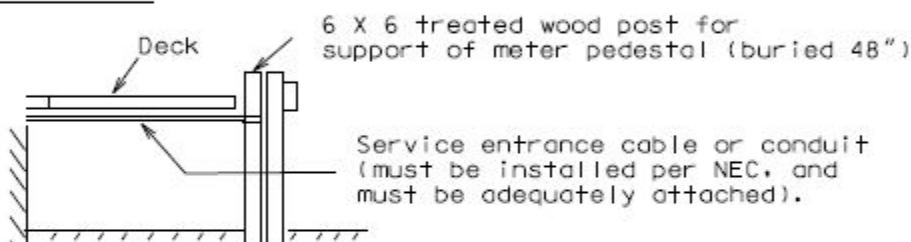
The first priority is to avoid decks when installing new underground or overhead services. This procedure is on how to deal with problems once decks are built around meters.

OPTION #1

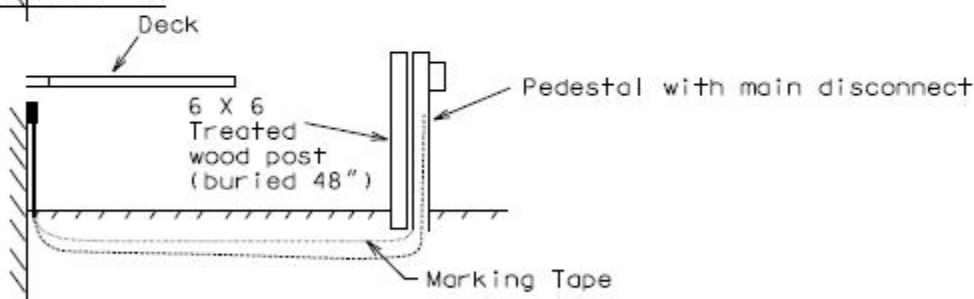


See Note #1

OPTION #2



OPTION #3



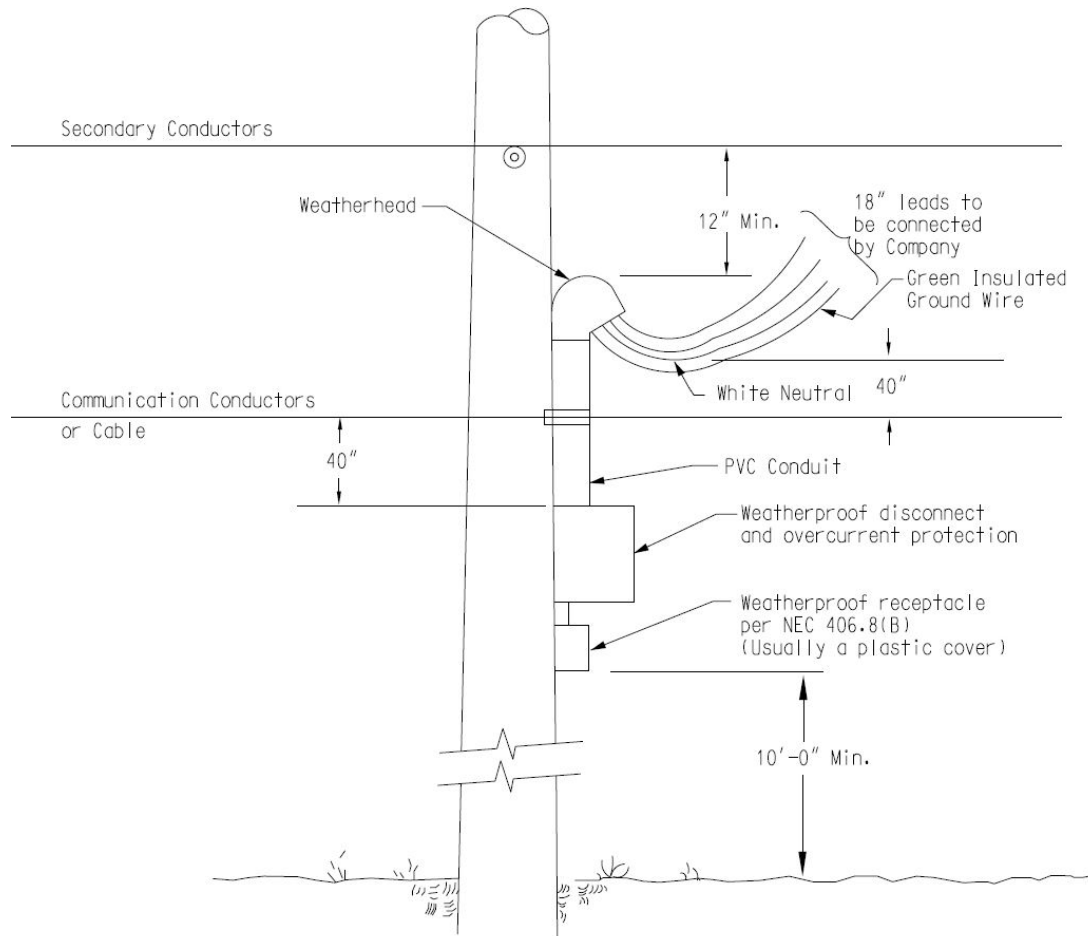
Notes

1. Use pedestal extensions to get the above minimum dimension. The lower dimension is critical for safety reasons when pulling or plugging in a meter in the event that a fault occurs. The connections in the pedestal must be accessible (cover able to come off). A possible solution is to design the deck so that one or two boards can be easily unscrewed to provide access to the connections.

Option 4

Move meter pedestal to an area on the house away from the deck. The service entrance conduit or cable can then go around the house to the old service pedestal site. Marking tape is required in Michigan for cable protection [NEC 300.5(D)].

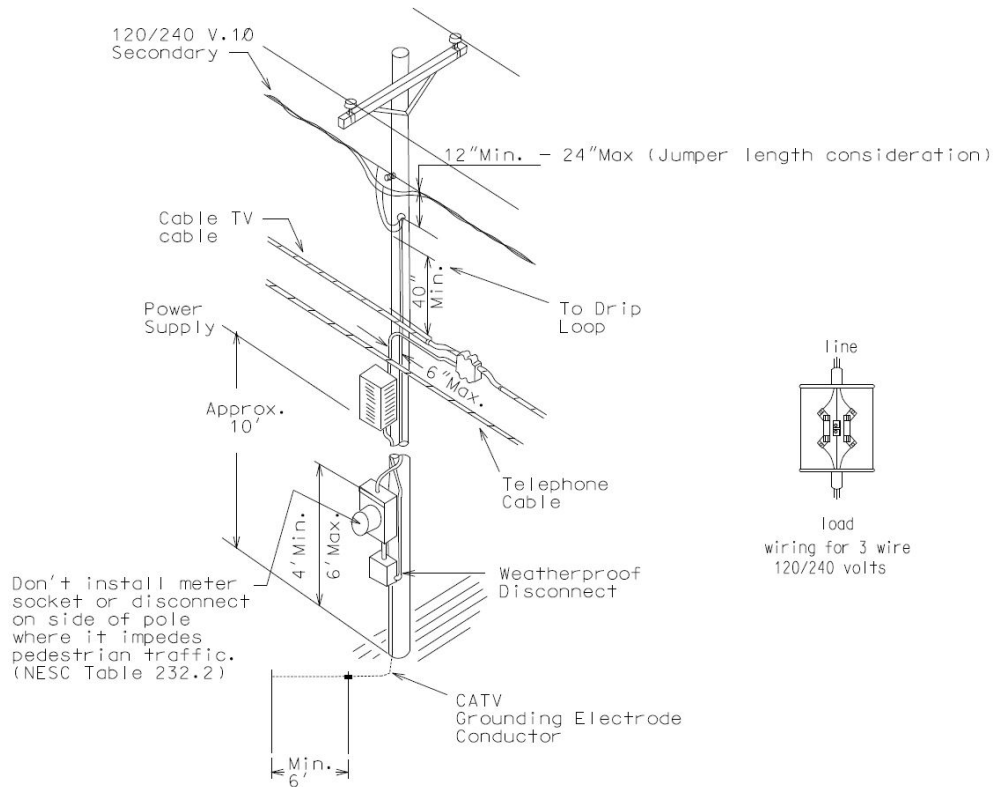
2-8 Unmetered Street Lighting Decorations



Notes:

1. The installation shall comply with code and Company requirements.
2. All materials shall be of an approved type and used in the manner intended.
3. The entrance may be 120 or 120/240 volt, depending on load requirements and availability of service on the pole, and shall be securely attached to the pole with bands or lag screws.
4. Service entrances should be avoided on transformer or switch poles.
5. A master agreement is required. The Company has the right to deny such attachments. The preferred method is to meter the usage. See Subsection 2-9.
6. Decorations and festoonery shall be removed when billing is terminated.
7. Drilling of holes in poles is not permitted. Pole bands or lag screws may be used to support decorations which shall be securely attached to the pole. Decorations shall not be strung between poles.
8. If the entire installation is above the communication conductors, the receptacle shall be 40" above the communication conductors.
9. An earth ground is not required if a separate grounding wire is run from the switch box through the conduit with the service entrance conductors to be connected to the secondary neutral or the Company ground by Company crews. This ground wire shall be connected in the switch box so that it grounds switch box, receptacle, and conduit. This ground should be a green insulated wire. The assumption here is that this is for a municipal government and therefore covered by the NESC. The 10-foot ground clearance is critical. Also, all work must be done by trained and "qualified personnel." See MIOSHA/NESC definitions.
10. Non-current-carrying metal parts of decorations operating at less than 150 volts to ground can be installed as close as 20" to communication cables or 20" above and 24" below communication conductors.

2-9 CATV Power Supplies



Notes:

1. Consult the Company before installing to ensure that 120/240 volt service is available on the pole in question.
2. All installations must conform with all applicable electrical codes and Company requirements, including requirements for clearances, climbing space and working space.
3. Only qualified and authorized personnel shall make this type of installation (See MIOSHA/NESC definitions). They shall be trained in and knowledgeable of the clearance requirements and working rules of the NESC (MIOSHA Rule 408.140.05). The qualified personnel shall be trained and competent in:
 - a. Distinguishing exposed live parts from other parts of electric equipment.
 - b. The techniques necessary to determine the nominal voltage of exposed live parts.
 - c. Minimum approach distances corresponding to the voltages to which the qualified personnel will be exposed.
4. All materials, except meter, shall be furnished and installed by the CATV company.
5. The service entrance conductors shall be run in non-metallic conduit, Schedule 40. If metallic conduit is used, it shall be covered with a non-metallic covering 40" above and 72" below any communications attachments (NESC 239G.1.). The service entrance conductors shall extend 30" beyond the weather head and shall be rated with 600 volt insulation. The Company will make connections to its lines.
6. It is a code violation to have fused and unfused service entrance conductors in the same raceway.
7. The disconnect, power supply unit, meter socket and CATV cable shall be mounted on the same quadrant of the pole. There shall be a maximum of 6" between the service entrance conduit and CATV cable.
8. Grounding shall be in accordance with the National Electrical Code article 250. Note that code requires a separate ground down the pole and a separate double ground rod.
9. When a unit contains both the service disconnect switch and the power supply, installation height shall be in accordance with applicable codes.
10. This unit may not be mounted on any pole on which there are transformers, primary risers, section cutouts, capacitors, circuit reclosers, regulators, traffic signals or similar fixtures without the consent of the Company's Regional Electrical Engineer.

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Section 3 – General Metering and Services

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3-1 Company Metering Policies

3-1.1 Metering Safety

Only Company-authorized personnel are permitted to make connections, cut meter seals, and remove meters. If any such customer actions are suspected or detected, the Company will investigate. Unauthorized removing of Company seals is unlawful and may result in a billing for the investigation and replacement of the seal, as well as criminal prosecution.

An unobstructed and level working space in front of the meter and Company facilities on customer property shall be provided. This space shall be a minimum of 3 feet in front of the meter with a vertical clearance of 6 feet 6 inches and two feet of horizontal clearance on either side. Free space in front of instrument transformer cabinets shall be 2 feet beyond the cover in the extended position or a minimum of 3 feet, whichever is greater. (See NEC 110.26). Clearances around all other company facilities is 6 feet in front of the work location.

Indoor meter locations, where grandfathered, shall be dry and free of hazardous conditions.

If customer-owned equipment is found in an unsafe condition, the customer shall be required to make changes to their equipment to make the condition safe. The customer will be notified of the condition in writing and provided with a timeline to correct the issue. If a customer fails to correct the issue and comply with these rules within a reasonable length of time after receiving notification of being in noncompliance, the Company reserves the right to discontinue electric service until the customer has made the required changes.

3-1.2 Available Voltages

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

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.

Service types and nominal voltages furnished are as follows:

Single-Phase, 120/240 Volt, 3-Wire - This service is available to customers whose demand will not exceed 800 amp (250 KVA). For services greater than 400 amps, customers are encouraged to consider a three phase service.

Three-Phase, 120/208 Volt, 3-Wire - This service is available to customers whose demand will not exceed 200 amps (50 KVA) due to high secondary neutral currents, associated voltage drop issues, and the severe phase imbalance problems on the three-phase transformer bank feeding this voltage. **This voltage is not preferred by the Company and is only available where 3 phase is present.**

Three-Phase, 480 Volt, 3-Wire - 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. **This voltage is closed to new customers.**

Single & Three-Phase, 120/240 Volt, 4-Wire Delta - 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. **This voltage is closed to new customers.**

Combination Single & Three-Phase, 120/208 Volt, 4-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

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services and the resulting congestion at the transformer setting and customer service entrance. For service capacities above 1600 Amperes, contact the Company for details.

Combination Single & Three-Phase, 277/480 Volt, 4-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. For service capacities above 1600 Amperes, contact the Company for details.

3-1.3 Service Location

The location of the customer's service entrance shall in all cases be designated by the Company. The Company or its representatives shall make all connections to its lines. In no case shall these connections be made by anyone other than a Company representative. To avoid misunderstanding and additional expense, the Company shall be consulted concerning all new service connections.

3-1.4 Number of Services

A customer is allowed one meter per voltage class for each structure.

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(2) 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."

For example, a customer may not have a 120/240V single phase-service and a 120/240V three-phase service to the same structure. However, a customer is permitted to have a 120/240V single-phase service and a 277/480V three-phase service at the same structure.

Customers with an existing three-phase service do not qualify for a second three-phase service of the same voltage class unless approved by the Company. For example, a customer with a 120/208V three phase-service does not qualify for a 120/240V three-phase service at the same structure.

Unless approved by the Company, any second service and/or meter shall be billed as a separate customer.

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 these rules are:

- a. Multiple Metering - Where more than one point of metering is necessary because of interruptible service rate, governmental requirements or regulatory rules.

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Examples:

1. House meters or common area meters for multi residential occupancy buildings, as required by NEC 210.25.
 2. Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants. This case requires inspector approval. NEC 230.2(B).
 3. Legacy programs.
- b. Large Loads - An additional service may be granted for loads that exceed the available service sizes listed in Section 3-1.2. These cases must meet the electrical code requirements, including inspector approval. The Company may refuse to supply two separate services where there is no indication of sufficient load.
- c. Voltage Drop / Power Quality - In cases where loads experience significant voltage drop or power quality issues and where voltage regulation and power conditioning would be unreasonable. The customer must exhaust all possible solutions to mitigate the problem to the satisfaction of the Company.
- d. Fire Walls - Where a structure is divided by a substantial firewall extending through the roof in accordance with state codes. The county electrical and/or building inspector must approve all firewalls.
- e. Fire Pumps / 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 Subsection 6.2-8 on fire pumps.)

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.

3-1.5 Customer Service Laterals

The customer service laterals (underground conductors past the metering point) are owned and maintained by the customer. The customer is responsible for maintaining and locating underground cable. (NEC 300.5 requires the use of locating ribbon for customer-owned service laterals). There may be charges involved in de-energizing the customer service laterals for customer work. The Company highly recommends that an overcurrent protection device be installed ahead of such direct buried cable.

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**.

See Appendix B for additional NEC code information regarding multiple service laterals.

3-1.6 Increased/Decreased Loads

The Company shall be given reasonable notice of an increase to customer loads to avoid outages, poor power quality, and/or damage to Company equipment. This policy applies to both temporary/portable equipment (welders, air compressors, RVs, etc) and permanent facilities (sawmills, growing operations, etc). The Company cannot be held liable for damage associated with an unauthorized increase in load or delays in restoration of service due to damaged facilities/equipment. The Company may charge for the replacement cost of damaged Company facilities/equipment.

The Company reserves the right to decrease the size of the transformer servicing a customer facility to minimize the losses associated with a lightly loaded transformer.

The Company reserves the right to install power quality monitoring equipment to ensure equipment is properly sized.

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Advanced notice of load changes shall be given to UPPCO Customer Service (See Section 1 for contact numbers).

3-1.7 Load Balancing

Customers shall connect their load to be as balanced as practicable. Three-phase customers (except 3-phase, 4-wire delta) shall attempt to connect equipment so that the load of any one phase will not exceed the load of any other phase by more than ten (10) percent.

3-1.8 Relocation of Facilities

A customer may be billed for the relocation of Company facilities requested by the customer or for the relocation as a result of a customer created code or company policy violations.

If changes are made to the customer's structure making the existing meter location unsafe or inaccessible for reading and testing, the customer shall be required to make changes in the wiring so that the meter may be relocated to comply with Company policy. If a customer fails to comply with Company policy within a reasonable length of time after receiving a written notification of being in noncompliance, the Company reserves the right to discontinue electric service until the customer has made the required changes.

3-1.9 Underground Service Installation

The Company is responsible for the installation of conduit and wire before the point of metering, including the digging of the trench. The Company will not use any wire supplied by the Customer.

Company service conductors will be placed in conduit if conditions warrant. Examples include:

- under surfaces where laying out conductors on the ground for emergency conditions is not practical
- where soil conditions warrant, such as rock, gravel, and areas prone to frost heave

3-1.10 Resale of Energy

Service shall be for the customer's use only and may not be sold, re-metered or otherwise disposed of by the customer to lessee, tenants or others, except with the consent of the Company in accordance with the Company's appropriate rate and appropriate state laws.

This does not prohibit the installation of test or check meters for informational purposes.

Including the cost of electric service in the rent without identification as such is permitted.

Refer to Section 7 for distributed generation requirements.

3-1.11 Theft of Service

Theft of service or tampering may result in criminal prosecution and/or billing.

The Company utilizes Advanced Metering Infrastructure (A.M.I) which provides near real time tamper and theft detection.

Only Company-authorized personnel are permitted to make connections, cut meter seals, and remove meters. If any such customer actions are suspected or detected, the Company will investigate for the possibility of theft of service.

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If the investigation determines that electricity is being stolen, the service will be disconnected.

Prior to restoration of service, the customer's service entrance equipment shall be made tamper resistant in accordance with Company requirements; and satisfactory arrangements will have been made for payment of the estimated amount of unmetered electricity.

For Michigan rules dealing with theft or interference with the providing of electric service, see Rule 460.3409 - Utility Rights and Requirements, Rule 750.282 - Utility interference Penal Code, and Rule 750.356 - Larceny Penal Code.

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3-2 General Metering Requirements

1. Ground electrode conductors will not be allowed in the meter socket or meter pedestal or CT cabinet unless that is also where the main is located.
2. The K-7 bolt in meter sockets are no longer acceptable for any installation.
3. The Company will not re-energize any 60 amp service that has been de-energized and requires an electrical inspection. (NEC 230.79 (C))
4. The main disconnect must be rated for a minimum of 22,000 amps of fault current.
5. For service capacities above 1600 Amperes, contact the Company for details
6. The Company requires all facilities to be metered unless consumption can be readily computed. (MI Rule 460.3301)
7. The customer shall furnish, install, and maintain all metering equipment, including meter sockets, switches, fuses, circuit breakers, termination enclosures, and associated equipment, as well as, electrical masts and service conductors below the weather head.
8. The electric meter shall be outside.
9. The electric meter shall not be covered or caged.
10. Customers shall provide a suitable location for meters and associated equipment determined by and without charge to the Company.
11. Meters shall be installed in an accessible location to enable them to be safely read, inspected and tested at reasonable times with a minimum of inconvenience to the customer and Company.
12. Line-side lugs shall be furnished and installed by Company. Load-side lugs shall be furnished and installed by the customer.
13. The customer shall be responsible for providing protection for the meter(s) from damage caused by falling ice, snow or other objects. In locations where the meter is not protected by roof overhang, the customer shall provide a protective shield. (See Subsection 3-4 for shield specifications).
14. The meter location shall be on a solid structure free from vibration and possible mechanical damage.
15. Metering equipment shall be adequately supported to maintain the meter socket in a level and plumb position. [NEC 110.13(A)].
16. Meters shall not be installed in patio, porch, deck, lean-to, or carport areas or areas likely to be enclosed.
17. Soil or groundwater conditions generally require the installation of above-ground entry of underground service conductors to prevent seepage or water entering through the entrance conduit. The Company shall not be responsible for any damage caused by water seeping into the structure.
18. At earth berm buildings that do not have an exposed side suitable for the meter location, the service shall be terminated at a meter pedestal. (Subsection 2-7).
19. Customer-owned lightning arresters or other surge protection devices, if used, shall be installed on the load side of the customer's service overcurrent protective devices unless specific approval has been received from the Company to install them ahead of the overcurrent protective devices.
20. Insulated neutral or grounded conductors of a service entrance shall be identified by a white or natural gray color. Four-wire 120/240 volt delta installations shall have the conductor with the higher voltage to ground identified orange over its entire length or shall be identified with orange paint or tape at any point when a connection is to be made.
21. The Company will under no circumstance permit "jumpers" to be placed in meter sockets which results in unbilled energy. Jumpers in the meter socket will be considered theft and prosecuted as such.
22. Metered and unmetered conductors shall not be installed in the same conduit or raceway.
23. The Company shall not permit meters or instruments other than its own to be connected to its meter wiring

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3-3 Multiple Occupancy Metering / Cell Towers

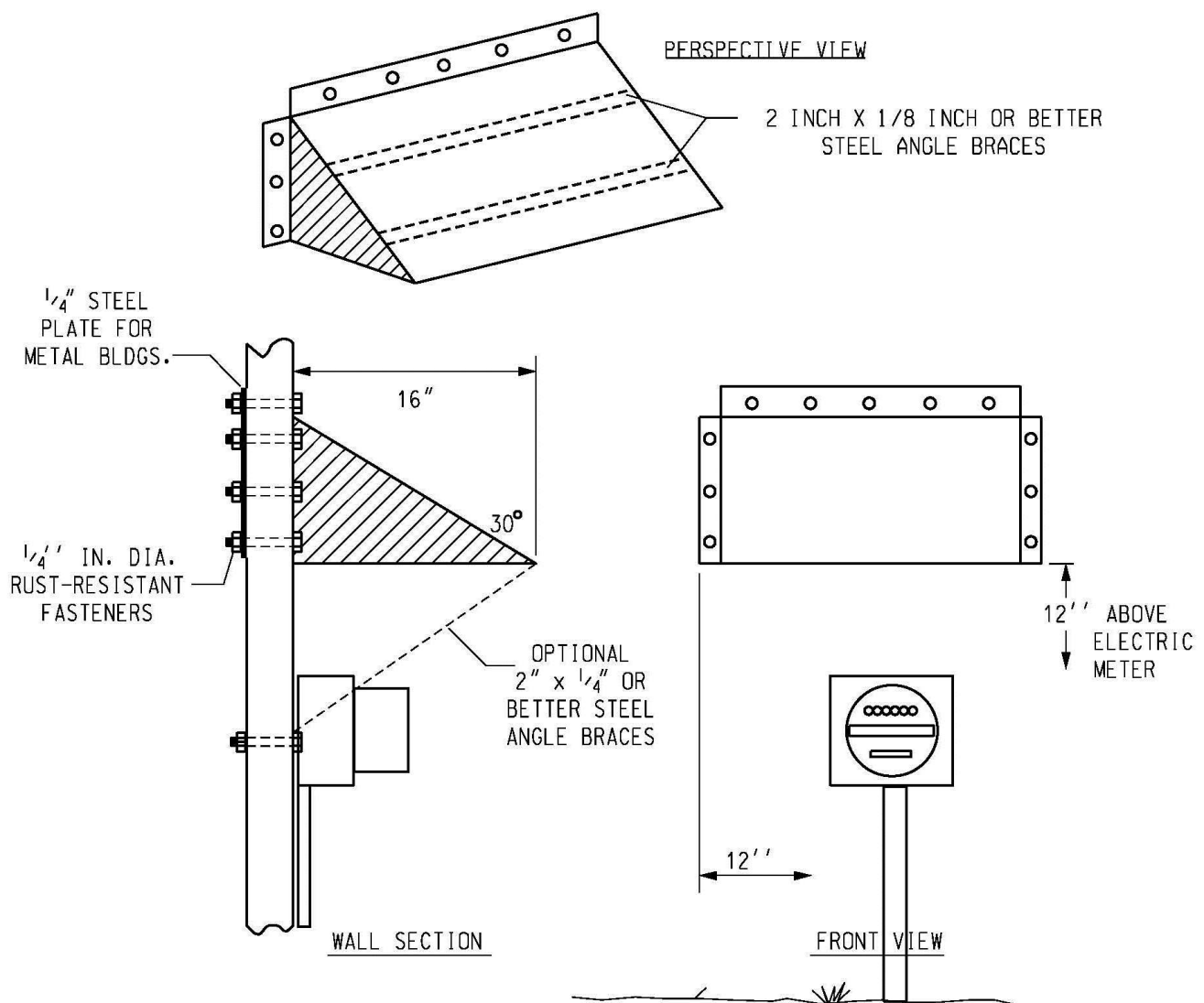
1. All metering shall be outside.
2. One service per voltage class
3. Michigan law requires the disconnects to be grouped.
 - It is the customer's responsibility to label the location being served by each meter and disconnect as required by NEC 110.22. The Company shall not be responsible for errors as a result of poor labeling.
4. Multi-occupancy Buildings:
 - The Company can only run one service to a multi-occupancy building.
 - To be considered separate buildings, a multi-occupancy building must have a fire wall extending through the roof. The county electrical and/or building inspector must approve all firewalls.
 - NEC 210.25 requires a separate meter for common areas of multi-occupancy buildings.
 - NEC 230.2(A & B) allows an additional service for special occupancies, please consult the Regional Engineer in these cases.
 - See Section 2-6 for clearances pertaining to large multiple metering installations.
5. Cell Towers:
 - Only one service will be run to a tower or a group of towers under one management (owner).
 - The Company will terminate the service at a single location. Acceptable points are pre-manufactured multiple meter packs (refer to metering requirements and Appendix A) or approved termination enclosures.
 - The Company will allow multiple services and/or metering locations, to preserve continuity of service, for a period of 6 months when the customer is performing upgrades.

3-4 Meter Protection from Snow and Ice

The customer is responsible to provide a safe location for the electric meter to protect them from damage. An ice/snow shield is mandatory on the pitched side of metal buildings (provided by the customer). A shield is highly recommended for other areas.

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

Below is a recommended design and construction drawing.



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4-1 Overhead Service Requirements

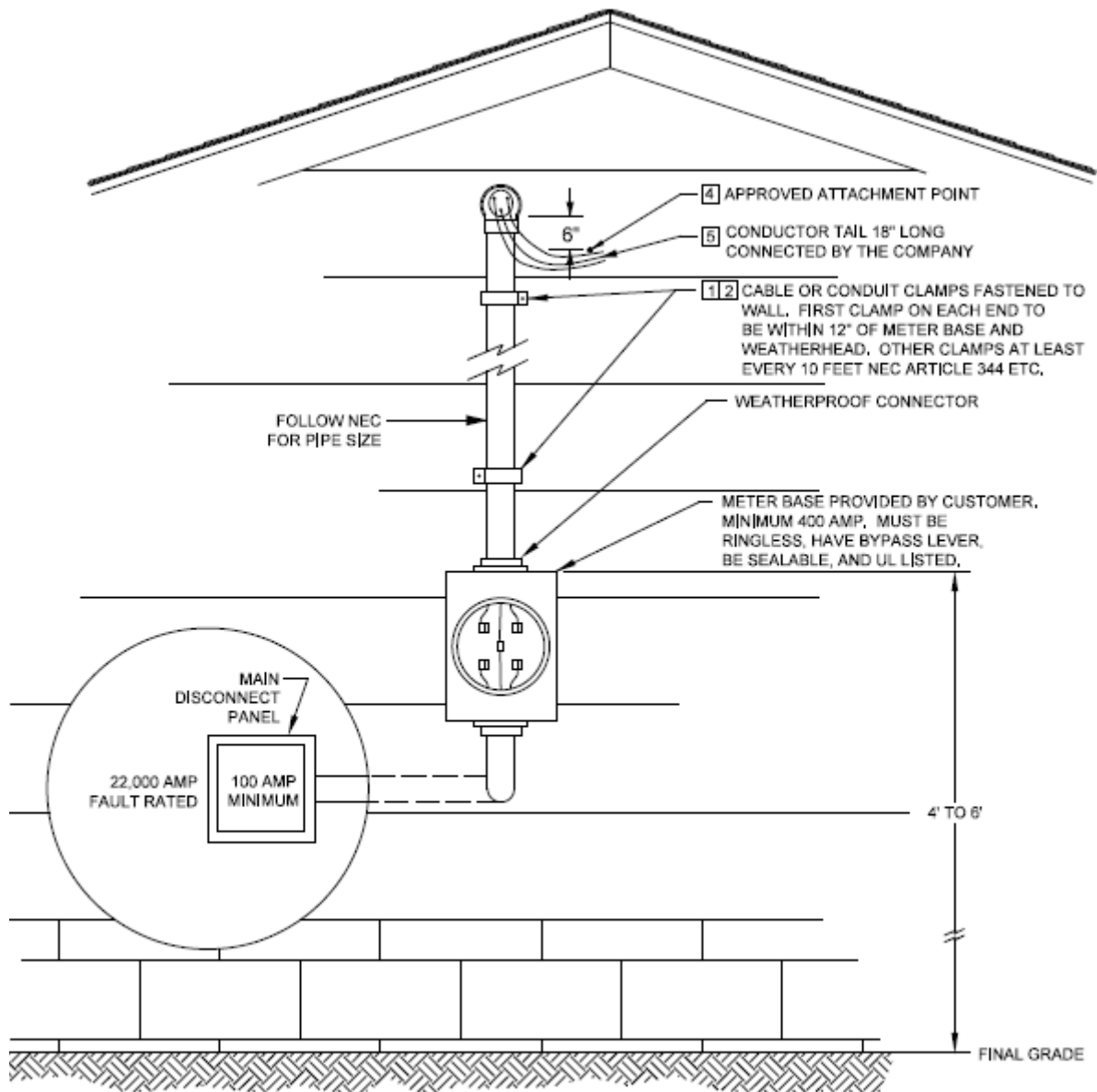
See Section 3-2 for General Metering Requirements

1. For 100 & 200A services, service entrance cable (rather than conduit) is acceptable if installed properly, accepted by local inspection authority, and not placed behind any siding.
2. Service entrance cable and/or conduit shall be adequately supported with clamps. The meter socket shall also be adequately attached to the structure.
3. Supports used to support service-drop conductors to attain clearance over buildings are not allowed for new installations. For existing installations, they must be substantial and meet the requirements of NEC 230.29.
4. The weather head must extend at least 6 inches above the "attachment point" for the service drop. This "attachment point" must be installed by the customer. It must be adequately attached so it can handle 650 lbs. of line tension.
5. The conductor coming out of the weather head shall be at least 18 inches long. The Company will make the connections to the overhead service conductors.
6. The meter socket shall be installed 4-6 ft above ground and be readily accessible to be read, tested, and inspected.
7. Company employees must designate the service location and specify the mounting height of the periscope due to code clearance issues with the overhead service drop conductors.
8. All periscopes (unsupported conduit extending above the roof) shall be made of rigid metal electrical conduit and shall be back guyed above 36" (per NEC 230.28). Aluminum, IMC or thin wall are NOT acceptable. Minimum size shall be 2 inch for 0-200 amp, because of strength requirements. This includes upgrades to 100 Amps. No couplings can be above where the conduit enters the roof overhang or anywhere above the roof on the periscope.
9. Communication and customer-owned circuits cannot be attached to electrical entrance periscopes (NEC 230.28) but can be grandfathered if attached prior to 1996.
10. The drip loop and overhead service conductors shall not be readily accessible and shall not be located within 3 feet in any direction from windows (designed to open), doors, porches or similar structures (per NEC 230.9(A)). An exception is above the top level of a window.
11. If an overhead service is mounted on a pole or post, the pole or post shall be back guyed, having a minimum of a 6-inch dia. top, and be pressure-treated with a wood preservative. An alternative is a minimum 6" x 6" treated timber. This pole or post location, height, and burial depth shall be approved by the Company.

4-1.1 Overhead 100-200 Amp - Option 1

Specifications:

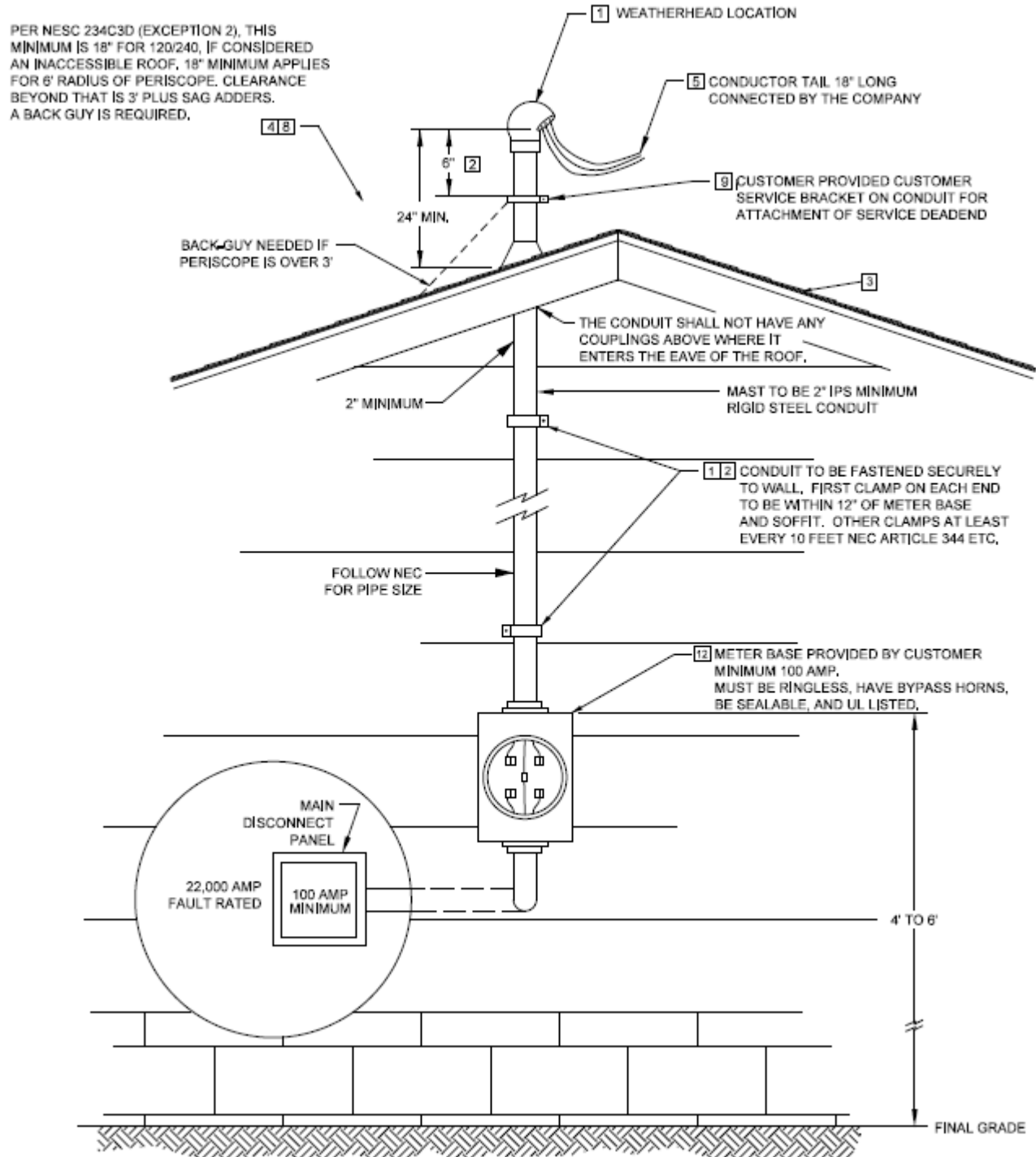
- Ringless Type Meter Socket
- Outdoor Enclosure (Nema type 3R)
- 1 Phase, 3-Wire
- 4 Jaw Meter Socket
- Horn Bypass
- Sealable
- No cover over meter
- UL Listed



4-1.2 Overhead 100-200 Amp - Option 2

Specifications:

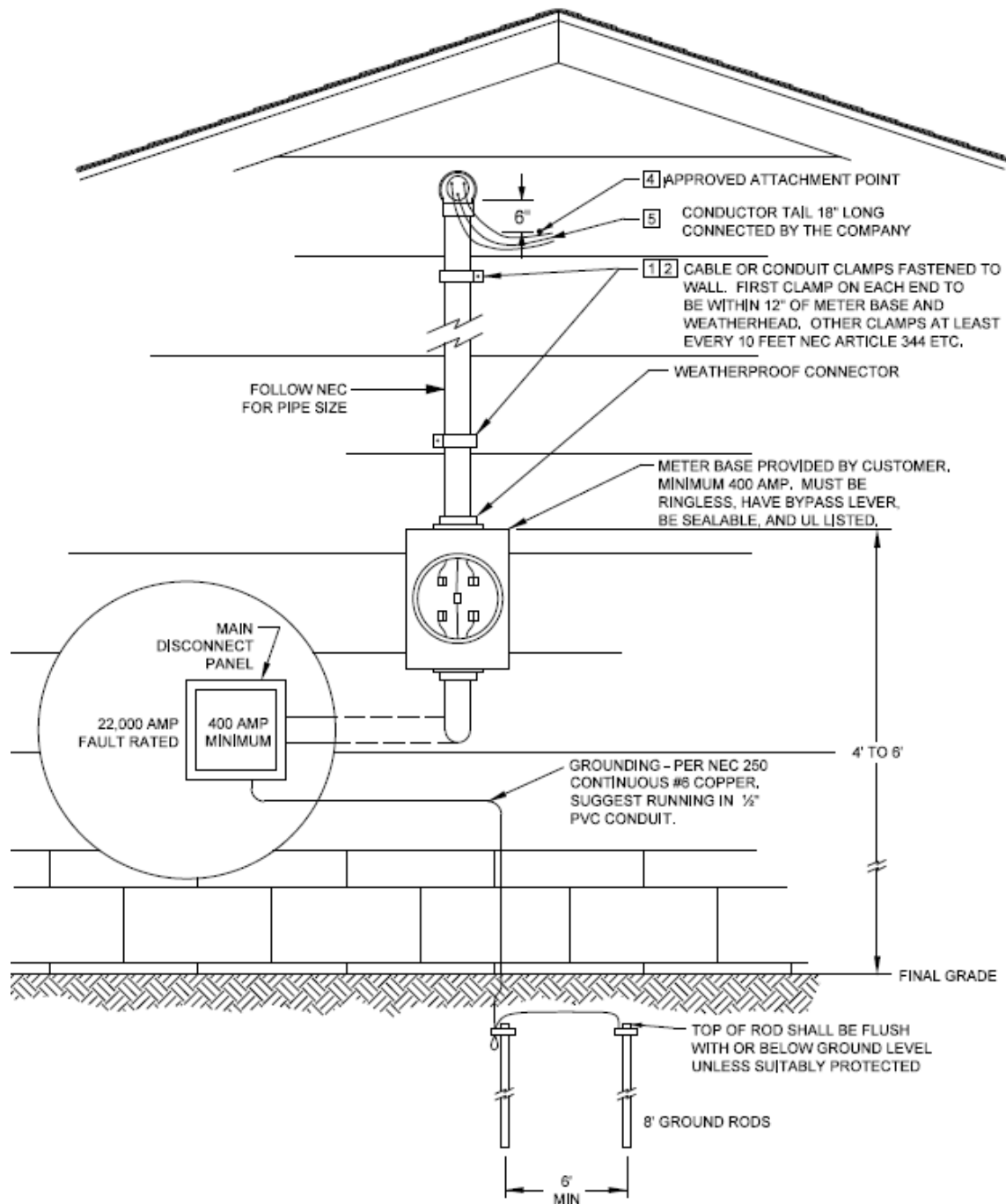
- Ringless Type Meter Socket
- Outdoor Enclosure (Nema type 3R)
- 1 Phase, 3-Wire
- 4 Jaw Meter Socket
- Horn Bypass
- Sealable
- No cover over meter
- UL Listed



4-1.3 Overhead 320 Amp

Specifications:

- Ringless Type Meter Socket
- 320A Continuous, 400A Max
- Rated 600V AC
- 1 Phase, 3-Wire
- UL Listed
- 4 Jaw Meter Socket
- Bypass Lever
- Sealable
- No cover over meter



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4-2 Underground Service Requirements

See Section 3-2 for General Metering Requirements.

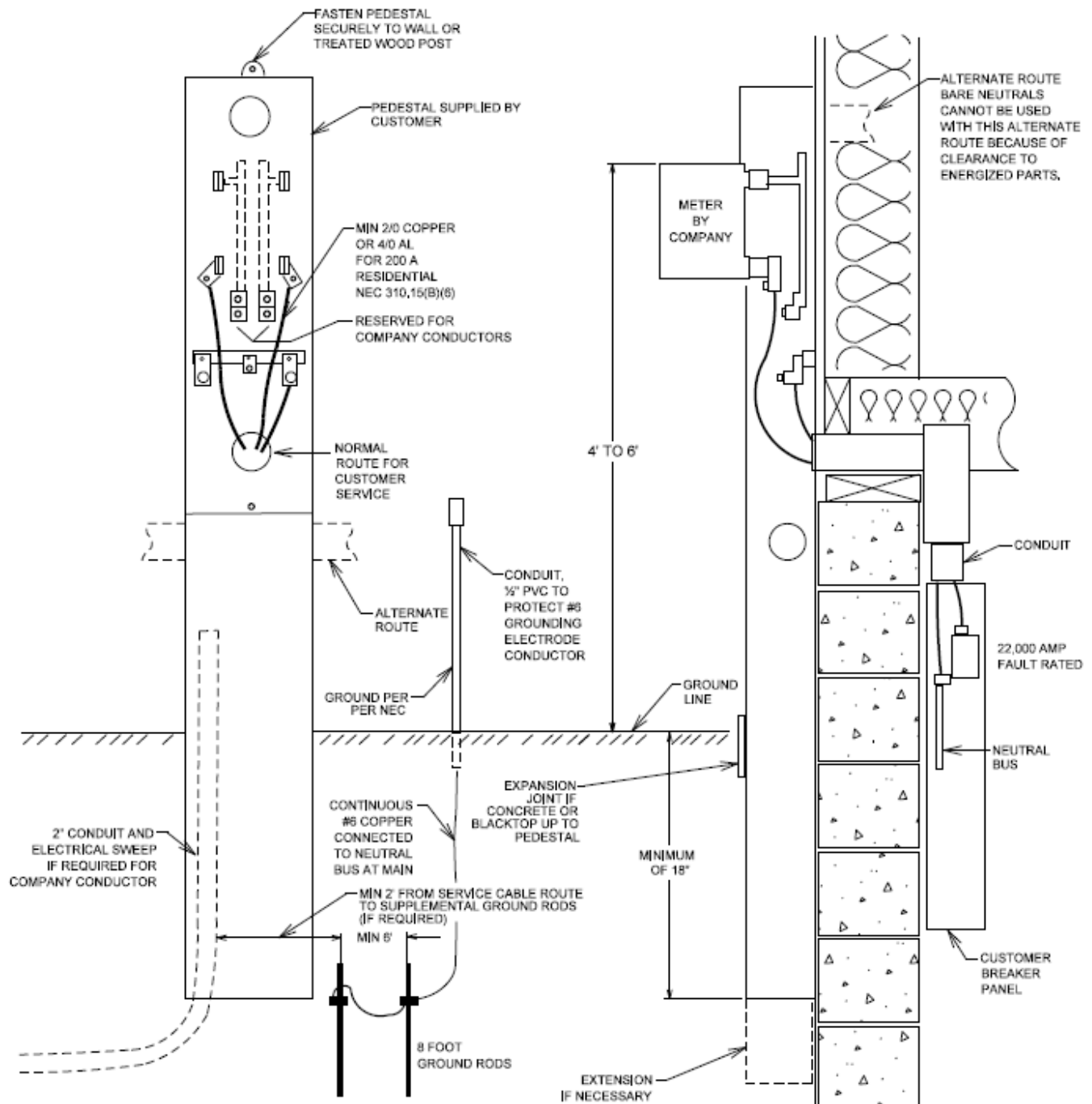
See Appendix A for a list of approved meter sockets and pedestal extensions.

1. A pedestal-style meter base shall be used for all meter sockets attached to buildings due to frost heave issues and soil settling around new foundations.
2. All meter sockets shall have adequate space to allow for slack cable and have a bending radius capable of accommodating 350 kcm cable.
3. The meter socket shall be installed 4-6 ft above ground and be readily accessible to be read, tested, and inspected.
4. A pedestal cannot be used for customer-owned wire other than the service entrance cable per NEC 230.7. The Company does not allow the customer ground to be located in the pedestal with the service entrance cables.
5. For free-standing applications (200A only), a minimum of an 8-foot, pressure-treated 6x6 or 4x6 is required and must be buried at least 48 inches with a support 'cookie' or 16-inch treated 2x6 below grade as a base.
6. A disconnect is needed on the meter pedestal if the service entrance conductor extends into the building longer than permitted by NEC 230.70(A). It is also acceptable to use a standard pedestal with a separate weatherproof disconnect.
7. The Company may require conduit for services under driveways and parking lot – see Underground Service Installation, Section 3-1.9
8. Due to ground settling concerns, it is necessary for the customer to provide adequate compaction for disturbed soils below 30 inches. This is soil below the normal underground service burial depth and must be done with sand or gravel. Frozen material and non-compacted clay are not acceptable. See also NEC 300.5(J).

4-2.1 Underground 200 Amp - Pedestal - Standard

Specifications:

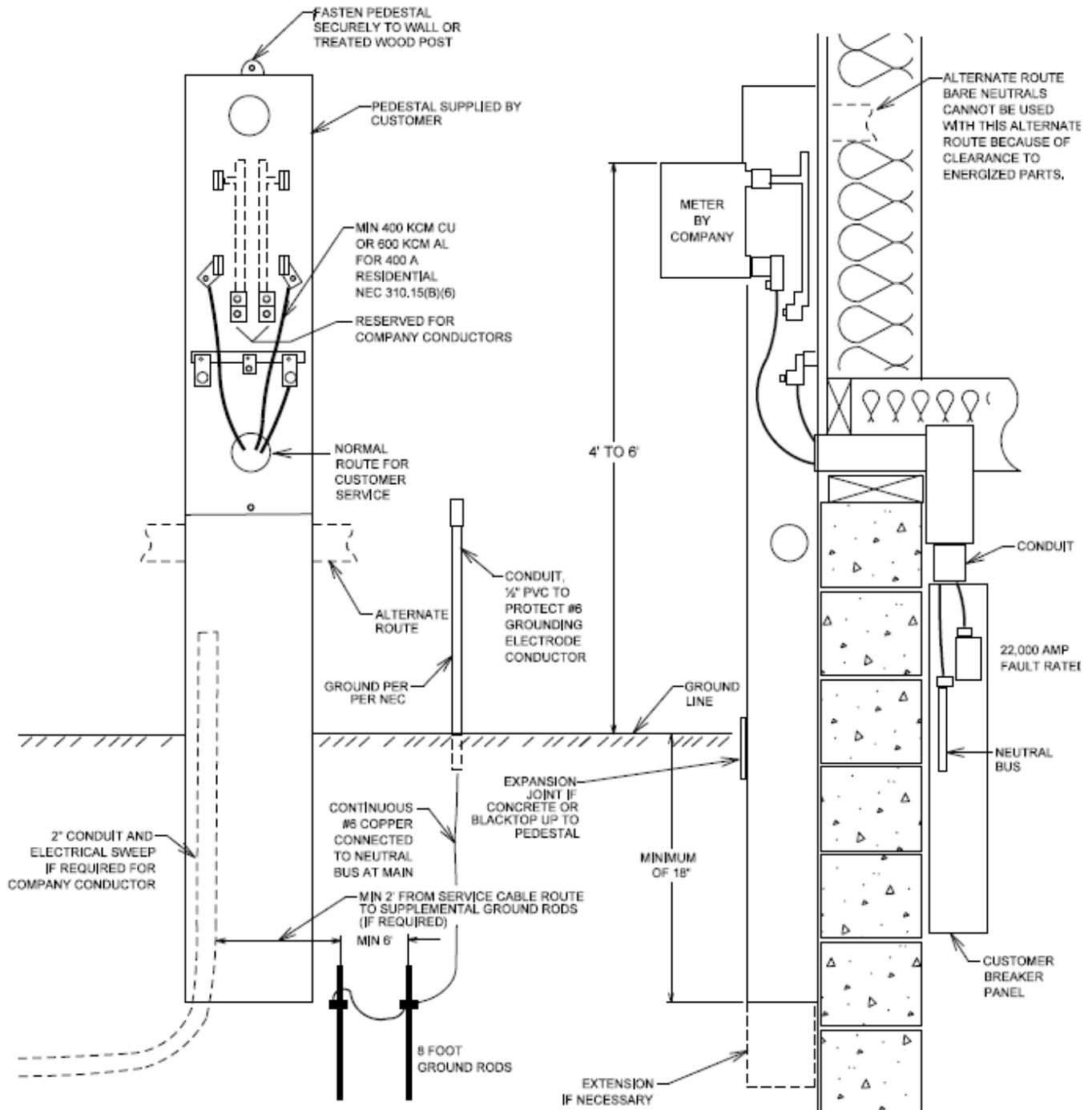
- Ringless Type Meter Socket
- Outdoor Enclosure (Nema type 3R)
- 1 Phase, 3-Wire
- 4 Jaw Meter Socket
- Horn Bypass
- Sealable
- No cover over meter
- UL Listed



4-2.2 Underground 320 Amp

Specifications

- Ringless Type Meter Socket
- 320A Continuous, 400A Max
- Rated 600V AC
- Outdoor Enclosure (Nema type 3R)
- 1 Phase, 3-Wire
- 4 Jaw Meter Socket
- Bypass Lever
- Sealable
- No cover over meter
- UL Listed



4-3 Services 400-800 Amp – CT Metering

See Section 3-2 for General Metering Requirements.

See Section 5-6 for meter base and CT cabinet mounting options and general notes.

The Company encourages a three-phase service for installations greater than 400A.

For Services 400A and greater, CT metering is required.

When CT metering is not located in/on the transformer, a CT cabinet is required.

1. The customer shall provide the CT cabinet and meter socket.
2. The CT cabinet shall be mounted outside.
3. The Company requires that all main disconnects rated over 400 Amp be provided with a means of locking the disconnect in the open position. This meets the MIOSHA Rule 408.14004 lock-out procedure.
4. See Appendix B for Fault Current information.

Instrument Transformer-Rated Meter Sockets (for CT installations)

“CC” 6 Terminal for 120/240 single phase.

Manufacturer	“CC”
Milbank	UC7532-XL
Durham	STS6-2B

Current Transformer Cabinets

Style of cabinet **“A”** With CTs mounted vertically, bottom in & top out
 “B” with CTs mounted vertically, bottom in & top or bottom out
 “C” With CTs mounted horizontally
 “D” Stepped termination style with CTs horizontal

Galva Closure also goes by RJB.

EMI stands for Electro-Mechanical Industries

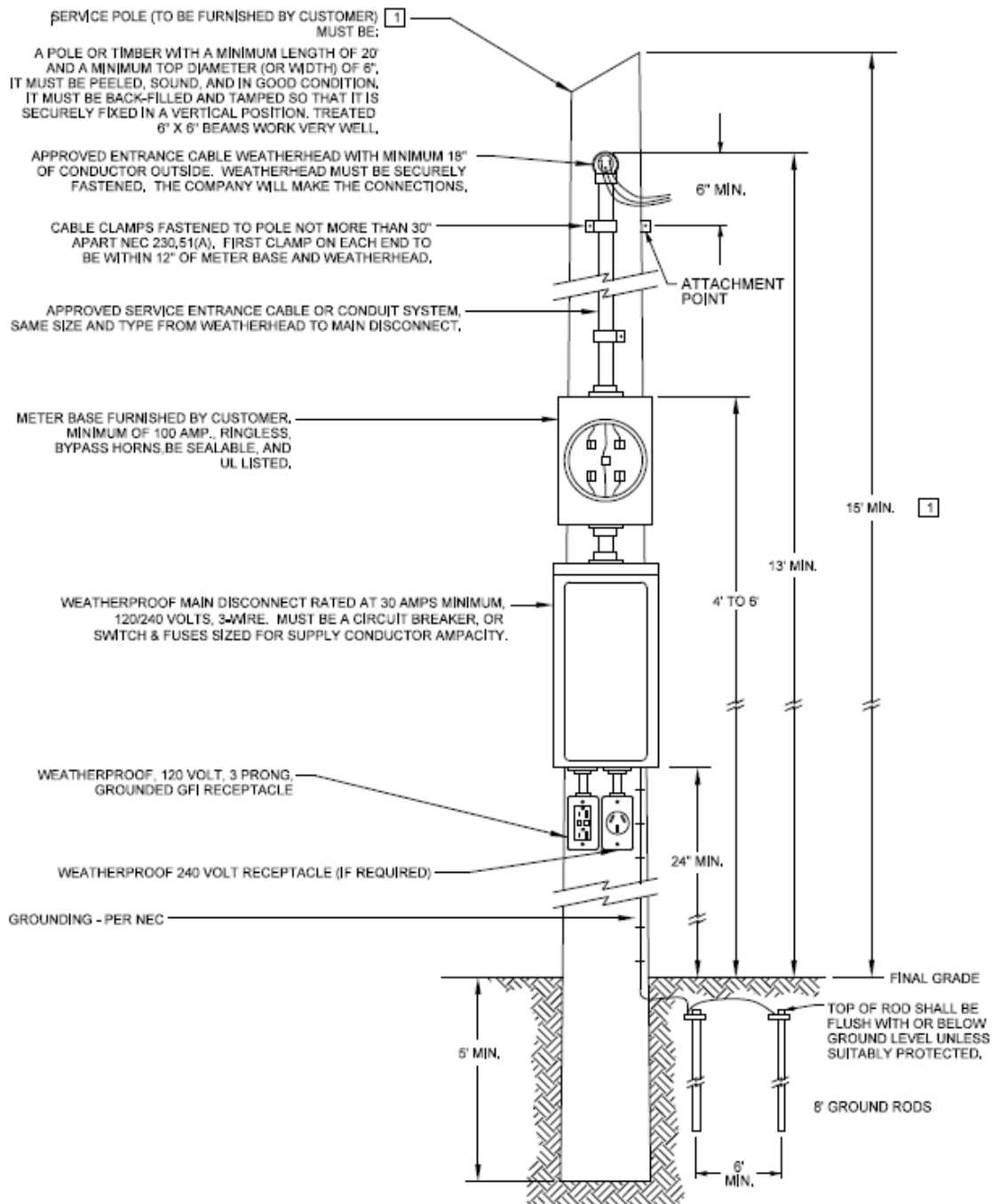
AMP stands for American Midwest Power

400 AMP CT	Style Cabinet	Manufacturer	Catalog #	Dimensions (“)	Fault Rating	Conduit
3-Wire	A	Erickson	WE1182-3	45.5x20x7.25	42,000	1-3”
	A	Galva-Closure	UPP-403UG	42x20x8.5	65,000	
	A & B	Galva-Closure	UPP-403UGBX	48x25x15	65,000	
	A	EMI	CTB146-WPS	48x30x10	65,000	
	B	AMP	WPST4-3TM	48x36x15	85,000	
	D	AMP	WPSSB8-3ACT	60x33x13	65,000	
600 AMP CT	Cabinet					
3-Wire	A	Erickson	WE283-USG	48x48x11	65,000	1-4”
	A	Galva-Closure	UPP-603UG	54x36x13	65,000	
	C	Galva-Closure	UPP-603UGBX	48x46x13	65,000	
	A	EMI	CTB146-WPS	48x30x10	65,000	
	D	AMP	WPSSB8-3ACT	60x33x12	65,000	
	B	AMP	WPST68-3TM	48x36x15	85,000	
800 AMP CT	Cabinet					
3-Wire	A	Erickson	CUCT-81	48x48x11		2-4”
	A	Galva-Closure	UPP-803UG	54x36x13	65,000	
	C	Galva-Closure	UPP-803UGBX	48x46x13	65,000	
	A	EMI	CTB180-WPS	60x34x18	65,000	
	D	AMP	WPSSB8-3ACT	60x33x13	65,000	
	B	AMP	WPST68-3TM	48x36x15	85,000	

* CT cabinets rated at 2000 Amp and higher shall accommodate split bar configuration CT's.

4-4 Overhead Service - Meter Poles/Posts

1. Customer must furnish, mount, and maintain all service entrance equipment and set pole/post in the ground. The pole/post location, height, and burial depth to be determined by the Company and coordinated with customer prior to installation.
2. The pole/post must be plumb and sufficiently back guyed/anchored by the customer if greater than 10 feet from the Company pole.
3. If the structure is defined as non-permanent (mobile home or a manufactured home that is not on a foundation), the customer-owned meter pedestal/pole/post must be within sight of and not more than 30' from the exterior wall of the structure (NEC 550.32(A)).



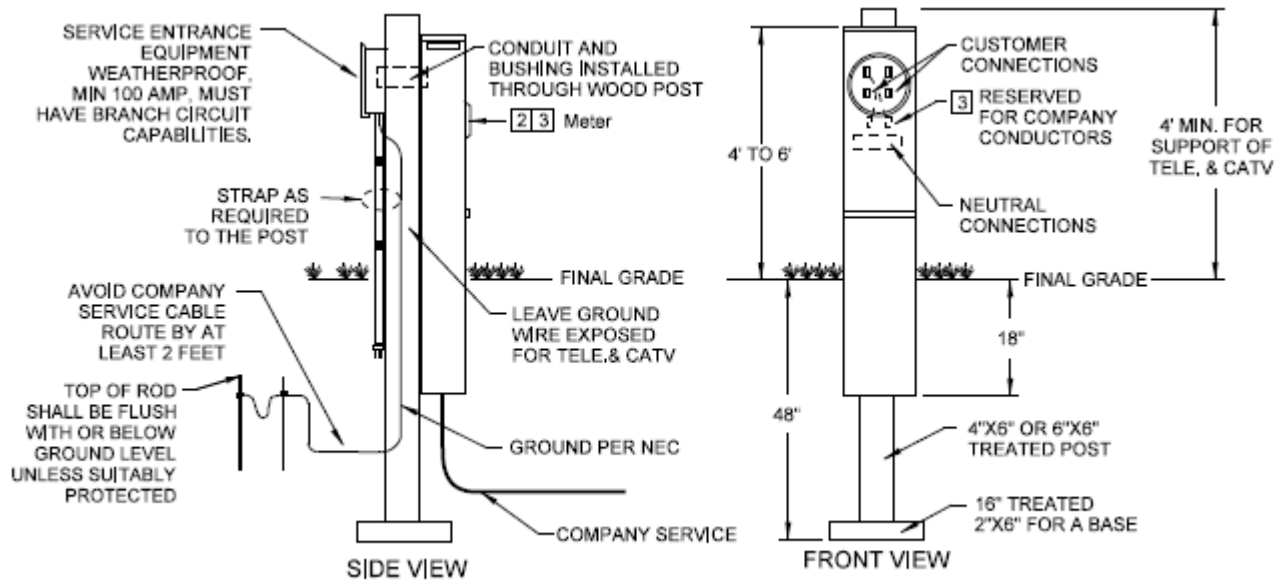
4-5 Mobile Home Services

This section also applies to manufactured homes that are not on a foundation and other non-permanent structures. See Appendix B for a full definition.

For overhead service entrances, see Section 4-4 – Meter Pole/Post.

See Appendix A for a list of approved meter sockets and pedestal extensions.

1. The Company requires that all new mobile home parks be built with an underground electrical system.
2. The Company shall designate the service location.
3. The meter must face toward the driveway or street and away from the mobile home.
4. Meters shall not be fastened to mobile homes. [NEC 550.32(A)].
5. The Company requires a substantial support (treated wood posts) as per the below specification.
6. Metering pedestals and associated means of disconnect shall be labeled as to which premise is fed from the pedestal (NEC 110.22).
7. The customer-owned meter pedestal/pole/post must be within sight of and not more than 30' from the exterior wall of the mobile home and no less than 100A (NEC 550.32(A)).



4-6 Temporary Services/Construction Power

Temporary services are subject to all policies outlined in Section 3-2 – General Metering Requirements

1. Temporary services are intended for short-term use, defined by the Company as 1 year. After 1 year, the Company reserves the right to require inspection of the temporary service. (NEC 590.3 – no permanent wiring off temp).
2. Customer must furnish and mount all service entrance equipment and the set pole/post in the ground. The pole/post location, height, and burial depth to be determined by the Company and coordinated with customer prior to installation.
3. The pole/post must be plumb and sufficiently backguyed/anchored by the customer if greater than 10 feet from the Company pole. An alternative is the use of two 2" x 4" push braces staked into the ground.
4. If the structure foundation is in place, a temporary service may not be necessary. See Option 4 below and Section 4-2 on underground service requirements.

(Option 1, Overhead)

Service pole (to be furnished by customer)
Must be:

A treated pole or treated timber with a minimum length of 20' and a minimum and a minimum top diameter (or width) of 6". It must be peeled, sound and in good condition. It must be back-filled and tamped so that it is securely fixed in a vertical position. Treated 6"x6" beams work well.

Approved entrance cable weather head with minimum 18" of conductor outside. Weather head must be securely fastened. The Company will make the connections.

Cable clamps fastened to pole not more than 30" apart, NEC 230.51 (A). First clamp on each end to be within 12" of meter base and weather head.

Approved service entrance cable or conduit system. Same size and type from weather head to main disconnect.

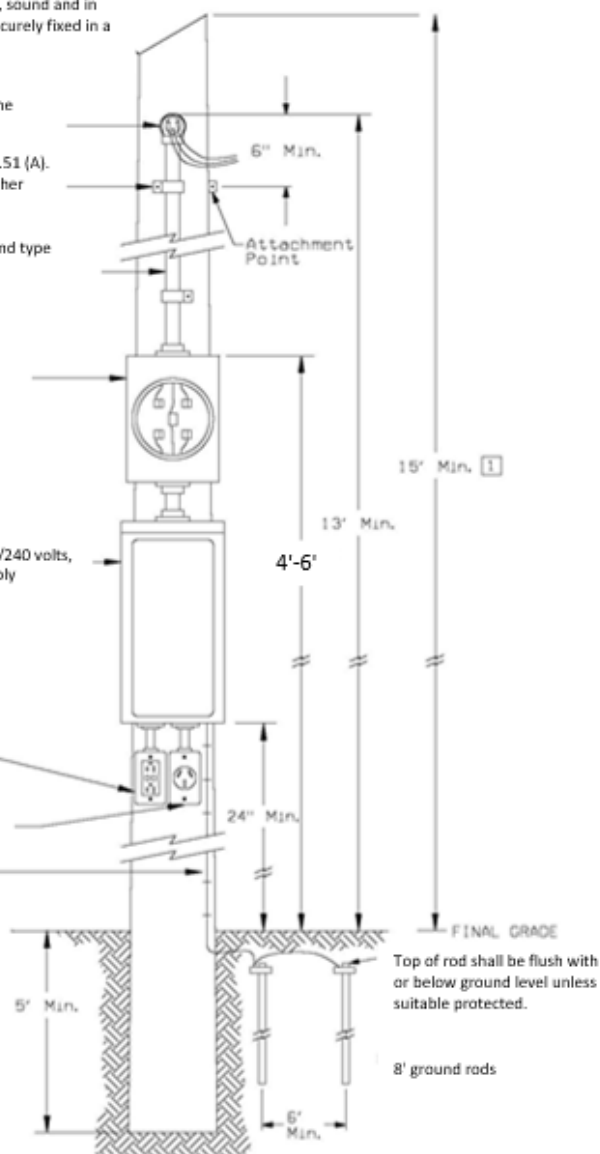
Meter base furnished by customer. Minimum of 100 amp, ringless, bypass horns, sealable and UL listed.

Weatherproof main disconnect rated at 30 amps minimum. 120/240 volts, 3-wire. Must be a circuit breaker or switch & fuses sized for supply conductor ampacity.

Weatherproof, 120v, 3 prong, grounded GFCI receptacle.

Weatherproof 240 volt receptacle (if required)

Grounding – Per NEC

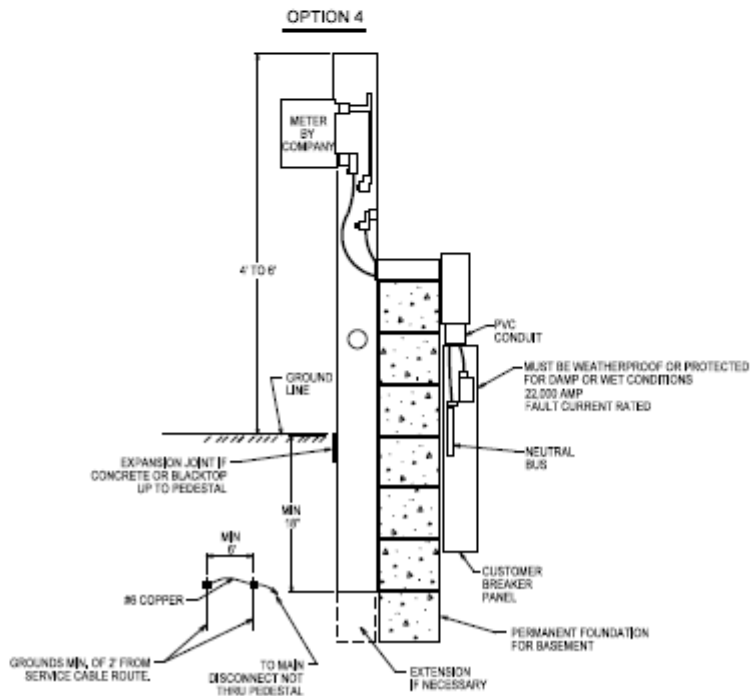
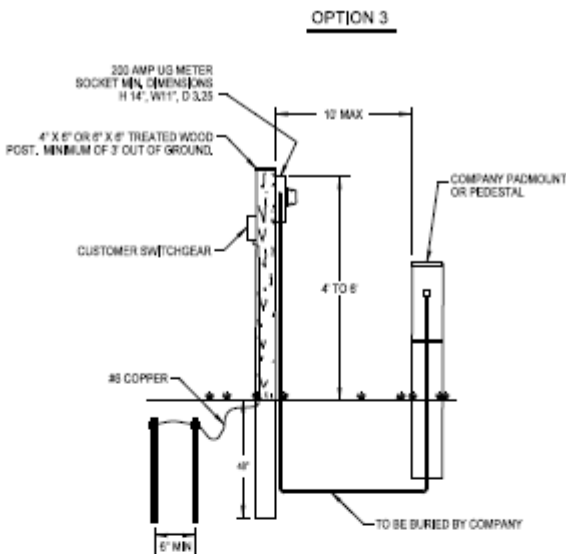


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(Options 2 through 4, Underground)

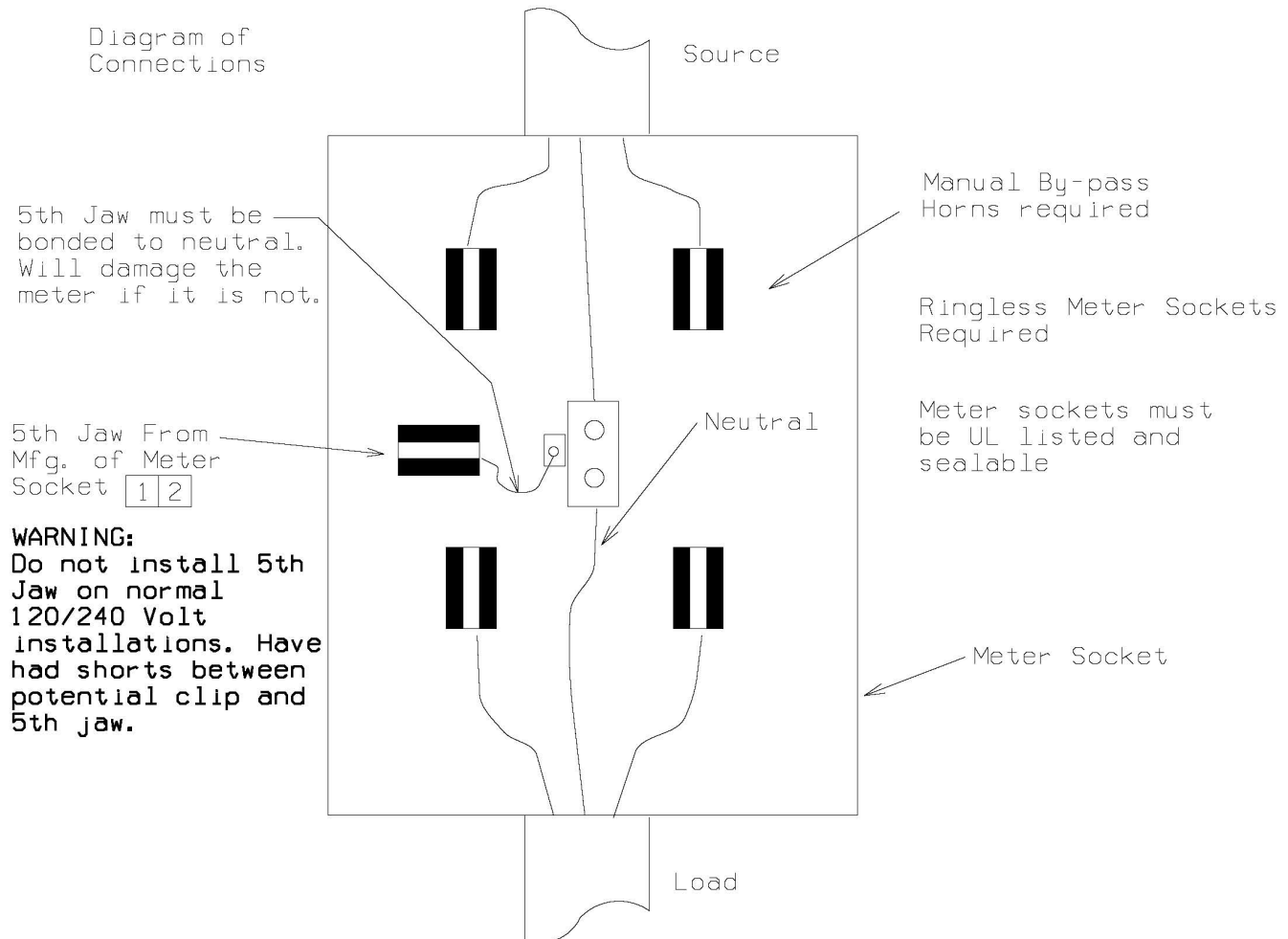


Self-supported meter base example:



4-7 120/208 Volt Service (100-200 Amp)

1. This is for single-phase applications, such as apartments, that are fed from a three phase service.
2. Single-phase service drop application shall be limited to 200 Amp. Larger installations shall have a three-phase service drop with the single-phase meters and connected loads balanced on all phases.
3. A fifth jaw can be added to most new-style, single-phase 120/240V meter sockets for 120/208V single-phase service. The fifth jaw shall be securely attached in the 9 o'clock position as pictured below.
4. Existing installations with the fifth jaw in the 6 o'clock position or with a wire jumper between the meter and the meter socket shall be corrected when upgrading the wiring.



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5-1 General Three-Phase Requirements

Three-Phase 120/208 Ampacities – Grounded Wye (4-wire)

- 200 Amp
- 320 Amp
- 400 Amp - 2000 Amp (CT metering required)

Three-Phase 277/480 Ampacities – Grounded Wye (4-wire)

- 200 Amp
- 400 Amp - 3000 Amp (CT metering required)

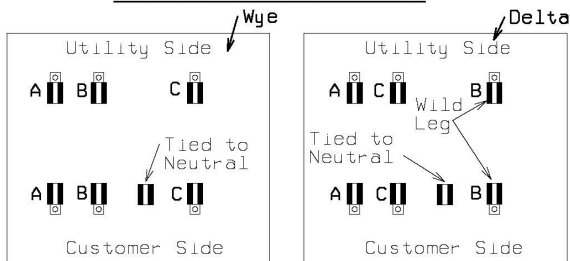
Historic Configurations – No longer offered as a new service

- Three-Phase Ungrounded Wye (3-wire)
 - If the customer service is upgraded, the Company will pull a 4th wire.
- Three-Phase Open Delta (3-wire)
 - If the customer service is upgraded, the Company will upgrade the transformer bank to wye configuration and pull a 4th wire.
- Three-Phase 120/240 Grounded Delta (4-wire)

General Three-Phase Meter Socket Requirements

1. Ringless style, 200 Amp minimum rated, clamp type jaws, 600 Volt rated, sealable, and provided with protective shield covering the jaws.
2. The meter sockets shall have a manual bypass that is designed so the cover cannot be installed with the bypass closed.
3. The phase designations from the Company do not indicate clockwise or counterclockwise rotation.
4. The meter socket (if required for non-CT metering) shall be installed 4-6 ft above ground and be readily accessible to be read, tested, and inspected.

VIEW OF METER SOCKETS

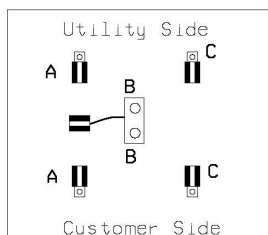


7 Jaw Meter Socket

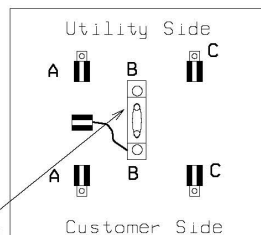
Used for:

120/208 4-wire 3 Ø wye
277/480 4-wire 3 Ø wye
120/240 4-wire 3 Ø delta

For 120/240 4-wire 3 Ø the far right side shall be connected to the wild leg. This conductor shall be identified with orange tape or marked by other approved means.



5 Jaw Meter Socket
Used for 240 Volt
3-wire 3 Ø Delta
The center conductor
is the grounded
conductor.



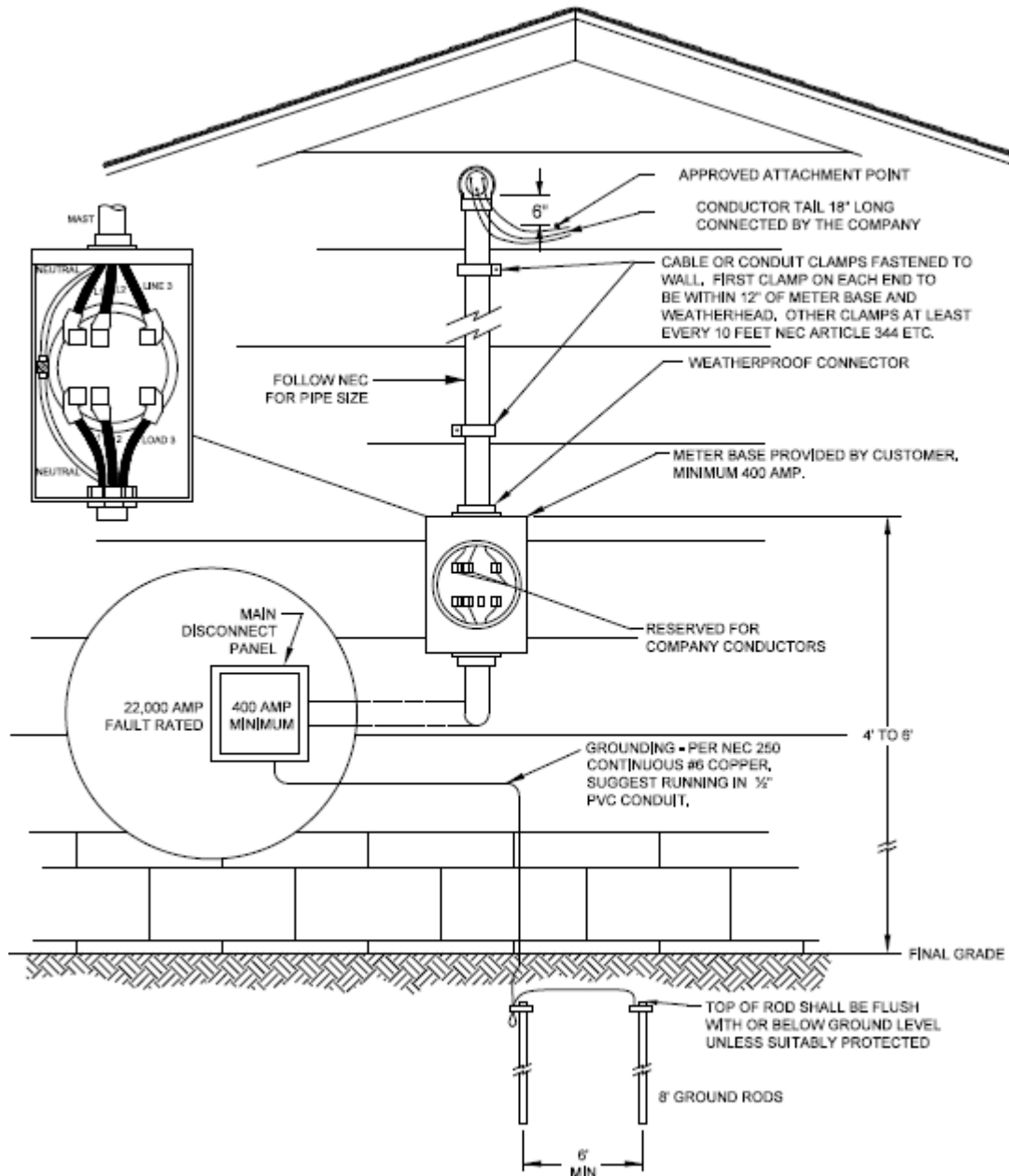
5 Jaw Meter Socket
Used for 480 Volt
3-wire 3 Ø Delta
The insulated slide
bar is used to
disconnect the third
phase, if necessary.

Note: 5 Jaw meter sockets are only permitted for maintenance of existing services. New installation of 3 wire 3 phase Delta are prohibited.

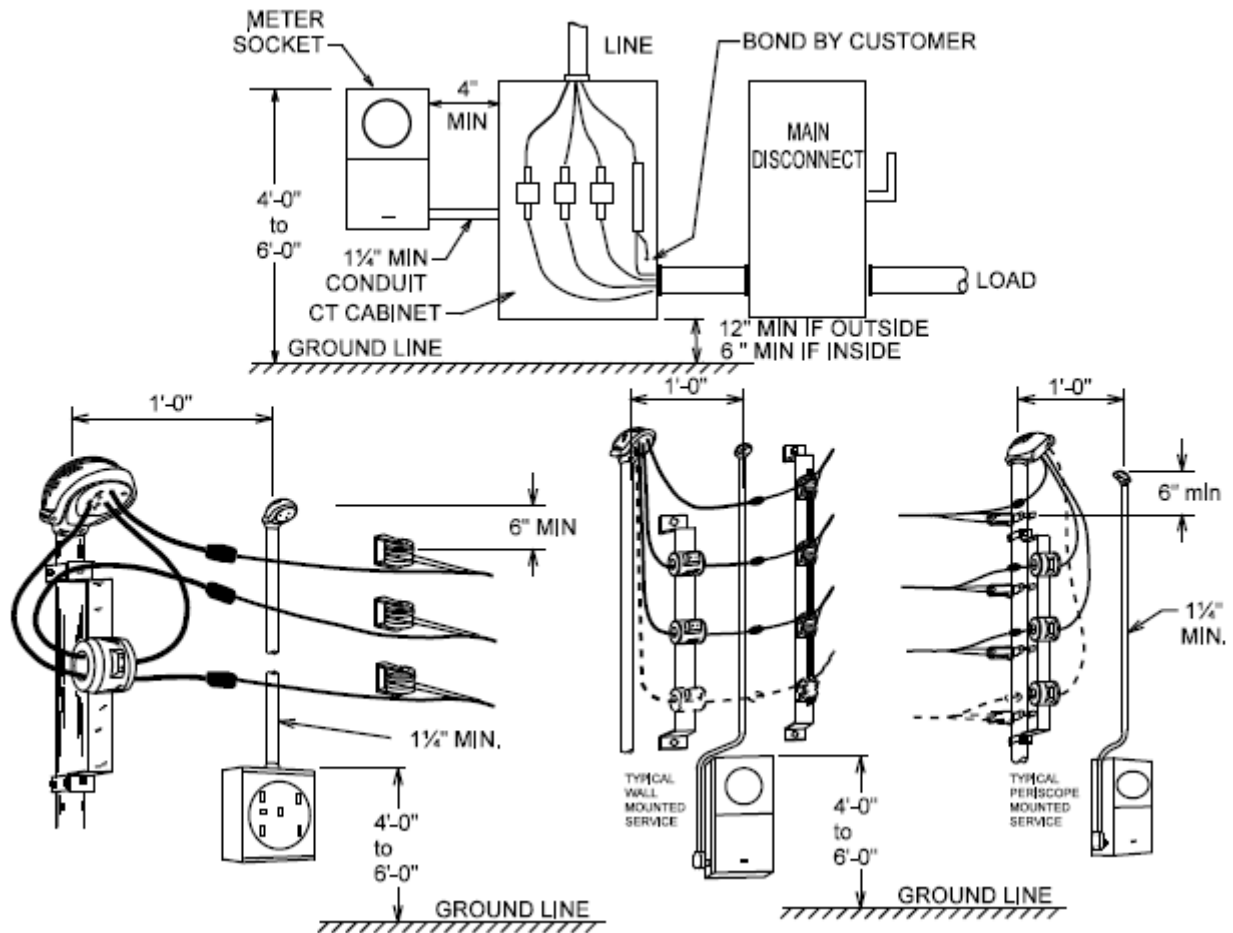
5-2 200A – 320A Three-Phase Overhead

Specifications:

- Ringless Type Meter Socket
- For 320A socket, 400A max
- Rated 600V AC
- 3 Phase, 4-Wire
- UL Listed
- 7 Jaw Meter Socket
- Bypass Lever
- Sealable
- No cover over meter



5-3 400A – 3000A Three-Phase Overhead – CT Metered



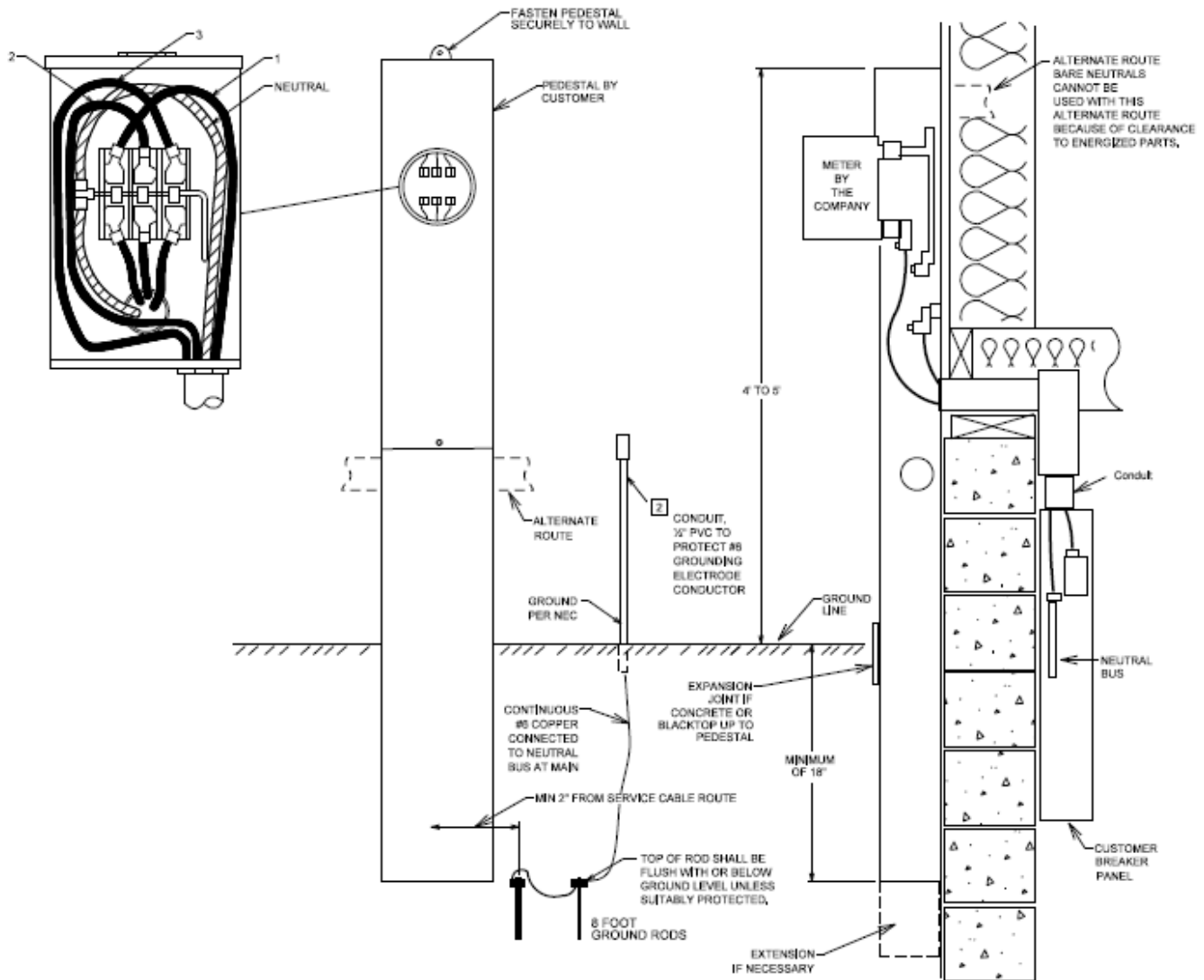
Notes:

1. Because of code clearance issues, the location of customer's service entrance and meter equipment shall, in all cases, be designated by the Company.
2. The customer shall furnish and install the meter socket, conduit to the meter socket and the CT cabinet, if applicable. The Company will provide the CT mounting bracket for periscope installation. The Company will mount the CT mounting bracket. The Company will supply the CTs, meter and meter wiring (including the meter socket ground).
3. The CT cabinet must be bonded per NEC 250.102. See Subsection 5-6 on bonding requirements.
4. Consult the Company for CT cabinet bonding requirements on three-wire 240 volt three-phase and three-wire 480 volt three-phase installations.
5. The connections to the Company's service drop shall be made by the Company.
6. In four-wire 120/240 three-phase installations, the wild leg shall be identified with orange tape or other acceptable means.
7. The length of the service entrance conductors protruding from the weather head shall be at least 18 inches.
8. Periscopes shall be back-guyed if used for dead ending the service drop.
9. See Subsection Appendix B for Fault Current information.
10. See Subsection 5-6 for approved list of CT cabinets.
11. To be used only with Regional Engineering approval.

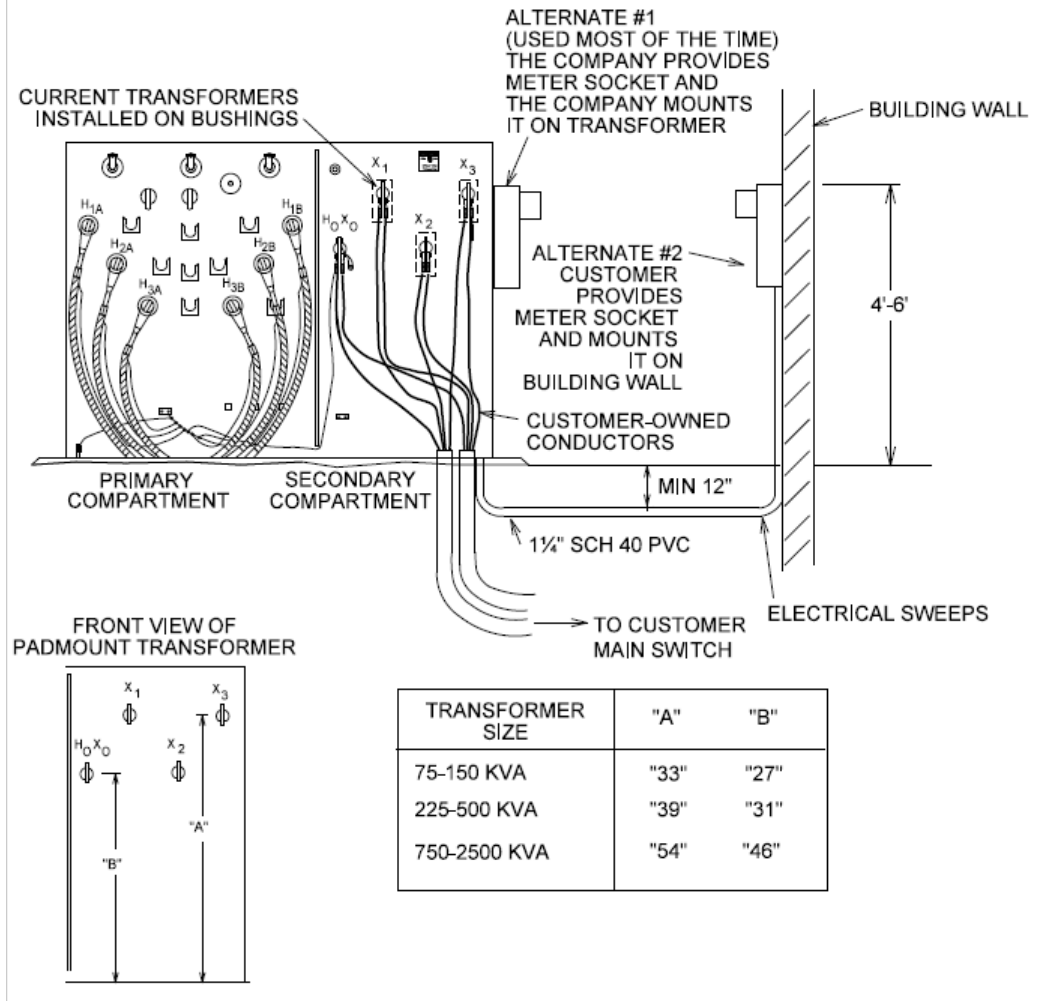
5-4 200A – 320A Three-Phase Underground

Specifications:

- Ringless Type Meter Socket
- 320A Continuous, 400A Max
- Rated 600V AC
- 3 Phase, 4-Wire
- UL Listed
- 7 Jaw Meter Socket
- Bypass Lever
- Sealable
- No cover over meter



5-5 400A – 3000A Underground - CT Metered in Pad mounted Transformer



Notes:

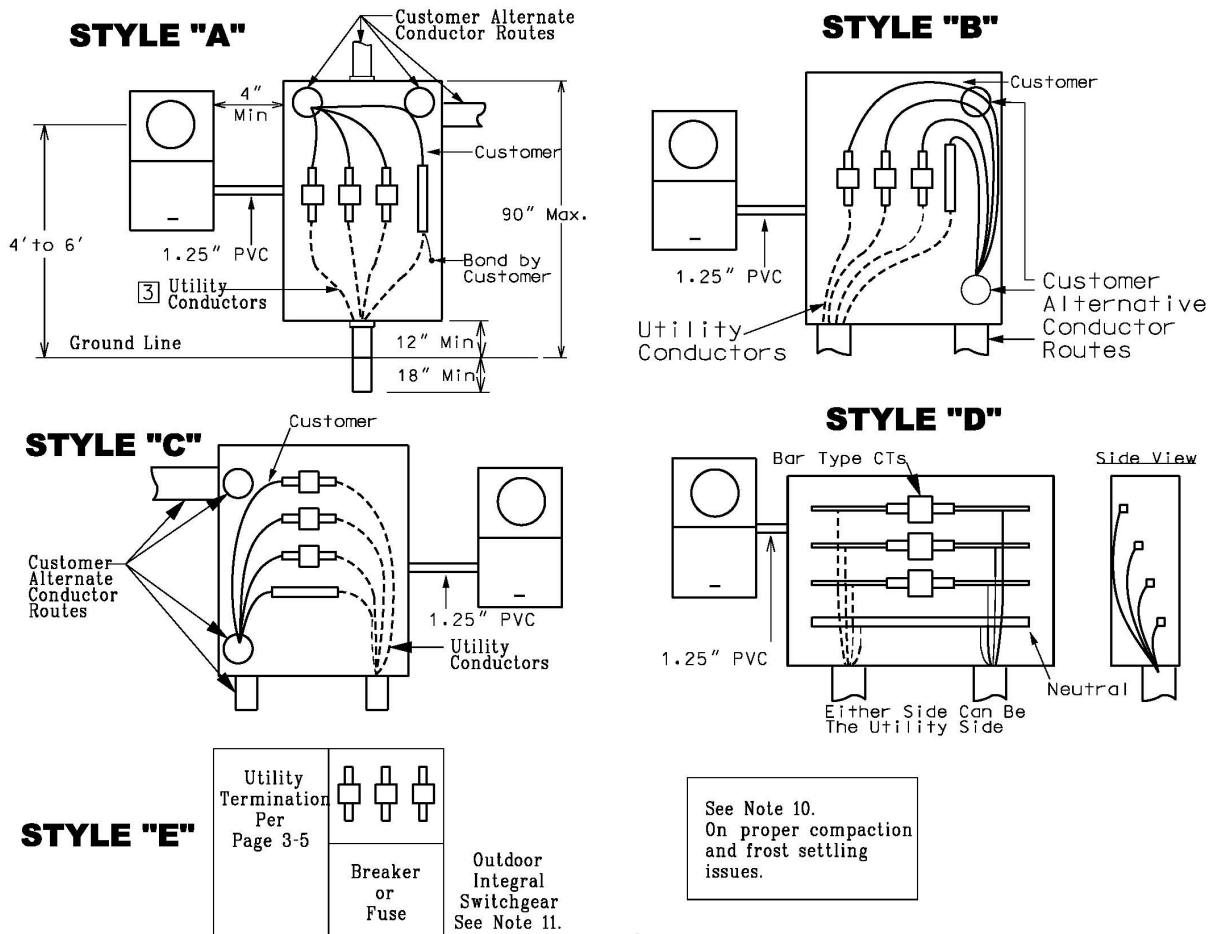
1. **Approval must be obtained from the Company to use this metering option.** It is only available from dedicated (no other customers possible) three-phase pad mounted transformers. **The service size must be 800 amp or larger.** With Company approval, however, 277/480 can get down to 400 amp. The service can only be run to one building, assumed that UPPCO will not want allowed to more than one building. Code in MI will allow.
2. The customer shall own, install and maintain the service. The Company will terminate the transformer end of the customer service conductors, if possible. Let the Company know the size and number of service conductors.
3. The above drawing is a diagram showing the metering. See Subsection 5-11 for details on pad mount setting.
4. The meter socket will be provided by the Company at cost where it is mounted on the pad mount transformer. If it is installed on the building wall, it will be provided by the customer and installed by the customer. The maximum distance between the pad mount and the building-mounted meter socket is 25 feet.
5. Mounting the meter socket on a free-standing pedestal is not acceptable.
6. The Company will ground the meter socket.
7. **The customer equipment grounding bond cannot occur in the pad mount transformer per NEC 250.24(A)(1).**

Instrument Transformer-Rated Meter Sockets (for CT Installations)

13 Terminal for 120/208 & 277/480 (Co. stock #136-1160)

Manufacturer	
Schneider Electric	TSS13-HO-SR1, USTS13-2B
Meter Devices	3040A-13
Milbank	UC7449-XL
Erickson	W-340
Talon (Siemens)	9837-8503
Durham	USTS13-2B
Cutler Hammer	USTS13-2B-CH
Midwest	USTS13-2B-MEP

5-6 400A – 3000A Underground - CT Metered in CT Cabinet



★See CT Cabinets Table on Subsection 3-4

□ Notes:

1. The customer provides the CT cabinet and meter socket.
2. The CT cabinet shall be mounted outside.
3. **Note the location of the customer and utility conductor terminations as shown above. The Company cannot terminate its conductors in any other location. Consult the Company with any questions.**
4. The Company requires that all main disconnects rated over 400 Amp be provided with a means of locking the disconnect in the open position. This meets the MIOSHA Rule 408.14004 lock-out procedure.
5. CT metering is required for 600 amp single phase and 600 amp 120/208 three phase. CT metering is required for 800 amp single phase, 800 amp and larger 120/208 three phase, and 400 amp and larger 277/480 three phase. With CT metering, there are several options. They are the use of the CT cabinet, CTs in the pad mount transformer (see Subsection 5-5) or CTs in the switchgear (also see Subsection 5-7) or overhead CT metering (see Subsection 5-8).
6. The CT cabinet must be bonded per NEC 250.102. See Bonding Table. Consult the Company for CT cabinet bonding requirements on three wire 240 volt three phase and three wire 480 volt three phase installations.
7. In four wire 120/240 three phase installations, the wild leg shall be identified with orange tape or other acceptable means.
8. See Subsection Appendix B on Fault Current information.
9. Minimum clear space in front of the cabinet and/or meter shall be 2 feet beyond the cover in the extended position or a minimum of 3 feet, whichever is greater.
10. The Company may require conduit for services under driveways and parking lots.
11. Because of settling problems, it is necessary for the customer to provide adequate compaction for disturbed soils below 30 inches. This is soil below the normal underground service burial depth. This needs to be done with sand or gravel. Frozen material and non-compacted clay are not acceptable. See also NEC 300.5(J).
12. Integral switchgear installations, similar to Style "E", need to be approved by the Company, if not already on the approved list. These installations need to be capable of accommodating an ABB Type CLC window current transformer. The switchgear manufacturer provides the bus bar and CT support with the switchgear.
13. The meter socket cannot be mounted to the CT cabinet door.

Instrument Transformer-Rated Meter Sockets (for CT installations)

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“AA” 13 Terminal for 120/208, 277/480, & 120/240 4-wire three phase.

“BB” 8 Terminal for 240 3-wire & 480 3-wire three phase (not Std.).

Manufacturer	“AA”	“BB”
Square D (Anchor)	TSS13-HO-SR1	TSS8-HO-SR1
Meter Devices	3040A-13	3040A-8
Milbank	UC7449-XL	UC7448-XL
Erickson	W-340	W-330
Talon (Siemens)	9837-8503	9837-8403
Durham	USTS13-2B	
Cutler Hammer	USTS13-2B-CH	
Midwest	USTS13-2B-MEP	
Schneider Electric	USTS13-2B	

Current Transformer Cabinets

Style of cabinet **“A”** With CTs mounted vertically, bottom in & top out
“B” with CTs mounted vertically, bottom in & top or bottom out
“C” With CTs mounted horizontally
“D” Stepped termination style with CTs horizontal
“E” Integral switchgear

Galva Closure also goes by RJB.

EMI stands for Electro-Mechanical Industries

AMP stands for American Midwest Power

400 AMP CT	Style Cabinet	Manufacturer	Catalog #	Dimensions (")	Fault Rating	Conduit
3-Wire	A	Erickson	WE-182-4	45.5x20x7.25	42,000	1-3"
	A	Galva-Closure	UPP-403UG	42x20x8.5	65,000	
	A & B	Galva-Closure	UPP-403UGBX	48x25x15	65,000	
	A	EMI	CTB146-WPS	48x30x10	65,000	
	B	AMP	WPSC4-3TM	48x36x15	85,000	
	D	AMP	WPSSB8-3ACT	60x33x13	65,000	
4-Wire	A	Erickson	WE-182-5	45.5x20x7.25	42,000	1-4"
	A	Galva-Closure	UPP-404UG	42x20x8.5	65,000	
	A & B	Galva-Closure	UPP-404UGBX	48x25x15	65,000	
	A	EMI	CTB346-WPS	48x30x10	65,000	
	B	AMP	WPSC4-4TM	48x36x15	85,000	
	D	AMP	WPSSB8-4ACT	60x33x13	65,000	
600 AMP CT	Cabinet					
3-Wire	A	Erickson	WE283-4-USG	48x48x11	65,000	1-4"
	A	Galva-Closure	UPP-603UG	54x36x13	65,000	
	C	Galva-Closure	UPP-603UGBX	48x46x13	65,000	
	A	EMI	CTB146-WPS	48x30x10	65,000	
	D	AMP	WPSSB8-3ACT	60x33x12	65,000	
	B	AMP	WPSC68-3TM	48x36x15	85,000	
4-Wire	A	Erickson	WE283-5-USG	48x48x11	65,000	2-4"
	A	Galva-Closure	UPP-604UG	54x36x13	65,000	
	C	Galva-Closure	UPP-604UGBX	48x46x13	65,000	
	A	EMI	CTB346-WPS	48x30x10	65,000	
	D	AMP	WPSSB8-4ACT	60x33x13	65,000	
	B	AMP	WPSC68-4TM	48x36x15	85,000	
800 AMP CT	Cabinet					
3-Wire	A	Erickson	CUCT-83	48x48x11	65,000	2-4"
	A	Galva-Closure	UPP-803UG	54x36x13	65,000	
	C	Galva-Closure	UPP-803UGBX	48x46x13	65,000	
	A	EMI	CTB180-WPS	60x34x18	65,000	
	D	AMP	WPSSB8-3ACT	60x33x13	65,000	
	B	AMP	WPSC68-3TM	48x36x15	85,000	
4-Wire	A	Erickson	CUCT-84	48x48x11	65,000	2-4"
	A	Galva-Closure	UPP-804UG	54x36x13	65,000	
	C	Galva-Closure	UPP-804UGBX	48x46x13	65,000	
	A	EMI	CTB380-WPS	60x34x12	65,000	
	D	AMP	WPSSB8-4ACT	60x33x13	65,000	
	B	AMP	WPSC68-4TM	48x36x15	85,000	

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1000 & 1200 AMP CT	Style Cabinet	Manufacturer	Catalog #	Dimensions (")	Fault Rating	Conduit
4-Wire	A or B	EMI	CTB312WPS	66x42x16	65,000	3-4"
	C	Erickson	CUCT-124WPS	60x51x15	85,000	
	C	Galva-Closure	UPP-1204UG	48x45.75x13	85,000	
	A	AMP	WPSC12-4TM	60x36x15	85,000	
1600 AMP CT	Cabinet					
4-Wire	A or B	EMI	CTB316WPS	72x46x18	65,000	4-4"
	C	Erickson	UCT-164WPS	60x60x15	85,000	
	C	Galva-Closure	UPP-1604UG	60x60x15	85,000	
	A	AMP	WPSC16-4TM	75x39x24	85,000	
* 2000 AMP CT	Cabinet					
4-Wire	C	Galva-Closure	UPP-2004UG	60x60x15	85,000	6-4"
	C	Erickson	CT204SG-WPS	60x66.5x15	100,000	

* CT cabinets rated at 2000 Amp and higher shall accommodate split bar configuration CT's.

Pedestal Raceways for CT Cabinets

(Alternate to Conduit Riser for Utility Conductors)

Length	Erickson 600/800 Amp	Galva-Closure 600/800 Amp
36"	USR-36	CC-36
48"	USR-48	CC-48
60"	USR-60	CC-60

AMP also makes pedestal raceways in varying sizes and lengths. This is under the WWPB catalog series.

Bonding Table

Size of Largest Service Entrance Conductor or Equivalent Area For Parallel Conductors		Bonding Jumper	
Copper	Aluminum	Copper	Aluminum Conductor
#2 or smaller	1/0 or smaller	#8 or 16.51 kcmil	#6
#1 or 1/0	2/0 or 3/0	#6 or 26.24 kcmil	#4
2/0 or 3/0	4/0 or 250 kcmil	#4 or 41.74 kcmil	#2
Over 3/0 – 350 kcmil	Over 250 kcmil – 500 kcmil	#2 or 66.36 kcmil	1/0
Over 350 kcmil – 600 kcmil	Over 500 kcmil – 900 kcmil	1/0 or 105.6 kcmil	3/0
Over 600 kcmil – 1100 kcmil	Over 900 kcmil – 1750 kcmil	2/0 or 133.1 kcmil	4/0
Over 1100 kcmil – 1300 kcmil	Over 1750 kcmil – 2000 kcmil	3/0 or 167.8 kcmil	250
Over 1300 kcmil – 1700 kcmil	Over 2000 kcmil – 2400 kcmil	4/0 or 211.6 kcmil	300
Over 1700 kcmil – 2000 kcmil	Over 2400 kcmil – 2800 kcmil	250 kcmil	350
Over 2000 kcmil – 2800 kcmil	Over 2800 kcmil – 4000 kcmil	350 kcmil	500
Over 2800 kcmil – 4000 kcmil	Over 4000 kcmil – 6000 kcmil	500 kcmil	750
Over 4000 kcmil – 6000 kcmil	Over 6000 kcmil – 10000 kcmil	750 kcmil	1250

Equipment Bond – supply side of Service and Main Bonding Jumper (CT Cabinets)

Table 250.66

NEC 250.96, NEC 250.102 and NEC 250.142

It is not necessary to run the bond from the CT cabinet back to the service disconnect if the CT cabinet is located on the supply side of the disconnect.

5-7 Space Required to Terminate in Service Entrance Panels & Switchgear

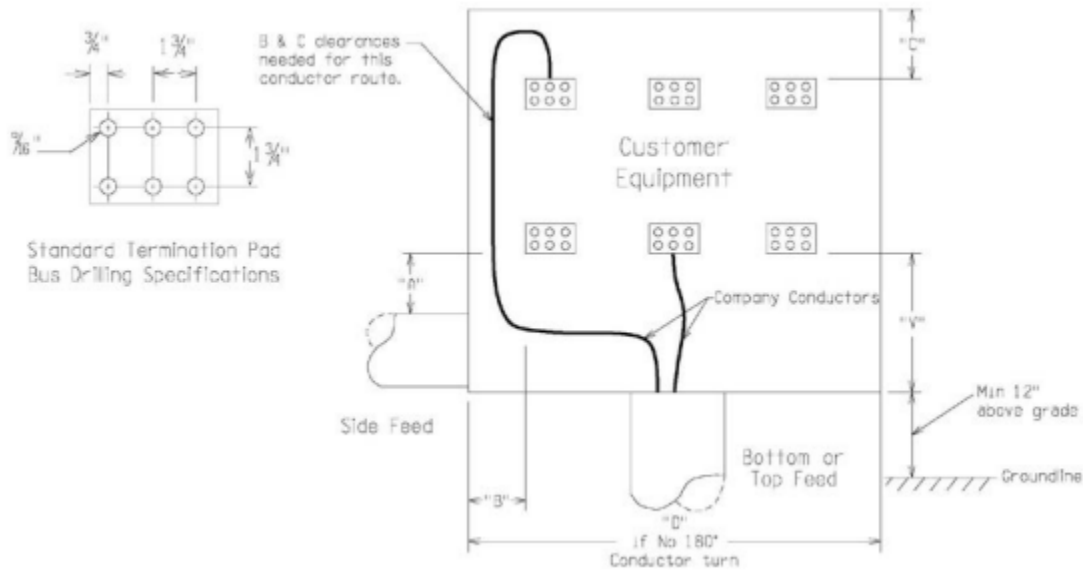


Table 1 – Standard Conductor and Conduit Sizes 5

Switchgear (Amps)	Phases	No. & Size Conductors Per Phase Aluminum	No. of Conduits and Size (in.)	"V"	"A"	"B"	"C"	"D"
			Conduit Run					
200	1	1-3/0	1-2"	12"	6.5"	4"	6.5"	8"
200	3	1-3/0	1-3"	12"	6.5"	4"	6.5"	10"
400	1	1-350	10 1-4"	18"	12"	5"	12"	9"
400	3	1-350	1-4"	18"	12"	5"	12"	11"
600	1	1-750	2-4"	18"	18"	8"	16"	10"
600	3	1-750	2-4"	18"	18"	8"	16"	12"
800	1	2-750+	2-4"	24"	24"	10"	18"	15"
800	3	2-750+	2-4"	24"	24"	10"	18"	19"
1000	3	3-750+	3-4"	30"	30"	14"	22"	35"
1200	3	3-750+	3-4"	30"	30"	14"	22"	35"
1600	3	4-750+	4-4"	36"	36"	-	-	40"
2000	3	6-750+	6-4"	42"	42"	-	-	40"
2500	3	7-750+	7-4"	42"	42"	-	-	40"
3000	3	8-750+	8-4"	42"	42"	-	-	40"

+ Std. is 350 neutral

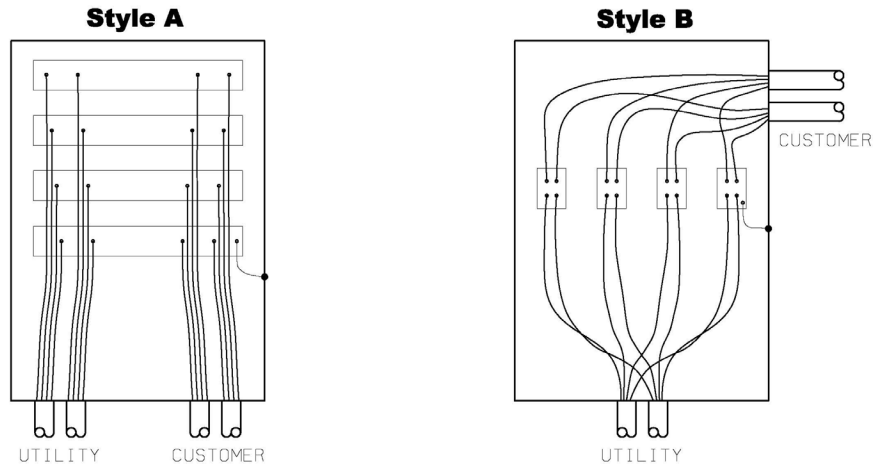
Notes:

1. This page deals exclusively with Company conductors.
2. The Company uses 90°C conductor; therefore, the Company cannot terminate on customer main disconnects. (NEC 110.14)
3. "V" dimension for 3/0 and 350 comes from NEC Table 312.6(B).
4. "B" dimension based on NEC 312.6(A). "C" dimension based on NEC 312.6(B). 180 degree cable bends are only allowed by the Company through 600 Amp. Consult the Company if you have such a situation with a larger entrance.
5. If these minimum termination dimensions cannot be met, it may be necessary to use a separate termination enclosure per Subsection 5-8.
6. This table gives standard Company conductor sizes. Customers must size their service entrance conductor based on the NEC. Note things such as Table 310.16 on general conductor ampacities, Table 310.15(B)(2)(a) on derating for more than three current-carrying cables in a raceway, duct configurations for over 2KV cables in Figure 310.60, Article 376 and 378 on raceway fill, etc.
7. Consult the Company when planning 2000 Amp and larger switchgear.

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8. "D" Dimension based on terminator widths and 1" phase spacing. This applies only to single direction termination. If some conductors must turn a 180 degree to terminate, add dimension "B" as necessary.
9. One additional conduit shall be required where potential problems may occur under blacktop, concrete, or building structure. Additional considerations shall be given for rocky conditions.
10. 3" acceptable if 320A pedestal.
11. Any variance of the conductor sizes above will need Regional Engineering approval.

5-8 Termination Enclosures



The above termination enclosures are options for certain wiring installations. Consult the Company before using these options.

Type A has horizontal bus bars that are stacked at different distances from the back of the cabinet in order to provide enough room to terminate (the top phase is the farthest from the back of the cabinet). The neutral is the bottom bus bar.

Type B has vertical bus bar and conductor training.

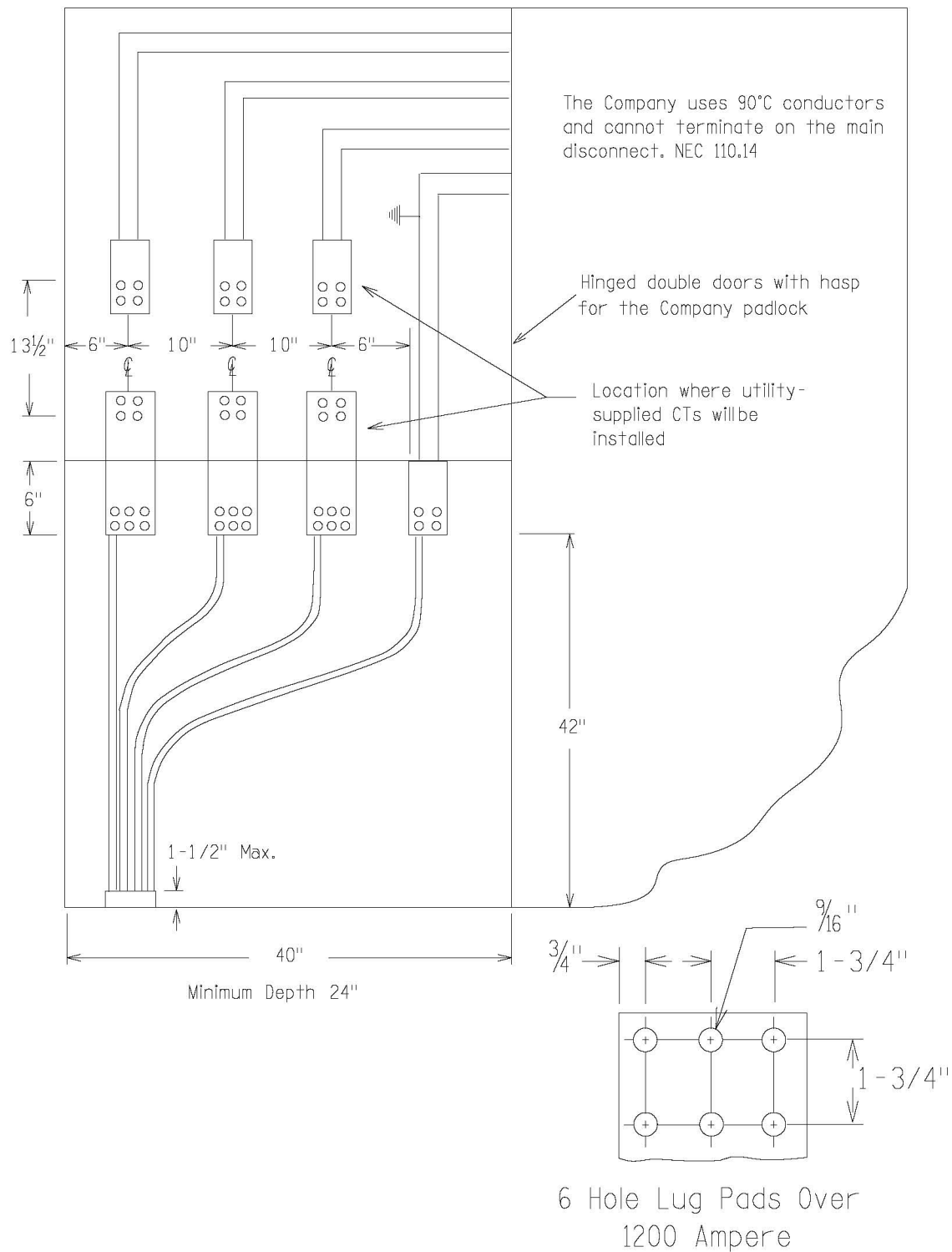
Amps		Type	Mfg	Catalog #	Dimensions (")
400 amp	3-wire	B	Erickson	TB-365N	42.25x20x7.25
		A	Galva-Closure	TBBXWPS-413-1	48x25x15
		B	Galva-Closure	TB-413-1	42x20x8.5
		A	AMP	WPSSB8-3A	60x33x13
		B	AMP	WPSTB4-3A	40x24x9
	4-wire	B	Erickson	TB-465N	42.25x20x7.25
		A	Galva-Closure	TBBXWPS-434-1	48x25x15
		B	Galva-Closure	TB-434-1	42x20x8.5
		A	AMP	WPSSB8-4A	60x33x13
		B	AMP	WPSTB4-4A	40x24x9
800 amp	3-wire	B	Erickson	TB-367N	56x42x11
		A	Galva-Closure	TBBXWPS-813-3	48x36x15
		B	Galva-Closure	TB-813-2	48x26x11
		A	AMP	WPSCSB8-3A *	60x33x13
		B	AMP	WPSCCTB8-3A *	60x33x13
	4-wire	B	Erickson	TB-467N	56x42x11
		A	Galva-Closure	TBBXWPS-834-3	48x36x15
		B	Galva-Closure	TB-834-2	48x26x11
		A	AMP	WPSSB8-4A *	60x33x13
		B	AMP	WPSTB8-4A *	60x33x13
1200 amp	4-wire	B	Erickson	TB-468N	60x36x15
		A	Galva-Closure	TBBXWPS-1234-5	54x46x15
		B	Galva-Closure	TB-1234-4	54x36x15
		A	AMP	WPSSB12-4A *	60x33x13
		B	AMP	WPSTB12-4A *	60x33x13
1600 amp	4-wire	B	Erickson	TB-469N	60x40x15
		A	Galva-Closure	TBBXWPS-1634-4	54x46x15
		B	Galva-Closure	TB-1634-5	60x38x17
		A	AMP	WPSSB16-4A *	60x33x13
		B	AMP	WPSTB16-4A *	60x33x13
2000 amp	4-wire	B	Erickson	TB-4610N	78.25x44x20.75
		A	Galva-Closure	TBBXWPS-2034-5	66x54x15
		B	Galva-Closure	TB-2034-6	72x42x21
		A	AMP	WPSSB20-4A *	60x33x13
		B	AMP	WPSTB20-4A *	60x33x13
Amps		Type	Mfg	Catalog #	Dimensions (")
2500 amp	4-wire	A	Galva-Closure	TBBXWPS-2534-7	72x50x21

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		B	Galva-Closure	TB-2534-7	72x42x21
		A	AMP	WPSTC25- *	60x51x39
3000 amp	4-wire	A	Galva-Closure	TBBXWPS-3034-8	72x50x21
		B	Galva-Closure	TB-3034-8	72x42x21

See Subsection 5-6 for bonding requirements between the neutral and the termination enclosure. Because of settling problems, it is necessary to provide adequate compaction under the normal UG service conductor depth (30") for disturbed soils. This needs to be done with sand or gravel. Frozen material and uncompacted clay are not acceptable.

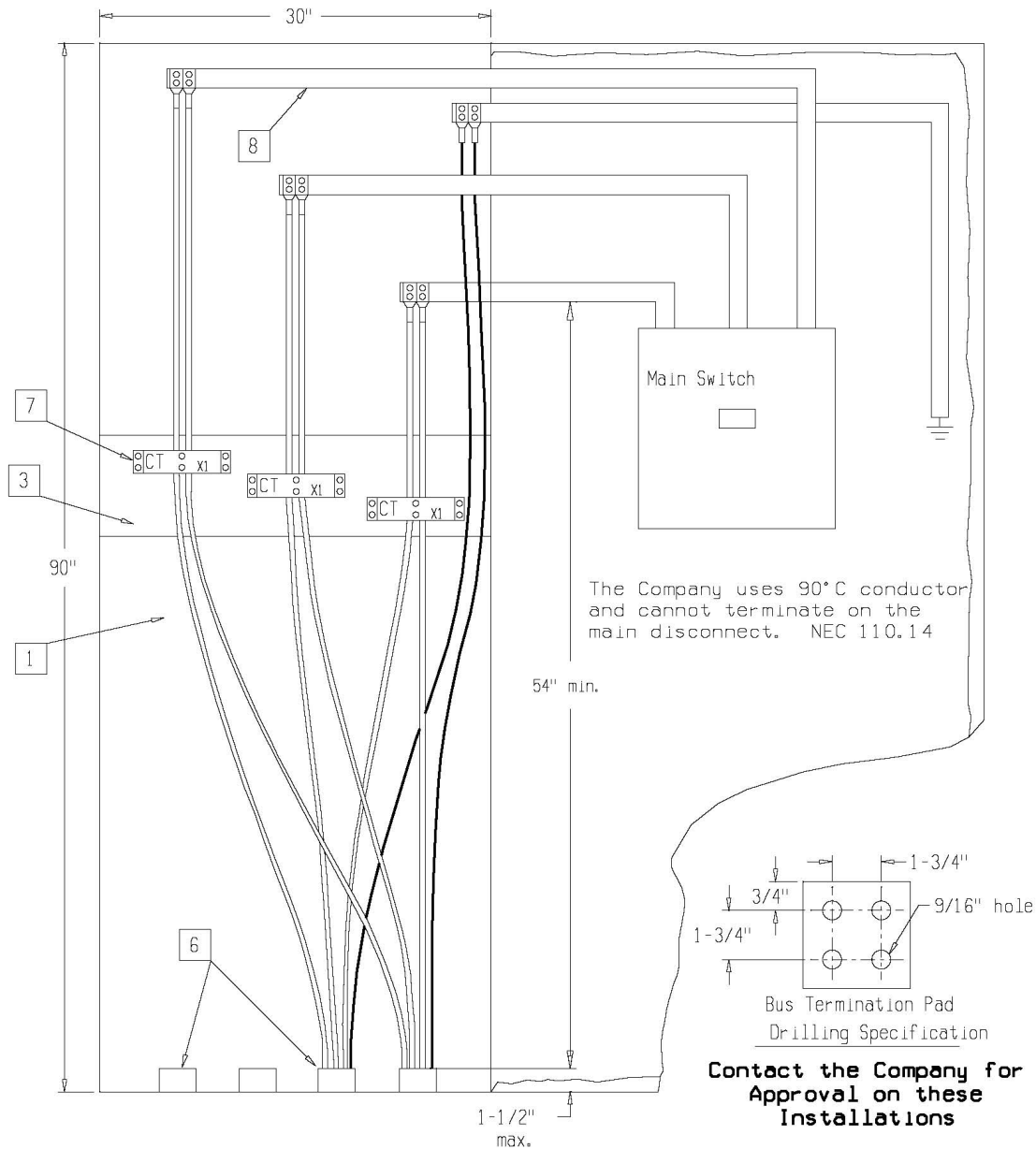
5-9 Large CT Installation, Bus Bars – 2500 - 3000 Amp – Metering in Switchgear



Contact the Company for approval on these installations.

Instrument meter socket to be located outside and within 25 feet of CT cabinet. The conduit between the meter socket and CT cabinet shall be min. 1-1/4" diameter.

5-10 Large CT Installation, Doughnuts – 2500 - 3000 Amp – Metering in Switchgear



Notes:

1. Depth of current transformer compartment shall be 24" minimum.
2. CT compartment shall have hinged door and locking hasp.
3. CT mounting bracket must be adjustable for depth and height.
4. For top feed, reverse diagram configuration.
5. Customer shall furnish detailed drawings for Company approval before equipment is ordered.
6. Check with the Company to determine how many conductors per phase will be used and how many holes will be needed on the termination pad.
7. CT's shall be located approximately 18" below bus.
8. Bus shall be adequately braced to support conductors.
9. Instrument meter socket to be located outside and within 25 feet of CT cabinet. The conduit between shall be minimum 1-1/4 inch.

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5-11 Standard Pad for 75 - 2500 KVA Pad mount Transformers

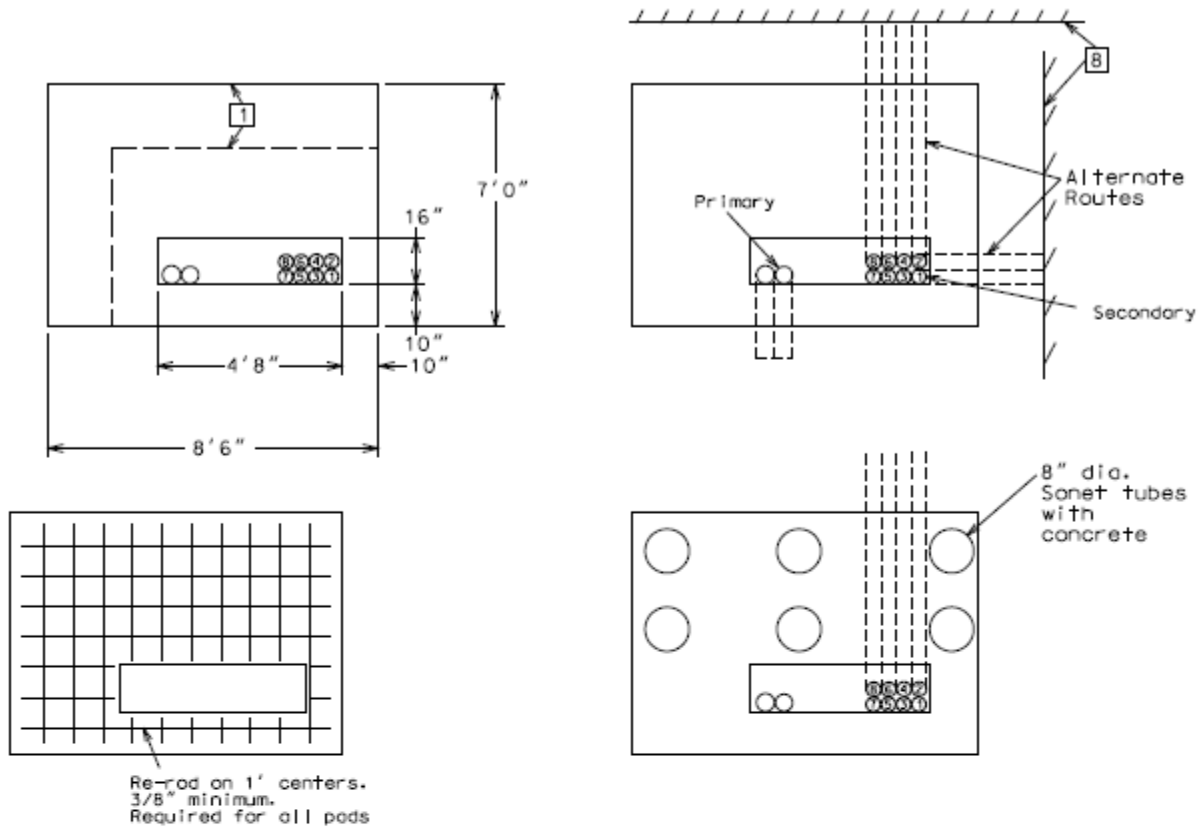
1. See Section 2-4 for required clearances.
2. A pre-cast option is available from the Company.
3. For customer-poured pads, a minimum cure time of 7 days is required before setting a transformer.
4. Require dimensions of 8'6" x 7' x 6" thick with a (minimum of) 3/8" re-bar reinforcement grid, spaced 1' on-center. See diagram below.
5. Finished surface of the transformer pad shall 4" – 6" above finished grade.
6. Service conduits shall always start from the front right corner of the window and tight to each other and in numbered order. See Section 5-7 for the number and size of the conduits if the Company is providing the service conductors. Install the conduits to extend a minimum of one foot beyond the edge of the pad.
7. The primary conduits shall start from the front left corner of the window and shall be positioned next to each other. There shall be two six-inch conduits. Install the conduits to extend a minimum of one foot beyond the edge of the pad.
8. All conduits shall not extend more than 3" from the pad surface per NEC 408.5
9. Soil conditions dictate whether a gravel base or concrete footings are required
 - a. If undisturbed soil capable of carrying weight is encountered within 3' of excavation, a tamped class 5 gravel base can be utilized.
 - b. Alternatively, 8" sonotubes extending 4' can be utilized. See diagram below for placement.
10. Concrete shall have a minimum strength of 3000# per sq. inch and contain not less than a 6 bag mix per cubic yard. A maximum of one bag of fly ash may be substituted for one bag of cement per cubic yard of concrete.
11. Approximate weights on transformers are 75 kVA (2300#), 500 kVA (6000#), 750 kVA (8400#), 2500 kVA (17000#).
12. Alternate dimensions of 6'6" x 5'0" can be used with Company approval.

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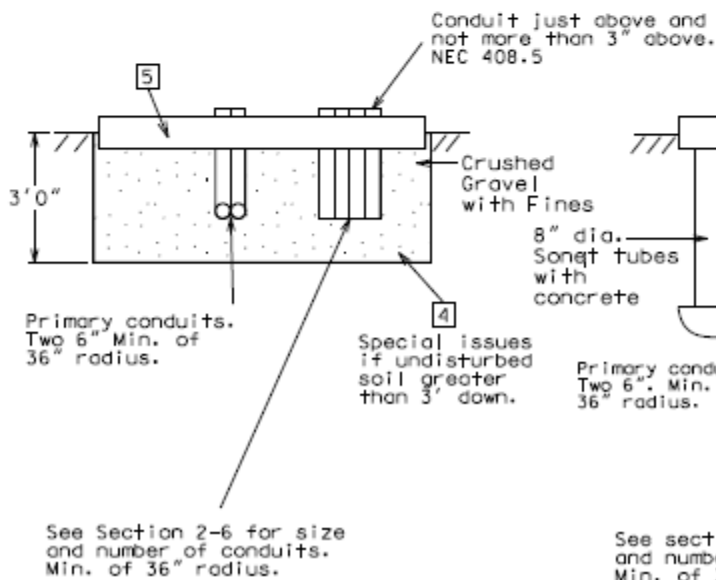
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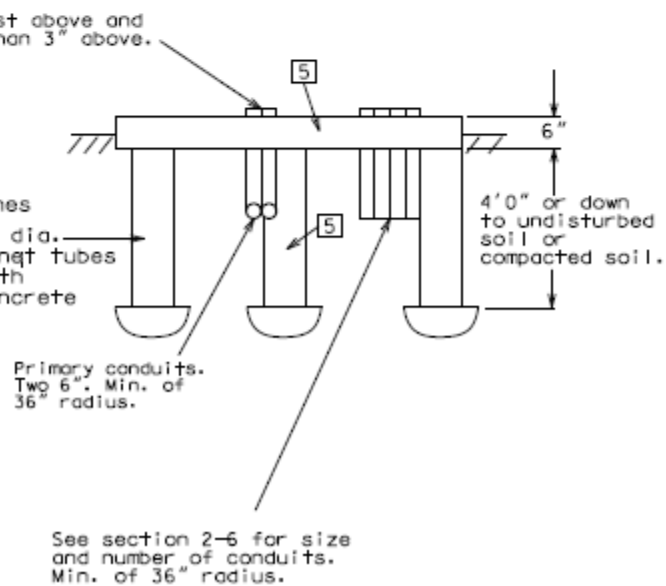
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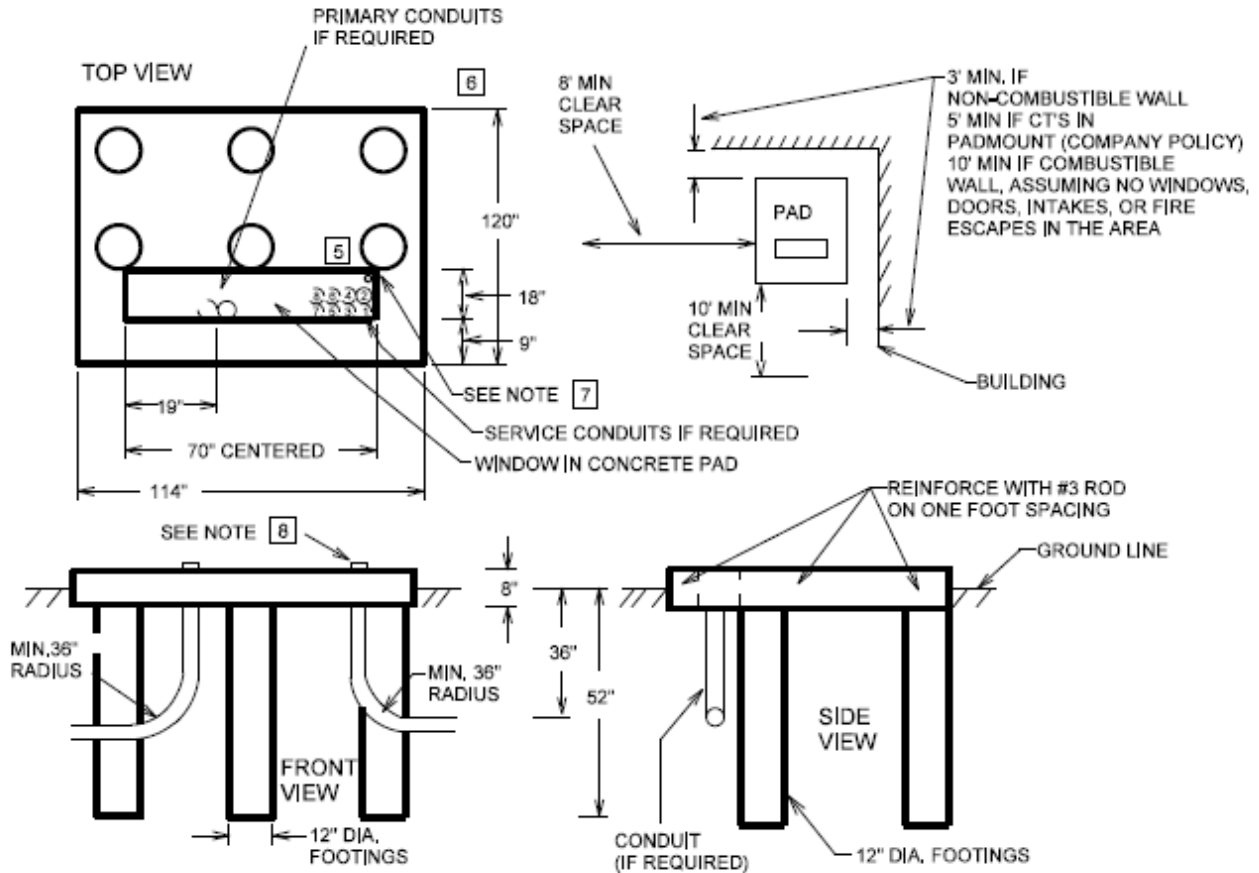


Gravel Base Alternative



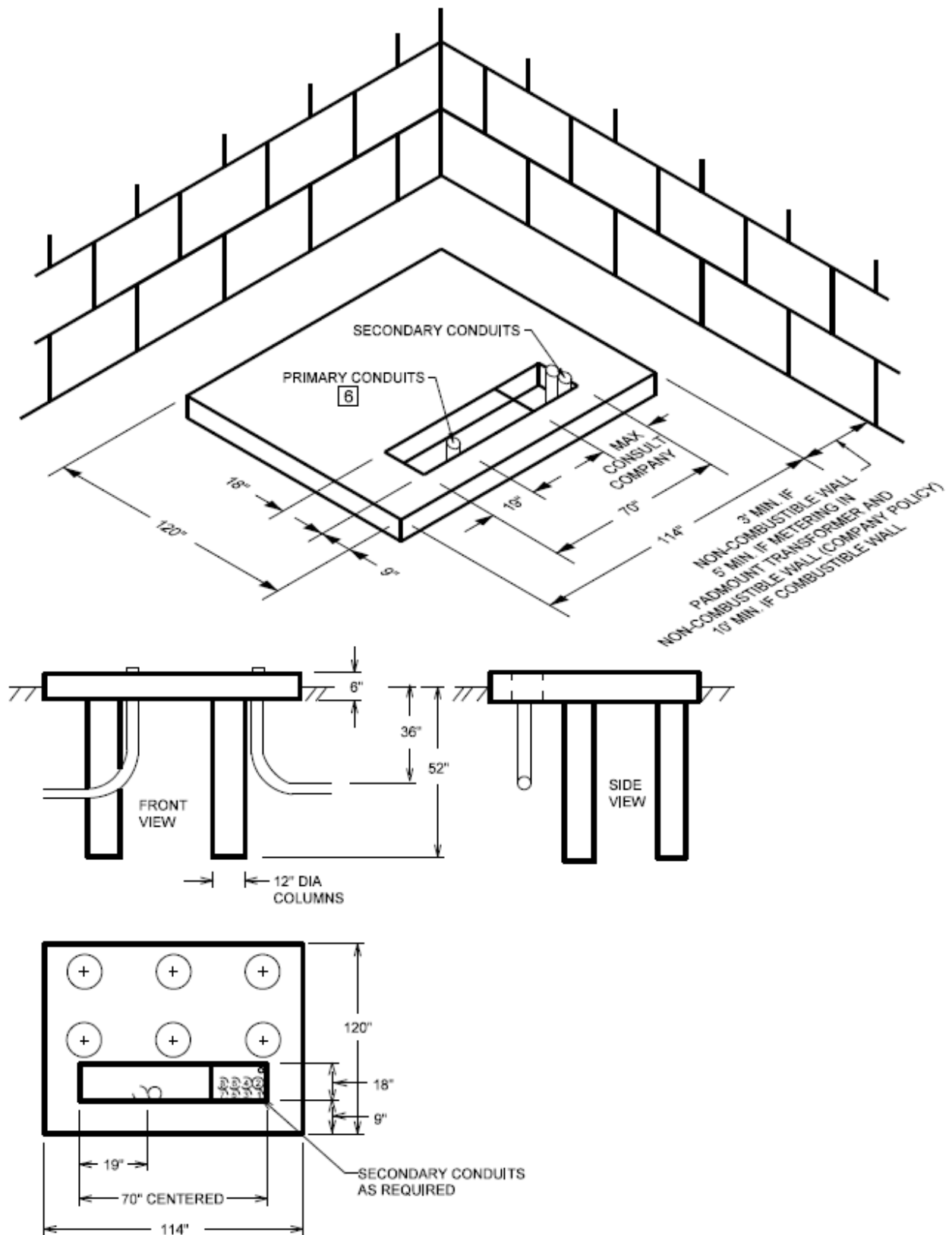
Concrete Footing Alternative



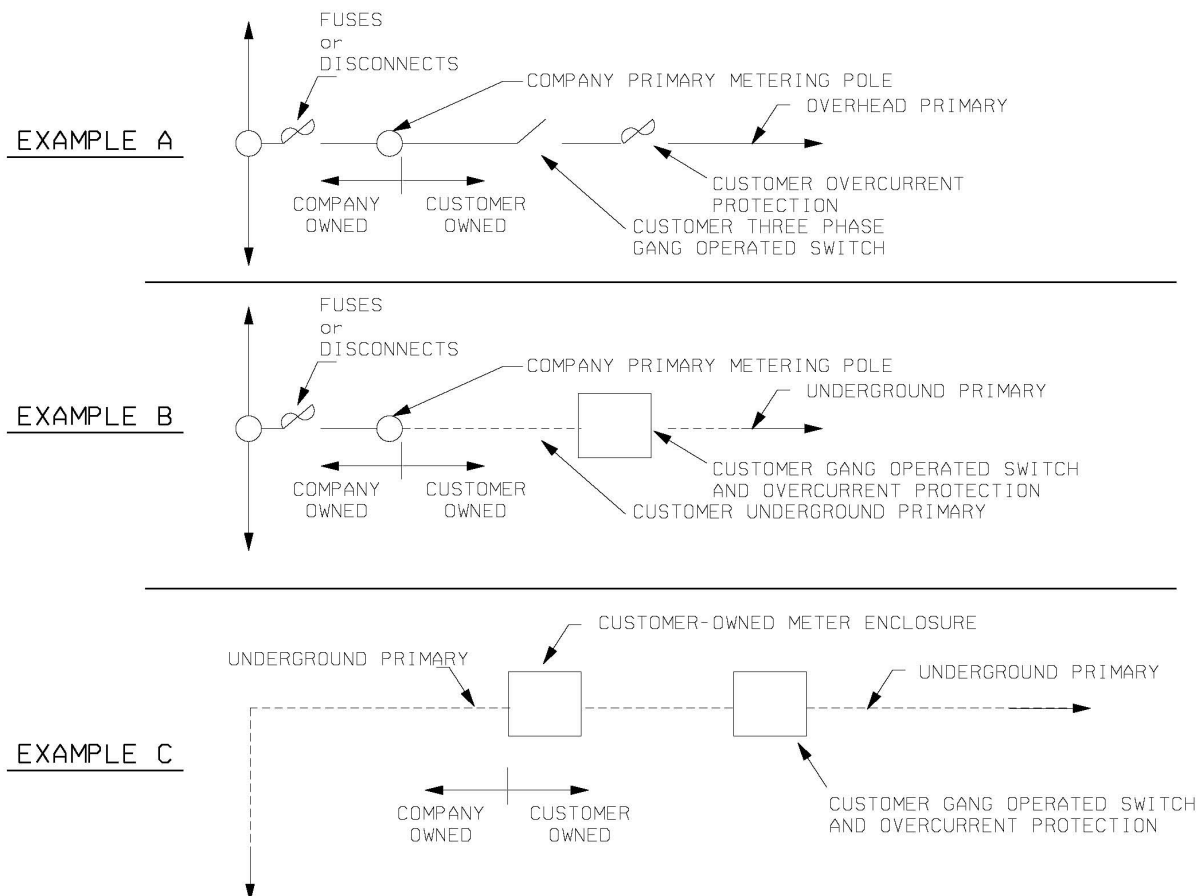
5-12 Large Concrete Pad for 3750 - 5000 KVA Pad mount Transformers

Notes:

1. Concrete shall have a minimum strength of 3000 lbs. per sq. inch and contain not less than 6 bags of cement per cubic yard. Approximately one bag of fly ash may be substituted for one bag of cement per cubic yard of concrete.
2. The top of the pad shall be reinforced with #3 rods on a one-foot spacing.
3. These transformers range from 20,000 to 28,000 lbs.
4. Service conduits shall always start from the front right corner of the window. The conduits must be positioned tight to the right side of the window and tight to each other and in numbered order. This is so that the conduits don't cross over into the primary side of the transformer.
5. Position primary conduits in the front of the window and 19 inches from the left side (see top view, above). Use two each, six inch conduits.
6. 1-1/4" PVC meter conduit to building wall, if required. End this 3 inches above pad.
7. Service and Primary conduits to be just above (max. 3") pad.
8. Concrete is considered fully cured in 21 days. However, the majority of the strength is obtained after 7 days. If transformers will be set in fewer than 7 days, cement should be tested to be sure it has at least 2500#/sq. in. of strength.



5-13 Primary Metering



Notes:

1. Consult the Company for any 2.4/4.16 kV wye or higher primary voltages (7.2/12.47 kV wye is standard for UPPCO).
2. A gang-operated three-phase disconnect that the customer can operate must be installed.
3. Overcurrent protection must be installed in conjunction with the three-phase gang-operated disconnect. Consult the Company on coordination issues between the customer overcurrent protection and utility protection.
4. The customer-owned facilities must comply with the state electric code &/or the NEC. If the Company is selling an existing system, changes may be necessary. This is because Company lines are built to comply with the NESC.
5. Some of the key NEC requirements are in NEC 240.21, 450.3 & 695.5.
 - A. Overcurrent protection must be on the primary side of each transformer setting.
 - B. Overcurrent protection must be on the secondary side of each transformer setting ahead of the service, or what is now called the feeder by the NEC. This is not required if the customer determines that they have conditions of maintenance and supervision to ensure that only qualified people will monitor and service the transformer installation.
 - C. If primary feed to the transformer (feeder per NEC) is outside, then the requirements for secondary overcurrent protection at the transformer are not required. The NEC does require a single main in the secondary switchgear. The six disconnect rule does not apply.
 - D. The fire protection system has special overcurrent protection requirements.
6. Customer-owned, three-legged core transformers shall be avoided. Only grounded wye / grounded wye four or five legged core transformers shall be used. Loss of phase and ferroresonance is a concern.

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6-1 Company Policies - General

6-1.1 Arc Flash Warning

Company electrical facilities have the potential of delivering very high levels of energy during an arc flash incident, potentially causing severe injury or death. Follow the appropriate requirements of MIOSHA and NFPA - 70E if exposed to energized parts of electrical service entrance equipment and electrical metering.

6-1.2 Code Compliance, Inspection & Reconnects

All wiring shall be done in accordance with requirements of Michigan Law (in particular the National Electrical Code as adopted by Michigan Rule 408.30801, Michigan Electrical Codes Rules (part 8) and revised by subsequent sections of law), the Company's rules and other local requirements, whichever applies.

In new wiring installations or when changes in existing wiring are made which require the removal of meters or the disconnection of service, the Company will not connect or resume service until the facility is inspected and approved by a certified inspector (MI Rule 408.30818).

The Company requires an inspection to reconnect if an account is inactive for greater than a year and/or if any modifications have been made to the meter socket or customer-owned wiring. It is the customer's responsibility to make sure that the electrical system is in a safe condition when requesting reconnection of a service. Note that some local jurisdictions may require inspection before a reconnection, superseding the Company's requirements. Some jurisdictions may require the service and/or meter components to be upgraded. The Company will refuse to reconnect inactive services due to out-of-compliance metering or obvious safety hazards at the customer-owned service entrance. Common problems include A-Base (see figure 1), bottom connected meters, 30 and 60 amp 1 & 2S meter sockets (see figure 2), as well as deteriorated insulation between the meter socket and weather head and/or service entrance wire.



Figure 1 – self-contained A-Base meter



Figure 2 – typical 60A S-Base meter

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The Company will not interpret the electrical code or inspect customer's wiring or equipment for compliance with the applicable codes. Questions concerning code interpretations should be referred to the local or state electrical inspector.

The Company will inspect for compliance with Company rules and will refuse or discontinue electric service if Company rules are not complied with or a hazardous condition exists.

Company crews setting meters or connecting new services test for infinite resistance at the meter socket load terminals. If this check indicates connected load at the load terminals, the meter will not be set. It is mandatory that the service disconnect switch be left open to avoid the indication of connected load at the meter base. COMPANY CREWS WILL NOT ENTER A BUILDING TO OPEN OR INSPECT THE SERVICE DISCONNECT SWITCH AND THE METER WILL NOT BE SET.

6-1.3 Continuity and Quality of Service

The Company will endeavor to, but does not guarantee, to furnish a continuous supply of electric energy and to maintain voltage and frequency within applicable IEEE code limits.

The Company will not be liable for interruptions in the service, phase failure or reversal, variations in the service characteristics, or for any loss or damage of any kind or character occasioned thereby, due to causes or conditions beyond the Company's control, and such causes or conditions shall be deemed to specifically include, but not be limited to, the following: acts or omissions of customers or third parties; operation of safety devices except when such operation is caused by the negligence of the Company, absence of an alternate supply of services; failure, malfunction, breakage, necessary repairs or inspection of machinery, facilities or equipment when the Company has carried on a program of maintenance consistent with the general practices prevailing in the industry; act of God; war; action of the elements; storm or flood; fire; riot; labor dispute or disturbances; or the exercise of authority or regulation by governmental or military authorities.

The customer shall be responsible for giving immediate notice to the Company of interruptions or variations in electric service so that appropriate corrective action can be taken.

The Company reserves the right to temporarily interrupt service for construction, repairs, emergency operations, shortages in power supply, safety and State or National emergencies and shall be under no liability with respect to any such interruption, curtailment or suspension.

All motors, appliances or equipment connected to the Company's system shall be designed, installed, and operated as to not cause interference to other customers' service equipment nor to handicap the Company in maintaining proper system conditions.

It shall be the responsibility of the customer to provide motor protection for undervoltage, overcurrent, short circuit, loss of a phase and phase reversal. Note that the NEC has required protection on all phases where overload relays are used, since 1965; for continuous duty motors; thus, providing single-phase protection. (NEC 430.36 and 430.37).

The voltage provided to the customer is intended to comply with the requirements of the Administrative Code (MI Rule 460.3702). This code allows occasional voltage transients, which may adversely affect the operation of certain sensitive equipment. It is the customer's responsibility to prevent undesirable operation of sensitive equipment caused by these transients.

6-1.4 Neutral Voltages

The system neutral may carry low voltage levels. This voltage creates no difficulty for most customers. If a customer experiences a problem due to this voltage, it is the customer's responsibility to eliminate the problem through proper grounding and bonding.

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6-1.5 Carrier Current

The Company reserves the right to use carrier frequency signals on its system for communication, system operation, and equipment control and shall not be held liable for potential damages. The customer should install suitable protective equipment if such frequencies might damage or interfere with their apparatus. The use by the customer of any part of the Company's distribution system for carrying foreign electric currents or for carrier current transmission, broadcasting, or control is forbidden. Customers using carrier current or any control frequency other than 60 hertz shall be required to install suitable equipment to prevent these frequencies from being imposed upon or entering the Company's distribution system.

6-1.6 AMI - Advanced Metering Infrastructure

The Company's meters are electronic in nature and communicate via radio frequency. In areas where communication is unreliable, the meter will be manually read.

If a customer attempts to block or shield the meter communications, such action will be considered 'tampering' and/or 'unauthorized use.' The MPSC defines 'unauthorized use' as theft, fraud, interference, or diversion of service. Attempts to block or shield will be addressed with an investigation, followed by corrective measures if appropriate. See Section 3-1.11 for the Theft of Service policy.

Customers have the right to 'opt out' of the AMI system and must contact Customer Service for the applicable forms.

6-1.7 Company Equipment on Customer Property

The Company shall have the right to install, inspect, and maintain Company equipment on the customer's property as necessary to furnish proper service without notice to the customer. All equipment is considered a Company facility unless granted to the customer in writing. The Company shall have the right to remove its equipment when discontinuing service. Company equipment includes, but is not limited to: poles, anchors, wires, transformers, junction boxes, meters, and protective and regulating equipment. If Company equipment on customer property serve other customers, the Company reserves the right to keep the Company owned equipment on the customer property.

In the event a customer discontinues service, any overhead primary lines that feed a single structure will be evaluated after a year and primary lines may be removed at the Company's discretion. Once removed, re-establishment of service to the structure will be considered as a new service.

The customer shall be responsible for damages and losses resulting from interference or tampering with such equipment caused or permitted by the customer. In the event that the Company equipment is interfered with or damaged, the Company may require the customer to change his wiring, at his own expense, to permit the installation of other Company equipment or to permit the relocation of Company equipment to avoid further interference or damage (Michigan Rule 460.3409 and 750.282).

6-1.8 Sealing of Equipment

Meters and all associated metering equipment, service termination boxes, wire raceways, and service entrance switches containing unmetered conductors are sealed by the Company. This equipment must be designed with provisions for seals or locks as specified by the Company.

Unauthorized removing of Company seals or meters is unlawful and may result in billing for the investigation and replacement of the seal, as well as criminal prosecution. AMI metering alerts the Company if a meter is removed or tilted.

Only Company personnel can pull electric meters. Electric meters are not designed or intended to be used as a switch to de-energize a facility. There are specific requirements for installing or removing electric meters due to the potential of severe injury. MIOSHA and NFPA 70E have specific requirements for installing and removing electric meters.

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The Company will de-energize the electrical feed, at no cost, to accommodate work on the service entrance equipment.

6-1.9 Line Extensions on Private Property

Extensions of the Company's distribution lines onto property of the customer to be served will be made in accordance with the Company's extension rules. These rules provide, among other things, that the Company will own and be responsible for the maintenance and operation of such lines and shall have the right of access at all reasonable times for construction, reconstruction, tree-trimming, maintenance, inspection, rebuilding, and operation of lines and equipment. The Company shall also be granted the right to extend its facilities to serve other customers from such lines. See Section C on the Company webpage for Tariff rules and regulations:

<https://www.uppco.com/residential/services-rates/#uppco-rates-and-tariff>.

Easement is required when crossing private property for the purpose of serving neighboring properties. The Company will prepare all necessary easements along the route selected. The customer requesting service shall be responsible for obtaining all signatures and all associated easement costs. In some cases, existing facilities are there by "prescriptive rights" (MI 15 year-Rule 600.5801) and unable to be modified without proper easement. As an example, an overhead line cannot be converted to and underground line if any easement is not in place and only prescriptive rights.

For customer requested line extensions, the following shall be provided at no expense to the Company:

1. The customer shall grant an easement satisfactory to the Company for the installation and maintenance (including truck access) of the electric facilities.
2. The easement as designated by the Company shall be cleared of trees and other obstructions.
3. The route of underground facilities shall be within 4" of finished grade to ensure proper installation.
4. Conductors located beneath pavement or other obstructions should be placed in conduit extending 3 feet beyond the obstruction. (NEC 300.5). Note the policy for underground services in Section 3-1.9.
5. Permanent survey markers, such as steel pipe or rod identifying property lines may be required by the Company before installing facilities and any other surveying that maybe required to supply service.

6-1.10 Line Extensions on Other Than Private Property

The Company shall obtain all necessary licenses and/or permits, including but not limited to, highway, railroad crossing, and wetland. The customer applying for service is responsible for associated permit, license and surveying fees.

If obstructions are placed on the right-of-way after the service is installed, additional costs incurred due to the obstruction will be billed to the customer if repairs or modifications to the service become necessary.

6-1.11 Overhead/Underground Conductor Clearances

Contact the Company prior to construction near or beneath overhead or underground power lines. State and Federal law mandate minimum clearances to which non-utility personnel must adhere. The customer may be responsible for costs associated with remedying clearance violations created by the customer.

6-1.12 Foreign Attachments on Company Poles

Attachments to Company-owned poles are not allowed. Exceptions are normal contractual users such as communication companies, other electric power utilities, and municipalities (Christmas lighting, etc.). Examples of unacceptable attachments are signs, posters, notices, fencing, birdhouses, clotheslines, satellite dishes, customer switchgear, customer electrical feeders, customer communication circuits, etc. Traffic control signs will be accepted, by contract, on Company-owned poles if there is no conflict with the use of the pole or safety issues.

Note: This includes political advertisements on utility poles.

6-1.13 Fault Current

It is necessary to consider available fault current levels when the customer/electrician is installing electrical service entrance equipment. Appendix B gives information on maximum expected fault current levels. A minimum of 22,000 amp short-circuit rated service entrance equipment is required for residential one- and two-family homes.

6-2 Company Policies – Utilization of Equipment

6-2.1 Motors - General

- All of the following motor equipment connected to the Company's system is subject to approval by the Company with respect to starting characteristics and frequency of starts:
 - Single-Phase Motors
 - 120 Volt - 1 HP and Larger
 - 240 Volt - 3 HP and Larger
 - Three-Phase Motors
 - 10 HP and Larger
 - Single-Phase Air Conditioners over 2 Ton (may need soft start capacitors)
(excessive cycling - more than four times per hour - may cause problems).
- Motor installations including starting devices, shall be designed to have starting characteristics that will not cause an objectionable voltage drop or lighting flicker to other customers' service. Note that this also applies to infrequent motor starts or infrequent motor load swings. The Company is required to follow IEEE 1453-2015-Voltage fluctuation/flicker standard for the analysis of fluctuating installations on power systems.

The Company will install a power quality meter where there is suspected voltage flicker.

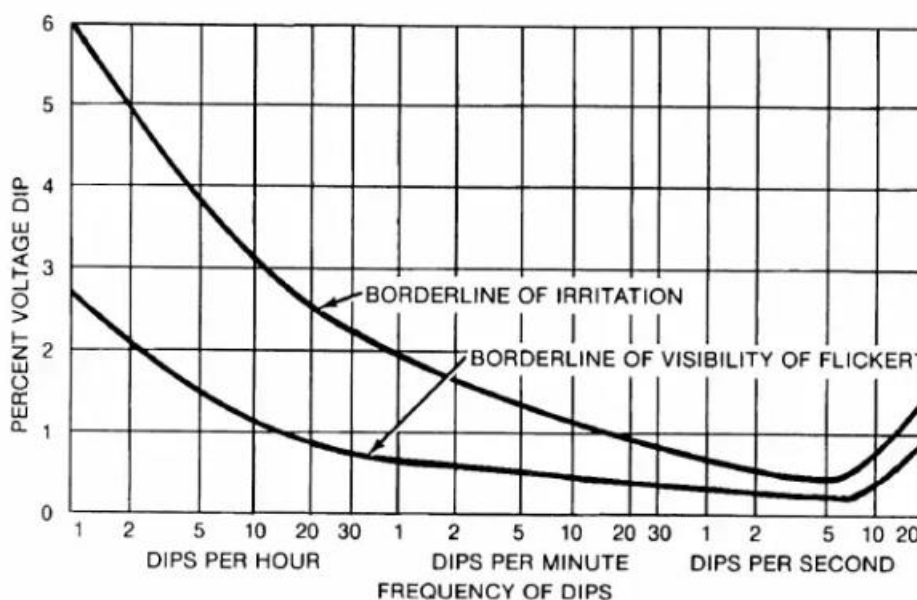


Figure A.1—Flicker tolerance curve from IEEE Std 141-1993/IEEE Std 519-1992

- Installations of motors used to drive equipment requiring a variable torque, such as compressors, reciprocating type pumps, sawmills, etc., shall be required to limit the variation of the motor current so it

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will not interfere with service to other customers. The Company reserves the right to require the customer to provide, at their expense, equipment to control the fluctuations within limits prescribed by the Company. The maximum allowable variation of motor current for each specific installation may be obtained upon application to the Company.

4. All customer-owned equipment shall be protected from excessive current which may result from overload, undervoltage, single-phase operation of three-phase motors (loss of phase), etc., with fuses, thermal cutouts, overload relays, or other protective devices designed to protect the individual motor. Undervoltage release coils shall be installed on all motors which require starting compensators. Reverse-phase relays and circuit-breakers or their equivalent are required on all elevator installations and are recommended on crane or other installations where phase reversal may cause damage or injury.
5. It is recommended that single-phase motors be connected for 240 volt operation, where feasible, to reduce lighting flicker for both the user and other customers.
6. If the size or number of motors contemplated is such that it necessitates the installation of special Company equipment to prevent interference with proper service, either to the customer using the service or to other customers, service to such motors will be delivered under the special facilities clause of the Company extension rules.

6-2.2 Water Heating

1. Water heaters may be connected to 120-volt or 240-volt service. Water heaters shall be equipped with thermostatically-controlled non-inductive heating elements. The maximum allowable wattage of the element is 1650 watts at 120 volts or 5500 watts at 240 volts. Water heaters having dual elements shall have them connected or interlocked to limit the connected load to the above limits.
2. Non-storage, instant recovery water heaters with wattages above 5500 watts may cause service interference. Special facility charges may be necessary to correct this interference.

6-2.3 Electric Space Heating

1. Electric space heating equipment may be connected to the general service meter under the residential or commercial rate.
2. Permanently installed electric space heating designed to operate at 120 volts shall be limited to 1650 watts controlled by a single thermostat. Electric space heating designed to operate at 240 volts and above shall be limited to 5500 watts per element. Multiple elements installed in or as part of a unit exceeding 5500 watts shall be energized in stages not to exceed 5500 watts per stage and at time intervals of not less than three seconds between each stage.

6-2.4 Electric Vehicle Charging Stations

Before any electric vehicle charging station is connected, the company should be contacted to determine if any company facilities will require upgrading; and any changes in the customer's wiring and in the Company's facilities necessary to permit operation under safe conditions and without interference to the service of other customers shall be completed.

The Company facilities are designed to provide sufficient capacity for normal system loads and load growth. Electric vehicle charging stations can create demand in excess of what would be considered normal.

6-2.5 Lighting Systems

Lighting systems utilizing ballasts or transformers as part of the fixtures or as auxiliary equipment to the fixtures which are installed as the major lighting source for a building, space or area shall maintain not less than 90 percent lagging power factor for individual units or the entire lighting installation.

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6-2.6 Electric Welders and Furnaces

Before any electric welder is connected, the company should be contacted to determine if any company facilities will require upgrading; and any changes in the customer's wiring and in the Company's facilities necessary to permit welder operation under safe conditions and without interference to the service of other customers shall be completed.

The Company facilities are designed to provide reasonably adequate voltage and sufficient capacity for normal system loads. If a welder creates voltage variations that exceed normal operating voltage limits, then these variations are not considered a violation of voltage codes (MI Rule 460.3702).

6-2.7 High-Frequency Apparatus

1. All wiring carrying high-frequency current used in connection with high-frequency apparatus shall be located as remotely as possible from the meter and wiring of the building. Motor generator sets supplying such apparatus shall be subject to the rules applying to motors. For the protection of meters supplying high-frequency apparatus, the Company may require the installation of an isolation transformer or suitable filters.
2. Equipment causing high-frequency current or harmonics must comply with IEEE Standard 519-Recommended practice and requirements for harmonic control in electric power systems.

6-2.8 Fire Protection Systems

See Appendix B for applicable code references. Options for Service from the Company:

- A. Source side tap in outside CT cabinet. CT cabinet cannot be near the main disconnect.
- B. Two separate services from the same transformer. One of these would be for the fire pump system. They cannot go to the same location on the building. This second service would be at a "special facilities" cost. This would involve at least two separate meters (main feed and the fire pump system).
- C. Customer runs two services, from the Company pad mounted transformer, if the Company has CT metering available in the pad mount (see Subsection 5-5).
- D. Separate transformer setting, just for the fire pump system. This would involve "special facilities" costs for the transformer, system, and service. This can be at a different voltage than the main feed.

6-3 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 or (517)
284-8100 Fax: (517) 284-8334

Section 7 – Interconnects and Distributed Generation

7-1 Standby Generation 2

7-2 Parallel Generation 3

7-1 Standby Generation

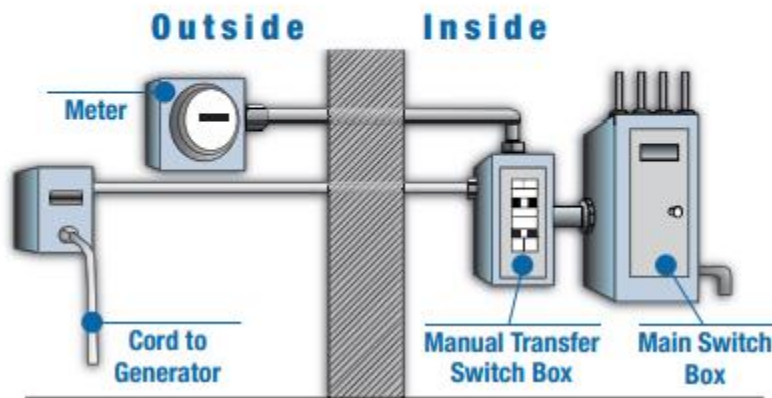
Permanent Generators:

The customer shall install an approved double-throw switch or throw over switches that are mechanically interlocked, are of adequate current and voltage rating and are so connected that the customer's generating equipment cannot energize the Company's supply lines. Refer to NEC articles 702 and 710. Must be rated as Service Entrance Equipment if ahead of the main and must be UL listed as a transfer switch under UL 1008.

- Before permanently installing a generator, contact your local electrical inspector and a qualified electrician to obtain the proper permits and connection criteria. Always read the Owner's Manual provided with your generator to obtain specific operating guidelines.

GENERATOR INSTALLATION

Below is an example of a properly installed generator.



- Permanent generators must meet local, state and national fire and electric codes and should only be installed by a licensed electrical contractor.
- There are several ways to connect your generator to your home's wiring circuit. However, the generator must be electrically isolated from the Company's distribution system.
 - A double-throw transfer switch, or similarly approved isolation switch, must be installed to isolate the generator from the Company's distribution system.
 - Be sure to obtain the proper electric permits and have your installations inspected.
 - The double-throw or throw over switch may be manually or automatically operated. Customer-owned generating equipment shall not operate in parallel with the Company's system except under specific contract with the Company covering the conditions of such operation.
 - Meter base mounted transfer systems are not allowed (GenerLink)
- Please notify the Company when installing a permanent generator for the safety of our utility personnel.

Portable Generators:

- Open the main breaker (or disconnect) on your panel when running a portable generator.
 - Never pull your electric meter to disconnect from the utility's distribution system.
 - A direct connection to the distribution system could result in great harm to utility personnel and cause damage to your home, neighboring homes and the generator, to which you will be liable.
- See Appendix B for general information on generator use.

7-2 Parallel Generation

Parallel Generation System:

A parallel generation system allows the transfer of electrical energy from the customer's generator into the Company's distribution system. Consult the Company for specific details. There are safety, liability, and contractual requirements.

Interconnection Process

Customer Project Planning Phase:

An applicant may contact the Company before or during the application process regarding the project. The Company can be reached by phone, e-mail, or by the external website to access information, forms, rates, and agreements.

Application

The Project Developer must first submit an Interconnection Application or a Combined Interconnection and Net Metering Application to the Company. A separate application is required for each Project, or Project site. The blank Interconnection Application or Combined Interconnection and Net Metering Application can be found on the Company website:

<https://www.uppco.com/residential/customer-generated-electricity/>

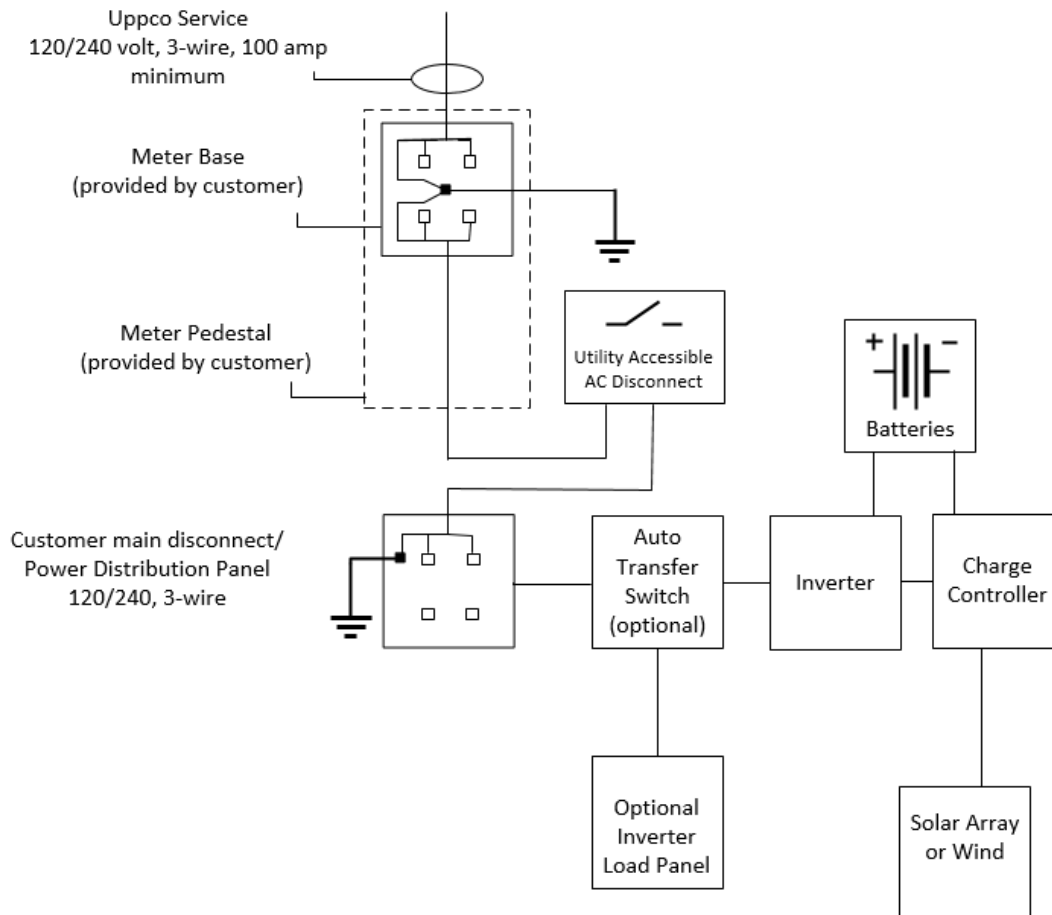
Design Example

Below is an example of a typical solar/wind parallel generation system. There are several notes about the system:

1. **Inverter:** Supply Make, Model and Power rating. Needs to be UL1741 and IEEE 1547 Compliant
2. **Utility Accessible AC Disconnect:** shall be lockable with visible open. Must also be clearly visible, labeled, accessible and within 10' of billing meter on the exterior of the building/home. The Company reserves the right to operate this switch if needed for circuit isolation.
 - a. The disconnect shown below can also be in between the inverter and customer power panel.
3. **Solar Panels:** Supply number of PV modules, make and model.
4. The output of the solar array (or wind generator) shall not be connected with any Company owned incoming service.
5. An auto transfer switch is required if the inverters are not automatically shut off in a power outage situation (loss of source power).
6. A state inspection will be required for any new solar/wind/generation installations.
7. This is only an example of a solar/wind connected system. Any design must be presented to the Company and approved by the Company distribution engineer.

7-2 Parallel Generation (Cont'd)

Example



Meter Install, Testing, & Inspection

Upon receipt of the local code inspection approval and Parallel Operating Agreement (POA) executed by the applicant, The Company will schedule the meter install, testing, and inspection. The Company shall have an opportunity to schedule a visit to witness commissioning tests required by IEEE 1547 and inspect the project. The Company may provide a waiver of its right to visit the site to inspect the project and witness the commissioning tests. The Company shall notify the applicant of its intent to visit the site, inspect the project, witness or perform the commissioning tests, or of its intent to waive inspection within 10 working days after notification that the installation and local code inspections have passed. Within 5 working days from receipt of the completed commissioning test report (if applicable), the Company will notify the applicant of its final approval or disapproval of the interconnection.

Operation in Parallel

Upon Company approval of the interconnection, the Company shall install required metering, provide to the applicant a written statement of final approval, and a fully executed POA authorizing parallel operation.

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Operational Provisions

Disconnection

The Company may refuse to connect, or may disconnect, a project from the distribution system if any of the following conditions apply:

7-2 Parallel Generation (Cont'd)

1. Applicant has not complied with any one of the technical requirements contained in the applicable Interconnection Procedures,
2. The electrical characteristics of the Applicant Facility are not compatible with the electrical characteristics of the Company distribution system,
3. An emergency condition exists on the Company distribution system,
4. Applicant's protective relay equipment fails,
5. The Company determines that the Applicant Facility is disrupting service to any Company customer,
6. Disconnection is required to allow for construction, installation, maintenance, repair, replacement, removal, investigation, inspection or testing of any of Company's facilities,
7. If a required installation fails, or becomes incapacitated, and is not repaired in a timely manner, as determined by the Company,
8. Applicant commits a material breach of the POA.

Maintenance and Testing

The Company reserves the right to test the relaying and control equipment that involves protection of the Company electric system whenever the Company determines a reasonable need for such testing exists. The Project Developer is solely responsible for conducting and documenting proper periodic maintenance on the generating equipment and its associated control, protective equipment, interrupting devices, and main Isolation Device, per manufacturer recommendations. The Project Developer is solely responsible for routine and maintenance checks of the relaying and control equipment that must be conducted in accordance with provided written test procedures which are required by IEEE Std. 1547 and test reports of such testing shall be maintained by the Project Developer and made available for Company inspection upon request. [NOTE – IEEE 1547 requires that testing be conducted in accordance with written test procedures, and the nationally recognized testing laboratory providing certification will require that such test procedures be available before certification of the equipment.]

Periodic test reports or a log for inspection shall be maintained and provided to the Company upon written request.

Operating in Parallel

The Project Developer will be solely responsible for the required synchronizing equipment and for properly synchronizing the Project with the Company electric system. Voltage fluctuation at the Point of Common Coupling (PCC) during synchronization is limited per IEEE std. 1547.

These requirements are directly concerned with the actual operation of the Project with the Company:

- The Project may not commence parallel operation until final approval has been given by the Company. The completed installation is subject to inspection by the Company prior to approval. Preceding this inspection, all contractual agreements must be executed by the Project Developer.

- The Project must be designed to prevent the Project from energizing into a de-energized the Company line. The Project's circuit breaker or contactor must be blocked from closing in on a de-energized Company distribution system.
- The Project shall discontinue parallel operation with a particular service and perform necessary switching when requested by the Company for any of the following reasons:
 1. When public safety is being jeopardized.

7-2 Parallel Generation (Cont'd)

2. During voltage or loading problems, system emergencies, or when abnormal sectionalizing or circuit configuration occurs on the Company system.
3. During scheduled shutdowns of the Company equipment that are necessary to facilitate maintenance or repairs.
4. In the event there is demonstrated electrical interference (i.e. Voltage Flicker, Harmonic Distortion, etc.) to the Company customers, suspected to be caused by the Project, and such interference exceeds then current system standards, the Company reserves the right to install special test equipment as may be required to perform a disturbance analysis and monitor the operation and control of the Project to evaluate the quality of power produced by the Project. In the event that no standards exist, then the applicable tariffs and rules governing electric service shall apply. If the Project is the source of the interference, and that interference exceeds Company standards or generally accepted industry standards, then it shall be the responsibility of the Project Developer to eliminate the interference problem.
5. When either the Project or its associated synchronizing and protective equipment is demonstrated by Company to be improperly maintained, so as to present a hazard to the Company system or its customers.
6. Whenever the Project is operating isolated with other Company customers, for whatever reason.
7. Whenever the Company notifies the Project Developer in writing of a non-safety related violation of the Interconnection Agreement and the Project Developer fails to remedy the violation within 10 working days of notification.

If the Project has shown an unsatisfactory response to requests to separate the generation from the Company system, the Company reserves the right to disconnect the Project from parallel operation with the Company electric system until all operational issues are satisfactorily resolved.

Appendix A

UPPCO Meter Base Requirements

1. 100-200 Amp Single-Phase UG

- Requirements:
 - a. Ringless Type Meter Socket
 - b. Outdoor Enclosure (Nema type 3R)
 - c. 1 Phase, 3-Wire
 - d. 4 Jaw Meter Socket
 - e. Horn Bypass
 - f. Sealable
 - g. No cover over meter
 - h. UL Listed
- Options:
 - Schneider Electric
 - UHT-RP2423-63
 - Extension: 1007680 (18") or 1008786 (30")
 - Available at Standard Electric
 - Cutler Hammer
 - UHT-RP2423-63-CH
 - Extension: 1007680-CH (18") or 1008786-CH (30")
 - Available at Menards
 - Midwest
 - UHT-RP2423-63-MEP
 - Extension: 1007680-MEP (18") or 1008786-MEP (30")
 - Landis & Gyr (Siemens)
 - UAP317-PPWI
 - Extension: 18" kit = 5007726 30" kit = 5007727
 - Millbank
 - U3358-0-KK
 - Extension: 15" K5800
 - Available at Westphal Electric
 - U1980-O-KK (Conduit entry)
 - Must have slip joint
 - Must have elbow below ground level
 - Minimum 2" conduit size
 - Midwest (100 Amp)
 - R101CP6

2. 100-200 Amp Single-Phase UG with Main

- Requirements:
 - Ringless Type Meter Socket
 - Outdoor Enclosure (Nema type 3R)
 - 1 Phase, 3-Wire
 - 4 Jaw Meter Socket
 - Horn Bypass
 - Sealable
 - No cover over meter
 - UL Listed
 - Options/Examples:
 - Milbank
 - NU8980
 - K3701 connector block required to replace breaker
 - U3358-O-KK
 - K3082 set screw connector kit required.
 - U5925-O-200-KK
 - Meter main with load center
 - Cutler Hammer
 - 1008846-CH
 - Extension: 1009021-CH (18") or 1009024-CH (30")
 - Available at Wesco
 - Eaton
 - MHR100P Series
 - MHR100P Series Extension: CHPEDEXT100
 - MHR200P Series
 - MHR200P Series Extension: MHPEDEXT
 - ~~MHR200P1MMBPH~~ (Main breaker and 8 spaces)
 - **Removed due to poor locking mechanism**
 - Available at Menards & All-Phase
 - Siemens (Main breaker and 20 space circuit)
 - MC2040B1200RJBC (add extension)
 - Available at Home Depot
 - **Mobile homes:**
 - Milbank U5844-PXL-200
 - Eaton MB816B200BTSD

3. 100-200 Amp Single-Phase OH

- Requirements:
 - a. Ringless Type Meter Socket
 - b. Outdoor Enclosure (Nema type 3R)
 - c. 1 Phase, 3-Wire
 - d. 4 Jaw Meter Socket
 - e. Horn Bypass
 - f. Sealable
 - g. No cover over meter
 - h. UL Listed
- The Company has no list of approved sockets for this application. The meter base shall meet the requirement above and be securely mounted. NEC 110.13(A)

4. 320 Class / 400 Amp Single-Phase OH

- Requirements:
 - a. Ringless Type Meter Socket
 - b. 4 Jaw Meter Socket
 - c. 320A Continuous, 400A Max
 - d. Outdoor Enclosure (Nema type 3R)
 - e. Bypass Lever
 - f. Rated 600V AC
 - g. Sealable
 - h. 1 Phase, 3-Wire
 - i. No cover over meter
 - j. UL Listed
- The Company has no list of approved sockets for this application. The meter base shall meet the requirement above and be securely mounted. NEC 110.13(A)

5. 320 Class / 400 Amp Single-Phase UG

- Requirements:
 - a. Ringless Type Meter Socket
 - b. 320A Continuous, 400A Max
 - c. Rated 600V AC
 - d. Outdoor Enclosure (Nema type 3R)
 - e. 1 Phase, 3-Wire
 - f. 4 Jaw Meter Socket
 - g. Bypass Lever
 - h. Sealable
 - i. No cover over meter
 - j. UL Listed
- Options/Examples:
 - Milbank
 - U1748-O-WI
 - U4363XQGK3K2
 - Extension: S1848
 - Available at All-Phase

- Schneider Electric
 - 1009018
 - Extension: 1009023 (18") or 1009026 (30")
- Cutler Hammer
 - 1009018-CH
 - Extension: 1009023-CH (18") or 1009026-CH (30")
 - Available at Menards
- Midwest
 - 1009018-MEP
 - Extension: 1009023-MEP (18") or 1009026-MEP (30")
- Durham
 - 1009018
 - Extension: 1009023 (18") or 1009026 (30")
- Landis & Gyr
 - 47604P-9WI

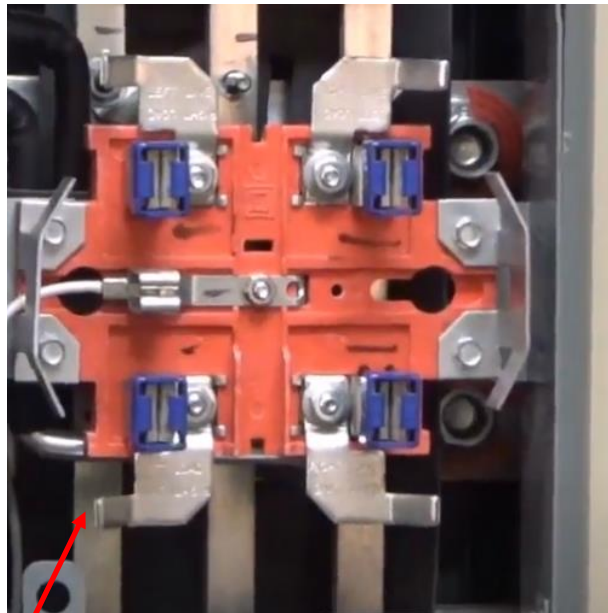
6. 320 Class / 400 Amp Single-Phase UG with two 200A Main Breakers

- Requirements:
 - a. Ringless Type Meter Socket
 - b. 4 Jaw Meter Socket
 - c. 320A Continuous, 400A Max
 - d. Bypass Lever
 - e. Rated 600V AC
 - f. Sealable
 - g. 1 Phase, 3-Wire
 - h. UL Listed
- Options/Examples:
 - Durham
 - 1009017
 - Extension: 1009022 (18") or 1009025 (30")
 - Cutler Hammer
 - 1009017-CH
 - Extension: 1009022-CH (18") or 1009025-CH (30")
 - Available at Menards
 - Milbank
 - U3849-0-2/200
 - U3849-0-INV
 - (no extension available)
 - Available at All-Phase

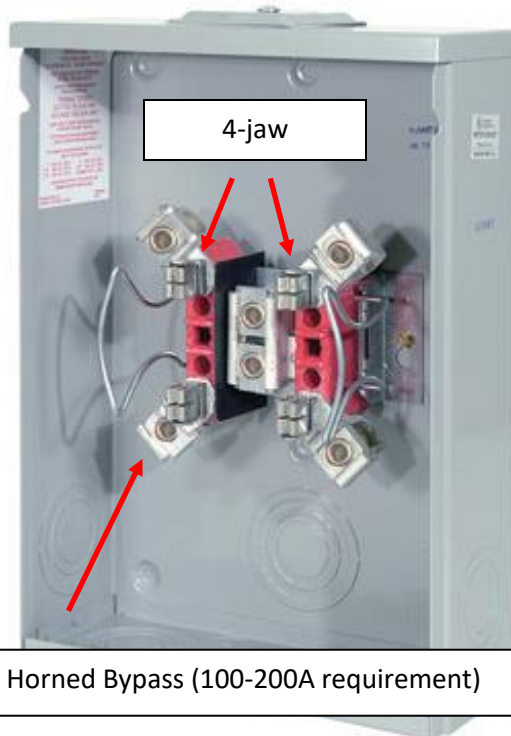
7. Multi-occupancy dwelling

- Requirements:
 - a. Ringless Type Meter Socket
 - b. Outdoor Enclosure (Nema type 3R)
 - c. 1 Phase, 3-Wire
 - d. 4 Jaw Meter Socket
 - e. Horn Bypass
 - f. Sealable
 - g. No cover over meter
 - h. UL Listed
- Options/Examples:
 - Siemens
 - WP6412 Uni-Pak (1ph - 120/240, 600a)
 - 1. Available at Menards
 - Square D
 - EZ Meter Pak series -
 - 1. EZM31600GCBU (3ph – 120/208, 1600a)
 - 2. EZMH113125 (1ph - 120/240, 125a)
 - 3. MPH22125 – two sockets (1ph - 120/240, 125a)
 - 4. EZML112225 (1ph – 120/240, 225a)
 - 5. EZM1800TB (800a terminal box)
 - 6. Available at Graybar and Standard Electric

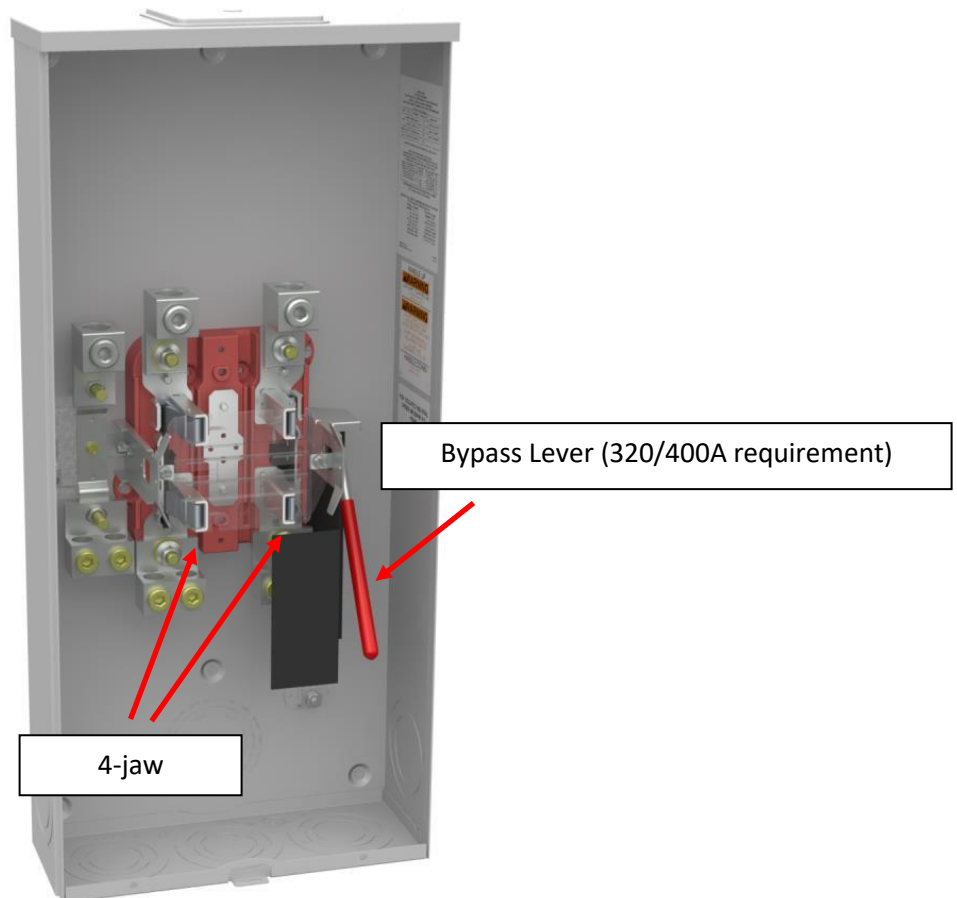
Examples:



Horned Bypass (100-200A requirement)
5 jaw network meter socket



Horned Bypass (100-200A requirement)



Appendix B – Helpful Info:

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B-1 State Code Information

Michigan Rule 460.3301 Metered Measurement of Electricity Required; Exceptions

1. All electricity that is sold by a utility shall be on the basis of meter measurement, except where the consumption can be readily computed or except as provided for in a utility's filed rates.
2. Where practicable, the consumption of electricity within the utility or by administrative units associated with the utility shall be metered.

Michigan Rule 460.3505 Utility Line Clearance Program

Each utility shall adopt a program of maintaining adequate line clearance through the use of industry-recognized guidelines. A line clearance program shall recognize the National Electric Safety Code standards that are adopted by reference in R 460.811 et seq. The program shall include tree trimming.

Michigan Rule 460.3605(2) Metering Electrical Quantities

Every reasonable effort shall be made to measure at one point all the electrical quantities necessary for billing a customer under a given rate.

Michigan Rule 460.3702 Standard Nominal Service Voltage; Limits; Exceptions

1. Each utility shall adopt and submit standard nominal service voltages.
2. With respect to secondary voltages, the following provision shall apply:
 - a. For all retail service, the variations of voltage shall be not more than 5% above or below the standard nominal voltage as submitted pursuant to subrule (1) of this rule, except as noted in subrule (4) of this rule.
 - b. Where 3-phase service is provided, the utility shall exercise reasonable care to ensure that the phase voltages are balanced within practical tolerances.
3. With respect to primary voltages, the following provisions shall apply:
 - a. For service rendered principally for industrial or power purposes, the voltage variation shall not be more than 5% above or below the standard nominal voltages as submitted pursuant to subrule (1) of this rule, except as noted in subrule (4) of this rule.
 - b. The limitations in subdivision (a) of this subrule do not apply to special contracts in which the customer specifically agrees to accept service with unregulated voltage.
4. Voltages outside the limits specified in this rule shall not be considered a violation if the variations are infrequent fluctuations or occur from adverse weather conditions, service interruptions, causes beyond the control of the utility, or voltage reductions that are required to reduce system load at times of supply deficiency or loss of supply.

Michigan Rule 460.813 Standards of Good Practice; Adoption by Reference

Parts 1, 2, and 3 and sections 1, 2, 3, and 9 of the National Electrical Safety Code, 1997 edition (ANSI-C2-1997), are adopted by reference in these rules as standards of accepted good practice. Parts 1, 2, and 3 and sections 1, 2, 3, and 9 of the National Electrical Safety Code, 1997 edition (ANSI-C2-1997) are available from the Michigan Public Service Commission, P.O. Box 30221, Lansing, MI 48909, (at a cost), or from the Institute of Electrical and Electronics Engineers, Service Center, P.O. Box 1331, Piscataway, NJ 08855-1331, (at a cost).

B-2 Lightning Protection

Lightning damage due to induced electrical surges from nearby lightning strikes is a common problem. Glaciated sand or gravel soil, common to the area, creates poor grounding conditions. 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.

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B-3 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

*Note: Costs noted in the above table are based on average fuel rates and are for informational purposes only.

Using a Generator:

- There are several ways to connect your generator to your home's wiring circuit. However, the generator must be electrically isolated from Uppco's distribution system.
 - A double-throw transfer switch, or similarly approved isolation switch, must be installed to isolate the generator from Uppco's distribution system.
 - Be sure to obtain the proper electric permits and have your installations inspected.
 - The double-throw or throw over switch may be manually or automatically operated. Customer-owned generating equipment shall not operate in parallel with the Company's system except under specific contract with the Company covering the conditions of such operation.
- Never operate a generator in your home, garage, basement or any other enclosed area.
- A generator should be at least 4 feet from enclosed areas, doors, windows, and fresh air intakes where exhaust fumes and carbon monoxide can enter the home. Proper ventilation is critical.
- A temporary canopy can be constructed over the portable generator to keep it dry. Leave adequate room for proper ventilation.
- Always read the owner's manual carefully following all manufacturer instructions and precautions before starting and operating your generator.
- Overloading your generator can cause damage to the generator and any connected appliance or component.
 - By alternating your appliances, you can stay within your portable generator's output.
- Start your generator before connecting appliances or equipment.
- Before shutting down your generator, turn off connected equipment.
- Most refrigerators and freezers are good for about 24 hours if the door is not opened. Beyond that, four to six hours of run time on a generator is usually adequate per day. Follow good food preservation practices, as suggested by "The Extension Service" or other similar authorities.
- Never plug a portable generator into a wall outlet; you could damage your home's wiring

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- When using a portable generator, connect appliances to the generator using flexible extension cords with current ratings adequate for the appliances being served.
- A double-throw transfer switch is not required when a portable generator serves appliances via a properly rated extension cord, i.e., refrigerators, freezers, space heaters, etc.

If you are installing a permanent standby generator system, consult an expert. There are other potential problems in addition to the need for the transfer switch. One problem is Ground Fault Interrupters (GFI's) installed on most portable generators. Another problem is that some generators are rated to only supply 240 volt or 120 volt loads and not both at the same time (120 / 240 rating-center tapped).

Care also needs to be taken in sizing generators. Normally, generators must be oversized to handle the in-rush of a starting motor. Also, they need to be oversized if there is a lot of electronic load on it. A special concern with electronic loads is the operation of the generator as it runs out of fuel (the internal voltage regulation may not be able to protect electronic equipment connected to the generator).

B-4 Basic Calculations

Full-Load Currents

Single Phase				
KVA	120	240	277	480
5	41.7	20.8	18.1	10.4
10	83.3	41.7	36.1	20.8
15	125	62.5	54.2	31.3
25	208	104	90.3	52.1
37.5	313	156	135	78.1
50	417	208	181	104
75	625	313	271	156
100	833	417	361	208
167	1392	696	603	348
250	2083	1042	903	521
333	2775	1388	1202	694
500	4167	2083	1805	1042
Full Load Current = $\frac{\text{KVA} \times 1000}{\text{Circuit Voltage}}$				

Three Phase			
KVA	208	240	480
15	41.6	36.1	18.0
30	83.3	72.2	36.1
45	125	108	54.1
75	208	180	90.2
112.5	312	271	135
150	416	361	180
225	625	541	271
300	833	722	361
500	1388	1203	601
750	2082	1804	902
1000	2776	2406	1203
1500	4164	3609	1804
2000	5552	4811	2406
2500	6940	6014	3007
3000	8327	7217	3609
Full Load Current = $\frac{\text{KVA} \times 1000}{1.732 \times \text{Circuit Voltage}}$			

Ohms Law: $V = IR$ $I = \frac{V}{R}$ $R = \frac{V}{I}$

Power (P) – $VI = I^2R = \frac{V^2}{R}$

$\text{KVA} = \sqrt{(\text{KW})^2 + (\text{KVAR})^2}$
 $\text{KW} = \text{pf} \times \text{KVA}$ pf = power factor

1 HP = 746 watts

Rough 50 Hz Rated Motor Conversions

6/5 of HP rating for 60 Hz operation
 6/5 of voltage rating for 60 Hz operation
 50 Hz Std. Voltage is 220/380 which is
 Similar to 277/480 at 60 Hz.

Formula for Timing an Electric Meter that has a Disc:
 $\text{Watts} = \frac{(3600)(\# \text{ of revolutions})(Kh)(\text{multiplier})}{(\text{Seconds})}$

$\text{RPM} = \frac{120 \times \text{frequency}}{\# \text{ of poles}}$

Kh comes off of the meter nameplate.

Multiplier is 1 on smaller installations. Large installations should have a well-marked multiplier.

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B-5 Maximum Fault Currents

Voltage	Entrance Size	Pole or Pad Mounted Transformer	Fault Current at Transformer	Fault Current with 25 foot Service	Fault Current with 50 foot Service	Fault Current with 75 foot Service	Fault Current with 100 foot Service	Assumed Service Conductors	X/R Values at Secondary Side of Transformer		Assumed Transformer Size
									With Pole Transformer	With Pad Mounted Transformer	
Single Phase 120/240	200	Either	(3) 4,500	4,300	4,100	3,900	3,800	3c3/0	1.0	0.9	15
	200	Either	(3) 7,900	7,400	6,900	6,500	6,100	3c3/0	1.4	1.4	25
	200	Either	14,300	12,800	11,600	10,500	9,500	3c3/0	2.0	1.6	50
	400	Either	25,500	22,700	20,300	18,400	16,700	3c350	2.3	2.4	100
	600	Either	39,600	35,500	29,500	29,000	24,700	2-3c350	12.9	19.6	167
	800	Either	49,900	46,600	43,600	40,900	38,000	6-700	22.9	14.2	250
Three Phase 120/208	200	Either	15,800	12,200	9,800	8,100	6,900	4c3/0	1.4	2.3	75
	400	Either	35,500	27,600	21,700	17,600	14,800	4c350	2.0	8.9	150
	600	Either	57,300	42,100	32,700	26,500	22,300	2-4c350	2.3	9.1	300
	800	Either	57,300	48,800	42,100	36,800	32,700	8-700	2.3	9.1	300
	1200	Either	71,600	64,500	58,600	53,600	49,200	16-700	12.9	12.8	500
	1600	Either	71,600	65,900	60,900	56,600	52,700	20-700	12.9	12.8	500
	2000	Pad Mounted	71,600	66,800	62,500	58,700	55,200	24-700	xx	14.6	750
	2000	Pole	99,700	90,800	83,100	76,400	70,600	24-700	20.2	xx	3-250
Three Phase 277/480	200	Either	13,300	12,300	11,300	10,400	9,600	4c3/0	2.0	13.1	150
	400	Either	25,100	22,800	20,800	19,100	17,600	4c350	2.8	17.5	300
	600	Either	34,500	31,600	29,100	26,900	24,900	2-4c350	6.6	15.9	500
	800	Pad Mounted	34,500	33,000	31,600	30,300	29,000	8-700	xx	11.5	750
	800	Pole	38,000	36,400	34,800	33,200	31,800	8-700	14.9	xx	3-250
	1200	Pad Mounted	34,500	33,700	33,000	32,300	31,600	16-700	xx	11.9	1000
	1200	Pole	47,800	46,400	45,100	43,900	42,700	16-700	25.3	xx	3-333
	1600	Pad Mounted	34,500	33,900	33,300	32,700	32,200	20-700	xx	12.2	1500
	1600	Pole	60,700	58,900	57,300	55,700	54,100	20-700	26.9	xx	3-500
	2000	Pad Mounted	46,200	45,400	44,500	43,700	42,900	24-700	xx	13.3	2500
	3000	Pad Mounted	46,200	45,500	44,800	44,100	43,500	28-1000 cu	xx	13.3	2500

Note: This Table Applies Only for Cases with One Service Fed from a Transformer

Notes:

1. WARNING: This information assumes a dedicated transformer feeding one customer. If a transformer feeds a large entrance and a small service is also tapped from that transformer, the fault current will be much higher than shown here for the small entrance. Call the Company for information in this case.
2. These tables are worst-case fault currents. Fault currents depend on distance from substation, type of feeder, type (overhead vs. underground) and size of transformer, size and length of service, etc. Call the Company for information on specific locations, sizes and voltages not given.
3. Minimum of 22 kA service entrance equipment required.
4. Meter sockets are exempt from fault current requirements per NEC 230.66, manufacturer testing issues.

Mobile Home Services

Mobile Home General Information

1. Definition:

A mobile home as defined by the NEC 550.2 is as follows: "A factory assembled structure or structures transportable in one or more sections, that is built on a permanent chassis and designed to be used as a dwelling without a permanent foundation where connected to the required utilities, and that includes the plumbing, heating, air conditioning, and electric systems contained therein." Mobile homes can be identified by a red rectangular Department of Housing and Urban Development (Federal HUD) inspection label on the outside corner of the home. Manufactured homes (Ex. Wausau Home), on the other hand, can be identified by a state inspection sticker on the electrical panel or inside of the closet door or similar location. These are often referred to as UDC homes (Uniform Dwelling Code).

2. General Code:

Mobile homes are built and inspected by the Federal Department of Housing and Urban Development. The external electrical wiring for mobile homes is covered by State Electrical Inspection requirements. As per the electrical code, a mobile home is always a mobile home. That is different than many local zoning ordinances. Zoning ordinances often allow mobile homes to be redefined if they are mounted on a permanent foundation. The external electrical wiring requirements for a mobile home are covered under NEC 550 with specific information on the service entrance equipment under NEC 550.32.

3. Practical Effect:

Mobile homes must be fed with an external electrical meter and external disconnect as per NEC 550.32. The NEC also requires provisions for a feed from that disconnect to an accessory building or other piece of equipment (such as a well). Provisions should also be made for a 15 or 20 amp, 120 volt GFI outlet. The NEC requires the disconnect to be located in sight of the mobile home and not more than 30 feet away. The electrical meter and disconnect cannot be attached to the mobile home (can be fastened to a permanent foundation or basement). The wiring from this external service entrance equipment into the mobile home must be four conductor (two hots, a neutral, and an equipment ground (green or bare)). The NEC requires this conductor to be in conduit where exposed under the mobile home.

The only way around the external disconnect is if the mobile home is mounted on a permanent basement. In this case you are actually feeding electricity to the basement with a sub feed to the mobile home. Crawl spaces do not work for this because of the head room requirement of 6.5 feet as per NEC 110.26. Also note that NEC 230.70(A)(1) requires the main disconnect to be located "nearest the point of entrance of the service conductors." Yet another issue is that the electrical panel in many mobile homes is not rated as "Service Entrance" equipment.

Multiple Metering

Code allows multiple service entrances as long as there is only one service drop or service lateral per voltage class (generally the utility's system). This allows multiple sites for main disconnects, but all of the metering must be at one location. The Company requires a single termination point unless multiple termination points are mutually beneficial. Note that code defines it as one service drop as long as it starts at a common bus, follows the same route, and terminates beside each other. (NEC 230.2 & 230.40). Consult your local inspector on any of these installations. (See also subsection 3.8).

Conduit Policy for Underground Services

Because of settling problems, it is necessary to provide adequate compaction under the normal UG service conductor depth (30") for disturbed soils. This needs to be done with sand or gravel. Frozen material and un-compacted clay are not acceptable.

The conduit shall be limited to a maximum of 270 degrees of total bends. This means 3-90 degree bends or 2-90 degree and 2-45 degree bends. The maximum length of the conduit run shall be 75 feet (shorter for very large entrances such as

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1600 amps and up). Anything with more bends or longer lengths needs Regional Engineer involvement. Note that large entrances are limited to less than 75 feet to avoid voltage problems or damage when pulling the cables.

Conduit shall be buried at least 24 inches deep. If problems are encountered, consult NEC Table 300.5. Note that NEC 300.5(D) requires exposed PVC conduit to be Sch. 80 from 18 inches below ground to 8 feet above ground.

Fire Protection Systems Codes

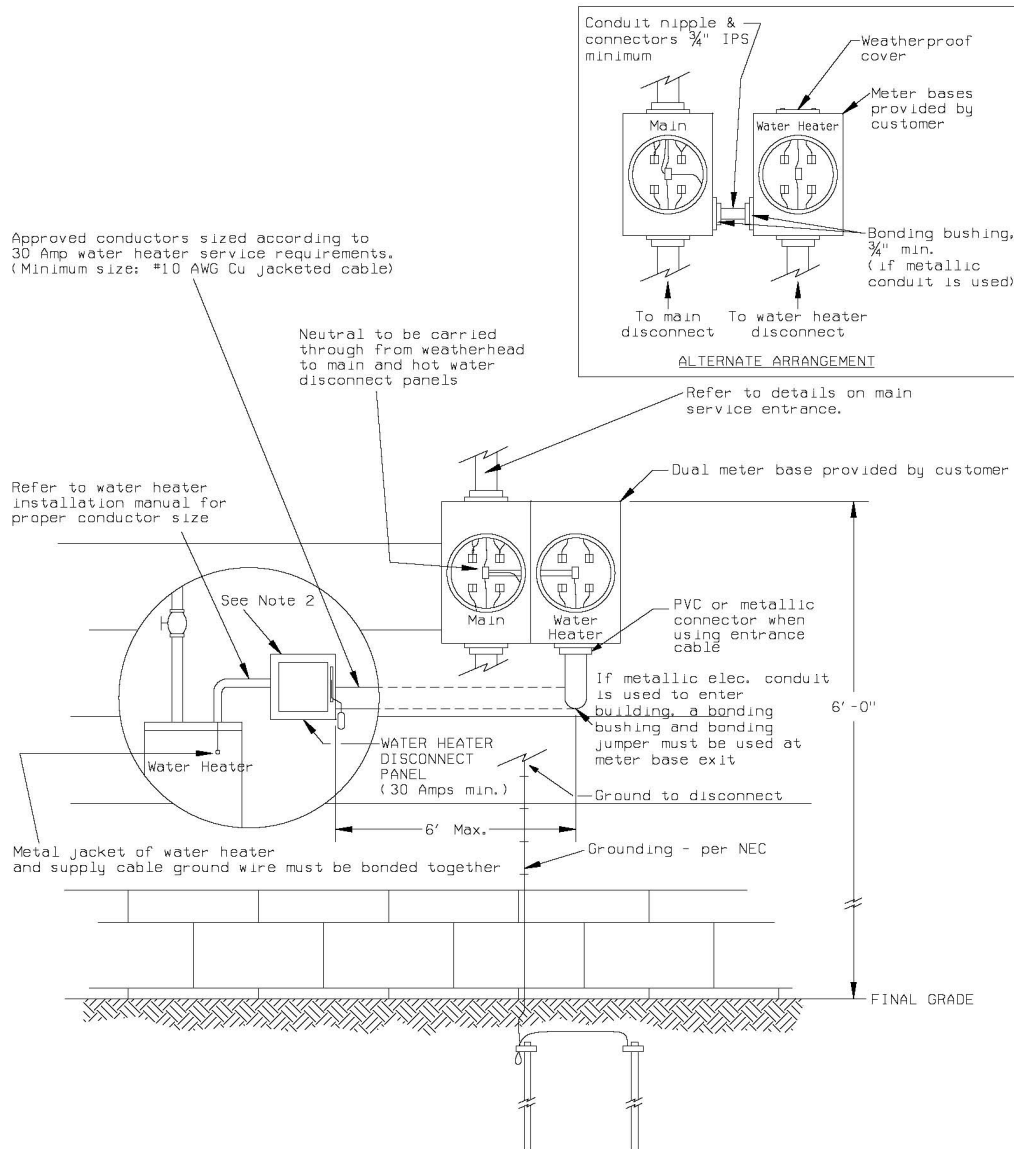
Codes (some of the codes that may apply):

NEC 230.1(A)(1)	Allows an additional service for a fire pump.
NEC 230.72(A)Excep.	Allows the fire pump disconnect to be remote from the other disconnects.
NEC 230.82(5)	Allows a tap to the Supply Side of the service disconnect for fire pump equipment and fire alarms and sprinkler alarms.
NEC 230.94 Excep. #4	Allows for separate overcurrent protection device tapped supply side of the service overcurrent device for fire pumps and fire alarm systems.
NEC 695.3(A)	Source must be capable of supplying locked rotor current plus associated equipment. This is not normally an issue with the utility source (primary system capacity).
NEC 695.3(A)(1)	Does not allow the fire pump system to be tapped inside of the service entrance disconnecting enclosure. This means that the fire pump tap cannot be made inside of the building or in a weatherproof, main disconnect, service entrance enclosure located outside. The only options are a separate CT cabinet on the outside. This CT cabinet can also not be located right next to an outdoor rated disconnect, for the rest of the building. The only other option is a tap at the transformer or a totally separate feed. This is new in 2005. Look at the actual wording of the NEC for specific details.
NEC 695.4(B)(1)	Requires the overcurrent protection for the fire pump system to handle full locked rotor current continuously. It does not require the conductor or other devices such as the utility transformer to be rated for full locked rotor current. This means that the conductor may be rather small for most pumps.
NEC 695.4(B)(2)	Requires the fire pump disconnect not to be located within enclosures that feed other loads. It must also be located remote from other disconnecting means to reduce the chance of accidental operation. The next couple sections further define this and labeling requirements. This section requires the fire pump disconnect to be lockable in the closed position.
NEC 695.5(A)	This section deals with customer-owned transformers feeding the fire pump system. This transformer must be able to supply 125% of the normal load current of the pump plus 100% of associated equipment.
NEC 695.6(A)	Requires the service entrance conductors for fire pumps to be located outside of the building with only a few, very special exceptions.
NEC 695.7	Motor voltage shall not drop more than 15% on starting on the output of the controller (reduced voltage starter or SCR drive). The maximum voltage drop at 115% of load is 5%. These stipulations may be a problem with large 120/208 motors, without reduced voltage starter or SCR drives.

Appendix C - Maintenance Only Information

C – 1 Residential Electric Water Heater Service Entrance (Maintenance Only)

FOR MAINTENANCE – NO LONGER AVAILABLE



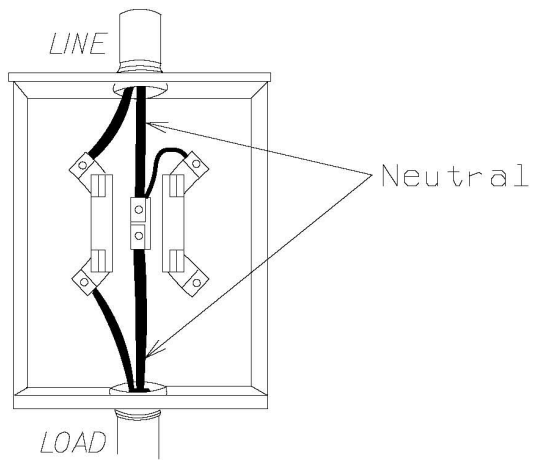
Notes:

1. Location of entrance to be determined by the Company and coordinated with customer prior to installation.

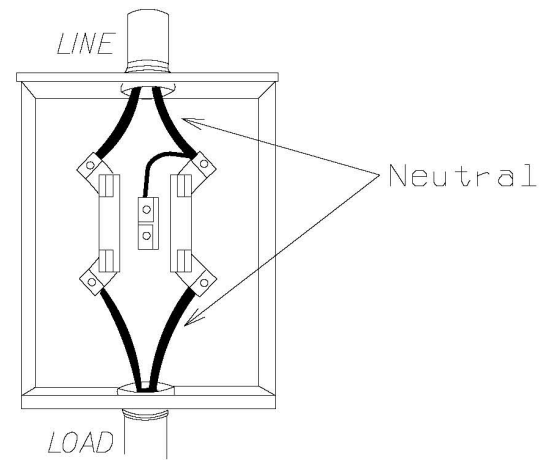
2. If the main service disconnect is grounded to the water supply line, then a minimum 10 AWG ground wire must be installed between the water heater disconnect panel and the main service panel.

C – 2 120 Volt Meter Socket (Maintenance Only)

FOR MAINTENANCE – NO LONGER AVAILABLE



Preferred



Alternate

(Use care when jumpering out!)

Wired for 2-wire, 120 Volt Service

C – 3 Foundation Penetrations**FOR MAINTENANCE – NO LONGER AVAILABLE**

The Company will no longer run its conductors through a basement wall because all new meters must be installed outside. For existing meters located inside buildings, the below diagrams show how to and how not to deal with water seepage through basement walls.

