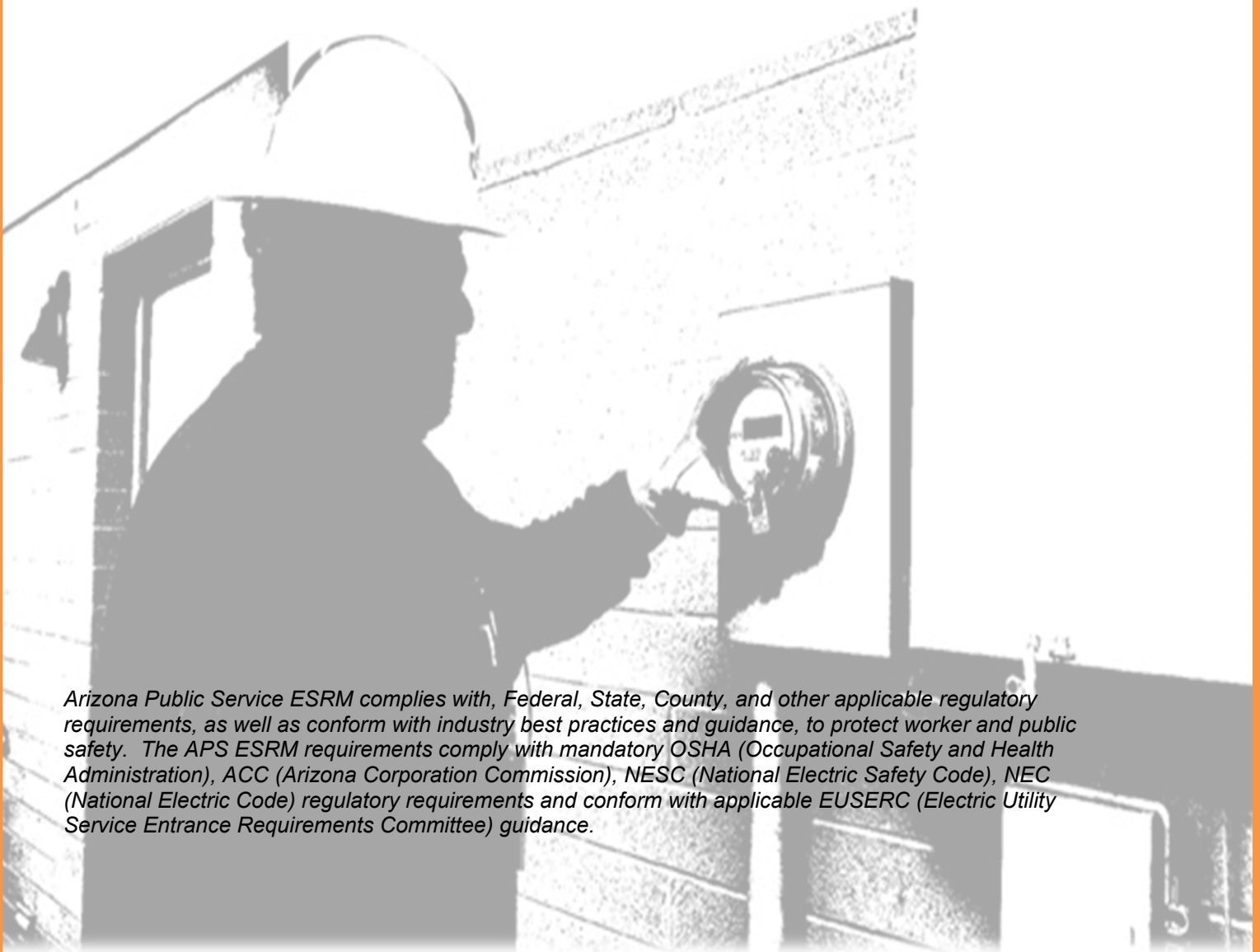




# Electric Service Requirements Manual

## May 2024



*Arizona Public Service ESRM complies with, Federal, State, County, and other applicable regulatory requirements, as well as conform with industry best practices and guidance, to protect worker and public safety. The APS ESRM requirements comply with mandatory OSHA (Occupational Safety and Health Administration), ACC (Arizona Corporation Commission), NESC (National Electric Safety Code), NEC (National Electric Code) regulatory requirements and conform with applicable EUSERC (Electric Utility Service Entrance Requirements Committee) guidance.*

# Introduction

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## **Purpose**

The Arizona Public Service Company “**2024 Electric Service Requirements Manual**” is provided as a reference for customers and contractors doing work in the APS service area. However, since business or industry changes may warrant frequent revisions, please visit the online manual at: [aps.com/esrm](https://aps.com/esrm) for the most up to date version.

## **Applicability**

These specifications and requirements are issued for your guidance and assistance in the installation of safe and adequate wiring and electric service equipment so that the customer may enjoy the full benefit of his/her electric energy.

These “Electric Service Requirements” cancel and supersede all previous APS specifications for Single-Phase and Three-Phase Electric Installations and Amendments.

These service requirements are subject to amendments as required, through developments and progress of the electrical industry, to protect the mutual interests of the customer and APS.

*Arizona Public Service ESRM complies with, Federal, State, County, and other applicable regulatory requirements, as well as conform with industry best practices and guidance, to protect worker and public safety. The APS ESRM requirements comply with mandatory OSHA (Occupational Safety and Health Administration), ACC (Arizona Corporation Commission), NESC (National Electric Safety Code), NEC (National Electric Code) regulatory requirements and conform with applicable EUSERC (Electric Utility Service Entrance Requirements Committee) guidance.*

## **Disclaimer**

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## **Service Entrance Equipment Inspections**

On new installations, or where changes necessitate relocating or replacing the electric meter, an APS Inspection and Approval is required before the service can become energized. This is in addition to the inspection required by the local authority. It is our desire that the APS inspection is accomplished in a timely manner, preventing unnecessary delays to the completion of the project. Neither the inspection of the work or equipment, or the lack of the inspection shall relieve the Customer from the responsibility to comply with APS specifications.

In order for the APS inspection to be accomplished in this manner, it is necessary for the contractor doing the work to initiate contact with the APS Customer Project Manager. This should be done at least twice during the course of the project. The first contact should occur initially as soon as the service entrance equipment is on site. The APS inspector will then make his inspection and recommendations immediately. The second contact should occur immediately after all the changes recommended by the APS inspector have been completed.

It is important that both of these contacts are made early enough in the project to assure that there is ample time left for the contractor to make modifications, if necessary, and to schedule a re-inspection of the equipment. If the inspections are not scheduled early enough there is a good chance the job will be delayed."

## **Customer Construction Contacts**

To schedule an inspection appointment, or if there are any questions regarding Service Requirements, please



call the APS Customer Project Representative for your project area. Refer to [Customer Construction Contacts website](#) for a list of phone numbers.

## **How To Use This Manual**

The APS Electric Service Requirements Manual (ESRM) has been formatted to provide easy access to specific information required to meet APS service requirements for multiple types of electric service installations. It details the design criteria, equipment requirements and construction methods necessary for the safe and efficient connection to APS's energy delivery system.

Please see below for a short description of each section of the ESRM. It is highly recommended to consult the ESRM prior to the design of a new installation or prior to beginning an upgrade to existing facilities. In addition to the ESRM, consulting with an APS Construction Project Representative is invaluable in the correct application of these requirements.

**Section 100 – General Information.** In this section of the ESRM you will find helpful information that details safe working clearances around APS energized lines and equipment, definitions of applicable terms used in the ESRM, and several items that require special considerations. Some of these special considerations include motor starting criteria, signal distortion requirements, the Harmonic Study policy and information on the interconnection of generation facilities.

**Section 200 – Application for Service.** In this section of the ESRM you will find information that details the required information and sequence of events for your project, as well as the available electric service voltages and limitations for each.

**Section 300 – Metering Installation Requirements.** In this section of the ESRM you will find information that details requirements for determining the location and working clearance around service equipment containing APS incoming service lines and electric meters.

**Section 400 – Overhead Services.** In this section of the ESRM you will find information that details how to design and install equipment that will require APS to provide overhead wiring to the customer service equipment.

**Section 500 – Underground Services.** In this section of the ESRM you will find information that details how to design and install equipment that will connect the customer service equipment to APS via an underground conduit and wiring system.

**Section 600 – Trenching.** In this section of the ESRM you will find information that details how to design and install the required trench containing the underground conduit system, including the required separation from other underground facilities.

**Section 700 – Grounding and Bonding.** In this section of the ESRM you will find information that details the ground electrode system requirements for service equipment connecting to APS facilities. In addition, this section also provides important guidance on additional grounding/bonding requirements typically enforced by the local AHJ.

**Section 800 – Short Circuit Protection.** In this section of the ESRM you will find information that details the level of short-circuit protection and physical bracing requirements the service equipment is required to meet in order to connect to the APS energy delivery system.

**Section 900 – Irrigation Pumping.** In this section of the ESRM you will find information that details additional

requirements specifically for electric services providing water pumping or irrigation.

Section 1000 – High Voltage Metering. In this section of the ESRM you will find information that details additional requirements specifically for locations requiring service at voltage levels above 600 volts.

Section 1100 – Manufacturing. In this section of the ESRM you will find information that details the specific metering equipment design criteria for any service equipment connected to the APS energy delivery system.

Section 1200 – Special Applications. In this section of the ESRM you will find information that details how to design and install service equipment that controls traffic signals, intersections, highway lighting and un-metered electric services.

Section 1300 – High Rise Applications. In this section of the ESRM you will find information that details additional requirements on the design and installation of service and metering equipment for multi-floor residential applications having four or more floors above ground level.

Section 1400 – Clearances. In this section of the ESRM you will find information that details the vehicular access requirements for APS electric facilities located on customer property. The required access dimensions are in addition to the electrical clearance standards.

## ESRM Revisions – May 15, 2024

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Section	Revision
300, 301.8-1, -2, -3	Clarified barrier post, working space, and escape route requirements for service equipment configurations. Deleted 301.8-3.
300, 301.15-3	Deleted the text at the end of 301.15-3 that incorrectly duplicates the text in the first paragraph of ESRM 301.16.
300, 304.5-1.0	Clarified working space and escape route requirements for outdoor service entrance section pads. Added cross-reference to 301.8 for barrier post placement requirements. Added cross-reference to ESRM 1000 for medium voltage concrete pad working space requirements.
500, 502.8, Fig. 3	Changed 502.8 heading to Service Conduits Under Foundation and clarified spacing between spacers in typical duct installation is 6 feet.
1100, 1101.1	Delete the drawings 1101.1, "Low-Profile Switchboard".
1100, EUSERC DWG 309	Delete the drawings EUSERC 309, Sheets 1 & 2 "Commercial Fixed Top Service Pedestals 0-200 Amperes, 0-600 Volts".

## ESRM Revisions – November 15, 2023

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Section	Revision
300, 301.2-1	Corrected the Note 4 incomplete sentence to state "IT IS THE CUSTOMER'S RESPONSIBILITY TO INSTALL CONDUIT AND WIRING BETWEEN THE METER LOCATION AND THE POINT OF ATTACHMENT."
300, 306.0	Deleted the SES riser sizes specified in Note 8 because the information is correctly specified in ESRM 501.1-3.
400, 401.9	Added MIN to the 18" dimension ("18" MIN") describing the unbraced minimum height above the roof for the service drop conduit point-of-attachment.
1000, 1000.1.C	Clarified "customers must notify APS Representative prior to implementing any proposed protective device changes at any time throughout the lifetime of the facilities."

## ESRM Revisions – May 15, 2023

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Section	Revision
300, 301.2-1	Clarify metering service location identification requirements.

## ESRM Revisions – November 15, 2022

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<b>Section</b>	<b>Revision</b>
300, 303.6-1	Added additional guidance.
300, 304.5-1	Added to note 5 for SES pad details and note reference added to Detail 2.
300, 304.6	Added note 5.
300, 306.0	Section Header name updated.
300, 306.0	Clarified Note 13.
400, 402.2	Clarified Customer Provided and Customer Owned wood poles.
500, 506.8-1	Added details to note 7.
900, 900.6	Added note 8.
900, 900.7	Added note 6.
1300, 1301.2-1	Clarity on letter height requirements.

## ESRM Revisions – May 15, 2022

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<b>Section</b>	<b>Revision</b>
100, 104.11	Added cross-reference to the APS Interconnection Requirements Manual for distributed Generation requirements at <a href="https://aps.com/dg">aps.com/dg</a> .
300, 302.1	Added cross-reference to the APS Interconnection Requirements Manual for all interconnect label requirements at <a href="https://aps.com/dg">aps.com/dg</a> .
700, 701.0, Notes 2 & 3	Clarified Note 2 is for sizing conductor used for bonding unfused nipples and equipment. Clarified Note 3 is for sizing main bonding jumper, system bonding jumpers, and supply-side bonding jumpers from equipment grounding bus to neutral bus, per NEC. Corrected NEC 250.66 to NEC 250.102(C)(1) in Column 3 heading.

## ESRM Revisions – March 02, 2022

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<b>Section</b>	<b>Revision</b>
300, B	Changed 302.13 section description to "Reserved".
302.13	Removed obsolete text, changed 302.13 to "Reserved"
303.1	Removed item 3. No longer applicable.

# ESRM Revisions – January 27, 2022

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Section	Revision
100, B	Inserted new 102.29 & 102.30 definitions.
100, C	Add 104.9 & 104.10 definitions.
100, 102.7	Add 'Generator' to clarify ESRM 102.7 heading.
100, 102.29	Add 'Switchboard' definition.
100, 102.30	Add 'Switchgear' definition.
100, 104.11-1	Update ANSI Z535.1-1998 to newer ANSI Z535.1-2011 version, & Grammatical errors corrected.
100, 104.11-2	Clarify customer rack-out breakers do not meet visual open requirements, and add placard/warning label requirements.
200, A	Clarify Primary Service (medium voltage range), (601V to 15kV).
200, 201.6	Clarify Primary Service, medium voltage range (601V to 15kV).
300, A	Add Equipment Working Space and Escape Route & Alternate Escape Route.
300, B	Update Service Section to Service Entrance Section.
300, C	Update Outdoor Service Entrance Section titles, add Outdoor Service Entrance Section Pads in Remote Locations with No Access to Water, & Indoor Service Entrance Section Housekeeping Pads.
300, 301.7	Clarify notes for working, clearance, and escape route requirements and updated detail.
300, 301.8, -1 to -3	Clarify barrier post, escape route, and service equipment requirements and added supporting details.
300, 301.15	Update Figures 3 & 4 and add Figures 5 & 6 to clarify the separation Requirements between meters and other utility meters/fuel sources.
300, 302.3-1, 302.9	Wording change switchgear to switchboard.
300, 302.11	Change service section to service entrance section.
300, 302.12	Clarify customer drawing submittal requirements per ESRM 302.9.
300, 304.5, -1 to -3	Clarify escape route, barrier post & equipment pad requirements and add detail and notes for pads where no access to water.
300, 304.6	Add 'Housekeeping Pads' to clarify ESRM 304.6 heading.
800, 800.4	Delete ESRM 800.4.
1000, A	Clarify heading with added text 601V-15V, wording change to 1000.4 from switchboard to switchgear.
1000, 1000.0	Change switchboard to switchgear.
1000, 1000.1	Update voltage for note B to 12.47kV.
1000, 1000.2	Change switchboard to switchgear.
1000, 1000.7	Change switchboard to switchgear.
1000, 1000.9	Change switchboard to switchgear.
1000, 1000.15	Change switchboard to switchgear.
1100, C	Add 407/APS addendum to EUSERC.
1100, 1100.2	Clarify customer drawing submittal requirements per ESRM 302.9.
1100, 407/APS	Clarify 15KV CT designs require 2-bolt, 22-inch between 0 & 1200 Amps.
1300, 1301.2	Clarify high rise APS meters are acceptable at the main SES location.
1400, A	Add sections 1400.3, 1400.3-1, 1400.3-2
1400, 1400.3, -1 & -2	Add new ESRM 1400, 1400-1 & -2 equipment accessibility requirements.

## ESRM Revisions – May 10, 2021

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Section	Revision
<b>200</b> , 201.2	Added 1200A limitation for SESs greater than 600V.
<b>300</b> , 301.8	Clarified SES concrete pad requirements.
300, 301.15	Added note 4 to clarify 48-inch minimum separation to gas stub out.
300, 302.3-1	Added service disconnect allowable ampacity requirements.
300, 302.9	Updated approval requirements for metering in service equipment.
300, 304.5, 304.5-1 & -2	Clarified SES concrete pad requirements.
300, 304.6	Update note 1 for not greater than 2-1/2 inches housekeeping pad.
<b>400</b> , 401.1	Adding missing note 4 regarding 10 ft. rule.
400, 401.7	Clarified OH service conductor 5 ft. radial clearance.
400, 402.3	Updated notes to clarify pole wrap and steel pole requirements.
<b>600</b> , 602.1-1, 2 & 3	Updated trench figures.
<b>1000</b> , 1000.2-1	Added 1200A limitation for SESs greater than 600V
1000, 1000.3	Clarified manufacturer drawings for approval submittal requirements.
<b>1100</b> , 305	Clarified voltage range is 0 to 600V (not 0 to 800V).
1100, 401/APS	Added notes 7 (1200A SES limitation) and 8 (reference to ESRM 1000.4).
<b>1400</b>	New section 1400 for vehicle approach requirements near APS equipment.

## ESRM Revisions – February 20, 2019

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Section	Revision
100, 104.1	Added missing text back into manual regarding underground riser.
<b>100</b> , 102.19-5	Added missing text back into ESRM regarding customer-owned UG conduits.
100, 104.1	Added missing text back into manual regarding underground riser.
100, 104.7.1	Harmonic Study Policy with 08/31/17 revision date.
<b>200</b> , 200.2-2	Added missing text regarding upgrading the service.
200, 201.3	Added missing text regarding maximum single phase motor size is 25 HP.
200, 201.7	Paragraph added on Service Voltage Ranges.
200, 201.8	Paragraphs added on Power Quality Investigation.
<b>300</b> , 301.4	Added clarification to note 3 regarding permanent ID tagging.
300, 301.6	Added Note to bottom of paragraph regarding unacceptable panel locations.
300, 301.7	Added note 2 regarding workspace requirements.
300, 301.9	Added to meter room requirements regarding access to interior of building.
300, 301.9	Clarified requirement for meter closets.
300, 301.11 & 301.11-1	Clarified requirement for meter closets.
300, 301.15-1, 2, & 3	New requirements for electric meter clearance to fuel sources.
300, 302.14	Updated meter types used on APS system.
<b>400</b> , 400.1	Added missing note to bottom of paragraph regarding attachment tensions.
400, 401.1	Deleted unnecessary note 4 and re-numbered.
<b>500</b> , multiple locations	Clarified UG conduit is customer-owned.
500, 501.1	Clarified UG riser sizes are minimum sizes required.
<b>800</b> , entire section	Updated multiple fault current tables.
<b>900</b> , 900.1	Clarified in note 6 that disconnects "simultaneously" open all conductors.
<b>1100</b> , entire section	Added updated EUSERC drawings and updated APS addendums.

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**NOTE:** See front of each Section for detailed listing



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## 100.0 INTRODUCTION

### 100.1 GENERAL STATEMENT

The Arizona Public Service APS has on file with the Arizona Corporation Commission its rates, regulations and extension policies, copies of which are open for inspection by the public at any APS business office.

The following are brief statements of those operating rules and practices which affect the majority of connections made to the APS lines. **Where information not included herein is needed, representatives of the APS will provide assistance.**

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### 100.2 PURPOSE

**The APS Electric Service Requirements Manual (ESRM) presents information and general specifications relative to the introduction and use of electricity supplied from its lines. This manual is intended as a guide in making electrical installations to protect the interest of the Customer and to comply with regulations which experience has shown to be necessary for safe, adequate, and satisfactory service.**

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### 100.3 SCOPE

The information and specifications included herein cover conditions and equipment connecting Arizona Public Service Company's electrical supply system to the Customer's premises. Subjects relative to this service are also presented for the mutual interest of the Customer and his representatives. **It is not a complete set of rules governing the installation of electrical wiring and equipment.**

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### 100.4 SERVICE AND LIMITATIONS

Service will be rendered to the Customer from the nearest suitable line of sufficient capacity to furnish adequate service at the phase and voltage available. Service shall not be used by the Customer for purposes other than that specified in the applicable rate. **ELECTRICAL ENERGY PURCHASED FROM APS SHALL NOT BE RESOLD.**

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### 100.5 CODES

These requirements are supplementary to and are not intended to conflict with the currently applicable National Electric Safety Code, National Electric Code, Municipal, County or State Codes, Ordinances or regulations within the State of Arizona.

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### 100.6 CUSTOMER SERVICES

APS Service Representatives will gladly provide you with useful information on the wise use of energy, electric heating, heat pumps, refrigeration, water heaters, residential and commercial lighting, security lighting, home economy, etc.

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### 100.7 RATE SCHEDULES

Upon request of application, representatives of APS will explain rate schedules and assist in selection of the rate best suited to applicant's requirements. Where more than one rate is applicable, applicant will be responsible for the final selection of the applicable rate schedules desired.

Certain rates such as totalized metering and special rates for medium and high voltage customers require prior approval from the Totalized Metering Committee. Contact your APS representative for more information

## 100.8 REQUESTS FOR INFORMATION

APS representatives will explain requirements and give advice with regard to the installation of electric service.

By calling APS before any installation is started, service plans may be coordinated, preventing costly changes and resulting in more rapid completion of the job.

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## 100.9 INSPECTION APPROVAL AND PERMITS

On new installations, or where changes necessitate relocating or replacing APS meters, or when an installation has been disconnected by APS or the Fire Department because of fire or other damage, **APS shall not energize or restore service until the wiring has been approved and proper notification given to APS by the inspection authorities where such inspection is required.**

In areas where local inspection is not required, the service entrance including grounding and bonding shall be in accordance with APS requirements and the National Electrical Code. The above equipment shall be inspected and approved by an APS representative prior to service being energized.

**APS SHALL NOT BE UNDER ANY OBLIGATION TO INSPECT THE WIRING OR APPLIANCES OF THE CUSTOMER. WHERE APS HAS REASON TO BELIEVE THAT THE WIRING OR APPLIANCES ARE UNSAFE, AND DO NOT COMPLY WITH THE NATIONAL ELECTRICAL CODE, LOCAL OR COUNTY CODES OR ORDINANCES, APS MAY REFUSE OR DISCONTINUE ELECTRIC SERVICE UNLESS REQUIRED CHANGES HAVE BEEN MADE.**

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## 100.10 IDENTIFICATION OF JOB SITE

The customer shall furnish to APS an exact street number corresponding to the job location. In the case of mobile home or recreation vehicle subdivisions, the space or lot number must also be furnished. This street/space number shall also be posted in a conspicuous location at the job site to assist APS personnel in performing their work as scheduled to meet the service date for the customer. The customer shall also install a permanent address number/space when the job is completed. To avoid delays in setting a meter and energizing a service, the address must agree with the address on the electrical permit and subsequent final clearance.

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## 100.11 DESIGN OF CUSTOMER'S EQUIPMENT

The provision for adequate electrical capacity must be made by the customer. As a public utility, APS cannot design, plan, install or maintain the customer's wiring, electrical equipment or other customer owned facilities. Compliance with the National Electrical Code or local municipal or county codes assures only that the installation will conform to recognized minimum safe practices. An electrical engineer and/or a qualified electrical contractor should aid the customer in determining that his electrical installation will have adequate capacity for future use.

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## 100.12 BEFORE YOU DIG

To comply with state law and OSHA, you must check with Blue Stake and other utilities who are not Blue Stake participants, but who may have underground facilities in your excavation area. You can save time, money and avoid hazards, prevent interruption of utility service and eliminate construction delays by getting underground utilities staked out in your excavation area prior to any digging.

APS is a participant in the Blue Stake Center. Call 602-263-1100 in Maricopa County or your local APS office in other areas, at least two (2) working days before you dig.

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**100.13 ATTACHMENTS ON APS POLES**

APS forbids all unauthorized attachments, including posters, fences and signs, to its poles, equipment or property. APS will remove all such unauthorized attachments or installations without notice and may prosecute any such trespass.

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**100.14 IDENTIFICATION OF EMPLOYEES**

APS employees authorized to visit a Customer's premises are furnished with an identification which they will show upon request. This is done to protect the Customer from unauthorized persons representing APS.

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**100.15 PROTECTION OF APS EQUIPMENT**

It is understood that any of the APS equipment located on the Customer's premises shall be adequately protected against damage. The Customer is responsible for any damage or loss resulting from improper protection or loss resulting from improper protection or neglect.

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**100.16 DE-ENERGIZING THE SERVICE ENTRANCE**

No person other than authorized employees of APS may break seals, move, relocate or replace meters and other equipment owned by APS. If de-energizing is needed, contact your local APS office to make arrangements. In other than an emergency situation, three (3) days advance notice is required to de-energize a service. There may be a charge to accomplish the above.

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**100.17 ENERGY THEFT**

Under no circumstances shall devices or attachments be connected to APS facilities in such manner as to permit the use of unmetered energy, except in emergencies when authorized and done only by authorized APS employees. Under Arizona law, tampering with the property of a utility and theft of electricity having a value of more than \$100 are felonies punishable by a fine of up to \$150,000 and/or imprisonment.

**100.18 WORKING SAFE NEAR APS FACILITIES**

When a party plans to do construction or repair work where personnel or equipment will be used under or near APS electric transmission or distribution facilities, that party must obtain from APS a “Special Work Permit” designating the limits of the safe working area. APS facilities or equipment will not be disconnected or re-energized without the issuance of a Special Work Permit and clearance for third parties; nor if the net result of the construction causes APS to be in violation of any code.

**TABLE A: MINIMUM APPROACH DISTANCE BETWEEN POWER LINES AND CRANES AND DERRICKS**

POWER LINE VOLTAGE	MINIMUM APPROACH DISTANCE FOR CRANE OR DERRICK, LOAD, AND LOAD LINE
Up to 50,000 volts	10 feet
Over 50,000 volts up to 200,000 volts	15 feet
Over 200,000 volts up to 350,000 volts	20 feet
Over 350,000 volts up to 500,000	25 feet

\*Cranes & Derricks must maintain 20 foot clearance up to 350kV, and 50 feet above 350kV. If this clearance cannot be maintained, contact the APS Public Safety Department for assistance @ 602-250-3418

**TABLE B: MINIMUM APPROACH DISTANCE BETWEEN ENERGIZED LINE/EQUIPMENT AND PEOPLE, MATERIALS, AND NON-CRANE EQUIPMENT**

ENERGIZED LINE VOLTAGE	MINIMUM APPROACH DISTANCE
Up to 50,000 volts	10 feet
Over 50,000 volts up to 69,000 volts	11 feet
Over 69,000 volts up to 115,000 volts	13 feet
Over 115,000 volts up to 161,000 volts	14 feet
Over 161,000 volts up to 230,000 volts	16 feet
Over 230,000 volts up to 345,000 volts	20 feet
Over 345,000 volts up to 500,000 volts	25 feet



100.18 WORKING SAFE NEAR APS FACILITIES (Cont'd)

APS PROCEDURE FOR DISCONNECTING AND RE-ENERGIZING POWER LINES

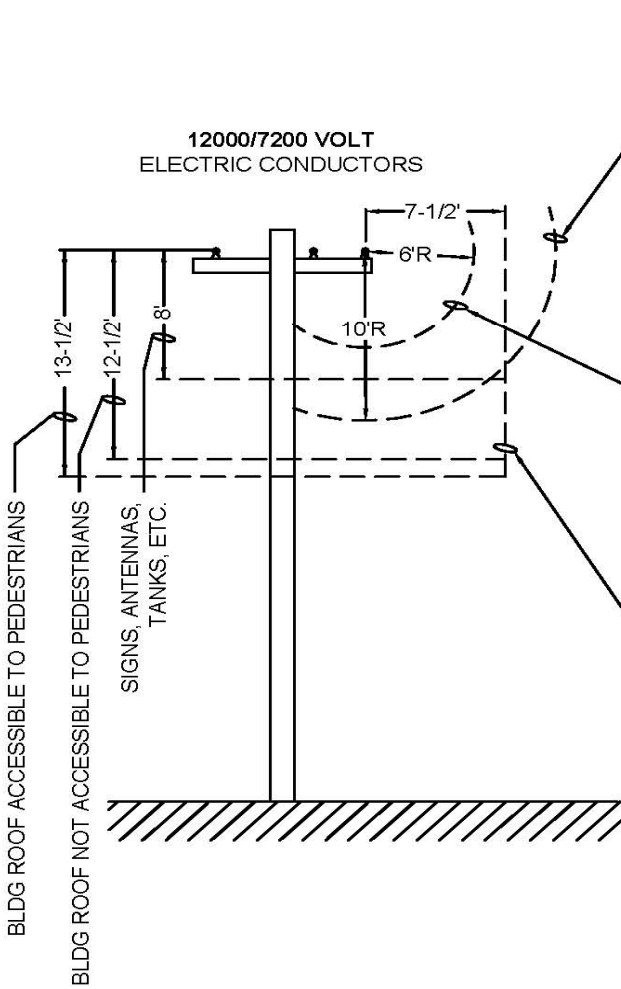
**YOU, as the Requesting Party:**

- 1 Contact APS before beginning work near APS facilities (lines, transformers, etc.) for de-energizing such facilities.
- 2 Arrange to have your authorized representative meet an APS representative at the job site.
- 3 Sign a Request for Special Work Permit at the job site.
- 4 After completion of work, for re-energizing those facilities, request a Release of Special Work Permit from APS.
- 5 Arrange to have your authorized representative meet an APS representative at the job site.
- 6 Sign a Release of Special Work Permit at the job site.

**APS Representative:**

- 1 Receive the call requesting a Special Work Permit to de-energize APS facilities.
- 2 Assign a number to the request and arrange for a date and time for an on-site meeting with an authorized representative of requesting parties.
- 3 Prepare a Special Work Permit Form #357-00B. Also, obtain signature of requesting party, sign for APS, and distribute copies as listed.
- 4 De-energize the requested facilities, making sure the requesting party is aware of safe working area.
- 5 Receive the call from the requesting party after completion of the work, to re-energize APS facilities.
- 6 Arrange for an on-the-job site meeting with the requesting party's authorized representative.
- 7 Re-energize APS facilities that were de-energized under the Special Work Permit.
- 8 Prepare the Release of Special Work Permit Form #357-00C, obtain signature of the requesting party, sign for APS, and distribute copies as listed.

If you have a question, please contact your Local APS office, or call Phoenix @ 602-250-3418, APS Public Safety Services



**OCCUPATIONAL SAFETY HEALTH ADMINISTRATION WORKING CLEARANCE REQUIREMENT FOR MACHINERY AND PEOPLE, AND ARIZONA STATUTE WORKING CLEARANCE REQUIREMENT FOR MACHINERY**

NO MACHINE OR ANYTHING ATTACHED TO THE MACHINE, INCLUDING THE LOAD AND "TAG LINE", MAY BE BROUGHT WITHIN THIS RADIUS UNLESS LINE IS DE-ENERGIZED. A PERSON MAY NOT GET ANY PORTION OF HIS BODY OR ANYTHING HE'S HANDLING WITHIN THIS RADIUS. LINES RATED OVER 50KV REQUIRE ADDITIONAL CLEARANCE.

**ARIZONA STATUTE WORKING CLEARANCE REQUIREMENT FOR A PERSON:**

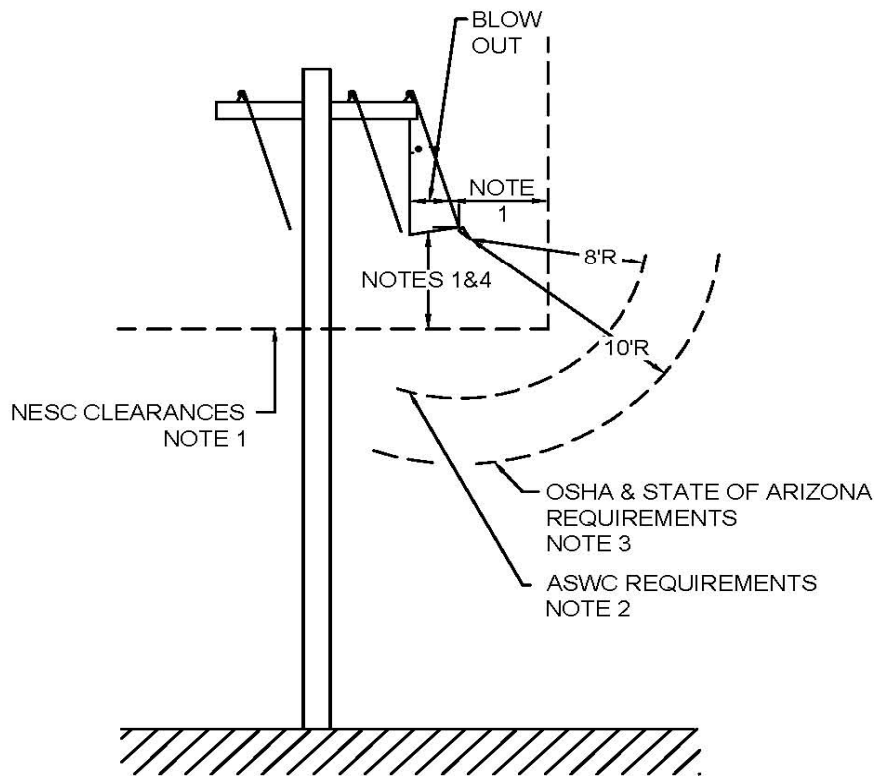
A PERSON MAY NOT GET ANY PORTION OF BODY, TOOLS OR MATERIAL HE'S HANDLING WITHIN THIS RADIUS UNLESS LINE IS DE-ENERGIZED. LINES RATED OVER 50 KV REQUIRE ADDITIONAL CLEARANCE. (THIS CLEARANCE IS ONLY APPLIED WHERE THE PERSON WORKING ISN'T SUBJECT TO OSHA REGULATIONS.)

**NATIONAL ELECTRIC SAFETY CODE MINIMUM CLEARANCE REQUIREMENT.**

NO PORTION OF A BUILDING, SIGN, OR OTHER OBJECT MAY BE WITHIN THIS BOUNDARY. CLEARANCES SHOWN ARE ILLUSTRATIVE ONLY AND VARY WITH VOLTAGE LEVELS, WIND AND OTHER CONDITIONS. SEE SECTION 234 FO THE 1993 NESC AND APS T&D CONSTRUCTION STANDARDS, PAGE 1144 FOR SPECIFIC CLEARANCE REQUIREMENTS.

NOTE: THIS DRAWING IS ONLY INTEDNDDED TO SHOW THE RELATIONSHIP OF THE NATIONAL ELECTRIC SAFETY CODE, OSHA, AND ARIZONA STATUTE WORKING CLEARANCE REQUIREMENTS. REFER TO THE PROPER CODE OR REGULATION FOR A SPECIFIC INSTALLATION.

**RELATIONSHIP OF NESC, OSHA AND ARIZONA STATUTE CLEARANCE REQUIRMENTS AT THE SPAN**



**CONSTRUCTION NOTES:**

1. NO PORTION OF A BUILDING MAY BE WITHIN THIS BOUNDARY. SEE APS T&D STANDARD 1144 FOR DETAILS.
2. FOR NON-APS PERSONNEL, ARIZONA STATUTE WORKING CLEARANCE (ASWC) REQUIRES THAT A PERSON MAY NOT GET ANY PORTION OF BODY, HANDS, TOOLS OR MATERIALS HE IS HANDLING WITHIN THIS RADIUS (LINES RATED 50KV AND BELOW), UNLESS POWERLINE IS FIRST DE-ENERGIZED. FOR LINES RATED OVER 50KV, CLEARANCE SHALL BE 72 INCHES PLUS 0.4 INCH FOR EACH KV OVER 50KV.
3. THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA AND ASWC) REQUIRES THAT NON-APS MACHINERY MAY NOT OPERATE WITHIN THIS RADIUS (LINES RATES 50KV AND BELOW), UNLESS POWERLINE IS FIRST DE-ENERGIZED. "MACHINERY" INCLUDES THE LOAD, CABLES, TAG LINES AND ANY OTHER ATTACHMENTS. OSHA REQUIRES THAT A PERSON MAY NOT GET ANY PORTION OF HIS BODY OR ANYTHING HE'S HANDLING WITHIN THIS RADIUS. FOR LINES RATED OVER 50KV, CLEARANCE SHALL BE 10 FEET PLUS 0.4 INCH FOR EACH KV OVER 50KV.
4. BUILDINGS ARE NOT PERMITTED UNDER APS FACILITIES.

**RELATIONSHIP OF NESC, OSHA AND ARIZONA STATUTE CLEARANCE REQUIREMENTS AT THE SPAN**

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## 101.0 ABBREVIATIONS

AHJ	—	Authority Having Jurisdiction
ANSI	—	American National Standards Institute
APS	—	Arizona Public Service
EUSERC	—	Electric Utility Service Equipment Requirements Committee
IAEI	—	International Association of Electrical Inspectors
IEEE	—	Institute of Electrical & Electronic Engineers
NEC	—	National Electrical Code (NFPA No. 70)
NECA	—	National Electrical Contractors Association
NEMA	—	National Electrical Manufacturers Association
NESC	—	National Electrical Safety Code
NFPA	—	National Fire Protection Association
OSHA	—	Occupational Safety and Health Act
U.L.	—	Underwriters Laboratories, Inc.

Note: When reference is made to any of the above codes, standards or regulations, it shall refer to the latest revision of same.

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## 102.0 DEFINITIONS - FOR THE PURPOSE OF THIS MANUAL

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### 102.1 AGENT

One who is authorized to act for another under a contract or relation of agency, either for Arizona Public Service Company, APS, or the Customer.

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### 102.2 APPLICANT

The property owner, lessee, sub-lessee, their authorized agents and/or contractors applying for electric service from APS.

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### 102.3 APPROVED

Acceptable to the Authority Having Jurisdiction (AHJ) over the matter.

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### 102.4 BASEMENT

As defined for the purposes of this manual is the floor(s) located below ground level.

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### 102.5 BUILDING

A structure which stands alone or which is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

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### 102.6 CLEARANCE

Approval of the electrical installation by the inspection authority.

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### 102.7 DISTRIBUTED GENERATION/GENERATOR

Any type of electrical generator or generating facility not owned or operated by APS that  
(a) has the capability of being operated in electrical parallel with APS distribution system, or  
(b) can feed a customer load that can also be fed by APS electrical system.

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### 102.8 APS

Arizona Public Service Company

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**102.9 CONTRACTOR**

Any person, company, or corporation acting under contractual agreements for either the Customer or APS.

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**102.10 CURRENT TRANSFORMER METERING - DEFINED**

When Customer loads are 201 amperes and above, current transformers are connected directly to the service entrance conductors to ratio the primary current down to a secondary current which can be accurately registered on the meter. (Example: A 400 to 5 amp. C. T. has a ratio of 80 to 1. The reading on the KW and KWHR scales is then multiplied by the ratio value of 80, indicated as X 80 on the face of the meter, to give the actual load in KWs or KWHs.

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**102.11 CUSTOMER**

The property owner, lessee, sub-lessee, their authorized agents and/or contractors receiving electric service from APS.

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**102.12 FIRST FLOOR**

As defined for the purposes of this manual is the floor that is closest to the elevation of ground level and above ground level.

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**102.13 HIGH RISE BUILDING**

A building with four floors or more above ground level.

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**102.14 METER**

The equipment required including mounting facilities, instrument transformers, protective devices and me-ters to measure the electric demand and/or consumption requirements of the Customer.

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**102.15 METER ROOM**

Meter rooms are defined as illuminated and ventilated rooms containing electric meters and electric service equipment. See Section 300 for regulations and restrictions of meter rooms.

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**102.16 MULTIPLE METER CENTER**

A multiple metering unit where two or more customers are metered at a common location.

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**102.17 NOMINAL VOLTAGE**

Designation of the value of the normal effective difference in potential between any two appropriate conductors of the circuit.

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**102.18 POINT OF ATTACHMENT**

The location at which restraining or anchoring contact is made on a building or structure to support APS wires.

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**102.19 POINT OF DELIVERY**

APS ownership of equipment ends at point when APS facilities are connected to customer facilities.

**102.19-1** For UG primary metering APS ownership ends at the last cable termination point.

**102.19-2** For OH primary metering APS ownership ends at the last pole the primary metering is installed.

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- 102.19-3** For radial UG secondary service the APS ownership ends at the wire termination on the meter section.
- 102.19-4** For radial OH secondary service the APS ownership ends at the conductor connection at the top of the weather head.
- 102.19-5** Customer owns and maintains the underground conduit riser.
- 

**102.20 READILY ACCESSIBLE**

Capable of being reached quickly and conveniently during all reasonable hours of operation, maintenance, inspection, testing or reading, without requiring climbing over or removing obstacles, obtaining special per-mission, keys or security clearances. Indoor meter locations require access from the exterior of the building.

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**102.21 RECOGNIZED TESTING LABORATORY**

An electrical component testing laboratory nationally recognized: Example: UL, ETL, etc.

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**102.22 SELF-CONTAINED METERS**

A self-contained meter is one which is capable of carrying the total current and voltage of the electric service supplied to the customer. This type of meter is connected directly to the service entrance conductors when it is plugged into the meter sockets.

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**102.23 SELF-CONTAINED METER SOCKETS**

Sockets for use with self-contained meters are available in two approved ratings. When connected to properly sized service entrance conductors, the approved standard-duty socket has a nominal capacity of 100 amperes, and the approved heavy-duty socket has a nominal capacity of 200 amperes. (See Section 300).

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**102.24 SERVICE ENTRANCE**

Customer's service equipment together with APS metering equipment.

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**102.25 SERVICE ENTRANCE SECTION**

A factory built floor standing service entrance.

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**102.26 SERVICE DROP**

The overhead service conductors between APS secondary distribution system and the point of attachment to the building or other structure.

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**102.27 SERVICE ENTRANCE CONDUCTORS OVERHEAD SYSTEM**

The conductors between the terminals of the service equipment and the point of connection with the service drop (Installed by Customer).

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**102.28 SERVICE ENTRANCE CONDUCTORS - UNDERGROUND SYSTEM**

The conductors between the terminals of the service equipment and the point of connection to the service lateral or transformer (Installed by APS).

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**102.29 SWITCHBOARD**

A service entrance rated for applications 600V and less.

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**102.30 SWITCHGEAR**

A service entrance rated for applications greater than 600V.

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**102.31 TEMPORARY SERVICE**

A temporary service is intended to be used for 12 months or less only for non-recurring service of a transitory character. APS shall determine whether the Customer's proposed installation is of a temporary nature.

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**102.32 THIRD PARTY**

Persons or Companies other than APS or its employee.

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**102.33 VENTILATED**

Provided with a means to permit circulation of air sufficient to remove an excess of heat. (N.E.C. Article 100).

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**102.34 TOTALIZED METERING**

Totalized Metering is the measurement of kw and kwh through one meter for billing purposes when multiple service entrance sections exist at a single premise.

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**103.0 ELECTRICAL TERMS**

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**103.1 WATTS**

Lamps and heating appliances are rated in watts to indicate the power which they will use. A 100 watt lamp in 10 hours will use 1000 watt-hours or 1 kilowatt hour (kwh) of energy. Likewise a 1000 watt flat iron in 2 hours will use 2000 watt-hours or 2 kilowatt hours (kwh) of energy.

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**103.2 KILOWATT (kw)**

1000 watts.

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**103.3 KILOWATT-HOUR (kwh)**

A quantity of electrical energy - equal to 1000 watts used continuously for one hour, or 100 watts used continuously for ten hours, or equivalent.

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**103.4 HORSEPOWER (hp)**

Motors are rated in horsepower, which is the mechanical output. Basically, 1 horsepower output requires approximately 1000 watts considering motor efficiency.

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**103.5 VOLTAGE (E)**

Potential measured in volts.

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**103.6 CURRENT (I)**

The rate of flow of electricity measured in amperes.

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**103.7 AMPACITY**

Current-carrying capacity expressed in amperes.

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## 104.0 SPECIAL CONSIDERATIONS

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### 104.1 RESPONSIBILITY: USE OF SERVICE OR APPARATUS

APS and the customer assume all responsibility on their respective sides of the point of delivery for the electric service supplied and taken, as well as for any apparatus used in connection therewith. Customer shall maintain SES equipment, inclusive of underground riser (UG), breakers, and switches.

Customer and APS each shall save the other harmless from and against all claims for injury or damage to persons or property occasioned by or in any way resulting from the electric service or the use thereof on their respective sides of the point of delivery. APS shall, however, have the right to suspend or terminate service in the event APS should learn of service use by Customer under hazardous conditions.

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### 104.2 LINE DISTURBANCES

The operation of large flashing signs, welders, and furnaces, dielectric and induction heaters, reciprocating compressors and similar apparatus having intermittent flow of large currents sometimes interferes with other users of the electric service. The Customer shall consult APS in each case in order that the character of electric service that will be supplied, the corrective equipment needed, and other special precautions that must be taken, will be mutually known factors before planning to use such apparatus.

Radio and television transmitters, x-rays and similar equipment may be affected by normal disturbances on APS lines. The Customer should consult APS regarding proper type of service for this equipment.

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### 104.3 MOTOR STARTING

The starting currents drawn from the source of supply by each rated size of alternating current motor (such values of currents to be determined by test or based on published data by the manufacturer) shall not exceed the allowable locked rotor current value for alternating current motors as given in the latest edition of the National Electric Code. Correction shall be allowed to adjust these current values so that they compensate for the difference between the terminal voltage and the rated voltage when applicable.

If the starting current of a motor exceeds the value given in the NEC, or creates undesirable service conditions, the Customer shall install, at his expense, a suitable reduced voltage or increment starting device to limit such starting current to the required values listed.

The values defined in the National Electrical Code apply only to motor types and nominal system voltages not exceeding those values quoted in these specifications. For types exceeding these quoted values and other information, consult with APS.

In some areas 208 and 240 volt motors larger than 25 HP and 480 volts motors larger than 75 HP shall be equipped with reduced voltage or increment starting devices to limit the starting currents. CHECK WITH APS.

The above-quoted specification may be modified to allow the use of across-the-line starting devices for larger motors by specific APS approval. Starters must conform to latest National Electric Manufacturer's Association Standards and installation must be in accordance with the National Electrical Code. Magnetic contactors in full voltage motor starters must have a coil capable of sealing in the contactor at 75% rated voltage.

Customers installing motors 7.5HP or larger to a single phase system (i.e. 120/240V, 1Ø, 3W) shall check with APS prior to installation. This is in all cases whether the motor is being supplied single phase voltage or three phase voltage through a single phase to three phase conversion device. APS may need to perform a Motor Flicker Study and Fuse Coordination Study to determine the impact on the APS System. Customer will be asked to provide motor nameplate information (voltage, max output, motor code, FLA and power factor) and conversion device information if one is used. NOTE: a Motor Flicker Study and Fuse Coordination Study may be required by APS for three phase motors 25HP or larger connecting to any three phase system (i.e. 120/208, 3Ø, 4W).

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#### 104.4 SERVICE INTERRUPTIONS

Arizona Public Service Company cannot guarantee uninterrupted service, and it is not APS policy to pay for damages that result from such interruptions, single phase conditions, or voltage fluctuations on our system occasioned by any cause beyond the reasonable care and control of APS.

The APS distribution and transmission system is designed to minimize potential problems but, as pointed out above, malfunctions and other external forces do cause occasional system failures. In these instances, may we suggest that compliance with the National Electrical Code, sound electrical engineer and prudent use of properly sized, installed and maintained protective devices will protect your equipment.

For detailed information on how to protect your electrical equipment, contact an electrical contractor, equipment manufacturer, pump company, an electrical engineer, or your local APS office.

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#### 104.5 POLYPHASE MOTOR PROTECTION

The following protective devices are required and/or strongly recommended by APS and shall be installed and maintained by the Customer:

1. Three element running overload protection shall be required on all motors; i.e., one overload element in each phase in the starter or equivalent protection devices. (per NEC).
2. All motor controllers shall be arranged so that in event of sustained loss in voltage, the motor will be dis-connected from the line, unless it is equipped for automatic starting after such failure. Where continuous operation of motorized equipment is essential, motor controllers shall provide for motors to operate through a transient no voltage condition lasting for 1/2 second. Consult with APS where problems of this nature may be encountered.

**The recommended devices listed below are strongly suggested to markedly reduce the possibility of damage to your polyphase equipment.**

3. Low voltage protection is recommended on all polyphase motors.
4. Phase reversal protection is recommended in all polyphase motors for elevators, cranes and well-pump motors.
5. Phase failure protection is recommended on all polyphase motor circuits.

**PLEASE NOTE: Some manufacturers supply a different device for each type of protection, while other may offer a single device that provides complete protection.**

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#### 104.6 COMPUTER PROTECTION

Electronic computers are sensitive to momentary voltage fluctuations oftentimes referred to as "blips" or "spikes." These may be created within the Customer's service through motor starts or other electric load turn-ons. This may also occur external to the Customer's service as a result of routine APS switching or fault clearance.

APS cannot assure a Customer that the electric service will be free of momentary voltage fluctuations. If this is a Customer concern, it is recommended that the Customer provide an interface between the electric service to the computer and the computer to screen out unwanted voltage fluctuations.

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#### 104.7 SIGNAL DISTORTION

In general, the operation of any electrical device or system should not cause excessive distortion of the utility voltage waveform or result in excessive injection of harmonic currents into the utility system to the detriment of APS, its customers, or other electric utilities. APS requires that all installations comply with IEEE 519 guidelines. APS reserves the rights to test the equipment to ensure compliance to these guidelines. Even though equipment may be found to be in compliance with these guidelines, if it can be shown that said equipment is the source of problems for other customers, for APS, or for other utilities within the interconnected power system, APS reserves the right to require remedial action be taken by the owner.

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## 104.7-1 HARMONIC STUDY POLICY

In the event Customer installs or causes to be installed Variable Frequency Drives (VFD), APS will require Customer to provide a harmonic study for any system with 750 HP aggregate or greater of motors. Any aggregate system less than 750 HP and greater than 100 HP, which utilizes less than 18 pulse rectifiers, will also be required to perform a harmonic study. The purpose of the harmonic study is to ensure the VFD created harmonic currents are not amplified by resonance conditions caused by capacitors switching or system load conditions.

The Customer shall, in accordance with Section 5.6 of Service Schedule 1, exercise reasonable care to ensure that the electrical characteristics of its load, such as deviation from sine wave form (a minimum standard is IEEE 519) or unusual short interval fluctuations in demand, shall not impair service to other Customers or interfere with operation of telephone, television, or other communication facilities. In the event APS determines the source of the problem to be Customer related (i.e. electrical equipment) it is the Customer's responsibility to remedy the issue satisfactory to APS. In addition, Customer must also meet a minimum IEEE 519, Section 104.7.1 of the APS ESRM and Section 8.4(C) of the APS Interconnection Requirements.

APS will provide the following information to the Customer once the Customer provides a detailed one-line of their system:

1. Short Circuit duty and Thevenin impedance of each possible system configuration which could supply the Customer's VFD. This will include the feeder impedance from the Customer's location to the 69/12 kV substation bus or transformer.
2. Substation transformer winding configuration, its impedance and any parallel transformers with their specifications.
3. Parallel feeder information, any other non-linear loads associated with the feeders from the substation and any other significant VFDs or non-linear loads for parallel feeders.
4. Impedance of each feeder section, between each significant node.
5. Capacitor location(s), size(s) and connection(s).
6. Regulator bank location(s), size(s) and connection(s).
7. Secondary service transformer(s), kVA rating(s), voltage(s) and impedance(s).
8. Service conductor type, estimated length and impedance.

Customer shall provide a completed harmonic study to APS with the following information:

1. System conditions (assumptions) along with loading at start up including full load and at steady state.
2. Any expected load growth and unbalance assumptions.
3. THD levels in accordance with IEEE 519 for all assumptions (best and worst case at all load conditions).
4. Various combinations of shunt capacitors on line and various load levels of the associated feeders.
5. All resonances in the system up to 49th harmonic.

APS will determine if the study meets APS requirements and will either accept the study or require additional analyses. APS will inform the Customer in writing the status of the Customer provided harmonic study after APS review. APS may also request clarifying information from the Customer regarding the approach, scope, and/or assumptions regarding the Customer provided harmonic studies. Lastly, the customer may be required to reconfigure its system should APS make changes to the configuration of its System.

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**104.8 AIR CONDITIONING - REMOTE (SPLIT) SYSTEMS**

Blower motors *larger than 1/3 HP* in the furnace of the air handler shall not be connected to 120 volts. If the blower cannot be connected for 240 volt operation, either the compressor or blower shall be time delayed to prevent them from starting simultaneously.

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**104.9 CONTROL CIRCUITS**

On three phase four wire Delta circuits, no control devices or single phase loads shall be connected to the power (wild) leg.

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**104.10 SPECIAL CASE TESTING**

On installations where there is no county or municipal inspection authority, APS reserves the right to require that the customer's service entrance equipment be tested for insulation breakdown prior to it being energized. This test is to assure that the service entrance equipment is free of all shorts or grounds.

Service equipment rated at 400 amperes or more shall withstand for a period of one minute without break-down, the application of a 60-hertz alternating potential of 1000 volts plus twice the rated phase-to-phase voltage of the device. This test shall be performed between all phases to ground and phase to phase.

A certified "hi-pot test" may be performed and a certificate issued to APS or a hi-pot test performed in the presence of qualified APS personnel.

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**104.11 CUSTOMER GENERATION**

Customer generation, for the purpose of this section, is defined as any type of distributed generator or generating facility not owned or operated by APS, which has the potential (a) for feeding a customer load, where this load can also be fed by, or connected to, the APS power system, or (b) for electrically paralleling, or feeding power back into the APS power system.

The term "Customer", as used in this section, shall be construed to also include any independent party or entity that either invests in, or owns or operates a distributed generator or generating facility.

Customer generators include induction and synchronous electrical generators and any type of electrical inverter capable of producing A/C power. An Emergency or Standby Generation System is designed so as never to electrically interconnect or operate in electrical parallel with APS system. An Interconnected Generation System is defined as any generator or generation system that can parallel, or has the potential to be paralleled via design or normal operator control, either momentarily or on a continuous basis, with the APS system.

Refer to the APS Interconnection Requirements for Distributed Generation for detailed requirements and system sizing limits. Go to [aps.com/dg](http://aps.com/dg) and click on Interconnection for the latest copy of this manual, along with several guides, tools, and sample diagrams.

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### 104.11-1 EMERGENCY OR STANDBY GENERATORS

Emergency or Standby generators used to supply part or all of the Customer's load during an emergency power outage shall be connected to the Customer's wiring through a double throw, break-before-make transfer switch specifically designed and installed for that purpose and listed to UL1008. The transfer switch shall be of a fail-safe mechanical throw over design which will under no circumstances allow the generator to electrically interconnect or parallel with the APS system. The transfer switch shall always disconnect the Customer's critical load from the APS power system prior to connecting it to the generator. Conversely, the transfer switch shall also disconnect the load from the generator prior to reconnecting it back to the APS System. These requirements shall apply to both actual emergency operation as well as to testing the generator. All transfer switches and transfer schemes must be inspected and approved by the jurisdictional electrical agency. Customers installing a manual or automatic transfer switch will be required to provide the following information to APS:

- (a) Documentation from the manufacturer indicating that the transfer switch is open transition (break-before make), listed to UL 1008 (Standard for Transfer Switch Equipment), and the AIC rating of the transfer switch.
- (b) One-line diagram of the system.

NOTE: Customer to ensure that the transfer switch and associated equipment is installed and labeled in accordance with the NEC and all applicable requirements of the local Authority Having Jurisdiction.

Portable generators are not designed nor intended to be connected to a building's permanent wiring system, and shall not be connected to any such wiring unless a permanent and approved transfer switch is used. Failure to use a transfer switch can result in backfeed into the APS system - the generator voltage can backfeed through the APS transformer and be stepped up to a very high voltage. This can pose a potentially fatal shock hazard to anyone working on the power lines.

#### **Placards/Warning Labels:**

Emergency or Standby Generators that operate in an open transition mode by means of an automatic transfer switch as described herein are required to include a warning sign with the following information located at the SES:

**WARNING**

1. AN EMERGENCY/STANDBY GENERATOR IS LOCATED ON THE PROPERTY
2. REMOVING THE BILLING METER WILL INITIATE GENERATOR START UP
3. AUTOMATIC TRANSFER SWITCH (ATS) SHALL PREVENT GENERATOR FROM BACKFEEDING THE ELECTRIC SERVICE.

All labels shall consist of a permanently attached weatherproof/UV resistant placard, letters shall be engraved or embossed/raised, and letters will be a minimum of 1/4 inch tall. Labels shall be securely attached to the applicable equipment as long as the attachment means does not violate the UL Listing of the equipment. Labels shall be made of (a) aluminum, brass or other approved corrosive resistant metal, or (b) a high density polyethylene material 55 mils thick comprised of a 35 mil black polyethylene base film capped (co-extruded) with a 20 mil color polyethylene. Labels should follow the ANSI Z535.1 -2011 color codes when applicable.

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### 104.11-2 INTERCONNECTED GENERATORS

Interconnected generators encompass any type of Customer generator or generating facility that can electrically parallel with, or potentially backfeed into the APS system. Additionally, any generator system using a "closed transition" type transfer switch, multi breaker transfer scheme, or an electrical inverter that can be configured or programmed to operate in a "utility interactive mode" constitute a potential backfeed source to the APS system, and are classified as an interconnected generator.

APS has specific Interconnection Requirements that shall to be complied with for all interconnected generators. These include a visible open disconnect switch meeting certain requirements to isolate the Customer's system from the APS system, as well as protective relaying, metering, special rate schedules, and other safety and information requirements. Customer rack-out breakers do not meet the visible open requirements for alternate power source. The Customer will also be responsible for having the generation system protective schemes tested by a qualified testing/calibration company. Qualified APS personnel will need to inspect the system and the Customer will need to sign an Interconnection Agreement with APS. Each proposal for an interconnected generator will be reviewed by APS on a case by case basis. APS does not extend "blanket approval" to any specific type of generator or generator scheme since each project review is site specific.

A line (supply) side tap constitutes a new service as defined by the National Electric Code (NEC), and is subject to all applicable NEC requirements and/or requirements adopted by the Authority Having Jurisdiction. Any line side tap shall be made without any modifications to any factory installed and/or factory listed equipment or components, unless such tap is expressly authorized by the manufacturer and/or listing agency, and performed in strict accordance with the manufacturer's directions and specifications.

Anyone contemplating installing an interconnected generator should contact their local APS office for further details. A copy of the APS Interconnection Requirements for Distributed Generation and supplementary information can be accessed by visiting [www.aps.com/dg](http://www.aps.com/dg).

**PLACARDS / WARNING LABELS:**

Interconnected Generators are required to include a warning sign with the following information located at the SES:

**WARNING**

1. AN INTERCONNECTED GENERATOR IS LOCATED ON THE PROPERTY
2. REMOVING THE BILLING METER WILL INITIATE GENERATOR START UP
3. FOLLOW PROPER LOCK-OUT / TAG-OUT PROCEDURES TO ENSURE GENERATOR SYSTEM UTILITY DISCONNECT SWITCH IS OPEN PRIOR TO PERFORMING WORK ON THIS DEVICE.

All labels shall consist of a permanently attached weatherproof/UV resistant placard, letters shall be engraved or embossed/raised, and letters will be a minimum of 1/4 inch tall. Labels shall be securely attached to the applicable equipment as long as the attachment means does not violate the UL Listing of the equipment. Labels shall be made of (a) aluminum, brass or other approved corrosive resistant metal, or (b) a light density polyethylene material 55 mils thick comprised of a 35 mil black polyethylene base film capped (co-extruded) with a 20 mil color polyethylene. Labels should follow the ANSI Z535.1 - 2011 color codes when applicable.

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**104.12 PROTECTION AND ISOLATION REQUIREMENTS FOR MULTIPLE UTILITY SERVICES TO A CUSTOMER FACILITY**

In instances when APS serves a customer facility from two or more separate electrical sources (services), it is necessary to ensure that:

- (a) The APS sources are not under any circumstances paralleled or in any way electrically connected together by the customer through the customer's equipment. Paralleling of APS sources by the customer can lead to the following conditions: fault current exceeding the fault duty rating of affected equipment; circulating currents in both the APS feeders and the customer's equipment due to voltage difference and/or phase imbalance between the sources; and reduced reliability of APS service in that a fault on one feeder will affect the other(s).
- (b) Suitable isolation devices are incorporated into each of the customer's service entrance sections for the purpose of ensuring that each APS service, including the metering compartment, can be isolated from all other APS sources feeding the facility that can present a potential back-feed source to APS personnel.



## 104.12-1 INTERLOCKS

To ensure that two or more APS sources are never paralleled or electrically connected together by the customer within the customer's facility, customer shall install suitable interlocks between the associated switches or breakers in all customer facility circuit arrangements that constitute, or could constitute, a transfer scheme between the utility power sources (e.g. "Main-Tie-Main" or "Main-Tie-Tie-Main"). The interlock scheme(s) shall prevent the simultaneous closing of all of the breakers in any such switch or breaker arrangement, and ensure that any load transfer between the utility power sources is always accomplished in an open-transition ("break-before-make") transfer mode.

In the event that manually-operated switches are used to effect a transfer between APS sources, and it is not physically possible to key - or otherwise interlock these switches, then the customer may, subject to prior APS approval, utilize written operating procedures along with suitable operational controls to effect a transfer of load between the sources. The customer will be responsible for establishing, maintaining and using written operating procedure(s) that govern the operation of all affected switches. The procedure(s) shall ensure that these switches will always be operated in such a manner to ensure an "open-transition" transfer between the utility power sources. In addition, such switches will remain locked by means of secure padlocks under the customer's operational control. Suitable placards will be installed at each affected switch, identifying the switch and cautioning that it is only to be operated in strict accordance with established written operating procedure(s).

Note that the requirements specified in this section do not apply to a network service or other paralleling arrangement that is under APS' operating jurisdiction and that has been specifically designed and installed to allow for paralleling of APS sources.

---

## 104.12-2 ISOLATION DEVICES

To protect APS personnel from potential electrical backfeed when it is necessary to electrically isolate APS-owned equipment on any given service to a customer facility that is supplied by two or more utility sources, the customer shall install and maintain a suitable isolation device(s) on each of the service entrance section main buses. The isolation device shall meet all the requirements specified in Section 8.2 ("Disconnect Switch") of the APS document entitled "Interconnection Requirements for Distributed Generation" including grounding requirements and the establishment of an "Operating Agreement" for systems with a line voltage over 500 V. A copy of this document can be accessed by visiting [www.aps.com/dg](http://www.aps.com/dg).

A customer facility receiving utility service under 500 V, and utilizing only a double-throw transfer switch to effect the transfer of load between the utility sources and between any separately sourced circuits within the customer facility, is exempt from the requirements of this section, provided that the transfer switch: (a) is of a true double-throw, break-before-make, fail-safe mechanical throw-over design, which will not under any circumstances allow the utility sources to be paralleled; (b) is listed to UL1008; and (c) is not comprised of a multi-breaker scheme, irrespective of any interlocking scheme used between the breakers.

Note that for any APS service to a customer facility at a voltage above 500V, irrespective of the number of services to the facility, or the type of transfer scheme(s) used, the customer is required to provide a suitable isolation device in accordance with drawing numbers 401/APS-1 and 401/APS-2 specified in Section 1100 of this manual.

---

## 105.0 SPECIAL WORK REQUEST FOR THIRD PARTY

1. When a third party must perform work near overhead lines or equipment and the work cannot be performed outside of the minimum clearance distance (see appendix C page 257 from the APM book); one of the following must be done:
  - a. De-energize line or equipment, establish a clearance, issue clearance form, & ground the line (when no system neutral is present the line shall be removed), and the Third Party Authorized Representative signs the proper form.
  - b. Permanently relocate the existing line, or
  - c. Temporarily re-route existing line to provide necessary minimum clearance distance.
2. If a third party will be performing work near energized line (but not within the minimum clearance distance), it may be appropriate to install insulating barriers as additional precautionary methods taken and have the Third Party Authorized Representative sign.
3. If method 1 (a) or 1 (c) is used, this condition shall remain in effect until a Third party Authorized Representative notifies the company the work is completed and sign proper release form.





**APPLICATION FOR SERVICE**  
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## 200.0 REQUESTS FOR SERVICE

Customers contemplating new meter installations or relocations shall contact the APS business office in that city or area for an approved service and meter location prior to proceeding with any electrical installation. By following this procedure, the Customer will eliminate inconvenience and delays in obtaining service by having to make unnecessary service entrance relocations or pay the expense incurred by APS for additional facilities to serve unauthorized meter locations.

---

### 200.1 REQUIRED INFORMATION

Each prospective customer desiring new service and/or a change in existing service must make application for the same with APS. Consult Page "B" and "C" (in front of book) for the address and telephone number of the APS office in your area. The customer must provide the following information.

1. Applicant's name.
2. Property owner's name.
3. Official street address and the complete legal description of the property to be served.
4. Type of structure or facilities to be served. Square footage of building.
5. Site plans and building plans showing desired meter location.
6. The estimated loads - voltage and phase desired.
7. Type of cooling/heat.
8. Credit information.

**It is suggested that the necessary information be submitted to APS as early in the development process as possible to assure meeting the customer's completion schedule.**

---

### 200.2 NORMAL SEQUENCE OF EVENTS

#### 200.2-1 NEW SERVICE

1. Customer provides sufficient notice of intent to build. Large projects tend to require longer lead times.
2. Customer provides preliminary information during planning stage.

3. Customer provides engineering design drawings to APS.

These drawings must include:

- a. Electrical load calculations.
- b. Electrical plan showing the meter panel location.
- c. Electrical service entrance section drawings (see section 300) with official street address on copies.
- d. Water, sewer, telephone, cable television and any other sub-grade obstruction.
- e. Curb, gutter and paving plans.
- f. Landscaping (including retention basins) and sprinkler plans.

4. APS to engineer the electrical system up to the customer's meter panel.
5. Customer obtains all necessary permits from the appropriate inspection authority.
6. Customer to provide acceptable easements.
7. Customer may need to pay a cash advance to aid APS construction. This may or may not be refundable.
8. Customer to sign the necessary agreements.
9. APS to review service entrance section drawings for approval.
10. APS to specify the trench and equipment locations.
11. Customer to provide property corners and grade stakes (Blue Tops).
12. APS to stake the trench and equipment locations.
13. Customer to provide the trench per APS design.
14. APS to inspect the trench. Approve if per APS design.
15. Customer to provide conduit and equipment pads as required.
16. APS to inspect conduit and equipment pads. Approve if per APS specs.
17. APS to schedule crew(s) for construction of its facilities.
18. Customer to provide credit or security information.
19. Customer to schedule for meter panel inspection. (Contact the assigned Customer Project Representative).
20. APS to inspect meter panel. Approve if per APS specifications.
21. Customer to obtain City or County electrical clearance (if applicable).
22. When APS receives a City or County clearance, APS will set a meter and energize the service. (If applicable).

**Adequate time must be provided in the customer's schedule to accomplish allocation of materials, scheduling APS crews and complete construction of APS facilities.**

**Only authorized APS employees shall energize a service.**

---

#### 200.2-2 UPGRADE SERVICE

Prior to service being changed or relocated to supply new or existing load, contact APS. All service entrances being upgraded (increased main breaker ampacity), or relocated must be brought up to current code and specification requirements. See paragraph 200.2-1, "New Service" for information and requirements.

---

**200.2-3 TEMPORARY SERVICE**

APS will provide temporary service to a customer providing the customer pays the installation and removal costs less the salvage value of such facilities in advance of installation. In addition to temporary load information, the customer should provide APS with a complete statement regarding the requirements for permanent service. (See Paragraph 200.2-1, New Service).

Customers requesting construction power may be delayed as a result of the APS construction backlog of customers that applied for permanent power. Normally these jobs consist of move-in or live-in customers.

When temporary service is provided on a customer's pole, the pole shall conform to the requirements set forth in Paragraph 402.0 in Section 400.

**The service entrance requirements for temporary service are the same as for permanent installations.**

---

**200.3 REMOVAL OF SERVICE/FACILITIES**

Requests for the removal of facilities may be made to the local APS office (see Pages B and C in front of book for addresses and telephone numbers). Due to normal schedule times for APS construction crews, a minimum of two weeks' notice should be given to APS prior to the date the facilities are to be removed.

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**201.0 CHARACTER OF SERVICE & LIMITATIONS.**

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**201.1 SINGLE PHASE**

120 volt, 2 wire (for two circuits and/or motors of 1/2 hp or less)

7200 volt, 2 wire (special applications)

12,500 volt, 2 wire (special applications)

120/240 volt, 3 wire (normally for residential including refrigeration compressors of 7 1/2 hp or less. Also for non-residential and industrial, but limited to 800 amp service entrance.)\*

120/208 volt, 3 wire (in some areas)

240/480 volt, 3 wire (Unmetered ADOT highway/lighting services only)

\* If a customer has load requirements over 800 amps at 120/240 volt and three phase service is not readily available, customer may install 2 or more service entrance sections. Each section will be limited to 800 amps and must be located within 10 feet of each other. APS will install at no cost to the customer the necessary totalized metering: however the customer will be required to provide all metering conduits and instrument cabinets in accordance with APS specifications. (See Section 300, Metering Installation Requirements and Schedule 4).

Due to weight of conductor on the overhead transformer spades, maximum length of overhead conductor limited to 40' on 800 amp service entrance sections.

Refer to section 104.3 for additional details regarding the installation motors 7.5 hp or larger to a single phase system (i.e. 120/240V, 1p, 3W).

**201.2 THREE PHASE**

VOLTAGE CLASS	MAXIMUM SES SIZE		
	OH XFMR/ OH SERVICE	OH XFMR/ UG SERVICE	PADMOUNT UG XFMR/ UG SERVICE
	120/208V, 4W	600A	800A
277/480V,4W	600A	600A	3000A
120/240V,4W (See Note 2, 120/240V, 3W)	600A	800A	800A
2,400V/4,160V, 4W	Primary Meter Application SES 1000		
(7,200/12,470V, 4W) Primary Service	Primary Meter Application SES 1000		
Spot Network Service (277/480V, 4W)	See Section 500, (See Division Engineering for Requirements)		

**Notes:**

1. Any Customer having over the 3,000 amp at 277/480 volt 3 phase requirement must install 2 or more service entrance sections. Each section will be limited to 3,000 amps and must be within 10 feet of each other. APS will install at no cost to the customer, the necessary totalized combined metering. The Customer will provide the metering conduits and the instrument cabinet per APS specifications (See Section 300, Metering Installation Requirements).
2. When a non-residential, industrial, water pumping or irrigation customer requests 3 phase 3 wire 240 volt or 480 volt service, APS will furnish a 3 phase 4 wire 120/240 volt or 277/480 volt grounded neutral service to the service entrance. The Customer shall provide a bus or bar in the section for grounding and bonding as per NEC Articles and provisions for 3 element metering. (This 4 wire service will eliminate confusion in providing a safe installation by permitting the use of over current devices in all phase wires of APS feeder and branch circuits.)
3. For specifications regarding service entrance equipment, see Section 1100, Manufacturing Requirements.
4. Overhead service application for 600A SES size shall use a maximum of parallel 4/0AL conductors. Due to weight of conductor, maximum conductor length limited to 40'.
5. Any Customer requesting service requiring greater than 1,200 amps at primary voltage (greater than 600V) 3 phase must install 2 or more service entrance sections.

**201.3 GUIDELINES for SERVICE VOLTAGES for NON-RESIDENTIAL INSTALLATIONS**

Non-residential customers with single phase loads up to 100 KVA demand can be most economically served with 120/240 volt single phase 3 wire. Any distribution line unbalanced conditions can be corrected by proper engineering and field application. In open delta transformer connection the maximum three phase load should not exceed 50KVA on this type of installation. Also, the largest single-phase motor size is limited to 25 hp.

**201.4 MASTER METERING**

Residential apartment complexes, condominiums and other multiple residential buildings shall not have a master metering installation unless building(s) have centralized air conditioning, ventilation and/or heating systems and meet ACC rules and regulations. Master metering will not be installed on existing or new permanent residential mobile home parks.

**201.5 ONE METER PER HOME**

All new homes must be wired for one meter. Existing homes adding load requiring an upgrade of facilities must be wired to be served through one meter..

**201.6 PRIMARY SERVICE (601V - 15kV)**

See Section 1000 for Medium Voltage (601V - 15kV) Metering and Service Equipment Specification.



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**201.7 SERVICE VOLTAGE RANGES**

APS shall maintain voltage at the Point of Delivery (POD) in accordance with ANSI standard C84.1 as noted in A.A.C. R14-2-208F. Customer shall ensure its load does not cause the RMS voltage at the POD to vary outside ANSI standard C84.1 during normal loading/steady state conditions (i.e. after equipment / motor / process startup and/or shut down period). APS may require the Customer to remedy any voltage excursion caused by its load at the POD, any point along the APS System and/or a neighboring customer's POD outside of this ANSI range.

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**201.8 POWER QUALITY INVESTIGATION**

APS is available to assist Customers with evaluating/investigating Power Quality issues (including harmonics, flicker, imbalance, voltage sags/swells and/or faulty equipment/event analysis). APS will evaluate if the source of the Power Quality issue originates from the APS System, and will remedy as deemed appropriate. If Customer requires additional assistance, APS can aid with on-site investigation by performing an inspection of impacted electrical equipment. Customer is advised to proactively install utility-grade event recording metering that measures voltage, current, kVAR, kW, kVA, power factor and imbalance set at pre-determined intervals. Customer installed equipment must be located outside of utility sealed compartment. Customer can provide data in advance to APS to expedite the Power Quality investigation.

If Customer requests APS' assistance to identify/resolve/troubleshoot a Power Quality issue on the Customer side of the point of common coupling, Customer shall provide the following:

- A Qualified Electrical Worker to assist APS representatives.
- Electrical one-line diagrams of Customer's electrical system.
- Event recording/history of issues (data downloads from metering are preferred).
- Make/Model numbers of impacted equipment needing support.
- Copy of Customer safety program along with required PPE prior to initial site visit.

If available, APS may loan Customer a Recording Volt Meter (RVM) in order to capture the event/issue. APS will provide instructions on how to install the RVM; however, Customer must provide the resources/means to install. APS will loan the RVM for a reasonable time period (i.e. up to 2 weeks), and may allow for longer duration depending on availability and/or need. In the event an Immediate Hazard exists on-site, APS may (1) require the escort of an APS Qualified Worker to assist, or (2) refuse to enter the property/area until the area in question is established as a safe work environment free from potential electrical and other safety concerns (i.e. Electrically Safe Condition, tripping, slipping, etc.). If Customer suspects a Power Quality concern, they shall contact the APS call center at 602-371-7171 to initiate a Power Quality investigation.

METERING INSTALLATION REQUIREMENTS

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## 300.0 METERING AND SERVICE ENTRANCE EQUIPMENT

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### 300.1 GENERAL

All meter and service equipment installations shall comply with the service requirements of APS and with rules and regulations of the inspection authorities having jurisdiction. All meter sockets and enclosures shall be listed and approved by a recognized testing lab.

If any question arises for which you cannot find the answer in the following pages, it is suggested that you call APS for further information. See Pages "B" and "C" in the front of this manual for telephone numbers and addresses of local APS offices.

Whenever any electrical wiring for service connection is installed whether regulated by inspection authorities or not, provision shall be made for the installation of metering equipment. It shall comply with these service requirements except when existing metering equipment, in the opinion of APS, is satisfactory and adequate to register all current to be supplied.

Whenever one meter registers the electricity supplied to two or more single family residential occupancies, it will be considered a non-residential installation for the purpose of these requirements.

**When a Customer does his own wiring, he will be considered the electrical contractor for the purpose of these requirements.**

---

### 300.2 METERED AND UNMETERED CONDUCTORS

**Line side (unmetered) and load side (metered) conductors shall not occupy the same raceway or enclosure. Exception:** Meter socket and current transformer enclosures.

---

### 300.3 SEALING OF METERS AND METERING EQUIPMENT

**All meters, meter facilities and all points of access to unmetered wiring on the Customer's premise shall be sealed by APS. All cabinets, conduit fittings and equipment enclosures containing unmetered conductors shall be made sealable by the Customer before service will be energized. The breaking of seals and tampering with meters or unmetered wiring by unauthorized persons is prohibited and subject to penalty of the law. (See Section 100, Paragraph 100.17).**

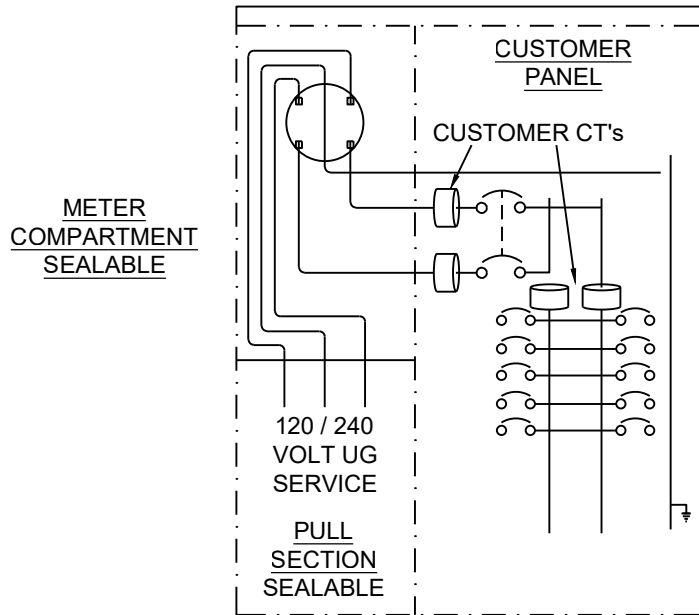
Stud and wing-nut assembly, or sealing screws shall be used for sealing all removable panels and covers to compartments used for routing or terminating unmetered conductors.

When a stud and wing-nut assembly is used for sealing, the stud shall be 1/4" x 20 (minimum). The stud and wing nut shall each be drilled .0635" (minimum) for sealing purposes.

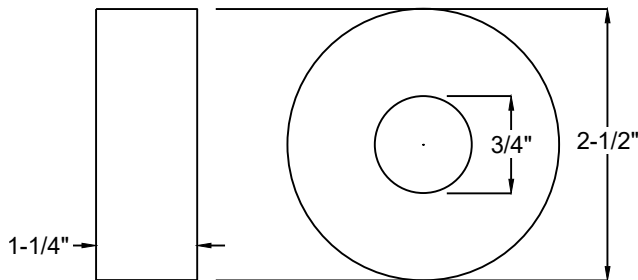
All sealing screws shall be drilled .0635" (minimum) for sealing purposes.

**300.4 UNACCEPTABLE EQUIPMENT IN SEALED AREA**

APS AND INDUSTRY POLICY SPELLS OUT THAT NO "CUSTOMER" RELATED EQUIPMENT BE ALLOWED IN THE SEALABLE (METERING) AREA OF ANY SERVICE ENTRANCE GEAR. ALL SUCH EQUIPMENT SHALL BE INSTALLED IN THE NON-SEALED PORTION OF THE SERVICE ENTRANCE EQUIPMENT. EXAMPLE: LOAD CONTROL CURRENT TRANSFORMERS MUST BE IN THE NON-SEALED AREA OF THE SERVICE ENTRANCE GEAR.



ACCEPTABLE CUSTOMER EQUIPMENT LOCATION



\* CURRENT TRANSFORMER DIMENSIONS  
 \* THESE ARE GENERAL DIMENSIONS OF CURRENT TRANSFORMERS AVAILABLE WITH EXISTING DEMAND CONTROLLERS. THERE MAY BE NEW UNITS IN THE FUTURE THAT WILL NOT CONFORM TO THESE DIMENSIONS.

TYPICAL 100 - 200 AMP  
 ALL IN ONE METER CAN - RESIDENTIAL

## 301.0 METER LOCATION REQUIREMENTS

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### 301.1 METER AND SERVICE LOCATIONS

**APS reserves the right to determine all meter and service locations.** Only authorized APS personnel shall determine these locations. See Section 100, Paragraph 102.20 and Section 200, Paragraph 200.0.

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### 301.2 PLANNING AND GROUPING FOR ADDITIONAL METERS

Occasionally there is a need to locate and install additional service and metering equipment after the originally planned electric service for a building is installed and energized.

The additional meters must be grouped with those already in services, and be installed in accordance with the established meter location plan for the building.

The added service equipment must be located and installed in conformance with applicable codes, laws, and ordinances of the inspection authority having jurisdiction, and with the requirements of this Service Requirements Manual.

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### 301.3 METER LOCATIONS - RESIDENTIAL

For single family residential buildings, meters and metering equipment shall be installed:

- a. Outdoors and mounted on or recessed in an exterior building wall, but not under a carport, breezeway, patio, porch, or in any area that can be enclosed, or
- b. Outdoors in a meter pedestal or service entrance section, but not under a carport, breezeway, patio, porch, or in any area that can be enclosed, or
- c. In a room within the building, approved by APS, for the location of electric meters, and with access only by a door opening to the outside of the building. See Paragraph 301.9 for meter room requirements.

In addition, the meter area must be readily accessible (See Section 100, Paragraph 102.20) without requiring passage through restricted private areas, gates or fences. See next page for acceptable meter locations for single family residences. **The meter and main switch shall be installed next to each other on the same wall.** See Paragraph 301.13.

**NOTE:** See Section 500, Paragraph 506.6-1 for requirements for mobile home pedestals.

---

### 301.3-1 METER LOCATIONS - FACTORY-BUILT BUILDINGS/HOMES

Factory-built buildings and homes (FBBs) shall meet the following requirements before meters and metering equipment can be mounted on the building:

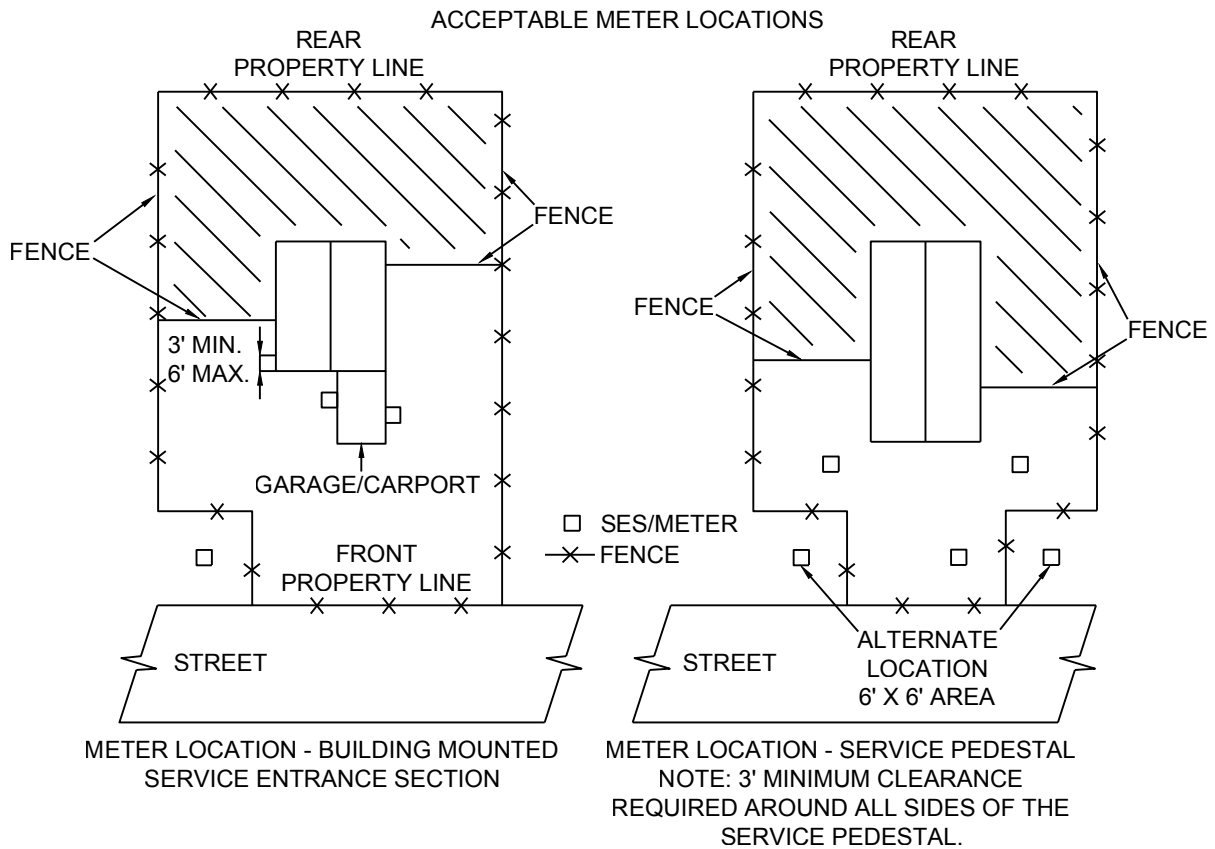
1. FBBs shall be secured on a permanent foundation (Type E) per HUD Permanent Foundations Guide for Manufactured Housing - December 1996 and requirements of the authority having jurisdiction.
2. The trailer tongue, axles and wheels shall be removed.
3. The meter panel shall meet all APS requirements.
4. Service entrance equipment attached to FBB's shall be completely installed by the manufacturer of the structure.
5. Meter location shall be per Paragraphs 301.3 or 301.5.
6. For overhead applications refer to Section 400.
7. For underground applications refer to Section 500.

**NOTE:** If the above requirements #1 - #3 are not met, a meter pedestal shall be required.

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**APS RESERVES THE RIGHT TO DETERMINE ALL METER AND SERVICE LOCATIONS.**

1. THE METER AND MAIN SWITCH SHALL BE ACCESSIBLE FOR READING AND MAINTENANCE WITHOUT PASSING THROUGH RESTRICTED AREAS, GATES, OR FENCES.
2. ALL METER AND MAIN SWITCHES SHALL BE LOCATED THREE FEET MINIMUM TO SIX FEET MAXIMUM ON THE FRONT CORNER OF A RESIDENCE, NEAREST TO THE POINT OF AVAILABLE SERVICE, AS DETERMINED BY APS ON AN EXTERIOR WALL OR ALTERNATE LOCATION (SUBJECT TO LOCAL INSPECTION AUTHORITY), BUT NOT UNDER A CARPORT, BREEZEWAY, PATIO, PORCH, OR OTHER AREA THAT CAN BE ENCLOSED WITH BUILDING EXPANSION OR FENCE.
3. THE ELECTRIC METER AND MAIN SWITCH "MAY BE" INSTALLED AT AN ALTERNATE LOCATION NOT ATTACHED TO A DWELLING TO ENSURE ACCESSIBILITY. (SUBJECT TO LOCAL INSPECTION AUTHORITY APPROVAL)
4. IF OVERHEAD SERVICE IS AVAILABLE IN THE REAR OF THE PROPERTY (ALLEY OR EASEMENT) THE POINT OF ATTACHMENT MAY BE ON THE REAR OF THE RESIDENCE. THE METER & MAIN DISCONNECT SHALL BE LOCATED PER ITEMS #1 & #2 ABOVE. IT IS THE CUSTOMER'S RESPONSIBILITY TO INSTALL CONDUIT AND WIRING BETWEEN THE METER LOCATION AND THE POINT OF ATTACHMENT. THE CONDUIT SHALL BE LOCATED ON THE EXTERIOR OF BUILDING IN ITS ENTIRETY.
5. WHEN REMODELING EXISTING RESIDENCES, CHECK WITH LOCAL APS OFFICE.
6. SERVICE ENTRANCE EQUIPMENT SHALL BE UTILIZED FOR ITS INTENDED PURPOSE.



### 301.4 METER LOCATIONS - RESIDENTIAL MULTI-FAMILY BUILDINGS

1. Meters and metering equipment shall be installed:
  - a. Outdoors and mounted on or recessed in an exterior building wall, or
  - b. In a room within the building, approved by APS for the location of electric meters, and with **access only** by a door opening to the outside of the building. See Paragraph 301.9 for meter room requirements.
2. Meters and metering equipment shall not be installed within any residential occupancy.
3. Before meters can be installed in multiple residential panels, each individual meter socket must be permanently and clearly identified. See Meter Identification, Paragraph 302.1. Permanently affixed identification tags are also required on all apartment/condo doors and buildings.

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### 301.5 METER LOCATIONS - COMMERCIAL AND INDUSTRIAL

1. Location of metering to be approved by the Electric Meter Shop prior to construction.
2. For single occupancy non-residential and industrial buildings, meters and metering equipment shall be installed:
  - a. Outdoors and mounted on an exterior wall with vehicle access, or
  - b. Within a meter room inside the building on the first floor (see Definitions, Section 100, Paragraph 102.12) and with access only by a door opening to the outside of the building with vehicle access. See Paragraph 301.9 for meter room requirements.
3. For multiple occupancy buildings meters and metering equipment shall be located per above Number 2a or 2b, and shall be grouped in one readily accessible central location, accessible to all occupants. Meter sockets must be permanently and clearly identified. See Meter Identification, Paragraph 302.1.
4. In large multiple occupancy buildings, extensive shopping centers or buildings, APS may, at its option, establish more than one meter location for groups of individual meter facilities. Consult APS prior to construction for approval of service plans.
5. Service stations - the meter location shall be located such that it is a minimum of twenty (20) feet clear of any gas pump and ten (10) feet clear of any gas storage tank fill spout and/or vent.

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### 301.6 UNACCEPTABLE METER LOCATIONS

For reasons of public safety, maintenance of service equipment, and reliability of metering, meters shall not be installed in any of the following locations:

1. Inside any building, unless located within an acceptable meter room. See Paragraph 301.9.
2. In any location not readily accessible. See Section 100, Paragraph 102.20.
3. In any substation or transformer vault.
4. In any location which may be hazardous to personnel.
5. On any surface subject to excessive vibration.
6. In or accessed through any rest, bath, shower, powder, or toilet room.
7. In any elevated area.
8. In any location not providing a clear and continuously unobstructed working space extending a minimum of three (3) feet from the face of the meter panel, and having a width to permit ready access to the complete metering installation. See Working Space, Paragraph 301.7.
9. In any location where moisture, fumes, or dust may interfere with the operation of the meter, or materially damage it.
10. In any location giving less than three feet clearance to any property line, or with less than three feet clearance to any sidewalk, alley or driveway giving access to non-residential or industrial property.
11. In any basement or depressed area.
12. Within carport or patio areas which are or can become enclosed, when served Overhead or Underground.
13. Mounted on APS poles.
14. In a room containing mechanical equipment.
15. In any elevator shaft or hatchway.
16. Mounted on any trees.
17. In any unsanitary areas in reference to farm animals and products.
18. In a plenum or any portion of a return or supply air ducting system.
19. In a drive-thru area (ex: fast food restaurants, drug stores, banks, etc.).

**NOTE:** If an existing meter panel has had the meter removed for more than 6 months and the panel is in an unacceptable location, the customer is required to move the panel to a location that complies with all applicable ESRM requirements prior to APS reconnecting the service.

301.7 WORKING SPACE (600 VOLTS OR LESS)

NOTES:

1. TO PERMIT ACCESS TO THE METERING INSTALLATIONS AND PROVIDE SAFETY FOR PERSONNEL, A WORKING AND STANDING SPACE ENTIRELY ON THE PROPERTY OF THE CUSTOMER SHALL BE PROVIDED IN FRONT OF ALL METERING EQUIPMENT.
2. WORKSPACE SHALL BE CLEAR OF OBSTRUCTIONS, INCLUDING A/C UNITS AND PIPING SYSTEMS AND SHALL HAVE A SLOPE TO PROVIDE DRAINAGE AWAY FROM THE METERING EQUIPMENT. MAXIMUM SLOPE ALLOWED IS 1 INCH IN 3 FEET. THERE SHALL BE 10" MINIMUM HORIZONTAL AND 9" MINIMUM VERTICAL CLEARANCES FROM THE CENTER OF THE METER SOCKET TO ANY OBSTRUCTION. WHEN THE PANEL WIDTH IS LESS THAN 36", THE CLEAR WORKING SPACE SHALL BE 18" MINIMUM HORIZONTALLY FROM THE CENTER OF PANEL. IN ALL CASES THE HORIZONTAL CLEARANCE SHALL BE THE GREATER OF EITHER THE 10" MINIMUM FROM THE CENTER OF THE METER SOCKET TO ANY OBSTRUCTION OR 18" MINIMUM FROM CENTER OF PANEL CLEARANCE.

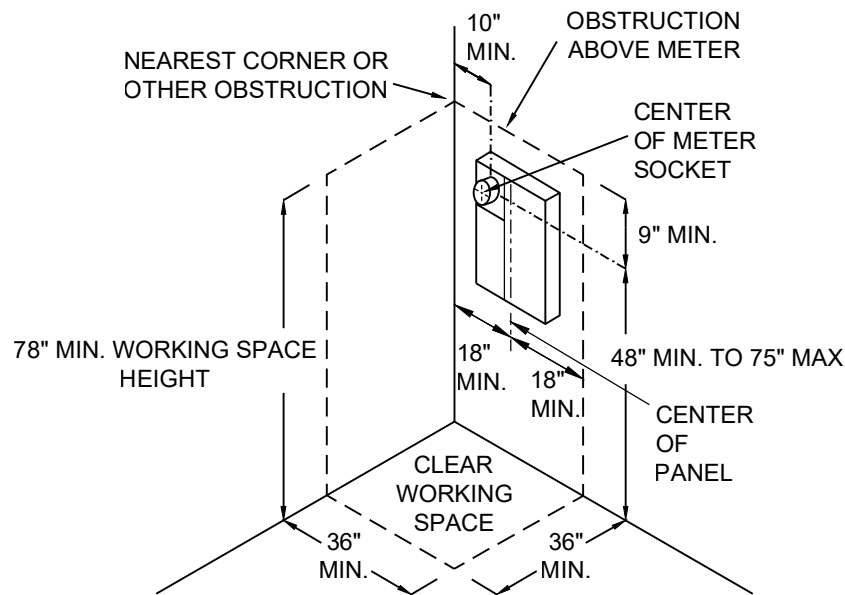


FIGURE 1  
SURFACE OR SEMI-FLUSH  
METER INSTALLATIONS

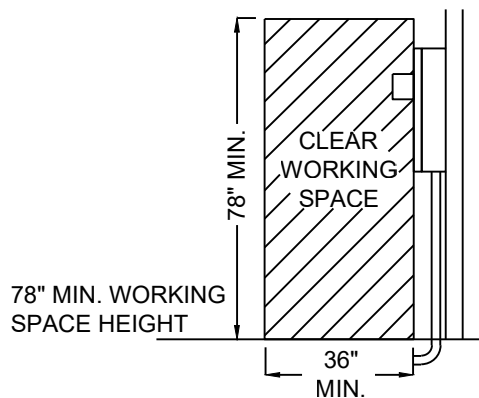
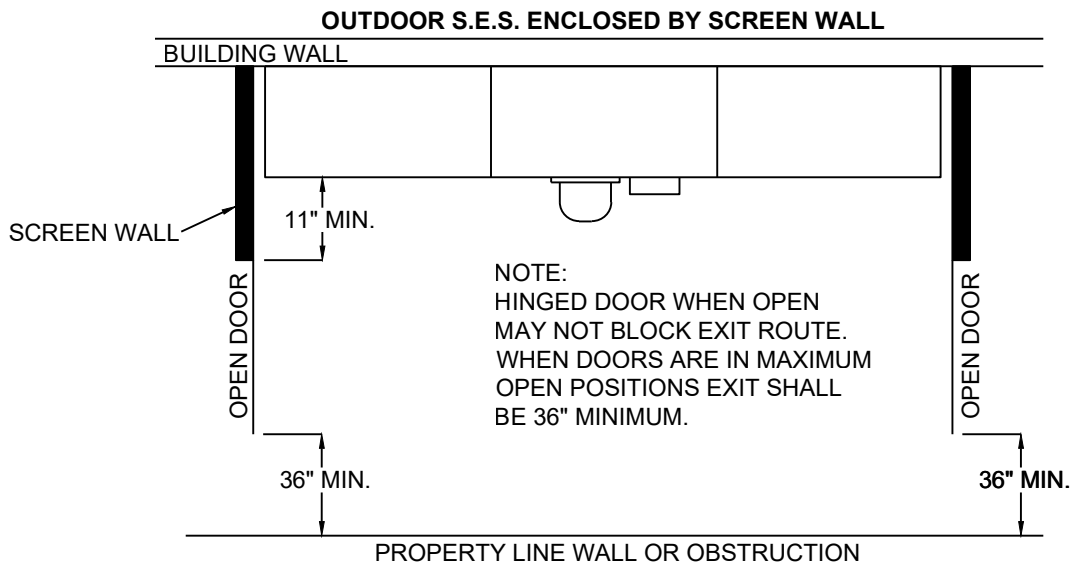
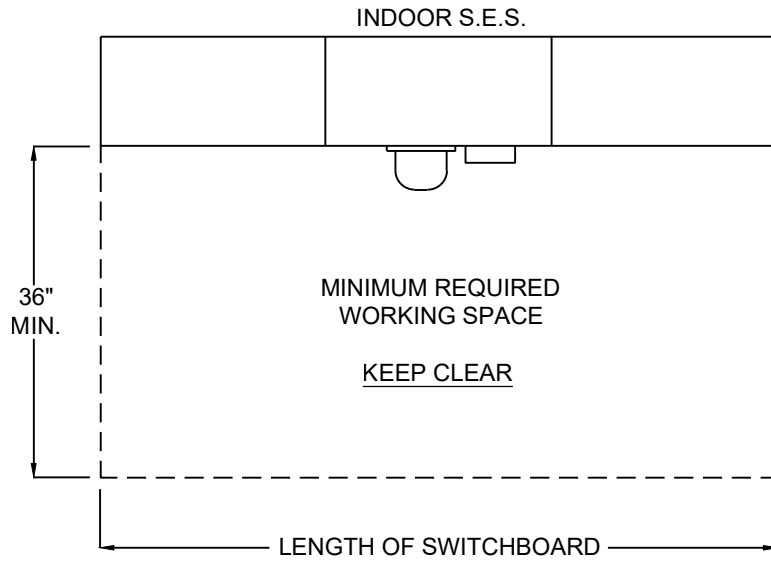


FIGURE 2  
WORKING SPACE - SIDE VIEW

**WORKING SPACE AND CLEARANCE REQUIREMENTS  
(TOP VIEW OF SWITCHBOARD)**

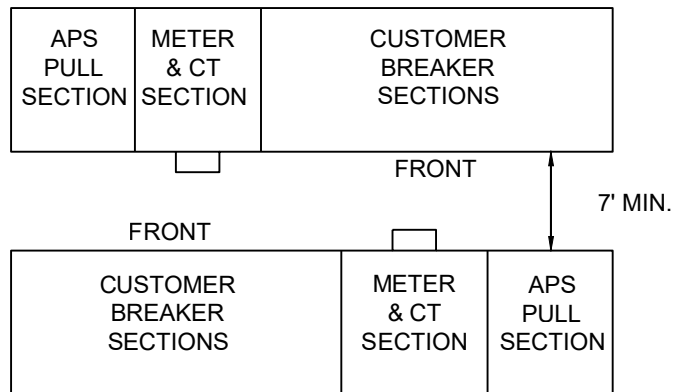


NOTE: Refer to ESRM 301.8 for additional outdoor SES working space, clearance and escape route requirements.



MULTIPLE SERVICE ENTRANCE SECTIONS

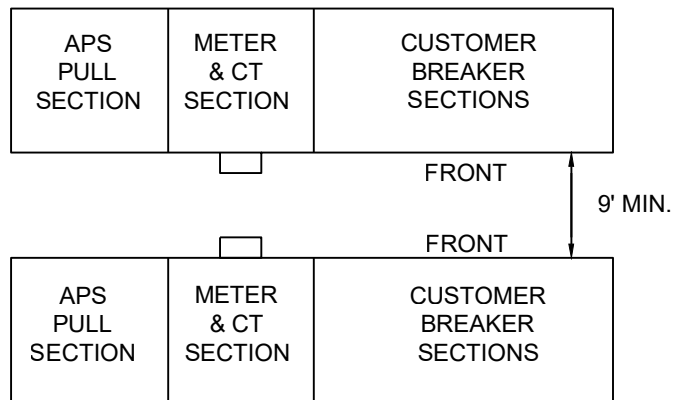
FIGURE 1 - METER STAGGERED



NOTES

1. SERVICE ENTRANCE SECTIONS THAT FACE EACH OTHER WITH STAGGERED METER LOCATIONS SHALL HAVE A MINIMUM WORKING SPACE OF 7 FEET BETWEEN SERVICE ENTRANCE SECTIONS.
2. TWO EXIT PATHS SHALL BE PROVIDED.

FIGURE 2 - METERS FACE - TO - FACE



NOTES

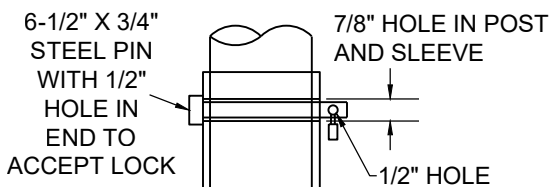
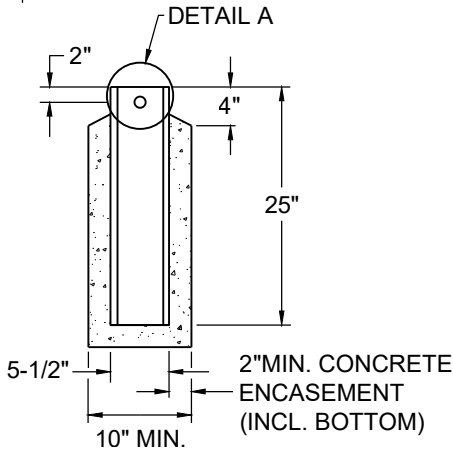
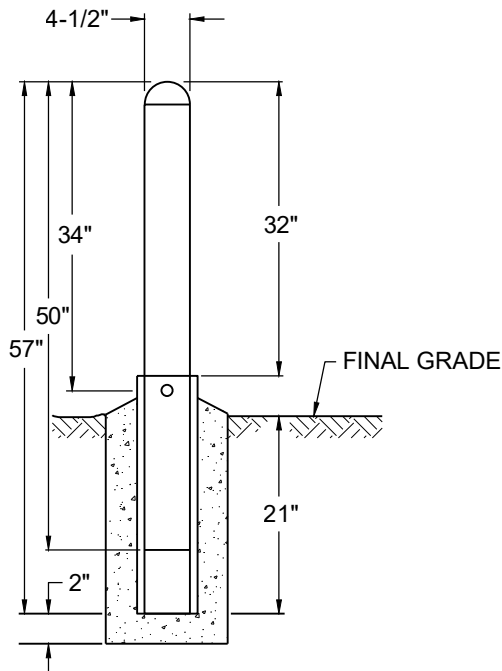
1. SERVICE ENTRANCE SECTIONS THAT FACE EACH OTHER WITH FACE-TO-FACE METER LOCATIONS SHALL HAVE A MINIMUM WORKING SPACE OF 9 FEET BETWEEN SERVICE ENTRANCE SECTIONS.
2. TWO EXIT PATHS SHALL BE PROVIDED.

**301.8 BARRICADE / BARRIER POSTS**

THE CUSTOMER SHALL FURNISH, INSTALL AND MAINTAIN PERMANENT BARRICADES/BARRIER POST(S) TO PROVIDE CLEARANCES AS SPECIFIED IN ESRM, SECTION 304.5-1, WHERE THE WORKING SPACE IS EXPOSED TO VEHICLES OR HAZARDOUS CONDITIONS. APS SHALL SPECIFY WHEN REMOVABLE POST(S) CAN BE USED. VEHICULAR TRAFFIC OR HAZARDOUS CONDITIONS INCLUDE BUT ARE NOT LIMITED TO MOTORIZED VEHICLES, PALLET JACKS, HAND CARTS, ETC., THAT COULD PHYSICALLY ENTER THE WORKING SPACE OR ESCAPE ROUTE.

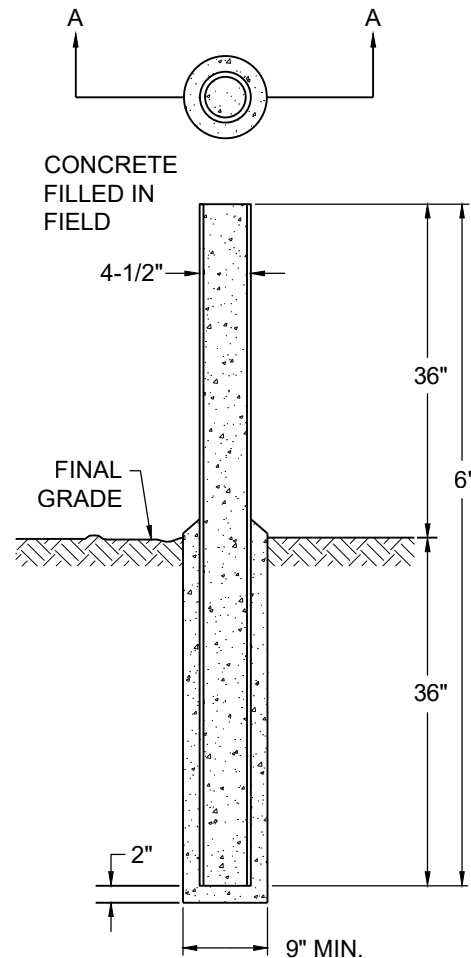
POSTS SHALL BE A MINIMUM 4" (4.5" OUTSIDE DIAMETER) GALVANIZED SCHEDULE 40 PIPE, OR 4" (4.5." OUTSIDE DIAMETER) GALVANIZED RIGID METAL CONDUIT.

**REMOVABLE POST**



DETAIL A

**FIXED POST**



SECTION A-A  
BARRIER POST DETAIL

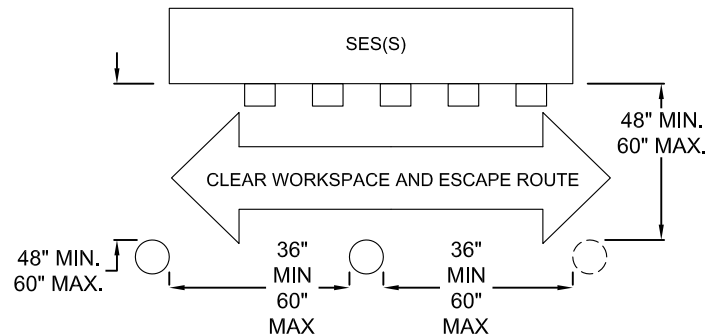
**CONSTRUCTION NOTES:**

1. USE ADDITIONAL BARRIER CENTER POST AS REQUIRED TO PREVENT TRAFFIC PENETRATIONS TO SES.
2. CAUTION MUST BE TAKEN INSTALLING POSTS SO THAT POSTS DO NOT MAKE CONTACT WITH CONDUIT SYSTEM.
3. STEEL BOLLARD SHALL NOT BE IN CONTACT WITH THE SOIL.
4. CALL ARIZONA811 FOR BLUE STAKING AT 811, TO GET ALL UTILITIES MARKED PRIOR TO EXCAVATION.

**301.8-1 BARRIER POSTS FOR EQUIPMENT WITHOUT DOORS**

EQUIPMENT WITHOUT DOORS

THE CUSTOMER SHALL PROTECT AN AREA 48" MEASURED FROM THE FRONT OF THE SES FOR THE ENTIRE WIDTH OF THE EQUIPMENT. THE PROTECTED AREA IS INTENDED TO PROVIDE A SAFE WORKSPACE AND CLEAR ESCAPE ROUTE. IF THE DISTANCE FROM THE FRONT OF THE SES TO THE BARRIER POST EXCEEDS 60", THEN ADDITIONAL BARRIER POSTS SHALL BE PROVIDED TO PREVENT SIDE VEHICLE PENETRATION INTO THE WORKSPACE.

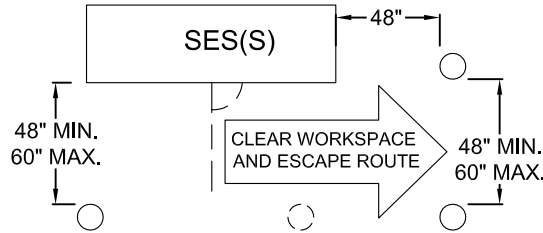


A FIXED BARRIER POST SHALL BE INSTALLED AT EACH END OF THE SES. IF SPACING BETWEEN BARRIER POSTS EXCEEDS 60" INSTALL ADDITIONAL POSTS TO PREVENT VEHICLE PENETRATIONS TO SES WORKSPACE AND ESCAPE ROUTE.

**301.8-2 BARRIER POSTS FOR EQUIPMENT WITH ONLY ONE DOOR**

EQUIPMENT WITH ONLY ONE DOOR

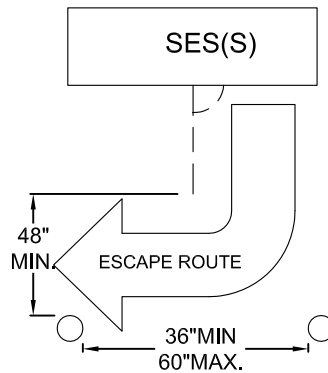
IF A 48" ESCAPE ROUTE CAN BE PROVIDED IN FRONT OF THE SES AND LEADING AWAY FROM THE OPEN SES DOOR THEN THE CUSTOMER SHALL PROTECT AN AREA 48" MEASURED FROM THE FRONT OF THE CLOSED SES DOOR FOR THE ENTIRE WIDTH OF THE EQUIPMENT. IF THE 48" ESCAPE ROUTE LEADING AWAY FROM THE OPEN SES DOOR IS SUBJECT TO VEHICULAR TRAFFIC ADDITIONAL BARRIER POST(S) MAY BE NEEDED TO PROTECT THE ESCAPE ROUTE. (SEE EXAMPLE 1) IF THE DISTANCE FROM THE FRONT OF THE SES TO THE BARRIER POST EXCEEDS 60", THEN ADDITIONAL BARRIER POSTS SHALL BE PROVIDED TO PREVENT SIDE VEHICLE PENETRATION INTO THE WORKSPACE.



**EXAMPLE 1**

A FIXED BARRIER POST SHALL BE INSTALLED AT EACH END OF THE SES. IF SPACING BETWEEN BARRIER POSTS EXCEEDS 60" INSTALL ADDITIONAL POSTS TO PREVENT VEHICLE PENETRATIONS TO SES WORKSPACE AND ESCAPE ROUTE.

IF A 48" ESCAPE ROUTE CAN ONLY BE PROVIDED AROUND THE OPEN SES DOOR THEN THE CUSTOMER SHALL PROTECT AN AREA 48" MEASURED FROM THE END OF THE LOCKED OPEN SES DOOR FOR THE ENTIRE WIDTH OF THE EQUIPMENT. (SEE EXAMPLE 2)

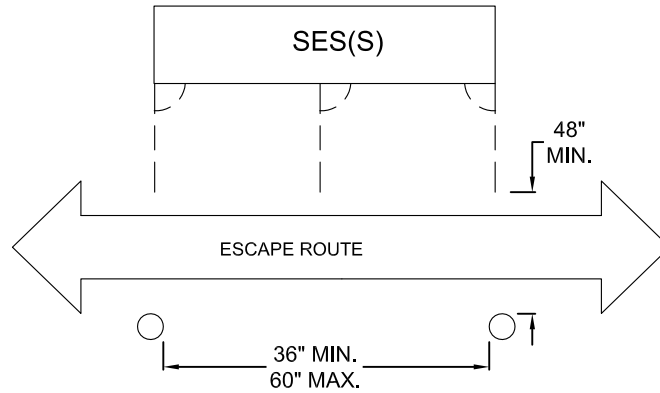


**EXAMPLE 2**

A FIXED BARRIER POST SHALL BE INSTALLED AT EACH END OF THE SES. IF SPACING BETWEEN BARRIER POSTS EXCEEDS 60" INSTALL ADDITIONAL POSTS TO PREVENT VEHICLE PENETRATIONS TO SES WORKSPACE AND ESCAPE ROUTE

**301.8-3 BARRIER POSTS FOR EQUIPMENT WITH MORE THAN ONE DOOR**

**EQUIPMENT WITH MORE THAN ONE DOOR**  
THE CUSTOMER SHALL PROTECT AN AREA 48" MEASURED FROM THE END OF THE LOCKED OPEN SES DOORS FOR THE ENTIRE WIDTH OF THE EQUIPMENT.



A FIXED BARRIER POST SHALL BE INSTALLED AT EACH END OF THE SES. IF SPACING BETWEEN BARRIER POSTS EXCEEDS 60" INSTALL ADDITIONAL POSTS TO PREVENT VEHICLE PENETRATIONS TO SES WORKSPACE AND ESCAPE ROUTE.

**301.9 METER ROOM REQUIREMENTS**

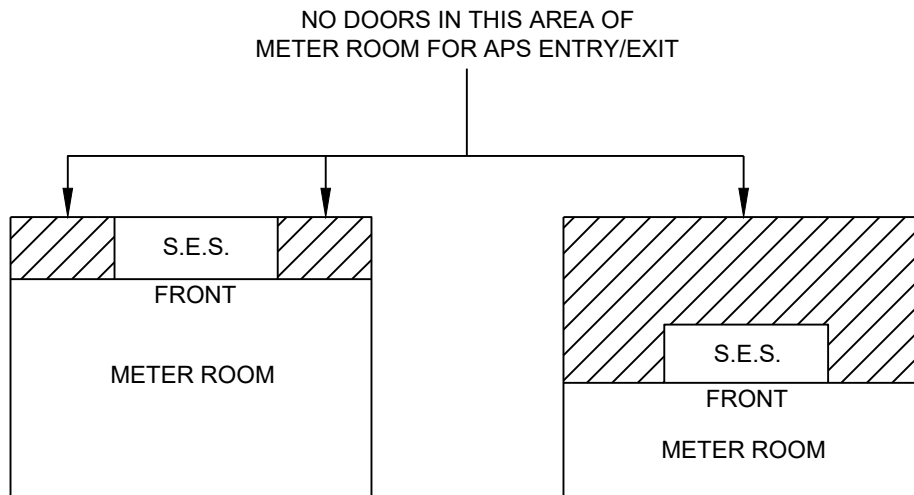
A meter room is a permanent, accessible, illuminated, ventilated room (per NEC section 100), provided by the customer for the exclusive use and location of the Customer's electric service and metering equipment, and for the installation of an APS meter or meters. The one exception to exclusive use will allow the installation of communication equipment provided space requirements for the electric installation is not impaired. Meter rooms shall be provided with a doorway opening to the outside of the building with a kick down doorstop and panic hardware. Meter room shall not provide access to interior of building. Meter room location and design to be approved by APS. For safety's sake, meter rooms are not to be used for storerooms.

Meter rooms may be locked provided independent access is given to APS. The Customer's key will not be accepted for retention by APS for entry; therefore, locking shall be accomplished only by one of the following methods:

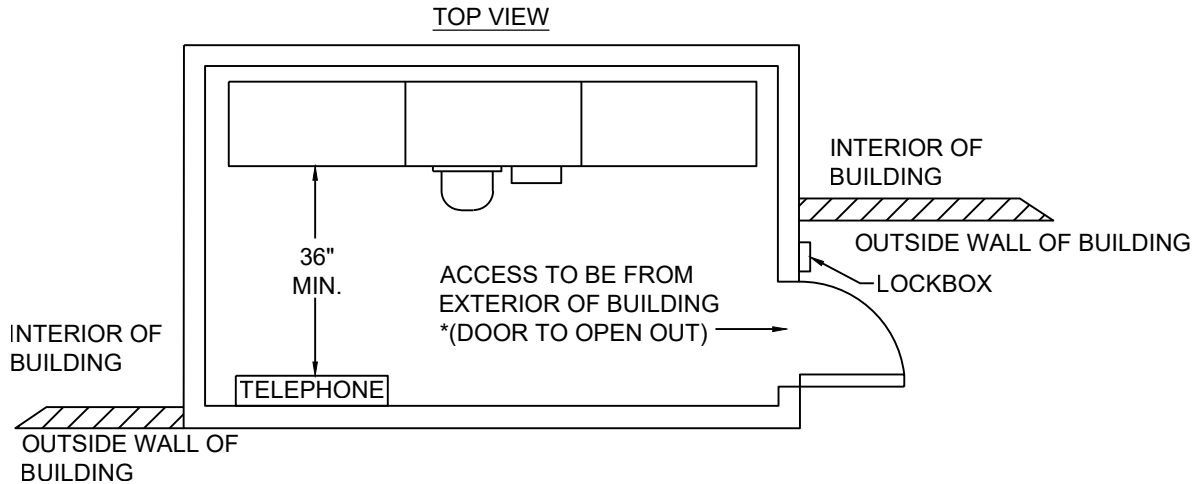
1. Customer may provide and install a device that will allow one pad lock for the Customer and one pad lock for APS on the door, or.
2. The Customer may place a meter room door key in an APS acceptable lockbox installed on or near the door. The meter room key shall not unlock any other door on the premises.

See Paragraph 301.10 for lock box location. Notify APS prior to the design stage for meter room requirements and locations in high rise buildings. (See definitions Section 100—High Rise Building).

See additional requirements referencing section 301 such as (301.4, 301.5 AND 301.6).

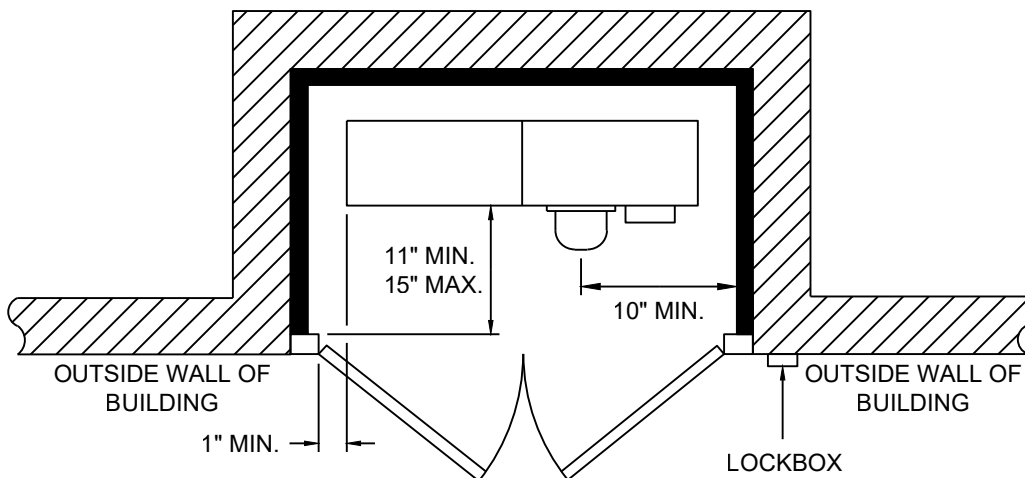


301.9 ELECTRIC METER ROOM REQUIREMENTS (CONT'D)



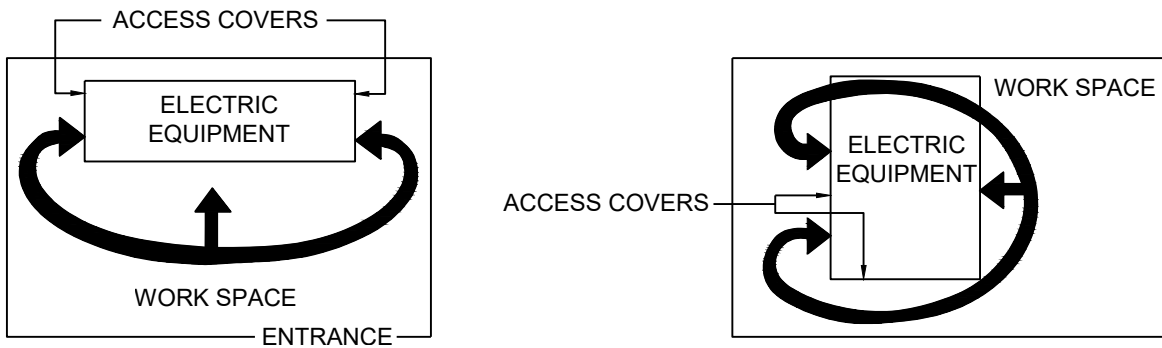
**NOTE: ADDITIONAL CLEARANCES MAY BE REQUIRED BY THE LOCAL INSPECTION AGENCY**

THE FOLLOWING ALTERNATIVE TO A METER ROOM IS ACCEPTABLE TO APS IF THE S.E.S. DOES NOT HAVE ANY REMOVABLE REAR PANELS. CHECK WITH THE LOCAL AGENCY FOR ACCEPTABILITY.

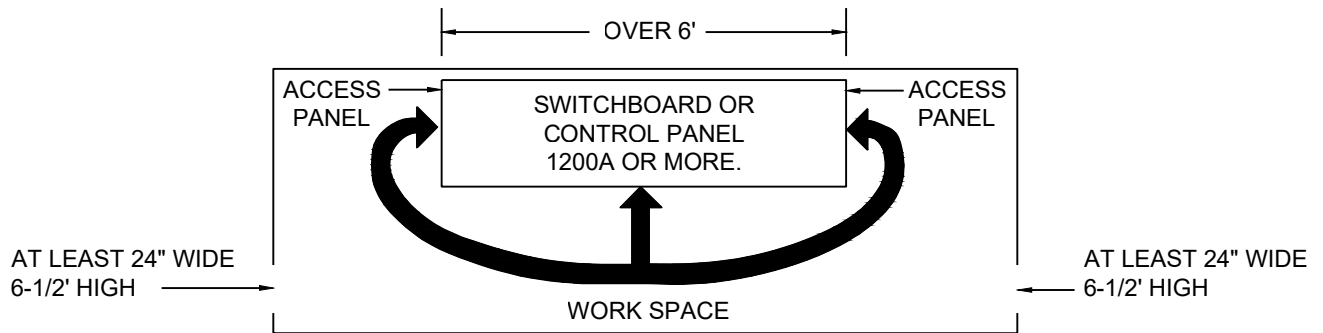


1. SEE REQUIREMENTS FOR LOCKING DOORS. (PARAGRAPH 301.10)
2. 36" CONCRETE PAD REQUIRED IN FRONT OF METERING.
3. SES METER DOORS MUST OPEN 90° (OR MORE) WITH METER AND TEST SWITCH INSTALLED. ALSO, EXTERIOR DOORS MUST BE EQUIPPED WITH A DEVICE TO HOLD THE DOOR IN THE 90° (OR MORE) POSITION.
4. CARE MUST BE EXERCISED TO DESIGN THE ENCLOSED SUCH THAT NEITHER THE ROOF NOR THE DOOR FRAME WILL INTERFERE WITH THE CLEARANCES OR THE INSTALLATION AND MAINTENANCE OF THE METERING EQUIPMENT.
5. WITH EXTERIOR METER DOORS IN OPEN 90° LOCKED POSITION, A 36" EXIT WAY IS REQUIRED BETWEEN DOOR EDGE AND CLOSEST OBJECT.
6. THIS ENCLOSURE IS APPROVED FOR COMMERCIAL LOCATIONS.

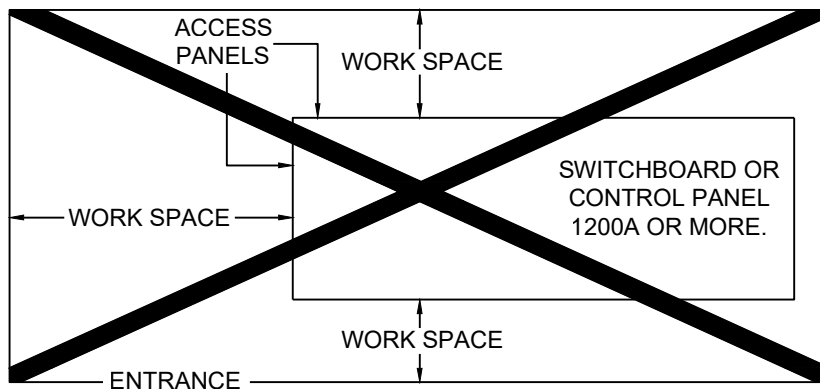
301.9 NATIONAL ELECTRIC CODE REQUIREMENTS



AT LEAST ONE ENTRANCE IS REQUIRED TO PROVIDE ACCESS TO THE WORKING SPACE AROUND ELECTRIC EQUIPMENT. THE INSTALLATION SHOWN IN THE SKETCH ON THE RIGHT WOULD NOT BE ACCEPTABLE IF THE ELECTRIC EQUIPMENT WAS A SWITCHBOARD OR PANELBOARD OVER 6' WIDE AND RATED 1200A OR MORE.



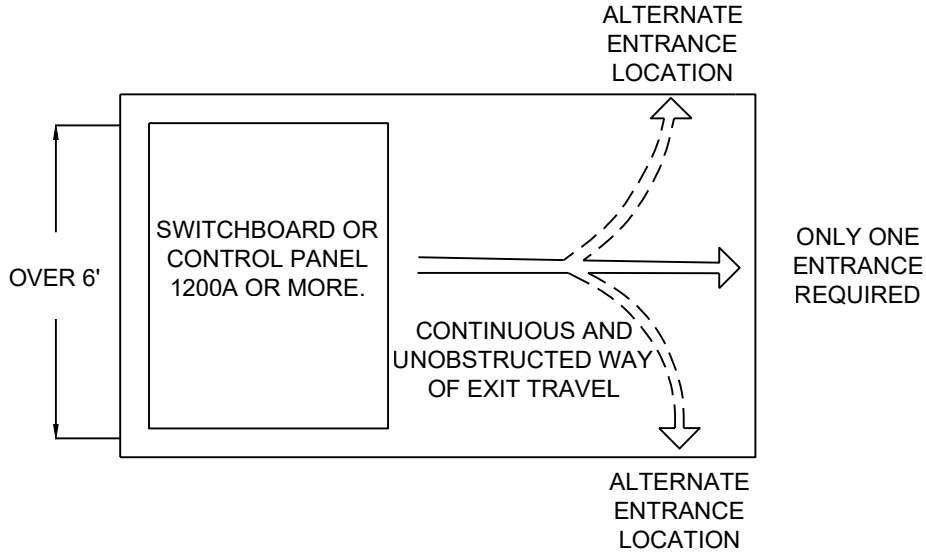
FOR SWITCHBOARDS AND CONTROL PANELS RATED 1200A OR MORE AND OVER 6' WIDE, THERE SHALL BE ONE ENTRANCE NOT LESS THAN 24" WIDE AND 6-1/2' HIGH AT EACH END.



**NOT ACCEPTABLE**

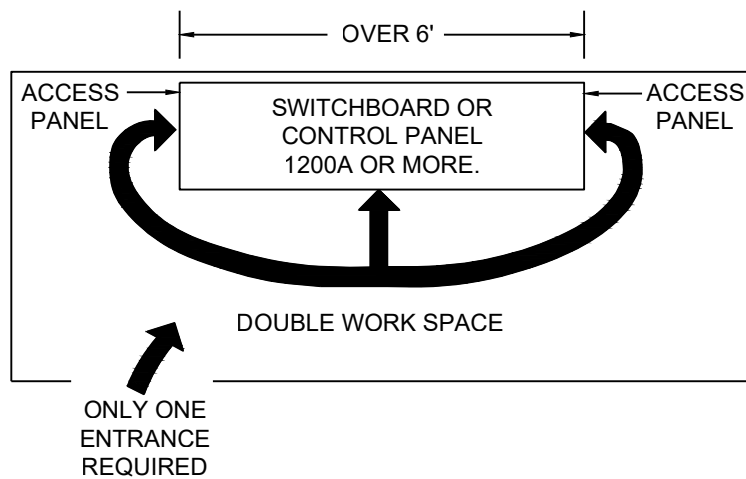


EXCEPTION #1: WHERE THE EQUIPMENT LOCATION PERMITS A CONTINUOUS AND UNOBSTRUCTED WAY OF EXIT TRAVEL.



EXCEPTION #1: WHERE THE EQUIPMENT LOCATION PERMITS A CONTINUOUS AND UNOBSTRUCTED WAY OF EXIT TRAVEL.

EXCEPTION #2: WHERE THE WORK SPACE REQUIRED BY SECTION 110-16(A) IS DOUBLED.



EXCEPTION #2: WHERE THE WORK SPACE REQUIRED BY SECTION 110-16(A) IS DOUBLED.

**301.9-1 UNACCEPTABLE EQUIPMENT IN METER ROOMS**

Equipment not permitted within the electric meter room includes, but is not limited to following:

1. Gas equipment – including piping.
2. Water heaters/boilers – including piping.
3. Mechanical equipment – including motor/generator sets.
4. Batteries and battery charging equipment.
5. Fire risers.

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**301.9-2 METER ROOM VENTILATION**

Meter room shall have at least two 10" X 10" air vents. Vent locations shall be designed to provide maximum separation, with one vent located high and the other vent located low.

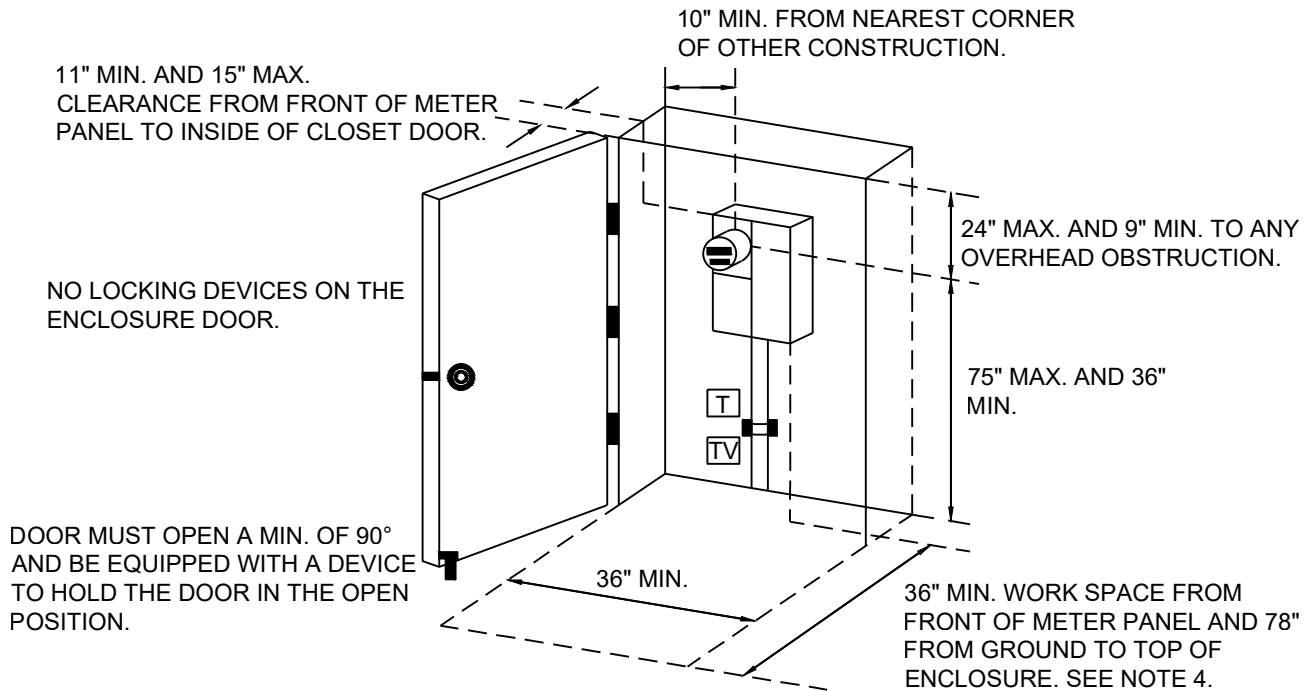
Meter room containing any electrical equipment that produces heat such as a dry type transformer shall require the room air temperature to be maintained at maximum of 95° F.

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**301.10 LOCK BOX LOCATION**

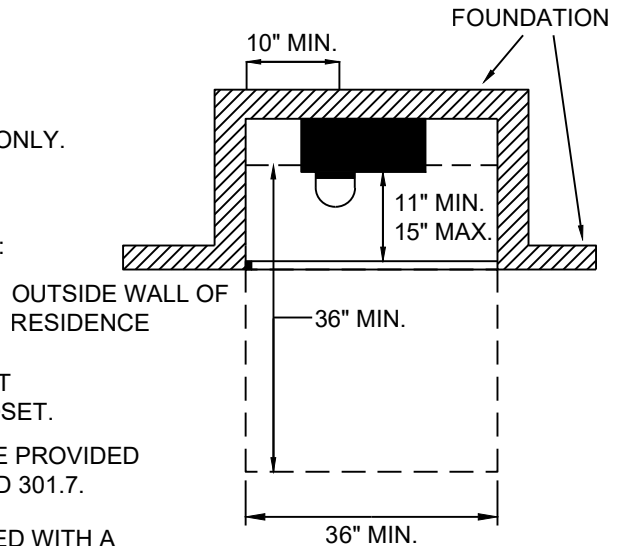
The customer may place a meter room door key in an APS acceptable lock box installed on or within 36" of the door. The minimum height shall be 36" and the maximum height 60". The meter room key shall not unlock any other door on the premises.

**301.11 RESIDENTIAL ELECTRIC METER CLOSET REQUIREMENTS - SELF CONTAINED**

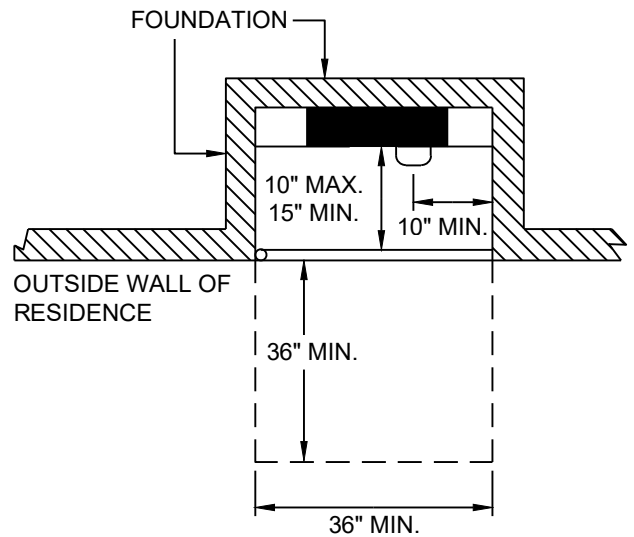
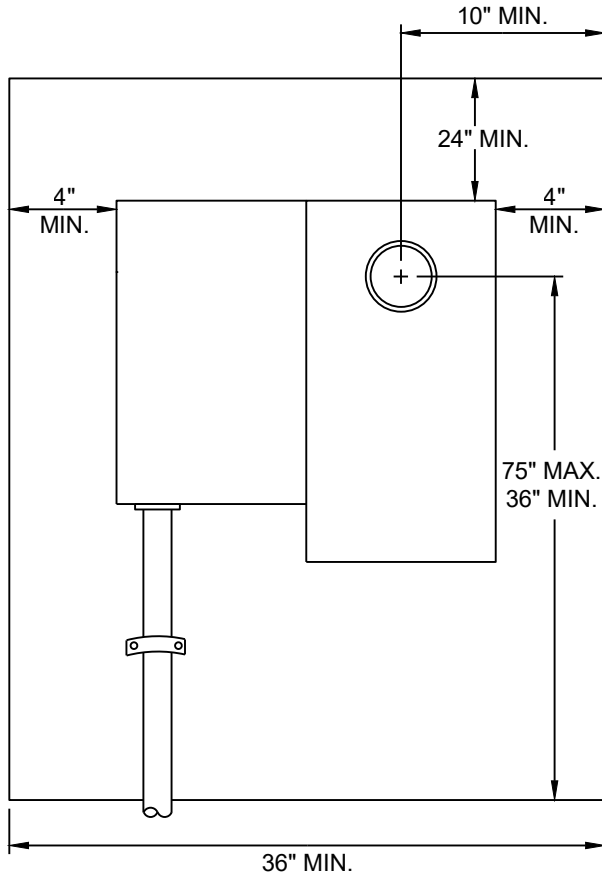


**NOTES:**

1. THIS ENCLOSURE IS APPROVED FOR:
  - A. SINGLE FAMILY SELF-CONTAINED USE ONLY.
  - B. COMMUNICATION EQUIPMENT
  - C. CATV
2. THIS ENCLOSURE IS NOT APPROVED FOR:
  - A. GAS SERVICE OR PIPING
  - B. WATER SERVICE OR PIPING
  - C. STORAGE OF ANY KIND
3. THE STRUCTURE FOUNDATION SHALL NOT EXTEND INTO OR UNDER THE METER CLOSET.
4. CLEAR AND LEVEL WORK SPACE SHALL BE PROVIDED PER PARAGRAPH 301.6, NOTES 8, 9, 10 AND 301.7.
5. METER CLOSET DOOR SHALL BE IDENTIFIED WITH A PERMANENT TAG SHOWING "ELECTRIC METER", MANUFACTURE PER 302.1
6. POCKET DOORS ARE ACCEPTABLE.



301.11-1 RESIDENTIAL ELECTRIC METER CLOSET REQUIREMENTS - 400 AMPS & LARGER



NOTES:

- 1) DOOR
  - A) MUST BE THE WIDTH AND HEIGHT OF THE CLOSET
  - B) OPEN 90° WITH DEVICE TO HOLD DOOR IN OPEN POSITION
  - C) HANDLE CAN NOT BE LOCKABLE
- 2) THIS ENCLOSURE APPROVED FOR:
  - A) SINGLE FAMILY
  - B) COMMUNICATIONS EQUIPMENT
  - C) CATV
- 3) THIS ENCLOSURE NOT APPROVED FOR:
  - A) GAS PIPING
  - B) WATER SERVICE OR PIPING
  - C) STORAGE OF ANY KIND
- 4) THE STRUCTURE FOUNDATION SHALL NOT EXTEND INTO OR UNDER THE METER CLOSET.
- 5) CLEAR AND LEVEL WORK SPACE PER 301.6 NOTES 8, 9, 10, AND 301.7.
- 6) METER CLOSET DOOR SHALL BE IDENTIFIED WITH A PERMANENT TAG SHOWING "ELECTRIC METER" MANUFACTURE PER 302.1

### 301.12 MAIN SWITCH LOCATION

The meter and service main switch shall be installed on the same wall adjacent to each other and accessible from the same working area. Exception Fire Pump disconnects may be located at the fire pump control panel. (See Paragraph 302.3 Main Switch).

### 301.13 METER AND MAIN SWITCH SEQUENCE

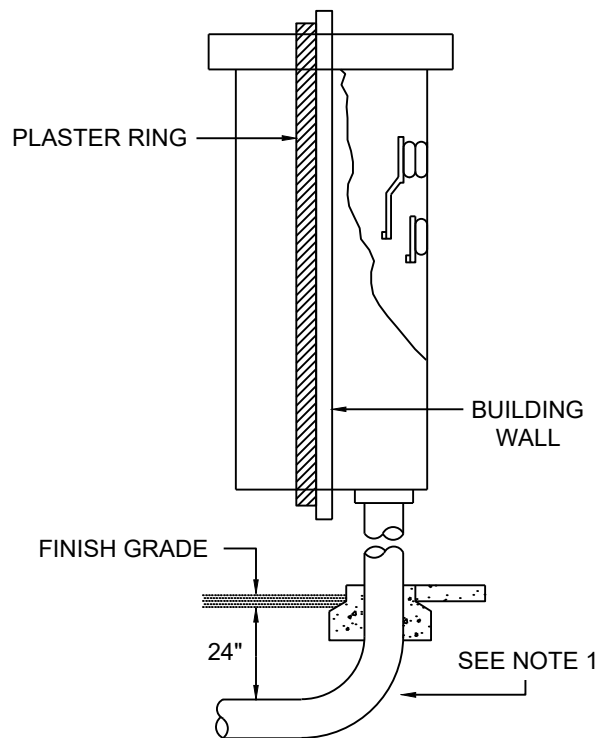
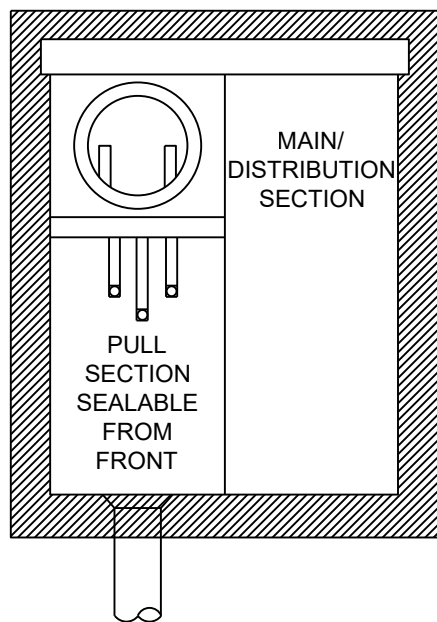
Meters and metering equipment for services of 0 - 600 volts shall be located ahead, or on the supply side, of the customer's main service entrance switch. Exception to this sequence is permissible only when required by electrical codes.

When a single set of service entrance conductors supply a multi-meter installation, numbering from two to six meters, a main switch for each meter shall be located on the load side of each meter.

For multi-meter installations, numbering seven or more meters connected to a single set of service entrance conductors, NEC 230-71 requires the installation of a main service switch located on the supply side of the group of meters (its access door shall be under APS lock and seal). In these instances, an individual main switch must also be installed on the load side of each meter.

**APS shall not allow a main service disconnect ahead of less than seven meters in or on a separate enclosure or switchboard.**

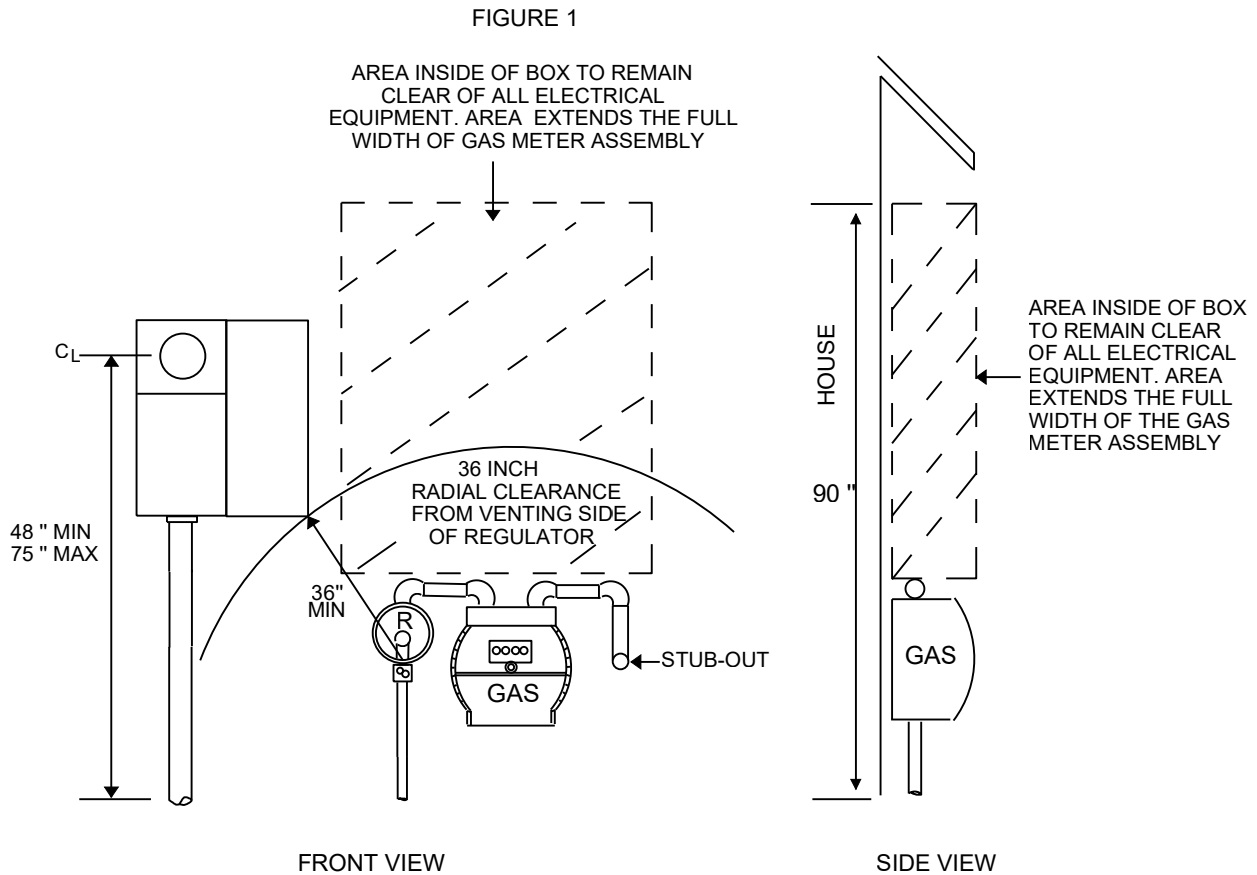
### 301.14 TYPICAL SEMI-FLUSH INSTALLATION



#### NOTES:

1. SEE SECTION 500 FOR UNDERGROUND CONDUIT AND RISER REQUIREMENTS.
2. SEE SECTION 1100, DRAWING 301 FOR METER CAN REQUIREMENTS.

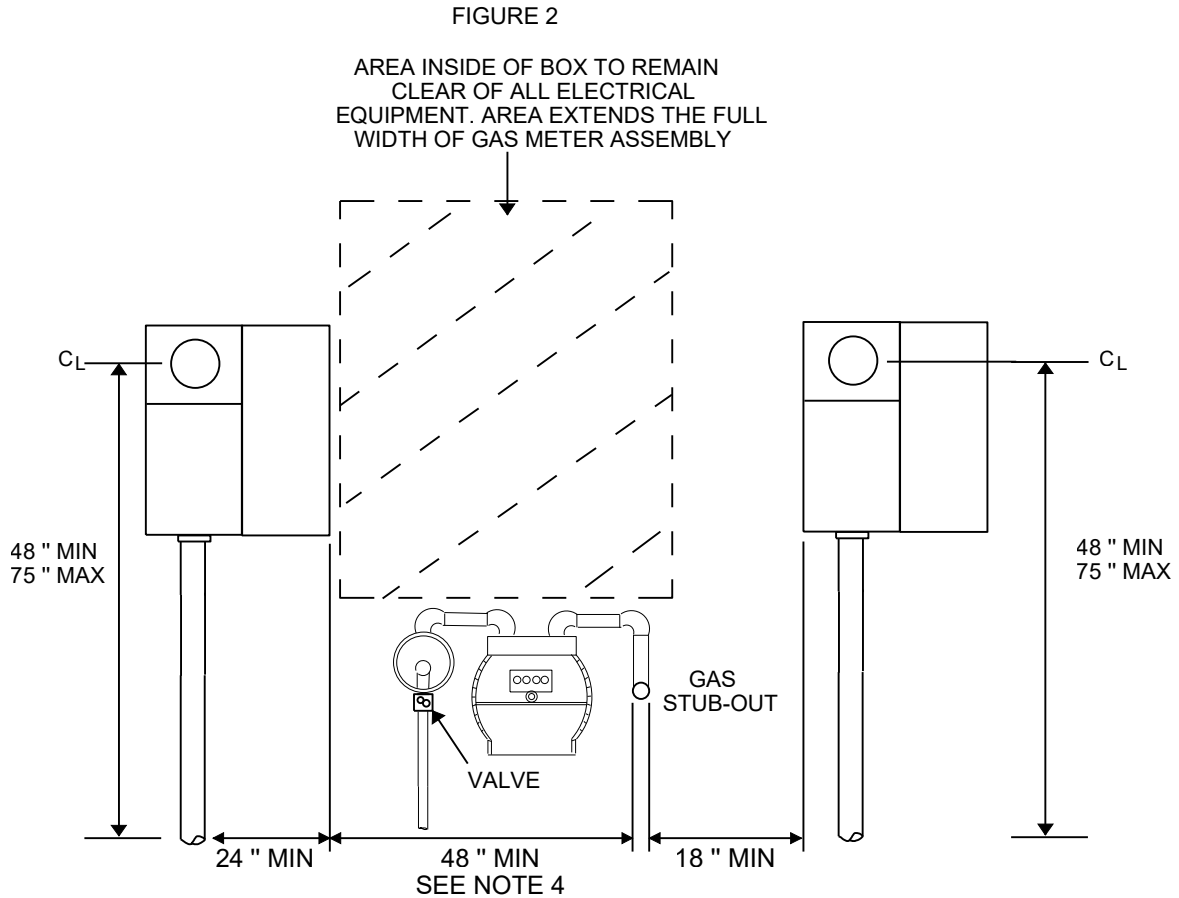
**301.15 ELECTRIC METER SEPARATION BETWEEN WATER, GAS METER, AND FUEL SOURCES**



**301.15-1 ELECTRIC, WATER AND GAS METER SEPARATION (FIGURE 1)**

1. Size and dimensions of panels will vary.
2. Working clearance shall be a minimum of 36 inches wide in front of meter panel. If electric panels extend wider than the 36 inch minimum, the working clearance shall be the width of the entire assembly. Working space shall extend out from the face of the electric meter panel a minimum of 36 inches. See paragraph 301.7 for additional workspace requirements.
3. Area directly above gas meter shall remain clear of any electrical equipment.
4. For conduit system and riser requirements, refer to Section 500.
5. For Trenching Requirements, refer to Section 600.
6. Gas piping (above grade) may be located below electric panel(s), but shall not include any couplings in that area.
7. APS prohibits water valves or hose bibs to be located within the 36 inch by 36 inch safe work area in front of the electric panels. This is to prevent any grounded surfaces in the work area and to ensure the standing surfaces remain safe and dry.
8. Drain pipes or soffits are prohibited above the meter enclosures to ensure the work area standing surfaces remain safe and dry.

**301.15 ELECTRIC METER SEPARATION BETWEEN WATER, GAS METER, AND FUEL SOURCES**

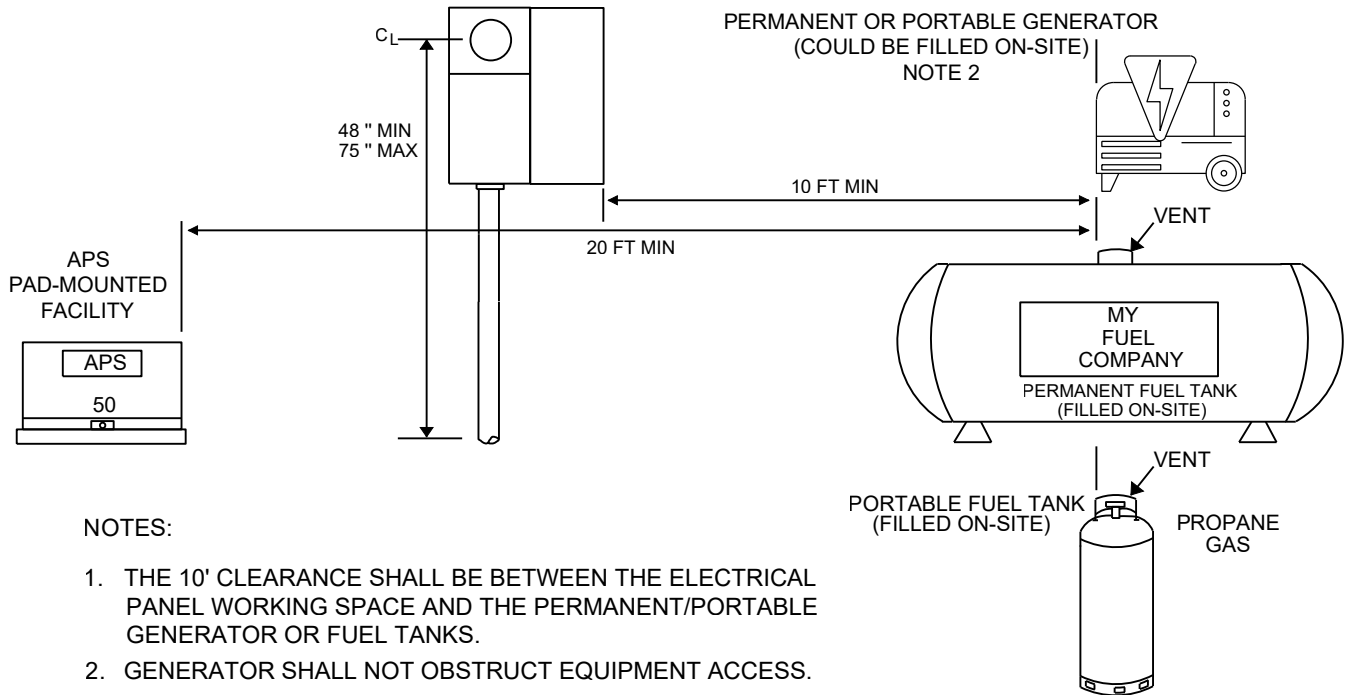


**301.15-2 ESTABLISHING GAS CLEARANCES DURING CONSTRUCTION (FIGURE 2)**

1. Measure the minimum horizontal separation from the edge of the electric meter panel to the closest point of the gas service (if known), or from the electrical UG riser pre-construction "Stub-Up" to the gas service "Stub-Out" on the house (Preferred Method).
2. Size and dimensions of panels will vary.
3. See paragraph 301.15-1 for additional requirements.
4. 48 inch dimension is required based upon typical gas meter dimensions and layout. The intent is to maintain a 36 inch radial clearance (see figure 1 in 301.15-1) from the venting side of the regulator to the closest corner of the electric panel. If the location does not provide 48 inches, contact the gas company to explore options for maintaining the 36 inch radial clearance that is required.

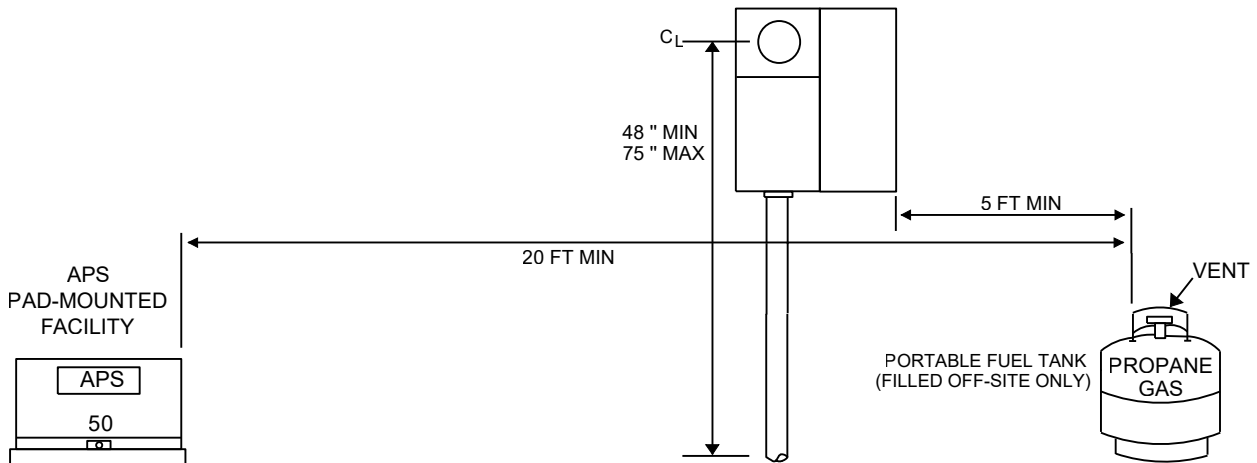
**301.15 ELECTRIC METER SEPARATION BETWEEN WATER, GAS METER, AND FUEL SOURCES**

**FIGURE 3**



**301.15-3**

**FIGURE 4**



A minimum 20-foot separation / clearance is required between APS electrical facilities in outdoor locations where fire or explosion hazards may exist and the following:

- |                                              |                                               |
|----------------------------------------------|-----------------------------------------------|
| GASOLINE                                     | DIESEL FUEL                                   |
| COMPRESSED NATURAL GAS (CNG)                 | LIQUEFIED NATURAL GAS (LNG)                   |
| LIQUEFIED PETROLEUM GAS (LPG)                | HYDROGEN IN A GASEOUS FORM (GH <sub>2</sub> ) |
| HYDROGEN IN A LIQUID FORM (LH <sub>2</sub> ) |                                               |

If the minimum 20-foot separation cannot be maintained, a fire barrier / fire wall shall be installed between the pad-mounted facility and the generator.

The fire barrier / fire wall shall have a minimum 2-hour fire rating. The fire wall height shall extend at least 1-foot above the line of sight between any point on the top of the pad-mounted facility and any point on the top of the generator. The fire wall shall also extend at least 2-feet horizontally beyond the line of sight between any point of the pad-mounted facility and any point of the generator. A minimum of 3-foot separation shall be maintained between the fire wall and side of APS pad-mounted facility except from the side of certain facilities (e.g., automatic transfer switch, supervisory switches) containing control features where a 6-foot separation shall be maintained. See FIGURES 5 AND 6 for illustration.



**301.15 ELECTRIC METER SEPARATION BETWEEN WATER, GAS METER, AND FUEL SOURCES**

Where the degree of hazard is unknown, Contact APS Representative for proper classification of the hazardous locations.

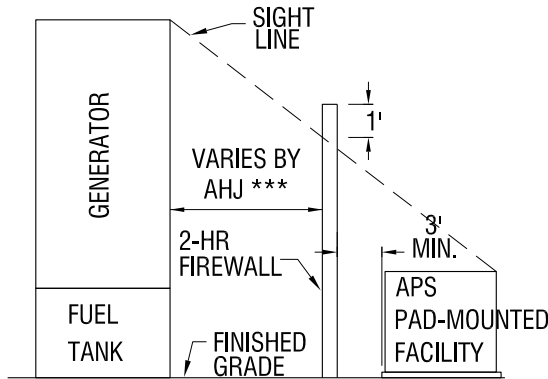


FIGURE 5 - FIRE WALL HEIGHT (PROFILE VIEW)

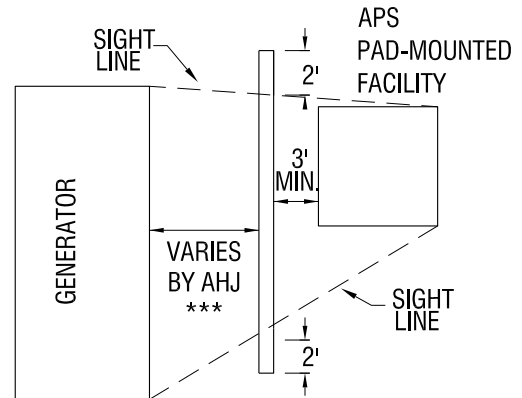


FIGURE 6 - FIRE WALL LENGTH (PLAN VIEW)

PAD USAGE (TYPICAL)	PAD DIMENSION		MINIMUM CLEARANCES		
	A	B	TO BUILDINGS	TO FENCES	TO COMM. PED
			C	C	D
1Ø LOW PROFILE TRANSFORMER 25-50KVA	42"	42"	24"	24"	12"
1Ø LOW PROFILE TRANSFORMER 75-167KVA	42"	48"			
1Ø BOX PAD INSTALLATION	57"	57"			
3Ø TWO TRANSFORMER BANK	90"	48"			24"
3Ø 75-750KVA TRANSFORMER	88"	75"			
3Ø 1000-2500KVA TRANSFORMER	102"	100"			

**301.16 ROLL-UP DOORS**

Aluminum Roll-up doors used in conjunction with enclosed meter rooms are to be constructed utilizing minimum 22-gauge slats. Dimensions of roll-up door must provide for a minimum clearance of 12" in width and height greater than the largest piece of equipment being located within the meter room. This is to provide for ease of installation and removal.

Door must be equipped with bottom and guide weather stripping.

A minimum clearance of 12" is required between the face of the service entrance equipment and the door.

The door may be operated either mechanically or electronically. Manual push-up doors are not permitted.

If the door is mechanically operated, the door must be equipped with an indoor mounted chain hoist with a maximum allowable pull tension of ten pounds. A minimum working clearance of 36" square must be provided adjacent to the chain hoist to provide for safe operation.

Room must be equipped with light.

If the door is electrically operated it must have an emergency release device.

Chain hoist and/or electrical control switch for the door must be located so that the door may be operated without the need to cross in front of the SES to operate.

APS lock box to be installed in close proximity to main entry door to meter room.

Owner is responsible for the on-going maintenance to insure continuous proper operation of the door.

**302.0 SPECIAL CONSIDERATIONS**

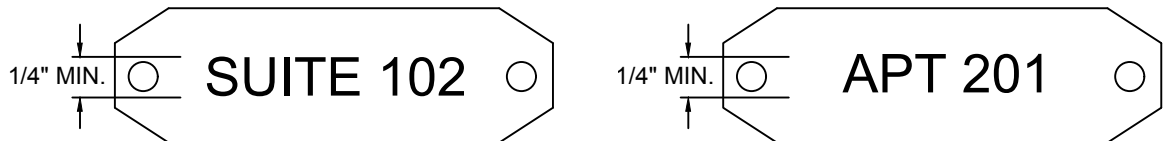
**302.1 METER AND SERVICE LOCATION LABELING IDENTIFICATION BY CUSTOMER**

Where the installation requires more than one meter for service to the premises, then each meter socket and corresponding disconnect shall be permanently (not painted) marked by the customer to properly identify the portion of the premises being served.

When adding a new meter to an existing service location, all meters and corresponding disconnects shall be labeled to properly identify the portion of the premises being served by each meter and corresponding disconnect.

The identification shall be the same as the apartment, townhouse, office, suite, trailer, R.V. space, etc., actually served through the socket and the corresponding disconnect. The identifying marking placed on each meter panel shall be impressed into or raised from a tag of aluminum, brass or other approved non-ferrous metal with minimum 1/4" high letters. The tag shall be riveted to the meter socket panel and corresponding disconnect.

If meters are located in a meter room or cabinet, micarda tags are acceptable. Tags will be black with white letters Minimum 1/4" high letters. Micarda tags shall be riveted to the meter panel. These requirements are intended to prevent the identification(s) from being obscured by painting of the building and attached service equipment.



The Company's meter department may require the assistance of the Customer prior to the setting of the meters in a multi-metered development in order to verify that each meter socket identification coincides with the apartment, townhouse, office, suite, trailer, R.V. space, etc. actually served through the socket.

For all interconnect label requirements, refer to the APS Interconnection Requirements for Distributed Generation at [aps.com/dg](http://aps.com/dg) for specific label verbiage. Go to [aps.com/dg](http://aps.com/dg) and click on Interconnection for the latest copy of this manual, along with several guides, tools, and sample diagrams.

For properties that have multiple buildings sharing the same address, each service section shall be permanently marked with the property address and the building's identification number or letter for which it serves.

EXAMPLE - 123 N MAIN ST BUILDING 1

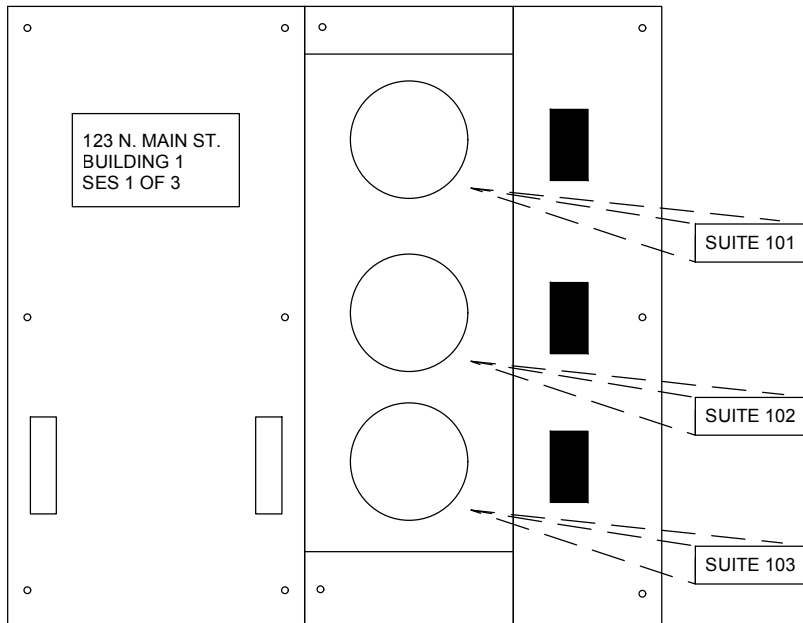
For buildings that have multiple service entrance sections, each service section shall be permanently marked with the property address, along with "1 of x", "2 of x", or "3 of x", etc. where x equals the total number of service sections serving that building.

EXAMPLE - 123 N MAIN ST SES 1 OF 3

For properties that have both multiple buildings and building(s) with multiple service entrance sections, apply all of the aforementioned identification.

**302.1 METER AND SERVICE LOCATION LABELING IDENTIFICATION BY CUSTOMER (CONTINUED)**

EXAMPLE - 123 N MAIN ST BUILDING 1 SES 1 OF 3



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**302.1-1 SERVICE IDENTIFICATION**

All equipment shall be permanently labeled for the specific voltage and current being served.

---

**302.2 METER HEIGHT**

The requirements for meter height, which is the vertical distance between the center line of the meter and the standing surface, shall be as follows:

1. When meters are located in a meter room or enclosed cabinet. 36" min. 75" max.
2. When meters are wall, semi-flush, pedestal, or surface mounted outdoors, but not located in a meter room or enclosed cabinet. 48" min. 75" max.

---

**302.3 MAIN SWITCH**

For each meter installed on a service, the contractor/customer, in compliance with applicable codes, shall furnish and install a fusible switch, a circuit breaker, or other approved disconnecting means which shall control all of and only the energy registered by that meter. The disconnecting means, where permitted by the governing code or ordinance, may consist of a group of fusible switches or circuit breakers. These fuses or circuit breakers must be lockable and designed to interrupt and withstand the available fault current. (See Paragraph 301.13 Main Switch Locations).

In cases where residential all-in-one meter panels are installed with multiple positions for main disconnects, APS requires all positions to be filled with disconnects that are designed to interrupt and withstand the available fault current.

---

### 302.3-1 MULTIPLE SERVICE DISCONNECTS (TWO TO SIX):

Code and Standards: NEC - Article 230.90(A), Exception No. 3  
UL 891 - Table 26 and Section 8.8.1.6.13

Using the Codes and Standards: NEC and UL 891 establish the rules for multiple service disconnects in dead-front switchboard. The following requirements shall be met:

1. Client provides calculations showing that the load does not exceed the sum of the ratings of service disconnects.
2. If the sum of the service disconnects does not exceed the service rating, then the installation is code compliant.
3. However, if the sum of the service disconnects exceeds the service rating, then Exception No. 3 in NEC 230.90 (A) can be used. To apply this exception, provide calculations showing a value below the service rating by utilizing the diversity factors from UL 891 Table 26 shown below.

Note: Exceeding the current rating of the SES after applying the factors in Table 26 of UL 891 will result in a violation of NEC 110.3(B).

*Exception: A UL891 switchboard that has been listed, and marked as "Solar Ready" would have a dedicated disconnect for a photovoltaic back-feed. In this case the disconnect can be excluded from the sum of disconnects. A permanent warning label shall be affixed by the manufacturer next to the disconnect indicating its purpose and that no loads are to be connected.*

Application Examples:

- Specification: 600A SES, with (6) 200A service disconnects  
The sum of the disconnects is 1200A. Apply the 70% factor from Table 26.  
(1200A X .7 = **840A > 600 A**) - **NOT APPROVED!**
- Specification: 600A SES, with (2) 200A & (4) 100A service disconnects  
The sum of the disconnects is 800A. Apply the 70% factor from Table 26.  
(800A X .7 = **560A < 600A**) - **APPROVED!**

Diversity Factors from UL 891, Table 26	
# Service Disconnects	Factor (%)
1	100
2 - 3	80
4 - 6	70

- *Preserving Utility Service Integrity: A separate but related issue arises in cases where a fusible disconnect configuration can physically accommodate a larger fuse ampacity than originally calculated using table 26. Mandating that the fusible disconnect configuration does not have the ability to accommodate a larger fuse ampacity will ensure that the potential for future load additions are limited to the rating of the utility equipment and SES.*

---

**302.4 FOREIGN DEVICES IN SEALABLE CABINETS**

No devices by the Customer shall be installed in or attached to the meter, meter socket, meter cabinet or the metering compartment and pull section area of a service entrance section. Emergency power transfer switches, energy devices, over-current devices, etc., shall be located on the load side and exterior to these metering components.

---

**302.5 METER SOCKET ENCLOSURES**

All socket enclosures shall be of the ring type. The meter socket shall be securely mounted so that its meter jaws are in true horizontal and vertical planes, and will support the meter without tilt in any direction. Gutter connectors (of the Chase nipple-sleeve type) shall not be used on unfused gutters.

Meter enclosures and pull sections shall not be used as junction boxes, raceways, or wireways.

---

**302.6 PROPER INSTALLATION OF COUPLINGS AND GUTTERS**

When entering or leaving service entrance enclosure, an approved method shall be used. Burning of holes in the enclosure or the welding of couplings or fittings in lieu of an approved hub is not permitted or acceptable.

---

**302.7 TERMINATIONS OR LUGS FURNISHED BY APS (Underground)**

APS shall furnish and install compression terminations for connecting APS service conductors to the bus bar in service entrance sections, 400 amp wall hung cabinets and pull boxes with cable terminating facilities when served from underground. See EUSERC DWG #347 in Section 1100 for termination bolt requirements. 200 amps and less - use mechanical terminals supplied by the customer.

---

**302.8 SECURED IN PLACE (S.E.S.)**

All service entrance sections shall be securely fastened to the surface on which it is mounted. Wooden plugs driven into holes in masonry, concrete, plaster, or similar material shall not be used.

---

**302.9 REQUIRED APPROVAL FOR METERING IN SERVICE EQUIPMENT**

Customer shall select from the pre-approved list for all single-phase residential self-contained services. If it is on the pre-approved list, then it is approved for that type of residential service only. If it is not on the list, then it is not approved to be used in APS service territory for self-contained services. Commercial sites require meter enclosures with EUSERC approved test blocks/bypass provisions for all self-contained services 200 Amps and below. All commercial sites above 200 Amps are required to have EUSERC approved CT rated meter enclosures. The following meter enclosures shall be submitted through an APS Representative for review and approval prior to manufacturing of the equipment: residential multi-meter packs not listed on the APS pre-approved list; residential CT rated enclosures; and all commercial meter enclosures. Customer shall coordinate through the APS Control Desk @ [APS Contact Map](#) for new service or service upgrades (also see ESRM 200.2-1 and 200.2-2).

Drawing submittal shall include: engineering and manufacturer one-lines showing location of neutral to ground bond link and neutral disconnecting means, switchboard manufacturer (name), EUSERC page references that are applicable, ampacity of switchboard, physical dimensions, voltage, phase, bus bracing (AIC rating), how many service disconnects (which all are required to have padlockable provisions), accurate address (street and number), etc.

In addition to the above equipment submittal requirements, a separate application is required for review and approval when this equipment includes any connections or provisions for any existing or proposed inverters or generators. Contact an APS Representative and review the guides and resources available @ [APS Interconnection](#) page. Begin the APS Interconnection Application Process @ [APS PowerClerk](#) login. Refer to ESRM 104.11 – 104.12-2 for additional information on backup generation.

**302.10 EUSERC - ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE**

Switchboard service sections and bus duct risers approved for use in the area served by APS are built to the standards developed by the Electric Utility Service Equipment Requirements Committee, and are available to the customer through electric wholesale distributors (See Section 1100).

---

**302.11 SERVICE ENTRANCE SECTION**

A standard service entrance section is a free-standing piece of equipment which contains bussing for the termination of service entrance conductors, bussing for the connection and mounting of current transformers, panels for the installation of the test switch and meter socket, a service main disconnect switch or breaker, and in many cases, distribution feeder breakers or switches.

The standard service entrance section is usually built to serve the Customer with heavy electrical supply needs, and is available with service main switch or breaker ratings from 200 amperes through 3000 amperes. For sections above 3000 amperes consult APS.

Standards for service entrance section have also been developed for self-contained meters, both residential and non-residential, and with either standard duty or heavy-duty sockets. This equipment is built on special order to meet the needs of the Customer's service.

---

**302.12 OVERHEAD RISER AND BUS DUCT RISER REQUIREMENTS**

Maximum number of conductors per phase shall be two (2); all service entrance conductor requirements exceeding 2-750 MCM conductors per phase shall be bus bar construction. All bus bar cabinets shall be constructed in accordance with Electric Utility Service Equipment Requirements (EUSERC). For address of Electric Meter Section, see Paragraph 302.9. For bus-way service head requirements, see EUSERC DWG. 349 in Section 1100. (See also Section 400, paragraph 400.3). The customer shall submit drawings and information to APS for review and approval in accordance with the submittal requirements described in ESRM 302.9.

---

**302.13 (RESERVED)**

---

**302.14 METER TYPES USED ON APS SYSTEM**

Direct Access meters shall have a visual kWh display and must have a physical interface to enable site interrogation of all stored meter data. All meters installed must support the Customer's APS rate tariff.

<u>FORM NUMBERS</u>	<u>DESCRIPTION</u>
1S	Single phase, 2 wire, Self-contained
2S	Single phase, 3 wire, Self-contained
3S	Single phase, 2 wire, 5 terminal, Transformer rated
5S*	Single phase, 3 wire, 6 terminal, Transformer rated
5S	Three phase, 3 wire, 8 terminal, Transformer rated
6S	Three phase, 4 wire Wye, 2 1/2 element, Transformer rated
8S	Three phase, 4 wire Delta, Transformer rated
9S	Three phase, 4 wire Wye, 13 terminal, Transformer rated
12S	Network, Three phase, 3 wire, 5 terminal, Self-contained
14S	Three phase, 4 wire Wye, 2 1/2 element, Self-contained
15S	Three phase, 4 wire Delta, Self-contained
16S	Three phase, 4 wire Wye, 3 element, Self-contained

\* = 5S for new installations - 4S for Maintenance Only



**303.0 SELF CONTAINED METERING**

---

**303.1 EQUIPMENT FURNISHED AND INSTALLED BY APS - STANDARD OFFER CUSTOMERS ONLY**

1. All meters and metering equipment required for billing purposes.
  2. Sealing rings and seals.
- 

**303.2 EQUIPMENT FURNISHED AND INSTALLED BY THE CUSTOMER**

1. Meter sockets.
  2. Multiple meter panels and prefabricated panels.
  3. Meter enclosures.
  4. Service entrance switchboards.
  5. Safety test blocks.
  6. Proper bonding and grounding.
- 

**303.3 SELF-CONTAINED SOCKET RATINGS**

<b>TYPE OF SERVICE</b>	<b>SIZE OF SERVICE ENTRANCE</b>	<b>SOCKET RATINGS</b>
Residential	All sockets shall have a maximum ampere rating not less than the ampacity of the main service switch (Maximum ampere rating of socket being 125% of continuous duty rating).	
Non-residential & Industrial	Up to 100 amp	100 amp Continuous
Non-residential & Industrial	101-200 amp	200 amp Continuous
Irrigation (277/480)	Up to 100 amp (Up to & including 75 HP)	100 amp Continuous
Irrigation (277/480)	101-200 amp (Up to & including 75 HP)	200 amp Continuous

In addition, self-contained sockets shall conform to the following requirements:

1. Dimensions and construction for sockets and enclosures shall comply with ANSI C12.7 standard for watt-hour meters, and UL 414 standard.
  2. Line and load terminals shall be compatible with either copper or aluminum wire.
  3. Terminals shall be of sufficient size as to permit insertion of maximum specified wire without removing any strands.
  4. The socket jaw or clip shall be of beryllium copper alloy or equivalent.
  5. The socket jaw or clips shall be clean. Foreign material (such as paint, mud, etc.) shall be removed by customer prior to APS installing service or meter.
- 

**303.4 SOCKET ENCLOSURES**

All socket enclosures shall be of the "ring-type."

---

**303.5 METER SOCKET CLOSING DEVICES**

Meter sockets shall not be equipped with circuit closing or bypass devices which automatically close when the meter is removed from the socket.

---



**303.6 SAFETY TEST BLOCKS**

**APS RESERVES THE RIGHT TO REQUIRE SAFETY TEST BLOCKS BE INSTALLED IN THE EVENT AN EXISTING SERVICE NO LONGER MEETS THE FOLLOWING REQUIREMENTS.**

---

**303.6-1 SINGLE-PHASE SAFETY TEST BLOCK INSTALLATIONS**

All single-phase non-residential services with self-contained meter installations shall require safety test blocks be furnished by the Customer. Reference Section 1100, Drawings 304,305 and 306.

Locations that do not have safety test blocks are subject to service interruptions for meter maintenance without prior notification.

**Locations where safety test blocks are not required:**

1. \* House meters on residential apartment complexes that serve non-essential loads.
2. Non-computerized sign boards.
3. Sprinkler controls.
4. Single-phase temporary construction services (when 400Amps are needed a CT-Current Transformer rated panel will be required).
5. Parking lot lighting services.
6. Barns.
7. Domestic wells serving individual or multifamily water supply so long as they are not a water company.
8. Residential hobby shops.
9. CATV rectifiers and dryers.
10. Gas Company cathodic protection sites.
11. Non-computerized gates to residential communities.
12. Generating Facility (GF) Production Metering (see 303.6-3 for additional details).

\* When a single phase socket (typically within a multi-pack) at a multi-family residential complex is designated as a "house meter", it will be intended to serve the common area's power needs. The house meter is not intended to serve essential loads (e.g. sales offices, pool equipment, security, common laundry facilities), thus not requiring safety test blocks.

---

**303.6-2 THREE-PHASE SAFETY TEST BLOCK INSTALLATIONS**

**Safety test blocks shall be required on all three-phase self-contained installations except for Generating Facility (GF) Production Metering as noted in section 303.6-3.**

---

**303.6-3 GENERATING FACILITY (GF) PRODUCTION METERING APPLICATIONS**

Safety Test Blocks are not required to be installed at Customer Installed Production Metering specified in Section 9.0 ("Metering Requirements") of the APS document entitled "Interconnection Requirements for Distributed Generation" for Customer Owned Generation (Reference section 104.11). The Customer shall install an isolation device(s) (i.e. Utility Disconnect Switch (on the Line side of the Production Meter to isolate/remove all voltage and current from the meter. This isolation device shall meet all the requirements of Section 8.2 ("Disconnect Switch") of the APS document entitled "Interconnection Requirements for Distributed Generation." (Reference Section 104.12.2).

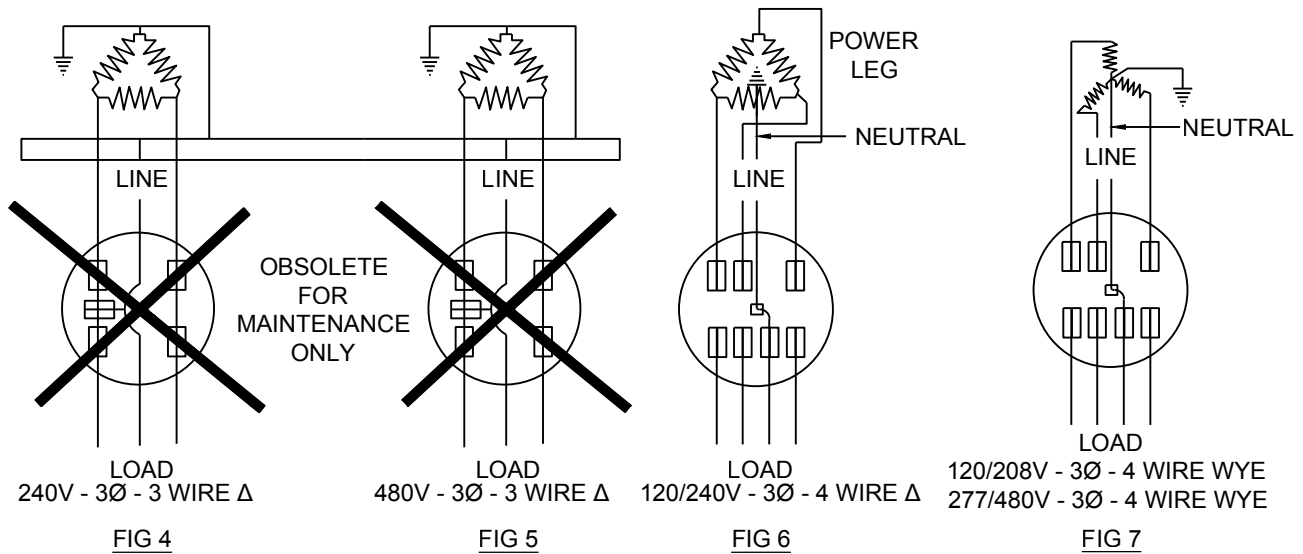
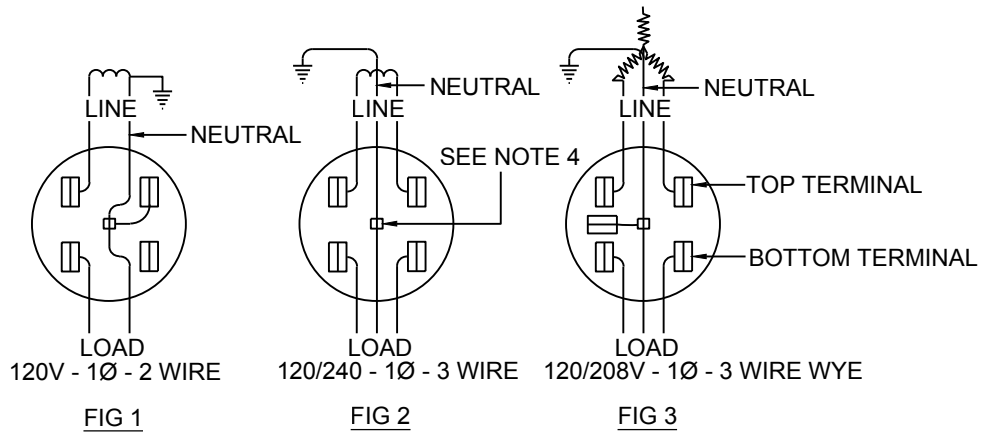
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**303.7 HIGH LEG LOCATION (3Ø 4W DELTA SERVICE)**

Self-contained Meter Sockets: wiring to self-contained meter sockets, whether individual sockets or in multiple meter panel boards, shall have the power phase or "high leg" to ground, in the right hand socket terminals. Identification of "high leg" shall be by an outer finish that is orange in color or permanent tagging. This identification shall be placed at all points where a connection is made or will be made, including leads where service will be connected. Refer to 304.3 for CT rated equipment.







**FRONT VIEWS SHOWN  
EUSERC DWG #G1**

**NOTES:**

1. SOCKETS FOR NON-RESIDENTIAL INSTALLATIONS SHALL BE EQUIPPED WITH TEST-BYPASS FACILITIES WHEN REQUIRED BY THE SERVING AGENCY.
2. LINE CONDUCTORS SHALL BE CONNECTED TO THE TOP TERMINALS OF SOCKET AND LOAD CONDUCTORS CONNECTED TO THE BOTTOM TERMINALS OF THE SOCKET.
3. POTENTIAL TAPS, INCLUDING THE NEUTRAL TAP, SHALL BE LOCATED BEHIND SEALED PANELS.
4. CLAMPED OR BOLTED CONNECTIONS IN METERING EQUIPMENT ENCLOSURES SHALL BE PERMITTED, INCLUDING THE NEUTRAL CONNECTION.
5. SEE PARAGRAPH 304.2-1 FOR CT METER SOCKETS

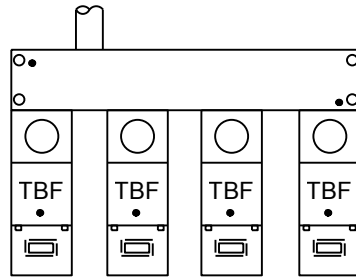


FIG. 1  
COMMERCIAL

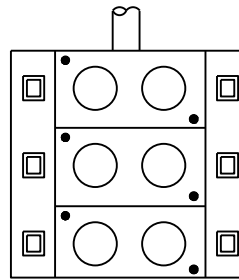


FIG. 2  
RESIDENTIAL

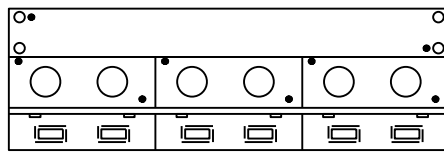


FIG. 3  
RESIDENTIAL

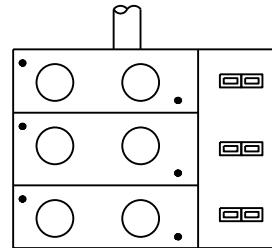


FIG. 4  
RESIDENTIAL

OVERHEAD INSTALLATIONS

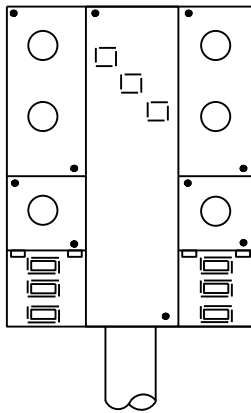


FIG. 5  
RESIDENTIAL

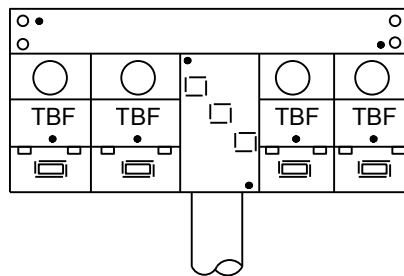


FIG. 6  
COMMERCIAL

UNDERGROUND INSTALLATIONS

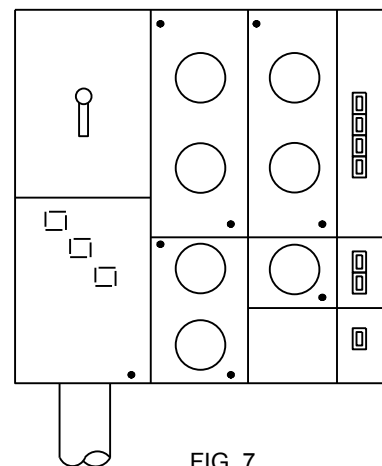
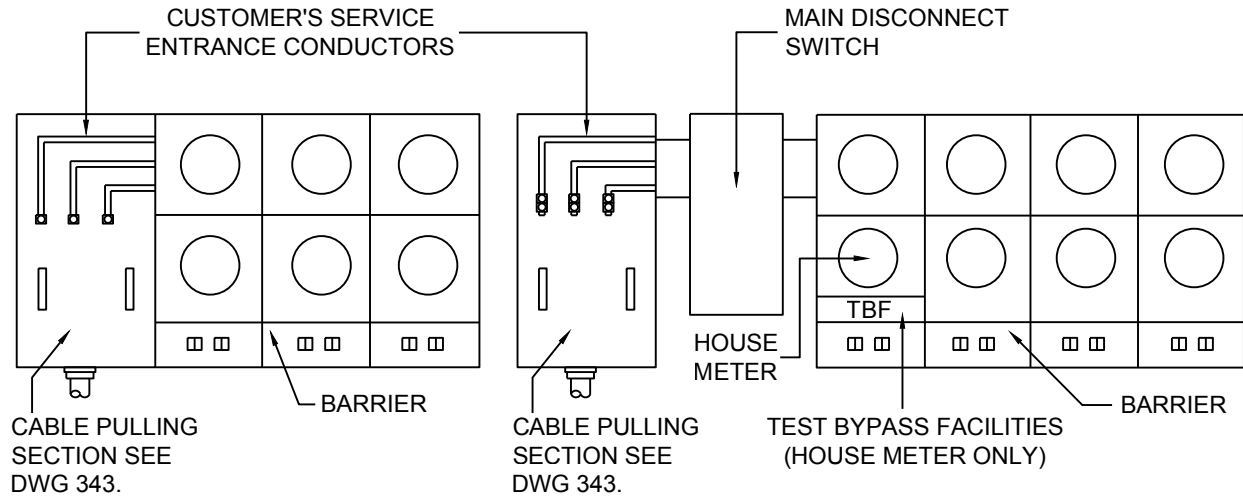


FIG. 7  
RESIDENTIAL

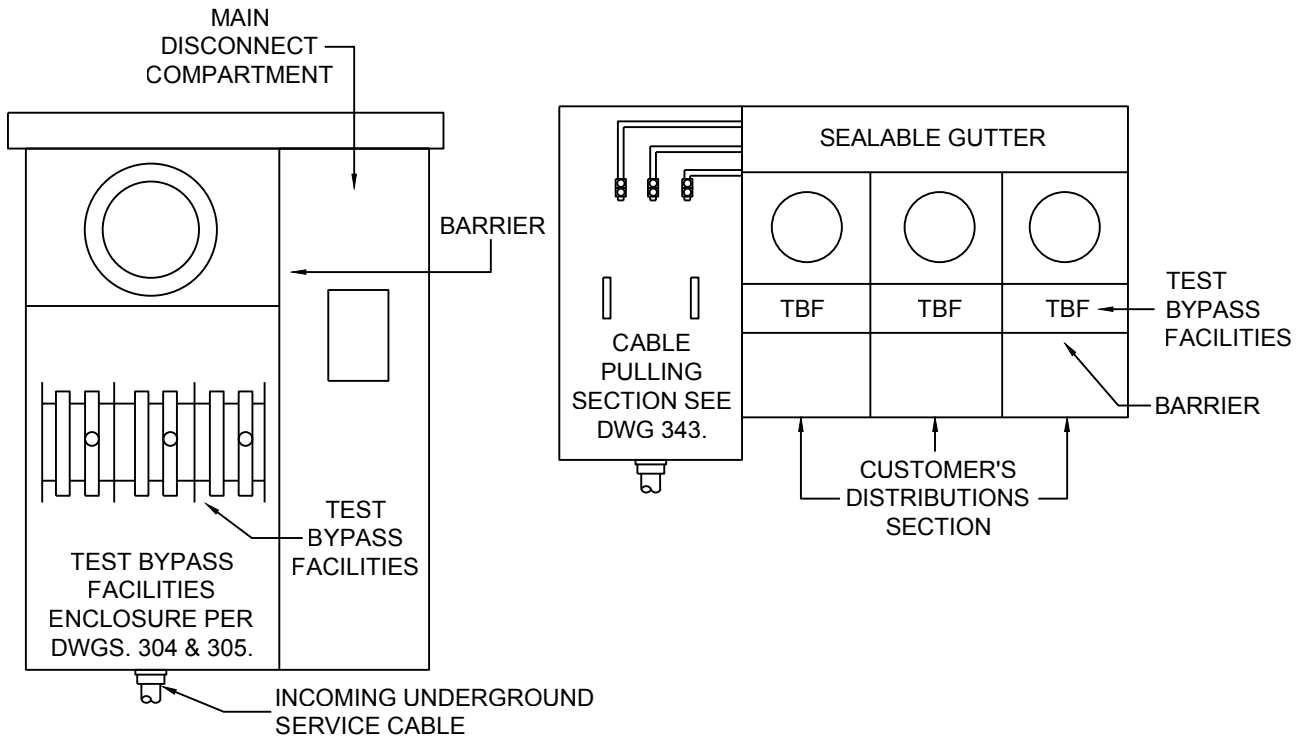
TBF = TEST BLOCK FACILITIES

EUSERC DWG #G2

303.10 INSTALLATION GUIDE DRAWING TYPICAL UNDERGROUND SERVICE TERMINATION ARRANGMENTS - DWG #G3



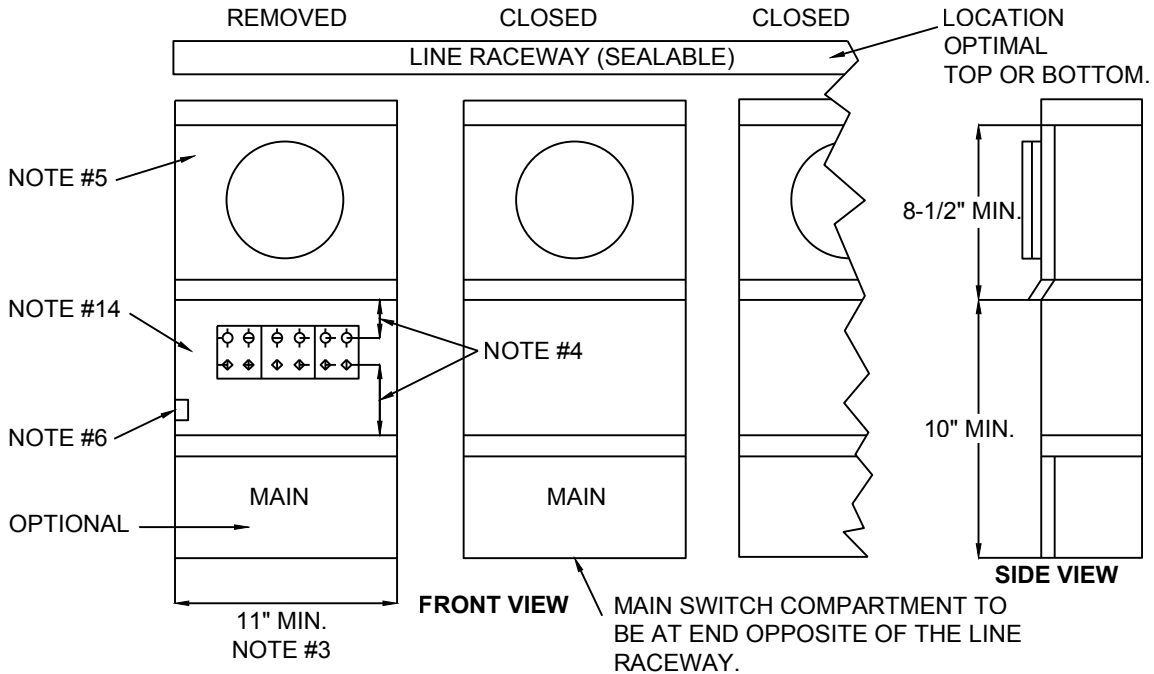
**FIG. 1** TYPICAL COMBINATION SERVICE TERMINATION ENCLOSURE AND METER SOCKET PANELS FOR MULTI-UNIT RESIDENTIAL USE.



**FIG. 2** TYPICAL SERVICE TERMINATION ENCLOSURE COMBINATION METER SOCKET PANEL COMMERCIAL USE.

EUSERC DWG #G3

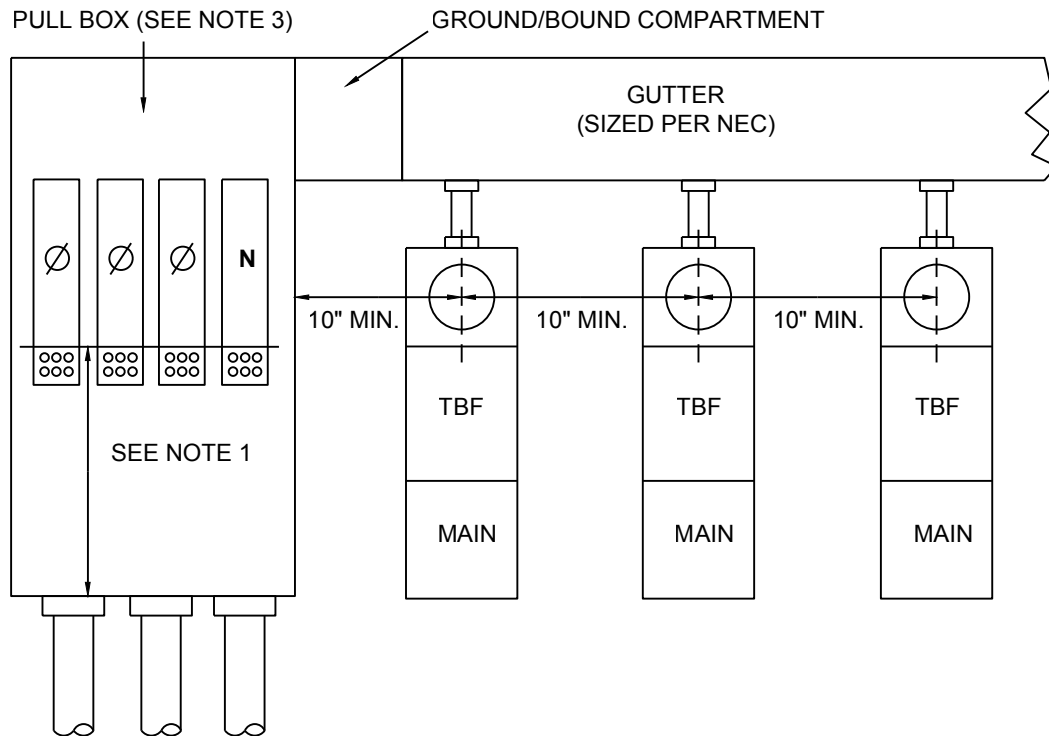
**303.11 SAFETY - SOCKET BOX WITH TEST BY-PASS FACILITIES FOR MULTIPLE SELF-CONTAINED METER INSTALLATIONS 0 - 200 AMPS, 0 - 600 VOLTS**



EUSERC DWG #G4  
ALL DIMENSIONS SHOWN ARE IN INCHES

1. THIS DEVICE MAY BE USED FOR MULTIPLE NON-RESIDENTIAL AND INDUSTRIAL METER INSTALLATIONS MOUNTED IN A GANGED ARRAY.
2. TEST-BYPASS BLOCKS WITH RIGID INSULATING BARRIERS SHALL BE INSTALLED AND WIRED OR BUSSED TO A LINE RACEWAY AND ALSO WIRED OR BUSSED TO THE METER SOCKET THEN TO THE MAIN SWITCH BY THE MANUFACTURER. BLOCKS AND BARRIERS SHALL CONFORM TO EUSERC DRAWING 312 REQUIREMENTS WITH PHYSICAL ARRANGEMENT CONFORMING TO DRAWINGS 304 AND 305. CONNECTIONS SEQUENCE IS LINE-LOAD, LINE LOAD, LINE LOAD FROM LEFT TO RIGHT.
3. MINIMUM ACCESS OPENING TO TEST-BYPASS BLOCK SHALL BE 11' X 10"
4. THREE INCHES MINIMUM CLEARANCE REQUIRED FOR UTILITY TEST PURPOSES.
5. ALL SECTION COVERS SHALL BE INDEPENDENTLY REMOVABLE. UPPER COVER SHALL BE NON-REMOVABLE WHEN METER IS IN PLACE. METER SOCKET SHALL BE MOUNTED ON SUPPORT AND ATTACHED TO PANEL. TEST BY-PASS COVER SHALL BE SEALABLE AND PERMANENTLY LABELED: "DO NOT BREAK SEAL. NO FUSES INSIDE".
6. WHEN A NEUTRAL IS REQUIRED FOR METERING OR TESTING, AN INSULATED NEUTRAL TERMINAL, MOUNTED ON EITHER SIDE, SHALL BE PROVIDED BEHIND EACH TEST-BYPASS COVER PANEL. THE TERMINAL SHALL BE READILY ACCESSIBLE WHEN THE COVER PANEL IS REMOVED AND SHALL BE INDIVIDUALLY CONNECTED TO THE NEUTRAL BUS WITH A MINIMUM OF NO. 8 COPPER WIRE.
7. FOR 3Ø, 4 WIRE. CONNECT 7TH JAW TO BODY OF NEUTRAL LUG WITH NO. 12 MINIMUM COPPER WIRE.
8. FOR 3Ø, 4 WIRE DELTA, IDENTIFY THE RIGHT HAND TEST-BYPASS BLOCK.
9. FOR 3Ø, 3 WIRE. INSTALL BUS TO CONNECT LINE AND LOAD POLES TOGETHER AT TOP OF CENTER TEST-BYPASS BLOCK AND CONNECT 5TH JAW TO THIS BUS USING NO. 12 MINIMUM COPPER WIRE.
10. FOR 1Ø, 3 WIRE, OMIT CENTER TEST-BYPASS BLOCK.
11. FOR 1Ø, 3 WIRE, 120/208 VOLTS, OMIT CENTER TEST-BYPASS BLOCK. CONNECT 5TH JAW TO BODY OF NEUTRAL LUG WITH NO. 12 MINIMUM COPPER WIRE.
12. PERMANENT LINE-LOAD LABELS ON INSIDE BACK OF ENCLOSURE IN 3/4" (MIN.) HIGH BLOCK LETTERS.
13. MINIMUM DEPTH SHALL BE 4 1/2" INCHES FOR 0 - 100 AMPS AND 6 INCHES FOR 101 - 200 AMPS
14. SEE EUSERC DRAWING 343 FOR PULL BOX DETAILS WHEN USED ON UNDERGROUND SERVICE

303.12 MULTIPLE METERING & SERVICE FOR SPEC. BLDGS. - 1200 AMP MAX

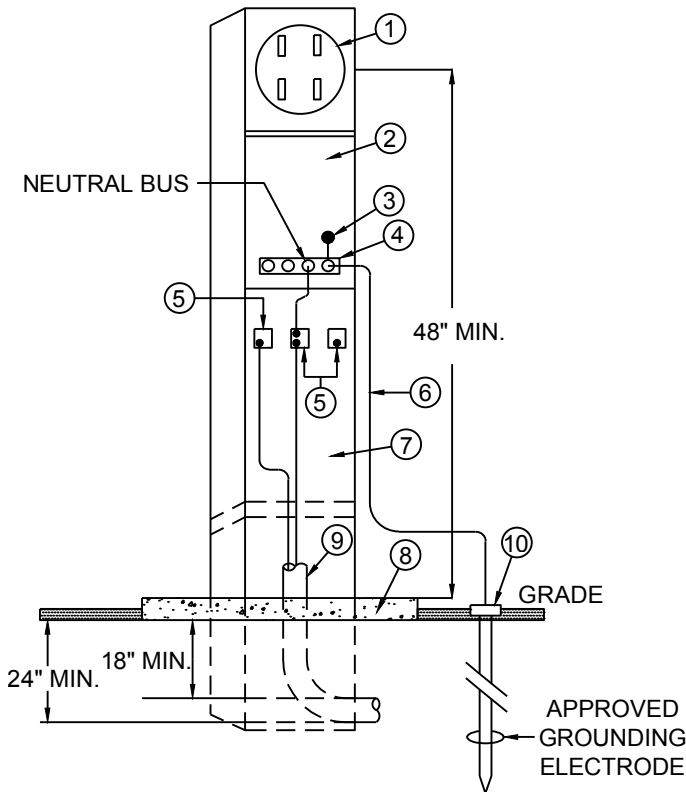


**TBF = TEST BLOCK FACILITIES**

NOTES:

1. THIS AREA OF PULL BOX FOR APS SERVICE CONDUCTORS. PULL BOX AND GUTTER COVERS TO BE SEALABLE.
2. A MINIMUM OF ONE (1) METER MUST BE INSTALLED AT THE TIME SERVICE IS ENERGIZED.
3. PULL BOX TO BE ACCORDING TO EUSERC DWG. 343.
4. CUSTOMER SHALL INSTALL EACH SET OF SERVICE CONDUCTORS FROM PULL BOX THROUGH GUTTER TO EACH METER. SIZE TO BE PER NEC REQUIREMENTS.
5. SEE SECTION 700 FOR GROUNDING AND BONDING REQUIREMENTS
6. SEE EUSERC DWGS. 304, 305 AND G4 FOR METER CAN REQUIREMENTS.
7. MAIN DISCONNECT REQUIRED TO BE ADJACENT TO THE METER (SEE PARAGRAPH 301.13). OPTIONAL FACTORY INSTALLED MAIN IS SHOWN.

**303.13 MOBILE HOME AND TEMPORARY METER PEDESTAL - 1Ø 3W 120/240 VOLT**



THIS IS A LIST OF MATERIAL FOR A NORMAL METER PEDESTAL INSTALLATION. IT IS NOT INTENDED TO BE ALL INCLUSIVE BUT GIVES THE MORE COMMON REQUIREMENTS. ALL EQUIPMENT SHALL COMPLY WITH EUSERC REQUIREMENTS (SEE SECTION 1100, DWG. 307) AND SECTION 500, PARAGRAPH 506.6-1, 2.

- 1.) METER SOCKET, BREAKER COMPARTMENT AND PULL SECTION MUST BE RAIN TIGHT EQUIPMENT. METER SOCKET JAWS OR CLIPS SHALL BE FREE OF FOREIGN MATERIAL (MUD, PAINT, PLASTER, ETC.). RINGLESS METER SOCKETS ARE NOT ACCEPTABLE.
- 2.) BREAKER COMPARTMENT.
- 3.) PEDESTAL BOND LUG. MAY BE A BOND SCREW IN SOME MODELS.
- 4.) CUSTOMER'S NEUTRAL LANDING BLOCK.
- 5.) SERVICE TERMINATION LUGS SHALL BE TWIN #2 TO #350 MCM ALUMINUM BODIED PRESSURE TYPE FOR IN AND OUT CONNECTION OF THE SERVICE CONDUCTORS.
- 6.) THE GROUND WIRE (#4 BARE COPPER) SHALL BE CONTINUOUS FROM THE NEUTRAL LANDING BLOCK IN THE BREAKER COMPARTMENT TO A GROUNDING ELECTRODE SYSTEM IN COMPLIANCE WITH NEC (CHECK WITH AHJ). THE GROUND WIRE MUST BE PROPERLY SUPPORTED AND ATTACHED TO THE OUTSIDE OF THE PEDESTAL AT 24" INTERVALS. WHEN ATTACHING THE GROUND WIRE TO THE PEDESTAL, THE METHOD OF ATTACHMENT SHALL NOT RESULT IN SHARP PROJECTIONS, SUCH AS METAL SCREWS INTO THE WIREWAY BELOW THE NEUTRAL LANDING BLOCK. SEE ILLUSTRATION AT LEFT FOR PREFERRED METHOD OF INSTALLING THE GROUND ELECTRODE CONDUCTOR.
- 7.) ACCESS TO UTILITY PULL SECTION SHALL NOT BE BLOCKED IN ANY MANNER. PULL SECTION SHALL BE SEALABLE. NO CUSTOMER WIRING OR EQUIPMENT IS ALLOWED IN THIS AREA.
- 8.) POURED CONCRETE SLAB SHALL BE 24" X 24" MINIMUM SIZE AND HAVE A 3 1/2" MINIMUM THICKNESS.
- 9.) PROVIDE AND INSTALL 2 1/2" CONDUIT(S) WITH 24" SWEEP(S). CONDUIT TO EXTEND A MINIMUM OF 1" AND A MAXIMUM OF 2" ABOVE THE CONCRETE SLAB. CONDUIT SYSTEM SHALL BE CUSTOMER INSTALLED PER APS SPECIFICATIONS TO A LOCATION DETERMINED BY AN APS REPRESENTATIVE.
- 10) APPROVED GROUND ELECTRODE CLAMP SHALL BE BURIED, FLUSH OR SOMEHOW PROTECTED FROM PHYSICAL DAMAGE. CLAMP SHALL BE DESIGNED FOR UNDERGROUND USE. GROUND ROD SHALL NOT BE INSTALLED IN OR BENEATH THE CONCRETE SLAB.

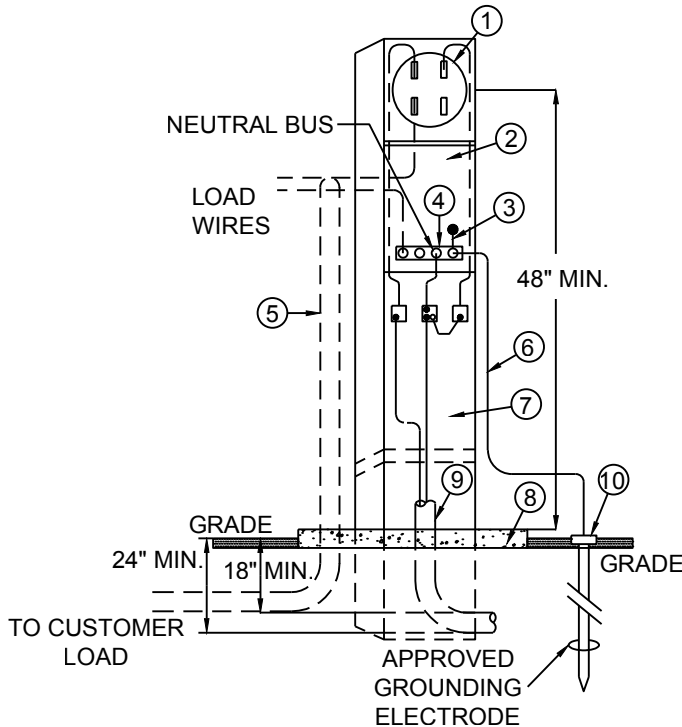
**GENERAL NOTES:**

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1. METER LOCATION TO BE SPECIFIED BY AN APS REPRESENTATIVE.</li> <li>2. PEDESTAL SHALL BE UL LISTED (AS EQUIPMENT SUITABLE FOR USE AS SERVICE EQUIPMENT) AND EUSERC APPROVED. THAT PORTION OF PEDESTAL BURIED IN CONCRETE AND EARTH SHALL BE COATED WITH AN APPROVED CORROSION RESISTANT MATERIAL SUCH AS ZINC, CADMIUM, OR ENAMEL TO WITHSTAND DETERIORATION.</li> <li>3. PEDESTAL AND METER SHALL HAVE A MINIMUM RATING OF 100 AMPS.</li> <li>4. PEDESTAL AND POWER OUTLET SECTION SHALL BE RATED 10,000 AIC MINIMUM.</li> <li>5. THE SOCKET SHALL BE FACTORY-WIRED WITH THE CONDUCTORS IN A SEPARATE OR BARRIERED WIREWAY FROM THE SERVICE TERMINATION LUGS TO THE METER SOCKET. THE CONDUCTORS WHICH EXTEND TO THE METER SOCKET SHALL BE CONNECTED AT THE SERVICE TERMINATION LUGS INDEPENDENT OF THE CONNECTIONS FOR THE SERVICE LATERAL CONDUCTORS.</li> </ol> | <ol style="list-style-type: none"> <li>6. SERVICE CABLE PULL AND TERMINATION SECTION SHALL BE COVERED WITH A SEALABLE, REMOVABLE PANEL, EXTENDING FROM AT LEAST 2" TO 6" ABOVE THE CONCRETE PAD AND WHEN REMOVED GIVE FULL ACCESS TO THE SERVICE TERMINATION LUGS.</li> <li>7. THE PEDESTAL AT GRADE LINE SHALL HAVE A MINIMUM CROSS-SECTIONAL DIMENSION OF 4" X 8". THE FIXED PANEL FOR THE FINAL GRADE AND CONCRETE POURS SHALL EXTEND 2" TO 6" ABOVE GRADE AND A MINIMUM OF 18" BELOW GRADE. THE PEDESTAL SHALL EXTEND 24" BELOW GRADE.</li> <li>8. THE CUSTOMER SHALL BE RESPONSIBLE FOR THE FINAL GRADE OF THE UTILITY ISLAND AND THE INCLUDED METER PEDESTAL.</li> <li>9. MINIMUM METER HEIGHT SHALL BE 48".</li> <li>10. SEE SECTION 500, PAGES 15, 16 AND 17 FOR FURTHER REQUIREMENTS.</li> </ol> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**303.14 120 VOLT 1Ø 2 WIRE METER PEDESTAL**

THE TOTAL AMPACITY OF THE BREAKERS IS NOT TO EXCEED 30 AMP, WITH NO MORE THAN TWO BREAKERS

THIS IS A LIST OF MATERIAL FOR A NORMAL METER PEDESTAL INSTALLATION. IT IS NOT INTENDED TO BE ALL INCLUSIVE BUT GIVES THE MORE COMMON REQUIREMENTS. ALL EQUIPMENT SHALL COMPLY WITH EUSERC REQUIREMENTS (SEE SECTION 1100, DWG. 307) AND SECTION 500, PARAGRAPH 506.6-1, 2.



- 1.) METER SOCKET, BREAKER COMPARTMENT AND PULL SECTION MUST BE RAIN TIGHT EQUIPMENT. METER SOCKET JAWS OR CLIPS SHALL BE FREE OF FOREIGN MATERIAL (MUD, PAINT, PLASTER, ETC.). RINGLESS METER SOCKETS ARE NOT ACCEPTABLE.
- 2.) BREAKER COMPARTMENT.
- 3.) PEDESTAL BOND LUG. MAY BE A BOND SCREW IN SOME MODELS.
- 4.) CUSTOMER'S NEUTRAL LANDING BLOCK.
- 5.) LOAD CONDUCTORS SHALL NOT BE RUN THROUGH UTILITY SERVICE CABLE PULL AND TERMINATION SECTION. METALLIC CONDUIT SHALL BE WRAPPED OR COATED PER PARAGRAPH 4.1-4 IN SECTION 500.
- 6.) THE GROUND WIRE (#4 BARE COPPER) SHALL BE CONTINUOUS FROM THE NEUTRAL LANDING BLOCK IN THE BREAKER COMPARTMENT TO A GROUNDING ELECTRODE SYSTEM IN COMPLIANCE WITH NEC (CHECK WITH AHJ). THE GROUND WIRE MUST BE PROPERLY SUPPORTED AND ATTACHED TO THE OUTSIDE OF THE PEDESTAL AT 24" INTERVALS. WHEN ATTACHING THE GROUND WIRE TO THE PEDESTAL, THE METHOD OF ATTACHMENT SHALL NOT RESULT IN SHARP PROJECTIONS, SUCH AS METAL SCREWS INTO THE WIREWAY BELOW THE NEUTRAL LANDING BLOCK. SEE ILLUSTRATION AT LEFT FOR PREFERRED METHOD OF INSTALLING THE GROUND ELECTRODE CONDUCTOR.
- 7.) ACCESS TO UTILITY PULL SECTION SHALL NOT BE BLOCKED IN ANY MANNER. PULL SECTION SHALL BE SEALABLE. NO CUSTOMER WIRING OR EQUIPMENT IS ALLOWED IN THIS AREA.
- 8.) POURED CONCRETE SLAB SHALL BE 24" X 24" MINIMUM SIZE AND HAVE A 3 1/2" MINIMUM THICKNESS.

- 9.) PROVIDE AND INSTALL 2 1/2" CONDUIT(S) WITH 24" SWEEP(S). CONSULT AN APS REPRESENTATIVE TO DETERMINE IF SERVICE WILL BE RADIAL OR CASCADED. CONDUIT TO EXTEND A MINIMUM OF 1" AND A MAXIMUM OF 2" ABOVE THE CONCRETE SLAB. CONDUIT SYSTEM SHALL BE CUSTOMER INSTALLED PER APS SPECIFICATIONS TO A LOCATION DETERMINED BY AN APS REPRESENTATIVE.
- 10) APPROVED GROUND ELECTRODE CLAMP SHALL BE BURIED, FLUSH OR SOMEHOW PROTECTED FROM PHYSICAL DAMAGE. CLAMP SHALL BE DESIGNED FOR UNDERGROUND USE. GROUND ROD SHALL NOT BE INSTALLED IN OR BENEATH THE CONCRETE SLAB.

**GENERAL NOTES:**

1. METER LOCATION TO BE SPECIFIED BY AN APS REPRESENTATIVE.
2. PEDESTAL SHALL BE UL LISTED (AS EQUIPMENT SUITABLE FOR USE AS SERVICE EQUIPMENT) AND EUSERC APPROVED. THAT PORTION OF PEDESTAL BURIED IN CONCRETE AND EARTH SHALL BE COATED WITH AN APPROVED CORROSION RESISTANT MATERIAL SUCH AS ZINC, CADMIUM, OR ENAMEL TO WITHSTAND DETERIORATION.
3. PEDESTAL AND METER SHALL HAVE A MINIMUM RATING OF 100 AMPS.
4. PEDESTAL AND POWER OUTLET SECTION SHALL BE RATED 10,000 AIC MINIMUM.
5. THE SOCKET SHALL BE FACTORY-WIRED WITH THE CONDUCTORS IN A SEPARATE OR BARRIERED WIREWAY FROM THE SERVICE TERMINATION LUGS TO THE METER SOCKET. THE CONDUCTORS WHICH EXTEND TO THE METER SOCKET SHALL BE CONNECTED AT THE SERVICE TERMINATION LUGS INDEPENDENT OF THE CONNECTIONS FOR THE SERVICE LATERAL CONDUCTORS.
6. SERVICE CABLE PULL AND TERMINATION SECTION SHALL BE COVERED WITH A SEALABLE, REMOVABLE PANEL, EXTENDING FROM AT LEAST 2" TO 6" ABOVE THE CONCRETE PAD AND WHEN REMOVED GIVE FULL ACCESS TO THE SERVICE TERMINATION LUGS.
7. THE PEDESTAL AT GRADE LINE SHALL HAVE A MINIMUM CROSS-SECTIONAL DIMENSION OF 4" X 8". THE FIXED PANEL FOR THE FINAL GRADE AND CONCRETE POURS SHALL EXTEND 2" TO 6" ABOVE GRADE AND A MINIMUM OF 18" BELOW GRADE. THE PEDESTAL SHALL EXTEND 24" BELOW GRADE.
8. THE CUSTOMER SHALL BE RESPONSIBLE FOR THE FINAL GRADE OF THE UTILITY ISLAND AND THE INCLUDED METER PEDESTAL.
9. MINIMUM METER HEIGHT SHALL BE 48".

**304.0 C.T. METERING**

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**304.1 EQUIPMENT FURNISHED AND INSTALLED BY APS STANDARD OFFER CUSTOMERS ONLY**

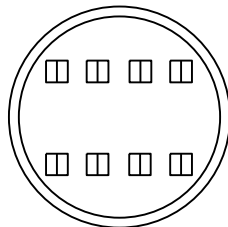
1. All meters and metering equipment required for billing purposes.
  2. Sealing rings and seals.
  3. Instrument transformers for metering.
  4. Test Switches.
  5. Secondary wiring to the meter sockets and the C.T.s.
  6. Meters and metering equipment for Direct Access Customers are supplied by the EPS, MSP or Customer and installed by the EPS, MSP.
- 

**304.2 EQUIPMENT FURNISHED AND INSTALLED BY CUSTOMER**

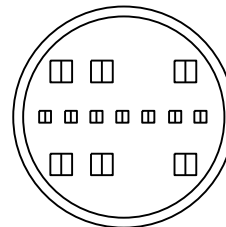
- a. Transformer rated meter sockets (See paragraph 304.2-1 for socket configuration).
  - b. Pre-fabricated panels.
  - c. Meter enclosures; refer to EUSERC drawings (1100 Section).
  - d. Service entrance sections.
  - e. Perches for test switches.
  - f. Metering transformer cabinets.
  - g. Proper grounding and bonding.
- 

**304.2-1 C.T. METER SOCKETS (See Section 300 Paragraph 303.8 for self-contained meter sockets)**

**FRONT VIEWS SHOWN**



**FIGURE 1  
8 JAW SOCKET  
120/240V 1Ø 3 WIRE**



**FIGURE 2  
13 JAW SOCKET  
120/208V 3Ø 4 WIRE  
277/480V 3Ø 4 WIRE  
120/240V 3Ø 4 WIRE**

(SEE SECTION 1100, EUSERC DWG. 332 FOR METER PANEL DRILLING & TAPPING SPECIFICATIONS)

---

**304.3 POWER LEG LOCATION (3Ø 4W DELTA SERVICE)**

The C or right phase is preferred for the power phase, or “high leg” to ground. The B or center phase may be used as the power phase but in either case the conductor having the higher voltage to ground shall be identified by an outer finish that is orange in color or permanent tagging. This identification shall be placed at all points where a connection is made or will be made (including leads where service will be connected). Refer to 303.7 for self-contained equipment.

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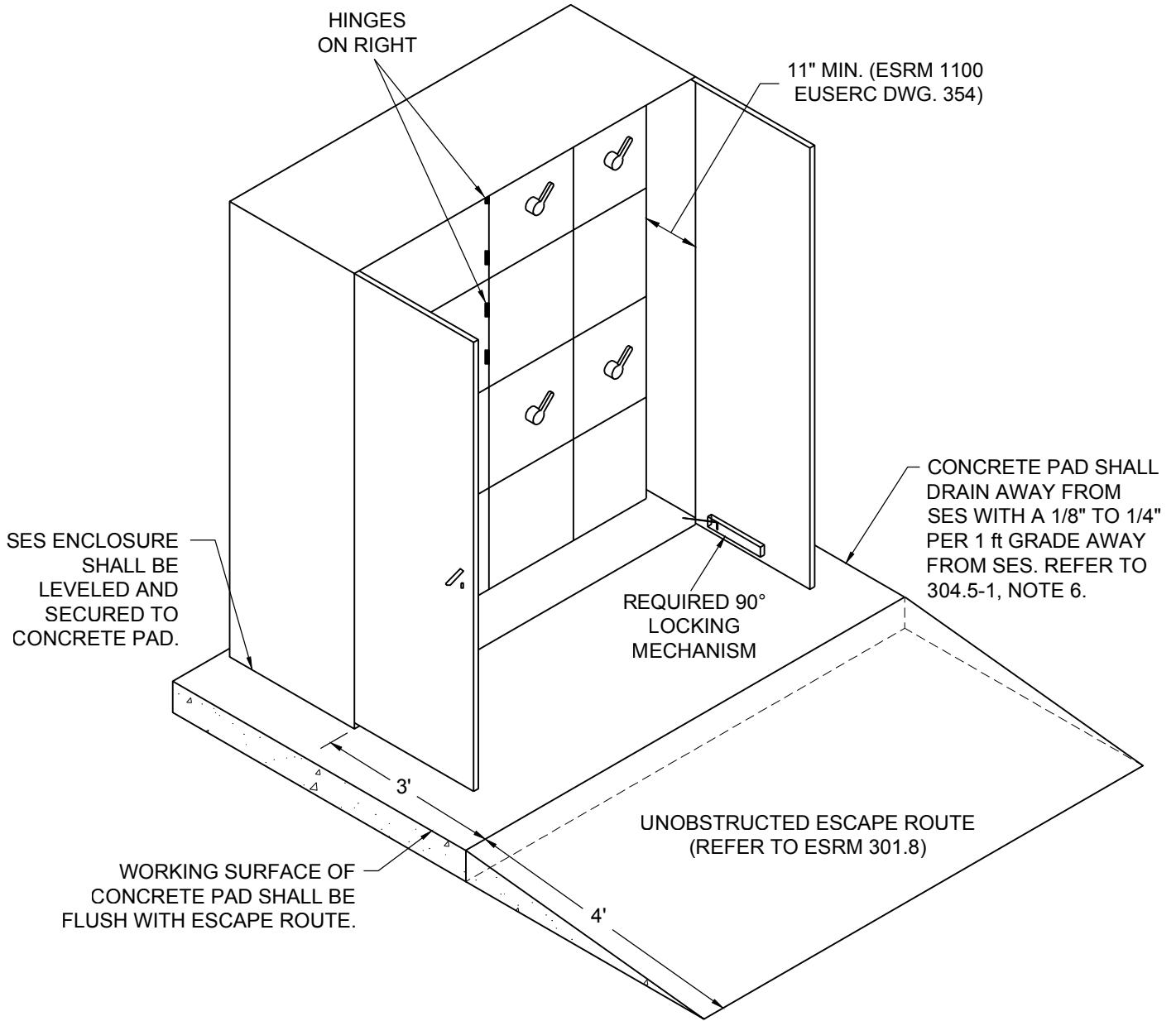
**304.4 EQUIPMENT FURNISHED AND INSTALLED BY CUSTOMER**

See Section 1100 for standard switchboard service section illustrations. The drawings on these pages are basically EUSERC drawings and show only sections as they would be used with overhead service entrance conductors. Pull sections would be added alongside for underground service entrance conductors and additional distribution feeder sections would be added as needed to supply a particular Customer’s electrical load.

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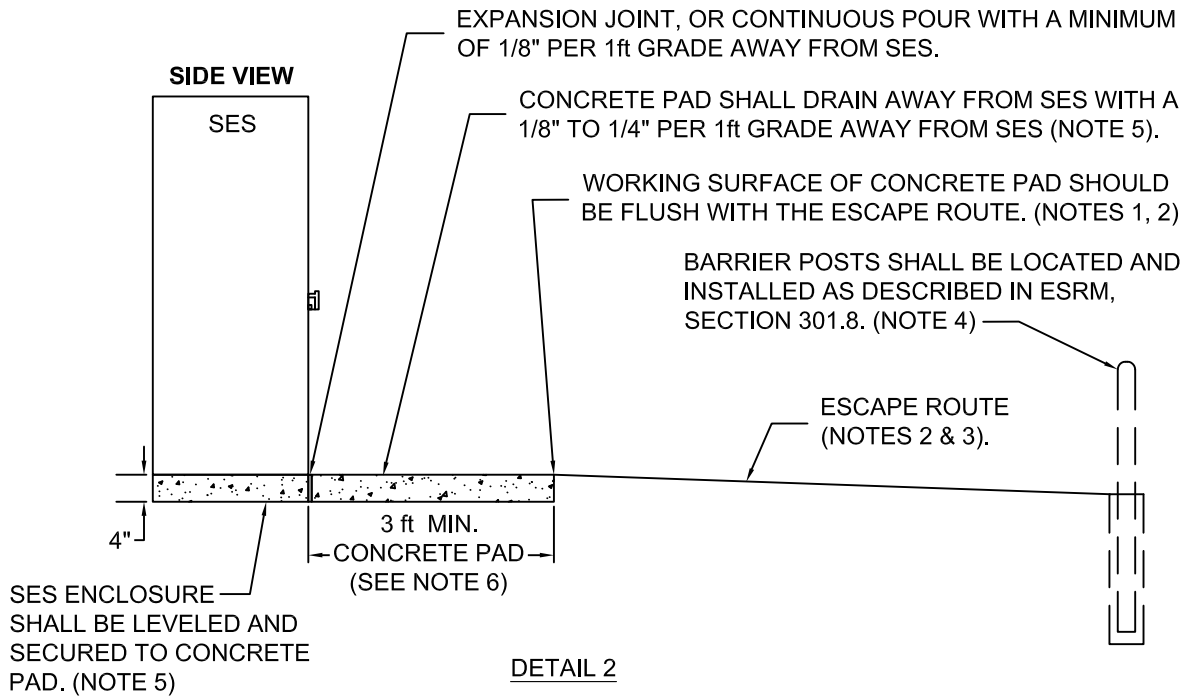


304.5 OUTDOOR SERVICE ENTRANCE SECTION PADS



**DETAIL 1**

304.5-1 OUTDOOR SERVICE ENTRANCE SECTION PADS



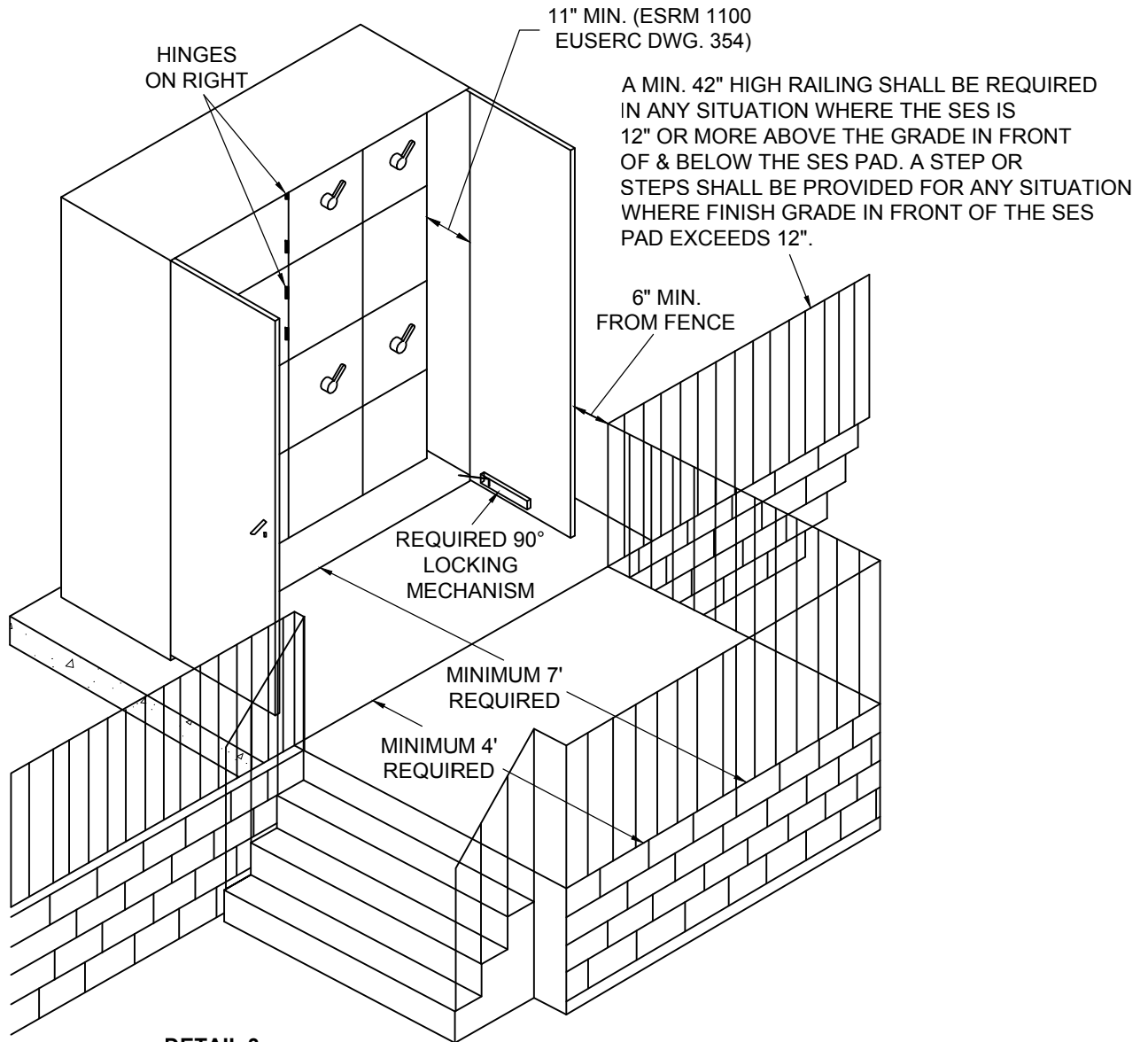
**NOTES:**

1. AN ACCEPTABLE PERSONNEL ESCAPE ROUTE SHALL BE PROVIDED IN FRONT OF THE SES. REFER TO ESRM 301.8 FOR PERSONNEL ESCAPE ROUTE AND BARRIER POST LOCATION REQUIREMENTS WHEN SUBJECT TO VEHICULAR TRAFFIC OR HAZARDOUS CONDITIONS.
2. THERE SHALL NOT BE MORE THAN 2" PER 1 ft GRADE AWAY FROM SES PAD ALONG THE ROUTE OF ESCAPE (SEE "DETAIL 1" ON PREVIOUS PAGE), UNLESS AN ALTERNATIVE ACCEPTABLE ESCAPE ROUTE IS PROVIDED. (SEE "DETAIL 3").

THE ESCAPE ROUTE IS A CONTINUOUS AND UNOBSTRUCTED PATH OF TRAVEL FROM ANY POINT WITHIN A WORKSPACE TO A PLACE OF SAFETY. AN ESCAPE ROUTE IS NECESSARY TO PROVIDE PERSONNEL EGRESS/INGRESS FROM THE EQUIPMENT DURING EMERGENCY CONDITIONS (E.G., ARC FLASH, FIRE). REFER TO ESRM 301.8 FOR ADDITIONAL REQUIREMENTS.

3. ABSOLUTELY NO OBSTRUCTIONS SHALL BE ALLOWED IN THE PROVIDED "SAFETY ESCAPE ROUTE", INCLUDING BUT NOT LIMITED TO: SHRUBS, TREES, ROCKS, OR GRAVEL IN EXCESS OF 1.5" DIAMETER. ADDITIONALLY, NO FENCING SHALL BE ALLOWED IN FRONT OF THE SES WITHIN THE ESCAPE ROUTE UNLESS AN OPERABLE GATE IS PROVIDED WHICH OPENS TO THE FULL WIDTH OF THE SES, OR UNLESS AN "ALTERNATIVE" ESCAPE ROUTE HAS BEEN PROVIDED. (SEE ADDITIONAL DETAILS PROVIDED IN "DETAIL 3").REFER TO ESRM 301.8 FOR ADDITIONAL REQUIREMENTS.
4. WHERE THE WORKING SPACE OR ESCAPE ROUTE IS EXPOSED TO VEHICLES OR HAZARDOUS CONDITIONS. REFER TO 301.8 FOR BARRIER POST PLACEMENT REQUIREMENTS.
5. "PADS" SHALL MEAN "CONCRETE PADS" FOR PAD-MOUNTED SES CABINETS. THE CONCRETE PAD THAT THE SES IS SECURED TO SHALL REMAIN LEVEL AND FLUSH THROUGHOUT THE ENTIRETY OF THE SES FOOTPRINT. THERE SHALL BE NO VAULT, BASIN, DEPRESSION, OR OPEN CONDUIT WINDOW ALLOWED IN THE CONCRETE PAD UNDER THE SES. OUTDOOR SES'S SHALL NOT HAVE HOUSEKEEPING PADS.
6. SEE ESRM 1000 FOR MEDIUM VOLTAGE CONCRETE PAD REQUIREMENTS THAT REQUIRE 10 FT MINIMUM WORKING SPACE IN FRONT OF THE SES.

**ALTERNATE ESCAPE ROUTE**



**NOTES :**

- 1) OPENING TO STEPS TO BE MINIMUM 3' WIDE
- 2) IF STEPS ARE PLACED DIRECTLY IN FRONT OF SES PAD THE 4' LANDING AREA WILL STILL BE REQUIRED.
- 3) HANDRAIL ACCORDING TO AHJ.

**304.5-3 OUTDOOR SERVICE ENTRANCE PADS IN REMOTE LOCATIONS WITH NO ACCESS TO WATER**

THIS ILLUSTRATION DEPICTS A PAD MOUNTED PEDESTAL BUT THE REQUIREMENTS SHALL APPLY TO ALL FREE STANDING SES'S.

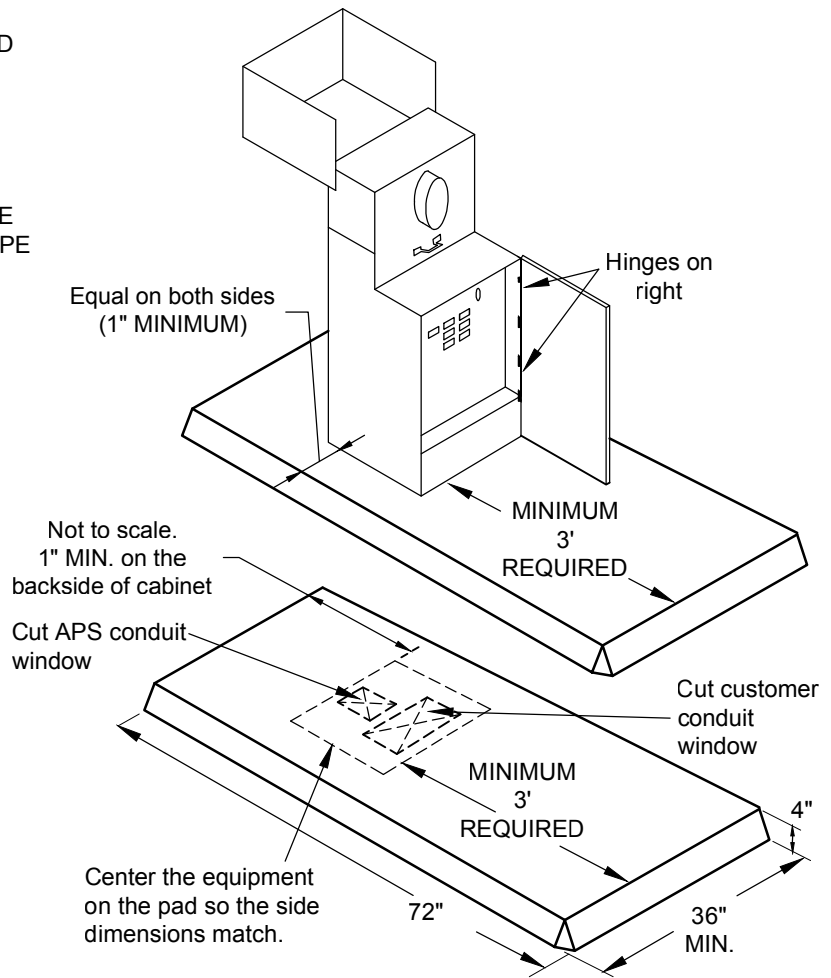
PRECAST FLAT PAD, FIBERCRETE OR CONCRETE, SHALL BE USED IN AREAS WHEN POUR-IN-PLACE PADS ARE NOT FEASIBLE DUE TO NO ACCESS TO WATER. FOAM FILLED TYPE PADS ARE NOT ALLOWED.

PAD AREAS SHALL BE FLAT WITH 95% COMPACTION RATING PRIOR TO SETTING PRECAST PAD.

PRECAST PAD SHOWN IS:  
CONCAST FIBERCRETE FLAT PAD FC-36-72-4  
INFO@CONCASTINC.COM

**FLAT PAD NOTES :**

1. SAND SLURRY CEMENT (1 PART PORTLAND CEMENT : 8 PARTS SAND) BACKFILL OPENING(S) IN PRECAST PAD TO PREVENT RODENT INTRUSION. 150 PSI MINIMUM WHEN FULLY CURED.
2. INSET PAD INTO LEVEL SOIL BY 1"-2", WHERE POSSIBLE.
3. SECURE EQUIPMENT SECTION TO PAD.

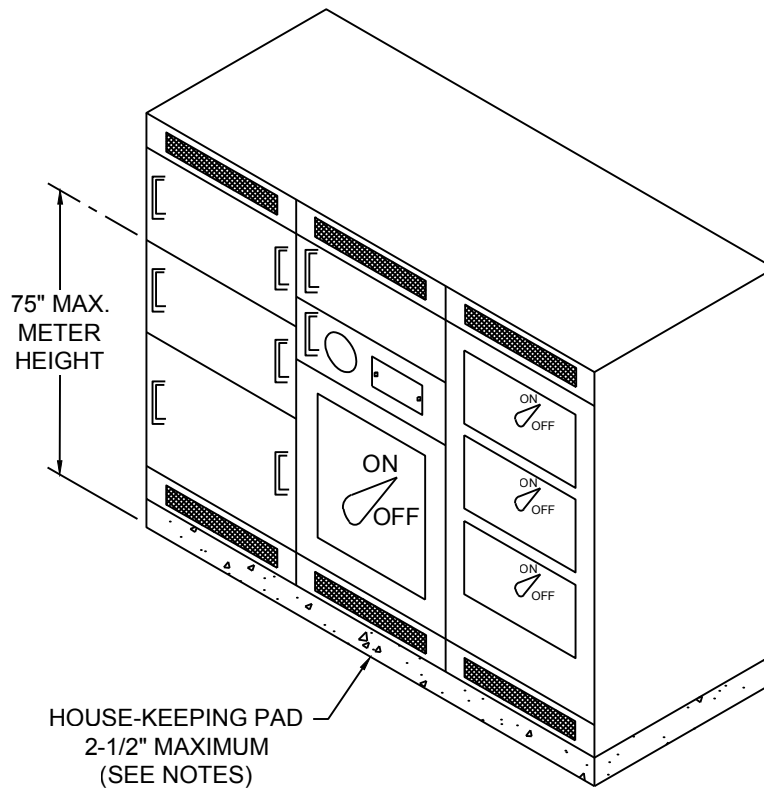


**DETAIL 4**

**NOTES:**

1. AN ACCEPTABLE PERSONNEL ESCAPE ROUTE SHALL BE PROVIDED IN FRONT OF THE SES PER 304.5-1 "DETAIL 2".
2. THERE SHALL NOT BE MORE THAN 2" PER 1 FT GRADE AWAY FROM SES PAD ALONG THE ROUTE OF ESCAPE (SEE 304.5 "DETAIL 1"), UNLESS AN ALTERNATIVE ACCEPTABLE ESCAPE ROUTE IS PROVIDED. (SEE 304.5-2 "DETAIL 3").
3. ABSOLUTELY NO OBSTRUCTIONS SHALL BE ALLOWED IN THE PROVIDED "SAFETY ESCAPE ROUTE", INCLUDING BUT NOT LIMITED TO: SHRUBS, TREES, ROCKS, OR GRAVEL IN EXCESS OF 1.5" DIAMETER. ADDITIONALLY, NO FENCING SHALL BE ALLOWED IN FRONT OF THE SES WITHIN THE ESCAPE ROUTE UNLESS AN OPERABLE GATE IS PROVIDED WHICH OPENS TO THE FULL WIDTH OF THE SES (GATE SHALL OPEN OUTWARDS AND AWAY FROM SES), OR UNLESS AN "ALTERNATIVE" ESCAPE ROUTE HAS BEEN PROVIDED. (SEE ADDITIONAL DETAILS PROVIDED IN 304.5-2 "DETAIL 3").
4. BARRIER POSTS SHALL BE INSTALLED AS DESCRIBED IN ESRM, SECTION 301.8. THE OUTSIDE EDGE OF THE BARRIER POSTS SHALL BE NO CLOSER THAN 6" FROM OPEN SES DOORS.
5. SEE 301.8 FOR ADDITIONAL BARRIER INFORMATION.
6. "PADS" SHALL MEAN "FIBERCRETE OR CONCRETE PADS" FOR PAD-MOUNTED SES CABINETS.

304.6 INDOOR SERVICE ENTRANCE SECTION HOUSEKEEPING PADS



**NOTES:**

1. IF CUSTOMER PREFERS TO INSTALL, HOUSEKEEPING PAD SHALL BE NO MORE THAN 2-1/2 INCHES THICK, AND SHALL NOT EXTEND MORE THAN 1 INCH BEYOND THE FRONT EDGE OF THE SERVICE ENTRANCE SECTION. **DO NOT USE 2" X 4" AS FORM FOR CONCRETE PAD.**
2. PAD MATERIAL TO BE RATED 3000 LB. AT 28 DAY MINIMUM.
3. SEE SECTION 300, PARAGRAPH 301.9 FOR METER ROOM REQUIREMENTS.
4. PAD IS NOT AN APS REQUIREMENT AND SHALL BE FOR INDOOR USE ONLY.
5. THE METER ROOM'S CONCRETE FLOOR OR, IF PREFERRED, THE CUSTOMERS HOUSEKEEPING PAD WHERE THE SES IS SECURED TO, SHALL REMAIN LEVEL AND FLUSH THROUGHOUT THE ENTIRELY OF THE SES FOOTPRINT. THERE SHALL BE NO VAULT, BASIN, DEPRESSION, OR OPEN CONDUIT WINDOW ALLOWED IN THE CONCRETE PAD UNDER THE SES.

### 305.0 INSTALLATION REQUIREMENTS FOR THE TOTALIZED METERING OF ELECTRIC LOADS

Totalized metering is the measurement for billing purposes at the appropriate rate, through one meter, of the simultaneous demands and energy of a Customer who receives this electric service at more than one delivery point. The Customer must qualify under APS "Conditions Governing the Totalized Metering of Electric Loads", and must receive prior approval from APS Totalizing Committee. The Customer will then be notified in writing, by the Design Project Leader, that totalized metering has been approved and may be implemented.

After determination by APS that totalized metering will be permitted, a meeting will be held with the Customer (or his representative), the APS Customer Service Representative, and a representative from the APS Electric Meter Shop. This is for the purpose of discussing conduit routing and general installation details. Following the meeting, the Customer shall submit an installation plan, showing all details, to the Design Project Leader. The Electric Meter Shop is responsible for the final approval of the plan. Installation of totalized metering facilities shall not begin prior to final approval.

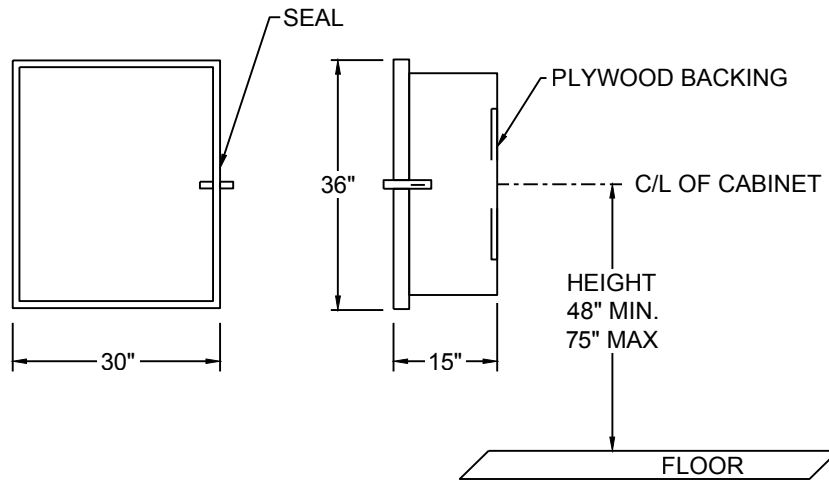
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### 305.1 GENERAL RULES FOR TOTALIZED METERING INSTALLATIONS

1. Totalized metering compartment and service entrance equipment locations shall meet APS specifications for meter locations, meter rooms, and other applicable requirements.
2. Totalized metering compartment shall be in accordance with Electric Meter Shop specifications. Customer shall provide and install totalizing cabinet. See Section 300, Paragraph 305.2 for requirements.
3. Customer shall provide and install all totalized metering conduit. Conduits shall be installed in accordance with the current National Electric Code requirements. All conduit installations shall be 1 inch conduit.
4. Totalized metering conduits shall originate in the individual service entrance section's CT compartments and shall terminate in the totalized metering compartment. Exact location of conduit entries shall be specified by the Electric Meter Shop.
5. Conduit shall be rigid steel when installed outdoor, underground, or in locations exposing it to possible mechanical damage. **EXCEPTION: Schedule 40 PVC conduit may be used in underground installations that have a minimum of 24 inches of cover over conduit, or DB 120 conduit may be used if encased in concrete per paragraph 502.8 in Section 500, and there is a minimum of 24 inches of cover over conduit. Conduit may be EMT when installed overhead indoors in an approved location. Plastic conduit is not acceptable.**
6. Steel conduit, bends, and accessory parts installed underground shall be factory coated or wrapped with an approved PVC tape (overlapped a minimum of 1/2 the tape width thereby providing a minimum thickness of 40 mils) suitable for direct burial. See Section 500, Paragraph 501.4 for coating requirements.
7. A pull box with a sealable cover shall be installed for each 270° of conduit bends. In no case shall pull boxes be more than 500 feet apart. Pull boxes shall normally be 6" x 18" x 18". If installed outdoors or below grade, pull boxes shall be watertight and approved for the purpose. All pull boxes shall be accessible after job completion. Pull box locations shall be approved by Electric Meter Shop. The conduit system shall be a clean, usable system at the time APS installs conductors.
8. Flat-strap or true-tape to be supplied and installed by Customer.
9. Customer wiring shall not be allowed in S.E.S. metering compartments, totalized metering conduits and pull boxes, or totalized metering compartment.

Because each installation is different, the above general rules may not be all inclusive. Each installation must be designed and approved on an individual basis; therefore, additional requirements may be necessary.

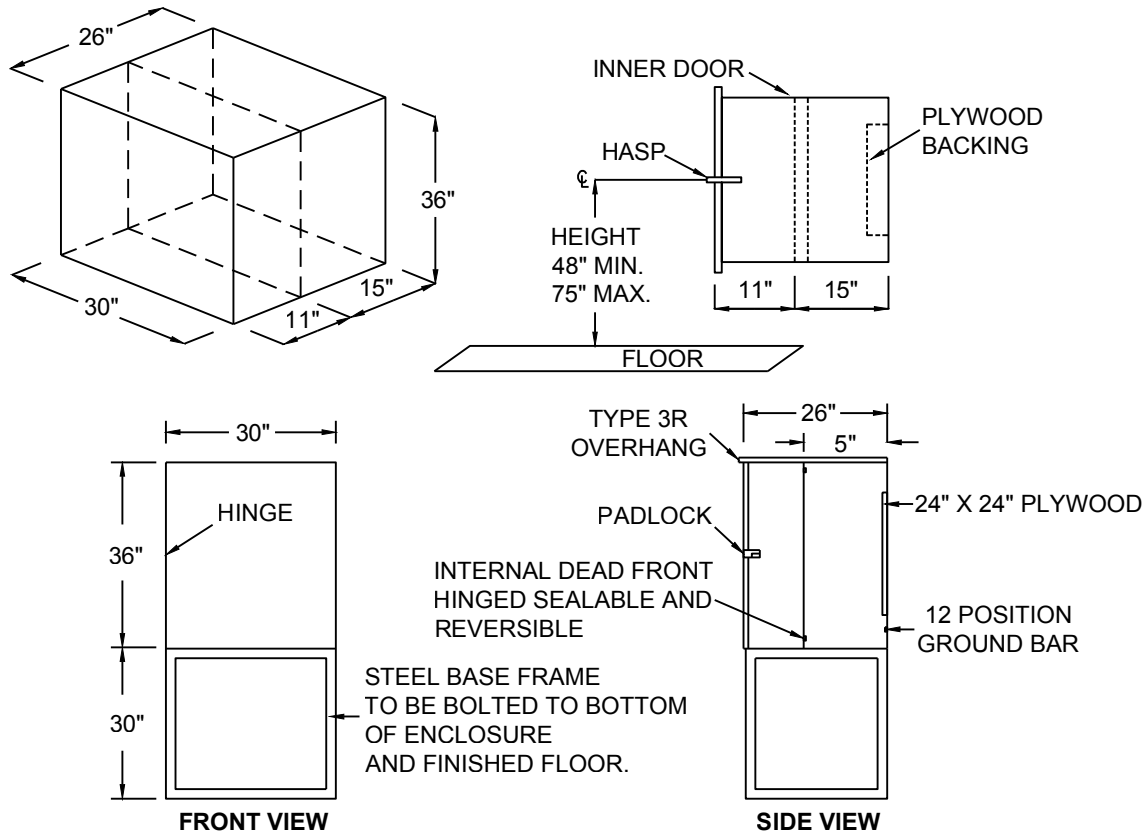
305.2 INDOOR TOATLIZING/COMBINING CABINET



**NOTES:**

1. CABINET TO BE MADE WITH A MINIMUM OF 12 GAUGE STEEL.
2. CABINET DIMENSIONS SHOWN ARE MINIMUMS.
3. CABINET TO BE PAINTED TO SAME SPECS AND COLOR AS SERVICE ENTRANCE SECTION.
4. COVER/DOOR TO BE DEMOUNTABLE AND REVERSIBLE.
5. COVER/DOOR TO BE SEALABLE.
6. 3/4" MINIMUM PLYWOOD TO BE INSTALLED ON BACK INSIDE WALL OF CABINET. SIZE TO BE 24" X 24". (SEE ABOVE)
7. CABINET TO BE BONDED TO SERVICE ENTRANCE SECTION WITH MINIMUM OF #8 COPPER WIRE.
8. CABINET TO BE SOLIDLY ANCHORED TO THE WALL.
9. APS METER SHOP TO DETERMINE SIZE OF CONDUIT AND POINT OF ENTRY INTO SERVICE SECTIONS.
10. DOOR TO BE HINGED.

305.2-1 APS OUTDOOR TOTALIZING/COMBINING CABINET



**NOTE:**

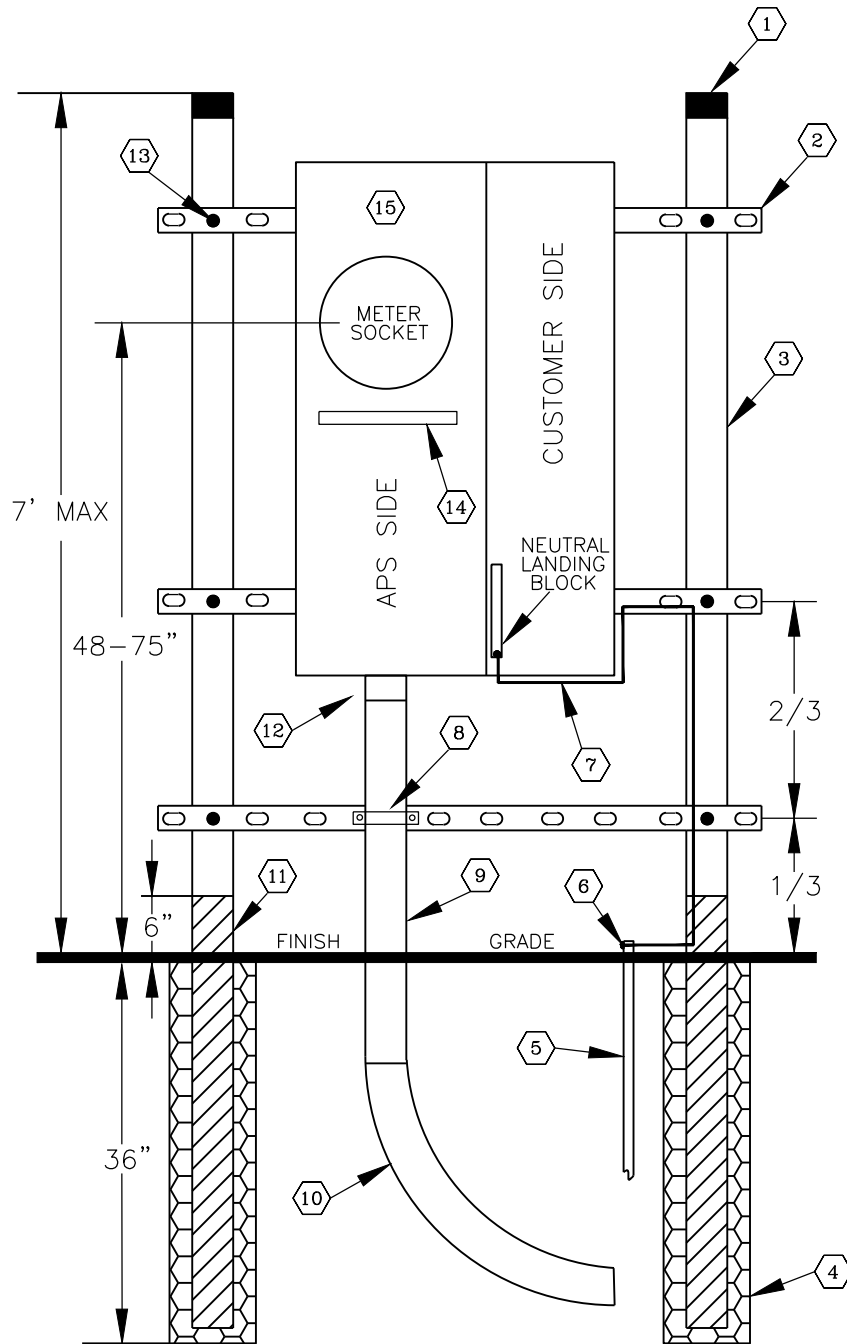
30" X 36" X 26" OUTDOOR TYPE 3R REMOVABLE REVERSIBLE AND SEALABLE DEAD FRONT COVER. STEEL REQUIRED TO BE PAINTED GRAY ENAMEL.

**NOTES:**

1. CABINET TO BE MADE WITH A MINIMUM OF 16 GAUGE STEEL.
2. CABINET DIMENSIONS SHOWN ARE MINIMUMS.
3. CABINET TO BE PAINTED TO SAME SPECS AND COLOR AS SERVICE ENTRANCE SECTION.
4. INNER DOOR TO BE DEMOUNTABLE AND REVERSIBLE.
5. INNER DOOR TO BE SEALABLE.
6. OUTER DOOR TO BE PAD LOCKABLE. PROVISION FOR TWO PADLOCKS IS REQUIRED.
7. 3/4" MINIMUM PLYWOOD TO BE INSTALLED ON BACK INSIDE WALL OF CABINET. SIZE TO BE 24" X 24". (SEE ABOVE)
8. CABINET TO BE BONDED TO SERVICE ENTRANCE SECTION WITH MINIMUM OF #8 COPPER WIRE.
9. CABINET TO BE SOLIDLY ANCHORED ON AN EXTERIOR WALL ADJACENT TO THE METERING SECTIONS, OR TO A SEPARATE STRUCTURE PER SECTION 300, PARAGRAPH 306.0 ADJACENT TO THE METERING SECTIONS.
10. APS METER SHOP TO DETERMINE SIZE OF CONDUIT AND POINT OF ENTRY INTO SERVICE ENTRANCE SECTIONS.
11. BOTH DOORS ARE TO BE HINGED.
12. CABINET TO BE WEATHERPROOF.
13. CABINET REQUIRED TO BE ON STAND.



**306.0 TYPICAL STAND ALONE SERVICE ENTRANCE SUPPORTS FOR SERVICE EQUIPMENT (UNDERGROUND ONLY)**



ALL DIMENSIONS ARE MANDATORY.

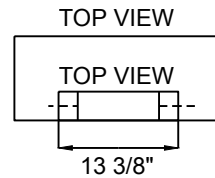
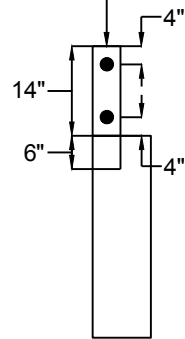
- ① ALL STEEL POSTS MUST BE CAPPED.
- ② STEEL UNISTRUT SUPPORTS.
- ③ THREE INCH DIAMETER RIGID GALVANIZED STEEL POSTS MINIMUM. (MAXIMUM LENGTH=10') THERE SHALL BE NO WELDS OR COUPLINGS IN STEEL POSTS.
- ④ POSTS SHALL BE PLACED IN THE CENTER OF A 12" MINIMUM DIAMETER CONCRETE FOOTING. THE FOOTING SHALL BE A MINIMUM OF 36" IN THE GROUND & EXTEND A MINIMUM OF 4" ABOVE GROUND LEVEL, & HAVE A 1/2" SLOPE AWAY FROM THE POST TO ALLOW FOR DRAINAGE.

**306.0 TYPICAL STAND ALONE SERVICE ENTRANCE SUPPORTS FOR SERVICE EQUIPMENT**

- 5 5/8"X8' GROUND ROD SHALL BE POSITIONED IN A PLACE WHERE IT DOES NOT POSE A TRIPPING HAZARD TO APS OR THE PUBLIC. THERE SHALL BE A MAINTAINED 3'x3' CLEAR FLAT SAFE WORKING SPACE IN FRONT OF METERING EQUIPMENT.
- 6 ACORN CLAMP REQUIRED AT CONNECTION. GROUNDING SHALL BE PROVIDED BY THE CUSTOMER IN COMPLIANCE WITH N.E.C. AND ARIZONA PUBLIC SERVICE. MADE ELECTRODES SHALL HAVE A RESISTANCE-TO-GROUND OF NOT MORE THAN 25 OHMS.
- 7 GROUND WIRE SHALL BE A MINIMUM SIZE OF #4 SOLID COPPER.
- 8 RISERS SHALL BE SECURELY FASTENED TO UNISTRUT BY AT LEAST ONE STRAP AND THE SERVICE EQUIPMENT ENCLOSURE. THE STRAP SHALL BE LOCATED 1/3 THE DISTANCE UP FROM FINISH GRADE BETWEEN THE RISER ENTRANCE TO THE SERVICE EQUIPMENT AND FINISHED GRADE.
- 9 UNDERGROUND RISERS SHALL BE RIDGED STEEL OR SCHEDULE 80 PVC AND NOT HAVE ANY PVC COUPLINGS ABOVE GRADE EXCEPT FOR THE CONNECTION AT THE PANEL., THREADED RIGID STEEL RISER SHALL NOT BE CUT WITH A TORCH, WELDED, BRAZED, OR CONTAIN ANY COMPRESSION COUPLINGS. ONLY TRUE ROUND CROSS-SECTION RISERS WILL BE ACCEPTABLE. RISERS SHALL BE PLUMB WITH NO KICKS OR BENDS.
- 10 RIGID STEEL RISER OR SCHEDULE 40, 24 INCH RADIUS ELBOW ARE ACCEPTABLE. IF ELBOW IS STEEL THE PORTION OF THE STEEL RISER BELOW GRADE, UP TO A MINIMUM OF 6" ABOVE GRADE, SHALL BE HALF-LAPPED WITH 20 MIL. TAPE SUITABLE FOR IT'S USE, TO A TOTAL THICKNESS OF 40 MIL. THE TAPE SHALL BE LABELED TO INCLUDE THE THICKNESS (20 MIL.) AND THE MANUFACTURER'S NAME OR FACTORY COATED. IF RISER IS FACTORY COATED, IT SHALL HAVE A U.L. LABEL. THE COUPLER CONNECTING THE PVC CONDUIT SYSTEM TO THE STEEL ELBOW SHALL ALSO BE TAPED.
- 11 ALL STEEL POSTS USED FOR PANEL SUPPORTS MUST BE HALF-LAPPED WITH 20 MIL. TAPE SUITABLE FOR IT'S USE, TO A TOTAL THICKNESS OF 40 MIL. UP TO A MINIMUM OF 6" ABOVE GRADE. THE TAPE SHALL BE LABELED TO INCLUDE THE THICKNESS (20 MIL.) AND THE MANUFACTURER'S NAME
- 12 FACTORY BOLT-ON HUB IS PREFERRED. ALL RISER KNOCK OUTS SHALL BE REMOVED BEFORE ANY RISER ATTACHMENT IS MADE. REDUCER WASHERS SHALL BE INSTALLED ON THE INSIDE AND OUTSIDE OF THE SECTION WHENEVER A SELF-BONDING HUB IS NOT USED. SCHEDULE 80 PVC CONDUIT RISERS SHALL BE SECURED TO THE PULL SECTION USING A THREADED MALE SLIP-SLEEVE CONNECTOR AND A STEEL LOCK NUT. STEEL CONDUIT RISERS SHALL BE SECURED TO THE PULL SECTION USING A RISER "HUB" WITH A BONDABLE LOCK NUT/BUSHING, A FACTORY BOLT-ON HUB, OR A SELF-BONDING HUB (MYERS OR EQUIVALENT).
- 13 ALL STEEL UNISTRUT SHALL BE ATTACHED TO THE POLE OR POST SECURELY WITH A MINIMUM 1/2" GALVANIZED THROUGH BOLT WITH ONE 1/2" GALVANIZED BACKING AND A LOCK NUT. LAG BOLTS WILL NOT BE ACCEPTED. UNISTRUT MAY BE WELDED TO STEEL POLES. WELDING MUST BE APPROVED BY AN APS INSPECTOR.
- 14 RIVETED NON-FERROUS METAL ADDRESS LABEL. SEE 302.1 FOR LABEL REQUIREMENTS
- 15 APS APPROVED PANEL.

307.0 JOB SITE POWER (TEMPORARY METER IN PERMANENT POSITION)

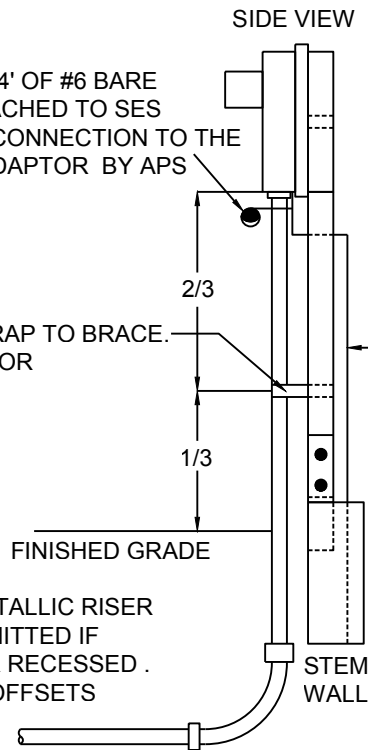
20 GA STEEL FRAMING STUD



PROVIDE A MIN. OF 4' OF #6 BARE COPPER WIRE ATTACHED TO SES GROUND BUS FOR CONNECTION TO THE JOB SITE POWER ADAPTOR BY APS PERSONNEL.

ATTACH RISER STRAP TO BRACE. MUST BE VISIBLE FOR INSPECTION.

ONLY RIGID METALLIC RISER SHALL BE PERMITTED IF SEMI-FLUSH OR RECESSED. NO BENDS OR OFFSETS ABOVE GRADE.



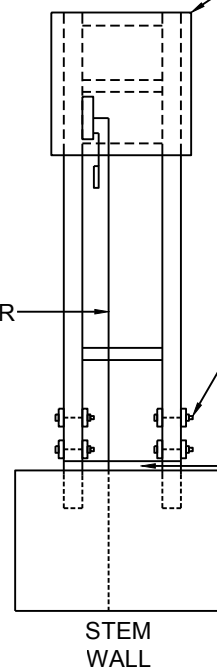
FRONT VIEW

20 GAUGE STEEL BACKING PLATE OVER LAMINATED WIRE, VAPOR BARRIER.

METER PANEL ASSEMBLY TO BE SQUARE TO AND PERMANENTLY ATTACHED TO 2 X 4 STEEL STUD FRAMING WHEN ERECTED. NO ADJUSTMENTS TO DEVICE SHALL BE ALLOWED AFTER PERMANENT WALL IS IN PLACE. ANY ADJUSTMENTS AFTER THE FACT WILL RESULT IN REFUSAL OF PERMANENT METER SET.

THROUGH BOLTS TO BE 1/4" X 2 1/4" WITH FLAT WASHERS. 2 BOLTS PER LEG REQUIRED.

PRESSURE TREATED MATERIAL IN CONTACT WITH AND ANCHORED TO STEM WALL.



#4 GROUNDING ELECTRODE CONDUCTOR (UFER) TO BE MADE UP IN SES.

**OVERHEAD SERVICE**  
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## 400.0 OVERHEAD SERVICES 0 - 600 VOLTS

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### 400.1 GENERAL

1. APS RESERVES THE RIGHT TO DETERMINE ALL METER LOCATIONS, INCLUDING POINTS OF ATTACHMENT, AND ONLY AUTHORIZED APS PERSONNEL SHALL DETERMINE THIS LOCATION.
2. The height of the point of attachment on the Customer's building or structure for overhead services shall be adequate to provide vertical clearances between the service drop conductors and the ground as shown in Paragraph 401.0. **The service attachment height may have to be higher than the minimums shown in Paragraph 401.0 to maintain proper vertical clearance between service conductors and the ground.**
3. Weatherhead and open wires between the weatherhead and point of connection to the service drop (drip loop) shall have proper height above ground as shown in Paragraph 401.0.
4. The point of service drop attachment on a building shall be located on the exterior wall facing and nearest APS pole line. **The point of attachment shall be insulated.**
5. A solid point of attachment shall be provided to withstand a minimum 200 pounds of tension. The responsibility for furnishing a sufficiently substantial service support rests solely with the Customer (**Lag bolts are not considered acceptable**).
6. Where the service conduit riser is used as a mast for supporting the service drop, it shall be 1 1/2" min. size rigid steel conduit and contain no coupling or fittings which would be subject to strain by the service drop. If necessary to use more than one 10' length of conduit, the full length (10') conduit shall be the upper conduit, thereby putting the coupling below any strain.
7. **EMT or Plastic shall not be used for riser.**
8. **Point of attachment on service conduit risers to be no more than 20" above the roof or parapet wall support for 1-1/2" rigid steel conduit, no more than 30" above the roof or parapet wall support for 2" rigid steel conduit and no more than 50" above the roof or parapet wall support for 2-1/2" and larger rigid steel conduit. Risers that exceed these height limits require back bracing. The point of attachment shall not be higher than 6' above the roof or the parapet wall support. See Paragraphs 401.4, 401.4-1, and Figures 1, 2, 3 and 4. See Paragraph 401.5 for alternative method for point of attachment.**
9. In the event a mast type riser is required to attain the required height, it shall be of such construction and so supported that it will withstand the strain imposed by the service drop. Mast type risers shall be braced every 30" and within 6" of the top of the wall. Raceway fittings shall be of a type identified for use with service masts.
10. Service riser conduits shall be so located that the corner of the point of attachment for the service drop will be within twelve (12) inches of the center of the weatherhead.
11. Single risers require 24" conductor leads for connection by company. When multiple risers are used, 36" leads are required.
12. A maximum of three (3) service riser conduits may be supplied from one overhead service drop. Multiple risers shall be placed a maximum of 12" apart and be braced together within 6" to 12" of the weatherhead per Paragraph 401.6-1, Detail A.
13. No foreign attachments shall be permitted on a service riser conduit.
14. **Overhead raceway (riser) shall not be enclosed by any wall.**

**NOTE** - Attachment tensions greater than 200 pounds may be required in special cases such as for bus duct risers.

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### 400.2 IDENTIFICATION OF CONDUCTORS

Any neutral or delta power (high) leg of service entrance conductors, provided as required for various classes of service, shall be permanently identified. The identification shall be applied on the open conductors (drip loop) extended from the weatherhead or on the bus-stubs of a bus-duct servicehead, whichever is applicable. The neutral shall be white and the delta power (high) leg shall be orange. (See Section 300, Paragraphs 303.7 and 304.3).



**400.3 MAXIMUM SERVICE ENTRANCE CONDUCTOR SIZE IN RISERS (OVERHEAD)**

Service entrance conductors installed by the customer shall be sized per NEC requirements. Maximum size conductor shall be 750 MCM with a maximum number of two conductors per phase.

If service riser conductors are to be paralleled, they shall be paralleled in separate conduits. When metallic (ferrous) conduit is used or there is any encirclement of ferrous metal, induced current heating will damage the cable insulation. The only acceptable method is to install one of each phase conductor and neutral in each metallic conduit (e.g. ABCN of a four wire service).

**EXCEPTION:**

Parallel service may be installed in one riser provided the conduit is sized properly per NEC for the total amount of wire installed. Parallel conductors must terminate on a common bus (e.g. 8 conductors in one conduit for a four wire service, 2 - ABCN).

**401.0 CLEARANCES ABOVE GROUND, THOROUGHFARES, DRIVEWAYS, ETC.**

Service drop conductors when not in excess of 300 volts phase to ground, shall have the following minimum clearance at the lowest point of the span. (The height of the point of attachment shall be governed by these clearances.) Clearances are based on conductors supported on and cabled together with an effectively grounded messenger.

Crossing over areas accessible to pedestrians only.....	12.0 ft
Crossing over residential driveways NOTES 1 & 2.....	12.5 ft
Crossing over non-residential areas, parking lots, agricultural or other areas subject to truck traffic NOTE 2.....	18.0 ft
Crossing over non-residential or industrial parking lots, not subject to truck traffic NOTES 2 & 3.....	12.5 ft
Crossing over public streets, alleys or roads in urban or rural districts and driveways on other than residential property.....	18.0 ft
Crossing over railroad tracks.....	27.0 ft

**NOTES:**

1. Residential driveways subject to RV or commercial truck traffic require 18' of clearance.
2. Trucks are defined as any vehicle exceeding 8 feet in height.
3. Truck height must be physically restricted.
4. Minimum height for Drip Loop shall be 10.5 feet.

**SPECIAL NOTE:**

The minimum Point of Attachment (POA) height shall be 12.5'. The POA height may need to be higher than the minimum to maintain proper clearances. Additional height may be required according to the Authority Having Jurisdiction (AHJ).

Where clearance is questionable, please call APS for instructions before installing service entrance, conduit and other equipment.

It is recommended that an onsite meeting be requested with an APS Representative to determine service attachment height before installation of service entrance, conduit and other equipment.



**401.0-1 CLEARANCE ABOVE GROUND - RESIDENTIAL**

THESE MINIMUM CLEARANCES APPLY TO THE LOWEST POINT OF SERVICE DROP SAG

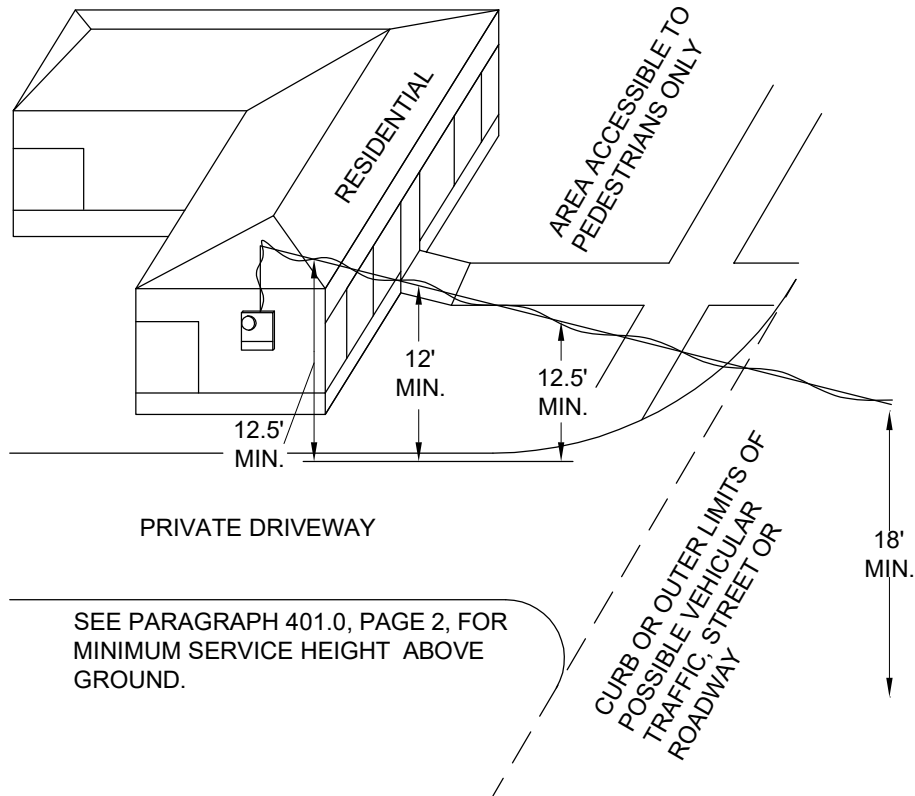
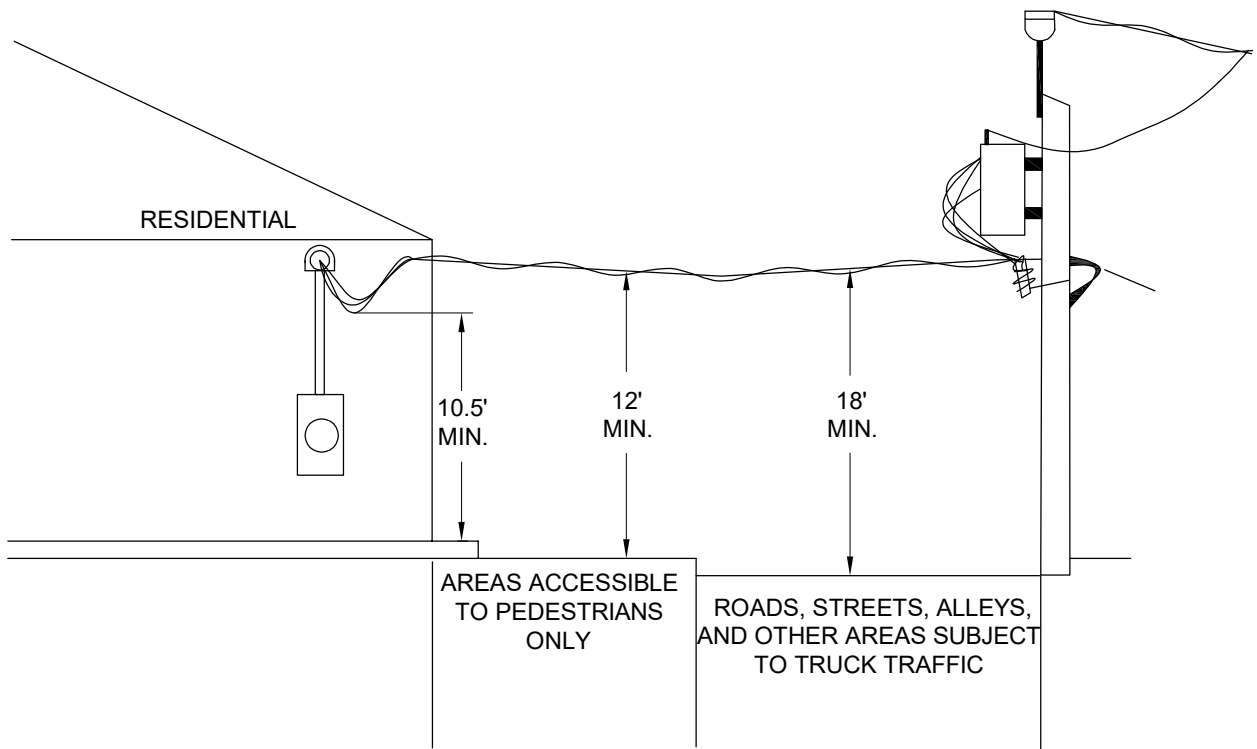


FIGURE 1



**401.0-2 CLEARANCE ABOVE GROUND - INDUSTRIAL & NON-RESIDENTIAL**

THESE MINIMUM CLEARANCES APPLY TO THE LOWEST POINT OF SERVICE DROP SAG

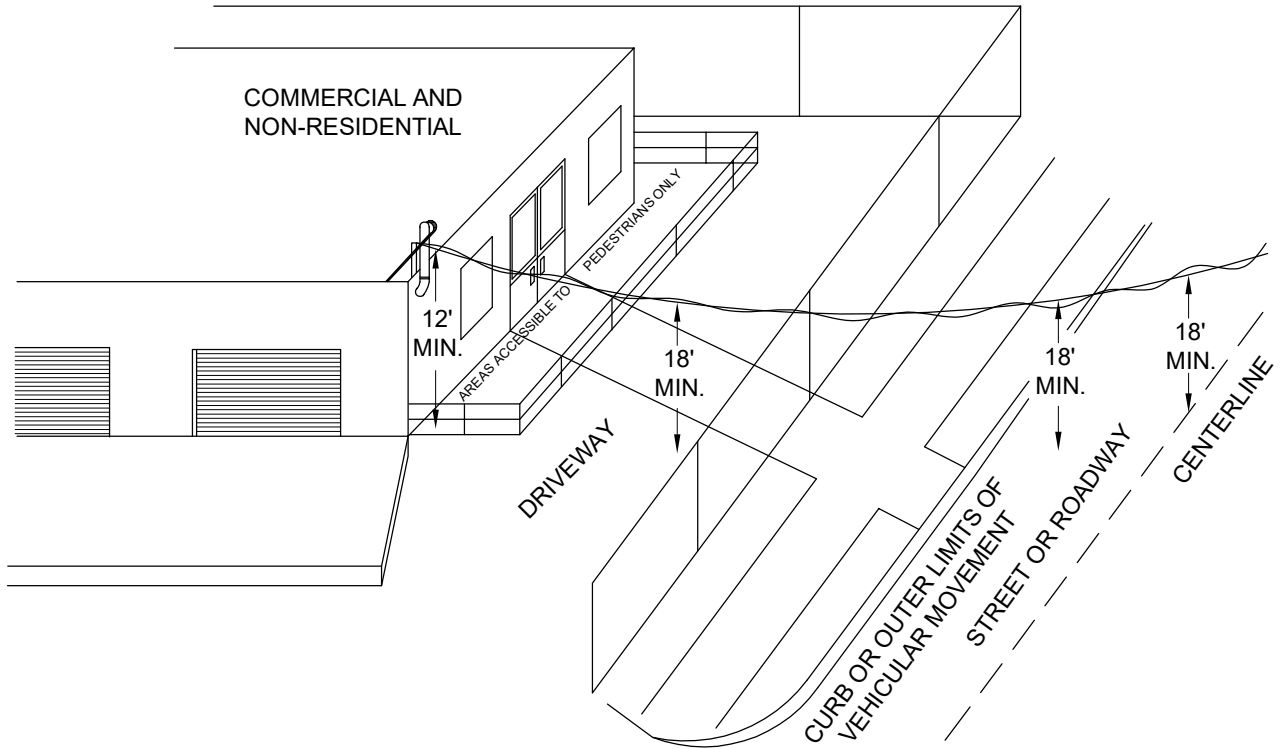
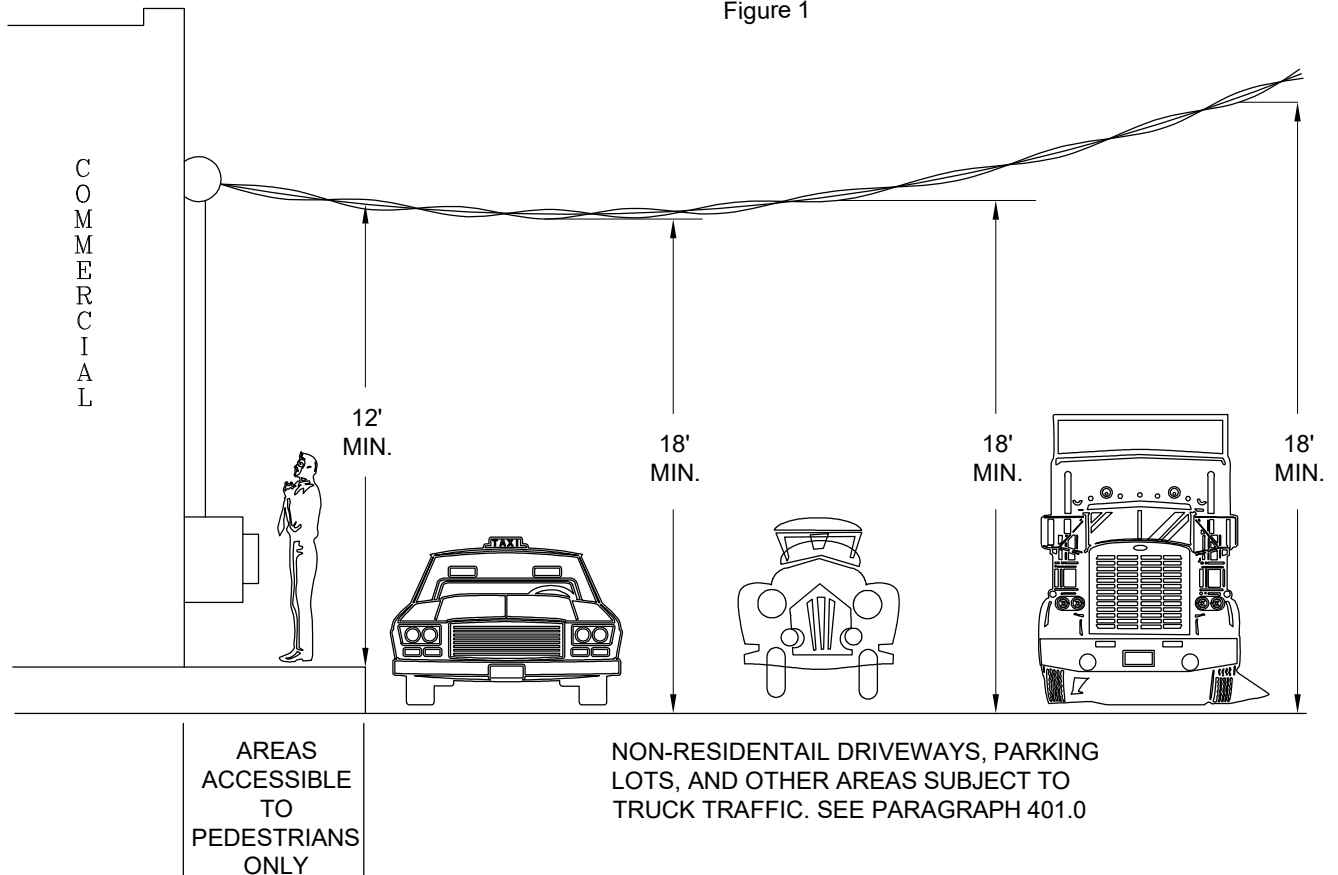
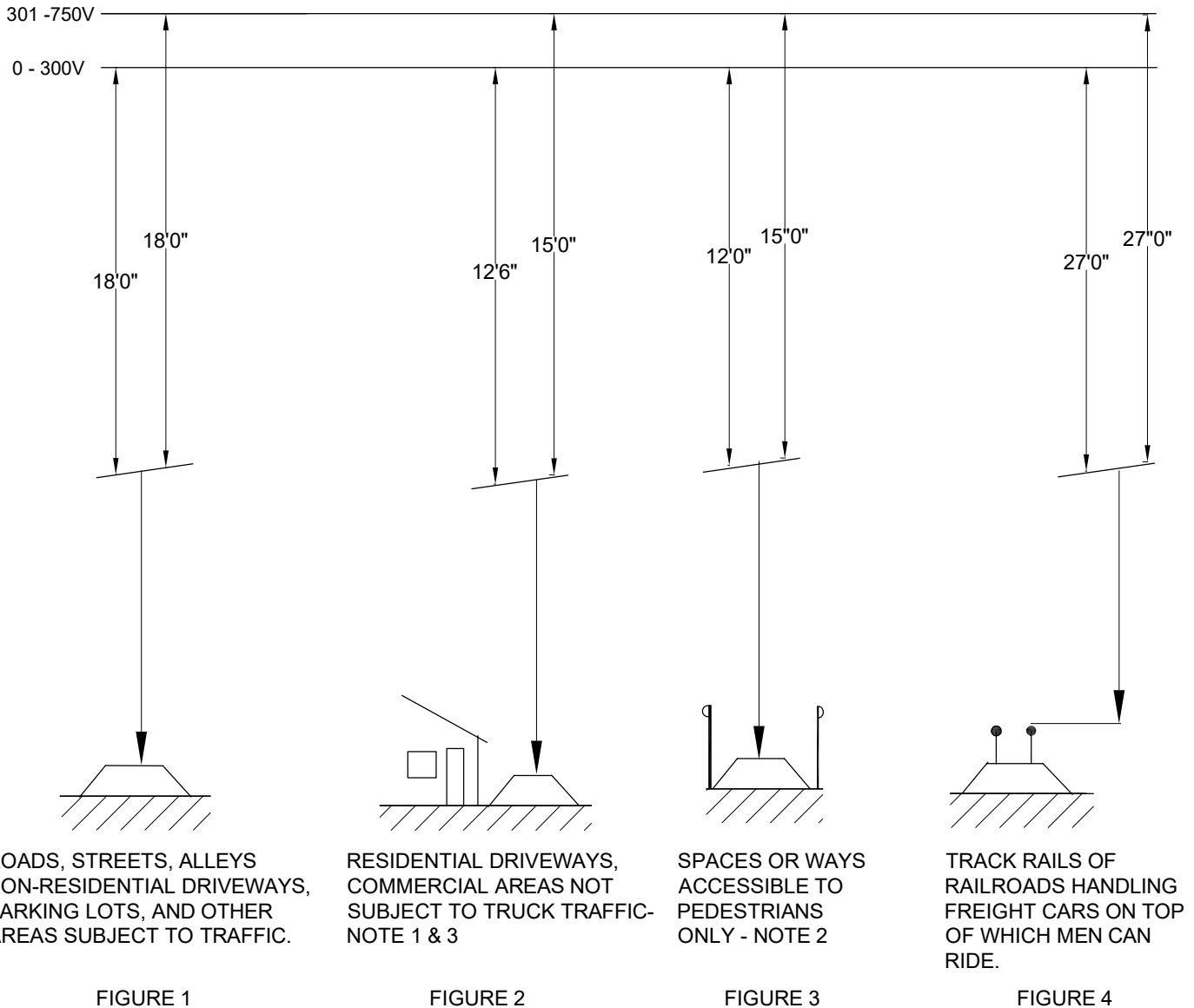


Figure 1





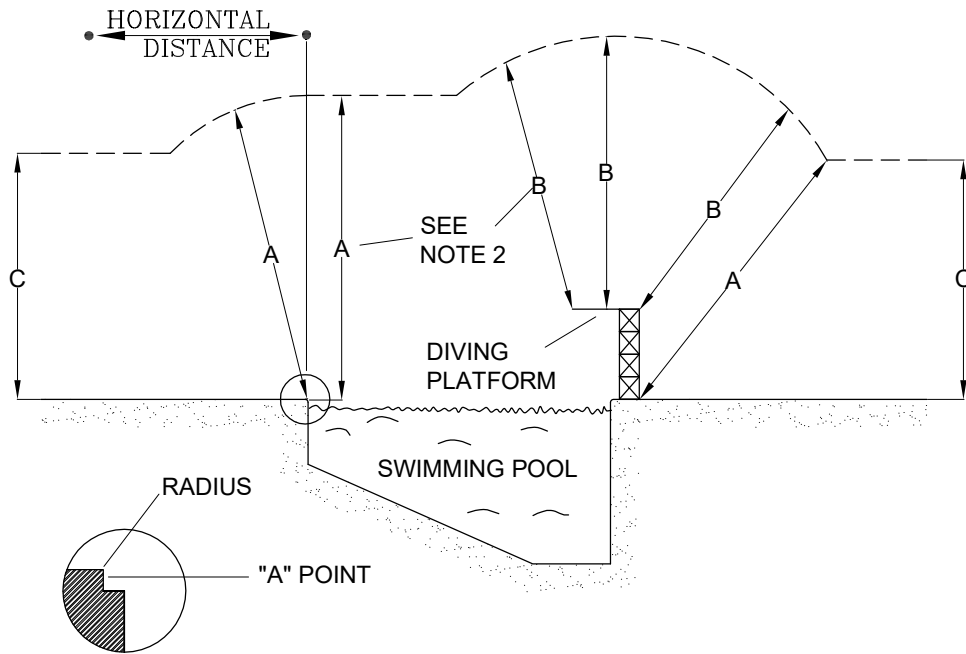
**401.0-3 CLEARANCE ABOVE GROUND**



**NOTES:**

1. TRUCKS ARE DEFINED AS ANY VEHICLE EXCEEDING 8 FEET IN HEIGHT.
2. IF ACCESSIBLE TO EQUESTIRIANS, USE FIGURE 1.
3. TRUCK HEIGHT MUST BE PHYSICALLY RESTRICTED.

**401.1 MINIMUM VERTICAL CLEARANCE (SWIM POOLS)**



VOLTAGE PHASE TO GROUND	DIMENSION "A" VERTICAL CLEARANCE OVER POOL OR RADIAL CLEARANCE FROM EDGE OF POOL OR DIVING PLATFORM	DIMENSION "B" CLEARANCE IN ANY DIRECTION TO DIVING PLATFORM OR TOWER	DIMENSION "C" VERTICAL CLEARANCE OVER ADJACENT LAND
50KV – 470KV	26'-0" + NOTE 7	26'-0" + NOTE 7	AS REQ'D BY 401.0-3
22KV – 50KV	26'-0"	18'-0"	AS REQ'D BY 401.0-3
750V – 22KV	25'-0"	17'-0"	AS REQ'D BY 401.0-3
0 – 750V OPEN	23'-0"	15'-0"	AS REQ'D BY 401.0-3
0 – 750 MULTIPLEX W/ MULTIGRND NEUT	23'-0"	15'-0"	AS REQ'D BY 401.0-3
GUY WIRE AND COMMUNICATIONS	22'-0"	14'-0"	AS REQ'D BY 401.0-3

**NOTES:**

1. All voltages are phase-to-ground.
2. When Dimension "A" is greater than the sum of Dimension "B" plus the diving platform height, use Dimension "A".
3. Minimum clearances must be maintained from neighboring services.
4. Dimensions A and B do not apply when conductors are greater than 10' minimum horizontally from edge of pool and diving platform.
5. The swimming pool clearances shown above apply to all types of swimming areas including above and below ground pools, and spas.
6. These dimensions shall also comply with local municipal requirements.
7. Increase clearances 0.4 inch per KV for all voltage in excess of 50KV. This 0.4 inch adder shall be increased 3 percent for each 1000 feet in excess of 3300 feet elevation. Add 5 percent to all nominal voltages over 50KV when calculating increased clearances.

**401.2 HORIZONTAL CLEARANCES FROM BUILDINGS**

Conductors shall have a horizontal clearance of not less than 3 feet from buildings. For clearances from balconies, windows, fire escapes, doors, etc., see Paragraph 401.7.

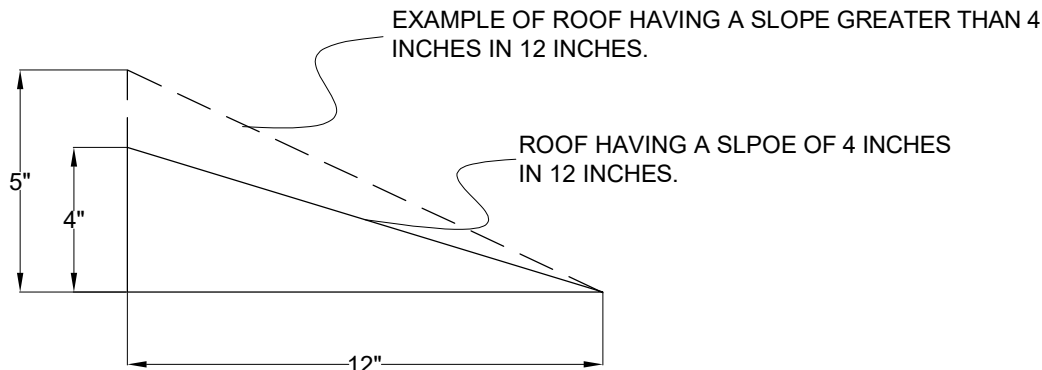
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**401.3 CLEARANCES OVER BUILDINGS AND STRUCTURES**

Service drop conductors shall not be readily accessible. When not in excess of 600 volts, they shall conform to the following: It shall be the customer's responsibility to provide a point of attachment so APS service drop conductors meet these requirements.

**Clearance Over Roof:** Conductors shall have a clearance of not less than 8 ft. from the highest point of roofs over which they pass, with the following exceptions:

Exception No. 1: Where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches in 12 inches the clearance may be not less than 3 feet.



The intent of this exception is that where the roof has a slope 4 in. in 12 in. or greater it is considered difficult to walk upon and the height of conductors could then be less than 8 ft. from the highest point over which they pass but in no case less than 3 ft. except as permitted in Exception 2.

Exception No. 2: Service drop conductors of 300 volts or less between conductors where not more than 4 ft. of service-drop conductors pass above the roof for the purpose of terminating at a (through-the-roof) service raceway or approved support may be maintained at a minimum of 18 inches from any portion of the roof over which they pass. (Illustrated on Paragraph 401.3-1, Figure 2).

401.3-1 CLEARANCE OVER BUILDINGS AND STRUCTURES

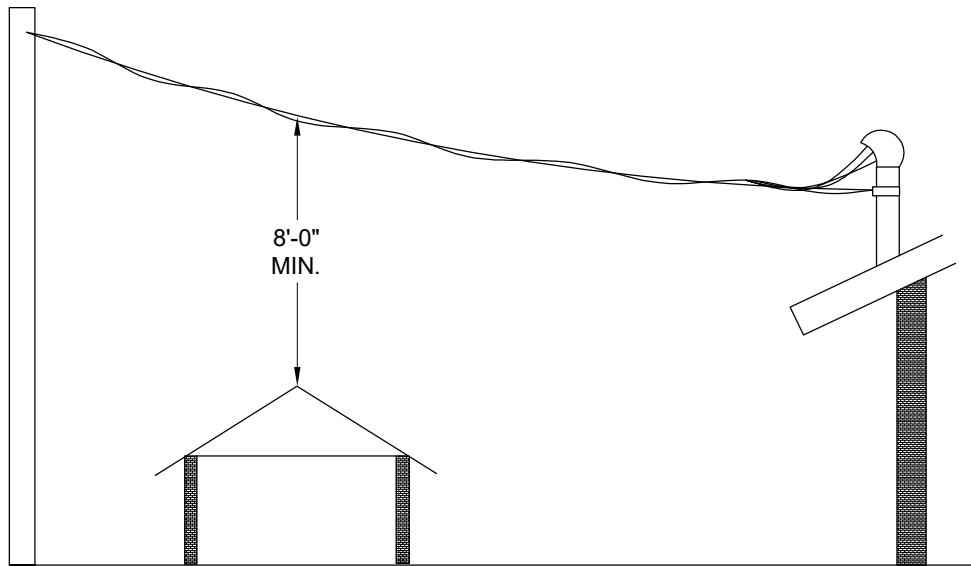
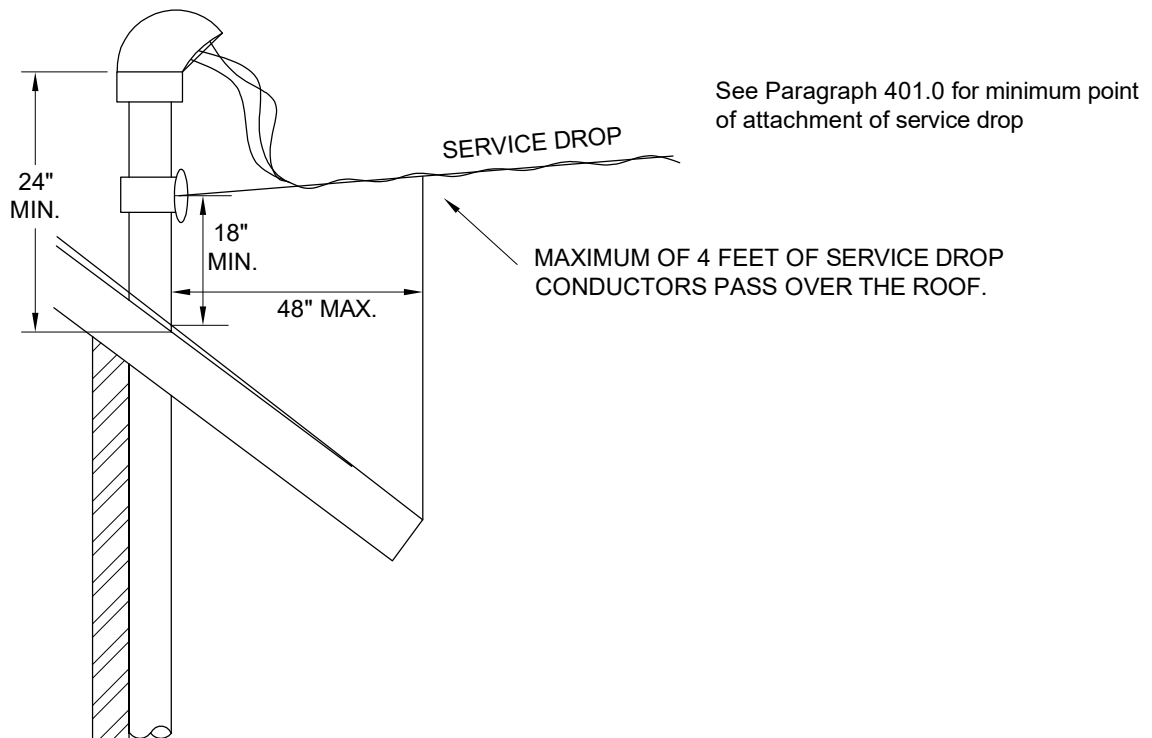


FIGURE 1

Clearance above residential, non-residential or industrial buildings on premises served or adjacent premises; OTHER THAN THE BUILDING SERVED. See Paragraph 401.3 for possible exceptions

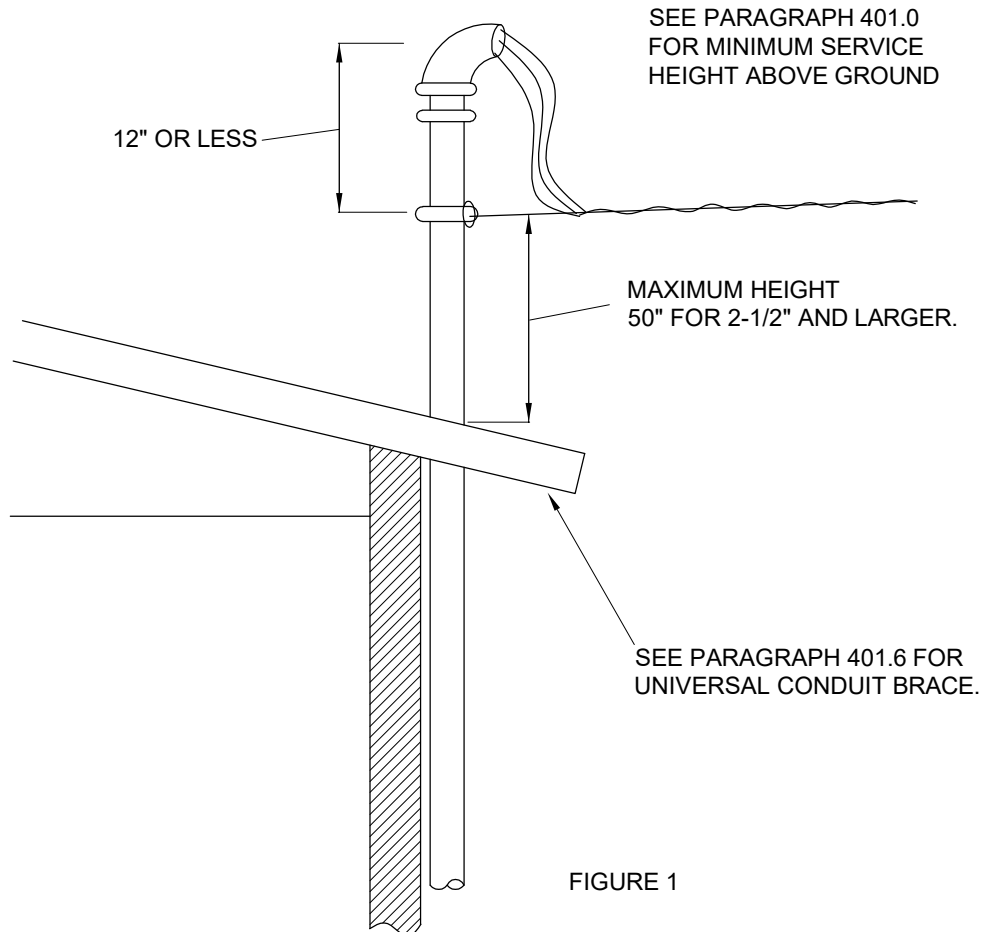


Service entrances shall not be located within a roofed-over area necessitating APS personnel to walk on, or place a ladder on roof to make attachment to riser conduit or support, and to connect Customer's service.

#### 401.4 POINT OF ATTACHMENT STRUCTURE

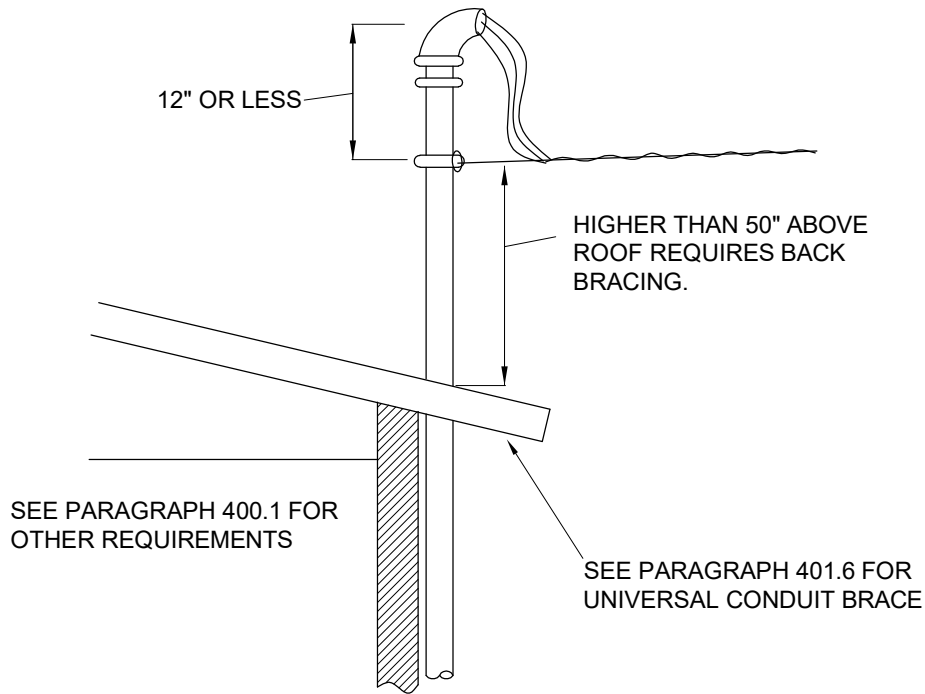
An attachment structure is a support for the purpose of providing a higher point of attachment for the service drop than is provided by the building itself. It may be constructed of rigid galvanized steel pipe or galvanized angle iron. When an attachment structure is necessary to maintain the required clearances, it shall be of a type satisfactory to APS and meet all applicable codes. Such a structure shall be installed and maintained at the expense of the property owner or customer and be of sufficient strength to support the service drop wires and service attachment. The service entrance conduit may be used as and considered to be, an attachment structure; in which case the riser shall be not less than 1 1/2" galvanized rigid steel conduit or IMC. (See Paragraph 400.1) EMT or Plastic shall not be used.

##### 401.4-1 ATTACHMENT STRUCTURE (BRACING RISERS)



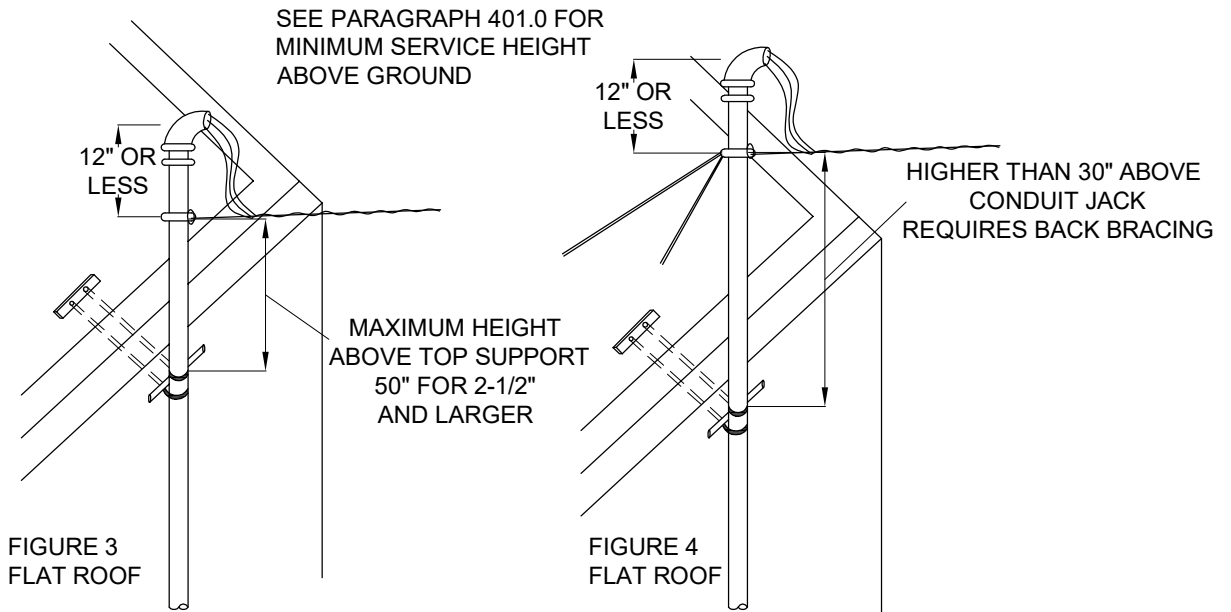
Where the service conduit riser is used as a mast for supporting the service drop, the point of attachment shall not be higher than 50" above the roof unless substantially braced (not guyed) on the roof to provide sufficient strength to support the strain of the service conductors, and to permit a man to work safely from a ladder bearing against the conduit (See Paragraph 401.5 for alternative to bracing for residential).

401.4-1 ATTACHMENT STRUCTURE (CONT.)



**BACK BRACING:** Risers that require back bracing shall be braced against the pull of the service drop conductors. Back bracing shall consist of two steel members installed at approximately a 90 degree spread. Minimum size braces shall be 3/4" rigid galvanized steel pipe or 1 1/4" x 1 1/4" x 1/8" steel angle.

**EXCEPTION:** Residential and non-residential, 200 ampere service or less: 3/4" electrical metallic tubing (EMT) may be used for back braces if used to pull against the load as shown in Figure 2 and 4, Paragraph 401.4-1. Push braces must be rigid steel as listed above.



**401.5 ALTERNATE METHOD FOR POINT OF ATTACHMENT (BLOCK STRUCTURE)**

This method of service attachment is acceptable to APS if point of attachment is no higher than 50" above the roof. Check the local municipal inspection agency for acceptance.

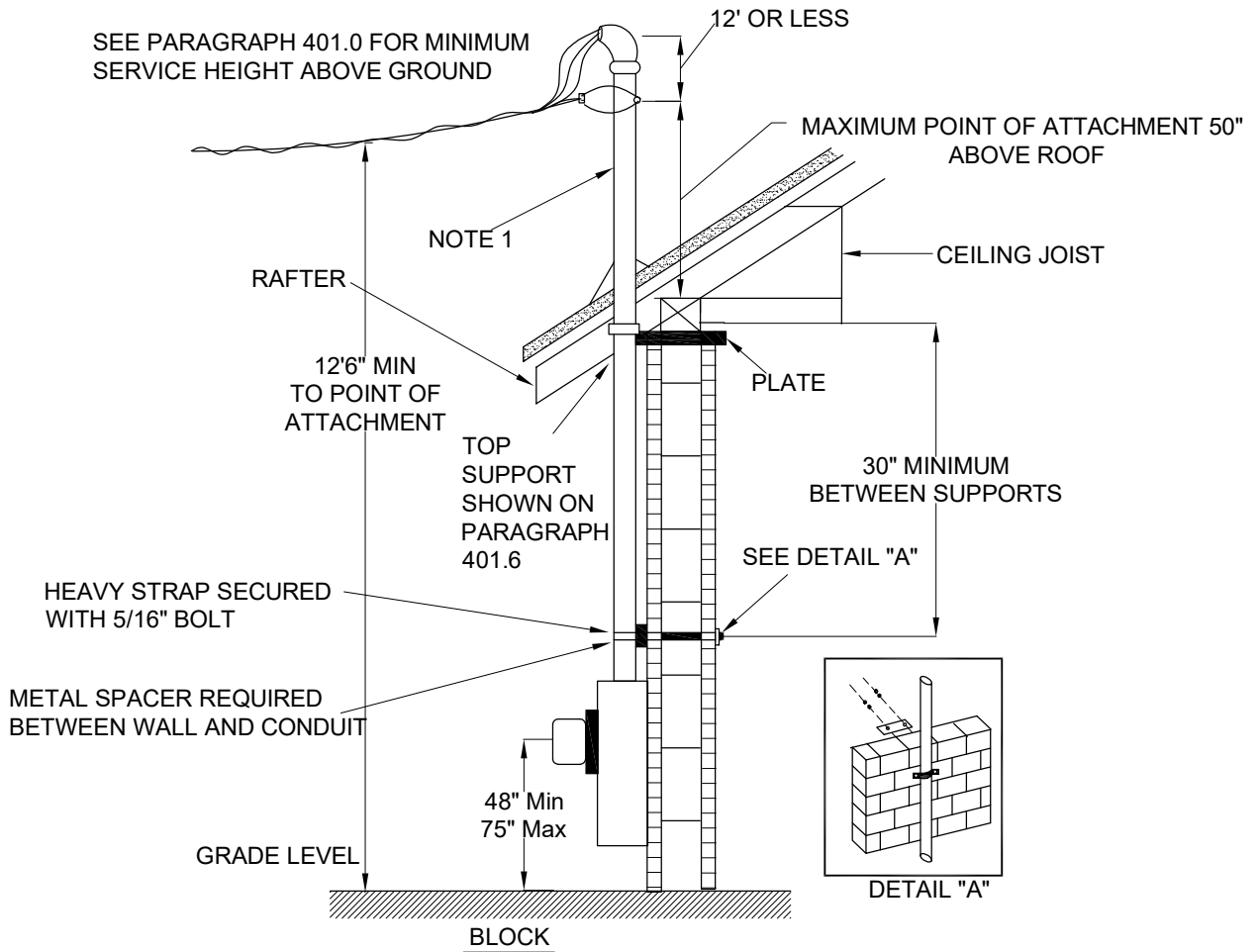


FIGURE 1

**NOTES:**

1. Riser to be minimum 2-1/2" rigid steel conduit or IMC. EMT or Plastic shall not be used, no thread less connection can be used.
2. No couplings are permitted above the highest brace.
3. APS will not be responsible for any damage to the building caused by rain or structural failure.
4. If point of attachment is higher than 50" above the roof then back bracing is required (See Paragraph 401.4-1).
5. Maximum service length for this installation is 100 feet.
6. See Section 300, Paragraph 301.16 for Electric to Gas clearances.

#### 401.5-1 ALTERNATE METHOD FOR POINT OF ATTACHMENT (WOOD FRAME STRUCTURE)

This method of service attachment is acceptable to APS if point of attachment is no higher than 50" above the roof. Check the local municipal inspection agency for acceptance above.

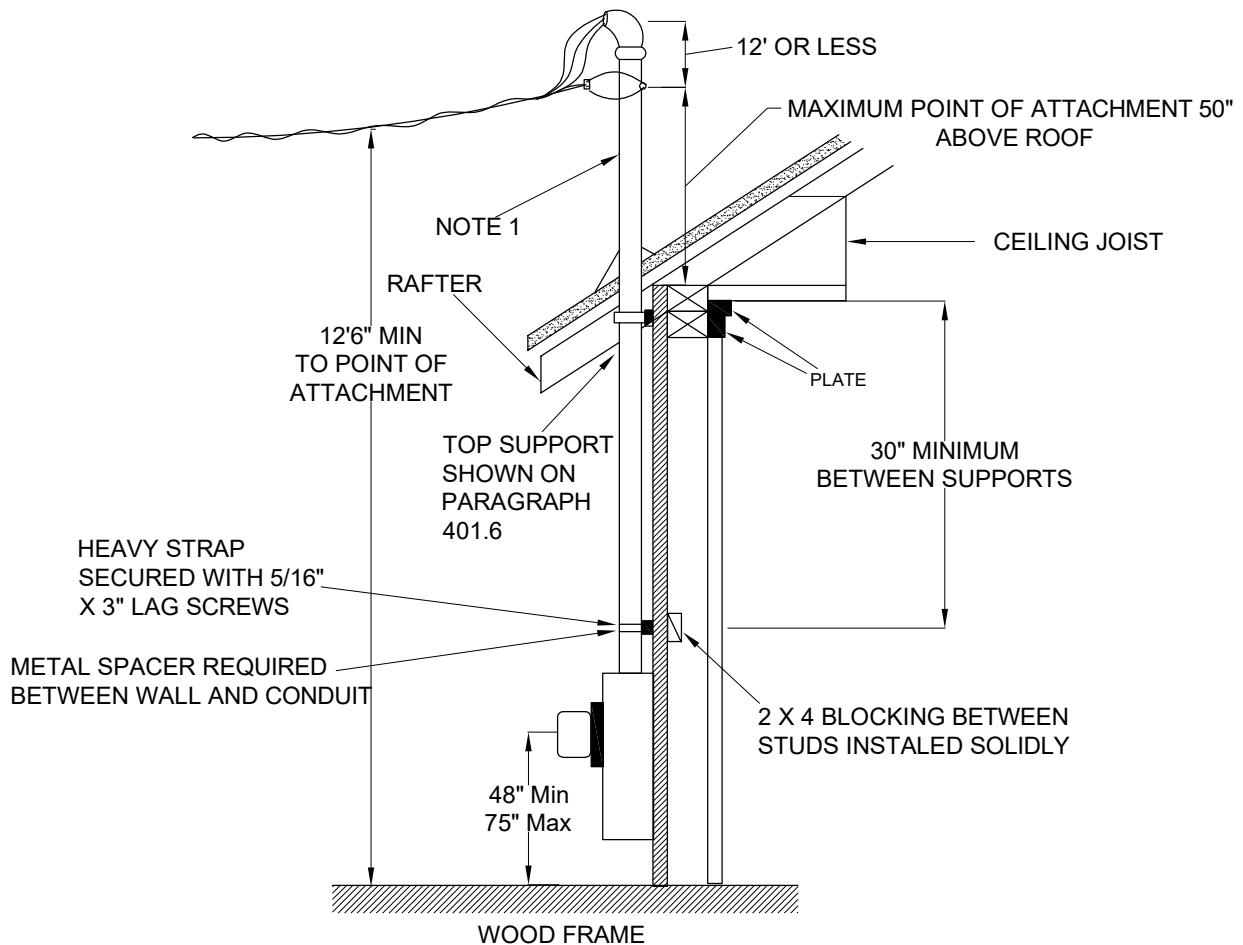


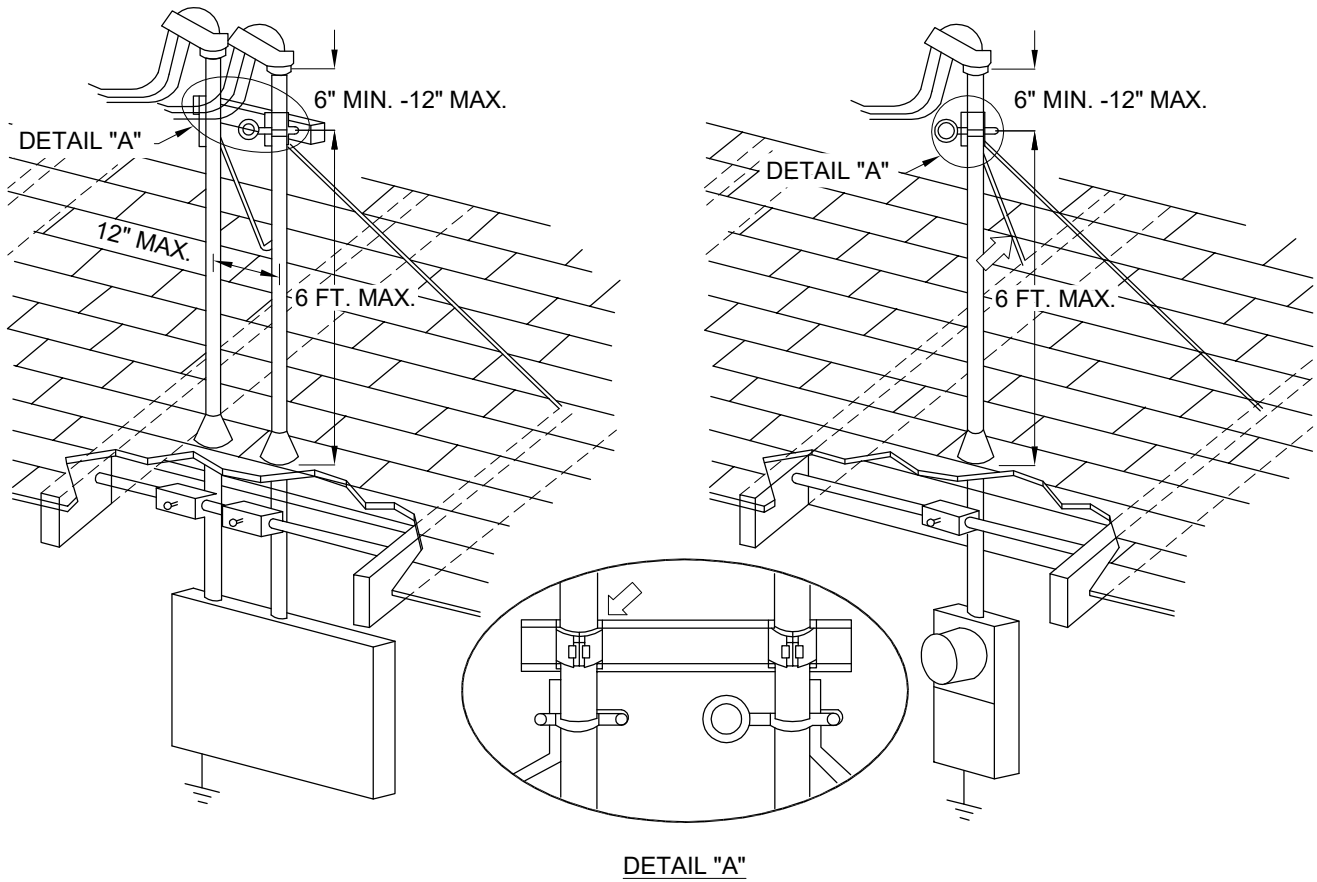
FIGURE 1

#### NOTES:

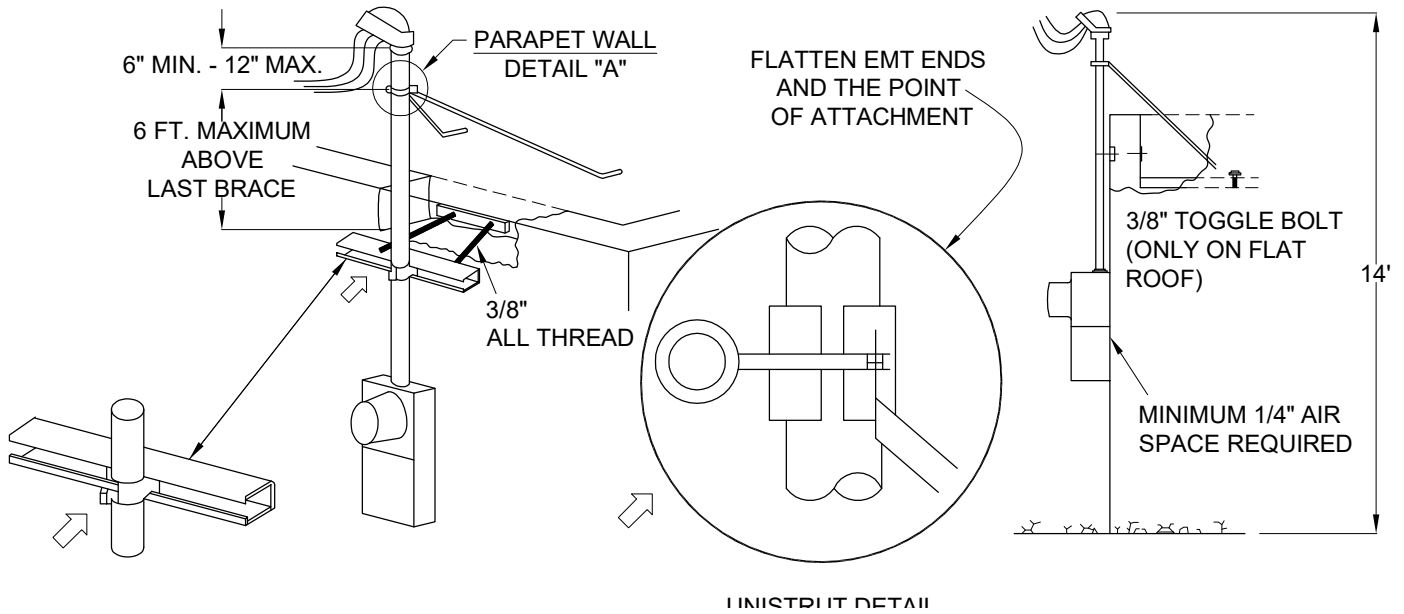
1. Riser to be minimum 2-1/2" rigid steel conduit or IMC. EMT or Plastic shall not be used, no thread less connection can be used.
2. No couplings are permitted above the highest brace.
3. APS will not be responsible for any damage to the building caused by rain or structural failure.
4. If point of attachment is higher than 50" above the roof then back bracing is required (See Paragraph 401.4-1).
5. Maximum service length for this installation is 100 feet.
6. See Section 300, Paragraph 301.16 for Electric to Gas clearances.

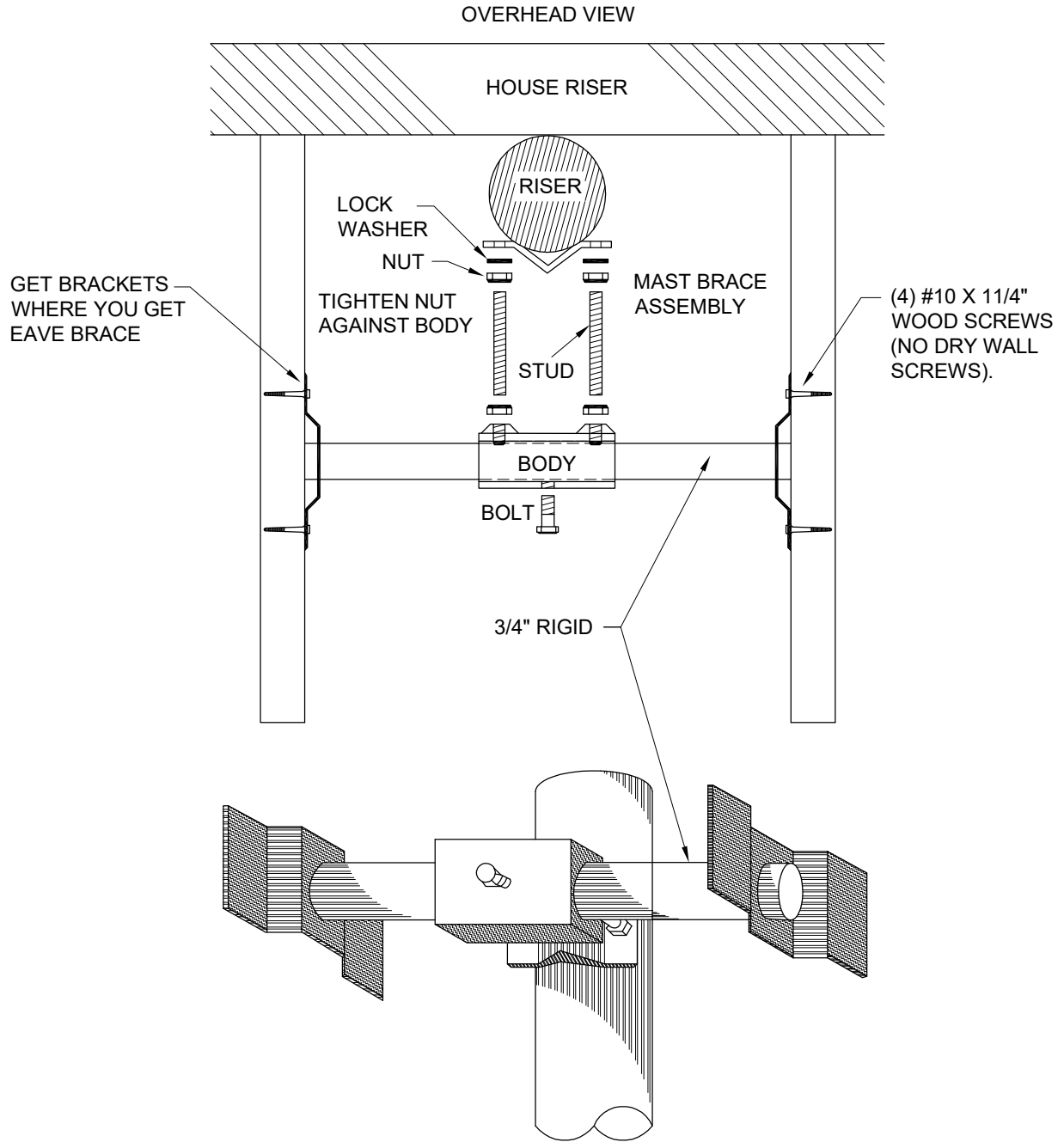


401.6-1 UNIVERSAL SERVICE DROP CONDUIT BRACE



NEED BACK BRACE IF 2" RISER IS HIGHER THAN 30" ABOVE PARAPET WALL BRACE



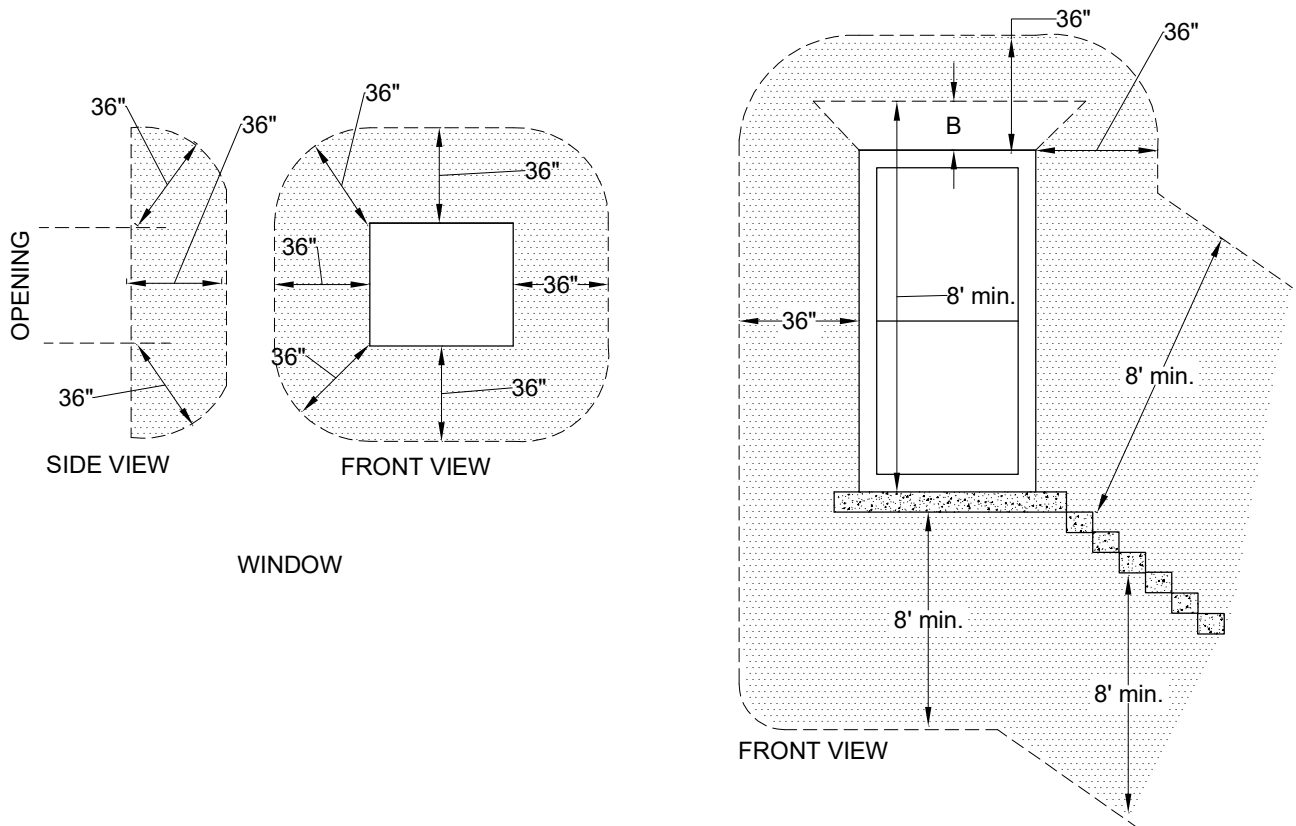


**401.7 CLEARANCE FROM DOORS, EXITS, WINDOWS, FIRE ESCAPES, BALCONIES, ETC.**

The vertical, horizontal and radial service drop conductor clearance from doors, exits, windows, fire escapes, vegetation, etc., at any of which human contact might be expected, shall not be less than that specified and illustrated:

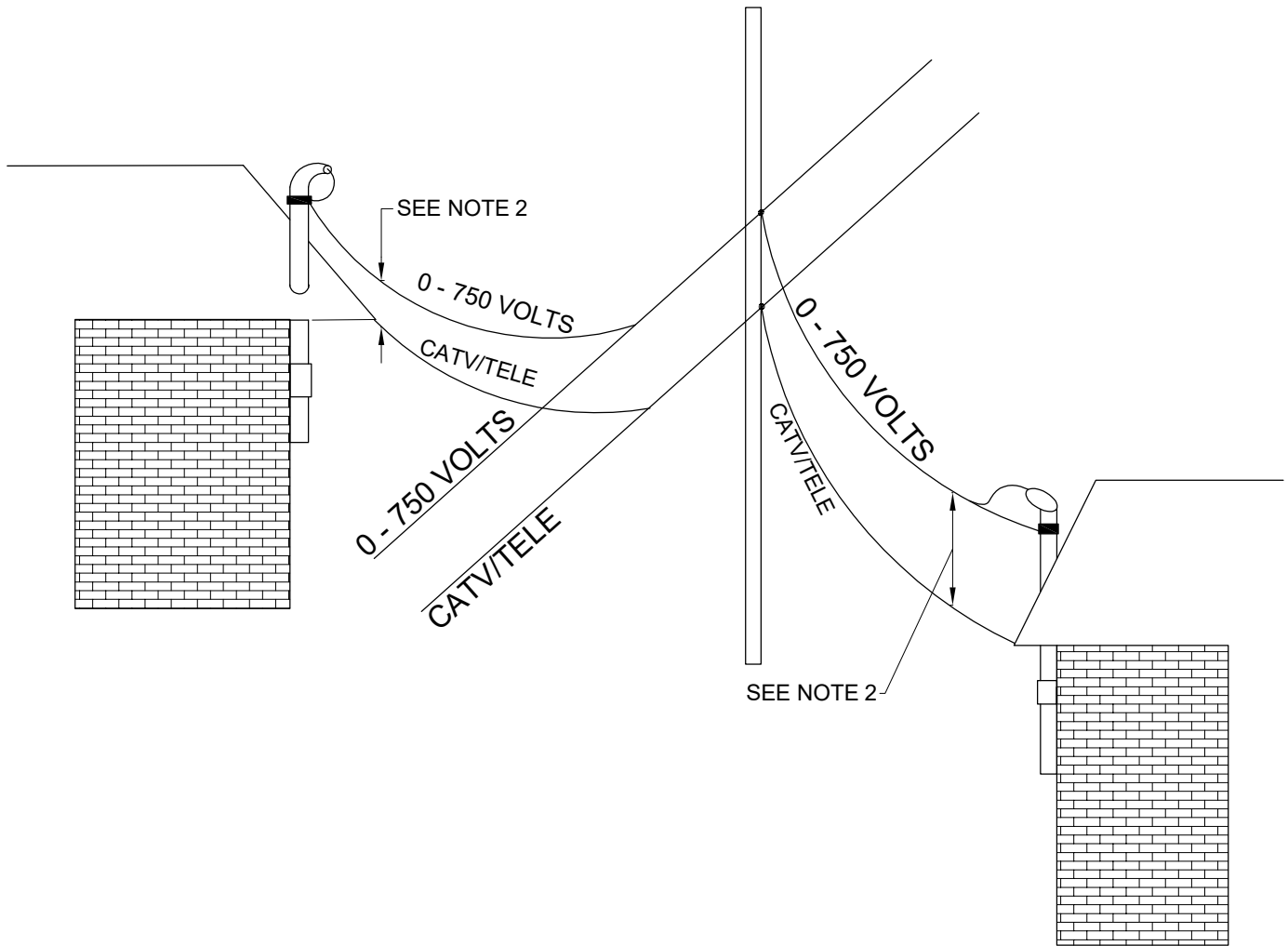
	Minimum Clearance
1. Vertically above and below surfaces of fire escapes, balconies, stairways and walkways .....	8 Feet
2. Horizontally and radially from doors, exits, windows and other openings .....	3 Feet
3. Horizontally and radially from the outer extremities of the fire escapes, balconies, stairways, satellite dishes, antennas, walkways, and other objects .....	3 Feet
4. Vegetation clearcut distance around service conductors in all directions .....	5 Feet

**CLEARANCE FROM DOORS, EXITS, WINDOWS, FIRE ESCAPES, BALCONIES, ETC.  
(For Exposed Service Conductors Only — See Note 3)**



**NOTES:**

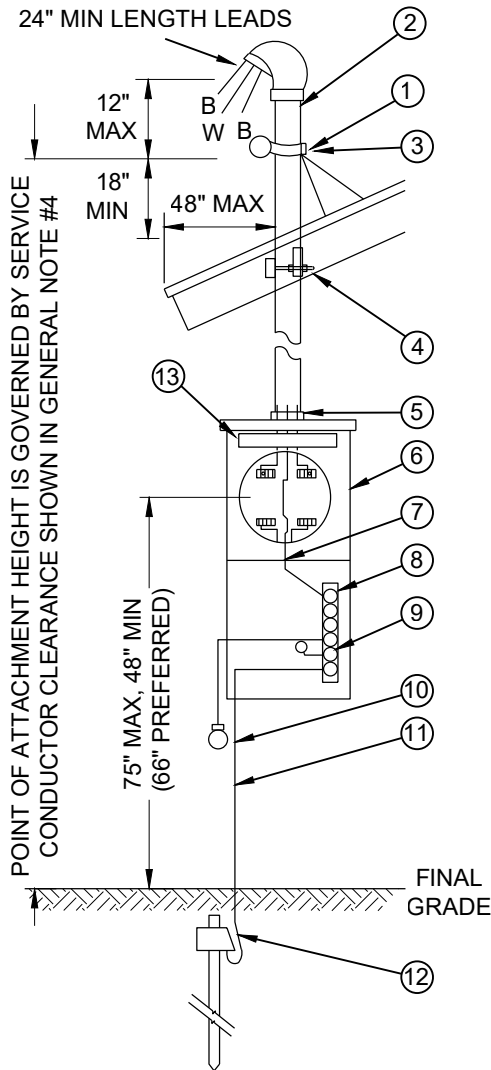
1. Service drop conductors not permitted within shaded zones.
2. Dimension "B" may be less than 36 inches, provided it is a minimum of 12 inches above opening and the minimum 8 foot vertical clearances shown are obtained.
3. Conduit and meter cans may be inside shaded areas. Service conductors, drip loops or any wire may not be inside shaded areas.
4. Vegetation management (tree work) is extremely hazardous work, particularly near energized powerlines. By law, such work nearby overhead conductors shall be undertaken only by an OSHA-defined, line-clearance arborist. Contact APS for questions or additional information.



**NOTES:**

1. Voltages are phase to ground.
2. Clearance from CATV/TELCO to electric service conductors.  
 12" ----- multiplex electric service  
 30" ----- open wire electric service
3. Clearances are for any point in the service span.
4. Clearances must be maintained between electric services and all telephone/CATV cables and services. A higher point of attachment may be necessary to maintain clearances. This is especially important if the electric point of attachment is close to existing APS pole lines. Contact your local APS customer service representative if you are in doubt about proper clearances.

**401.9 TYPICAL OVERHEAD RESIDENTIAL METER INSTALLATION**  
100-225A, 1 PH, 3W, 120/240 VOLT



This is a list of material for a normal overhead residential meter installation. It is not intended to be all inclusive but gives the more common requirements. All equipment shall comply with EUSERC requirements and all specifications found in the APS Electric Service Requirements Manual (ESRM). Recommended wire sizes shown below are for information only. The Local Authority Having Jurisdiction (AHJ) determines the actual sizes required.

SERVICE RATING	COPPER	ALUMINUM	WEATHERHEAD & CONDUIT
100A	#4	#2	1-1/2"
125A	#2	#1/0	1-1/2"
150A	#1	#2/0	1-1/2"
200A	#2/0	#4/0	2"
225A	#3/0	#250	2" (2-1/2" IF #250)

1. Point-of-attachment to be insulated. (ESRM 400.1)
2. Rigid metal conduit is required if service is attached to the service drop damp. If conduit is attached to building, Customer is to install a 1/2" bolt with a 2" backing washer.
3. Unbraced point-of-attachment maximum height above roof is 20" for 1-1/2" conduit and 30" for 2" and larger conduit.
4. Universal service drop brace.
5. Approved hub, must be raintight.
6. Meter socket, breaker panel must be raintight equipment. Meter socket jaws or clips shall be free of foreign material (mud, paint, plaster, etc.). **RINGLESS METER SOCKETS ARE NOT ACCEPTABLE.**
7. Neutral to be a continuous, unbroken conductor from the weatherhead to the neutral landing block.
8. Neutral landing block.
9. Install a bonding jumper or screw if the neutral landing block is insulated from the enclosure.
10. Bonding of piping systems - all interior metal piping shall be bonded to the electric grounding system. Gas piping shall be bonded on the house side of the insulating coupling.
11. The ground wire (#4 bare solid copper) shall be continuous from the neutral landing block to an approved grounding electrode system in compliance with NEC Article 250. The ground wire must be properly supported and attached to the building at 24" intervals.
12. Approved grounding electrode system.
  - a. 5/8" x 8' long ground rod and approved clamp. Entire length of rod to below grade.
  - b. 20' of bare #4 copper wire installed in concrete footer (UFER)

Permits and inspections are required. Please contact the governing inspection agency in your area.

**Note:** Enough wire to reach main disconnect enclosure must extend outside concrete footer.

**GENERAL NOTES:**

1. Meter location to be specified by Company Representative.
2. If more than one meter to the premises, each meter shall be permanently identified, by the Customer, to properly identify that portion of the premises being served. Metal stamping or metal tag is required. Painted identification is not acceptable.
3. All materials or work furnished by the Customer shall be in accordance with all applicable codes or standards.

4. Minimum service height above ground (phase to ground voltages):

- |                                                                                                                                     |        |
|-------------------------------------------------------------------------------------------------------------------------------------|--------|
| a) Within Right-of-Way of roads, streets, alleys, non-residential driveways, parking lots, and other areas subject to truck traffic | 18'-0" |
| b) Service over residential driveways. (See 401.0)                                                                                  | 12'-6" |
| c) Commercial spaces, driveways, and parking lots                                                                                   |        |
| NOT subject to truck traffic                                                                                                        | 12'-6" |
| d) Areas accessible to pedestrians only                                                                                             | 12'-0" |

**5. Minimum attachment height is 12ft - 6in. Additional height may be required according to Authority having jurisdiction (AHJ).**

## 402.0 CUSTOMER SERVICE POLE

---

### 402.1 LOCATIONS

THE LOCATION OF CUSTOMER METER POLES SHALL BE APPROVED BY APS BEFORE SETTING.

Meters or attachments shall not be mounted on APS poles. When it is necessary for the service point of attachment and service entrance to be made to a pole instead of the residence or building, that pole is to be provided by the Customer and its height shall be great enough to give sufficient clearance for APS service wires.

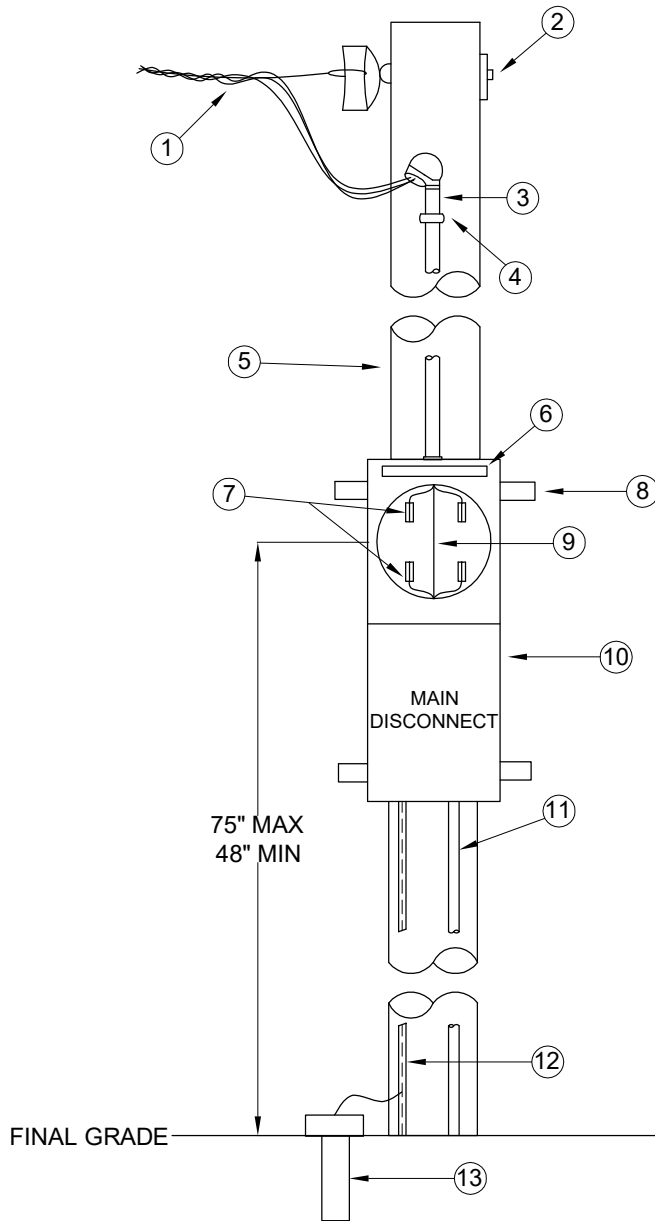
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### 402.2 REQUIREMENTS: (WOOD)

Customer provided Wood Poles shall comply with the following requirements:

1. Full length pressure treated pole per American Wood Protection Association (AWPA) Book of Standards, latest revision. This can only be done by a commercial plant specifically designed to perform this treatment. Surface applications of preservatives will not meet this requirement.
2. Any AWPA specified treatment for poles is acceptable.
3. Temporary service poles may be moved from jobsite to jobsite, but must be inspected and approved by APS prior to each installation.
4. For permanent or temporary installations, a used pole may be used as a customer service pole without being retreated, if both of the following conditions are met:
  - a.) The pole is eight years of age or less
  - b.) The butt has not been cut off, or damaged by abrasion or penetration
5. If a used pole is over eight years old, has a damaged butt, or has had the top cutoff, it may be reused provided it is sound and retreated in accordance with the following items below. Additionally, the pole must be inspected and approved by authorized APS personnel prior to being installed in place.
  - a.) If the pole is over eight years old or the butt has been cut off or damaged, the pole must be retreated by a full length pressure treatment as specified in items 1 and 2 above.
  - b.) If the top of the pole has been cut off, a commercial wood preservative must be applied to the cut to prevent water penetration and resultant pole deterioration.
6. Supplier information shall be identified on the face of the pole, using a burn brand or a non-corrosive metal tag, per Section 402.2-1.

402.2-1 CUSTOMER SERVICE POLE 0 - 300 VOLTS

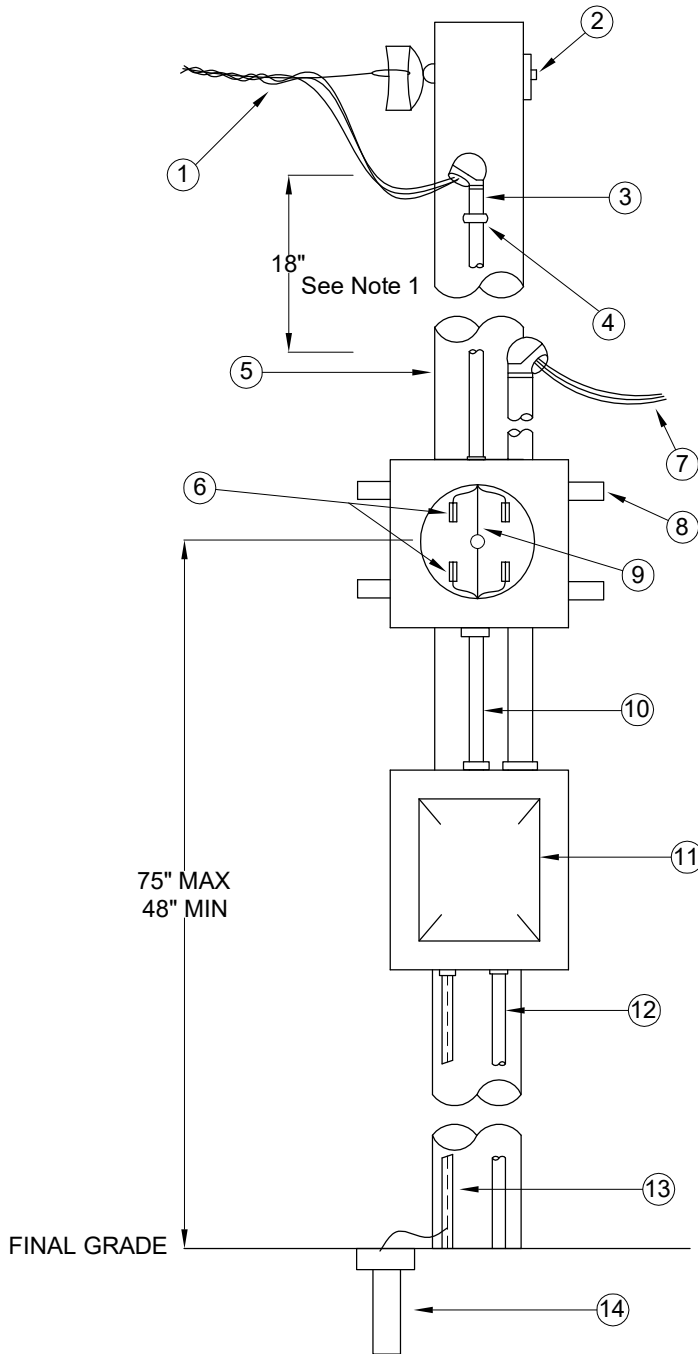


- 1.) APS SERVICE WIRES AND POINT OF ATTACHMENT CONNECTION MADE BY APS. WEATHERHEAD MUST BE WITHIN 12" OF POINT OF ATTACHMENT.
- 2.) CUSTOMER TO DRILL HOLE THROUGH POLE IN THE DIRECTION OF SERVICE DROP AND INSTALL 1/2" EYEBOLT WITH 2" SQUARE WASHER FOR SERVICE ATTACHMENT.
- 3.) ENTRANCE CONDUIT SHALL NOT BE INSTALLED ON OPPOSITE SIDE OF POLE FROM POINT OF ATTACHMENT.
- 4.) PIPE STRAP SUPPORTS NOT OVER 6'-0" APART.
- 5.) POLE FURNISHED BY CUSTOMER (SEE LOCATION - REQUIREMENTS - SIZES).
- 6.) RIVETED NON-FERROUS METAL ADDRESS LABEL. SEE 302.1 FOR LABEL REQUIREMENTS.
- 7.) WIRES TO BE CONNECTED IN METER SOCKET BY CUSTOMER.
- 8.) UNISTRUT.
- 9.) NEUTRAL SHALL NOT BE CUT.
- 10.) APPROVED ALL-IN-ONE METER PANEL.
- 11.) UNDERGROUND CONDUIT TO CUSTOMER'S LOAD.
- 12.) APPROVED GROUND WIRE.
- 13.) APPROVED GROUND ROD AND CLAMP.

NOTES:

1. See Paragraph 401.0 for minimum heights.
2. Drip Loop conductors minimum height is 10 feet 6 inches.
3. See Paragraph 402.3 for wood and steel pole sizes.
4. Weatherhead must be located within 12 inches of point of attachment.
5. Wood poles are exempt from insulated point of attachment requirement.
6. Unistrut shall be mounted to pole using a 1/2" minimum galvanized through bolt with a 1 1/2" backing and a lock nut. Meter panel shall be attached to unistrut using 1/4" minimum through bolts. Pole shall be notched to the depth of the unistrut (1" unistrut maximum).

402.2-2 CUSTOMER SERVICE POLE



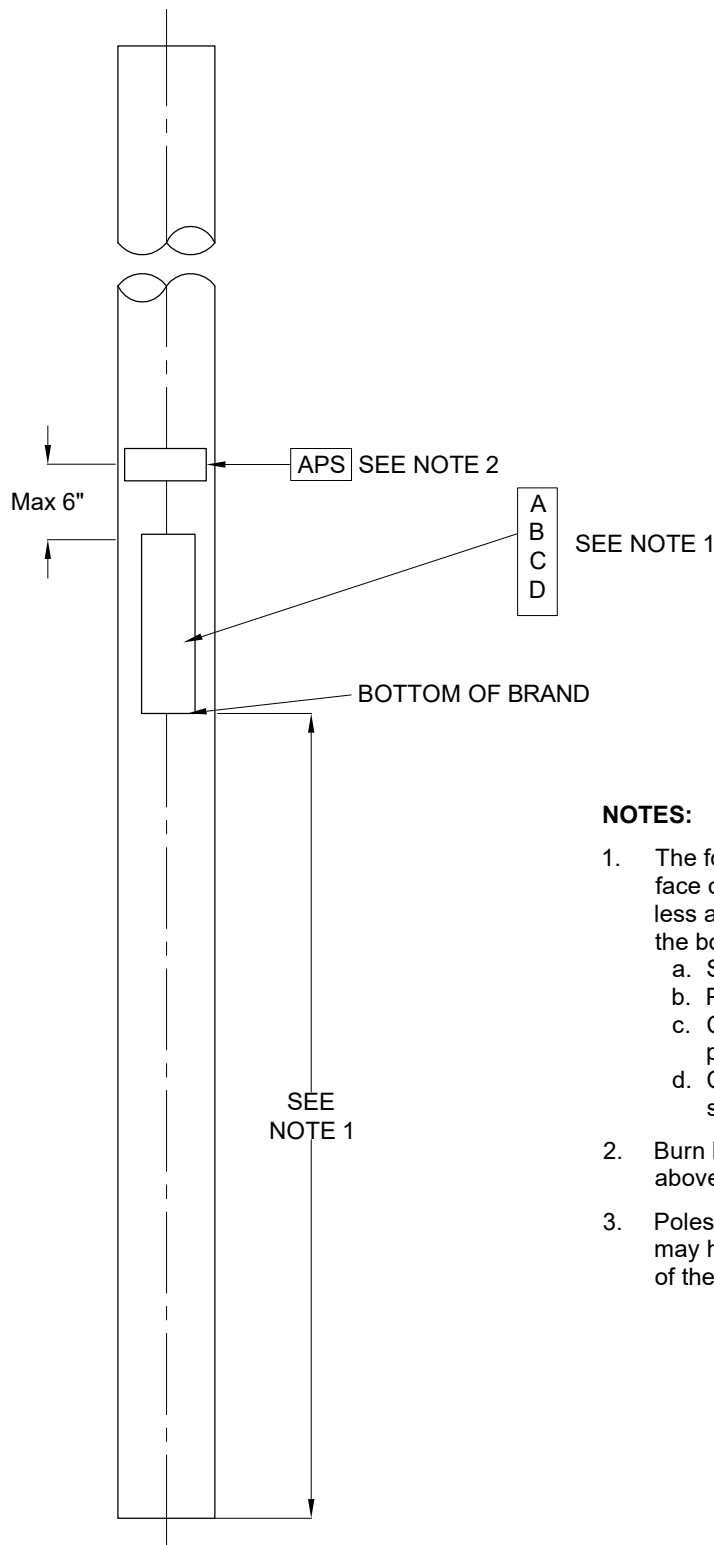
- 1.) APS SERVICE WIRES AND POINT OF ATTACHMENT CONNECTION MADE BY APS. WEATHERHEAD MUST BE WITHIN 12" OF POINT OF ATTACHMENT.
- 2.) CUSTOMER TO DRILL HOLE THROUGH POLE IN THE DIRECTION OF SERVICE DROP AND INSTALL 1/2" EYEBOLT WITH 2" SQUARE WASHER FOR SERVICE ATTACHMENT.
- 3.) ENTRANCE CONDUIT SHALL NOT BE INSTALLED ON OPPOSITE SIDE OF POLE FROM POINT OF ATTACHMENT.
- 4.) PIPE STRAP SUPPORTS NOT OVER 6'-0" APART.
- 5.) POLE FURNISHED BY CUSTOMER (SEE 402.2-3 & 402.3 FOR REQUIREMENTS).
- 6.) WIRES TO BE CONNECTED IN METER SOCKET BY CUSTOMER.
- 7.) TO CUSTOMER'S LOAD.
- 8.) UNISTRUT.
- 9.) NEUTRAL SHALL NOT BE CUT.
- 10.) 4" NIPPLE MINIMUM GROUND BUSHINGS AND BONDING REQUIRED ON ALL UNFUSED NIPPLES.
- 11.) APPROVED ENCLOSED BREAKER PANEL.
- 12.) ALTERNATE UNDERGROUND CONDUIT TO CUSTOMER'S LOAD.
- 13.) APPROVED GROUND WIRE.
- 14.) APPROVED GROUND ROD AND CLAMP.

**NOTES:**

1. Minimum clearance from the APS line-side wires to the Customer's load-side wires, or Customer attachments, shall be 18 inches.
2. No Customer facilities shall be located above APS facilities.
3. Wood poles are exempt from insulated point of attachment requirement.
4. Unistrut shall be mounted to pole using a 1/2" minimum galvanized through bolt with a 1 1/2" backing and a lock nut. Meter panel shall be attached to unistrut using 1/4" minimum through bolts. Pole shall be notched to the depth of the unistrut (1" unistrut maximum).



402.2-3 CUSTOMER SERVICE POLE REQUIREMENTS (WOOD)



**NOTES:**

1. The following information shall be burn branded on the face of the pole at a distance of  $10' \pm 2''$  for poles 50' and less and  $14' \pm 2''$  for poles 55' and greater from the butt to the bottom of the brand.
  - a. Supplier's Code or Trade Mark.
  - b. Plant location and the Year of Treatment.
  - c. Code letters denoting the pole species and preservative used.
  - d. Circumference Class numeral and numerals of showing length of the pole.
2. Burn brand "APS" on the face of the pole 6" maximum above the suppliers trade mark.
3. Poles purchased between May 1958 and December 1991 may have the pole brand stamped at 12 feet from the butt of the pole.

**WOOD POLE MARKING**

(per APS T&D Material Specification MS-1913)

**402.3 CUSTOMER SERVICE POLE - SIZES**

**(WOOD POLES)**

Minimum Attachment Clearance Above Ground (Feet)	Length Of Pole (Feet)	Minimum Circumference At Top (Inches)	Minimum Circumference At 6 Feet From Butt (Inches)	Minimum Setting Depth (Feet)
12.5	18**	19	24	4
15	20	19	28	4
18	25	19	28	5
24	30	19	30	5

**(STEEL POLES)**

Clearance Above Ground (Feet)	Length Of Pole (Feet)	Minimum Setting Depth (Feet)*	Minimum Diameter (Inches)	Minimum Gauge (Inches)
12.5	16	3	3.5	0.226
16	20**	4	4	0.237
20	25	5	5	0.258
25	30	5	5	0.258

\* Minimum setting depth in rock is 3' when approved by APS.

\*\* Minimum length for joint use with communications.

**NOTES:**

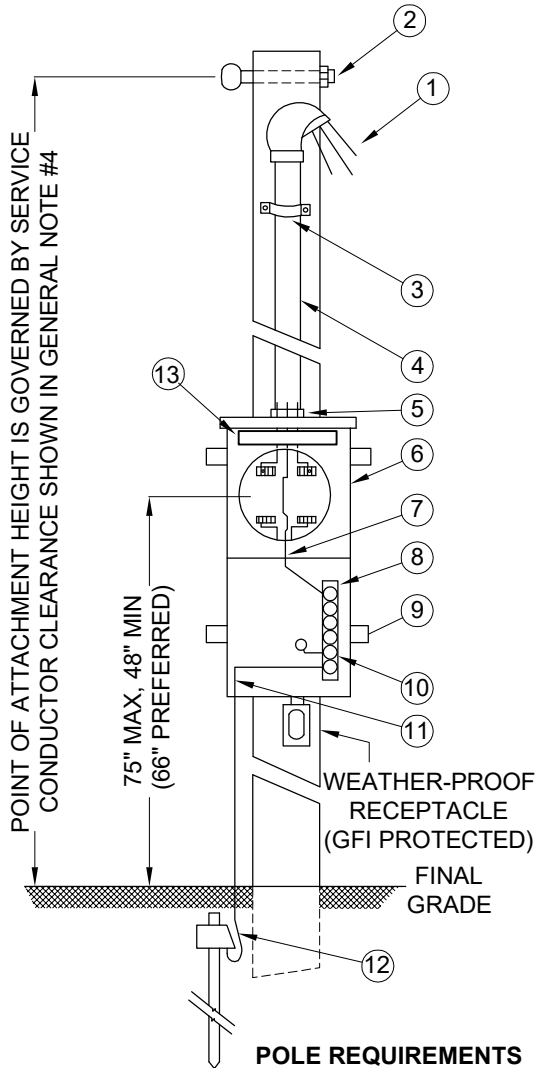
1. Point of attachment of conductors for steel poles shall be insulated.
2. Circumferences are for Class 5 Ponderosa Pine.
3. For Steel Poles, the portion of the steel pole that is below grade, up to a minimum of 6" above grade, shall be factory coated or shall be half-lapped with minimum 20 mil. tape suitable for its use, to a total thickness of 40 mil. The tape shall be labeled to include the thickness (20 mil.) and the manufacturer's name. Pole-wrapping tape to be installed in accordance with tape manufacturer specifications.
4. Steel poles shall be of a single continuous piece construction.

**402.4 SERVICE RISER CONDUCTORS**

Wires from the weatherhead and from the main service switch shall be properly made-up and connected to the meter socket - by the Customer. The neutral wire shall be bonded to the meter socket at the "lay-in" lug on the socket (It shall not be cut within the socket enclosure. See Paragraph 400.2 for identification of conductors).

**402.5 TYPICAL POLE-MOUNTED METER INSTALLATION FOR RESIDENTIAL / COMMERCIAL OR TEMPORARY SERVICE**  
 100-225A, 1 PH, 3W, 120/240 VOLT

Permits and inspections are required. Please contact the governing inspection agency. This is a list of material for a normal pole-mounted meter installation. It is not intended to be all inclusive but gives the more common requirements. All equipment shall comply with EUSERC requirements and all specifications found in the APS Electric Service Requirements Manual (ESRM).



1. Weatherhead-conductor leads to extend a minimum of 24" beyond the weatherhead.
2. 1/2" eyebolt with a 2" backing washer. Must be located within 12" of the weatherhead & shall be point of attachment. Customer to drill hole through pole in the direction of service drop. Insulated point of attachment required if steel pole is used.
3. Conduit support. Not over 6' apart.
4. Rigid or IMC metal conduit.
5. Approved hub must be rain-tight.
6. Meter socket, breaker panel must be rain-tight equipment. Meter socket jaws or clips shall be free of foreign material (mud, paint, plaster, etc.). **RINGLESS METER SOCKETS ARE NOT ACCEPTABLE.**
7. Meter box to be bolted to unistrut. Unistrut to be mounted to using through bolts. Pole shall be notched to the depth of the unistrut. Minimum 1/4" bolt diameter or box to unistrut & 1/2" minimum for unistrut to pole.
8. Neutral to be a continuous, unbroken conductor from the weatherhead to the neutral landing block.
9. Neutral landing block.
10. Install a bonding jumper or screw if the neutral landing block is insulated from the enclosure.
11. The ground wire (#4 bare, stranded or solid copper) shall be continuous from the neutral landing block to an approved grounding electrode system In compliance with NEC Article 250. The ground wire must be properly supported and attached to the pole at 24" intervals.
12. Approved grounding electrode system. 5/8" x 8' long ground rod and approved clamp. Entire length of rod shall be below grade.
13. Riveted non-ferrous metal address label. See Note 2 below and Paragraph 302.1 for label requirements.

**POLE REQUIREMENTS**

Only approved poles will be accepted. The pole must be fully commercially pressure treated and branded in accordance with APS specifications. A used or cut-off pole must be approved by a company representative. Minimum pole length is 18' with 4' set in the ground. Additional pole length will be required if the pole will be used by other utility companies. If a steel pole is used, refer to note 402.3.

**GENERAL NOTES:**

1. Meter location to be specified by Company Representative.
2. If more than one meter to the premises, each meter shall be permanently identified, by the Customer, to properly identify that portion of the premises being served. Metal stamping or metal tag is required. Painted identification is not acceptable.
3. All materials or work furnished by the Customer shall be in accordance with all applicable codes or standards.

4. Minimum service height above ground (phase to ground voltages):
  - a) Within Right-of-Way of roads, streets, alleys, non-residential driveways, parking lots, and other areas subject to truck traffic ..... 18'-0
  - b) Service over residential driveways. (See 401.0)..... 12'-6
  - c) Commercial spaces, driveways, and parking lots NOT subject to truck traffic ..... 12'-6
  - d) Areas accessible to pedestrians only..... 12'-0
5. Minimum attachment height is 12ft - 6in. Additional height may be required according to Authority having jurisdiction (AHJ).



**403.0 OVERHEAD SERVICE WIRE SIZES TABLE**

Permits and inspections are required. Please contact the governing inspection agency. This is a list of material for a normal typical overhead meter installation. All equipment shall comply with EUSERC requirements and all specifications found in the APS Electric Service Requirements Manual (ESRM). Wire size is braced on ampacity of the panel.

**RESIDENTIAL**

SERVICE RATING	COPPER	ALUMINUM	WEATHERHEAD & CONDUIT	NEUTRAL
100A	#4	#2	1-1/2"	Minimum size: 1 size smaller than phase conductor
125A	#2	#1/0	1-1/2"	
150A	#1	#2/0	1-1/2" (2" If #3/0)	
200A	#2/0	#4/0	2" (2-1/2" If > 4/0)	
225A	#3/0	#250	2" (2-1/2" If > 4/0)	

**COMMERCIAL**

SERVICE RATING	COPPER	ALUMINUM	WEATHERHEAD & CONDUIT	NEUTRAL
100A	#3	#1	1-1/2"	Minimum size: 1 size smaller than phase conductor
125A	#1	#2/0	1-1/2"	
150A	#1/0	#3/0	1-1/2" (2" If #3/0)	
200A	#3/0	#250	2" (2-1/2" If > 4/0)	
225A	#4/0	#300	2" (2-1/2" If > 4/0)	



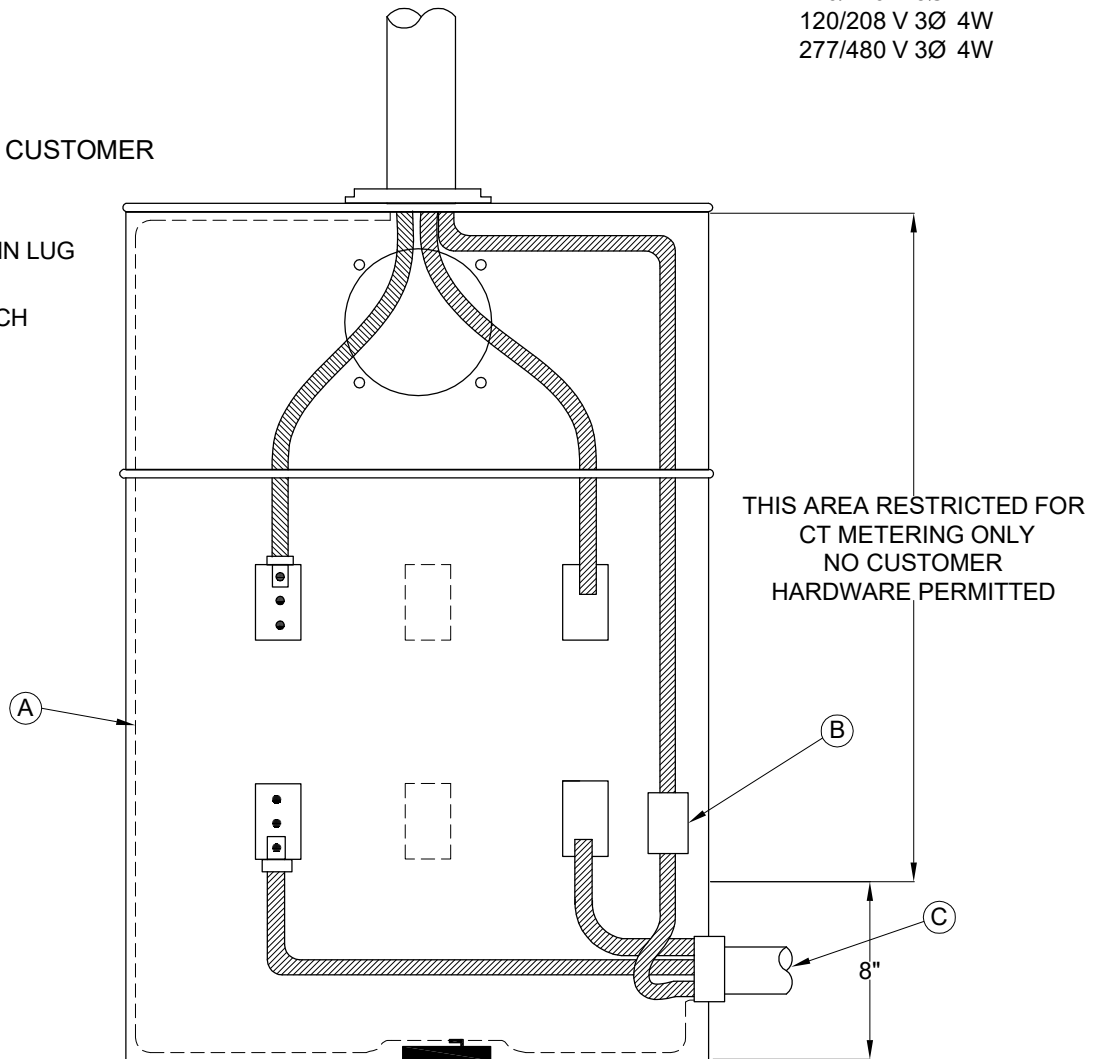
APPLICATION

120/240 V 1Ø 3W  
 120/240 V 3Ø 4W  
 120/208 V 3Ø 4W  
 277/480 V 3Ø 4W

A.) BONDING BY CUSTOMER  
 SEE NOTE 2

B.) NEUTRAL LAY IN LUG

C.) TO MAIN SWITCH



(1Ø 3W and Customer Wiring Shown)  
**400 AMP Overhead Service**

1. Wire and conduit sizes shall be per NEC.
2. When approved bond bushings are used, bond wire may be eliminated.
3. APS furnishes and installs CTs and test switch. The Customer installs the meter socket and runs customer neutral into meter panel.
4. When used for 3Ø-4W Delta service, high phase shall be on the right hand side and identified.

**UNDERGROUND SERVICE**  
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**500.0 GENERAL**

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**500.1 UNDERGROUND**

Underground services are installed in Customer provided conduit. See paragraphs 501 and 502 for U.G. Riser and Conduit Requirements. See Section 600 for Trenching Requirements. Consult with a Company Customer Service Representative for information regarding specifics to your situation.

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**500.2 TRENCHING**

**Remember to always call your local Blue Stake office for underground utility location at least two days before you dig.** (See paragraph 100.12 Section 100) The phone number in the Phoenix Area is 602-263-1100. Outside of Phoenix please call your local APS office, phone numbers are listed in front of this manual on pages "B" and "C". See Trenching Requirements Section 600.

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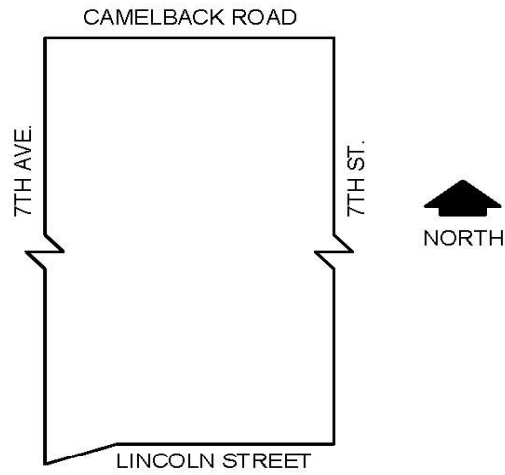
**500.3 UNDERGROUND SERVICE PLANNING**

In order to eliminate unnecessary delays, changes, etc., the Customer shall contact the Company at the initial planning stage so that the location of the service and meter can be determined. Company phone numbers are in front of this manual on pages "B" and "C".

**THE COMPANY RESERVES THE RIGHT TO DETERMINE ALL METER AND UNDERGROUND SERVICE LOCATIONS AND ONLY AUTHORIZED PERSONNEL SHALL DETERMINE THE LOCATION**



IN ALL CASES WHEN PROPOSING INSTALLATIONS OR ALTERATIONS WITHIN THE PHOENIX NETWORK AREA, CONTACT APS REGARDING THE TYPE OF SERVICE AVAILABLE, ETC. ALL VOLTAGES LISTED IN PARAGRAPHS 201.1 AND 201.2, SECTION 200 ARE AVAILABLE IN THIS AREA PLUS 277/480 VOLT NETWORK SERVICE. BY CONTACTING APS AND PROVIDING THE NECESSARY CUSTOMER DATA AT INITIAL PLANNING STAGES, SERVICE REQUIREMENTS, INCLUDING FAULT CONTRIBUTION DATA, WILL BE FURNISHED TO THE CUSTOMER



## 501.0 CUSTOMER – OWNED UNDERGROUND RISER REQUIREMENTS

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### 501.1-1 RESIDENTIAL SINGLE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Min. Riser Trade Size</u>	<u>Min. Radius Size</u>
100 – 225A	2 1/2"	24"
226 - 400A	3"	24"
600A	2 - 3"	24"
800A	2 - 4"	24"

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### 501.1-2 COMMERCIAL SINGLE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Min. Riser Trade Size</u>	<u>Min. Radius Size</u>
100 - 225A	2 1/2"	24"
* 226 - 400A	4"	24"
* 600A	2 - 4"	24"
* 800A	2 - 4"	24"

\* Includes multi-meter packs for multi-family residential installations.

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### 501.1-3 COMMERCIAL AND RESIDENTIAL THREE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Min. Riser Trade Size</u>	<u>Min. Radius Size</u>
100 - 225A	3"	24"
225 - 400A	4"	36"
600A	2 - 4"	36"
800A	2 - 4"	36"
1000A	2 - 4"	36"
1200A	3 - 4"	36"
1600A	4 - 4"	36"
2000A	* 5 - 4"	36"
2500A	* 7 - 4"	36"
3000A	* 9 - 4"	36"

\* Dedicated Service Trench required for each S.E.S., separated by 10' center to center horizontally. No more than 9 conduits allowed in one trench.

**NOTE: Outside diameter is approximately 1/2" larger than riser trade size.**

---

## 501.2 RISER MATERIAL

**Riser shall not be cut with a torch**, welded or brazed. Underground risers shall be of Schedule 80 PVC, Rigid Metallic or Intermediate Metallic Conduit (IMC) and listed or rated for their intended use. **Only true round cross-section risers will be acceptable.**

NOTE: SCHEDULE 80 PVC RISERS CANNOT BE ENCLOSED. A RISER THAT IS ENCLOSED IN ANY MANNER, WHETHER PARTIALLY OR IN ITS ENTIRETY SHALL BE OF RIGID OR INTERMEDIATE METALLIC CONDUIT.

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### 501.2-1 RISER COUPLINGS

**No PVC riser couplings allowed above grade**

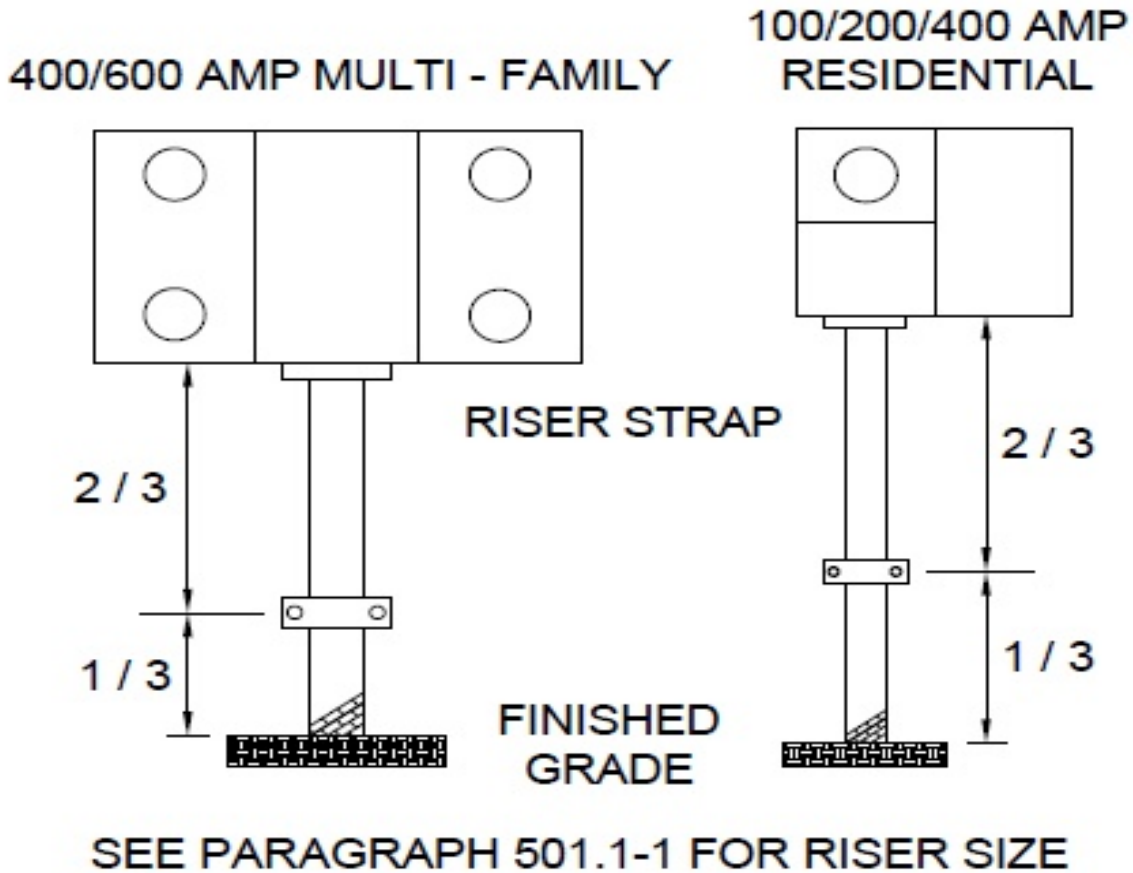
\* Dedicated Service Trench required for each S.E.S., separated by 10' center to center horizontally. No more than 9 conduits allowed in one trench.

\*\* Exception to be reviewed on case by case basis by operations, Asset Management, and the Energy Delivery Compliance Committee.

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**501.3 RISER INSTALLATION**

Risers shall be securely fastened to wall by at least one strap and the service equipment enclosure. The strap shall be located between the riser entrance to the service equipment and finished grade, plus or minus 6". Riser straps are not required if riser is 18" or less in length from ground to panel. The riser strap/straps shall be listed for the purpose for which it's intended. Plumbers tape or similar materials are unacceptable. The riser shall be plumb with no kicks or bends other than one sweep at the bottom for transition to trench elevation and securely fastened to wall with 1/4" lag screws or equivalent. Any deviation from plumb may result in the entire installation being turned down. (See Paragraphs 501.6-1, 2 and 3)



**SEE PARAGRAPH 501.1-1 FOR RISER SIZE**

**501.4 METALLIC RISER COATING**

The portion of metallic risers below grade, up to a minimum of 6" above grade, shall be factory coated or shall be half-lapped with 20 mil. tape suitable for its use, to a total thickness of 40 mil. The tape shall be labeled to include the thickness (20 mil.) and the manufacturer's name. If riser is factory coated, it shall have a U.L. label.

Note: The coupler connecting the PVC conduit system to the metallic riser shall also be taped per the above paragraph.

**501.5 ATTACHMENT TO SES**

Schedule 80 PVC conduit risers shall be secured to the pull section with a threaded male slip-sleeve connector and a steel lock nut, a threaded male slip-sleeve connector into a factory bolt-on hub, or a malleable “chase nipple” into a threaded female slip-sleeve connector on the riser. (See Figure 1)

Metallic conduit risers shall be secured to the pull section using a riser “hub” with a bondable lock nut/bushing, a factory bolt-on hub, or a self-bonding hub (Meyers or equivalent). The self-bonding hubs shall be installed in the largest knock-out provided. (See Figure 2)

**NOTES:**

1. If factory bolt-on hub is used, all knock-outs shall be removed.
2. Reducer washers shall be installed on the inside and outside of section whenever the largest knock-out is not used.
3. A riser that is enclosed in any manner, whether partially or in its entirety shall be of rigid or intermediate metallic conduit.

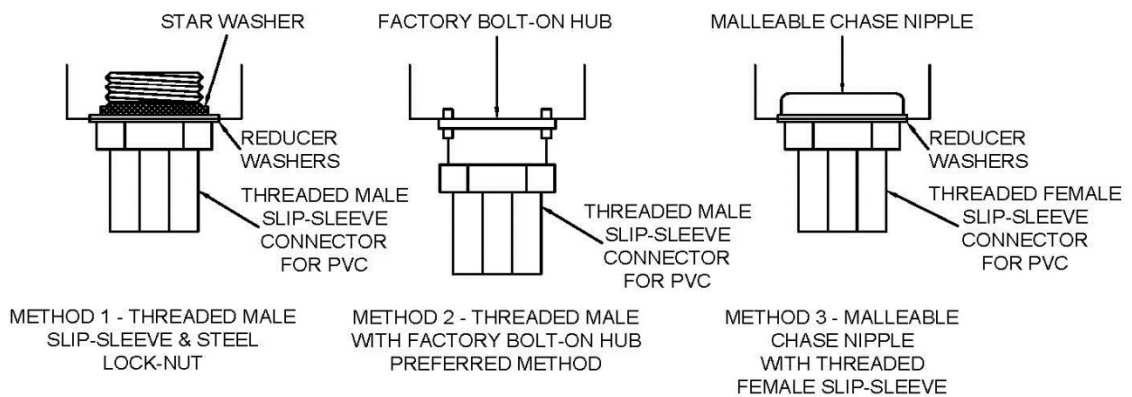


FIGURE 1 - APPROVED METHODS FOR PVC RISER ATTACHMENT

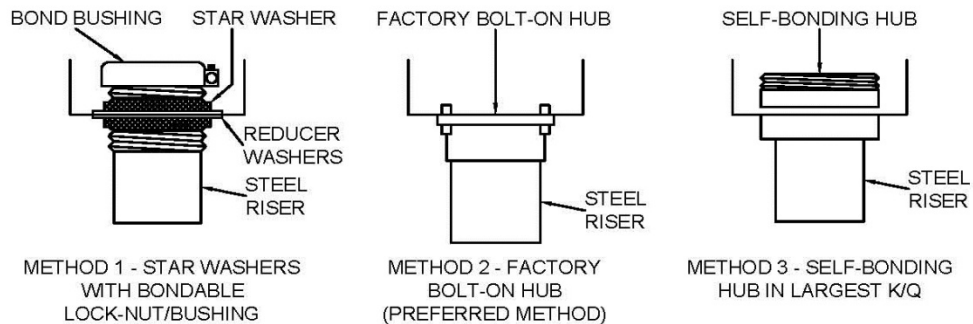


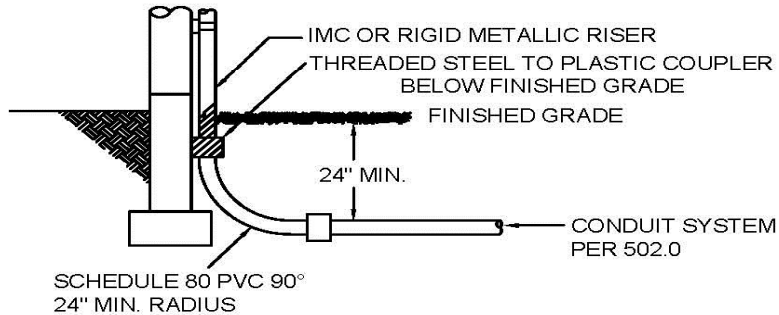
FIGURE 2 - APPROVED METODS FOR METALLIC RISER ATTACHMENT

**501.6 RISERS FOR SERVICES INSTALLED IN CONDUIT**

When service conduit is extended away from riser bend, there are three methods of making the vertical to horizontal transition. They are listed in order of preference. (See 501.6-1,2,3)

**501.6-1 CUSTOMER – OWNED METALLIC RISER WITH SCH 80 RIGID PLASTIC 90° SWEEP**

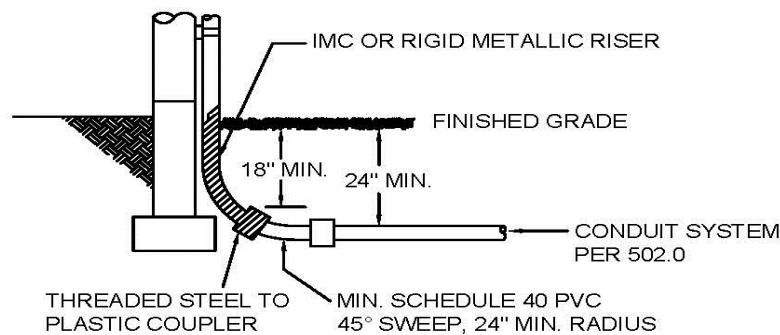
1. No portion of plastic sweep, including fittings, will be above grade.
2. A threaded steel to plastic fitting is installed at bottom of riser so that it will be below finished grade.
3. Where sweep runs horizontal, it shall have 24" minimum cover.
4. Sweep will have 24" radius as a minimum and shall be of SCH 80 grade rigid plastic conduit.
5. Metallic riser as required in Paragraph 501.2, 501.4, 502.5 and 502.5-1



METALLIC RISER COUPLED TO SCH 80 PVC 90° BEND FOR CONDUIT SYSTEM

**501.6-2 CUSTOMER - OWNED METALLIC RISER WITH 45° SWEEP AND SCHEDULE 40 RIGID PLASTIC 45° SWEEP**

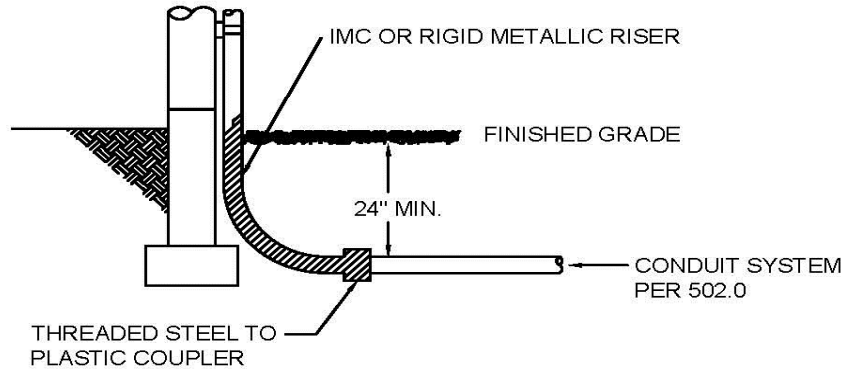
1. A threaded steel to plastic fitting to make transitions from steel riser to approved rigid plastic 45° sweep. (See Conduit Requirements, Paragraph 502.0) Metallic 45° sweep and plastic 45° sweep to be minimum 24" radius. Where sweep runs horizontal, there shall be a minimum of 24" of cover.
2. Metallic riser shall be as required in Paragraph 501.2, 501.4, 502.5 and 502.5-1



METALLIC RISER WITH 45° BEND COUPLED TO A PVC CONDUIT SYSTEM

**501.6-3 CUSTOMER – OWNED METALLIC RISER WITH 90° SWEEP**

1. A threaded steel to plastic fitting is installed at bottom of metallic sweep to make transitions from metallic to approved rigid plastic conduit (See Conduit Requirements, Paragraph 502.0) Where sweep runs horizontal, it shall have 24" minimum cover.
2. Metallic riser shall be as required in Paragraph 501.2, 501.4, 502.5 and 502.5-1



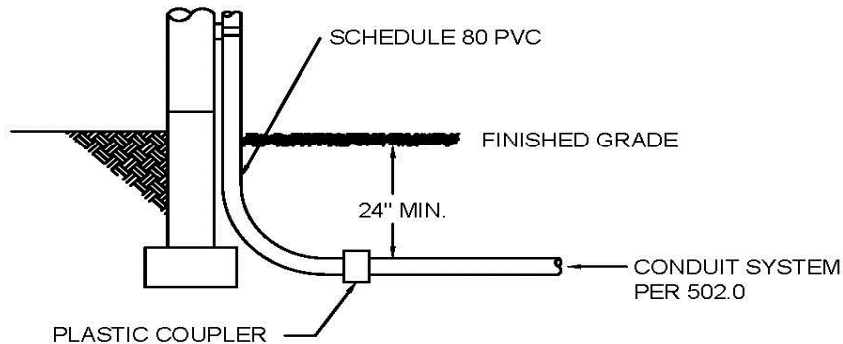
24" MIN. RADIUS, METALLIC RISER WITH 90° BEND COUPLED TO A PVC CONDUIT SYSTEM (SEE PARAGRAPH 502.5 AND 502.5-1)

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**501.6-4 CUSTOMER – OWNED SCHEDULE 80 PVC RISERS WITH 90° SWEEP**

1. A riser that is enclosed in any manner, whether partially or in it's entirely shall be of rigid or intermediate metallic conduit.
2. No PVC couplings allowed above grade
3. See paragraph 501.6-6 and 502.4

NOTE: Schedule 80 PVC markings on conduit riser shall remain visible for inspection purposes.

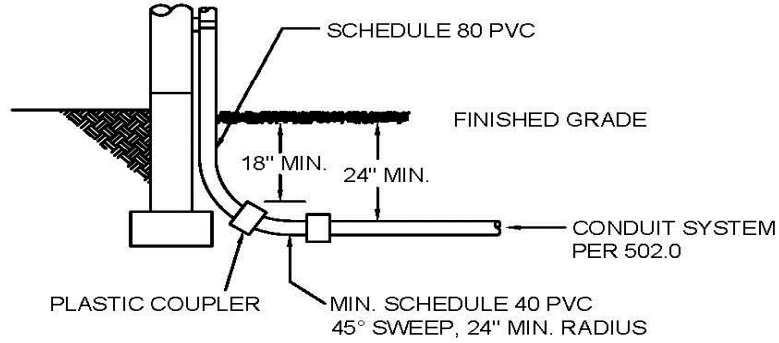


24" MIN. RADIUS, SCHEDULE 80 PVC WITH 90° BEND COUPLED TO A PVC CONDUIT SYSTEM ( SEE PARAGRAPH 502.5 AND 502.5-1)

**501.6-5 CUSTOMER – OWNED SCHEDULE 80 PVC RISER WITH 45° SWEEP AND SCHEDULE 40 RIGID PLASTIC 45° SWEEP**

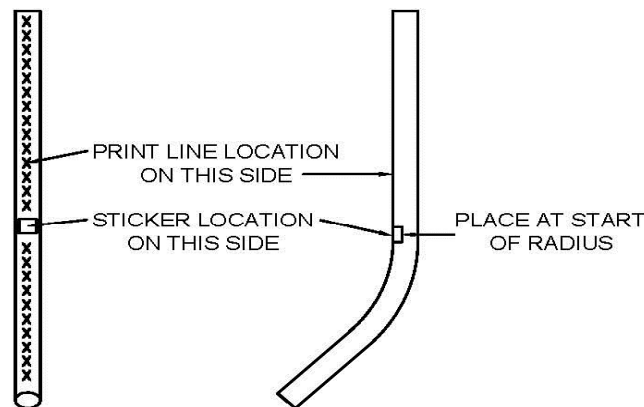
1. A riser that is enclosed in any manner, whether partially or in it's entirely shall be of rigid or intermediate metallic conduit.
2. No PVC couplings allowed above grade
3. See paragraph 501.6-6 and 502.4

NOTE: Schedule 80 PVC markings on conduit riser shall remain visible for inspection purposes



24" MIN. RADIUS, SCHEDULE 80 PVC WITH 45° BEND COUPLED TO A PVC CONDUIT SYSTEM (SEE PARAGRAPH 502.5 AND 502.5-1)

**501.6-6 SCHEDULE 80 PVC MANUFACTURER RISER MARKINGS OR STICKER PLACEMENT**



1. THE PRINT LINE OR STICKER PLACEMENT FOR A SCH 80, 24" R X 45° PVC RISER SHALL BE AS SHOWN. THIS WILL FACILITATE INSPECTION OF THE RISER AFTER INSTALLATION.

**502.0 SERVICE CONDUIT REQUIREMENTS**

**502.1 MATERIAL FOR SERVICE CONDUIT**

Material for service conduit shall be listed as electrical conduit. Acceptable material shall be PVC rigid conduit and when specified, IMC or Rigid metallic conduit taped or coated per 501.4 for direct burial.

**502.2 STEEL CONDUIT**

All rigid or intermediate conduits and fittings shall be hot-dipped galvanized. Rigid or Intermediate steel conduit shall be installed with threaded couplings and joints made up tight. (See Paragraph 501.4 for taping and coating requirements) **Conduit shall not be cut with a torch, welded or brazed.**

**502.3 NON-METALLIC CONDUIT**

Non-metallic conduit shall meet the following material and marking requirements for each application by product material used or as specified on the construction or composite drawing.

**TABLE 502.3  
APPROVED SERVICE CONDUIT FOR CUSTOMERS INSTALLATION**

APPLICATION	ACCEPTABLE PRODUCT MATERIAL	CONDUIT MARKING REQUIREMENTS
Straight Conduit PVC DB-120 (See Notes 1 & 2)	PVC DB-120 (Modulus 400,000 PSI)	Mfg. name, nom. size, 90°C, Type (i.e. DB120), ASTM F-512, PVC 12254
	PVC SCH 40 or SCH 80	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2
Bends, Sweeps and Elbows (See Note 3)	PVC SCH 40 or SCH 80 (See Note 4)	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2 radius, degree of curvature
Fittings	PVC SCH 40 or SCH 80	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2 (marking may be on packaging material)

**NOTES:**

1. 12254B minimum cell classification per ASTM D-1784.
2. PVC DB-100, modulus 400,000 PSI, ASTM F-512 is suitable for 4" and 5" diameters.
3. 4" diameter & under - SCH 40 NEMA TC-2; 5" diameter & larger - SCH 80 NEMA TC-2, 60" radius.
4. Sweeps at house end may be required to be SCH 80. (See Paragraph 501.6-1)
5. All PVC shall be gray.

**502.4 MARKINGS ON PLASTIC CONDUIT**

Each length of plastic conduit shall be marked at least every 5'. Each bend shall also be marked. All markings must include the items required in Table 502.3, above.

**502.5 BENDS AND SWEEPS**

**METALLIC** - One shot bending. Specified radius maintained. Internal diameter of conduit not effectively reduced. Factory bent sweeps are preferred; however, field bent sweeps are acceptable if done properly.

**NON-METALLIC** - Factory bent sweeps shall be used.



**502.5-1 MINIMUM BENDING RADIUS FOR SWEEPS IN A CONDUIT SYSTEM**

All sweeps in a conduit system to be a minimum of 24" radius, "unless otherwise specified." All sweeps in a 4" conduit system designed for 3Ø to be a minimum of 36" radius, "unless otherwise specified." All non-metallic sweeps to be Schedule 40 minimum except as specified in Paragraph 501.6-1.

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**502.6 WORKMANSHIP (PVC)**

Conduit shall be cut cleanly and square. All burrs and sharp edges which may damage conductors shall be removed before joining. PVC joints shall be primed before gluing. Gluing solvent shall be applied to both pieces to be joined. The conduit system shall be clean of internal obstructions and contaminants which may interfere with pulling of the conductors, the life of the conductors or conduit system. Installed conduit shall not be left uncapped.

---

**502.7 INSTALLATION OF NON-METALLIC CONDUIT**

a) **Conduit transitions from Schedule 40 or Schedule 80 to DB conduit shall be chamfered.** All conduit and fittings not chamfered by the manufacturer shall be chamfered in the field with a knife, half-round file or abrasive open mesh cloth, to provide a smooth transition which will not cause scuffing of the cable when it is pulled through the conduit during installation.

b) Wipe dirt and foreign material from conduit and fitting with a clean, dry cloth.

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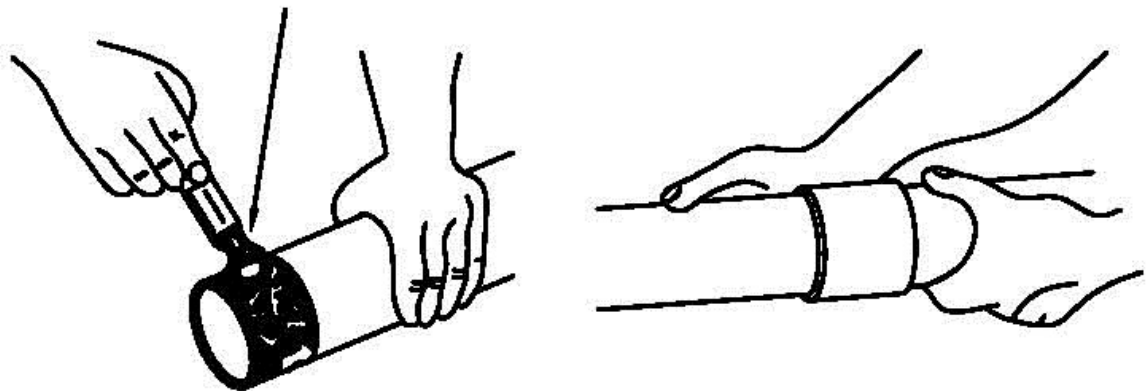
**502.7-1 PVC TO PVC JOINTS**

**Apply purple primer/cleaner ASTM F 656**, to both the fitting socket and the conduit. Avoid puddling of the primer. Verify all surfaces to be joined are covered. This primer coat is important, as it helps to penetrate the hard inner surfaces on most bell-end conduit and on fittings which are fabricated from conduit stock. Many of the extruded conduit stocks and some molded fittings have hard inner surfaces, and are more difficult for the cement to penetrate without aid from the primer.

**Apply a coat of gray PVC to PVC cement ASTM D 2564**, to both parts of the joint, and immediately push the joint together with a slight rotating motion (in one direction only). When the joint bottoms out, hold without motion for 15 seconds (1 minute in extreme cold weather), so that conduit does not push out of the fittings. Do not twist or drive conduit after insertion is complete.

**NOTE: The requirement for the purple color on the primer and the gray color on the PVC cement is to aid in the inspection of finished work. Use of clear cement makes for poor inspection, performance and failure to use primer with any PVC system results in a joint that is almost guaranteed to fail.**

BRUSH / APPLICATOR

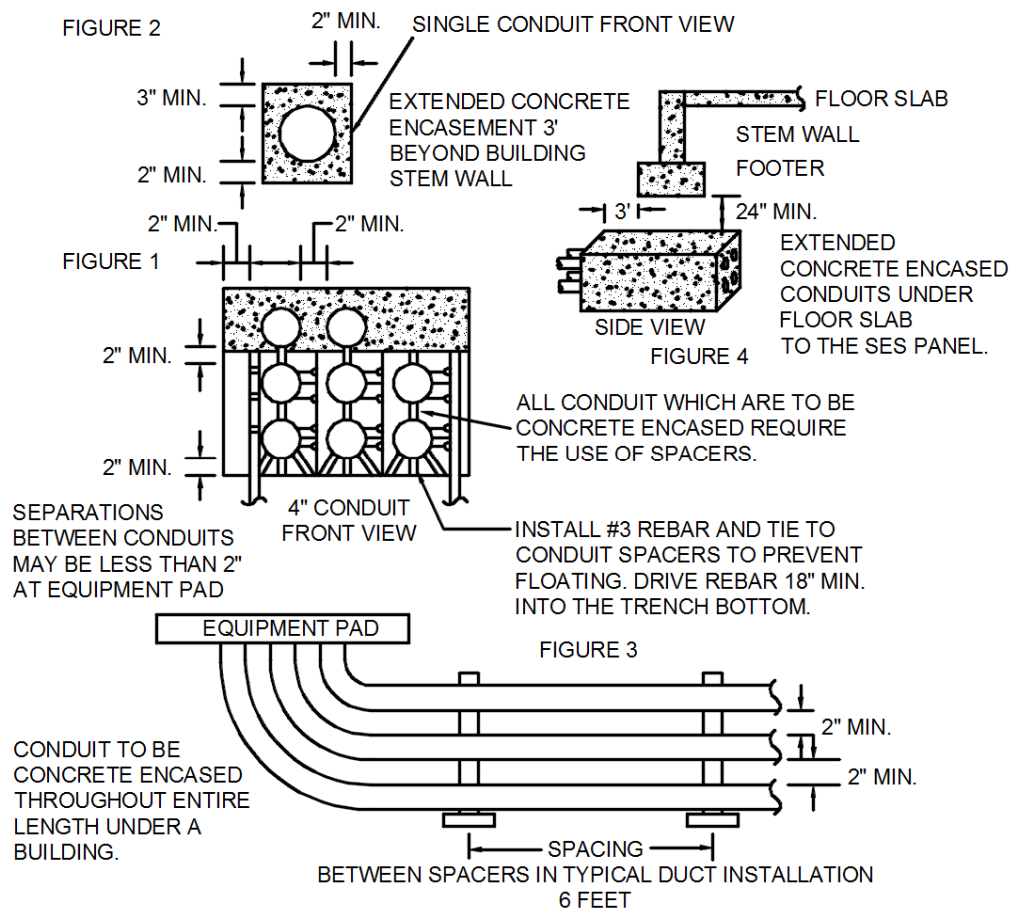


**502.7-2 USE OF PRIMERS OR CEMENTS, OTHER THAN THE ONES LISTED ABOVE, WILL RESULT IN UNACCEPTABLE JOINTS**

A natural bristle brush or the applicator supplied with the cement container shall be used. Plastic bristle brushes shall not be used as the primer and cement will dissolve the bristles. Follow the manufacturer's instructions on the primer and cement containers. Do not use any cement which shows signs of thickening. Shelf life on the unopened container is 3 years from the date of manufacture stamped on the container.

**502.8 SERVICE CONDUITS UNDER FOUNDATION**

Where service conduits must be installed under a building, the conduits shall be concrete encased (3000 psi at 28 days) and the top of the encasement shall have a minimum of **24 inches** clear separation below the structure foundation. **A minimum of 2 inches vertical and horizontal separation is required between concrete-encased conduits. (See Figure 1) Sidewalls and bottom of trench shall provide a minimum of 2 inches separation from conduit. (See Figure 1 and 2) The top of concrete encasement to be a minimum of 3 inches from top of conduit.** Sweeps are to be concrete encased also with a minimum of 2 inches of concrete; however, the minimum separations between conduits do not apply at service entrance or transformer pads. (See Figure 3) All concrete encased conduits require the use of spacers to ensure conduit does not move during pouring of concrete. (See Figure 3 for maximum distance between spacers.) All conduits encased in concrete shall be mandrelled.



**502.9 USABILITY OF CONDUIT SYSTEMS**

Extreme care shall be exercised to ensure that concrete and other foreign matter does not enter the conduit being laid, while encasing, or at any time thereafter. All conduit shall be free of obstruction, dirt, rock, etc. **The conduit systems shall be clean useable systems at the time APS installs conductors.** In all cases the customer is responsible for the usability of the conduit systems at the time APS install conductors.

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**502.10 CONNECTING TO EXISTING CONDUITS**

Empty conduits which have been stubbed out by APS for future attachments to Customers may be located and exposed by the Customer performing the attachment. (See 502.12-3, 4, and 5)

Contact an APS Customer Service Representative for the approximate location of service conduit stub-outs on your property.

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**502.11 SEPARATION FROM OTHER UNDERGROUND INSTALLATIONS**

In order to permit access to and maintenance of either facility without damage to the other, a 24 inch horizontal separation shall be maintained between APS Electric Facilities and water, sewer or gas pipeline systems. A minimum 60 inch clear horizontal separation is required between cable installed in conduit and the outside wall of the pool or its auxiliary equipment.

APS Facilities shall not be installed beneath cool decking.

Exception: Natural gas facilities shall be permitted to be "Joint-Trench" with APS facilities. Provided all requirements of Section 600 are met.

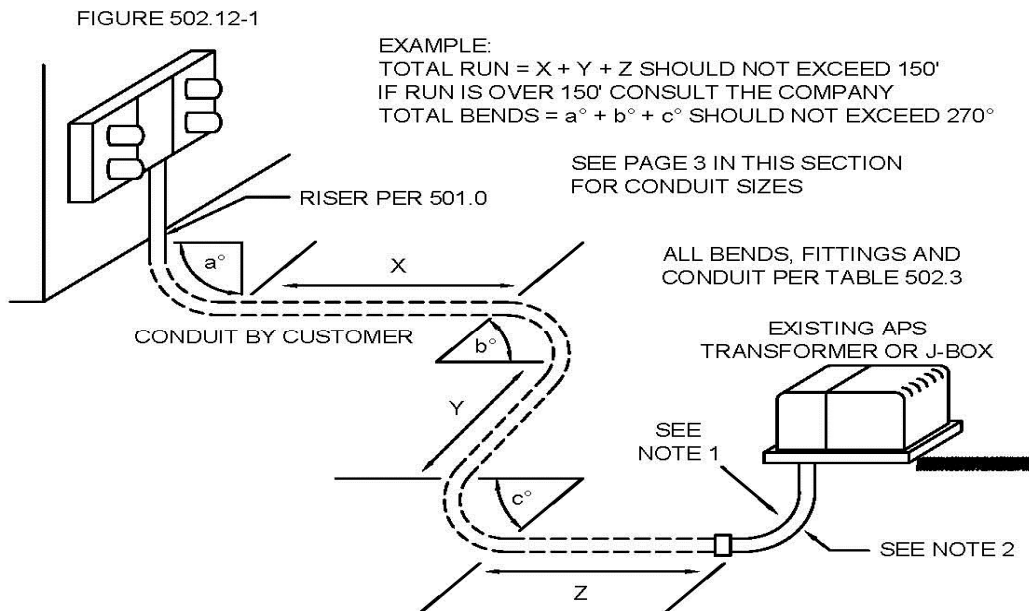
In the event of an inconsistency or conflict with any Municipal specifications, the more stringent specification shall apply. Check your local city or country codes for possible greater separation requirements.

## 502.12-1 THE SERVICE CONDUIT SYSTEMS (EXISTING TRANSFORMER OR J-BOX)

### DESIGN GUIDELINES:

Each single-phase service conduit systems, from the bottom of service equipment enclosure to source of service as designated by APS, shall meet the following requirements unless otherwise directed by APS.

- A) Conduit to be same trade size as approved single-phase riser (SEE 501.1-1 and 501.1-2).
- B) Total run shall not exceed 150ft. total length or more than 270° of bends including 90° sweep at riser bottom. 90° sweep at transformer is not included in 270° total.
- C) A service conduit system in excess of that described in "B" may require larger radius bends and/ or concrete encased sweeps. APS Division Engineering should be consulted in these instances.
- D) **The conduit shall have as a minimum, 24" of cover to finished grade from top of conduit.**



### NOTES:

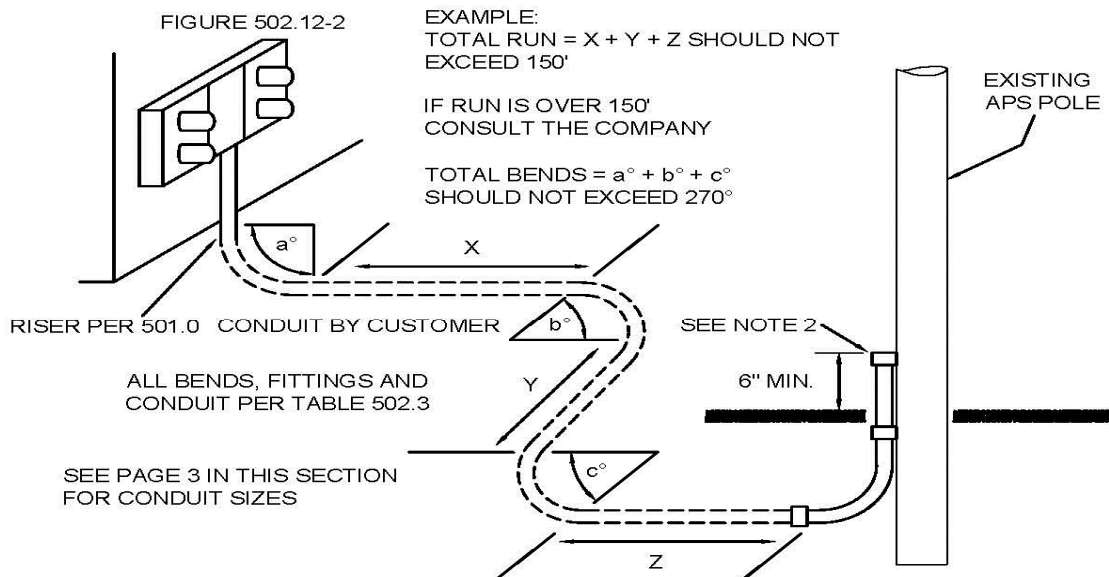
- 1. Customers to install conduit from service entrance equipment to transformer pad or j-box. Conduit to be capped. Customers to provide 36"x36"x depth of facilities "bell hole" per 502-12-5
- 2. APS to install Customer provided sweep into energized source.
- 3. Customer to supply, own and maintain the UG riser. For conduit installation procedure, See Section 502.0
- 4. **This drawing shows existing transformer with no future stub-outs installed. For existing transformers with stub-outs, See Paragraph 502-12-3 and 502-12-5.**
- 5. Customers to follow Blue Stake requirements.

## 502.12-2 THE SERVICE CONDUIT SYSTEMS (FROM TRANSITION POLE) SINGLE PHASE

### DESIGN GUIDELINES:

Each single-phase service conduit systems, from the bottom of service equipment enclosure to source of service as designated by APS, shall meet the following requirements unless otherwise directed by APS.

- A) Conduit to be same trade size as approved single-phase riser (SEE 501.1-1 and 501.1-2).
- B) Total run shall not exceed 150ft. total length or more than 270° of bends including 90° sweep at riser bottom. 90° sweep at pole is not included in 270° total.
- C) A service conduit system in excess of that described in "B" may require larger radius bends and/ or steel sweeps. APS Division Engineering should be consulted in these instances.
- D) **The conduit shall have as a minimum, 24" of cover to finished grade from top of conduit.** If crossing a street or right of way, check with APS Division Engineering for minimum depth requirements.

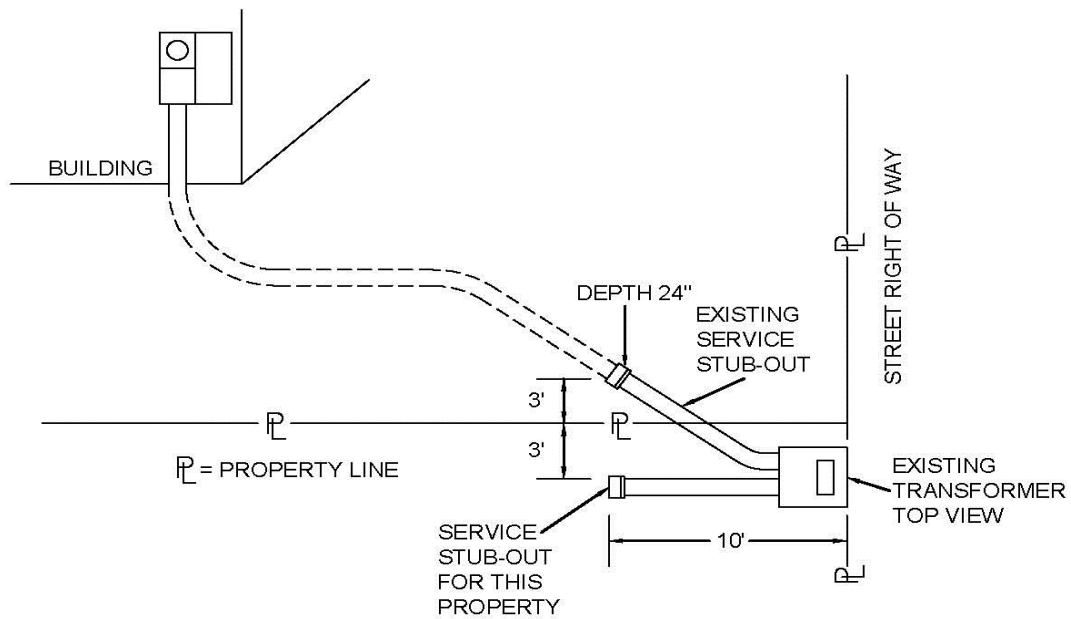


### NOTES:

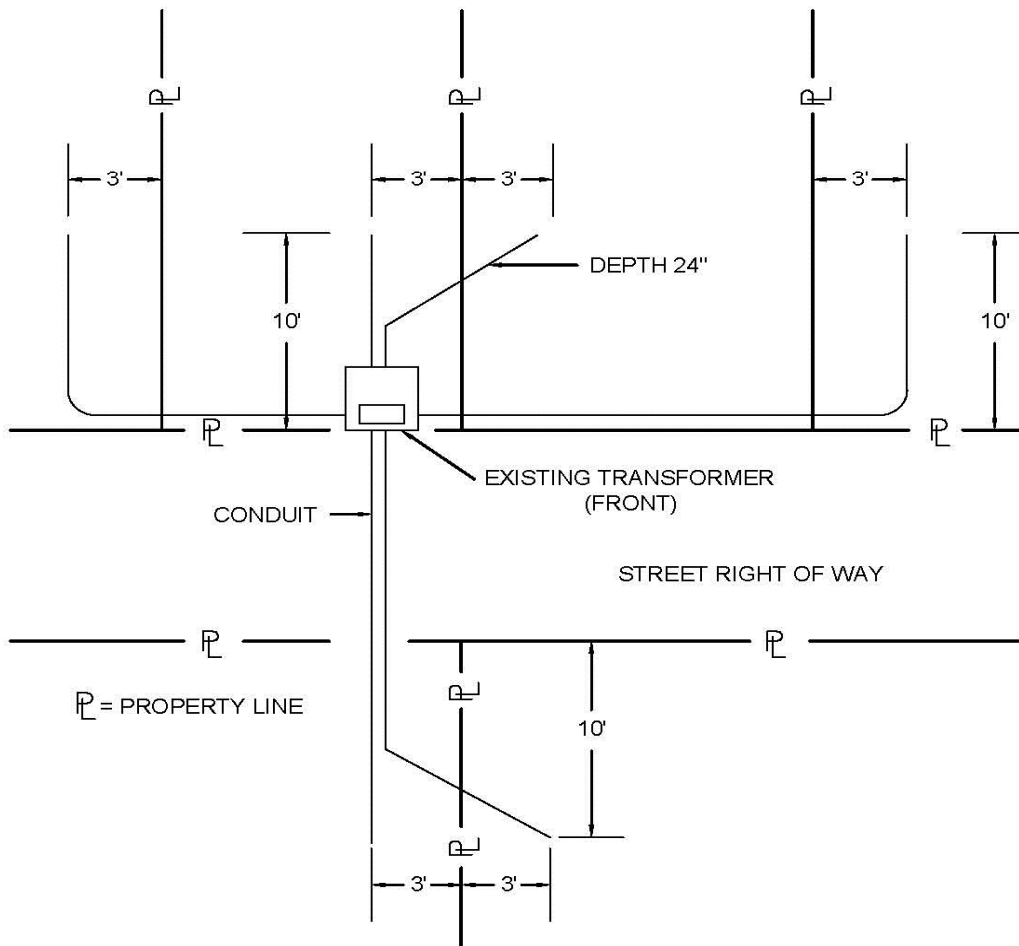
1. Customers shall contact a qualified APS representative prior to trenching to determine the trench alignment and location of the transition sweep at the pole.
2. Customers to install conduit from service entrance to base of APS pole and install approved sweep at pole location. Conduit to be extended a minimum of 6" above finished grade and capped.
3. Customers to follow Blue Stake requirements
4. For conduit installation procedure, See Paragraph 502.0
5. UG riser supplied, owned and maintained by customer.

### 502.12-3 THE SERVICE CONDUIT SYSTEM - (CONDUIT STUB-OUTS) SINGLE PHASE

- a) Customer to contact an APS Customer Service Representative for the approx. location of conduit stub-out on property then, Customer to locate and expose end of existing conduit stub-out from transformer. See drawing on next page for typical location of stub-out.
- b) Customer to supply, own and maintain UG conduit riser
- c) Customer to install conduit from service entrance to exposed stub-out.
- d) Customer to join existing stub-out and conduit from service entrance. Make certain no debris enters conduit. (See Paragraph 502.9)
- e) See Paragraph 502.12-1 & 2 for maximum number of bends in conduit run. (Check with your Customer Service Representative for number of bends in existing stub-outs. Maximum number of bends includes bends in stub-out conduit.)
- f) APS to install service conductors

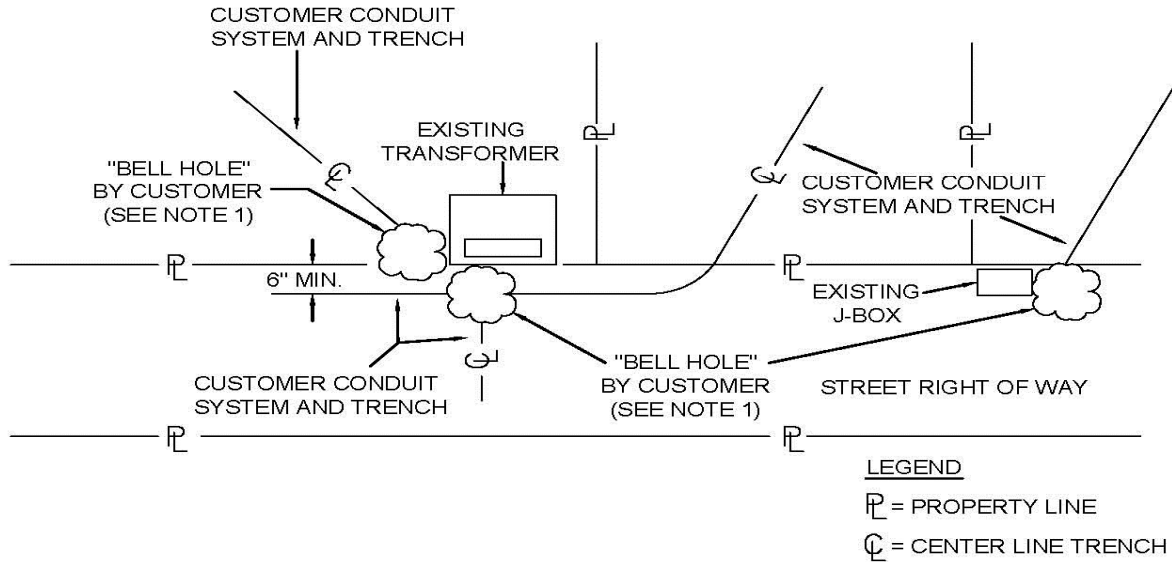


THE SERVICE CONDUIT SYSTEM - SINGLE PHASE  
TYPICAL CONDUIT STUB-OUT LOCATIONS FOR USE WITH RIGID STUB-OUTS:



**CHECK WITH APS CUSTOMER SERVICE REPRESENTATIVE FOR THE APPROX. LOCATION OF CONDUIT STUB-OUTS ON YOUR PROPERTY**

**THE SERVICE CONDUIT SYSTEM - SINGLE PHASE  
TYPICAL SECONDARY CONDUIT ENTRY FOR EXISTING  
TRANSFORMERS AND J-BOXES:**



**CHECK WITH APS CUSTOMER SERVICE REPRESENTATIVE FOR THE APPROX. LOCATION OF CONDUIT STUB-OUTS ON YOUR PROPERTY**

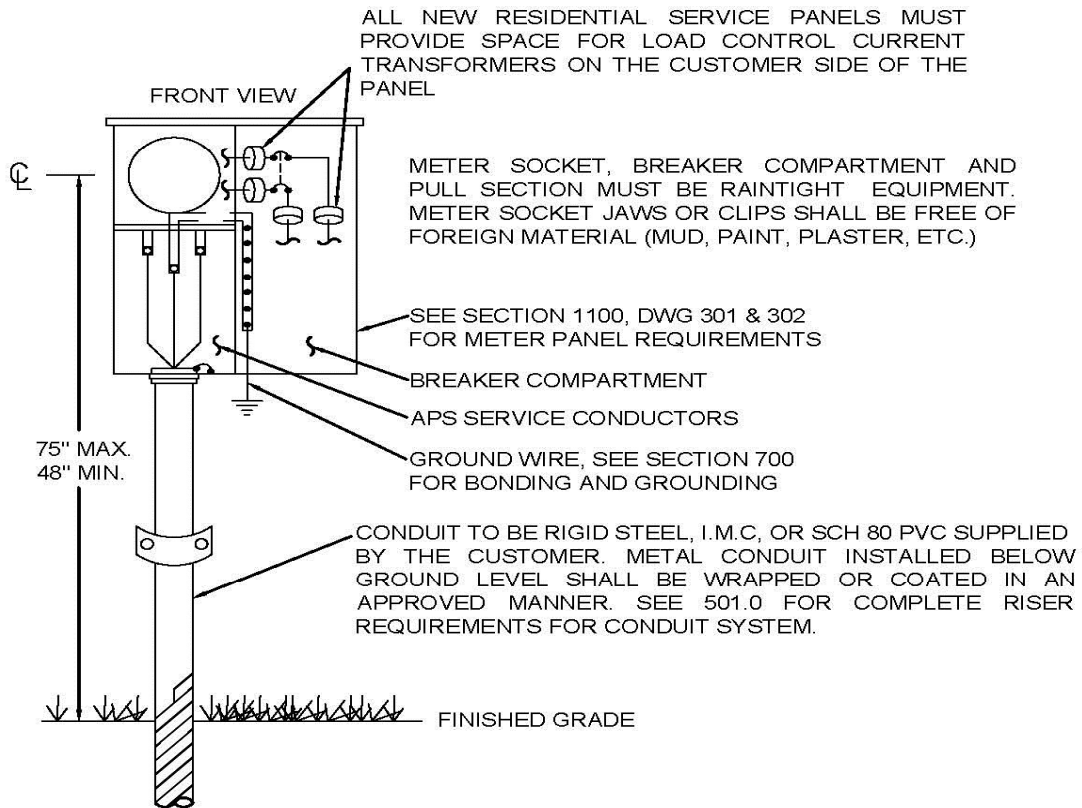
NOTE:

1. "Bell Hole" shall be dug by Customer to a location designated by APS Representative at transformer or J-Box, with minimum dimensions of 36" x 36" x depth of facilities being installed



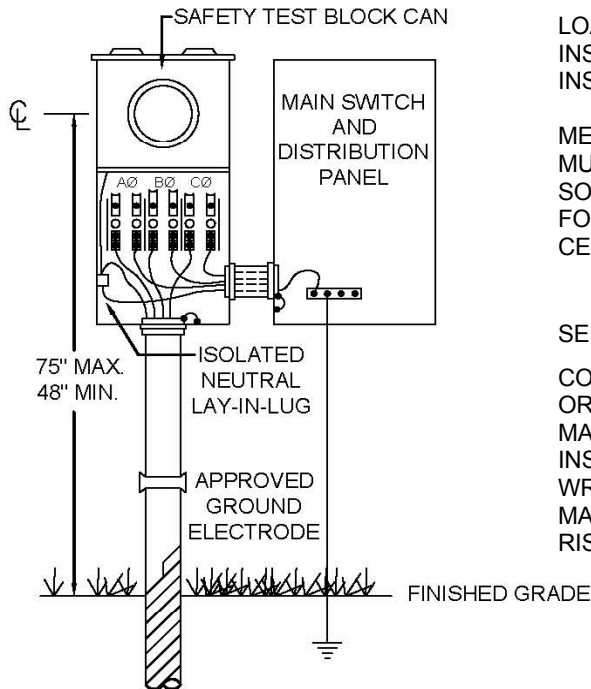
506.0 TYPICAL SERVICE ENTRANCE INSTALLATION (U.G.)

506.1 100 AMP – 400 AMP SINGLE PHASE THREE WIRE (RESIDENTIAL)



NOTES:

1. See section 1100 DWG 301 & 302 for residential meter panel requirements
2. Underground service conductors and connections to service terminals provided by APS
3. UG Riser is supplied, owned and maintained by the customer.
4. This is the preferred installation for single family residential applications.



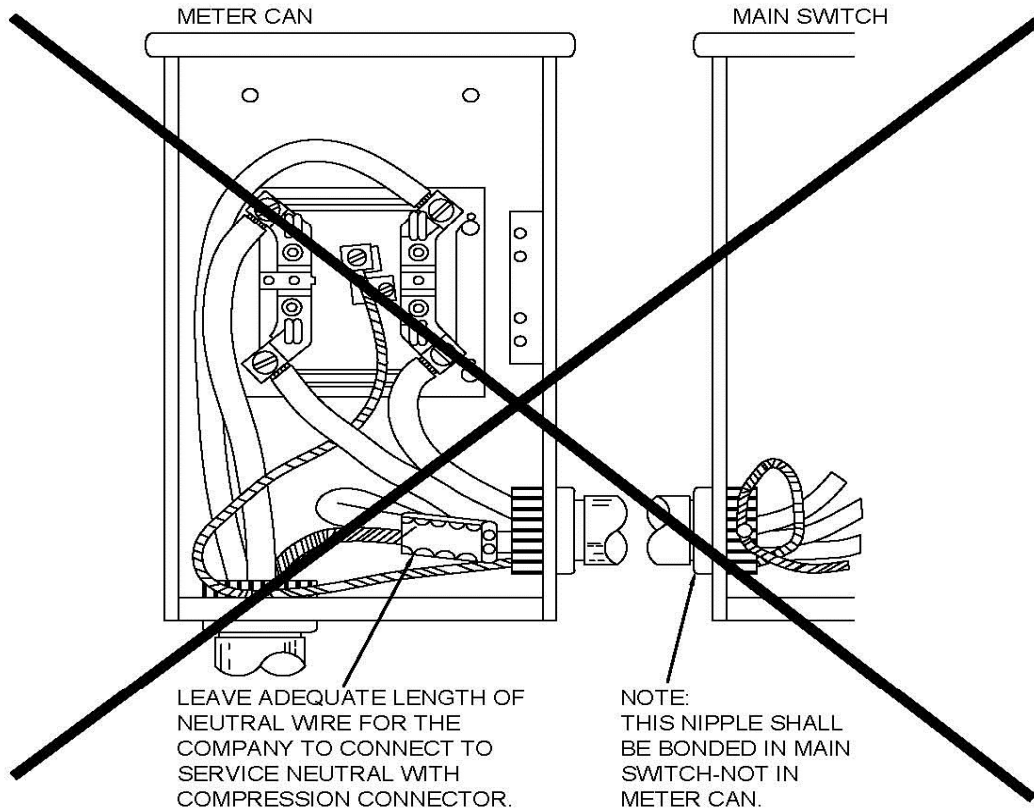
LOAD CONTROL CURRENT TRANSFORMERS TO BE INSTALLED IN DISTRIBUTION PANEL, NOT TO BE INSTALLED IN METER PANEL.

METER SOCKET AND BREAKER COMPARTMENT MUST BE WEATHER-PROOF EQUIPMENT. METER SOCKET JAWS OR CLIPS SHALL BE FREE OF FOREIGN MATERIAL.. ( MUD, PAINT, PLASTER, CEMENT, ETC.)

SEE SECTION 700 FOR BONDING AND GROUNDING CONDUIT TO BE 3" MINIMUM RIGID STEEL, I.M.C., OR SCH 80 PVC AND IS SUPPLIED, OWNED AND MAINTAINED BY THE CUSTOMER METAL CONDUIT INSTALLED BELOW GROUND LEVEL SHALL BE WRAPPED OR COATED IN AN APPPROVED MANNER. SEE PARAGRAPH 501.0 FOR COMPLETE RISER REQUIPMENT FOR CONDUIT SYSTEM.

#### NOTES:

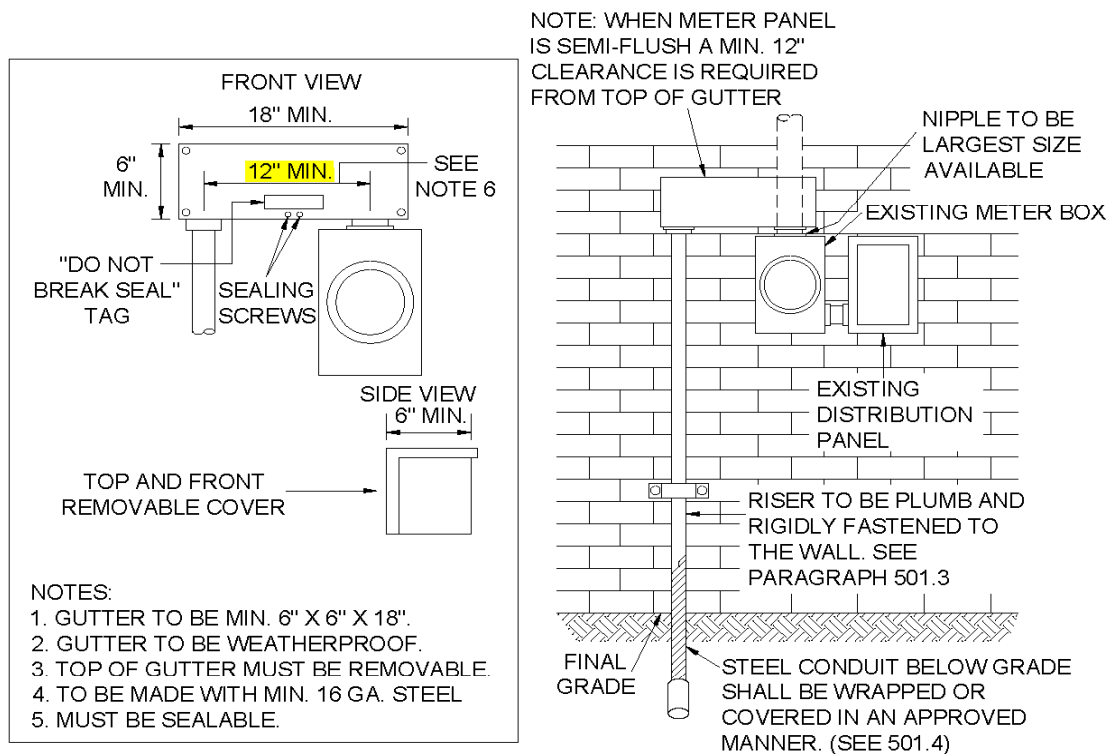
1. Neutral conductor from customer's distribution panel shall be code sized and shall extend into meter cabinet 18" for connection by APS. APS shall supply compression connector and make up neutral in the meter cabinet.
2. Underground service conductors are provided by APS.
3. See Section 502.0 for conduit requirements.
4. All wire and equipment shall comply with the National Electric Code.
5. For a 3Ø 4wire Delta service, the power phase (high leg) must be installed in the right hand (CØ) test block and meter socket position and identified by an outer finish that is orange in color. See Section 300, Paragraph 303.7.



U.L. APPROVED BONDING HUBS MAY BE USED IN LIEU OF BONDING BUSHINGS.

# OBSOLETE: FOR MAINTENANCE ONLY

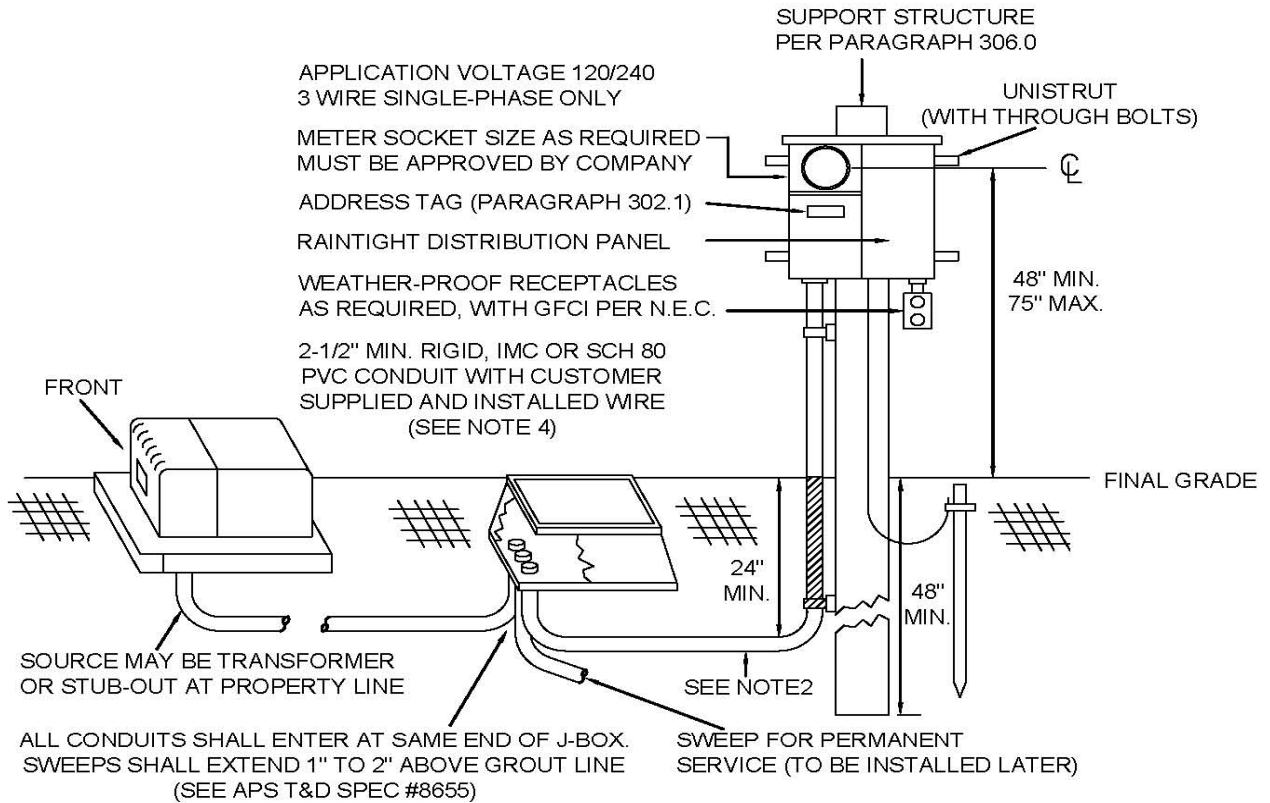
See Paragraph 506.1 and 506.2



## NOTES:

1. The Customers shall be responsible for the revamping of the service entrance from overhead to underground, as shown on this drawing.
2. Customer supplies, owns and maintains the UG riser. See 501.0 for riser requirements.
3. All wiring and equipment shall comply with the NEC
4. Riser, gutter and OH nipple shall be bonded and include bushing for cable protection.
5. NOT TO BE USED ON NEW INSTALLATIONS.
6. Gutter may be a special order item. See your electrical supplier.
7. Due to the complexities of these installations, each installation shall be treated on a case by case basis, and shall be approved by the APS Meter Shop.

TEMPORARY FOR CONSTRUCTION - SERVICE AND METER POLE,  
SINGLE PHASE THREE WIRE, 120/240 VOLT



NOTES:

1. APS to determine which transformer or junction box shall feed service pole
2. Approved service wires in conduit shall be installed by Customer and extended to a point designated by APS. **A sufficient coil of wire to reach the secondary terminals of the transformer must be left. APS to terminate service in transformer.** If conduit stub-out from source is not available, see 502.12-5  
  
**Exception: Temporary services of 200 amps or less, located 10 feet or less from the junction box or transformer, may use approved direct-buried wire instead of conduit.**
3. All wires and equipment shall be per N.E.C. and local codes. See section 400, Paragraph 402.2 for recommended pole material requirements, See Section 500, Paragraph 506.6-1 for alternative installations. See Section 100 for definition of "temporary"
4. **If temporary pole cannot be set within 10 feet of a junction box or transformer, all conduit sizes shall be per 501.1-2 and must meet all permanent installation requirements. Customer to supply, own and maintain the UG riser. (APS will install wire from meter to junction box or transformer.)**

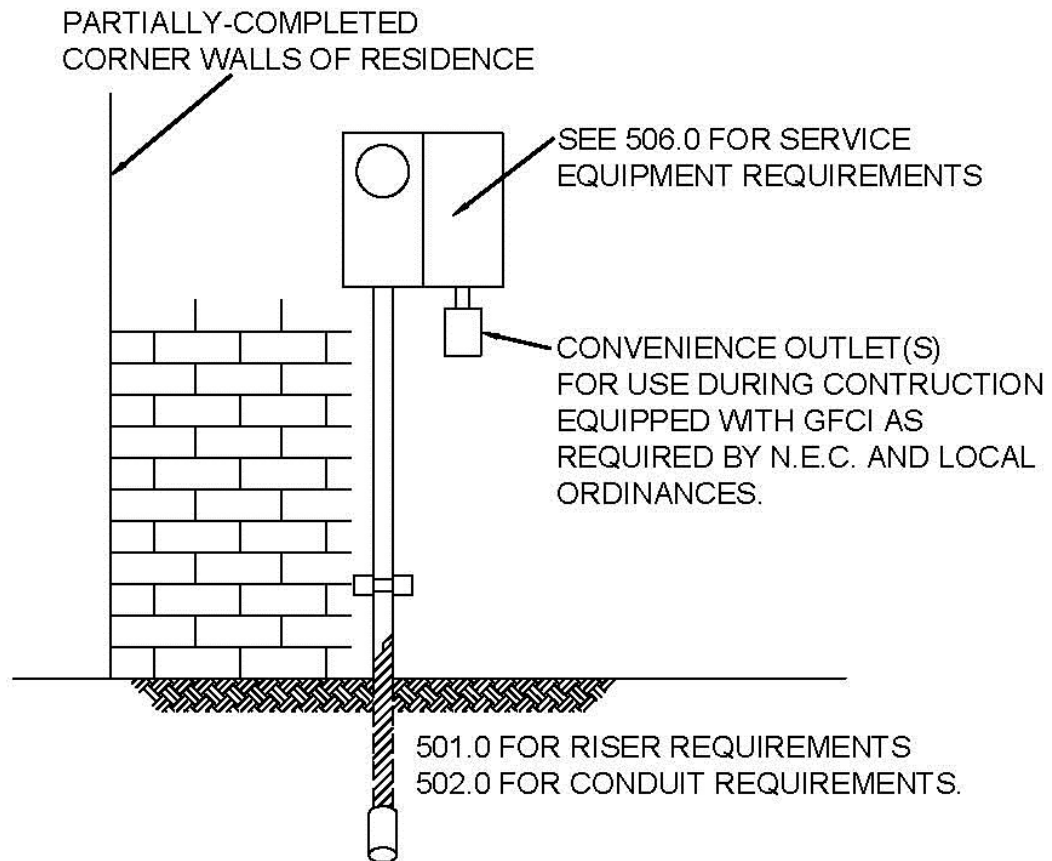
CAUTION:

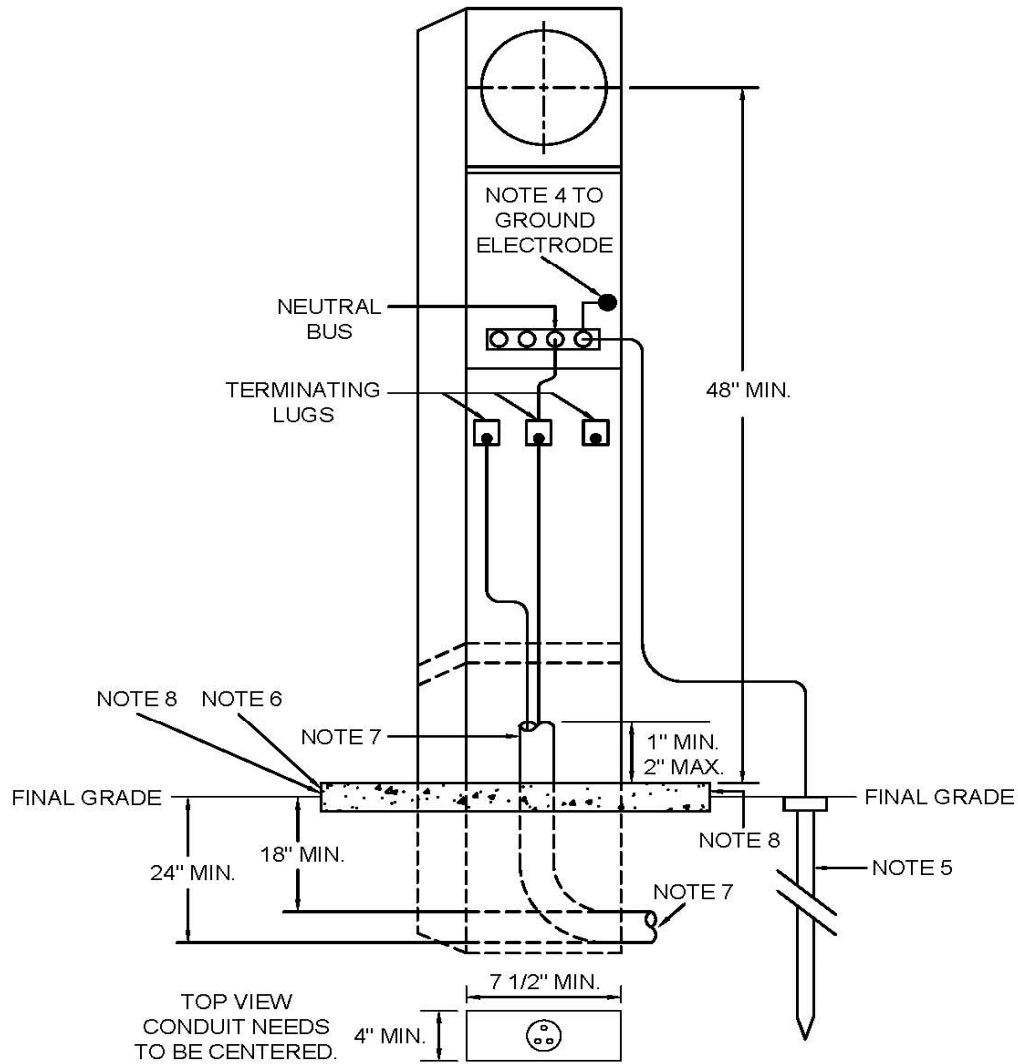
Before setting pole and driving ground rod be sure to notify Blue Stake. See Section 100, Paragraph 100.12 for phone Number.

506.5

**TYPICAL TEMPORARY/PERMANENT SERVICE ENTRANCE (RESIDENTIAL)**

1. Customer shall obtain permit for temporary service for this type of installation from local Inspection Agency before installing the equipment. **May not be available in all jurisdictions.**
2. Customers shall install service equipment on wall in permit location.
3. Customer shall supply, own and maintain the UG riser.
4. APS shall install underground service to entrance on a permanent basis.
5. Customer's installation shall be approved by the Inspection Agency.





ALL DIMENSIONS SHOWN ARE IN INCHES.

PAGE 1 OF 2 FOR NOTES, SEE PAGE 25.

**INSTALLATION GUIDELINES:**

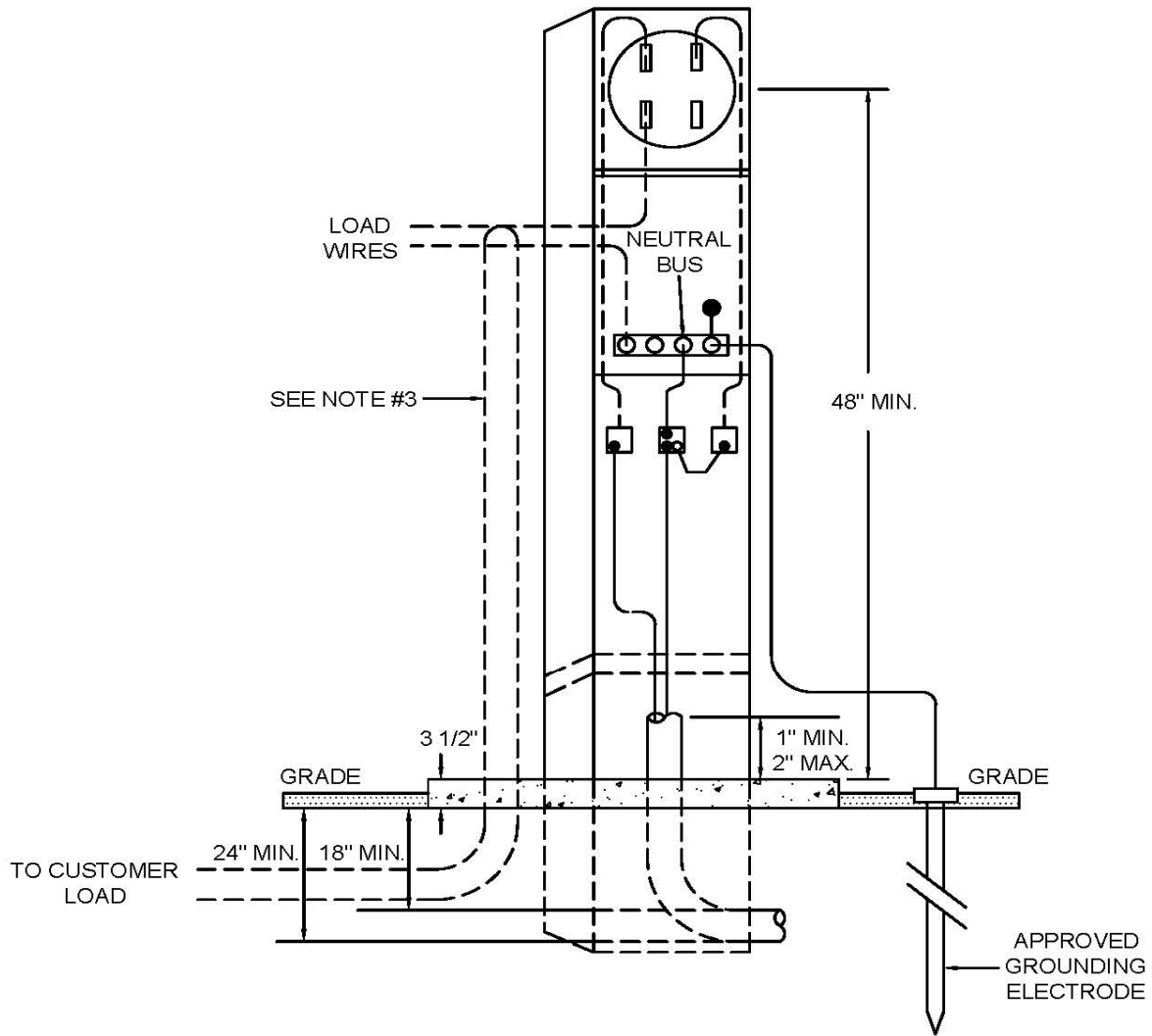
1. See Section 1100, DWG. 307 for meter pedestal requirements
2. Pedestal may be used as temporary for construction.
3. Pedestal and power outlet section shall be rated 10,000 A.I.C. minimum.
4. The grounding electrode conductor shall be continuous to the neutral landing block in the breaker compartment. Bare copper conductor may be used if properly supported. Connect pedestal bond lug as shown.
5. Grounding shall be provided by the Customer in compliance with the N.E.C. made electrodes shall have a resistance to ground of not more than 25 Ohms.
6. Poured concrete slab shall be 24" x 24" minimum size and have a 3 - ½ inch thickness.
7. Customer to provide and install 2 - ½ inch rigid PVC conduit and sweeps per 502.0. A 24" radius is required. Conduit to extend a minimum of 1" and a maximum of 2" above the concrete slab. (See Drawing). Cascaded pedestals are not allowed.
8. Customer shall be responsible for final grade of the utility island and the included meter pedestal.
9. Receptacle plugs, cords or "hard-wire" connections shall not block access to panel(s) covering service cable and termination pull section. ( See Note 6)
10. Meter location to be approved by APS. See Section 300, Paragraph 301.3 for details.

**INSTALLATION PROCEDURE FOR CUSOMERS**

11. Set the meter pedestal in place over the 2 - ½" plastic service conduit.
12. Install the required size continuous grounding electrode conductor from an approved grounding electrode to the neutral bus in the breaker compartment.  
**Do Not Run the Grounding Electrode through the Service Pull Section.** Bond the pedestal through its bonding lug with the grounding conductor as shown. Grounding the neutral landing block to the pedestal by means of a jumper or the grounding screw. (See DWG 303.13 Note 10)
13. Back fill around the pedestal, and compact fill to provide good support, plumb and level the pedestal, and pour the concrete slab. (See Note 17 above) Observe that the fixed panel for the final grade and concrete pour is positioned so access is properly maintained to the service lugs through the removal panels.
14. APS shall connect the service conductors to the service lugs in the meter pedestal, install and seal the pull section panel, and blank off and seal the meter socket ring. The meter shall be set upon completion of the application for service by the customer.
15. When the pedestal is used as temporary for construction power the edge of the pedestal concrete pad shall be a minimum of 2 feet from the edge of the transformer pad. Maximum distance shall be 10 feet from transformer pad. If terrain dictates a problem contact APS Customer Service Representative.

**CAUTION** – Before digging or driving ground rods be sure to notify Blue Stake or you local APS Office to locate underground facilities. See Section 100, Paragraph 100.12.





120 VOLT METERING PEDESTAL

PAGE 1 OF 2 – FOR NOTES, SEE PAGE 27.

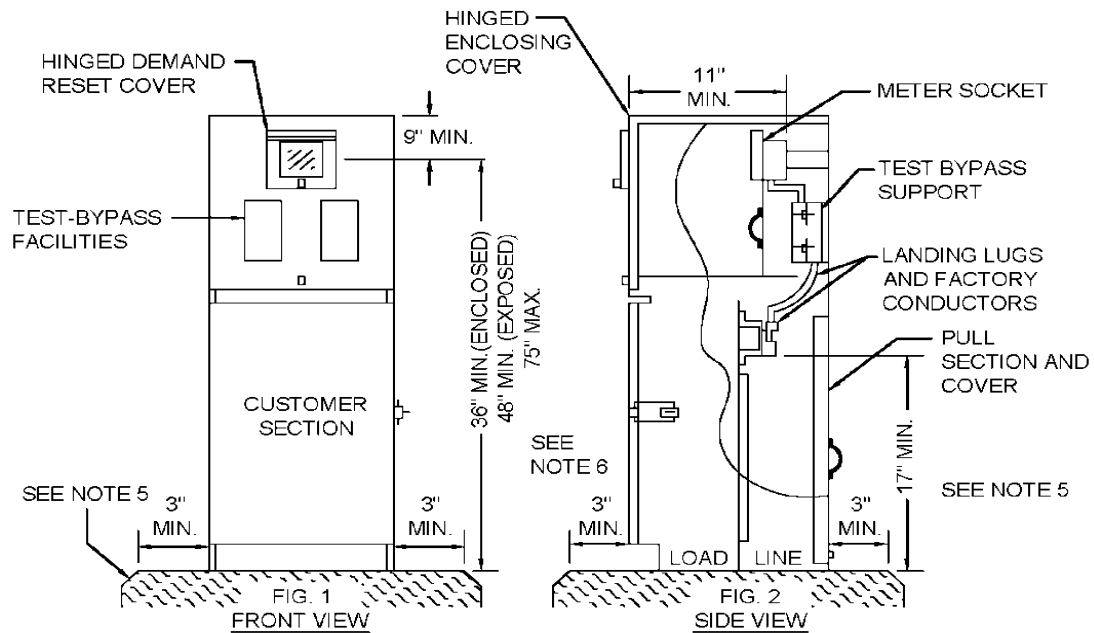
## 506.7-2 TYPICAL 120 VOLT 2 WIRE PEDESTAL

(Page 2 of 2)

### NOTES:

1. Meter Pedestal to be U.L. Listed. ( As service Equipment)
2. See Section 1100, Dwg. 307 for Meter Pedestal Requirements
3. Load conductors shall not be run in Utility's service cable pull and termination section. Metallic conduit shall be wrapped or coated per Paragraph 501.4.
4. A 3 foot, minimum working space in front of any removable panel(s) is required.
5. Wiring from meter pedestal to customer equipment shall be installed per National Electric Code.
6. Meter location is to be approved by APS.
7. Pedestal may be used for metered cable TV Installations.

**\*\*For additional installation requirements, see Paragraph 506.6-2\*\***



ALL DIMENSIONS SHOWN ARE IN INCHES

#### INSTALLATION GUIDELINES:

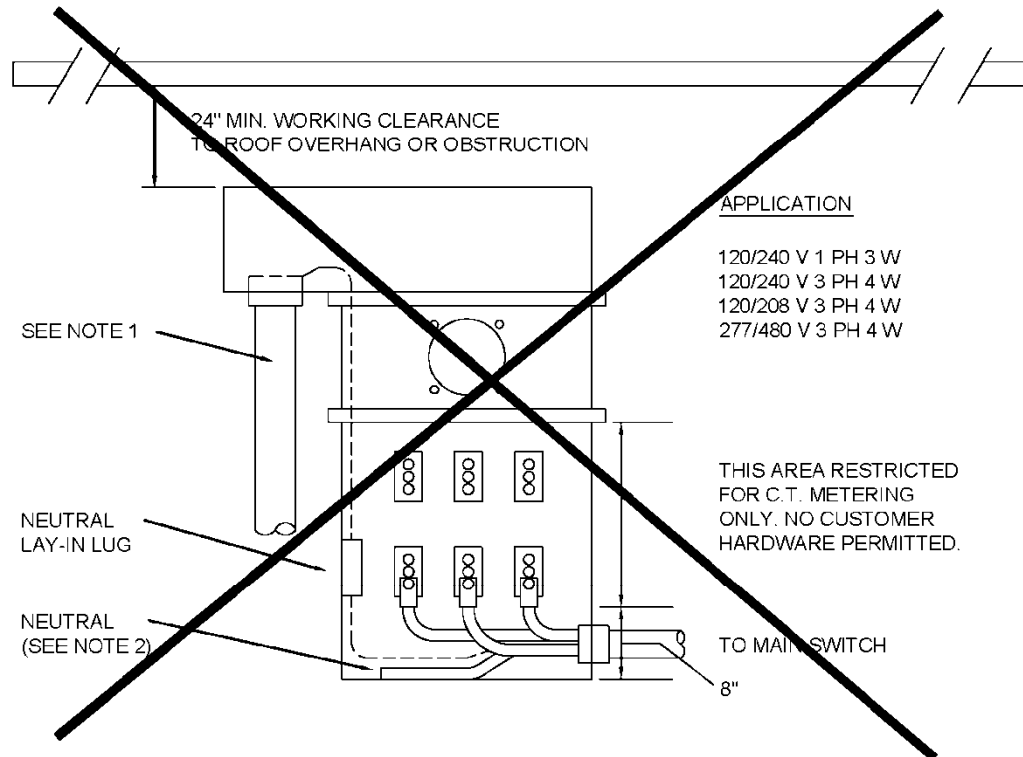
1. Pedestal shall be U.L. listed and EUSERC approved.
2. See Section 1100, DWG. 308 for meter pedestal requirements.
3. Pedestal and main disconnect shall be rated for the available fault current (A.I.C.). Check with APS representative to verify
4. The ground electrode conductor shall be continuous to the neutral landing block in the breaker compartment. The ground electrode conductor shall not pass through the pull section, service termination, or meter compartments of the pedestal.
5. Concrete foundation shall be a minimum size 24" x 24" x 6"
6. Acceptable to install ground rod and connected inside load compartment of SES

**\*\*Page 1 of 2 - for additional notes, see Page 29\*\***

**506.8-1 TYPICAL COMMERCIAL SERVICE AND METER PEDESTAL MAXIMUM 200 AMPS, 0-600 VOLTS**

7. Meter location to be approved by APS. (See also Section 300, Paragraph 301.5)
8. Customers to provide and install rigid PVC conduit and sweeps per Paragraph 502.0. A 24" radius is required. Conduit to extend a minimum of 1 inch and a maximum of 2 inches above the concrete slab.
9. Conduit shall be sized per Paragraph 501.1-2 or 501.1-3
10. Customers shall be responsible for final grade of the utility island and the included meter pedestal.
11. APS Shall connect the service conductors to the service lugs in the meter pedestal, install and seal the pull section panel, and blank off and seal the meter socket ring. The meter shall be set upon completion of the application for service by the Customer.

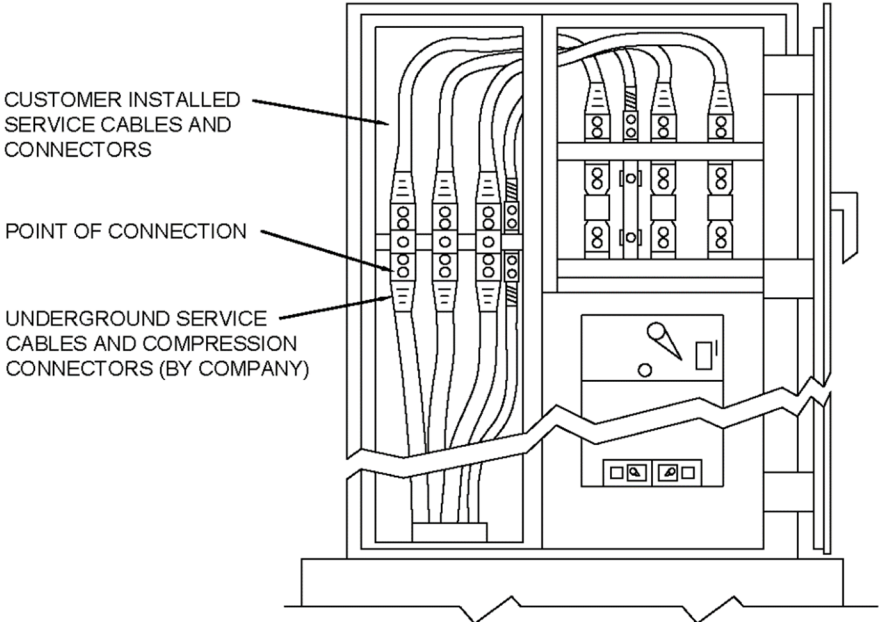
**CAUTION** – Before digging or driving ground rods be sure to notify Blue Stake or you local APS Office to locate underground facilities. See Section 100, Paragraph 100.12.

**NOTES:**

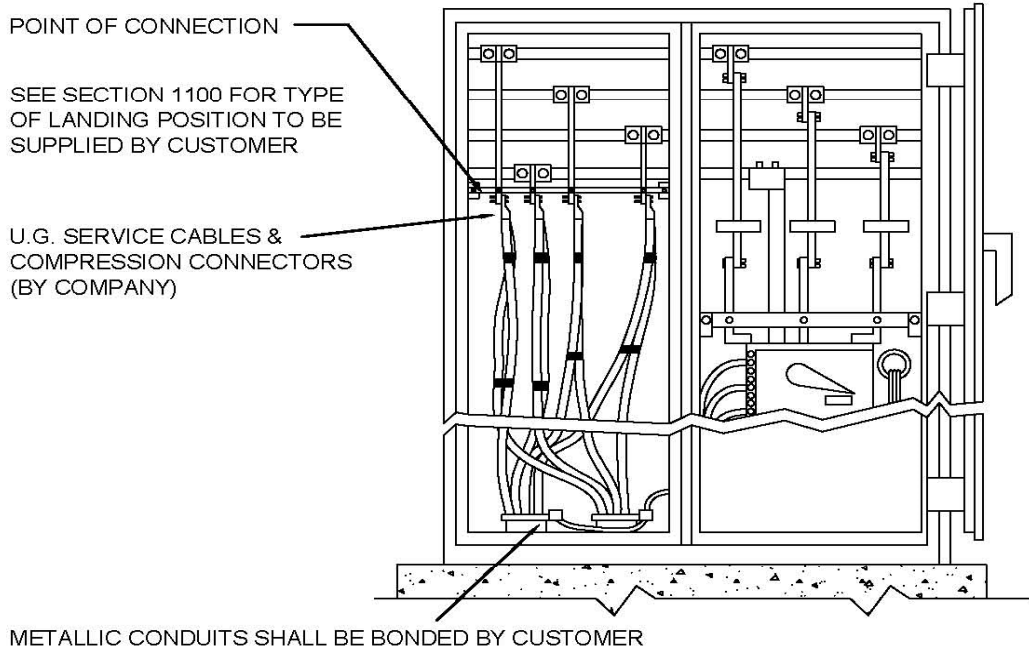
1. Side riser conduit will be existing panels, new panels will have their own pull-section.
2. The company furnishes and installs the C.T.'s test switch and connects the Customer's neutral. The Customer installs the meter socket. Customers to run neutral wire from main disconnect.
3. Service lines must be installed first before meter and CT's are installed.

**OBSOLETE: FOR MAINTENANCE ONLY**

506.11 S.E.S. UNDERGROUND 400 THROUGH 800 AMPS (FREE STANDING S.E.S.):

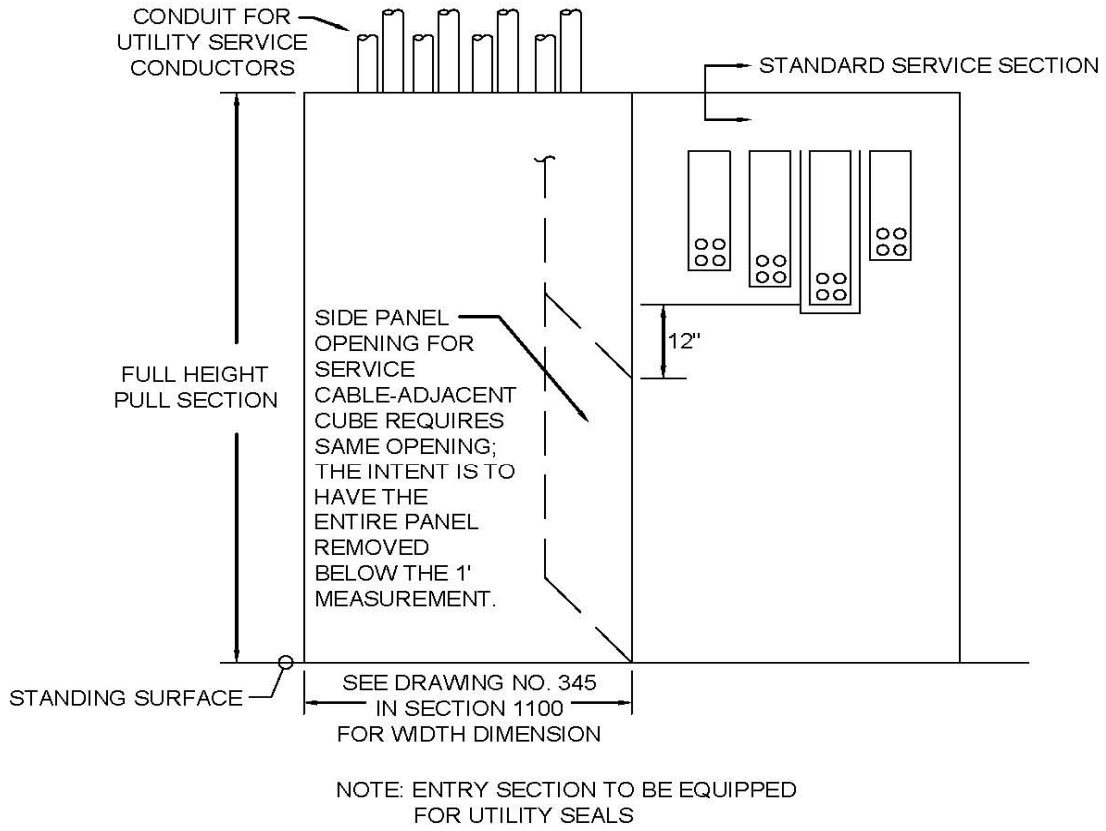


SEE SECTION 1100, DWGS. 345 & 347 FOR WIREWAY AND CABLE LANDING REQUIREMENTS.

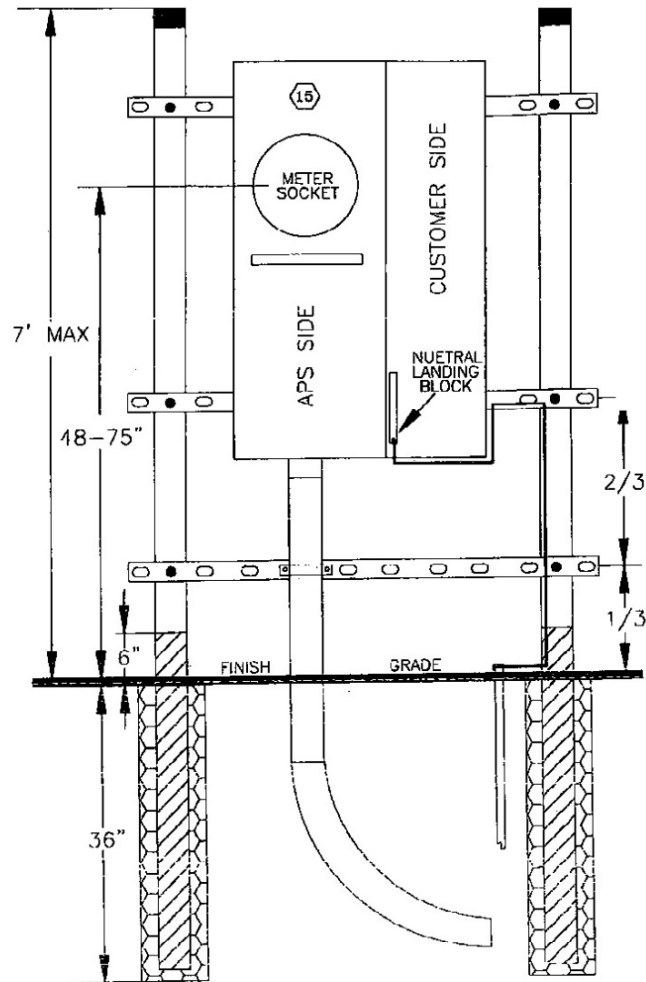


SEE SECTION 1100 DWGS. 345 & 347 FOR WIREWAY AND CABLE LANDING REQUIREMENTS.

OPTIONAL TOP ENTRY PULL SECTION FOR S.E.S. INSIDE BUILDINGS  
(NOT APPLICABLE TO NETWORK INSTALLATIONS)





**NOTES:**

1. See Section 306.0 for complete breakdown of requirements
2. See Section 700 for grounding and bonding requirements.
3. Minimum dimensions of posts shall be.
  - a. Pipes posts = 3" in diameter. Pipe posts to be of rigid galvanized steel. (Maximum Length = 10")
4. The post shall be placed in the center of 12" minimum diameter concrete footing. The footing shall be a minimum of 36 inches in the ground and extend a minimum of 4 inches above ground level, and have a 1/2 inch slope away from the post to allow for drainage
5. All boards, steel and unistrut shall be attached to steel pole or post securely with a minimum 1/2" galvanized through bolt with a 1 1/2" galvanized backing and a lock nut. Nails or lag screws will not be acceptable.
6. All service equipment shall be securely fastened to steel with a minimum 1/4" through bolts. Nails or lag screws will not be acceptable.
7. Meter panel must meet APS requirements.
8. Customer to supply, own and maintain the UG riser.

**TRENCHING REQUIREMENTS**  
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600.1 GENERAL

1. Customer shall provide trench, conduit, backfill and 3 phase transformer pads. Customer shall install conduit, backfill, 3 phase transformer pads and APS provided equipment pads/box pads, pull boxes, J-Boxes and manholes. These items shall be provided and installed according to the Trenching Agreement and the Facilities Installation Specifications provided by APS for the installation.
2. APS shall be responsible for surveying and inspecting all trench, conduit and equipment installations outlined in #1 above. Customer shall provide easements for trench routes, equipment locations, and secure all necessary permits required by local municipalities and/or governing agencies.
3. Customer shall have property corners and other control points as requested, installed and flagged before APS will survey the job. In addition, easements, alleys, streets and water retention areas adjacent to proposed trench route must be graded to within 6" of finished grade and grade stakes set before APS approves trench and begins construction.
4. Customer shall be responsible for having all existing underground facilities located and identified in the field before excavation begins.
5. APS approved and Customer provided concrete caps shall be installed over conduit in trenches which cross or are located in drainage areas, washes, and other areas subject to erosion. Concrete cap (partially encased) shall consist of 3000 lb. concrete at 28 days, 4 inches thick and 2 inches minimum on all sides. Trench depth shall be specified for the voltage utilized.
6. APS will not energize underground cable until the trench depth is verified and backfill is compacted with a minimum of 24" of cover for secondary/service and 36" of cover for primary, unless otherwise shown on the APS approved plans.
7. Customer shall restore, at customer's expense, any damaged landscaping or property to it's original condition due to Customer provided trenching, backfilling, or equipment installations.
8. APS reserves the right to inspect all and every part of Customer's work during or after completion of trenching, conduit installation, shading, backfilling or compaction. If all or any part of the work has not been done according to APS specifications, Customer shall take corrective action at Customer's expense. APS, at Customer's request, may perform the corrective action at the Customer's expense. Neither inspection of the work nor lack of same, shall relieve Customer of the responsibility to provide and perform the work according to APS specifications.
9. Where Customer provides the trenching and backfilling, Customer shall indemnify and save harmless APS and any other utility who is a joint trench occupant with APS, from any and all claims, losses, costs and damages incurred by the utilities, on account of injuries or damages to persons or property received or sustained by any persons, firms or corporations by reason of any acts or omissions of Customer, it's agents or employees, or any defects in the methods, materials, equipment or tools used in the trenching or backfilling or any contingencies arising therefrom.
10. Customer shall use a properly licensed contractor when excavating in the public right-of-way or utility easement. Licensing information is available through the State Registrar of Contractors.

## 600.2 SEPARATIONS FROM OBSTRUCTIONS

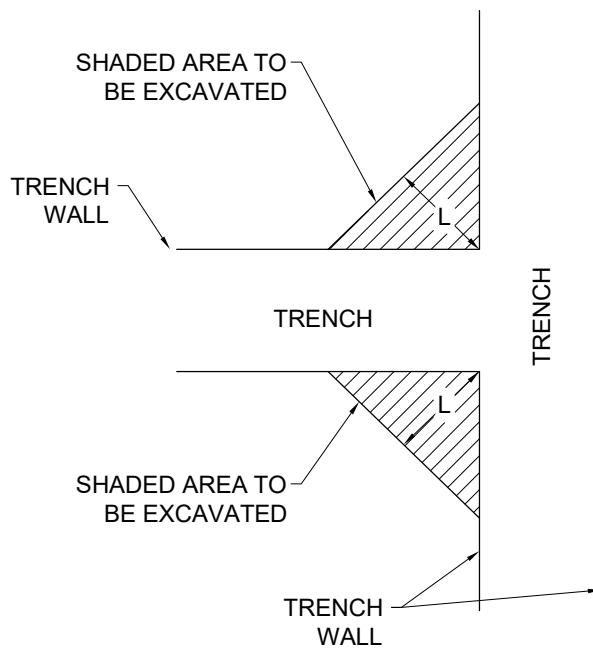
- a) It may become necessary to excavate for additional depth and/or width, as approved by APS Division Engineering, where electric facilities approach or cross other existing utility lines. (Sewer, storm, water, telephone, television or unidentified facilities.)
- b) All crossings shall provide a minimum of 12" clear vertical separation from the APS electric facilities to the underground obstruction being crossed. Exception: When the other underground facilities (e.g. natural gas service lines) are "sleeved", and are located above electric facilities, the clear vertical separation required above may be reduced to 6". The "sleeves" shall consist of rigid PVC conduit, and shall extend a minimum of 12" beyond both sides of the electric facilities, measured perpendicular to the electric facilities.
- c) If APS facilities are "joint trench" with natural gas facilities, natural gas lines shall be installed with a minimum of 12" clear vertical separation, measured from outside wall to outside wall on conduits, and shall be located above all APS conduits. In addition, natural gas lines shall maintain a minimum of 12" horizontal separation from the outside edge of all APS equipment pads to the closest edge of the natural gas lines. If APS facilities and natural gas facilities will be installed in separate trenches, a 24" minimum horizontal separation shall be maintained between APS electric facilities and natural gas facilities.
- d) Telephone and CATV facilities installed in "joint trench" with APS electric facilities and natural gas facilities shall maintain a minimum 12" clear vertical above all APS electric facilities. Exception: If "joint trench" does not have natural gas facilities, the 12" clear vertical separation may be reduced to 6 inches.
- e) Water and Sewer facilities shall not be allowed to be "joint trench" with APS electric facilities. A minimum of 24" clear horizontal separation shall be maintained between APS electric facilities and water or sewer facilities.
- f) Customer wiring to maintain 24" separation from APS electric facilities.

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## 600.3 TRENCH BOTTOM

Trench bottoms shall be smooth, flat, and without surface irregularities, otherwise a sufficient amount of bedding material shall be installed to provide the required surface. The bedding material shall not contain rocks larger than 1-1/2 inches in their greatest dimension. The bedding material shall contain a sufficient volume of fines to fill all voids. Trench bottoms shall be free and clear of debris or any organic material. Any change in level of the trench bottom shall be made over sufficient distance to give as gradual a change in grade as possible.

When changing elevations with straight conduit sections, a change in elevation of the trench bottom shall not exceed 1 foot in 12 feet.



CUT CORNERS OF TRENCH THE MINIMUM DISTANCE AS SHOWN BY "L". **THE ENTIRE SHADED AREA MUST BE REMOVED.**

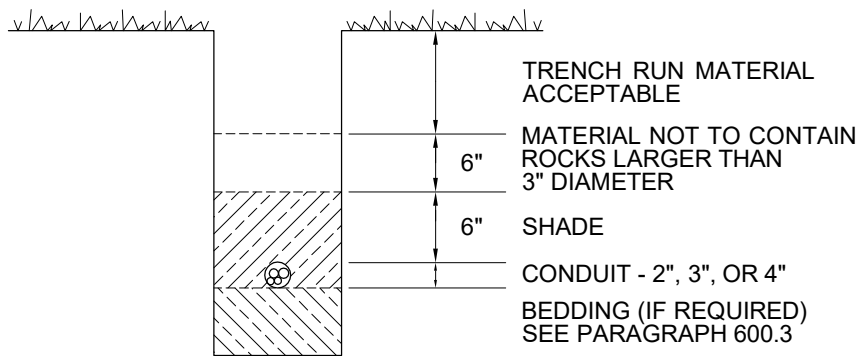
- A) L = 15" FOR 24" RADIUS CONDUIT SWEEPS.
- B) L = 22" FOR 36" RADIUS CONDUIT SWEEPS.
- C) L = 39" FOR 60" RADIUS CONDUIT SWEEPS.

**600.5 SUITABLE SHADING FOR CONDUIT:**  
 (SEE SECTION 500 FOR CONDUIT INSTALLATION)

THE TRENCH BOTTOM SHALL BE SMOOTH, FLAT AND WITHOUT SURFACE IRREGULARITIES. (SEE PARAGRAPH 600.3) SHADING MATERIAL SHALL NOT CONTAIN ROCKS LARGER THAN 1-1/2 INCHES (SEE "A" BELOW) IN THEIR GREATEST DIMENSION. MATERIAL SHALL CONTAIN ENOUGH FINES TO FILL ALL VOIDS. THE SOIL SHALL BE FREE OF DECOMPOSABLE (ORGANIC) MATERIAL.

BACKFILL WITHIN 6 INCHES ABOVE CONDUIT SHALL MEET THE ABOVE REQUIREMENTS.

- a) IF THE NATIVE SOIL TO BE USED FOR SHADING CONFORMS TO THE ABOVE SPECIFICATIONS, USE IT. IF THE NATIVE SOIL DOES NOT CONFORM THE CUSTOMER SHALL PROVIDE APPROVED MATERIAL FOR 6 INCHES OF SHADING (INSTALLED BY CUSTOMER) MATERIAL AROUND ALL ELECTRICAL CONDUIT. [IF ABC IS USED, SCREENED 1" MINUS MATERIAL IS REQUIRED. SELECT FILL (SAND) IS ALSO ACCEPTABLE FOR SHADING MATERIAL.] THE FIRST 6 INCHES OF BACKFILL MATERIAL PLACED IN THE TRENCH ABOVE THE SHADING MATERIAL FOR THE CONDUIT SHALL NOT CONTAIN ROCKS LARGER THAN 3" IN DIAMETER. TRENCH RUN MATERIAL MAY BE USED FOR THE REMAINDER OF THE BACKFILL.



**TYPICAL TRENCH**

**NOTES:**

- 1. SHADE - MEASURED FROM TOP OF CONDUIT.
- 2. FOR TRENCH DETAILS, SEE PARAGRAPH 602.0.

**600.6 REDUCED TRENCH DEPTH FOR DIFFICULT TRENCHING:**

Shale, broken rock, solid rock, etc., are reasons for reducing trench depths. (See Paragraph 602.1-2 Fig. 4) It is important that reduced trench depths be used only when necessary, and with approval of APS Engineering.

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**600.7 UNACCEPTABLE BACKFILL:**

- a) Backfill containing foreign objects such as trash, cans, glass, decomposable material or lava.
  - b) Backfill which contains concrete pieces larger than 3" in diameter or any asphalt material.
  - c) Any native soil that will not compact to achieve the required composition level (**Must have some fines**).
  - d) Any backfill material not conforming to the requirements of the local governmental agency or other public regulatory agency.
- 

**600.8 COMPACTION:**

Acceptable compaction methods are: hand-tamping with pneumatic or vibrating equipment, and/or jetting or irrigation-style flooding of each backfill lift. (**Each backfill lift not to exceed 12".**) **Vehicular-mounted tamping equipment or wheel rolling is not acceptable.** Irrigation-style flooding must be so controlled that soil erosion of the shaded material does not occur in the trench. (Before tamping in areas of conduit, at least 6" of APS approved material must be placed over the top of the facilities to avoid damage. Backfill shall be compacted to 85% of maximum density as defined by ASTM D-2922 and D-3017. APS reserved the right to check soil compaction through the use of a certified laboratory.

**601.0 SPECIAL CONSIDERATIONS**

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**601.1 ENERGIZING UNDERGROUND CABLE**

APS will not energize underground cables until the trench is verified, and backfill is compacted with a minimum of 24" cover for secondary service and 36" cover for primary, unless otherwise shown on the attached drawings.

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**601.2 INSPECTION OF CUSTOMER'S WORK**

APS reserves the right to inspect all and every part of the Customer's work during or after completion of trenching, conduit installation, shading, backfilling or compaction. If all or any part of the work has not been done according to APS's specifications, Customer shall take correction action at Customers expense. APS at Customer's request may perform the corrective action at the Customer's expense. Neither inspection of the work by APS nor lack of same shall relieve Customer of the responsibility to provide and perform the work per APS specifications. In all cases the Customer is responsible for conduit system location, integrity and usefulness until APS conductors are energized.





602.1-1 ELECTRIC SERVICE ONLY - IN CONDUIT

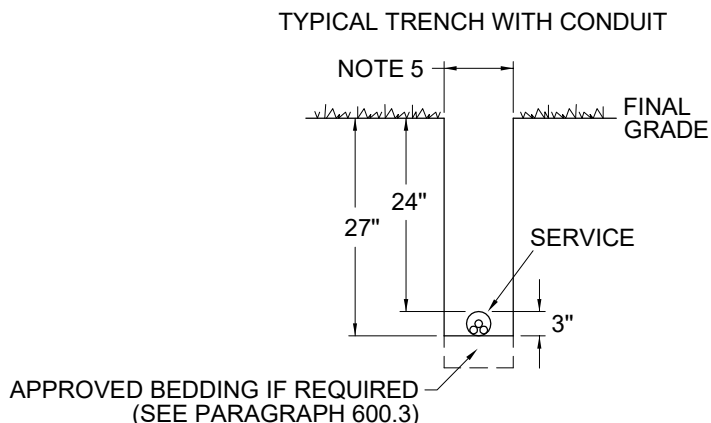


FIGURE 1

602.1-2 ELECTRIC SERVICE (IN CONDUIT). TELCO AND CATV

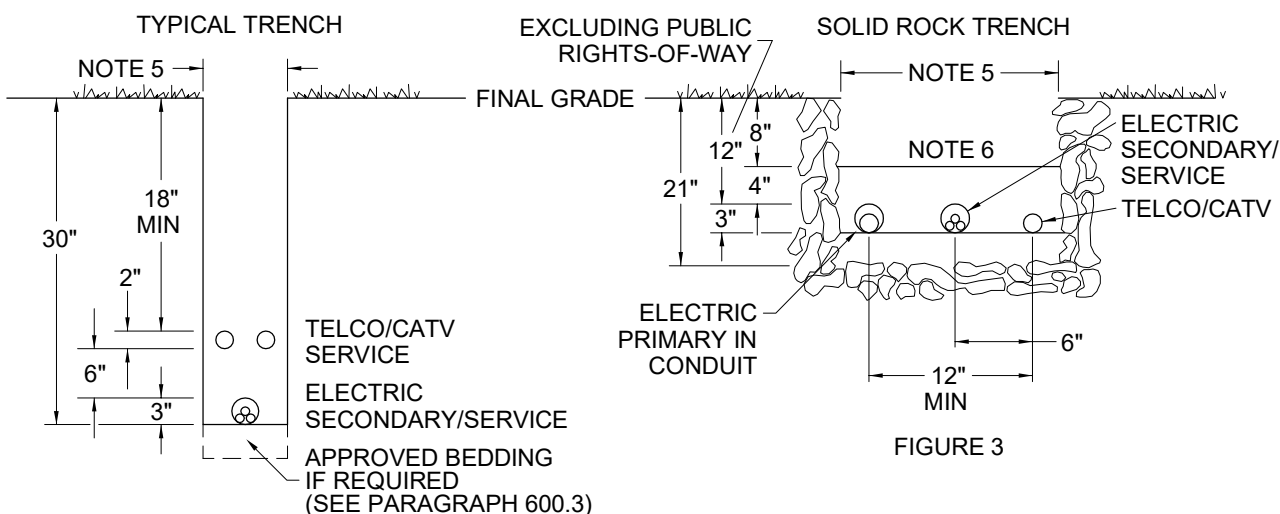


FIGURE 3

FIGURE 2

**NOTES:**

1. GRADES SHOWN ARE FINAL GRADES.
2. TRENCH WIDTHS SHOWN ARE MINIMUMS.
3. MINIMUM TRENCH WIDTH IS 16" IF MAN MUST ENTER TRENCH.
4. SEE PARAGRAPH 600.3 FOR DEFINITION OF APPROVED TRENCH BOTTOM.
5. WHERE RANDOM SPACING BETWEEN DIRECT-BURIED CONDUITS IS ALLOWED, THE MINIMUM TRENCH WIDTH IS 1-INCH PLUS THE SUM OF THE HORIZONTALLY SPACED CONDUIT OUTSIDE DIAMETERS PLUS 1/2-INCH FOR EACH HORIZONTALLY SPACED CONDUITS (OVER ONE).
6. CONDUIT IN A SHALLOW ROCK TRENCH REQUIRES A 4" CONCRETE CAP.

**602.1-3 ELECTRIC SERVICE (IN CONDUIT) - "JOINT TRENCH"  
(WITH NATURAL GAS, TELCO, AND CATV)**

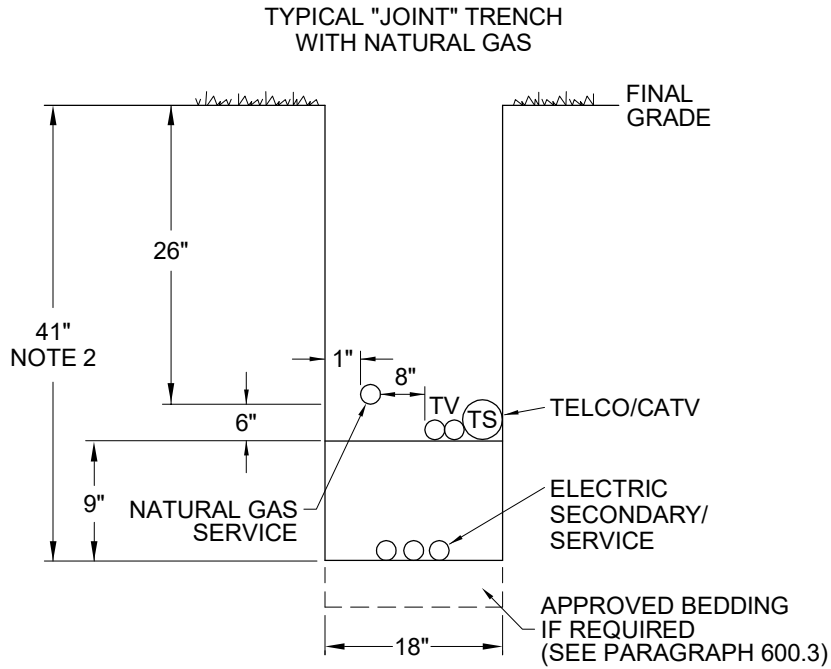
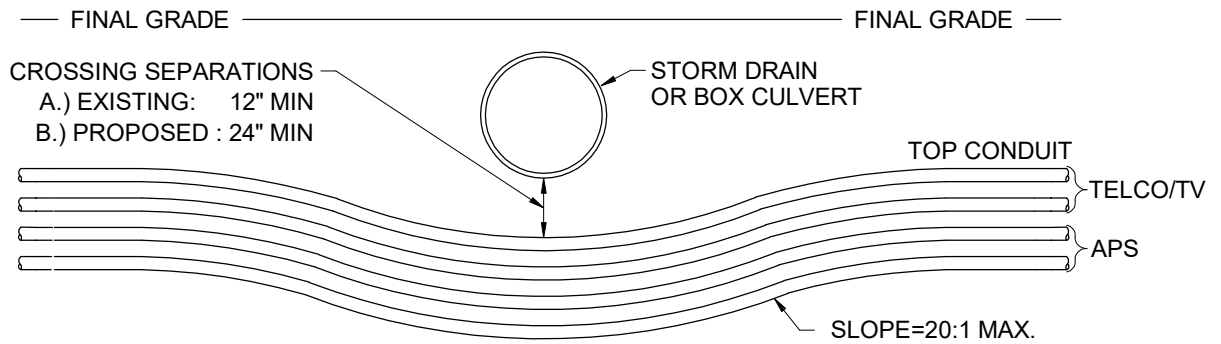


FIGURE 1

**602.1-4 ELECTRIC SERVICE CONDUITS UNDER STORM DRAIN CULVERT**



**602.2 MINIMUM COVER OVER FACILITIES IN CITY OF PHOENIX**

MINIMUM COVER OVER FACILITIES WITHIN CITY OF PHOENIX ONLY				
TYPE OF FACILITIES	UNDEVELOPED AREAS (SEE NOTE 2)	DEVELOPED AREAS (SEE NOTE 3)		FIRST UTILITY CONSTRUCTION - BACK OF SIDEWALK ON MAJOR AND COLLECTOR STREETS (TOP UTILITY IN A JOINTLY-USED TRENCH)
		MAJOR & COLLECTOR STREETS	LOCAL STREETS & ALLEYS	
0-600V LOW VOLTAGE IN CONDUIT	35"	36"	24"	48"

**NOTES:**

1. The minimum cover requirements listed above apply to facilities installed in the public right-of-way located within the boundaries of the City of Phoenix.
2. An Area is considered undeveloped under one or all of the following conditions:
  - a. Final grade has not been established;
  - b. A 40 foot paved road on a section line with only partial development alongside;
  - c. Obviously underdeveloped areas.
3. An area is considered developed under one or all of the following conditions:
  - a. Final grade has been established;
  - b. Grading for subgrade stakes is complete, and normally water and sewage have been established;
  - c. Curbs and gutters are existing.
4. For more specific details consult UST 06 in the APS Underground Distribution Construction Standards.

# GROUNDING AND BONDING

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## 700.0 INTRODUCTION

Arizona Public Service Company recognizes the value of the Industry Uniform Grounding and Bonding requirements. We are pleased to share the following illustrations and data applicable to the requirements.

This information will provide assistance and guidance to person's installing Service Entrance equipment in areas served by APS with no municipal or county electrical inspection authority.

The methods of Grounding and Bonding of Service Entrance equipment shown in this manual are recommended by APS to maintain consistency throughout APS's service territory.

The following drawings and tables will assist in assuring a safe and adequate grounding installation, acceptable under any code.

If the area you are building in has a county or municipal inspection authority, please contact that authority for their regulations.

---

## 700.1 GENERAL INFORMATION

1. Customer wire shall not be run through utility sealed areas. This includes ground electrode conductors as well as any avoidable bond conductors.
2. Weatherproof hubs, jam nuts, etc., shall be used on any penetrations of equipment at the same height or above energized areas. A good rule of thumb is; that unless the penetration is on the bottom surface of a can, it shall be done with a weatherproof connection. Indoor equipment is an exception to this requirement.
3. Self-bonding hubs (Meyers or equivalent) shall not be used on multi-centric knockouts, unless the largest knockout is used.
4. Interior metal water piping systems shall be bonded to the service entrance enclosure with conductors sized to the ampacity of the main bus per NEC. (See Paragraph 701.0)  
In multiple occupancy buildings where the interior metal water piping system for the individual occupancies is isolated from all other occupancies by the use of non-metallic pipe, each water system may be bonded to the panel board or switchboard enclosure supplying that occupancy, sized per NEC.
5. Other metal piping systems (E.G. Gas pipe) shall be bonded to the service equipment enclosure with a conductor sized to the largest branch circuit or feeder supplying the facility, sized per NEC (See Paragraph 701.0)
6. Nonconductive paint must be removed at threads, contact points and contact surfaces of any ground/bond lugs, terminal strips, etc., to assure a good electrical **connection**.

---

## 700.2 GROUNDING

The ground electrode conductor may be either bare or with green insulation. See **Paragraph 701.0** for ground electrode conductor size. Ground electrode conductors not encased in conduit shall be a minimum size of No. 4 copper or larger and must be securely fastened to the building or structure with approved fastening devices. The spacing of such devices shall not exceed 2 feet. If a ground rod is used as an electrode, at least 8 feet shall be in contact with the soil.

Ground Electrode conductors smaller than size No. 4 copper shall be solid copper wire, or shall be attached to the ground rod using the exothermic welding process.

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## 700.3 BONDING (Unfused areas)

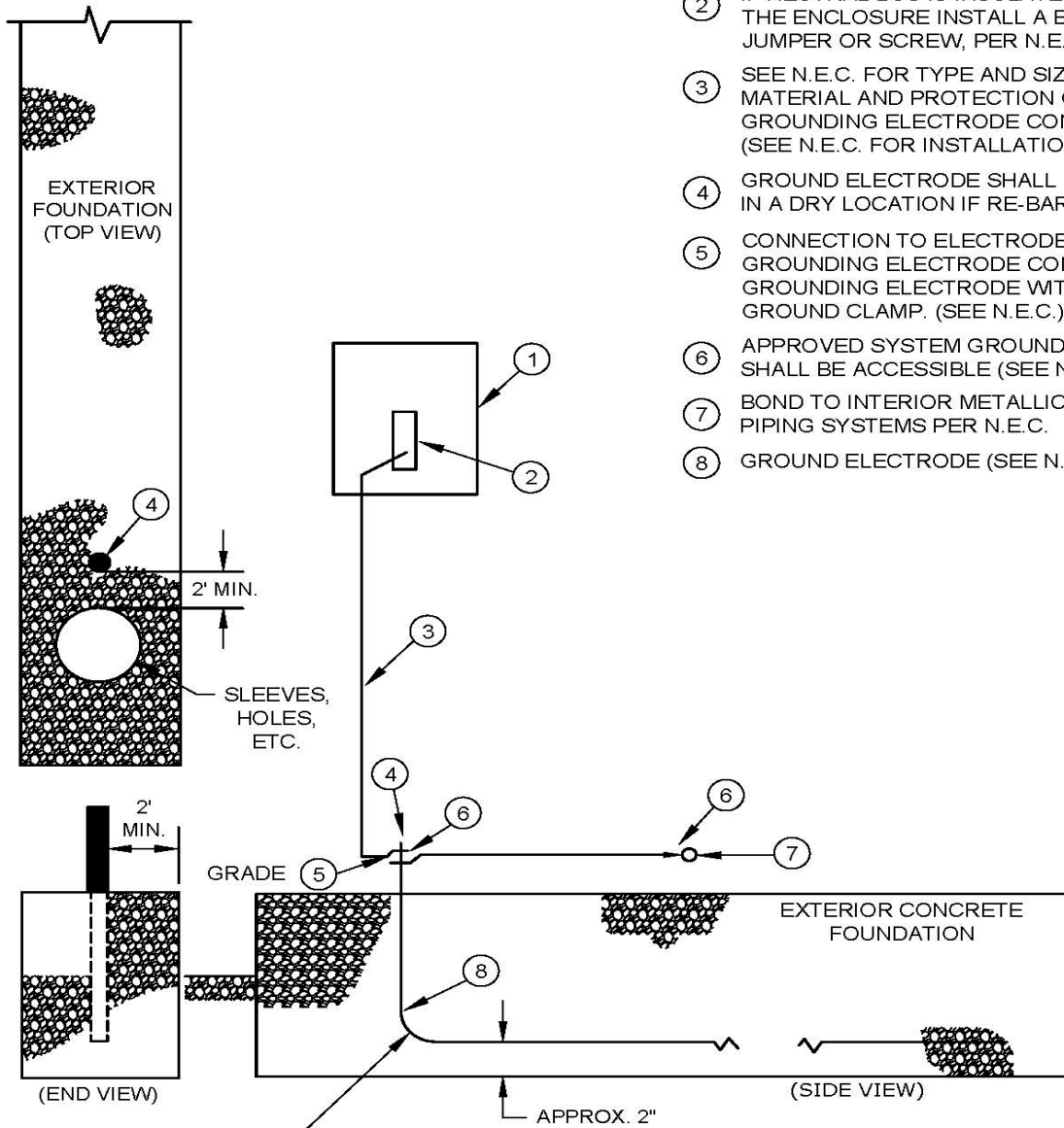
See **Paragraph 701.0 for bond conductor size**. Bonding is required on all enclosures, equipment, raceways, and fittings which contain unfused service conductors. Nipples and bushings installed with eccentric or concentric lock nuts must be bonded with ground bushings, wedges, or other approved devices. **Bond conductor size shall be determined by the ampere rating of the service entrance equipment.**

TABLE 701.0

MAXIMUM AMPERE RATING	COLUMN 1 LOAD SIDE		COLUMN 2 LINE SIDE		COLUMN 3	
	SIZE OF EQUIPMENT GROUNDING OR BONDING CONDUCTOR MINIMUM (AWG OR MCM) FROM NEC 250.122 SEE NOTE 1		SIZE OF GROUNDING ELECTRODE CONDUCTOR MINIMUM (AWG OR MCM) FROM NEC 250.66 SEE NOTE 2 & 4		SIZE OF MAIN BONDING JUMPER, MINIMUM (AWG OR MCM) FROM NEC 250.102(C)(1) SEE NOTE 3	
	COPPER	ALUMINUM	COPPER	ALUMINUM	COPPER	ALUMINUM
20	12	10	-	-	-	-
60	10	8	-	-	-	-
90	8	6	-	-	-	-
100	8	6	6	4	6	4
150	6	4	6	4	6	4
200	6	4	4	2	4	2
300	4	2	2	1/0	2	1/0
400	3	1	1/0	3/0	1/0	3/0
500	2	1/0	2/0	3/0	2/0	3/0
600	1	2/0	2/0	4/0	2/0	4/0
800	1/0	3/0	3/0	4/0	3/0	4/0
1000	2/0	4/0	3/0	250	3/0	300
1200	3/0	250	3/0	250	300	400
1600	4/0	350	3/0	250	400	600
2000	250	400	3/0	250	600	700
2500	350	500	3/0	250	700	900
3000	400	600	3/0	250	900	1250
4000	500	800	3/0	250	1250	1500
5000	700	1200	3/0	250	1500	1750
6000	800	1200	3/0	250	1750	2000

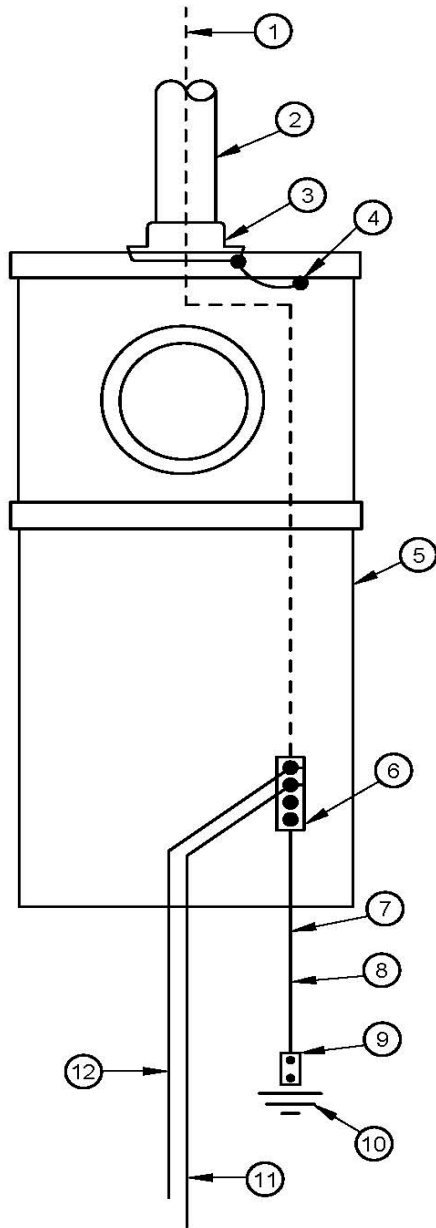
## NOTES:

1. For sizing bonding conductor for gas line, per NEC. For sizing any bond conductor required on **the load side of fuses or circuit breakers**.
2. For sizing water bonds per NEC. For sizing conductor used for bonding unfused nipples and equipment.
3. For sizing main bonding jumper, system bonding jumpers, and supply-side bonding jumpers from equipment grounding bus to neutral bus, per NEC.
4. Grounding electrode conductors need not be larger than #4 (solid or stranded) copper if there is only one connection between the concrete encased electrode or manmade electrode (for example – ground rod) & grounded system conductor (neutral conductor), per NEC.



- ① SERVICE DISCONNECT
- ② IF NEUTRAL BUS IS INSULATED FROM THE ENCLOSURE INSTALL A BONDING JUMPER OR SCREW, PER N.E.C.
- ③ SEE N.E.C. FOR TYPE AND SIZE OF MATERIAL AND PROTECTION OF THE GROUNDING ELECTRODE CONDUCTOR. (SEE N.E.C. FOR INSTALLATION AND SIZE)
- ④ GROUND ELECTRODE SHALL BE TERMINATED IN A DRY LOCATION IF RE-BAR USED.
- ⑤ CONNECTION TO ELECTRODE. CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑥ APPROVED SYSTEM GROUND CLAMPS SHALL BE ACCESSIBLE (SEE N.E.C.)
- ⑦ BOND TO INTERIOR METALLIC COLD WATER PIPING SYSTEMS PER N.E.C.
- ⑧ GROUND ELECTRODE (SEE N.E.C.)

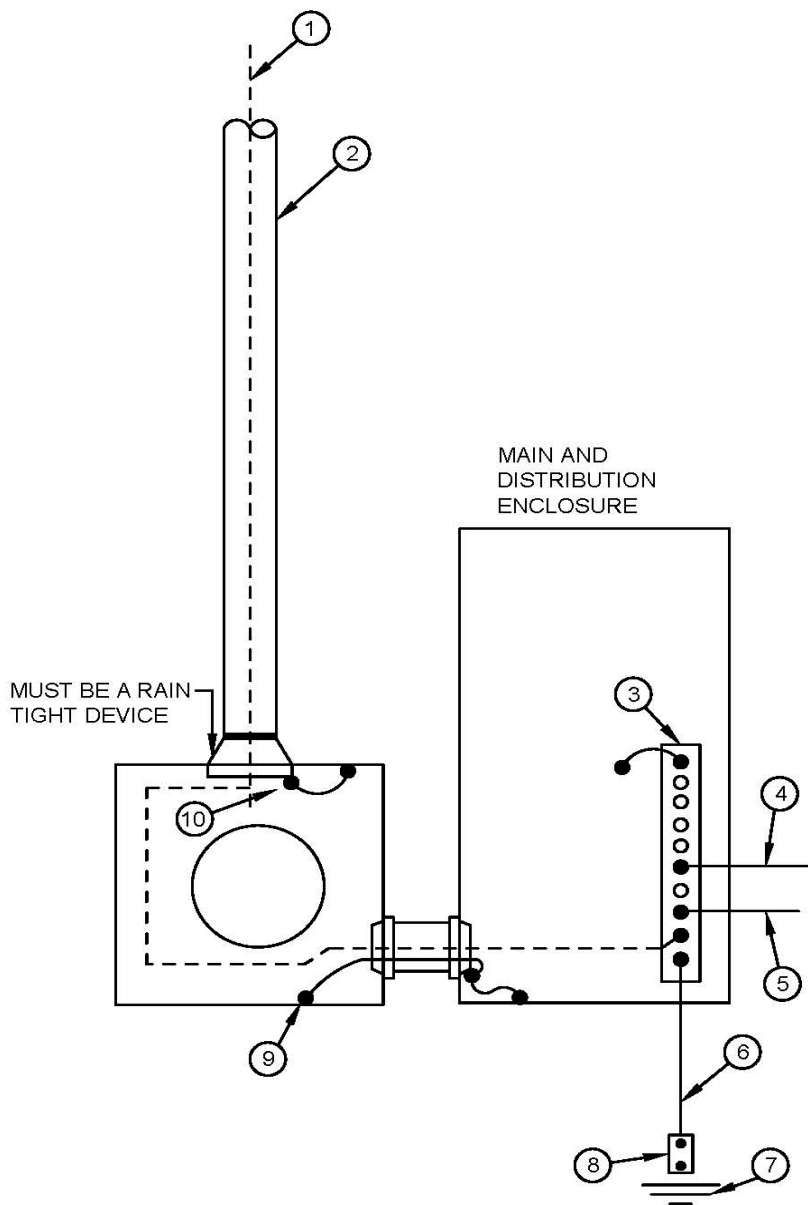
NOTE:  
 20 FT. OR MORE #4 REINFORCING STEEL , OR 3/4 IN. RIGID METALLIC CONDUIT OR NO. 4 BARE COPPER WIRE (OR LARGER). (SEE N.E.C.)



- ① GROUNDED (NEUTRAL) SERVICE ENTRANCE CONDUCTOR.
- ② SERVICE ENTRANCE RACEWAY.
- ③ MUST BE A RAIN TIGHT DEVICE.
- ④ IF BOLTED HUB OR SELF BONDING HUB IS USED BONDING JUMPER IS NOT REQUIRED PER N.E.C. SIZE BONDING JUMPER PER **TABLE 701.0, COLUMN 3, ESRM.**
- ⑤ SERVICE DISCONNECT ENCLOSURE.
- ⑥ NEUTRAL TERMINAL BUS. WHERE NEUTRAL TERMINAL IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW. (SEE N.E.C.) NEUTRAL DISCONNECT MEANS SEE N.E.C.
- ⑦ BARE OR INSULATED GROUNDING ELECTRODE CONDUCTOR (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE)
- ⑧ SIZE PER **TABLE 701.0, COLUMN 2, ESRM.**
- ⑨ CONNECTION TO ELECTRODE, CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑩ GROUNDING ELECTRODE SYSTEM. (SEE N.E.C.)
- ⑪ OTHER METAL WATER - (SEE N.E.C.) SIZE BOND CONDUCTOR PIPING PER **TABLE 701.0 COLUMN 1, ESRM.**
- ⑫ SIZE BOND CONDUCTOR FOR METAL WATER PIPING PER **TABLE 701.0 COLUMN 2, ESRM.**

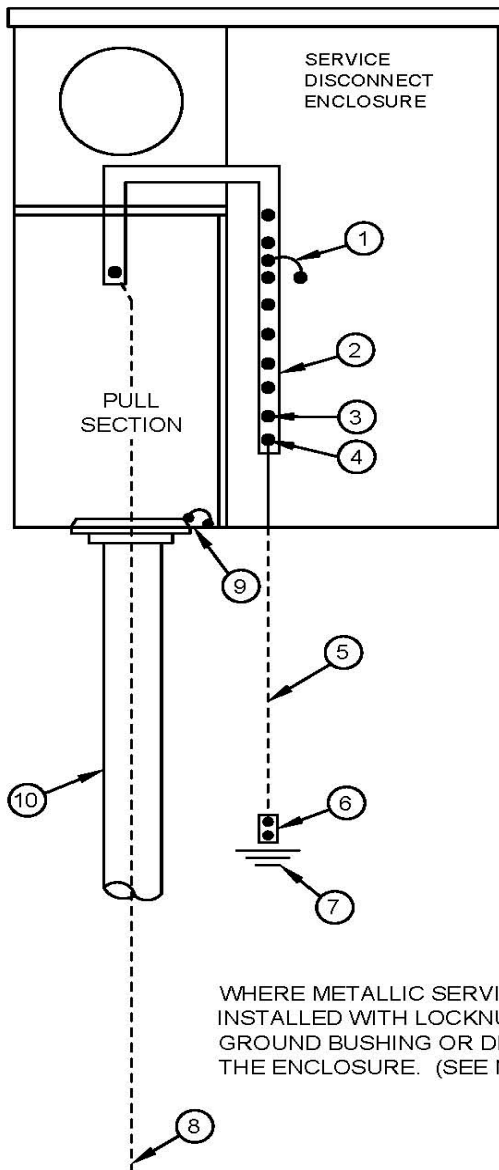


703.2 TYPICAL RESIDENTIAL OVERHEAD SERVICE - SEPARATE METER AND DISTRIBUTION CAN.  
MAX 200 AMP. (SINGLE PHASE)



- ① NEUTRAL
- ② SERVICE ENTRANCE RACEWAY
- ③ WHERE NEUTRAL TERMINAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BOND JUMPER OR SCREW.
- ④ METAL WATER PIPING PER **TABLE 701.0, COLUMN 2, ESRM.** (SEE N.E.C.)
- ⑤ OTHER METAL PIPING PER **TABLE 701.0, COLUMN 1, ESRM.** (SEE N.E.C.)
- ⑥ GROUNDING ELECTRODE CONDUCTOR. (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE.)
- ⑦ GROUNDING ELECTRODE SYSTEM. (SEE N.E.C.)
- ⑧ CONNECTION TO ELECTRODE CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑨ BONDING JUMPERS SIZE PER **TABLE 701.0, COLUMN 3, ESRM.** (SEE N.E.C.)
- ⑩ IF BOLTED HUB OR SELF BONDING HUB IS USED. BONDING JUMPER IS NOT REQUIRED. SIZE BONDING JUMPER PER **TABLE 701.0, COLUMN 3, ESRM.** (SEE N.E.C.)

TYPICAL RESIDENTIAL UNDERGROUND SERVICE (SINGLE FAMILY)  
 MAX 200 AMP. SINGLE PHASE

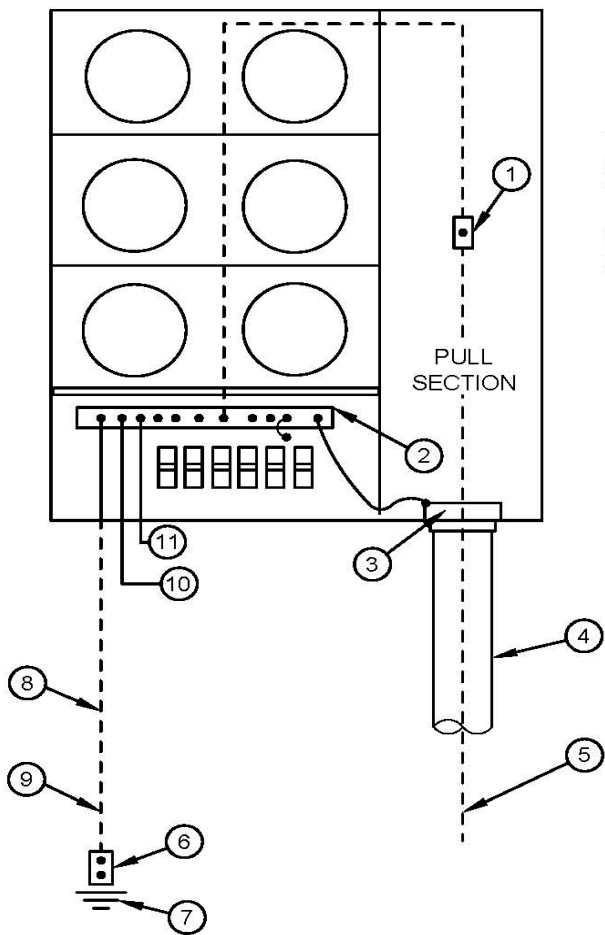


- ① WHERE NEUTRAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW. (SEE N.E.C.)
- ② NEUTRAL DISCONNECT MEANS SEE N.E.C.
- ③ METAL WATER PIPING PER TABLE 701.0, COLUMN 2, ESRM. (SEE N.E.C.)
- ④ OTHER METAL PIPING PER TABLE 701.0, COLUMN 1, ESRM. (SEE N.E.C.)
- ⑤ BARE OR INSULATED GROUNDING ELECTRODE CONDUCTOR. (SEE N.E.C. FOR MATERIAL INSTALLATION AND SIZE.) SEE TABLE 701.0, COLUMN 2, ESRM.
- ⑥ CONNECTION TO ELECTRODE. CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑦ GROUNDING ELECTRODE SYSTEM. (SEE N.E.C.)
- ⑧ GROUNDED (NEUTRAL) SERVICE CONDUCTOR.
- ⑨ IF BOLTED HUB OR SELF BONDING HUB IS USED, BONDING JUMPER IS NOT REQUIRED. (SEE N.E.C.)
- ⑩ SERVICE ENTRANCE RACEWAY

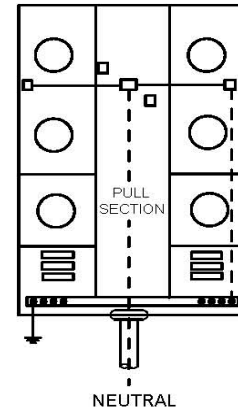
WHERE METALLIC SERVICE RACEWAY IS INSTALLED WITH LOCKNUTS, INSTALL A GROUND BUSHING OR DEVICE AND BOND TO THE ENCLOSURE. (SEE N.E.C.)

704.1 UNDERGROUND MULTI-FAMILY RESIDENTIAL SERVICE - SINGLE PHASE  
(400 AMP AND LARGER)

- ① NEUTRAL LANDING TERMINAL (INSULATED FROM ENCLOSURE)
- ② WHERE NEUTRAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW. (SEE N.E.C.) NEUTRAL DISCONNECT MEANS SEE N.E.C.
- ③ IF BOLTED HUB OR SELF BONDING BUSHING IS USED. BONDING JUMPER IS NOT REQUIRED. (SEE TABLE 701.0, COLUMN 3, FOR BOND WIRE SIZE, ESRM.)
- ④ SERVICE ENTRANCE RACEWAY
- ⑤ GROUNDED (NEUTRAL) SERVICE CONDUCTOR
- ⑥ CONNECTION TO ELECTRODE. CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP (SEE N.E.C.)
- ⑦ GROUNDED ELECTRODE SYSTEM (SEE N.E.C.)
- ⑧ GROUNDING ELECTRODE CONDUCTOR SEE N.E.C. (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE.)
- ⑨ SIZE PER TABLE 701.0, COLUMN 2. ESRM.
- ⑩ OTHER METAL PIPING PER TABLE 701.0, COLUMN 1, ESRM. (SEE N.E.C.)
- ⑪ METAL WATER PIPING PER TABLE 701.0, COLUMN 2, ESRM. (SEE N.E.C.)

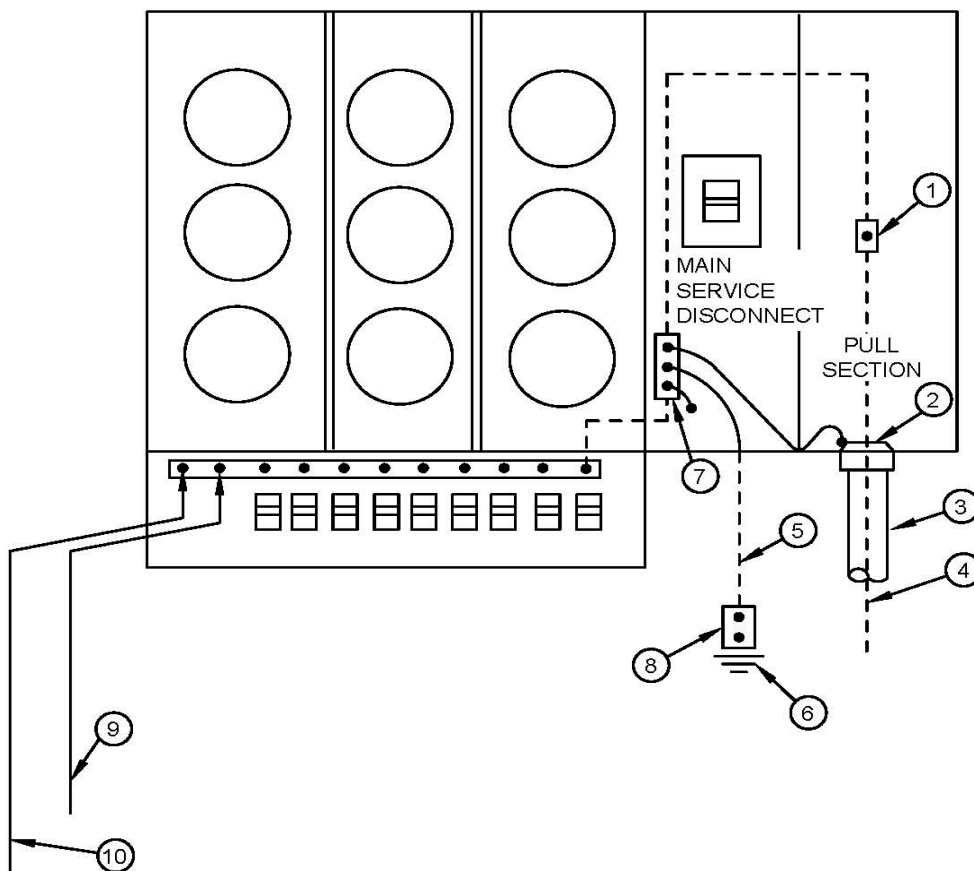


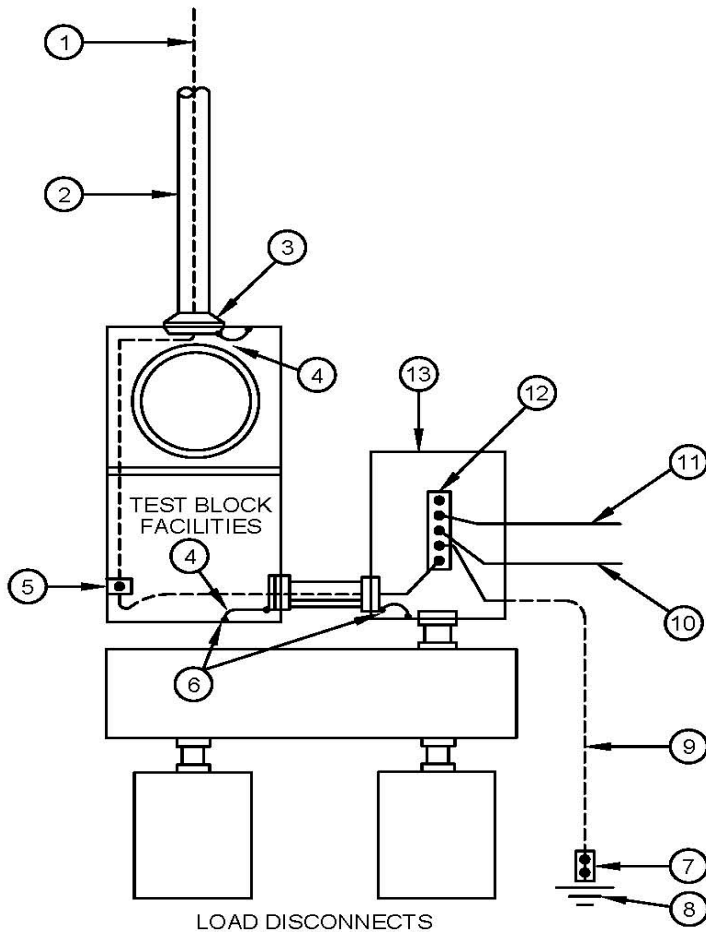
WHERE METALLIC SERVICE RACEWAY IS INSTALLED WITH LOCKNUTS, INSTALL A GROUND BUSHING OR DEVICE AND BOND TO THE ENCLOSURE. (SEE N.E.C.)



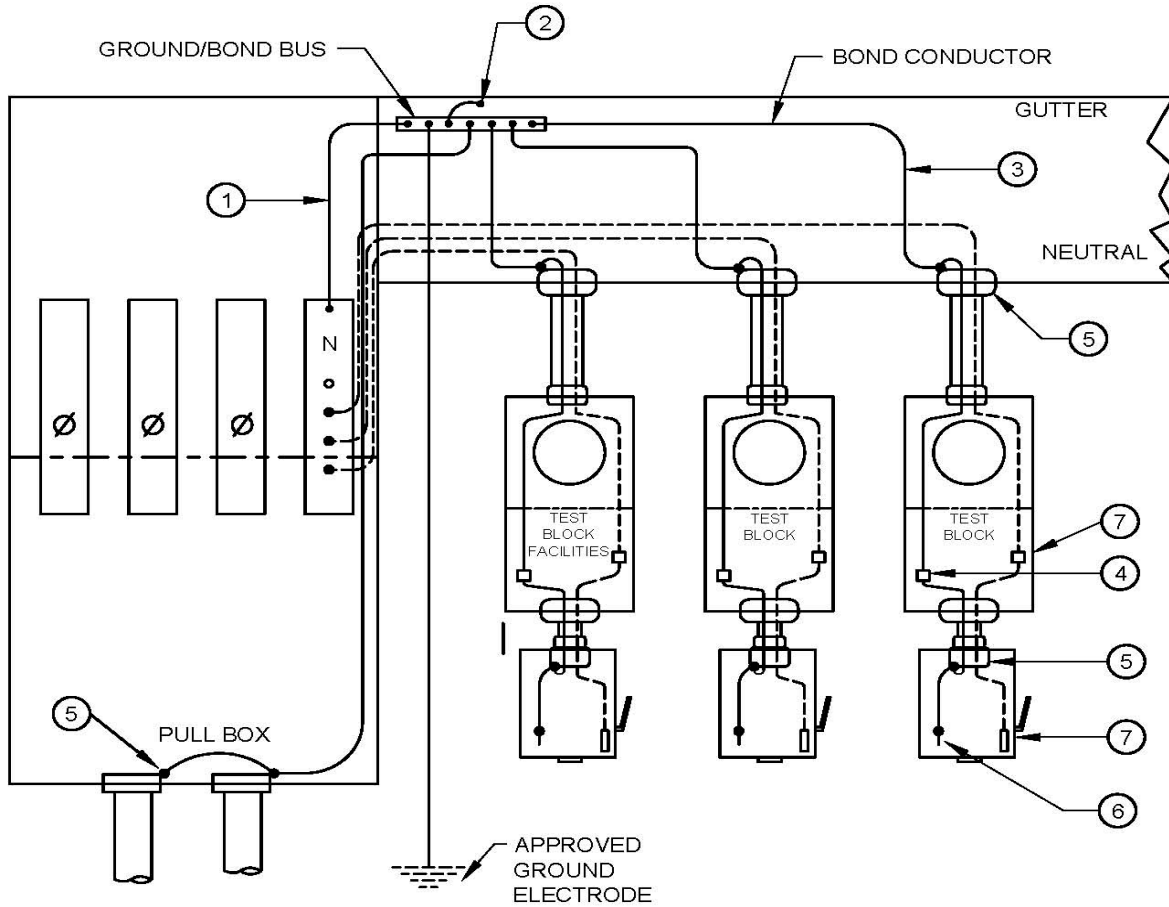
UNDERGROUND MULTI-FAMILY RESIDENTIAL SERVICE - MORE THAN DISCONNECTS  
(SUBDIVISIONS) - SINGLE PHASE

- ① NEUTRAL LANDING TERMINAL (INSULATED FROM ENCLOSURE)
- ② IF BOLTED HUB OR SELF BONDING HUB IS USED, BOND JUMPER IS NOT REQUIRED. (SEE TABLE 701.0, COLUMN 3, ESRM FOR BOND WIRE SIZE.)
- ③ SERVICE ENTRANCE RACEWAY.
- ④ GROUNDED (NEUTRAL) SERVICE CONDUCTOR
- ⑤ GROUNDING ELECTRODE CONDUCTOR (SEE N.E.C.) (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE.) SEE TABLE 701.0, COLUMN 2, ESRM.
- ⑥ GROUNDING ELECTRODE SYSTEM (SEE N.E.C.)
- ⑦ WHERE NEUTRAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW. (SEE N.E.C.) NEUTRAL DISCONNECT MEANS SEE N.E.C.
- ⑧ CONNECTION TO ELECTRODE, CONNECT GROUNDING ELECTRODE CONDUCTOR TO THE GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑨ METAL WATER PIPING, PER TABLE 701.0, COLUMN 2, ESRM. (SEE N.E.C.)
- ⑩ OTHER METAL PIPING, PER TABLE 701.0, COLUMN 1, ESRM. (SEE N.E.C.)



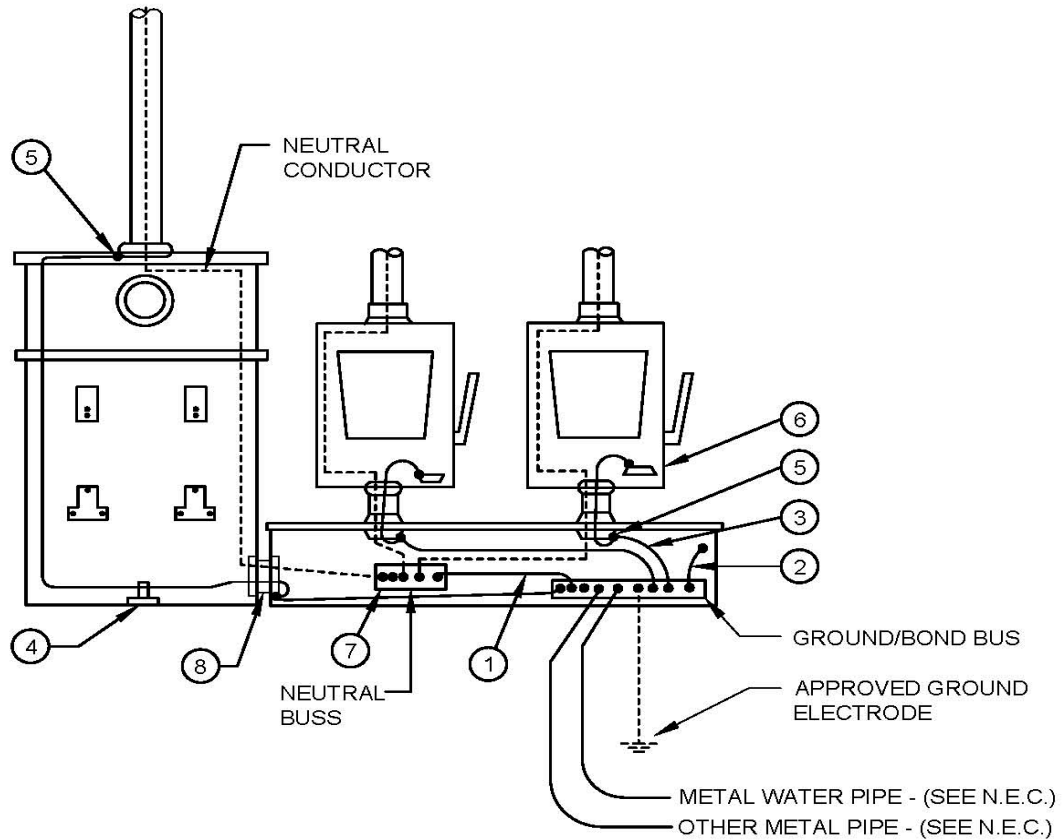


- ① GROUNDED (NEUTRAL) SERVICE ENTRANCE CONDUCTOR
- ② SERVICE ENTRANCE RACEWAY
- ③ MUST BE A RAIN TIGHT DEVICE
- ④ IF BOLTED HUB OR SELF BONDING HUB IS USED BOND JUMPER IS NOT REQUIRED. (SEE TABLE 701.0, COLUMN 3, ESRM FOR BOND WIRE SIZE.)
- ⑤ NEUTRAL LAY IN LUG SHALL BE INSULATED FROM ENCLOSURE.
- ⑥ BONDING JUMPERS (SEE N.E.C.)
- ⑦ CONNECTION TO ELECTRODE, CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑧ GROUNDING ELECTRODE SYSTEM. (SEE N.E.C.)
- ⑨ GROUNDING ELECTRODE CONDUCTOR (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE.) SEE TABLE 701.0, COLUMN 2, ESRM.
- ⑩ OTHER METAL PIPING PER TABLE 701.0, COLUMN 1, ESRM (SEE N.E.C.)
- ⑪ METAL WATER PIPING PER TABLE 701.0, COLUMN 2, ESRM (SEE N.E.C.)
- ⑫ WHERE NEUTRAL TERMINAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW. (SEE N.E.C.) NEUTRAL DISCONNECT MEANS SEE N.E.C.
- ⑬ MAIN SERVICE DISCONNECT ENCLOSURE

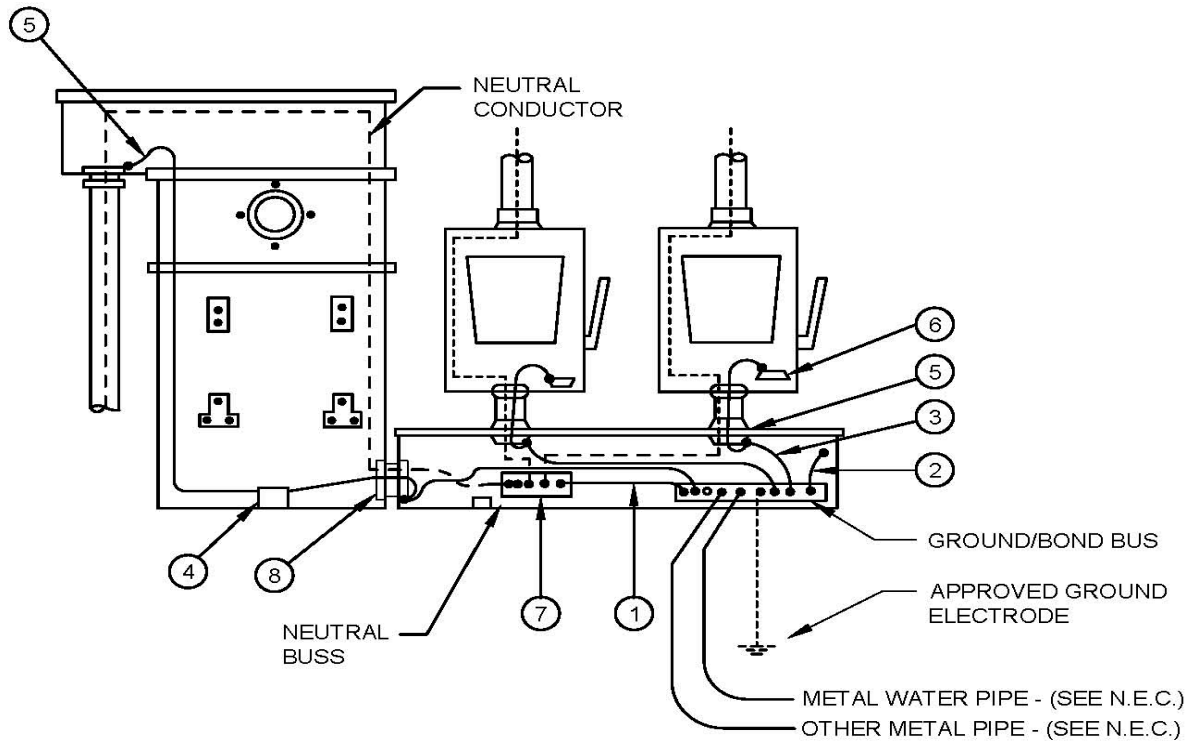


- ① MAIN BONDING JUMPER SIZED PER **TABLE 701.0 COLUMN 3** (per NEC)
- ② GROUND BOND BUS TO BE TIED TO METAL GUTTER. PER **TABLE 701.0 COLUMN 3** (per NEC)
- ③ INSULATED BOND CONDUCTOR SIZED PER NEC. SIZED PER **TABLE 701.0 COLUMN 3 ESRM.**
- ④ INSULATED BOND CONDUCTOR TO BE TIED TO METAL ENCLOSURE.
- ⑤ ALL UNFUSED NIPPLES TO BE BONDED PER NEC. SIZE PER **TABLE 701.0 COLUMN 3 ESRM.**
- ⑥ BOND TERMINAL BAR TO BE TIED TO METAL ENCLOSURE.
- ⑦ NEUTRAL TERMINAL SHALL BE INSULATED FROM METAL ENCLOSURE.





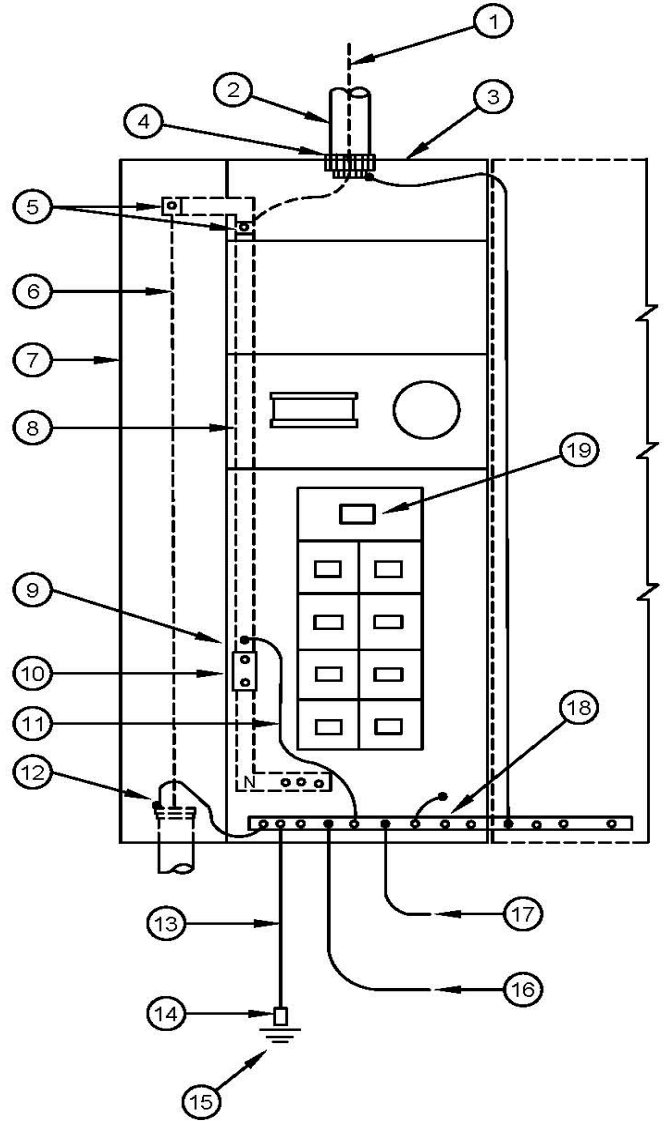
- ① MAIN BONDING JUMPER SIZED PER NEC. SIZE PER **TABLE 701.0 COLUMN 3, ESRM.**
- ② GROUND BOND BUS TO BE TIED TO METAL GUTTER.
- ③ BOND CONDUCTOR SIZED PER NEC. SIZED PER **TABLE 701.0 COLUMN 3, ESRM.**
- ④ BOND CONDUCTOR TO BE TIED TO METAL ENCLOSURE.
- ⑤ ALL UNFUSED NIPPLES TO BE BONDED. SIZE PER **TABLE 701.0 COLUMN 3, ESRM.**
- ⑥ BOND TERMINAL BAR TO BE TIED TO METAL ENCLOSURE.
- ⑦ NEUTRAL TERMINAL SHALL BE INSULATED FROM METAL ENCLOSURE.
- ⑧ IF PARALLEL CONDUCTORS RUN FROM THE CAN INTO THE GUTTER A BOND WIRE MUST BE INSTALLED IN EACH CONDUIT (PER NEC). SEE SECTION 300 PAGE 60 FOR PARALLEL REQUIREMENTS.

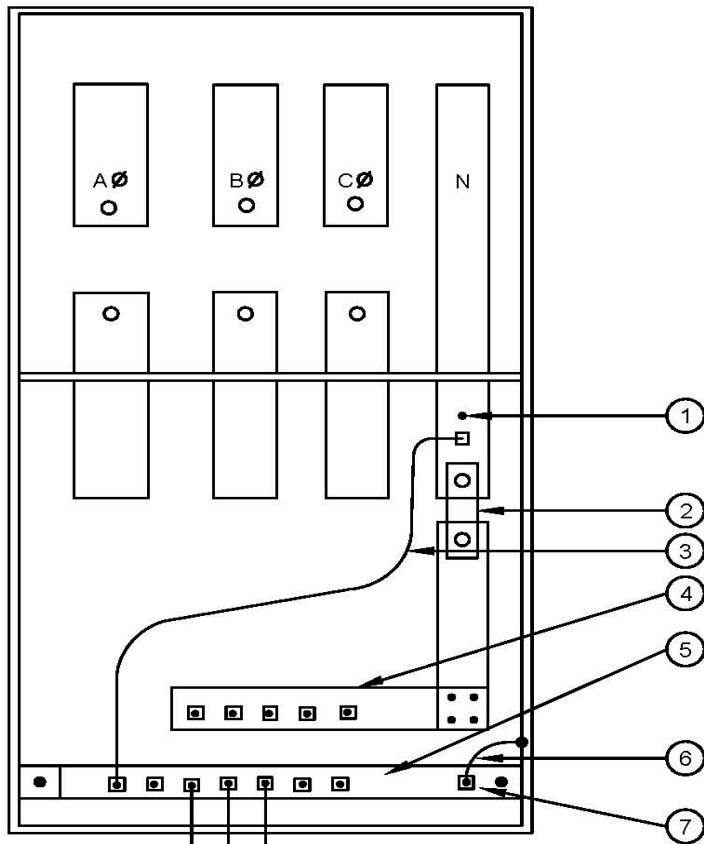


- ① MAIN BONDING JUMPER SIZED PER NEC. SIZE PER **TABLE 701.0 COLUMN 3, ESRM.**
- ② GROUND BOND BUS TO BE TIED TO METAL GUTTER.
- ③ BOND CONDUCTOR SIZED PER NEC. SIZED PER **TABLE 701.0 COLUMN 3, ESRM.**
- ④ BOND CONDUCTOR TO BE TIED TO METAL ENCLOSURE.
- ⑤ ALL UNFUSED NIPPLES TO BE BONDED. SIZE PER **TABLE 701.0 COLUMN 3, ESRM.**
- ⑥ BOND TERMINAL BAR TO BE TIED TO METAL ENCLOSURE.
- ⑦ NEUTRAL TERMINAL SHALL BE INSULATED FROM METAL ENCLOSURE.
- ⑧ IF PARALLEL CONDUCTORS RUN FROM THE CAN INTO THE GUTTER A BOND WIRE MUST BE INSTALLED IN EACH CONDUIT (PER NEC). SEE SECTION 300 PAGE 60 FOR PARALLEL REQUIREMENTS.



- ① GROUNDED (NEUTRAL) SERVICE CONDUCTOR.
- ② OVERHEAD SERVICE ENTRANCE CONDUIT
- ③ BONDING JUMPER (NOT REQUIRED IF HUB IS USED.)
- ④ MUST BE RAIN TIGHT DEVICE
- ⑤ NEUTRAL LANDING TERMINAL
- ⑥ NEUTRAL SERVICE CONDUCTOR
- ⑦ UNDERGROUND PULL SECTION
- ⑧ NEUTRAL BUS
- ⑨ CONNECTION FOR MAIN BOND JUMPER, MUST BE ON LINESIDE OF NEUTRAL DISCONNECT LINK.
- ⑩ NEUTRAL DISCONNECT LINK
- ⑪ MAIN BOND JUMPER (SEE N.E.C.)
- ⑫ WHERE METALLIC CONDUIT IS USED, INSTALL A BOND BUSHING AND BOND PER N.E.C.
- ⑬ GROUNDING ELECTRODE CONDUCTOR. (SEE N.E.C.) (SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE.)
- ⑭ CONNECTION TO ELECTRODE, CONNECT GROUNDING ELECTRODE CONDUCTOR TO GROUNDING ELECTRODE WITH APPROVED GROUND CLAMP. (SEE N.E.C.)
- ⑮ GROUNDING ELECTRODE SYSTEM (SEE N.E.C.)
- ⑯ OTHER METAL PIPING PER N.E.C. SIZE PER TABLE 701.0, COLUMN 1, ESRM.
- ⑰ METAL WATER PIPING PER N.E.C. SIZE PER TABLE 701.0, COLUMN 2, ESRM.
- ⑱ GROUND/BOND BUS
- ⑲ MAIN SERVICE DISCONNECT

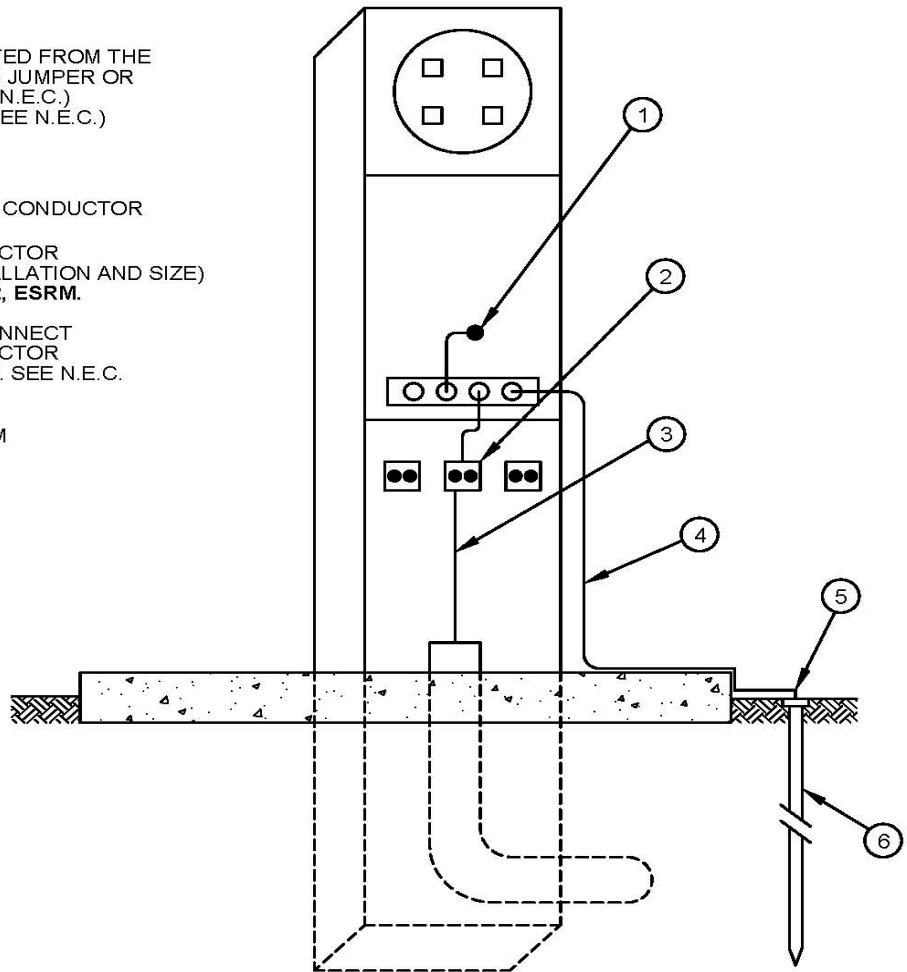




- ① CONNECTION FOR MAIN BOND JUMPER AHEAD OF NEUTRAL DISCONNECT LINK.
- ② NEUTRAL DISCONNECT LINK.
- ③ MAIN BOND JUMPER(S) (SEE N.E.C.) **SIZE PER TABLE 701.0, COLUMN 3, ESRM.**
- ④ ALL NEUTRAL WIRES, TO BE PLACED ON NEUTRAL BUS
- ⑤ ALL BOND WIRES PER N.E.C. - TO BE PLACED ON BOND BUS.
- ⑥ ENCLOSURE GROUNDED PER N.E.C.
- ⑦ (A WIRE MAY NOT BE NECESSARY IF GROUNDING BUSBAR HAS BEEN INSTALLED ON A CLEANED SURFACE OF THE FRAME WITH BOLTS OF ADEQUATE SIZE AND STRENGTH.)

TO GROUNDING ELECTRODE N.E.C. **SIZE PER TABLE 701.0, COLUMN 2, ESRM.**  
PIPING SYSTEMS PER N.E.C.  
 METAL WATER PIPING PER N.E.C. **SIZE PER TABLE 701.0, COLUMN 2, ESRM.**  
 OTHER METAL PIPING PER N.E.C. **SIZE PER TABLE 701.0, COLUMN 1, ESRM.**

- ① WHERE NEUTRAL BUS IS INSULATED FROM THE ENCLOSURE, INSTALL A BONDING JUMPER OR SCREW TO THE PEDESTAL. (SEE N.E.C.)  
NEUTRAL DISCONNECT MEANS (SEE N.E.C.)
- ② NEUTRAL LANDING TERMINAL
- ③ GROUNDING (NEUTRAL) SERVICE CONDUCTOR
- ④ GROUNDING ELECTRODE CONDUCTOR  
(SEE N.E.C. FOR MATERIAL, INSTALLATION AND SIZE)  
**SIZE PER TABLE 701.0, COLUMN 2, ESRM.**
- ⑤ CONNECTION TO ELECTRODE CONNECT  
GROUNDING ELECTRODE CONDUCTOR  
WITH APPROVED GROUND CLAMP. SEE N.E.C.  
(CHECK WITH AHJ).
- ⑥ GROUNDING ELECTRODE SYSTEM  
SEE N.E.C. (CHECK WITH AHJ).  
(SEE DWG 303.13 NOTE 10).



**SHORT CIRCUIT PROTECTION**  
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**800.0 SHORT CIRCUIT PROTECTION**

**800.1 GENERAL**

The National Electric Code, State, County and Municipal Codes and/or Regulations require that service entrance equipment shall be suitable for the short-circuit current available at its supply terminals.

It is the responsibility of the Customer to install service entrance equipment and protective devices (fuses or circuit breakers) capable of interrupting and withstanding the available fault current.

In cases where multiple service entrance sections are served from one transformer the utility fault current contribution may exceed the values noted. Please consult your Service Representative before ordering or designing your equipment and refer to section 800.5.

The fault current values are based on a bolted phase-to-ground, phase-to-phase or three phase fault, whichever is greater.

**Arc Flash hazard calculations** should be performed by a Registered Professional Engineer. The dynamic electric utility system grid makes it impractical to provide any further information other than the fault current values noted, in Table 800.2. APS will provide only maximum fault current values at the service entrance section. Customers can obtain additional information in order to calculate arc flash values by surveying APS field conditions (i.e. approximate wire distance obtained via field measurement). Table 800.2 represents worst case scenarios. Transformer sizes could be larger if serving multiple SESs (see Section 800.5). APS can only provide, upon request, transformer impedance ranges. Conductor lengths can be approximated by Customer field survey. An APS construction sketch identifying conductor length, number of conductors per phase and type was provided to the Customer's contractor during the construction phase of the project and may be available. APS can provide typical conductor information upon request. For secondary service customers, primary fault current data, actual transformer impedance nameplate information, and primary coordination information (i.e. upstream primary over-current protective device type, size and setting) will not be provided. For services 600V and larger, contact the local APS representative for assistance.

See Section 1000.2-1 (MEDIUM VOLTAGE METERING AND SERVICE EQUIPMENT) for information, primary fault current and protection scheme data.

**Explanation of Short Circuit Transformer Size:**

The transformers listed in the short circuit table 800.2 are based upon supplying 80% of the indicated SES size in Amps. This was established as a result of the NEC enforcement by the authority having jurisdiction. The NEC requires continuous and uniform load with an adder of 25% depending upon the type of load or building class. If established building occupant calculate and apply for a permit for any added load the existing and new load will be 80% or less of the SES size.

800.2-1 MAXIMUM SERVICE EQUIPMENT SHORT CIRCUIT CAPABILITIES

SES#	1 PH 120/240 POLE/PAD XFMR		3 PH 120/240- Closed Delta POLE TOP XFMR		3 PH 120/240- Open Delta POLE TOP XFMR		3 PH 120/240-Open Delta PAD XFMR (based upon a 167/75kva transformers)		3 PH 120/208 POLE TOP XFMR		3 PH 120/208 PAD XFMR		3 PH 277/480 POLE TOP XFMR		3 PH 277/480 PAD XFMR	
	AMPS	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA
100	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	75	5,192	112.5	8,688
125	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
150	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
200	75	14,318	3-25	10,478	75-75	25,625	167-75	33,705	3-25	10,483	112.5	16,178	150	10,347	150	12,076
*400	100	20,955	3-50	20,034	75-75	28,369	167-75	39,681	3-50	21,553	150	27,478	300	20,938	300	25,573
600	167	32,755	3-75	28,369	100-75	35,297	167-75	44,187	3-75	33,789	225	39,066	500	31,615	500	25,773
800	167	36,451	3-100	33,208	167-75	44,186	167-75	44,187	**3-100	43,106	300	49,505			750	25,773
1,000									**3-100	45,740	300	53,011			750	25,773
1,200											500	53,011			1,000	25,773
1,600											500	56,194			1,500	32,990
2,000											750	56,194			1,500	33,207
2,500											750	56,194			2,000	44,250
3,000											1,000	56,194			2,000	44,346

\*400 Amp, 120/240 V, Single Phase Panels: Second breaker is an APS Requirement and needs to be minimum 22K AIC rated

\*\* Maintenance only, refer to 201.2, Note 4.

Notes:

- For service equipment designed for underground feed using overhead transformers use the highest fault current between the OH and Pad XFMR values. This provides for proper bracing, if future conversions occur.
- Please refer to the General Section 800.1 for additional information.
- Table 800.2 indicates the minimum interrupting requirements for service entrance equipment, and is based on an infinite buss located on the transformer primary and 25 ft. of service conductor sized to serve at least 80% of the service entrance section. **WARNING:** Services less than 25' lateral may have higher fault current values. Check with APS for revised fault current values.
- Current values are symmetrical amperes of three-phase faults on three-phase transformers and either phase-to-phase or phase-to-neutral, whichever is larger for single-phase transformers.
- Values do not apply to primary services. Consult with APS, primary fault current value can be 26kA and spot network can be 200kA values.
- Arc Flash hazard calculations** should be performed by a Registered Professional Engineer. The dynamic electric utility system grid makes it impractical to provide any further information other than the fault current values noted in Table 800.2. APS will provide only maximum fault current values at the service entrance section. Primary fault current data and coordination information will not be provided, except primary services see section 1000.2-1. Customer's seeking typical secondary transformer impedance values and typical APS secondary conductor configurations can access the APS Arc-Flash guidelines available at [www.aps.com/ESRM](http://www.aps.com/ESRM).
- The maximum size transformer for new installation is limited to 2000kVA @ 480V and 1000kVA @ 208V. For **MAINTENANCE PURPOSES:** a 2,500kVA transformer rated at 480V with 25 feet (of 750 Cu) service length can produce fault current value of 55,219, also this requires 11-4" service conduits.



800.2-2 MAXIMUM SERVICE EQUIPMENT SHORT CIRCUIT CAPABILITIES FOR SINGLE PHASE APPLICATIONS

SES #	1Ph 120/208 Svc. Fed via a 3 Ph 120/208 Pad Xfmr		1Ph 120/240 Svc. Fed via 3Ph 120/240 Closed Delta Pole Xfmr		1Ph 120/240 Svc. Fed via 3Ph 120/240 Open Delta Xfmr	
	AMPS	kVA	Isc	kVA	Isc	kVA
100	***1000	17431	3-100	16494	167-75	18122
200	***1000	26521	3-100	22943	167-75	26219
400	***1000	39298	3-100	29185	167-75	34700
600	***1000	48031	3-100	33781	167-75	41395
800	***1000	48031	3-100	34541	167-75	42542

\*\*\*Transformer sizes may vary; information shown represents typical worst case yielding the largest fault current value. A 500 kVA 120/208, 3Ph, 4W transformer may yield a higher fault current value based on typical average impedance values; however the largest transformer APS will set could be a 1000 kVA. The total SESs served via a single transformer for the 120/208V shall not exceed 3000 Amps.



**800.3 FAULT CURRENT FOR RESIDENTIAL MULTI-FAMILY APARTMENT PROJECTS**

APS will design the following minimum criteria as a method to limit fault current for single phase (1Φ) 120/240, residential multi-family apartment projects to 22,000 amps or less:

1. Transformer size does not exceed 100 KVA.
2. Service wire runs will not be less than the following distances:

UA 1/0	-	6 Ft.
UA 4/0	-	12 Ft.
2-UA 4/0	-	27 Ft.
UA 500	-	23 Ft.
2-UA 500	-	46 Ft.

**If the transformer size is larger or service length is shorter than shown, refer to Table 800.2 for available fault current.**

**800.4 (RESERVED)**





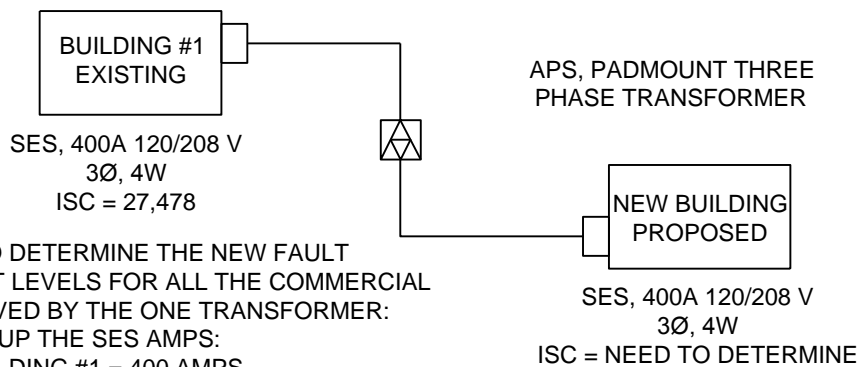
**800.5 MULTIPLE SERVICES FOR COMMERCIAL APPLICATIONS**

USE THE FOLLOWING TO DETERMINE THE FAULT CURRENT FOR MULTIPLE SERVICES FROM ONE THREE PHASE TRANSFORMER:

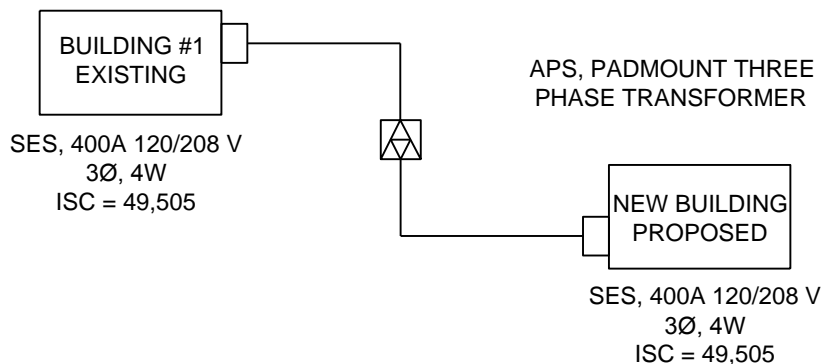
ADD ALL OF THE EXISTING AND PROPOSED SERVICE ENTRANCES (SES) AMPERE RATINGS. THEN USE THIS TOTAL SES AMP FIGURE TO FIND THE APPROPRIATE FAULT CURRENT USING, TABLE 800.2. EACH SES BEING SERVED FROM THIS TRANSFORMER NEEDS TO BE BRACED FOR THIS FAULT CURRENT LEVEL. ALSO, ENSURE THE NEW BUILDING PLANS INDICATE ON THE ONE-LINE THE PROPER BRACING OR AIC RATING FOR THE EQUIPMENT.

**NOTE:** THE MAXIMUM VALUE OF ALL SES'S ADDED TOGETHER CANNOT EXCEED A TOTAL OF 3,000AMPS FOR MULTI-SES'S SERVICE FROM ONE THREE PHASE TRANSFORMER.

**FAULT CURRENT FOR MULTIPLE COMMERCIAL SERVICES FROM ONE TRANSFORMER**



1. FIRST, TO DETERMINE THE NEW FAULT CURRENT LEVELS FOR ALL THE COMMERCIAL SES SERVED BY THE ONE TRANSFORMER:
  - ADD UP THE SES AMPS:
    - BUILDING #1 = 400 AMPS
    - BUILDING #2 = 400 AMPS
    - TOTAL OF ALL SES SIZE'S = 800 AMPS
2. FIND FROM THE FAULT CURRENT TABLE 800.2  
ISC FOR 800 AMPS = 49,505 AMPS
3. EACH SES SERVED BY THE ONE TRANSFORMER WILL NEED TO BE BRACED FOR 49,505 AMPS OF FAULT CURRENT.
4. VERIFY THE EXISTING SES BRACING.
5. IF THE EXISTING SES IS NOT ADEQUATELY BRACED FOR THE NEW AVAILABLE FAULT CURRENT LEVEL, APS WILL CONSIDER INSTALLING A SEPARATE TRANSFORMER FOR THE NEW BUILDING.



**IRRIGATION PUMPING**  
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**900.0 IRRIGATION PUMPING**

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**900.1 GENERAL**

1. Permits and inspection may be needed. Check with governing inspection agency in the area.
2. All pump control panels, main disconnect and metering panels shall be weatherproof.
3. Across-the-Line starting is normally acceptable up through 75 horsepower at 480 volts. There may be circumstances which require reduced voltage starting in some areas. Check with your local APS Customer Service Representative in the initial Planning Stages Regarding starting requirements.
4. When a water pumping or irrigation customer requests a 3-phase 240 volt or 480 volt service, the Customer shall provide for and APS will furnish a 3-phase 4-wire 120/240 or 277/480 volt grounded neutral service to the service entrance. Customer meter can and main disconnect shall be 3-phase 4wire equipment. (See section 200, Paragraph 201.2 and page 6 of this section)
5. The main switch shall be immediately adjacent to the meter panel. (See Section 300, Paragraph301.3) Meters and metering equipment shall be located ahead of or on the supply side of the customer's main disconnect. (See Section 300, Paragraphs 301.14 and 302.3)
6. Where current limiting fuses are required in the main switch, the fuse holder shall not permit insertion of fuses that are not current limiting. All main disconnects shall simultaneously open all conductors of the circuit. All ungrounded conductors shall be fused in the main disconnect.
7. A 3-pole circuit breaker (interrupting all three phases) may be substituted for the main fused disconnect switch provided it is properly sized for the equipment and can safely interrupt the available fault current.
8. Please refer to 104.3 for motor starting.

---

**900.2 METERING REQUIREMENTS**

1. **100 Ampere Meter Box.**
  - a. Where the name plate horsepower rating of any motor or group of motors does not exceed **25 HP** at **240** volts **3 $\phi$  4W** or **50 HP** at **277/480** volts **3 $\phi$  4W**, factory bussed safety socket meter box with test blocks rated at 100 ampere minimum continuous duty shall be installed by the Customer. (See Section 300, page21)
  - b. The meter socket for 240 volt 3 $\phi$  4W Delta or a 277/480 volt 3 $\phi$  4W Wye shall be 7-clip. Socket shall be rated 100 ampere continuous duty. (See Section 300, pages 29, Figures 6 & 7)
  - c. The total actual continuous operating load current, excluding motor starting current, shall not exceed 100 amperes.

**900.2 METERING REQUIREMENTS Cont'd**

**2. 200 Ampere Meter Box.**

- a. Where the name plate horsepower rating of any motor or group of motors does not exceed 125 horsepower at 277/480 volt 3ø 4W Wye, a factory busssed safety socket meter box with test blocks rated at 200 amperes continuous duty shall be installed by the Customer. (See Section 300, page 22)
  - b. The meter socket for 277/480 volt 3ø 4W Wye shall be 7 dip. Socket shall be rated 200 ampere continuous duty. (See Section 300, page 29, Figures 6 & 7)
  - c. The total actual continuous operating load current, excluding meter starting current, shall not exceed 175 amperes.
3. Where the name-plate horsepower rating of any mot or group of motors exceeds the 125 horsepower and /or the total actual operating load current, excluding motor starting current, for any reason exceeds 175 amperes, either at the time of installation or thereafter, the Customer shall install facilities consisting of an approved meter/CT box or an approved switched to accommodate current transformer metering. (See Section 300, Pages 37-71)
4. No Customer conductors or conduit shall be in any sealable area.

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**900.3 CUSTOMER'S CONTROL EQUIPMENT**

- 1. Three element running overload protection shall be required on all motors.  
Example—one overload unit in each phase is the starter.
- 2. Under voltage, phase failure and phase reversal protection, time—delay back spin relays, surge capacitor and lightning arresters are strongly recommended for the protection of each pump motor installation.
- 3. All reduced voltage starters shall be automatically switched from Start to Run mode of operation. Manual Transfer is not acceptable. The timing relay shall be set such that the line current when switched to the Run mode does not exceed the initial starting line current.
- 4. All reduced voltage starters shall employ closed transition switching. Exceptions to be approved by APS Division Engineering for a specific installation.
- 5. Customer's switch and motor control equipment shall be of proper horsepower and voltage rating and shall be weatherproof.
- 6. Customers switch and motor control cover shall be effectively locked or sealed if the enclosure contains accessible electrically energized parts.
- 7. From starter to motor, conduits shall be flexible liquid-tight (20 feet maximum recommended length) and each shall contain an equipment bonding jumper along with the phase conductors. If parallel conduits there shall be a bond wire in each.

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**900.4 SERVICE CONDUCTOR REQUIREMENTS**

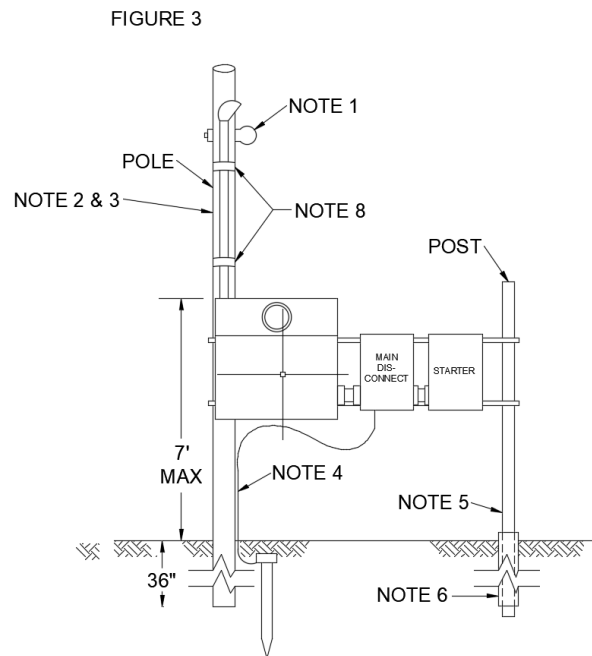
For overhead clearances of services see section 400, paragraphs 401.0 and 401.0-3.

For underground service requirements see section 500—Underground Service and Section 600 Trenching Requirements.

<b>RECOMMENDED AND SPECIFICATIONS FOR 3Ø PUMP INSTALLATION FOR OVERHEAD</b>									
<b>(FOR UNDERGROUND REQUIREMENTS SEE SECTION 500)</b>									
Motor H.P.	Motor Amps F.L.A. PER NEC	Amps @ 125% PER NEC	Main Switch Amp (Min)	Fuse Duel Element Amp (Min)	Copper Wire 75° C Rating Terminations must indicate min 75° C (Min)	*Equip Ground Cond (Min)	Riser Conduit Size (Note 9) (Min)	Starter Size NEMA (Min)	Sys Fault Amps at the SES (Note 8) (Max)
1	2	3	4	5	6	7	8	9	10
<b>240 Volts 3Ø 4W 100A. Self-Contained Meter. 7 - Terminal Socket &amp; Test Block</b>									
10	28	35	60	40	8	10	1"	2	14,000
15	42	53	60	60	4	10	1"	2	14,000
20	54	68	100	80	3	8	1 1/4"	3	14,000
25	68	85	100	100	1	8	1 1/4"	3	14,000
<b>277/480 Volts 3Ø 4W 100A. Self-Contained Meter. 7 - Terminal Socket &amp; Test Block</b>									
10	14	18	30	20	12	12	1"	1	10,000
15	21	26	30	30	10	10	1"	2	10,000
20	27	34	60	40	8	10	1"	2	10,000
25	34	43	60	50	6	10	1"	2	10,000
30	40	50	60	60	4	10	1"	3	10,000
40	52	65	100	80	3	8	1 1/4"	3	10,000
50	65	81	100	100	1	8	1 1/4"	3	10,000
<b>277/480 Volts 3Ø 4W 200A. Self-Contained Meter. 7 - Terminal Socket &amp; Test Block</b>									
60	77	96	200	100	1	8	1 1/4"	4	14,000
75	96	120	200	125	1/0	6	1 1/4"	4	14,000
100	124	155	200	175	2/0	6	2 1/2"	4	14,000
125	156	195	200	200	3/0	6	2 1/2"	5	14,000
<b>277/480 Volts 3Ø 4W 400 amp C.T./Meter Can</b>									
150	180	225	400	250	250kcmll	4	2"	5	25,000
200	240	300	400	350	500kcmll	3	3"	5	25,000
250	302	378	400	400	600kcmll	3	3"	6	25,000
<b>277/480 Volts 3Ø 4W 600 amp C.T./Meter Can</b>									
300	361	451	600	500	2-250kcmll	2#2	2-2"	6	30,000
350	414	518	600	550	2-300kcmll	2#1	2-2"	6	30,000
400	477	596	600	600	2-350kcmll	2#1	2-2 1/2"	6	30,000
<b>277/480 Volts 3Ø 4W 800 amp C.T./Meter Can</b>									
450	515	644	800	700	2-500kcmll	2-1/0	2-3"	7	30,000
500	590	738	800	800	2-600kcmll	2-1/0	2-3"	7	30,000
<b>* Equip. ground conductor refers to bond conductor size on load side of fuses. For bonding requirements on line side of fuses, See Section 700, Paragraph 701.0 Column 3.</b>									

**NOTES:**

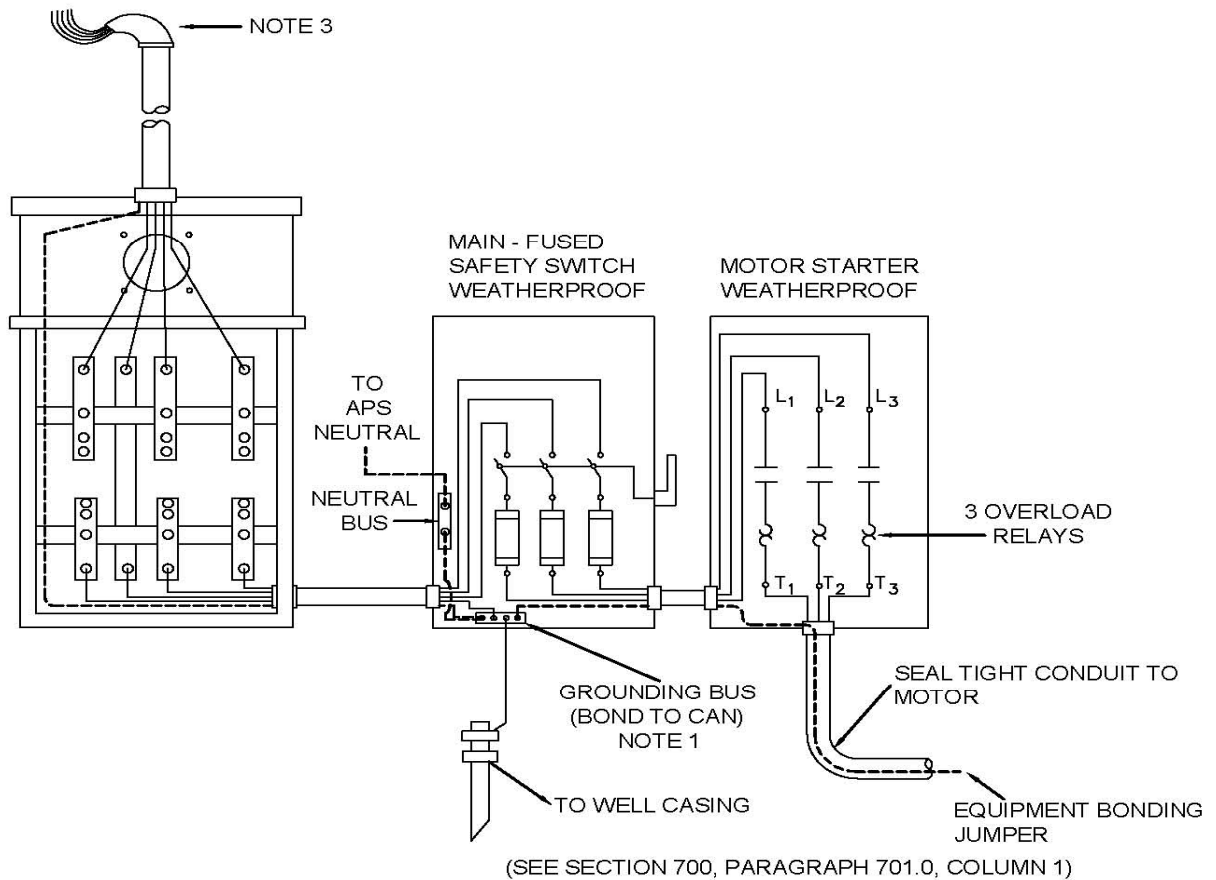
1. All 3Ø services to be served 4 wire.
2. See section 700 for Bonding & Grounding Requirements.
3. See section 300, pages 21 and 22 for 100 & 200 Amp Meter Can Requirements.
4. See sections 300, pages 59 and 43 for 400 Amp Meter, C.T. Requirements.
5. See Section 300, pages 61 and 43 for 600 Amp Meter, C.T. Requirements.
6. See section 300, page 43 for 800 Amp Meter, C.T. Requirements.
7. See section 500 for underground installation.
8. Minimum interrupting and bracing capabilities to be provided by the Customer in his service equipment.
9. Riser conduit size for overhead installation only. See section 500 for underground requirements



TYPICAL OVERHEAD  
SERVICE ENTRANCE SECTION

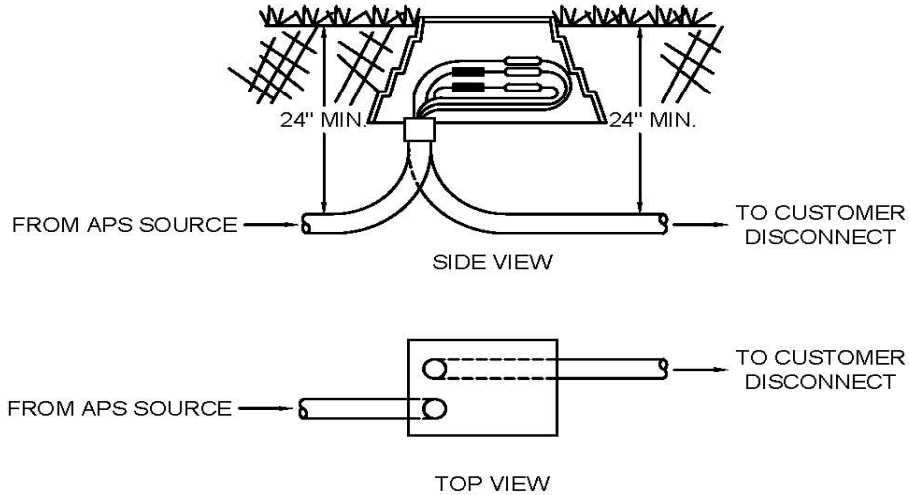
**NOTES:**

1. See Section 400, Paragraphs 401.0 to 401.0-3 for Minimum service heights.
2. See Section 700 - Grounding and Bonding.
3. Pole furnished by customer. See Section 400, Paragraphs 402.2-3 & 402.3 for pole requirements.
4. The post shall be placed in the center of a 12-inch minimum diameter concrete footing. The footing shall be a minimum of 36 inches in the ground and extend a minimum of 4 inches above ground level, and have  $\frac{1}{2}$  inch slope away from the post to allow for drainage.
5. All steel or unistrut shall be attached to pole or post securely with a  $\frac{1}{2}$ ' minimum galvanized through bolt with a 1-1/2' galvanized backing and lock nut. All services equipment shall be securely fastened to boards or steel with minimum  $\frac{1}{4}$ " through bolts. Lag screws shall not be acceptable.
6. Conduit support not over 6 feet apart.
7. See Section 300, Paragraph 306.0 for complete breakdown of requirements
8. Pipe strap supports not over 6'-0" apart.

**NOTES:**

1. Neutral conductor to run through meter can, into main disconnect enclosure where it shall land on a neutral bus bar. All grounding and bonding shall be made on a grounding bus bar. Main bond jumper is required. Neutral need not go any further than the main disconnect if no single phase load is needed.
2. For Bonding and Grounding sizes, see Section 700, Paragraph 701.0
3. See Section 400 for overhead conductor heights and requirements.
4. See Section 500 and 600 for underground installations.
5. For Metering Specification, see Section 300 and 1100.
6. See Sections 306.0 and 306.1 for typical stand-alone service entrance supports for service equipment.

TYPICAL UN-METERED SERVICE (FOR METERED INSTALLATIONS, SEE SECTION 500 PARAGRAPH 506.7) 15 AMP MAXIMUM, 120V 1Ø 2 WIRE OR 120/240V 1Ø 3 WIRE, CONSTANT LOAD:

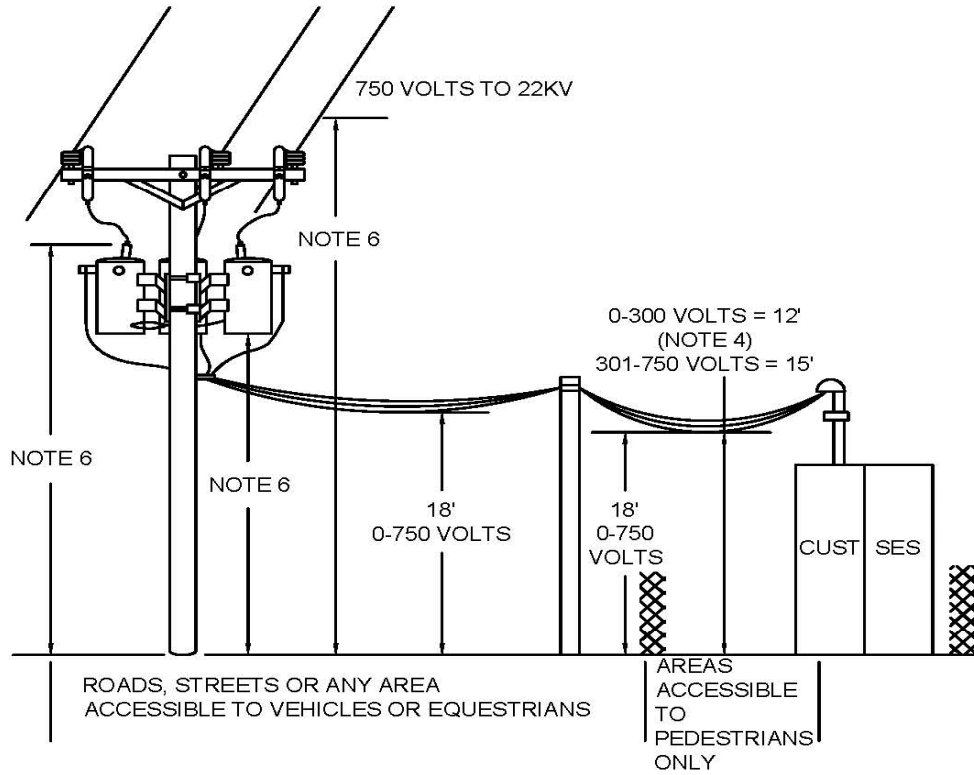


**NOTES:**

1. Installation shall be per NEC and approved by local jurisdiction having authority.
2. Customer disconnect is required per N.E.C. also requires permanent ID tag.
3. Installation shall be an all conduit systems with a minimum size 1 inch conduit. A 12 radius sweep is acceptable for 1' conduit.
4. See Section 500, Paragraph 502.0 for requirements for conduit system.
5. See Section 500, Paragraph 501.4 regarding coating required on steel conduit below grade.
6. Before digging or diving ground rod, be sure to call blue stake to get location of underground facilities, (See Section 100, Paragraph 100.12)
7. 5/8' X 8' ground rod to be installed at customer disconnect location. Rod must be 8' in the ground.
8. A #4 minimum copper ground wire is to be required for the ground rod connection.
9. Access shall be provided to J-box, with a minimum of 3 feet working clearance required in front of at least two adjacent sides of the box
10. Customer to extend conduit to an APS supplied, Customer installed J-box. APS shall specify J-box type and location. Customer to install j-box per APS specifications.( See local representative)
11. J-boxes shall not be installed in areas exposed to vehicular traffic.
12. Customer to install conductors to APS J-box. APS to terminate service in box.
13. APS provided and installed fuses shall be required at j-box termination. APS "Point-of-Delivery" shall be the fused connection in the J-box.
14. For conduit system design between the j-box and the APS source, see Section 500 Paragraph 502. 12-1 and 502.12-2.

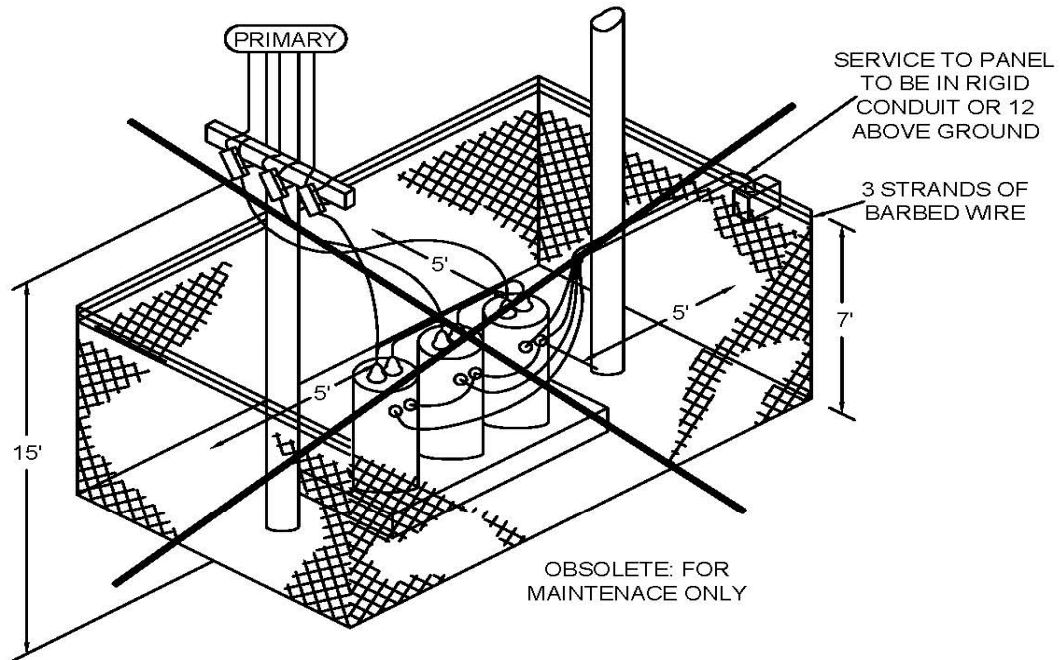


CLEARANCES ABOVE GROUND, IN AGRICULTURAL AREAS-  
(TYPICAL CUSTOMER TRANSFORMER BANK)

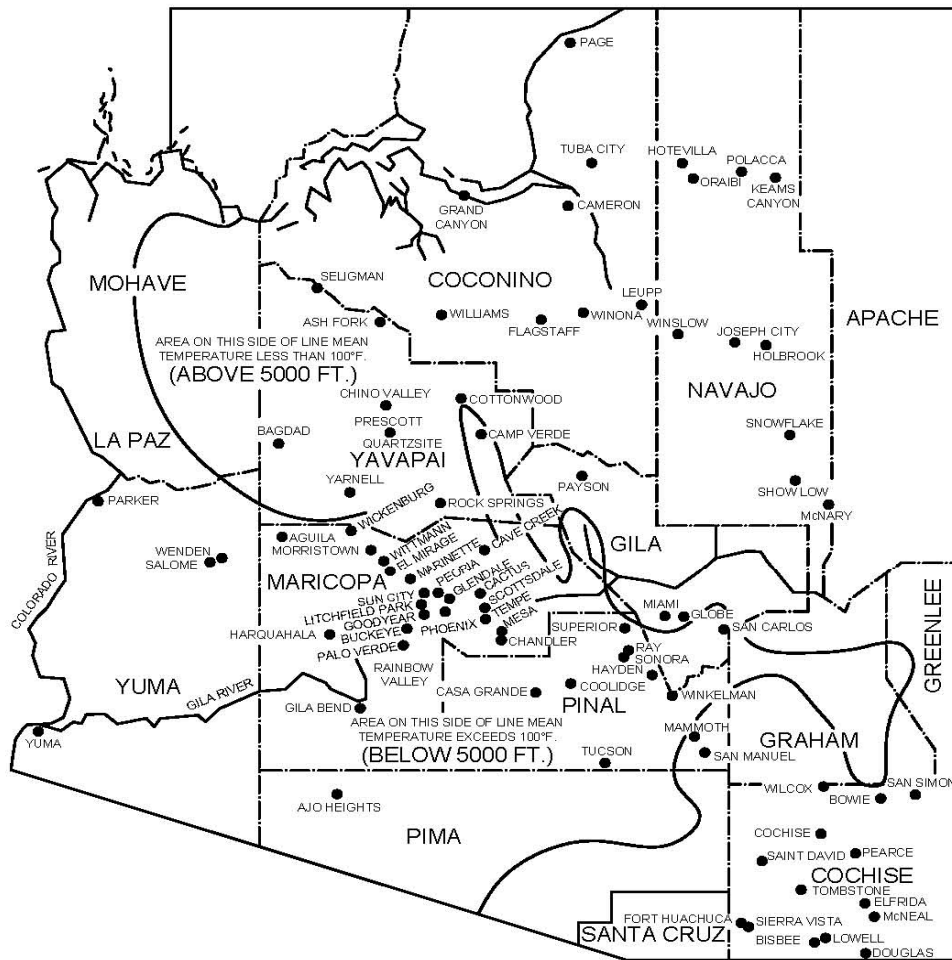


**NOTES:**

1. All clearances shown are minimums.
2. See Section 400 for clearances from building and other clearances.
3. When it is reasonable to assume vehicles higher than 14 feet will be operating under the line, the clearance shall be increased by the difference between 14 feet and the height of the vehicles.(e.g.--- vehicle 17 feet high---raise the lines an additional 3 feet)
4. If service is not tied to system neutral, clearance must be 15 feet.
5. See paragraph 100.18 section 100, pages 3, 4, 5 and 6 for safe working clearance from electric lines.
6. For minimum heights to transformers and high voltage conductors ( over 750 volts) please contact APS Divisions Engineering.

**NOTES:**

1. Fencing shall be required if.
  - a. The platform or bottom of transformers is less than 14 feet above grade.
  - b. The platform braces extend to less than 10 feet above grade.
2. Fencing when required shall consist of chain-link type fence a minimum of 3 strands of barbed wire above the chain-link for total of 7 in height minimum. No part of the fence shall be less than 5 feet from any live parts on the transformer(s), or bare conductor. At least one (1) "Danger High Voltage" sign shall be on each side of the fence (lettering shall be minimum 1' block letters) the fence shall be effectively grounded.
3. The fenced area must be accessible to APS personnel. Customer to install a locking device that will allow one APS lock and one Customer lock on the gate.



**MEDIUM VOLTAGE (601V - 15KV) METERING AND SERVICE EQUIPMENT**

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## 1000.0 MEDIUM VOLTAGE METERING AND SERVICE EQUIPMENT

The following requirements apply to switchgear and services between 601 volts and 15 kV. For higher voltages, contact an APS Customer Project Representative (CPR). Requirements in other sections of this manual also apply to high voltage services.

---

### 1000.1 GENERAL

APS may furnish primary service of a voltage and phase listed in Section 200, Paragraph 201.0 where available.

**The Customer shall provide fault interrupting means that will interrupt the maximum fault current supplied by APS at the time a new service entrance section is installed and at any future time. Because fault duties generally trend upward, the Customer is encouraged to provide equipment that has interrupting capability to meet future needs. APS will provide the fault current figures.**

#### A. SINGLE PHASE INSTALLATIONS

Single phase primary metered load (no transformation by APS) will be limited by the size of the APS protective device on the source side of meter. **All loads over 150 KVA must receive APS Engineering approval.**

If transformation by APS is required, load will be limited to a 167 KVA transformer.

#### B. THREE PHASE INSTALLATIONS

Three phase 2400 or 4160 V will normally be limited to 5000 KVA of transformation at a single point of delivery. For loads above 5000 KVA of transformation, Customer will be required to accept the APS primary distribution or transmission voltage (12.47 kV or higher).

#### C. COORDINATION GUIDELINES

The type and setting of the Customer's protective device must coordinate with upstream equipment. Customer must notify APS Representative prior to implementing any proposed protective device changes at any time throughout the lifetime of the facilities, APS will then verify proper coordination with the APS upstream protective equipment.

---

### 1000.2 ENGINEERING SPECIFICATIONS

Each switchgear and service exceeding 600 volts will be considered "specially engineered." To properly coordinate the provisions of these requirements, the consulting engineer, manufacturer or contractor (Customer) must contact an APS Customer Project Representative (CPR) as early in the design stage as possible. Specifications for all equipment (e.g., service entrance section, pull section, breakers, etc.) must be submitted to APS for approval prior to fabrication of the equipment. See paragraph 1000.3. APS Engineering will prepare and issue engineering specifications and drawings for each medium voltage service installation. These specifications will be based on the following.

**1000.2-1 CUSTOMER TO SUPPLY THE FOLLOWING INFORMATION**

1. Location (address) of the property to be served.
2. Type of structure or facilities to be served. (See Section 200 - Application for Service)
3. Voltage and phase desired. (See Section 200, Paragraph 201.0)
4. Size (ampacity) of the proposed service entrance section (normally 12470/7200 or 20780/12000.) Service entrance sections of 100 amps or greater shall require a breaker (or acceptable interrupting device with phase and ground time current curves to coordinate with APS upstream equipment) for Customer's main disconnect. Any application requesting service needing a protection study will be required to pay in advance a study fee determined by APS.

**NOTE: Services below 100 amps may also require a breaker for the main disconnect. Consult an APS Representative to facilitate an engineering review.**

5. Size of main disconnect/breaker.
6. Anticipated peak load. (Electrical load calculations)

**NOTE: Underground Service Entrance Sections at primary voltage (greater than 600V) 3 phase are limited to 1,200 amps. Any customer requiring more than 1,200 amps will be required to install 2 or more service entrance sections.**

---

**1000.2-2 APS ENGINEERING WILL THEN SUPPLY THE FOLLOWING INFORMATION**

1. Recommend the type of protective device (breaker or fused disconnect) to be installed by the Customer on his equipment.
2. Type of protective device that is used by APS on the line that will serve Customer.
3. The minimum operating current and time current characteristics of APS relays with which customer equipment must coordinate.

---

**1000.2-3 CUSTOMER THEN TO SUPPLY THE FOLLOWING INFORMATION TO APS ENGINEERING FOR APPROVAL**

1. When a breaker is necessary to coordinate with APS facilities, phase and ground relays are required. Relays shall have timed and instantaneous trip capabilities. Characteristics of the timed trip shall be "very inverse." Customer relay information needed:
  - a. Manufacturer of relay.
  - b. Current transformer ratio.
  - c. Setting ranges of relay.
  - d. Proposed settings of relay.
  - e. Time current characteristics.
2. If a fused disconnect is acceptable to APS Engineering, the following information is needed:
  - a. Name of fuse manufacturer.
  - b. Fuse type.
  - c. Continuous current rating of fuse.
  - d. Total clearing time-current characteristic of the fuse.

**NOTE: Customer's equipment (relays/fuses) must be designed to isolate the APS system from faults in the Customer's distribution lines, equipment and transformers. Coordination time of customer protective devices must be 1/4 second faster than APS protective devices at the maximum available fault current. The installation shall comply with all applicable codes and ordinances.**

### 1000.3 MANUFACTURER'S DRAWINGS FOR APPROVAL

The designer or manufacturer of the medium voltage switchgear for the customer's service shall submit PDF drawing copies of the service cable terminating section, metering isolation, bus isolation switch and main breaker to an APS Representative in accordance with Paragraph 302.9, Section 300.

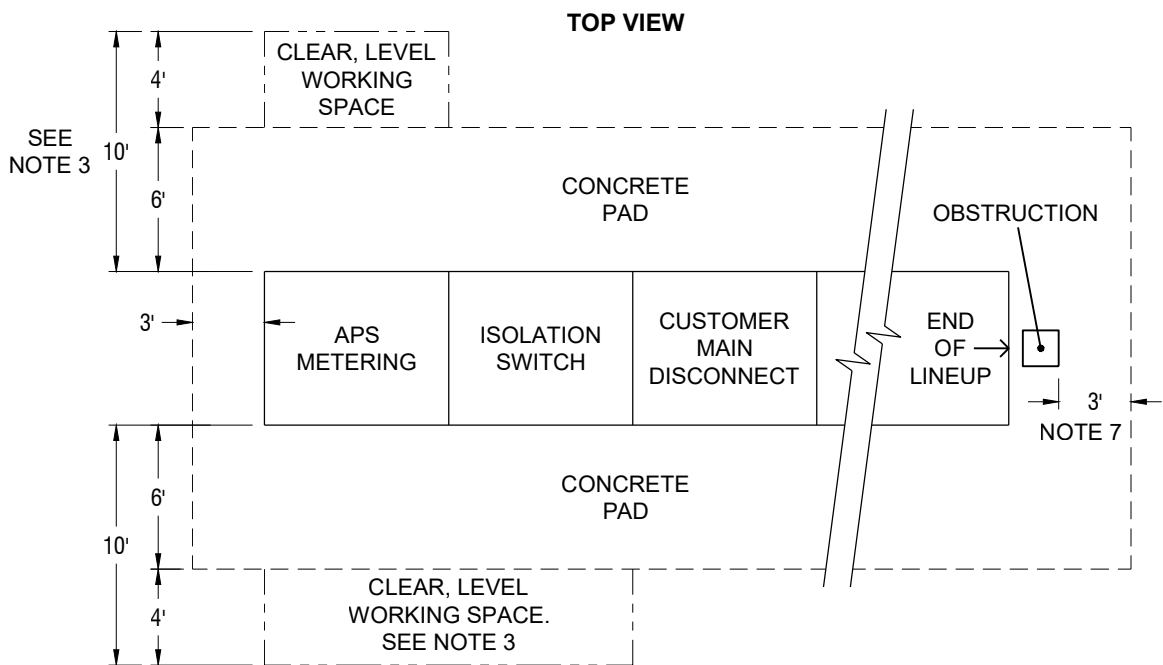
**1000.3-1** For UG primary metering the customer protective equipment shall be in load side adjacent to primary meter isolation switch cubicle.

**1000.3-2** For OH primary metering the customer protective equipment shall be on a load pole within 100 feet of the APS primary meter pole.

### 1000.4 SPACE REQUIREMENTS FOR INSTALLATION OF PRIMARY METERED SWITCHGEAR (WORKING SPACE)

Medium voltage switchgear shall be installed with at least the clear space shown in the figure below. A level concrete standing and working space shall be provided in front of any part of the side or end of the switchgear where such portions of the service equipment supports or provides access to metering components, test equipment, utility service termination compartment, or switches. These are minimum working space clearances. Working space clearance may need to be increased as described in the NEC, and should be verified with the AHJ.

Concrete walkways at least 36 inches wide shall be provided around the ends of the medium voltage switchgear because access is required to both the front and rear of the switchgear to perform maintenance, servicing, operation and testing. Additionally, refer to the ESRM, Section 301.9 for meter room requirements. Rooms containing equipment that exceeds 600V ratings must have a sign on all doors stating "Warning – Medium Voltage – Keep Out".



#### NOTES:

1. EUSERC 401 CABINET IS DOUBLE SIDED. CTs AND UTILITY TERMINATIONS ON ONE SIDE, METER, TEST SWITCH, PTs & PT DISCONNECT ON OTHER SIDE.
2. LABELING PER EUSERC 400 SHEETS PLUS SITE ADDRESS.
3. 10' CLEAR WORKING SPACE IN FRONT OF METERING AND ISOLATION SWITCH IS FOR HOT STICK USE (INDOOR OR OUTDOOR). THE ADDITIONAL 4' AREA IS PREFERRED TO BE CONCRETE.
4. INCOMING UTILITY CONDUITS ON CT SIDE ARE PER MANUFACTURER.
5. DIMENSIONS OF GEAR DETERMINED BY MANUFACTURER.
6. CONCRETE PAD SHALL BE 6-INCHES THICK MINIMUM AND 3,000 PSI @ 28 DAYS.
7. CONCRETE WALKWAY SHALL BE 36" FROM THE END OF LINEUP OR ANY OBSTRUCTION.

---

**1000.5 ENCLOSURE AND SEALING OF METERING AND PULL SECTIONS**

Service terminating pull sections and metering sections shall be fully enclosed. All removable parts that will give access to these sections or to any secondary wiring shall be sealable.

---

**1000.6 MAIN SERVICE SWITCH OR BREAKER**

The manufacturer or contractor shall furnish and install main service switch(s) or breaker(s) for each medium voltage service. The maximum number of main service switches or breakers shall be limited to no more than 6 and shall be installed on the load side of the metering equipment. Consult an APS Representative if requesting an alternate feed/spot network service for location of service switch/breaker in respect to metering equipment.

---

**1000.7 OVERHEAD BUSWAY (2400 AND 4160 VOLTS)**

In cases where the top feed connection employing busway is desired, the contractor shall furnish and install such busway. The busway shall extend from the meter section of the switchgear to a location designated by APS as being suitable for connection to its supply facilities and shall be equipped with a suitable service head.

---

**1000.8 UNDERGROUND SERVICE**

The Delivery Point will be at the connection of the pull section located at ground level. The customer shall furnish and install the appropriate pull section and metering cubicle in accordance with this section. Any exceptions to the above must be approved by APS Engineering.

---

**1000.9 SERVICE CABLE TERMINATING SECTION**

Medium voltage switchgear to which underground service is to be supplied by APS shall be equipped with a fully enclosed service terminating pull section by the manufacturer. The pull section shall be part of the switchgear that houses the metering section and disconnecting device. Bus bars with provisions for terminating lugs (See Section 1100 Dwg #347) are required from the pull section into metering cubicle. One landing position per phase and neutral shall be provided for each 400 amps of section size.

---

**1000.10 METER PANEL DETAILS**

Two 15" meter panels as shown in Section 1100, EUSERC Dwg. 332 (1-panel cutout and 1-panel blank) or one 30" panel are acceptable to APS. (See Paragraph 302.2 of Section 300 for meter height requirements.) A #4 AWG flexible braided bond wire shall be installed across at least one hinge per door.

---

**1000.11 LIFTING HANDLES ON REMOVABLE PANELS**

Each removable panel giving access to an instrument transformer or medium voltage termination compartment shall be equipped with two lifting handles. The area of any single panel shall not exceed 9 square feet. Where hinged doors are used, their size is not limited. Both panels and doors used for meter compartments or termination compartments shall be sealable and lockable.

---

**1000.12 CUSTOMER'S LOAD CONDUCTORS**

Customer's load conductors may not run through any meter or termination area.

---

**1000.13 UNACCEPTABLE METER LOCATIONS**

See Paragraph 301.6 of Section 300 for unacceptable meter locations.

---



**1000.14 WEATHER-PROOF ENCLOSURES**

See Section 300 for outdoor switchgear requirements.

---

**1000.15 EUSERC - ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE**

Switchgear service sections approved for use in the area served by APS are built to the standards developed by the Electric Utility Service Equipment Requirements Committee, and are available to the Customer through switchgear manufacturers. (See Manufacturing Requirements, Section 1100 - EUSERC DWGS #401 through 408)

---

**1000.16 CONDUCTORS PASSING THROUGH COMPARTMENT WALLS**

When cable or bus pass through compartment walls, through-the-wall bushings must be used, or bare bus clearance must be maintained.

---

**1000.17 INSULATED NEUTRAL TERMINATION**

The neutral termination shall be located in the service termination area. The insulated neutral bus shall extend from the service termination in the pull section through the metering voltage transformer (V.T.) area into the Customer's disconnect compartment (non-sealed area), where it shall have a disconnect link, if necessary and provisions for a bond tie on the line side of said link. The insulated neutral bus is to be separate from the ground/bond bus. (See Bonding and Grounding, Section 700, Paragraph 705.6)

---

**1000.18 GROUND/BOND BUS**

A ground/bond bus shall extend from the pull section, through the metering section into the Customer's disconnect compartment (non-sealed area). The ground/bond bus shall be tied to the Customer's neutral in the Customer's disconnect compartment (non-sealed area) with a properly sized main bond jumper. (See Section 700, Paragraph 705.6)

---

**1000.19 METER HEIGHT**

See Section 300, Paragraph 302.2 for meter heights.

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## 1100.0 METERING AND SERVICE EQUIPMENT MANUFACTURING REQUIREMENTS

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### 1100.1 EUSERC - ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE

Switchboard service sections approved for use in the area served by APS are built to the standards developed by the Electric Utility Service Equipment requirements Committee, and are available to the Customer through electric wholesale distributors.

---

### 1100.2 REQUIRED APPROVAL FOR METERING IN SERVICE EQUIPMENT

When a Customer proposes to install a multi-meter panel assembly or service section, the customer shall submit drawings and information to APS for review and approval in accordance with the submittal requirements described in ESRM 302.9.

---

### 1100.3 SWITCHBOARD SERVICE SECTION

A standard switchboard service section is a free-standing unit of switchgear which contains bussing for the termination of service entrance conductors, bussing for the connection and mounting of current transformers, panels for the installation of the test switch and meter socket, a service main disconnect switch or breaker, and in many cases, distribution feeder breakers or switches.

The standard switchboard service section is usually built to serve the Customer with heavy electrical supply needs, and is available with service main switch or breaker ratings from 200 amperes through 3000 amperes. For sections above 3000 amperes, consult APS.

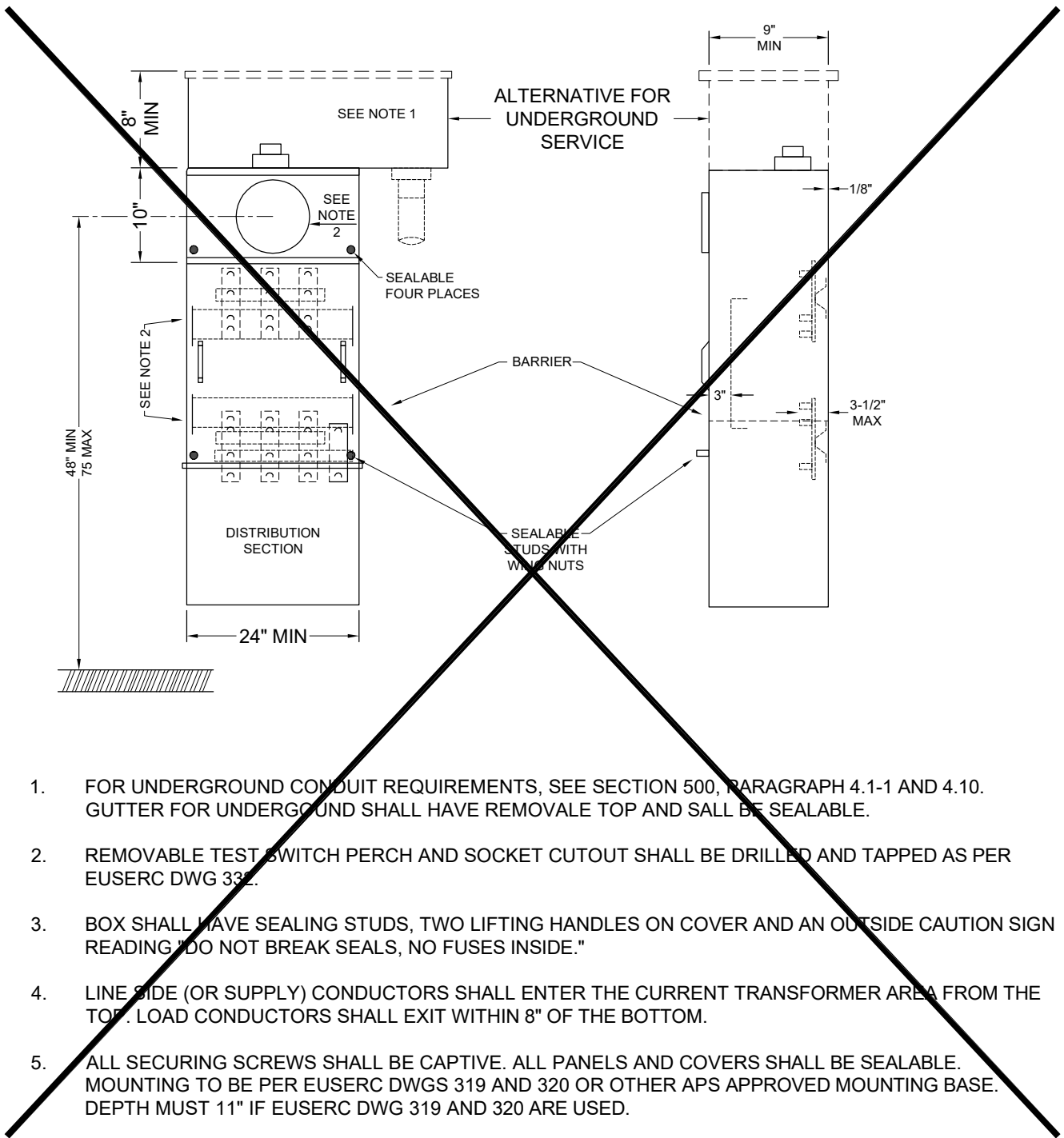
Standards for service switchgear have also been developed for self-contained meters, both residential and non-residential, and with either standard duty or heavy duty sockets. These sections of switchgear are built on special order to meet the needs of the Customer's service.

1101.1 (RESERVED)

1101.1 (RESERVED)



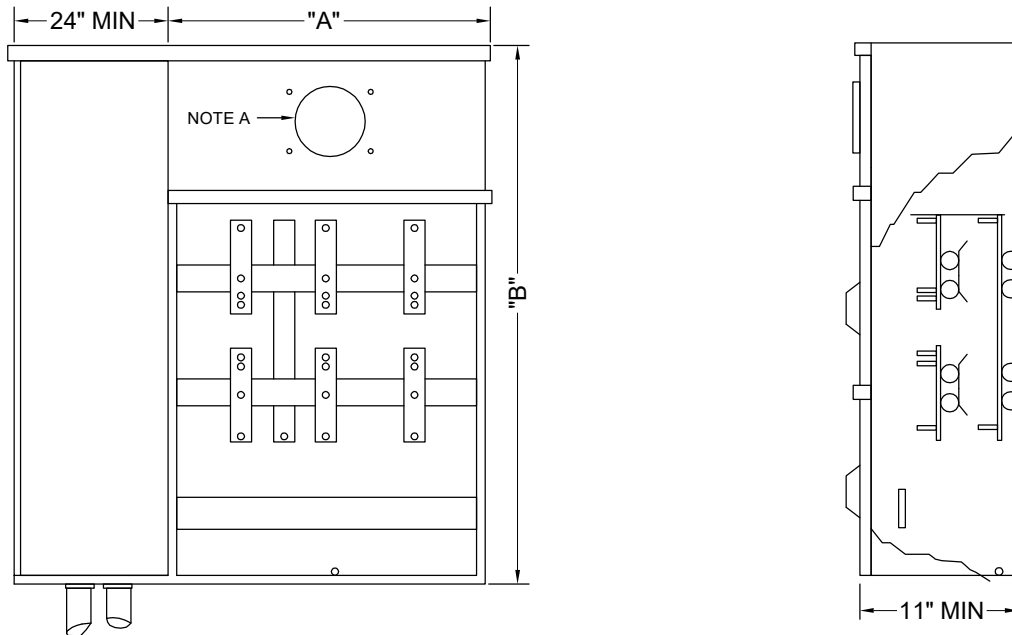
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1. FOR UNDERGROUND CONDUIT REQUIREMENTS, SEE SECTION 500, PARAGRAPH 4.1-1 AND 4.10. GUTTER FOR UNDERGROUND SHALL HAVE REMOVABLE TOP AND SHALL BE SEALABLE.
2. REMOVABLE TEST SWITCH PERCH AND SOCKET CUTOUT SHALL BE DRILLED AND TAPPED AS PER EUSERC DWG 332.
3. BOX SHALL HAVE SEALING STUDS, TWO LIFTING HANDLES ON COVER AND AN OUTSIDE CAUTION SIGN READING "DO NOT BREAK SEALS, NO FUSES INSIDE."
4. LINE SIDE (OR SUPPLY) CONDUCTORS SHALL ENTER THE CURRENT TRANSFORMER AREA FROM THE TOP. LOAD CONDUCTORS SHALL EXIT WITHIN 8" OF THE BOTTOM.
5. ALL SECURING SCREWS SHALL BE CAPTIVE. ALL PANELS AND COVERS SHALL BE SEALABLE. MOUNTING TO BE PER EUSERC DWGS 319 AND 320 OR OTHER APS APPROVED MOUNTING BASE. DEPTH MUST 11" IF EUSERC DWG 319 AND 320 ARE USED.



1101.3 COMBINATION INSTRUMENT TRANSFORMER AND METER BOX 0 - 600 VOLTS, 400 - 600 AMP



DIMENSIONS	3Ø 4W	1Ø 3W
"A"	36"	3Ø
"B"	54"	48"

1. FOR UNDERGROUND CONDUIT REQUIREMENTS, SEE SECTION 500.
2. ALL PANELS AND COVERS SHALL BE SEALABLE. SEALING PROVISIONS SHALL CONSIST OF TWO DRILLED STUD AND WING NUT ASSEMBLIES ON OPPOSITE SIDES OF EACH PANEL.
3. COVERS SHALL BE PROVIDED WITH TWO LIFTING HANDLES AND BE LIMITED TO A MAXIMUM SIZE OF 9 SQUARE FEET IN AREA.
4. REMOVBLE TEST SWITCH PERCH AND METER SOCKET CUTOUT TO BE DRILLED AND TAPPED PER EUSERC DWG. 332.
5. C.T. MOUNTING TO BE PER EUSERC DWG. 319 OR 320.

## 1102.0 EUSERC DRAWINGS - LOW-VOLTAGE SERVICE EQUIPMENT

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### 1102.1 SWITCHBOARD SERVICE SECTION ILLUSTRATIONS

The following pages are inserted to illustrate the appearance of standard switchboard service sections.

The drawings on these pages are basically EUSERC drawings and show only sections as they would be used with overhead service entrance conductors. Pull sections would be added along-side for underground service entrance conductors, and additional distribution feeder sections would be added as needed to supply a particular Customer's electrical load.

---

### 1102.2 APS ADDENDUMS TO EUSERC DRAWINGS

Although most EUSERC drawings are accepted by APS "as is", some of the drawings are not. APS has provided an Addendum page for each drawing that it does not accept "as is".

This Addendum will immediately follow the EUSERC page in this manual, and will explain any required changes and/or additions APS requires. **These changes are mandatory, and APS will not accept any equipment in violation of these addendums.**

## METERING AND SERVICE EQUIPMENT (0-600V)

### I. SCOPE

- A. This section contains minimum manufacturing requirements for utility metering and service equipment rated 0-600V.
- B. The following general notes apply to all drawings in this section where applicable. Each drawing may also contain additional notes which should be considered unique to that drawing unless reference is made to another specific drawing or section.
- C. Refer to Section 200 for specific utility requirements and utility acceptability of these requirements.
- D. Refer to the *installation guide* section for typical application and installation requirements.

### II. METERING EQUIPMENT REQUIREMENTS, GENERAL

These Requirements are based on practices that are necessary to supply uniform satisfactory and safe service. Interpretations or clarifications of intent of these Requirements are subject to EUSERC approval. Installations shall also conform to the provisions of applicable codes and ordinances of local inspection authorities and the servicing agency.

#### A. Grounding, General

1. Lugs for terminating the customer's ground wire (or other grounding conductors) shall be located outside of the sealable section and shall be designed to readily permit the customer's neutral system to be isolated, when necessary, from the serving agency.
2. Ground buss, when provided, shall be located at the rear of underground terminating enclosures (i.e. pull boxes and pull sections).

#### B. Meter Sequence

The metering arrangement, approved as the standard and required by all the serving agencies, provides for the line current to enter the meter first and then the disconnecting means and overload protective devices (meter-switch-fuse sequence). For multiple meter installations, refer to local codes.

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**C. Meter Access**

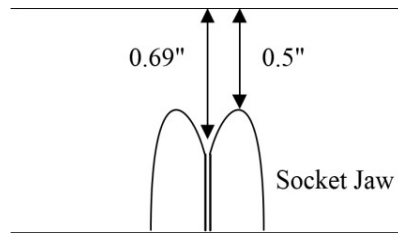
Customer locking for meter enclosures shall provide for independent access by the serving agency.

**D. Meter Heights**

Meters shall be located not more than 75 inches and not less than 48 inches above the ground or standing surface when installed outdoors. When meters are enclosed in a cabinet or indoors in a meter room, the minimum height may be reduced to 36 inches. The meter height shall be measured to the meter axis. Exception: Utilities in snow areas may require increased height.

**E. Meter Sockets, General**

1. See Section 200 for tabulation of meter socket requirements of member utilities.
2. The socket and enclosure shall be designed in accordance with the latest revision of AEIC-EEI-NEMA Standards for Watthour Meter Sockets, Publication ANSI C12.7, and Underwriters Laboratories Standard for Meter Sockets UL414. Socket rim to jaw clearance shall be no less than ANSI C12.7 (0.500") or more than (0.690").



Exception: The 0.690" dimension does not apply to transformer rated sockets and ground and neutral clips on self-contained sockets.

3. Meter sockets provided for self-contained meters shall be rated as follows:
  - a. For residential service applications, meter sockets shall have a maximum ampacity rating not less than the ampacity rating of the associated service disconnect. The maximum ampacity rating is 125% of the continuous-duty rating.
  - b. For commercial and industrial service applications, meter sockets shall have a continuous-duty rating of 100 amperes for service disconnects rated up to 125 amperes (maximum) and a continuous-duty rating of 200 amperes for service disconnects rated up to 250 amperes (maximum)

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4. Sockets for self-contained meters shall be furnished, installed and wired by the customer. Diagrams of connections are shown on Drawing G-1 of the installation guides.
5. When self-contained meter sockets are installed in switchboards, they are to be wired by the switchboard manufacturer. Consult the Utility for use of lever bypass meter sockets.
6. Sockets for instrument transformer installations shall be furnished and installed by the customer. The serving agency will furnish and install the normal secondary wiring from the instrument transformers to the meter socket.
7. Potential taps, including the neutral potential tap, shall be located behind a sealed panel. The customer's grounding electrode connection shall not be located within the meter socket or socket area of a combination CT / meter enclosure.
8. Ring-type sockets shall be furnished with sealing rings. Consult the Utility for usage of ring less sockets.
9. Instrument-rated meter sockets installed on:
  - a. Hinged panels shall be fabricated and installed by the manufacturer for back connection. (See Drawings 332 and 333)
 

Note: Screws used to mount cast meter sockets to hinged panels shall provide a 1/8" minimum clearance between the screw head and the back of the meter socket ring.
  - b. Non-hinged panels shall be fabricated and installed by the manufacturer for front connection. (See Drawings 313, 314 & 339)
 

Note: Meter sockets shall be attached with machine screws so that they maybe interchanged or replaced. Sheet metal and self-tapping screws are not acceptable.
10. Instrument-rated meter sockets installed on:

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- a. Hinged panels shall be fabricated and installed by the manufacturer for back connection. (See Drawings 332 and 333)

Note: Screws used to mount cast meter sockets to hinged panels shall provide a 1/8" minimum clearance between the screw head and the back of the meter socket ring.

- b. Non-hinged panels shall be fabricated and installed by the manufacturer for front connection. (See Drawings 313, 314 & 339)

Note: Meter sockets shall be attached with machine screws so that they maybe interchanged or replaced. Sheet metal and self-tapping screws are not acceptable.

- 11. All self-contained meter sockets shall be rigidly attached to the backwall of the socket enclosure or to a stationary support connected to the enclosure. For ring-type meter panels, the meter sockets shall be attached to the meter panel to assure alignment of the socket ring to the socket jaws and prevent removal of the panel with the meter in place. Sheet metal or self-tapping screws are not acceptable.

**F. Meter Sockets with Test-Bypass, Disconnect Facilities**

- 1. Sockets equipped with test-bypass disconnect facilities are required for some installations and prohibited on others. For use in any locality, consult the serving agency.

**G. Meter & Cover Panels, General**

- 1. The hinged meter panels shown on Drawings 332 & 333 are designed to accommodate only transformer-rated socket meters. Self-contained sockets shall not be mounted on hinged panels.
- 2. The nonhinged meter panels shall not be used in front of a current transformer section. For a specially engineered switchboard, the nonhinged panel as shown on Drawing 336 will accommodate a socket-type meter when used with current transformers.
- 3. Not more than two meters shall be mounted on any removable meter panel.
- 4. Additional space may be required for recording or graphic demand meters (see Drawing 333).
- 5. Hinged meter and filler panels shall be equipped with stops to prevent inward swinging beyond the front surface of the switchboards.

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6. A hinged instrument transformer cabinet cover may be used provided there is proper clearance to open the cover when the cabinet is installed. A cabinet with a hinged cover shall be designed so that the cover cannot be removed by tampering with the hinges when the cabinet cover is closed. Provisions shall be made for sealing the cabinet cover by use of approved method.
7. All pull and termination section cover panels shall be removable, sealable, provided with two lifting handles, and limited to a maximum size of nine square feet in area.

**H. Lifting Handles**

1. When lifting handles are required on panels and covers, each handle shall be sized for full hand grasping, securely attached, and have strength to withstand handling stresses of a minimum of 75 pounds.

Note: Chest type handles with a folding bale grasp are not acceptable.

**I. Sealing**

1. All cover panels, removable access panels, and hinged panels for compartments containing unmetered conductors shall be sealable. When a raceway or conduit for meter secondary wiring is necessary, the raceway or conduit shall be sealable. No removable panel or cover requiring sealing shall be located behind other panels, covers or doors (except raintight enclosure doors).

Note: Carriage bolts may be used to secure cover panels in place of sealing provisions when the bolts are installed at the factory and do not require field removal and installation to complete assembly of the switchboard sections.

2. Sealable latches, stud and wing-nuts, or sealing screws shall be provided as the means of sealing removable or hinged access covers.
3. Hinged cover panels shall be sealed on the side opposite the hinges.
4. Removable cover panels shall be sealed with stud and wing-nut assemblies on opposite sides of the cover. Alternate sealing methods may be used if the removable covers are self-supporting with the captive screws and sealing provisions removed.

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5. Sealing and securing devices shall be provided as follows:
  - a. Stud and wing-nut assemblies shall consist of a ¼ inch X 20 (minimum) stud and an associated wing-nut, each drilled .0635 inches (minimum) for sealing purposes. The stud shall be securely attached to not loosen or screw out when being fastened.
  - b. Sealing screws shall be drilled .0635 inches (minimum) for sealing purposes.
  - c. Latching devices shall be designed to permit positive locking and be made of a durable corrosion resistant material.

**J. Cover Panel Labeling**

Test-bypass block compartment cover panels shall have a caution sign on the front reading

“Do Not Break Seal – No Fuses Inside.”

**K. Unmetered Conductors**

Customer unmetered service wires and metered load wires are not to be run in the same conduit, raceway or wiring gutter. Metered and unmetered wires shall be separated by suitable barriers. Metered wires from the customer's distribution section (branch circuits) shall not pass through sealable sections. For exceptions, see Apartment Metering.

**L. Buss Bars**

1. Ampacity

- a. The dimensions in these requirements are based on the use of rectangular bus bar. Ampacities of buss bar conductors shall be based on UL-891. Standard for Dead-Front Switchboard, including ampacities based on thermal limits provided for therein. Maximum widths and number of bus bars shall conform to EUSERC requirements.
- b. Ampacity of instrument transformer compartments bus shall conform to NEMA Standards Publication PB2, Part 6.04, Paragraph A, for Section Bus.

2. Plating

- a. Buss bars shall be plated to prevent corrosion.

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3. Attachment to the Enclosure

- a. Buss bars and other hardware attached to the outer walls of the enclosure shall be secured with devices that may not be loosened from the outside. Screws or bolts requiring special tools for installation or removal are not acceptable.

**M. Service Disconnects**

1. Meter Disconnects, General

- a. For each meter, the customer shall furnish and install a circuit breaker, fused switch, or other approved disconnecting means with over-current protection referred in these requirements as a meter disconnect.
- b. The meter disconnect shall control all the energy registered by its related meter.
- c. Where permitted by the serving agency, the meter disconnect may consist of up to six separate devices.

2. Meter Disconnects, Locking Provisions

- a. Meter disconnects supplied from instrument-transformer compartments shall be capable of being locked in the open off position.
- b. Locking provisions may be:
  - (1) A lockout device which is incorporated as an integral part of each meter disconnect
  - (2) A lockable cover for each meter disconnect where the lock prevents the operation of the disconnect and prevents removal of the cover
  - (3) A lockable cover for multiple meter disconnects where the lock prevents the operation of any of the disconnects, prevents removal of the cover, and all disconnects are supplied from a single instrument transformer compartment.
  - (4) Items 1, 2, and 3 shall be permitted to be accomplished by a maximum of two (2) locking provisions per disconnect.
  - (5) For fused disconnects, the fuse access cover shall be lockable when the disconnect is in the off (open) position.

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(6) All locking provisions for disconnects rated less than 400 amperes shall accept a lock shank of not less than 1/4 inch.

(7) All locking provisions for disconnects rated 400 amperes and above shall accept a lock shank of not less than 5/16 inch.

3. Main Service Disconnects

- a. A main service disconnect device is installed on the supply (line) side of a group of meter sockets and may be a circuit breaker, fused disconnect, or other approved disconnecting means.
- b. A service disconnect shall be installed on the supply (line) side of more than six-meter sockets.
- c. A service disconnect may be permitted on the supply side of two to six-meter sockets. Consult the serving agency for specific requirements.
- d. A service disconnect is not permitted on the supply (line) side of a single meter socket. (Old Sequence).
- e. The cover on a line side disconnect shall be sealable, (see Drawing 315 Note 5).

**N. Utility Compartment Labeling**

Manufacturers shall provide information and safety labels in utility compartments as follows:

- 1. Caution labels for switchboard pull sections shall be provided on the safety barrier and cover of each pull section where energized buss is less than 4 inches from removable access cover panels. See Drawing 347 for additional requirements.
- 2. Torque labels shall be provided in each utility compartment where nut and bolt assemblies using cone-type (Belleville) washers are used for utility terminations, test-bypass block circuit closing nuts, or for securing current transformers or current transformer buss removable links. Labels shall be readily visible and shall not be installed on any removable or hinged cover panel.

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### III. SELF-CONTAINED RATED METERING INSTALLATION

Self-contained meters are designed to carry rated current and be energized at line potential. They do not require auxiliary instrument transformers to step down line current or voltage.

#### A. Residential, General

Four Types of self-contained meters are commonly used for this application.

1. Class 100 socket-type meter
2. Class 200 socket-type meter
3. Class 320 socket-type meter
4. Class 400 bolt-in type meter

*(See Section 200 for specific utility requirements)  
Note: Automatic socket bypass devices are not allowed.*

#### B. Commercial, General

Class 100 or 200 socket-type meters are commonly used; and test-bypass disconnect facilities are required for this application. Some utilities allow Class 320 or Class 400-amp meters for specialized installations (Go to [euserc.org](http://euserc.org) for specific utility requirements).

#### C. Multiple, Switchboard

1. The socket and socket enclosure shall be designed in accordance with the latest revision of AEIC-EEI-NEMA Standards for Watthour Meter Sockets, Publication ANSI C12.7, and with Standard for Meter Sockets UL414.
2. The bussing or cables to each individual meter socket are to be installed so they can be visibly traced.
3. Multiple Meter enclosures that are not factory bussed shall have non-removable, solid metal barriers to isolate the metered conductors from the un-metered conductors.
4. The service termination enclosure, socket enclosures, raceways and sections for test-bypass or manual circuit closing facilities shall have separate, removable and sealable access panels (or plates). Meter socket enclosures shall have a separate sealable cover containing no more than two-meter positions.

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#### D. Meter Spacing and Clearances

1. The rules for spacing of socket meters in multiple residential meter installations shall be as follows:  
 Horizontal spacing - 7 1/2 inches minimum on centers.  
 Vertical spacing - 8 1/2 inches minimum on centers.
2. See Drawing 353 for Multiple Meter clearances.

#### E. Apartment Metering Excluding Switchboards

1. Where many apartments in one building are to be individually metered; a combination of service termination, raceway and meter enclosures may be used.  
*(Consult local utility for approval.)*
2. When these units are constructed with metered and un-metered conductors in the same raceway behind adjacent meter sockets, the serving agency will require the following additional specifications.
  - a. Metered and un-metered conductors shall be separated so that all the load is being metered (Line and Load conductors not cabled together).
  - b. Factory "harness-style" wiring (or equivalent) shall be used between the line wire and line terminals of each meter socket, between the load terminals of each meter socket, and the line side of the corresponding circuit breaker.
  - c. Connecting wires between meter socket load terminals and circuit breaker line terminals shall be separately cabled for each position in the row.
  - d. When the installation is completed, all panels must be removable for inspection of wiring.
  - e. Panel design shall permit convenient replacement of any individual meter socket.
3. See installation guides for typical arrangements.

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## IV. TRANSFORMER RATED METERING INSTALLATIONS

### A. General Requirements

1. Instrument transformer compartments are generally required when the connected load exceeds 200 amperes. See Section 200 for exceptions and utility acceptability of these requirements and Section 400 when the voltage between conductors exceeds 600 volts.
2. Meter, instrument transformers and test switches will normally be furnished and installed by the serving agency. Any required conduits or raceways shall be furnished and installed by the switchboard manufacturer or contractor,  
(See Section 200 for specific utility requirements).
3. All compartments containing unmetred conductors shall be sealable. When a raceway or conduit for meter secondary wiring is necessary, such raceway or conduit shall be sealable.

### B. Switchboard Service Sections, General

1. For both standard and specially engineered switchboard service sections, all service or supply conductors shall enter the service section through one end and leave through the opposite end of the instrument transformer compartment. This stipulation applies to either overhead or underground service or if two or more service sections are connected. The direction of feed shall be vertical through the instrument transformer compartment, (See Drawing 345).
2. When more than one switchboard service section is installed, each service section shall be completely barriered from other service sections, pull sections, or service switches or disconnects. Barriers may have an opening to allow passage of unmetred conductors between sections. Barriers shall be constructed from 16-gauge (minimum) steel in accordance with (B)(3) below.

Note 1: A portion of the barrier between sealed utility metering sections and the pull section may be 1/8" minimum glastic or equivalent due to potential electrical clearance issues.

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Note 2: The clearance between bus bar and steel or glastic shall be a maximum of 3". The maximum clearance shall be measured in accordance with Fig. 1. No barrier shall be required between individual phases and neutral.

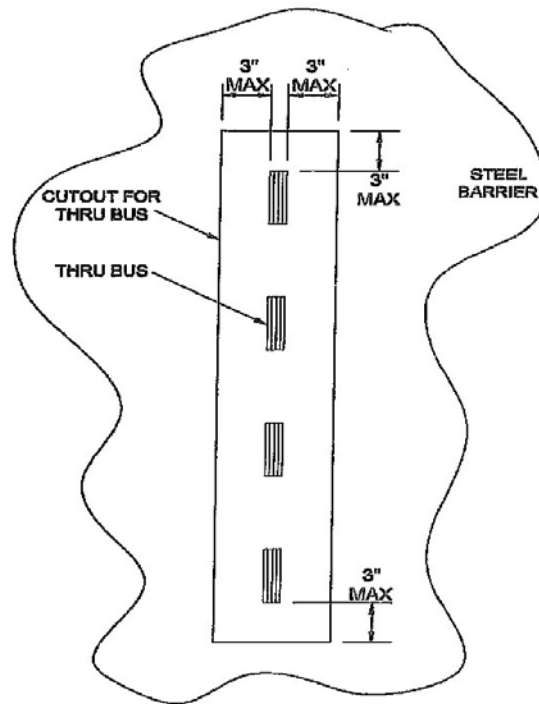


Fig. 1

3. Except where otherwise specified in these requirements, barriers used in switchboard installations to separate customer sections from utility sections (i.e., pull sections and metering sections) and sections containing un-metered conductors or buss shall be constructed from 16-gauge (minimum) steel and shall be secured with devices that are not removable from either the customer sections or the exterior of the switchboard.
4. When two or more switchboard service sections are supplied from one set of service conductors, the supply conductors are to be arranged so they are readily accessible without disturbing the instrument transformers and associated secondary wiring.
5. Additional service connections may be made in the main service termination and pull section where more than one metering installation is necessary or where more than one rate schedule is desired. Additional service connections shall not be made in the instrument transformer compartment. Consult serving agency for approval.

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6. Meter installations of six meters or less shall be connected "new sequence". Consult serving agency for exceptions.

**C. Standard Switchboard Service Section**

1. The general arrangement of a standard switchboard section is shown on Drawings 325 and 326.
2. A standard switchboard service section has a hinged meter panel located in front of the instrument transformer compartment. Drawing 333 shows spacings for various combinations of multiple meters.
3. Hinged meter panels must have handles and open a minimum of 90 degrees with meters and test switches mounted to permit safe and ready access to the instrument transformers. When hinged panels are recessed, the section shall have additional width to meet this requirement. A recessed panel requires utility approval as a specially engineered section, (See Drawing 354).
4. Hinged meter panels must be sealable and easily removable with the hinges readily interchangeable from the right or left side on the job site.
5. The hinged meter panels on Drawings 332 and 333 are designed for transformer-rated, socket-type meters.
6. Meter panels and filler panels shall be equipped with stops to prevent inward swinging beyond the front surface of the switchboard.
7. Not more than two meters shall be mounted on any removable meter panel.
8. For hinged socket meter panels, see Drawings 332 and 333.
9. For underground service application Of Standard Switchboard Service Sections, see Drawing 345

**D. Specially Engineered Service Sections**

1. Switchboards which do not conform to standard design criteria are considered specially engineered and include installations:
  - a. Rated over 3000 amperes or 600 volts.
  - b. Where the service breaker ampacity rating exceeds that of the standard service section.
  - c. Where multiple metering sections are used.

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d. Where recessed meter panels are used.

**E. Specially Engineered Service Sections**

1. Switchboards which do not conform to standard design criteria are considered specially engineered and include installations:
  - a. Rated over 3000 amperes or 600 volts.
  - b. Where the service breaker ampacity rating exceeds that of the standard service section.
  - c. Where multiple metering sections are used.
  - d. Where recessed meter panels are used.
  
2. When a specially engineered service section is necessary, drawings in triplicate of the proposed section shall be submitted to the serving agency for approval prior to manufacture and bidding. Such drawings shall indicate the contractor's and the customer's name, address and job location.
  
3. The general arrangement of Specially Engineered Switchboard Service Sections should follow, as nearly as practicable, the Standard Switchboard Service Sections and the following general requirements shall be observed:
  - a. Instrument transformer-rated socket meters, used with current transformers, are normally mounted on hinged panels.
  - b. If a hinged meter panel is located behind a door, a clear space of at least 11 inches between the meter panel and the door is required and shall be designed to open 90 degrees with meters and test switches in place. If needed, additional section width shall be provided to meet this requirement.
  - c. A clear space behind a meter panel shall be provided for the secondary wiring and phase shifting device. For minimum dimensions between the hinged meter panel and the nearest buss, see Drawings 319-324.
  - d. For nonhinged meter panels, a clear space of four inches minimum to any barrier or obstruction shall be provided.
  - e. The nonhinged meter panels shall not be used in front of a current transformer section. For a specially engineered switchboard, nonhinged panels will accommodate socket-type instrument transformer-rated meters.

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- f. For minimum clearance between meters, (see Drawings 306, 333, 336, and 353).
- g. Additional panel space is required for recording or graphic demand meters, (see Drawing 333).
- h. Not more than two meters shall be mounted on any removable meter panel.
- i. Busses shall be adequately supported in the metering transformer compartment to withstand the mechanical stresses of a short circuit. The buss supports shall not interfere with installation or removal of current transformers. Current transformers shall not be used to support the busses. The busses shall be entirely self-supporting.
- j. The busses and current transformer mountings shall be designed so that each of the current transformers may be withdrawn from its mounting position directly through the access panel without disturbing any other current transformer. When multi-leaf busses are used, the busses shall be oriented so that they appear "edgewise" when viewed from the access panel.

**F. Instrument-Transformer Compartments**

1. For details of instrument transformer compartments, (see Drawings 319-322).
2. Covers for instrument transformer compartments shall be made of code gauge metal. If nonhinged panels are used as covers, they shall be provided with lifting handles and be attached with sealable studs and wing-nuts or by other approved means.
3. Copper or aluminum buss bars shall be used on both the line and load sides of all current transformers. When aluminum bus is used, the bus bars shall be plated, (See Bus Bar Plating, Drawing 300).
4. When the serving agency requests links and supports for through-type current transformer(s), the bus and removable links must be of a compatible material.
5. Instrument transformers supplied by the serving agency for metering shall not be utilized for any other purpose.
6. The ends of the current transformer buss stubs shall be located so the current transformers can be installed without removing adjacent panels.

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7. The current transformer bus stub supports in the instrument transformer compartment shall be sufficiently rigid to maintain alignment of the buss where the conductors are installed. The current transformers or bus links shall not provide buss support or alignment.
8. Except for factory-installed cross-bussing and conductors, either bus or cable, used to supply the instrument-transformer compartment, no other conductors or devices shall be installed in the instrument-transformer compartment or in the sealed area above the instrument-transformer compartment.

**V. SERVICE TERMINATION EQUIPMENT, GENERAL**

**A. Switchboards Excluded**

This paragraph of the Requirements applies to all meter and service equipment when not installed on switchboards.

1. General
  - a. Service termination facilities shall be specifically designed to receive the serving agency's underground service lateral conductors as a single cable entry. Enclosures designed for either overhead or underground cable entry are acceptable provided they meet requirements for both types of cable entry.
  - b. Service cable termination lugs or connectors shall be suitable for use with both aluminum and copper conductors. The serving agency should be consulted for specific lug or connector requirements.
  - c. Socket enclosures designed for single sockets rated up to, and including 200 amperes, shall have service terminating lugs independently mounted from the socket jaw support.
  - d. Test for meter sockets shall be in accordance with the current Standard for Meter Sockets UL414.
  - e. Service terminating space in enclosures rated greater than 200 amperes with multiple meter sockets shall accommodate either compression-type or screw-type mechanical landing lugs. All bussing or cable conductors beyond the terminating lugs shall be provided by the manufacturer or the customer's contractor. Bus stubs or bussing in the service terminating space used for terminating the utility service lateral shall have mounting bolts spaced in accordance with NEMA Standards. For termination buss detail, (see Drawing 343.)

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	<b>METERING &amp; SERVICING EQUIPMENT</b>			
<b>SECTION 300</b>				

- f. The service cable termination compression or screw type mechanical lugs shall be compatible with the size and type of the service being installed (i.e., aluminum bodied AL-CU with aluminum cables, etc.). The termination lug landings for the neutral and each phase conductor shall be rigidly and permanently affixed in the service termination space and all grouped at one location.
- g. Wireways in the service termination space designed for terminating the utility service lateral shall be clearly identified for such use. Service termination shall be made in the service termination enclosure or in a specially designed space a meter panel which has a separate removable and sealable access plate.
- h. The layout or design of the service termination enclosure that requires bending the utility service conductors should provide space to permit a minimum cable bending radius equal to four times the overall diameter of the cable measured from the inner surface of the cable (from Minimum Bending Radius for Thermo-Plastic Insulated Cables, IPCEA S-61-402 and NEMA WC 5-1961 Standards).

NOTE: The overall termination enclosure size is not predicated solely on the cable bending radius. Adequate working space and electrical clearances are also considered in establishing enclosure dimensions in these requirements.

- i. The service termination enclosure, socket enclosure and test-bypass disconnect block section shall be sealable and isolated or barriered from other integral enclosure sections which are accessible to the customer to effectively prevent unauthorized connections to unmetered conductors or terminals.
- j. The manufacturer's rating label, or other markings used in lieu of a label, shall show among other things:
  - (1) The socket or socket enclosure is designed for overhead service entry, underground service entry, or both.
  - (2) The terminating lugs are designed for both aluminum and copper conductors.
  - (3) The wire size range of the terminating lugs.

2. Single Self-Contained Meter Termination, Underground Service

- a. The socket and enclosure shall be specifically designed to receive service cables from an underground supply system. Separate service terminating lugs supported independent of the socket and connected by buss bars are required for single family residential meter socket enclosures, (See Drawing 301).

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				SECTION 300

- b. Wiring space for service lateral conductors shall be clearly identified as intended for such use. The wiring space shall be clear of all projections and shall be used exclusively for such purposes.
- c. A separate removable cover, independent of the meter panel, is required in front of the pull section, (See Drawing 301).
- d. Knockouts in cable wireways shall be positioned to minimize service lateral cable bending.
- e. The service cable entry and the meter socket section shall be sealable and isolated or barriered from other integral enclosure sections which are accessible to the customer to effectively prevent the attachment of unauthorized connections to unmetered conductors or terminals.
- f. The load wires from the distribution section (branch circuits) shall not pass through any sealable section.

3. Multiple Self-Contained Meter Termination, Underground Service

- a. When self-contained meters are installed on switchboards, the service termination requirements for switchboards shall be followed (see Switchboards).
- b. When self-contained meters are installed in multiple arrangements, in separate meter enclosures, the GENERAL service equipment requirements shall be followed. (See Drawing 343 for termination enclosure requirements and installation guide section for typical arrangements).

**B. Switchboards**

1. Switchboard Termination, Underground Service

- a. For underground services, the serving agency will terminate its service conductor on lug landings at the current transformer bus stubs only when the service is a single-meter installation and the switchboard is rated 400 amperes or less.

NOTE: Some utilities require the service conductors to be terminated in the pull section for switchboards rated less than 400 amperes.

- (i) The serving agency will terminate its service conductors on lug landings the pull section when the service is for multiple metering or the switchboard is rated 401 amperes or larger, (see Figure 1 on Drawing 345).

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				SECTION 300

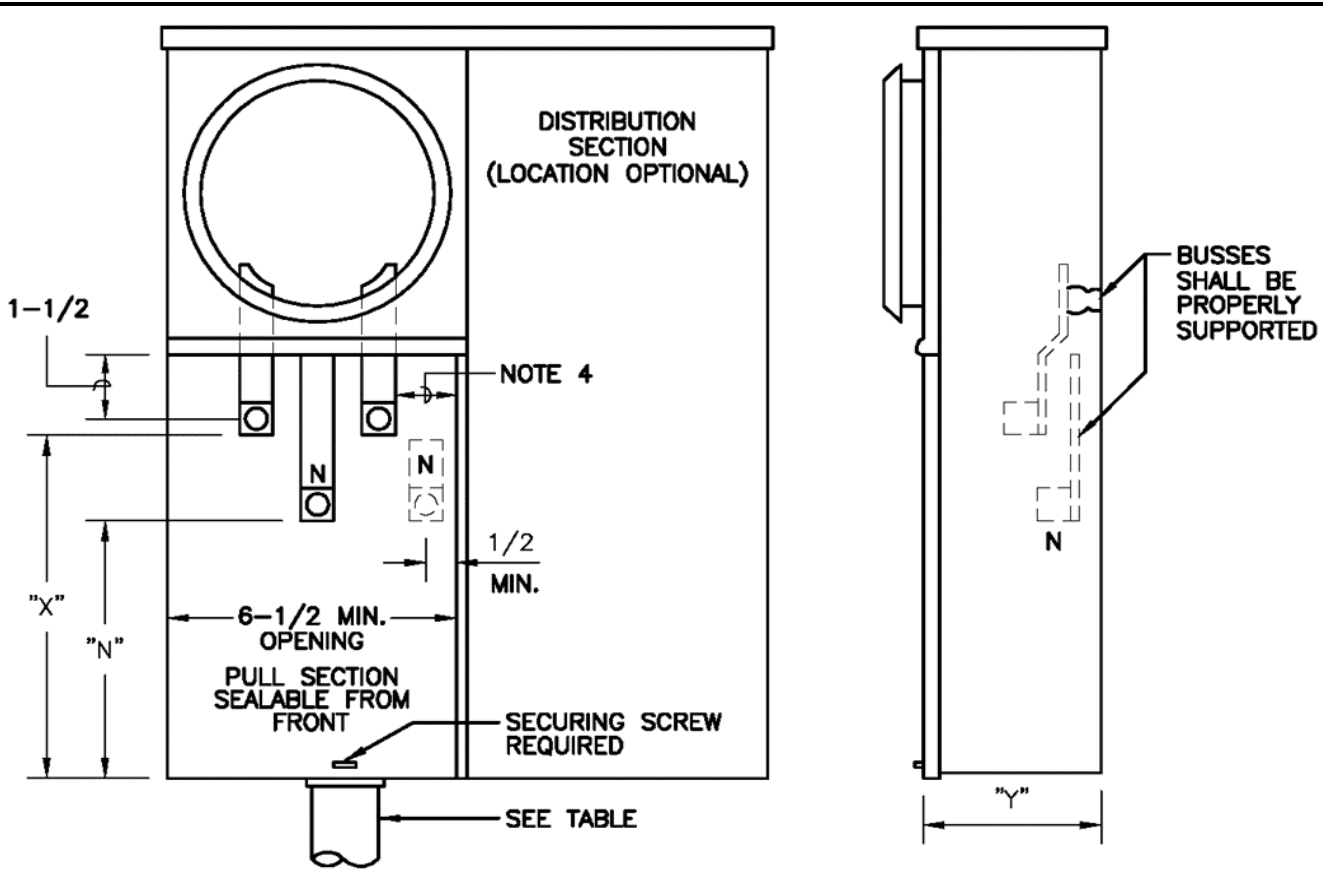
- (a) On switchboards rated 401-800 amperes, the customer shall install conductors from the service termination lug landings to the line side of the current transformer compartment.
- (b) On switchboards rated 800 amperes or with multiple meters, bus bars shall extend from the service terminating lug landings into the current transformer compartment or the meter sockets.

2. Switchboard Termination, Overhead

For overhead services, the customer shall furnish lugs and connect the cable to line and load sides of the bus stubs in the current transformer compartment, (see Drawing 348).

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MAXIMUM AMPACITY	"X" MIN. DIM.	"N" MIN. DIM.	"Y" MIN. DIM.	CONDUIT RANGE
125	8"	6"	4"	1-1/4" TO 2-1/2"
225	11"	8-1/2"	5"	1-1/2" TO 3"

**NOTES:**

1. This equipment may be constructed for underground service supply or as a combination panel allowing either overhead or underground service supply applications.
2. Only one set of terminating facilities shall be provided and located as shown for both underground and overhead service supply applications. The terminating facilities for the service conductors shall be aluminum bodied mechanical lugs with a range of No. 6 through 1/0 AWG for the 125 ampere device and No. 4 AWG through 250 KCMIL for the 225 ampere device.
3. Provide a bonding screw or jumper if the neutral terminal is insulated from the enclosure.
4. A minimum radial clearance of 1-1/2 inches shall be provided between the hot bus terminals, hot bus and ground, and hot bus and neutral surfaces.

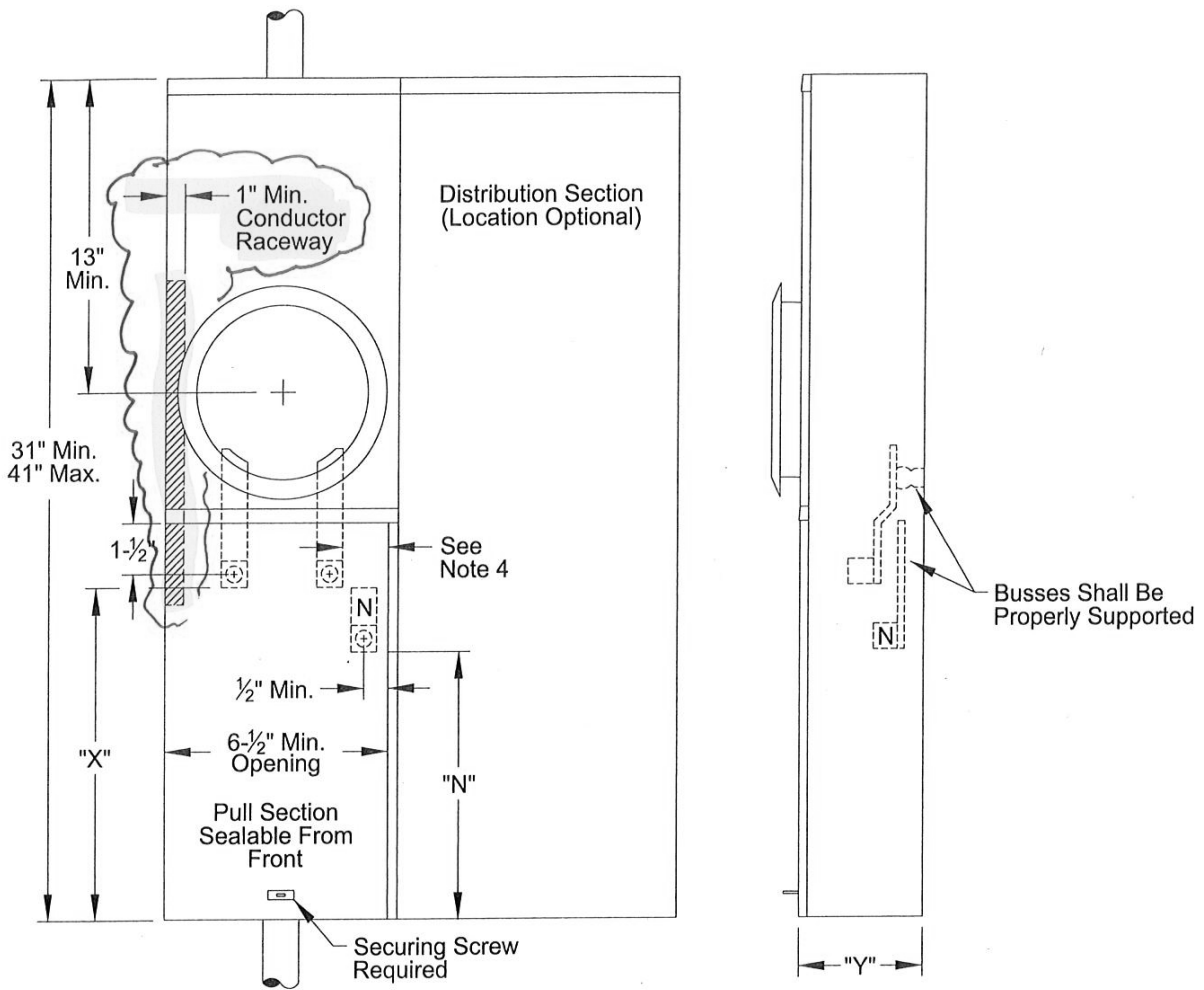
Exception: The clearance from the hot bus to the back of the enclosure may be reduced to 1-inch.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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	<b>RESIDENTIAL COMBINATION METER PANEL 225 AMPERES MAXIMUM 0-600 VOLTS</b>			

**SECTION  
300  
DRAWING  
301**



Maximum Ampacity	"X" Min. Dim.	"N" Min. Dim.	"Y" Min. Dim.	Conduit Range
125	-	-	-	1-1/4" to 2-1/2"
225	12"	9-1/2"	7"	1-1/2" to 4"

All Dimensions Shown Are In Inches

Notes:

1. This equipment may be constructed as a combination panel allowing either Overhead or underground service supply applications.
2. Only one set of terminating facilities shall be provided and placed on the bottom side, as shown, for both underground and overhead service supply applications. In overhead applications a dedicated wire way shall be provided to allow conductor to pass by meter socket jaws. The terminating facilities for the service conductors shall be aluminum bodied mechanical lugs with a range of NO.6 through 1/0 AWG for the 125 ampere device and No.4 AWG through 250 KCMIL for the 225 ampere device.
3. Provide a bonding screw or jumper if the neutral terminal is insulated from the enclosure.
4. A minimum radial clearance of 1-1/2 inches shall be provided between the hot bus terminals, hot bus and ground, and hot bus and neutral surfaces.

Exception: The clearance from the hot bus to the back of the enclosure may be reduced to 1 inch.

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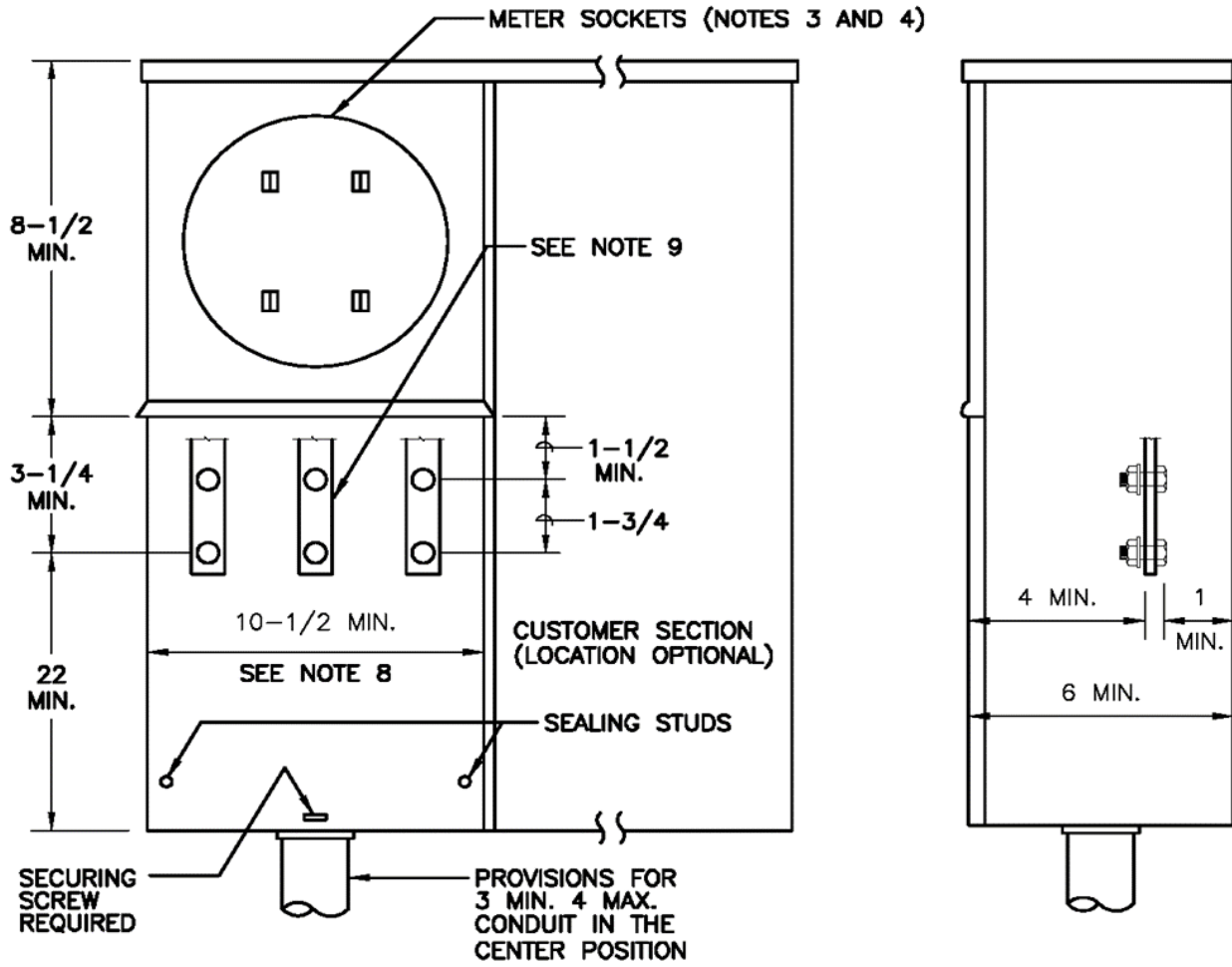
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**RESIDENTIAL COMBINATION METER PANEL  
225 AMPERES 0-600 VOLTS**

**SECTION  
300  
DRAWING  
301B**



**FRONT VIEW**

**SIDE VIEW**

**NOTES:**

1. The panel shown is a combination device having both a utility section (i.e. pull section and metering section) and customer section, but may also be constructed without an attached customer section.
2. The panel shall be marked with either a rating of "320 amperes continuous" or "400 amperes maximum (320 amperes continuous)".
3. The meter panel shall be removable, sealable, and rainproof.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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	<p>EUSERC MANUAL</p>				
	<p><b>RINGLESS METER PANEL FOR SINGLE FAMILY RESIDENTIAL UNDERGROUND SERVICE 400 AMPERE (CLASS 320), 120/240 VOLT, 1 PHASE, 3 WIRE</b></p>				



4. The meter socket may be located above, to the left, or right of the terminating pull section.
5. Manual bypass facilities which maintain service continuity to the customer while the meter is removed for test or inspection shall be provided. Automatic bypasses are unacceptable. Bypass provisions which de-energize the meter socket are preferred but not required. Manufacturers shall submit proposed manual bypass methods to EUSERC Materials Committee for approval.
6. Manual bypass access panels shall be padlockable and sealable.
7. Pull section cover panels shall be removable, sealable, provided with two lifting handles, and limited to a maximum size of 9 square feet in area.
8. The access opening dimension shown is measured between the return flanges.
9. Cable terminating facilities shall consist of single-position studs with clearance and access requirements complying with Drawing 347.

Exception: The neutral clearance to the back wall of the enclosure may be reduced.

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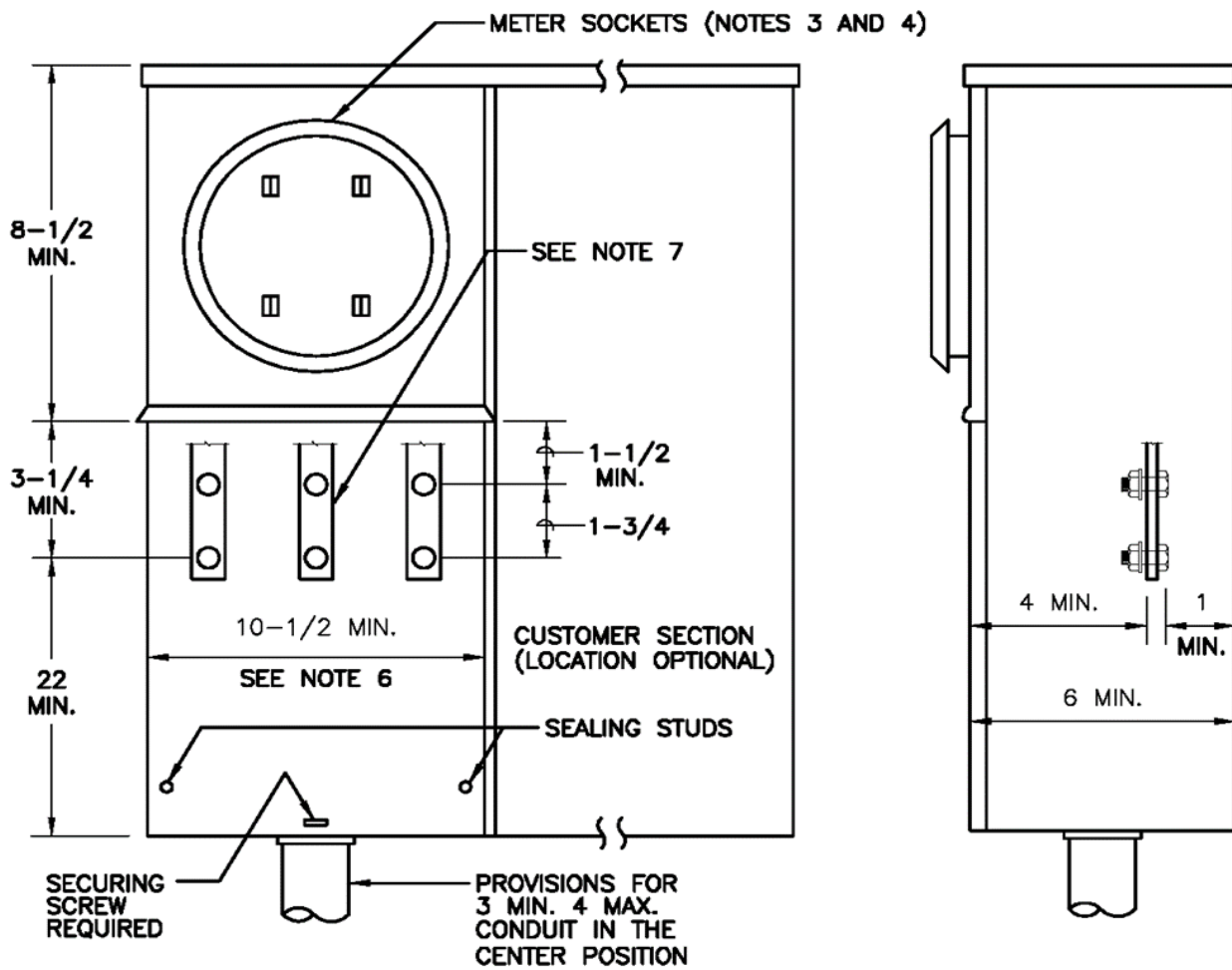
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	EUSERC MANUAL				
	<b>RINGLESS METER PANEL FOR SINGLE FAMILY RESIDENTIAL UNDERGROUND SERVICE 400 AMPERE (CLASS 320), 120/240 VOLT, 1 PHASE, 3 WIRE</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 302/APS**

**NOTES:**

1. Change note #1 to indicate that APS requires the main disconnect to be adjacent to, and in the same workspace as the meter.
2. Change note #3 to indicate that APS does not accept ringless style meter cans.
3. Change note #5 to indicate that APS does not accept any manual bypass meter sockets.





**FRONT VIEW**

**SIDE VIEW**

**NOTES:**

1. The panel shown is a combination device having both a utility section (i.e. pull section and metering section) and customer section, but may also be constructed without an attached customer section.
2. The panel shall be marked with either a rating of "320 amperes continuous" or "400 amperes maximum (320 amperes continuous)".
3. The panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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	<b>METER PANEL WITHOUT SOCKET BYPASS FACILITY RESIDENTIAL UNDERGROUND SERVICE 400 AMPERE (CLASS 320), 120/240 VOLT, 1 PHASE, 3 WIRE</b>			

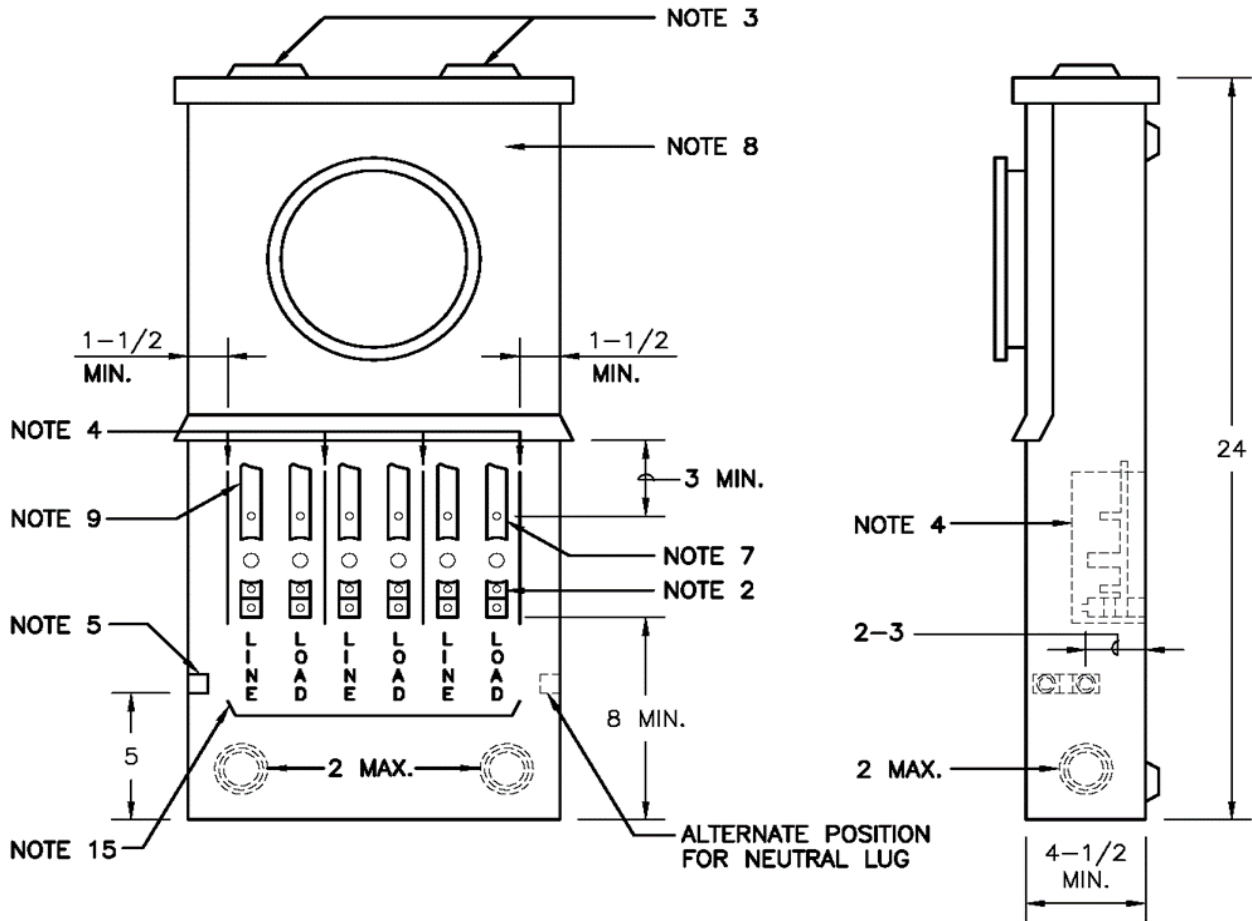
**SECTION  
300  
DRAWING  
302A**

4. The meter socket may be located above, to the left, or right of the terminating pull section.
5. Pull section cover panels shall be removable, sealable, provided with two lifting handles, and limited to a maximum size of 9 square feet in area.
6. The access opening dimension shown is measured between the return flanges.
7. Cable terminating facilities shall consist of single-position studs with clearance and access requirements complying with Drawing 347.

Exception: The neutral clearance to the back wall of the enclosure may be reduced.

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	EUSERC MANUAL				
	<b>METER PANEL WITHOUT SOCKET BYPASS FACILITY RESIDENTIAL UNDERGROUND SERVICE 400 AMPERE (CLASS 320), 120/240 VOLT, 1 PHASE, 3 WIRE</b>				



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EUSERC MANUAL

**SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST-BYPASS FACILITIES, 100 AMPERE, 0-600 VOLTS**

SECTION  
300  
DRAWING  
304

**NOTES:**

1. This device may be used for commercial, multi-family residential (not separately metered) and other types of occupancies.
2. Cable terminating facilities shall be aluminum bodied mechanical lugs with a range of No. 6 AWG through No. 1/0 AWG.
3. Hubs capped off if used for underground feed.
4. Rigid insulating barriers.
5. Insulated bondable vertical lay-in, double neutral lug with No. 1/0 wire capacity, mounted on either sidewall.
6. Test-bypass blocks shall be bussed or wired to socket jaws or terminals.
7. Upper test connector studs.
8. All panels shall be independently removable. Meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on support and attached to the meter panel. Test-bypass compartment cover panel shall be sealable and permanently labeled: "DO NOT BREAK SEALS. NO FUSES INSIDE".
9. Test-bypass block detail on Dwg. 312.
10. For 3-phase, 4 wire, connect 7th jaw to body of neutral lug with No. 12 Min. copper wire, white in color.
11. For 3-phase, 4 wire delta, identify right hand test-bypass block (2 poles) as power leg. Identification to be orange in color.
12. For 3-phase, 3 wire, install bus to connect line and load poles together at top of center test-bypass block and connect 5th jaw to this bus, using No. 12 Min. copper wire. Color shall be other than white, gray, green or orange.
13. For 1-phase, 3 wire, provide two test-bypass blocks mounted in the outer positions and a four jaw socket.
14. For 1-phase, 3 wire, 120/208 volt, provide two test-bypass blocks mounted in the outer positions and a five jaw socket. Connect 5th jaw of meter socket to body of neutral lug with a No. 12 Min. copper wire, white in color.
15. Test-bypass block connection sequences shall be LINE-LOAD from left to right and shall be clearly identified in 3/4 inch minimum block letters.
16. Minimum width of access opening shall be 11-1/2 inches.

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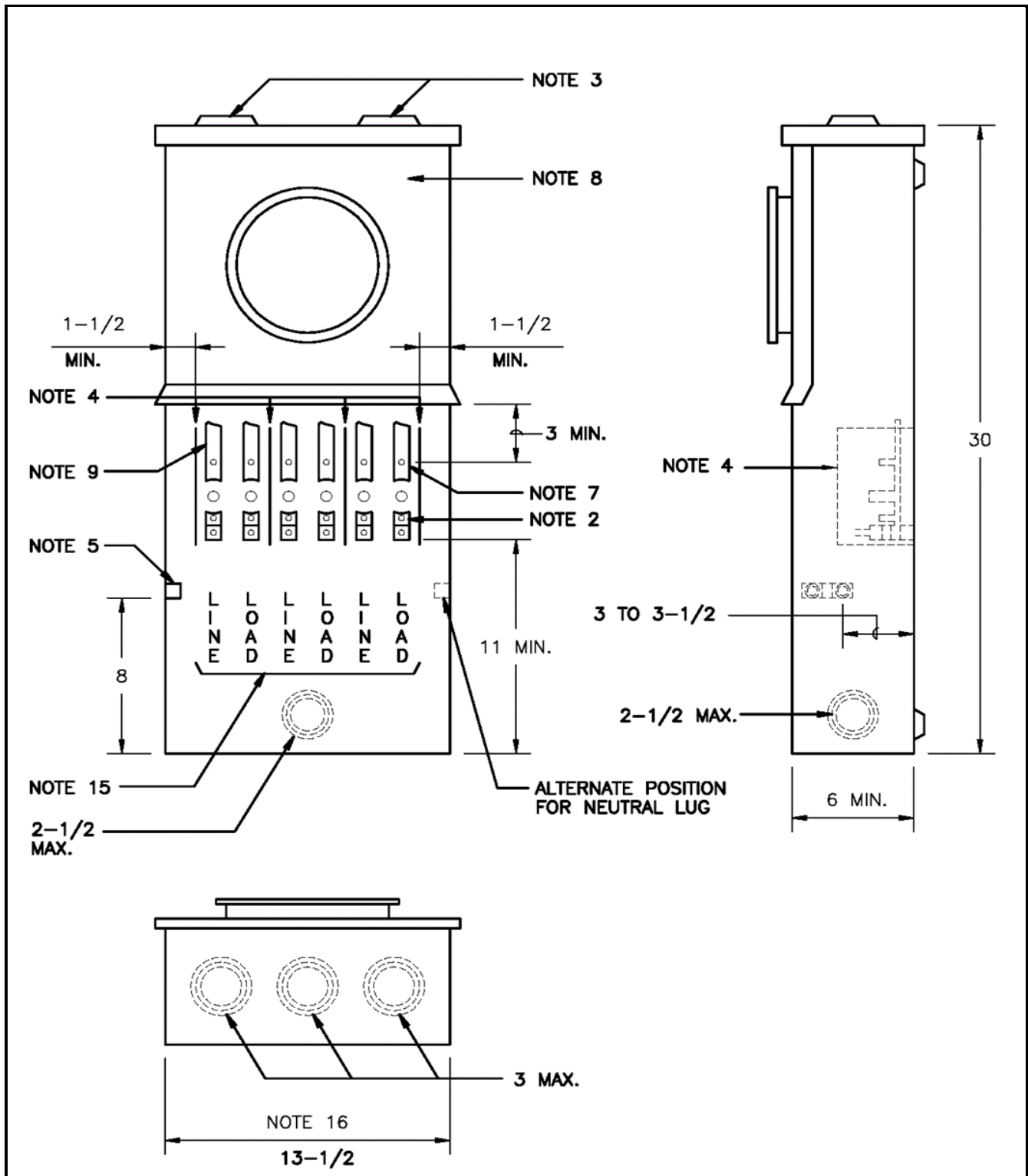
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	<b>SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST-BYPASS FACILITIES, 100 AMPERE, 0-600 VOLTS</b>			
<b>SECTION 300 DRAWING 304</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 304/APS**

**NOTES:**

1. Eliminate note #12 - APS does not allow 3 Phase 3 Wire services.





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	<b>SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST-BYPASS FACILITIES, 200 AMPERE, 0-800 VOLTS</b>			
SECTION 300 DRAWING 305				



**NOTES:**

1. This device may be used for commercial, multi-family residential (not separately metered) and other types of occupancies.
2. Cable terminating facilitates shall be aluminum bodied mechanical lugs with a range of No. 1/0 AWG through No. 250 KCMIL.
3. Hubs capped off if used for underground feed and permanently labeled: "DO NOT BREAK SEALS. NO FUSES INSIDE".
4. Rigid insulating barriers.
5. Insulated bondable vertical lay-in, double neutral lug with No. 250 KCMIL wire capacity, mounted on either sidewall.
6. Test-bypass blocks shall be bussed or wired to socket jaws or terminals.
7. Upper test connector studs.
8. All panels shall be independently removable. Meter panel shall be provided with a sealing ring and the meter socket shall be rigidity mounted on support and attached to the meter panel. Test-bypass compartment cover panel shall be sealable and permanently labeled: "DO NOT BREAK SEALS. NO FUSES INSIDE".
9. Test-bypass block detail on Dwg. 312.
10. For 3-phase, 4 wire, connect 7th jaw to body of neutral lug with No. 12 Min. copper wire, white in color.
11. For 3-phase, 4 wire delta, identify right hand test-bypass block (2 poles) as power leg. Identification to be orange in color.
12. For 3-phase, 3 wire, install bus to connect line and load poles together at top of center test-bypass block and connect 5th jaw to this bus, using No. 12 Min. copper wire. Color shall be other than white, gray, green or orange.
13. For 1-phase, 3 wire, provide two test-bypass blocks mounted in the outer positions and a four jaw socket.
14. For 1-phase, 3 wire, 120/208 volt, provide two test-bypass blocks mounted in the outer positions and a five jaw socket. Connect 5th jaw of meter socket to body of neutral lug with a No. 12 Min. copper wire, white in color.
15. Test-bypass block connection sequences shall be LINE-LOAD from left to right and shall be clearly identified in 3/4 inch minimum block letters.
16. Minimum width of access opening shall be 11-1/2 inches.

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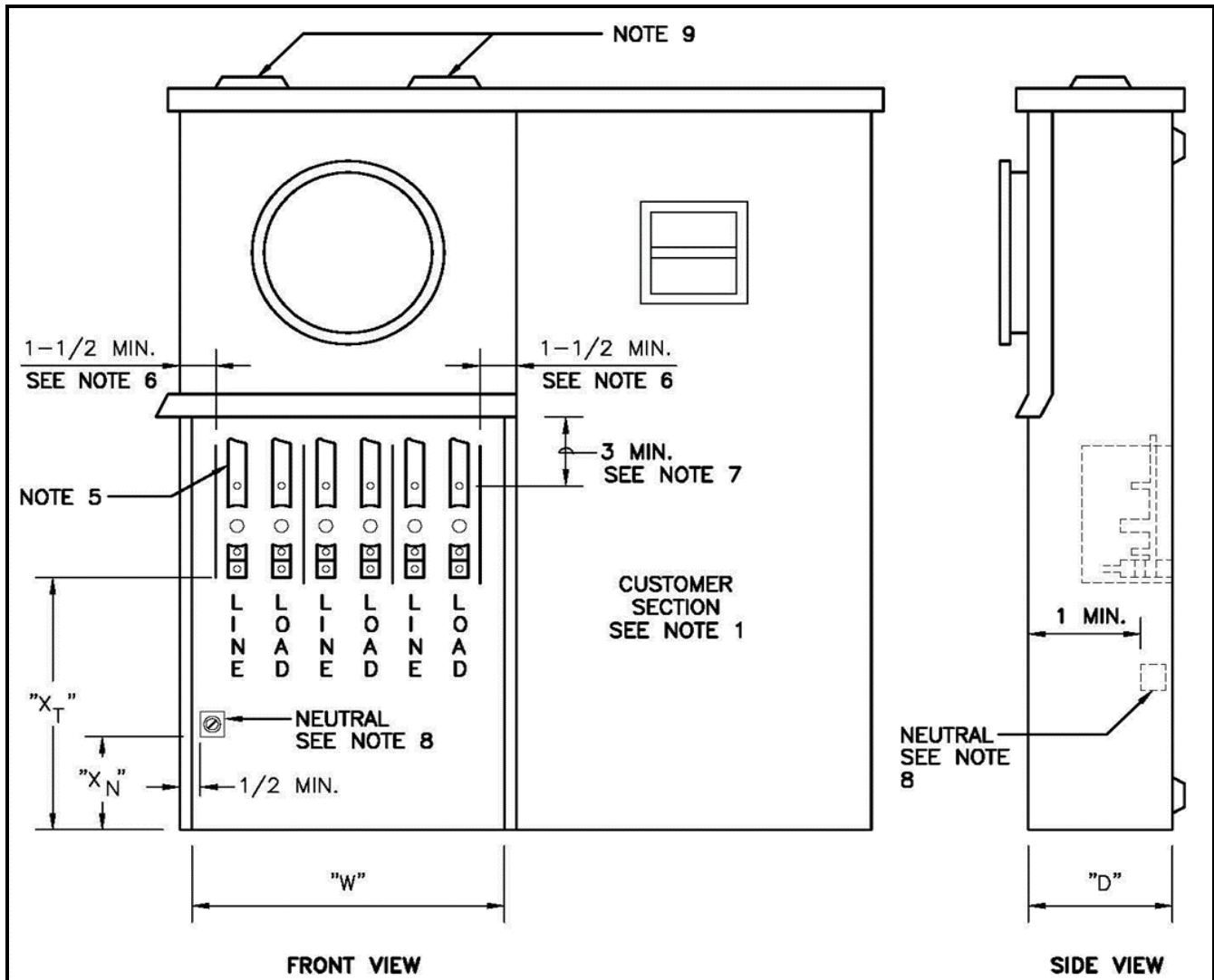
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	<p>EUSERC MANUAL</p>				
	<p><b>SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST-BYPASS FACILITIES, 200 AMPERE, 0-800 VOLTS</b></p>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 305/APS**

**NOTES:**

1. Eliminate note #12 - APS does not allow 3 Phase 3 Wire services.
2. The Title in the Title Block for this Drawing should read:  
SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST-BYPASS FACILITIES, 200 AMPERE,  
0-600 VOLTS (not 800 VOLTS).





**TABLE - MINIMUM DIMENSIONS**

PANEL TYPE	PANEL RATING* (AMPERS)	"D"	"W" SEE NOTE 4	"XT"	"XN"
STANDARD	100	4-1/2	11-1/2	8	5
HEAVY-DUTY	200	6	13-1/2	11	8

\* Continuous-duty

**NOTES:**

- The panel shown above is typical with the customer's distribution section located to the side of the metering compartment. The distribution section may also be located below the test-bypass compartment (overhead supply only) or above the meter panel.

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EUSERC MANUAL  
**COMBINATION SAFETY-SOCKET PANEL WITH FACTORY  
 INSTALLED TEST BLOCKS AND SERVICE DISCONNECT,  
 100 AND 200 AMPERES, 0-600 VOLTS**

**SECTION  
 300  
 DRAWING  
 305A**

2. Meter socket shall be mounted on a rigid support and attached to the meter socket panel.
3. All panels shall be independently removable. Meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel. test-bypass compartment cover shall be sealable.
4. Minimum test compartment access opening dimension.
5. Test-bypass blocks with rigid insulating barriers shall be furnished installed, and bussed or wired to the meter socket by the manufacturer as follows:
  - a. For 1 $\phi$ , 3-wire, provide two test-bypass blocks mounted in the outer positions and a 4-jaw socket. For 120/208 volts, 1 $\phi$  3-wire, provide two test-bypass blocks mounted in the outer positions and a 5-jaw socket connect the 5th jaw of the meter socket to the neutral lug with a white No. 12 AWG (minimum) copper wire.
  - b. For 3 $\phi$ , 3-wire, provide three test-bypass blocks and a 5-jaw meter socket-connect the line and load poles together at the top of the center position test-bypass block with a bus section and connect the bus to the 5th jaw of the meter socket with a No. 12 AWG (minimum) copper wire. Color used to identify the wire shall not be either white, gray, green or orange.
  - c. For 3 $\phi$ , 4-wire, provide three test-bypass blocks and a 7-jaw meter socket-connect the 7th jaw of the meter socket to the neutral lug with a white No. 12 AWG (minimum) copper wire. For 120/240 volts, 4-wire delta, the right hand test-bypass block shall be the power leg (measures 208 volts-to-ground) and shall be identified with an orange color.
  - d. Test-bypass block connection sequence shall be LINE-LOAD from left to right and shall be clearly identified in 3/4-inch minimum block letters.
  - e. Cable terminals shall be aluminum-bodied mechanical lugs with a range on No. 6 AWG through 1/0 AWG for the 100 ampere test-bypass block and No. 1/0 AWG through 250 KCMIL for the 200 ampere test-bypass block.
6. 1-1/2 inch (minimum) dimension measured from compartment side to the test-bypass block rigid insulating barrier.
7. 3-inch (minimum) dimension measured from the upper test connector stud (stud "A") to the socket meter cover.
8. The neutral terminal may be provided as follows:
  - a. A single mechanical lug or lay-in lug, located on either side or side wall. The lug shall be mounted on a neutral bus bar extending into, and terminating in, the customer section.
  - b. Two mechanical lugs or lay-in lugs, located on either side or side wall. the neutral conductor provided from one of the lugs to the neutral bus in the customer section may be factory or field installed.
  - c. Overhead supply only - a single insulated, bondable, vertical, lay-in lug located on either side or side wall with the neutral conductor installed unbroken through the lug and terminating on the neutral bus in the customer section.
9. Knockouts for the service supply conduit may be cut in the locations shown at the top of the panel.

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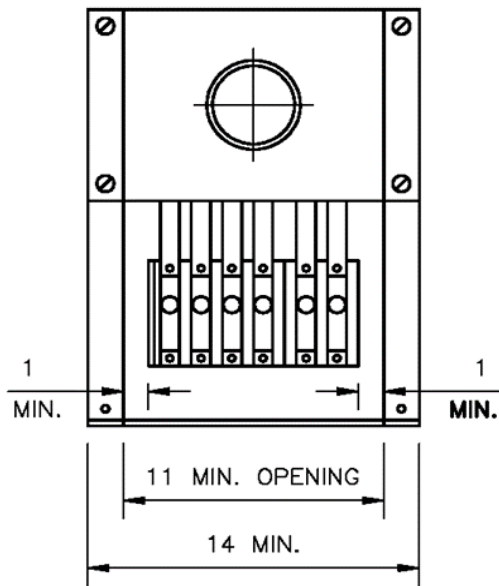
<b>SHEET 2 OF 2</b>	<input type="checkbox"/> Indicates Latest Revision	<input checked="" type="checkbox"/> Completely Revised	<input type="checkbox"/> New Page	<input type="checkbox"/> Information Removed	<b>SECTION 300 DRAWING 305A</b>
	<b>EUSERC MANUAL</b>				
	<b>COMBINATION SAFETY-SOCKET PANEL WITH FACTORY INSTALLED TEST BLOCKS AND SERVICE DISCONNECT, 100 AND 200 AMPERES, 0-600 VOLTS</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 305A/APS**

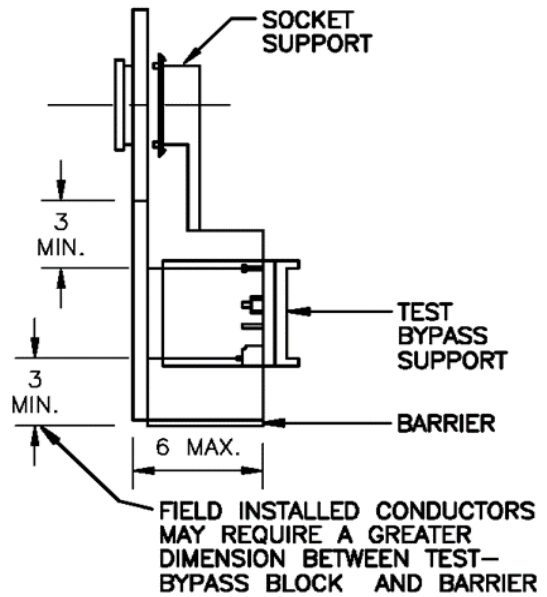
**NOTES:**

1. Eliminate note #5b - APS does not allow 3 Phase 3 Wire services.

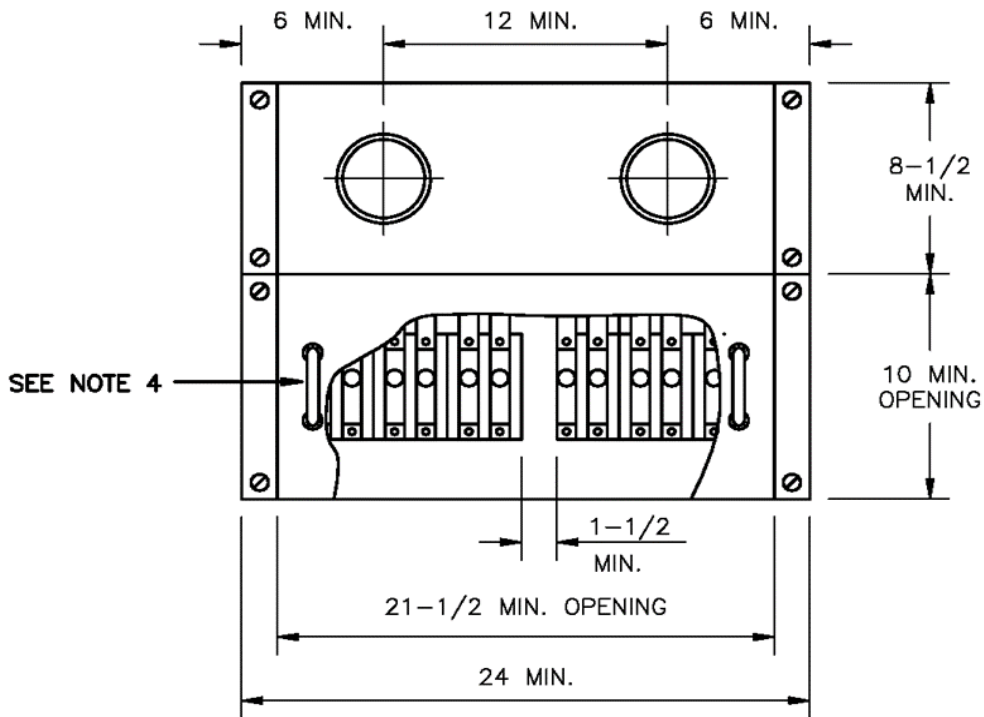




**BARRIER  
(SEE NOTE 6)**



**BARRIER  
(SEE NOTE 6)**



**TEST-BYPASS BLOCK WITH  
4 RIGID INSULATING BARRIERS  
(SEE NOTE 1)**

**ALL DIMENSIONS SHOWN ARE IN INCHES**

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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C						F					

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SHEET  
1 OF 2

EUSERC MANUAL

**SELF-CONTAINED METERS INSTALLED IN  
SWITCHBOARDS 0-200 AMPS, 0-600 VOLTS**

**SECTION  
300  
DRAWING  
306**



**NOTES:**

1. Test-bypass blocks with rigid insulating barriers shall be furnished, installed, and wired or bussed to the meter socket by the manufacturer. Connection sequence shall be LINE-LOAD from left to right and shall be identified IN 3/4 inch block letters.
2. Metered conductors shall not pass through adjacent metering compartments except in enclosed wireways. To insure proper identification of cables in factory cabled equipment, metered cables (except in the test-bypass area), shall be either physically barriered or bundled so as to separate them from un-metered cable or permanently marked and isolated from un-metered cables. Physical barriers will not be required if the un-metered conductors are bus.
3. Meter panels shall be removable with a maximum of two meters per panel. Meter panels shall be provided with a sealing ring for each meter socket and each meter socket shall be rigidly mounted on a support and attached to the meter panel.
4. Test-bypass block cover panel shall be sealable and fitted with a lifting handle. All panels exceeding 16 inches in width shall require two lifting handles.
5. When a neutral is required for metering or testing, an insulated neutral terminal shall be provided behind each test-bypass cover panel. The terminal shall be readily accessible when the cover panel is removed and shall be individually connected to the neutral bus with a minimum size No. 12 AWG copper wire.
6. A factory-installed, full-width insulating barrier shall be located at the bottom of each test-bypass compartment. In addition, a full width and depth isolating barrier shall be located below the bottom test-bypass compartments and above the load terminals of the meter disconnect devices. If a factory-installed rear load wireway is provided, the isolating barrier shall extend back to that wireway. Ventilation openings, when provided, shall not exceed a maximum diameter of 3/8 inch. A slot in the isolating barrier provided for the load conductors supplied from the test-bypass blocks shall be a maximum of 3 inches in depth and may extend to the width of the meter disconnect devices. The slot may not be located in the front 6 inches of the test-bypass compartment insulating barrier.
7. For 3 phase, 4 wire, connect 7th jaw of meter socket to body of neutral lug with a white No. 12 AWG copper wire.
8. For 3 phase, 4 wire delta, identify right hand test-bypass block (2 poles) as power leg. identification to be orange in color.
9. For 3 phase 3 wire, install bus to connect line and load poles together at top of center test-bypass block and connect 5th jaw of meter socket to this bus using minimum No. 12 AWG copper wire. Color used to identify the wire shall not be white, gray, green, or orange.
10. For 1 phase, 3 wire, omit center test-bypass block.
11. For 1 phase, 3 wire, 208Y/120 volts, omit center test-bypass block and connect 5th jaw of meter socket to body of neutral lug with white No. 12 AWG copper wire.
12. Separate line and load conductors shall be installed by the contractor or manufacturer for each meter socket.
13. All access panels shall be sealable. See drawing 300, note II (I).
14. All panels shall be independently removable. Meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on support and attached to the meter panel. Test-bypass compartment cover panel shall be sealable and permanently labeled: "DO NOT BREAK SEALS. NO FUSES INSIDE".

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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	EUSERC MANUAL			
	<b>SELF-CONTAINED METERS INSTALLED IN SWITCHBOARDS 0-200 AMPS, 0-600 VOLTS</b>			
<b>SECTION 300 DRAWING 306</b>				

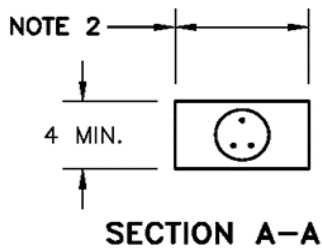
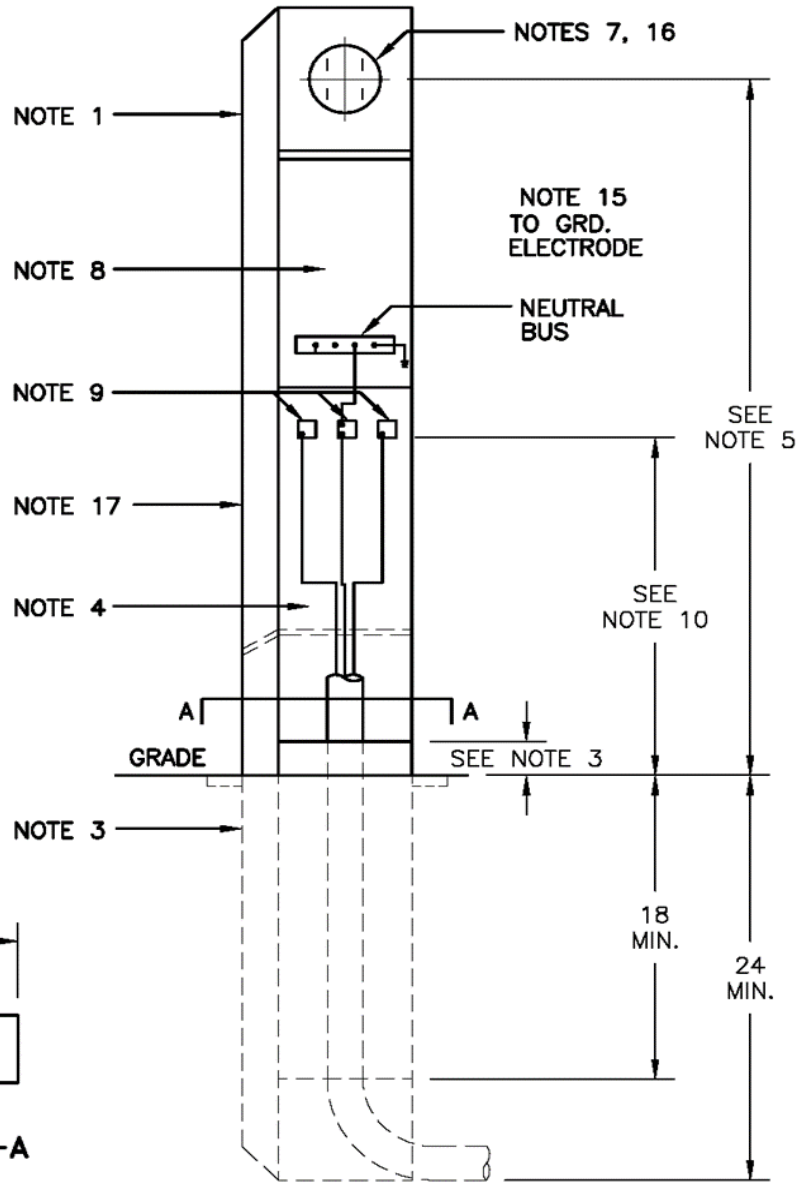
**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 306/APS**

**NOTES:**

1. Eliminate note #9 - APS does not allow 3 Phase 3 Wire services.
2. Minimum width of NEMA 3R Cabinet shall be 30". Dimensioned widths of 14 & 24 inches shown on EUSERC dwg. no. 306, sht. 1 of 2 are not acceptable.







**NOTES:**

**GENERAL CONSTRUCTION:**

1. This type post shall have minimum rating of 100 amperes. Construction, material, and corrosive-resistant finish shall be approved by a Committee-recognized test laboratory.
2. Minimum width of access opening shall be 7-1/2 inches.
3. The minimum depth of the post in the ground shall be 24 inches, with openings at the base to permit the service lateral conduit or conductors to sweep into the post from the front (meter side). A fixed panel shall extend 2 inches minimum to 6 inches maximum above grade, and 18 inches minimum below grade.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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1 OF 2

EUSERC MANUAL  
**UNDERGROUND SERVICE AND METER POST FOR  
 MOBILE HOME OR NON-COMMERCIAL USE 200  
 AMPERES MAXIMUM, 240 VOLTS MAXIMUM**

**SECTION  
 300  
 DRAWING  
 307**

4. Adequate ventilation shall be provided to inhibit the condensation of moisture within the enclosure.
5. The minimum meter height shall be 36 inches above the grade line when the meter is enclosed or 48 inches when exposed. Consult the serving agency for permissible deviations.
6. The service cable pull and terminating section shall be accessible from either the front or rear of the post by removing an 8 inch minimum width sealable panel (or panels). The removable panel (or panels) shall extend from the top of the fixed panel (See note 3) and when removed, allow full access to the terminating lugs. The service cable pull and terminating section space shall be restricted to serving agency use.
7. If the meter is enclosed, the enclosing cover shall be hinged and self-supporting, equipped with a reading window and be removable for meter testing or inspection.
8. The service main disconnect and power outlet section shall have barriers installed to prevent access to the service cable pull and termination section and to un-metered conductors which connect to the socket.

**TERMINATING FACILITIES, WIRING AND CONNECTIONS:**

9. Termination for service conductors shall be aluminum-bodied mechanical lugs accepting two sets of conductors with a range of No. 2 AWG through 350 KCMIL (consult the utility for permissible deviations).
10. Lug height, measured from the bottom of the terminating lug from the top of the fixed panel, shall be a 18 inches minimum to 48 inches maximum.
11. The space between the lugs, from lugs to sides of post, from lugs to any grounded surface, or from lugs to panel above, shall be 1-1/2 inches minimum. Rigid insulating barriers, projecting 1/4 inch minimum beyond any energized parts, are required when the required lug spacing is reduced.
12. Terminating lugs may be positioned either in line or staggered and access shall be unobstructed when all service conductors are in place.
13. The conductors which extend to the meter socket shall be connected at the service terminating lugs independently of the connection for the service laterals.
14. The pedestal shall be factory-wired from the service terminating lugs to the meter socket. The conductors shall be located in a separate or barriered raceway.

**GROUNDING FACILITIES:**

15. An accessible equipment grounding lug shall be provided.

**METERING FACILITIES:**

16. Meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel.

**ENCLOSURE ATTACHMENTS:**

17. For authorization to attach telephone and cable TV terminating facilities to the post, consult the serving agency.

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<b>SHEET 2 OF 2</b>	<b>EUSERC MANUAL</b> <b>UNDERGROUND SERVICE AND METER POST FOR MOBILE HOME OR NON-COMMERCIAL USE 200 AMPERES MAXIMUM, 240 VOLTS MAXIMUM</b>				<b>SECTION 300 DRAWING 307</b>

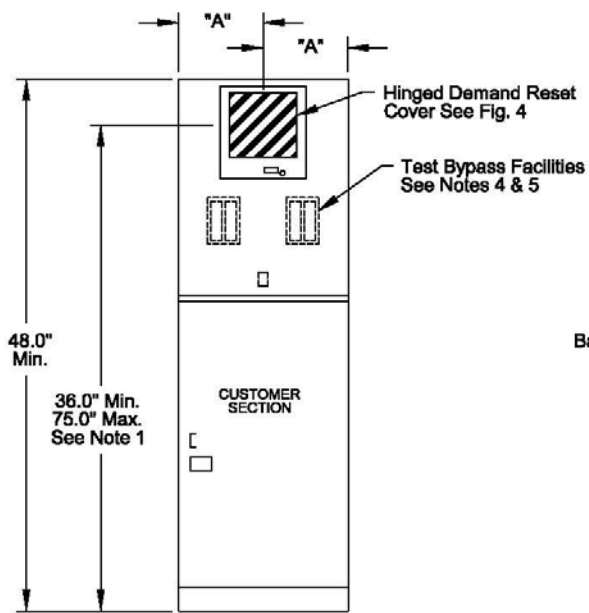


Fig. 1  
FRONT VIEW

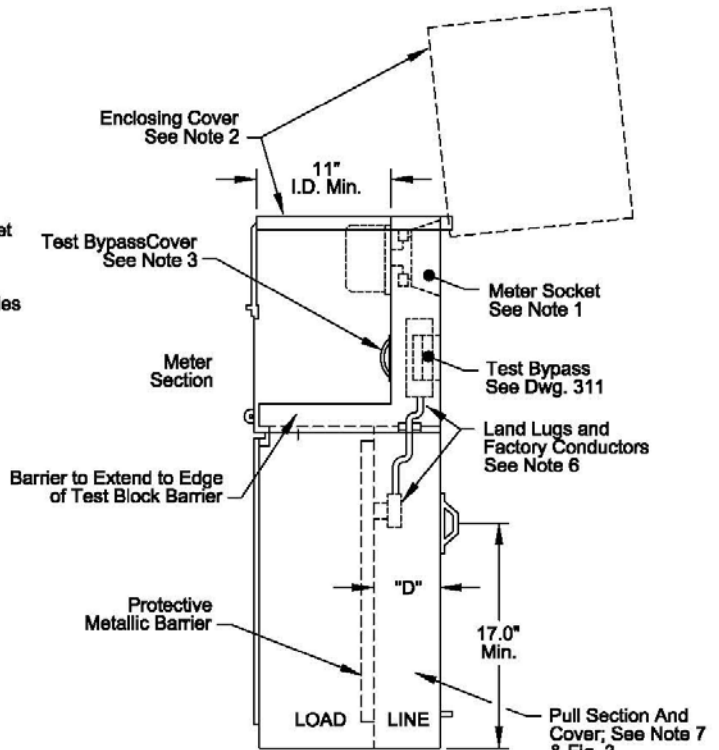


Fig. 2  
SIDE VIEW

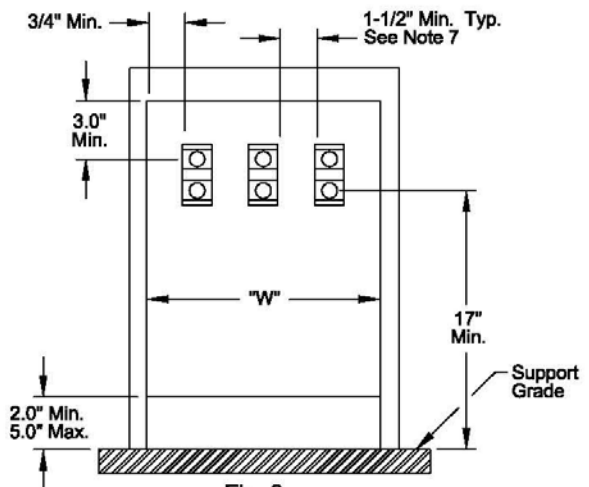


Fig. 3  
WIREWAY PULL SECTION

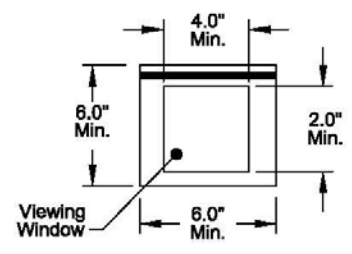


Fig. 4  
FRONT VIEW  
Hinged Demand Reset  
with Polycarbonate View

Service	A**	W*
1 Phase	10"	10-1/2
3 Phase		12-1/2

\*\* See Note 2  
\* See Note 6

All Dimensions Shown Are In Inches

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	Updated Views				10/18	D					
B						E					
C						F					

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SHEET  
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EUSERC MANUAL  
**COMMERCIAL HINGED TOP SERVICE PEDESTALS  
0-200 AMPERES, 0-600 VOLTS**

SECTION  
300  
DRAWING  
308

**Notes:**

1. The meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel. Ringless sockets are not acceptable. Meter height is measured from the center of the meter socket.
2. The meter socket shall be enclosed and the enclosing cover shall be:
  - a. Hinged to allow the top front and sides to be rotated back or laterally as one unit to expose the metering section. The lifting force required to open the cover shall not exceed 25 pounds.
  - b. Equipped with a lifting handle.
  - c. Sealable and lockable with a padlock having a 5/16 inch lack shaft.
  - d. Provided with a demand reset cover with a viewing window (See Fig. 3). The reset cover shall be sealable and lockable with a padlock having 5/16 inch lock shaft.
3. Test-bypass compartment covers shall be sealable and provided with a lifting handle. Covers exceeding 16 inches in width shall require two lifting handles.
4. Test-bypass blocks with rigid barriers shall be furnished, installed and wired or bussed to the meter socket by the manufacturer. Connection sequences shall be LINE-LOAD from left to right and clearly identified by 3/4 inch minimum black letter labeling. See Drawings 311 and 312 for test-bypass block details.
5. Test-bypass section shall be installed with the following clearances:
  - a. 3-inches of vertical clearance from the upper test connector stud to the upper compartment access opening and 3-inches from the center of the cable terminal screw to the lower compartment access opening.
  - b. 1-1/2 inches of side clearance from the rigid insulating barriers to the compartment sides and 1 inch t to the compartment access opening.
6. When a neutral is required for metering or testing, an insulated neutral terminal shall be provided behind the test-bypass compartment cover. The terminal shall be readily available when the cover is removed and shall be connected to the neutral terminal in the pull section by a minimum size no. 12 copper wire.
7. The terminating pull section shall:
  - a. Comply with minimum dimensions shown in Table an Sheet 1, be equipped with lifting handles, and accept a minimum 3-inch conduit. The "W" dimension is measured between the access opening return flanges.
  - b. Be equipped with aluminum-bodied, pressure-type lugs with range of No. 6 AWG through 250 KCMIL, for termination of the service supply conductors. Insulated cable or bus shall be provided between the terminating lugs and the test-bypass facilities.
  - c. A 1-1/2" minimum spacing shall be provided between the energized lugs or bussing. The 1-1/2" spacing may be reduced if rigid insulating barriers (1/16" minimum thickness) are provided which extend a minimum of 1/2" beyond any exposed energized part when the maximum wire size is installed.
  - d. Have a protective metal barrier (16 gauge minimum) installed between the pull section and the customer section. The barrier shall provide 1/4-inch minimum clearance between the customer section wall and barrier to prevent damage by screws and bolts from protruding into the pull section area.
8. The utility pull section cover shall be equipped with a lifting handle and be sealable and lockable with a padlock having a 5/16 inch lock shaft.
9. Internal equipment attached to the outer walls of the enclosure shall be secured in place with devices that may not be loosened from the outside. Screws or bolts requiring special tools for installation or removal are not acceptable.
10. For structural mounting and support of the pedestal consult the serving agency.

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	Updated Notes				10/18	D					
B						E					
C						F					

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	EUSERC MANUAL			
	<b>COMMERCIAL HINGED TOP SERVICE PEDESTALS 0-200 AMPERES, 0-600 VOLTS</b>			
				<b>SECTION 300 DRAWING 308</b>



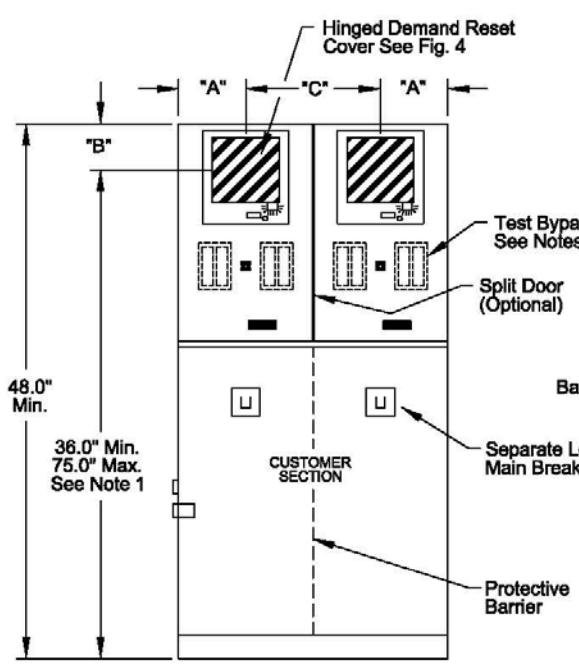


Fig. 1  
FRONT VIEW

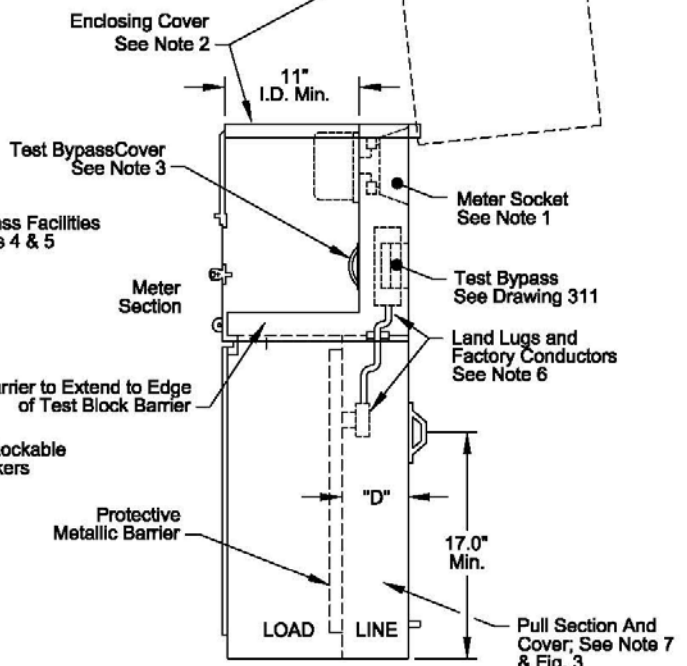


Fig. 2  
SIDE VIEW

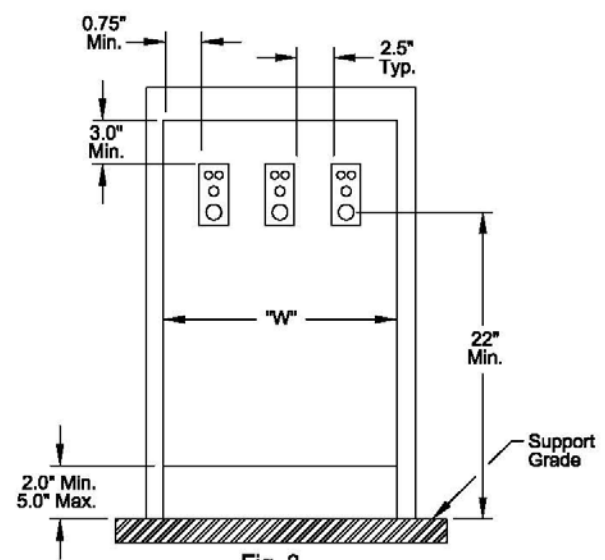


Fig. 3  
WIREWAY PULL SECTION

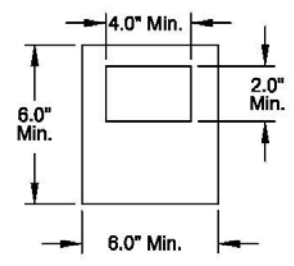


Fig. 4  
FRONT VIEW  
Hinged Demand Reset  
with Polycarbonate View

Service	"A"	"B"	"C"	"D"	"W"
1 Phase	6.0"	4.5"	12.0"	5.25"	12.0"

All Dimensions Shown Are In Inches

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	Added as new EUSERC Drawing				05/18	D					
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	EUSERC MANUAL				
	<b>DUAL SOCKET COMMERCIAL HINGED TOP SERVICE PEDESTAL 0-400 AMPERES, 0-600 VOLTS SINGLE PHASE</b>				

**Notes:**

1. The meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel. Ringless sockets are not acceptable. Meter height is measured from the center of the meter socket. Meter socket shall be no larger than 200A. Max. per section.
2. The meter socket shall be enclosed and the enclosing cover shall be:
  - a. Hinges to allow the top front and sides to be rotated back or laterally as one unit metering compartment. The "A" dimension applies then the metering compartment side panels are fixed in place and obstruct the meter socket side clearance. The lifting force required to open the cover shall not exceed 25 pounds.
  - b. Equipped with a lifting handle.
  - c. Sealable and lockable with a padlock having a 5/16" inch lock shaft.
  - d. Provide with a demand reset cover with a viewing window (See Fig. 3). The reset cover shall be sealable and lockable with a padlock having 5/16 inch lock-shaft.
3. Test-bypass compartment cover shall be sealable and provided with a lifting handles, covers exceeding 16 inches in width shall require two lifting handles.
4. Test-bypass blocks with rigid barriers shall be furnished, installed and wired or bussed to the master socket by the manufacturer. Connection sequence shall be LINE-LOAD from left to right and clearly identified by 3/4 inch minimum block letter labeling. See Drawing 311 and 312 for test-bypass block details.
5. The terminating pull section shall:
  - a. 3 inches of vertical clearance for the upper test connector stud to the upper compartment access opening and 3 inches from the center of the center of the cable terminal screw to the lower compartment access opening.
  - b. 1-1/2 inches of side clearance from the rigid insulating barriers to the compartment sides and 1 inch to the compartment access opening.
6. When a neutral is required for metering or testing, an insulated neutral terminal shall be provided behind the test-bypass compartment cover. The terminal shall be readily available when the cover is removed and shall be connected to the neutral terminal in the pull section by a minimum size no. 12 copper wire.
7. The terminating pull section shall:
  - a. Comply with minimum dimensions shown in Table on Sheet 1, be equipped with lifting handles, and accept a minimum 3-inch conduit. The "W" dimension is measured between the access opening return flanges.
  - b. Be equipped with aluminum-bodied, pressure-type lugs with range of No. 6 AWG through 350 KCMIL, for termination of the service supply conductors. Insulated cable or bus shall be provided between the terminating lugs and the test-bypass facilities.
  - c. 1-1/2" minimum spacing shall be provided between the energized lugs or bussing. The 1-1/2" spacing may be reduced if rigid insulating barrier (1/16" minimum thickness) are provided which extend a minimum of 1/2" beyond any exposed energized part when the maximum wire size installed.
  - d. Have a protective metal barrier (16 gauge minimum) installed between the pull section and the customer section. The barrier shall provide 1/4 inch minimum clearance between the customer section wall and barrier to prevent damage by screws and bolts from protruding into the pull section area.
8. The utility pull section cover shall be equipped lifting handle and be sealable and lockable with a padlock having a 5/16 inch lockshaft.
9. Internal equipment attached to the outer walls of the enclosure shall be secured in place with devices that may not be loosened from outside. Screw or bolts requiring special tools for installation or removal are not acceptable.
10. For structural mounting and support of the pedestal consult the serving agency.

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	Added as new EUSERC Drawing				05/18	D					
B						E					
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	<b>EUSERC MANUAL</b>			
	<b>DUAL SOCKET COMMERCIAL HINGED TOP SERVICE PEDESTAL 0-400 AMPERES, 0-600 VOLTS SINGLE PHASE</b>			
<b>SECTION 300 DRAWING 308A</b>				

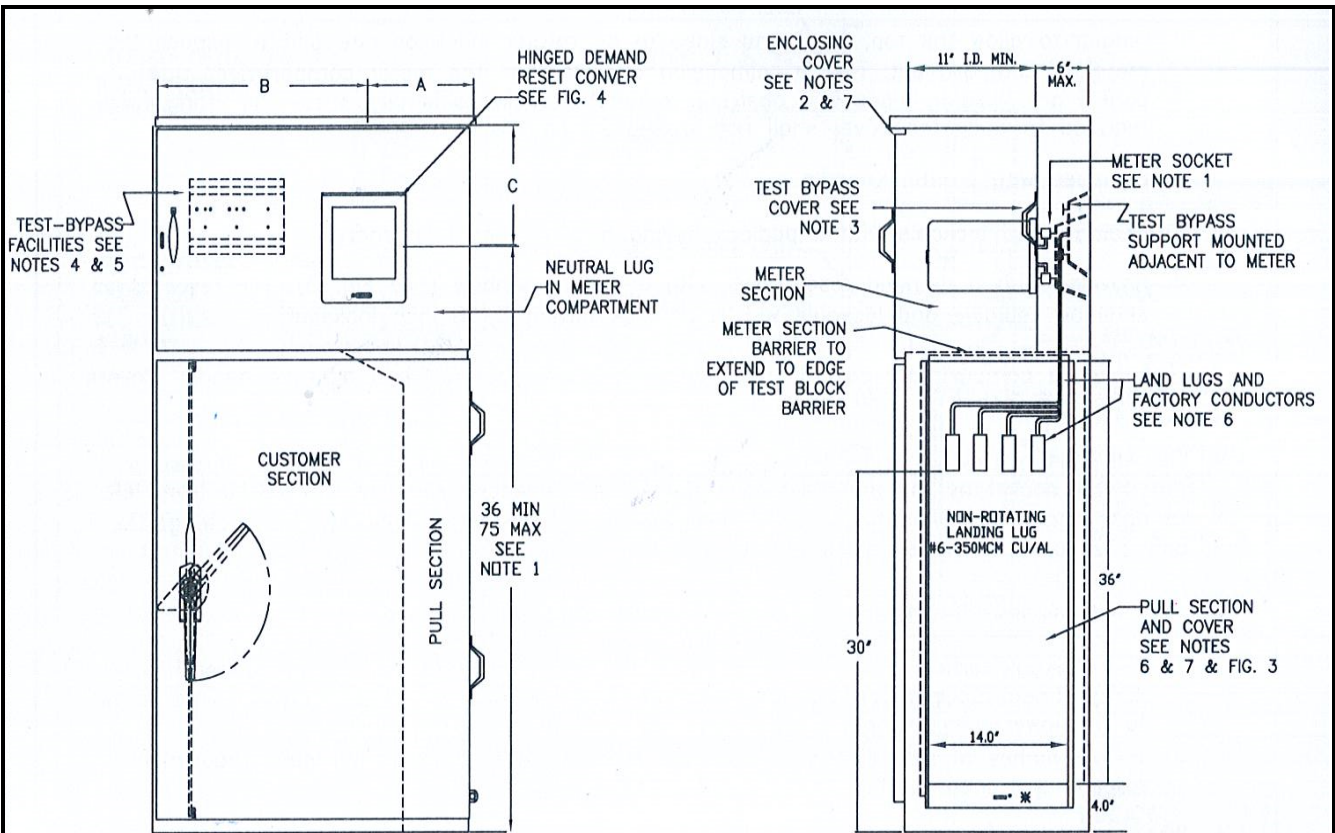


FIG. 1  
FRONT VIEW

FIG. 2  
SIDE VIEW

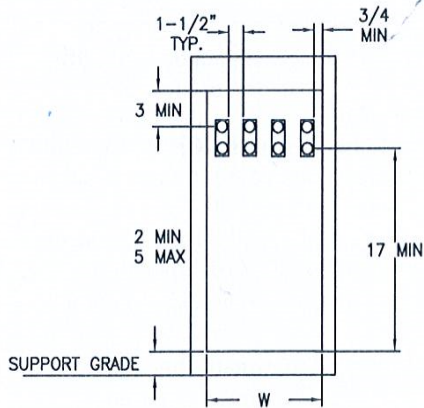


FIG. 3  
WIREWAY PULL SECTION

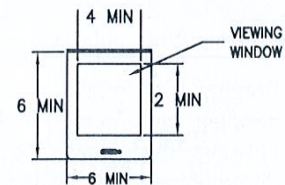


FIG. 4

HINGED DEMAND RESET  
WITH POLYCARBONATE VIEWING

TABLE 1 - MINIMUM DIMENSIONS

SERVICE	W*	A**	B**	C**
1 PHASE	10-1/2	10	20	9
3 PHASE	12-1/2			

\* SEE NOTE 6 & 7

\*\* SEE NOTE 2 & 7

ALL DIMENSIONS ARE SHOWN IN INCHES

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	UPDATED DRAWING				1/16	D					
B						E					
C						F					

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EUSERC MANUAL  
COMMERCIAL FIXED TOP SERVICE PEDESTALS  
0-200 AMPERES, 0-600 VOLTS

SECTION  
300  
DRAWING  
309



NOTES:

1. The meter panel shall be provided with a sealing ring and the meter socket shall be rigidly mounted on a support and attached to the meter panel. Ringless sockets are not acceptable. Meter height is measured from the center of the meter-socket.
2. The meter shall be enclosed and the enclosing cover shall meet the following conditions:
  - a. Constructed with fixed top and sided with access to the metering compartment provided through a hinged door. Meter socket shall be located on the hinged side of the enclosure. The hinged door shall be equipped with a device to hold the door in the open position at 90 degrees or more.

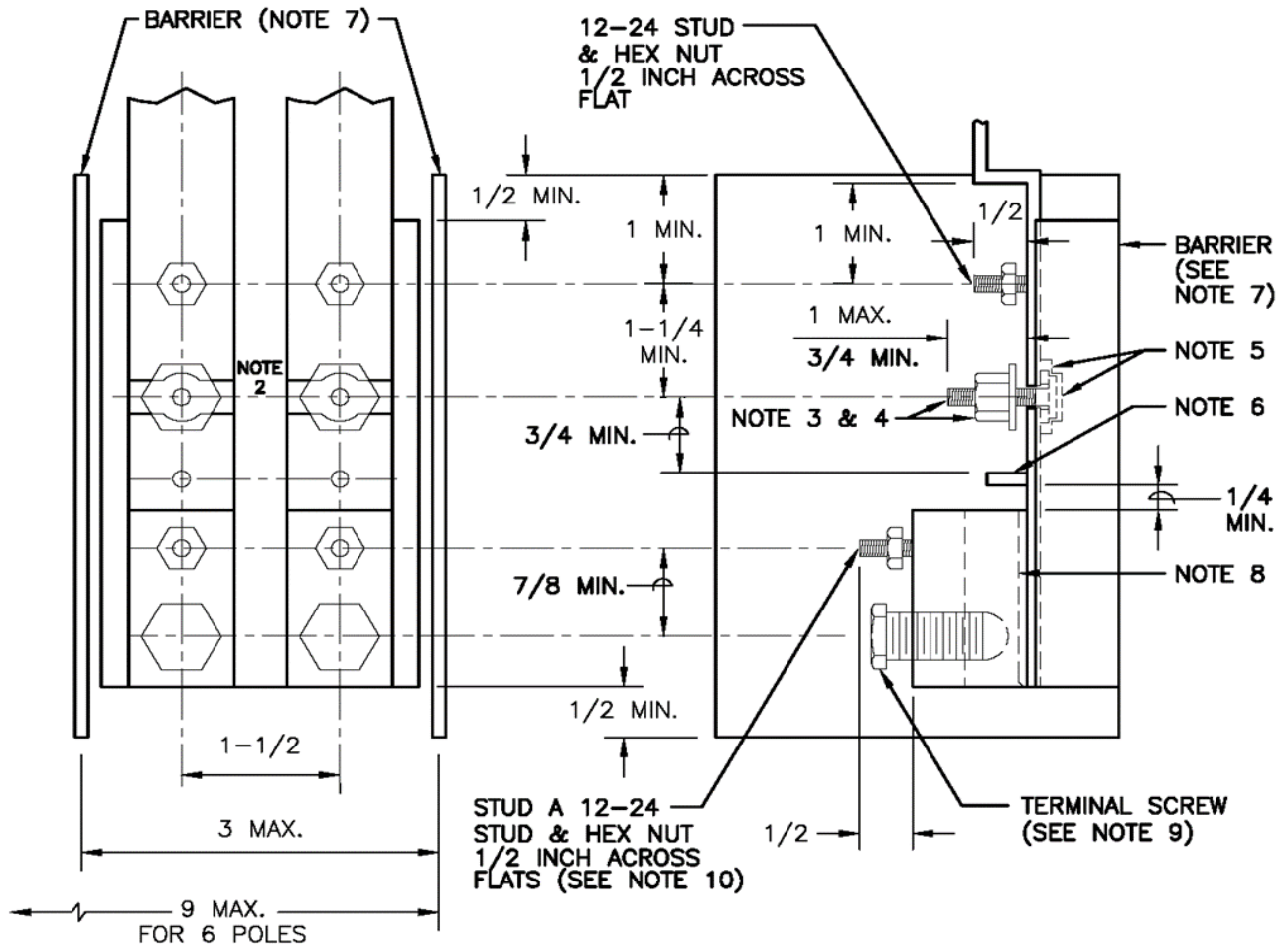
Note: "A" and "B" dimensions are measured from the center of the meter socket to the access opening return flanges.

  - b. Sealable and lockable with a padlock having a 5/16-inch lock shaft.
  - c. Provided with a demand reset cover with a viewing window (see fig. 4). The reset cover shall be sealable and lockable with a padlock having a 5/16-inch lock shaft.
3. Test-bypass compartment covers shall be sealable and fitted with a lifting handle. Covers exceeding 16 inches in width shall require two lifting handles.
4. Test-bypass blocks with rigid barriers shall be furnished, installed and wired or bussed to the meter socket by the manufacturer. Connection sequences shall be LINE-LOAD from left to right and clearly identified by 3/4 inch minimum block letter labeling. See Drawing 311 and 312 for test-bypass block details.
5. Test-bypass shall be installed with the following clearances:
  - a. 3-inches of vertical clearance from the upper test connector stud to the upper compartment access opening and 3-inches from the center of the cable terminal screw to the lower compartment access opening.
  - b. 1-1/2 inches of side clearance from the rigid insulating barriers to the compartment sides and 1 inch to the compartment access openings.
6. When a neutral is required for metering or testing, an insulated neutral terminal shall be provided behind the test-bypass compartment cover. The terminal shall be readily available when the cover is removed and shall be connected to the neutral terminal in the pull section by a minimum size no. 12 copper wire.
7. The terminating pull section shall:
  - a. Comply with the minimum dimensions shown in Table on sheet 1, be equipped with lifting handles, and accept a minimum 3-inch conduit. The "W" dimension is measured between the access opening return flanges.
  - b. Be equipped with an aluminum-bodied, pressure-type lugs, with a range of No. 6 AWG through 350 Kcmil, for termination of the service supply conductors. Insulated cable or bus shall be provided between the termination lugs and the test-bypass facilities.
  - c. A 1-1/2" minimum spacing shall be provided between the energized lugs or bussing. The 1-1/2" spacing may be reduced if rigid insulating barriers (1/16" minimum thickness) are provided which extend a minimum of 1/2" beyond any exposed energized part when the maximum wire size is installed
  - d. Have a protective metal barrier (16 gauge minimum) provided between the pull section and the customer distribution section. There shall be a 1/4 inch minimum clearance between the customer section wall and the barrier to prevent screws and bolts from protruding into the pull section.
8. Utility compartment covers (i.e., meter cover, demand reset cover, and pull section) shall be sealable and lockable with a padlock having a 5/16 inch lock shaft.
9. Internal equipment attached to the outer walls of the enclosure shall be secured in place with devices that may not be loosened from the outside. Screws or bolts requiring special tools for installation or removal are not acceptable.
10. For structural mounting and support of the pedestal consult the serving agency.

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A	UPDATED DRAWING				1/16	D					
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C						F					

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	EUSERC MANUAL			
	<b>COMMERCIAL FIXED TOP SERVICE PEDESTALS 0-200 AMPERES, 0-600 VOLTS</b>			
<b>SECTION 300 DRAWING 309</b>				





**NOTES:**

1. All designs must receive approval of the EUSER Committees prior to production.
2. Strike distance between upper and lower bus sections shall not be less than 1/4 inch when the circuit-closing nut is backed off.
3. Circuit-closing nut shall be a hex nut 5/8 inch across flats with plated copper washer attached and have threads counter-bored at bottom to facilitate re-installation. Bolt head shall be secured in place to prevent turning and backout.
4. The circuit-closing nut and bolt assembly shall maintain the applied contact pressure between the plated copper washer and the bus members of the test-bypass block.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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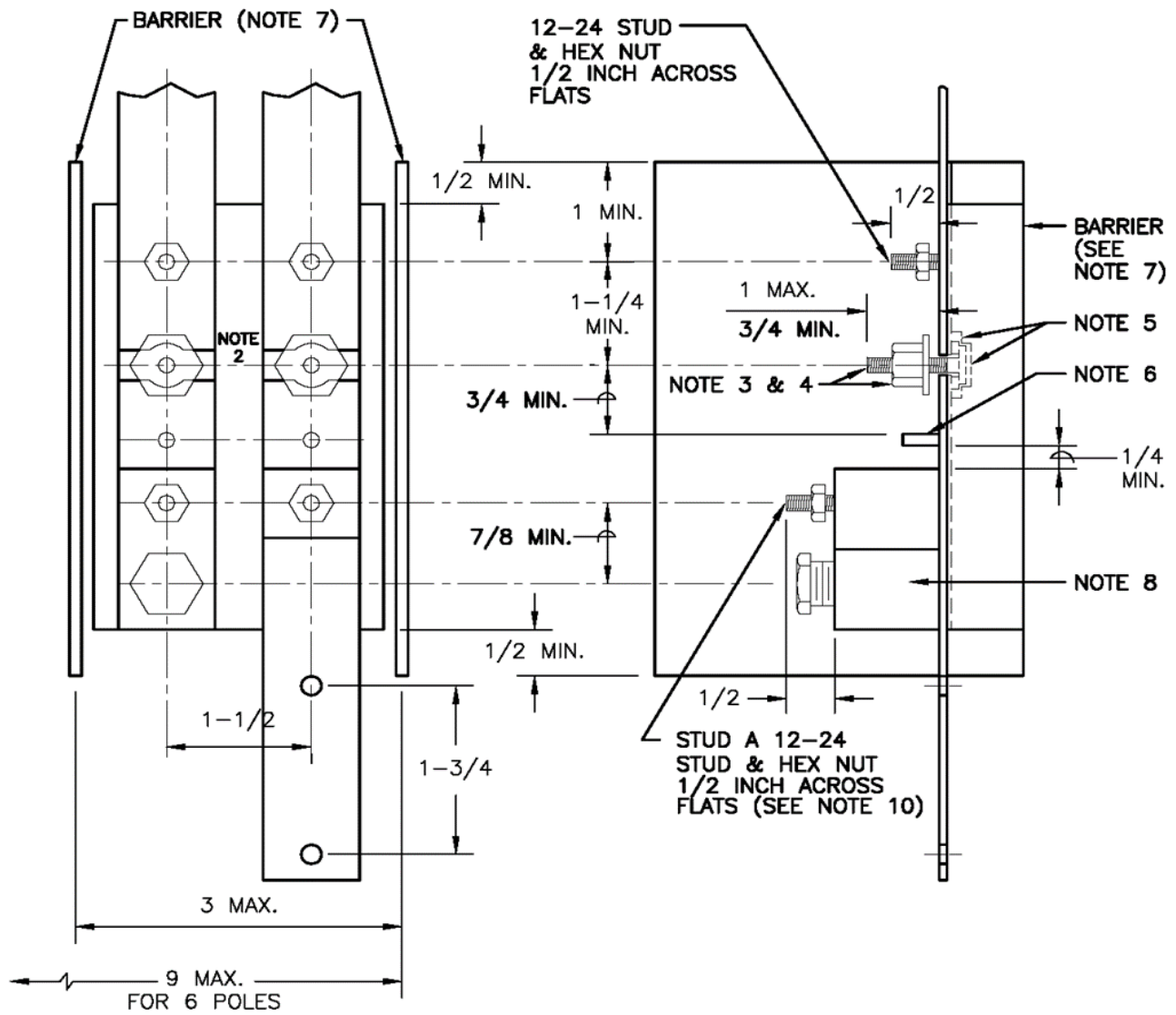
EUSERC MANUAL  
**TEST BYPASS/DISCONNECT BLOCK FOR SAFETY  
 SOCKETS 100 AND 200 AMPERES, 0-600 VOLTS**

**SECTION  
 300  
 DRAWING  
 311**

5. Insulating washer shall be made from dimensionally stable, nontracking material and shall provide a minimum of 1/8 inch creep distance between the bolt and the bus sections. Bus sections shall be plated.
6. Wire stops shall extend to center of terminal opening or beyond.
7. Rigid insulating barriers shall project at least 1/4 inch beyond any energized parts when the maximum wire size is installed.
8. Cable terminating facilities shall be aluminum bodied mechanical lugs (for required conductor range, see Dwgs, 304 and 305). The opening shall extend through the terminal body and, if wire hole is round, shall be chamfered as necessary to facilitate installation of the largest size wire.
9. The terminal screw may be of Allen type (3/16 inch across flats for 100 amp, 5/16 inch across flats for 200 amp).
10. Stud "A" may be located either on the terminal body, on the bus member between the circuit-closing nut and the wire stop, or incorporated as part of the wire stop.

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	EUSERC MANUAL			
	<b>TEST BYPASS/DISCONNECT BLOCK FOR SAFETY SOCKETS 100 AND 200 AMPERES, 0-600 VOLTS</b>			
SECTION 300 DRAWING 311				



**NOTES:**

1. All designs must receive approval of the EUSER Committee prior to production.
2. Strike distance between upper and lower bus sections shall not be less than 1/4 inch when the circuit-closing nut is backed off.
3. Circuit-closing nut shall be a hex nut 5/8 inch across flats with plated copper washer attached and have threads counter-bored at bottom of facilitate re-installation. Bolt head shall be secured in place to prevent turning and backout.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL

**TEST BYPASS/DISCONNECT BLOCK FOR SAFETY  
SOCKETS 100 AND 200 AMPERES, 0-600 VOLTS  
(BUSSED AND/OR CABLE TERMINATIONS)**

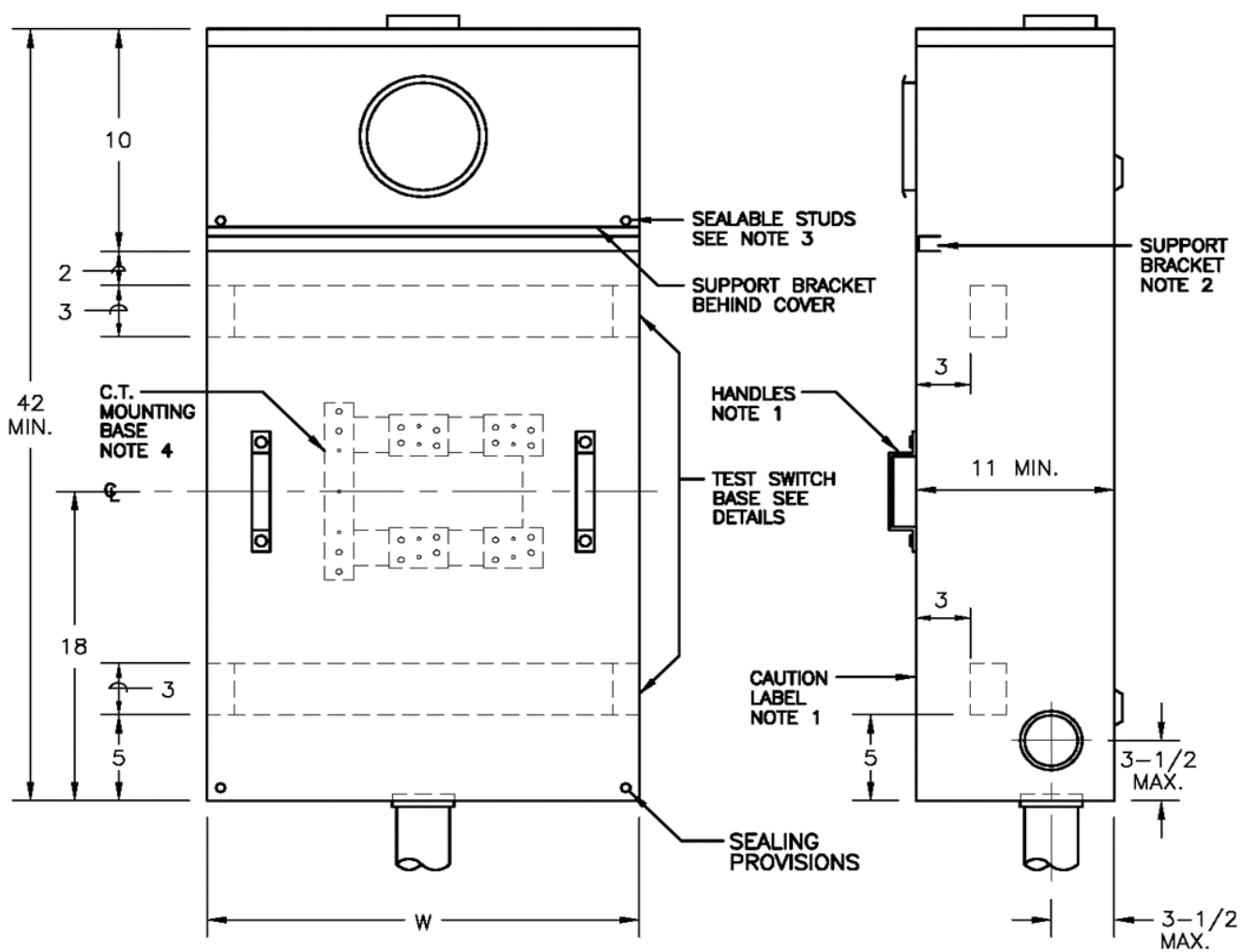
**SECTION  
300  
DRAWING  
312**

4. The circuit-closing nut and bolt assembly shall maintain the applied contact pressure between the plated copper washer and the bus members of the test-bypass block.
5. Insulating washer shall be made from dimensionally stable, nontracking material and shall provide a minimum of 1/8 inch creep distance between the bolt and the bus sections. Bus sections shall be plated.
6. Wire stops are not required if line and/or load is connected with bus bar. If cable terminals are used, Drawing 311 construction requirements shall apply.
7. Rigid insulating barriers shall project at least 1/4 inch beyond any energized parts when the maximum wire size is installed.
8. Terminals shall be aluminum bodied (for required conductor range, see Dwgs. 304 and 305). The opening shall extend through the terminal body and, if wire hole is round, shall be chamfered as necessary to facilitate installation of the largest size wire.
9. The terminal screw may be of Allen type (3/16 inch across flats for 100 amp, 5/16 inch across flats for 200 amp).
10. Stud "A" may be located either on the terminal body, on the bus member between the circuit-closing nut and the wire stop, or incorporated as part of the wire stop.

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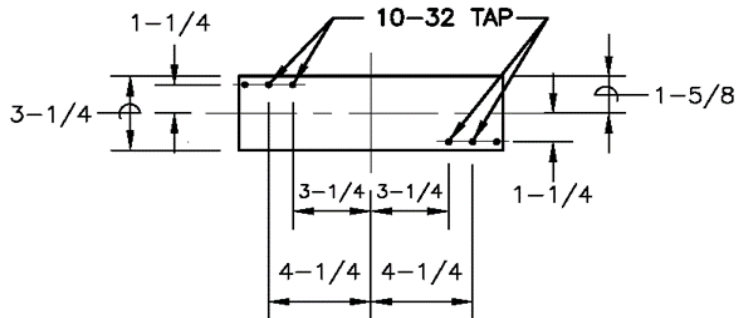
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	EUSERC MANUAL			
	<b>TEST BYPASS/DISCONNECT BLOCK FOR SAFETY SOCKETS 100 AND 200 AMPERES, 0-600 VOLTS (BUSSED AND/OR CABLE TERMINATIONS)</b>			

<b>SECTION 300 DRAWING 312</b>
--------------------------------------------



**FRONT VIEW**

**SIDE VIEW**



**REMOVABLE TEST SWITCH MOUNTING BASE DETAIL**

**MINIMUM BOX DIMENSIONS**

W (MIN.)	
3 PHASE, 4 WIRE WYE OR DELTA	SINGLE PHASE 3 PHASE, 3 WIRE
36"	24"

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL

**COMBINATION CURRENT-TRANSFORMER CABINET AND  
METER SOCKET PANEL FOR OVERHEAD SERVICE  
400-800 AMPERES, MAXIMUM 0-600 VOLT**

**SECTION  
300  
DRAWING  
313**

**NOTES:**

1. The current-transformer compartment cover panel(s) shall be limited to a maximum of 9 square feet in area, shall have two lifting handles and a caution label reading "DO NOT BREAK SEALS, NO FUSES INSIDE".
2. A panel support bracket shall be provided as shown for the meter and current transformer panels. The meter panel shall be attached to the bracket with securing screws to prevent the panel from pulling out when the meter is removed from the socket.
3. The meter panel and current transformer compartment cover shall be sealable. See Drawing 300, note 11(l).
4. See Drawings 328A, 328B and 329B for CT, mounting base details.
5. Consult the Utility for 800 ampere applications.

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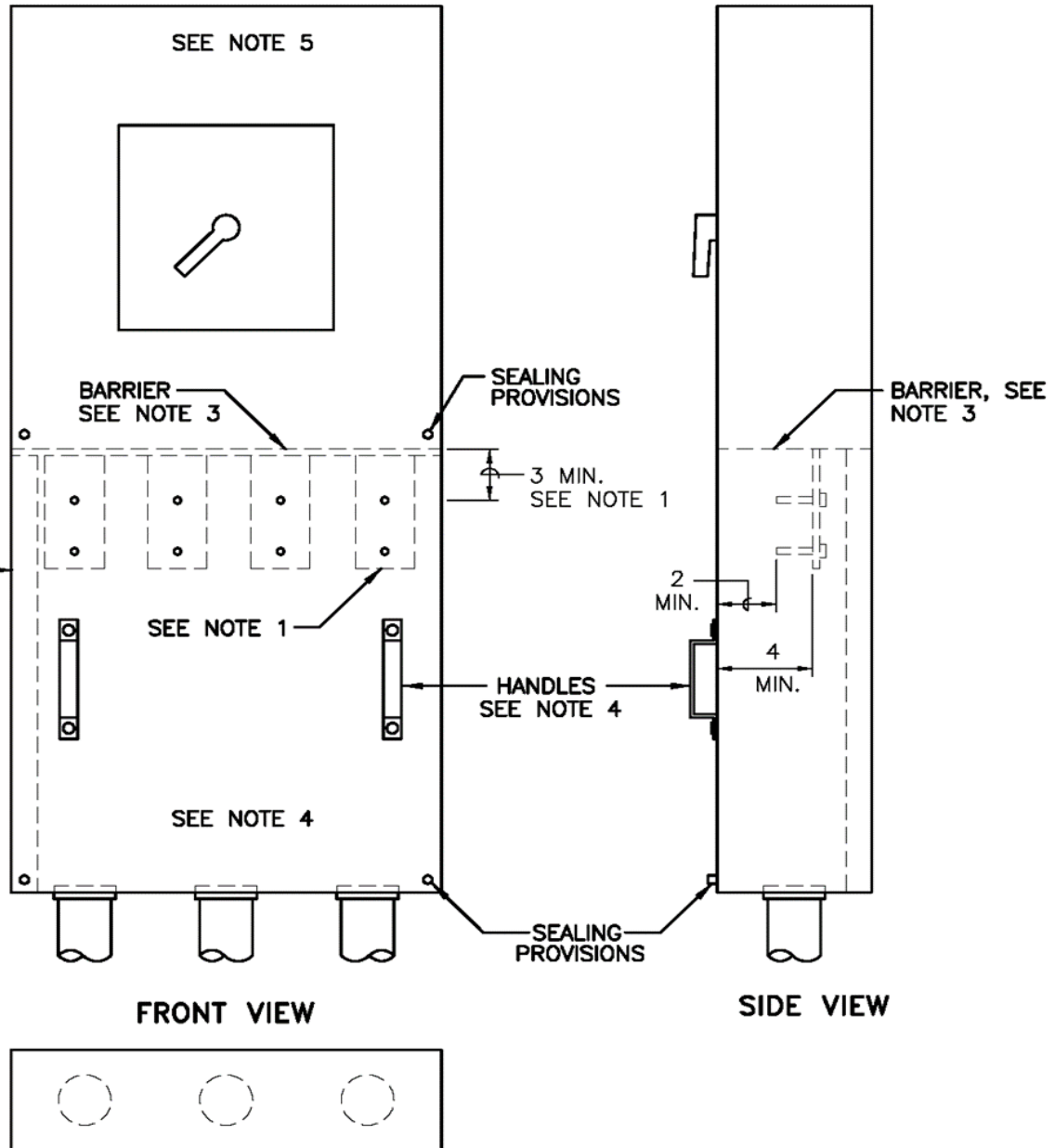
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	EUSERC MANUAL				
	<p><b>COMBINATION CURRENT-TRANSFORMER CABINET AND METER SOCKET PANEL FOR OVERHEAD SERVICE 400-800 AMPERES, MAXIMUM 0-600 VOLT</b></p>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 313/APS**

**NOTES:**

1. Device shown is allowable on Overhead Services only, unless Underground Termination Section is included.
2. Device must meet APS's available Fault Current requirements. See Section 800.





**NOTES:**

1. A vertical clearance of 3 inches minimum shall be maintained between the centerline of the top bolts of the terminating facilities to any obstruction. See Drawing 343 for terminating enclosure dimensions, and terminating facility clearances and construction details.

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EUSERC MANUAL  
**COMBINATION DISCONNECTING DEVICE AND  
 TERMINATING ENCLOSURE 1200 AMPERES, 0-600 VOLT**

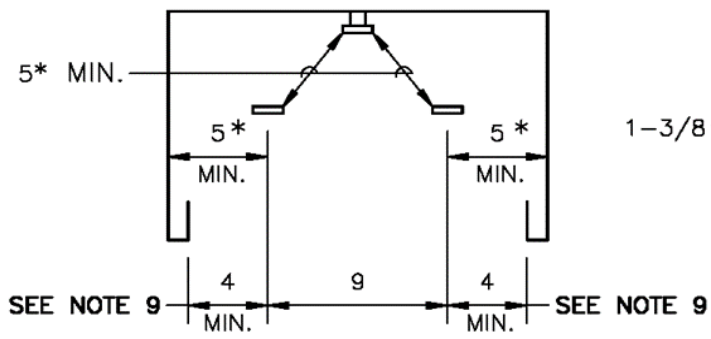
**SECTION  
 300  
 DRAWING  
 315**



2. The grounding electrode conductor may be installed in a fully enclosed, factory installed wireway located in either back corner of the pullbox. The raceway shall not impede the serving utility's required working space or reduce any specified clearances.
3. A full width and depth, insulated, rigid barrier shall be provided to separate the termination and main disconnect device compartments.
4. Terminating enclosure covers shall be:
  - a. Independent of other equipment and removable without disturbing adjacent panels.
  - b. Sealable, and provided with two lifting handles, and limited to maximum of 9 square feet in area.
5. The main disconnect cover shall be sealable.

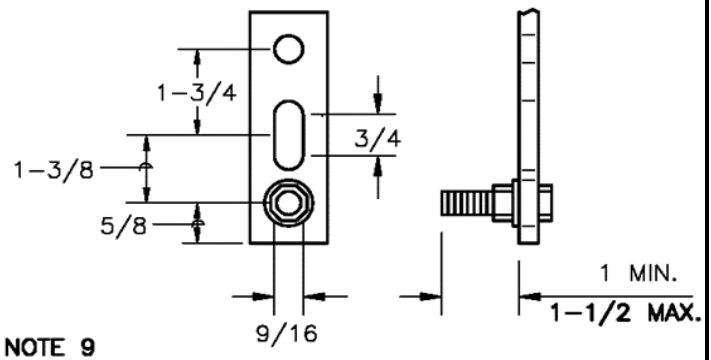
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	EUSERC MANUAL				
	<b>COMBINATION DISCONNECTING DEVICE AND TERMINATING ENCLOSURE 1200 AMPERES, 0-600 VOLT</b>				

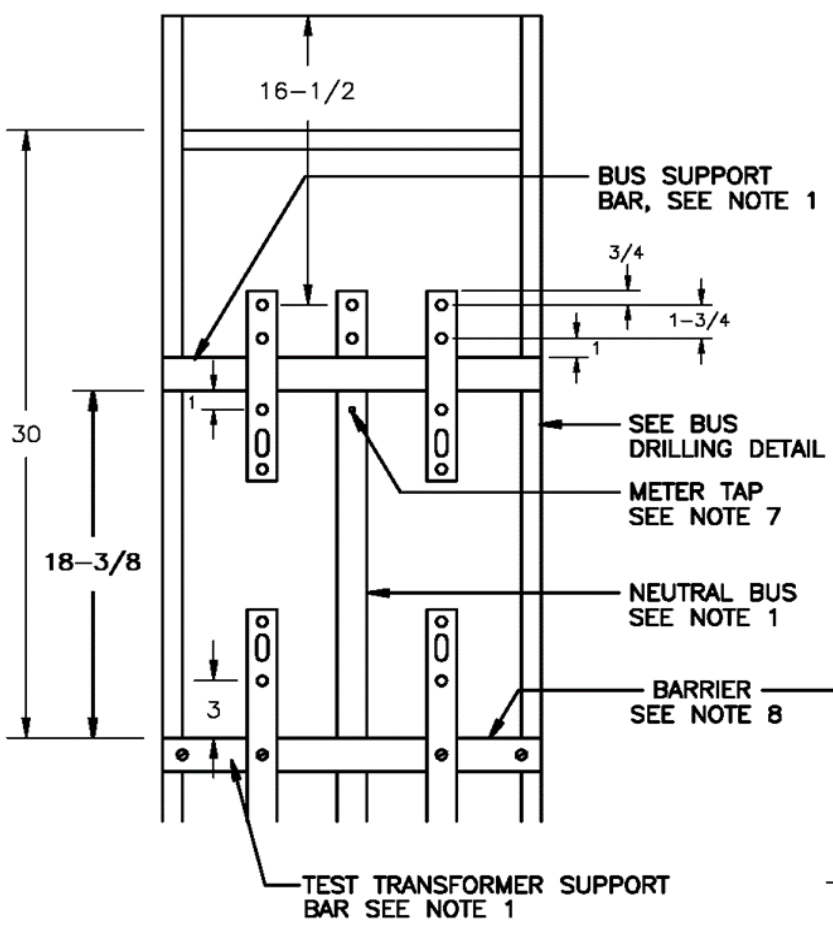


**TOP VIEW**

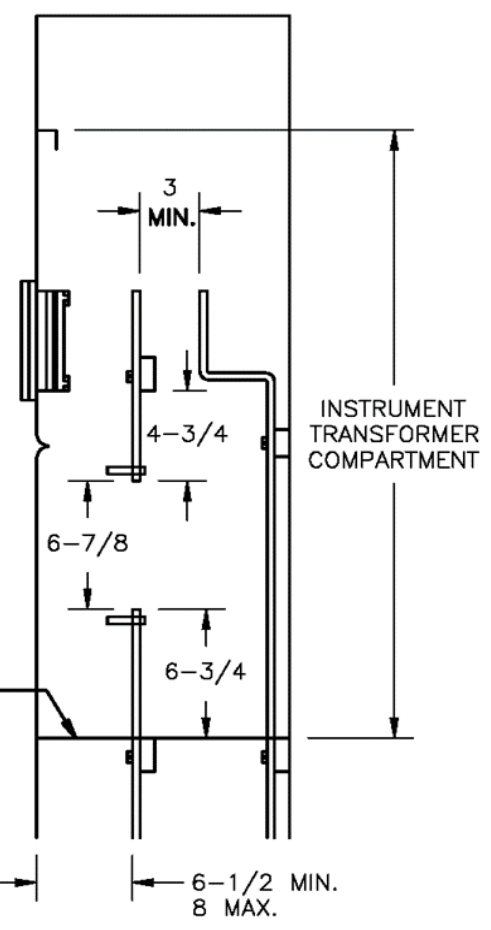
\* SEE NOTE 6



**BUS DRILLING DETAIL**  
TYPICAL 4 LOCATIONS  
SEE NOTE 3



**FRONT VIEW**



**SIDE VIEW**

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL  
**INSTRUMENT-TRANSFORMER COMPARTMENT FOR  
 SWITCHBOARDS 0-1000 AMPERES, 0-600 VOLTS,  
 SINGLE PHASE 3 WIRE AND 3 PHASE 3 WIRE**

**SECTION  
 300  
 DRAWING  
 319**

**NOTES:**

1. Bus arrangement and supports shall be provided as shown, except the neutral bus may be located at either side or on either side wall. Bus supports shall be constructed of a continuous bar of insulating material and shall be rigid to prevent misalignment of the bus units with the cables in place.
2. The bus units may be supplied from the top or bottom, and shall be anchored to prevent turning. Bus units shall be constructed of rectangular bus and when laminated shall have no space between laminations. Bus dimensions shall be provided as follows:
 

Minimum: 1/4 inch X 2 inches  
Maximum: 3/4 inch X 2 inches
3. Bus unit shall be provided with a fixed stud as shown for mounting the current transformers. Each shall:
  - a. Consist of a 1/2-inch steel bolt and shall be provided with a spring washer and a nut. The spring washer may be either a cone-type (belleville) washer or a split-ring washer and flat washer. All parts shall be plated to prevent corrosion.
  - b. Be secured in place. "Secured in place" shall mean that the stud will not turn, back-out, or loosen in any manner when tightening or loosening the associated nuts (including cross-threaded situations).
4. When the compartment is supplied from horizontal cross-bussing, the bussing shall pass through the compartment or in the sealed area above the compartment.
5. Except for conductors supplying the instrument-transformer compartment, and the ground bus, no other conductors or devices shall be installed in, or routed through, the compartment or the sealed area above the compartment. The ground bus shall not infringe on utility compartment space, or reduce any clearances. Customer connections to the ground bus shall not be allowed in the instrument transformer compartment.
6. A clear unobstructed work space shall be provided around the current-transformer bus units from the barrier to the upper support bar.
7. Taps for attachment of meter wiring shall be provided on the neutral bus unit shown, or when the compartment is supplied from cross-bussing, a tap may be provided on the neutral cross-bus, or on a bus bar extension provided from the neutral cross-bus. A 10-32 screw and washer shall be provided for the neutral bus. Tap locations shall be centered between phase bus units, or at either side, and shall be readily accessible under energized conditions and with the current-transformers in place.
8. The barrier shall be constructed of a rigid insulating material resistant to ARC tracking, and shall be secured in place with a maximum deflection of 1/2 inch from an applied force of 25 pounds downward. Openings in the barrier (i.e., peripheral gaps around barrier, cutouts around bus bars, and hole diameters provided for ventilation) shall not exceed 3/8 inch. The barrier shall be attached with nonconductive fasteners.
9. Dimension measured to inside edge of the compartment access opening.
10. Torque labels shall be provided in each utility compartment where nut and bolt assemblies using cone-type (Belleville) washers are used for utility terminations, test-bypass block circuit closing nuts or for securing current-transformers or current transformer bus removable links. Labels shall be readily visible and shall not be installed on any removable or hinges cover panel.

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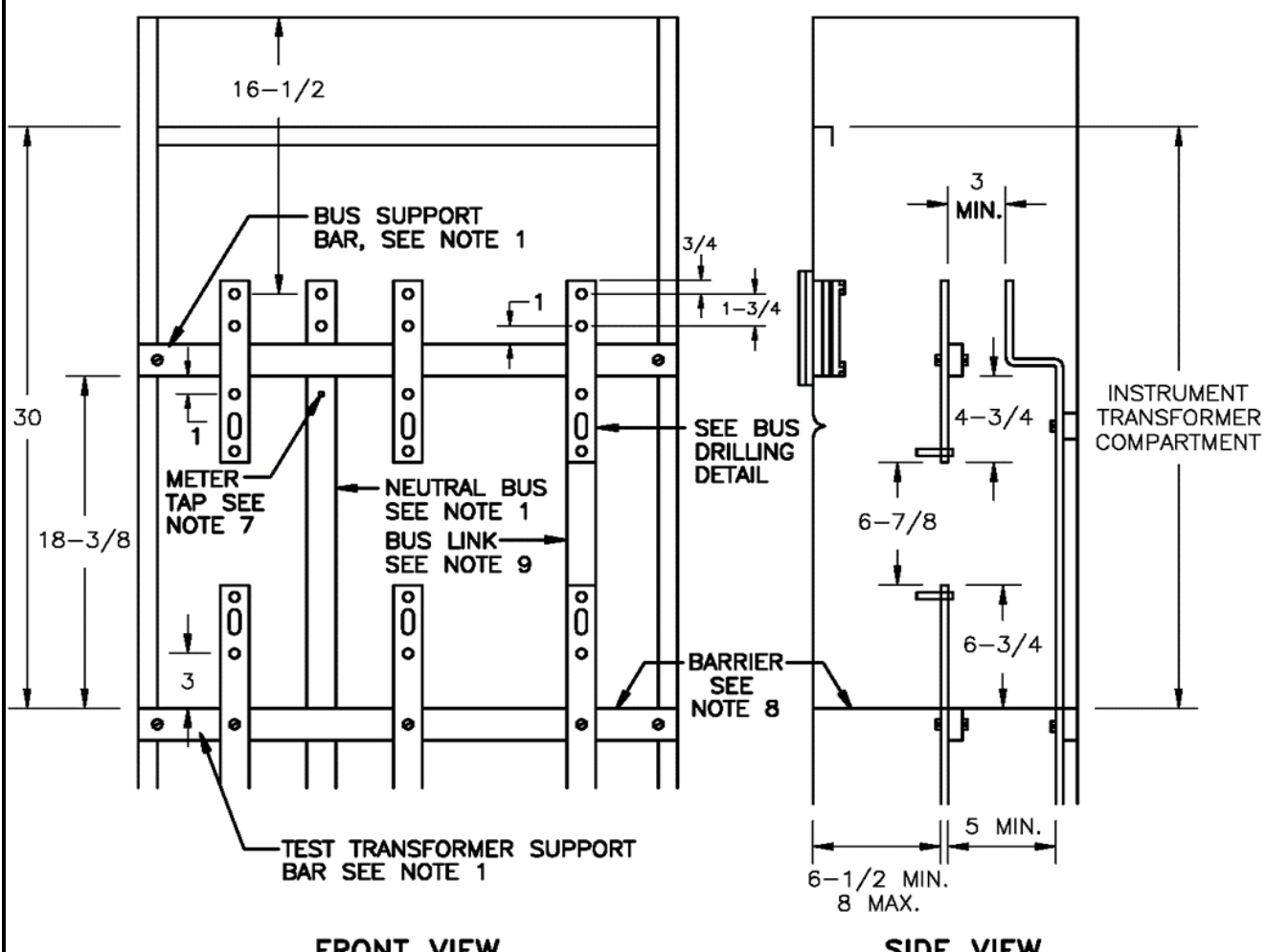
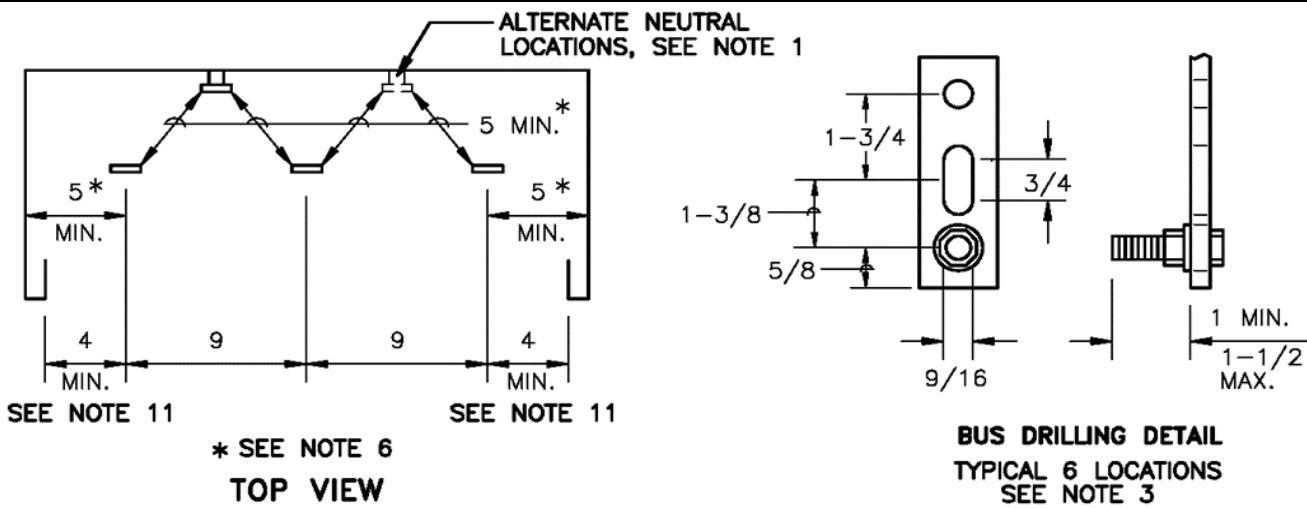
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	<b>INSTRUMENT-TRANSFORMER COMPARTMENT FOR SWITCHBOARDS 0-1000 AMPERES, 0-600 VOLTS, SINGLE PHASE 3 WIRE AND 3 PHASE 3 WIRE</b>			
				SECTION 300 DRAWING 319

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 319/APS**

**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.
2. Maximum allowable service for 1 Phase 3 Wire services is 800 Amp.





ALL DIMENSIONS SHOWN ARE IN INCHES

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	INSTRUMENT-TRANSFORMER COMPARTMENT FOR SWITCHBOARDS 0-1000 AMPERES, 0-600 VOLTS, 3 PHASE 3 WIRE AND 4 WIRE			
SECTION 300 DRAWING 320				

**NOTES:**

1. Bus arrangement and supports shall be provided as shown, except the neutral bus may be located at either side or on either side wall (Note: neutral bus not required for 3-phase 3-wire service). Bus supports shall be constructed of a continuous bar of insulating material and shall be rigid to prevent misalignment of the bus units with the cables in place.
2. The bus units may be supplied from the top or bottom, and shall be anchored to prevent turning. Bus units shall be constructed of rectangular bus and when laminated shall have no space between laminations. Bus dimensions shall be provided as follows:  
 Minimum: 1/4 inch X 2 inches  
 Maximum: 3/4 inch X 2 inches
3. Bus unit shall be provided with a fixed stud as shown for mounting the current transformers. Each shall:
  - a. Consist of a 1/2-inch steel bolt and shall be provided with a spring washer and a nut. The spring washer may be either a cone-type (belleville) washer or a split-ring washer and flat washer. All parts shall be plated to prevent corrosion.
  - b. Be secured in place. "Secured in place" shall mean that the stud will not turn, back-out, or loosen in any manner when tightening or loosening the associated nuts (including cross-threaded situations).
4. When the compartment is supplied from horizontal cross-bussing, the bussing shall pass through the compartment or in the sealed area above the compartment.
5. Except for conductors supplying the instrument-transformer compartment, and the ground bus, no other conductors or devices shall be installed in, or routed through, the compartment or the sealed area above the compartment. The ground bus shall not infringe on utility compartment space, or reduce any clearances. Customer connections to the ground bus shall not be allowed in the instrument transformer compartment.
6. A clear unobstructed work space shall be provided around the current-transformer bus units from the barrier to the upper support bar.
7. Taps for attachment of meter wiring shall be provided on the neutral bus unit shown, or when the compartment is supplied from cross-bussing, a tap may be provided on the neutral cross-bus, or on a bus bar extension provided from the neutral cross-bus. A 10-32 screw and washer shall be provided for the neutral bus. Tap locations shall be centered between phase bus units, or at either side, and shall be readily accessible under energized conditions and with the current-transformers in place.
8. The barrier shall be constructed of a rigid insulating material resistant to ARC tracking, and shall be secured in place with a maximum deflection of 1/2 inch from an applied force of 25 pounds downward. Openings in the barrier (i.e., peripheral gaps around barrier, cutouts around bus bars, and hole diameters provided for ventilation) shall not exceed 3/8 inch. The barrier shall be attached with nonconductive fasteners.
9. A removable link shall be installed in the right side phase bus for 3-phase, 3-wire service.
10. The power leg bus for a 4-wire delta service shall be identified by an orange outer finish or by tagging or other effective means.
11. Dimension measured to inside edge of the compartment access opening.
12. Torque labels shall be provided in each utility compartment where nut and bolt assemblies using cone-type (Belleville) washers are used for utility terminations, test-bypass block circuit closing nuts or for securing current-transformers or current-transformer bus removable links. Labels shall be readily visible and shall not be installed on any removable or hinges cover panel.

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	<b>INSTRUMENT-TRANSFORMER COMPARTMENT FOR SWITCHBOARDS 0-1000 AMPERES, 0-600 VOLTS, 3 PHASE 3 WIRE AND 4 WIRE</b>							

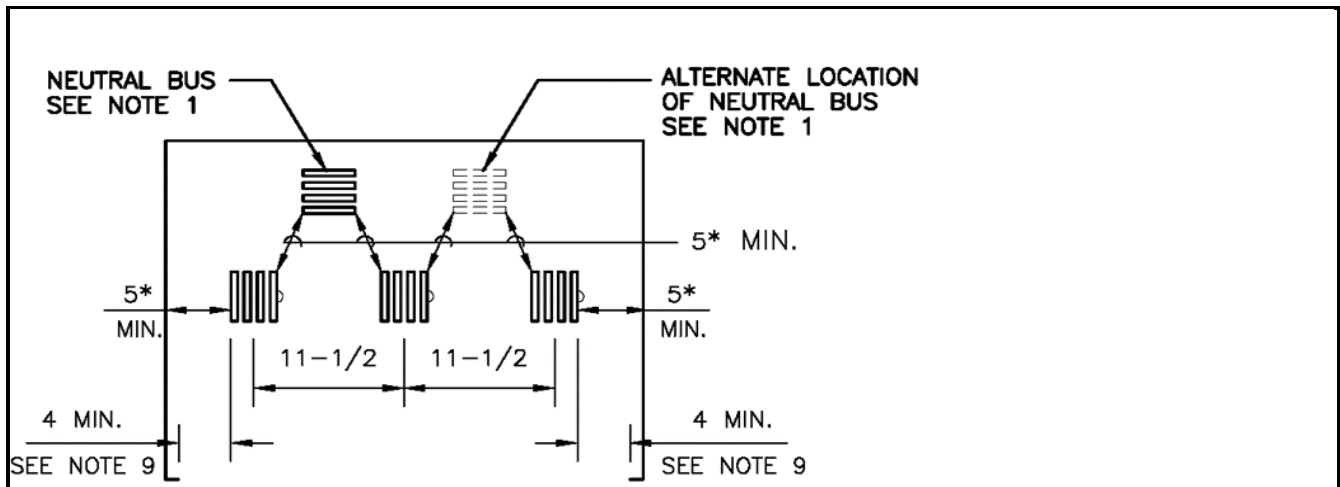
**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 320/APS**

**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.

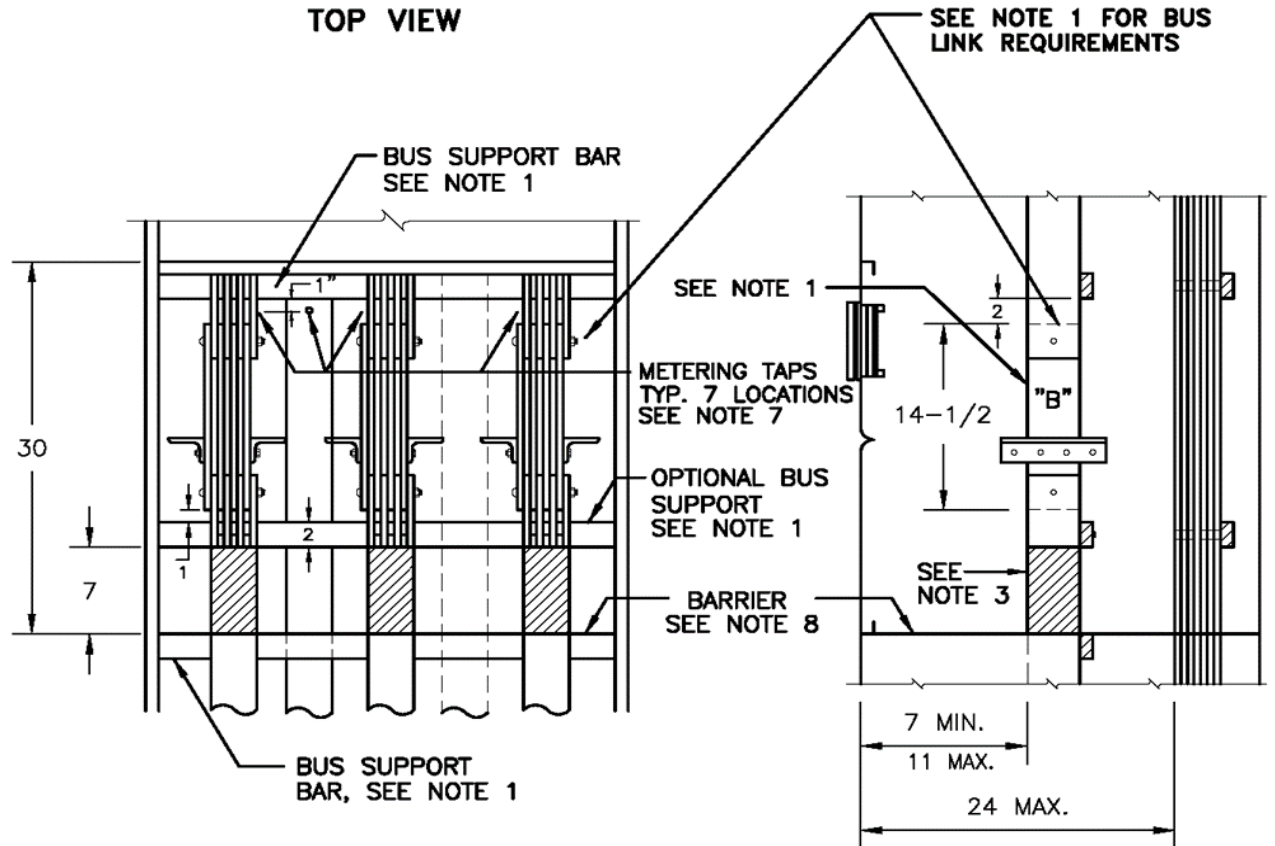






\* SEE NOTE 6

TOP VIEW



FRONT VIEW

SIDE VIEW

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EUSERC MANUAL  
**INSTRUMENT-TRANSFORMER COMPARTMENT FOR  
 SWITCHBOARDS 1001-3000 AMPERES AND ABOVE, 0-600 VOLTS,  
 THREE PHASE 3 WIRE AND 4 WIRE**

SECTION  
300  
DRAWING  
322



**NOTES:**

1. Bus arrangements and supports shall be provided as shown, except the neutral bus may located at either side or on either side wall. (Note: neutral bus not required for 3-phase, 3-wire service). Bus units shall be anchored so that busses will remain in position when section "B" is removed. For details of section "B" and the insulated current-transformer support, see Drawing 330 and Drawing 331. Bus supports shall be constructed of a continuous bar of insulating material.
2. The bus units may be supplied from the top or bottom, and shall be constructed of rectangular bus. Maximum allowable bus size shall be four 1/4-inch x 4-inch bars spaced 1/4-inch.
3. Bus units shall be insulated as shown and the insulating material shall be rated for the serving voltage. Round bus corners as necessary to prevent damage to insulation.
4. When the compartment is supplied from horizontal cross-bussing, the bussing shall pass through the compartment or in the sealed area above the compartment.
5. Except for conductors supplying the instrument transformer compartment, and the ground bus, no other conductors or devices shall be installed in, or routed through, the compartment or the sealed area above the compartment. The ground bus shall not infringe on utility compartment space, or reduce any clearances. Customer connections to the ground bus shall not be allowed in the instrument transformer compartment.
6. A clear unobstructed work space shall be provided around the current-transformer bus units from the barrier to 2 inches above the removable current-transformer bus sections ("B").
7. A 10-32 tap for attachment of meter wiring shall be provided as follows:
  - a. One tap on each upper and lower phase bus unit with a 10-32 screw and washer provided for each phase bus in either the upper or lower position.
  - b. One tap on the neutral bus as shown, or when the compartment is supplied from cross-bussing, a tap may be provided on the neutral cross-bus, or on a bus bar extension provided from the neutral cross-bus. A 10-32 screw and washer shall be provided for the neutral bus. Tap locations shall be centered between phase bus units, or at either side, and shall be readily accessible under energized conditions and with the current-transformers in place.
8. The barrier shall be constructed of a rigid insulating material resistant to ARC tracking and shall be secured in place with a maximum deflection of 1/2 inch from an applied force of 25 pounds downward. Openings in the barrier (i.e., peripheral gaps around barrier, cutouts around bus bars, and hole diameters provided for ventilation) shall not exceed 3/8 inch. The barrier shall be attached with nonconductive fasteners.
9. Dimension measured to inside edge of the compartment access opening.

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	<b>INSTRUMENT-TRANSFORMER COMPARTMENT FOR SWITCHBOARDS 1001-3000 AMPERES AND ABOVE, 0-600 VOLTS, THREE PHASE 3 WIRE AND 4 WIRE</b>			

SECTION 300 DRAWING 322
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**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 322/APS**

**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.



NEUTRAL BUS  
SEE NOTE 1

ALTERNATE LOCATION  
OF NEUTRAL BUS  
SEE NOTE 1

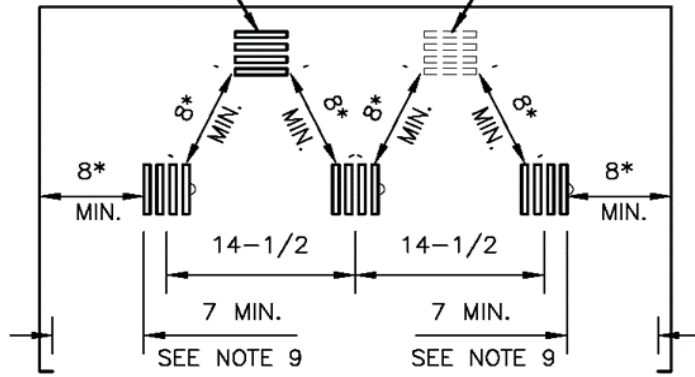


TABLE 1

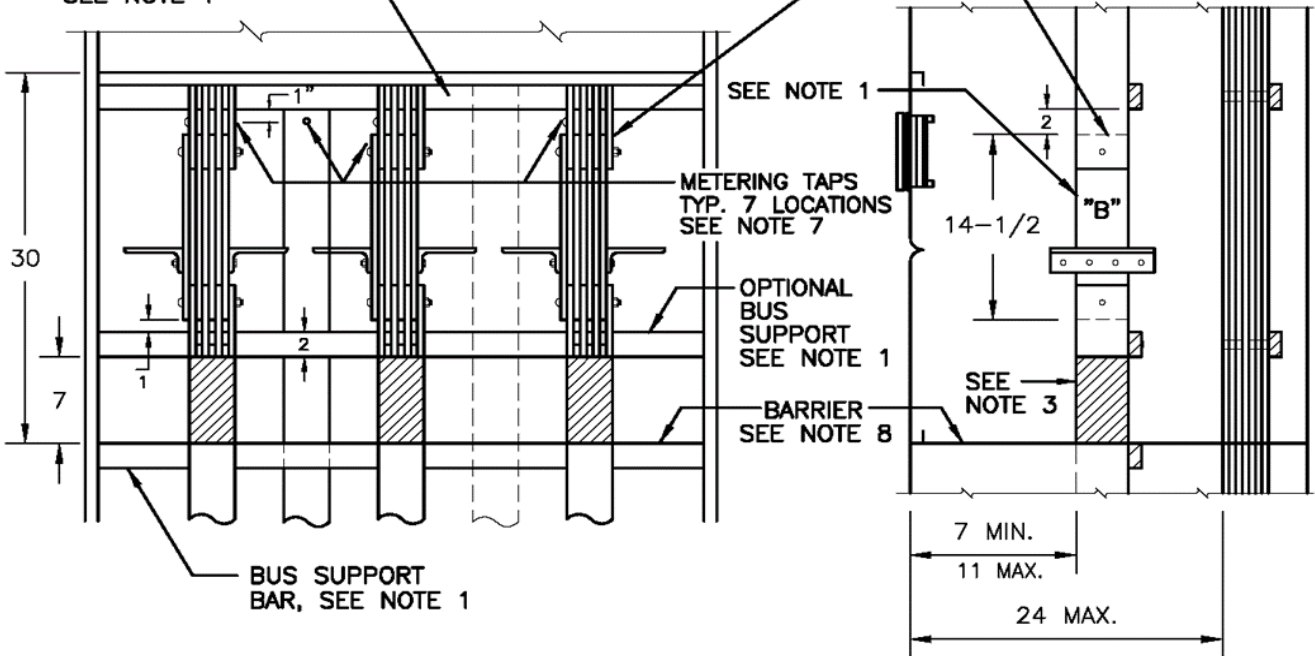
MAXIMUM ALLOWABLE BUS			
FOUR	1/4 INCHx4 INCH	BARS SPACED 1/4	
SIX	1/4 INCHx5 INCH	BARS SPACED 1/4	
FIVE	3/8 INCHx5 INCH	BARS SPACED 3/8	

\* SEE NOTE 6

TOP VIEW

SEE NOTE 1 FOR BUS  
LINK REQUIREMENTS

BUS SUPPORT BAR  
SEE NOTE 1



FRONT VIEW

SIDE VIEW

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INSTRUMENT-TRANSFORMER COMPARTMENT FOR  
SWITCHBOARDS 3001 AMPERES AND ABOVE, 0-600 VOLTS,  
THREE PHASE 3 WIRE AND 4 WIRE

SECTION  
300  
DRAWING  
324

**NOTES:**

1. Bus arrangements and supports shall be provided as shown, except the neutral bus may be located at either side or on either side wall. (Note: neutral bus not required for 3-phase, 3-wire service). Bus units shall be anchored so that busses will remain in position when section "B" is removed. For details of section "B" and the insulated current-transformer support, see Drawing 330 for 4-inch and Drawing 331 for 5-inch bus. Consult serving agency for the use of bus larger than 5-inches. Bus supports shall be constructed of a continuous bar of insulating material.
2. The bus units may be supplied from the top or bottom, and shall be constructed of rectangular bus. For maximum allowable bus sizes, see Table 1.
3. Bus units shall be insulated as shown and the insulating material shall be rated for the serving voltage. Round bus corners as necessary to prevent damage to insulation.
4. When the compartment is supplied from horizontal cross-bussing, the bussing shall pass through the compartment or in the sealed area above the compartment.
5. Except for conductors supplying the instrument transformer compartment, and the ground bus, no other conductors or devices shall be installed in, or routed through, the compartment or the sealed area above the compartment. The ground bus shall not infringe on utility compartment space, or reduce any clearances. Customer connections to the ground bus shall not be allowed in the instrument transformer compartment.
6. A clear unobstructed work space shall be provided around the current-transformer bus units from the barrier to 2 inches above the removable current-transformer bus sections ("B").
7. A 10-32 tap for attachment of meter wiring shall be provided as follows:
  - a. One tap on each upper and lower phase bus unit with a 10-32 screw and washer provided for each phase bus in either the upper or lower position.
  - b. One tap on the neutral bus as shown, or when the compartment is supplied from cross-bussing, a tap may be provided on the neutral cross-bus, or on a bus bar extension provided from the neutral cross-bus. A 10-32 screw and washer shall be provided for the neutral bus. Tap locations shall be centered between phase bus units, or at either side, and shall be readily accessible under energized conditions and with the current-transformers in place.
8. The barrier shall be constructed of a rigid insulating material resistant to ARC tracking and shall be secured in place with a maximum deflection of 1/2 inch from an applied force of 25 pounds downward. Openings in the barrier (i.e., peripheral gaps around barrier, cutouts around bus bars, and hole diameters provided for ventilation) shall not exceed 3/8 inch. The barrier shall be attached with nonconductive fasteners.
9. Dimension measured to inside edge of the compartment access opening.

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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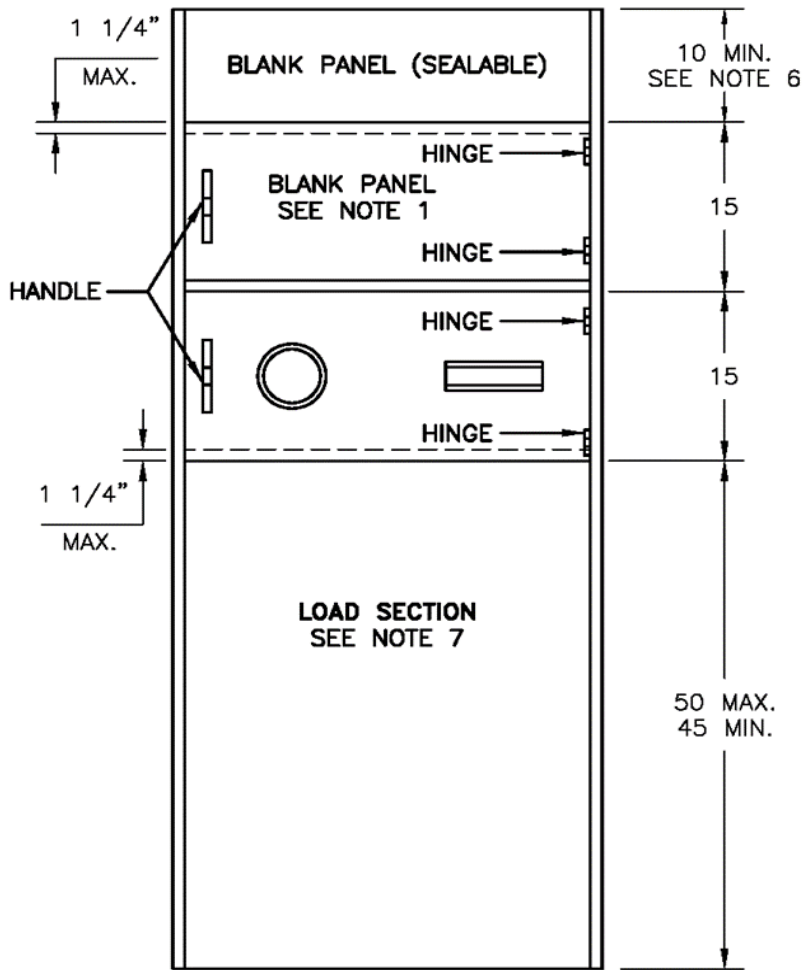
SHEET 2 OF 2	<input type="checkbox"/> Indicates Latest Revision	<input checked="" type="checkbox"/> Completely Revised	<input type="checkbox"/> New Page	<input type="checkbox"/> Information Removed	SECTION 300 DRAWING 324
	EUSERC MANUAL				
	<b>INSTRUMENT-TRANSFORMER COMPARTMENT FOR SWITCHBOARDS 3001 AMPERES AND ABOVE, 0-600 VOLTS, THREE PHASE 3 WIRE AND 4 WIRE</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 324/APS**

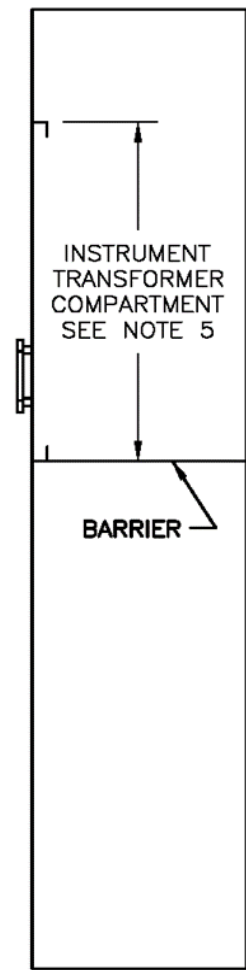
**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.





FRONT VIEW



SIDE VIEW

ALL DIMENSIONS SHOWN ARE IN INCHES

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SHEET  
1 OF 2

EUSERC MANUAL  
**STANDARD SWITCHBOARD SERVICE SECTION WITH  
 INSTRUMENT-TRANSFORMER COMPARTMENT 0-600 VOLTS**

SECTION  
300  
DRAWING  
325

**NOTES:**

1. Socket meter panel with blank meter panel shown. Consult serving utility regarding alternate meter panel arrangements. Blank meter panel shall be constructed of 12 gauge (minimum) steel. See Drawings 332, 333 and 336 for socket meter panel details.
2. Meter panels shall be equipped with stops to prevent inward swinging beyond the front surface of the service section.
3. Hinges shall be readily interchangeable, left or right, on the job site.
4. Removable or hinged panels enclosing unmetred bus or cable shall be sealable. See drawing 300, note II(I).
5. For requirements regarding instrument-transformer compartments, see;
  - 0 to 1000 Amperes See Drawings 319, 320
  - 1001 to 3000 Amperes See Drawings 321, 322
  - 3001 Amperes and above See Drawings 323, 324
6. Dimension may be reduced if the service section is supplied from horizontal cross-bussing or bus duct.
7. When used as a utility terminating section in a bottom-fed service section, See Drawing 327.
8. For outdoor applications, See Drawing 354 for weatherproof enclosure requirements.

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	EUSERC MANUAL			
	<b>STANDARD SWITCHBOARD SERVICE SECTION WITH INSTRUMENT-TRANSFORMER COMPARTMENT 0-600 VOLTS</b>			
				<b>SECTION 300 DRAWING 325</b>

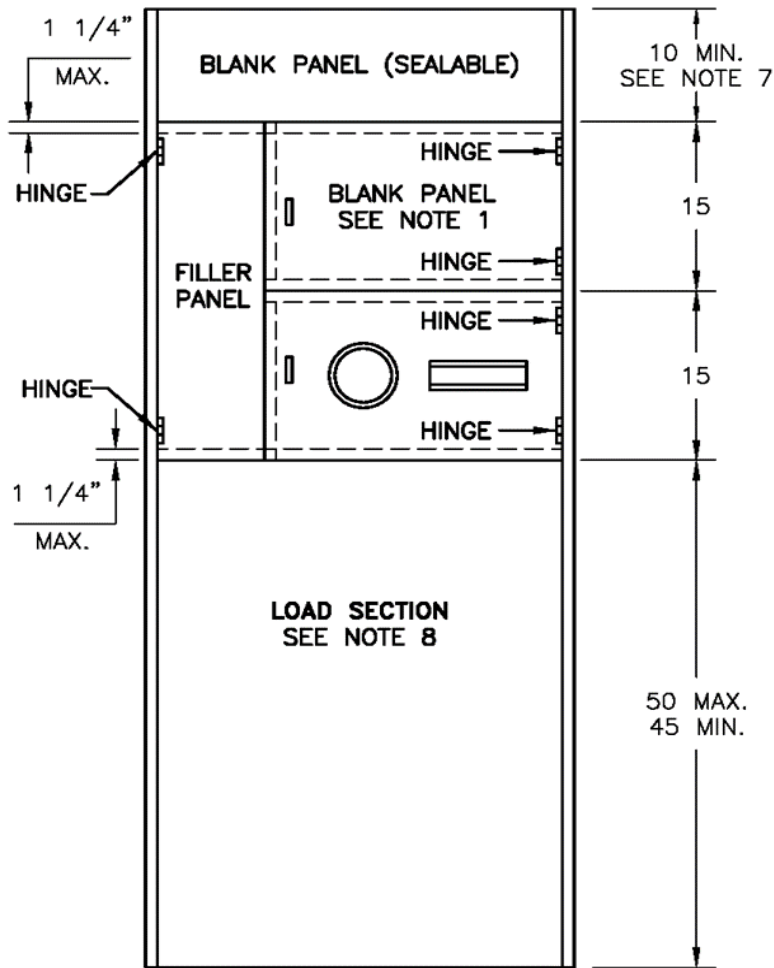
**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 325/APS**

**NOTES:**

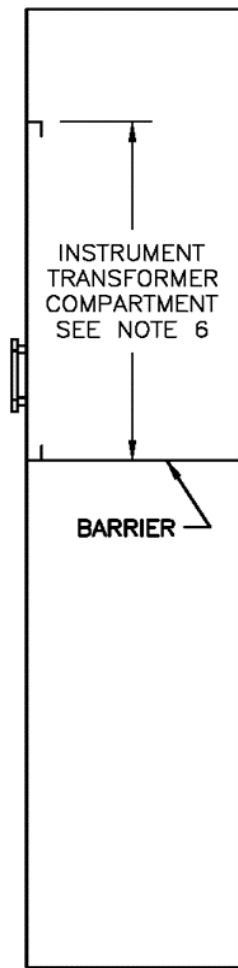
1. Change note #1 to include: "APS requires the upper meter panel blank, and the lower meter panel drilled and cut per Dwg #332.
2. See Section 200, paragraph 201.1 and 201.2 for available services and restrictions.







FRONT VIEW



SIDE VIEW

ALL DIMENSIONS SHOWN ARE IN INCHES

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EUSERC MANUAL

**STANDARD SWITCHBOARD SERVICE SECTION WITH  
INSTRUMENT-TRANSFORMER COMPARTMENT AND FILLER PANEL  
0-600 VOLTS**

SHEET  
1 OF 2

SECTION  
300  
DRAWING  
326

**NOTES:**

1. Socket meter panel with blank meter panel shown. Consult serving utility regarding alternate meter panel arrangements. Blank meter panel shall be constructed of 12 gauge (minimum) steel. See Drawings 332, 333 and 336 for socket meter panel details.
2. Filler panels shall be used where the service section width exceeds the meter panel width. Meter panels, either socket or blank, shall not be hinged to hinged filler panels. Non-hinged filler panels shall not extend into the required instrument-transformer compartment access opening.
3. Meter panels and filler panels shall be equipped with stops to prevent inward swinging beyond the front surface of the service section.
4. Hinges shall be readily interchangeable, left or right, on the job site.
5. Removable or hinged panels enclosing unmetered bus or cable shall be sealable. See drawing 300, note II(I).
6. For requirements regarding instrument-transformer compartments, see;
  - 0 to 1000 Amperes See Drawings 319, 320
  - 1001 to 3000 Amperes See Drawings 321, 322
  - 3001 Amperes and above See Drawings 323, 324
7. Dimension may be reduced if the service section is supplied from horizontal cross-bussing or bus duct.
8. When used as a utility terminating section in a bottom-fed service section, See Drawing 327.
9. For outdoor applications, See Drawing 354 for weatherproof enclosure requirements.

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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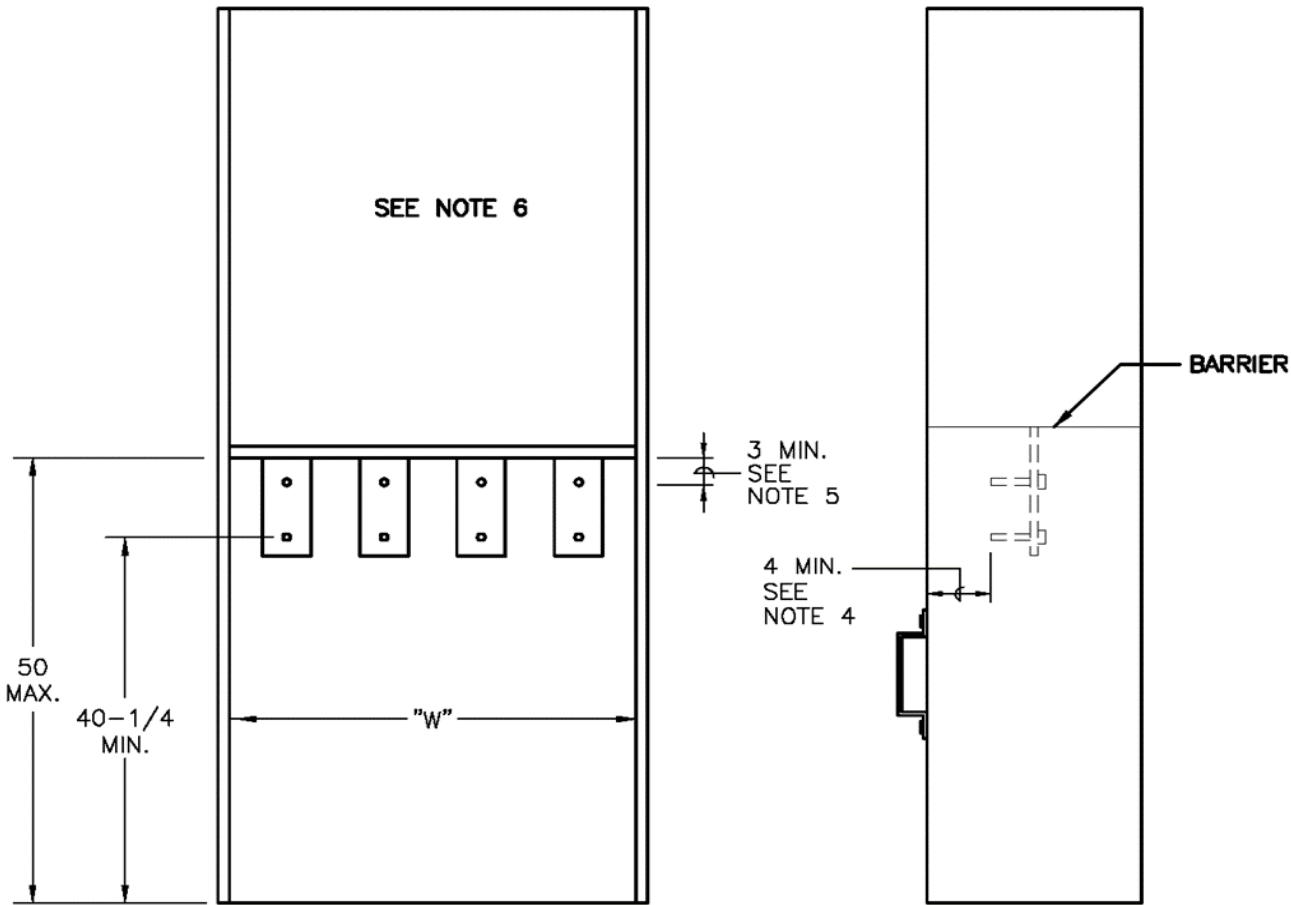
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	EUSERC MANUAL			
	<b>STANDARD SWITCHBOARD SERVICE SECTION WITH INSTRUMENT-TRANSFORMER COMPARTMENT AND FILLER PANEL 0-600 VOLTS</b>			
SECTION 300 DRAWING 326				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 326/APS**

**NOTES:**

1. Change note #1 to include: "APS requires the upper meter panel blank, and the lower meter panel drilled and cut per Dwg #332.
2. See Section 200, paragraph 201.1 and 201.2 for available services and restrictions.





**FRONT VIEW**

**SIDE VIEW**

**TABLE – MINIMUM DIMENSIONS**

SWITCHBOARD RATING (AMPERES)	MINIMUM ACCESS OPENING DIMENSION (W) – SEE NOTE 8	
	3-WIRE	4-WIRE
BELOW 400	CONSULT SERVING AGENCY	
400 – 800	24	24
801 – 1200	24	30
1201 – 2000	30	35

**NOTES:**

1. The pull section may supply either a current-transformer compartment or a main service disconnect device.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL

**COMBINATION SWITCHBOARD SERVICE SECTION AND  
PULL SECTION 0-600 VOLTS, 2000 AMPERES MAXIMUM**

**SECTION  
300  
DRAWING  
327**

2. Pull section covers shall be:
  - a. Independent of other equipment and removable without disturbing adjacent panels.
  - b. Sealable, provided with two lifting handles, and limited to a maximum of 9 square feet in area.
3. The panel shall be equipped with terminating facilities complying with Drawing 347. Terminating facilities shall be secured to prevent misalignment and shall be rigid without the installation of current-transformers.
4. The clearance from the energized bus to the pull section removable access covers may be reduced if a safety barrier is provided by the manufacturer. For additional clearance and barrier requirements, see Drawing 347, Note 12.
5. A vertical clearance of 3 inches minimum shall be maintained between the centerline of the top bolts of the terminating facilities to any obstruction.
6. When the upper section is:
  - a. An instrument-transformer compartment, see Drawings 325 and 326 for additional service section requirements.
  - b. A main service disconnect device.
    - (1) A full width and depth, insulated, rigid barrier shall be provided to separate the pull section and main service disconnect compartment.
    - (2) The main service disconnect cover shall be sealable.
7. Sealing provisions for removable covers shall consist of two drilled stud and wing-nut assemblies located on opposite sides of the cover. Hinged covers shall be sealed on the unsupported side. See drawing 300, note II(I).
8. The minimum pull section access opening (W) is measured between the left side and right side return flanges.

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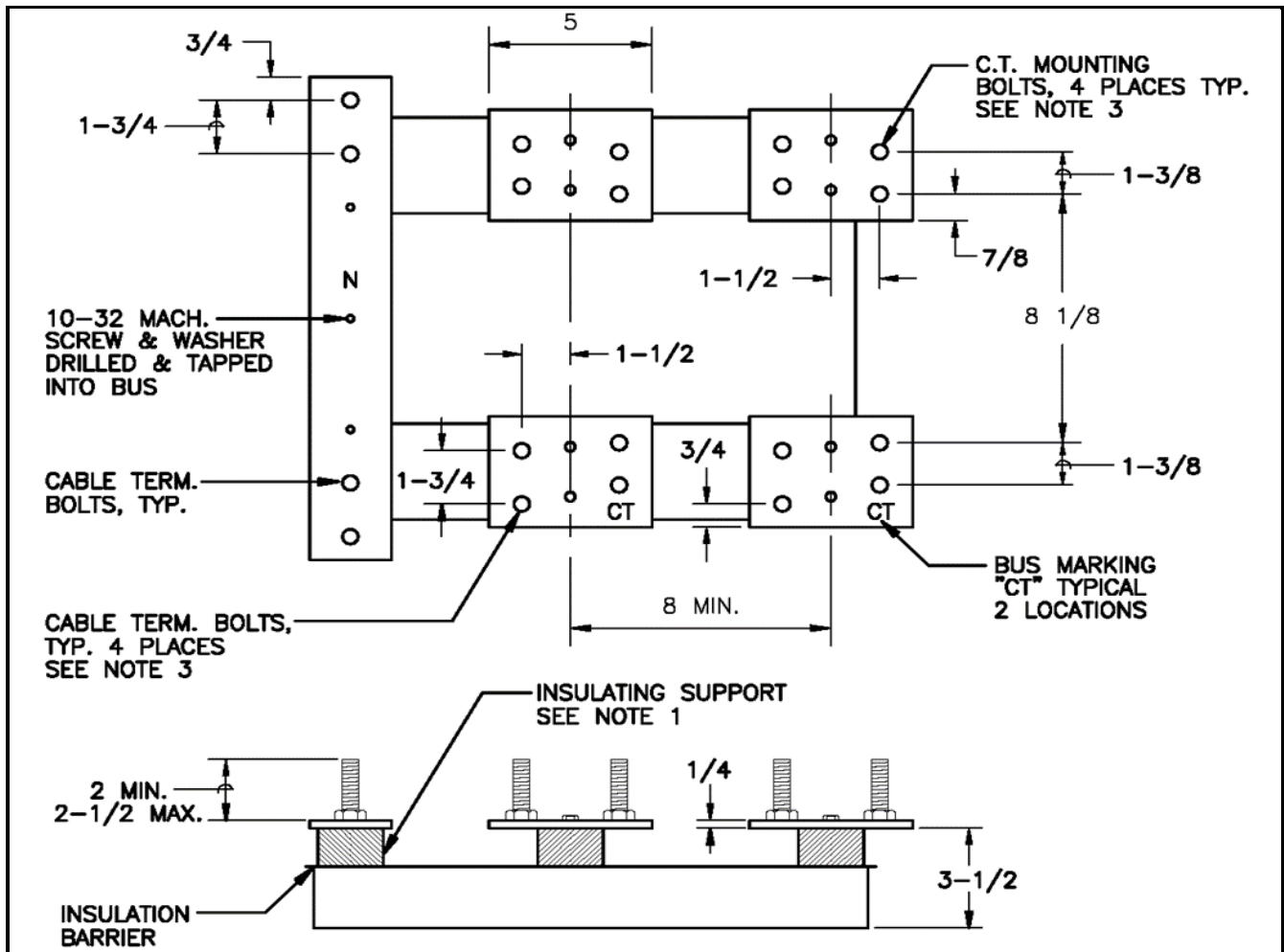
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	EUSERC MANUAL				
	<b>COMBINATION SWITCHBOARD SERVICE SECTION AND PULL SECTION 0-600 VOLTS, 2000 AMPERES MAXIMUM</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 327/APS**

**NOTES:**

1. Add note #6 (c): "Equipped with meter doors, APS requires the upper meter panel blank, and the lower meter panel drilled and cut per Dwg #332.
2. See Section 200, paragraph 201.1 and 201.2 for available services and restrictions.
3. Change Title bar to indicate device shown is acceptable up to a maximum of 3,000 amperes (Device must meet all other EUSERC and APS dimension requirements).





**NOTES:**

1. Insulated supports shall be rated for the serving voltage and have sufficient mechanical strength for the application.
2. Mounting base accepts bar type current transformers only.
3. Two 1/2 inch steel bolts shall be provided for each cable terminating and current-transformer mounting position. Each bolt shall be furnished with a spring washer and a nut. The spring washer may be either a cone-type (belleville) or a split-ring washer and a flat washer. Bolts shall be secured in place and spaced as shown. All parts shall be plated to prevent corrosion.  
 "NOTE: When Belleville washers are used, the manufacturer shall provide a label with the required torque setting. This label shall be in a readily visible location within the compartment that the washers are being utilized and shall not be installed on the meter or filler panels".
4. For applications, see Drawings 313, 314 and 316.
5. Consult the serving utility for 800 ampere applications.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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	EUSERC MANUAL			
	<b>CURRENT TRANSFORMER MOUNTING BASE SINGLE PHASE OR THREE PHASE THREE WIRE 400-800 AMPERES MAXIMUM, 0-600 VOLTS</b>			
				SECTION 300 DRAWING 328A

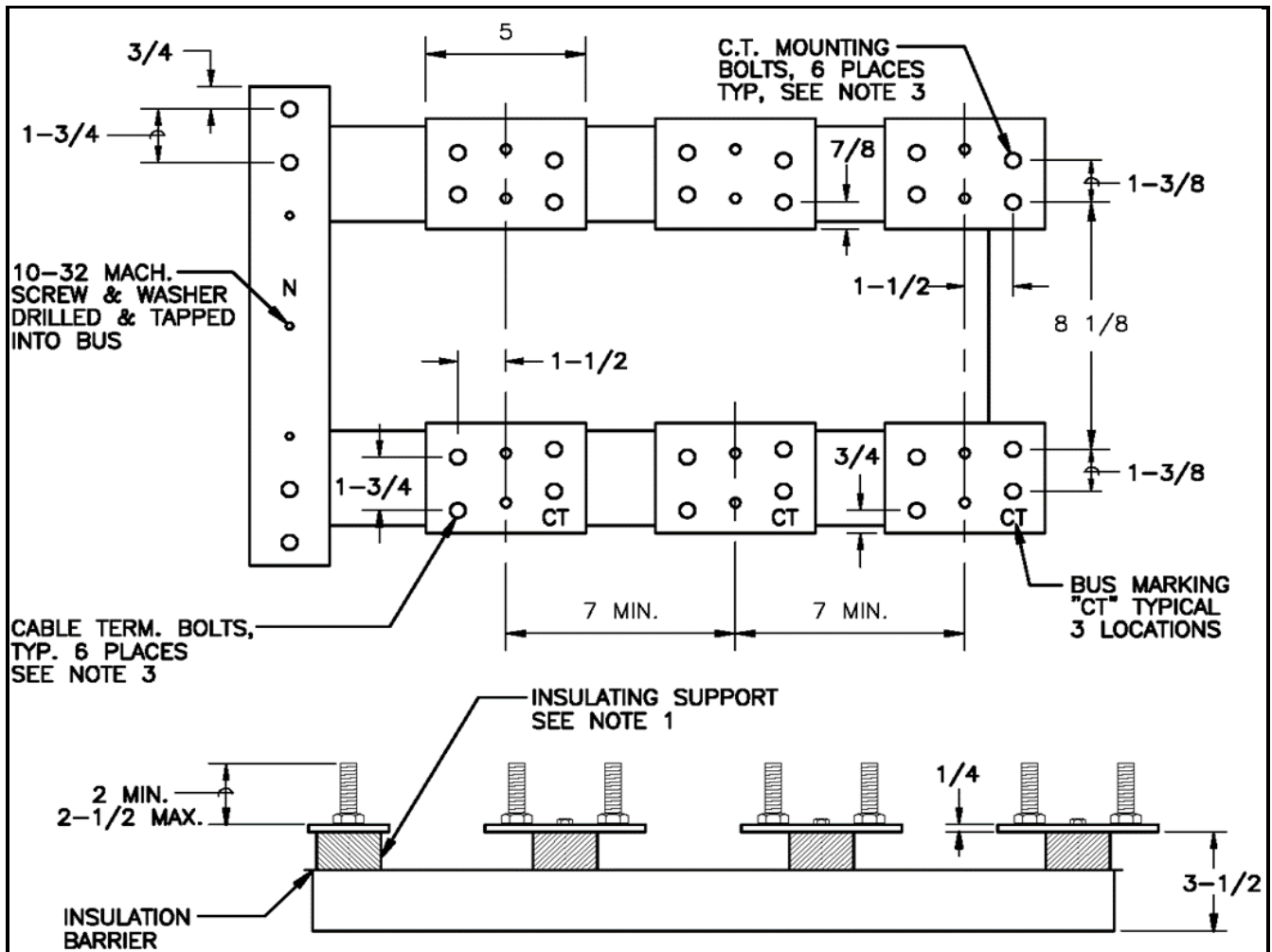
**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 328A/APS**

**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.







**NOTES:**

1. Insulated supports shall be rated for the serving voltage and have sufficient mechanical strength for the application.
2. Mounting base accepts bar type current transformers only.
3. Two 1/2 inch steel bolts shall be provided for each cable terminating and current-transformer mounting position. Each bolt shall be furnished with a spring washer and a nut. The spring washer may be either a cone-type (belleville) or a split-ring washer and a flat washer. Bolts shall be secured in place and spaced as shown. All parts shall be plated to prevent corrosion.  
 "NOTE: When Belleville washers are used, the manufacturer shall provide a label with the required torque setting. This label shall be in a readily visible location within the compartment that the washers are being utilized and shall not be installed on the meter or filler panels."
4. For applications, see Drawings 313, 314 and 316.
5. Consult the serving utility for 800 ampere applications.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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	EUSERC MANUAL			
	<b>CURRENT TRANSFORMER MOUNTING BASE THREE PHASE THREE WIRE OR FOUR WIRE 400-800 AMPERES MAXIMUM, 0-600 VOLTS</b>			

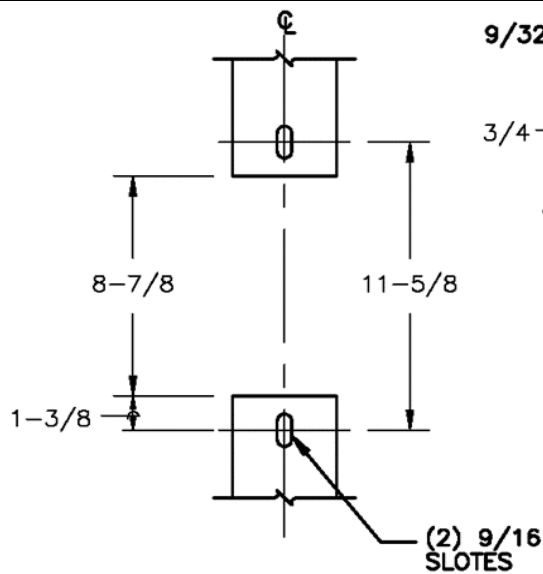
**SECTION  
300  
DRAWING  
329A**

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 329A/APS**

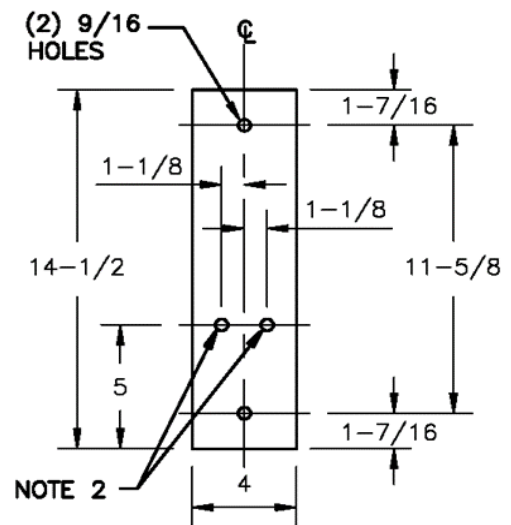
**NOTES:**

1. APS does not allow 3 Phase 3 Wire services.

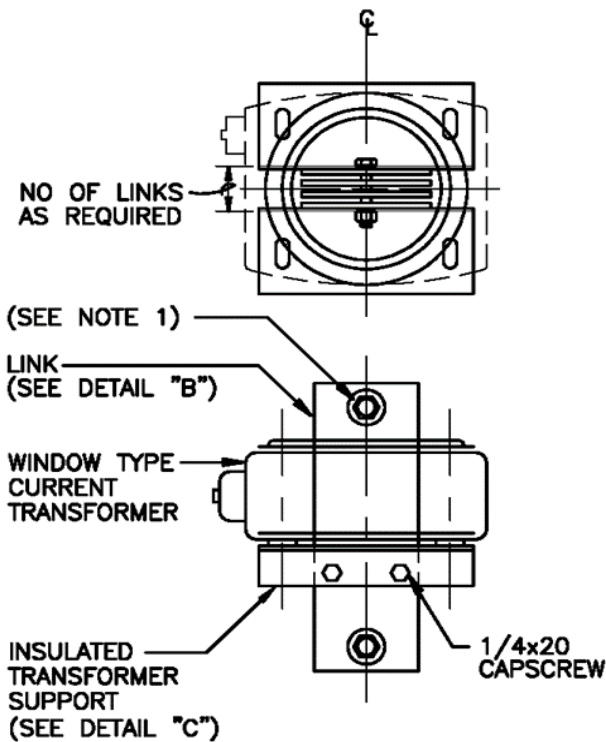




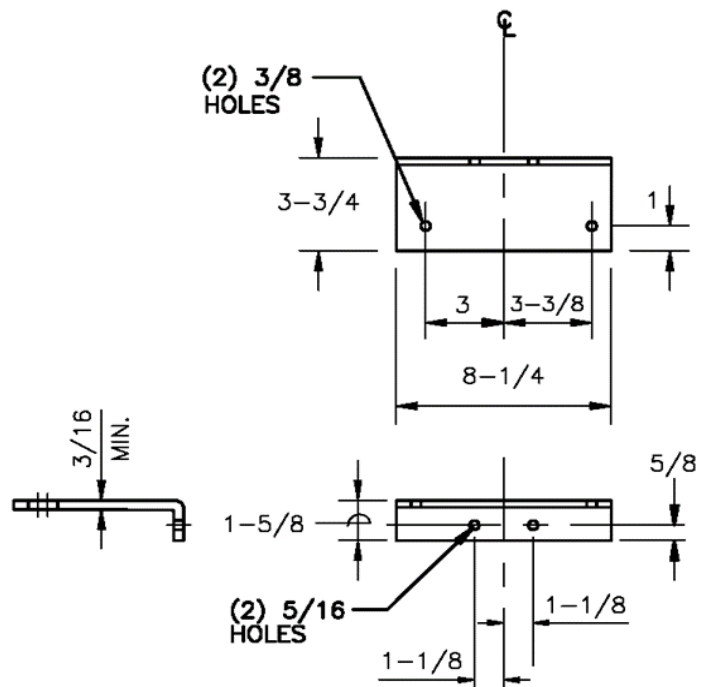
**DETAIL 'A'**  
DRILLING AND SPACING OF BUS



**DETAIL 'B'**  
1/4x4 LINK  
(SAME MATERIAL AS BUS)



**REMOVABLE LINK**  
(FURNISHED BY MANUFACTURER)



**DETAIL 'C'**  
INSULATED SUPPORT FOR  
CURRENT TRANSFORMER  
(MATERIAL: INSULATING, NON-TRACKING)

ALL DIMENSIONS SHOWN ARE IN INCHES

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EUSERC MANUAL

REMOVABLE LINK AND CURRENT TRANSFORMER SUPPORT  
FOR INSTRUMENT TRANSFORMER COMPARTMENTS WITH 4-INCH  
BUS, 0-600 VOLTS

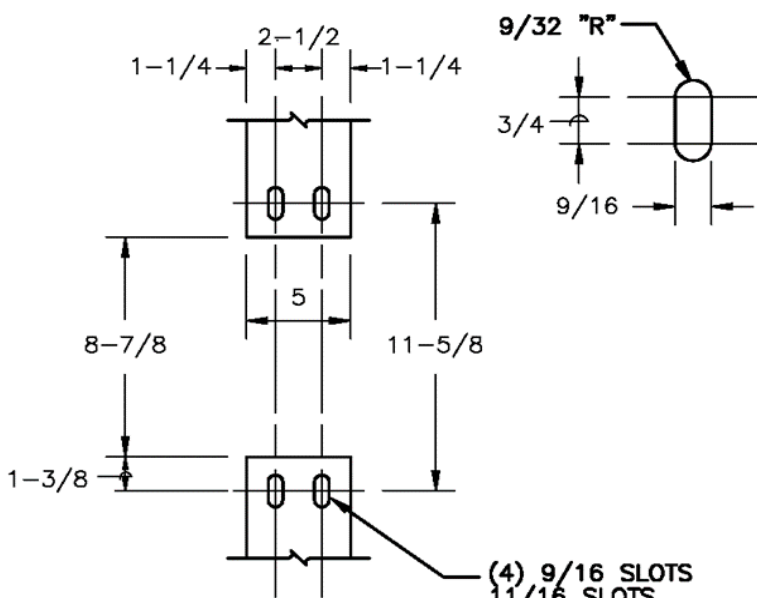
SECTION  
300  
DRAWING  
330

**NOTES:**

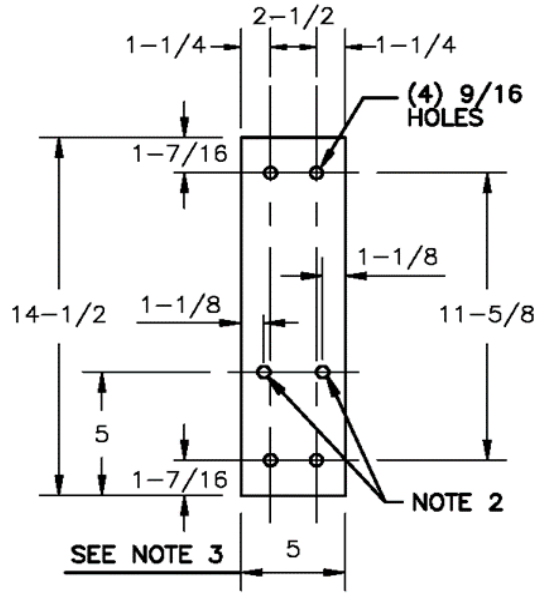
1. Manufacturer shall secure the removable bus link to the upper and lower current transformer bus units using 1/2-inch hex-head (grade 5) steel bolts with associated washers and nut. Each bolt shall be provided with a flat washer, a spring washer and a nut. Spring washer may be either a cone-type (belleville) washer or a split-ring washer with a flat washer. All washers (belleville or flat) shall be 2-1/4 inches minimum.  
 "Note: When belleville washers are used, the manufacturer shall provide a label with the required torque setting. This label shall be in a readily visible location within the compartment that the washers are being utilized and shall not be installed on the meter or filler panels."
2. Drill and tap two holes as shown on the outer bus units for 1/4-inch x 20 capscrews.

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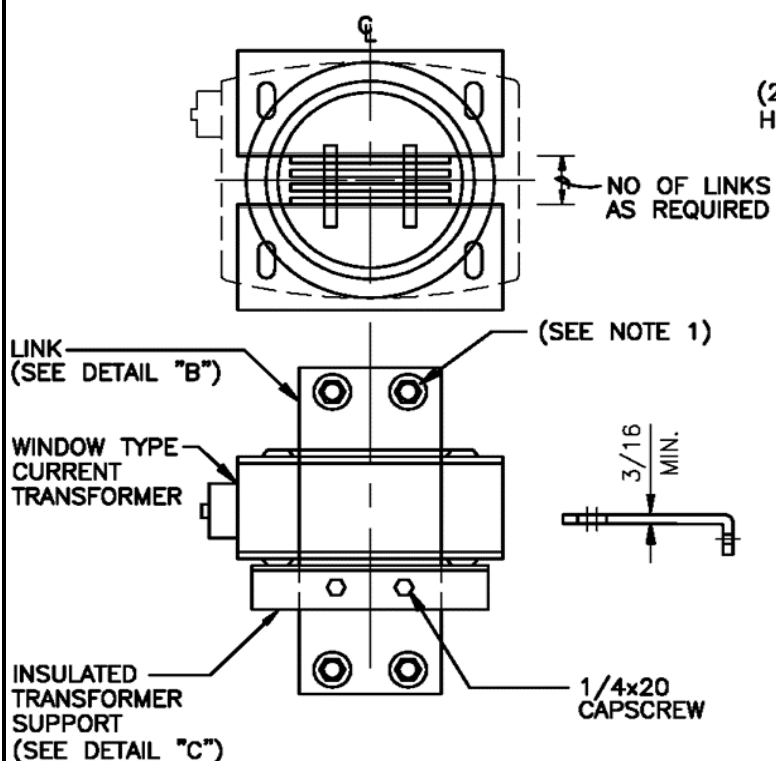
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	EUSERC MANUAL				
	<b>REMOVABLE LINK AND CURRENT TRANSFORMER SUPPORT FOR INSTRUMENT TRANSFORMER COMPARTMENTS WITH 4-INCH BUS, 0-600 VOLTS</b>				



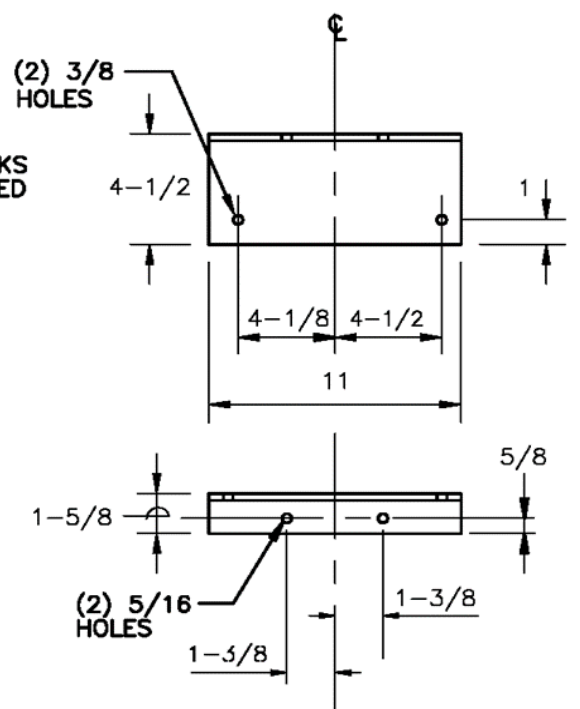
**DETAIL 'A'**  
DRILLING AND SPACING OF BUS



**DETAIL 'B'**  
1/4x5 LINK  
(SAME MATERIAL AS BUS)



**REMOVABLE LINK**  
(FURNISHED BY MANUFACTURER)



**DETAIL 'C'**  
INSULATED SUPPORT FOR  
CURRENT TRANSFORMER  
(MATERIAL: INSULATING, NON-TRACKING)

ALL DIMENSIONS SHOWN ARE IN INCHES

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SHEET  
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EUSERC MANUAL  
**REMOVABLE LINK AND CURRENT TRANSFORMER SUPPORT  
FOR INSTRUMENT TRANSFORMER COMPARTMENTS WITH 5-INCH  
BUS, 0-600 VOLTS**

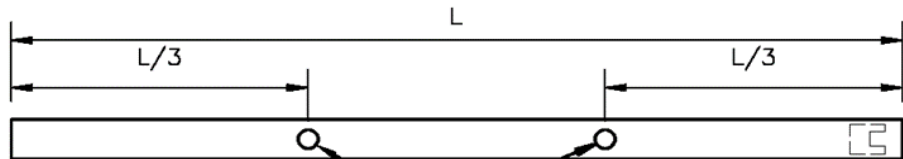
SECTION  
300  
DRAWING  
331

**NOTES:**

1. Manufacturer shall secure the removable bus link to the upper and lower current transformer bus units using 1/2-inch hex-head (grade 5) steel bolts. Each bolt shall be provided with two belleville washers installed on opposite sides of the bus units and a nut. Use of belleville washers requires a label on each phase of the bus link assembly indicating proper torque setting.  
 "Note: When Belleville washers are used, the manufacturer shall provide a label with the required torque setting. This label shall be in a readily visible location within the compartment that the washers are being utilized and shall not be installed on the meter or filler panels."
2. Drill and tap two holes as shown on the outer bus units for 1/4-inch x 20 capscrews.
3. Consult the serving agency for use of bus bars larger than 5 inches.

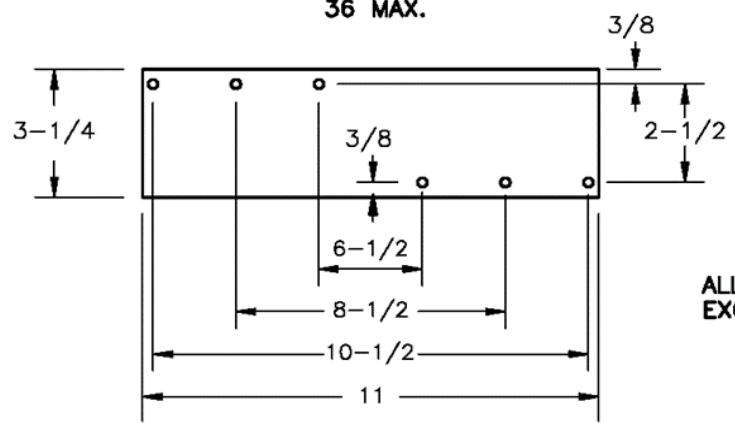
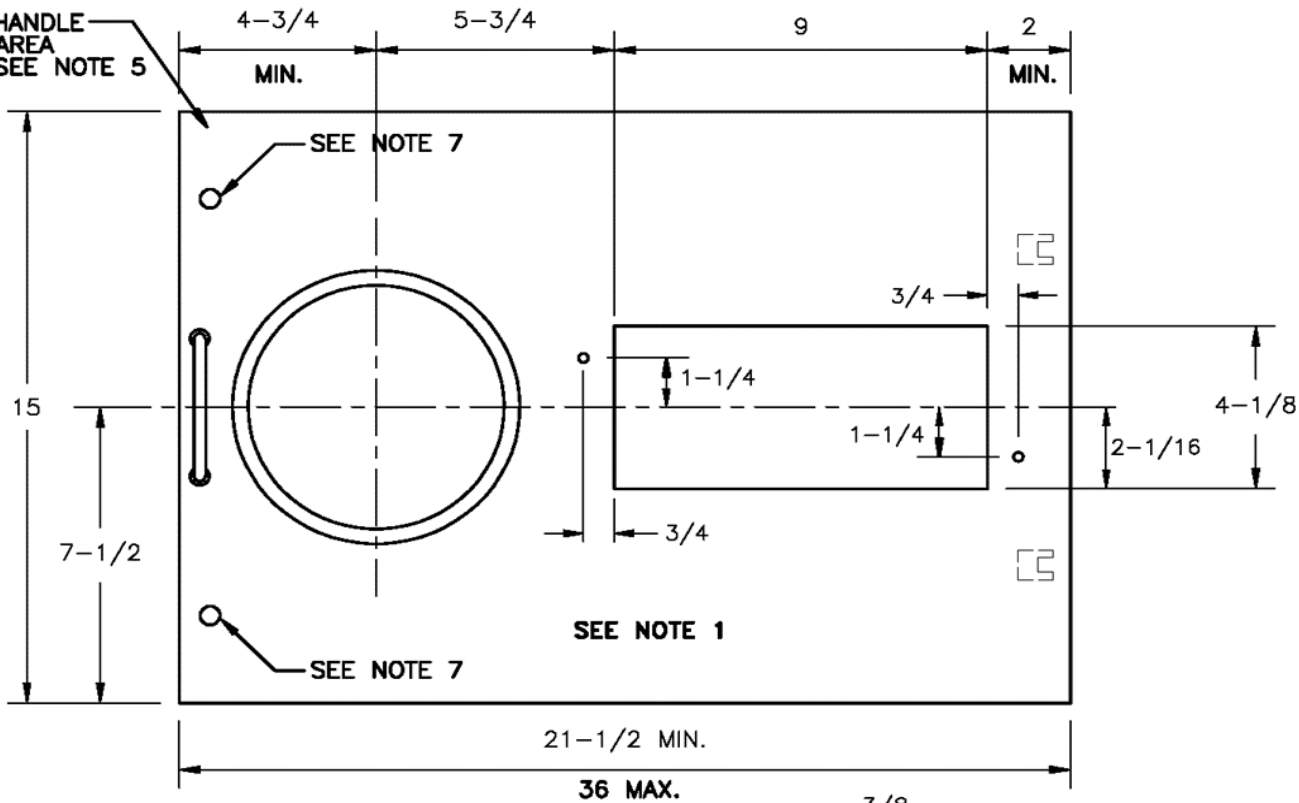
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	EUSERC MANUAL				
	<b>REMOVABLE LINK AND CURRENT TRANSFORMER SUPPORT FOR INSTRUMENT TRANSFORMER COMPARTMENTS WITH 5-INCH BUS, 0-600 VOLTS</b>				



FOUR 5/16 HOLES  
2 EACH, UPPER &  
LOWER FLANGES

HANDLE  
AREA  
SEE NOTE 5



ALL HOLES 10-32 TAP  
EXCEPT AS NOTED

**TEST SWITCH MOUNTING**

ALL DIMENSIONS SHOWN ARE IN INCHES

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EUSERC MANUAL  
15 INCH HINGED METER PANEL,  
0-600 VOLTS

SECTION  
300  
DRAWING  
332

**NOTES:**

1. The panel shall be constructed of 12 gauge (minimum) steel and shall be hinged at the test switch side by the manufacturer. The panel shall be furnished with a meter socket, sealing ring, and a slotted opening and removable plate for the installation of a secondary test switch. The slotted opening and removable plate edges shall be smooth to prevent damage to meter wiring.

Note: When a cast meter mounting ring is provided, the screws used to attach to the meter panel shall provide a minimum 1/8-inch clearance between the screw heads and the back of the ring.

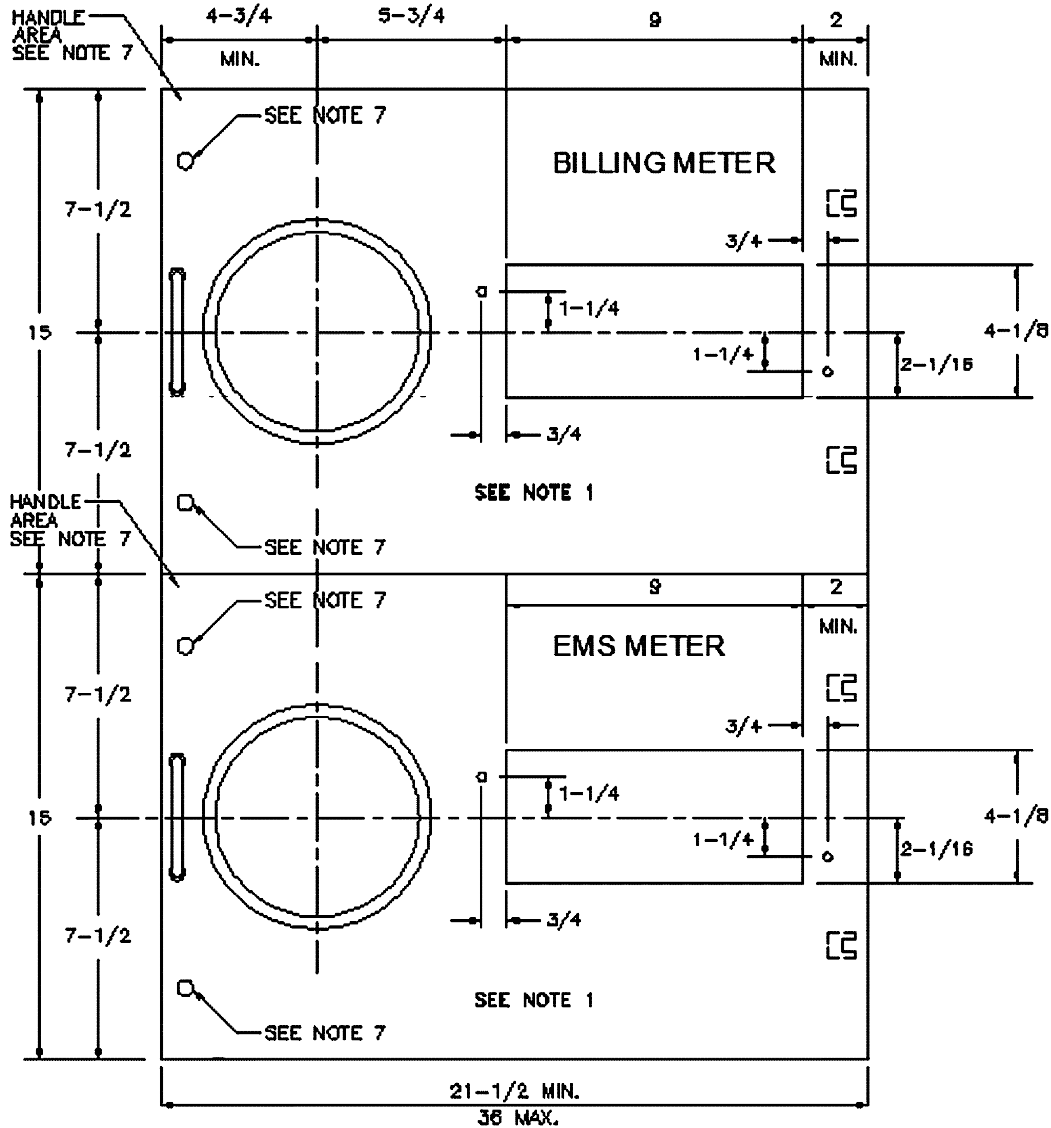
2. The removable plate shall be attached to the rear of the panel with screws that do not protrude through the face of the panel.
3. The meter socket shall be designed for back connection.
4. The panel shall be equipped with hinges. The hinges shall permit the panel to open to 90-degrees, and shall be easily interchangeable, right or left, on the meter socket panel. Removable pin type hinges are required, the pin shall be removable from the top.
5. The panel shall be equipped with a handle on the unsupported end. The handle shall be interchangeable, right or left, on the meter socket panel and maintain a 1-inch (minimum) clearance from the meter socket flange and slotted opening.
6. The panel shall support a 25-pound load applied at the unsupported end when fully opened with a maximum sag of 1/8 inch.
7. Stud and wing nut assemblies shall be sealable when used.
8. See Section 200 for correct meter socket configuration.
9. Test switch mounting holes shall be located on the top left and bottom right for safety.

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	EUSERC MANUAL			
	<b>15 INCH HINGED METER PANEL, 0-600 VOLTS</b>			
SECTION 300 DRAWING 332				



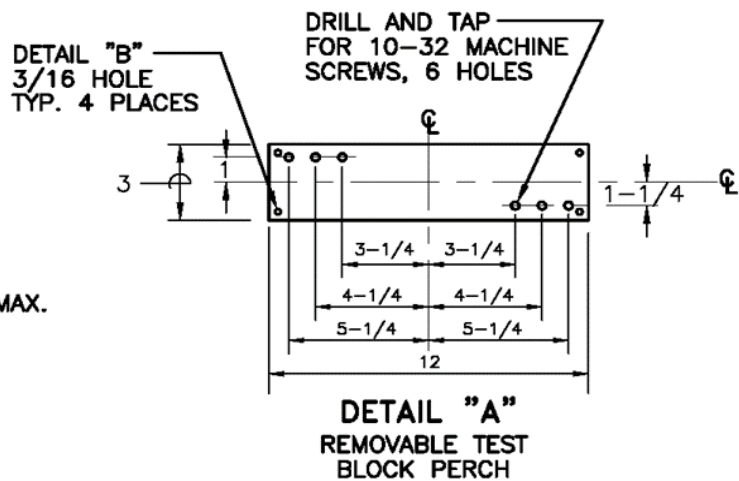
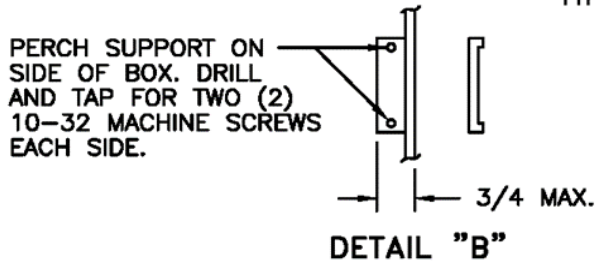
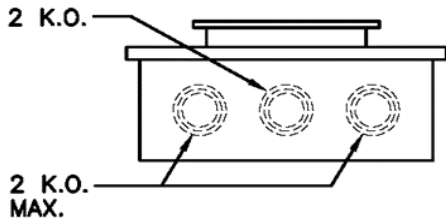
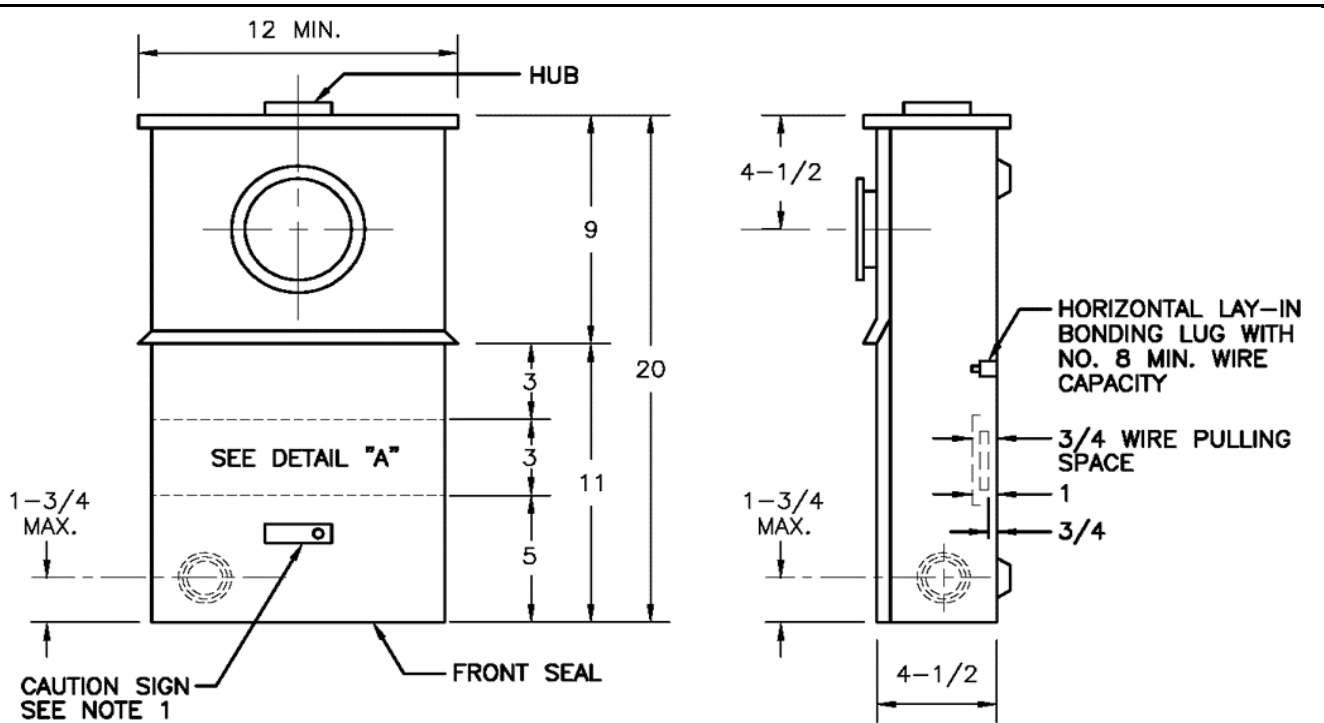
## APS ADDENDUM TO EUSERC DWG 332



**(2) 15-INCH HINGED METER PANEL  
0 - 15000 VOLTS**

GENERAL NOTES:

- A. Refer to sheet 1 of 2 and 2 of 2 of the EUSERC 332 drawing for test switch dimensions, test switch mounting information, and applicable notes.
- B. This diagram shall be used for applications requiring a second meter socket in order to meet APS requirements for large scale (utility scale) Generating Facility (e.g. Photovoltaic).
- C. Prior to applying this standard, check with the appropriate APS Representative.



**NOTES:**

1. All section covers shall be independently removable. Upper cover shall be non-removable when meter is in place. Lower cover shall be sealable and permanently labeled: "DO NOT BREAK SEALS, NO FUSES INSIDE".
2. For meter socket configurations, see Section 200, Drawing F-4.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL  
**SAFETY SOCKET FOR METERS USED  
 WITH INSTRUMENT - TRANSFORMERS**

**SECTION  
 300  
 DRAWING  
 339**

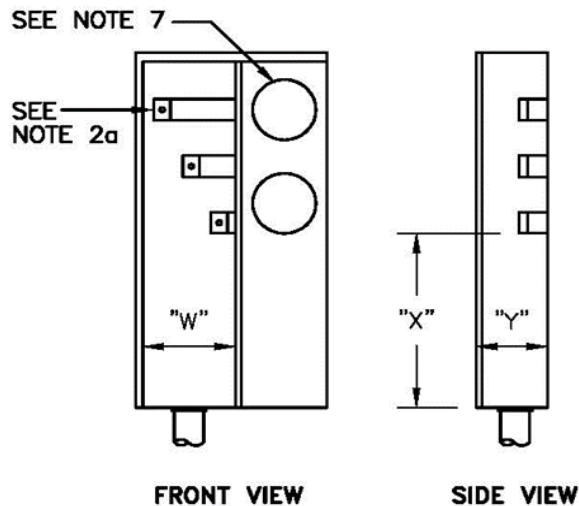


FIGURE 1

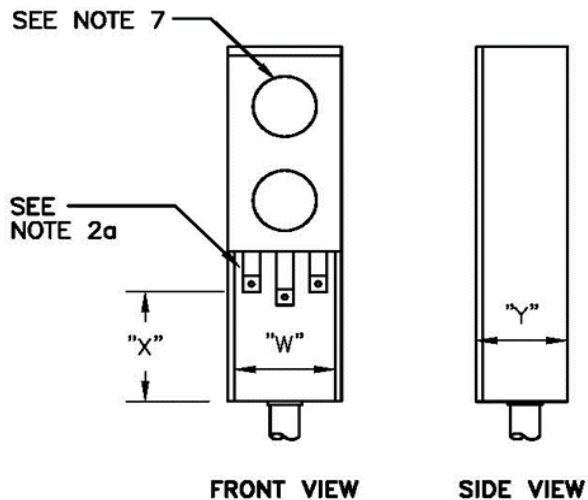


FIGURE 2

TYPICAL SERVICE TERMINATING ARRANGEMENTS. TWO (2) METERS (0-200 amp)

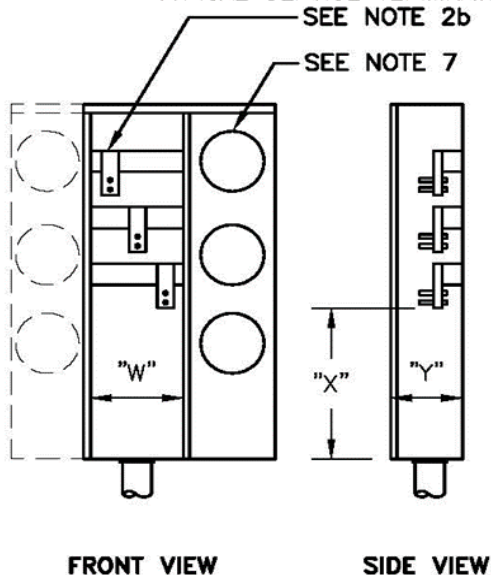


FIGURE 3

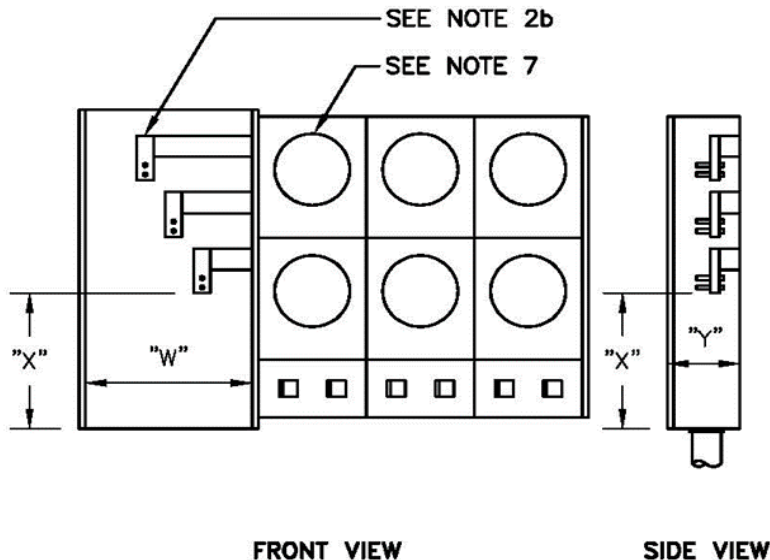


FIGURE 4

TYPICAL SERVICE TERMINATING ARRANGEMENTS. 3 - 6 METERS (201-600 AMPS)

EQUIPMENT RATING	"W"	"Y"	"X"
Amperes (Continuous)	SEE NOTE 6		SEE NOTES 3 & 4
0-200 AMPS	6-1/2 MIN.	5-1/2 MIN.	11 MIN.
201-600 AMPS	10-1/2 MIN.	6 MIN.	22 MIN.

ALL DIMENSIONS SHOWN ARE IN INCHES

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**COMBINATION TERMINATING ENCLOSURE AND MULTI-METER  
PANELS FOR RESIDENTIAL SERVICES - 6 METER MAXIMUM  
SINGLE PHASE 3 WIRE, 600 AMPERES MAXIMUM, 0-600 VOLTS**

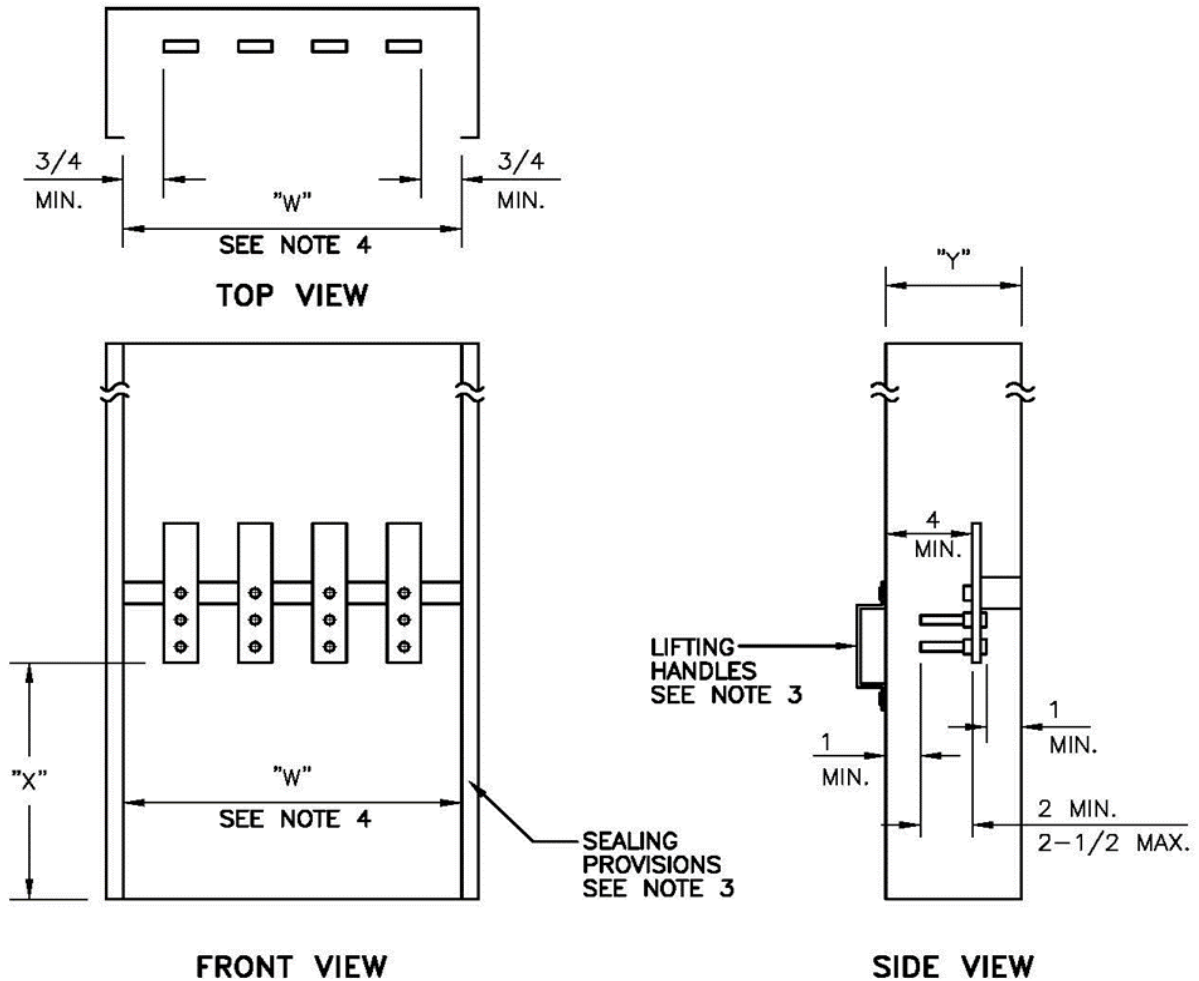
SECTION  
300  
DRAWING  
342

**NOTES:**

1. Pull section covers shall be:
  - a. Independent of other service equipment and removable without disturbing adjacent panels
  - b. Removable, sealable, provided with two lifting handles and limited to a maximum size of 9 square feet in area. See Drawing 300, General Notes for handle and sealing requirements.
2. Terminating facilities for service supply conductors shall be provided as follows:
  - a. For equipment rated 200 amperes (Figures 1 and 2), terminations may be aluminum-bodied, mechanical lugs with a range of No. 4 AWG through 250 KCMIL. See Drawing 301 for termination clearance and spacing requirements.
  - b. For equipment rated 201–600 amperes (Figures 3 and 4), terminations shall be two 1/2–inch steel bolts as shown. See Drawing 347 for additional bolt details and termination clearance and spacing requirements.
3. The neutral terminating position shall be identified. A bonding screw or jumper shall be provided if the neutral terminal is insulated from the enclosure.
4. For equipment rated up to 200 amperes, the neutral termination height may be reduced to 8–1/2 inches.
5. Cross–bussing of a different phase or potential installed behind or below any terminating position shall be fully insulated or barriered. Insulating barriers shall be rigid, non–flammable, rated for the serving voltage, resistant to ARC tracking, resistant to puncture or damage by impact and attached with non–conductive fasteners.
6. The minimum pull section access opening (W) is measured between the left side and right side return flanges.
7. See Drawing 353 for meter socket and panel requirements.

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	<b>COMBINATION TERMINATING ENCLOSURE AND MULTI-METER PANELS FOR RESIDENTIAL SERVICES – 6 METER MAXIMUM SINGLE PHASE 3 WIRE, 600 AMPERES MAXIMUM, 0-600 VOLTS</b>			
SECTION 300 DRAWING 342				



**TABLE 1 (MINIMUM PULLBOX DIMENSIONS)**

SERVICE AMPACITY	"W" (See note 4)		Y	X
	3-WIRE	4-WIRE		
0-200	10-1/2"	14"	6"	11"
201-400	10-1/2"	14"	6"	22"
401-800	16-1/2"	22"	11"	26"
801-1200	22-1/2"	30"	11"	26"

**NOTES:**

1. Terminating facilities for service supply conductors shall be two 1/2-inch steel bolts as shown. One set of bolts shall be provided for terminations rated up to 400 amperes, two sets of bolts for terminations rated 401-800 amperes and three sets of bolts for terminations rated 801-1200 amperes. See Drawing 347 for additional bolt details and termination and clearance requirements.

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	<b>WALL-MOUNTED PULL BOX WITH TERMINATING FACILITIES 0-600 VOLTS, 1200 AMPERES MAXIMUM</b>	

2. Terminating facilities shall be secured to prevent turning or bus misalignment when the cables are installed.
3. Pull box covers shall be removable, sealable, provided with two lifting handles, and limited to a maximum size of 9 square feet in area. See Drawing 300, General Notes, for handle and sealing requirements.
4. The minimum pull box access opening (W) is measured between the left side and right side return flanges.

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	<b>WALL-MOUNTED PULL BOX WITH TERMINATING FACILITIES 0-600 VOLTS, 1200 AMPERES MAXIMUM</b>				



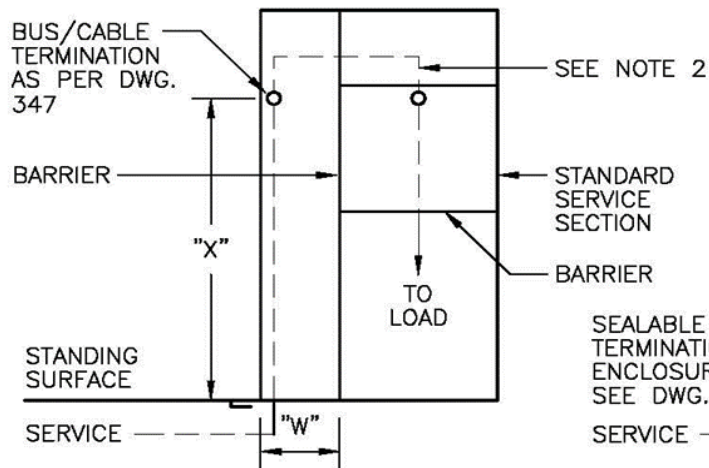


FIGURE 1  
SWITCHBOARD  
PULL SECTION

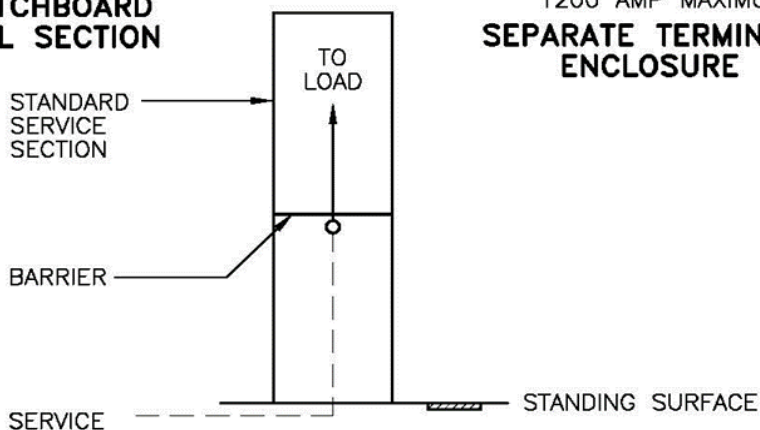


FIGURE 2  
1200 AMP MAXIMUM  
SEPARATE TERMINATION  
ENCLOSURE

FIGURE 3  
2000 AMP MAXIMUM  
SEE DRAWING 327 FOR PULL SECTION REQUIREMENTS

**BOTTOM FEED PULL SECTION**

TABLE 1 MINIMUM PULLBOX DIMENSIONS – SEE NOTE 5

SWITCHBOARD RATING (AMPERES)	MINIMUM ACCESS OPENING DIMENSION (W)–SEE NOTE 4		TERMINATION HEIGHT (X)
	3-WIRE	4-WIRE	
BELOW 400	CONSULT SERVING AGENCY		
400 – 800	24	24	42 MIN. – 72 MAX.
801 – 1200	24	30	
1201 – 2000	30	35	60 MIN. – 72 MAX.
2001 – 3000	---	42	
3001 – 4000	---	44	60 MIN. – 72 MAX.

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**UNDERGROUND SERVICE TERMINATION STANDARD  
SWITCHBOARD SERVICE CONNECTION 400 TO 4000 AMP,  
0-600 VOLTS**

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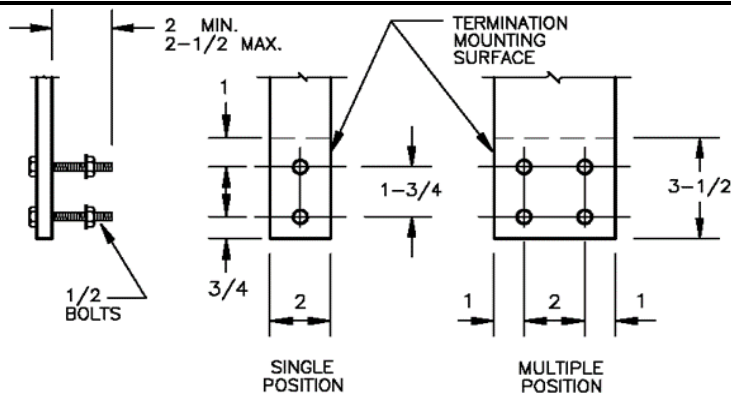
**NOTES:**

1. A switchboard pull section as shown in Figure 1, a separate (nonattached) termination enclosure as shown in Figure 2, or a combination switchboard service section and pull section (bottom feed) as shown in Figure 3 shall be provided for underground services.
2. Bus bars or cables may extend from the pull section into switchboard service sections rated up to 800 amperes. Bus bars are required when the service section rating exceeds 800 amperes or multiple metering is supplied.
3. When the service section is supplied from a switchboard pull section as shown in Figure 1, the bus bars or cables shall enter through the side of the sealable section above the current-transformer compartment, or by means of horizontal cross-busing in back of the metering compartment.
4. When horizontal cross busing exists the switchboard pull section below the terminating facilities, the lowest cross bus unit and the transition bussing supplying the cross bus units shall not be less than two feet above the bottom of the enclosure or more than 8 inches from the back of the enclosure.
5. The minimum pull section access opening (W) is measured between the left side and right side return flanges.
6. Side or rear entry of service entrance cables into the pull section may require greater dimensions than shown in Table 1. Consult the serving agency for requirements.
7. All terminating enclosures (i.e. pull boxes and pull sections) shall have full front access. Cover panels shall be removable, sealable, provided with two lifting handles, and limited to a maximum of 9 square feet in area.
8. Sealing provisions shall consists of two drilled stud and wing-nut assemblies on opposite sides of the panels.
9. See Drawing 347 for construction details and clearance requirements for terminating facilities in pull boxes and pull section.
10. Ground bus, when provided, shall be located at the rear of the terminating enclosure.

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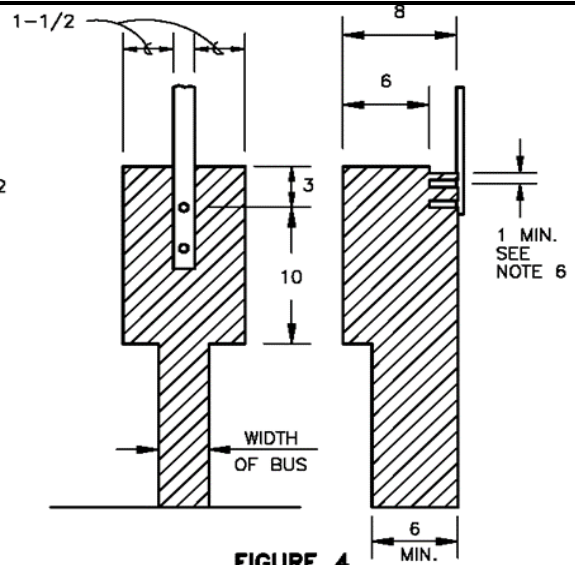
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	<b>UNDERGROUND SERVICE TERMINATION STANDARD SWITCHBOARD SERVICE CONNECTION 400 TO 4000 AMP, 0-600 VOLTS</b>				





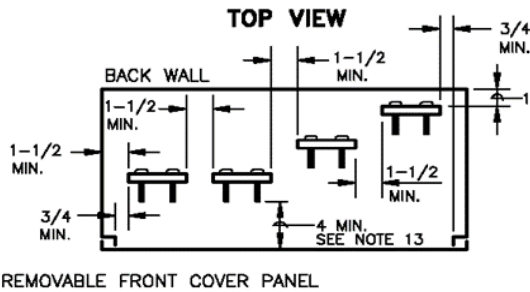
**FIGURE 1**

TERMINATING BOLT AND DRILLING DETAIL OF TERMINATING FACILITIES



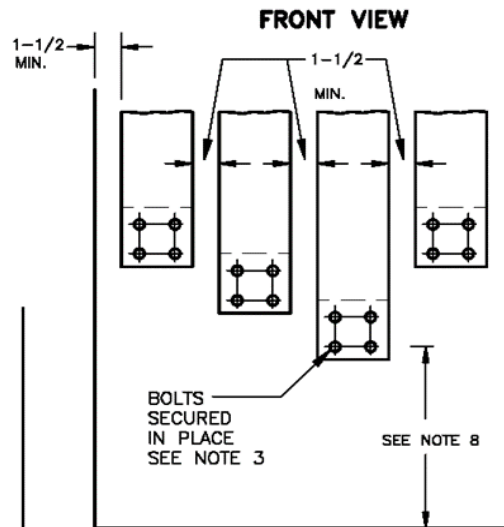
**FIGURE 4**

REQUIRED UNOBSTRUCTED WORKING SPACE FOR ALL TERMINATIONS.



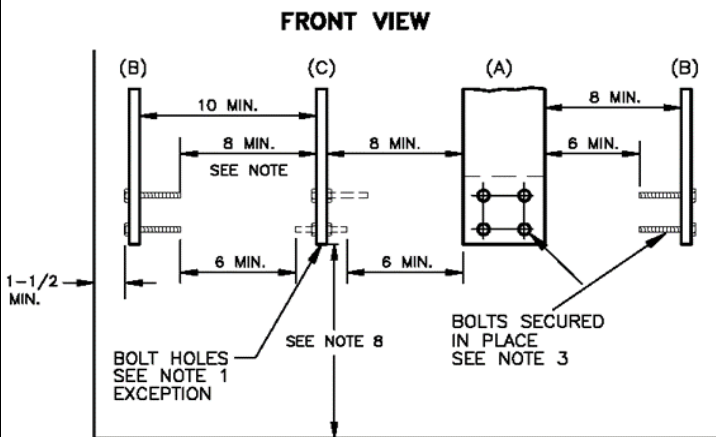
**FIGURE 2**

SPACING REQUIREMENTS FOR TERMINATING FACILITIES (SIDE BY OR STAGGERED)



**FIGURE 5**

SPACING REQUIREMENTS FOR TOP TO BOTTOM STAGGER OF TERMINATING FACILITIES



**FIGURE 3**

SPACING REQUIREMENTS FOR TERMINATING FACILITIES ACCESSIBLE FROM (A) FRONT ONLY, (B) ONE SIDE ONLY, OR (C) FROM EITHER SIDE. SEE NOTE 3 AND 4

**NOTE:**

4 INCH MIN. REQUIRED [ASSURE 1 INCH MINIMUM CLEARANCE FROM BODY OF TERMINATING LUG (WHEN IN PLACE TO FRONT PANEL)]

**EXCEPTION: SEE NOTES 4 AND 5**

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**UNDERGROUND SERVICE TERMINATING FACILITIES IN  
PULL BOXES OR PULL SECTIONS, 0-600 VOLTS**

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**NOTES:**

1. One landing position is required for each 400 amperes of service ampacity or fraction thereof (i.e., one position for up to 400 amperes, two positions for 401 through 800 amperes, three positions for 801 through 1,200 amperes, etc.). Each landing position shall consist of two 1/2-inch steel bolts. The bolts shall extend from 2-inches to 2-1/2-inches from the mounting surface and be spaced on 1-3/4-inch vertical centers. When multiple landing positions per phase are required, the horizontal spacing between the bolt positions shall be 2-inches (minimum).

**EXCEPTION:** Edgewise terminating facilities may consist of 9/16-inch holes having the same spacing as specified for the 1/2-inch bolts as specified above and in Figure 1. The unobstructed working space shall be provided on both sides of the termination bus (see figure 3).

2. Each terminating bolt shall be provided with a spring washer and a nut. The spring washer may be either a cone-type (Belleville) washer or a split-ring washer and a flat washer. All parts shall be plated to prevent corrosion.

**NOTE:** When Belleville washers are used, the manufacturer shall provide a label with the required torque settings. This label shall be in a readily visible location within the compartment that the washers are being utilized.

3. Terminating bolts must be secured in place. "Secured in place" shall mean that the studs will not turn, back out, or loosen in any manner when tightening or loosening terminal nuts (including cross-threaded situations). Terminating bolts shall not be used to secure the termination bus in place.

4. In the terminal mounting area, which is defined as the area of the terminating facilities shown in Figure 1, a clear space (barrel of proximity) of 1-1/2 inches minimum is required around any terminating facility including its bolts and bolt heads, any other bus, any other terminating facility, or any grounded surface, except:
  - a. The minimum clearance to the back of the pull section may be reduced to 1 inch.
  - b. The minimum clearance to any fully insulated horizontal bus behind the terminating facility may be reduced to 1 inch.
  - c. The neutral terminating facility may have a minimum clearance of 1 inch from any grounded surface.

5. Each terminating facility shall have an unobstructed working space, accessible from the front of the pull section as viewed from the access compartment opening, in front of the entire mounting surface as shown in figure 4.

**EXCEPTION:** For terminating facilities with bolts facing the access opening as shown in figure 2, the required 1-1/2 inch side clearance (bus to access opening return flange) may be reduced to 3/4 inch.

6. The clearance directly above and measured from the center of the top termination bolt may be reduced to 1 inch to either an insulated surface or bus of the same potential.

7. No more than one termination facility may be mounted along any sidewall.

8. See Drawings 302, 303, 342, 343, and 345 for the minimum distance from the lowest bolt on the termination facility to the bottom of the termination enclosure.

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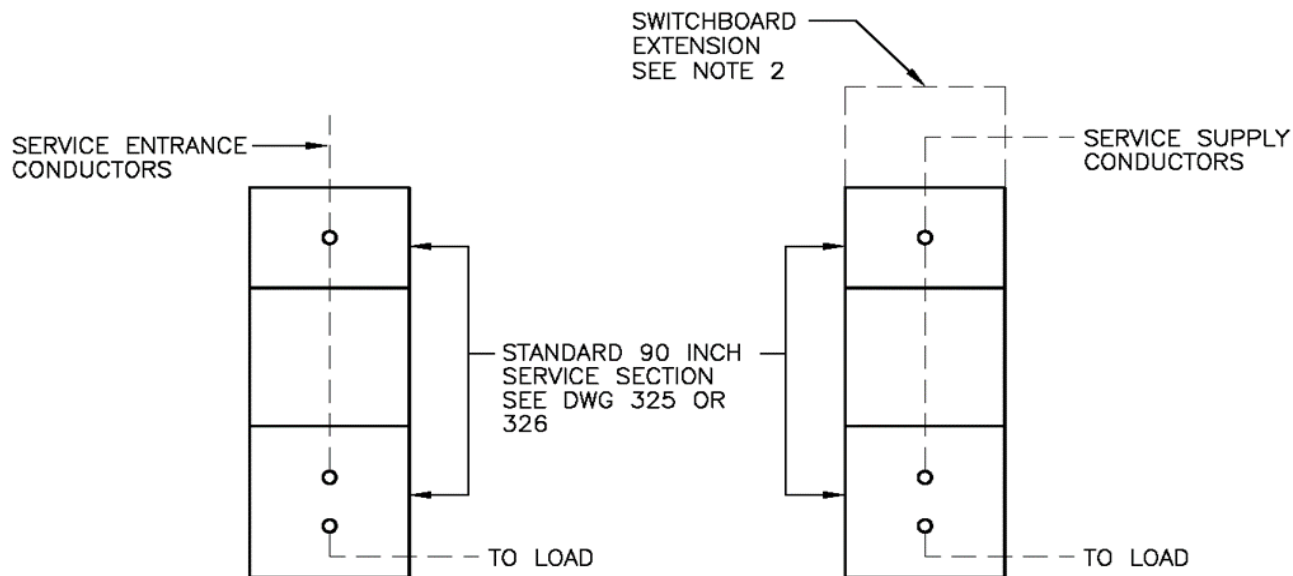
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	<b>UNDERGROUND SERVICE TERMINATING FACILITIES IN PULL BOXES OR PULL SECTIONS, 0-600 VOLTS</b>			
				SECTION 300 DRAWING 347

9. Terminating facilities shall be secured to prevent turning or bus misalignment when the cables are installed.
10. The neutral terminating facility shall be permanently identified in clearly visible block lettering reading either "neutral" or "N".
11. For 120/240 volt 3Ø 4-wire delta services, the power leg (measuring 208-volts-to-ground) shall be identified with an orange color.
12. Cross-bussing of a different phase or potential installed behind or below any terminating position shall be fully insulated or barriered. Insulating barriers shall be rigid, non-flammable, rated for the serving voltage, resistant to ARC tracking, resistant to puncture or damage by impact and attached with non-conductive fasteners.
13. For switchboard pull sections, the minimum clearance from any energized part to a removable access cover panel shall be 4 inches. This clearance may be reduced to 1-1/2 inches when a safety barrier is provided by the manufacturer. The safety barrier shall:
  - a. Be constructed of a rigid insulating material, resistant to damage by impact or puncture, with a minimum thickness of 1/8 inch.
  - b. Extend a minimum of 10 inches below terminating bus and extend upward to cover all energized parts that infringe into the 4 inch minimum clearance dimension, and be removable.
 

Note: Brackets and associated hardware used to mount the safety barrier shall not extend into the provided access opening.
  - c. Have a caution sign affixed to the barrier reading "WARNING: THE BARRIER MUST BE INSTALLED BEFORE REPLACING PULL SECTION COVERS". Additional caution signs shall be affixed to exterior of each section access cover reading "DO NOT REPLACE PULL SECTION COVERS UNTIL SAFETY BARRIER IS IN PLACE".
  - d. Screws or bolts requiring special tools for installation or removal are not acceptable.

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**FIGURE 1**

**FIGURE 2**

**NOTES:**

1. The service entrance conductors, Figure 1, either cable or bus bar, are furnished and installed by the customer in the following manner:
  - a. When switchboards are served through bus bar conductors, the conductors shall enter through the top, or at the side or back in the upper 10-inch section.
  - b. When switchboards are served through cable conductors, the conductors shall enter through the top of the board only, as shown Figure 1.
2. When the serving agency or customer requires incoming conduits from the side or rear for the service conductors, an extension as shown in Figure 2, or other special designed termination may be required. Consult the serving agency for the extension dimension.
3. The direction of feed is from top to bottom in the standard switchboard service section. Load conductors shall leave below the metering compartment and may not be routed back through the current transformer compartment in order to exit the service section.
4. Service entrance conductors shall be connected to the bussing in the service section with lugs approved by the serving agency for the type conductors used.

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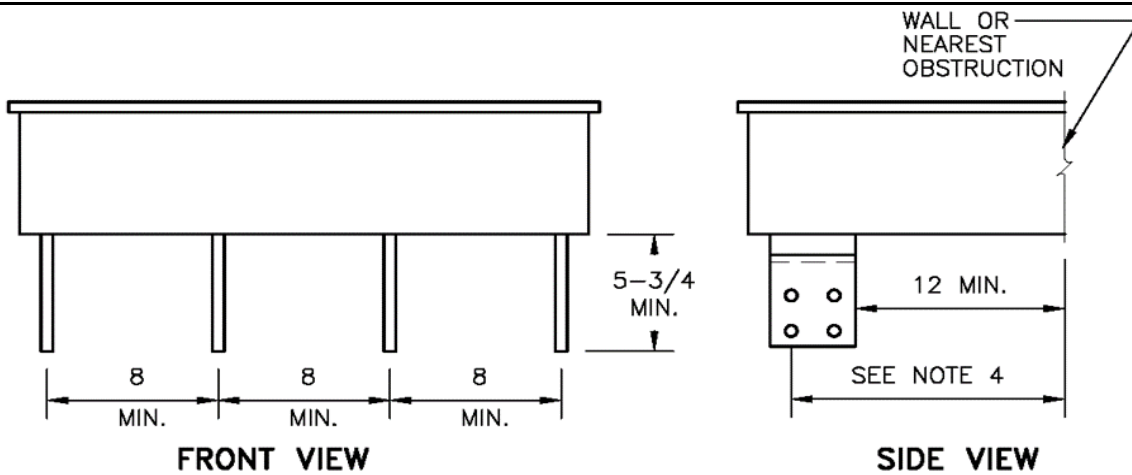
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**OVERHEAD SERVICE TERMINATION STANDARD  
 SWITCHBOARD SERVICE SECTION 0-600 VOLTS**

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 DRAWING  
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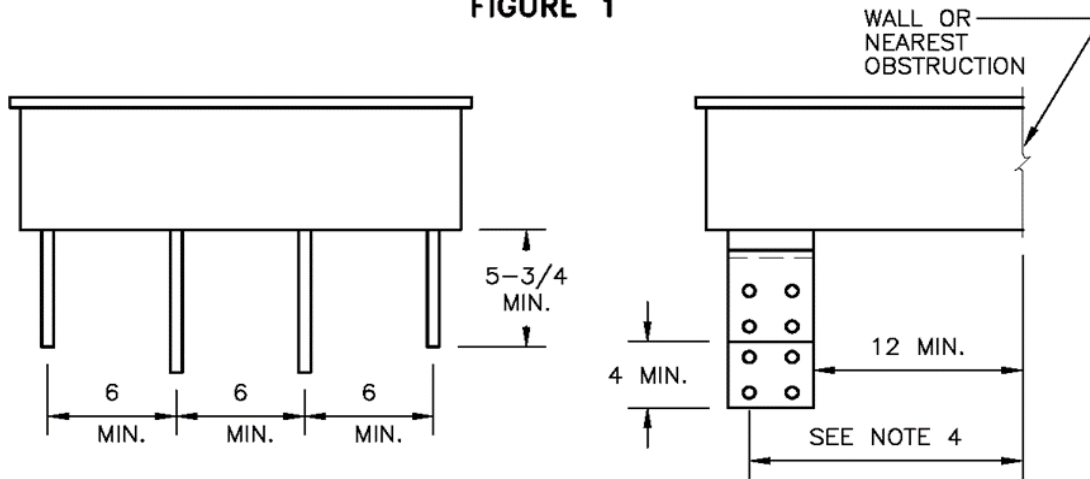


**FRONT VIEW**

**SIDE VIEW**

TERMINATING FACILITIES SAME LENGTH (4-WIRE SHOWN)

**FIGURE 1**



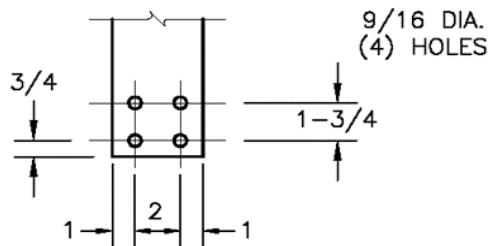
**FRONT VIEW**

**SIDE VIEW**

TERMINATING FACILITIES STAGGERED (4-WIRE SHOWN)

**FIGURE 2**

CLEARANCES INDICATED ARE FOR SINGLE LUG MOUNTING ONLY, NOT MULTIPLE STACKING LUGS



DRILLING DETAIL FOR TERMINALS (800 AMPERE TERMINAL SHOWN)  
SEE NOTES 1, 2 AND 3

**FIGURE 3**

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**OVERHEAD SERVICE TERMINATION STANDARD  
SWITCHBOARD SERVICE SECTION 0-600 VOLTS**

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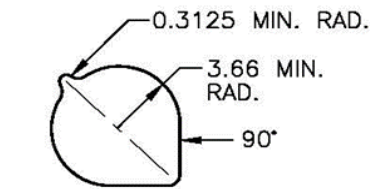
**NOTES:**

1. One terminal landing position is required for each 400 amperes of service ampacity (or portion thereof). Each landing position shall consist of two 9/16-inch holes spaced on 1-3/4 inch vertical centers. When multiple landing positions are required, the horizontal spacing between landing positions shall be 2 inches (minimum).
2. Neutral terminal shall be permanently marked by the manufacturer.
3. For 240/120 volts 3 $\phi$  4-wire services, the power leg ("C" $\phi$ ) terminal shall be permanently marked in orange color by the manufacturer.
4. The maximum dimension from the building or nearest obstruction to the outermost landing position shall not exceed 25 inches unless approved by the serving utility.
5. Service heads with enclosed terminating positions are not permitted.

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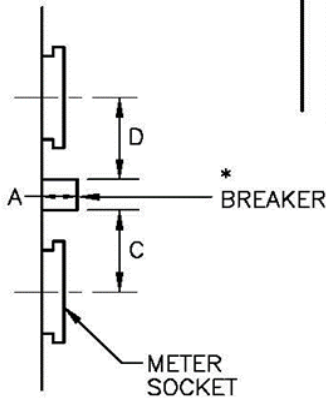
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METER CUTOUT DETAIL

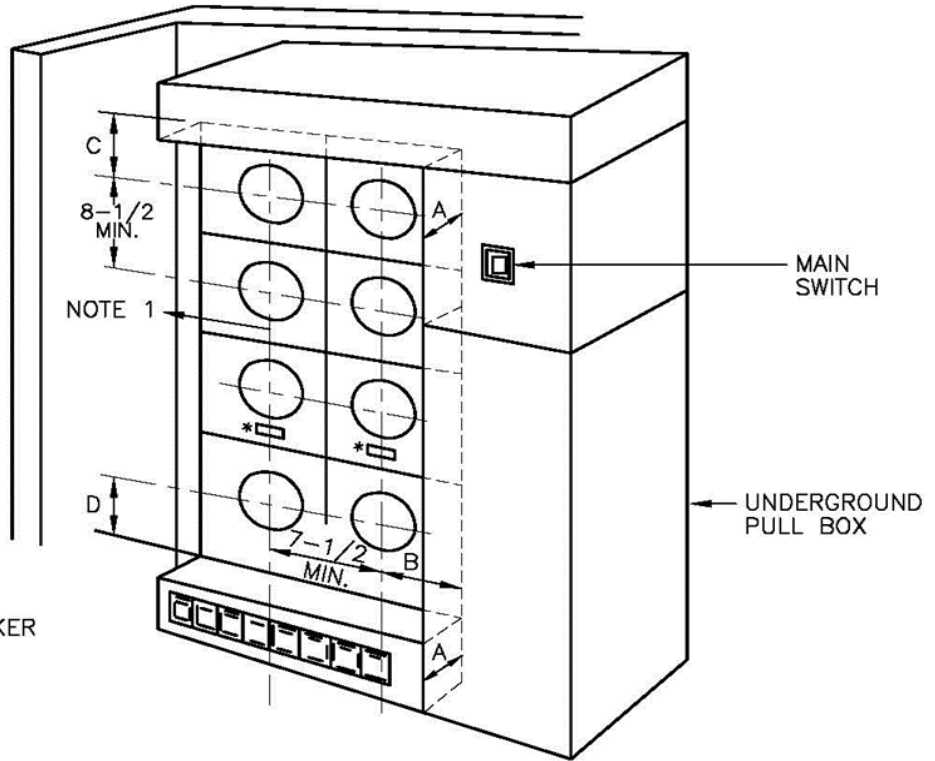
FIGURE 1



SIDE VIEW DETAIL

FIGURE 2

\* Alternate breaker position below meter socket  
See side view detail for clearance dimension



DIMENSIONS - INCHES			
"A" (PROTRUSIONS)	"B" MIN.	"C" MIN.	"D" MIN.
0 (No protrusion)	3-3/4"	4"	4-3/4"
Greater than 0" to 1-1/8"	4-1/4"	4"	4-3/4"
Greater than 1-1/8" to 2"	4-1/4"	4-1/4"	6-1/4"
Greater than 2" to 4"	6-1/4"	4-1/4"	8"
Greater than 4" to 11" max.	6-1/4"	10"	8"

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**CLEARANCES FOR RESIDENTIAL MULTIPLE  
 METERING INSTALLATIONS**

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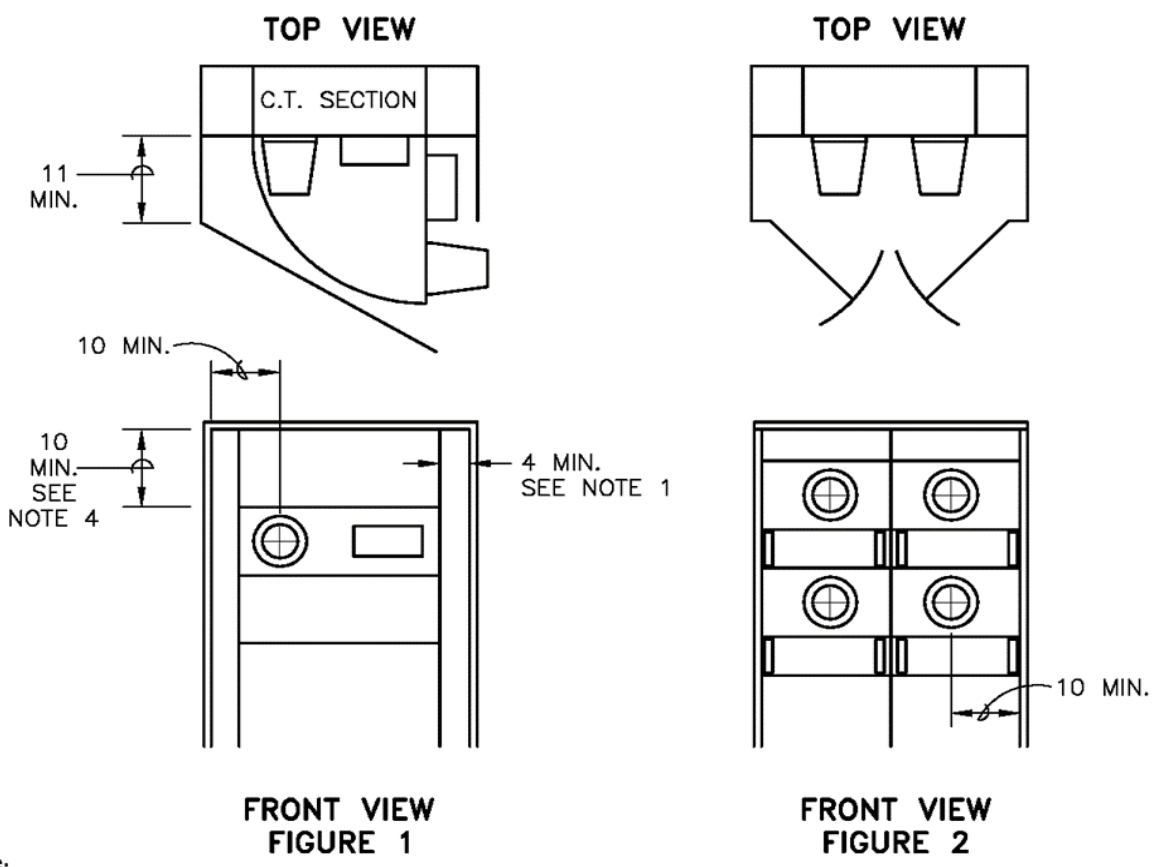
**NOTES:**

1. Where an adjacent wall or other obstruction extends more than 11 inch perpendicular from the face of the meter panel, a 10 inch minimum dimension to the meter socket axis is required. For obstructions extending 11 inch or less from the meter panel, the side clearance shall conform to that of Dimension "B".
2. Panels shall be removable to provide access to the customers equipment with the utility meters and tamperproof sealing rings in place. When there is more than one meter socket per panel, the minimum meter cutout opening, as detailed in Figure 1 above shall apply.
3. Underground landing lugs shall not be placed under any socket cover.
4. Dimension "B" shall be increased by the amount that the main switch door, including operating handle, reduces the clearance when opened 90 degrees.
5. See drawing 300 II D Meter Heights for meter maximum and minimum heights.
6. Removable meter panel covers shall not exceed 6 square feet in area.
7. Distribution conductors shall be barriered from metering compartment.

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	<b>CLEARANCES FOR RESIDENTIAL MULTIPLE METERING INSTALLATIONS</b>			
<b>SECTION 300 DRAWING 353</b>				





**NOTES:**

1. Hinged meter panel shall be capable of being opened 90–degrees with meter and test facilities in place, and provide the following clearances to any obstruction – 11 inches at the meter socket and 4 inches at the test–switch slotted opening. See Drawing 332 and 333 for hinged meter panels construction details.
2. Meter panels, either socket or blank, shall not be hinged to a hinged filler panel. Non–hinged filler panels shall not extend into the required instrument–transformer compartment access opening.
3. Enclosure doors providing access to utility compartments (i.e., metering sections and pull sections) shall be:
  - a. Equipped with a device to secure the doors in the open position at 90–degrees or more.
  - b. Secured in the closed position with a single, handle–operated, latching system. When provided with a locking means, each door, or set of doors, shall be equipped with an approved double–locking device, accepting padlocks with a 5/16 inch lock shaft, to allow access by both the serving utility and the customer.
4. Dimension may be reduced if the service section is supplied from horizontal cross–bussing or bus duct.

**ALL DIMENSIONS SHOWN ARE IN INCHES**

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	EUSERC MANUAL			
	<b>OUTDOOR OR RAIN TIGHT ENCLOSURES FOR SWITCHBOARDS, 0-600 VOLTS</b>			
				SECTION 300 DRAWING 354

1103.1 **APS ADDENDUMS TO EUSERC DRAWINGS**

Although most EUSERC drawings are accepted by APS “as is”, some of the drawings are not. APS has provided an Addendum page for each drawing that it does not accepted “as is”.

This Addendum page will immediately follow the EUSERC page in this manual, and will explain any required changes and/or additions APS requires. **These changes are mandatory, and APS will not accept any equipment in violation of these addendums.**



## METERING AND SERVICE EQUIPMENT (2400-27,000V)

### I. SCOPE

This section of the requirements applies only to revenue metering compartments of indoor and outdoor metal-clad switchgear for 601 through 27,000-volt installations, (See Drawings 401 and 404 for enclosure requirements). Front access medium voltage switchgear is acceptable.

### II. SWITCHGEAR WITH FUSED VOLTAGE TRANSFORMERS

#### A. General

##### 1. Drawing Approval

The manufacturer shall submit copies of the design drawings to the serving agency as required for high-voltage metering equipment prior to fabrication. Such drawings shall indicate the customer's name, the job address, the contact address, and the telephone number of the manufacturer's representative.

##### 2. Utility Compartment Labeling

Compartments of the metering enclosure shall be permanently labeled with machine engraved laminated phenolic (or equal) tags. Tags shall have quarter-inch white letters and numbers on red colored material that is readily visible and mechanically attached to the face of the following designated compartments.

- a. Utility voltage transformer compartment.
- b. Utility voltage transformer fuse compartment.
- c. Utility current transformer compartment.
- d. Utility service termination compartment.
- e. Utility metering panel.

##### 3. Safety Grounding Provisions

Bare bus 7 inches above and below the current transformers shall be provided to permit application of serving agency safety grounds. A grounding knob may be provided on the line and load side of the bus at each current transformer location.

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		<b>METERING &amp; SERVICING EQUIPMENT HIGH VOLTAGE</b>									
		<b>SECTION 400</b>									

4. Meter Panel

Meter panel and hinges are to be designed to adequately support a 25-pound load applied at the unsupported end with 1/8-inch maximum sag when open. Bond meter door to switchgear enclosure with a #4 AWG flexible braided bond wire, (See drawing 408 and 409 for meter panel layout).

5. Lifting Handles

When lifting handles are required on panels and covers, each handle shall be sized for full hand grasping, securely attached, and have strength to withstand handling stresses of 75 pounds minimum (See Drawing 401, 408, 409 and 418).

Note: Chest type handles with a folding bale grasp are not acceptable.

6. B.I.L. Rating

B.I.L. (Basic Impulse Level) for the metering enclosure shall not be less than the customer's associated switchgear. Reference shall be made to ANSI Standards for the minimum acceptable.

B.I.L. ratings for high voltage switchboards built to the listed nominal voltages shown in the applicable tables "Voltages and Insulation Levels for AC Switch Gear Assemblies" and as tabulated for Metal Enclosed Interrupter Switchgear. The metering cubicle shall be labeled with the B.I.L. rating.

Rated Maximum Voltage (kV)	Impulse Withstand (BIL-kV)
4.76	60
8.25	75
15.0	95
27.0	125

7. Rear Door Access to Metering Cubicle

Working clearances (\*) at the customer's job site may determine if the manufacturer is to furnish either a single or double full height hinged rear door access. Provisions for a three-point locking mechanism with hardware for attachment of the utility-furnished padlock are required.

All external doors shall, when open, be equipped with a device to hold the door at 90 degrees or more.

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	<b>METERING &amp; SERVICING EQUIPMENT HIGH VOLTAGE</b>			
				SECTION 400

8. Weatherproofing and Locking

Enclosure sketches on the following drawings show equipment with weatherproof doors. The meter panel shall be hinged on the side opposite that of the outer door on weatherproof units to permit 90-degree openings with the meters and test facilities in place. The weatherproof doors may be omitted if the equipment is located indoors. If the outer door is omitted, the meter panel must be lockable. The front weatherproof door shall be a single door equipped with a latch-type handle to accommodate the serving agency's padlock.

9. CT and VT Installation

Current transformers, voltage transformers, meters, testing facilities, and all normal secondary wiring from the transformers to the meters will be furnished and installed by the serving agency.

10. Working Space for Medium Voltage Switchgear

(\*) (Consult with utility for working clearance. Working clearances are governed by utility, code and customer requirements. Clearances can vary.)

**B. Bus Bars and Conductors**

1. Approved Bus Material

In CT & VT installations, copper buss shall be plated to prevent corrosion.

2. Bus Installation, Main Switch Ahead of Metering

When the main switch or circuit breaker enclosure is adjacent to and on the source side of the metering enclosure, connections from the load side of the main switch or circuit breaker to the line side of the current transformers shall be made using bus bars.

3. Conductors Passing Through Compartment Walls

When full BIL insulation cables or buses pass through compartment walls, full voltage and a BIL insulation system shall be provided.

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				SECTION 400

### C. Terminations

#### 1. Service Cable Terminations

For service ampacities up to 800 amperes, one landing position (\*) shall be provided on each phase and neutral bus for every 400 amperes, or portion thereof, of service ampacity. All bolts shall be secured in place and provided with nuts and pressure maintaining spring washers. All parts must be plated to prevent corrosion. Consult the serving agency for termination requirements when the ampacity exceeds 800 amperes.

Note: When Belleville (cone) washers are used, the manufacturer shall provide a label with the required torque setting. This label shall be in a readily visible location within the compartment that the washers are being utilized.

(\*) Two 1/2-inch steel bolts on 1-3/4-inch vertical centers extending 1 inch minimum to 1-1/2 inches maximum from the mounting surface. Terminating bolts must be secured in place. "Secured in place" shall mean that the stud will not turn, back out, or loosen in any manner when tightening or loosening terminal nuts (including cross-threaded situations).

#### 2. Insulated Neutral Termination

When an insulated neutral is required, it shall have full-voltage rated insulation from the metering cubicle. Consult the serving agency to determine if an insulated neutral is required.

### D. Instrument Transformer Mounting Bases and Bus Links

Voltage transformer and current transformer mounting bases are to be provided by the manufacturer, (See Drawing 407).

#### 1. Voltage Transformers

Locate the front or leading set of voltage transformer mounting holes 9 inches from the voltage transformer compartment door.

#### 2. Current Transformers and Bus Link

The current transformer bus units shall be drilled and spaced to accept the current transformers of the proper rating and class, (See Drawing 407, 2 of 2) and permit installation and removal of individual transformers without disturbing adjacent transformers. Center bus shall include a removable link dimensioned the same as the current transformer bars on the metered phases.

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	<b>METERING &amp; SERVICING EQUIPMENT HIGH VOLTAGE</b>							

3. Phase and Neutral Taps for Fuses and VT's

Lugs for voltage transformer phase and neutral connections shall be provided in the voltage transformer compartment.

4. Fuse Specification

Voltage transformer fuses shall be furnished and installed by the serving agency. The manufacturer shall provide mounting clips for indoor current limiting fuses with mounting clip separation and fuse ferrule diameter appropriate for the voltage rating of the equipment. Fuses shall be accessible through V.T. interlocked compartment door.

**III. METERING COMPARTMENT**

**A. Voltage Transformer Disconnect Requirements**

1. Key Interlocking is required between the voltage transformer disconnect and the voltage transformer compartment door so that, for personal safety, the voltage transformer compartment cannot be entered until all the following conditions are met:
  - a. The disconnect is fully open and visibly grounded.
  - b. When the voltage transformer disconnect is fully open, the disconnect blades must ground automatically.
  - c. The disconnect is locked open with a key interlock system.
2. The interlock system must prevent closing of the disconnect without first closing and locking the voltage transformer compartment.
3. The local utility will be provided with two keys for the interlock system.
4. Primary contacts for the voltage disconnect shall be of the blade and jaw design or equivalent to assure continued adequate contact. Wiping contact or pressure contact is not acceptable.
5. Operating handle or lever of the voltage transformer disconnect switch shall be pad lockable in the closed position.
6. The voltage transformer compartment door shall provide unobstructed access to the voltage transformer and fuses.

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	<b>METERING &amp; SERVICING EQUIPMENT HIGH VOLTAGE</b>			
				SECTION 400

7. Voltage Transformer Disconnect shall have minimum voltage rating equal to the customer equipment supplied. Voltage rating and BIL shall be as listed in Table on II. A-6.

**B. Alternate Meter Panel Location**

1. As an alternate, the meter panel may be mounted in front of the CT/Termination compartment. When the meter panel is opened, the compartment should be fully isolated by a removable or hinged barrier.
2. All external and internal doors providing access to the CT bus including the outer door, meter panel door, and hinged barrier shall be equipped with a device to hold them open at 90 degrees or more.

**IV. INSTRUMENT TRANSFORMER MOUNTING**

See Drawing No. 407.

**V. FUSE SPECIFICATION**

Voltage transformer fuses shall be furnished and installed by the serving agency. The manufacturer shall provide mounting clips for indoor current limiting fuses with mounting clip separation and fuse ferrule diameter dimensions as shown on Drawings 401 and 404.

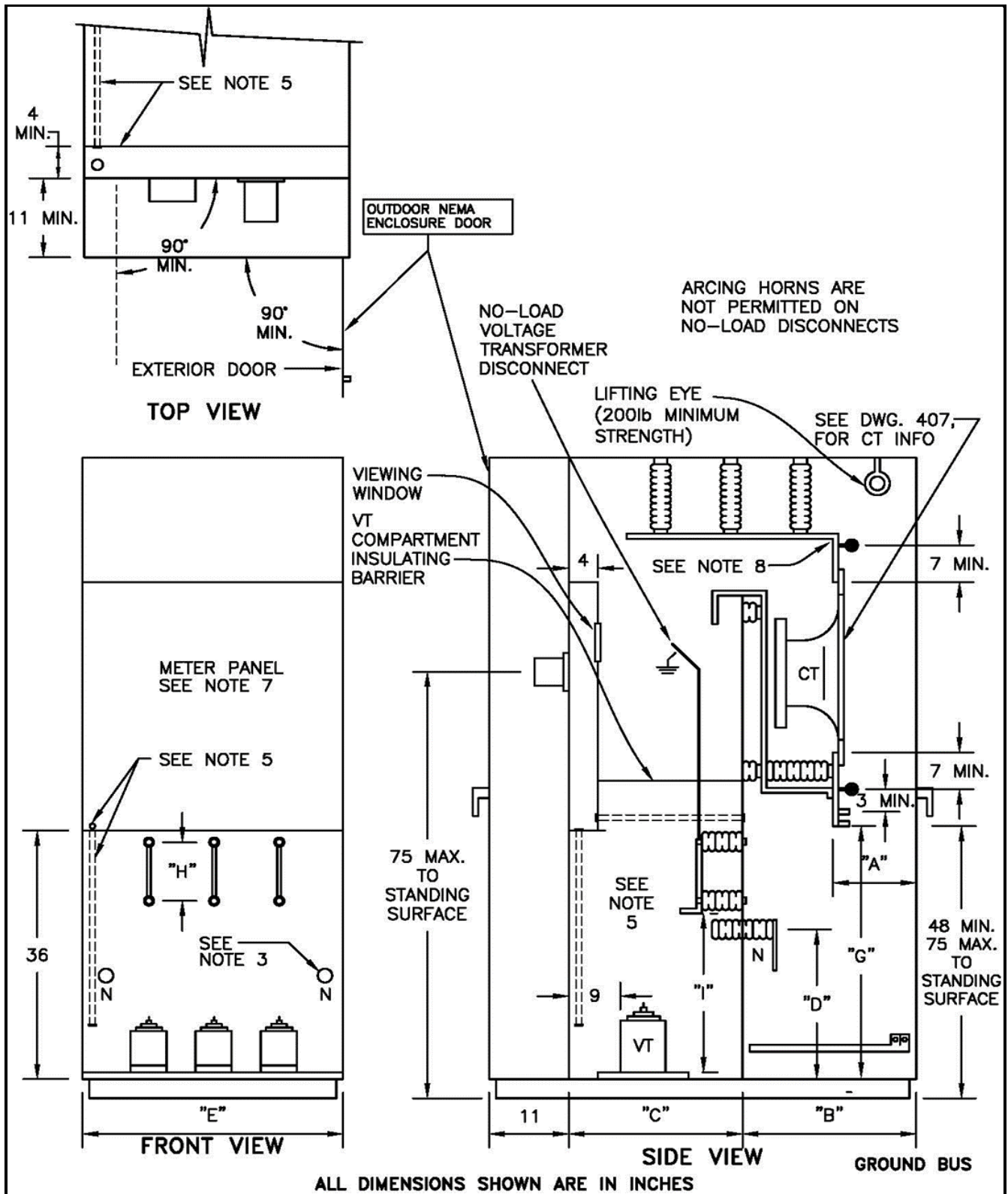
**VI. METERING COMPARTMENT (27,000 VOLTS SERVICE)**

- A. Vertical busing in the pull section and C.T. compartment shall be spaced 18 inches on the centerline between phases and the center phase shall be on the enclosure centerline.
- B. Current and voltage transformers will be outdoor type. Provide the transformer mounting bases and busing configuration (in the C.T. compartment) to accommodate this style of transformer. Consult utility for manufacturer catalog number and obtain the C.T. drawing.

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	<b>HIGH VOLTAGE METERING ENCLOSURE 2400 TO 15000 VOLT SERVICE</b>			

**SECTION  
400  
DRAWING  
401**

SPECIFICATIONS	VOLTAGE RATING	
	4800 Max.	4801-15000
MINIMUM BARE BUS CLEARANCE Ø TO GROUND	3-1/2"	6"
MINIMUM BARE BUS CLEARANCE Ø TO Ø	5"	7-1/2"
DIMENSION "A"	5" Min. 10" Max.	8" Min. 10" Max.
DIMENSION "B"	24" Min.	24" Min.
DIMENSION "C"	24" Min.	24" Min.
DIMENSION "D"	18" Min.	18" Min.
DIMENSION "E"	48" Min.	60" Min.
DIMENSION "G" (*See note below)	36-3/4" Min.	36-3/4" Min.
DIMENSION "H" FUSE MOUNTING (**) CLIP CENTER	8-1/2"	11-1/2"
DIMENSION "H" FUSE FERRULE DIAMETER	1-5/8"	1-5/8"
DIMENSION "I"	24"	24"

\* Dimension "G" applies when used as a cable termination section.  
Consult Utility.

\*\* Fuse centerlines shall be adjustable to allow fuse voltage selection at not less than 70% of the actual system voltage application.

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EUSERC MANUAL  
**HIGH VOLTAGE METERING ENCLOSURE  
2400 TO 15000 VOLT SERVICE**

SECTION  
400  
DRAWING  
401

**NOTES:**

1. For rear access door refer to dwg 400, sheet 2 note 7.
2. Consult serving utility for neutral requirements in 4 wire applications.
3. Provide full voltage and bil insulated neutral bushing for connection to V.T. compartment.
4. Primary taps for V.T.'s shall be connected to line side of metering C.T.'s.
5. One inch, non-metallic, V.T. and C.T. conduit shall be located on the hinged side of the meter panel at a maximum of 75 inches above the standing surface. The conduits shall be continuous conduits with no junction boxes or condulets.
6. The grounding bus shall extend on either left or right side of the access area of the C.T. compartment. The grounding terminals for use with the ball studs shall be two aluminum-bodied mechanical lugs accepting a range of 6 AWG through 250 KCMIL conductors, and shall be identified with a label reading "SAFETY GROUNDING POINT FOR UTILITY USE ONLY".
7. For single socket meter panel requirements see drawing 408. For dual socket panel requirements see drawing 409.
8. Ball studs (1/2"-13 threads with insulating covers) for the attachment of safety grounds shall be provided on the line and load side of the current transformer (C.T.) bus units. The studs shall be located on less than 7 inches from the end of the bus unit and oriented toward the compartment access opening.

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	<p><b>HIGH VOLTAGE METERING ENCLOSURE 2400 TO 15000 VOLT SERVICE</b></p>				

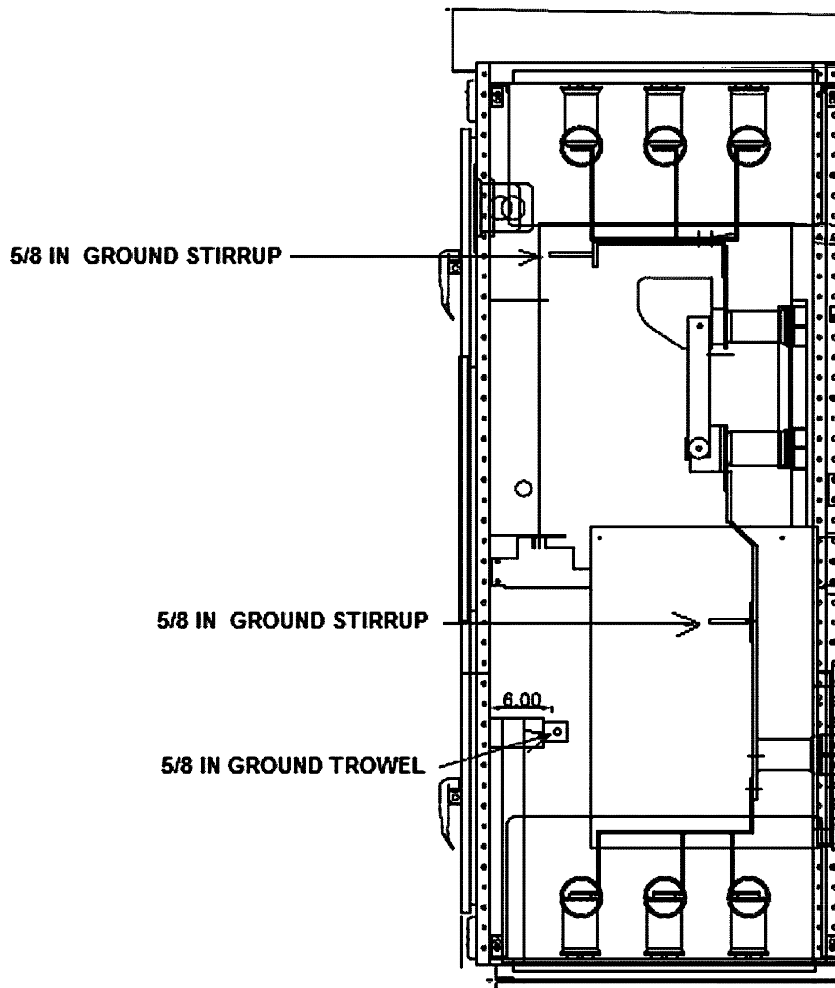
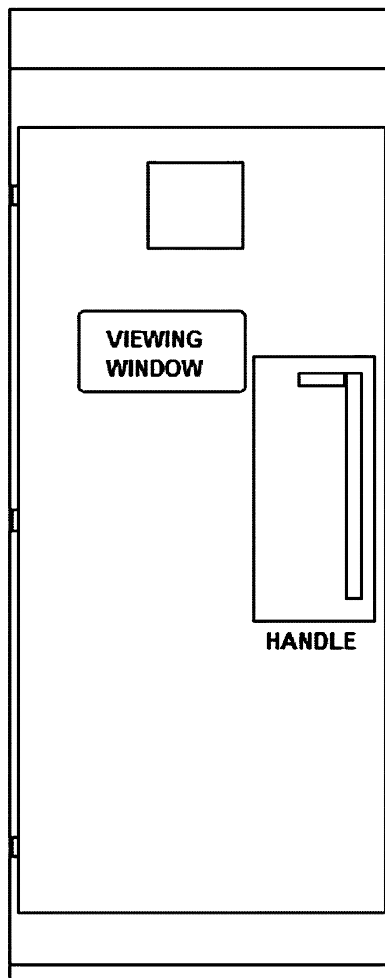
# APS ADDENDUM TO EUSERC REQUIREMENTS

## PAGE 401/APS

### NOTES:

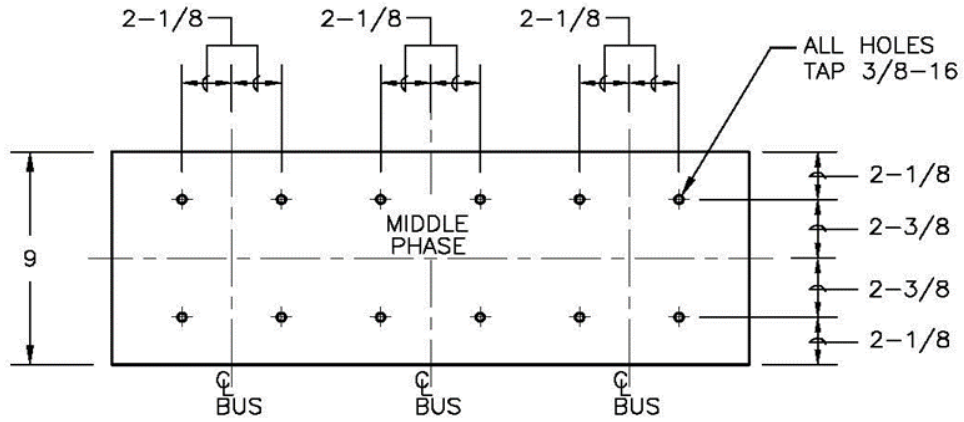
1. APS requires a horizontal insulating barrier between the PT compartment and the PT metering disconnect switch. The barrier shall be full width and depth and shall be supplied by the manufacturer.
2. APS is requiring a removable insulating barrier that shall be installed by the manufacturer. This is to shield personnel from any exposed buses in the CT compartment once the outer door is opened. The safety barrier shall be constructed of 1/4" thick clear acrylic, resistant to damage by impact or puncture, and shall be rated for the voltage served. This safety barrier shall be a two piece acrylic, extended a minimum of 10 inches below terminating bus, shall extend upward to cover all energized parts, and be hinged side as outer door. The safety barrier shall have a caution sign affixed to each barrier, reading "WARNING this barrier must be installed before closing compartment door."
3. APS requires additional labels stating the Service Voltage, Service Ampacity and the Site Address.
4. Modify drawing to show the insulated neutral bus extending from the service termination in the pull section through the metering PT compartment into the Customer's first disconnect compartment (non-sealed area), where it shall have a disconnect link if necessary and provisions for a bond tie on the line side of the said link. The insulated neutral bus is to be separate from the ground/bond bus (See Section 1000, Paragraph 705.6).
5. Grounding Stirrups shall be installed on each phase above service termination and below CT.
6. Labels need to be riveted on.
7. Underground Service Entrance Sections at primary voltage (greater than 600V) 3 phase are limited to 1,200 amps. Any customer requiring more than 1,200 amps will be required to install 2 or more service entrance sections.
8. Refer to ESRM 1000.4 for space requirements for primary metered switchgear (working space).





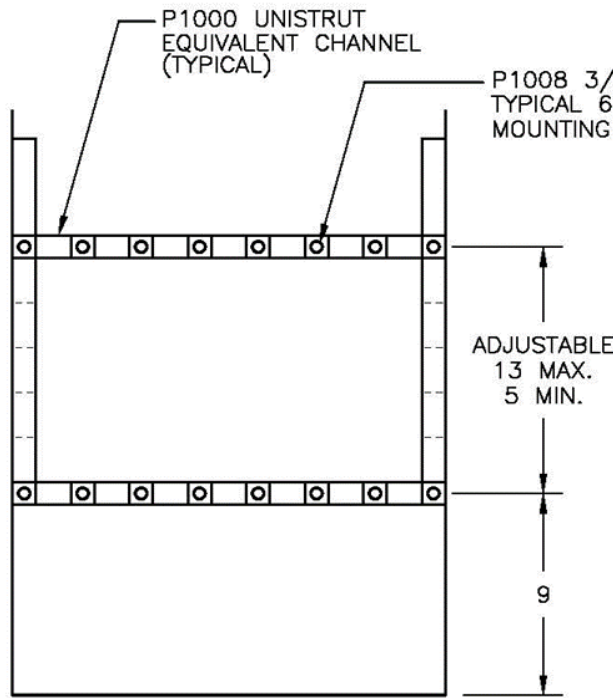
**NOTES:**

1. BUS ISOLATION SWITCH ENCLOSURE MUST BE BETWEEN EUSERC 401 METERING ENCLOSURE AND CUSTOMER'S FIRST MAIN DISCONNECT COMPARTMENT.
2. GROUNDING STIRRUPS ARE REQUIRED ON EACH SIDE OF SWITCH. GROUND ATTACHMENT POINTS MUST BE MINIMUM 5/8" ROUND BAR. GROUND STIRRUPS NEED TO BE MOUNTED HORIZONTALLY.
3. SWITCH TO BE GANG OPERATED.
4. GROUND BAR TO BE MINIMUM 5/8" ROUND BAR.
5. SWITCH HANDLE TO BE LOCKABLE IN BOTH OPEN AND CLOSED POSITIONS. MUST BE ABLE TO USE 5/16" SHACKLE PAD LOCK.
6. ENCLOSURE TO HAVE 120 VOLT LIGHT WITH SWITCH.
7. ENCLOSURE DOOR TO BE PAD LOCKABLE BUT NOT INTERLOCK OR KEYLOCK ON DOOR. MUST BE ABLE TO USE 5/16" SHACKLE PAD LOCK.
8. ISOLATED NEUTRAL BUS AND GROUND BUS FROM METERING ENCLOSURE MUST PASS THRU BUS ISOLATION SWITCH ENCLOSURE TO CUSTOMER'S FIRST MAIN DISCONNECT COMPARTMENT (NON SEALED AREA). SEE ADDENDUM 401/APS NOTE 5.
9. LABEL ENCLOSURE AS "BUS ISOLATION SWITCH". FOR LABEL REQUIREMENTS, SEE EUSERC DRAWING 400, SHEET 1, PARAGRAPH II A 2.

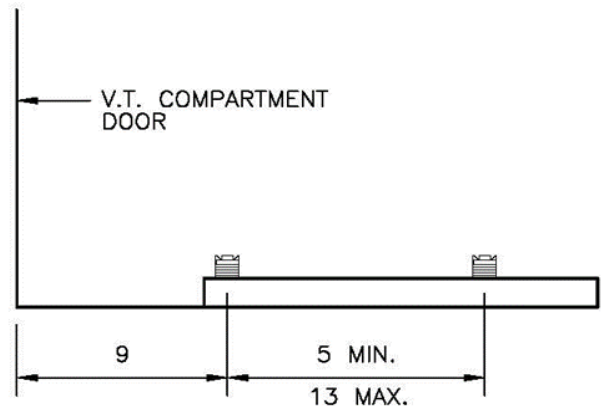


**CURRENT TRANSFORMER MOUNTING BASE**

NOTE: CENTER THE MOUNTING BASE BETWEEN THE UPPER AND LOWER CURRENT-TRANSFORMER BUS UNITS.



**TOP VIEW OF COMPARTMENT VOLTAGE TRANSFORMER MOUNTING RAIL DETAIL**



**SIDE VIEW OF V.T. MOUNTING**

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EUSERC MANUAL  
**MOUNTING PATTERN FOR INSTRUMENT TRANSFORMERS**  
**2400-27000 VOLT SERVICE**  
**CONSULT UTILITY FOR 15001 VOLTS AND HIGHER**

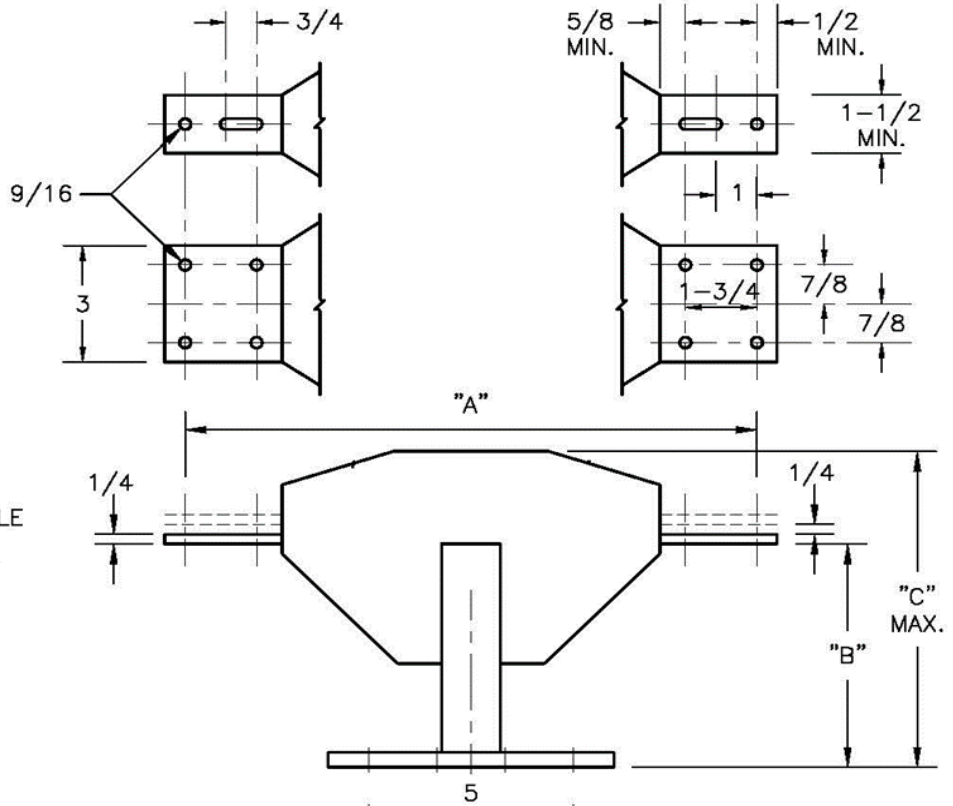
**SECTION**  
**400**  
**DRAWING**  
**407**



PRIMARY RATING  
800 AMPS OR LESS

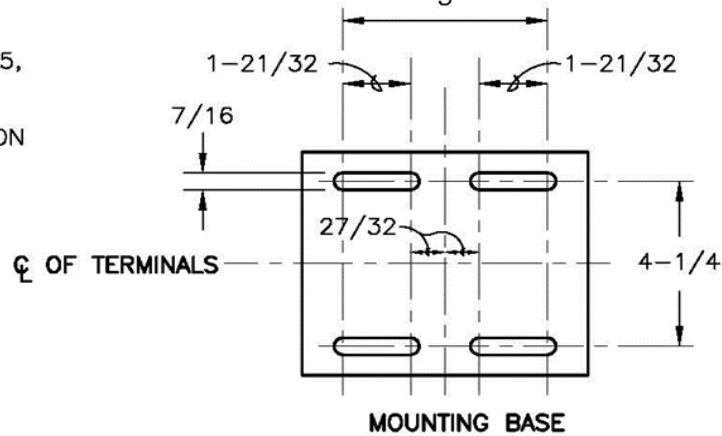
PRIMARY RATING OVER  
800 AMPS, 4 BOLT  
MOUNTING AT EACH  
C/T END

1/4 APPLIES TO MULTIPLE  
BAR THICKNESS. SINGLE  
BAR THICKNESS MAY BE  
FROM 3/16 TO 3/8.



NOTES:  
INSULATION CLASSES ARE 5,  
8.7 AND 15 KV.

BASIC IMPULSE INSTALLATION  
LEVELS (BIL) FOR THESE  
CLASSES ARE 60, 75 AND  
110 KV. RESPECTIVELY.



INSULATION CLASS KV.	DIMENSIONS IN INCHES *					
	"A"		"B"		"C" (Maximum)	
	AMPERES		AMPERES		AMPERES	
	10-800	1200-2000	10-800	1200-2000	10-800	1200-2000
5.0	14	-	5-3/4	-	8	-
8.7	15	-	8	-	10-1/2	-
15.0	22	26	9	5-3/4	11-1/4	13

\* Unless otherwise indicated tolerance, plus or minus 1/16 inch.

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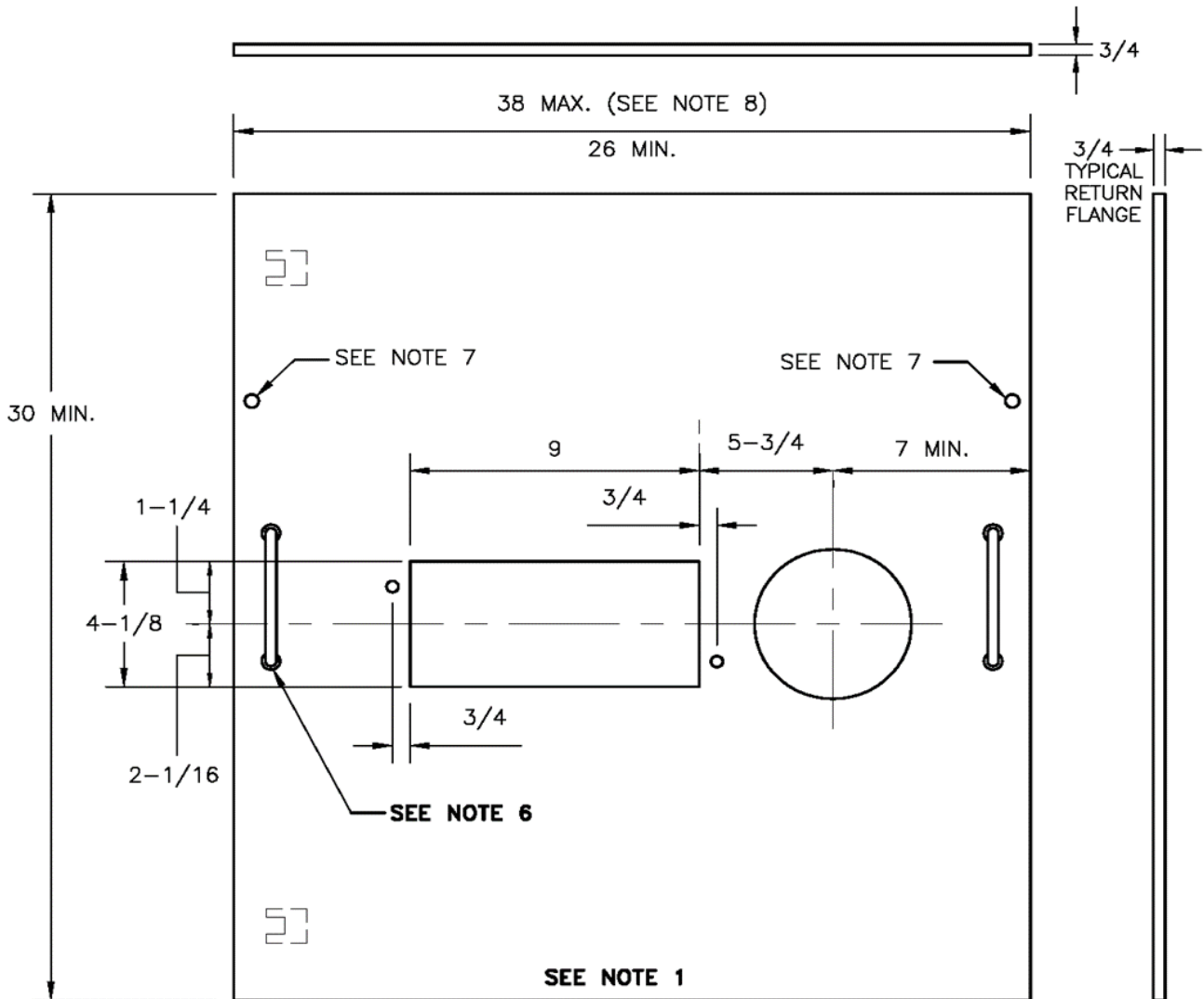
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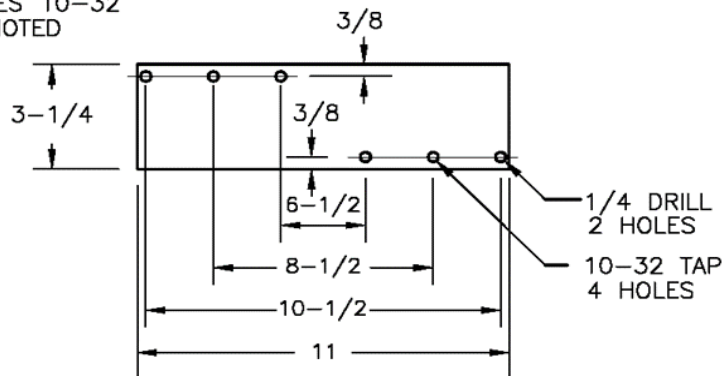
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**INDOOR CURRENT TRANSFORMER DIMENSIONS  
FOR METERING PURPOSES 5000-15000 VOLTS**

**SECTION  
400  
DRAWING  
407**



NOTE : TAP ALL HOLES 10-32 EXCEPT AS NOTED



**TEST SWITCH MOUNTING**  
**ALL DIMENSIONS SHOWN ARE IN INCHES**

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EUSERC MANUAL  
**HINGED METER PANEL WITH SINGLE SOCKET**  
**FOR 2400 TO 27000 VOLT SERVICE**

SECTION  
400  
DRAWING  
408



**NOTES:**

1. The panel shall be constructed of 12 gauge (min) steel and furnished with meter sockets, sealing rings, slotted openings, a removable plate for installation of a secondary test switch. Slotted openings and removable plate edges shall be smooth to prevent damage to meter wiring.

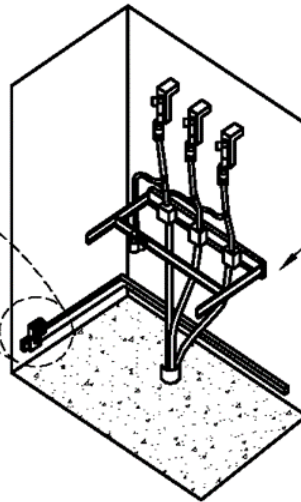
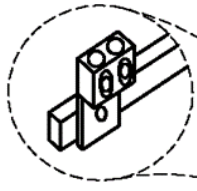
Note: When a cast meter mounting ring is provided, the screws used to attach to the meter panel shall provide a minimum 1/8-inch clearance between the screw heads and the back of the ring.

2. The removable plates shall be attached to the rear of the panel with screws that do not protrude through the face of the panel.
3. Meter sockets shall be designed for back connection.
4. The panel shall be reequipped with hinges. The hinges shall permit the panel to open to 90 degrees, and shall be easily interchangeable, right or left, on the meter socket panel. Removable pin type hinges shall be removable from the top.
5. The panel shall support a 25-pound load applied at the unsupported end when fully opened with a maximum sag of 1/8 inch.
6. The panel shall have a handle attached to both sides.
7. Stud and wing nuts shall be sealable when used.
8. Consult serving utility for panel width more than 38 inches.
9. Consult serving utility meter socket requirements.

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	<b>HINGED METER PANEL WITH SINGLE SOCKET FOR 2400 TO 27000 VOLT SERVICE</b>				

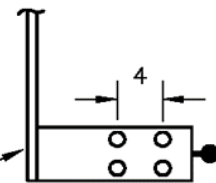
SEE NOTE 11



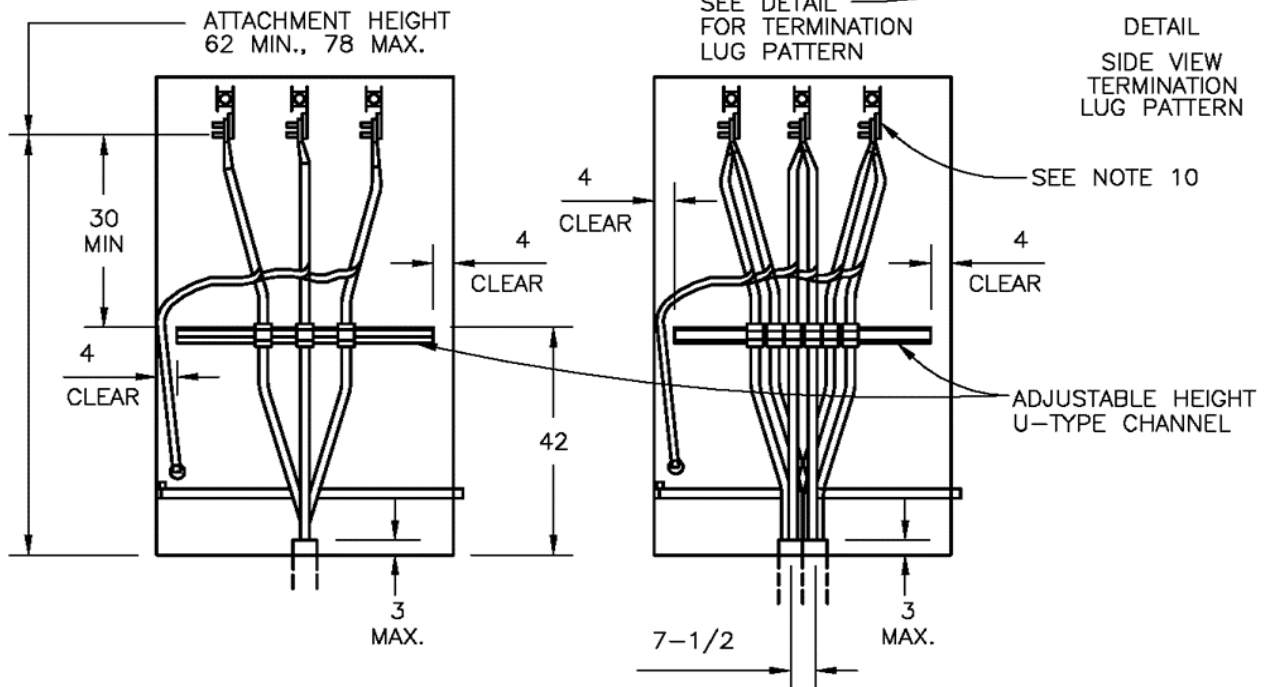
NOTE 8

**MINIMUM BARE BUS CLEARANCE**

4160 VOLTS (MAXIMUM): 5 PHASE TO PHASE, 3-1/2 PHASE TO GROUND  
 4800-15,000 VOLTS: 7-1/2 PHASE TO PHASE, 6 PHASE TO GROUND  
 SEE NOTE 7



DETAIL  
SIDE VIEW  
TERMINATION  
LUG PATTERN



**ALL DIMENSIONS SHOWN ARE IN INCHES**

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
A						D					
B						E					
C						F					

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SHEET  
1 OF 2

EUSERC MANUAL  
**UNDERGROUND SERVICE TERMINATING PULL SECTION**  
**5000 TO 15000 VOLT SERVICE**

SECTION  
400  
DRAWING  
418

**NOTES:**

1. Consult the serving agency regarding the metering cubicle requirements.
2. Consult the serving agency for number of service cables, number, size, and location of service conduits, type of pull section and type of termination required.
3. To main or metering cubicle, consult the serving agency regarding metering sequence, (i.e. main-metering or metering-main.)
4. Consult the serving agency to determine if an insulated neutral landing is required.
5. Consult the serving agency for required clear working space in front of the enclosing panels.
6. Pull section cover panels shall be:
  - a. Independent of other service equipment and removable without disturbing adjacent panels.
  - b. Sealable, provided with lifting handles, be limited to 9 square feet in area with a maximum width or length of 5 feet.  
Sealing provisions shall be studs and wing nuts.
  - c. A full height hinged door may be provided in place of removable cover panels. The door shall:
    - i. Be hinged and equipped with device to hold the door open at 90 degrees or more.  
Clevis or removable pin type hinges shall be removable from the top.
    - ii. Be sealable and a handle on the side opposite the hinges.
7. Bare bus clearances shall be a minimum 12 inches from any phase bus to a removable access cover panel.  
Note: For full height hinged doors see sheet 1 for bare bus clearances.
8. Furnish and install one piece of U-type channel as shown. One set of channel is required per set of conductors.
9. Bill for the pull section shall be not less than that for the customer's associated switchgear.
10. Ball studs (1/2"-13 threads with insulating covers) for the attachment of safety grounds shall be provided.
11. The ground bus shall extend to either the front left or right sides. The grounding terminals for use with the ball studs shall be two aluminum-bodied mechanical lugs accepting a range of 6 AWG through 250 KCMIL conductors and shall be identified with a label reading "SAFETY GROUNDING POINT FOR UTILITY USE ONLY."

RE	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
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C						F					

<b>SHEET 2 OF 2</b>	Indicates Latest Revision	<input checked="" type="checkbox"/> Completely Revised	<input type="checkbox"/> New Page	<input type="checkbox"/> Information Removed	<b>SECTION 400 DRAWING 418</b>
	EUSERC MANUAL				
	<b>UNDERGROUND SERVICE TERMINATING PULL SECTION 5000 TO 15000 VOLT SERVICE</b>				

**APS ADDENDUM TO EUSERC REQUIREMENTS  
PAGE 407/APS**

**NOTES:**

1. APS requires the 2-bolt, 22 inch, on all 15KV insulation class CT designs from 0-1200 amps instead of the 0-800 amps indicated on the EUSERC Dwg 407.



**SPECIAL APPLICATIONS**  
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## 1200.0 SPECIAL APPLICATIONS

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### 1200.1 GENERAL

The information and specifications included herein cover conductors and equipment connecting the APS electrical supply system to the Customer's premises. Subjects relative to this service are also presented for the mutual interest of the Customer and his representatives. **It is not a complete set of rules governing the installation of electrical wiring and equipment.**

These requirements are supplementary to and are not intended to conflict with the currently applicable National Electric Safety Code, National Electric Code, Municipal, County or State Codes, Ordinances or Regulations within the State of Arizona.

On new installations, or where changes necessitate relocating or replacing the service equipment, or when an installation has been disconnected by APS or the Fire Department because of fire or other damage, **APS shall not energize or restore service until the wiring has been approved and proper notification given to APS by the inspection authorities where such inspection is required.**

In areas where local inspection is not required, the service entrance including grounding and bonding shall be in accordance with APS requirements and the National Electric Code. The above equipment shall be inspected and approved by an APS representative prior to service being energized.

## 1201.0 TRAFFIC SIGNAL, INTERSECTION AND HIGHWAY SERVICE EQUIPMENT

---

### 1201.1 METERED LOCATIONS

- A) Metering equipment shall be located in a readily accessible location outside of the “controlled access” area of highway crossings or intersections. (See Figure 1, Paragraph 1201.5)
  - B) If fencing is required around the front of the metering equipment, there shall be two gates, one in front with an APS lock and one in the rear with a Customer lock. (See Figure 2, Paragraph 1201.5)
  - C) Metering equipment shall be either:
    - 1) a “EUSERC” and APS approved non-residential metering pedestal with safety test-bypass and the top and sides of the meter cover panel hinged. (Meter height to be per Section 300, Paragraph 302.2)
    - or -
    - 2) a “EUSERC” and APS approved non-residential “all-in-one” safety test-bypass can, mounted to the outside of the control cabinet. (Meter height to be per Section 300, Paragraph 302.2) The conduit riser shall be a minimum 2-1/2 inch rigid steel or Sch 80 PVC and shall be installed on the exterior of the control cabinet.
    - or -
    - 3) a “EUSERC” and APS approved non-residential “all-in-one” safety test-bypass can, mounted to the traffic signal pole. (Meter height to be per Section 300, Paragraph 302.2) Meter shall not face traffic. Conduit riser shall be a minimum 2-1/2 inch rigid steel or Sch 80 PVC and shall be installed on the exterior of the pole.
  - D) APS shall supply 120/240 Volt, 1Ø 3 Wire service as it's standard service.
  - E) APS shall approve the meter location and shall instruct the Customer where the “source” of service will be.
  - F) The Customer shall install conduit system to APS requirements. (See Sections 500 and 600)
  - G) APS shall pull service conductors from the “source” all the way to the metering equipment.
  - H) Each location shall be identified with a permanent address tag per Section 300, Paragraph 302.1.
- 

### 1201.2 UN-METERED LOCATIONS

- A) The APS “point-of-service” shall be an APS supplied, Customer installed J-Box. (See Paragraph 1202.1-1,2)
- B) APS shall specify J-Box type and location.
- C) The Customer shall install conduit system to J-Box, and pull wires from control cabinet to the J-Box.
- D) APS shall make the connections in the J-Box.
- E) If J-Box “source” will be a transition pole, Customer shall extend conduit to pole location and install an approved sweep, extend conduit a minimum of 6 inches above finished grade and cap it. (See Section 500, Paragraph 502.12-1,2)
- F) Standard service voltage provided shall be 120/240 Volt, 1Ø 3 Wire. A 240/480 Volt 1Ø 3 Wire is available for “non-standard” applications, **un-metered service only**.
- G) Each location shall be identified with a permanent address tag per Section 300, Paragraph 302.1. (Attached to controller cabinet.)

**1201.3 COMBINATION METERED/UN-METERED LOCATIONS:**

- A) Metered and un-metered services **shall not occupy the same conduit or meter can.**
- B) The APS "point-of-service" for the un-metered service shall be an APS supplied, Customer installed J-Box. For the metered service, the "point-of-service" shall be the meter can or pedestal.
- C) APS shall specify J-Box type and location.
- D) Two separate conduit systems shall be installed by the Customer. One from the J-Box to the meter can for the metered service and one from the J-Box to the control cabinet/disconnect for the un-metered service.
- E) APS shall install wire from the J-Box to the meter can for the metered service.
- F) The Customer shall install wire from the J-Box to the control cabinet/disconnect for the un-metered service.
- G) Meter locations and equipment shall meet all requirements listed in Paragraphs 1201.1 and 1201.2.

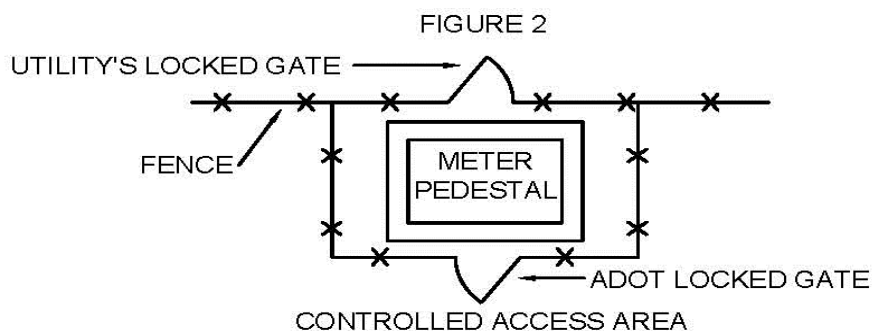
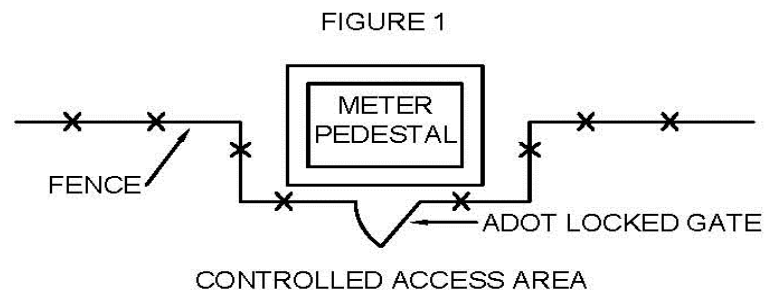
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**1201.4 MAINTENANCE AT INTERSECTIONS**

- A) APS shall notify ADOT, appropriate local City personnel and local Police Department before any outages at intersections.
- B) The Customer shall notify APS of any changes to load at un-metered locations that will affect flat-rated billing.

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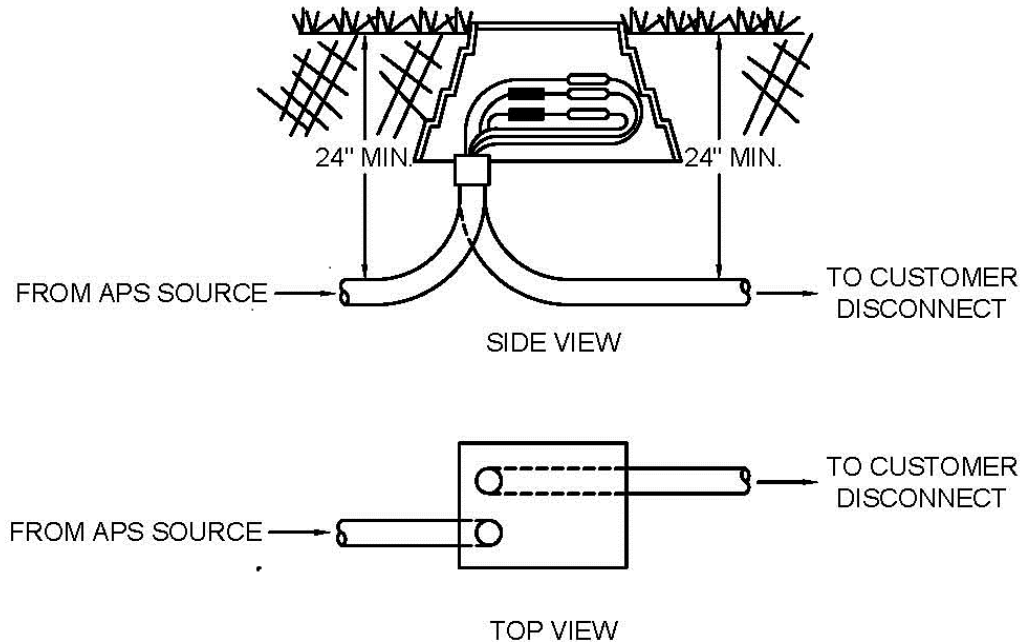
**1201.5 CONTROLLED ACCESS AREA FENCING REQUIREMENTS**





## 1202.0 UN-METERED SERVICE REQUIREMENTS

### 1202.1 TYPICAL UN-METERED SERVICE (For metered installations, see Section 500 Paragraph 506.7) 15 AMP MAXIMUM, 120V 1Ø 2 WIRE OR 120/240V 1Ø 3 WIRE, CONSTANT LOAD:



#### NOTES:

1. Installation shall be per N.E.C. and approved by local jurisdiction having authority.
2. Customer disconnect is required per N.E.C., also requires permanent ID tag.
3. Installation shall be an all conduit system with a minimum size 1 inch conduit. A 12" radius sweep is acceptable for 1" conduit.
4. See Section 500, Paragraph 502.0 for requirements for conduit system.
5. See Section 500, Paragraph 501.4 regarding coating required on steel conduit below grade.
6. Before digging or driving ground rod, be sure to call Blue Stake to get location of underground facilities. (See Section 100, Paragraph 100.12)
7. 5/8" x 8' ground rods to be installed at customer disconnect location. Rod must be 8' in the ground.
8. A #6 minimum copper ground wire is to be required for the ground rod connection.
9. Access shall be provided to J-box, with a minimum of 3 feet working clearance required in front of at least two adjacent sides of box.

**1202.1-2 TYPICAL UNMETERED SERVICE** (For metered installations, see Section 500, Paragraph 506.7)

**15 AMP MAXIMUM, 120V 1Ø 2 WIRE OR 120/240V 1Ø 3 WIRE, CONSTANT LOAD:**

10. Customer to extend conduit to an APS supplied, Customer installed J-box. APS shall specify J-box type and location. Customer to install J-box per APS specifications. (See local representative)
11. J-boxes shall not be installed in areas exposed to vehicular traffic.
12. Customer to install conductors to APS J-box. APS to terminate service in box.
13. APS provided and installed fuses shall be required at J-box terminations. APS "Point-of-Delivery" shall be the fused connection in the J-box.
14. For conduit system design between the J-box and the APS source, see Section 500 Paragraph 502.12-1 and 502.12-2



FIGURE 1 - POLE MOUNTED

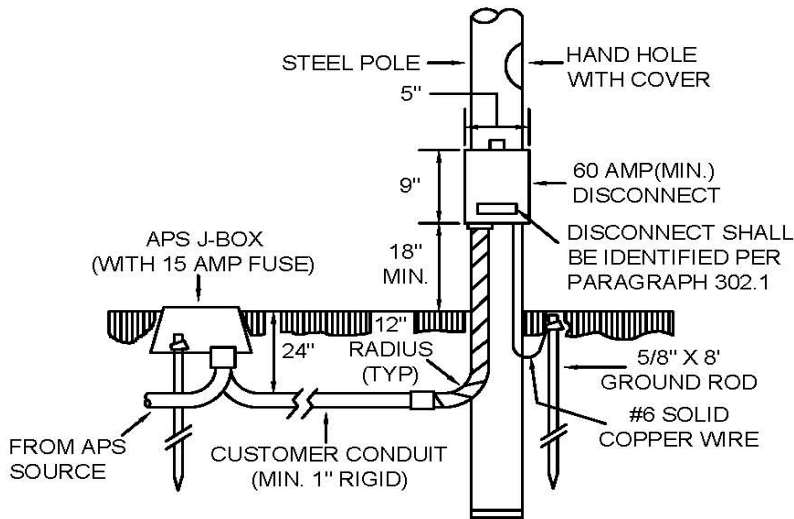
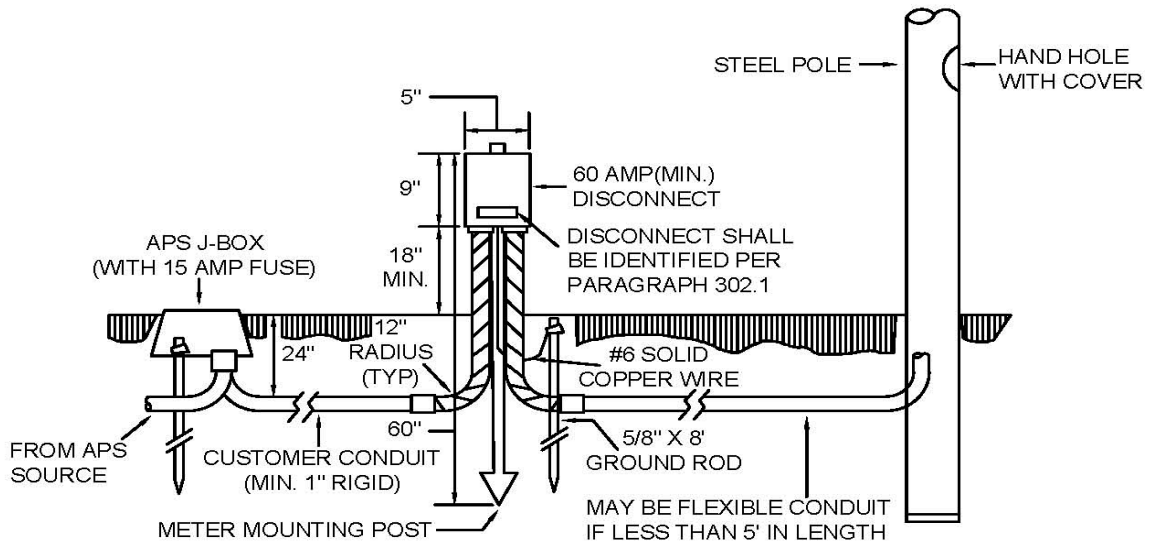
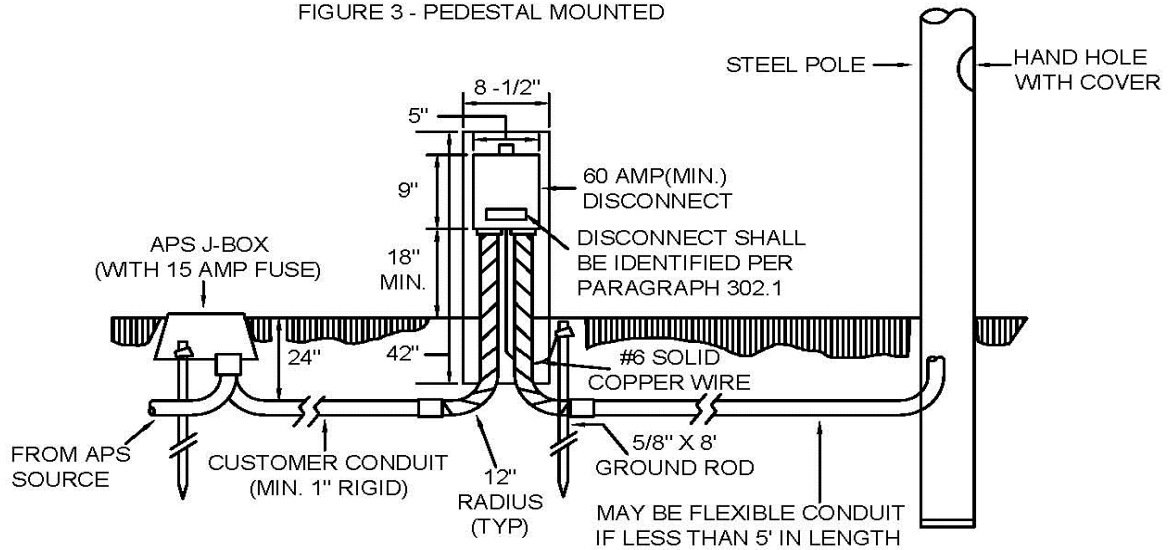


FIGURE 2 - STAKE MOUNTED



1202.2 CUSTOMER - OWNED DUSK-TO-DAWN LIGHTS CONT'D

FIGURE 3 - PEDESTAL MOUNTED



NOTES:

1. Pole location must be accessible to Company maintenance vehicles
2. Customers shall install service disconnect with over-current protection. The disconnect may serve more than one fixture or pole.
3. Customer shall install 5/8 inch by 8 foot copper clad ground rod and connect to the service disconnect with a #6 solid copper conductor.
4. Customer shall bond all non current carrying parts at the service entrance.
5. Company shall install conductors to the utility junction box 15amp maximum fuses.
6. Customer to provide and install all materials beyond the utility junction box.
7. Installation requires city or county inspection and clearance prior to Company connections.
8. Minimum 1" galvanized steel riser with 12 inch radius sweep required. (Rigid or IMC) See Section 500, Paragraph 501.4 regarding coating requirements on steel conduit below grade. See also Paragraph 502.0 for additional requirements for conduit, and Section 600 for Trenching Requirements.
9. Before digging or driving ground rod, be sure to call Blue Stake to get underground facilities located. (See Section 100, Paragraph 100.12)
10. Fixture requirements: Luminaire Style – any meeting the following requirements:  
Voltage: 120 or 240 Volt 1 Phase  
Ballast: Lag or High Reactance, normal Power Factor

**LOW PRESSURE SODIUM**

55 WATT – 8,000 LUMENS  
 90 WATT – 13,500 LUMENS  
 135 WATT – 22,500 LUMENS  
 180 WATT – 33,000 LUMENS

**HIGH PRESSURE SODIUM**

70 WATT – 5,800 LUMENS  
 100 WATT – 9,500 LUMENS  
 150 WATT - 15,000 LUMENS  
 250 WATT – 30,000 LUMENS  
 400 WATT – 50,000 LUMENS

11. Fixtures and fixture height must meet local city ordinances and state "Dark Sky" ordinance requirements
12. A Junction box is required at each point of service.

**HIGH RISE METERING AND EQUIPMENT**

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## 1300.0 HIGH RISE METERING AND EQUIPMENT

---

### 1300.1 GENERAL

This section pertains to Condominium type residential dwelling structures. There are specifications and requirements that can also be applied to High Rise commercial projects dealing with the type of equipment used and equipment locations. The objective of the design practices reviewed in this section are to establish an electrical system multi floor metering that will provide a safe, reliable, secure, operable and minimum maintenance requirements for the life of the building.

---

### 1300.2 DEFINITION FOR HIGH RISE RESIDENTIAL MULTI-FLOOR METERING

Any multi-residential dwelling building, planned to provide individual meters for each residential dwelling unit having four or more floors above ground level requiring three phase service, qualifies for High Rise multi floor metering. Also, refer to high rise building definition in section 102.12.

Metering rooms can be installed at every other floor.

---

### 1300.3 SERVICE REQUIREMENTS

The maximum service entrance section size shall be 3,000 amp. The standard service voltage for these installations is 120/208v 3 phase 4 wire. When a 120/208v service will result in excessive voltage drop or if additional capacity is required that cannot be delivered at 120/208v, the Customer may submit a request for an upgrade to 277/480v 3 phase 4 wire. The request shall include all appropriate calculations and shall undergo an engineering review for accuracy. The Developer/Builder/Customer is responsible for any voltage transformation beyond the service delivery point. If 277/480volt service is requested, APS will need to ensure the type of transformation impedance specified prior to any line extension design. Residential metering will be limited to 120/208v single or three phase. Developer/Customer is responsible for meeting all code and governing agency requirements regarding voltage drop and load balancing. Developer may also be required to pay additional charges, as determined by Company, when voltage delivery is taken at 277/480V.

---

### 1300.4 USE OF SERVICE

Customer and APS each shall save the other harmless from and against all claims for injury or damage to persons or property occasioned by or in any way resulting from the services being provided by APS or the use thereof on their respective sides of the point of delivery. Customer shall exercise all reasonable care to prevent loss or damage to APS property installed on Customer's premise for the purpose of supplying service to the Customer.

---

### 1300.5 ACCESS TO CUSTOMER PREMISES

APS authorized agents shall have unassisted access to Customer's premises at all reasonable hours to install, inspect, read, repair or remove meters or to install, operate or maintain other APS equipment. Also, refer to readily accessible definition in section 100, paragraph 102.20.

Access to APS metering rooms and equipment locations shall be for authorized personnel only not for public use. Alarms for the meter rooms are to be disabled during normal business hours. Normal business hours are from 6am to 5pm Monday through Saturday.

---

### 1300.6 DISCLOSURE OF INTENT

Customer/Developer to include explanations and descriptions for the Point of Service, Access to Premise and Equipment, and responsibilities of both parties contained within the Home Owner Association CCR's (Covenants, Conditions and Restrictions) document or by recorded easement that is recorded. This also, will be included within APS extension agreement.

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**1300.7 BUILDING DIAGRAM**

A building diagram shall be permanently posted at the service delivery point and in all meter rooms/locations on the electric pull section cover of the SES. The diagram shall list all meter locations and associated units. See example below:

Meter Floor	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
1st	100	101	200	201	202	203	204	205		
3rd	300	301	302	303	304	400	401	402	403	404
5th	500	501	502	503	504	600	601	602	603	604
7th	700	701	702	703	704	800	801	802	803	804
9th	900	901	902	903	904	1000	1001	1002	1003	1004
11th	1100	1101	1102	1103	1104	1200	1201	1202	1203	1204

---

**1301.0 SERVICE DELIVERY POINT**

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**1301.1 DEFINITION OF SERVICE DELIVERY POINT**

Point of delivery is where APS facilities are connected to those of the Customer. Refer to section 100, paragraph 102.19. This point of delivery will be at the location where APS service conductors terminate at the Customers service entrance section.

---

**1301.2 HIGH RISE SERVICE DELIVERY POINT**

APS point of service will end at the service cable terminations at the Customers main SES. A load break disconnect switch will be required in the next compartment just after the APS service cable termination delivery point. This switch or main breaker will have a rating equivalent to 100% rating of the proposed SES size.

Customer shall own, install, operate and maintain all wiring and equipment beyond the point of delivery, including the main switch. APS is not required to install or maintain any lines and equipment on the Customer's side of the point of delivery except for the billing meters. APS will only own, read and maintain the electrical APS billing meters beyond the main SES switch.

APS meters are acceptable at the main SES location. All necessary service entrance sections need to be pre-approved by APS meter shop, please refer to section 300, paragraph 302.9 and 302.10.

### 1301.2-1 PLACARD AT POINT OF SERVICE

A Placard is required at the service delivery point. Location of this placard shall be outside the metal enclosure where APS service cables terminate. The placard will be red background with 1/4" high white letters. The placard will state:

*CAUTION: ENERGIZED EQUIPMENT  
DO NOT OPEN*

*THE "POINT OF DELIVERY" OF APS' ELECTRICAL SERVICE IS IN THIS ENCLOSURE AT THE CABLE TERMINATION. ALL ELECTRICAL WIRING AND EQUIPMENT BEYOND APS' "POINT OF DELIVERY" (OTHER THAN APS' METERS) ARE CONSIDERED "CUSTOMER OWNED" FACILITIES AND ARE OWNED, CONTROLLED, SECURED, SAFEGUARDED AND MAINTAINED BY SOMEONE OTHER THAN APS.*

ALTHOUGH THIS ENCLOSURE IS ALSO "CUSTOMER OWNED", ONLY APS' AUTHORIZED EMPLOYEES ARE ALLOWED ACCESS INTO THIS ELECTRICAL ENCLOSURE. ALL UTILITY WIRE SEALS ARE TO REMAIN INTACT WITHOUT BEING CUT OR REMOVED. ANY QUESTIONS CALL 602-371-7171 OR 1-800-253-9405.

---

### 1301.2-2 SERVICE DELIVERY POINT LOCATION

**APS service delivery point is preferred at the ground level. Metering points also, will be allowed at the first level below grade, but not the lowest level below grade. Vehicle clearance of 8 feet is required from the ramp opening to the electrical equipment room. A permanent parking spot for maintenance and delivery vehicles shall be provided with a minimum 13' width and 18' depth. Parking spots shall be marked with yellow stripes.**



**1302.0 SECURITY**

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**1302.1 SECURITY OF EQUIPMENT**

The Developer/Owner or Management Company will ensure all the building electrical feeders from main gear to all the floor metering points are properly secured. Secure means no possible access by the public for safety, damage and energy theft concerns. Customer equipment access points shall provide for a sealable means by an APS authorized person.

---

**1302.2 LOCK HARDWARE PROGRAM – SSRC 6300**

All High Rise projects shall implement the lock program designated as SSRC or the Sargent Signature Removable Core 6300 program (hardware to be supplied by contractor) during construction. Permanent 6300 cylinder will be supplied by APS. This lock program will allow both APS and the property management authorized personnel access to the SES and meter rooms when appropriate. APS will have a master key and the Owner will be provided ten keys. Each of these keys will operate all of the access doors required for APS entry. Each building will have a unique key configuration. APS master key will provide access to our electrical equipment in all buildings using the SSRC 6300 lock program.

The type of lock required is a Sargent Removable Core 6-pin hardware.

The Customer or Builder will provide the SSRC 6300 door hardware for all of APS termination and metering access points for keyed doors. When the point of service is energized, APS will exchange the lock core and provide the Developer/Owner with ten keys. It is best to have all the metering rooms ready in the building for service prior to the APS security lock technician installing the removable core. APS will coordinate this program and identify on each account, SSRC 6300 under the gate code in CIS.

**1303.0 METERING ROOM OR CLOSET REQUIREMENTS**

**1303.1 FLOOR METERING ROOM OR CLOSET REQUIREMENTS**

Each meter room shall be within 100 feet of an elevator.

The meter room will have adequate space for reading meters and allowance for maintenance of equipment. The rooms shall be clear of clutter and will not be used for any type of storage. Hallway meter closets shall have doors that open 180 degrees. All room doors will have panic hardware on the inside door. For air ventilation in meter rooms refer to 301.9-2.

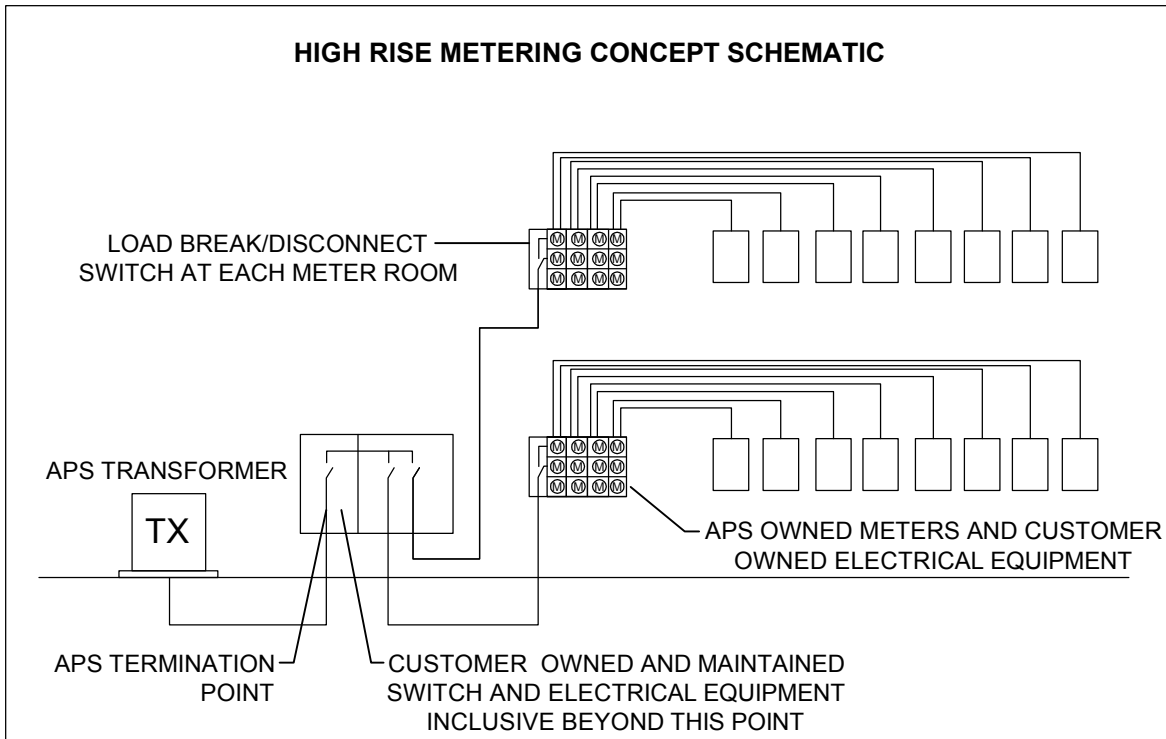
**1303.2 OTHER UTILITY ROOM REQUIREMENTS**

Communications, fire control boxes and electrical equipment can occupy space inside a room without encroaching upon the required equipment and working clearances stipulated by code. Fire risers and water valves are not allowed in these electrical rooms. Fire sprinkler heads should not be directly above the meter panel equipment. Refer to section 301.9-1.

**1303.3 ROOM ELECTRICAL REQUIREMENTS**

EACH ELECTRICAL SECTION IN THE METER ROOM WILL HAVE A LOAD BREAK DISCONNECT SWITCH ON THE SOURCE SIDE OF EACH MULTI-METER PANEL.

THE ONE-LINE BELOW DISPLAYS THE CONFIGURATION REQUIRED:



#### 1304.0 MASTER METERING

Master metering is an option for the High Rise project. Please see section 200, paragraph 201.4.

---

#### 1305.0 EQUIPMENT: NON-NETWORK

APS construction standards for underground installations utilize pad mount equipment, transformers, capacitors and switchgear. Customers/developers are required to provide sufficient space at finished grade level to allow for the equipment to be installed, maintained and operated safely.

If a customer/developer is not able to provide the required space, the Company may provide with prior approval the following optional installations:

- a. Front access pad mount switchgear at finished grade.
- b. Vault type installations in designated equipment rooms within building structures located at or below finished grade. Below grade installations are limited to one (1) level below ground level.
- c. Vault type installations required that the customer/developer service entrance equipment is to be installed on the same level as APS' equipment. Equipment room shall be a minimum of 15' in height.

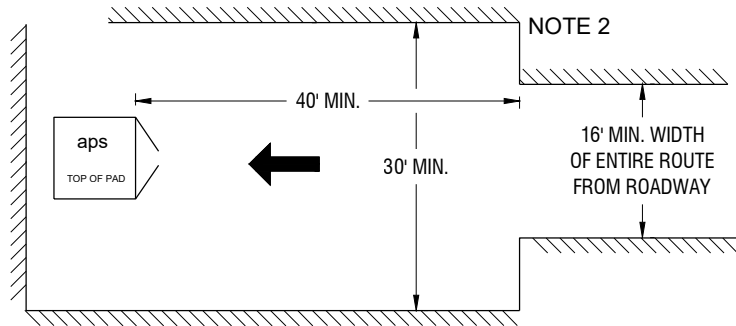
Additional Vault specifications and access requirements for installations below grade are available from your APS representative under the T&D Construction Standards, Network Requirements section 9500.

**CLEARANCES**  
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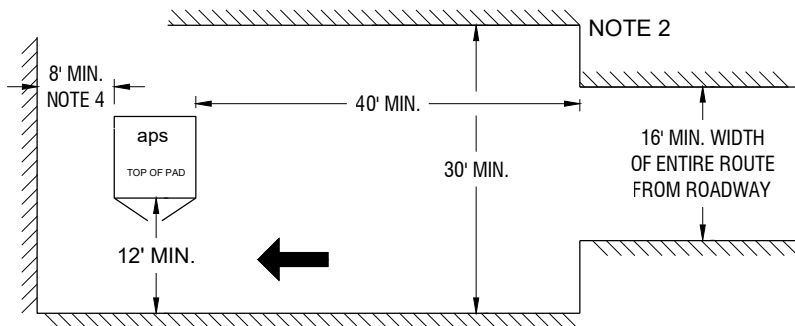
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1400.2	1-WAY ACCESS TO SWITCHING CABINETS.....	3
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1400.3-1	1-WAY DIRECT (STRAIGHT) ACCESS TO PAD MOUNTED FACILITY, COMMERCIAL SES, METER ROOM OR VAULT (PLAN VIEW) .....	5
1400.3-2	1-WAY INDIRECT (REQUIRES A TURN) ACCESS TO PAD MOUNTED FACILITY, COMMERCIAL SES, METER ROOM OR VAULT (PLAN VIEW) .....	5

1400.1 1-WAY ACCESS TO 3 PHASE TRANSFORMERS

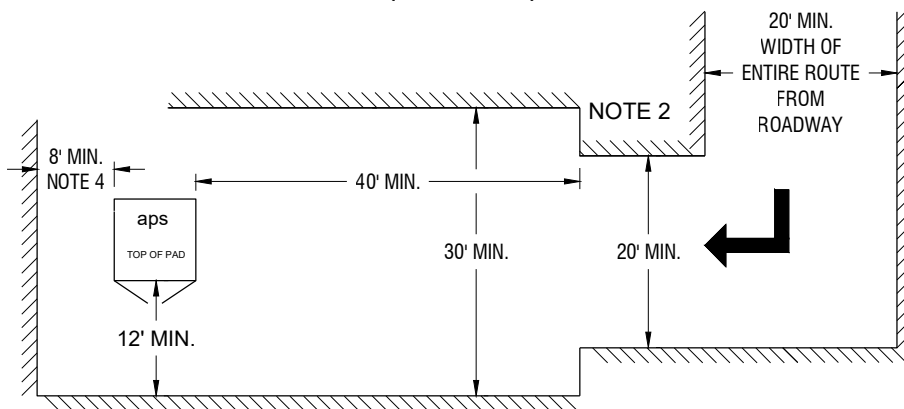
3 PHASE TRANSFORMER WITH ONE-WAY DIRECT (STRAIGHT) ACCESS TO THE FRONT (PLAN VIEW)



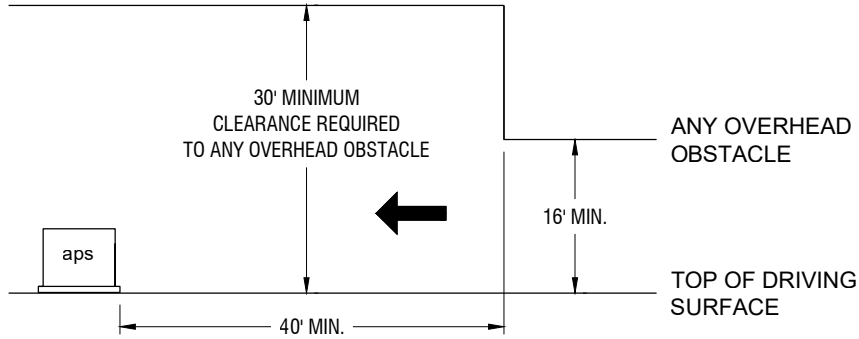
3 PHASE TRANSFORMER WITH ONE-WAY DIRECT (STRAIGHT) ACCESS FROM THE SIDE (PLAN VIEW)



3 PHASE TRANSFORMER WITH ONE-WAY INDIRECT (REQUIRING A TURN) ACCESS (PLAN VIEW)



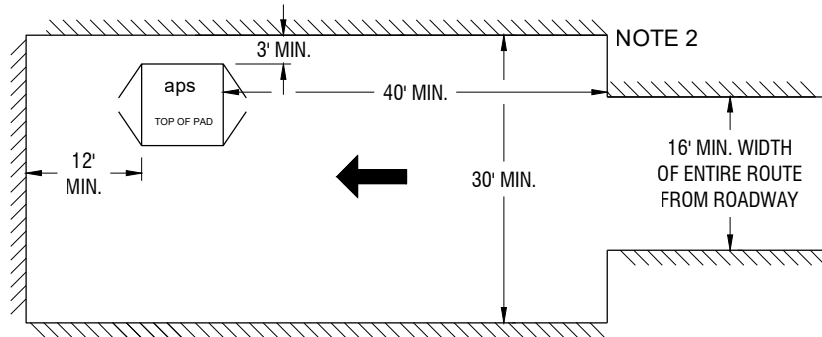
**3 PHASE TRANSFORMER ACCESS HEIGHT CLEARANCE REQUIREMENTS  
(PROFILE VIEW)**



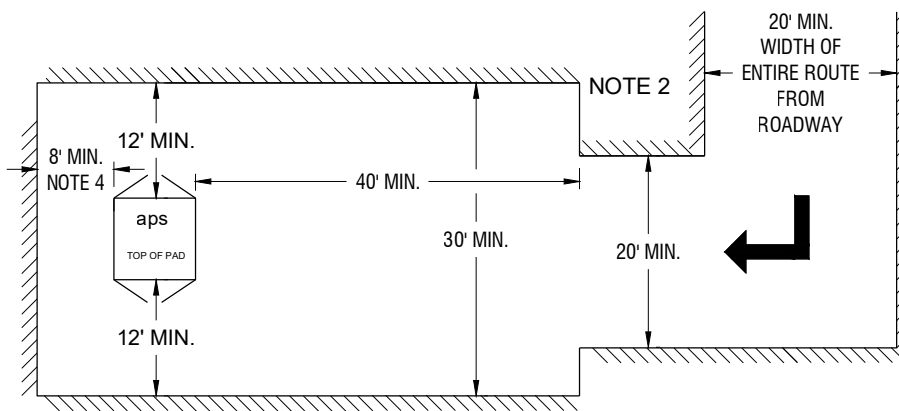
**NOTES:**

1. THESE REQUIRED ACCESS DIMENSIONS ARE IN ADDITION TO THE ELECTRICAL CLEARANCE STANDARDS.
2. THE BOUNDARY OF TRAVELED WAY IS ANY PERMANENT OBSTACLE TO VEHICLE ACCESS ( I.E., BUILDING, FENCE, CUSTOMER EQUIPMENT, LANDSCAPE, DITCH, CURB, ETC.)  
 BOUNDARY OF TRAVELED WAY
3. IF PROPOSED ACCESS ROUTE IS DIFFERENT THAN ANY OF THE ONES SHOWN IN THESE DETAILS, CONSULT YOUR PROJECT REPRESENTATIVE. THESE REQUIREMENTS ARE BASED ON APS SERVICE TRUCK MANEUVERING REQUIREMENTS.
4. 8' MINIMUM CLEAR SPACE IS REQUIRED FOR BACKING AND POSITIONING BEYOND THE EQUIPMENT.
5. ACCESS WAY MUST SUPPORT 80,000 LBS GVW.
6. CONSULT CUSTOMER PROJECT REPRESENTATIVE FOR VEHICLE ACCESS TO MULTIPLE PAD-MOUNTED EQUIPMENT.

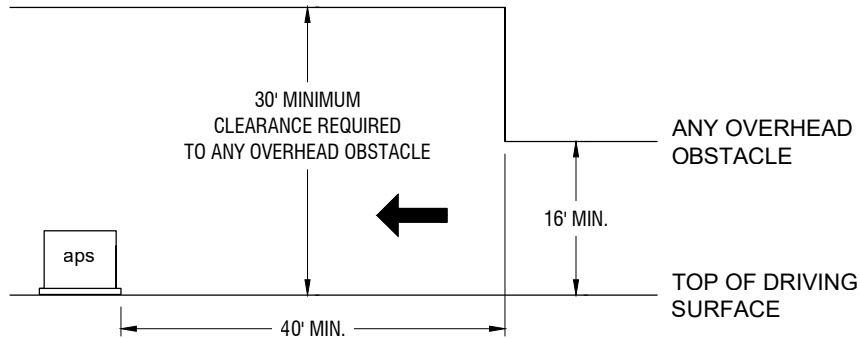
**3 PHASE SWITCHING CABINET WITH ONE-WAY DIRECT (STRAIGHT) ACCESS  
(PLAN VIEW)**



**3 PHASE SWITCHING CABINET WITH ONE-WAY INDIRECT (REQUIRING A TURN) ACCESS  
(PLAN VIEW)**



**3 PHASE SWITCHING CABINET ACCESS HEIGHT CLEARANCE REQUIREMENTS  
(PROFILE VIEW)**



**NOTES:**

1. THESE REQUIRED ACCESS DIMENSIONS ARE IN ADDITION TO THE ELECTRICAL CLEARANCE STANDARDS.
2. THE BOUNDARY OF TRAVELED WAY IS ANY PERMANENT OBSTACLE TO VEHICLE ACCESS ( I.E., BUILDING, FENCE, CUSTOMER EQUIPMENT, LANDSCAPE, DITCH, CURB, ETC.)

BOUNDARY OF TRAVELED WAY

3. IF PROPOSED ACCESS ROUTE IS DIFFERENT THAN ANY OF THE ONES SHOWN IN THESE DETAILS, CONSULT YOUR PROJECT REPRESENTATIVE. THESE REQUIREMENTS ARE BASED ON APS SERVICE TRUCK MANEUVERING REQUIREMENTS.
4. 8' MINIMUM CLEAR SPACE IS REQUIRED FOR BACKING AND POSITIONING BEYOND THE EQUIPMENT.
5. ACCESS WAY MUST SUPPORT 80,000 LBS GVW.
6. CONSULT CUSTOMER PROJECT REPRESENTATIVE FOR VEHICLE ACCESS TO MULTIPLE PAD-MOUNTED EQUIPMENT.



**1400.3 PAD-MOUNTED FACILITY, COMMERCIAL SES, METER ROOM OR VAULT ACCESSIBILITY REQUIREMENTS**

**1400.3-1 1-WAY DIRECT (STRAIGHT) ACCESS TO PAD-MOUNTED FACILITY, COMMERCIAL SES, METER ROOM OR VAULT**

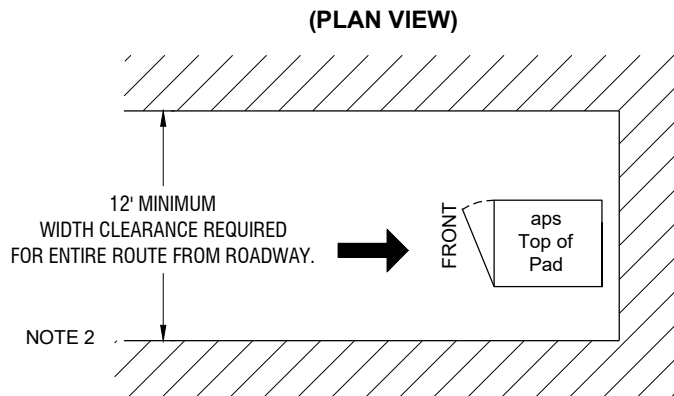


FIGURE 1: ACCESS TO THE FRONT OF THE EQUIPMENT OR ACCESS DOOR

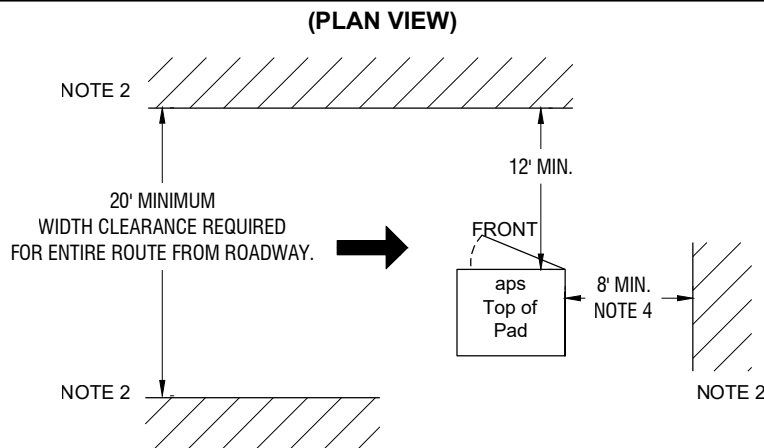


FIGURE 2: ACCESS TO THE SIDE OF THE EQUIPMENT OR ACCESS DOOR

**1400.3-2 1-WAY INDIRECT (REQUIRES A TURN) ACCESS TO PAD MOUNTED FACILITY, COMMERCIAL SES, METER ROOM OR VAULT**

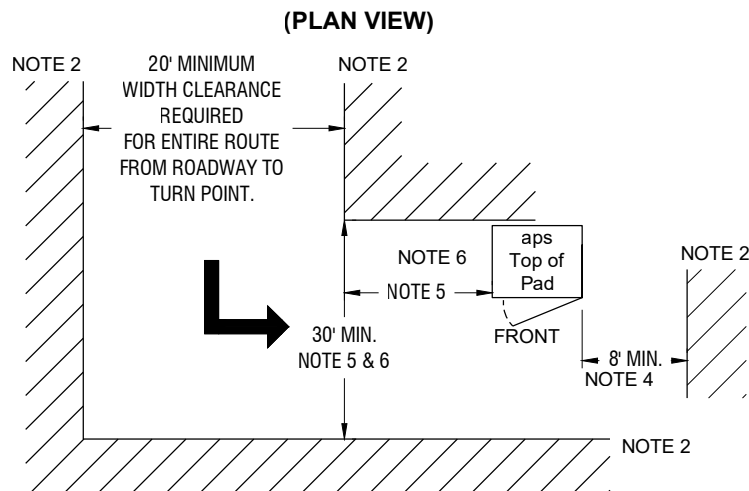


FIGURE 1: ACCESS TO THE FRONT FROM THE SIDE OF EQUIPMENT OR ACCESS DOOR

**NOTES:**

1. THESE REQUIRED ACCESS DIMENSIONS ARE IN ADDITION TO THE ELECTRICAL CLEARANCE STANDARDS. CLEARANCES PROVIDE ADEQUATE SPACE FOR APS VEHICLE ACCESS WITH PROPER EMERGENCY PERSONNEL INGRESS/EGRESS. THE ACCESS AND CLEARANCE REQUIREMENTS SHALL NOT OVERLAP/CONFLICT WITH SEPARATE JURISDICTION RESERVED AREAS (E.G., CITY FIRE LANES). SEE APS'S ELECTRIC CLEARANCE STANDARDS. SECTIONS 301.2, 301.3-1, 301.5, 301.6, 301.7, & 301.9.
2. THE BOUNDARY OF TRAVELED WAY IS ANY PERMANENT OBSTACLE TO VEHICLE ACCESS ( I.E., BUILDING, FENCE, CUSTOMER EQUIPMENT, LANDSCAPE, DITCH, CURB, ETC.)

BOUNDARY OF TRAVELED WAY 

3. IF PROPOSED ACCESS ROUTE IS DIFFERENT THAN ANY OF THE ONES SHOWN IN THESE DETAILS, CONTACT AN APS REPRESENTATIVE. THESE REQUIREMENTS ARE BASED ON APS SERVICE TRUCK MANEUVERING REQUIREMENTS.
4. 8' MINIMUM CLEAR SPACE IS REQUIRED FOR BACKING AND POSITIONING BEYOND THE EQUIPMENT.
5. IF APS PADS OVER 40' BEYOND CORNER OF TURN, THE WIDTH OF THE TRAVELED WAY MAY BE REDUCED FROM 30' TO 20'.
6. FOR METER ROOM OR VAULT DOORS, THE WIDTH OF THE TRAVELED WAY MAY BE REDUCED FROM 30' TO 20'.
7. THERE ARE ADDITIONAL ACCESS REQUIREMENTS FOR VAULTS WITH HATCHES. CONTACT AN APS REPRESENTATIVE.
8. ACCESS WAY MUST SUPPORT 80,000 LBS GVW. (Per Federal Limits per D.O.T.)
9. CONSULT CUSTOMER PROJECT REPRESENTATIVE FOR VEHICLE ACCESS TO MULTIPLE PAD-MOUNTED EQUIPMENT.

**THE ABOVE NOTES ALSO APPLY TO PAD-MOUNTED AND MULTIPLE PAD-MOUNTED FACILITIES ACCESS HEIGHT CLEARANCE REQUIREMENTS.**