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# **ELECTRIC**

## SERVICE MANUAL

### **2023**



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### **2023**



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REVISIONS MADE TO THE 2023 ELECTRIC SERVICE MANUAL

2023 MANUAL PAGE	SECTION	ITEM	REVISION
Various 9	1.0 AVAILABILITY AND CHARACTERISTICS OF SERVICE	Extension Policies	Update all instances of MEC to Company.  Changed link to " <a href="https://www.midamericanenergy.com/rates-tariffs">https://www.midamericanenergy.com/rates-tariffs</a> "
13	3.1 AVAILABLE FAULT CURRENT INFORMATION GUIDE	NEW PAGE	NEW PAGE
14	3.2 OVERHEAD TRANSFORMER AVAILABLE FAULT CURRENT	NEW PAGE	NEW PAGE
15	3.3 Padmount Transformer Available Fault Current	NEW PAGE	NEW PAGE
16	4.0 MOTORS AND SPECIAL EQUIPMENT	Introduction	Change sentence to read: "For all motor installations greater than five horsepower, customers are required to fill out the motor data form provided by your local distribution engineering representative. Contact your local distribution engineering representative with the completed form. "
16	4.0 MOTORS AND SPECIAL EQUIPMENT	Guidelines for Motor Sizes	Added Sentence to Guidelines for Motor Sizes table: "5 horsepower and smaller": "Air conditioning units shall be limited to a Locked Rotor Amps (LRA) of 100 amps. LRA exceeding 100 amps may impair service voltage and require additional facilities necessary to provide adequate service. Cost of excess facilities will be at the expense of the customer to remediate."
19	5.0 SERVICE INFORMATION	Customer Responsibility	Removed point "Electrical service entrance diagram and location"
19	5.0 SERVICE INFORMATION	Customer Responsibility	Change sentence to read: " A completed service application."
20	5.0 SERVICE INFORMATION, continued	New Section - Requirements for Scheduled Work for Service	New Section
21	6.0 SERVICE AND SERVICE ENTRANCES (General)	One Service	Changed sentence to read: "Unless stated otherwise in the rate, price schedule, or tariff, the Company will normally permit only one service per structure."
21	6.0 SERVICE AND SERVICE ENTRANCES (General)	Customer Supplied Equipment	Changed sentence to read: "The customer must provide, install and maintain the additional equipment necessary for the service, including the meter socket and any required weather proof placards."
23	6.0 SERVICE AND SERVICE ENTRANCES	Meter Location	Added a bullet point: "A weatherproof placard with minimum 3/4 inch etching lettering labeling the address of service must be installed on standalone meter structures."
24	6.1 OVERHEAD SERVICE	Requirements	Added Sentence: "Where not accessible by a service truck, overhead service attachment must not exceed 18' above ground level."
25	6.2 UNDERGROUND SERVICE	Residential Service	<p>Changed substation to read: "Underground service to individual residential dwellings and duplexes will normally be installed, owned and maintained by the Company. The Customer has the option to install a residential service initially per the requirements below and in Appendix G. The service will become the property of the Company once the service is approved and placed in service. This includes individual residential structures on zero-lot line properties.</p> <p>Services to residential multi-plex structures (more than two residential units on a connected structure) will be furnished, installed, owned and maintained by the Customer. Meters must be grouped with multi-meter equipment unless required by the local jurisdiction to be split out to individual meters per unit. Individual services on a multi-plex structure will be furnished, installed, owned and maintained by the Customer.</p> <p>For zero-lot line residential structures, the customer is required to install a conduit system for all primary and secondary cable routes in a manner satisfactory to the Company."</p>
25	6.2 UNDERGROUND SERVICE	Customer Installed, Residential Service	Added Bullet 4: "Customer-installed, Company-owned cable MUST match service size conductor referenced in Appendix G Section 5.1. Incorrect wire types will be re-installed by the company at the customer's expense."
25	6.2 UNDERGROUND SERVICE	Customer Installed, Residential Service	Added Bullet 5: "The customer or contractor must call the Company and schedule a site review after the service cable is installed. Both ends of the trench, at the electric meter and at the Company's enclosure, must be left open for the review. Ends of the red marking tape must be exposed at both ends of the trench. The bottom end of the riser pipe must be visible at the meter end of the trench."
25	6.2 UNDERGROUND SERVICE	Customer Installed, Residential Service	Added Bullet 6: "See Appendix G for more information on customer installed residential services."

REVISIONS MADE TO THE 2023 ELECTRIC SERVICE MANUAL

2023 MANUAL PAGE	SECTION	ITEM	REVISION
25	6.2 UNDERGROUND SERVICE	Commercial, Industrial and Other Services	Changed subsection to read: "Underground commercial, industrial, and "other" services will be furnished, installed, owned and maintained by the Customer. Other services include residential multi-plex structures (a structure containing more than two residential units), second service to a detached garage, pole buildings, and any service not defined as a residential service. The Customer will install per NEC requirements, the Company will terminate and make final connections in the transformer. "
25	6.2 UNDERGROUND SERVICE	Network Services	New subsection to 6.2 labeled "Network Services"
25	6.2 UNDERGROUND SERVICE	New Subsection - Ground Movement	Copied "Ground Movement" section from section 6.3
26	6.2 UNDERGROUND SERVICE, continued	Transformer Pads	Changed bullet two to read: "Constructed in a location approved by the Company, with hard surface truck access and unobstructed work space for large vehicles. Truck access is to be permanently maintained by customer."
27	6.2 UNDERGROUND SERVICE, continued	New Subsection - Communication Tower Service	Add new subsection to section 6.2 labeled "Communication Tower Service".
28	6.3 UNDERGROUND CONDUIT	Single-phase customers	Removed bullet point: "Where the customer wants to expedite cable installation"
28	6.3 UNDERGROUND CONDUIT	Single-phase customers	Adjusted format of bullet 1 to match the rest of the list.
28	6.3 UNDERGROUND CONDUIT	Typical Conduit Req	Changed Material to read: "schedule 40 PVC stick or coillable, schedule 40 HDPE coillable, or SDR 13.5 HDPE coillable. Fiberglass stick conduit may be permitted if reviewed by local distribution engineering."
28	6.3 UNDERGROUND CONDUIT	Typical Conduit Req	Added note: "Either rigid conduit risers or box outs must be used where underground service risers will be surrounded by concrete to avoid frost heave."
29	6.3 UNDERGROUND CONDUIT, Continued	Installation Requirements	Changed fourth bullet point to read: "Customer will install a synthetic pull tape of 500 lbs. test in the conduit. Pull tape shall be one continuous pull type, and may not be multiple pieces tied together."
29	6.3 UNDERGROUND CONDUIT, Continued	Installation Requirements	Added bullet point and bolded: "Trenches must be inspected by a Company representative before being back filled."
29	6.3 UNDERGROUND CONDUIT, Continued	Ground Movement	Changed second bullet point to read: "An expansion joint shall be a minimum twelve (12) inch length Schedule 80 PVC installed on the conduit riser."
30	6.4 OVERHEAD PRIMARY METERING (Over 600 volts)	Company Responsibility	Added sentence to first line: "Primary metering is required ahead of any customer owned primary facilities. The Company will provide and install the following:"
30	6.4 OVERHEAD PRIMARY METERING (Over 600 volts)	Customer Responsibility	Added sentence to third bullet point: "The use of a fuse as a disconnecting means will be permitted for single-phase, primary metered services."
30	6.4 OVERHEAD PRIMARY METERING (Over 600 volts)	Customer Responsibility	Added fifth bullet point: "Reference Figure 37 for additional details."
31	6.5 UNDERGROUND PRIMARY METERING (Over 600 volts)	Provided by Customer	Added sentence after bullet points: "Reference Figure 37 for additional details."
33	7.0 CONDUCTOR IDENTIFICATION	Multiple Conductors Per Phase	Added sentence to second paragraph: "Single-phase services will be limited to 500 kcmil conductor. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed."
34	8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS	Conductor Sizes	Changed first paragraph to read: "The Company will allow the use of any NEC approved service conductor as shown in Figure 7. For 3-phase commercial services, no conductor size above 750 kcmil is allowed, including compressed and compact conductors. For Single-phase commercial services, no conductor size above 500 kcmil conductor is allowed. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed."
34	8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS	Conductor Sizes	Added second paragraph: "Single-phase services will be limited to 500 kcmil conductor. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed."
34	8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS	Conductor Sizes	Added sentence: "Residential services must be specific sizes shown in Appendix G. "
34	8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS	Customer Connections	Changed fourth bullet point to read: "Bolts must be 1/2" diameter, except as restricted by the terminal hole size of the instrument transformer. These should be sized with no modifications to the CT bars. The instrument transformer terminal holes shall not be enlarged to accept larger bolts. An effort should be made to match the lug hole to the instrument transformer hole size."
34	8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS	Customer Connections	Changed fifth bullet point to read: "Lugs must be attached with the maximum number of bolts possible. Two-bolt lugs are required on each side of bar type CT connections."
35	9.0 METERING EQUIPMENT	Meter Socket Mounting	Added bullet point: "If meter socket is installed ahead of siding, insure that the meter socket has room for the installation of the riser pipe."
36	9.0 METERING EQUIPMENT, Continued	Current	Section bolded.
37	10.0 STANDBY GENERATOR SERVICE	General	Added link to section: " <a href="https://www.midamericanenergy.com/media/pdf/trimecs---interconnection-requirements.pdf">https://www.midamericanenergy.com/media/pdf/trimecs---interconnection-requirements.pdf</a> "
37	10.0 STANDBY GENERATOR SERVICE	Transfer Switch	Added bullet point: "Must be installed in a location readily accessible to the company."



REVISIONS MADE TO THE 2023 ELECTRIC SERVICE MANUAL

2023 MANUAL PAGE	SECTION	ITEM	REVISION
39	START OF FIGURES		Added a "THIS PAGE WAS INTENTIONALLY LEFT BLANK" page after the "FIGURES" tab, before Figure 1.
40	FIGURE 1 NOTES	A	Added Sentence: "Where not accesible by a service truck, overhead service attachment must not exceed 18 feet above ground level."
40	FIGURE 1 NOTES	B	Changed sentence to read: "The clearance between the esrvce attachment and weatherhead shall be 24 inch maximum."
41	FIGURE 1		Added clearance dimensions from gas meter to Figure 1
41	FIGURE 1	C	Adding window next to weatherhead and move clearance "C"
41	FIGURE 1	5	Changed item 5 to read: "Overhead service entrance conductor must be in conduit. See Figure 4 (pg. 45) for details."
43	FIGURE 2	Drawing note	Edit Figure 2(C) to add down guy and notes
45	FIGURE 4	Maximum Service Drop Length	Add 600A and 800A Maximum Service Drop Lengths.
45	FIGURE 4	5	Added point 6: "Conduit couplings are not allowed above the roofline or less than 2 feet below the soffit line."
50	FIGURE 7		Figure 7 title changed to "Allowable Service Conductor Sizes for Commercial Services"
50	FIGURE 7		Added sentence to first paragraph: "Single phase services will be limited to 500 kcmil conductor. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed."
52	FIGURE 9	Figure A	Wording changed to: "6" MAXIMUM CONDUIT SIZE"
54	FIGURE 10 NOTES		Added item 10: "Single-phase temporary services fed from a 120/208V three-phase transformer and three-phase temporary services of any voltage class require a manual clamping jaw lever bypass."
56	FIGURE 11 NOTES		Added Item 11: "All temporary liquid tight flexible conduit must have steel ends and may not be constructed with 90-degree ends. Temporary liquid tight flexible conduit for secondary pedestals may not be larger than 1 inch diameter."
56	FIGURE 11 NOTES		Added item 12: "Single phase temporary services fed from a 120/208V three-phase transformer and three-phase temporary services of any voltage class require a manual clamping jaw lever bypass."
57	FIGURE 11	DETAIL A	Updated Detail "A" to read "For 1-1/2" holes in Secondary Pedestals, Use 2" OD (Outside Diameter) Washer -For 2" Holes in transformers, use 2-1/2" OD (Outside Diameter) Washer"
57	FIGURE 11		Added footnote to page: "**It is recommended, for reliability purposes, that temporary services be installed with copper conductor."
58	FIGURE 12	Drawing note	Add "45" MIN" dimension. Add "18" MAX BETWEEN THE WEATHERHEAD AND THE GUY ATTACHMENT" leader.
58	FIGURE 12		Changed sentence to read: "The customer is responsible to install, own, and maintain all other items."
59	FIGURE 13	Drawing Note	Changed note to read: "An expansion joint shall be a minimum twelve (12) inch length Schedule 80 PVC installed on the conduit riser"
59	FIGURE 13		Changed drawing note for depth of conduit to read: "18"
59	FIGURE 13	Drawing note	Changed drawing note to read: "Galvanized Insulated Bushing"
59	FIGURE 13		Changed sentence to read: "The customer is responsible to install, own, and maintain all other items."
60	FIGURE 14 NOTES	TITLE	Changed title to read "Typical Underground Service Meter Pedestal"
60	FIGURE 14 NOTES	ITEM 2	Changed sentence to read: "An address, lot number or trailer number must be permanently posted on the outside of the cabinet, below the meter. A weatherproof placard with min. 3/4 inch etched lettering must be used."
60	FIGURE 14 NOTES	NEW ITEM	Added note 7: "**Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter."
61	FIGURE 14	TITLE	Changed title to read "Typical Underground Service Meter Pedestal"
62	FIGURE 15 NOTES	ITEM 1	Changed second sentence in item 1 to read: "The customer is responsible to install, own, and maintain all other items."
62	FIGURE 15 NOTES	NEW ITEM	Added note 14: "Service attachment point should be a through-bolt and match requirements in Figure 3"
62	FIGURE 15 NOTES	NEW ITEM	Added note 15: "Weatherproof placard with min. 3/4 inch etched writing including address and service designation is required."
62	FIGURE 15 NOTES	NEW ITEM	Added note: "**Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter."
66	FIGURE 19		Added second sentence: "The customer is responsible to install, own, and maintain all other items."
67	FIGURE 20	Drawing Note	Changed note to read: "An expansion joint shall be a minimum twelve (12) inch length Schedule 80 PVC installed on the conduit riser opening downward."
67	FIGURE 20		Changed second sentence in item 1 to read: "The customer is responsible to install, own, and maintain all other items."
74	FIGURE 23		NEW: TYPICAL PRIMARY AND SECONDARY UNDERGROUND COMMUNICATION TOWER SERVICE
73	FIGURE 24	Drawing Note	Illustrate a "Box" around APT 1, 2, etc... to show a placard.
73	FIGURE 24	ITEM 4	Add second sentence: " A weatherproof placard with min. 3/4 inch etched lettering must be used."
73	FIGURE 24	ITEM 8	Changed sentence to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering."

REVISIONS MADE TO THE 2023 ELECTRIC SERVICE MANUAL

2023 MANUAL PAGE	SECTION	ITEM	REVISION
73	FIGURE 24	SERVICE CHARACTERISTICS	Add row for 3-phase 277/480V 4-wire service characteristics.
74	FIGURE 26	Drawing note	Illustrate a "Box" around APT 1, 2, etc... to show a placard.
74	FIGURE 26	ITEM 4	Add second sentence: "A weatherproof placard with min. 3/4 inch etched lettering must be used."
74	FIGURE 26	ITEM 6	Changed sentence to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering."
74	FIGURE 26	SERVICE CHARACTERISTICS	Add row for 3-phase 277/480V 4-wire service characteristics.
75	FIGURE 27	ITEM 7	Changed sentence to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering."
75	FIGURE 27	NEW ITEM	Added item 8: "Customer is liable to fix the knockout should the wrong size be removed."
75	FIGURE 27	NEW ITEM	Added note: "*Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter."
76	FIGURE 28	Figure 28(A)	Remove bus-bars and extend cable to the socket lugs.
76	FIGURE 28	Figure 28(B)	Remove bus-bars and extend cable to the socket lugs.
76	FIGURE 28	ITEM 7	All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service."
76	FIGURE 28	NEW ITEM	Added note: "*Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter."
77	FIGURE 29	Drawing Note	Added dashed bypass lever to both 100A and 200A meter socket drawings with a "commercial service" indicator.
77	FIGURE 29	Drawing note	Change both drawing notes to read: "5th terminal required in 9 o'clock position"
77	FIGURE 29	ITEM 7	Changed sentence to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service."
77	FIGURE 29	NEW ITEM	Added note: "*Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter."
78	FIGURE 30	ITEM 3	Update Item 3 Reference to page 33.
78	FIGURE 30	ITEM 5	Changed sentence to read: The neutral, if insulated, shall be identified by a white or gray covering or tape. (Reference pg. 33)
78	FIGURE 30	ITEM 6	Update Item 6 Reference to page 33
78	FIGURE 30	ITEM 7	Update Item 7 Reference to page 33
78	FIGURE 30	ITEM 8	Changed sentence to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service."
79	FIGURE 31	ITEM 3	Added sentence: "Pull out style disconnects will not be allowed."
79	FIGURE 31	ITEM 4	Added sentence: "Pull out style disconnects will not be allowed regardless of being installed on the line or load side."
79	FIGURE 31	ITEM 5	Changed sentence to read: "A "480 VOLTS" identification (weatherproof placard with min. 3/4 inch etched lettering) shall be applied in a conspicuous location on the front exterior surface of the meter socket enclosure."
79	FIGURE 31	ITEM 6	Changed sentence to read: The neutral, if insulated, shall be identified by a white or gray covering or tape. (Reference pg. 33)
79	FIGURE 31	ITEM 8	Update Item 8 Reference to page 24
79	FIGURE 31	ITEM 9	Changed sentence to read: "The neutral shall be installed from the source to the means of disconnection."
80	FIGURE 32 NOTES	REMOVE	REMOVE THIS PAGE
81	FIGURE 32	REMOVE	REMOVE THIS PAGE
81	FIGURE 33 NOTES	ITEM 13	Added point 13: Metering circuit to be grounded in only one place.
81	FIGURE 33 NOTES	ITEM 14	Added point 14: Cabinets shall be bonded to ground at one place—either neutral or system ground.
81	FIGURE 33 NOTES	ITEM 15	Added point 15: Metering and bonding wires shall not parallel the neutral.
84	FIGURE 33	WORKING SPACE IN FRONT OF METER	Adjusted working clearance in front of meter to 36"
83	FIGURE 34	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
83	FIGURE 34	ITEM 6	Removed point 6
83	FIGURE 34	ITEM 9	Added point 9: "The neutral connector shall be UL listed and insulated from the instrument transformer cabinet."
84	FIGURE 35	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
84	FIGURE 35	ITEM 6	Changed sentence to read: The neutral, if insulated, shall be identified by a white or gray covering or tape. (Reference pg. 33)
84	FIGURE 35	ITEM 7	Removed point 7
84	FIGURE 35	ITEM 10	Changed sentence to read: "A weatherproof placard with min. 3/4 inch etched writing stating "480V" will be placed at all CT and PT cabinets for a 277/480V service."
84	FIGURE 35	NEW ITEM	Added point 12: "If 1 inch metering conduit is to be installed from transformer secondary cabinet to the meter socket, install red WARNING tape 1 foot above conduit."
85	FIGURE 35A	NEW PAGE	Add new page to Instrument Transformer Wiring

REVISIONS MADE TO THE 2023 ELECTRIC SERVICE MANUAL

2023 MANUAL PAGE	SECTION	ITEM	REVISION
86	FIGURE 36	TITLE	Added title: "CONFIGURATION FOR INSTRUMENT TRANSFORMER RATED SERVICES WITH INTEGRATED VT PACK METER SOCKETS"
86	FIGURE 36	DIAGRAM	Changed sentence to read: 1" CONDUIT MINIMUM SEPERATION FROM HINGED SIDE OF CT CABINET TO BE WIDTH OF HINGED DOOR PLUS 3 INCHES
86	FIGURE 36	DIAGRAM	Add drawing note "ADD RED "WARNING" TAPE 1" ABOVE METERING CONDUIT"
87	FIGURE 36A	NEW PAGE	Add new page
88	FIGURE 37	NEW PAGE	Add "PRIMARY METERING SERVICE"
89	FIGURE 37A	NEW PAGE	Add "OVERHEAD PRIMARY SERVICE"
90	FIGURE 37B	NEW PAGE	Add "OVERHEAD TO UNDERGROUND PRIMARY SERVICE"
91	FIGURE 37C	NEW PAGE	Add "THREE PHASE UNDERGROUND PRIMARY SERVICE TO METERING ENCLOSURE (DEAD-FRONT ONLY)"
92	FIGURE 37D	NEW PAGE	Add "THREE PHASE UNDERGROUND PRIMARY SERVICE TO SWITCHGEAR"
93	FIGURE 37E	NEW PAGE	Add "REQUIREMENTS FOR METERING ENCLOSURE AND SWITCHGEAR"
94	APPENDIX A	ITEM 8	Changed bullet point 5 to read: "All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service."
96	APPENDIX B-1	ITEM 2	Changed point 2 to read: "Constructed in a manner satisfactory to the Company, in a mutually agreed upon location with hard surface truck access and unobstructed work space for large vehicles. Truck access is to be permanently maintained by customer."
96	APPENDIX B-1	ITEM 5	Added sentence: " It is recommended that conduit not be installed under the transformer pad between the piers."
96	APPENDIX B-1	ITEM 7	Changed first sentence to read: "When necessary for traffic protection or at local engineering's discretion, set a 4" diameter concrete-filled galvanized steel post 3'-0" from pad corner. Post shall be 8' long with a 4' concrete embedment."
96	APPENDIX B-1	ITEM 9	Changed sentence to read: "A trench 2'-0" deep and 3'-0" wide will be dug on all four sides. The trench will be lined with silt fence fabric tucked under the pad and filled with either 2" or 3" screened river rock to final grade. Contact local distribution engineering representative if design needs modification."
96	APPENDIX B-1	NEW ITEM	Added note 10: "Primary and secondary conduit bays must be back filled with a minimum of 1" on concrete after primary transformer pad has been formed to contain oil leaks."
101	APPENDIX B-3	5.3.6	Changed sentence to read: "The finished slab must be level."
101	APPENDIX B-3	NEW ITEM	Added item 6.1.7: "A minimum of 1" of concrete must be filled in to the primary and secondary conduit bays after the main transformer pad has cured and forms are removed to contain oil leaks."
102	APPENDIX B-4	SECTION B-B	Changed drawing B-B to read: "(4) 8" DIA CORNER PIERS"
103	APPENDIX B-5	SECTION B-B	Changed drawing B-B to read: "(4) 10" DIA CORNER PIERS"
106	APPENDIX C-1	ITEM 6	Bolded statement: "A hinged cover (with heavy-duty, pin type hinges on the side of the box) is required"
106	APPENDIX C-1	ITEM 16	Changed sentence to read: "A weatherproof placard with min. 3/4 inch etched writing stating "480V" will be placed at all CT and PT cabinets for a 277/480V service."
107	APPENDIX C-2	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
108	APPENDIX C-3	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
108	APPENDIX C-3	TABLE	Changed all depths (L-W-D) from 10" to 12"
109	APPENDIX C-4	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
109	APPENDIX C-4	TABLE	Changed all depths (L-W-D) from 10" to 12"
110	APPENDIX C-5	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
110	APPENDIX C-5	TABLE	Changed all depths (L-W-D) from 10" to 12"
111	APPENDIX C-6	DIAGRAM	Changed diagram label to read: "NEUTRAL FLOATED"
111	APPENDIX C-6	TABLE	Changed all depths (L-W-D) from 10" to 12"
105	APPENDIX E		REMOVE PAGE
113	APPENDIX F	Drawing Note	Make the dashed outline of the PT/CT cabinet and meter socket bold.
113	APPENDIX F	ITEM 1	Added sentence: "Unistrut is not allowed for pedestal support."
113	APPENDIX F	ITEM 6	Changed Item 6 to read: "Driven ground rod to be bonded to the inside of the CT or PT cabinet."
114	APPENDIX G	3.5	Changed second sentence to read: "A 36" x 36" handhole that is 8" below the bottom of the conduit riser immediately adjacent to the base of the enclosure must be hand dug by the customer/contractor."
114	APPENDIX G	3.7	Item 3.7 bolded.
115	APPENDIX G	5.1	Removed 100 A or less classification from entrance size table.
115	APPENDIX G	5.1	Add allowance for services over 400 A.
117	APPENDIX H	Item 5 at the top	Updated to read: "Before service is connected, each meter socket cover, socket back plate and associated breaker of fuse panel must be plainly marked with a weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service. (Section 6.0, pg. 21, Multiple Meters)"

# ELECTRIC SERVICE MANUAL

## INTRODUCTION

---

### Purpose

The purpose of this manual is to supply essential information to anyone concerned with the electrical installations of MidAmerican Energy Company (Company) customers, such as:

- Customers
- Customers' representatives
- Employees
- Architects
- Engineers
- Contractors

It is the Company's objective to cooperate with and assist customers to obtain safe, efficient electric service.

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### Code Compliance

Nothing contained in this manual shall be construed to relieve or lessen the responsibility of the customer or the customer's representative from complying with all applicable codes, rules and regulations.

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### Company Liability

Consistent with the Company's tariff, no inspection by the Company, nor failure to object to the customer's installation, shall render the Company liable for injury or damage resulting from any defective installation by the customer.

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### Drawings

The drawings and written portion of this manual supplement each other.

Materials and workmanship specified or implied by one and not the other shall be supplied and installed in accordance with the more stringent of the requirements.

The drawings are general in nature and are not intended to be design specifications.

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## CUSTOMERS TO CALL 48 HOURS BEFORE DIGGING TO LOCATE UNDERGROUND FACILITIES

In Illinois call	(800) 892-0123
In Iowa call	(800) 292-8989
In South Dakota call	(800) 781-7474
In Nebraska call	(800) 331-5666
Universal Call	811

*Continued on next page*

## INTRODUCTION, continued

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### **Safety Codes and Regulations**

The information in this manual is based on management-approved interpretations of the intended safe and practical applications of the following:

- *National Electrical Code (NEC)\**
- Regulations of the governing state's utilities commission/board
- MidAmerican Energy Company tariff

Local governing authorities may impose more stringent requirements than shown in this manual.

The governing state's electrical safety code and National Electrical Safety Code (NESC) contain provisions relating to Company installations and work practices.

- \* *The National Electrical Safety Code* is a registered trademark of the Institute of Electrical and Electronic Engineers, Inc., New York, New York 10016. The *NEC* is registered trademarks of the National Fire Protection Association, Inc., Quincy, MA 02269.
- 

### **Manual Does Not Cover**

This manual does not cover:

- Electric utility installations that are under the exclusive control of the Company for the purpose of:
    - Metering
    - Generation
    - Control
    - Transformation
    - Transmission
    - Distribution
  - Associated work practices of the Company in the exercise of its function as a utility.
- 

### **Specific Problems**

**If you desire to discuss specific problems not covered or resolved by this manual, contact your Company representative.**

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### **Additional Copies of the Electric Service Manual**

For additional copies of the 2023 Electric Service Manual, contact your Company Representative. An electronic version of the 2020 Electric Service Manual is also available online at [www.midamericanenergy.com](http://www.midamericanenergy.com), under the "Contractor Training and Safety" tab.

*Continued on next page*

# INTRODUCTION, continued

## Communities

STATE	INC	TOWN	COUNTY	STATE	INC	TOWN	COUNTY
Iowa		Ackley	Hardin	Iowa		Bronson	Woodbury
Iowa		Ackworth	Warren	Iowa	No	Brooks	Adams
Iowa		Adel	Dallas	Iowa		Brunsville	Plymouth
Iowa		Alleman	Polk	Iowa		Buck Grove	Crawford
Iowa		Allison	Butler	Iowa		Buffalo (Whsle)	Scott
Iowa		Altoona	Polk	Iowa	No	Burnside	Webster
Iowa		Alvord	Lyon	Iowa		Bussey	Marion
Iowa	No	Anderson	Fremont	Iowa	No	California Junction	Harrison
Iowa		Ankeny	Polk	Iowa		Callender (Whsle)	Webster
Iowa		Arcadia	Carroll	Iowa		Calumet	O'Brien
Iowa		Archer	O'Brien	Iowa		Camanche	Clinton
Iowa		Aredale	Butler	Iowa	No	Capitol Heights	Polk
Iowa		Arion	Crawford	Iowa		Carbon	Adams
Iowa		Arthur	Ida	Iowa	No	Carbondale	Polk
Iowa		Aspinwall	Crawford	Iowa		Carlisle (Whlse)	Warren
Iowa	No	Astor	Crawford	Iowa	No	Carmel	Sioux
Iowa		Athelstan	Taylor	Iowa	No	Carnarvon	Sac
Iowa	No	Attica	Marion	Iowa	No	Carnes	Sioux
Iowa		Auburn (Whsle)	Sac	Iowa	No	Carney	Polk
Iowa		Audubon	Audubon	Iowa		Carroll	Carroll
Iowa	No	Austinville	Butler	Iowa		Carson	Pottawattamie
Iowa		Avoca	Pottawattamie	Iowa		Castana	Monona
Iowa	No	Avon Lake	Polk	Iowa	No	Cedar	Mahaska
Iowa		Ayrshire	Palo Alto	Iowa	No	Chapin	Franklin
Iowa		Badger	Webster	Iowa		Charles City	Floyd
Iowa		Barnes City	Mahaska	Iowa		Charter Oak	Crawford
Iowa		Barnum	Webster	Iowa		Chatsworth	Sioux
Iowa	No	Bartlett	Fremont	Iowa		Cherokee	Cherokee
Iowa		Battle Creek	Ida	Iowa	No	Churchville	Warren
Iowa		Beacon	Mahaska	Iowa		Clare	Webster
Iowa		Bedford	Taylor	Iowa		Clarinda	Page
Iowa	No	Beech	Warren	Iowa		Clarion	Wright
Iowa	No	Beeds Lake	Franklin	Iowa		Clarksville	Butler
Iowa	No	Beloit	Lyon	Iowa		Cleghorn	Cherokee
Iowa	No	Bentley	Pottawattamie	Iowa	No	Climbing Hill	Woodbury
Iowa	No	Berwick	Polk	Iowa		Clive	Dallas/Polk
Iowa		Bettendorf	Scott	Iowa	No	Coalville	Webster
Iowa		Bevington	Madison	Iowa		Coburg	Montgomery
Iowa	No	Bingham/Norwich	Page	Iowa		Coin	Page
Iowa		Blanchard	Page	Iowa		Colfax	Jasper
Iowa		Blencoe	Monona	Iowa		College Springs	Page
Iowa		Blue Grass	Scott	Iowa	No	Columbia	Marion
Iowa		Bode	Humboldt	Iowa	No	Conger	Warren
Iowa		Bondurant	Polk	Iowa		Coralville	Johnson
Iowa	No	Booneville	Dallas	Iowa	No	Corley	Shelby
Iowa	No	Botna	Shelby	Iowa	No	Cornelia	Wright
Iowa	No	Bowsher	Polk	Iowa		Correctionville	Woodbury
Iowa		Boyden	Sioux	Iowa	No	Cosgrove	Johnson
Iowa	No	Boyer	Crawford	Iowa		Council Bluffs	Pottawattamie
Iowa		Braddyville	Page	Iowa		Craig	Plymouth
Iowa		Bradgate	Humboldt	Iowa		Crescent	Pottawattamie
Iowa		Brayton	Audubon	Iowa		Cumming	Warren
Iowa		Breda (Whsle)	Carroll	Iowa		Cushing	Woodbury
Iowa	No	Bremer	Bremer	Iowa		Cylinder	Palo Alto
Iowa		Bristow	Butler	Iowa		Dakota City	Humboldt

INC = Incorporated

*Continued on next page*

## INTRODUCTION, Continued

### Communities

STATE	INC	TOWN	COUNTY	STATE	INC	TOWN	COUNTY
Iowa		Dallas Center	Dallas	Iowa		Gray	Audubon
Iowa		Danbury	Woodbury	Iowa		Grimes	Polk
Iowa		Davenport	Scott	Iowa		Griswold	Cass
Iowa		Dedham	Carroll	Iowa		Halbur	Carroll
Iowa		Defiance	Shelby	Iowa		Hamburg	Fremont
Iowa		Deloit	Crawford	Iowa		Hamilton	Marion
Iowa		Denver (Whlse)	Bremer	Iowa	No	Hamlin	Audubon
Iowa		Des Moines	Polk	Iowa		Hampton	Franklin
Iowa		Desoto	Dallas	Iowa		Hancock	Pottawattamie
Iowa	No	Dewar	Black Hawk	Iowa		Hansell	Franklin
Iowa		Doon	Lyon	Iowa		Hardy	Humboldt
Iowa		Dougherty	Cerro Gordo	Iowa		Hartford	Warren
Iowa		Dow City	Crawford	Iowa		Harvey	Marion
Iowa		Dumont	Butler	Iowa		Hastings	Mills
Iowa		Duncombe	Webster	Iowa	No	Hawleyville	Page
Iowa		Dunkerton	Black Hawk	Iowa		Henderson	Mills
Iowa		Dunlap	Harrison	Iowa		Hepburn	Page
Iowa		Eagle Grove	Black Hawk	Iowa	No	Holly Springs	Woodbury
Iowa		Earlham	Madison	Iowa	No	Holmes	Wright
Iowa		Earling	Shelby	Iowa		Holstein	Ida
Iowa		Early	Sac	Iowa		Hornick	Woodbury
Iowa		Eldridge (Whsle)	Scott	Iowa	No	Horton	Bremer
Iowa		Elk Horn	Shelby	Iowa		Hospers	Sioux
Iowa		Elk Run Heights	Black Hawk	Iowa		Hudson	Black Hawk
Iowa		Elkhart	Polk	Iowa		Hudson (Whlse)	Black Hawk
Iowa		Elliott	Montgomery	Iowa		Hull	Sioux
Iowa		Emerson	Mills	Iowa		Humboldt	Humboldt
Iowa		Emmetsburg	Palo Alto	Iowa		Ida Grove	Ida
Iowa		Essex	Page	Iowa		Imogene	Fremont
Iowa		Estherville (Whsle)	Emmet	Iowa		Inwood	Lyon
Iowa		Evansdale	Black Hawk	Iowa		Iowa City	Johnson
Iowa		Exira	Audubon	Iowa		Ireton	Sioux
Iowa		Farnhamville	Calhoun	Iowa		Irwin	Shelby
Iowa	No	Farragut	Fremont	Iowa	No	Jacksonville	Shelby
Iowa	No	Faulkner	Franklin	Iowa	No	James	Plymouth
Iowa	No	Fern	Grundy	Iowa		Janesville	Bremer
Iowa	No	Fiscus	Audubon	Iowa		Jesup	Buchanan
Iowa	No	Flagler	Marion	Iowa	No	Joetown	Johnson
Iowa		Floyd	Floyd	Iowa		Johnston	Polk
Iowa		Fonda (Whsle)	Pocahontas	Iowa		Jolley	Calhoun
Iowa		Fort Dodge	Webster	Iowa	No	Kalo	Webster
Iowa		Galva	Ida	Iowa		Kalona	Washington
Iowa	No	Gaza	O'Brien	Iowa		Keomah Village	Mahaska
Iowa		Geneva	Franklin	Iowa	No	Kesley	Butler
Iowa	No	Germantown	O'Brien	Iowa		Kingsley	Plymouth
Iowa		Gilbertville	Black Hawk	Iowa		Kirkman	Shelby
Iowa		Gilmore City	Humboldt/ Pocahontas	Iowa		Kirkville	Wapello
Iowa		Glenwood	Mills	Iowa		Kiron	Crawford
Iowa		Goldfield	Wright	Iowa	No	Knierim	Calhoun
Iowa		Granger	Dallas	Iowa		Knoke	Pocahontas
Iowa	No	Grant Center	Woodbury	Iowa	No	Knoxville	Marion
Iowa	No	Grant City	Sac	Iowa		Lacey	Mahaska
Iowa		Granville	Sioux	Iowa		Lake City	Calhoun
Iowa		Gravity	Taylor	Iowa		Lakeside	Buena Vista
				Iowa		Lakeview (Whsle)	Sac

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## INTRODUCTION, continued

### Communities

STATE	INC	TOWN	COUNTY	STATE	INC	TOWN	COUNTY
Iowa		Lanesboro	Carroll	Iowa		Nemaha	Sac
Iowa		Larrabee	Cherokee	Iowa		New Hartford	Butler/Grundy
Iowa		Latimer	Franklin	Iowa		New Liberty	Scott
Iowa	No	Lavinia	Calhoun	Iowa		New Market	Taylor
Iowa		Lawton	Woodbury	Iowa		New Sharon	Mahaska
Iowa		Le Mars	Plymouth	Iowa		Newell	Buena Vista
Iowa		LeClaire	Scott	Iowa	No	Newkirk	Sioux
Iowa		Leighton	Mahaska	Iowa		Nodaway	Adams
Iowa		Lewis	Cass	Iowa		Northboro	Page
Iowa	No	Liberty Center	Warren	Iowa		Norwalk	Warren
Iowa		Lidderdale	Carroll	Iowa	No	Norwich	Page
Iowa		Linwood	Scott	Iowa		Oakland	Pottawattamie
Iowa		Little Sioux	Harrison	Iowa	No	Oasis	Johnson
Iowa	No	Littleton	Buchanan	Iowa		Odebolt	Sac
Iowa		Logan	Harrison	Iowa		Oskaloosa	Mahaska
Iowa		Lohrville	Calhoun	Iowa		Otho	Webster
Iowa	No	Loveland	Pottawattamie	Iowa	No	Otley	Marion
Iowa		Lovilia	Monroe	Iowa		Oto	Woodbury
Iowa	No	Lovington	Polk	Iowa		Ottosen	Humboldt
Iowa	No	Luton	Woodbury	Iowa		Oyens	Plymouth
Iowa		Luverne	Kossuth	Iowa		Pacific Junction	Mills
Iowa		Lytton	Calhoun	Iowa		Palmer	Pocahontas
Iowa		Macedonia	Pottawattamie	Iowa	No	Palmyra	Warren
Iowa		Magnolia	Harrison	Iowa		Panama	Shelby
Iowa		Malvern	Mills	Iowa		Panorama Park	Scott
Iowa		Manson	Calhoun	Iowa		Parkersburg	Butler
Iowa	No	Maple River	Carroll	Iowa		Patterson	Madison
Iowa		Marcus	Cherokee	Iowa	No	Peoria	Mahaska
Iowa		Marne	Cass	Iowa	No	Percival	Fremont
Iowa		Martensdale	Warren	Iowa	No	Perkins	Sioux
Iowa		Marysville	Marion	Iowa	No	Pershing	Marion
Iowa		Maurice	Sioux	Iowa		Persia	Harrison
Iowa		McClelland	Pottawattamie	Iowa		Pierson	Woodbury
Iowa	No	McPaul	Fremont	Iowa		Pioneer	Humboldt
Iowa		Melcher-Dallas	Marion	Iowa		Pisgah	Harrison
Iowa		Meriden	Cherokee	Iowa		Plainfield	Bremer
Iowa		Merrill	Plymouth	Iowa		Pleasant Hill	Polk
Iowa	No	Middleburg	Sioux	Iowa	No	Pleasant Valley	Scott
Iowa		Milo	Warren	Iowa		Pleasantville	Marion
Iowa		Minburn	Dallas	Iowa		Pocahontas(Whsle)	Pocahontas
Iowa		Minden	Pottawattamie	Iowa		Polk City	Polk
Iowa	No	Mineola	Mills	Iowa		Pomeroy	Calhoun
Iowa		Mingo	Jasper	Iowa	No	Ponderosa	Poweshiek
Iowa		Missouri Valley	Harrison	Iowa	No	Port Neal	Woodbury
Iowa		Mitchellville	Polk	Iowa		Portsmouth	Shelby
Iowa		Modale	Harrison	Iowa	No	Powersville	Floyd
Iowa		Mondamin	Harrison	Iowa		Prairie City	Jasper
Iowa		Monroe	Jasper	Iowa		Princeton	Scott
Iowa		Moorhead	Monona	Iowa	No	Prole	Warren
Iowa		Moorland	Webster	Iowa		Quimby	Cherokee
Iowa	No	Morse	Johnson	Iowa		Randolph	Fremont
Iowa	No	Mount Carmel	Carroll	Iowa		Raymond	Black Hawk
Iowa		Mount Joy	Scott	Iowa		Red Oak	Montgomery
Iowa		Moville	Woodbury	Iowa	No	Red Rock	Marion
Iowa		Nashua	Chickasaw	Iowa	No	Richards	Calhoun

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## INTRODUCTION, continued

### Communities

STATE	INC	TOWN	COUNTY	STATE	INC	TOWN	COUNTY
Iowa		Ricketts	Crawford	Iowa		Truesdale	Buena Vista
Iowa	No	Rising Sun	Polk	Iowa		Turin	Monona
Iowa	No	River Sioux	Harrison	Iowa	No	Twin Lakes	Calhoun
Iowa		Riverdale	Scott	Iowa	No	Ulmer	Sac
Iowa		Riverton	Fremont	Iowa		Underwood	Pottawattamie
Iowa		Rock Valley	Sioux	Iowa	No	Union Mills	Mahaska
Iowa		Rockwell	Cerro Gordo	Iowa		University Heights	Johnson
Iowa		Rockwell City	Calhoun	Iowa	No	University Park	Mahaska
Iowa		Rodney	Monona	Iowa		Urbandale	Dallas/Polk
Iowa	No	Roselle	Carroll	Iowa		Ute	Monona
Iowa	No	Ross	Audubon	Iowa		Vail	Crawford
Iowa		Runnells	Polk	Iowa	No	Valeria	Jasper
Iowa		Ruthven	Palo Alto	Iowa		Van Meter	Dallas
Iowa		Rutland	Humboldt	Iowa		Varina	Pocahontas
Iowa		Sac City	Sac	Iowa		Vincent	Webster
Iowa		Salix	Woodbury	Iowa	No	Voorhies	Black Hawk
Iowa		Sandyville	Warren	Iowa		Wall Lake (Whsle)	Sac
Iowa		Saylorville	Polk	Iowa		Walnut	Pottawattamie
Iowa		Schaller	Sac	Iowa	No	Washburn	Black Hawk
Iowa		Schleswig	Crawford	Iowa		Washta	Cherokee
Iowa	No	Scotch Ridge	Warren	Iowa		Waterloo	Black Hawk
Iowa	No	Seney	Plymouth	Iowa		Waukee	Dallas
Iowa		Sergeant Bluff (Whlse)	Woodbury	Iowa		Webster City	Hamilton
Iowa		Shambaugh	Page	Iowa		West Des Moines	Polk
Iowa		Sheffield	Franklin	Iowa	No	Weston	Pottawattamie
Iowa		Sheldon	O'Brien	Iowa		Westphalia	Shelby
Iowa		Shell Rock	Butler	Iowa		Westside	Crawford
Iowa		Shenandoah	Page	Iowa		Whiting	Monona
Iowa		Sidney	Fremont	Iowa	No	Wick	Warren
Iowa		Silver City	Mills	Iowa		Willey	Carroll
Iowa		Sioux City	Woodbury	Iowa	No	Windham	Johnson
Iowa		Sloan	Woodbury	Iowa		Windsor Heights	Polk
Iowa		Smithland	Woodbury	Iowa	No	Wright	Mahaska
Iowa		Soldier	Monona	Iowa		Yetter	Calhoun
Iowa		Somers	Calhoun	Iowa		Yorktown	Page
Iowa	No	Spring Hill	Warren				
Iowa		St Charles	Madison				
Iowa	No	St Joseph	Kossuth				
Iowa		St Marys	Warren				
Iowa		Storm Lake	Buena Vista				
Iowa		Stout	Butler				
Iowa	No	Strahan	Mills				
Iowa		Struble	Plymouth				
Iowa	No	Sulphur Springs	Buena Vista				
Iowa	No	Summerset	Warren				
Iowa		Sutherland	O'Brien				
Iowa	No	Swan	Marion				
Iowa		Tabor	Fremont				
Iowa	No	Taintor	Mahaska				
Iowa		Templeton	Carroll				
Iowa	No	Tenville	Page				
Iowa		Thor	Humboldt				
Iowa		Thurman	Fremont				
Iowa	No	Tracy	Marion				
Iowa		Treynor	Pottawattamie				

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## INTRODUCTION, continued

### Communities

STATE	INC	TOWN	COUNTY	STATE	INC	TOWN	COUNTY
Illinois		Andalusia	Rock Island	South Dakota		Alcester	Union
Illinois		Andover	Henry	South Dakota	No	Dakota Dunes	Union
Illinois		Barstow	Rock Island	South Dakota		Fairview	Lincoln
Illinois	No	Boden	Mercer	South Dakota		Hudson	Lincoln
Illinois	No	Buffalo Prairie	Rock Island	South Dakota		Jefferson	Union
Illinois	No	Cable	Mercer	South Dakota		North Sioux City	Union
Illinois		Carbon Cliff	Rock Island				
Illinois		Cleveland	Henry				
Illinois		Coal Valley	Rock Island				
Illinois		Colona	Henry				
Illinois		Cordova	Rock Island				
Illinois	No	Coyne Center	Rock Island				
Illinois		East Moline	Rock Island				
Illinois	No	Edgington	Rock Island				
Illinois	No	Green River	Henry				
Illinois		Green Rock	Henry				
Illinois	No	Hamlet	Mercer				
Illinois		Hampton	Rock Island				
Illinois		Hillsdale	Rock Island				
Illinois	No	Illinois City	Rock Island				
Illinois	No	Joslin	Rock Island				
Illinois	No	Lynn Center	Henry				
Illinois		Matherville	Mercer				
Illinois		Milan	Rock Island				
Illinois	No	Millersburg	Mercer				
Illinois		Moline	Rock Island				
Illinois		Oak Grove	Rock Island				
Illinois	No	Ophiem	Henry				
Illinois		Orion	Henry				
Illinois	No	Osborne	Rock Island				
Illinois	No	Osco	Henry				
Illinois		Port Byron	Rock Island				
Illinois	No	Preemption	Mercer				
Illinois		Rapids City	Rock Island				
Illinois		Reynolds	Rock Island				
Illinois		Rock Island	Rock Island				
Illinois		Sherrard	Mercer				
Illinois		Silvis	Rock Island				
Illinois	No	Swedona	Mercer				
Illinois	No	Taylor Ridge	Rock Island				

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## 1.0 AVAILABILITY AND CHARACTERISTICS OF SERVICE

### Introduction

The electric service supplied by the Company is 60 hertz alternating current.

### Service Voltages

One service voltage will be provided to each service location.

The following table lists:

- Nominal voltages offered to the customer.
- Maximum size service entrance that the Company can accommodate without special consideration.

SERVICE VOLTAGES AND LIMITATIONS					
Type of Service			Max. Service Entrance Size (Amperes)		
Voltage	Wire	Phase	Overhead	Overhead to URD	Underground
120 volt	2-wire	Single-phase	60	60	60
120/240 volt	3-wire	Single-phase	800	800	1000
120Y/208 volt	3-wire	Single-phase	(see note)*	(see note)*	(see note)*
120Y/208 volt	4-wire	Three-phase	1000	800	3000
120/240 volt	4-wire delta	Three-phase	800	800	(see note)**
277Y/480 volt	4-wire	Three-phase	400	400	4000*

Higher voltage service may be available for approved loads upon application to the Company.

It is the customer's responsibility to contact the Company prior to design of the customer's electrical system to determine the type of service available at any specific location.

The customer should be aware that not all voltages are available at all locations or for all loads. It is recommended that the customer contact the Company before purchasing equipment.

Calculations are based on 80% load level per *NEC* overhead transformer sizes, based on a combined 300 kVA. Contact your Company representative for service availability on 100% rated panels.

\* Contact your Company representative for service availability.

\*\* Not available from a padmounted transformer.

### Extension Policies

All extensions of service will be installed according to the Company's tariff. Extension cost information is available at Company business offices or online at <https://www.midamericanenergy.com/rates-tariffs>

## 2.0 DIVERSION OF SERVICE OR TAMPERING

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**Diversion and  
Tampering  
Prohibited**

The following are prohibited:

- Tampering with Company equipment
- Breaking of meter seals
- Opening or damaging of Company locks
- Interference with operation of Company equipment
- Unauthorized work performed on meter installations or other property of the Company

If access to Company equipment is needed, the Company requires a minimum of 24-hours notice.

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**Disconnection**

The Company will disconnect service to the customer and remove the meters and metering equipment in the event of such diversion or tampering.

---

**Customer  
Cost**

The customer shall be responsible for payment of all costs which result from such diversion or tampering.

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### 3.0 PROTECTION OF CUSTOMER EQUIPMENT

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#### Introduction

The Company will use reasonable diligence to supply continuous and sufficient electric service to its customers that meets or exceeds all regulatory requirements.

In some instances, such as major storms where lightning, high winds or similar adverse conditions occur, the Company's electrical system may experience momentary outages and/or voltage spikes.

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#### Protection of Motors and Other Equipment

The customer is advised to provide adequate protection against the effects of outages or voltage spikes in accordance with the *NEC* or other pertinent sources of information for all types of motors and other equipment.

Equipment that should be protected includes, but is not limited to:

- Motors
- Computers
- Electronics equipment
- Equipment in which computers or electronics form an integral operating part

Equipment should be protected under all conditions, including:

- Overload
- Loss of voltage
- High or low voltage
- Loss of phase(s) (e.g. single phasing on polyphase motors)
- Re-establishment of service after any of the foregoing
- Phase reversal
- Motors that cannot be subjected to full voltage on starting
- Harmonics or wave form irregularities

Failure to provide such protection may result in needless damage to equipment and the expense of delay and repair.

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*Continued on next page*

### 3.0 PROTECTION OF CUSTOMER EQUIPMENT, Continued

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#### **Microprocessor-Based Electronics**

Sensitive electronics, such as microprocessor-based home electronics and business computers, are susceptible to damage due to voltage spikes or surges.

Before any microprocessor-based electronics are installed:

- Wiring practices that meet manufacturer specifications need to be assured. (For example, proper grounding and dedicated circuits are important.)
- Consideration should be given to installing transient voltage surge suppression at the:
  - Main service entrance and
  - Point of use
- An uninterruptible power supply (battery backup) should be considered if a momentary voltage dip or outage would cause loss of data.

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#### **Additional Information**

If you have any questions concerning minimum protective requirements, contact the equipment supplier or your Company representative.

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### 3.1 AVAILABLE FAULT CURRENT INFORMATION GUIDE

<b>Introduction</b>	<p>The following two pages show the available fault currents for various combinations of transformers and service voltages. Page 14 is dedicated to overhead transformers, while page 15 is dedicated to padmounted transformers. Both tables can be used for new installations or for older installations where the transformer impedance has been verified and is consistent with the values in the tables.</p>
<b>Background</b>	<p>The impedance values used in the tables are based on DOE 10 CFR Part 431 standards. The lowest impedance value for each transformer size was used in the table to determine the maximum fault current value available at the secondary terminals of the transformer.</p>
<b>Service Panel Interrupting Ratings</b>	<p>Service equipment panels have industry standard ratings of: 10,000 – 22,000 – 42,000 – 65,000 – 100,000 Amps RMS symmetrical. Circuit breakers also have similar interrupting ratings and in general should be sized to match the panel. Since circuit breakers will fit many panels, it is possible for a customer to install a 65,000 amp panel, but use 42,000 amp circuit breakers. In this case, the overall panel rating would be the lowest of the two values or 42,000 amps.</p> <p>The fault current values in the table are the maximum available at the secondary terminals of the transformer. The service entrance panel may be sized to accommodate this amount of worst case fault current, or a qualified electrical contractor/electrician may choose to further calculate the available fault current at the location of the panel by calculating the fault current reduction(s) due to any secondary and/or service lateral conductors. Company personnel will not specify customer equipment ratings and only a qualified electrical contractor/electrician should determine the proper service panel and circuit breaker sizes &amp; configurations.</p> <p>Available fault current values are subject to change. If a transformer is replaced with a unit of different size, the available fault current may increase beyond the existing panel's rating.</p>
<b>Fault Current Calculations</b>	<ul style="list-style-type: none"><li>• Calculated using an "infinite bus" on the primary side of the transformer</li><li>• Calculated using the smallest transformer impedance per DOE 10 CFR Part 431 standards</li><li>• Fault types are a bolted (solidly grounded) 3-phase line-to-line fault for the three-phase transformers and a bolted line-to-line fault for the single-phase transformers</li><li>• Calculated at the secondary terminals of the transformer</li><li>• Does not include any secondary/service wire impedances that could further reduce available fault current and allow a lower rated panel to be installed</li></ul>
<b>Additional Help</b>	<p>Please contact your local distribution engineering representative if more precise calculations are required, if there is a combination that is not in the charts, or if the transformers are not 15 kV class (12.47 kV to 13.8 kV).</p>



## 3.2 OVERHEAD TRANSFORMER AVAILABLE FAULT CURRENT

Available Fault Current (RMS Symmetrical) for 12.47kV to 13.8kV overhead transformer

### Single-Phase Overhead (120/240 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
15	1.00%	6,250
25	1.00%	10,417
50	1.50%	13,889
75	1.50%	20,833
100	1.50%	27,778

### Three-Phase Overhead (120/208 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
75	1.00%	20,818
150	1.50%	27,757
225	1.50%	41,636
300	1.50%	55,514

### Three-Phase Overhead (277/480 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
75	1.00%	9,021
150	1.50%	12,028
225	1.50%	18,042
300	1.50%	24,056

### Three-Phase Overhead (120/240 Volt - 4 Wire)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
75	1.00%	18,042
150	1.50%	24,056
225	1.50%	36,084
300	1.50%	48,113

#### Notes:

1. This guide can be used to estimate the maximum available fault current at the secondary terminals of transformers. Values shown are for a bolted 3-phase fault for the 3-phase transformers, and a bolted line-to-line fault for the 1-phase transformers.
  2. Calculations are based upon an infinite high-side available fault current and the lowest impedance that can be expected for each transformer size. Therefore, the fault currents are the largest that can be expected at the transformer secondary terminals under worst-case conditions.
  3. Consideration must be given to the possibility of an increase in available fault current if the existing transformer is replaced with a unit of different size.
- \* Secondary cable runs will lower the fault current seen at the service equipment location. It may be possible to reduce this value, but a qualified person should calculate the new fault current to verify that this can be done. The impedance of the secondary system must be included in this calculation.

### 3.3 Padmount Transformer Available Fault Current

Available Fault Current (RMS Symmetrical) for 12.47kV to 13.8kV padmount transformer

#### Single-Phase Padmount (120/240 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
25	1.00%	10,417
50	1.50%	13,889
75	1.50%	20,833
100	1.50%	27,778
167	1.50%	46,389

#### Three-Phase Padmount (120/208 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
75	1.00%	20,818
150	1.50%	34,697
300	1.50%	69,393
500	1.50%	92,524
750	5.00%	41,636
1000	5.00%	55,514

#### Three-Phase Padmount (277/480 Volt)

Transformer (kVA)	Impedance (%)	Maximum Fault Current (Amps)
75	1.00%	9,021
150	1.20%	15,035
300	1.20%	30,070
500	1.50%	40,094
750	5.00%	18,042
1000	5.00%	24,056
1500	5.00%	36,084
2000	5.00%	48,113
2500	5.00%	60,141

#### Notes:

1. This guide can be used to estimate the maximum available fault current at the secondary terminals of transformers. Values shown are for a bolted 3-phase fault for the 3-phase transformers, and a bolted line-to-line fault for the 1-phase transformers.
  2. Calculations are based upon an infinite high-side available fault current and the lowest impedance that can be expected for each transformer size. Therefore, the fault currents are the largest that can be expected at the transformer secondary terminals under worst-case conditions.
  3. Consideration must be given to the possibility of an increase in available fault current if the existing transformer is replaced with a unit of different size.
- \* Secondary cable runs will lower the fault current seen at the service equipment location. It may be possible to reduce this value, but a qualified person should calculate the new fault current to verify that this can be done. The impedance of the secondary system must be included in this calculation.

## 4.0 MOTORS AND SPECIAL EQUIPMENT

### Introduction

The proper operation of motors and other electrical equipment is necessary to:

- Minimize objectionable motor starting effects.
- Protect the service integrity to other customers.

All motors require starting currents substantially greater than their normal running currents. Normal starting currents can be five to six times greater than the running current. Excessive starting currents will result in objectionable drops in the supply voltage to customers in the vicinity. Per the MidAmerican Energy Electric Tariff No. 1 filed with the Iowa Utilities Board, *customer facilities must be maintained and operated so they do not adversely affect service to other customers.*

Therefore, the customer's equipment must normally conform to the following requirements. Any exceptions thereto will be subject to a distribution engineering review and documented in a written agreement between MidAmerican Energy and the customer.

For all motor installations greater than five horsepower, customers are required to fill out the motor data form provided by your local distribution engineering representative. Contact your local distribution engineering representative with the completed form.

It is imperative an engineering system study be completed prior to any motor purchases. Starting current limitations on the electric distribution system may force the Company to make upgrades at the customer's expense in order to accommodate the load. Each customer should recognize the possible need to upgrade an existing electric service entrance in order to properly serve the new load.

### Guidelines for Motor Sizes

Single-Phase Motor	Guideline
Up to 2 horsepower	May be operated on 120 volts
2 horsepower and larger	Must be operated on 208 or 240 volts
5 horsepower and smaller	May be operated without special means of reducing starting current. <ul style="list-style-type: none"><li>• Air conditioning units shall be limited to a Locked Rotor Amps (LRA) of 100 amps. LRA exceeding 100 amps may impair service voltage and require additional facilities necessary to provide adequate service. Cost of excess facilities will be at the expense of the customer to remediate.</li></ul>
Larger than 5 horsepower	May be permitted with Company approval if: <ul style="list-style-type: none"><li>• Company facilities are adequate to supply the service and</li><li>• The use of such motor does not interfere with quality of service to other customers.</li></ul>

Single-phase motors rated 230-240 volts may not operate satisfactorily on 208 volts. Check manufacturer's specifications.

*Continued on next page*

## 4.0 MOTORS AND SPECIAL EQUIPMENT, Continued

Poly-phase Motor	Guideline
Larger than 5 hp operated from single-phase service by use of phase converter	May be allowed only with Company approval
15 horsepower and over	May be permitted with Company approval if: <ul style="list-style-type: none"><li>• Company facilities are adequate to supply the service and</li><li>• The use of such motor does not interfere with quality of service to other customers.</li></ul> Company may require customer to limit the motor starting current by use of reduced voltage starters or other acceptable means.

Reduced-voltage starting requirements for the larger motors, single-phase or poly-phase, must be equivalent to the maximum allowable across-the-line starting current for smaller motors, five horsepower and under. Contact Company representative regarding any starting current limitations or information on high-efficiency motors.

### Special Equipment

The installation of certain special types of equipment may have an adverse effect upon the electric service to adjacent customers. The customer is responsible for any cost associated with alleviating adverse effects caused by the installation of special equipment.

Types of special equipment in this category include, but are not limited to:

- Grain bin motors
- Welders
- X-ray equipment
- Diathermy equipment
- Radio transmitters
- Geothermal heat pumps
- Tankless water heaters

Prior to installation, contact Company representatives to determine if any specific installation requirements are necessary.

### Power Factor

A low power factor in a customer's electric system produces an adverse effect on the:

- Company's electric supply system and
- Customer's electrical equipment

*Continued on next page*

## 4.0 MOTORS AND SPECIAL EQUIPMENT, Continued

Additional charges may be imposed on the customer when the customer's power factor falls below a specified limit, as stated in the rate schedules of the Company's tariff.

It may be cost-effective for the customer to install high power factor equipment and/or capacitors to maintain an acceptable power factor.

Contact your Company representative for information regarding power factor correction techniques.

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<b>Load Balance</b>	If poly-phase service is provided, the customer must maintain reasonable electrical balance between the phases as measured at the meter.
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## 5.0 SERVICE INFORMATION

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<b>Company</b>	To avoid unnecessary expenses or delays, the customer is required to contact a Company representative before construction or remodeling begins.
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<b>Customer Responsibility</b>	For residential services, the customer must submit the following to a Company representative:
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- A completed service application
- Must post address prior to installation of service
- Site must meet requirements identified on the service application

For all service other than residential (single family or duplex), the customer must submit the following to a Company representative:

- A minimum of two sets of
  - Plot plans
  - Building elevations
  - Electrical service entrance diagrams
    - Connected load
    - Anticipated demand
- An electronic copy of site plan in CAD file
- A completed service application
- Must post address prior to installation of service

These items will be used to discuss the most economical and mutually beneficial service location.

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<b>Service Agreement</b>	A Company representative will submit an agreement or proposal to the customer to be signed and returned.
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<b>Service Location</b>	A Company representative will discuss and determine the service location with the customer or their representative.
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The Company may refuse connection to any service entrance not installed in an approved location.

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## 5.0 SERVICE INFORMATION, continued

<b>Customer Contribution</b>	<p>If a customer contribution is required, a Company representative will make arrangements with the customer for payment.</p>
<b>Inspection and Approval</b>	<p>When the installation is ready for service, the customer should contact the Company and, if required, the appropriate governmental authority to request inspection(s).</p> <p>When accepted by a Company representative and, if required, approved by the appropriate governmental authority the service and meter will be installed.</p>
<b>Requirements For Scheduled Work For Service</b>	<p>The customer should provide an approximate need date for installation. MidAmerican Energy personnel will inspect site for readiness and, if appropriate, will schedule work to be done. The customer is responsible to have site ready for construction by completing the following items:</p> <ul style="list-style-type: none"><li>• Address must be clearly posted at property.</li><li>• All necessary easements and permits for electric utilities that are required to be obtained by customer have been obtained and staked, where applicable</li><li>• Ground must be within four (4) inches of final grade where Company facilities are to be installed.</li><li>• Foundation or meter site must be backfilled and properly compacted to prevent settling.</li><li>• All material and obstructions must be removed from path where Company facilities are to be installed.</li><li>• The location of any customer-owned underground facilities (i.e. fuel lines, sanitary sewer/septic lines, sump pump lines, watering systems, satellite TV cables, etc.) must be identified and clearly marked.</li><li>• The customer is required to maintain all erosion control.</li></ul>
<b>Recreational Vehicle Parks</b>	<p>Service to vacation and recreational vehicle parks will normally be:</p> <ul style="list-style-type: none"><li>• Supplied through one metering installation or as determined by Company representative.</li><li>• Billed to the park owner/operator on the applicable general service or commercial/industrial rate.</li></ul> <p>Any variation to the above will require approval by a Company Representative.</p> <p>Service will be extended as provided in the Company's tariff.</p>
<b>Pole Attachments</b>	<p>Nothing shall be attached to Company poles without a contractual agreement with the Company.</p>

## 6.0 SERVICE AND SERVICE ENTRANCES (General)

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### One Service

Unless stated otherwise in the rate, price schedule, or tariff, the Company will normally permit only one service per structure.

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### Disconnection Means

Section 230.70 of the NEC requires a service to have a disconnecting means.

The main switch and fuses or circuit breakers shall be of ample capacity to:

- Carry the load
- Safely interrupt the available fault current at the particular location

If fault current information is required, contact your Company representative for the available fault current.

If the customer's load is larger than that which can be protected with standard fusing, the customer will be required to install a disconnecting means acceptable to the Company.

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### Location of Disconnection Means

The service disconnecting means shall be installed at a readily accessible location per *NEC* and shall comply with applicable local electrical codes, and shall be:

- Outside of the building or structure, or
  - Inside nearest the point of entrance of the service conductors, or
  - On the meter pole when applicable.
- 

### Overcurrent Device

An overcurrent device (fused or breakered):

- May not be required adjacent to the metering point, but
  - Shall be installed in accordance with the *NEC* at each entrance served through the meter.
- 

### Customer Supplied Equipment

The customer must provide, install and maintain the additional equipment necessary for the service, including the meter socket and any required weatherproof placards.

The customer must provide a service attachment of adequate strength to support the Company's service conductors. (*NEC* Section 230.27, 230.28, 230.29). See Figures 3 and 4.

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## 6.0 SERVICE AND SERVICE ENTRANCES (General), continued

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### Conductor Sizing

It is recommended that customer-installed service conductor ampacity be matched to the main breaker size.

The minimum size allowed for service entrance conductors is #8 AWG.

Although it is not recommended, the grounded neutral may be reduced in ampacity in accordance with the *NEC*. However, if the neutral is reduced more than two sizes, calculations justifying the reduction must be accepted by the Company. The grounded neutral may be bare copper conductor or may be insulated and marked with a white or natural gray color. (*NEC* Section 200.6, 200.7, 230.41).

Reference pg. 34 for allowable conductor size.

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### Equipment Specifications

All service entrance equipment shall be UL listed.

Meter sockets shall meet Company specifications and shall be UL Listed. See Appendix A.

Contact your Company representative for an approved meter socket list or see MidAmerican Energy website <https://www.midamericanenergy.com/media/pdf/approved-socketlist-midam.pdf>

Service entrances for residential customers shall have a rated ampacity of at least 100 amperes at 120/240 volts, three-wire, single-phase. A minimum 200 amp meter socket is required for all underground residential services smaller than 200 amps.

If the service size is 400 amps or less, self-contained metering will be used.

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### Service Entrance Conductors

Only service entrance conductors shall be installed in the service entrance conduit.

Service entrance conductors shall not exceed 10 per phase.

The service drop and attachment point shall not be enclosed within any buildings, alteration, facade or addition.

The point of attachment shall be on the side of the structure adjacent to the distribution facilities.

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### Clearance Requirements

If changes occur to a customer's property, such as grade changes or construction of decks or garages, which result in inadequate clearance, the customer will be required to relocate or bring the service into compliance with current *NEC* and/or *NESC* requirements. Refer to Figures 1 and 2.

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## 6.0 SERVICE AND SERVICE ENTRANCES (General), Continued

<b>Meter Location</b>	<p>All meter and related metering equipment locations shall be approved by the Company. Unless Company approval of an exception is given, all meters and related metering equipment must be:</p> <ul style="list-style-type: none"><li>• Installed outside and securely attached to a permanent structure</li><li>• Located on the front half of the structure</li><li>• Accessible to Company employees</li><li>• Protected from physical damage</li><li>• Provided with adequate traffic protection, if deemed necessary by the Company</li><li>• Separated from a source of combustion by at least 3 feet</li><li>• In compliance with Figure 1</li><li>• A weatherproof placard with minimum 3/4 inch etching lettering labeling the address of service must be installed on standalone meter structures.</li></ul>
<b>Meter Poles</b>	<p>If a meter pole is used, it shall be:</p> <ul style="list-style-type: none"><li>• Owned and installed by the customer (except for primary-metered customers)</li><li>• In a location mutually agreed upon between the customer and the Company</li><li>• In an accessible location out of the way of traffic</li></ul>
<b>Meters Not On Permanent Buildings</b>	<p>Meters shall not be installed on a trailer, mobile home or any building not on a permanent foundation.</p> <p>Typical meter installations for these applications are referenced in Figure 14 for meter pedestal and Figure 15 for meter pole.</p>
<b>Meter Clearances</b>	<p>A clear working space of not less than:</p> <ul style="list-style-type: none"><li>• 36 inches in front of the meter</li><li>• 30 inches wide</li></ul> <p>must be maintained at all times or the meter will be relocated at the customer's expense. (NEC Section 110.26)</p>
<b>Multiple Meters</b>	<p>Upon prior approval from the Company, two meter sockets installed on a duplex may be separated. Three or more meter sockets installed on the same building must be grouped.</p> <p>Unused meter sockets shall have a plastic protective cover and shall be sealed.</p> <p><b>Before service is energized, the following information, where applicable, must be plainly marked on each meter socket cover, socket back plate, and associated breaker or fuse panel with a weatherproof placard with min. 3/4" etched writing.</b></p> <ul style="list-style-type: none"><li>• Apartment numbers</li><li>• Duplex numbers</li><li>• House meter</li><li>• Water heater, etc.</li></ul> <p>Identification and marking of these meter sockets and the breaker or fuse panel for each individual unit or apartment, is the responsibility of the customer. See Figures 24 and 26.</p>

## 6.1 OVERHEAD SERVICE

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<b>Company Responsibility</b>	The Company will install, operate and maintain all overhead facilities located between the customer's property line and the first point of attachment to the customer's building or other structure.
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<b>Customer Responsibility</b>	The customer shall install, own, operate, and maintain all overhead facilities beyond the meter
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<b>Requirements</b>	<p>Attachment of the customer's metering equipment and distribution wiring will not be allowed on Company poles without a contractual agreement including an acceptable hold harmless provision with the Company.</p> <p>Service entrance conductors, between the weatherhead and the main disconnect, must be installed in conduit and will extend 36 inches beyond the weatherhead.</p> <p>Where not accessible by a service truck, overhead service attachment must not exceed 18' above ground level.</p> <p>The service drop should not cross adjoining property or livestock areas.</p> <p>Conduit must be installed between the meter socket and main disconnect.</p> <p>Check with your Company representative concerning service and metering applications over 600 volts.</p> <p>Reference pg. 34 for allowable conductor size.</p> <p><b><u>The use of any conduit body fitting (LB, LL, LR, etc.) ahead of the meter is prohibited.</u></b></p>
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## 6.2 UNDERGROUND SERVICE

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### Residential Service

Underground service to individual residential dwellings and duplexes will normally be installed, owned and maintained by the Company. The Customer has the option to install a residential service initially per the requirements below and in Appendix G. The service will become the property of the Company once the service is approved and placed in service. This includes individual residential structures on zero-lot line properties.

Services to residential multi-plex structures (more than two residential units on a connected structure) will be furnished, installed, owned and maintained by the Customer. Meters must be grouped with multi-meter equipment unless required by the local jurisdiction to be split out to individual meters per unit. Individual services on a multi-plex structure will be furnished, installed, owned and maintained by the Customer.

For zero-lot line residential structures, the customer is required to install a conduit system for all primary and secondary cable routes in a manner satisfactory to the Company.

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### Customer-Installed, Residential Service

Upon prior approval from the Company, the customer may be allowed to make the underground service installation.

- Customer-installed, Company-owned cable shall be approved by and installed in a manner satisfactory to the Company. All cable must be installed between 30" and 42" below final grade.
  - Customer-installed residential and duplex underground services will be owned and maintained by the Company per applicable tariff.
  - The customer will be required to pay the applicable income tax surcharge.
  - Customer-installed, Company-owned cable MUST match service size conductor referenced in Appendix G Section 5.1. Incorrect wire types will be re-installed by the company at the customer's expense.
  - The customer or contractor must call the Company and schedule a site review after the service cable is installed. Both ends of the trench, at the electric meter and at the Company's enclosure, must be left open for the review. Ends of the red marking tape must be exposed at both ends of the trench. The bottom end of the riser pipe must be visible at the meter end of the trench.
  - See Appendix G for more information on customer installed residential services.
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### Commercial, Industrial and Other Services

Underground commercial, industrial, and "other" services will be furnished, installed, owned and maintained by the Customer. Other services include residential multi-plex structures (a structure containing more than two residential units), second service to a detached garage, pole buildings, and any service not defined as a residential service. The Customer will install per NEC requirements, the Company will terminate and make final connections in the transformer.

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### Mobile Home Park Services

Underground services for mobile home parks will be furnished, installed, owned and maintained by the Customer.

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### Network Services

Underground network services are normally furnished, installed, owned and maintained by the Company. Please contact local engineering to determine if network service is available in your area.

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### Ground Movement

- A slip sleeve or expansion joint shall be furnished and installed by the customer on all new and rewired underground residential services and recommended for all commercial services.
- An expansion joint shall be a minimum twelve (12) inch length Schedule 80 PVC installed at the bottom of the meter cabinet.

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## 6.2 UNDERGROUND SERVICE, continued

<b>Placement of Transformer</b>	<p>Consult your local governing authority regarding placement of transformers adjacent to buildings and building openings.</p> <p>It is necessary to have adequate and unobstructed space for the installation and maintenance of padmounted transformers.</p> <p>Minimal clearances are shown in Appendix B-1 for Company installation and maintenance requirements.</p> <p>A 3'-0" minimum clearance is to be maintained from pad sides and back, to the nearest structure. A level graded, 10'-0" minimum clearance is to be maintained from the front of the pad, to the nearest fixed structure.</p> <p>When traffic protection is necessary, contact local distribution engineering for requirements.</p>
<b>Transformer Pads</b>	<p>Pads for single-phase transformers will be furnished and installed by the Company</p> <p>Three-phase transformer pads must be:</p> <ul style="list-style-type: none"><li>• Installed by the customer at the customer's expense</li><li>• Constructed in a location approved by the Company, with hard surface truck access and unobstructed work space for large vehicles. Truck access is to be permanently maintained by customer.</li></ul> <p>See concrete pad specifications in Appendix B.</p> <p>Contact the appropriate Company office for an inspection after the framework is placed. A two business days notice shall be given to the Company for this inspection.</p>
<b>UG Service Installed by Customer in OH Areas</b>	<p>Sufficient cable shall be left at the base of the service riser pole to connect to the Company's overhead system.</p> <p>The dimensional limitations and acceptable arrangements of conduit exits are shown on Figure 9.</p>
<b>Requirements</b>	<p>Conduit must be installed between the meter socket and main disconnect.</p> <p><b><u>The use of any conduit body fitting (LB, LL, LR, etc.) ahead of the meter is prohibited.</u></b></p>

## 6.2 UNDERGROUND SERVICE, continued

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### Communication Tower Service

The Company will normally permit only one service per communication tower site, regardless of the number of tower users. The tower owner is required to install sufficient meter positions when the first tenant goes on the tower to accommodate all possible tenants. Label each position as Unit #1 or A, etc... **Do not use tenant names as tenants may change.**

**Minimum four gang multi-meter pack required for new tower installations. (See Figure 24 & 26)**

Metering shall be made accessible to Company personnel. Metering shall be installed in one of the following ways:

- Outside of the customer's secured area.
- Inside a common fenced area or a separately fenced area and provide provisions for a Company padlock.
- Working space in front of service entrance equipment and meter sockets shall be in 36" in front and 30" wide. See page 23 for Meter Clearances.

## 6.3 UNDERGROUND CONDUIT

### Polyphase Customers

All Company-owned polyphase cables (primary and secondary) installed on commercial/ industrial customer property must be installed in a Company approved, customer provided conduit system, which may include manholes or vaults.

### Single-Phase Customers

Customers requiring single-phase service will be required to install conduit for the following conditions:

- Under existing or likely future hard surface areas
- Where area available for trenching is limited by any of the following:
  - Less than 10 feet clear width
  - Less than 10 feet clear height
  - Slope greater than 1 to 3
  - Distance between paved areas is less than 50 feet
  - Where the edge of the non-trenchable surface on property line is parallel to and within 5 feet of the structure foundation
- Where a single corridor is used for multiple utilities
- Where existing or future landscaping or obstructions will make cable installation, location and repair difficult
- Where a developer is paving a street with islands or medians, and it is necessary to install cable (either street lighting or primary)
- New subdivisions, when required by the company

### Typical Conduit Requirements (All Customers)

Size: single-phase primary - 2 inch  
three-phase primary 4/0 or smaller - 4 inch  
three-phase primary 500 kcmil or larger - 6 inch  
single-phase secondary 1/0, 4/0 and 350 - 4 inch  
single-phase services 1/0, 4/0 - 2.5 inch  
single-phase services 350 kcmil - 3 inch

Number: one for residential, local distribution engineering's discretion for commercial/ industrial

Material: schedule 40 PVC stick or coilable, schedule 40 HDPE coilable, or SDR 13.5 HDPE coilable. Fiberglass stick conduit may be permitted if reviewed by local distribution engineering.

Riser: service riser conduit must be galvanized rigid or schedule 80 PVC. Either rigid conduit risers or box outs must be used where underground service risers will be surrounded by concrete to avoid frost heave.

Color: gray, or black with red stripe only, no other colors allowed

**Local distribution engineering must be contacted before installation to review conduit plan and discuss inspection requirements.**

**The use of any conduit body fitting (LB, LL, LR, etc.) ahead of the meter is prohibited.**

*Continued on next page*

## 6.3 UNDERGROUND CONDUIT, Continued

### Sweep Requirements (All Customers)

Material: fiberglass, or steel (which must be grounded), or HDPE coilable with special approval. Sweeps must be burn-proof (exceeding burn resistant rating) and steel sweeps must include ground lugs and must be bonded where exposed, per the *NEC*.

Radius: 3" or less - 36" sweep  
over 3" - 48" sweep

### Installation Requirements (All Customers)

Conduit materials and installation methods must be acceptable to the Company.

- All conduit depth measurements are from finished grade.
- Conduit for primary cables shall have a minimum cover of 42 inches and maximum cover of 48 inches.
- Conduit for secondary and streetlight cables shall have a minimum cover of 30 inches and maximum of 42 inches.
- Customer will install a synthetic pull tape of 500 lbs. test in the conduit. Pull tape shall be one continuous pull type, and may not be multiple pieces tied together.
- Customer will seal off conduit with a conduit cap glued to end of pipe and mark it with a stake. A Company supplied locator ball may be required in addition to a stake.
- The bottom of the trench in which the conduit is placed should be relatively smooth, undisturbed earth, well-tamped earth or sand.
- No more than 270° in a pull.
- Openings in manholes for new conduit installations need to be grouted in or installed with hydraulic cement to prevent debris entering manhole. This seal must be inspected by an Company representative before the trench is backfilled.
- Conduit shall be cut down to 3" above grade when being installed in a fiberglass transformer basement or enclosure basement.
- **Trenches must be inspected by a Company representative before being backfilled.**

The customer may choose to install the service entrance at a location on the building that eliminates the necessity for Company cables to be in conduit. The location must meet the requirements of Section 6.0 of this manual. Reference Appendix G for other installation instructions.

Where the customer owns and maintains the service, the requirements to install the conduit may be waived by the Company.

### Ground Movement

- A slip sleeve or expansion joint shall be furnished and installed by the customer on all new and rewired underground residential services and recommended for all commercial services.
- An expansion joint shall be a minimum twelve (12) inch length Schedule 80 PVC installed on the conduit riser.



## 6.4 OVERHEAD PRIMARY METERING (Over 600 volts)

---

**Company  
Responsibility**

Primary metering is required ahead of any customer-owned primary facilities. The Company will provide and install the following:

- Primary service drop conductors
- Primary meter pole
- Meter socket
- Instrument transformers
- Meter grounding
- Meter
- Meter wiring

Location and design of the metering shall be referred to appropriate Company technical personnel. See local distribution engineering for pole location.

The primary meter pole will be located at the property line.

The design of the customer's primary system should be submitted to the Company representative for approval by appropriate technical personnel.

---

**Customer  
Responsibility  
(For Untrans-  
Formed  
Service  
Voltages)**

The customer will have the following responsibilities:

- Install and maintain overhead conductors beyond the primary meter pole.
  - Maintain proper clearances in accordance with the NESC.
  - Own, install and maintain a group operated visible break disconnecting means and over current protection immediately beyond the metering pole. The use of a fuse as a disconnecting means will be permitted for single-phase, primary metered services.
  - Ensure that all wiring and equipment installed beyond the meter are in accordance with the NESC in addition to the requirements of the *NEC*.
  - Reference Figure 37 for additional details
-

## 6.5 UNDERGROUND PRIMARY METERING (Over 600 volts)

---

### Provided by Company

The Company will provide and install the following:

- Primary underground conductors between the Company's distribution system and the first point of attachment in the customer-supplied switchgear
- Meters

The Company will provide instrument transformers for metering, which are to be installed by the customer.

---

### Provided by Customer

The customer must provide, in a Company-approved location:

- Company-approved enclosed upright or padmount switchgear
- Fuses
- Grounding bails
- Metering cubicle
- Concrete pads
- Conduits

Reference Figure 37 for additional details.

---

### Clearances

The customer must maintain adequate clearances around the switchgear for operating purposes.

These clearance requirements will be determined by Company technical personnel and meet minimum NESC requirements.

---

### Customer Switchgear

In the design, purchase, and installation of the switchgear package, close coordination is necessary between the customer, switchgear manufacturer and Company personnel.

The customer must furnish a minimum of three copies of the switchgear drawings and site plan for Company engineering approval.

A letter of agreement between the Company and the customer is recommended before the switchgear is ordered.

---

### Wiring

The customer must provide and install all wiring connected to and beyond the metal-clad switchgear according to the NESC in addition to the requirements of the *NEC*.

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*Continued on next page*

6.5 UNDERGROUND PRIMARY METERING (Over 600 volts), Continued

<b>Transformers Beyond Primary Metering</b>	<hr/> <p>For any new primary metering, the customer must furnish, own, maintain, and operate all transformers located beyond the first point of attachment.</p> <p>Padmount transformer installations should be in accordance with Appendix B.</p> <p>All indoor, rooftop, or specialty transformers must be furnished and maintained by the customer.</p> <hr/>
<b>Company- Owned Transformers</b>	<hr/> <p>For existing primary metered customers, the Company may provide standard distribution transformers located beyond the first point of attachment.</p> <p>The customer must provide primary fusing determined to be necessary by the Company to protect Company transformers.</p> <p>The Company will provide loadbreak bushing inserts for Company-owned padmount transformers.</p> <p>All Company transformers will be located in an area accessible to Company vehicles and will meet the clearance requirements of the NESC.</p> <hr/>

## 7.0 CONDUCTOR IDENTIFICATION

### Neutral Conductor

Neutral conductor identification shall be in accordance with *NEC* Section 200.6.

Insulated Neutral	Identification
No. 6 or smaller	An insulated grounded conductor of 6 AWG or smaller shall be identified by a continuous white or gray outer finish or by three continuous white stripes on other than green insulation along its entire length.
Larger than No. 6	An insulated grounded conductor larger than 6 AWG shall be identified either by a continuous white or gray outer finish or by three continuous white stripes on other than green insulation along its entire length or at the time of installation by a distinctive white marking at its terminations. This marking shall encircle the conductor or insulation.

A neutral conductor may be uninsulated in accordance with *NEC* Section 230.41, except for neutral jumpers as indicated in Figures 27, 29, 30, 31 and 32.

### High Phase Conductor

High phase (wild leg) conductor identification shall be marked orange or by other effective means and shall be in accordance with *NEC* Section 110.15 and Section 230.56.

The high phase (wild leg) conductor must be located on the RIGHT HAND TERMINALS OF SELF-CONTAINED METER SOCKETS. See Figure 30 of this book and *NEC* Section 408.3(e).

### Multiple Conductors Per Phase

When multiple conductors per phase are needed for a service, the phase wires must be identified with colored tape so the proper grouping can be determined. The tape must be installed below the termination height so the grouping remains identifiable after cutting the cables to their final height.

Contact a local distribution engineering representative if more than three sets of service conductors are to be installed. Single-phase services will be limited to 500 kcmil conductor. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed.

## 8.0 SERVICE CONDUCTOR SIZES AND CONNECTIONS

---

### **Conductor Sizes**

The Company will allow the use of any NEC approved service conductor as shown in Figure 7. For 3-phase commercial services, no conductor size above 750 kcmil is allowed, including compressed and compact conductors. For Single-phase commercial services, no conductor size above 500 kcmil conductor is allowed. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed.

Residential services must be specific sizes shown in Appendix G.

Contact a local Company representative for questions regarding allowable conductor sizes.

---

### **Connectors Furnished**

The Company will furnish and install connectors to attach standard service conductors to the source of power at Company owned transformers or Company owned secondary enclosures.

---

### **Customer Connections**

All service conductor connections made by the customer ahead of the main disconnect, or connections to instrument transformers, must meet the following requirements:

- All lugs must be UL listed and not modified.
  - Lugs may not be stacked for any application.
  - For other than UL listed, factory-assembled connections, bolts must be Grade 5 or better, plated steel, assembled with a heavy flat washer and cupped spring washer (Belleville) and properly tightened.
  - Bolts must be 1/2" diameter, except as restricted by the terminal hole size of the instrument transformer. These should be sized with no modifications to the CT bars. The instrument transformer terminal holes shall not be enlarged to accept larger bolts. An effort should be made to match the lug hole to the instrument transformer hole size.
  - Lugs must be attached with the maximum number of bolts possible. Two-bolt lugs are required on each side of bar type CT connections.
-

## 9.0 METERING EQUIPMENT

### Metering

The Company will supply meters for metering installations in accordance with the following:

Installation and Capacity of Load-Size Wiring	Metering	Refer To
Single-phase 400 amps or less	Self-contained socket-type	Figures 27-29
Three-phase 400 amps or less	Self-contained socket-type with manual clamping jaw bypass lever	Figures 30-32
Single-phase or Three-phase over 400 amps	Socket-type with instrument transformers	Figures 33-34

The following are prohibited:

- Splices in instrument transformer cabinets or meter sockets for the purpose of service entrance conductor extensions to additional metering points or customer equipment.
- Use of meter sockets and other Company sealed enclosures as junction boxes and raceways for customer's circuits, including 480 volt PT supply wiring.
- Meter sockets with automatic bypass.

### Meter Socket Mounting

Meter sockets must be firmly attached to the structure.

- Mounting screws should be:
  - One-quarter inch diameter
  - At least two inches long
- At least two screws should penetrate a wall stud.
- If attachment is made between studs, molly bolts (or equivalent) are required to provide adequate holding strength.
- If meter socket is installed ahead of siding, insure that the meter socket has room for the installation of the riser pipe.
- If padmount metering with meter socket mounted adjacent to transformer, see Figure 14, or for instrument metering see Appendix F.

*Continued on next page*

## 9.0 METERING EQUIPMENT, Continued

---

### Company Responsibility

The Company will be responsible for the following:

- Furnish the instrument transformers
  - Furnish and install the meters
  - Furnish and install wiring leads from instrument transformers to meter socket
- 

### Customer Responsibility

The customer will have the following responsibilities:

- Furnish, install, and maintain the related
    - Cabinets
    - Conduits
    - Meter sockets
    - Test switches (see Appendix D)
    - Cabinets and conduits shall be grounded per *NEC* Article 250
  - Provide protective bushings on conduit ends
  - Make service entrance conductor connections to the instrument transformers
  - Install pull rope in conduit on instrument transformer installations
- 

### Padlocks or Seals

Meter and instrument transformer cabinets must be equipped with padlockable handle or other means to padlock or seal.

Key locks will not be approved.

---

### Current Transformer

**For service sizes 1200 amps and below, current transformers required for metering shall be installed in a separate cabinet (reference Appendices C-3, C-4, C-5, C-6). With Company approval, current transformers may be installed in transformers for services above 1200 amps. See your local distribution engineering contact.**

---

### Potential Transformer

The potential transformers shall be installed in a separate cabinet (reference Appendix C-1, item 2). They will not be allowed in the secondary compartment of the padmount transformer.

---

### Demand Monitoring

If the customer desires the use of a Company meter signal for demand monitoring purposes, the Company will install, at the customer's expense, a pulse initiation relay external to the meter socket or cabinets.

These contacts will provide the customer with a real and/or reactive power pulse.

---

## 10.0 STANDBY GENERATOR SERVICE

### General

The Company will allow a customer to have standby generators for temporary or emergency electric service; such interconnections must adhere to “Technical Requirements for Interconnection of Generation to the MidAmerican Energy Company Distribution System” (“TRIMECS”).

<https://www.midamericanenergy.com/media/pdf/trimecs---interconnection-requirements.pdf>

### Parallel Operation

For the safety of Company personnel, as well as protection of the customer's Operation equipment and other customers' equipment, there must be a positive means to guarantee that the standby generator cannot accidentally be connected in parallel to the Company's system.

### Transfer Switch

A manual or automatic transfer switch must meet the following requirements:

- Must be installed at the customer's expense.
- Must be installed in a location readily accessible to the company
- **Must be designed so that under no conditions will the standby generator and the Company's electrical system operate in parallel without express written agreement between the customer and the Company.** (For a positive break-before-make design, see Figure 17.)
- Should incorporate a visual indication or some means of determining the physical position of the switch.
- Shall be installed in compliance with this manual and the *NEC*.
- Interlocking breakers with visible means of determining the open are acceptable.
- Socket-mounted transfer switches are allowed.

Before installing a system, please contact your Company representative to be sure the proposed standby transfer switch and meter socket installation meets the Company requirements.

If a standby generator is connected without an approved transfer switch, service will be disconnected until such switch is installed. Safety of personnel demands this requirement.



## 11.00 PARALLEL GENERATION OPERATION

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### Introduction

Operation of generating equipment, connected to the customer's electric system, in parallel with the Company's system is prohibited without express written agreement between the customer and the Company; such interconnections must adhere to Technical Requirements for Interconnection of Generation to the MidAmerican Energy Company Distribution System" ("TRIMECS").

An interconnection customer seeking to operate a distributed generation facility in parallel with the Company's electric distribution system is subject to federal and state laws regarding interconnection of distributed generation facilities. These laws require an interconnection request be submitted to the Company before the generator is installed. Contact the Company's Private Generation group for information regarding interconnection requests:

MidAmerican Energy Company  
Private Generation  
PrivateGeneration@midamerican.com  
P.O. Box 4350  
Davenport, IA 52808-9986  
877-815-0010  
[www.midamericanenergy.com/customer-interconnection](http://www.midamericanenergy.com/customer-interconnection)

### General

Any electric service entrance modifications needed to accommodate a distributed generator require a customer non-refundable payment for the full cost of the utility service modifications.

Federal and state laws require an electric distribution system study be completed prior to any distributed generator interconnection. Limits on the electric distribution system may require the Company to make distribution system upgrades at the customer's expense in order to accommodate the distributed generator interconnection. Any distribution system upgrades needed to accommodate a distributed generator require a customer non-refundable payment for the full cost of the distribution system upgrades.

Federal and state laws allow the Company to conduct a witness test of the distributed generator prior to continuous operation of the distributed generator in parallel with the Company's electric distribution system. The interconnection customer is responsible for providing an authorized representative on site during the witness test that is capable of taking measurements that are required for the witness test. The interconnection customer's representative must be capable of operating a multimeter safely to take voltage and current readings while a MidAmerican representative witnesses the measurements.



# FIGURES

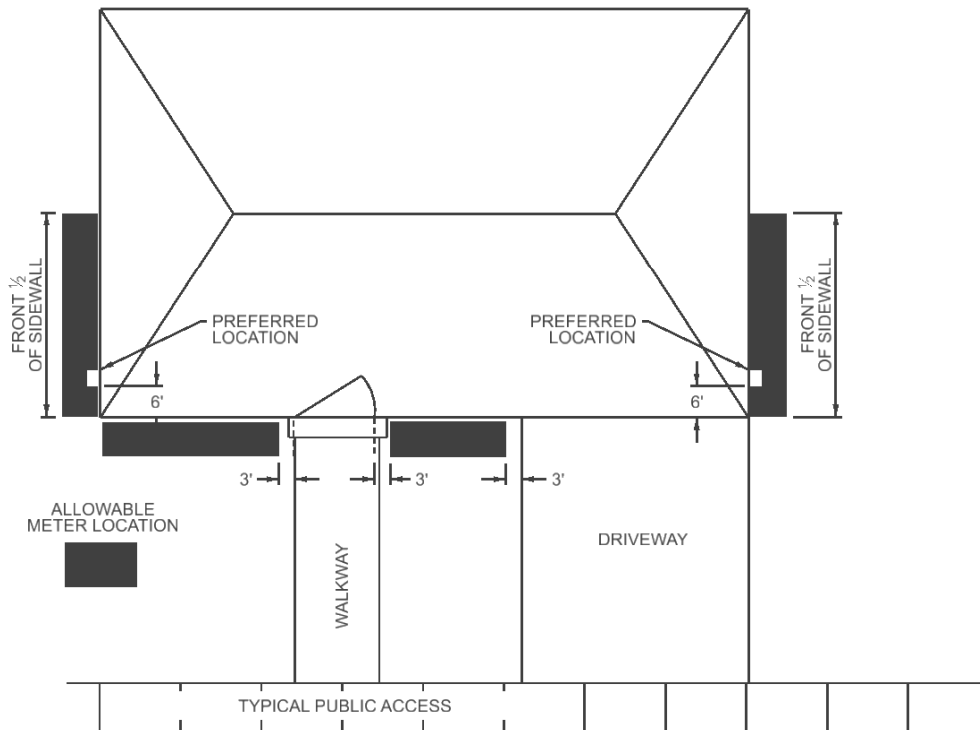
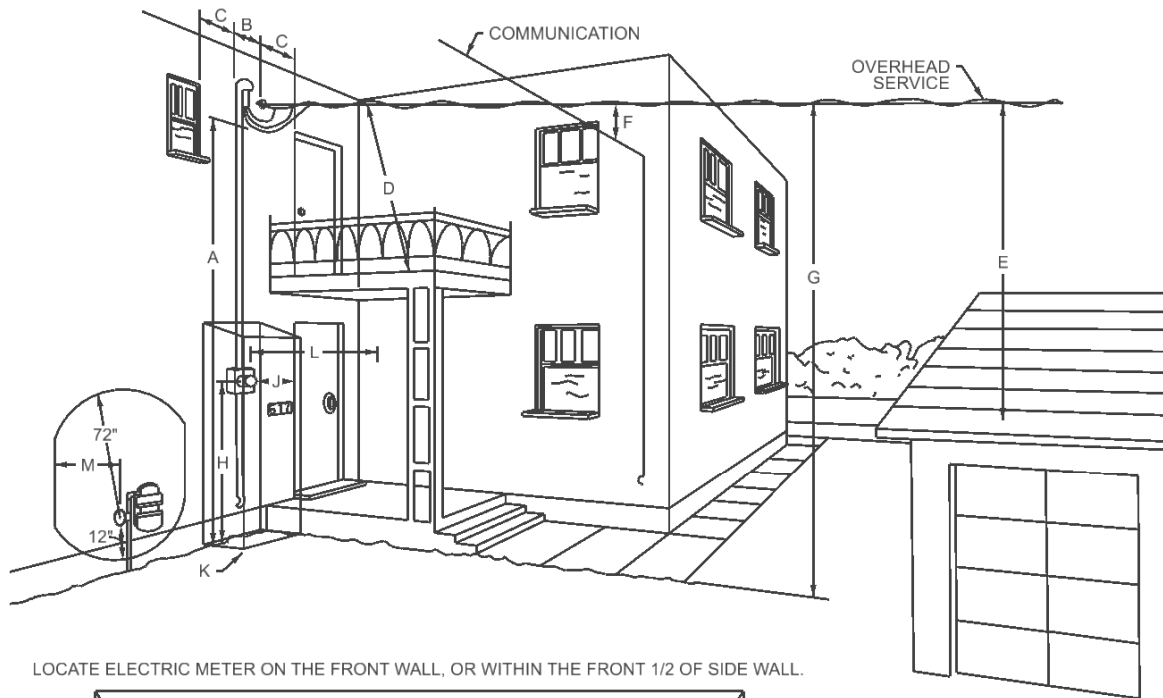
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## MINIMUM CLEARANCES FOR SERVICES 480 V AND BELOW

The following general clearances, under any and all conditions, include MidAmerican Energy Company's requirements and interpretations derived from the NESC Rule 234 and the *NEC* Section 230.24. Refer to these codes for specific conditions not shown in Figure 1. Clearances for utility-owned service drops and cables, beyond the perimeter of the customer's building, will be controlled by the NESC requirements. The following alphabetical designations and respective dimensions apply to Figure 1 on the opposite page. Clearances shown are for multiplex (duplex, triplex and quadruplex) service drop conductors. Open wire service conductors require greater clearances.

- A - The drip loop or service attachment fixture, whichever is the lowest point, shall have 12 feet minimum vertical clearance above final grade. Higher clearances may be required, reference "G" below. Where not accessible by a service truck, overhead service attachment must not exceed 18 feet above ground level.
- B - The clearance between the service attachment and weatherhead shall be 24 inch maximum.
- C - Service conductors that are not protected by conduit or raceway shall have a minimum clearance of 3 feet from windows designed to be opened, doors, porches, fire escapes, signs, and similar construction. Conductors run above the top level of a window shall be permitted to be less than the 3 feet requirement.
- D - The diagonal distance from the nearest edge of a balcony or deck floor that is readily accessible to the service conductor shall be 10 feet minimum.
- E - Refer to Figure 2D.
- F - Minimum vertical clearances between service drop and communication conductors shall be 2 feet at the conductor crossing and 12 inches at adjacent vertically spaced attachments to the building.
- G - The minimum vertical clearance shall be
  - 12 feet above sidewalk and ground
  - 16 feet above residential driveways
  - 18 feet above commercial areas, public driveways, alleys and streets, and other land traversed by vehicles
  - 20 feet above Department of Transportation right of way and others as required by local jurisdiction
- H - For individual settings, the clearance between the center of the meter and the finished grade is to be 6 feet maximum and 4 feet minimum.
- J - The dimension between the hinged side of a door and the nearest surface of the meter is to be door width plus 6 inches.
- K - A clear working space, as shown by the box in the diagram, of not less than 36 inches in front of the meter and 30 inches wide shall be maintained at all times. (*NEC* Section 110.26).
- L - The horizontal clearance from the nearest side of the meter socket enclosure to any structural protrusion shall be 3 inches minimum.
- M - Horizontal distance of electric meter to gas regulator vent is 3-feet minimum.

## MINIMUM CLEARANCES FOR SERVICES 480 V AND BELOW



### **GENERAL NOTES:**

- (1) The house number must be clearly posted and readable from the street.
- (2) The service weatherhead is to be located no lower than the service attachment point to insure a positive drip loop.
- (3) Contact your Company representative for entrance and meter location. The Company will refuse connection to any service entrance not installed in an approved location.
- (4) The customer shall install a suitable service attachment point to obtain proper ground clearance. See Figure 3.
- (5) Overhead service entrance conductor must be in conduit. See Figure 4 (pg. 45) for details.

## **SERVICE CONDUCTOR CLEARANCES OVER ROOFS**

Clearances shown are for multiplex (duplex, triplex, and quadruplex) service drop conductors. Open wire service conductors require greater clearances.

### **GENERAL REQUIREMENTS:**

1. The customer shall install a suitable service attachment point. For proper ground clearance, see Figure 1. For adequate strength requirement, see Figures 3 and 4.
2. Eyebolts connected directly to the roof will not be approved.
3. The service weatherhead is to be located no lower than the service attachment point to insure a positive drip loop.
4. Service drop conductor shall not pass over or within 3.5 feet of furnace, chimney, antenna, fireplace, or sewer vents. See Figure (2A), NESC 234.C.1.b and NESC Table 234.1.

### **SPECIAL CONDITIONS REQUIRED FOR USING CLEARANCES SHOWN IN FIGURE 2(B):**

5. Voltage between open conductors is 300 volts or less; and for multiplex conductors up to 750 volts.
6. The service entrance mast must not be more than 4 feet from the nearest edge of the roof. At a distance of 6 feet from the mast, the service conductors must have a vertical clearance of 3 feet over the roof. If the mast is more than 4 feet from the edge of roof, see Figure 2(C).
7. Roof must be classified as not readily accessible to pedestrians.

### **SPECIAL CONDITIONS REQUIRED FOR USING CLEARANCES SHOWN IN FIGURE 2(C):**

8. Voltage between open conductors is 300 volts or less; and for multiplex conductors up to 750 volts.
9. Roof must be classified as not readily accessible to pedestrians.

### **SPECIAL CONDITIONS REQUIRED FOR USING CLEARANCES SHOWN IN FIGURE 2(D):**

10. For multiplexed conductors up to 750 volts.
11. Special conditions required by Figure 2(B) and Figure 2(C) are not met. Service passes over, but is not attached to building.

## SERVICE CONDUCTOR CLEARANCES OVER ROOFS

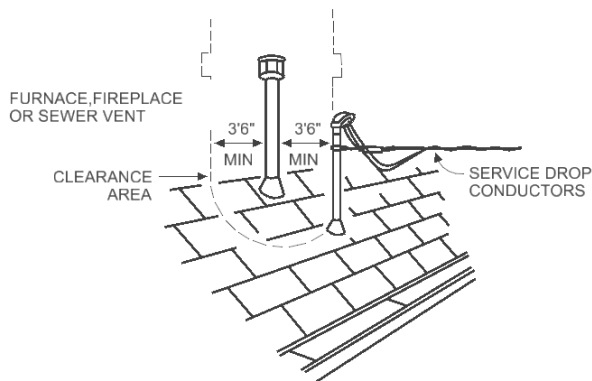


FIG. 2(A)

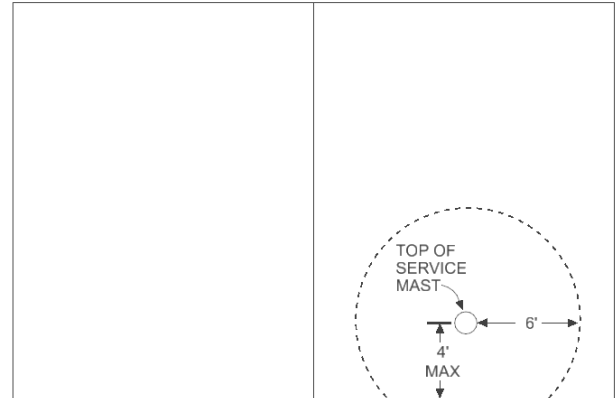


FIG. 2(B)  
ROOF - TOP VIEW

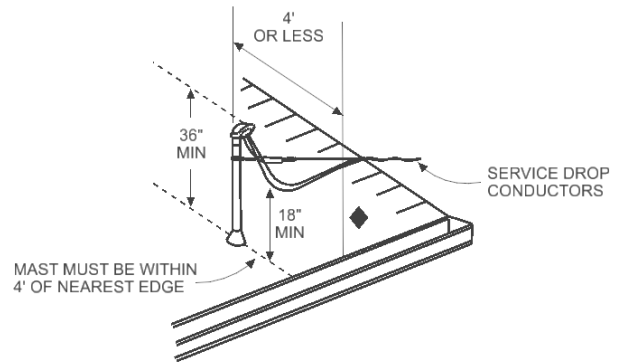


FIG. 2(B)

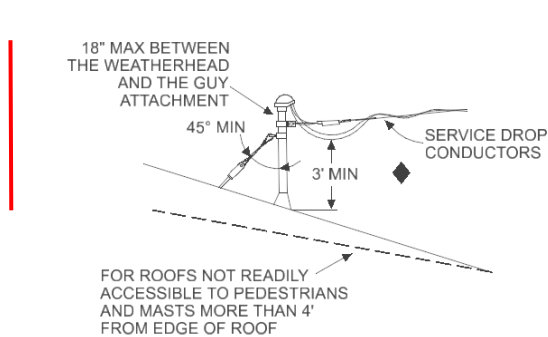


FIG. 2(C)

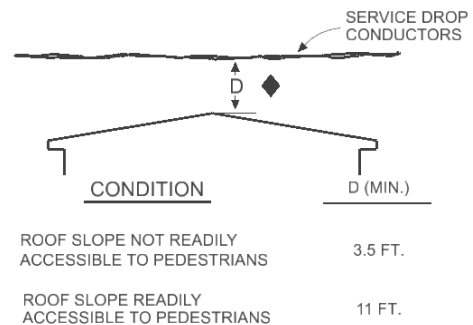
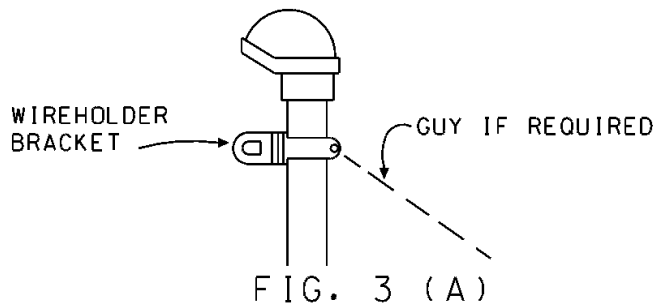


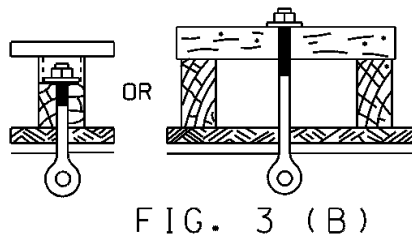
FIG. 2(D)

- THIS VERTICAL DIMENSION APPLIES TO ANY POINT ON THE ROOF SURFACE DIRECTLY UNDER THE CONDUCTORS.

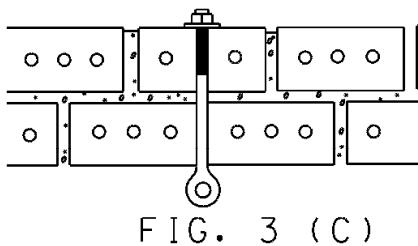
## TYPICAL SERVICE ATTACHMENT PROVISIONS



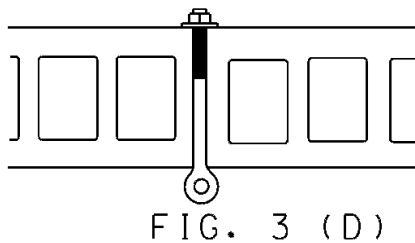
SERVICE RISER MAST  
(REFER TO FIG. 4 FOR  
CONDUIT SIZE REQUIREMENTS)



BRICK VENEER, STUCCO, PLASTER,  
SHEET METAL WALLS, OR ANY  
FRAME BUILDING



SOLID MASONRY, BRICK, OR CEMENT:  
EYE BOLTS MAY BE INSTALLED  
THROUGH THE MORTAR JOINT



CONCRETE BLOCK OR HOLLOW TILE:  
EYE BOLTS MAY BE INSTALLED  
THROUGH THE MORTAR JOINT

1. The customer shall be responsible for all service attachment provisions.
2. Eye bolts, where required, shall be galvanized, 1/2 inch minimum diameter, and installed by the customer. Screw point or lag type attachments (4 inches of thread) are only permitted on rewires with Company approval.
3. Other types of service attachments may be required for larger services.
4. Service drop conductors shall not be attached to fire walls, parapet walls or chimneys.



## TYPICAL OVERHEAD SERVICE MAST REQUIREMENTS

MAXIMUM SERVICE DROP LENGTHS						
ENTRANCE SIZE	RISER MAST CONDUIT SIZE FOR ABOVE THE ROOFLINE (Rigid or Intermediate)	SERVICE ATTACHMENT HEIGHT ABOVE SUPPORT (Ft.)				
		1.5	2	3	4	5
		MAXIMUM SERVICE DROP LENGTH (Ft.)				
100A	2" 2-1/2" or 3" 3-1/2" or 4"	125	100	75	75	50
		150	150	100	100	75
		150	150	150	125	100
200A	2" 2-1/2" or 3" 3-1/2" or 4"	100	75	50	50	50
		150▲	100	75	75	75▲
		150▲	150▲	125▲	100	75
400A	2-1/2" or 3" 3-1/2" or 4"	100	100	75	50	50
		125	100	100	75	75
600A	2-1/2" or 3" 3-1/2" or 4"	50	50	50	50	50
		50	50	50	50	50
800A	3-1/2" or 4"	50	50	50	25	25

### APPLICATION AND CONDITIONS FOR ABOVE TABLE

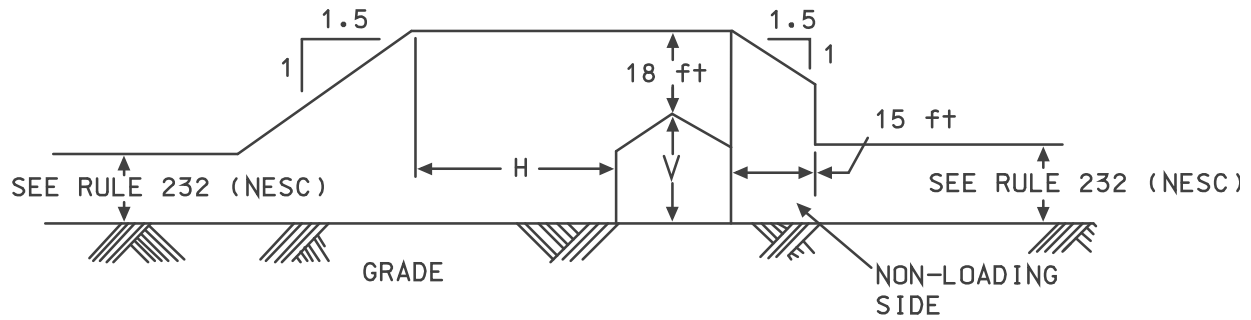
- The maximum service drop lengths shown are for triplex and quadruplex services attached to unguyed riser masts. ▲Marked span lengths indicated that 25 ft. must be subtracted from the indicated span length if service is quadruplex.
- Conductor supports for spans longer than the maximum service drop lengths, for a given condition listed in the above table, must be guyed or braced to withstand the following maximum actual service drop tension:

<u>Entrance Size</u>	<u>Maximum Actual Tension</u>
100A	1500 Lbs.
200A	2000 Lbs.
400A	3500 Lbs.

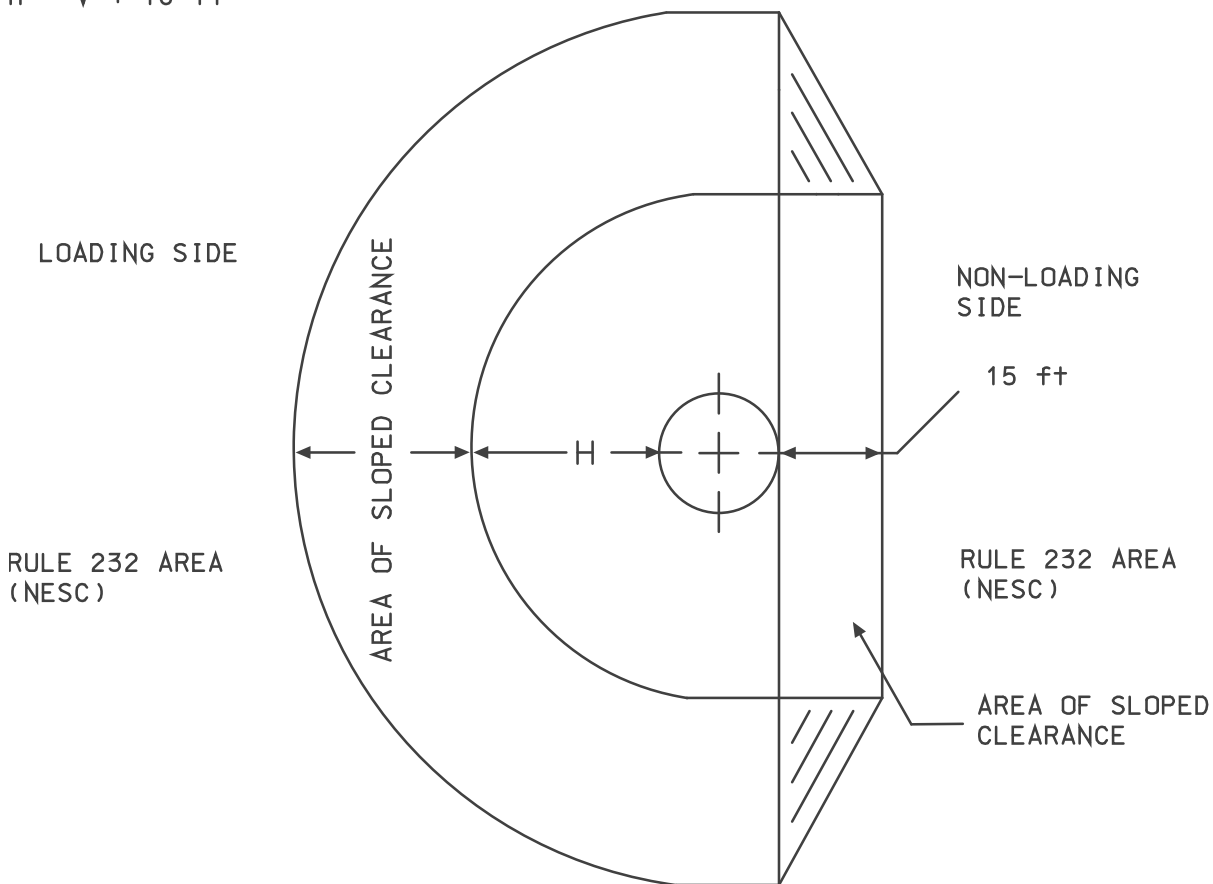
The customer should consider providing additional strength as a "Safety Factor" (*NEC* Section 230.28).

- The service conductor type and span length will be selected by the Company representative as part of their inspection to determine the service entrance location. This information will be made available to the customer on request.
- EMT (thinwall conduit) is not acceptable for any portion of the service mast.
- Conduits of different sizes below the soffit line may not be "slip fit" together and must be joined with an approved electrical conduit reducer (RE, REA, REC) and approved by the local jurisdictional authority.
- Conduit couplings are not allowed above the roofline or less than 2 feet below the soffit line.

# CLEARANCE REQUIREMENTS AROUND GRAIN BINS NESC RULE 234F



$V$  = HEIGHT OF HIGHEST FILLING OR PROBING PART ON GRAIN BIN  
 $H = V + 18 \text{ ft}$



1. Overhead conductors should not be routed through the clearance envelope as shown above. For exceptions or for voltages exceeding 22 kV, see NESC Rule 234F.
2. The customer shall contact the Company representative to review clearances between grain bins and Company facilities.

# CLEARANCE FOR CONDUCTORS INSTALLED OVER OR NEAR SWIMMING AREAS (REFERENCE NESC 234E)

## Swimming Pools

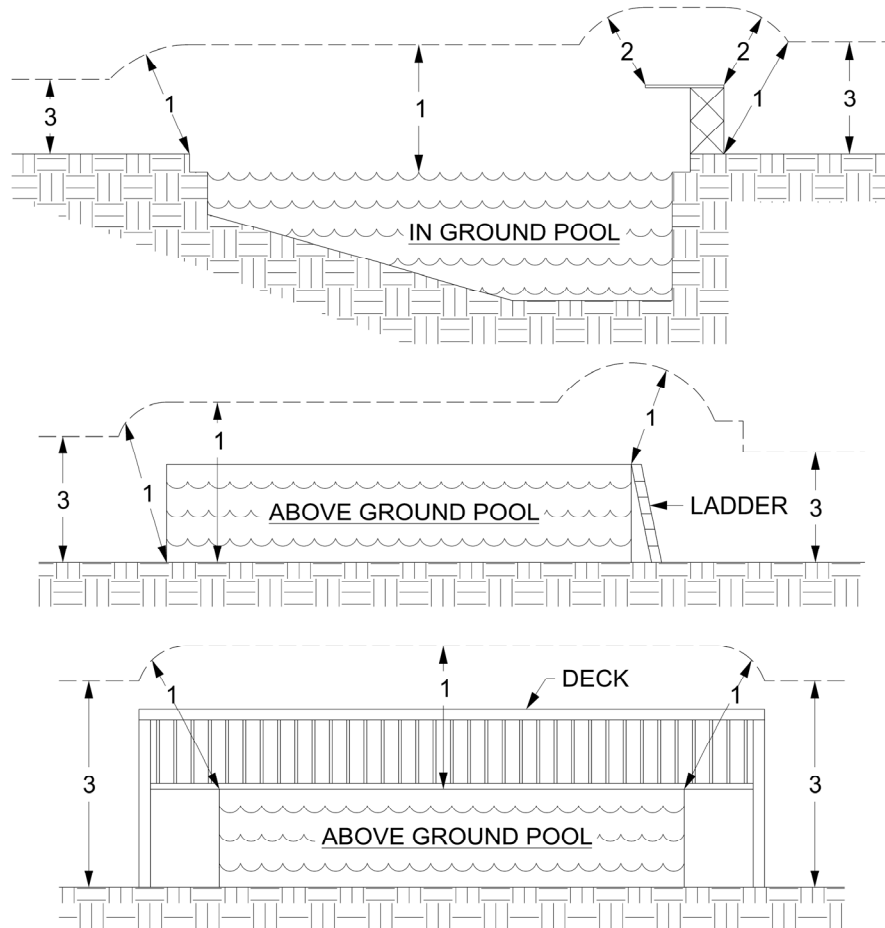
Conductors installed within 10 feet horizontally from the pool edge or diving platform must maintain basic vertical clearances as depicted in the following table.

This rule does not apply to a pool fully enclosed by a solid or screened permanent structure.

## Beaches and Waterways Restricted to Swimming

Where rescue poles are used by lifeguards at supervised swimming beaches, the required basic vertical and horizontal clearances shall be as shown on the following table.

CLEARANCES TO SWIMMING AREAS	UNGUARDED RIGID LIVE PARTS, 0-750V; SECONDARY CABLE	GROUNDED OR INSULATED GUYS; NEUTRAL COND.	OPEN SUPPLY CONDUCTORS		
			0-750V	750V-15kV	ALL 34.5kV
(1) CLEARANCE IN ANY DIRECTION FROM THE EDGE OF POOL, BASE OF DIVING PLATFORM, OR ANCHORED RAFT	22'-6"	22'-0"	23'-0"	25'-0"	25'-6"
(2) CLEARANCE IN ANY DIRECTION TO THE DIVING PLATFORM OR TOWER	14'-6"	14'-0"	15'-0"	17'-0"	17'-6"
(3) VERTICAL CLEARANCE OVER ADJACENT LAND	AS REQUIRED IN CLEARANCES ABOVE GROUND OR ROADWAYS (REF. NESC 232)				
(4) UNDERGROUND DIRECT BURIED CABLE	5' FROM POOL OR AUXILIARY EQUIPMENT (REF. NESC 351C1)				



## GROUNDING REQUIREMENTS

1. All grounding of electric installations shall meet the requirements of *NEC* Article 250, requirements of the Company as shown in these construction standards, adhere to local jurisdictional requirements, and all other applicable codes.
2. The grounding electrode system shall consist of the provisions specified in *NEC* Section 250.50, Section 250.52, and Section 250.56. The Company does not allow the use of gas piping for grounding of electrical services. However, interior metallic gas piping, upstream of equipment service shutoff valves which may become energized, shall be electrically continuous and bonded to any grounding common electrode as defined by the *NEC*.
3. Ground rods, when used, shall be at least 8 feet long and 1/2 inch in diameter if copper, copperclad, or stainless steel, or 5/8 inch in diameter if galvanized or steel. The top of the rod shall be 2 to 6 inches below ground level. In certain instances additional grounding electrodes may be required, see *NEC* Section 250.56. *NEC* Section 250.60 prohibits using a lightning rod grounding electrode as one of the electrodes listed above. Ground rod placement shall take into consideration the direction the service conductor will be installed to avoid damage.
4. Concrete-encased electrode (Ufer Ground), when used, shall be encased by at least 2 inches of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 20 feet of one or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 1/2 inch in diameter, or consisting of at least 20 feet of bare copper conductor not smaller than 4 AWG. Reinforcing bars shall be permitted to be bonded together by the usual steel tie wires or other effective means.
5. If a metal underground water pipe is in direct contact with the earth for 10 feet or more, it must be bonded to the grounding electrode system. In addition, a copper bonding conductor, or equivalent, must be connected around the water meter. See the following *NEC* Table 250.66, reprinted with permission from NFPA 70-2002, the *National Electrical Code*, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association on the referenced Subject which is represented only by the standard in its entirety.
6. The service grounding electrode conductor shall be connected to the neutral bus in the service disconnect or overcurrent device, but may not be connected in the meter socket.

TABLE 250.66 GROUNDING ELECTRODE CONDUCTOR FOR AC SYSTEMS			
SIZE OF LARGEST SERVICE-ENTRANCE CONDUCTOR OR EQUIVALENT AREA FOR PARALLEL CONDUCTORS		SIZE OF GROUNDING ELECTRODE CONDUCTOR	
COPPER	ALUMINUM OR COPPER CLAD ALUMINUM	COPPER	ALUMINUM OR COPPER CLAD ALUMINUM*
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 240 kcmil	4	2
Over 3/0 thru 350 kcmil	Over 250 kcmil thru 500 kcmil	2	1/0
Over 350 kcmil thru 600 kcmil	Over 500 kcmil thru 900 kcmil	1/0	3/0
Over 600 kcmil thru 1100 kcmil	Over 900 kcmil thru 1750 kcmil	2/0	4/0
Over 1100 kcmil	Over 1750 kcmil	3/0	250 kcmil

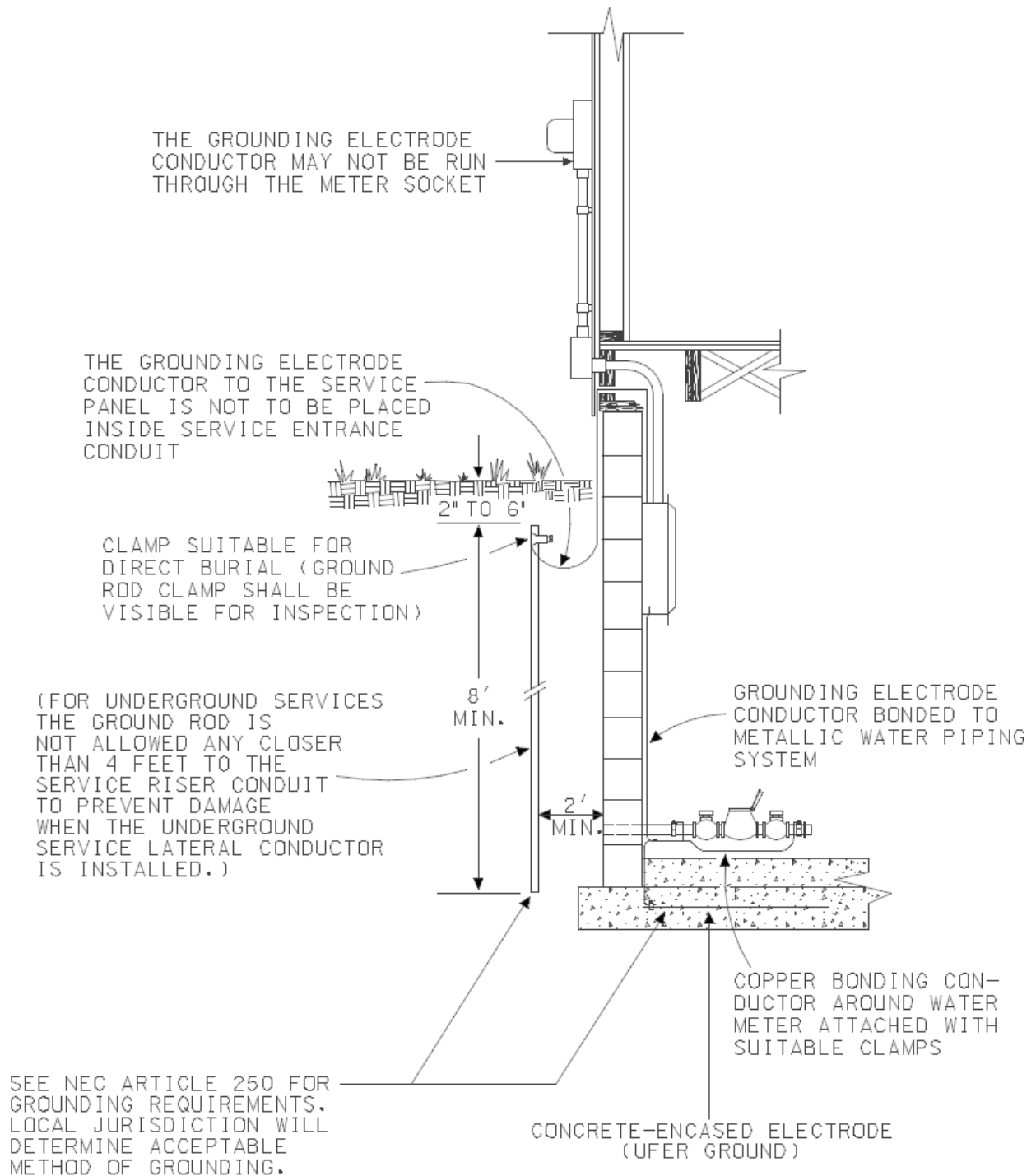
Where multiple sets of service-entrance conductors are used as permitted in *NEC* Section 230.40, Exception No. 2, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.

NOTE: Where the grounding electrode is a rod, pipe, or plate electrodes as permitted in *NEC* Sections 250.52(A)(5) or 250.52(A)(6), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than No. 6 copper wire or No. 4 aluminum wire. Where the grounding electrode conductor is connected to a concrete-encased electrode as permitted in 250.52(A)(3), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than No. 4 AWG copper wire.

\* See installation restrictions in *NEC* Section 250-64.

*National Electric Code* and *NEC* are registered trademarks of the National Fire Protection Association, Inc., Quincy, MA 02269.

## GROUNDING REQUIREMENTS



## ALLOWABLE SERVICE CONDUCTOR SIZES FOR COMMERCIAL SERVICES

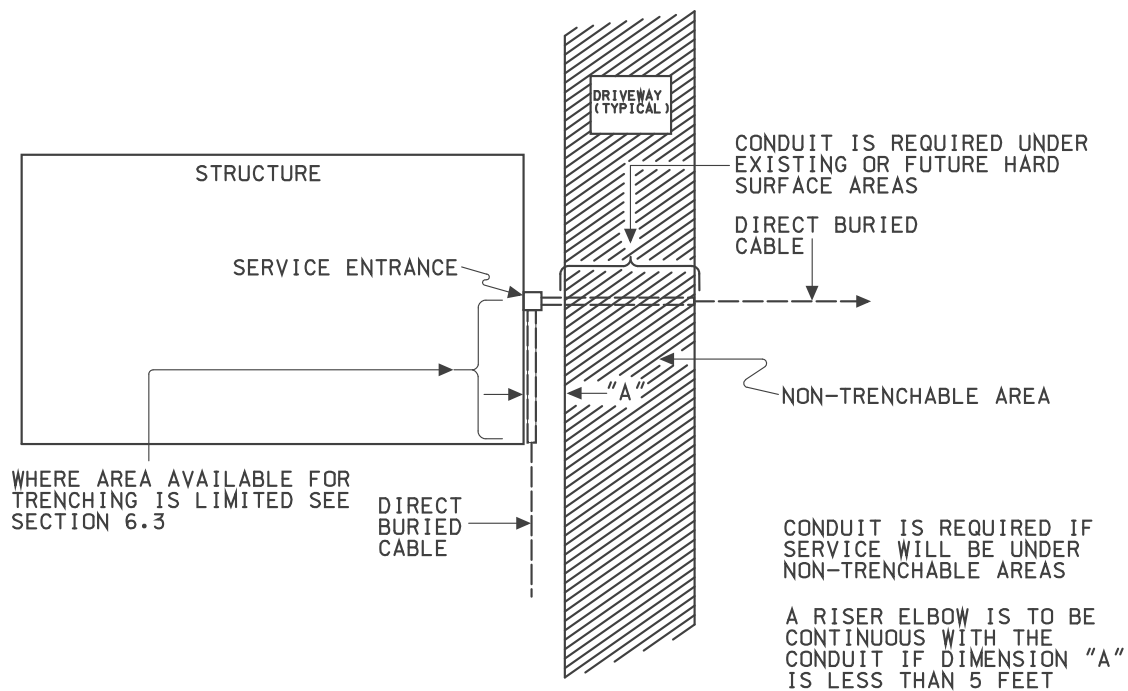
Allowable ampacities of insulated conductors rated 0-2000 Volts, 60° to 90°C (140° to 194°F) not more than three conductors in raceway or cable or earth (directly buried), based on ambient temperature of 30°C (86° F). No conductor sizes above 750 kcmil will be allowed, including compact and compressed conductors. Single-phase service will be limited to 500 kcmil conductor. Contact local distribution engineering if using conductor larger than 350 kcmil to ensure proper secondary terminals are installed.

SIZE	TEMPERATURE RATING OF CONDUCTOR, SEE TABLE 310.13 OF THE NEC						SIZE
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
AWG kcmil	TYPES TW, UF	TYPES RHW THHW, THW THWN, XHHW USE, ZW	TYPES TBS, SA SIS, FEP FEPB, MI RHH, RHW-2 THHN, THHW THW-2, THWN-2 USE-2, XHH XHHW-2, ZW-2	TYPES TW, UF	TYPES RHW THHW, THW THWN XHHW USE	TYPES TA, TBS SIS THHN, THHW THW-2, THWN-2 RHH, RHW-2 USE-2 XHH, XHHW XHHW-2, ZW-2	AWG kcmil
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
8	40	50	55	-	-	-	-
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750

For residential applications, see *NEC* Section 310.15(B)(6).

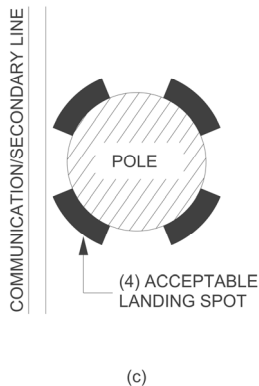
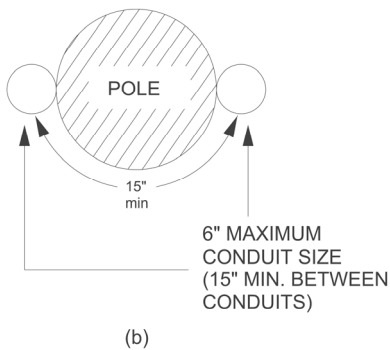
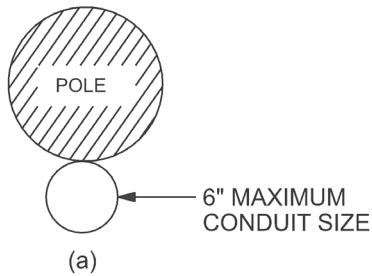
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## UNDERGROUND CONDUIT INSTALLATION



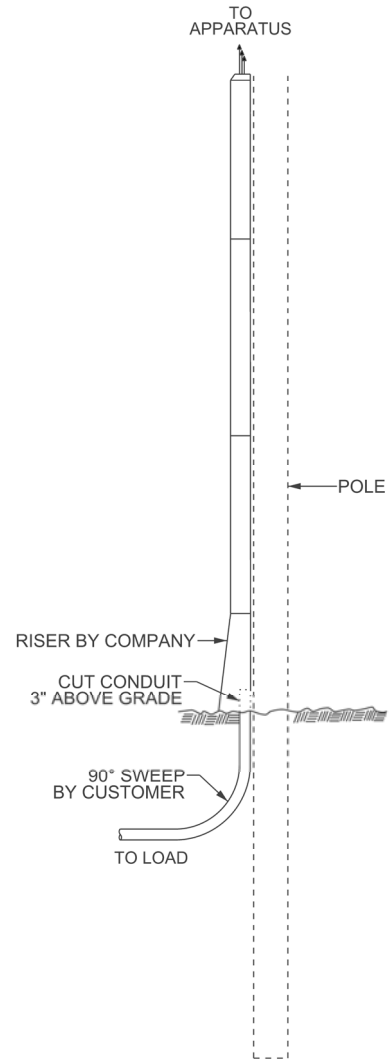
REFER TO SECTION 6.3 FOR CONDUIT  
INSTALLATION REQUIREMENTS

# UNDERGROUND CONDUIT INSTALLATIONS AT RISERS



## NOTES:

1. Contact the Company for approved conduit position prior to each installation. Normally the riser should be mounted on the side of the pole that is opposite the direction of traffic.
2. Installations requiring larger conduit capacity or different conduit orientation than shown must be approved in advance by your Company representative.
3. Conduits are to be installed so that the top end is 3 inch above final grade.
4. PVC conduit is recommended. Sweeps are to be rigid steel or fiberglass. If rigid steel is used, it must be effectively grounded.
5. Contact the Company for recommended length of conductor to be coiled at base of pole so sufficient length is available to reach apparatus.
6. See Section 6.3 for conduit installation requirements.
7. Where conduit is to be extended to a location requiring a new or replacement pole, such extensions shall not be made until the pole work is completed by the Company.
8. Spare conduit to be capped with permanent cap.
9. Conduit will be installed flush against the pole.
10. Where possible, conduit will be landed on the pole quartered away from the communications, secondary, or neutral attachment.



TYPICAL SIDE VIEW



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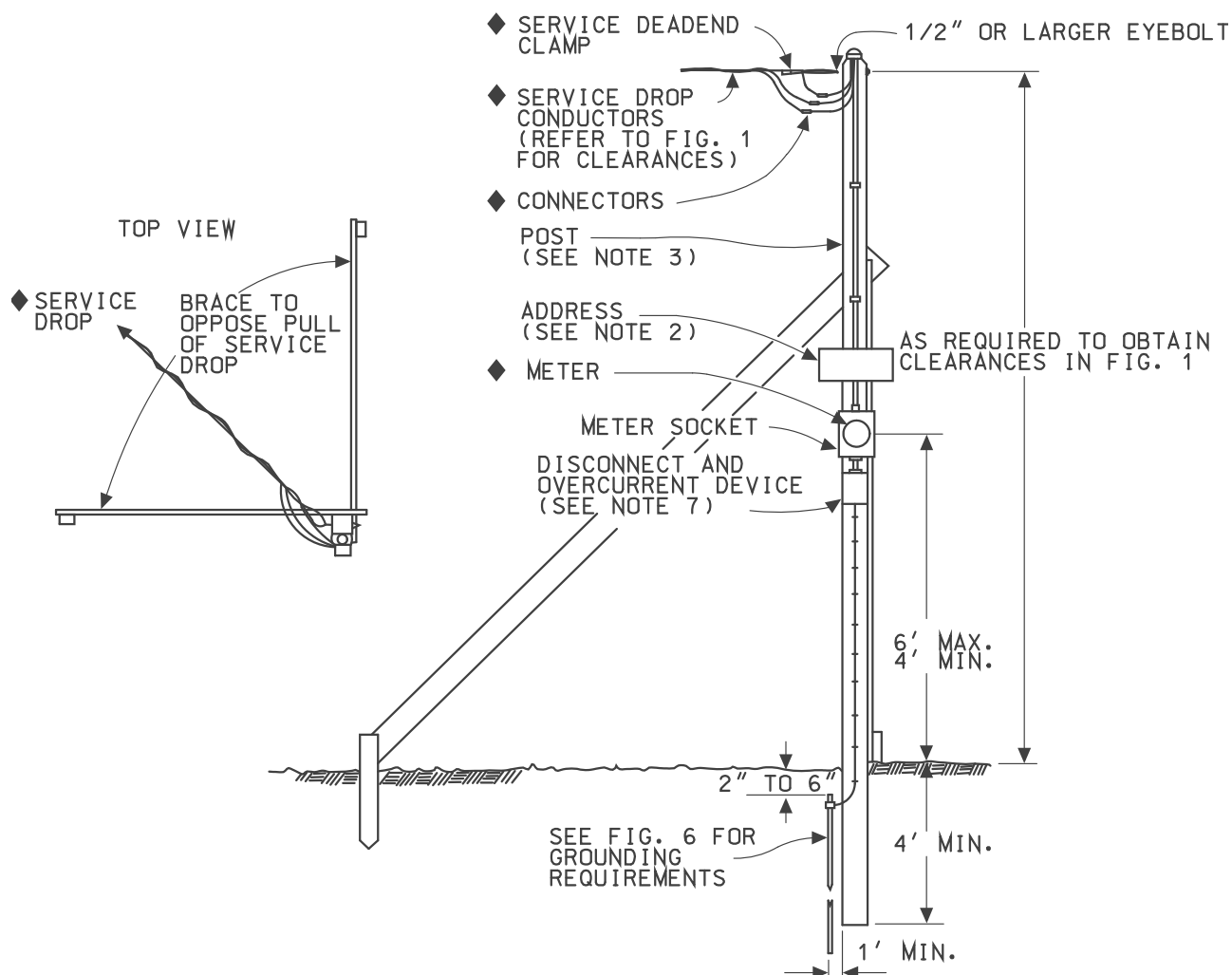
## TYPICAL OVERHEAD TEMPORARY SERVICE

1. The Company will provide and install all ♦ marked items. The customer shall be responsible for all other items.
2. An address sign that is visible from the street shall be posted on the meter setting. It shall be made of materials that provide a clearly legible address for the duration of the setting.
3. With the exception of pedestal type settings, the support shall be a square or round treated timber post, 4 inch x 4 inch minimum or equivalent.
4. Meters shall not be installed on trailers, portable houses, or any buildings not on a permanent foundation.
5. The weatherhead is to be located above the level of the service attachment point.
6. The customer shall provide, install and connect all grounding equipment.
7. All 120 volt circuits shall have ground fault circuit interrupters (GFCI) (*NEC* Section 590.6).
8. All customer provided equipment shall be weatherproof.
9. The service drop conductors shall not cross adjoining property.
10. Single-phase temporary services fed from a 120/208V three-phase transformer and three-phase temporary services of any voltage class require a manual clamping jaw lever bypass.

## CUSTOMERS TO CALL 48 HOURS BEFORE DIGGING TO LOCATE UNDERGROUND FACILITIES

In Illinois call	(800) 892-0123
In Iowa call	(800) 292-8989
In South Dakota call	(800) 781-7474
In Nebraska call	(800) 331-5666
Universal Call	811

## TYPICAL OVERHEAD TEMPORARY SERVICE



SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120 V 2-WIRE	60 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/240 V 4-WIRE	200 A MAX.	FIG. 30
3-PHASE 120/208 V 4-WIRE	200 A MAX.	FIG. 30
3-PHASE 277/480 V 4 -WIRE *	400 A MAX.	FIG. 31

Note: Contact your Company representative for service availability.

\* Disconnect required for 480 V temporary service.

For other temporary service requirements, contact your Company representative.

## TYPICAL UNDERGROUND TEMPORARY SERVICE

1. The Company will provide and install all ♦ marked items. The customer shall be responsible for all other items.
2. An address sign that is visible from the street shall be posted on the meter setting. It shall be made of materials that provide a clearly legible address for the duration of the setting.
3. The service lateral conductors shall be suitable for direct burial.
4. The customer shall provide and install the service lateral conductors in a manner that provides a sufficient length of conductor coiled at the transformer, secondary handhole or secondary pedestal, and end fittings (reference Detail "A") for connection to the power source by the Company.
5. With the exception of pedestal type settings, the support shall be a square or round treated timber post, 4 inch x 4 inch minimum or equivalent.
6. The customer shall provide, install and connect all grounding equipment.
7. All temporary circuits shall have ground fault circuit interrupters (GFCI) (*NEC* Section 590.6).
8. All customer provided equipment shall be weatherproof.
9. If the temporary meter setting is located adjacent to a padmount transformer, secondary pedestal or secondary handhole, it shall be between 5 to 7 feet away from the enclosure.
10. Depending on local regulations, Figure 14 may be used for temporary services.
11. All temporary liquid tight flexible conduit must have steel ends and may not be constructed with 90-degree ends. Temporary liquid tight flexible conduit for secondary pedestals may not be larger than 1 inch diameter.
12. Single-phase temporary services fed from a 120/208V three-phase transformer and three-phase temporary services of any voltage class require a manual clamping jaw lever bypass.

### CUSTOMERS TO CALL 48 HOURS BEFORE DIGGING TO LOCATE UNDERGROUND FACILITIES

In Illinois call	(800) 892-0123
In Iowa call	(800) 292-8989
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## TYPICAL UNDERGROUND TEMPORARY SERVICE

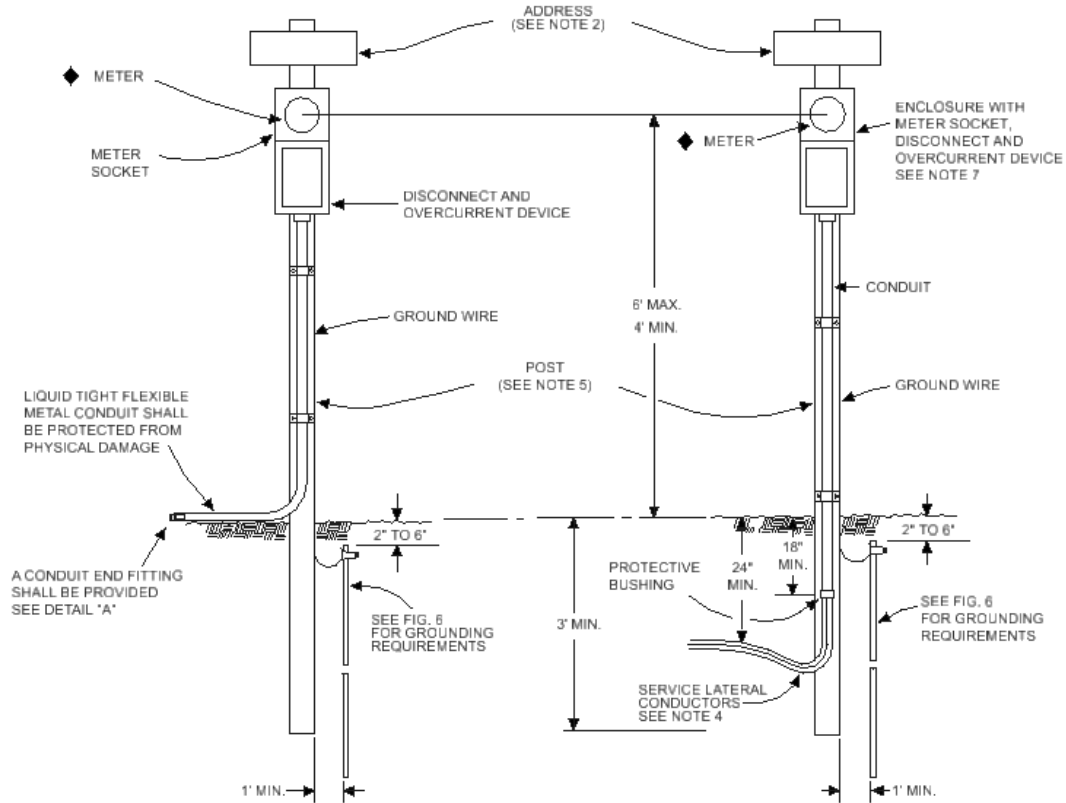


FIG. 11(A)  
ABOVE GRADE SERVICE LATERALS

FIG. 11(B)  
BELOW GRADE SERVICE LATERALS

DETAIL "A" - END FITTINGS WITH WASHERS



### SERVICE CHARACTERISTICS

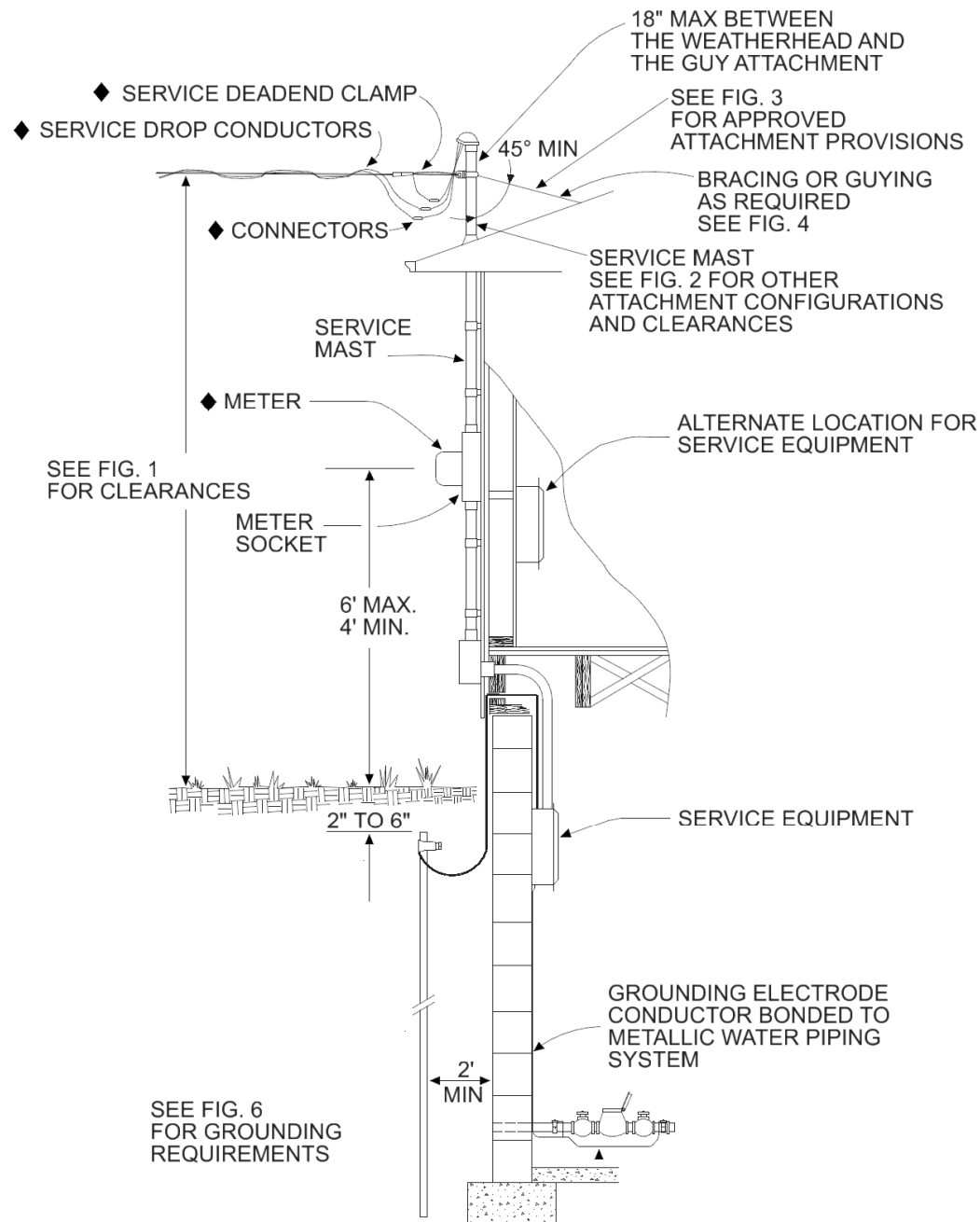
VOLTAGE	SIZE	METER WIRING
1-PHASE 120 V 2-WIRE	60 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/208 V 4-WIRE	200 A MAX.	FIG. 30
3-PHASE 277/480 V 4-WIRE *	400 A MAX.	FIG. 31

Note: Contact your Company representative for service availability.

\* Disconnect required for 480 V temporary service.

\*\* It is recommended, for reliability purposes, that temporary services be installed with copper conductor.

## TYPICAL OVERHEAD RESIDENTIAL SERVICE

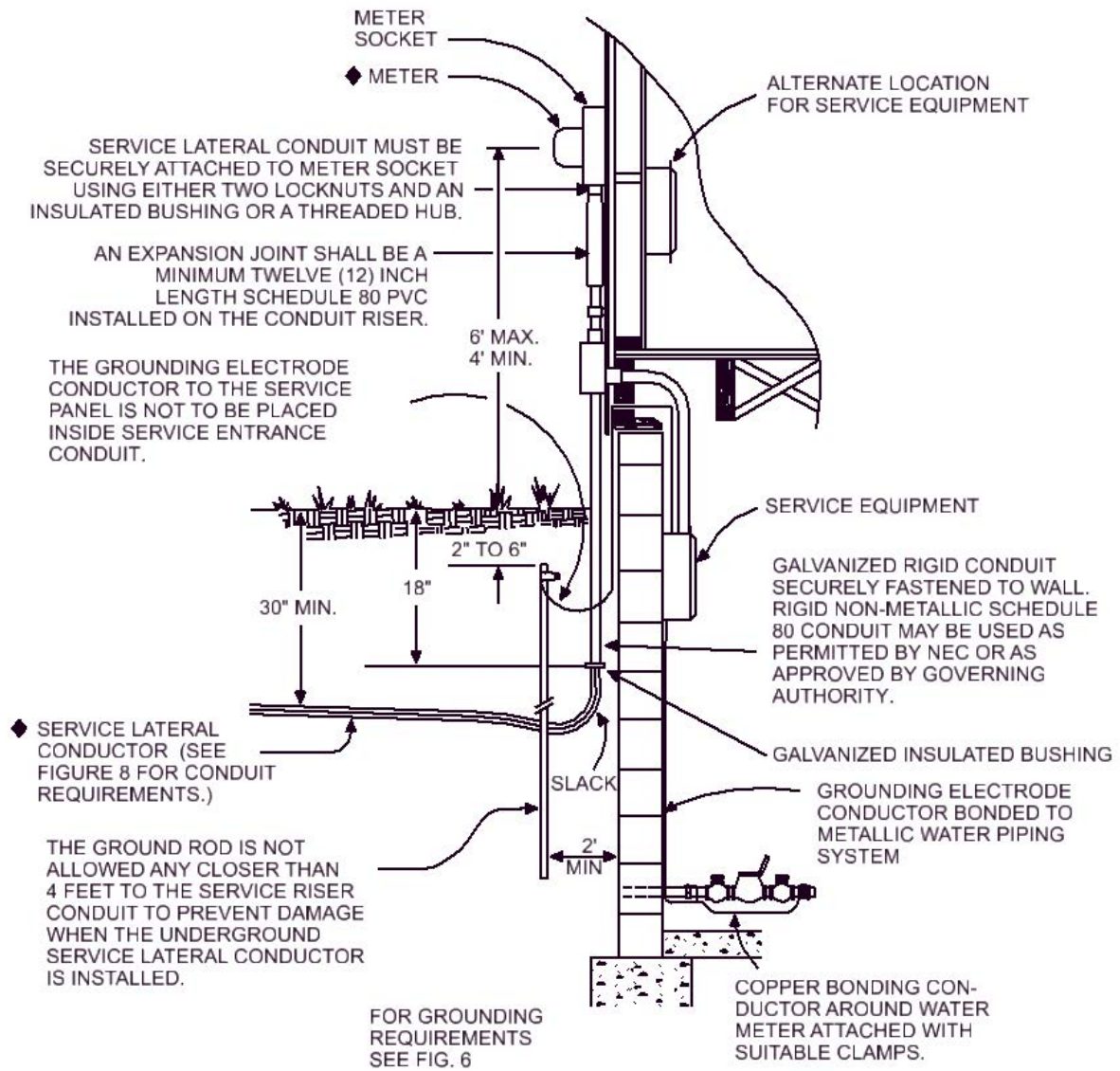


### SERVICE CHARACTERISTICS

VOLTAGE	SIZE	METER WIRING
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 28

The Company will provide and install all ◆ marked items. The customer is responsible to install, own, and maintain all other items.

## TYPICAL UNDERGROUND RESIDENTIAL SERVICE



SERVICE CHARACTERISTICS			
VOLTAGE	SIZE	METER WIRING	CONDUIT SIZE
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27	2 1/2" *
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 28	3"

The Company will provide and install all ♦ marked items.

The customer is responsible to install, own, and maintain all other items.

\* Services smaller than 200 amp are allowed, but a minimum 200 amp underground meter socket and 2-1/2 inch conduit are both required.

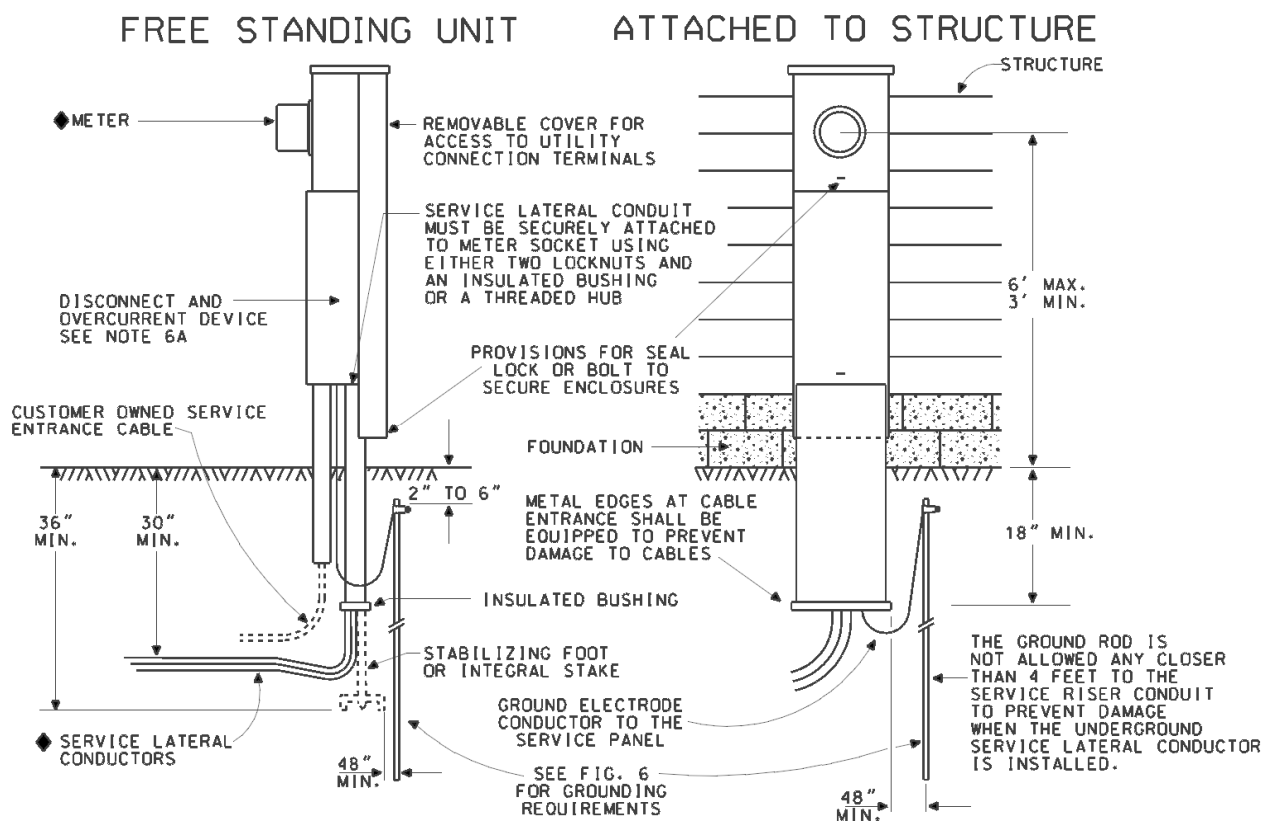
See Appendix G (pg. 107) for details on underground service installations.

## TYPICAL UNDERGROUND SERVICE METER PEDESTAL

1. The company will provide and install all ♦ marked items. The customer shall be responsible for all other items.
2. An address, lot number or trailer number must be permanently posted on the outside of the cabinet, below the meter. A weatherproof placard with min. 3/4 inch etched lettering must be used.
3. For free standing units, backfill around the pedestal shall be well tamped along the full 36 inch minimum length of the setting.
4. Any 120 volt outlet located on the pedestal shall have GFCI protection per *NEC* Section 210.8.
5. For pedestals attached to the masonry footings or basement walls, use three and one-half (3 1/2) inch length bolts (minimum) for secure mounting. Meter pedestal may be installed before house frame is constructed to eliminate the need for a temporary service.
6. Minimum specifications for meter pedestal are as follows:
  - A. Free standing meter pedestals shall have a disconnect and overcurrent device on the load side of the meter.
  - B. Meter pedestals shall have a removable cover for access to utility connection terminals.
  - C. Meter pedestal shall have one provision for a seal, lock or sealable bolt to secure the line-side enclosure. Key locks will not be approved.
  - D. All meter mounting equipment shall meet the requirements listed in Appendix A.
  - E. All pedestal materials shall be fiberglass, steel or wood. Steel shall have a minimum of 14 gauge and plated or galvanized. The finish shall be tough, non-fading and have a long service life. Wood shall be treated 6 inch by 6 inch post.
  - F. All meter pedestals shall be bonded to the neutral conductor. The neutral conductor shall be equipped with a lug for exclusive use of a copper ground wire.
  - G. Customer installed wire should not impede the installation of Company wires.
7. Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter.



## TYPICAL UNDERGROUND SERVICE METER PEDESTAL



SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 27 or FIG. 28

## TYPICAL RURAL SERVICE METER POLE

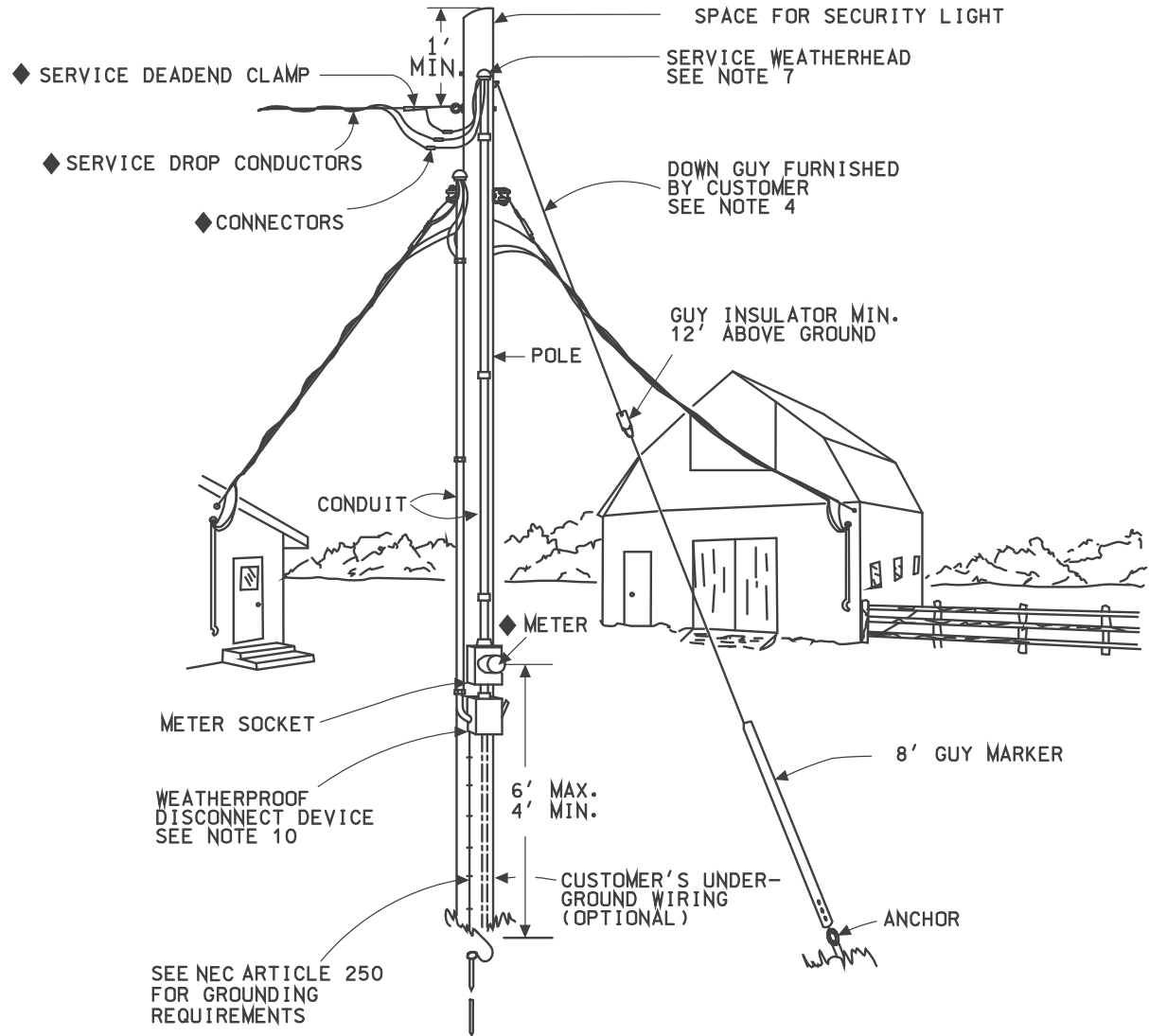
1. The Company will provide and install all ♦ marked items. The customer is responsible to install, own, and maintain all other items.
2. The attachment of the customer's metering equipment and distribution wiring will not be allowed on Company poles.
3. The customer shall be responsible for providing and installing a pole that is in suitable condition for extended service life, to support the service drop conductors and equipment. The pole shall be in an accessible location out of the way of farm equipment traffic. The pole is to meet or exceed the following minimum requirements:

Length:	Sufficient to maintain proper clearances, see Figure 1.
Setting Depth:	5 feet
Top Diameter:	5.5 Inches
Treatment:	Pentachlorophenol or equivalent

4. Contact your Company representative to determine the need for an approved down guy.
5. The Company can provide and install, at the customer's expense, a pole and (if necessary) the down guy.
6. The customer's service riser, metering equipment and wiring shall conform to *NEC* requirements.
7. The service weatherhead is to be located above the service attachment point to insure a positive drip loop.
8. When facilities for a standby generator are installed refer to Figure 17.
9. Locations of fuel storage tanks and dispensing devices shall be in accordance with *NEC* Table 514-3(B)(1) and Table 514-3(B)(2).
10. The customer shall install a disconnecting means incorporating an overcurrent protection device on the load side of the meter. Reference *NEC* 230.90 (A).
11. The service conductors should not cross adjoining property or livestock areas.
12. Metered and unmetered conductors shall not be installed in the same conduit.
13. Reference Meter Clearances, page 21.
14. Service attachment point should be a through-bolt and match requirements in Figure 3.
15. Weatherproof placard with min. 3/4 inch etched lettering including address and service designation is required.

\* Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter.

## TYPICAL RURAL SERVICE METER POLE

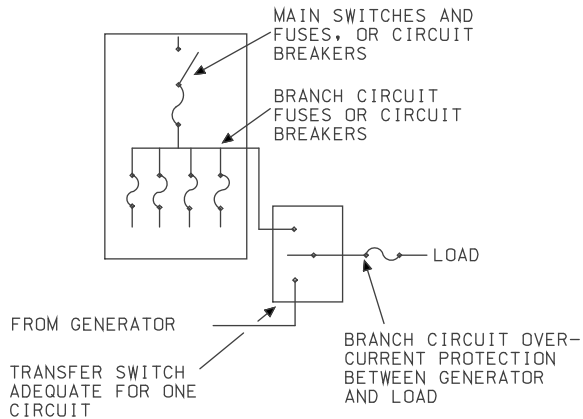


SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120 V 2-WIRE	60 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 28

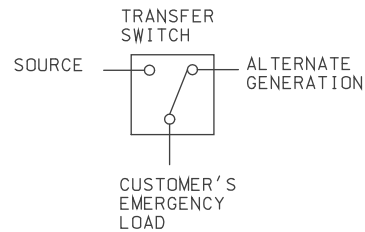
Other service voltages may be available. Contact your Company representative.

## STANDBY GENERATOR PROVISIONS

IF A STANDBY GENERATOR IS CONNECTED WITHOUT AN APPROVED TRANSFER SWITCH, SERVICE WILL BE DISCONNECTED UNTIL SUCH SWITCH IS INSTALLED. SAFETY OF PERSONNEL DEMANDS THIS REQUIREMENT. SEE SECTION 10 OF THIS MANUAL FOR ADDITIONAL INFORMATION.



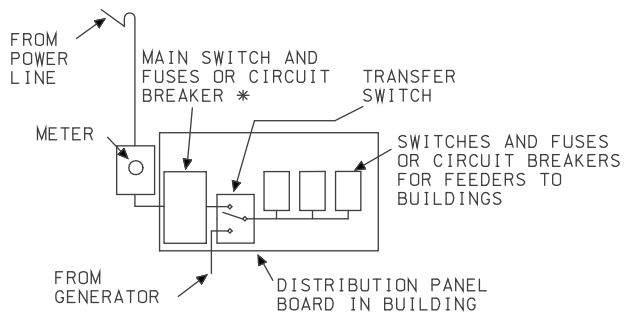
STANDBY GENERATOR CONNECTED TO ONE CIRCUIT  
FIGURE 17A



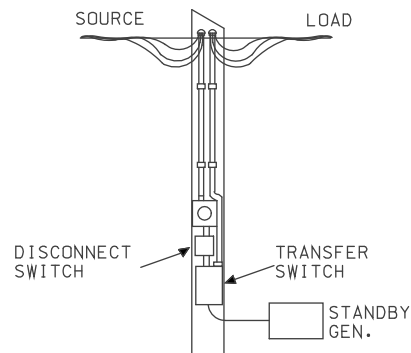
### GENERAL REQUIREMENTS:

1. DOUBLE THROW SWITCH BREAK BEFORE MAKE ACTION.
2. IF LOCATED AT SERVICE ENTRANCE, MUST MEET ALL SERVICE ENTRANCE REQUIREMENTS.
3. ALL UNGROUNDED CONDUCTORS MUST BE SWITCHED SIMULTANEOUSLY (NEUTRAL NOT SWITCHED).

ONE LINE DIAGRAM  
FIGURE 17B



STANDBY GENERATOR CONNECTED AT SERVICE ENTRANCE ON BUILDING  
FIGURE 17D



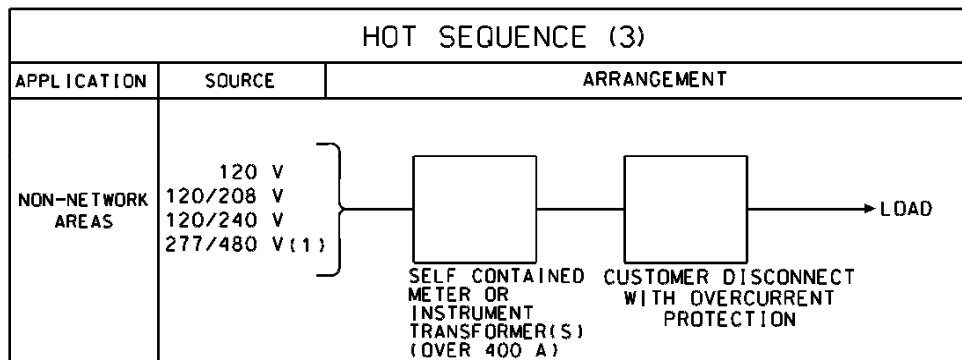
POLE MOUNTED SERVICE ENTRANCE WITH SELF-CONTAINED METER  
FIGURE 17E

\* If the transfer switch is located ahead of the main switch, the transfer switch shall be service entrance rated. The position of the transfer switch, with respect to the main switch, can vary from that shown. Contact your Company representative to be sure that the proposed transfer switch installation meets the Company requirements.

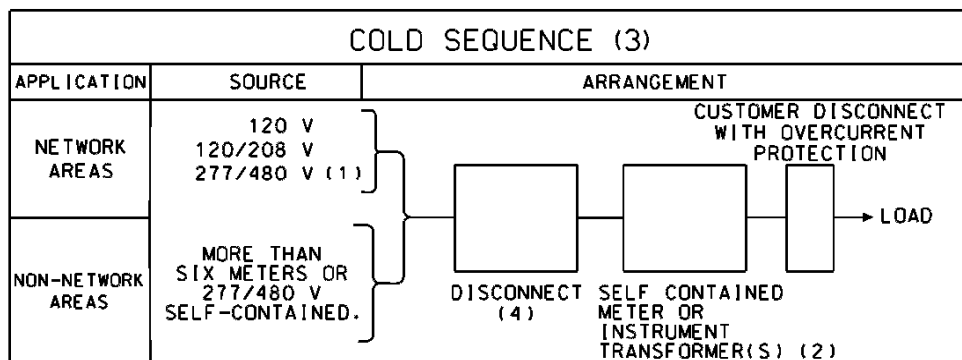
# METERING SEQUENCE REQUIREMENTS NON-RESIDENTIAL INSTALLATIONS

## NOTICE

CONTACT COMPANY TO DETERMINE THE  
PROPER METERING SEQUENCE REQUIRED



(1) WITH INSTRUMENT TRANSFORMERS



(1) WITH INSTRUMENT TRANSFORMERS

(2) SEPARATE INSTRUMENT TRANSFORMERS ARE NOT REQUIRED WITH SELF-CONTAINED METERING

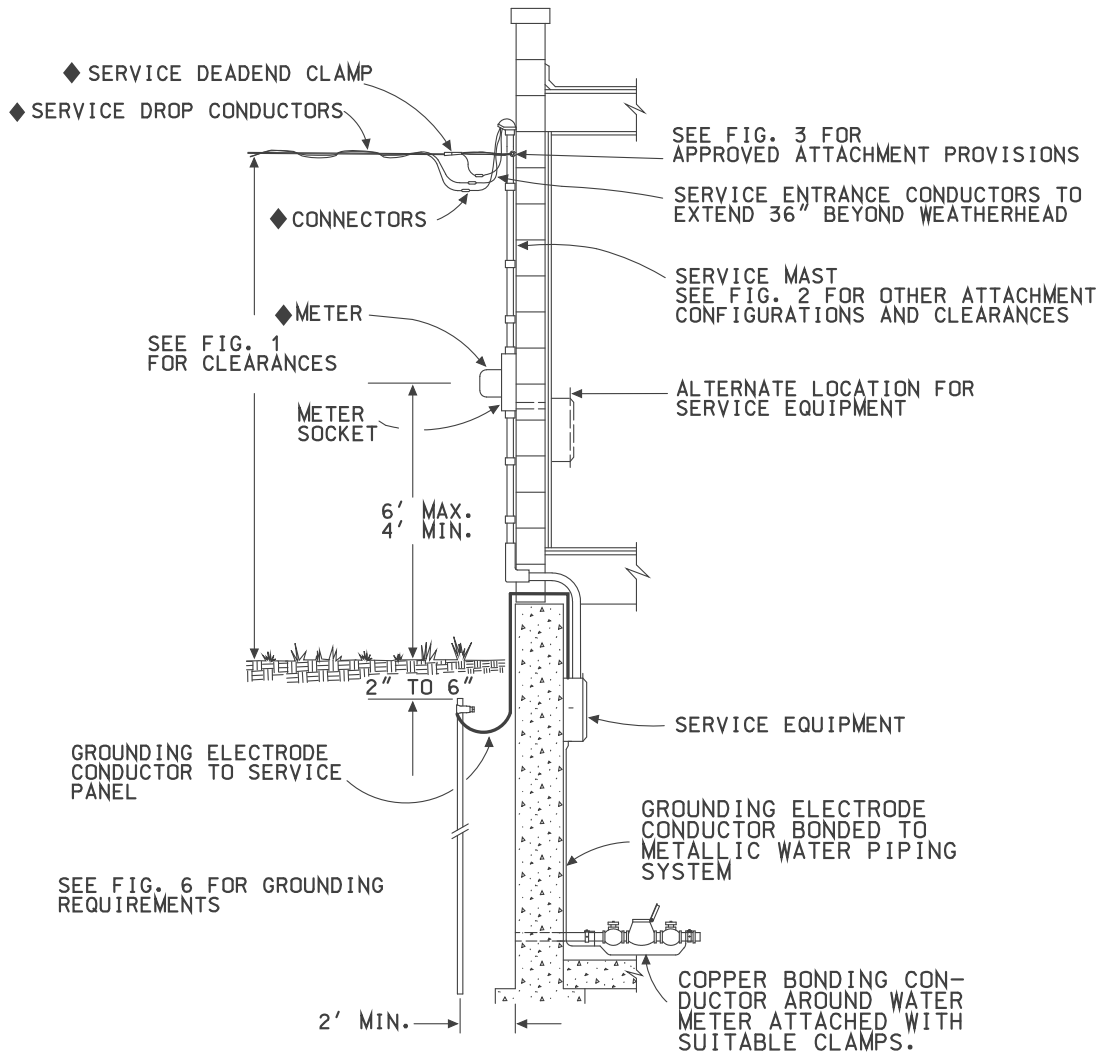
(3) EXIT LIGHTS, FIRE PUMPS, AND OTHER EMERGENCY SERVICES AHEAD OF THE MAIN MUST HAVE OVERCURRENT PROTECTION AND BE METERED

(4) DISCONNECT MAY BE FUSED OR UNFUSED DEPENDING ON WHAT IS NEEDED TO MEET MEC AND NEC FAULT CURRENT REQUIREMENTS FOR THE PARTICULAR APPLICATION.

## NETWORK AREA DEFINITIONS:

Geographical areas exist in the downtown business districts of Carroll, Council Bluffs, Davenport, Des Moines, Moline, Rock Island, Sioux City, and Waterloo, in which service and related equipment must meet certain special requirements. Your Company representative must be contacted to determine if the service location is within this area.

## TYPICAL OVERHEAD COMMERCIAL-INDUSTRIAL SERVICE WITH SELF-CONTAINED METER



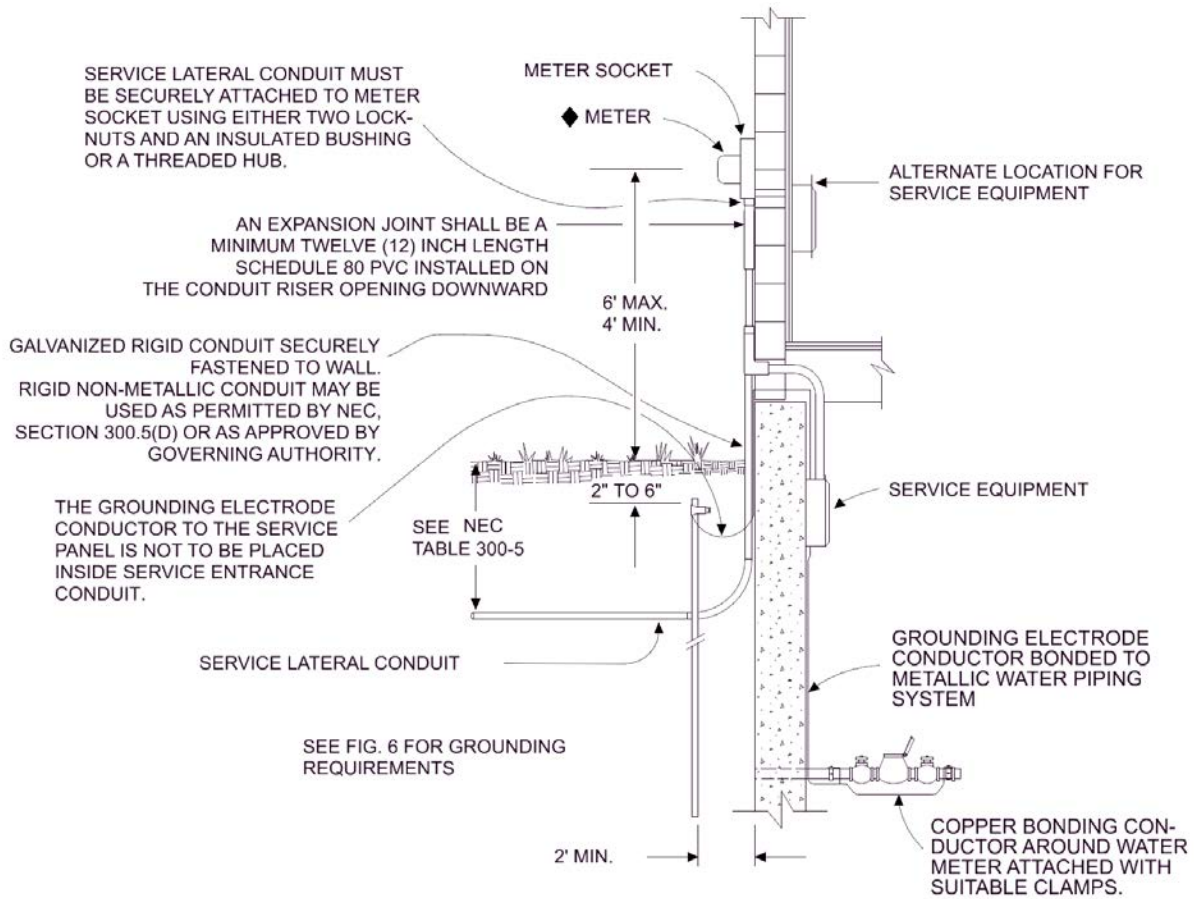
### SERVICE CHARACTERISTICS

VOLTAGE	SIZE	METER WIRING
1-PHASE 120 V 2-WIRE	60 A MAX	FIG. 27
1-PHASE 120/240 V 3-WIRE	400 A MAX	FIG. 27 or FIG. 28
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/240 V 4-WIRE	400 A MAX	FIG. 30 or FIG. 32
3-PHASE 120/208 V 4-WIRE	400 A MAX	FIG. 30 or FIG. 32
3-PHASE 277/480 V 4-WIRE	400 A MAX	FIG. 31 or FIG. 32

Note: Contact your Company representative for service availability.

The Company will provide and install ♦ marked items. The customer is responsible to install, own, and maintain all other items.

## TYPICAL UNDERGROUND COMMERCIAL-INDUSTRIAL SERVICE WITH SELF-CONTAINED METER



1. The Company will provide and install all ♦ marked items. The customer is responsible to install, own, and maintain all other items.
2. The conductor (and conduit when required) shall be furnished, installed and maintained by the customer. The Company will connect the service lateral conductors to the Company facilities.
3. A 36 inch x 36 inch handhole that is 8 inch below the bottom of the conduit riser immediately adjacent to the base of the enclosure must be hand dug by the customer/contractor (see Appendix G).

SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120/240 V 3-WIRE	200 A MAX.	FIG. 27
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 28
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/208 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 120/240 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 277/480 V 4-WIRE	400 A MAX.	FIG. 31 or 32

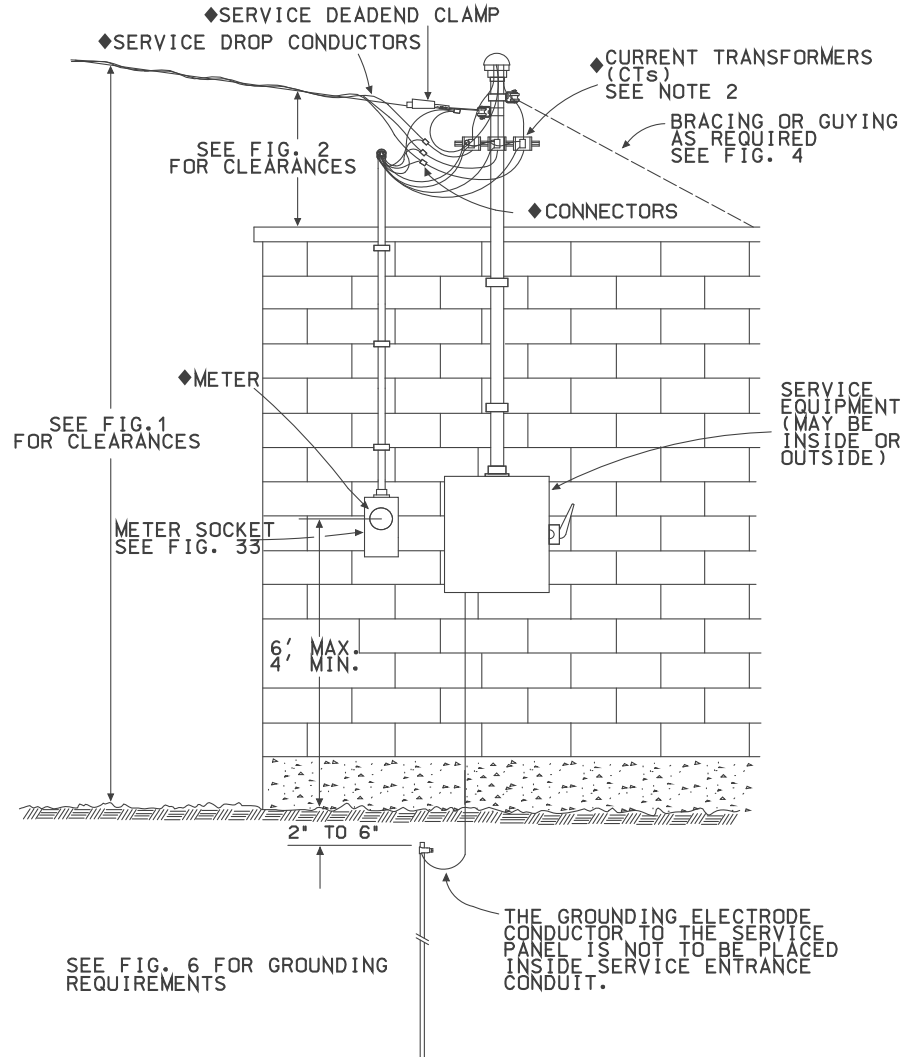
Note: Contact your Company representative for service availability.  
Other service voltages may be available. Contact your Company representative.

**TYPICAL COMMERCIAL-INDUSTRIAL SERVICE ENTRANCE  
METERING WITH OVERHEAD-MOUNTED INSTRUMENT TRANSFORMERS  
FOR MAINTENANCE ONLY**

1. The Company will provide and install all ♦ marked items. The customer shall be responsible for all other items.
2. Current transformers and potential transformers are furnished by the Company and installed by the customer.
3. Submit current transformer and potential transformer mounting details to the Company for approval.
4. Mount current transformers and potential transformers so that the polarity marks of each set are arranged in identical position.
5. Instrument transformer wiring on Figures 34 and 35 shows indoor mounting bar type current transformers. Wiring for outdoor installations is similar except that window type current transformers are used.
6. Bond all metal racks to the neutral wire.
7. Working space from electrical equipment shall be in accordance with *NEC* Section 110.26.
8. Service entrance conduit shall be mounted on an exterior wall accessible to Company personnel.



# TYPICAL COMMERCIAL-INDUSTRIAL SERVICE ENTRANCE METERING WITH OVERHEAD-MOUNTED INSTRUMENT TRANSFORMERS FOR MAINTENANCE ONLY



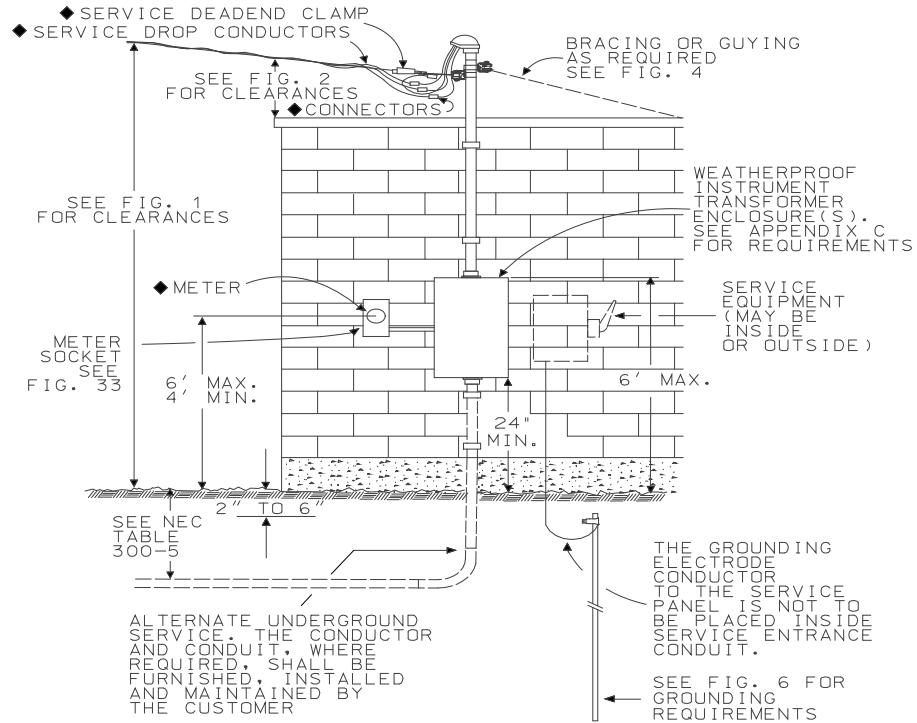
SERVICE CHARACTERISTICS				
VOLTAGE	SIZE	INSTRUMENT TRANSFORMER QUANTITY		INSTRUMENT TRANSFORMER WIRING
		CT's	PT's	
1-PHASE 120/240 V 3-WIRE	OVER 400 A THRU 800 A	2	-	FIG. 34
3-PHASE 120/240 V 4-WIRE	OVER 400 A THRU 800 A	3	-	FIG. 35
3-PHASE 120/208 V 4-WIRE	OVER 400 A THRU 1000 A	3	-	FIG. 35

\* Refer to Fig. 35, Note 8.

**TYPICAL COMMERCIAL-INDUSTRIAL SERVICE ENTRANCE  
METERING WITH CABINET-MOUNTED INSTRUMENT TRANSFORMERS  
PREFERRED INSTALLATION**

1. The Company will provide and install all ♦ marked items. The customer shall be responsible for all other items.
2. Current transformers and potential transformers are furnished by the Company and installed by the customer. The contractor shall mark line and load conductors within any CT cabinet.
3. The instrument transformer enclosure(s) shall be mounted outdoors. Consult your Company representative for an approved location.
4. Mount current transformers and potential transformers so that the polarity marks are orientated on the line side.
5. The instrument transformer enclosure(s) shall be bonded to the grounding electrode conductor, or neutral.
6. Working space from electrical equipment shall be in accordance with *NEC* Section 110.26.
7. When supplying size information from the SERVICE CHARACTERISTICS Table on Figure 22; "O.H. Max." - refers to services supplied from the pole mounted transformers, and "U.G. Max." - refers to services supplied from padmounted transformers.

# TYPICAL COMMERCIAL-INDUSTRIAL SERVICE ENTRANCE METERING WITH CABINET-MOUNTED INSTRUMENT TRANSFORMERS



SERVICE CHARACTERISTICS					
VOLTAGE	SIZE (See Note 7)			INSTRUMENT TRANSFORMER QUANTITY CT's PT's	INSTRUMENT TRANSFORMER WIRING
	MINIMUM	O.H. MAX	U.G. MAX		
1-PHASE 120/240 V 3-WIRE	OVER 400 A	800 A **	1000 A	2      -	FIG. 34
3-PHASE 120/240 V 4-WIRE	OVER 400 A	800 A	N.A.	3      -	FIG. 35
3-PHASE 120/208 V 4-WIRE	OVER 400 A	1000 A	3000 A	3      -	FIG. 35
3 PHASE 277/480 V 4-WIRE	OVER 400 A	N/A	4000 A	3      3 *	FIG. 35

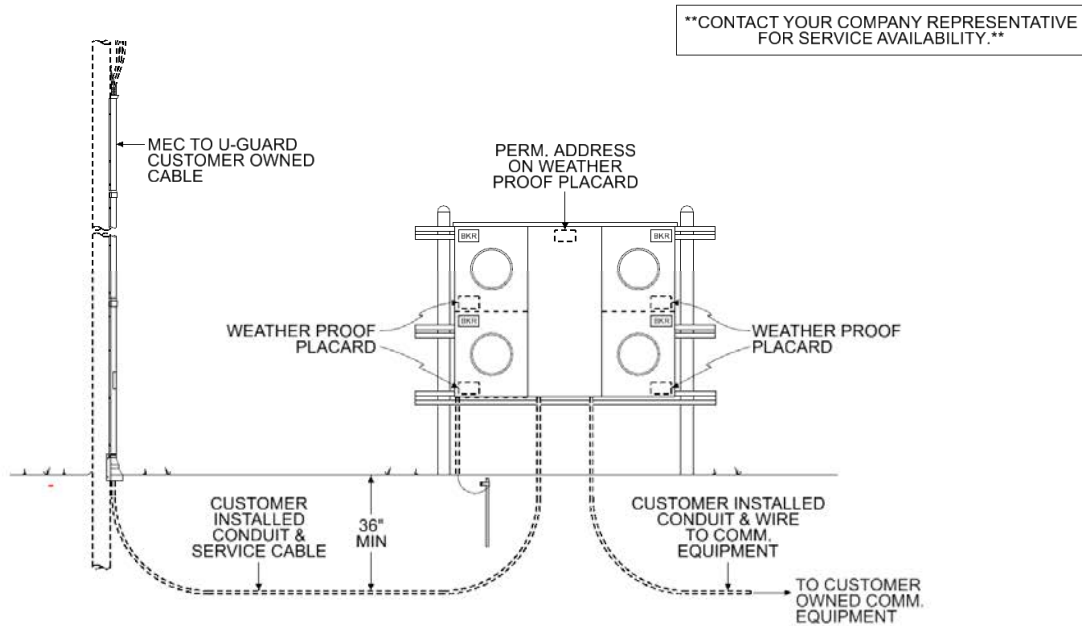
N.A. – NOT AVAILABLE

\* Refer To Fig. 35, Note 8

\*\* Contact your Company representative for availability.

# TYPICAL PRIMARY AND SECONDARY UNDERGROUND COMMUNICATION TOWER SERVICE

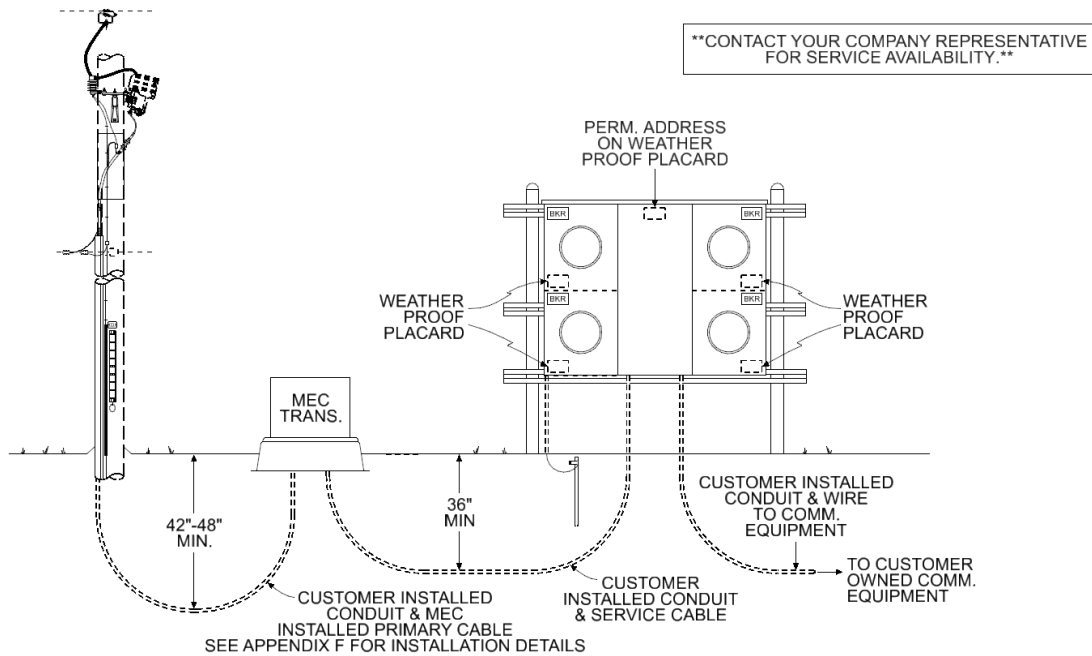
## TYPICAL SECONDARY UNDERGROUND COMMUNICATION TOWER SERVICE



### NOTES

1. MINIMUM FOUR GANG METER PACK REQUIRED.
2. FOR PEDESTAL SUPPORT REQUIREMENTS, REFERENCE APPENDIX F.
3. FOR METERING REQUIREMENTS, REFERENCE FIGURE 24 & 26.
4. LABEL EACH POSITION AS UNIT #1, #2...OR A, B...DO NOT USE TENANT NAMES AS TENANTS MAY CHANGE.
5. DISCONNECT AND OVERCURRENT PROTECTION IS REQUIRED ON EACH METERED CIRCUIT

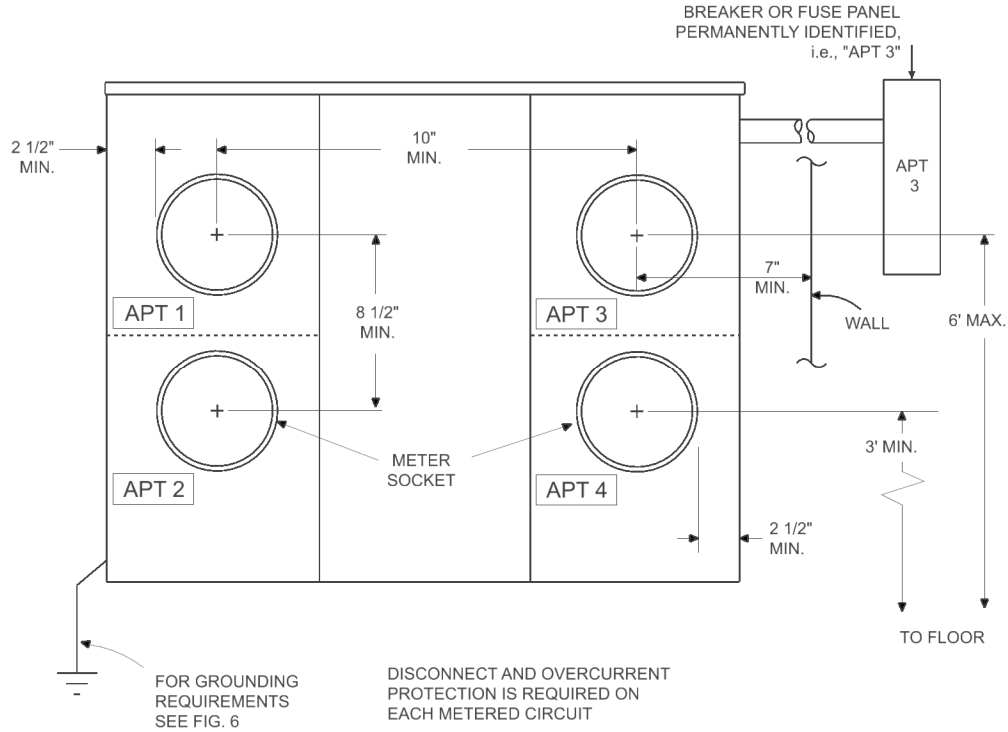
## TYPICAL PRIMARY UNDERGROUND COMMUNICATION TOWER SERVICE



### NOTES

1. MINIMUM FOUR GANG METER PACK REQUIRED.
2. FOR PEDESTAL SUPPORT REQUIREMENTS, REFERENCE APPENDIX F.
3. FOR METERING REQUIREMENTS, REFERENCE FIGURE 24 & 26.
4. LABEL EACH POSITION AS UNIT #1, #2...OR A, B...DO NOT USE TENANT NAMES AS TENANTS MAY CHANGE.
5. DISCONNECT AND OVERCURRENT PROTECTION IS REQUIRED ON EACH METERED CIRCUIT

# **TYPICAL GROUP METERING SIX OR LESS METERS FACTORY FABRICATED**



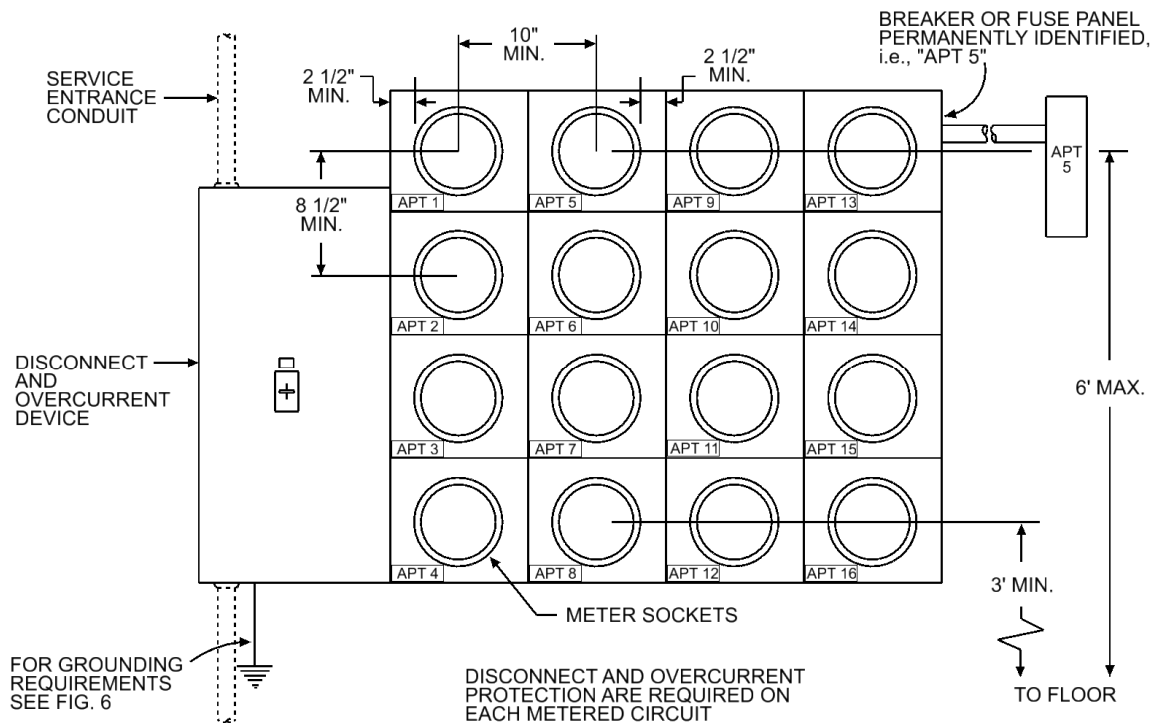
1. All service entrance equipment shall be UL listed.
2. All meter sockets shall meet Company specifications, see Appendix A.
3. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26. Refer to page 21 for Meter Clearances.
4. An address, lot number or trailer number must be permanently posted on the outside of the cabinet, below the meter. A weatherproof placard with min. 3/4 inch etched lettering must be used.
5. Group metering installed in network areas, as defined in Figure 18, shall be of type shown in Figures 25 and 26.
6. Metered and un-metered conductors shall not be installed in the same conduit or trough.
7. Spring, clip type add-on 5th terminals are not allowed.
8. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering.
9. Open meter sockets shall have a plastic protective cover and shall be sealed.

SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 27 or 28
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/240 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 120/208 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 277/480 V 4-WIRE	400 A MAX.	FIG. 31

Note: Contact your Company representative for service availability.

Other service voltages may be available. Contact your Company representative.

# TYPICAL GROUP METERING FOR MORE THAN SIX METERS OR ANY METERS IN NETWORK AREAS FACTORY FABRICATED



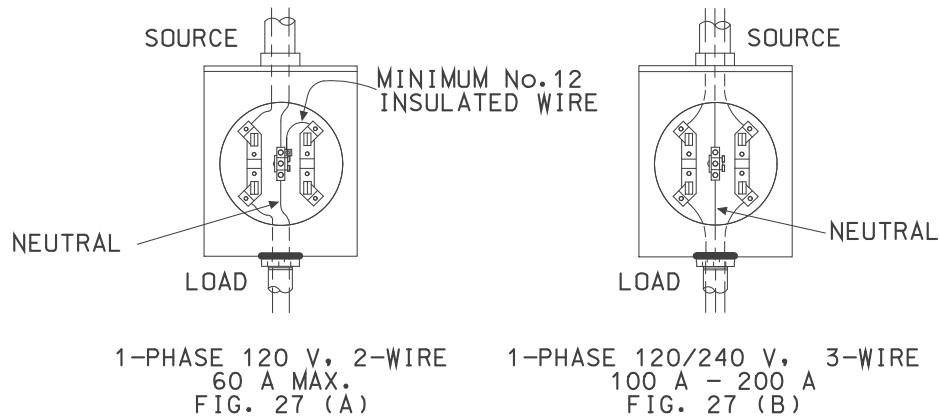
1. All service entrance equipment shall be UL listed.
2. All meter sockets shall meet Company specifications, see Appendix A.
3. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26. Refer to page 21 for Meter Clearances.
4. Apartments or suites shall have identical marking on the entry door, meter socket, and fuse or breaker panel. A weatherproof placard with min 3/4 inch etched lettering must be used.
5. Spring, clip type add-on 5th terminals are not allowed.
6. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering.
7. Metered and un-metered conductors shall not be installed in the same conduit or trough.
8. Open meter sockets shall have a plastic protective cover and shall be sealed.
9. Group metering banks shall meet 3 feet minimum and 6 feet maximum height requirements.

SERVICE CHARACTERISTICS		
VOLTAGE	SIZE	METER WIRING
1-PHASE 120/240 V 3-WIRE	400 A MAX.	FIG. 27 or 28
1-PHASE 120/208 V 3-WIRE	See Note	FIG. 29
3-PHASE 120/240 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 120/208 V 4-WIRE	400 A MAX.	FIG. 30 or 32
3-PHASE 277/480 V 4-WIRE	400 A MAX.	FIG. 31

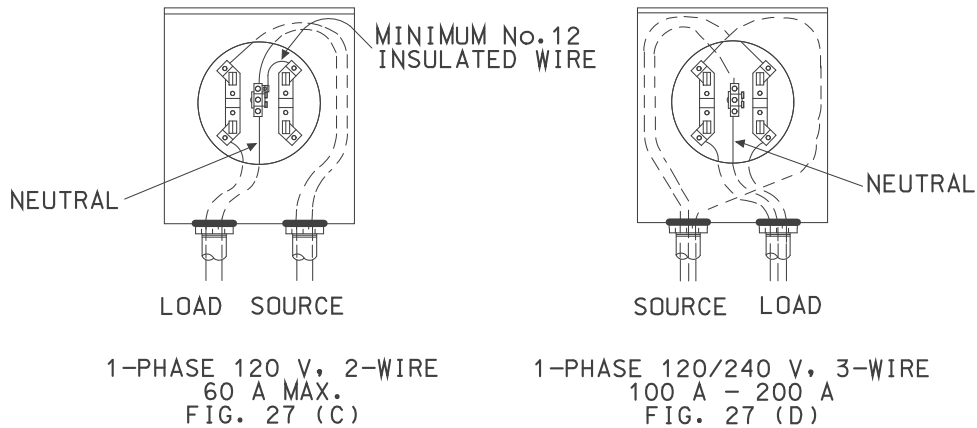
Note: Contact your Company representative for service availability.  
Other service voltages may be available. Contact your Company representative.

**SELF-CONTAINED METER SOCKET WIRING**  
**1-PHASE 120 V, 2-WIRE, 60 A MAX.**  
**1-PHASE 120/240 V, 3-WIRE, 100 A – 200 A**

OVERHEAD SERVICE



UNDERGROUND SERVICE



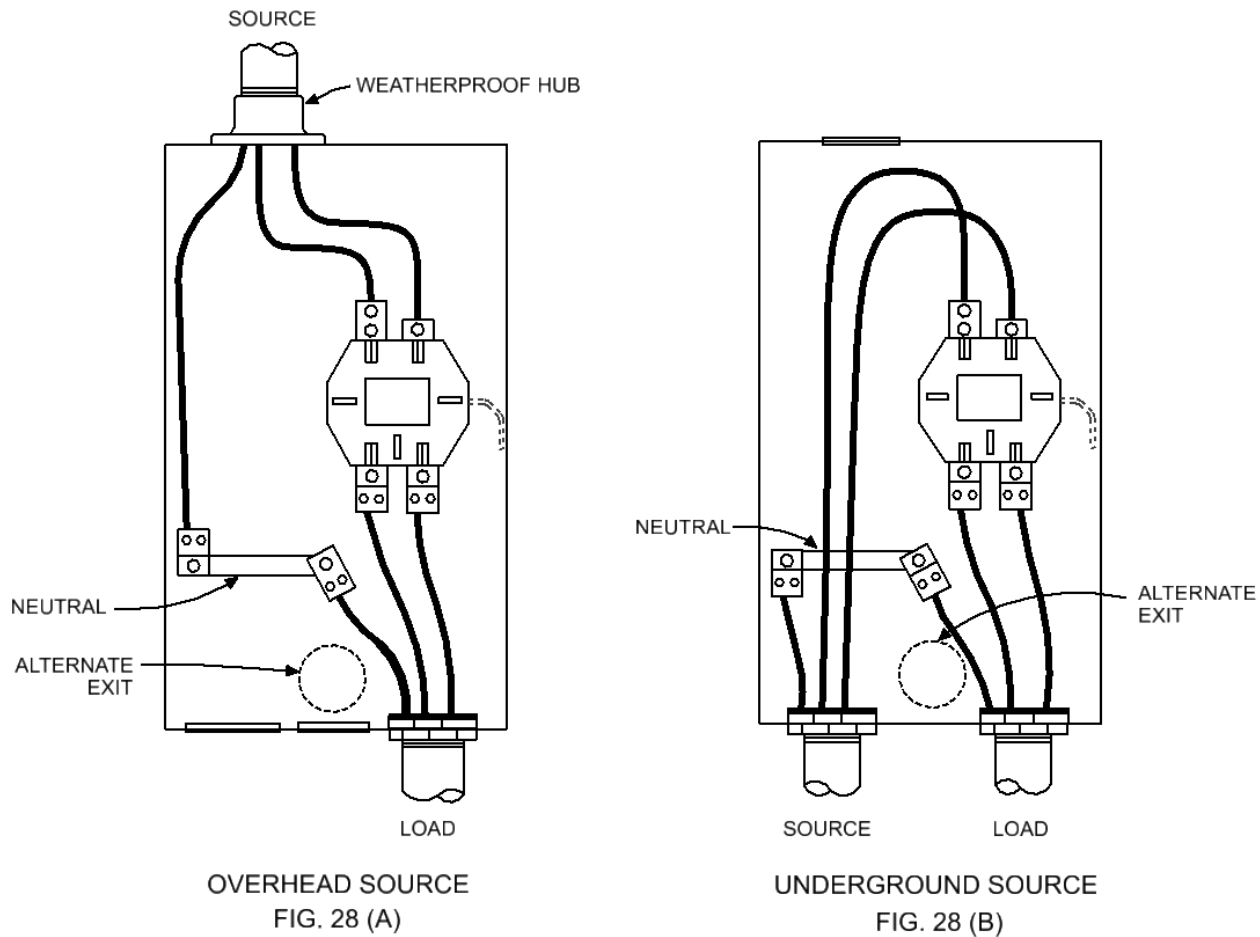
**CAUTION**

Source conductors shall be positioned along the sides of the meter socket, utilizing adequate bending radius, to provide maximum clearance from other socket terminals. Source conductors shall be looped to the top jaws shown in figures 27 (c) and (d).

1. The meter sockets shall meet Company specifications, see Appendix A.
2. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26. Refer to page 21 for Meter Clearances.
3. When using aluminum conductors, wire brush the conductors and apply oxide inhibitor on all connections.
4. When the neutral is not continuous through the meter socket, a dual lug neutral connector shall be used.
5. Use one of the two outside conduit knockouts for the underground service riser lateral.
6. Spring, clip type add-on 5th terminals are not allowed.
7. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with min 3/4 inch etched lettering.
8. Customer is liable to fix the knockout should the wrong size be removed.

\* Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter.

# **SELF-CONTAINED METER SOCKET WIRING** **1-PHASE 120/240 V, 3-WIRE, 320 A SOCKET** **400 A ENTRANCE**

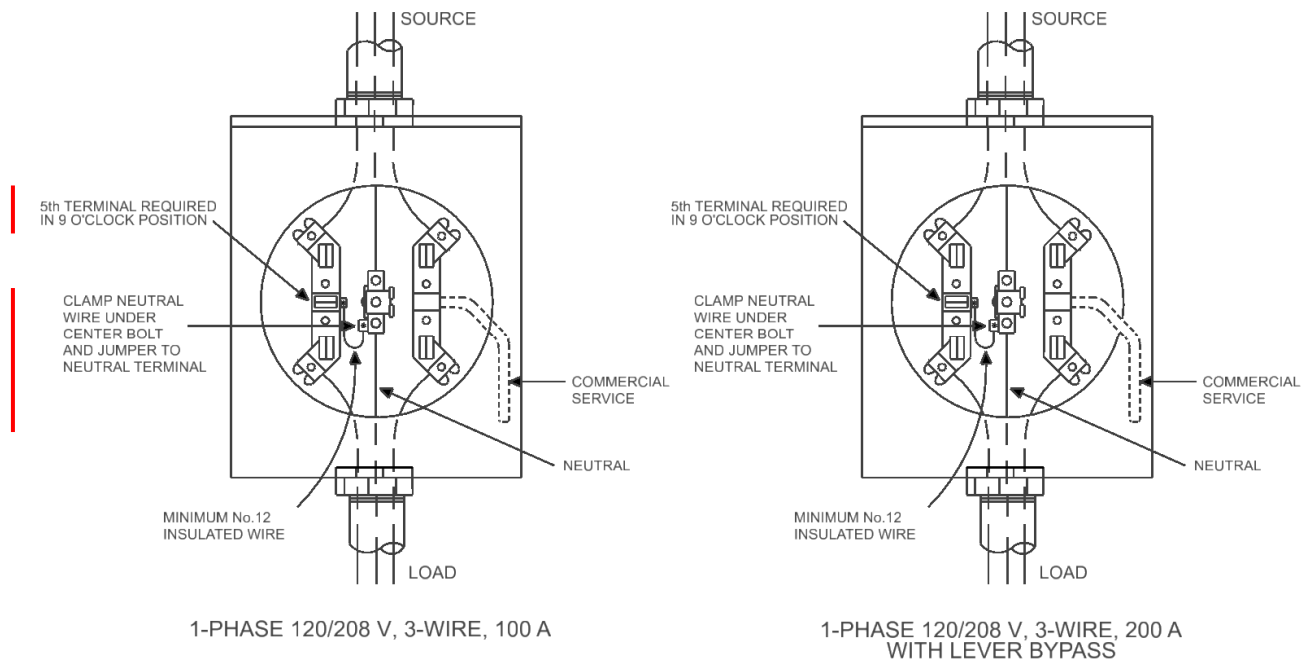


1. The meter sockets shall meet Company specifications, see Appendix A.
2. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26. Refer to page 21 for Meter Clearances.
3. When using aluminum conductors, wire brush the conductors and apply oxide inhibitor on all connections.
4. The neutral shall be grounded at the main disconnect in accordance with the *NEC*.
5. Please contact your Company representative if any questions arise concerning this installation.
6. Spring, clip type add-on 5th terminals are not allowed.
7. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service.
8. Customer to provide all lugs.

\* Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter.



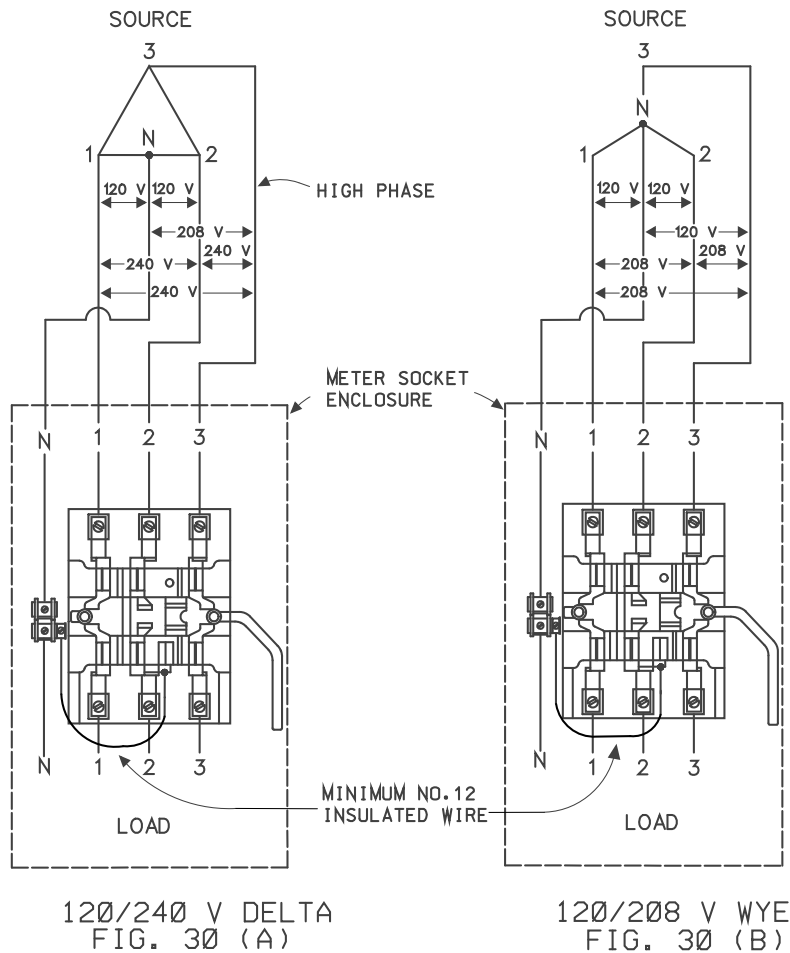
# **SELF-CONTAINED METER SOCKET WIRING** **1-PHASE 120/208 V, 3-WIRE, 100 A** **1-PHASE 120/208 V, 3-WIRE, 200 A**



1. The meter sockets shall meet Company specifications, see Appendix A.
2. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26. Refer to page 21 for Meter Clearances.
3. When using aluminum conductors, wire brush the conductors and apply oxide inhibitor on all connections.
4. When the neutral is not continuous through the meter socket, a dual lug neutral connector shall be used.
5. 120/208 V 3-wire is normally available only from a 3-phase 120/208 V 4-wire service entrance. 200 ampere service may be available in certain areas. Consult your Company representative.
6. Spring, clip type add-on 5th terminals are not allowed.
7. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service."

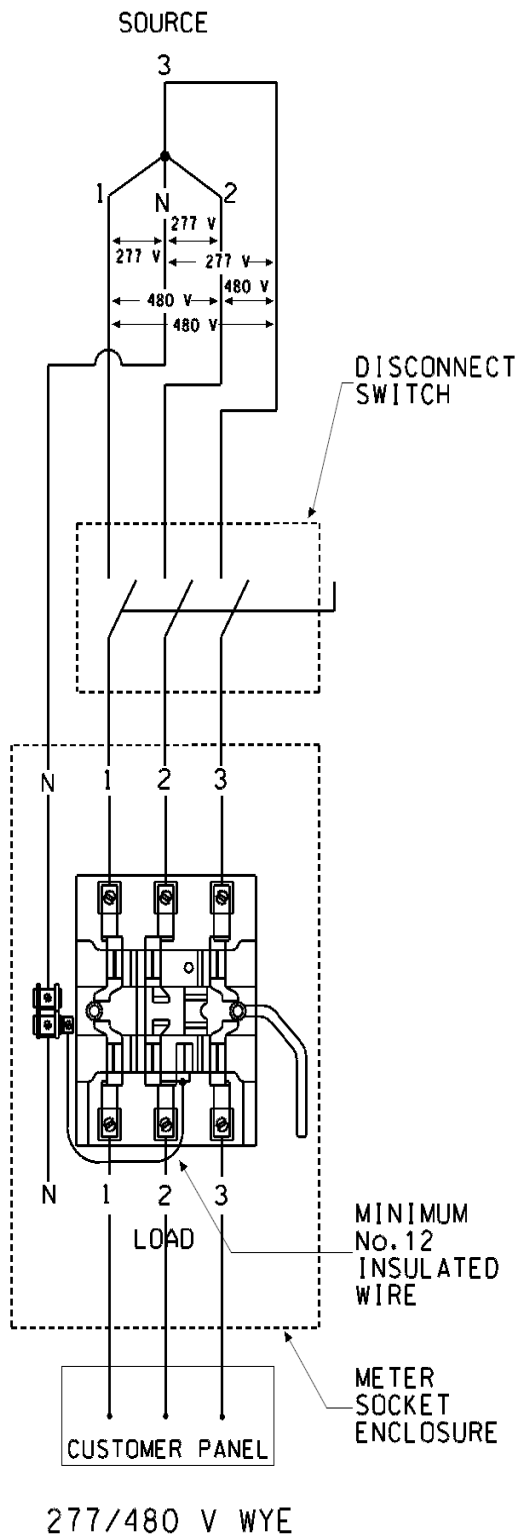
\* Check with local jurisdiction on the requirement of a service disconnect installed adjacent to the meter.

**SELF-CONTAINED METER SOCKET WIRING**  
**3-PHASE 120/240 V, 4-WIRE, 400 A MAX.**  
**3-PHASE 120/208 V, 4-WIRE, 400 A MAX.**



1. If the service size is 400 amps or less, self-contained metering will be used.
2. The meter sockets shall meet Company specifications, see Appendix A.
3. Working space of not less than 36 inches in front of service entrance equipment and meter sockets and 30 inches wide shall be maintained in accordance with *NEC* Section 110.26. (Reference page 33)
4. When using aluminum conductors, wire brush the conductors and apply oxide inhibitor on all connections.
5. The neutral, if insulated, shall be identified by a white or gray covering or tape. (Reference page 33)
6. The high phase of a 120/240 V installation shall be identified by orange color, either insulation, paint, or tape, in accordance with *NEC* Section 110.15 and Section 230.56. (Reference page 33)
7. The high phase (wild leg) of a 120/240 V installation must be on the right hand terminals of the self-contained meter socket. (Reference page 33)
8. All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service.

## SELF-CONTAINED METER SOCKET WIRING 3-PHASE 277/480 V, 4-WIRE, 400 A OR LESS

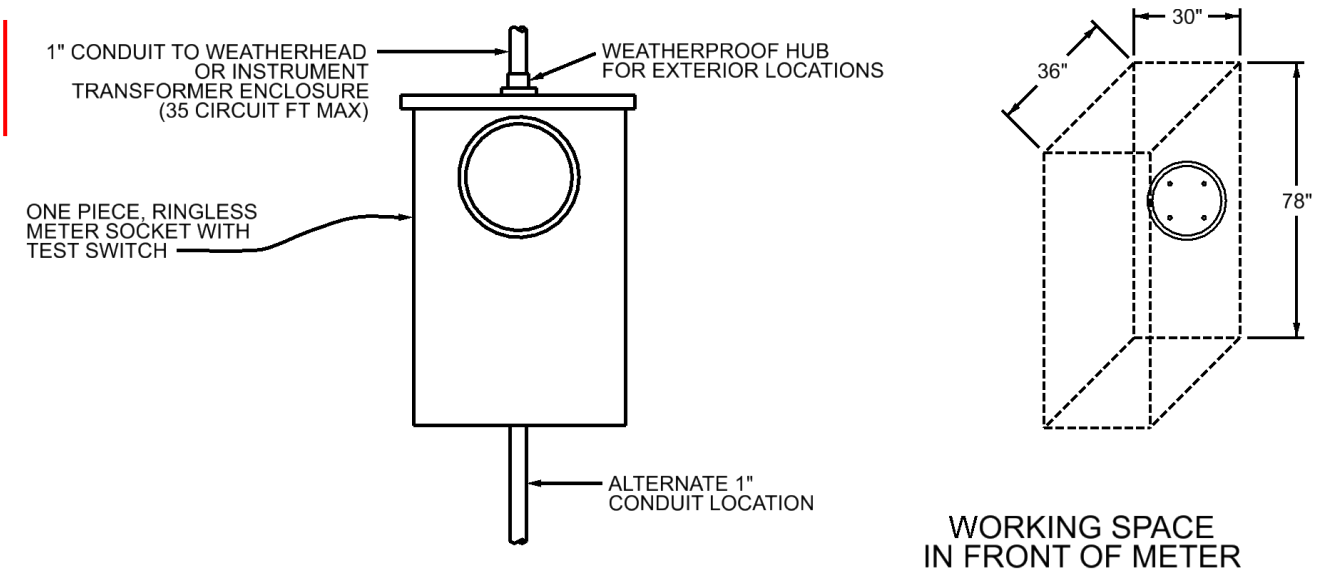


1. If the service size is 400 amps or less, self-contained metering will be used.
2. The meter sockets shall meet Company specifications, See Appendix A.
3. 277/480 V self-contained meter settings are limited to installations rated 400 A or less. Pull out style disconnects will not be allowed.
4. A disconnect switch shall be installed on the source side, immediately adjacent to each 277/480 V self-contained meter setting in a cold sequenced "switch-meter-load" configuration. The switch shall have provisions for padlocking in the open position and for installing a Company seal in the closed position. The disconnect may be fused or unfused depending on what is needed to meet Company and *NEC* fault current requirements for the particular application. It is the customer's responsibility to determine if the disconnect switch should be fused or unfused. (Reference page 63) Fused disconnects must be lever operated. Pull out style disconnects will not be allowed. All fuses for fused disconnects on 480V services must be supplied by the customer. Pull out style disconnect will not be allowed regardless of being installed on the line or load side.
5. A "480 VOLTS" identification (weatherproof placard with min. 3/4 inch etched lettering) shall be applied in a conspicuous location on the front exterior surface of the meter socket enclosure.
6. The neutral, if insulated, shall be identified by a white or gray covering or tape. (reference pg. 33)
7. When using aluminum conductors, wire brush the conductors and apply an oxide inhibitor on all connections.
8. Working space of not less than 36 inches in front of service entrance equipment and meter sockets and 30 inches wide shall be maintained in accordance with *NEC* Section 110.26. (Reference page 24)
9. The neutral shall be installed from the source to the means of disconnection.
10. Commercial installations require a manual clamping jaw lever bypass.

## INSTRUMENT TRANSFORMER METERING GREATER THAN 400 A

1. Meter sockets shall not be mounted more than **35 circuit feet** from instrument transformers.
2. Meters will be furnished and installed by the Company.
3. Test switches shall be furnished by the customer. See Appendix D for specifications.
4. Meter sockets shall be bonded to the grounding electrode conductor.
5. Insulated bushings are required on all conduits.
6. Working space in front of service entrance equipment and meter sockets shall be in accordance with *NEC* Section 110.26.
7. Spring, clip-type add-on 5th terminals are not allowed.
8. Customer supplies and installs meter socket and test switch.
9. Meter sockets shall be weatherproof for exterior locations.
10. See Appendix C-1 for instrument transformer requirements.
11. All cabinet mounted CT's shall be bar type.
12. The instrument transformer enclosure(s) shall be mounted outdoors. Consult your Company representative for an approved location.
13. Metering circuit to be grounded in only one place.
14. Cabinets shall be bonded to ground at one place—either neutral or system ground.
15. Metering and bonding wires shall not parallel the neutral.
16. The 1 inch conduit from the meter socket enclosure to the instrument transformer enclosure must be continuous and contain less than three 90 degree bends. **The use of any conduit body fitting (LB, LL, LR, etc.) is prohibited.** Metering circuit to be grounded in only one place.

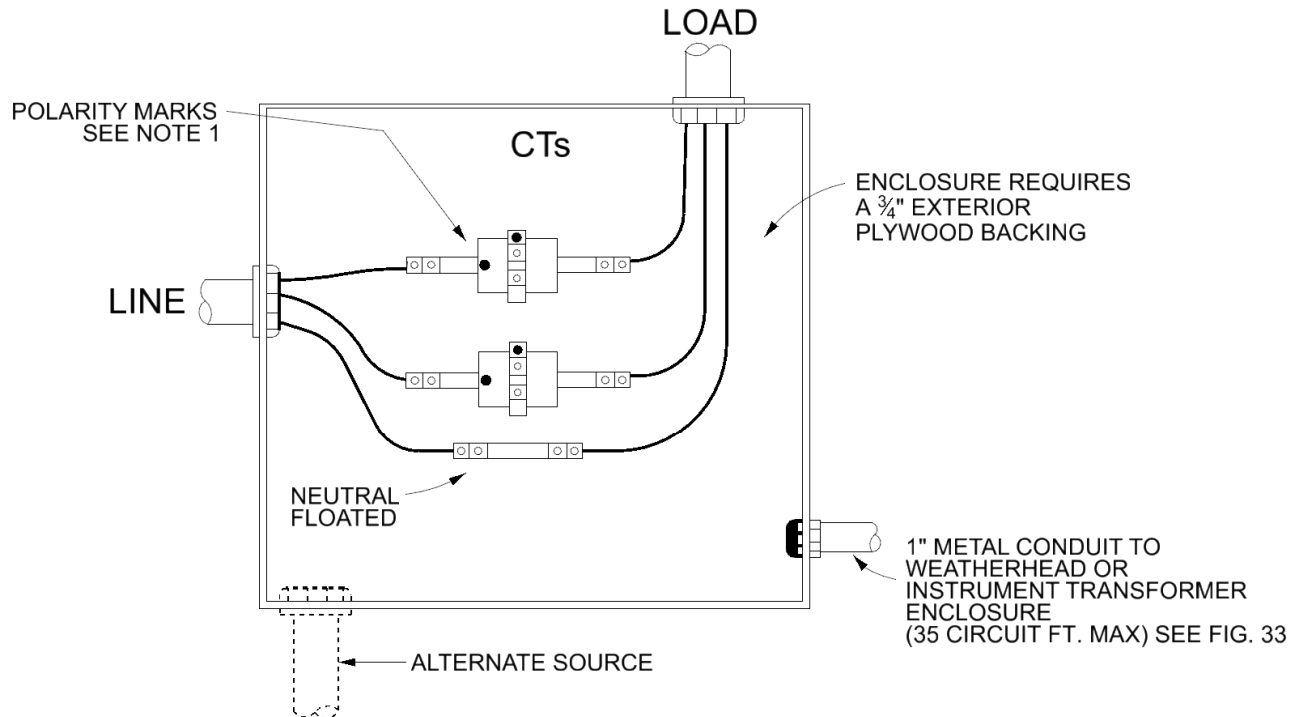
# INSTRUMENT TRANSFORMER METERING GREATER THAN 400 A



SERVICE	SOCKET
1-PHASE, 120/240 V, 3-WIRE, W/1 CT	5 TERMINAL, W/TEST SWITCH
1-PHASE, 120/240 V, 3-WIRE, W/2 CTs	6 TERMINAL, W/TEST SWITCH
3-PHASE, 4-WIRE, W/3 CTs	13 TERMINAL, W/TEST SWITCH

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# **INSTRUMENT TRANSFORMER WIRING 1-PHASE 120/240 V, 3-WIRE GREATER THAN 400 A**

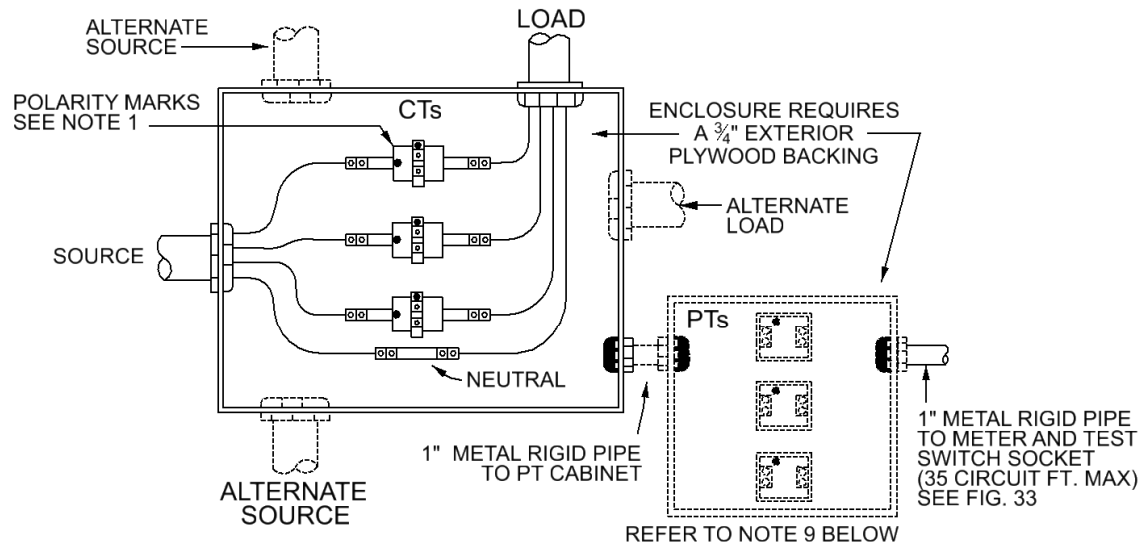


## **TRANSFORMER ENCLOSURE**

REFER TO APPENDIX C FOR ALL INSTRUMENT TRANSFORMER ENCLOSURES  
SEE FIG. 27 & 28 FOR SERVICES RATED 400 A OR LESS

1. The CTs shall be mounted so that the polarity marks are arranged facing source side.
2. Insulated bushings are required on all conduits.
3. Instrument transformer enclosures shall be grounded per *NEC* Article 250.
4. Covers on all instrument transformer cabinets shall be hinged on the side.
5. Bar type CTs will be used in instrument transformer enclosures and will be provided by the Company. The contractor shall mark line and load conductors within any CT cabinet.
6. The neutral shall be available in the instrument transformer enclosure for connection of the meter potential leads. A single 12 gauge neutral wire must be bonded inside the enclosure.
7. CT's shall be installed so they may be removed without access to the back of the cabinet.
8. See Appendix C-1 for instrument transformer requirements.
9. The neutral connector shall be UL listed and insulated from the instrument transformer cabinet.

**INSTRUMENT TRANSFORMER WIRING**  
**3-PHASE 120/240 V, 4-WIRE DELTA**  
**3-PHASE 120/208 V, 4-WIRE WYE**  
**3-PHASE 277/480 V, 4-WIRE**  
**GREATER THAN 400 A**

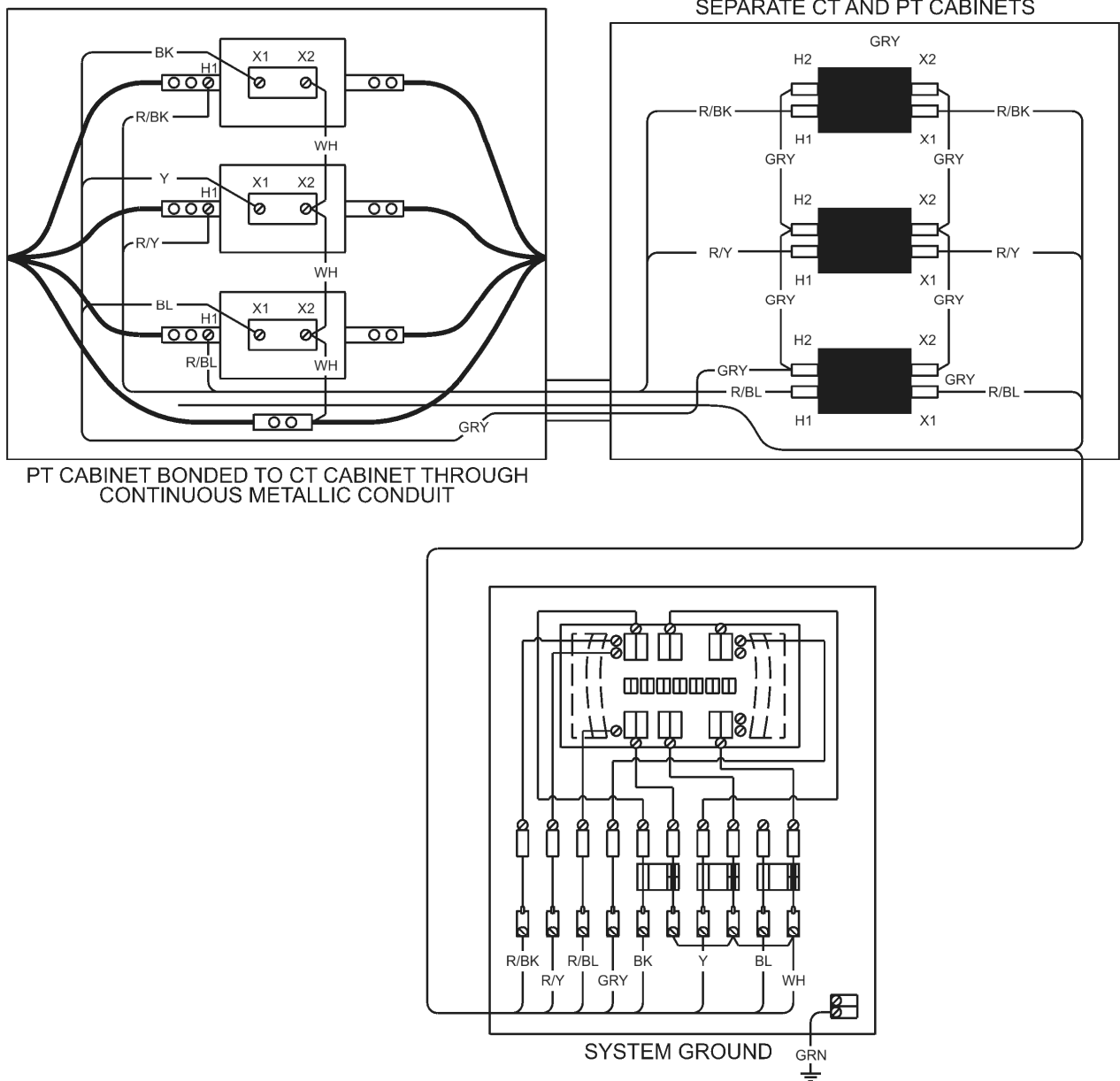


**TRANSFORMER ENCLOSURE**  
 REFER TO APPENDIX C AND APPENDIX E  
 FOR ALL INSTRUMENT TRANSFORMER ENCLOSURES  
 NEUTRAL FLOATED

1. The CTs and PTs, if required, shall be mounted so that the polarity marks are arranged facing source side.
2. Insulated bushings are required on all conduits.
3. Instrument transformer enclosures shall be grounded per *NEC* Article 250.
4. Covers on all instrument transformer cabinets shall be hinged on the side with heavy-duty hinges.
5. Bar type CTs will be used in instrument transformer enclosures and will be provided by the Company. The contractor shall mark line and load conductors within any CT cabinet.
6. The neutral, if insulated, shall be identified by a white or gray covering or tape. (Reference pg. 33)
7. The neutral shall be available in the instrument transformer enclosure for connection of the meter potential leads. A single 12 gauge neutral must be bonded inside the enclosure. The neutral connector shall be UL listed and insulated from the instrument transformer cabinet
8. In a metering device, defined as a meter socket or CT cabinet, one conductor may be secured in a lug; multiple lugs, each with a single conductor, may be used to parallel conductor to a device or may run to other devices in the same area.
9. CT's shall be installed so they may be removed without access to the back of the cabinet.
10. A weatherproof placard with min. 3/4 inch etched writing stating "480V" will be placed at all CT and PT cabinets for a 277/480V service.
11. See Figure 36 for additional PT Cabinet (VT Pack) configurations.
12. If 1 inch metering conduit is to be installed from transformer secondary cabinet to the meter socket, install red WARNING tape 1 foot above conduit.



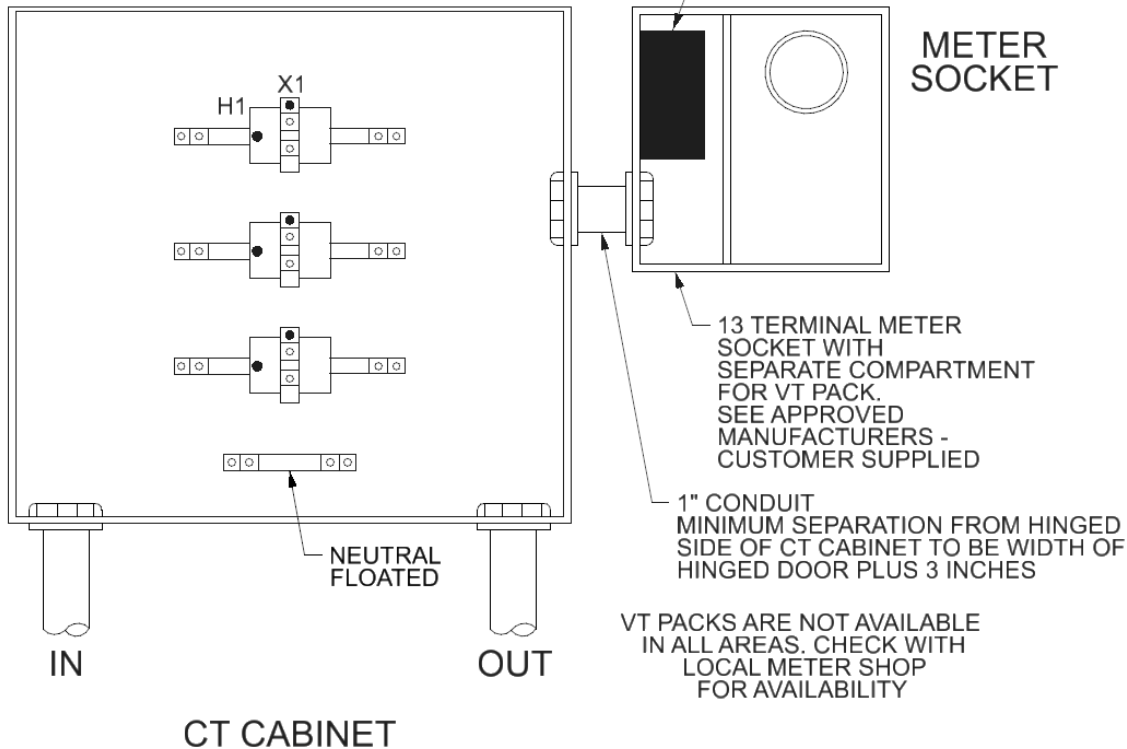
# INSTRUMENT TRANSFORMER WIRING FOR SEPARATE CT AND PT CABINETS



# **CONFIGURATION FOR INSTRUMENT TRANSFORMER RATED SERVICE WITH INTEGRATED VT PACK METER SOCKETS**

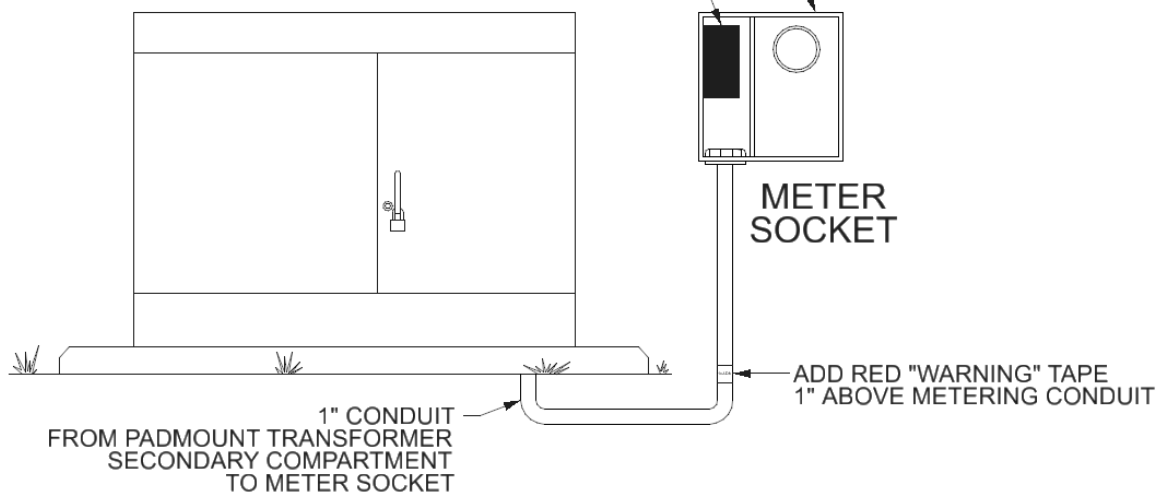
PT CABINET AND METER SOCKET CAN BE MOUNTED ON THE LEFT OF THE CT CABINET

TWO SOCKETS - TWO METERS  
VT PACK - MEC SUPPLIED



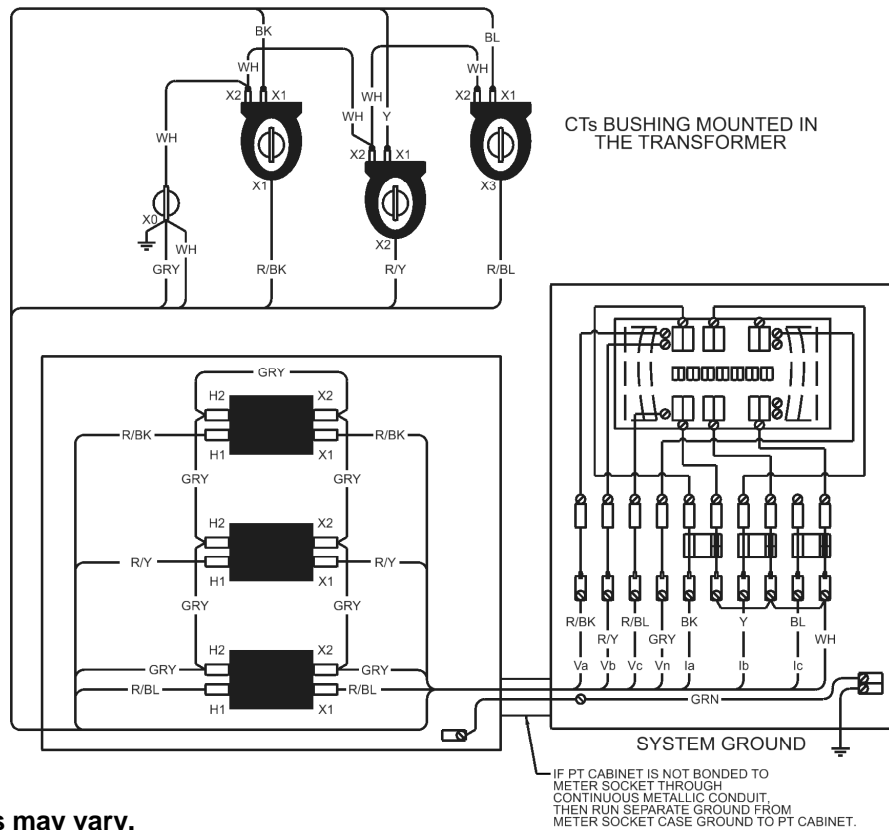
13 TERMINAL METER SOCKET  
WITH SEPARATE COMPARTMENT  
FOR VT PACK. SEE APPROVED  
MANUFACTURERS -  
CUSTOMER SUPPLIED

TWO SOCKETS - TWO METERS  
VT PACK - MEC SUPPLIED

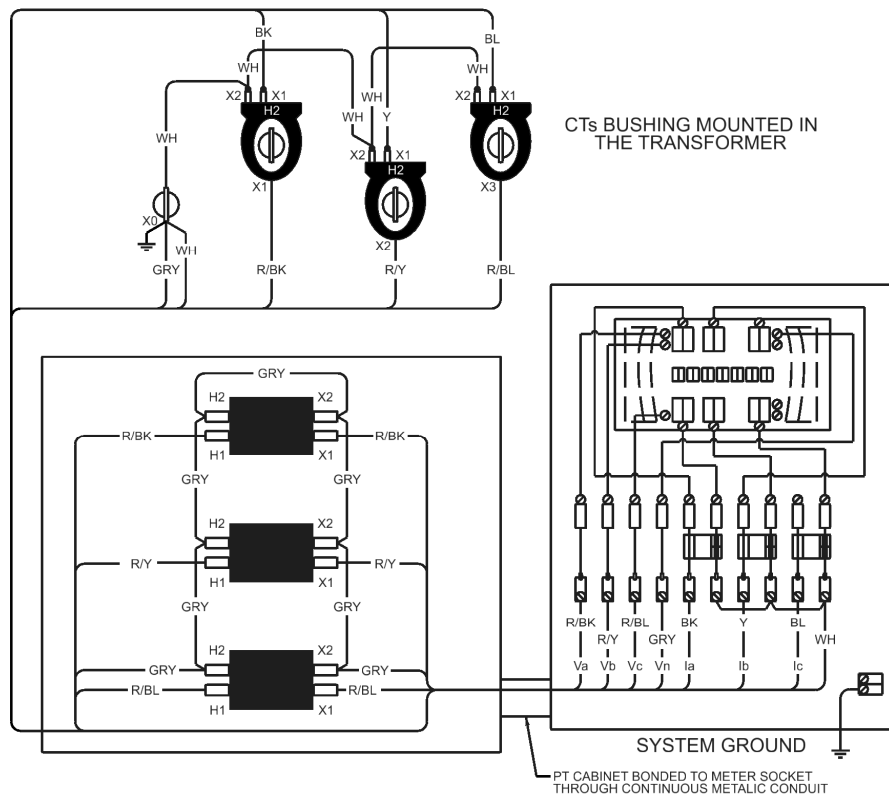


**PADMOUNT TRANSFORMER**

# INSTRUMENT TRANSFORMER WIRING FOR CT LOCATED IN THE TRANSFORMER AND PT CABINETS



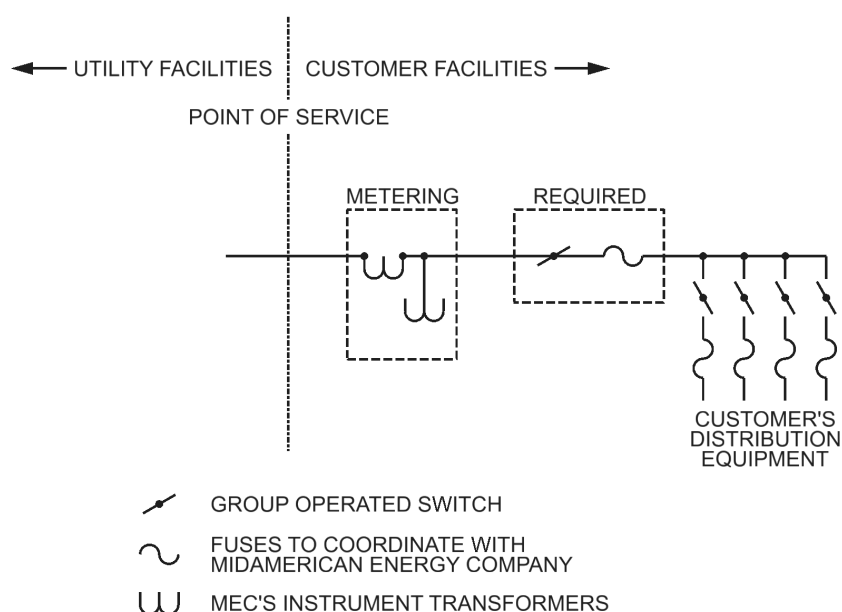
Wire colors may vary.



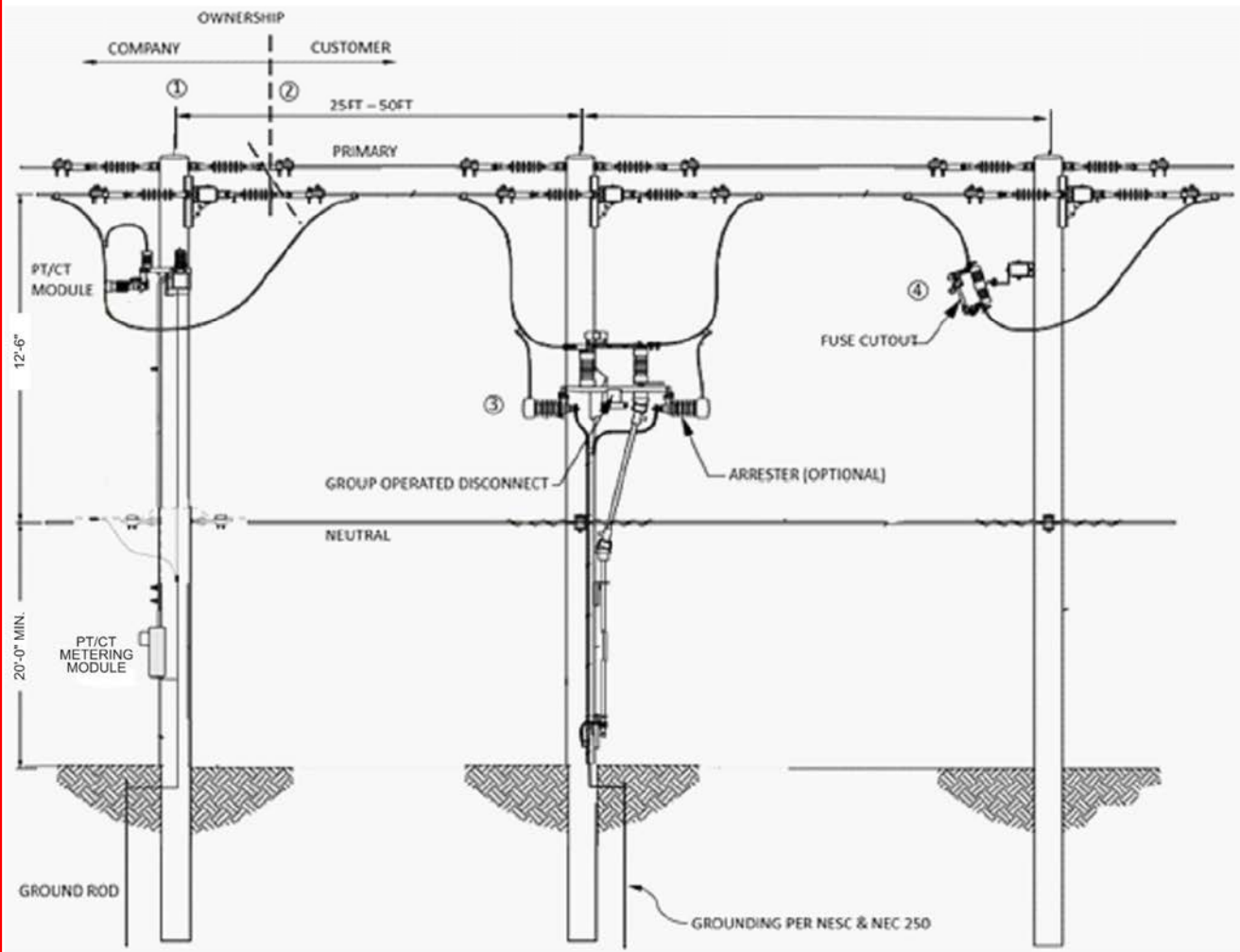
Wire colors may vary.

## PRIMARY METERING SERVICE

1. Customer shall submit an application to Company and obtain approval of the service voltage, size, location, equipment, and design before ordering and starting installation of the service entrance.
2. Company shall furnish, install and maintain all primary service conductors and cable terminators up to the point of service. For overhead primary service, instrument transformers shall be furnished, installed, and maintained by Company. For underground primary service, instrument transformers are provided by Company and typically shipped to the switchgear manufacturer for installation.
3. Customer shall furnish, install and maintain all service entrance equipment at the point of service including metering transformer cabinet and the installation of 1 inch galvanized steel metering conduits where required for underground service. Bar type CTs will be used in instrument transformer enclosures and will be provided by the Company. The contractor shall mark line and load conductors within any CT cabinet.
4. Prior to finalizing orders for service equipment, the customer shall submit a design package including, but not limited to, plan view and elevation view drawings, one-lines and equipment lists included in the installation for approval. For underground service, detailed shop drawings of the metering cabinet or switchgear are required.
5. If the service includes a backup source that is not a break-before-make transferring scheme, the customer shall submit an interconnect application and obtain approval with Company's Private Generation Group for equipment and design before ordering equipment and starting installation of the service entrance. See Electric Service Manual Section 11.0 Parallel Generation Operation for details.
6. Three-phase service entrance equipment shall include a group operated load-break disconnecting means and over current protection device immediately beyond the metering point. The disconnecting device shall be located to provide a visible open and operating capability to both the customer and Company. The sequence of the equipment toward the load shall be meter-switch-fuse with variations approved by MEC. (See Figure 1). For single-phase overhead service, a fuse cutout immediately beyond the metering point is acceptable.
7. Customer shall ensure that all wire and equipment installed beyond the meter are in accordance with the NESC in addition to the requirements of the NEC.

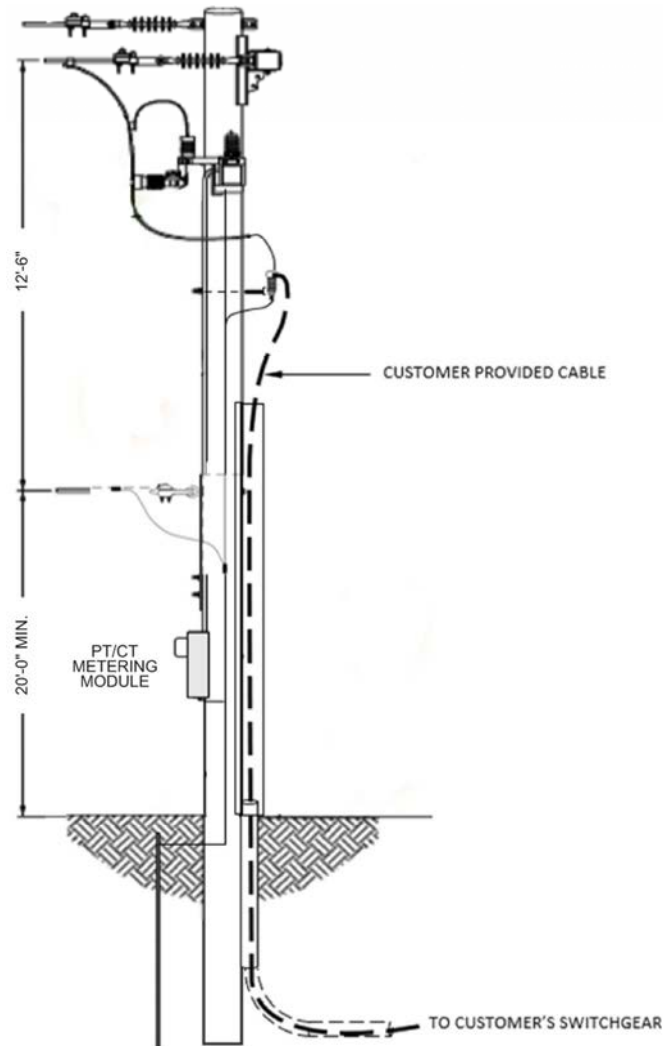


## OVERHEAD PRIMARY SERVICE



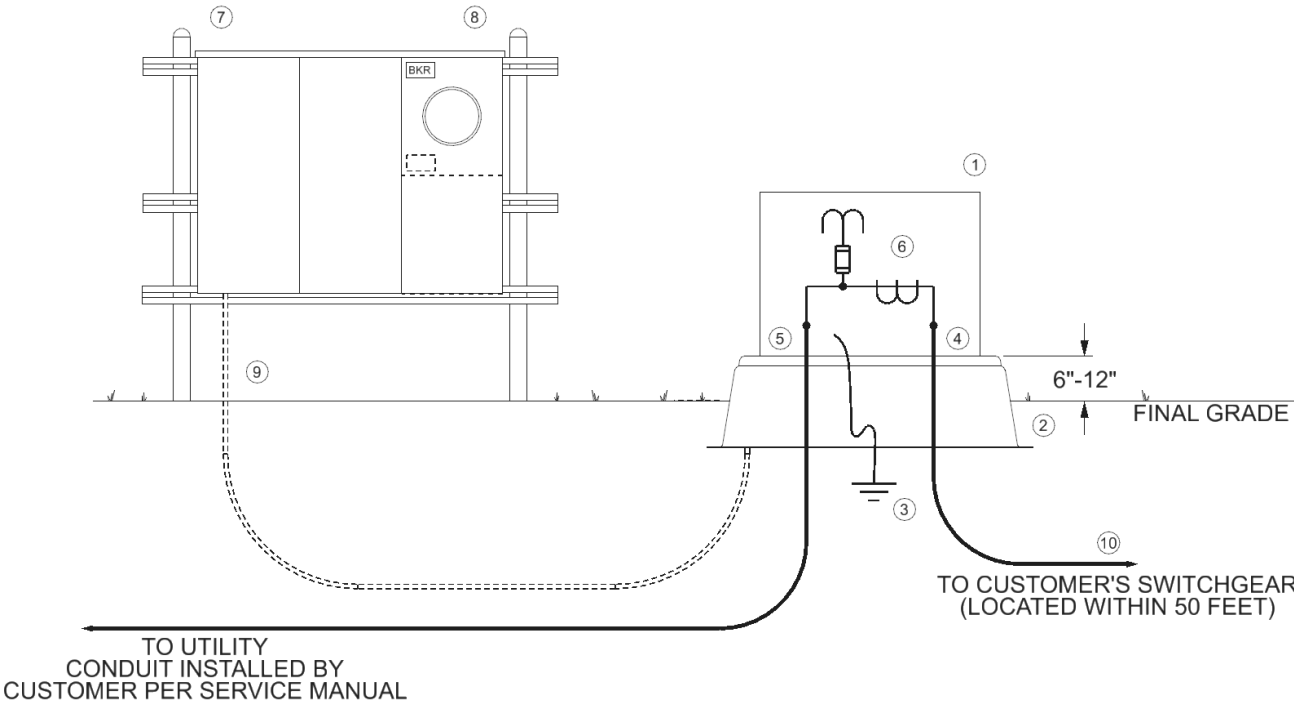
1. MEC shall furnish and install all facilities up to the point of service (typically at the property line) including meter pole, crossarm, conductors, terminators/suspension insulators, jumpers, PT's CT's module, and meter socket assembly.
2. Customer shall furnish and install all facilities beyond meter pole including dead-end clamps.
3. Customer's isolation switch shall be group operated from ground level with visible open/close, be lockable, be operable by both the customer and MEC, be capable of interrupting all load being served, and withstanding maximum available fault current.
4. Main fuses or breakers shall have minimum interrupting maximum available fault current. Consult with MEC local distribution engineering for coordination with upstream device.

## OVERHEAD TO UNDERGROUND PRIMARY SERVICE



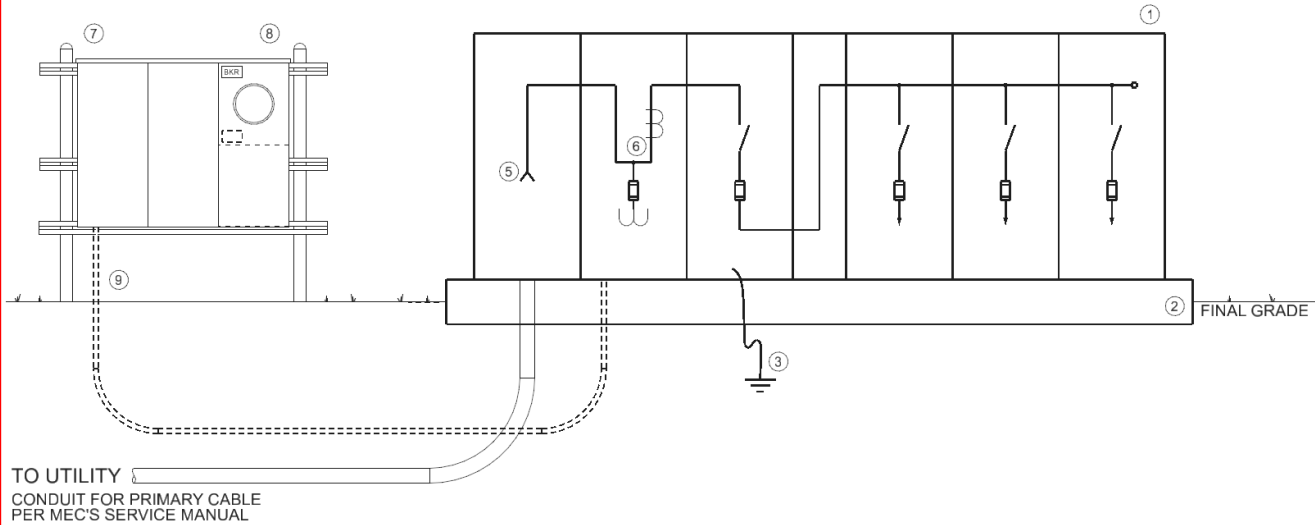
1. MEC shall furnish and install all facilities up to the point of service including meter pole, crossarm, conductors, terminators/insulators, jumpers, PT's CT's module, service riser and meter socket assembly.
2. MEC shall furnish and install primary service riser with customer provided cable. Allowable service conductors: 1/0, 2/0 or 4/0 AWG, aluminum, XLP or EPR insulation, concentric neutral with insulating jacket.
3. Customer switchgear shall be located within 50 feet from riser pole, have a main disconnect that is group operated with lockable visual open, be operable by both the customer and MEC, and be capable of withstanding maximum available fault current.

**THREE-PHASE UNDERGROUND PRIMARY SERVICE TO METERING ENCLOSURE  
(DEAD-FRONT ONLY)**



1. Customer shall furnish and install primary metering enclosure. Customer must submit metering enclosure drawings to MEC for review and must receive signed approval from MEC before ordering equipment. See Figure 37E for detailed requirements.
2. Customer shall furnish and install box pad (fiberglass or concrete) with minimum of 30 inch in height for training of primary cable.
3. Customer shall furnish and install grounding per NEC 250. Do not bond neutral to ground.
4. Customer shall furnish and install primary cable with elbow terminators on the load side.
5. MEC shall furnish and install primary cable with elbow terminators on the line side with customer installed conduit.
6. 3-CT's and 3-PT's with 1A fuses shall be provided by MEC and typically drop-shipped from the instrument transformer manufacturer to the metering enclosure manufacturer for preinstallation and wiring. Contact MEC for cut sheets of appropriate PT's and CT's.
7. Customer shall furnish and install a terminal box with PT fuse block (3-pole, 250V, 30A, #10-#18 copper only connections, Bussman Cat No. H25030-3S with non-6 amp fuse) and 4-position CT shorting terminal block.
8. Customer shall furnish and install an MEC approved 13-terminal meter socket with a 10-pole test switch. 1-inch conduit between meter socket and terminal box.
9. Customer shall furnish and install 1-inch rigid conduit from metering enclosure to terminal box and from terminal box to meter socket.
10. Customer switchgear beyond the metering enclosure shall be located within 50 feet of the metering enclosure, have a main disconnect that is group operated with lockable visual open, be capable of withstanding maximum available fault current.

## THREE-PHASE UNDERGROUND PRIMARY SERVICE TO SWITCHGEAR



1. Customer shall submit switchgear drawings to MEC for review and receive signed approval from MEC before ordering equipment. See Figure 37E for detailed requirements..
2. Customer shall furnish and install concrete pad for switchgear.
3. Customer shall furnish and install grounding per NEC 250.
4. Customer shall furnish and install conduit(s) for primary cable from switch bay (point of service) to prop-erty line. MEC shall furnish and install primary cable including terminators.
5. Switchgear shall have a main single service disconnect that is group operated with lockable visual open. Clear space shall be provided for primary conductors below the termination points.
6. CT's and PT's with 1A fuse shall be provided by MEC and typically drop-shipped from the instrument transformer manufacturer to the switchgear manufacturer for installation in the switchgear prior to deliv-ery. Contact MEC for cut sheets of appropriate PT's and CT's.
7. Customer shall furnish and install a terminal box with PT fuse block (3-pole, 250V, 30A, #10-#18 copper only connections, Bussmann Cat No. H25030-3S with non-6 amp fuse) and 4-position CT sorting termi-nal block.
8. Customer shall furnish and install an MEC approved 13-terminal meter socket with a 10-pole test switch.
9. Customer shall furnish and install 1-inch rigid conduit from switchgear metering bay to terminal box and from terminal box to meter socket.



## REQUIREMENTS FOR METERING ENCLOSURE AND SWITCHGEAR

### PRIMARY METERING CABINET (DEAD-FRONT STYLE ONLY)

1. Shall be capable of withstanding maximum available fault current at point of service. Contact Company for available fault current.
2. Shall have provisions for MEC provided 3-PT's and 3-CT's. Typically, these are directly shipped from the instrument transformer manufacturer to the switchgear manufacturer for installation in the cabinet prior to delivery to customer. Contact MEC's Metering Department for PT & CT catalog numbers or shop drawings.
3. Instrument transformers shall be installed complete with #6 or larger THHN copper primary wiring for PT and #6 solid-copper ground conductors.
4. Secondary wiring shall be #10 THW/XHHW stranded copper wire connecting the PT secondary to a 3-pole 250V 30A fuse block (Bussmann Cat No. H25030-3S with NON-6 amp Bussmann fuses) and CT secondary to a 4-position terminal block (GE Cat No. EB27B04S or similar) located on the outside wall of the enclosure next to meter socket.
5. Shall have readily access to instrument transformers by MEC for maintenance as needed.

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### PRIMARY METERING SWITCHGEAR

1. Shall be capable of withstanding maximum available fault current at point of service.
2. Service disconnect shall be group operated, be operable by both the customer and MEC, and have means to show visual open contacts.
3. A 2-hole NEMA standard lug landing shall be provided for each service lateral cable in the termination bay for live-front switchgear. A minimum height of 54 inches is required from the termination lugs to the floor with cable support provided as necessary.
4. Lightning arresters are required in termination bay with an 8.4kV MCOV rating.
5. Grounding bails shall be provided for all three-phases and neutral bus in the termination bay and metering bays.
6. Hinged doors with provisions for locking with an MEC padlock for direct working access to the termination bay and metering bay.
7. Shall have provisions for MEC provided 3-PT's and 3-CT's. Typically, these are directly shipped from the instrument transformer manufacturer to the switchgear manufacturer for installation in the switchgear prior to delivery. Contact MEC's Metering Department for catalog numbers or shop drawings.
8. Lifting eyes shall be provided for CT installation.
9. Instrument transformers shall be installed complete with #6 or larger THHN copper primary wiring for PT and #6 solid-copper ground conductors.
10. Secondary wiring shall be #10 THW/XHHW stranded copper wire connecting the PT secondary to a 3-pole 250V 30A fuse block (Bussmann Cat No. H25030-3S with NON-6 amp Bussmann fuses) and CT secondary to a 4-position terminal block (GE Cat No. EB27B04S or similar) located near the socket.
11. Under no circumstances shall any customer load be tapped off of the switchgear bus ahead of the utility instrument transformers.



# APPENDICES

## REQUIREMENTS FOR METER MOUNTING EQUIPMENT

### 1. ENCLOSURE MATERIALS

- Meter sockets shall meet Company specifications and shall be UL Listed.
- Shall be steel (plated or made of galvanized steel) or aluminum.
- The finish shall be tough, non-fading and have a long service life.

### 2. INSULATING MATERIALS

- Bus Support – Shall be high strength and track-resistant.
- Sheet Insulation – High dielectric strength.
- Insulating materials meet UL requirements.

### 3. MOUNTING BASES

- Shall be high impact strength, track-resistant.

### 4. SAFETY SHIELD BARRIERS

- Shall be track-resistant.

### 5. CONNECTORS

- Shall have high strength tops.
- Single hex screw and floating pressure pad; shall be tin-plated, suitable for copper or aluminum wire; shall have a built-in, anti-turn provision.
- Shall meet UL requirements for electrical connectors.
- Only one conductor per lay in connector is allowed.

### 6. JAWS

- Shall be tin-plated electrolytic copper. Jaws rated at 100 A and above shall be spring reinforced.
- Spring, clip type add-on 5th terminals are not allowed.

### 7. COVERS

- Shall be one piece.
- Shall be lockable using a hasp-type lock.
- Shall be ringless type.

### 8. INSTALLATION EASE

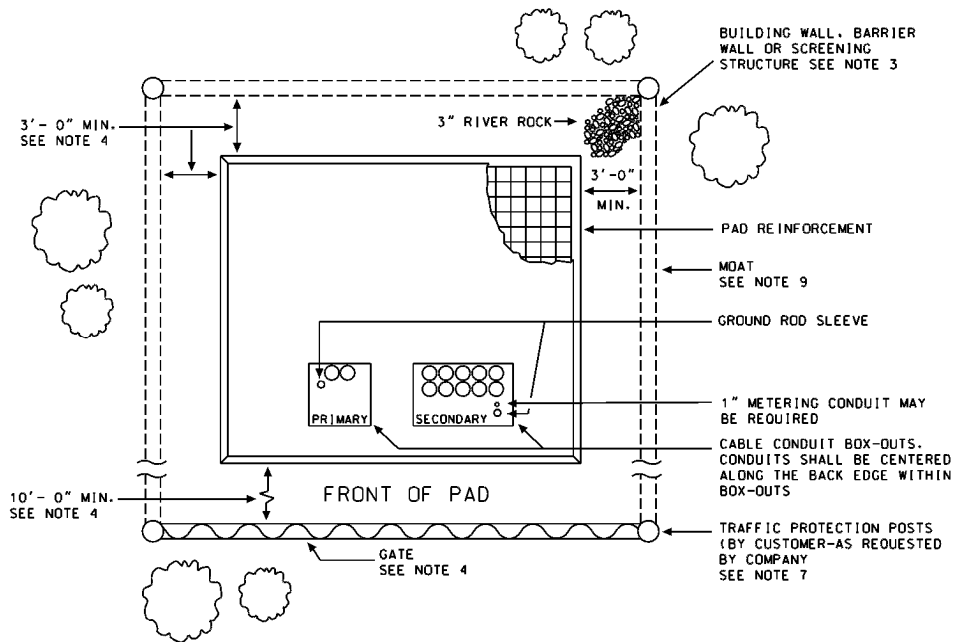
- Door shall be removable for installation ease.
- Terminals shall accept copper or aluminum wire for installation flexibility.
- Enclosure shall have a broad range of concentric knock-outs to accommodate varied wiring needs.
- Residential meter sockets rated greater than 200 amps require a manual clamping lever bypass.
- All commercial and non-residential installations require a manual clamping jaw lever bypass and weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service.

### **NOTE: METER MOUNTING EQUIPMENT IS NOT ACCEPTABLE IF:**

- Designed for flush-mounting only.
- Equipped with automatic bypass or sliding bar bypass.
- Equipped with ring-type mounting cover.
- Used for UG application when specifically manufactured only for overhead application.
- Not UL approved.

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## LOCATION OF CUSTOMER FURNISHED PADS FOR 3-PHASE PAD-MOUNTED TRANSFORMERS (ALL SIZES)



Three-phase transformer pads must be:

1. Installed by the customer at the customer's expense. Ongoing maintenance and repair to the pad are the responsibility of the customer.
2. Constructed in a manner satisfactory to the Company, in a mutually agreed upon location with hard surface truck access and unobstructed work space for large vehicles. Truck access is to be permanently maintained by customer.
3. The installation of a screening or barrier structure may be required by your local governing authority. It is the customer's responsibility to determine if a barrier structure is required. If screening or a barrier structure is required, or installed as an optional feature, the clearance limitations of notes 2 and 3 must be maintained.
4. A 3'-0" minimum clearance is to be maintained from pad sides and back, to the nearest structure or plantings. A level graded, 10'-0" minimum clearance is to be maintained from the front of pad, to the nearest fixed structure or plantings. If a full length gate is installed, it shall be hinged and no closer than 3'-0" from pad front. Local government, fire protection, and building codes may require greater clearances. Customer will avoid plantings or construction that interferes with Company's required maintenance access to its equipment. If a fence or barrier is to be installed, it must be coordinated with the Company.
5. All conduits shall extend 5'-0" beyond the pad and screening structure (if used) and the locations of the ends of primary conduits shall be identified. Primary conduit shall be installed between 42" and 48" below final grade. Secondary conduit shall be installed between 30" and 42" below final grade. It is recommended that conduit not be installed under the transformer pad between the piers.
6. When metallic conduit is utilized, customer shall install grounding bushings.
7. When necessary for traffic protection or at local engineering's discretion, set a 4" diameter concrete-filled galvanized steel post 3'-0" from pad corner. Post shall be 8' long with a 4' concrete embedment.
8. All Company transformers shall be located in mutually agreed upon location with hard surface access and unobstructed work space for large vehicles. If special equipment, such as a crane, is required for setting or replacing the transformer, the customer shall pay all expenses.
9. A trench 2'-0" deep and 3'-0" wide will be dug on all four sides. The trench will be lined with silt fence fabric tucked under the pad and filled with either 2" or 3" screened river rock to final grade. Contact local distribution engineering representative if design needs modification.
10. Primary and secondary conduit bays must be back filled with a minimum of 1" of concrete after primary transformer pad has been formed to contain oil leaks.

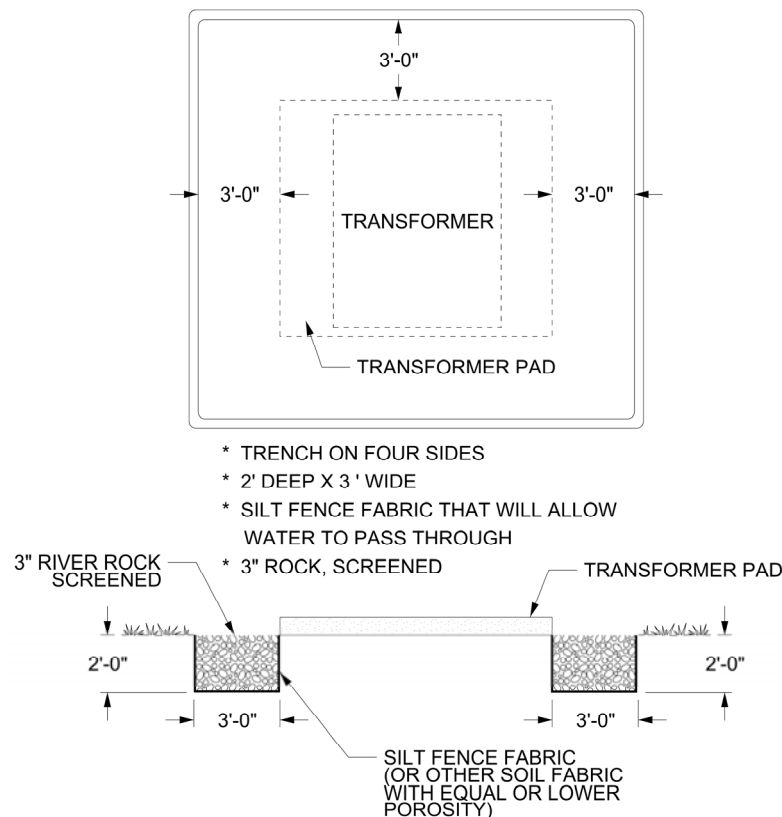
## SPILL PREVENTION, CONTROL AND COUNTERMEASURE (SPCC) PLANS AND OIL CONTAINMENT FOR CUSTOMER FURNISHED PADS FOR 3-PHASE PAD-MOUNTED TRANSFORMERS (ALL SIZES)

Federal regulations prohibit the discharge of oil onto or into navigable waters of the United States or adjoining shorelines. A facility with aggregate above ground oil storage capacity of more than 1,320 gallons (counting only containers with oil storage capacity of 55 gallons or more) which could reasonably be expected to discharge oil to navigable waters of the United States, must prepare a Spill Prevention, Control and Countermeasure (SPCC) Plan. More specifically, whenever MidAmerican owned equipment at a customer facility exceeds this threshold (customer owned oil filled equipment at the site excluded), a plan must be prepared. This requirement affects bulk oil containers, oil-filled electrical equipment and oil-filled process equipment. Development of a site-specific SPCC Plan requires detailed knowledge of the facility and the potential effects of any oil release. Each SPCC Plan must include certain standard elements to ensure compliance with federal regulations. One of the elements is a description of appropriate containment and/or diversionary structures or equipment designed to prevent a discharge of oil to the environment.

Due to potential for oil release from oil-filled electrical equipment, any proposed facility that includes installation of 3-phase padmount transformers (any size) will incorporate secondary containment measures to minimize a potential oil release. The following secondary containment design is recommended. An alternate design may be used with approval by MidAmerican Energy.

For additional information on oil spill prevention or SPCC Plans, contact MidAmerican Energy Company, environmental services, at 515- 281-2953.

To discuss an alternative containment design, contact local MidAmerican Energy Company, distribution engineering personnel.



# **CONCRETE PAD SPECIFICATION 3-PHASE PAD-MOUNTED TRANSFORMERS**

## **1.0 GENERAL**

### **1.1 Scope of Work**

The Contractor shall furnish all labor, materials, formwork, equipment, and services required to complete all concrete pad work shown on the drawings specified in this appendix.

### **1.2 Quality Assurance**

#### **1.2.1 Codes and Standards:**

Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings."

ACI 318 "Building Code Requirements for Reinforced Concrete" Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

#### **1.2.2 Concrete Testing Service:**

The Contractor may be required to employ a testing laboratory acceptable to the Company to perform material evaluation tests and to design concrete mixes.

## **2.0 MATERIALS**

### **2.1 Form Materials**

Forms for Exposed Finish Concrete: Unless otherwise indicated, construct framework for concrete surfaces with construction lumber, plywood, metal, metal framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without deflection.

### **2.2 Reinforcing Materials**

#### **2.2.1 Reinforcing Bars (ReBar):**

ANSI/ASTM A 615 Grade 40, Deformed.

#### **2.2.2 Welded Wire Fabric (WWF):**

ANSI/ASTM A 185, Welded steel wire fabric.

#### **2.2.3 Supports for Reinforcement:**

Provide supports (including bolsters, chairs, and spacers) for positioning reinforcing bars and welded wire fabric in place.

### **2.3 Concrete Materials**

2.3.1 Cement shall conform to the latest revised standard specification for Portland Cement, ASTM C 150, Type 1, or standard specification for blended hydraulic cements, ASTM C 595.

## **CONCRETE PAD SPECIFICATION 3-PHASE PAD-MOUNTED TRANSFORMERS**

### **2.0 MATERIALS** (Continued)

#### **2.3 Concrete Materials** (Continued)

- 2.3.2 Concrete aggregates shall conform to the latest revised standard specification for concrete aggregates, ASTM C 33. **Use crushed limestone for all aggregates.** Maximum coarse aggregate size shall be not more than 1-1/2 inches.
- 2.3.3 All mixing water shall be clean and free from deleterious amounts of acids, alkaline, or organic materials.
- 2.3.4 Air-entraining admixtures for concrete shall conform to the latest revised standard specifications for air-entraining admixtures for concrete, ASTM C260.
- 2.3.5 Calcium chloride is not permitted.
- 2.3.6 All other materials used in the concrete shall conform to current applicable ASTM specifications.

### **3.0 SUBGRADE PREPARATION**

#### **3.1 Material**

- 3.1.1 All soft and yielding material and portions of the subgrade that will not compact readily when rolled or tamped shall be removed and replaced with suitable material.

#### **3.2 Compaction**

- 3.2.1 The subgrade shall be brought to a firm and unyielding condition.
- 3.2.2 Soil greater than/or equal to 95% Proctor density or 55 psi presumptive bearing value (pbv).
- 3.2.3 Soil should be compacted at or slightly above standard optimum moisture.

#### **3.3 Moisture Barrier**

- 3.3.1 A minimum 6 mil polyethylene film shall be placed on top of the sand leveling bed prior to pouring the concrete.

### **4.0 CONCRETE SPECIFICATIONS**

#### **4.1 General**

- 4.1.1 All concrete shall have a minimum 28-day compressive strength of 3500 psi.
- 4.1.2 Concrete shall be produced with a minimum cement content of 520 lb per cubic yard and an entrained air content of 7% by volume.
- 4.1.3 Maximum allowable concrete slump shall be 4 inches.
- 4.1.4 Where it can be shown that adequate strength, surface finish, and durability can be obtained on a consistent basis with mix designs other than those specified above, such designs may be used upon written approval.



## CONCRETE PAD SPECIFICATION 3-PHASE PAD-MOUNTED TRANSFORMERS

### 5.0 EXECUTION

#### 5.1 Forms

- 5.1.1 Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work of finished structure.
- 5.1.2 Provide for openings, sinkages, chamfers and blocking in the structure.
- 5.1.3 Fabricate forms for easy removal without hammering or prying against concrete surfaces.

#### 5.2 Placing Reinforcement

- 5.2.1 Clean reinforcement of loose rust, mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- 5.2.2 Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations.
- 5.2.3 Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.
- 5.2.4 Place reinforcement to obtain adequate concrete protection.

#### 5.3 Concrete Placement

- 5.3.1 Preplacement Inspections: **Before placing concrete, the Contractor shall give the Company 2 business days notification.** All items to be embedded will be exposed at the time of the inspection. The Company will not place a transformer on a concrete pad that has not been inspected. The Company has the right to request the Contractor to replace the pad due to failure to properly and timely request such inspection.

#### 5.3.2 Temperature

- a. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes.
- b. When air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.
- c. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures.
- d. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.
- e. At any time the ambient temperature is expected to fall below 32°F, the concrete shall be immediately protected and maintained at a surface temperature of 40°F for a period of 7 days after placing.
- f. Use of frozen materials or materials containing ice or snow is not permitted. Concrete shall not be placed on frozen subgrade or subgrade containing frozen materials.

## **CONCRETE PAD SPECIFICATION 3-PHASE PAD-MOUNTED TRANSFORMERS**

### **5.0 EXECUTION** (Continued)

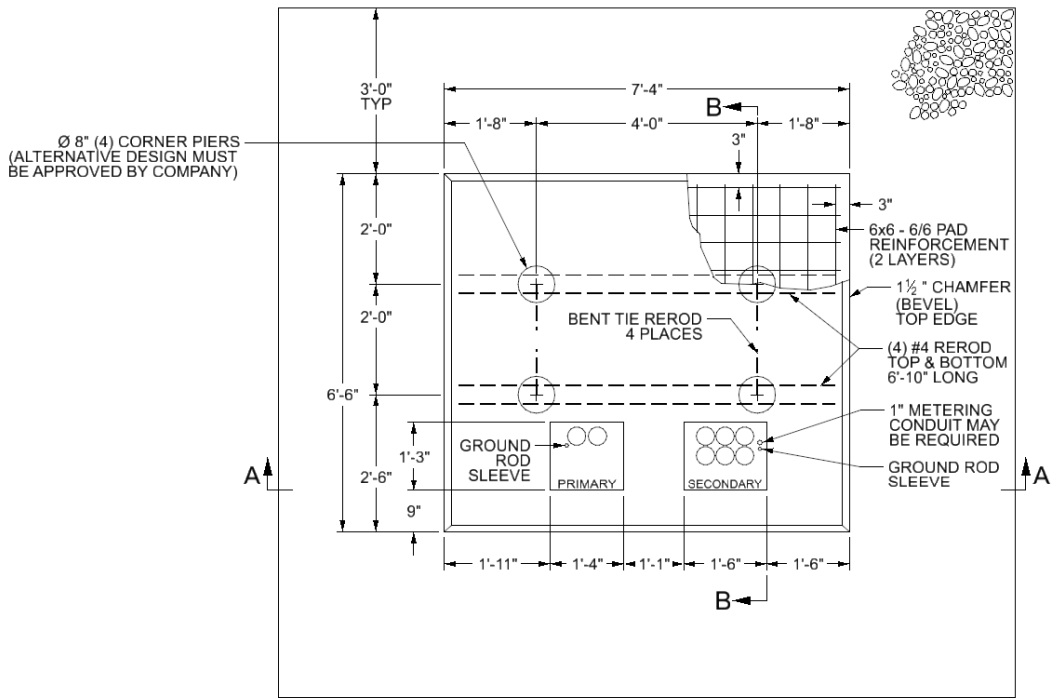
- 5.3.3 Deposit concrete continuously and as nearly as practicable to its final location to avoid segregation.
- 5.3.4 Consolidation
  - a. Consolidate placed concrete by mechanical vibrating equipment so that concrete is thoroughly worked around reinforcement and other embedded items.
  - b. Use equipment and procedures for consolidations of concrete in accordance with ACI recommended practices.
  - c. Excessive or over vibration will not be permitted.
- 5.3.5 Maintain reinforcing in proper position during concrete placement operation.
- 5.3.6 Bring slab surfaces to correct level with straight edge and strike-off. Use bull floats, darbies or hand floats to smooth surface free of humps or hollows. The finished slab must be level.

### **6.0 FINAL INSPECTION**

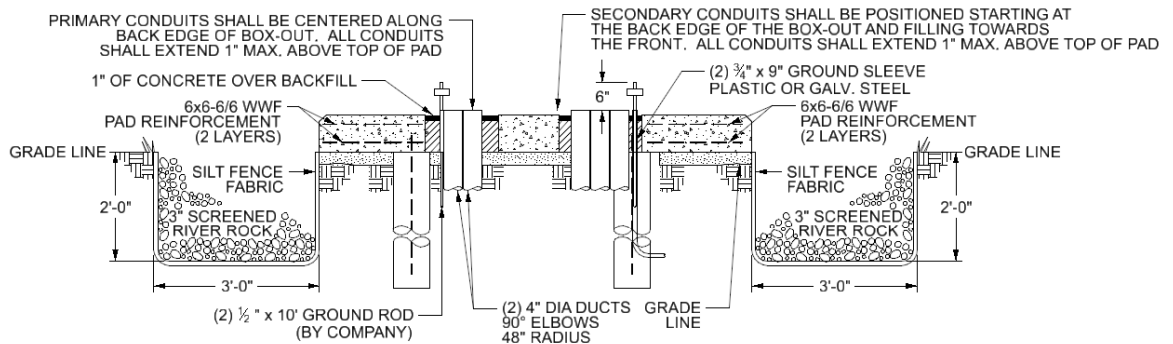
#### **6.1 Finish Work**

- 6.1.1 Apply non-slip broom-finish to exposed concrete.
- 6.1.2 Seal concrete with a standard concrete sealer. Apply sealing compound to concrete as soon as final finishing operations are complete (within two (2) hours). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions.
- 6.1.3 Let concrete cure for 24 hours before removing forms without putting undo pressure on concrete that may cause chipping or cracking.
- 6.1.4 Backfill and tamp around pad where applicable.
- 6.1.5 All edges are to be finished with an edger.
- 6.1.6 Contact the appropriate Company office for an inspection after the framework is placed. Two business days notice shall be given to the Company for this inspection.
- 6.1.7 A minimum of 1" of concrete must be filled in to the primary and secondary conduit bays after the main transformer pad has cured and forms are removed to contain oil leaks.

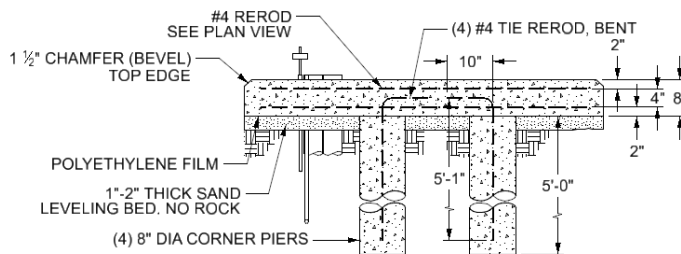
# CONSTRUCTION DETAILS CUSTOMER FURNISHED PADS FOR 3-PHASE PAD-MOUNTED TRANSFORMERS 75-500 kVA



**PLAN VIEW**



**SECTION "A-A"**

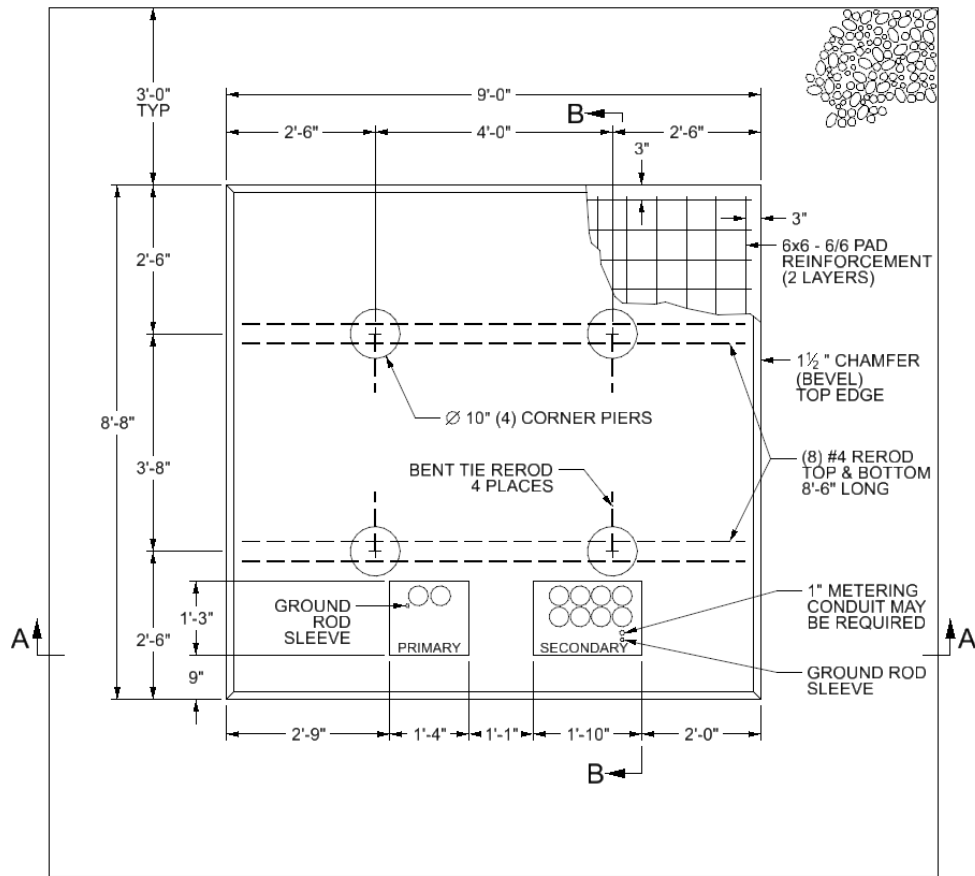


**SECTION "B-B"**

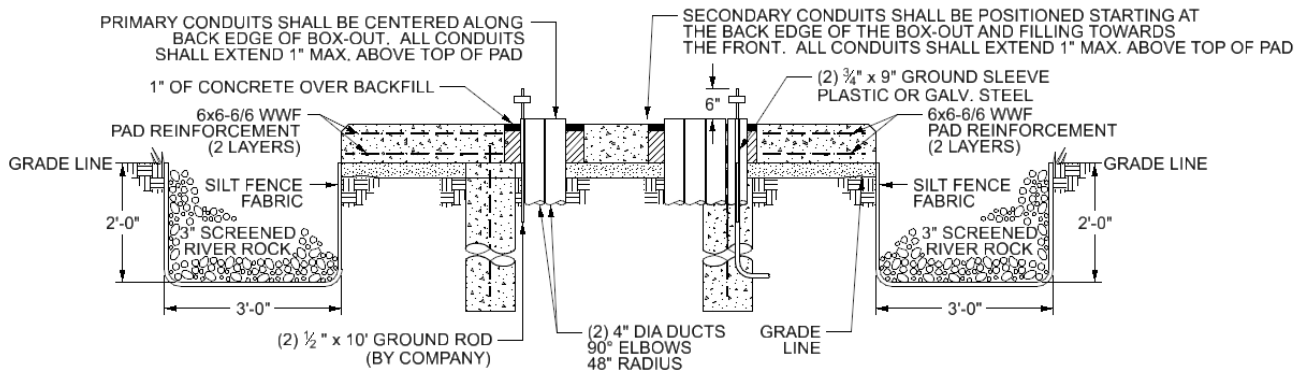
## DESIGN DATA

CONCRETE  $f'_c > 3500$  PSI AT 28 DAYS  
REINFORCING STEEL: ASTM A 615-40  
6x6-6/6 WELDED WIRE FABRIC (WWF)  
ASTM A 185  
SOIL: >95% PROCTOR DENSITY OR 55 PSI PBV

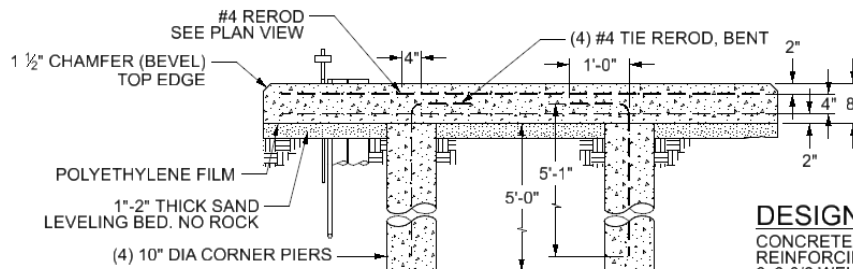
# **CONSTRUCTION DETAILS CUSTOMER FURNISHED PADS FOR 3-PHASE PAD-MOUNTED TRANSFORMERS 750-1000 kVA**



**PLAN VIEW**



**SECTION "A-A"**

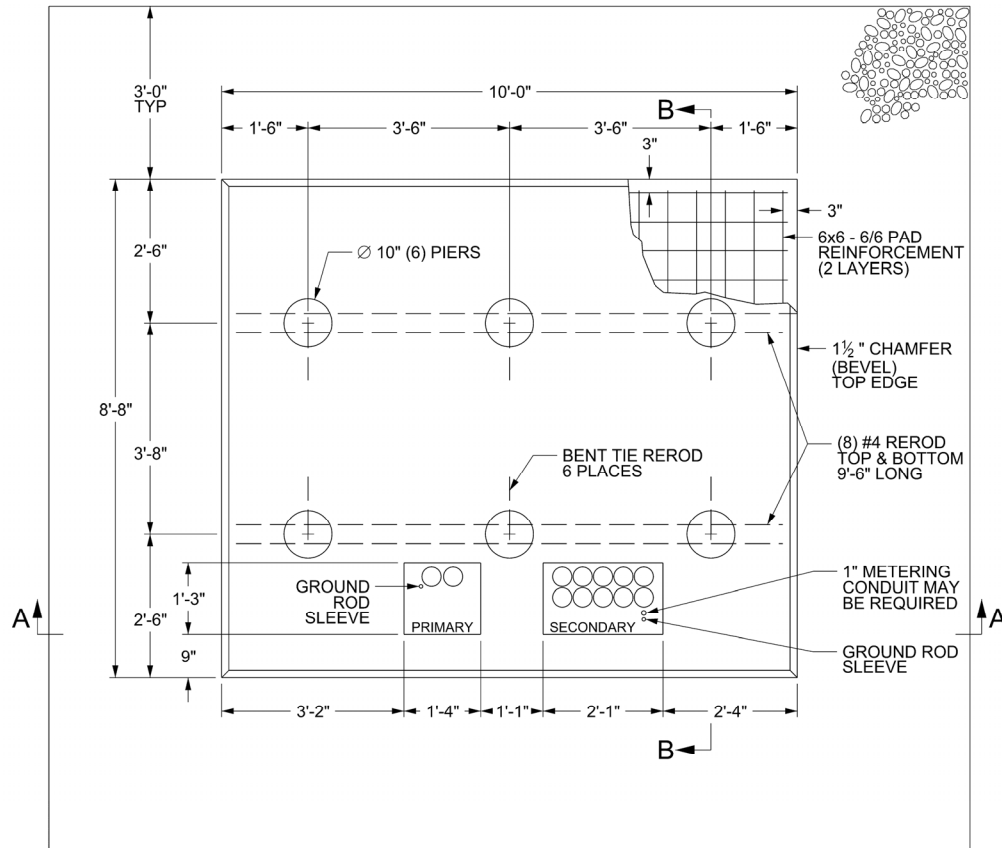


**SECTION "B-B"**

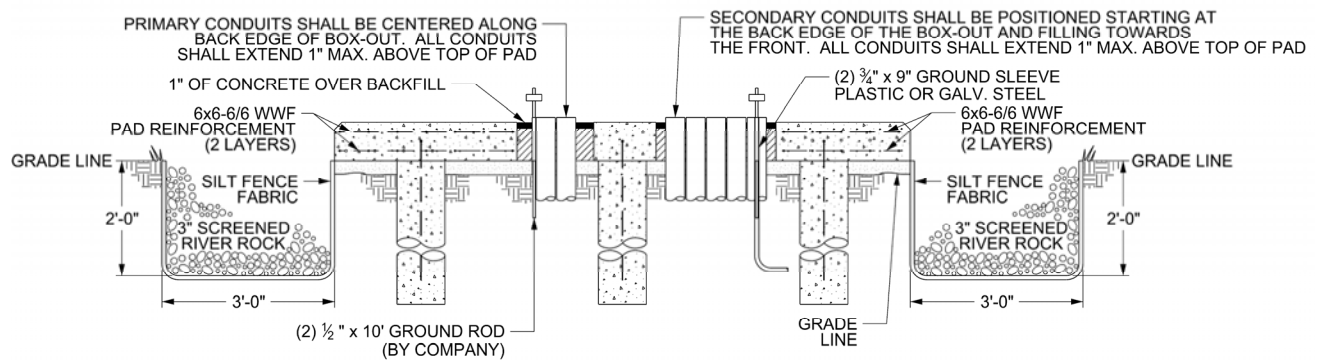
## **DESIGN DATA**

CONCRETE  $f_c > 3500$  PSI AT 28 DAYS  
 REINFORCING STEEL: ASTM A 615-40  
 6x6-6/6 WELDED WIRE FABRIC (WWF)  
 ASTM A 185  
 SOIL: >95% PROCTOR DENSITY OR 55 PSI PBV

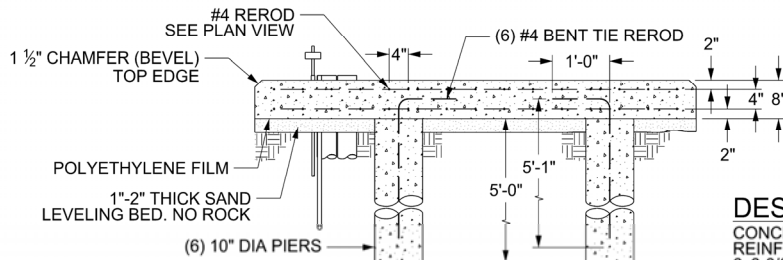
# CONSTRUCTION DETAILS CUSTOMER FURNISHED PADS FOR 3-PHASE PAD-MOUNTED TRANSFORMERS 1500-2500 kVA



**PLAN VIEW**



**SECTION "A-A"**



**SECTION "B-B"**

## DESIGN DATA

CONCRETE  $f_c > 3500$  PSI AT 28 DAYS  
 REINFORCING STEEL: ASTM A 615-40  
 6x6-6/6 WELDED WIRE FABRIC (WWF)  
 ASTM A 185  
 SOIL: >95% PROCTOR DENSITY OR 55 PSI PBV

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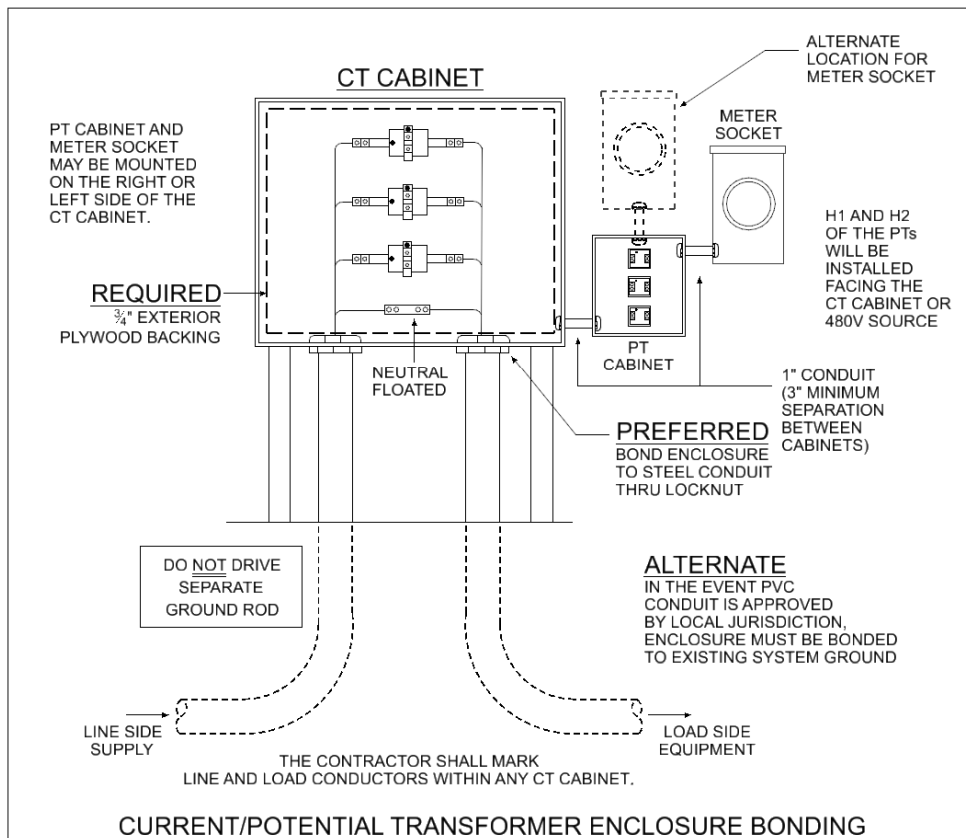
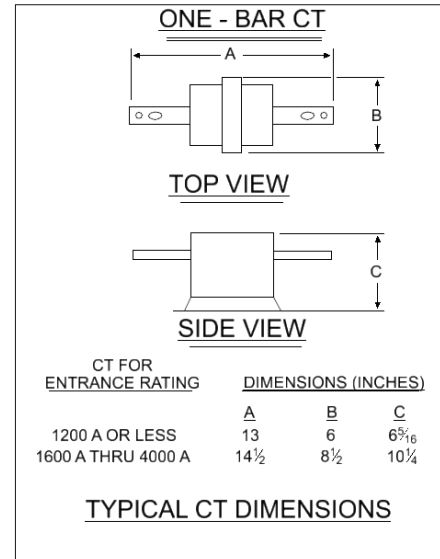
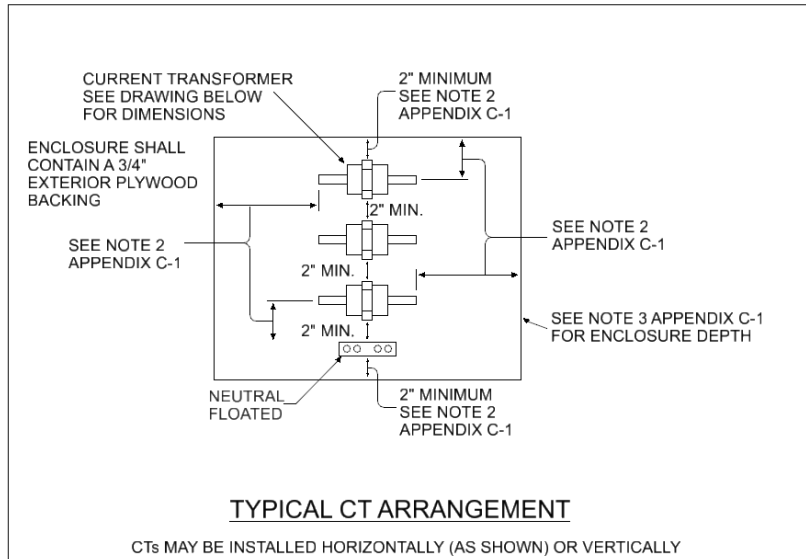
## HINGED INSTRUMENT TRANSFORMER ENCLOSURES

1. The fabrication requirements and minimum sizes for enclosures shall conform to *NEC* Article 312. The size of separate potential transformer (PT) enclosures, when required, is indicated in Note 4 below. The remaining information applies to the minimum size for current transformer (CT) enclosures.
2. Space requirements for wire bends as specified in *NEC* Tables 312.6(A) and 312.6(B) will affect these dimensions, depending on the wire exit arrangement. The customer has the option to use the CT size and spacing information shown in Appendix C 2, along with the *NEC* tables, to determine the minimum size required as directed by the *NEC*, or to use the simplified enclosure size reference shown on Appendix C 3 through C 6. The customer shall contact a Company representative for approval of exceptions to these arrangements or when it is preferred to mount the CTs and PTs in the same enclosure.
3. The minimum CT enclosure depth will vary depending on entrance size as follows:

<u>Entrance</u>	<u>Depth</u>
1200 A or smaller	10"
Larger than 1200 A	12"

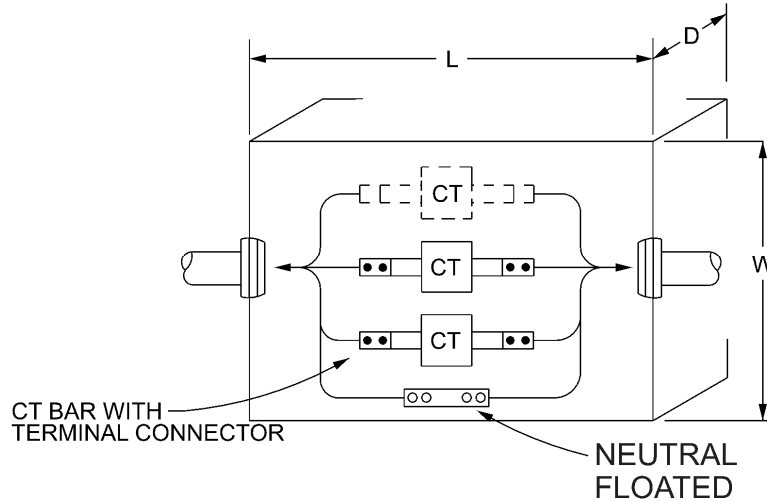
4. The minimum size of the PT enclosure shall be 22" wide x 22" high x 10" deep.
5. The top of instrument transformer enclosures shall be no more than 6 feet and the bottom no less than 2 feet above the final grade, centered as best as possible. Working space in front of enclosures shall be in accordance with *NEC* Section 110.26.
6. **A hinged cover (with heavy-duty, pin type hinges on the side of the box) is required**, with a latch no more than 5 feet above the floor. If the enclosure is 48 inches or wider, the cover shall be split, and hinged at each side. All hinged covers shall be installed with sufficient clearance to open at least 90 degrees. All enclosures shall have provisions for sealing and/or padlocking capabilities.
7. The enclosures shall be weatherproof. Aluminum or stainless steel is recommended.
8. Covers must include a lever for opening/closing the cabinet. Securing covers in place with multiple screws is not acceptable.
9. Company provided current transformers and potential transformers may be mounted by the manufacturer in a customer's factory fabricated switchgear. Contact your Company representative for details. Before fabrication, switchgear shop drawings shall be submitted to the appropriate Company representative for review and approval of instrument transformer mounting details.
10. Refer to Section 8.0 in this manual for connection requirements when using bar type CTs. The contractor shall mark line and load conductors within any CT cabinet.
11. No customer equipment or other wiring shall be allowed in or to pass through the instrument transformer enclosure.
12. Enclosure requires a 3/4" exterior plywood backing.
13. Instrument transformer enclosures shall be grounded per *NEC* Article 250 and Company requirements as shown in Appendix C-2.
14. Installations within corrosive environments shall use fiberglass enclosures.
15. Installations within harsh or dirty environments shall use dust proof enclosures.
16. A weatherproof placard with min. 3/4 inch etched writing stating "480V" will be placed at all CT and PT cabinets for a 277/480V service.

# HINGED INSTRUMENT TRANSFORMER ENCLOSURES





## CURRENT TRANSFORMER ENCLOSURE SIZE REQUIREMENTS GREATER THAN 400 A

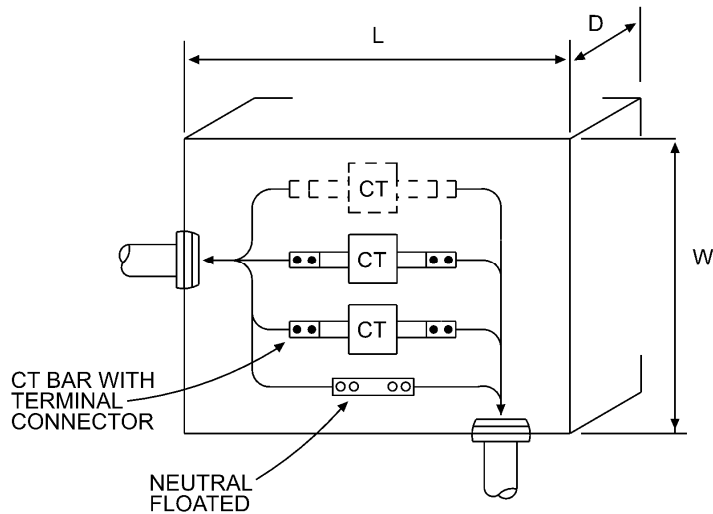


### MINIMUM CT ENCLOSURE SIZE REQUIREMENTS (DIMENSIONS L, W, D)

WIRE SIZE	NUMBER OF WIRES PER TERMINAL CONNECTION				
	1	2	3	4	5
	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)
4/0	29-26-12	30-26-12	32-26-12	—————	—————
250	32-26-12	32-26-12	33-26-12	35-26-12	—————
300	35-26-12	35-26-12	37-26-12	39-26-12	—————
350	39-26-12	39-26-12	41-26-12	43-26-12	—————
400	41-26-12	41-26-12	43-26-12	45-26-12	47-35-12♦
500	43-26-12	43-26-12	45-26-12	49-35-12♦	49-35-12
600	45-26-12	47-26-12	51-26-12	55-35-12♦	55-35-12
700	47-26-12	51-26-12	55-26-12	61-35-12	61-35-12
750	49-26-12	53-26-12	61-35-12♦	65-35-12	65-35-12

1. The above W dimensions are for three CT installations. Subtract 8" to obtain the W dimensions for two CT installations.
2. Dimensions followed by a ♦ may be reduced as follows if aluminum wire is used: Reduce L by 2" and reduce W by 9". All other dimensions apply when aluminum or copper wire is used.
3. Refer to Appendix C-1 for general information.
4. Two or three CT versions of this arrangement may be installed horizontally (as shown), or vertically, or opposite hand. Rotate the page around until the diagram fits the preferred arrangement.

# CURRENT TRANSFORMER ENCLOSURE SIZE REQUIREMENTS GREATER THAN 400 A

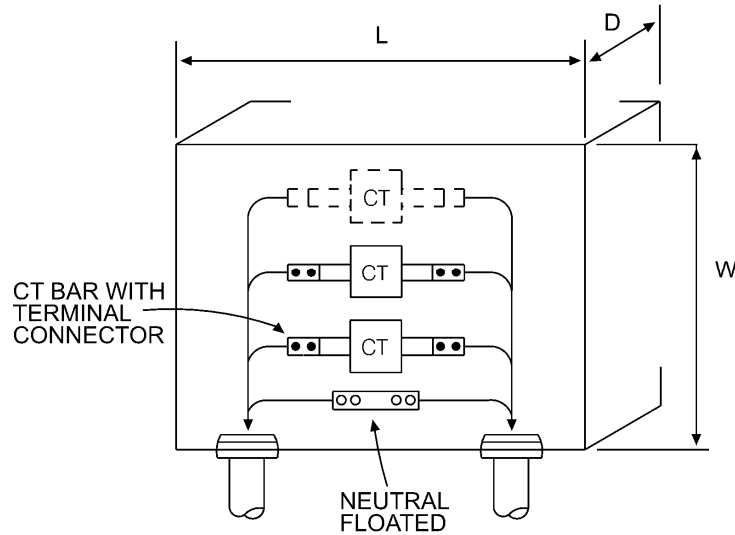


## MINIMUM CT ENCLOSURE SIZE REQUIREMENTS (DIMENSIONS L, W, D)

WIRE SIZE	NUMBER OF WIRES PER TERMINAL CONNECTION				
	1	2	3	4	5
	L-W-D	L-W-D	L-W-D	L-W-D	L-W-D
	(INCHES)	(INCHES)	(INCHES)	(INCHES)	(INCHES)
4/0	26-26-12	29-27-12	32-29-12	—————	—————
250	28-26-12	30-27-12	32-29-12	35-31-12	—————
300	30-26-12	33-29-12	36-31-12	39-33-12	—————
350	32-26-12	35-29-12	38-31-12	41-33-12	—————
400	34-27-12	36-29-12	39-31-12	42-33-12	46-43-12♦
500	35-27-12	37-29-12	40-31-12	45-41-12♦	47-43-12
600	38-29-12	41-31-12	45-33-12	50-43-12♦	52-45-12
700	39-29-12	43-31-12	47-33-12	53-43-12	55-45-12
750	40-29-12	46-33-12	53-43-12♦	57-45-12	59-47-12

1. The above W dimensions are for three CT installations. Subtract 8" to obtain the W dimensions for two CT installations.
2. Dimensions followed by a ♦ may be reduced as follows if aluminum wire is used: Reduce L by 2" and reduce W by 7". All other dimensions apply when aluminum or copper wire is used.
3. Refer to Appendix C-1 for general information.
4. Two or three CT versions of this arrangement may be installed horizontally (as shown), or vertically, or opposite hand. Rotate the page around until the diagram fits the preferred arrangement.

## CURRENT TRANSFORMER ENCLOSURE SIZE REQUIREMENTS GREATER THAN 400 A

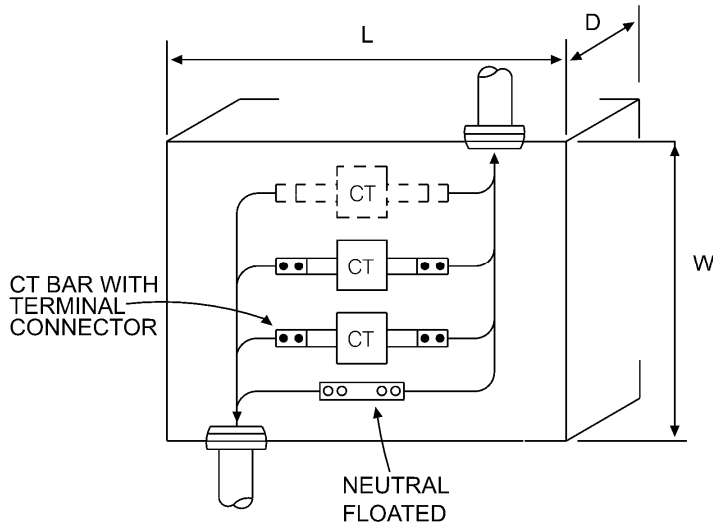


### MINIMUM CT ENCLOSURE SIZE REQUIREMENTS (DIMENSIONS L, W, D)

WIRE SIZE	NUMBER OF WIRES PER TERMINAL CONNECTION				
	1	2	3	4	5
	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)
4/0	23-26-12	27-27-12	31-29-12	—————	—————
250	24-26-12	27-27-12	31-29-12	35-31-12	—————
300	25-26-12	31-29-12	35-31-12	39-33-12	—————
350	25-26-12	31-29-12	35-31-12	39-33-12	—————
400	27-27-12	31-29-12	35-31-12	39-33-12	45-43-12♦
500	27-27-12	31-29-12	35-31-12	41-41-12♦	45-43-12
600	31-29-12	35-31-12	39-33-12	45-43-12♦	49-45-12
700	31-29-12	35-31-12	39-33-12	45-43-12	49-45-12
750	31-29-12	39-33-12	45-43-12♦	49-45-12	53-47-12

1. The above W dimensions are for three CT installations. Subtract 8" to obtain the W dimensions for two CT installations.
2. Dimensions followed by a ♦ may be reduced as follows if aluminum wire is used: Reduce L by 2" and reduce W by 8". All other dimensions apply when aluminum or copper wire is used.
3. Refer to Appendix C-1 for general information.
4. Two or three CT versions of this arrangement may be installed horizontally (as shown), or vertically, or opposite hand. Rotate the page around until the diagram fits the preferred arrangement.

## CURRENT TRANSFORMER ENCLOSURE SIZE REQUIREMENTS GREATER THAN 400 A



### MINIMUM CT ENCLOSURE SIZE REQUIREMENTS (DIMENSIONS L, W, D)

WIRE SIZE	NUMBER OF WIRES PER TERMINAL CONNECTION				
	1	2	3	4	5
	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)	L-W-D (INCHES)
4/0	23-26-12	27-28-12	31-32-12	—————	—————
250	24-26-12	27-28-12	31-32-12	35-36-12	—————
300	25-26-12	31-32-12	35-36-12	39-40-12	—————
350	25-26-12	31-32-12	35-36-12	39-40-12	—————
400	27-28-12	31-32-12	35-36-12	39-40-12	45-51-12♦
500	27-28-12	31-32-12	35-36-12	41-47-12♦	45-51-12
600	31-32-12	35-32-12	39-40-12	45-51-12♦	49-55-12
700	31-32-12	35-36-12	39-40-12	45-51-12	49-55-12
750	31-32-12	39-40-12	45-51-12♦	49-55-12	53-59-12

1. The above W dimensions are for three CT installations. Subtract 8" to obtain the W dimensions for two CT installations.
2. Dimensions followed by a ♦ may be reduced as follows if aluminum wire is used: Reduce L by 2" and reduce W by 8". All other dimensions apply when aluminum or copper wire is used.
3. Refer to Appendix C-1 for general information.
4. Two or three CT versions of this arrangement may be installed horizontally (as shown), or vertically, or opposite hand. Rotate the page around until the diagram fits the preferred arrangement.

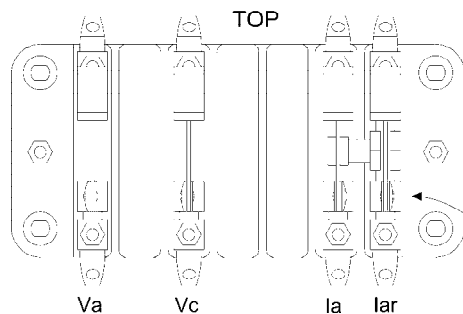
## SPECIFICATIONS FOR METER TEST SWITCHES

Test switches are used with instrument transformer rated meter sockets and are mounted in the lower half of the enclosure. The test switches and meter sockets shall be furnished, installed, owned and maintained by the customer. Specifications for test switches are as follows:

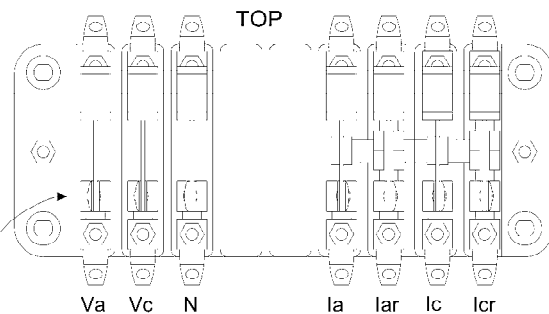
1. Test switches shall be tin corrosion resistant.
2. Test switches shall be blade type using front connections.
3. Test switches shall be mounted vertically with the hinge side on the bottom.
4. Connections for the metering leads shall be stud type connections, with nuts, for stranded copper conductors.
5. The connections shall have serrated "test ears" for test connections.
6. The neutral shall be a switch and not a solid bar.
7. The test switches shall be covered by the lockable cover of the meter socket.
8. The customer or contractor shall install the appropriate test switch inside the meter socket for CT metering.

SERVICE	NUMBER OF POLES
1-PHASE, 2-WIRE	4
1-PHASE, 3-WIRE	6
3-PHASE, 4-WIRE	10

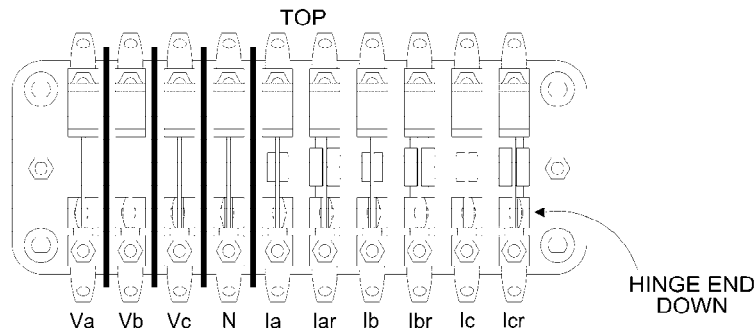
4 - POLE METER TEST SWITCH



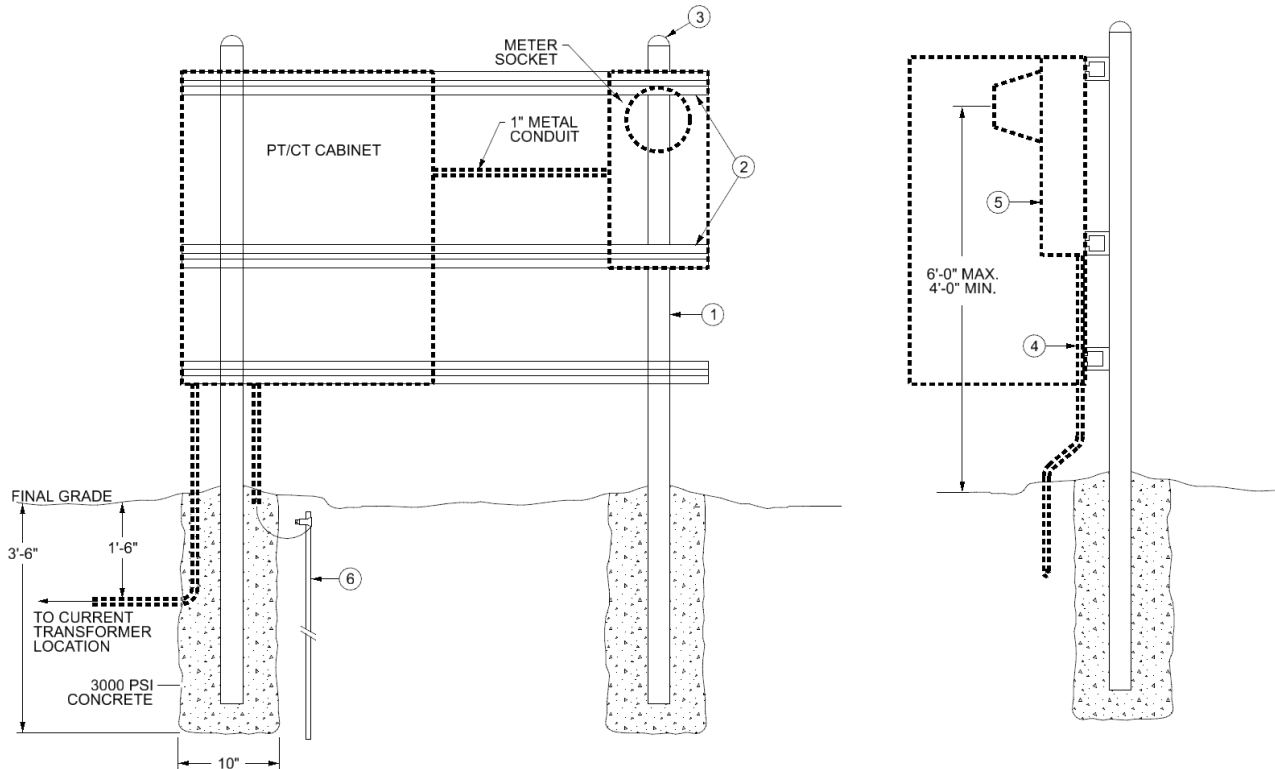
7 - POLE METER TEST SWITCH



10 - POLE METER TEST SWITCH



## METER PEDESTAL INSTALLATION FOR INSTRUMENT TRANSFORMER METERING



### Customer furnishes and installs the following equipment:

1. Pedestal support – 3 inch (minimum size) standard steel pipe or galvanized steel conduit or 2 inch by 1/4 inch (minimum size) channel/angle iron. Unistrut is not allowed for pedestal support.
2. Meter socket/conduit brackets – Weld or bolt uni-strut brackets to pedestal support. Length of brackets and vertical spacing will be determined by meter socket and conduit dimensions.
3. Cap – Pedestal support shall have either a welded or threaded cap or be filled with concrete and rounded on top.
4. Conduit – 1 inch rigid galvanized steel or schedule 80 PVC conduit shall be installed between meter socket and padmount transformer.
5. Meter socket meeting Company specifications with test switches (not shown).
  - Company approved location within **35 circuit feet** of transformer.
  - Finished pedestal to be either primed and painted or galvanized.
6. Driven ground rod to be bonded to the inside of the CT or PT cabinet.
7. Meter pedestal will be installed outside of the containment moat around the transformer with a minimum 3' clearance from the transformer pad.

**Current transformers shall not be mounted in single-phase transformers.**

**Current transformers (not shown) may be mounted on secondary spades of three-phase transformer with prior Company approval.**

**Company furnishes and installs bushing mounted current transformers and metering wires from the instrument transformers to the test switches in the meter socket.**

# SPECIFICATIONS FOR INSTALLATION OF UNDERGROUND RESIDENTIAL AND SMALL COMMERCIAL SERVICES BY CUSTOMERS OR CONTRACTORS

## 1.0 SCOPE

- 1.1 This specification covers requirements for single-phase, 120/240 Volt, three wire underground residential services rated 400 Amps or less and installed by customers or their contractors. The Company will assume responsibility for owning and maintaining these services only if the requirements listed below are satisfied.
- 1.2 These specifications supplement requirements contained in this manual. A copy of this booklet is available from a Company representative.

## 2.0 ENTRANCE LOCATE

- 2.1 Prior to installing a customer's underground residential service, the customer or their contractor must contact the Company to obtain permission to install the service, to reach agreement on the service entrance location, and to verify the service conductor size that will be required. Sources for underground services are determined when the distribution system is designed for a development. Location of the source for the underground service dictates the location of the meter socket and service entrance equipment. Service length determines the required conductor size. Please refer to Section 5.2 of this specification.

## 3.0 TRENCH

- 3.1 Customers and contractors must call the underground locate numbers, as presented on Page 54, at least 48 hours prior to digging so utilities can mark the locations of their facilities. Any damage to Company facilities that have been properly located will be repaired at customer or contractor expense.
- 3.2 Service cable shall have at least 30" to 36" of cover below final grade.
- 3.3 The trench shall extend from the meter socket to a point within five feet of the nearest side lot line. From this point, the trench shall extend parallel to and within five feet of the side lot line to the Company-owned transformer, handhole, or pedestal. The trench shall be dug in straight lines parallel to lot lines. The trench shall not be dug on and shall not cross any lot lines.
- 3.4 Any trench route that does not conform to the requirements of Paragraph 3.3 must be approved by a Company representative prior to installation of the service.
- 3.5 Trenches may be mechanically dug no closer than 18 inches to the base of Company-owned transformers, handholes, or pedestals. A 36" x 36" handhole that is 8" below the bottom of the conduit riser immediately adjacent to the base of the enclosure must be hand dug by the customer/contractor. Any damage to Company facilities will be repaired at customer or contractor expense.
- 3.6 Locations of conduit sweeps for riser installations on poles must be approved by the Company prior to installation. Please refer to Figure 9.
- 3.7 **Trenches must be inspected by a Company representative before being back filled.**

## 4.0 CONDUIT INSTALLATION

- 4.1 If the cable will be installed in contact with any rocks or other exposed obstructions by trenching, the service cable must be installed in a PVC conduit to protect the cable .
- 4.2 Where the service is to be located under a planned non-trenchable surface or future obstacle such as a driveway or sidewalk, the service cable must be installed in a PVC conduit of suitable size that extends past the non-trenchable or obstructed area. Please refer to Figure 8 and Section 6.3.

## SPECIFICATIONS FOR INSTALLATION OF UNDERGROUND RESIDENTIAL AND SMALL COMMERCIAL SERVICES BY CUSTOMERS OR CONTRACTORS

### 5.0 CABLE INSTALLATION

- 5.1 Cable shall be 600 Volt, triplex, rated 90° C, with aluminum conductors and cross-linked polyethylene (XLPE) insulation. The following table provides minimum conductor size by entrance rating. Only those sizes shown in the table will be accepted by the Company.

ENTRANCE SIZE	PHASE CONDUCTORS	NEUTRAL CONDUCTOR
200 A	4/0 AL	2/0 or 4/0
400 A	350 AL	4/0
Greater than 400 A	Contact your Company representative	

- 5.2 If the underground service will be excessively long, service cable larger than specified in Paragraph 5.1 may be required to meet voltage drop or voltage flicker limitations. A Company representative will determine the proper service cable size when the customer calls for an entrance locate and permission to install the service as described in Paragraph 2.1.
- 5.3 The neutral conductor shall be clearly distinguishable from the phase conductors.
- 5.4 Cable ends shall be sealed against excessive moisture ingress with tape or protective caps.
- 5.5 Care must be taken to prevent damaging cable insulation or excessively bending the cable during installation.
- 5.6 Ten feet of cable shall be left outside Company-owned transformers, pedestals, or handholes. Forty feet of cable shall be left at the base of a riser pole. The Company will insert cable into the enclosure or install the riser on the pole.
- 5.7 The customer or contractor shall leave a small amount of slack cable at the bottom end of the service riser pipe to allow for expansion, contraction, and settling. The Company will not be responsible for any damage to customers' equipment due to settling. Please refer to Figure 13 and Figure 14.
- 5.8 The bottom end of the service riser pipe shall be installed at least 18 inches and at most 24 inches below final grade. The customer or contractor must install a bushing or terminal fitting with an integral bushed opening on the bottom end of the service riser pipe. The service riser pipe shall be securely fastened to the wall with two-hole conduit straps. Please refer to Figure 13.

### 6.0 BACKFILL

- 6.1 After the cable has been placed, the trench shall be backfilled using clean soil. Six feet of trench shall be left open immediately adjacent to a Company-owned enclosure. At the meter setting, the bottom end of the riser pipe must be left exposed. Backfill within four inches of cables must be clear of any rocks or debris. If backfill is not clear of rocks or debris, service conductors must be installed in conduit as described in Section 4.1. Red marking tape is to be laid in the cable trench 20 inches below final grade. Marking tape must be left exposed at both ends of the trench.
- 6.2 The customer or contractor is responsible for completing the backfill of the trench after the service is connected.
- 6.3 The Company is not responsible for restoring settled service trenches. The customer or contractor is encouraged to tamp backfill to minimize settling of trenches.



# **SPECIFICATIONS FOR INSTALLATION OF UNDERGROUND RESIDENTIAL SERVICES BY CUSTOMERS OR CONTRACTORS**

## **7.0 SITE REVIEW**

- 7.1 The customer or contractor must call the Company and schedule a site review after the service cable is installed. Both ends of the trench, at the electric meter and at the Company's enclosure, must be left open for the review. Ends of the red marking tape must be exposed at both ends of the trench. The bottom end of the riser pipe must be visible at the meter end of the trench.

## **8.0 CONNECTIONS**

- 8.1 The customer or contractor shall install and connect the service conductors in the customer's meter socket. Oxide inhibitor shall be used on aluminum conductor connections. Conductors shall be looped in the top of the meter socket as shown in Figure 27(D).
- 8.2 Meter socket terminals shall not be energized by any backfeed from the customer's main panel.
- 8.3 The Company will make connections at Company-owned equipment and install the electric meter in the customer's meter socket.

## **9.0 OWNERSHIP OF SERVICE CONDUCTORS**

- 9.1 The customer or contractor shall own and maintain service conductors until such time as the Company approves the installation and connects and energizes the conductors. The Company will not connect or energize any service that does not meet the requirements of this specification. Any changes required to meet these specifications will be performed by the customer or contractor at their expense.
- 9.2 The Company will own and maintain the service conductors after they have been connected and energized.

## **10.0 QUESTIONS**

- 10.1 Questions concerning these specifications should be directed to a Company representative.

## ELECTRIC METERING INFORMATION

**Availability and Characteristics of Service, Section 1.0, pg. 9**

**Diversion of Service or Tampering, Section 2.0, pg. 11**

**Equipment Specifications, Section 6.0, pg. 20**

1. Meter Sockets shall meet Company specifications. See your Company representative for an approved socket list. (Section 6.0, pg.20, Equipment Specifications)
2. Spring, clip type add-on 5th terminals are not allowed.
3. Open meter sockets shall have a plastic protective cover and shall be sealed. (Section 6.0, pg.21, Multiple Meters)
4. If the service size is 400 amps or less, self-contained metering will be used. (New 2005)
5. Before service is connected, each meter socket cover, socket back plate and associated breaker of fuse panel must be plainly marked with a weatherproof placard with minimum 3/4 inch etched lettering labeling the address of service. (Section 6.0, pg. 21, Multiple Meters)

**Meter Location..... See Section 6.0, pg. 21**

**Meter Poles ..... See Section 6.0, pg. 21**

**Meter..... See Section 6.0, pg. 21**

**Overhead Primary Metering ..... See Section 6.4, pg. 27**

**Underground Primary Metering .....See Section 6.5, pgs. 28 & 29**

**Metering Equipment, Section 9.0, pgs. 32, 33 & 34**

1. Bar type current transformers will be used in a current transformer cabinet. See your Company representative for exceptions.

**Grounding Requirements .....See Figure 6, pgs. 46 & 47**

**Metering Sequence ..... See Figure 18, pg. 63**

**Typical Commercial - Industrial Overhead Service.....See Figure 21, pgs. 66 & 67**

**Typical Commercial - Industrial Underground Service.....See Figure 22, pgs. 68 & 69**

**Instrument Transformer Metering.....See Figure 33, pgs. 80 & 81**

**Requirements for Meter Mounting Equipment, Appendix A, pg. 86**

1. Meter sockets shall be of a ringless type and have a one-piece cover.
2. Automatic bypasses are prohibited.

**Instrument Transformer Enclosures, Appendix C-1 and C-2, pgs. 98 & 99**

1. Potential transformers will not be allowed in the secondary compartment of the padmount transformer. They may be installed in the current transformer cabinet if the cabinet is sized appropriately.
2. All instrument transformer cabinets shall have 3/4" plywood backing installed. (Pgs. 82, 83, 99)
3. Instrument transformer cabinets shall be mounted so the top of the cabinet is not more than 6' above the final grade and the bottom is not less than 2' feet above the final grade. (App. C-1, #5)
4. Meter sockets shall not be mounted more than 35 circuit feet from the instrument transformers.
5. Covers on all instrument transformer cabinets shall be hinged with heavy duty, pin type hinges..

**Specifications for Meter Test Switches..... See Appendix D, pg. 104**

**Optional Instrument Transformer Metering Cabinet ..... See Appendix E, pg. 105**

**Meter Pedestal Installation .....See Appendix F, pg. 106**

## ELECTRIC SPACE HEATING DEVICE SPECIFICATIONS

### General

Electric space heating devices shall:

- Meet all applicable local, state, and federal laws in regard to the installation and use of the electric space heating devices
  - Have UL approval or other comparable safety rating
- 

### Device Specifications

Electric space heating devices shall:

- Be specifically designed and engineered for the sole and primary purpose of providing heat to a space or building
  - Not be waste heat recovery systems that actively or passively capture byproduct heat that would otherwise be rejected into the environment
  - Be thermostatically controlled to cycle the heat source off when heating is not required
  - Be regularly used and relied upon for supplying the heating requirements to the customer's premises
  - Be solidly and permanently connected to its electrical source, i.e., not a plug in
  - Be energized in step stages of 7.5 kW or less for heating elements of electric furnaces and heat pumps
- 

### Capacity

The amount of installed heating capacity shall be determined in accordance with current recognized standard practices in the industry. Installed capacity shall not exceed the capacity determined by the standard practices by more than 15 percent.

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