



Electric Service Requirements:
Commercial
August 2020
(Dark Blue Book)

This booklet supersedes all previous editions.
Important! See Major Changes & Important Notes.

This manual with the most current changes will also be available online
at:

www.myavista.com

MAJOR CHANGES & IMPORTANT NOTES

Please contact Avista Utilities at 1-800-227-9187 when planning, and prior to starting construction of your electric project.

- Avista requires the customer to bring their service entrance including point of attachment up to the current Avista standards when the service is altered before permanent connection will be made. Customer conductor changes between load side of meter and customer panel do not qualify as an altered service. See **Section 1.10.**
- DO-X.XXX and DU-X.XXX refer to Avista internal Construction Standards
- A passed inspection by Authority Having Jurisdiction does not constitute approval by Avista. Avista has final approval.
- Only qualified Avista personnel are authorized to disconnect service conductors or pull meters.
- In rural areas or on service equipment not attached to a permanent structure, customer must install a phenolic label with the address on the meter can.
- Fire pumps may be fed with a separate service terminating at a Manual Circuit Closing (MCC) meter socket, and be within 25' of the building service.
- Where multiple services supply a building, meters shall be clearly marked with phenolic labels.
- For overhead installations, temporary service meter must be located on the same side of the building as the permanent service location.
- Customers shall not install conduit or excavate any area within 2' of Avista underground or padmount equipment.
- Service mast extending through roof shall not extend more than 6' above roof without preapproval by Avista representative.
- Couplings in the mast above the roofline are not allowed when the mast is being used for the anchor point for the service conductor.
- Overhead service mast must be a horizontal distance of 15' (minimum) from the source. This applies to both temporary and permanent overhead services.

- Meters installed on buried posts require concrete backfill around post.
- In applications where spaces for more than one service entrance disconnect are provided, Avista requires all positions to be fully populated so there are no empty positions at the time of service installation.

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PREFACE

Please contact Avista Utilities at 1-800-227-9187 when planning, and prior to starting construction of your electric project.

If you are planning to install, repair, or upgrade your electric service, you probably have some questions and concerns. Avista has designed this handbook to help guide you through the process.

This handbook includes Avista's requirements. They must be met before a new or modified electric service can be connected. Although we have tried to include everything, please call your nearest Avista Utilities office for further details or questions. Spending some extra time during your project's planning phase can save time and minimize confusion as it moves ahead.

This handbook supersedes all previous editions. It is published yearly, but since requirements are subject to change without notice please coordinate your work with Avista.

For the purposes of this book, residential services are those that serve individual residences, apartments, mobile homes or living units for domestic purposes. Commercial services include all other services.

SAFETY

Please contact Avista Utilities at 1-800-227-9187 when planning, and prior to starting construction of your electric project.

CALL BEFORE YOU DIG



**Know what's below.
Call before you dig.**



CALL 2 DAYS BEFORE YOU DIG

NATIONAL # 811

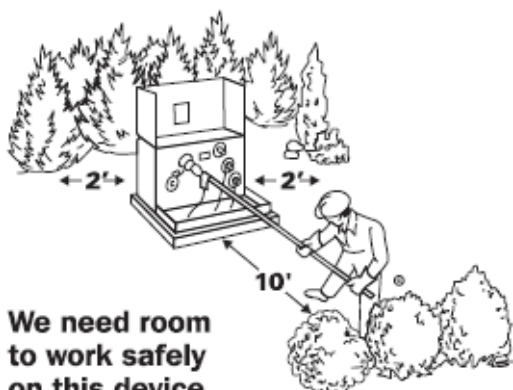
LOCAL AREA NUMBERS

SPOKANE _____ 1-800-424-5555
PULLMAN-MOSCOW _____ 1-800-424-5555
LEWISTON _____ 1-800-324-1585
CLARKSTON _____ 1-800-553-4344

COEUR D'ALENE AREAS:

BENEWAH – SHOSHONE CO _____ 1-800-398-3285
BONNER – BOUNDARY CO _____ 1-800-626-4950
KOOTENAI CO _____ 1-800-428-4950

NOTICE



We need room to work safely on this device. Shrubs and landscaping should be 10 feet from front and 2 feet from sides and backs.

Obstructions will cause delays when restoring electric service and will be removed as necessary and not replaced.

For information call Avista Utilities at 1-800-227-9187.



WASHINGTON-WAC 296-45B-450
IDAHO-IPUC TARIFF NO.28

WAS060-S-A2-113
Electromark

CONTACT INFORMATION

Avista Utilities Call Center	1-800-227-9187
Clarkston / Lewiston / Orofino	(208) 798-1472
Coeur d'Alene	(208) 769-1377
Colville	1-800-227-9187
Davenport	(509) 725-2467
Deer Park	1-800-227-9187
Electric Meter Department	1-800-227-9187
Grangeville	(208) 983-0711
Kellogg	(208) 786-6931
Othello	1-800-227-9187
Pullman / Moscow	(509) 336-6240
Sandpoint	1-800-227-9187
Spokane	(509) 495-4180
St. Maries	(208) 245-2222

1.0 GENERAL SERVICE REQUIREMENTS

Please contact Avista Utilities at 1-800-227-9187 when planning, and prior to starting construction of your electric project.

These guidelines are based on the typical utility practices necessary to supply reliable and safe service. All meter and service equipment required for the construction of new or remodeled installations as well as services disconnected for a period of one year or more and all seasonal installations must meet these guidelines. In addition installations must conform to the rules and regulations of the inspection authorities having jurisdiction. These regulations include, but are not limited to the National Electrical Code, National Electrical Safety Code, State Rules and Regulations, City and County ordinances and codes, and rules on file with or issued by the Public Utility Commission.

1.1 UTILITY RATES & REGULATIONS

Copies of Avista's currently effective rates, rules, and regulations filed with the Public Utility Commission are available to you on request or at www.avistautilities.com.

1.2 ELECTRICAL PERMIT & INSPECTION

The customer or their electrician is responsible for obtaining an electrical permit before work is started and having their completed work inspected by the authority having jurisdiction. The authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. Federal buildings must have electrical inspection by third party. A passed inspection by Authority Having Jurisdiction does not constitute approval by Avista. Avista has final approval.

1.3 CONNECTION REQUIREMENTS

Avista will only connect a new service meeting Avista's requirements to equipment which has passed local inspection and has a visible inspection sticker posted on the meter socket.

When Avista disconnects a service to allow an electrical upgrade or altered service it will be reconnected if the modifications meet our current standard requirements and;

1. If work is performed by the property owner – a final inspection approval must be posted on site
2. If work is performed by a licensed electrician - inspection requirements vary by local electrical inspection office. The electrician should call the local Avista office for current Avista standard requirements. See Contact Information in a previous section.
3. Inspection of that service and equipment is required before reconnection and service must meet current Avista standards. In some cases an official inspection by the governing agency may also be required.
4. If any service has been disconnected for a period of one year or more both an Avista inspection and a safety inspection by the governing agency is required.

5. 48 hour notice must be given to Avista for disconnection of service conductors or removal of any meter locking device.
6. Avista will not attach any services and facilities to trees.
7. Replacement of mobile homes at a service constitute a major change and require both an Avista inspection and a local electrical inspection by the governing agency.
8. Seasonal installations that are shut off for less than a year are subject to an Avista safety inspection and can be required to bring installation up to current code requirements if deemed unsafe.
9. In rural areas or on service equipment not attached to a permanent structure, customer must install a phenolic label with the address on the meter can. Phenolic labels can be purchased from the following suppliers: Engraver at 3817 N. Monroe, Spokane; Quick Engraving at 1527 E 9th, Spokane; and Northwest Business Stamp at 5218 N Market, Spokane.

1.4 AVAILABILITY OF SERVICE

It is important that Avista be provided, as soon as possible, with accurate load information and other requested data before the purchase or installation of equipment and wiring. This will allow Avista to determine the availability of service, service location and available voltage.

1.5 SERVICE AGREEMENT

For new installations a signed service agreement and payment is required before Avista's work can be scheduled.

1.6 POINT OF DELIVERY

The point of delivery is the location where Avista's service conductors and the Customer's service entrance conductors are connected. Avista requires a building be served using a single point of delivery, supplied through a single meter installation, at a single voltage and phase classification unless permitted by exception.

- Avista owns, installs, and maintains equipment on the source side of the point of delivery as well as the meter and instrument transformers. The Customer is responsible for the equipment on the load side.
- Buildings, subdivided into individual tenant spaces, require multiple meters for the individual tenants. The service entrance conductors for these meters must be fed from a main disconnect, switch board or bussed together to provide a single point of delivery.
- Metering equipment is located outside of building as close as practical to the point of delivery, but in no case more than 25 feet.
- The customer is responsible for providing equipment to Avista specifications needed to provide one point of connection. See the Commercial Section for acceptable point of delivery equipment.
- The point of delivery is to be located outside and above ground except in the Spokane Downtown Network. Avista will no longer pull underground secondary

conductors through an outside wall or through a slab into a customer's building or structure. The point of delivery will be on the outside wall in a customer provided Pulling/termination enclosure or free standing pulling enclosure mounted on (2) 2 inch rigid steel pipe (in concrete) with unistrut as needed and must be within 25 feet of metering equipment. An underground service over 1200 amps will require outside mounted switch gear if multiple meters are needed and the transformer is not dedicated to one service.

Note: Contact with the appropriate Avista representative during the early planning and design phase of a project is recommended to help alleviate costly and time consuming modifications (made by the customer) and required by the utility to meet these requirements.

Exceptions Allowing Multiple Services:

Exceptions require prior written approval by Avista and if required, approval by the Authority Having Jurisdiction: Additional services may be subject to Exceptional Costs.

- Single buildings that are sufficiently large to make two or more services necessary. For example it may be impractical to serve an industrial plant with a single service that has sufficient capacity for any and all future loads. It may also be impractical to design long feeders with acceptable voltage drops. Voltage drop calculation per National Electrical Code shall be provided by the customer to confirm this problem.
- Large commercial multi-story buildings require a single point of delivery. Metering for individual premises may be provided with a minimum number of meter rooms located on various floors if it is impractical to design long feeders with acceptable voltage drop. Voltage drop calculation per National Electrical Code shall be provided by the customer.
- Buildings designed for multiple services to supply enhanced reliability.
- At the request of a Customer, multiple buildings or structures in close proximity used in a single integrated commercial, industrial, or institutional enterprise can be considered a single premise and served from a single point. In this case the Customer shall own and be responsible for installation, operation and maintenance of the electrical distribution system between buildings. Under some circumstances Avista may provide, own and maintain this system under an agreement.
- Existing single space buildings sub-divided into two or more separate buildings, having two or more separate addresses due to installations of approved Party Walls, constructed as fire walls without openings, in accordance to the International Building Code (Section 706) and approved by the local jurisdiction, can each be served with separate electric and or gas services.
- Fire pumps may be fed with a separate service terminating at a Manual Circuit Closing (MCC) meter socket, and be within 25' of the building service. See **Section 4.2.1.**

- Where multiple services supply a building, meters shall be clearly marked with phenolic labels.
- Buildings accommodating multiple services that have walls moved such as strip malls, the electrical services must be altered to match new space and preapproved by Avista representative.

Location

Contact an Avista Construction Representative to determine the location of the point of delivery and meter before installing any equipment. Avista provides service locations based on capacity requirements, service quality, safety, access, and cost. All of the following will be considered when determining the location for the point of delivery.

- Overhead point of delivery at a location with line of site to Avista's facilities.
- For accessibility it should be installed outside in an unlocked area. Fenced areas which prevent access must be avoided. Fenced areas accessible by Avista must be preapproved by Avista representative.
- Provide required clearances from and over present and future buildings, garages, driveways, parking areas etc. for overhead service conductors.
- Provide required clearances from buried objects, like septic systems, drain fields and fuel tanks for underground service conductors.
- Avista will not route underground primary URD cable or service wire under buildings. Any building built over existing underground primary or secondary conductor will not be energized until overbuilt conductor is moved at customer expense. Reference: **NESC 351 C2.**
- Altered Services – normally do not require relocation unless there are serious conflicts with Avista's service location requirements. For example serious conflicts would be failure to meet code required clearances, critical access, or safety concerns.
- For overhead installations, temporary service meter must be located on the same side of the building as the permanent service location.

Failure to install service entrance in a location approved by Avista could result in customer having to move equipment at their expense.

1.7 FLAT RATE ACCOUNTS

Avista requires all loads to be metered, but reserves the right to flat rate certain fixed loads under special circumstances (such as lighting). The terms related to any flat rate situations must be set forth in an agreement between Avista and the customer. Under no circumstances will Avista flat rate any variable loads.

1.8 AVAILABLE PHASE AND VOLTAGE

The number of phases and service voltage are subject to availability at your location. Contact an Avista Construction Representative for determination. Special permission is required for more than one service voltage serving a single building.

On three phase services, all single phase loads must be balanced between the three phases, except for a four wire delta service.

A list of available service voltages can be found in the Standard Service Voltages section of this booklet.

Single phase 120/240V services shall not exceed 800 amps of continuous load. If load exceeds 800 amps then service must be 3 phase 120/208 or 277/480 volt. All service meters to be located on outside of building.

1.9 SERVICE ENTRANCE CONDUCTORS

Service entrance conductors must be specified and installed in accordance with the national, state and local electrical codes. In addition they must meet Avista's specific requirements.

- The neutral conductor shall be marked with a white strip or tape.
- The customer service entrance conductors will be connected to bottom position in socket.
- On four-wire, 120/240 volt delta installation, an orange marker shall be used to identify that phase which is approximately 208 volts to ground (high leg or power leg). This shall be located on the right side of the meter socket, CT landing platform and in the middle of the main disconnect.
- Metered and non-metered circuits shall not be run in the same raceway or conduit.

SCOPE:

This standard documents the long standing practice of only marking secondary cable at the service point with tape that marks phase rotation and not phase designation.

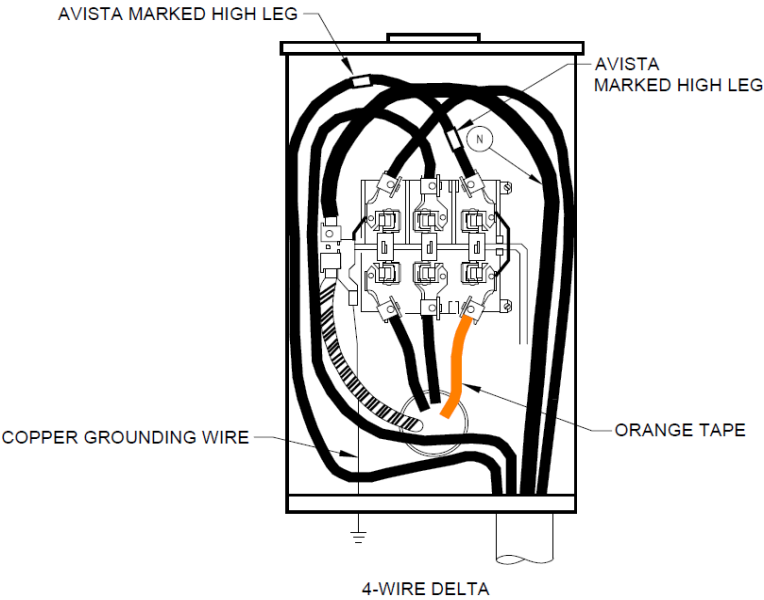


Figure 1 – Cable Phase Rotation Marking

AVISTA Utilities Distribution Standards DU-7.120/ESR

NOTES:

1. Always verify voltage and rotation before working on any existing 3 phase service regardless of existing markings.
2. Avista's standard practice is to use red, white and blue tape only for marking phase rotation on the utility side of the service point. No other color tape will be used to mark rotation on the utility side of the service point.
3. On a 4 wire 120/240 service, always mark the high leg or (power leg) blue. The other two hot legs shall be marked red and white.
4. The NEC code for marking the high leg or (power leg) on a 4 wire 120/240 meter socket or weatherhead is orange. Always connect the blue marked conductor to the orange marked lug or conductor for this voltage. On 3 phase services and secondaries, red, white and blue tape is used for marking phase rotation only, and does not indicate any specific voltage.
5. Avista will supply ABC or CBA rotation to the weatherhead or meter socket. On new installations, it is up to the electrician to establish the desired rotation.
6. Red, white and blue tape can also be used for marking both ends of service conductors during installation on multiple run services.
7. Red, white and blue tape matches the red, white and blue leads on Avista standard purchased rotation meters.
8. The NEC code for marking the neutral is white. Avista does not mark the neutral. On multiplex underground cables, the neutral conductor is marked with a yellow stripe. The NESC code does not specify any color coding for phase rotation or voltage.
9. While performing maintenance on an existing 3 phase overhead or underground service, the established rotation must be maintained.
10. During a scheduled or unscheduled outage, customer electrician may need to be on site to reestablish the correct phase rotation.
11. All secondary and service cables shall be marked on both ends using Avista standard cable marking tags (575-0830). Refer to DU-4.320 for instructions on punching out the necessary information for a specific run of cable.

REFERENCES:

1. Refer to DU-4.320 Cable Marking CMT.
2. Refer to Avista Electric Service Requirements Book latest edition.

AVISTA Utilities Distribution Standards DU-7.120/ESR

1.10 SERVICE CHANGES/ALTERED SERVICE

Whenever major changes, relocations, or additions are made to the electrical service, metering must be modified to meet current Avista standards.

Avista will consider a service to be altered when one of the following occurs and will require the customer to bring their service entrance including point of attachment up to the current Avista standards before permanent connections will be made.

- a) Customer mast or conductors in mast are changed/moved or upgraded.
- b) Location of the service entrance is moved.
- c) The meter can is changed/repaired/ or upgraded.

In the event of Avista replacing an existing Delta 480V 3-wire 3 phase service with a 277/480V Wye 4-wire 3 phase service, Avista will notify customer in writing that the existing 3-wire three phase service has been replaced with a 3 phase 277/480V 4-wire service. Available fault currents will change significantly at the service if the neutral is connected at the service (see **Section 1.23** for Available Fault Current). The neutral will be available from Avista for connection at the service panel.

1.11 LOAD ADDITIONS

It is the customer's responsibility to notify Avista when adding significant load. Before installing electric tankless water heating systems, central air conditioners, electric vehicle chargers, central electric space heating, large motors and/or other major loads please contact Avista. Avista representatives will help to determine if the transformer and service wires are adequate for the increased load. In some cases Avista will need to install larger transformers and wires to accommodate the increased load. The costs of these changes may be charged to the customer.

1.12 INSTALLATION AND REPAIR

The customer provides, maintains, and operates at their expense all wiring and equipment, except the meter, on the load side of the point of delivery.

The customer owns the meter socket and is responsible to remove or remount it to facilitate the installation of siding. Siding shall be installed so as not to interfere with the installation or removal of the meter.

Avista provides, maintains, and operates at their expense all wiring, poles and equipment, on the source side of the point of delivery. In addition Avista is responsible for the installation, repair, and calibration of the electric meter.

Note: On new construction and customer requested changes/alterations to the existing system, the customer will be responsible for the costs of material and labor required by the utility to meet the customer's request. Contact local Avista representative for details on requirements and costs.

1.13 LANDSCAPING

Avista provides information on acceptable methods for screening of pad-mounted transformers and switching enclosures. These designs should be tailored to fit specific needs of the home or business owner. This information is available from your local Construction Office.

1.14 TREE TRIMMING

The customer is responsible to keep trees and bushes away from overhead service conductors from the pole to the building. Avista will disconnect the service to make trimming safe. Call Avista 48 hours in advance of the work. Service disconnects done on weekends and after normal Avista business hours will require a charge to the customer.

A minimum of 3' of clearance is required from service conductors.

1.15 OTHER UTILITIES

It is the customer's responsibility to coordinate the use of a joint ditch or poles before the permanent service is connected. Required clearances between utilities must be met.

1.16 EQUIPMENT PROTECTION

It is the responsibility of the customer to provide power conditioning devices that may be required to provide the quality of "power" necessary for optimum performance of their sensitive equipment such as computers or other electronic appliances. Since power disturbances can be created on the utility or customer side of the delivery point, the best locations of these devices may be at the equipment.

Customers are responsible to provide protection for their equipment that could be damaged by single phasing of three-phase loads.

Customers are responsible for mast and meter protection from ice and snow loading.

1.17 CUSTOMER OWNED EQUIPMENT ON AVISTA POLES

Customer owned metering, switches, luminaries, signs or other equipment shall not be mounted on Avista's poles.

1.18 METER SEALS

The purpose of meter seals is for safety and prevention of tampering. Only Avista personnel shall remove seals.

Caution: With some types of meter bases, removal of the meter does not de-energize the service.

Any person, who cuts Avista seals and/or wrongfully obtains electric service by by-passing, tampering with, or modifying a meter, may be convicted of a crime and billed for costs associated with investigation.

Bypassing meter sockets by electricians or customers is not allowed for any reason without Avista approval. All power must be metered.

1.19 MOTORS

Three phase motors 35 horsepower or larger and frequently started 10 horsepower and larger motors may require reduced-voltage starting equipment. Avista requires reduced-voltage starting in some cases to limit voltage flicker and the problems it causes. Avista will furnish starting flicker calculations on request. The allowed starting current will depend on the frequency of starting, and the size of the electrical service. Customers can install reduced voltage starting equipment to reduce voltage flicker. Three phase motors 25 horsepower or larger require closed delta or wye service.

1.20 UNDERGROUND SERVICE CUSTOMER REQUIREMENTS

Avista Utilities will provide underground electric service under the following conditions:

1. The location of transformer shall be specified by Avista before the start of site preparation.
 - The transformer must be located to provide the clearances described in DU-4.222 and DU-5.020.
2. The location of the point of service shall be specified by Avista before the start of site preparation.
3. The customer must provide accurate electric load sizing information as calculated according to the National Electric Code.
4. The customer must indicate the desired number and size of customer service conduits and cables. If the customer specified secondary conductors exceed the limits of the transformer, Avista may be required to install a secondary enclosure (DU-5.124) at the customer's expense. When provided, a secondary enclosure becomes the point of service, regardless where the meter resides. Increasing conductor size to reduce the number of parallel conductors may help to avoid the need for a secondary enclosure.

5. All conductors on the customer's side of the service point (customer owned) must be sized per the National Electric Code (NEC) which differs from utility owned conductors which are sized according to the National Electric Safety Code (NESC).
6. A customer's failure to provide complete and accurate load and/or secondary conductor information prior to Avista's utility construction design and/or contract signing may result in either costly changes for the customer. This may include but is not limited to the Customer having to change the quantity and size of Customer installed service conductors.
7. Concrete transformer pads provided by the customer must meet the requirements of DU-5.112 and conform to the size requirements specified by Avista.
 - Avista will provide a ground sleeve for installation below the window in the pad or may require the customer to provide an acceptable vault under the pad.
8. The direction of entrance of customer conduits shall be specified by Avista to avoid conflict with primary voltage conduits and cables.
9. The customer shall meet the requirements of the company's electric extension tariff, Schedule 51, including payment of costs in advance of construction and the general and special terms of the Electric Service Agreement Avista (Form 1475).
10. Customer-provided ditch and conduit installations must meet Avista standards. Any damage prior to the company's acceptance of the work must be repaired at the customer's expense.

REFERENCES:

1. Avista Electric Service and Meter Requirements.
2. Refer to Construction Standard DU-5.020 for transformer clearances.
3. Refer to Construction Standards DU-5.122, 5.123, 5.124 and DU-4.222 for construction of concrete transformer pads and the space allocated to the service.
4. Refer to Construction Standards DU-1.430 and DU-7.450 for ditching requirements.
5. Refer to Construction Standards Section 4.7 for conduit requirements

AVISTA Utilities Distribution Standards DU-9.110 ESR

1.21 SERVICE CONDUIT

The following information is intended for the installation of electrical service conductor. This information does not apply to roadway crossings or primary conduit systems.

1.21.1 General Requirements

- Conduit is required in all areas for Avista service conductor.
- Run conduit as straight as possible with the exception of the sweeps required by Avista. The conduit route, distance, sweep angles, size and number of runs must be **pre-approved** by the Avista Customer Project Coordinator.
- Avista must approve conduit installation prior to backfilling. Do not backfill the last 5 feet to the transformer or handhole until Avista crews have completed the connection. (Note: The conductor will not be energized until the backfill has been completed.)
- The customer is responsible to obtain all necessary permits.
- Customers shall not install conduit or excavate any area within 2' of Avista underground equipment.
- Conduits that are run to the base of a pole must terminate with a sweep at the exact location on the pole designated by Avista.
- Multiple runs must be bundled together. Conduit sweeps entering handholes or transformers must also be bundled together. Service conduits enter the left hand side of a single phase transformer as viewed from the front.
- Pull strings are required on all conduit runs and should be approximately 1/8 inch in diameter and must be adequate to pull a 1/2 inch rope the entire distance of the conduit run when required.
- The ends of the conduit must be taped or capped, and sealed to keep dirt and water out of the conduit. Customer is responsible for any obstructions within the conduit.

1.21.2 Conduit Type

- All conduits shall be gray electrical PVC. Galvanized rigid metal conduit (RMC) may be substituted for PVC above ground for greater mechanical protection.
- All conduit and fittings shall be a minimum of schedule 80 PVC above ground and schedule 40 PVC below ground. Schedule 40 PVC sweeps must be entirely below grade.
- Riser conduits shall be plumb.
- All conduit connections must be glued and fully seated.
- Swedge couplings required on all 2", 3", and 4" pipe.
- Factory bell ends are allowed for connections in lieu of swedge couplings.

Note: PVC conduit risers shall have a telescoping coupling (Expansion Coupling) inserted just before the meter as a measure to allow for the settling of the ground and to prevent damage to the customer's meter base.

1.21.3 Conduit Trade Size and Number

- For conduit runs with up to three sweeps (270 degrees or less), including the source and the termination sweeps, and up to 200 feet in length, the diameter of the conduit shall be as specified below. For other designs contact Avista.
- For commercial systems consider future upgrades in service size that might require larger size or additional conduit runs.
- Heated bends are allowed up to 30 degrees. The conduit diameter and consistency of the radius must be maintained.

Cable Size	SIZE OF CONDUIT		
	2 Inch	3 Inch	4 Inch
#2 TXUG	1	2 or 3	
2/0 TXUG	1		2 or 3
4/0 TXUG		1	2
350 TXUG		1	
2/0 QXUG		1	2
4/0 QXUG		1	
350 QXUG		1	
4-750 AL			1
4-250 CU		1	2
4-500 CU			1

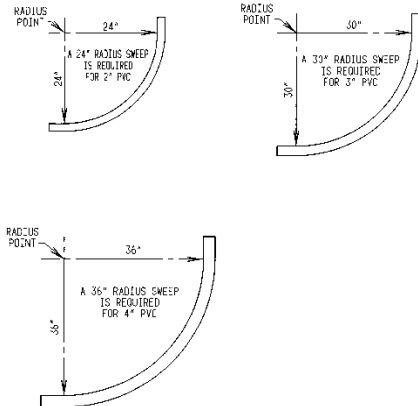
Table 1 - Service Conduit Sizing

1.21.4 Sweep Size

Conduit Size	Minimum Sweep Radius
2"	24"
3"	30"
4"	36"

Table 2 - Conduit Sweep Sizing

ELECTRIC SERVICE CONDUIT SPECIFICATIONS



- Swedge couplings required on all conduit runs



Figure 2 – Electric Conduit Sweep Specifications

- Any conduit sweep that extends above the ground line must be schedule 80 PVC.
- Any conduit fittings must be a minimum of schedule 40 PVC or schedule 80 PVC if above grade.

2, 3, and 4" Swedge couplings and Schedule 80 sweeps are available at CED 3333 E Main Spokane (509) 535-8891 and Graybar 4001 E Ferry Spokane (509) 532-7100 or other electric supply stores.

1.21.5 Location of Joint Use Vaults at Avista Poles

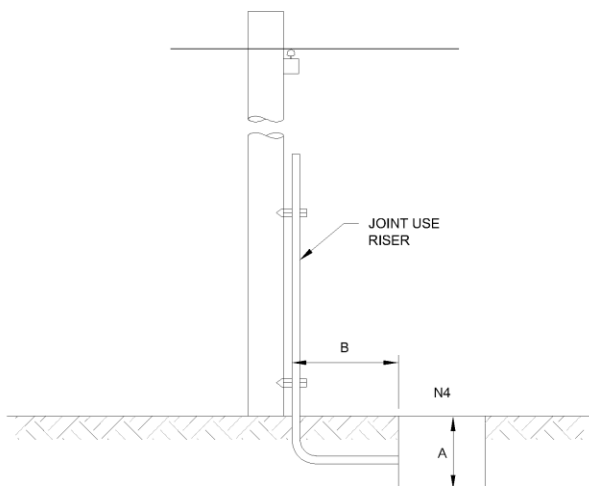


Figure 3 – Location of Sweeps on Avista Poles

NOTES:

1. Risers are not allowed on Avista Utilities air switch poles.
2. No later than two business days prior to any excavation deeper than 12 inches, the excavator is required by law to mark the area of excavation and contact the local "One Call" office.
3. Minimize the disturbance of soil, at the pole, to prevent loss of treated soil and premature deterioration of the butt of the pole.
4. All excavations for handholes, manholes and vaults must be no closer, to the pole, than five feet or the depth of the excavation ($A = B$), whichever is greater.
5. Backfill must be tamped or otherwise compacted to prevent settling and must be protected from erosion.
6. The joint user is responsible for the cost of installing risers, conduits, ditches and manholes which it uses for its communications cables. Risers which connect to communication handholes, manholes or vaults will be owned and maintained by the communication company. Risers which connect to Avista Utilities handholes, manholes, or vaults will be owned and maintained by Avista Utilities.
7. Equipment such as power supplies must be mounted under the electric crossarm and must not block space for additional communication attachments or climbing space. Large boxes should be installed below the communications space and approved by the Avista Utilities Joint Use Administrator prior to installation (R2).

REFERENCES:

1. Refer to DO-1.431 for Joint Use on Air Switch Poles.
2. Refer to DO-1.449/DU-1.458/ESR for Joint Use New Riser Installations.

AVISTA Utilities Distribution Standards DO-1.446/DU-1.460 ESR

1.21.6 Joint Use New Riser Installations

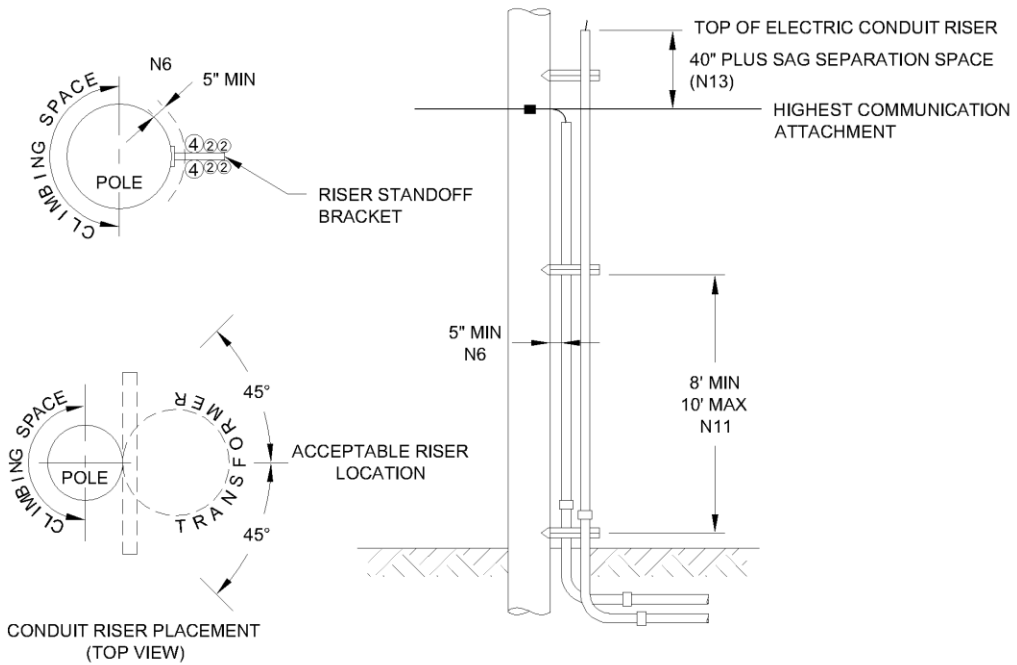


Figure 4 – Joint Use New Riser Installation

NOTES:

1. Risers are not allowed on air switch poles (R1).
2. Joint use risers are not allowed on substation riser poles.
3. New riser installations will require that all conduit risers on the pole be strapped to one set of standoff brackets, including electric conduits.
4. Joint use companies are limited to one (1) 4-inch conduit per pole or two (2) 2-inch conduits per pole, unless otherwise approved by the Avista Utilities Joint Use Administrator.
5. Maximum total number of conduits for all companies, including Avista conduits, is four (4) 4-inch conduits on any pole. Two (2) 2-inch conduits may be counted as one (1) 4-inch conduit. No more than six conduit risers shall be placed on a set of standoff brackets. This is based on 15-inch standoff brackets. Longer standoffs for joint use require the prior approval of the Joint Use Administrator.

6. All risers must be mounted to provide a minimum five-inch clearance between the face of the pole and the riser closest to the pole.
7. If standoff brackets have electric conduits and need to be changed to longer brackets to accommodate additional communication conduit risers, then the change out of the brackets shall be done by Avista Utilities at the expense of the communication company. The electric conduits should be placed outside of the communication conduits whenever possible.
8. Small communication service drops may be secured directly to the pole. When more than two small service drops are involved, those communication service drops are required to be installed in conduit on standoffs and must be located on the equipment side of the pole and not infringe on the pole climbing space.
9. Small service splice boxes are allowed near the bottom of the pole so long as they are located on the equipment side of the pole and do not infringe on the pole climbing space.
10. Locate the standoff brackets and conduit riser on the equipment side of the pole opposite the climbing space. Avoid trapping communication lines between the riser and the pole.
11. Maintain a minimum of eight feet (ten feet maximum) between the ground line or lowest standoff bracket and the next higher bracket.
12. Placement of standoff brackets and conduit risers should avoid vehicular traffic and not enter into a sidewalk or curb area.
13. A minimum clearance of 40-inches shall be maintained for safety space between the top of the electric conduit and the highest communication attachment.
14. When necessary, use split duct covering to wrap each individual conductor (1-inch, stock number 578-0280 and 2-inch, stock number 578-0282) for safety space clearances.
15. An 18-inch standoff bracket should be used if there is joint use on a 600 amp, three-phase primary riser (three (3) four-inch conduits). This may result in the distance between the face of the pole and the riser closest to the pole to be less than the five-inch minimum clearance, which will require prior approval by the Avista Utilities Joint Use Administrator.
16. Innerduct must not extend more than 4 inches beyond the top of the riser.

REFERENCES:

1. NESC 217A2c, Table 238-1.
2. Refer to DO-1.431 for Joint Use on Air Switch Poles.
3. Refer to DO-1.446 for Joint Use Vault Installations.
4. Refer to DO-4.520 for Three Phase 900 Amp Loadbreak Air Switch with Steel Base
5. Refer to DO-4.530 for Three Phase 900 Amp 15/25 kV Loadbreak Air Switch with Insulated Base AS.
6. Refer to DO-4.540 for Three Phase 900 Amp 15/25 kV Air Switch Hookstick with Fiberglass Base AS90025HOG.
7. Refer to DU-7.520 for Secondary Risers.

AVISTA Utilities Distribution Standards DO-1.449/DU-1.458 ESR

1.22 CLEARANCE OF GAS METERS TO ELECTRIC METERS

Note: the below drawing is intended to show the required clearance between gas and electric meters at the same building. Do not use this drawing as a guide for installation or clearances for electric meters. See **Section 1.26**.

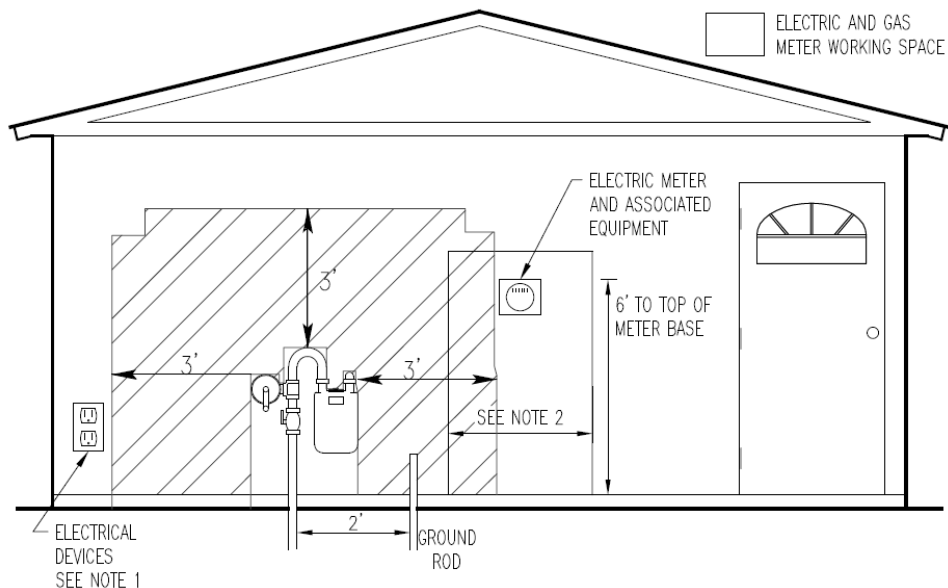


Figure 5 – Gas and Electric Meter Clearances

NOTES:

1. Electrical components, devices, and equipment including switches, receptacles, light fixtures, disconnects, circuit breakers, pad mounted air conditioners or heat pumps that do not supply ventilation air, generators, and transformers should be at least 36" away from regulator vent.
2. Electric meter working space shall be the greater of 30" wide or the total width of the electric service and metering equipment, centered on the equipment, and a clear space of at least 36" in front and permit at least a 90 degree opening of equipment doors or hinged panels. No bollards are allowed in this space.
3. For specific gas metering clearance requirements refer to gas engineer standards. Any exceptions must be approved by gas engineering.

1.23 AVAILABLE FAULT CURRENT AT POINT OF DELIVERY

Customer must provide service entrance equipment rated to interrupt the amount of fault current available. Contact Distribution Engineering for information on available fault current at the service point and for information for arc flash study. Minimum main circuit breaker fault duty rating shall be 10,000 amperes for residential and 22,000 amperes minimum for multi-family and all commercial installations. Higher ratings may be required depending on transformer and service wire size and proximity to service entrance. Please reference maximum fault currents for frequently used transformers below.

Note: All construction temps require a minimum of 15 ft of #2 AL conductor between transformer and meter.

SINGLE PHASE TRANSFORMER FAULT CURRENT CALCULATIONS **at (240V) WITH CONDUCTOR**

(Important) When max. available fault current exceeds 10,000 amps the customer will be required to provide equipment that has an AIC rating that exceeds the max. available fault current.

Transformer KVA	Max Fault current at transformer	Conductor size ,length and fault current in amps		
15	5208	under 10,000 amps AIC needed with 4/0AL and smaller		
25	8013	under 10,000 amps AIC needed with 4/0AL and smaller		
37.5	11161	2AL @15ft =7413	2/0AL @15ft =8771	4/0AL @15ft
50	14881	2AL @15ft =8890	2/0AL @15ft =10915	4/0AL @15ft
75	20833	2AL @15ft =10719	2/0AL @15ft =13809	4/0AL @15ft
100	26042	2AL @15ft =11949	2/0AL @15ft =15920	4/0AL @15ft
167	33135	2AL @15ft =13250	2/0AL @15ft =18317	4/0AL @15ft

Note: This table is only for reference to help with residential/commercial services and single phase temporary service installations. If your application is not shown here, please call Avista Utilities.

Note: A permanent label with service equipment AIC rating must be affixed to outside of service equipment for all multi-family and commercial meter installations.

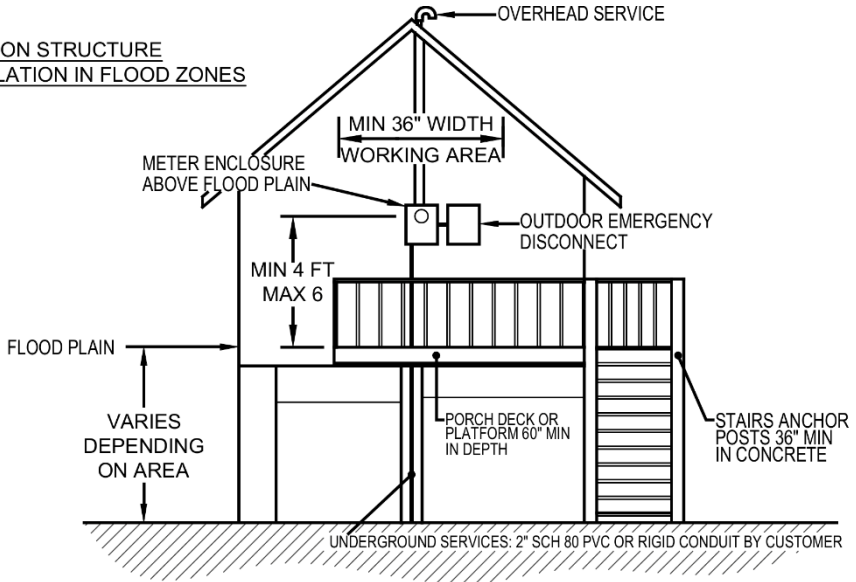
Table 3 – Single Phase Point of Delivery Available Fault Current

3-Phase Padmount Transformers					
Transformer KVA	Secondary Voltage	Max Fault Current (AMPS)	Transformer KVA	Secondary Voltage	Max Fault Current (AMPS)
45	208	8922	300	208	41637
45	480	3866	300	480	18043
75	208	14870	500	208	42058
75	480	6444	500	480	18225
112.5	208	22306	750	208	39280
112.5	480	9666	750	480	17021
150	208	27758	1000	208	52374
150	480	12028	1000	480	22695
225	208	41637	1500	480	34043
225	480	18043			

Table 4 – Three Phase Point of Delivery Available Fault Current

1.24 METER ENCLOSURE INSTALLATION IN FLOOD ZONES

METER ON STRUCTURE INSTALLATION IN FLOOD ZONES



METER POST/PLATFORM FOR FLOOD PRONE AREAS

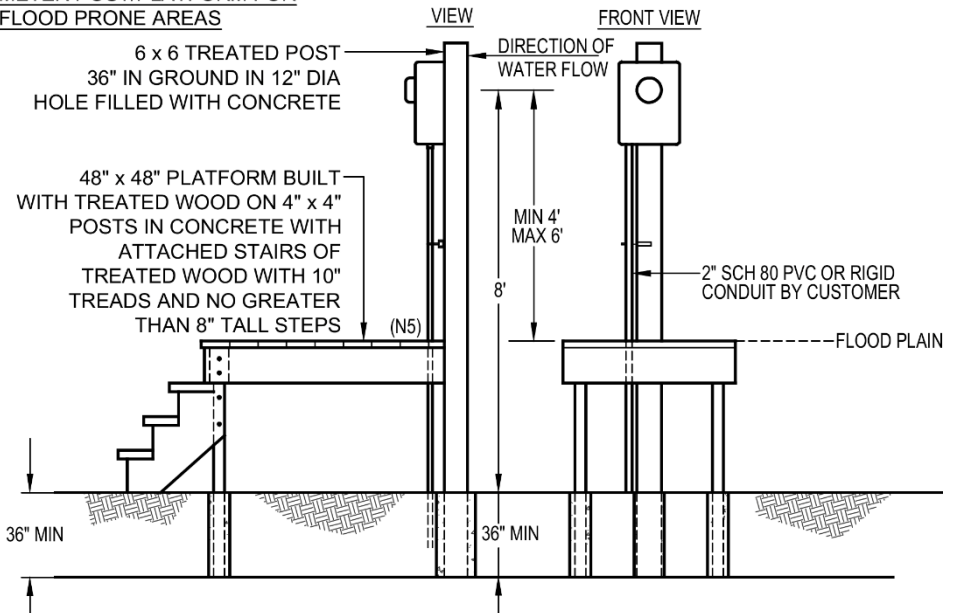


Figure 6 – Flood Zone Meter Enclosure Installation

NOTES:

1. When elevation of the meter enclosure is required by the authority having jurisdiction, the permanent installation of deck/platform and stairs shall be installed and provided by customer prior to energizing the facility.
2. Meter and conduit to face downstream when installed near flowing water such as rivers and streams.
3. Additional meter protection required in areas with possible log flows.
4. Stairs must be treated wood, no taller than 8" rise per step.
5. Guard rails needed if deck or platform 12" or higher, above grade.

REFERENCES:

1. NEC Article 682.2
2. Overhead services must comply with Avista Overhead Construction standard DO-6.260/ESR.
3. NESC Article 112.C

AVISTA Utilities Distribution Standards DO-7.316/DU-9.134 ESR

1.25 POWER QUALITY

It is the customer's responsibility to meet industry power quality standards as recorded at the point of service with Avista and any alterations shall be at the customer's expense.

- < 5% Total Harmonic Distortion at point of common coupling of voltage.

Reference: IEEE 519

2.0 TEMPORARY OR CONSTRUCTION SERVICE

There is an installation fee for temporary service and additional charges for correction trips.

Each new house should have one duplex outlet available when temporary power is disconnected.

Temporary single phase service from a 120/208 three phase transformer or transformer bank requires a 5 terminal meter socket.

Temporary CT Enclosures are allowed on wood posted for a period of one year.

Connection point for overhead temporary service must be on the same side of building as the permanent service point.

Location of overhead temporary service point must be at least 15' away from source.

2.1 TEMPORARY OVERHEAD SERVICE

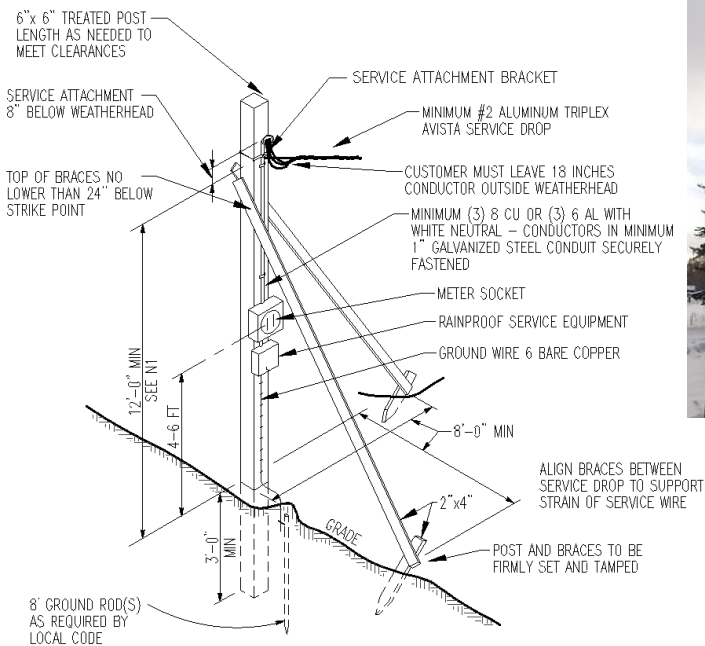


Figure 7 – Temporary Overhead Service

DIRECTIONS:

1. The customer or their electrician must consult the local electrical code authority for specific requirements. An electrical inspection permit must be displayed on meter can before a service connection can be made.

2. Contact the local Avista Utilities office before installation to request temporary service and to determine available voltage and location. Whenever possible the temporary service must be located within 125 feet of the nearest pole and as near as possible to the permanent service mast location.
3. The customer provides and installs all materials shown. Avista will install the service conductor and meter.
4. Temporary Service must be located on the same side of building as permanent service.

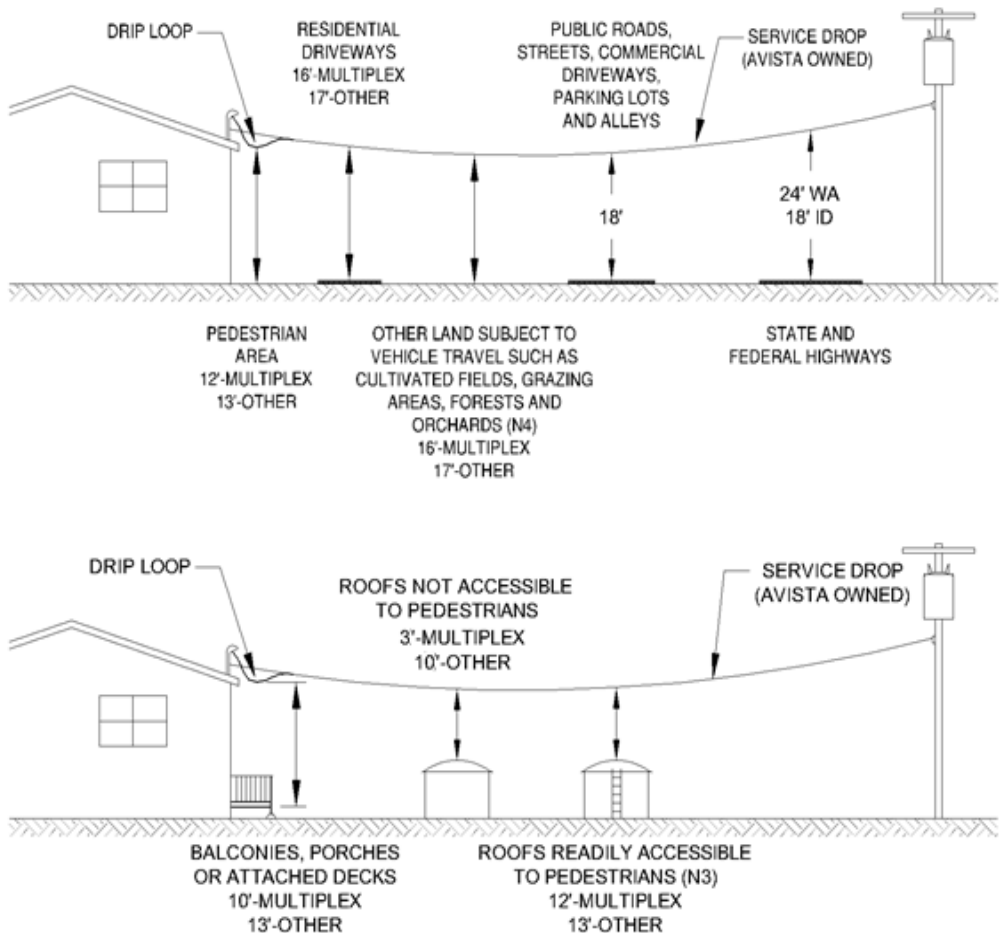


Figure 8 – Overhead Service Clearances over Ground and Buildings

NOTES:

1. Location and height of post must allow service drop to meet service clearance in DO-6.210.
2. The temporary service must be overhead when the permanent service is from an overhead transformer.
3. Temporary Service shall be at least 3 feet from all electric and gas service stubs.
4. Service mast must be a minimum of 15 feet, horizontally, away from the source.

REFERENCES:

1. Refer to Electric Service Requirements section 1.23 for available fault current at Point of Delivery
2. Refer to DO-6.210 for Service Clearances

AVISTA Utilities Distribution Standards DO-6.250 ESR

2.2 TEMPORARY UNDERGROUND SERVICE

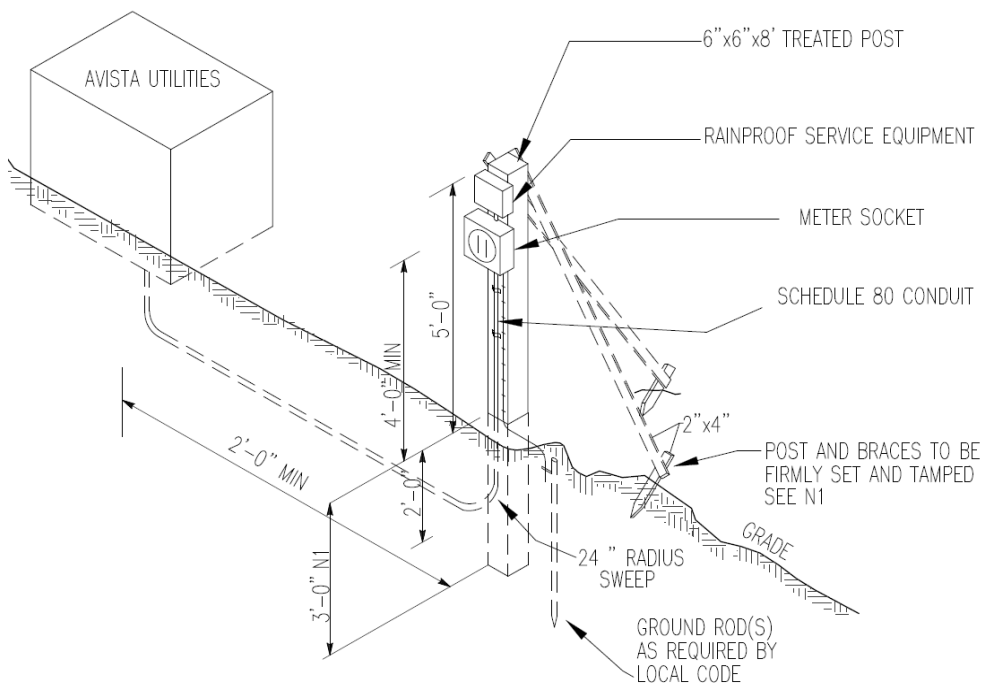


Figure 9 – Temporary Underground Service

These are general Avista Utilities requirements. The customer or their electrician must consult the local electrical code authority for specific requirements. An electrical inspection permit must be displayed before a service connection can be made.

Contact the local Avista Utilities office before installation to request temporary service and to determine available voltage and location. The temporary service must be located to avoid interference with existing or future services.

The customer provides and installs all materials including the service conductor and 2" conduit. The service conductor must be long enough to reach the source plus 5 feet and be approved by Avista. Minimum of (3) 8 CU or (3) 6AL with white neutral; maximum conductor size is 1/0 AL. Below grade 2" conduit shall be schedule 40 PVC and schedule 80 PVC above grade. Avista does not allow conduit bodies between the service transformer and meter enclosure. The service conductor length must be long enough to be compliant with the AIC rating of their service equipment. This may require extra conductor to be coiled up and buried by the customer opposite the transformer side of the temp meter post. AIC rating and utility max. available fault current must be noted on outside of temp meter can.

Avista installs the meter and connects the service conductor to the source:

- If the post is between 2 and 5 feet from the source, Avista will dig and backfill the ditch.
- If the post is further than 5 feet from the source, the customer will dig and backfill the ditch. Backfill can not contain any rock larger than 4 inches. The customer is responsible for the costs required due to additional trench length.

NOTES:

1. If the full 3 foot burial depth cannot be met or the backfill does not support the post adequately, then the post must be braced.
2. The temporary service must be overhead when the permanent service is from an overhead transformer, even if the permanent service is to be fed underground.
3. Call 811 before digging to locate buried utilities.
4. Temp shall be at least 3 feet from all electric and gas service stubs.

REFERENCES:

1. Refer to Electric Service Requirements section 1.22 for available fault current at point of delivery.

AVISTA Utilities Distribution Standards DU-9.140 ESR

3.0 COMMERCIAL SERVICE REQUIREMENTS

3.1 GENERAL

For the purposes of this book, a commercial premise is used for other than domestic living.

A single point of delivery will be provided to a commercial building. Metering will be located as close as practical to this point. See Point of Delivery and Service Location sections in General section for additional information.

Commercial service design requirements vary widely depending on customer needs, site requirements and electrical design constraints. To determine transformer and service conductor requirements contact Avista Construction Project Coordinators during architectural design phase and before construction of commercial site to answer your questions and ours when planning begins. Please provide a copy of the physical and electrical site plans to the CPC before construction begins. Spending some extra time up front can save time and minimize confusion as the project moves ahead.

Commercial customers with a non-diversified continuous load cannot exceed 800 amps of true load for single phase service. For loads larger than 800 amps, a 120/208V or 277/480V 3 phase service is required. All service meters must be located on outside of building.

Any single phase commercial customer over 200 amp must have CT metering.

In multi-tenant facilities where customer owned wiring is used between the building service entrance and an Avista meter, all wiring beyond the service entrance, including that used to feed Avista meters, must be sized and installed by the customer according to NFPA 70: National Electric Code (NEC) and inspected by the authority having jurisdiction before energization. In addition, to these requirements, Avista requires that the maximum voltage drop between the service entrance and each meter be no greater than 2% as calculated using NEC Chapter 9 Table 9 Note 2. The voltage drop between the service entrance and meter is included in the overall voltage drop requirement contained in NEC 210.19(A) Informational Note No. 4.

3.1.1 Customer Responsibility

The customer will supply and install:

- Service entrance mast(s), and anchor points and guying or bracing if needed.
- A single point of connection for Avista service drop or lateral conductors.
- Meter socket for self-contained meter or
- CT enclosure w/CT mounting base and meter socket or enclosure.
- See **Metering Requirements** for specific information on the metering equipment needed for various services.
- Additional specific requirements are listed below.
- All commercial services require manual circuit closing (MCC) meter sockets.

3.1.2 Avista Responsibility

Avista will supply and Install:

- Transformer(s)
- Service conductors to point of delivery
- Current Transformers and instrument wiring if required
- Meter(s)
- Avista will make all electrical connections at agreed upon point of delivery (line side for termination enclosures and both line/load sides for pad transformers and secondary enclosures).

3.2 OVERHEAD SERVICES

3.2.1 Point of Delivery

The point of delivery for self-contained metering is at the ends of the service entrance conductor extending from the mast head. An extra 24" of wire must extend beyond weather head for utility connection and neutral wire must be taped in white tape or marked by factory stripe.

3.2.2 Mast Location

Contact Avista's Design Representative to determine where on the building to locate the mast. Wall or roof mounted masts may be used. Roof masts must be 30" of the roof's edge. Masts on building walls must be mounted or guarded so that snow and ice damage to the service and metering equipment is prevented. Any mast taller than 6' must be preapproved by Avista.

3.2.3 Anchor Points

Anchoring points are required to meet Avista strength and height requirements. Commercial services must meet the clearance requirements in the Overhead Residential Section. The strength needed will depend on the service drop conductor size and number. Guying may be required on the roof mast used as the anchor point. Refer to **Section 2.2.6** for information.

3.2.4 Current Transformers

Current transformers for building points of delivery will be installed in a wall mounted meter enclosure.

3.2.5 Multiple Masts

The customer may use multiple masts to feed various distribution panels or to feed multiple meters. Multiple masts must be grouped together so there is a single point of delivery for Avista's service drop conductors. Extend service entrance conductor from each mast to a common point near the service drop attachment. Avista will normally make the connections between customer and utility conductors unless size, number of conductors or improperly spaced masts prevent this. Check with Avista for approval.

3.3 UNDERGROUND SERVICES

For all commercial underground services, knockouts on either side of the bottom meter must be used (do not use bottom center knockout).

3.3.1 Point of Delivery

The point of delivery for underground services will vary depending on the circumstances described below. Contact Avista's Customer Project Coordinator to determine the location in your case.

3.3.2 Single Phase

The point of delivery for single phase underground service is normally at the building. Avista conductors are run to this point and connected to the landing lugs in a self-contained meter socket, CT mounting base or pulling/termination enclosure.

3.3.3 Three Phase

The point of delivery and meter for a service from a dedicated transformer will be at the transformer. A secondary termination enclosure will be required if the number of customer secondary conductors exceeds maximum conductors allowed in the transformer. See the table in **Section 3.4.4** for the maximum number of conductors.

For multiple meters on a single building the preferred point of service is the outside of the building. Avista will no longer pull secondary conductor inside a commercial building to the metering point but will stop secondary conductors at a point outside of a building.

3.3.4 Transformer Delivery Point

Customer Responsibility: Supply and install

- Concrete transformer pad. See drawing **Section 3.4.1** for details:
- Pedestal mounted meter enclosure and conduit. See drawing **Section 3.4.2** for details:
- Service conduit and conductor to the secondary section of the transformer.
- Customer provided secondary conductors must extend minimum of 6 feet from top of ground sleeve for landing on secondary spades.
- Install Avista supplied ground rod in low voltage side of transformer.
- Install Avista supplied ground sleeve which creates a conduit window in the poured concrete transformer pad.
- Bollards to protect transformer from being struck by vehicle traffic. Refer to **Section 3.3.7** for details.

Avista Responsibility: Supply and Install,

- Transformer
- Current Transformers and wiring as required.
- Meter(s)
- Lugs to land customer conductor on the transformer secondary spades. See **Section 3.4.4** for allowed secondary conductors.

3.3.5 Delivery Point at Secondary Enclosure

Customer Responsibility: Supply and install

- Install Avista provided box pad for secondary enclosure See **Section 3.4.3** for details.
- Pedestal mounted meter enclosure and conduit See **Section 3.4.2** for details:
- Conduit and conductor from the building to the secondary enclosure and conduit from transformer to enclosure.
- Customer provides enclosure and concrete pad if above 3000A and must get Avista engineering approval on design.

Avista Responsibility: Supply and Install,

- Transformer
- Provide a Standard 3000 amp diversified load rated secondary enclosure and associated box pad.
- Current Transformers and wiring as required.
- Meter
- Lugs and land customer conductor on the secondary enclosure bus. Customer landing area is on the bus end away from the transformer see **Section 3.4.4**.
- Land and install conductor between the transformer and secondary enclosure.

3.3.6 Building Delivery Point

Customer Responsibility: Supply and install

- Contact your local office for conduit and ditch requirements.
- Concrete transformer pads for three phase transformers. See drawing in **Section 3.4.1**: Note; meter enclosure shown in this drawing is not required.
- Required metering equipment. See **Section 4.0** Metering Requirements for information on metering equipment needed for various service sizes.
- EUSERC rated Pulling/termination enclosure or external Switch board as needed.

Avista Responsibility: Supply and Install,

- Transformer
- Current Transformers and wiring as required
- Meter(s)
- Install and connect secondary conductors to both transformer and at service delivery point.

Self-Contained Meters

Avista will terminate service conductors in the meter socket.

Instrument Rated Meters

Avista will terminate service conductors in the current transformer cabinet.

Self-Contained Meter Modules

2 – 6 Units:

Avista will terminate service conductors on the bus of a 2 to 6 meter modules.

More than 6 Units:

Avista will terminate at the main disconnect feeding several multiple meter modules.

Multi-Meter: Combination CT & Self-contained

Avista will terminate in a wall mounted or free standing termination/pull box or disconnect supplying individual self-contained or instrument rated meters. See enclosure requirements in **Section 4.0** Meter Requirements and **Section 4.1.6** Meter Mounting.

Switch Gear

Avista will terminate in the termination/pull section of switch gear located outside. An option in this case is for the customer to install, own and maintain service conductors from the building to Avista transformer. Switch gear shall meet EUSERC requirements with manufacturing drawings to be preapproved by Avista. See requirements in **Section 4.4.7** Switchgear Metering.

Multiple Transformers

Contact Avista for design requirements when multiple pad mount transformers are used.

3.3.7 Vehicle Barriers

The customer may be required to install bollards or other vehicle barriers to protect the transformers, padmounted equipment or meter equipment if they cannot be set 5' back from curb or are in an area subject to vehicle traffic. Contact Avista for information regarding bollard placement, spacing. Removable bollards are not acceptable.

SCOPE: This standard provides guidance for installation of bollards when protection is required for padmounted equipment.

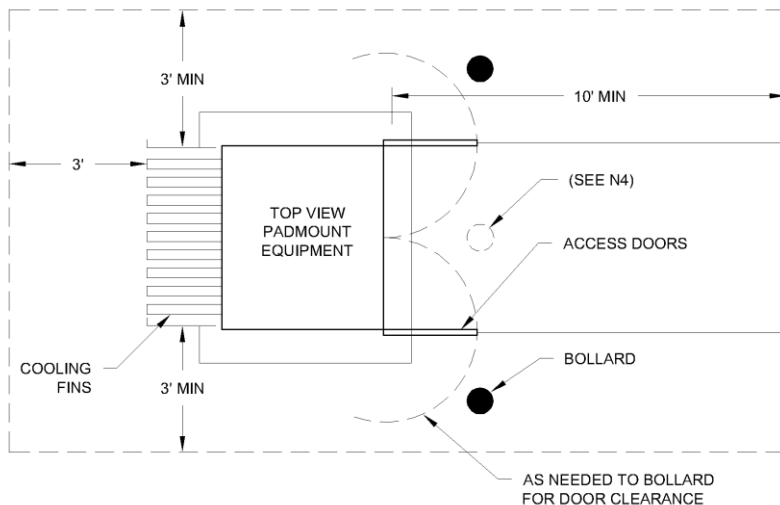


Figure 10 – Bollard Clearances

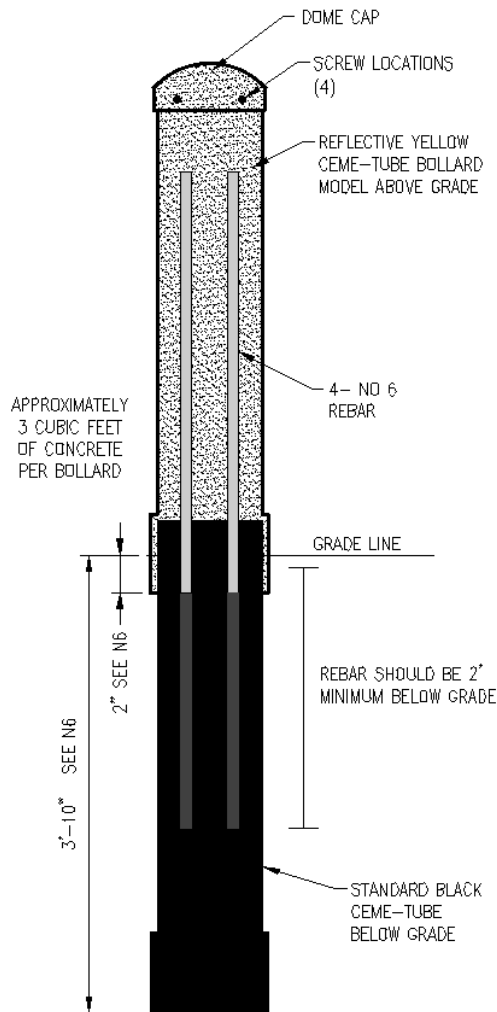


Figure 11 – Bollard Construction

NOTES:

1. The installation of bollards (Guard Posts) may be required when electrical equipment is exposed to vehicular traffic or when minimum clearances around equipment cannot be met.
2. The customer is responsible for supplying and installing bollards when directed by an Avista representative. If Avista has available inventory, Avista may be able to supply and install the bollards at the expense of the customer. The customer is responsible for maintaining bollards.

3. See detail Figure 1 for clearances to padmount equipment.
4. If large equipment such as a three-phase transformer or padmount capacitor bank requires bollards for protection, and if the five (5) foot spacing between bollards cannot be obtained while maintaining adequate clearance, a single third bollard may be installed subject to the following provisions:
 - a. There must be a clear possibility of vehicle strikes to the equipment.
 - b. The bollard must be installed in line with the line between the doors on the equipment (three phase transformers doors do not typically meet at the exact center of the equipment but are displaced to the right.
 - c. The bollard must be installed sufficiently far away from the equipment cabinet so as not to interfere with door opening.
 - d. Removable bollards are not permitted.
5. Plastic tube 8" bollards filled with concrete are preferred for the protection of Avista Utilities equipment. They are easy to install, yellow in color, maintenance free and locally available (Graybar, Anixter Power Solutions, White Block or other locations) and do not require bonding to the equipment cabinet. All other bollards must be approved by an Avista representative.
6. Follow manufacturer's installation instructions. The hole for the bollard should be 3 ft 10 in deep. Setting depth is not critical so long as the bottom of the top section of the bollard is below the ground line.
7. Bollards shall be a minimum of 48 inches tall. If several bollards are needed, they shall be placed at a maximum of 5' on center from each other.
8. Approved bollards installed in front of Avista equipment must be set a minimum of 6 feet from face of equipment and comply with N4.

REFERENCES:

1. Refer to WAC 296-46B-450(f).
2. Refer to DU-4.512 Grounding/Bonding of Adjacent Equipment.

AVISTA Utilities Distribution Standards DU-4.234 ESR

3.3.8 Handholes

Handholes are to be used at the discretion of Avista for maintenance or repair of the utilities existing facilities. Contact Avista's Customer Project Coordinator for approval.

3.3.9 Service Ditch

The ditch route, width and the need for sand padding and bedding must be pre-approved by the Avista Customer Project Coordinator.

All ditching must be inspected and approved by Avista personnel prior to backfilling and crew scheduling. Conductor will not be energized until the ditch has been fully backfilled. All ditches must be in accordance with Avista design requirements. Truck access is desirable. Time and material charges may result from additional trips necessary for energizing or correction of facilities.

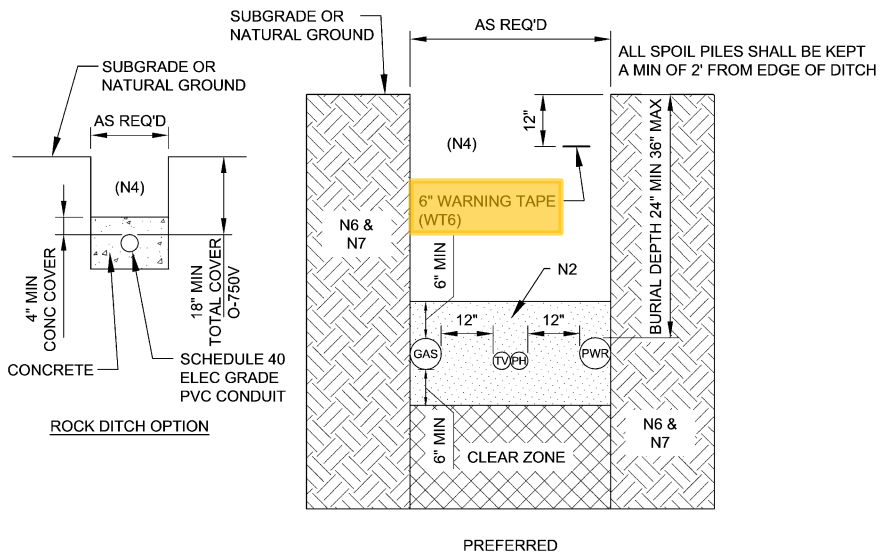
Customer is responsible for backfilling and returning landscape back to required condition, haul-off, and all compaction requirements, including select backfill if required. Customer is also responsible for obtaining all required permits.

State law requires all excavators to notify "One-Call" 48 hours in advance so that all utilities may locate and mark buried facilities before trenching begins. The law requires that the ditch be hand-dug within 2 feet of a locate mark. Extreme caution should be used. All hand-digging must be completed prior to inspection by Avista.

Customer dug ditches shall end no closer than 2 feet to an in service, energized padmount transformer or junction enclosure and or no closer than 6 inches to an in service, energized secondary handhole or pedestal. Allow more distance if soil conditions cause ditch to cave in. Extreme caution should be used. The conduit must be installed to the end of the ditch and the sweep left unattached for Avista crews to complete.

Ditches for service from an overhead facility shall be dug from the base of the pole to a point designated by the Avista Customer Project Coordinator.

Ditch must be in relation to final grade within 2"- 4", including all drainage areas.



BURIAL DEPTH IN INCHES		
VOLTAGE	IN CONDUIT	
	MIN	MAX
0 to 600 V	24	36
601 to 35kV	36	48

NOTES:

1. Gas service pipe and electric conduit should not be run in the water ditch. Avista requires 5' separation between water mains and electric cable. Refer to DU-1.410.
2. Bedding and padding for services in conduit shall be classified as select backfill. Select backfill is clean, screened material consisting of 3/4" minus rock and sand free of rubbish, cinders, chemical refuse or other materials that could cause damage to the conduit.
3. All customer ditches must pass Avista Utilities inspection.
4. Approved backfill shall not contain any rock larger than 4 inches.
5. Electric and communication cables may be installed with less than 12 inches separation when the general joint use requirements and the requirements of this standard are met. All parties with less than 12 inches separation must agree to random lay. Refer to DU-1.420.
6. All cables must have at least 12 inches radial separation from URD structures such as natural gas lines, fuel lines, building foundations, other cables not in random lay, etc.
7. Gas services should be installed with a 5' minimum longitudinal separation from sewer utility pipelines or storm drains or at further distances as specified by the appropriate regulating agency.

REFERENCES: (Contact Avista)

1. NESC Section 35.
2. Refer to DU-1.410 for Joint Use General Requirements
3. Refer to DU-1.420 for Joint Use Random Lay.
4. Refer to DU-7.450 for Service Cable Ditch.
5. Refer to Gas Standard Trenching and Backfilling 3.15.
6. Refer to Electric Service and Meter Requirements.

AVISTA Utilities Distribution Standards DU-1.430/DU-7.450 ESR

3.3.11 Clearance to Transformers

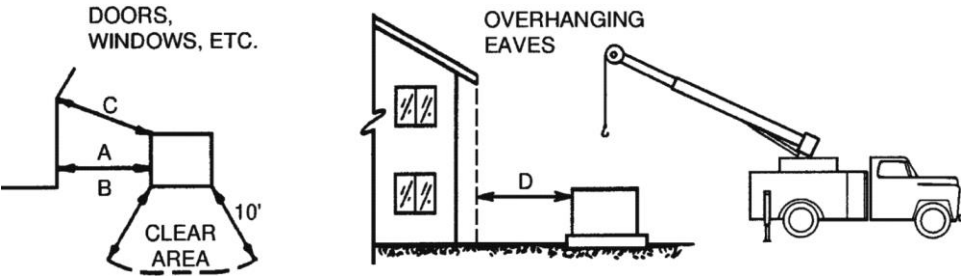


Figure 13 – Clearance to Transformers

NOTES:

- 1. The locations of the pad, transformer, and the point of delivery shall be as specified by Avista Utilities prior to the start of site preparation and construction.
- 2. The transformer shall be located to provide the following clearances. For the purpose of compliance with this standard, FR3 fluid is considered flammable and necessitates the same clearances as conventional oil filled transformers.

CLEARANCE TO:	SHALL BE NO LESS THAN:
Noncombustible Wall (N7)	2'
Wall with combustible component (N7)	8'
Doors, windows, or other openings	8'
Combustible eaves, decks, or patio roofs 14 f less above grade (N7)	8' horizontal from eave, deck, or roof
Other vertical obstructions	Boom truck Access Required
Gas Meter	3'
Propane Tank	Refer to Section 3.3.12

3. . Boom truck access must be provided.
4. The front of the transformer shall open away from the building. An area clear of all obstructions including landscaping must be provided for a radius of 10 feet from the front of the transformer, to provide personnel access for the operation and maintenance of the transformer. The grade of the ground in the clear area should approximately match that of the transformer. In addition, the grade of the ground at the pad-mounted transformer shall be such that any oil leaking from the transformer will flow away from the building.
5. Transformers shall not be covered, concealed, disguised, or enclosed. Where fences are permitted, they must be at least two (2) feet from the transformer on all sides (or more if required to allow the doors to open fully), must allow unrestricted access to the front, and must meet the clearance requirements listed above.
6. Pedestal and meter cabinets shall not be in front of or obstruct the transformer doors. The minimum distance from the edge of the three phase transformer pad to the meter is 1 foot (R6, R7).
7. Noncombustible walls shall be constructed with a minimum 3-hour fire resistance rating and comprise of either a minimum of 6 inch thick reinforced concrete or 8 inch thick Concrete Masonry Unit (CMU) with all cavities filled with reinforced concrete.
8. The pad shall be located and sized to permit the required clearances. No part of the transformer shall extend beyond the outer edge of the pad. (See R7, DU-5.122, for concrete pad dimensions and construction details).
9. Phone and TV pedestals must not be in front of the transformer and must be at least 2' away from sides and back of transformer.

REFERENCES:

1. WAC 296-46B-450.
2. WAC 296-24-95703.
3. International Building Code Ch. 6 & 7
4. Distribution Engineering FR3 Policy and Cold Weather Documents.
5. Refer to DU-4.222 for clearances to Propane Tanks and equipment
6. For metering cabinet and cans, see Electric Service and Metering Requirements Book.
7. Refer to DU-5.122 Concrete Pads Three-Phase Transformers.
8. Landscape Screening for Pad-mounted Transformers booklet.
9. Refer to DU-4.234 Bollard Equipment Protection for transformer protection in traffic areas.

AVISTA Utilities Distribution Standards DU-5.020 ESR

3.3.12 Clearance to Other Equipment Buildings & Swimming Pools

SCOPE:

This standard provides direction for establishing clearances to existing buildings and other equipment when installing underground distribution cables and equipment.

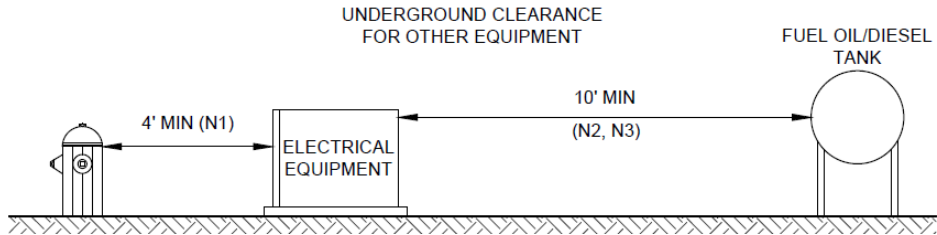


Figure 14 – Clearances Between Hydrants and Fuel Oil, Diesel, or Gasoline Tanks

Propane Tank Capacity (gallons of water)	Minimum Distance to Buried Tank (ft)	Minimum Distance to Above-Ground Tank (ft)
< 501	15	15
501 - 2000	15	25
2001 – 30,000	50	50
30,001 or more	50	Contact Distribution Engineering

Table 6 – Clearance: Propane Storage Tanks and Electrical Equipment

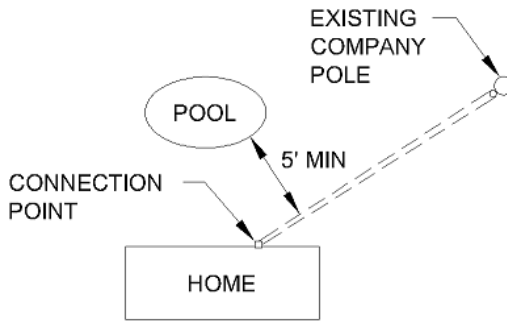


Figure 15 – Underground Clearance for Swimming Pools

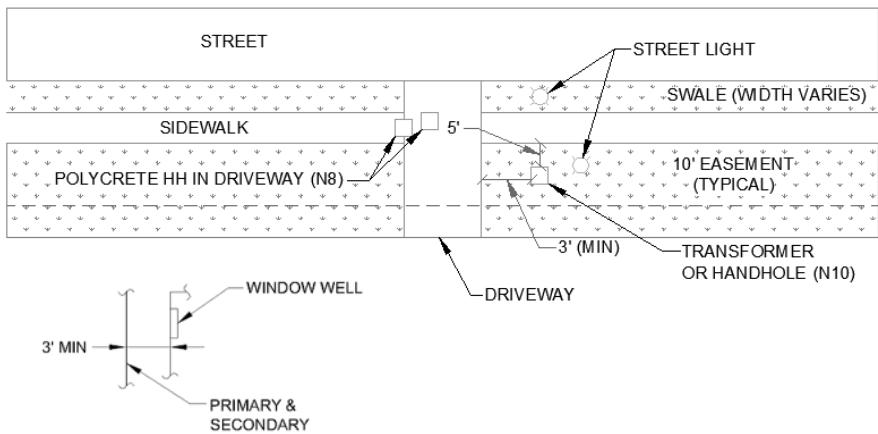


Figure 16 – Underground Clearances for New Developments

NOTES:

1. Transformers and secondary pedestals shall have a minimum of 4' clearance from fire hydrants to facilitate water maintenance and fire department operations. Secondary handholes may be substituted where 4' minimum clearance is not attainable.
2. Clearance to fuel tanks (shown in Figure 1) is ONLY applicable for tanks containing fuel oil, diesel or gasoline.
Required clearances to Propane tanks are defined in Table 6; propane tank capacity **MUST** be confirmed before construction begins.
3. If any Propane handling facility other than a tank is involved, or if the electrical distribution equipment is downhill from the propane equipment, contact Distribution Engineering.

4. Electric Distribution Equipment located within 15 feet of a propane tank must be rated as explosion proof (R2). See Distribution Engineering.
5. Cables may not be installed under above-ground pools.
6. Refer to Joint Use section for clearances to other underground utilities. (R9)
7. Maintain 5' minimum distance between water main and electric.
8. Use polycrete handholes for installation in driveways or areas where vehicles may drive over. (R7)
9. Avista Utilities will not install underground primary or service wire under any portion of a building. (R1, R4)
10. Location of pad mount transformers or junction enclosures near roadways shall be in accordance with DU-4.206 (R5).

REFERENCES:

1. NESC 351C1 & 351C2
2. NEC 500.5(2); 500.6(4); NEC 500.7(A)
3. Liquefied Petroleum Gas Guide NFPA 58, 2004; Sections 6.3, 6.20.2
4. Refer to Avista Utilities Electric Service Requirements book.
5. Refer to DU-4.206 for Control Zone Streets and Hydrants.
6. Refer to DU-5.020 for Transformer Clearances
7. Refer to DU-7.325 for Traffic Rated Handholes
8. Refer to DO-3.338 for Swimming Pools
9. Refer to Section DU-1.4 for Joint Use
10. WAC 296-307-41047 Liquid Petroleum Gas Installations

AVISTA Utilities Distribution Standards DU-4.222 ESR

3.3.13 Pipe Type Meter Pedestal for 200A Service

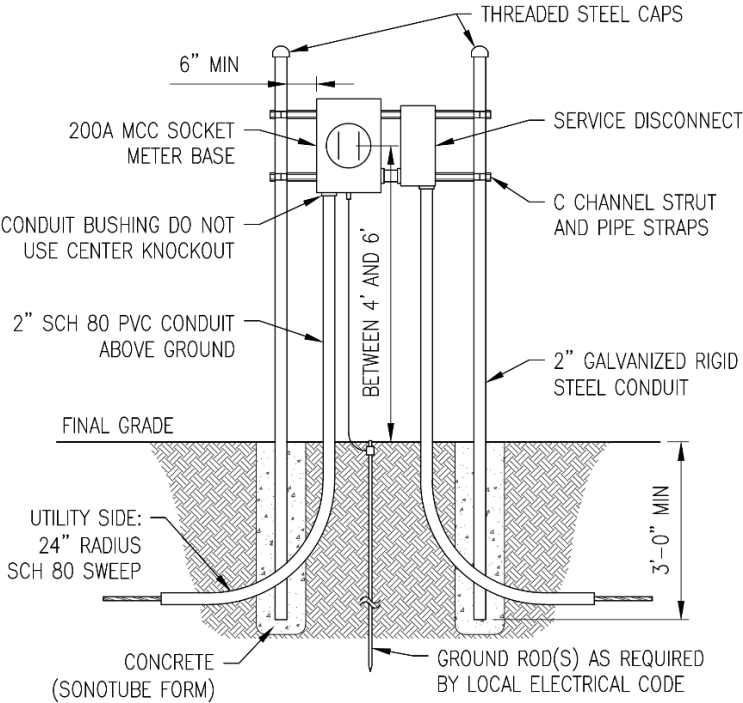


Figure 17 – 200 A Pipe Meter Pedestal Installation



Figure 18 – 200 A Pipe Meter Pedestal Install Photo

NOTES:

1. Note: Underground service pedestals are the preferred method of construction.
2. These are general Avista Utilities requirements. The customer or their electrician must consult the local electrical code authority for specific requirements. **An electrical inspection permit decal must be displayed on the Meter Socket before a service connection can be made.**
3. Customer to furnish and install post in concrete or unistrut attached to two 2 inch rigid steel pipes (with threaded steel caps) embedded in concrete.
4. Customer to furnish and install Meter / disconnect enclosure and sealing ring. Enclosures shall be securely mounted (minimum 2 points) without flex or wobble.
5. Customer to furnish and install Utility service trench, backfill, and conduit.
6. Customer to furnish and install ground electrode(s), connectors and bonding wire.
7. Customer to furnish and install conduit and wire as necessary to serve the home.
8. Avista Utilities to furnish and install meter and utility service wire.
9. Pedestal must not be located under drip eave of building or where sliding snow could impact pedestal.
10. The 200A meter pedestal must be installed on the two pipe and unistrut configuration. Refer to figures 13 and 14.
11. Meter pedestals greater than 200A shall comprise of a CT enclosure mounted on the two pipe and unistrut configuration. Refer to figures 20, 34, 35, and 36.
12. Meter pedestal must be installed so the utility service cable pull and terminating section shall be lockable, and restricted to Avista use only.
13. Meter pedestal must have corrosion inhibitor on aluminum connections.
14. Meter pedestal must be kept clear for maintenance access.
15. Meter pedestal must have plumb installation with the meter facing away if located within 5 feet of the structure.

REFERENCES:

1. Refer to DU-7.450 for Joint Use Service Ditch Detail.

AVISTA Utilities Distribution Standards DU-9.132 ESR

3.4 PADMOUNTED EQUIPMENT DRAWINGS

3.4.1 Three-Phase Transformer Concrete Pads

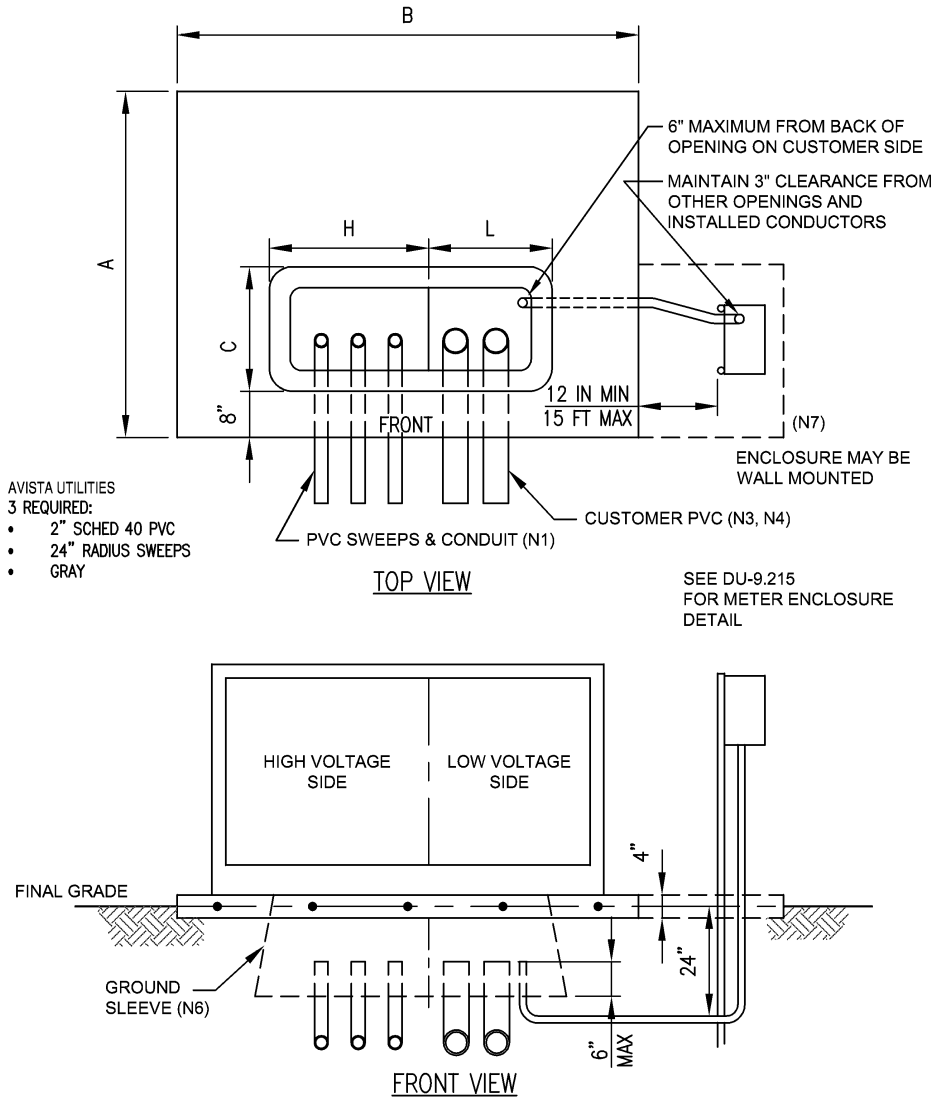


Figure 19 – Three Phase Transformer Concrete Pads

3-PHASE

KVA	DIMENSIONS IN INCHES				UNIT ASSEMBLY	
	A	B	C	H	L	
45-500	80	90	18	40	25	GNDSL3V3
750-1500	90	132	24	40	25	GNDSL3V3LRG

Table 7 – Three Phase Transformer Concrete Pad Dimensions**NOTES:**

1. Direction of entry of high voltage conduits may vary according to the job requirements.
2. Service conduits must be installed prior to forming and pouring the pad to avoid undermining the pad.
3. Service conduits must be confined to the low voltage side of the window.
4. When the number of secondary conductors exceeds the limits in DU-5.124, the customer shall make reasonable attempts to accommodate connection to secondary side of transformer (i.e. use copper conductor instead of aluminum, etc) If the limits in DU-5.124 are still exceeded after modifying service conductors, Avista will provide a 3000A secondary enclosure and box pad at the expense of the customer. This additional expense is considered customer requested and is excluded from any allowance.
5. A ground sleeve will be supplied by Avista. It shall be centered left to right in the pad.
6. For transformers larger than 500 kVA, the customer will be required to provide a larger concrete pad.
7. The meter pedestal shall be located as specified by Avista Electric Meter Shop. The rigid upright steel conduits for metering enclosure shall be set in concrete and capped with steel cap.
8. Pad shall be located and oriented as specified by Avista (R2).
9. Pad shall be constructed on firm undisturbed or well-compacted earth, shall be bedded on 3" of compacted 3/4" gravel and shall be level.
10. Concrete shall be 5-bag mix with 3/4 inch maximum size aggregate. Top surface shall be broom finished. Edges shall be rounded.

11. Concrete shall be at least 4 inches thick and shall be reinforced at half the depth with #4 rebar on 12 inch centers each way. Reinforcing extending around window shall consist of a minimum of 2 rebar.
12. 2" steel pipe poles should be bonded to transformer ground.
13. Concrete pad installations must inspected by Avista before pad is poured and again after pad is poured.
14. Install 1" conduit for metering 6" maximum from back of opening on customer side.

REFERENCES:

1. Avista Utilities Electric Service and Meter Requirements manual.
2. Clearances to Other Equipment, Buildings, and Swimming Pools DU-4.222
3. Refer to Underground Standard DU-5.120.
4. Refer to DU-9.215 Pedestal Mounted Meter Enclosure.

AVISTA Utilities Distribution Standards DU-5.122 ESR

3.4.2 Pedestal Mounted Meter Enclosure – For Dedicated Transformer

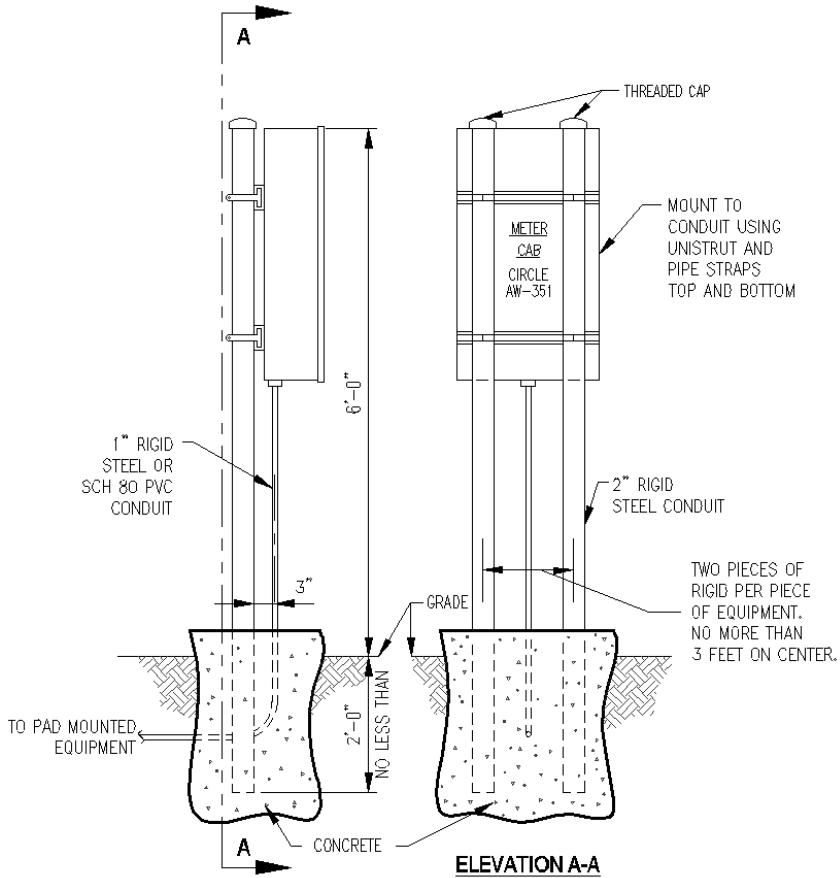
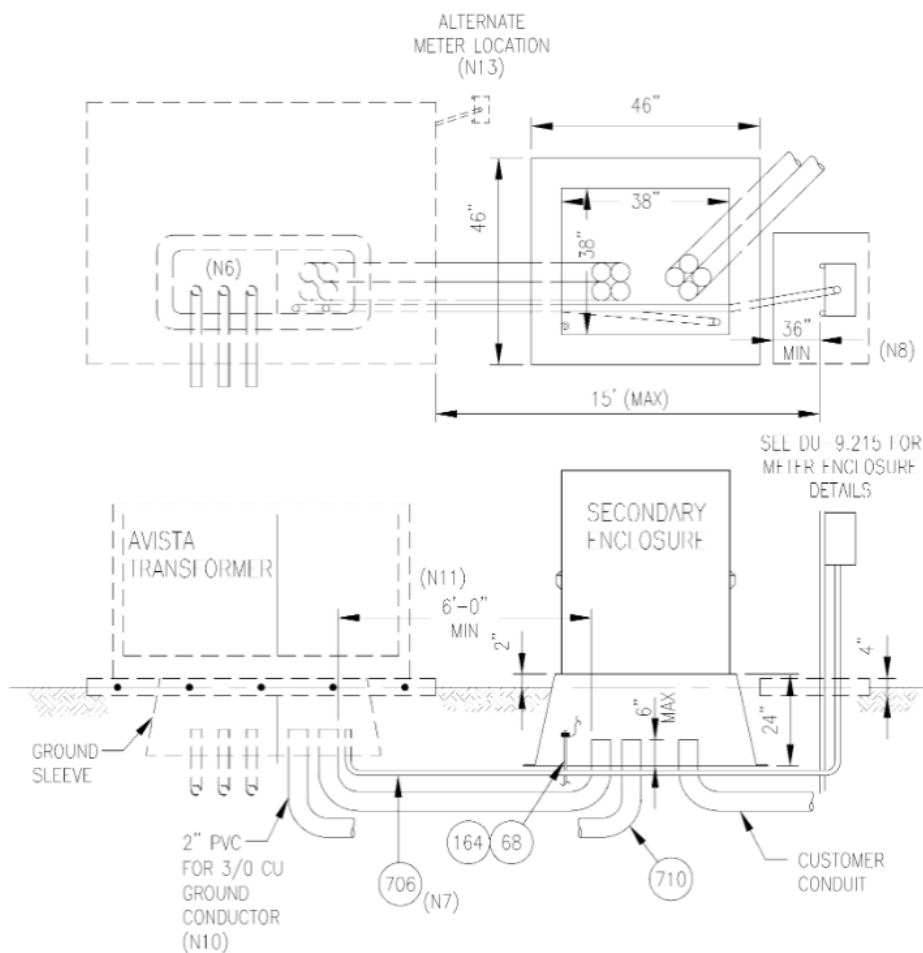


Figure 20 – Pedestal Mounted Meter Enclosure for Dedicated Transformer

Note: Self-standing gear must be supported by 2" rigid metal conduit at intervals of no more than 3'.

AVISTA Utilities Distribution Standards DU-9.215 ESR

3.4.3 Secondary Enclosures



PREFERRED – SECONDARY ENCLOSURE FIBERGLASS BOX PAD

Figure 21 – Secondary Enclosure Fiberglass Box Pad

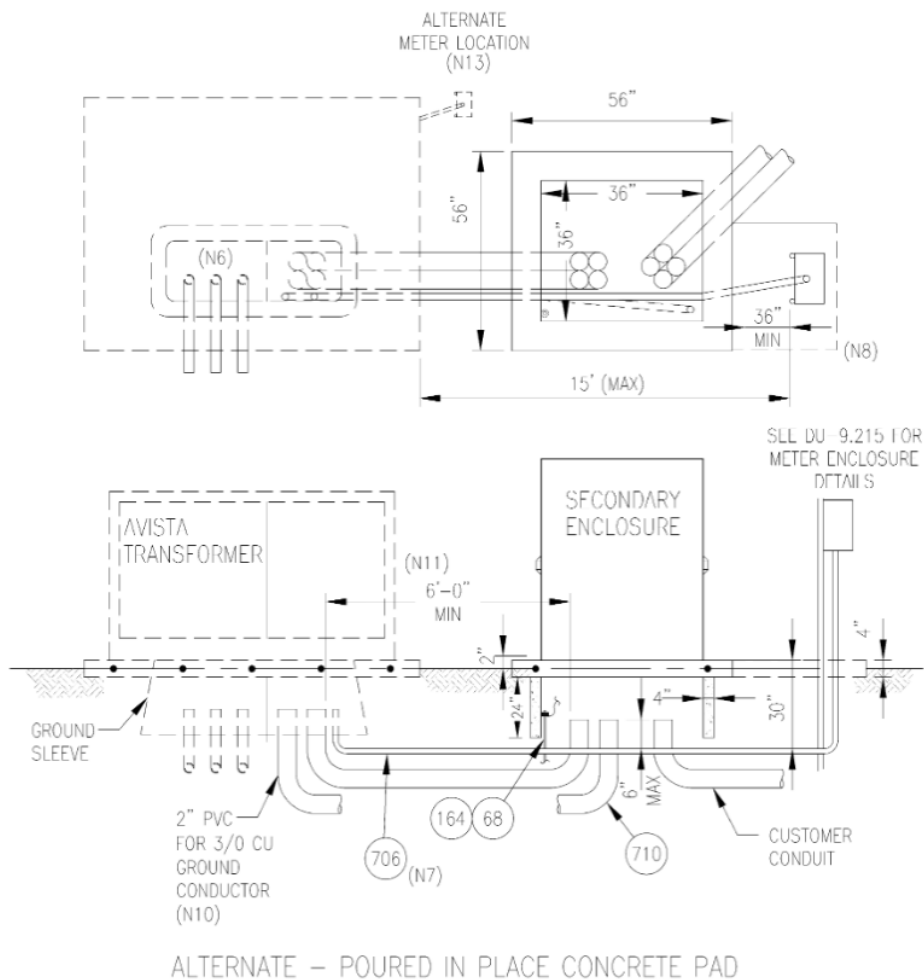


Figure 22 – Secondary Enclosure Poured In Place Concrete Pad

NOTES:

1. When the number of secondary conductors exceeds the limits in DU-5.124, the customer shall make reasonable attempts to accommodate connection to secondary side of transformer (i.e. use copper conductor instead of aluminum, etc) If the limits in DU-5.124 are still exceeded after modifying service conductors, Avista will provide a 3000A secondary enclosure and box pad at the expense of the customer. This additional expense is considered customer requested and is excluded from any allowance.

2. Pad shall be located and oriented as specified by Avista Utilities (R2). The bus in the secondary enclosure will be the point of service as defined in Avista Utilities rates and tariffs.
3. Pad shall be constructed on firm undisturbed or well-compacted earth, shall be bedded on gravel and shall be level.
4. Concrete shall be 5-bag mix with 3/4 inch maximum size aggregate. Top surface shall be broom finished. Edges shall be rounded.
5. Concrete shall be at least 4 inches thick and shall be reinforced at half the depth with #4 rebar on 6 inch centers each way. Reinforcing shall extend around window.
6. Direction of entry of utility conduits may vary according to the job requirements.
7. Conduits must be installed before fiberglass box pad installation or before forming and pouring the pad to avoid undermining the pad.
8. The meter pedestal shall be located as specified by Avista Utilities. The rigid conduits shall be set in concrete. Avista Utilities Meter Shop will determine CT applications. Meter location may vary with specific application. Leave room to open enclosure doors.
9. Conduit between transformer and enclosure may be a gutter in some applications.
10. A separate ground conductor (3/0 copper) must be installed between the transformer neutral bus and the case ground of the secondary enclosure.
11. Area between transformer concrete pad and secondary enclosure box pad or concrete pad can be concrete. Leave enough room for setting transformer.
12. Seal the source side conduit where customer conduits enter a building. Fire barrier water-tight sealant SN 668-0600 with fire barrier packing material SN 668-0601 if needed.
13. Alternate meter location must be approved by Avista before installation.

REFERENCES:

1. Avista Utilities Electric Service and Meter Requirements manual.
2. Refer to DU-5.020, Transformer Clearances.
3. Refer to DU-5.124, Secondary Enclosure Padmount.
4. Refer to DU-5.122, Concrete Pads Three-Phase Transformers.
5. Refer to DU-9.215, Pedestal Mounted Meter Enclosure.

AVISTA Utilities Distribution Standards DU-5.123 ESR



3.4.4 Padmounted Secondary Enclosure

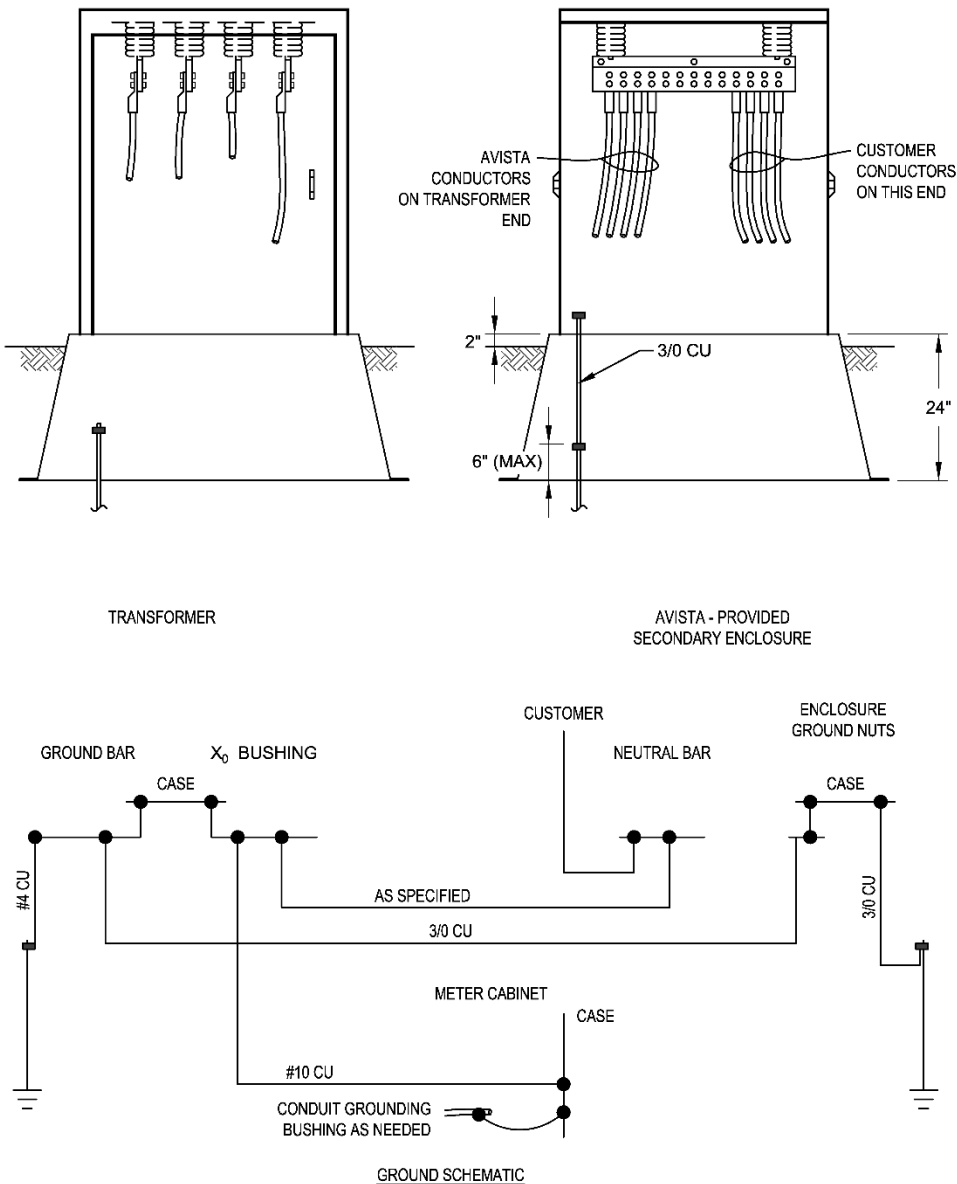


Figure 23 – Padmounted Secondary Enclosure

TRNSF KVA	FULL LOAD AMPS	SEC VOLTS	REC MAX CUST SEC WIRES PER PHASE FROM TRNSF (N6)	CONDUITS FROM TRNSF TO ENCL	PHASE & NEUTRAL WIRES FROM TRANSF TO SEC ENCLOSURE (N3, N8)
45	125	208Y/120	3	2-3" PVC	1 x 2/0 AL Quadruplex
75	210	208Y/120	3	2-3" PVC	1 x 350 AL Quadruplex
112.5	315	208Y/120	3	2-4" PVC	1 x 750 AL (500 CU) PH & 1 x 350 Neut
150	415	208Y/120	3	3-4" PVC	2 x 350 AL Quadruplex
225	625	208Y/120	4	3-4" PVC	2 x 750 AL (500 CU) PH & 2 x 350 Neut
300	835	208Y/120	6	5-4" PVC	3 x 750 AL (500 CU) PH & 3 x 350 Neut
500	1390	208Y/120	6	7-4" PVC	5 x 750 AL (500 CU) PH & 5 x 350 Neut
750	2080	208Y/120	8	9-4" PVC	7 x 750 AL (500 CU) PH & 7 x 350 Neut
1000	2775	208Y/120	9	9-4" PVC	9 x 750 AL (500 CU) PH & 9 x 350 Neut
45	54	480Y/277	3	2-3" PVC	1 x 2/0 AL Quadruplex
75	90	480Y/277	3	2-3" PVC	1 x 2/0 AL Quadruplex
112.5	135	480Y/277	3	2-3" PVC	1 x 2/0 AL Quadruplex
150	180	480Y/277	3	2-3" PVC	1 x 4/0 AL Quadruplex
225	270	480Y/277	4	2-4" PVC	1 x 350 AL Quadruplex
300	360	480Y/277	6	2-4" PVC	1 x 750 AL (500 CU) PH & 1 x 350 Neut
500	600	480Y/277	6	3-4" PVC	2 x 750 AL (500 CU) PH & 2 x 350 Neut
750	900	480Y/277	8	4-4" PVC	3 x 750 AL (500 CU) PH & 3 x 350 Neut
1000	1200	480Y/277	9	6-4" PVC	4 x 750 AL (500 CU) PH & 4 x 350 Neut
1500	1800	480Y/277	9	6-4" PVC	6 x 750 AL (500 CU) PH & 6 x 350 Neut

Table 8 – Conduits & Conductors from Transformer to Secondary Enclosure

NOTES:

1. When the customer has more cables to terminate than the recommended number of cables per phase from the transformer, as shown in the table above, a padmount secondary enclosure shall be installed. The Avista provided secondary enclosure should be placed onto a fiberglass box pad (R3) where conditions permit. If use of a box pad for the secondary enclosure is not practical, the customer shall provide a concrete pad for the transformer and the secondary enclosure (R4).

2. The customer must provide conduits between the transformer and the secondary enclosure to accommodate the connecting cables.
3. Three-phase conductors and one neutral conductor shall be installed in each conduit.
4. Install cables shown in the table above to obtain full transformer capacity.
5. Bond the enclosure case to the enclosure ground electrode(s) with two - 2/0 conductors.
6. The customer's cables should be no larger than 750 CU or 1000 AL when terminated in the secondary enclosure.
7. Avista will furnish and install lugs on the secondary and service conductors and land those conductors on the secondary enclosure terminals.
8. This column lists the number and size of secondary conductors recommended between the transformer and junction enclosure. It does not apply to longer service runs where voltage drop may be a consideration. These recommendations are based on the ampacities listed in DU-7.102. The secondary conductors are sized to meet both the summer and winter ratings of the transformer, taken as 114% and 138% of the OA rating respectively.
9. The transformer neutral bus and case ground of the secondary enclosure must be bonded together with a 3/0 CU conductor.
10. Table values allow ability to go up one transformer size.
11. Where customer conduits enter a building, the secondary conduits must be sealed below the secondary enclosure and where the conduits enter the building wall. Use fire barrier water-tight sealant SN 668-0600 with fire barrier packing material SN 668-0601.
12. When a secondary enclosure is installed, the point of delivery will generally be the bus bars in the secondary enclosure (R4). Avista will install lugs at point of delivery. No CT's will be installed in secondary enclosures.
13. Secondary enclosure has not been UL approved and is owned by Avista.

REFERENCES:

1. NESC 374, NESC 384
2. NESC 96C
3. Refer to DU-5.123, Fiberglass or Concrete Pads Secondary Enclosure.
4. Refer to Avista Utilities Electric Service and Meter Requirements manual.
5. Refer to DU-7.203, Heavy Duty Lugs.
6. Refer to DU-7.101, Secondary Cable Characteristics.
7. Refer to DU-5.122, Concrete Pads Three-Phase Transformer

AVISTA Utilities Distribution Standards DU-5.124 ESR

3.4.5 Conduit Entrance Single-Phase Transformer

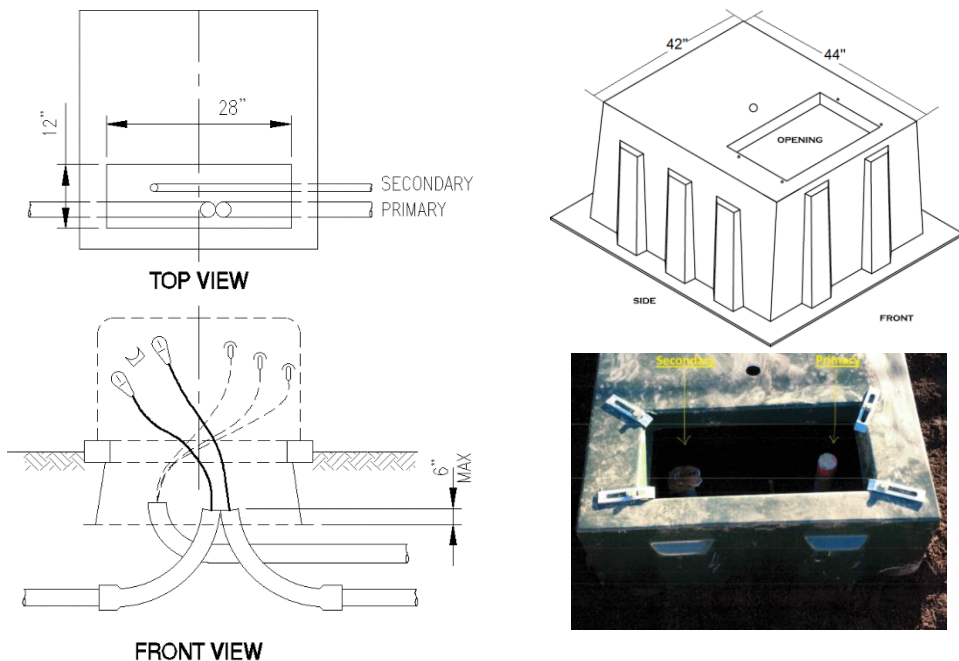


Figure 24 – Conduit Entrance Single-Phase Transformer

NOTES:

1. Backfill trench for 8 to 10 feet, one foot deep, on all sides of enclosure to anchor primary conduit (R6).
2. Seal unused conduits with plastic caps.
3. Other conduit arrangements may be required depending on the situation.
4. Spare conduits stubbed into ground sleeve shall be located to the front of the window.
5. Customer will excavate a hole for the transformer ground sleeve that is 3 feet deep and 8 feet by 8 feet square with approved bedding sand and within 3 feet of excavation.

REFERENCES:

1. NESC 321B.
2. NESC 360B.
3. NESC 361A.
4. NESC 363A.
5. Refer to DU-3.202 and DU-3.212 for junction enclosures.
6. Primary Ditching DU-4.605

AVISTA Utilities Distribution Standards DU-4.750 ESR

3.4.6 Conduit Entrance 1&2-Phase Padmounted Junction Enclosures

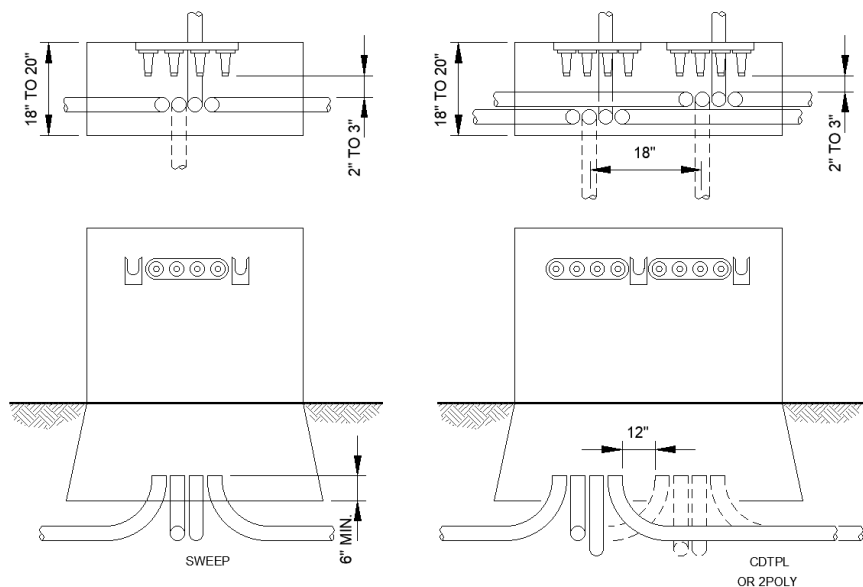


Figure 25 – Conduit Entrance 1 & 2 Phase Padmounted Junction Enclosures

NOTES:

1. To protect the cables and maintain bending radius greater than allowed minimums, sweeps are required for cable in conduit installations; sweeps are not required for direct buried primary cable installations. Conduit sweeps may need to be cut off to provide additional cable movement; if the conduit is cut off, leave at least 6 inches of conduit above the bottom of the ground sleeve.
2. Seal unused conduits with plastic conduit caps.
3. Other conduit arrangements may be required depending on the situation.

REFERENCES:

1. NESC 321B
2. NESC 360B
3. NESC 361A
4. NESC 363A
5. Refer to DU-3.202 and DU-3.212 for junction enclosures.

AVISTA Utilities Distribution Standards DU-4.751 ESR

3.4.7 Conduit Entrance 3-Phase Padmounted Junction Enclosures

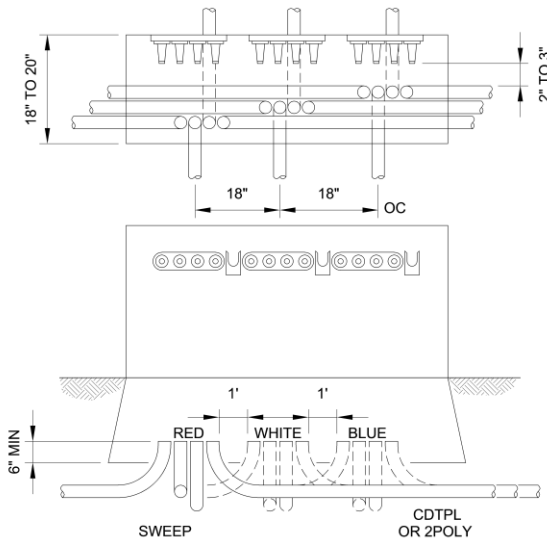


Figure 26 – Conduit Entrance 3-Phase Padmounted Junction Enclosures

NOTES:

1. Backfill trench for 8 to 10 feet, one foot deep, on all sides of enclosure to anchor primary conduit (R4).
2. Seal unused conduits with plastic conduit caps.
3. Other conduit arrangements may be required depending on the situation.

REFERENCES:

1. NESC 321B.
2. NESC 360B.
3. NESC 361A.
4. NESC 363A.
5. Refer to DU-3.202 and DU-3.212 for junction enclosures

AVISTA Utilities Distribution Standards DU-4.752 ESR

3.5 OVERHEAD SERVICE CLEARANCES AT BUILDING

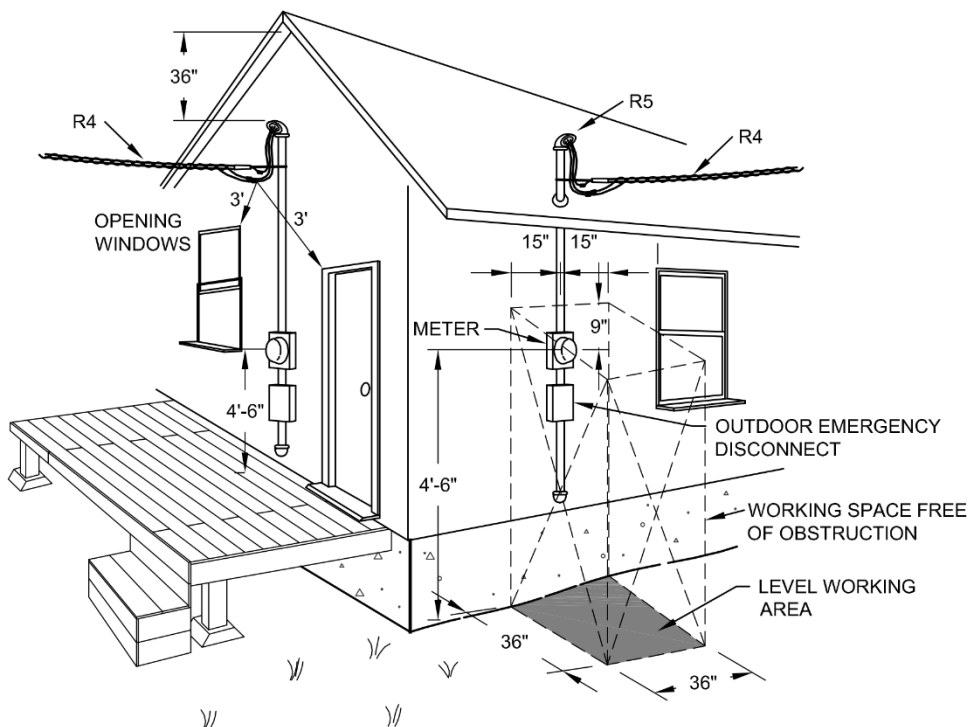


Figure 27 – Overhead Service Clearances at Building

NOTES:

1. A roof, balcony, or area is considered readily accessible to pedestrians if it can be casually accessed through a doorway, ramp, window, stairway, or permanently mounted ladder by a person on foot who neither exerts extraordinary physical effort nor employs tools or devices to gain entry. A permanently mounted ladder is not considered a means of access if its bottom rung is 8 feet or more from the ground or other permanently installed accessible surface.
2. These clearances to building openings apply to the closest point on the service drop, conductor, drip loop, or connectors. They do not apply to the meter.

3. Service attachment height must be such that these minimum building clearances as well as clearances above ground, driveways and streets can be met. Avista can assist the customer in determining the service mast height to meet these requirements. Call the local office number listed in the Electric Service Requirements Handbook early in the planning stage.
4. Services cannot be connected if service drop attachment height prevents required clearances from being met.
5. Conductors may be run above the top level of a window but shall be no less than 18" above window.
6. Meter sockets installed within 15 inches from center of meter to wall of structure (inside corner) will not be approved nor hooked up.

REFERENCES:

1. NESC 234C3
2. NEC 230.9 Clearances on Buildings
3. NEC 230.24 Clearances
4. Refer to DO-6.210 (ESR Section 3.6) Service Wire clearances.
5. Refer to DO-6.230 for House Mast specifications.
6. Refer to DO-6.107 through DO-6.149 for stringing sags and tensions of service conductors.
7. NESC Table 234-1 1(b)(1)

AVISTA Utilities Distribution Standards DO-6.270 ESR

3.6 OVERHEAD SERVICE CLEARANCES OVER GROUND AND BUILDINGS

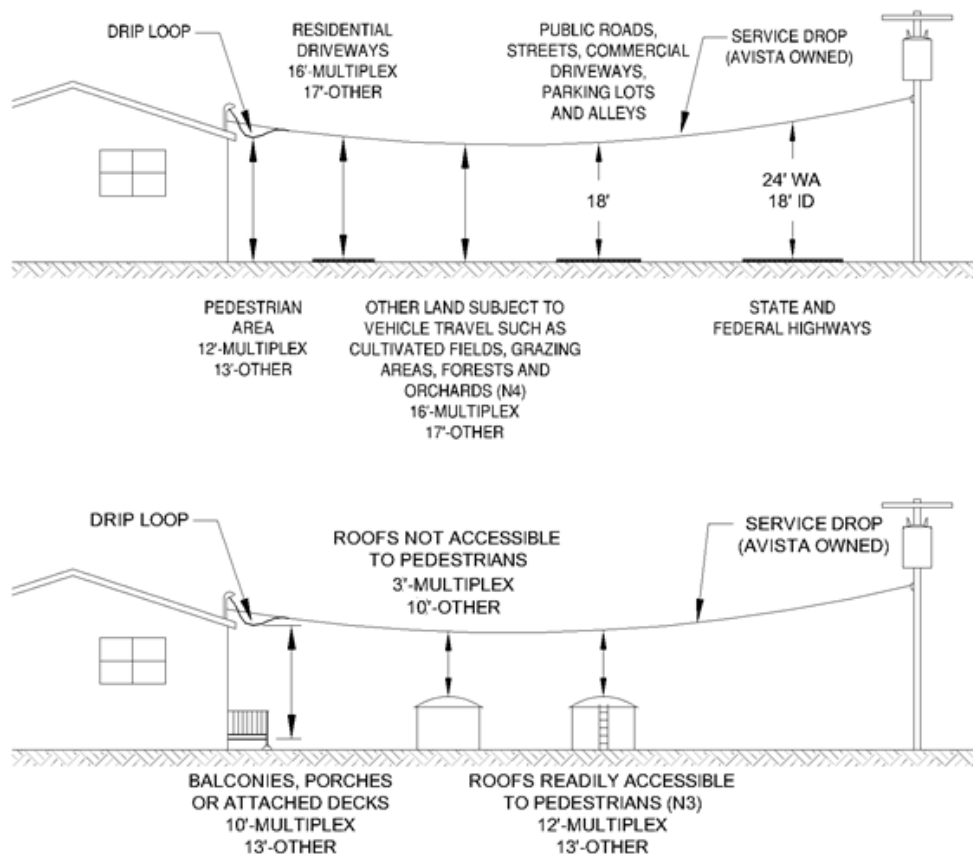


Figure 28 – Overhead Service Clearances over Ground and Buildings

DIRECTIONS:

1. Provide the clearances shown using the final sag listed in DO-6.149.

NOTES:

1. Clearances are code or Avista Utilities Standard Practices. Clearances less than those listed or for higher voltages must be approved by the Avista Utilities Engineering Department.
2. Trees cannot be used to support service conductor.
3. A roof, balcony, or area is considered readily accessible to pedestrians if it can be casually accessed through a doorway, ramp, window, stairway, or permanently mounted ladder by a person on foot who neither exerts extraordinary physical effort nor employs tools or devices to gain entry. A

permanently mounted ladder is not considered a means of access if its bottom rung is 8 ft or more from the ground or other permanently installed accessible surface.

4. In areas subject to combine harvesting increase clearances to 20 ft when possible.
5. Altered services will require the customer to change clearances (as needed) to meet Avista's current clearance requirements.

REFERENCES:

1. NESC 232
2. NESC 234

AVISTA Utilities Distribution Standards DO-6.210 ESR

3.7 CLEARANCES TO BUILDINGS AND APPURTENANCES

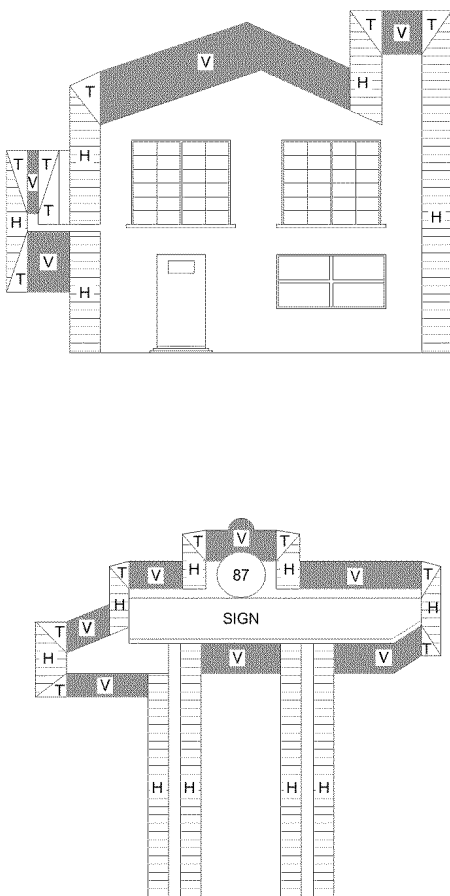


Figure 29 – Clearances to Buildings and Appurtenances

T = Transitional Area, treat as horizontal clearances

H = Horizontal

V = Vertical

Conductor Clearances	Voltage Phase to Ground or Phase to Phase for Ungrounded Circuits		
	0 to 750 V (ft)		750 - 22 kV (ft) (35 kV requires greater clearances)
	Multiplex, Neutral or Guys on Secondary Poles	Bare, Insulated or Covered Conductor	Bare Conductor, Ungrounded Guys on Primary Poles
Attached to Buildings See DO-6.210 & 6.270			
Adjacent to Buildings			
Horizontal Clearances to walls, windows, balconies and areas readily accessible to pedestrians. (N5)	5	5.5 or 3.5+Blowout (N3)	7.5 or 4.5+Blowout (N3)
Vertical Over and under roofs or balconies not accessible to pedestrians (N5)	3	10	12.5
Over or under roofs or balconies accessible to pedestrians and vehicles under 8ft (N5)	12	13	15
Accessible to truck traffic	16	17	20
Adjacent to Signs, Chimneys, or Billboards			
Horizontal Areas not accessible to Pedestrians	3.5	5.5 or 3.5+Blowout (R5)	7.5 or 4.5+Blowout (R5)
Areas accessible to Pedestrians	5	5.5 or 3.5+Blowout (R5)	7.5 or 4.5+Blowout (R5)
Vertical Over and under catwalks and other surfaces where people walk	11.0 (for Neutral) or 12*	13	15
Over or under other portions	3.5	6	8
Antennas (R2)			
Horizontal Structure below line height	5	5.5 or 3.5+Blowout (R5)	7.5 or 4.5+Blowout (R5)
Structure above line height (R2)	Structure Height+10ft	Structure Height+10ft	Structure Height+10ft
Structure above line height (R2)	Structure Height+10ft	Structure Height+10ft	Structure Height+10ft
Vertical	5	5.5	7.5
*Multiplex covered conductors.			
Working Clearances			
Radial Clearances	10' Min., 20' Min for Cranes		

Note: Customer is responsible for any costs associated with rework necessary to achieve clearance.

Table 9 – Clearances to Buildings and Appurtenances

NOTES:

1. For conductors above surfaces provided the vertical clearances above based on final unloaded sag at +176 degrees F (R4).
2. For conductors below projections use the initial unloaded sag at -20 degrees F (R3).
3. Check with local fire departments for ladder space clearances.
4. Clearances are code requirements or Avista Utilities Standard Practices. Clearances less than those listed or higher voltages must be approved by the Avista Utilities Engineering Department.
5. A roof, balcony, or area is considered readily accessible to pedestrians if it can be casually accessed through a doorway, ramp, window, stairway, or permanently mounted ladder by a person on foot who neither exerts extraordinary physical effort nor employs tools or devices to gain entry. A permanently mounted ladder is not considered a means of access if its bottom rung is 8 ft or more from the ground or other permanently installed accessible surface.
6. The transitional areas marked "T" in the above drawings should be treated as horizontal clearance area.

REFERENCES:

1. NESC 234.
2. WAC 296 – 155 – 459(1)(d).
3. Refer to Section DO-3.2 for Sag.
4. Refer to DO-3.270 for Final Vertical Sag at 176 Degrees F.
5. Refer to DO-3.302 for Blowout (In Feet).
6. Refer to DO-6.270/ESR for OH Service Drop Clearance to Attached Structure.
7. Refer to DO-3.334 for Other Structures.
8. Refer to Section DO-6.1 for Conductors.
9. Refer to DO-6.149 for Services and Secondary Final Vertical Sag 176 Degrees F.

AVISTA Utilities Distribution Standards DO-3.330 ESR

4.0 METERING REQUIREMENTS

4.1 GENERAL

1. Only Avista owned metering equipment will be used to provide billing information.
2. The customer must provide Avista with access for meter reading, maintenance, installation or removal per WAC 480-100-168.
3. Consideration shall be given to the safety of Avista employees who must install, test, and read the meters on a regular basis.
4. Work Space shall be provided around the metering equipment and kept clear at all times. Minimum space shall be 15" on both sides of the meter down to grade. Minimum frontal clearance is 36" per National Electric Code.
5. CPC Note: Meter shop shall install 3 or more meters on multi-meter service point.
6. All meters and Avista equipment must be protected from ice and water damage (see Section 1.16).
7. For all commercial installations, single phase customers over 200 amp must have CT metering.
8. For underground service installation, use side-bottom knockouts of meter enclosure (do not use center-bottom knockouts).
9. Avista strictly prohibits the installation of customer owned meter collars of any kind, including but not limited to meter socket transfer switches (GenerLink, et al.), and surge arrestor/protectors (Leviton 50240-MSA, et al.). Avista's engineers do not feel that such installations meet our high standard for customer safety because Avista does not inspect, test, or maintain customer owned equipment and neither the customer nor the fire department would be able to remove or isolate meter collars in the event that the device fails or catches fire.

4.1.1 Listing

All meter sockets, enclosures shall be listed by a qualified electrical testing laboratory acceptable to the jurisdiction having the authority.

4.1.2 Location

Metering equipment locations are subject to the following; Exceptions must be approved through the Avista Meter Department.

1. The meter must be located as close as practical to the delivery point, generally within 10' of the front corner of the building or attached to the front of the house. For new construction, please coordinate meter location with CPC.
2. Located on the line side of the service disconnect (Hot sequence).
3. Each customer premise will be supplied through a single meter.
4. At a multi-meter service point, meters will be grouped at one location with all meters located as closely as practical to the service point (within 25 feet of each other).

5. Meters must be grouped together and installed at the service equipment and not separated by walls or partitions.
6. Located outdoors or in approved meter rooms with permission from the Avista Electric Meter Department. No metering equipment shall be installed at a service switch located in an inaccessible place such as a manhole or in a vault.
7. Non-diversified continuous load grow operations over 200 continuous amps must have service meters located outside of building.
8. Readily accessible, free from vibration, corrosive atmosphere, abnormal temperatures, and well lighted per WAC-480-100-308
9. Whenever the customer makes additions, or changes that encloses the meter and prevents access they may be required to relocate the metering equipment, at their expense, to meet Avista's specifications.
10. Meters must be protected from ice and water off roofs, damage from doors and materials and vehicular traffic.
11. No Avista meters are allowed downstream of customer equipment such as dry transformers.

4.1.3 Meter Room Requirements

1. Must meet all electrical and mechanical code requirements.
2. Meters must be grouped together in the same room. Not separated by walls or partitions.
3. Located on the ground floor with exterior doors opening outward with direct access to meters. Exceptions require prior approval through Avista Electric Meter Shop.
4. The exterior door shall be equipped with a panic bar.
5. If locked, the customer will provide a key for an Avista installed lock box. 24 hour access to room required via lock box key, controller or keypad code. 24 hour call number is not sufficient to meet this requirement of physical access.
6. Area must be well lit and not used for storage.
7. 3 ft. working clearance is required in front of each meter and 15" on both sides of meter enclosures.

8. Avista will no longer run secondary conductors into customer's commercial or multi residence building through the wall or up through the slab. Going forward the "Point of Delivery" will be in an outside wall mounted Pulling/termination enclosure or a standalone Pulling/termination enclosure away from the building wall installed on (2) 2 inch rigid steel pipe embedded in concrete with unistrut for attachment points as needed.
9. If direct customer access (tenant) is not available an NCC Bypass is required for all service points not directly accessible.
10. Provisions to facilitate remote meter reads including the following requirements:
 - a) A dedicated 15 amp (circuit) power source in the meter room ceiling to be mounted within 2 feet of the interior enclosure.
 - b) An interior 6" x 6" x 4" deep enclosure, minimum (box) for a signal amplifier and coaxial connection to be provided.
 - c) Signal amplifier (if necessary) will be powered by the 15 amp circuit referenced above.
 - d) Interior enclosure (box) shall be mounted to the meter room ceiling, centrally located midway between meters spread and a minimum of 2' away from the front face of the nearest meter surface.
 - e) Interior enclosure not to exceed 3' higher elevation than highest meter mounting position. For high meter room ceilings this distance can be increased, with an increased in item 4 above with a 1:1 ratio.
 - f) A 1" conduit shall be provided that runs from the interior enclosure to the exterior enclosure that penetrates the structure to the exterior of the building.
 - g) Total conduit length not to exceed 100 feet.
 - h) A 6" x 6" x 4" deep minimum weatherproof surface mounted enclosure (box) shall be attached to the exterior of the building. The enclosure is to be mounted on the exterior wall, preferably as close to the meter vault as possible to minimize coax length.
 - i) The exterior enclosure is to be mounted between 10 feet and 12 feet above finish grade to allow signal propagation to meter reading equipment.
 - j) A minimum of 6" clearance above external enclosure is required to allow for antenna installation.
 - k) The exterior enclosure will be the mounting and make up location for the exterior antenna.

TOP VIEW

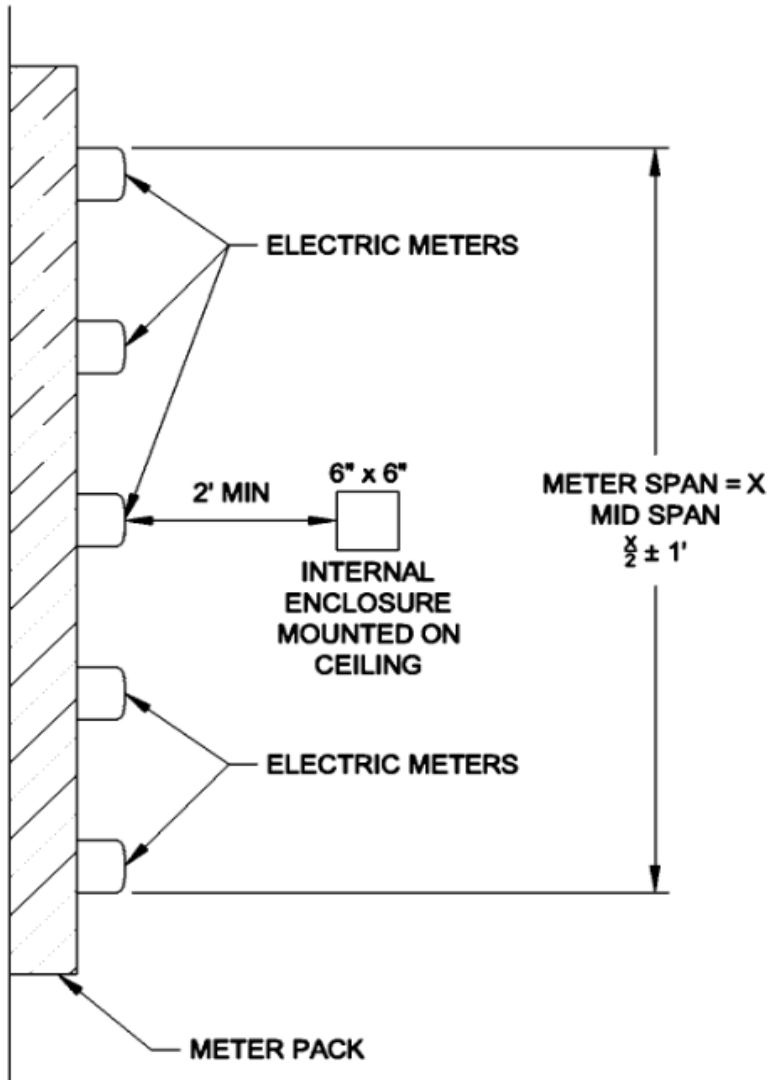


Figure 30 – Meter Vault

4.1.4 Meter Identification

For multi-unit dwellings with a separate meter for each customer all meter sockets must be marked with engraved or embossed lettering. The equipment installer / electrician are responsible to provide a label with the unit number or address on both the meter socket and unit panel. A house meter for common facilities must be marked as "House Meter". Marking must be complete before meters can be installed. If there is no address on building, meter socket must be labeled with address.

Labels shall be of an engraved or embossed type, minimum size ½" x 2" engraved plastic with sticky back. Letters or numbers must be a minimum of 5/16". Individual screw on house numbers/letters will not be accepted.

Common gas and electric meters must have the same space designation marking; i.e., numbers or letters.

Avista will not install any meters at multi-metered facilities until each individual meter is properly labeled and each circuit is physically verified jointly by the installing electrician and Avista's meter installer. The building owner must provide Avista's meter installer or Customer Project Coordinator with a floor plan or similar document clearly identifying each unit's physical location and address in order to perform this physical audit prior to meter installation.

Commercial multi-unit with separate meters shall have both meter and panel labeled.

The building owner is responsible for proper identification of electric and gas meters. The building owner could be held responsible for Avista costs associated with correcting billing errors caused by mixing wiring or mislabeled meters.

If two electric services service one building or space, a warning tag must be located at each meter point indicating such. Refer to NEC Article 230.2E.

Labels, as described above, marked with voltage and phasing information are required if two or more services with different voltages or phasing are supplied to a building.

Phenolic labels can be purchased in the Spokane area at the following locations: Engraver at 3817 N. Monroe, Spokane; Quick Engraving at 1527 E 9th, Spokane; Northwest Business Stamp at 5218 N Market, Spokane; and other locations.

4.1.5 Security

- No conduit bodies (i.e. LBs, junction boxes, etc.) are allowed ahead of meter.
- All removable enclosure covers or doors, raceways or conduits containing unmetrated conductors shall be sealable for locking by Avista.
- Factory installed carriage bolts may be used to seal panel covers that do not require field removal.
- Only rain tight enclosure doors may cover the sealed areas.
- Sealable latches, stud and wing-nuts, or sealing screws shall be used to seal removable doors.

- Acceptable sealing devices:
 - Stud and wing-nut assemblies, ¼ inch x 20 (minimum). The stud and associated wing-nut shall have 0.0635 inches holes
 - Sealing screws with 0.0635 inch holes.

4.1.6 Meter Mounting

Meter sockets and/or enclosures must be plumb and level and securely mounted to a rigid surface. Mounting to metal siding only is not acceptable.

If a meter socket is to be mounted to a post or pole, it must be mounted on C-channel securely fastened to the pole/post. Post must be at least 2" galvanized steel with threaded caps.

All 480V 200 amp self-contained and all 400 amp galvanized meter cans that are standalone and not attached to a building must be mounted on unistrut attached to two 2 inch rigid steel pipes (with threaded steel caps) imbedded in concrete.

Meter sockets must be flush-mount or surface-mount and not recessed behind any building material.

Single meters shall be installed between four and six feet to the center of the meter above the floor or finished grade. Meter modules shall be installed no more than six feet to the center of the top meter and not less than 24 inches to the center of the bottom meter.

4.1.7 Lifting Handles

When lifting handles are required on panels and covers of enclosures, each handle shall be sized for full hand grasping, securely attached and designed to support 75 lbs. Chest type handles with a folding bale grasp are not acceptable.

4.1.8 Sprinkler Service

120V/240 volt sprinkler services must be provided instead of 120 voltage single phase. UL listed combination meter socket and breaker panel are not available for 120V single phase service.

4.2 SELF CONTAINED METERING

4.2.1 Manual Circuit Closing (MCC) Sockets

Manual circuit closing, MCC sockets allow the meter to be removed without interruption of the electrical service. When required they must be in working condition. Wiring in the socket must not interfere with the operation of circuit closers. MCC sockets must be approved by Avista.

The following services require MCC Sockets:

- All commercial services including meter modules.
- All 480V services and pumps require MCC safety sockets.
- 400 A residential services, optional on 200 permanent or temporary services.
- House meters serving common area in apartment buildings.
- Digital commercial signs.
- Irrigation controls.
- Pumps.
- Interconnected Customer Generators.
- Meter modules with slide type and horn style bypasses are not approved.

4.3 METERING EQUIPMENT RATINGS AND TYPE

4.3.1 Approved Self-Contained Sockets

NOTES:

1. Three-Wire, three-phase, 480 volt delta is no longer available on new services.
2. One hundred (100) amp, three-phase, four-wire sockets are not allowed because of inadequate clearances.
3. 480V Self-Contained requires a safety socket.
4. Meter modules with slide type and horn style bypasses are not approved.
5. Meter sockets not listed must be individually approved by Avista's area meter technician.
6. Avista will not hook up overhead meter sockets being used for underground service, even if they have been approved by the local authority having jurisdiction – (They do not have adequate horizontal space).
7. For 120/240V, three-phase, 4-wire, Delta, identify high leg to ground with orange tape and connect to right side of meter or CT platform.
8. Customer is responsible for selecting the correct meter base top and accessories (e.g. hub, closing plate, or blank).
9. MCC – Manual Circuit Closing / Bypass meter socket.

Service	Voltage	Meter Socket	Capacity (Amperes)	Make	Model
Single-Phase, 2-Wire	120V	4 Terminal	100 OH only	Eaton	121314 (OH only)
				Milbank	U3504 (OH only)
Single-Phase, 3-Wire	120/240V	4 Terminal MCC required for commercial	100 OH only	Eaton	121314 (OH only)
				Milbank	U3504 (OH only)
			200	Eaton	U264 (OH/UG) 124 TB (OH/UG)
				Milbank	U1211 (OH/UG) U3852 (OH/UG) U9801 (OH only) U3514 (OH only)
					40404 with ground lugs (OH/UG) 404042-01 (OH/UG)
				Siemens	
				See 1-phase instrument transformer metering DO-7.313, ESR Section 4.4	
	120/208V Wye (Network)	5 Terminal in 9 o'clock position. MCC required for commercial	100 OH only	Eaton	121315 (OH only)
				Milbank	U3504 & 5T8K2 (OH only)
			200	Eaton	U264 & 50365 (OH/UG)
				Milbank	U1211 & K3866 (OH/UG) U3514 & K5T (OH only)
					40405 with ground lugs (OH/UG) 404052-023NU (OH/UG)
				Siemens	
		CT Socket	201 - 1,000	See 3-phase instrument transformer metering DO-7.313, ESR Section 4.4	
Three-Phase, 4-Wire	120/240V Delta	7 Terminal MCC required	200	Eaton	U267 (OH/UG) 127 TB (OH/UG)
	120/208V Wye			Milbank	U7423 (OH/UG) U9701 (OH/UG) U3517 (OH only)
	277/480V Wye				40407 with ground lugs (OH/UG) MS27TB (OH/UG) 404072-023NU (OH/UG)
	All Voltages			Siemens	
	All Voltages	CT Socket	Over 200	See 3-phase instrument transformer metering DO-7.313, ESR Section 4.4	
Switchgear	All Voltages	13 Terminal Panel Mounted	All	Manufacturer supplied 13 terminal panel mounted socket with test switch mounts. Avista supplies flush mounted 13 terminal meter with trim can.	

Table 10 – Self-Contained Socket Required Metering Equipment

AVISTA Utilities Distribution Standards DO-7.315/DU-9.315 ESR

4.3.2 Self-Contained In-Line Socket Diagrams

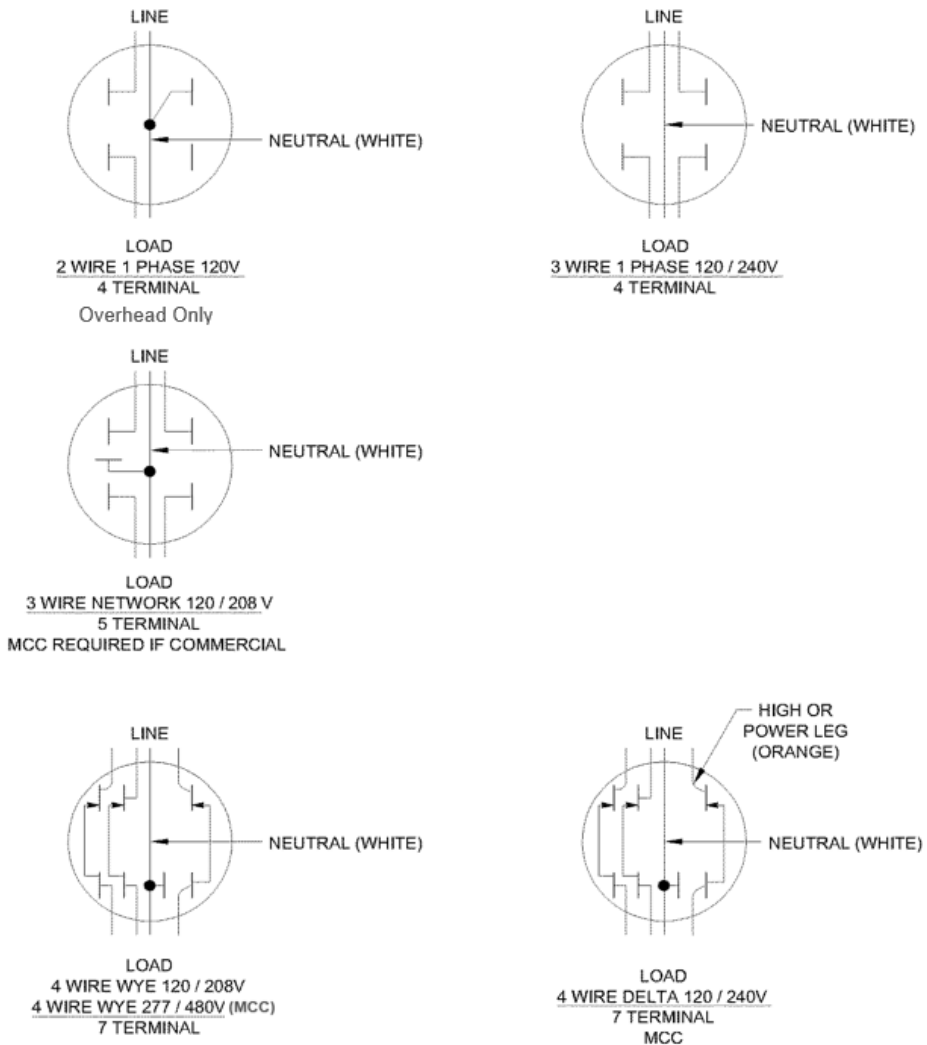


Figure 31– Self-Contained In-Line Meter Socket Diagrams

AVISTA Utilities Distribution Standards DO-7.314/DU-9.314 ESR

4.4 INSTRUMENT TRANSFORMER METERING

Current transformers meter and wiring are provided by Avista. The customer provides solidly mounted approved meter enclosures or sockets, current transformer enclosures, and conduit.

4.4.1 Current Transformer Location

CT's are normally mounted in an enclosure located on the building.

At Avista's option, current transformers may be mounted in a three-phase pad mount transformer that is dedicated to only one customer. In this case the meter enclosure is mounted next to the pad or in an approved location.

CTs will not be mounted in single phase pad transformers.

On overhead transformers larger than 300KVA Avista would prefer to locate CT's at the transformers on the rack.

4.4.2 CT Metering Conduit Requirements

- Conduit length must be such that wire length between meter(s) and current transformer(s) is less than thirty feet.
- 1 inch gray electrical PVC.
- Schedule 80 PVC and fittings, rigid above grade.
- Minimum sweep radius is 9".
- Maximum of two 90 degree sweeps.
- Bushings are required at both ends of the conduit run. The local inspector may require grounding bushings.
- The ends of the conduit must be taped or capped, and sealed to keep dirt and water out of the conduit. Customer is responsible for any obstructions within the conduit.
- All conduit connections must be glued and fully seated and a pull string installed if there is more than 20' of one inch conduit.

4.4.3 CT Enclosures - General Requirements

- Weatherproof.
- For underground service installation, use side-bottom knockouts of CT enclosure (do not use center-bottom knockouts). Use the knockout opposite of the neutral lug.
 - The conduit must enter in the bottom of the enclosure or on the side within 2" of the bottom with a rain tight fitting if service is fed from underground.
 - Conduit may enter top of enclosure if service is fed from overhead provided rain tight fittings are utilized.

- Enclosures cannot be used as junction boxes or raceways.
- Lockable.
- Each CT metered service requires its own CT enclosure and meter enclosure or socket.
- Avista will no longer allow or hookup new or repaired CT enclosures mounted on plywood. Unistrut type cross struts are the required attachment points for enclosures.
- CT cans must have a hinged door with fixed handles for removing.

4.4.4 Multi-Meter: Combination CT & Self-contained

A multi-meter building served using a combination of individually mounted CT rated, self-contained, and/or meter modules requires a pulling/termination enclosure to provide a single point of delivery. Individual meters shall be located as close as physically possible, but no case more than 25 ft. from the point of delivery. The utility compartment of the enclosure must meet the requirements below.

4.4.5 Pulling/Termination Enclosure Utility Space

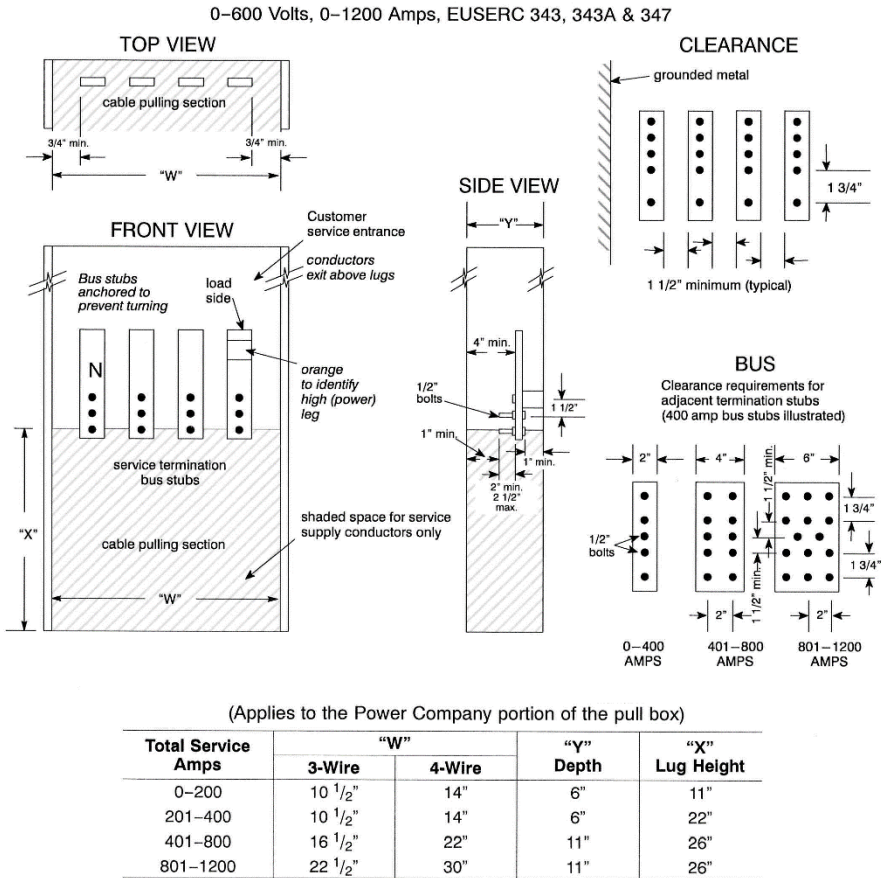


Figure 32 – Pulling/Termination Enclosure Utility Space

Examples of Approved EUSERC Rated Termination Enclosures (utility underground pull boxes)

Service Amperage	# of Phases	Buss type	Manufacture	Model #
201-400	1	Feed Thru	Cooper B-Line	R9000C
201-400	1	Feed Thru	Eaton	1UGPB400R
401-800	1	Feed Thru	Cooper B-Line	R9000E
401-800	1	Feed Thru	Eaton	1UGPB800R
801-1200	1	Feed Thru	Cooper B-Line	R9000F
801-1200	1	Feed Thru	Eaton	1UGPB1200R
1200	1	Feed Thru	Siemens	WT11200PU
201-400	3	Feed Thru	Cooper B-Line	R9000CC
201-400	3	Feed Thru	Eaton	3UGPB400R
401-800	3	Feed Thru	Cooper B-Line	R9000EE
401-800	3	Feed Thru	Eaton	3UGPB800R
801-1200	3	Feed Thru	Cooper B-Line	R9000FF
801-1200	3	Feed Thru	Eaton	3UGPB1200R
1200	3	Feed Thru	Siemens	WT31200PU
1600	3	Feed Thru	Erickson	TB-469N (NON- EUSERC)
<hr/>				
201-400	1	Hor. Cross Buss	Siemens	WET1400BU
401-800	1	Hor. Cross Buss	Siemens	WET 1800BU
801-1200	1	Hor. Cross Buss	Siemens	WET11200BU
201-400	3	Hor. Cross Buss	Siemens	WET3400BU
401-800	3	Hor. Cross Buss	Siemens	WET3800BU
801-1200	3	Hor. Cross Buss	Siemens	WET31200BU

Table 11 – EUSERC Rated Termination Enclosures

4.4.6 Notes

1. The area below the load side lugs is reserved for utility conductors only. Customer conductors cannot pass through the utility's section of the cabinet.

2. Terminating facilities for utility conductors shall be aluminum-bodied mechanical lugs with a range accepting a single #4AWG through 750KCMIL or two #1AWG through 250KCMIL conductors. Number of lugs for each current range is listed above.
3. Avista will supply and install line side lugs.
4. Lugs shall be secured to prevent turning or misalignment.
5. The minimum pull box access opening (W) is measured between the left and right.
6. Enclosure covers shall be removable, sealable, provided with two lifting handles, hinged and limited to the maximum size of 9 sqft. Note general sealing requirements above.
7. All customer conduit, sealable conduit, or solid bus bars must exit above utility side connections and all fittings must be weathertight type.
8. Utility conduits shall enter termination enclosure from the bottom.
9. Termination enclosure must be EUSERC rated and approved.

4.4.7 Switchgear Metering

A EUSERC approved switchgear metering section is required for service ratings greater than 800 amperes at building delivery points. They are also normally used for single points of delivery with a combination of self-contained and instrument transformer rated services exceeding 1200 amperes. Unless coordinated with Avista prior to installation, switchgear must be located on the exterior of the building, at ground level.

Prior to manufacture contact Avista Utilities for approval of manufactures drawings and to determine the type of metering, size of current transformers and mounting arrangements.

- Meets EUSERC recommendations.
- All unmetered conductors in separate, sealable, and lockable compartments.
- Must have an accessible instrument transformer mounting section.
- 13 terminal socket and test switch slots if CT metered.
- 7 terminal socket if self-contained.
- Termination section approved for utility connection.
- Mechanical or compression lug.

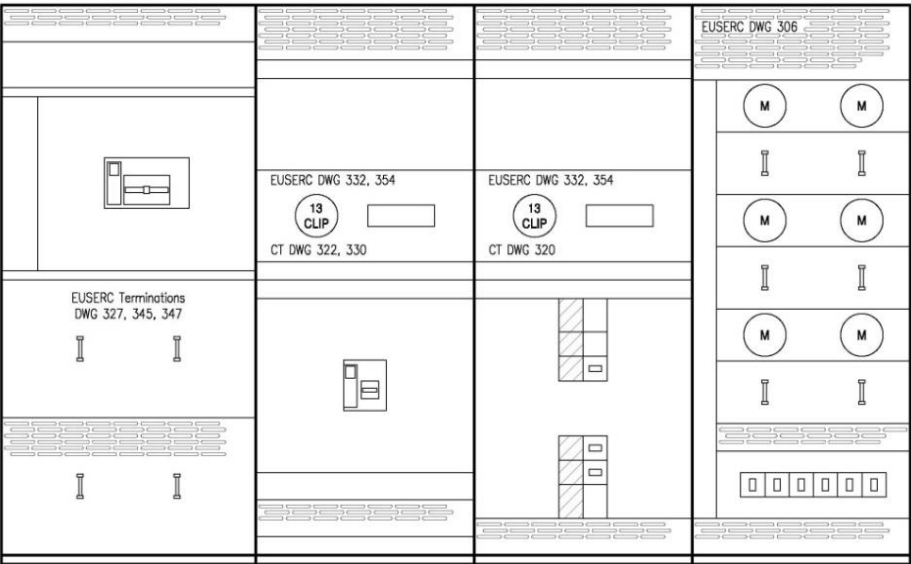


Figure 33 – Typical Switchboard Multi-Meter Layout

4.4.8 Single Phase Current Transformer Metering

1 PHASE CURRENT TRANSFORMER METERING
OVERHEAD AND UNDERGROUND
201 TO 800 AMPSCOMMERCIAL

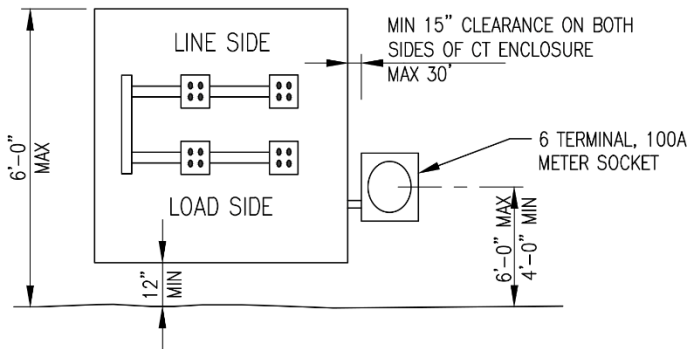


Figure 34 – Single Phase Current Transformer Metering 401 to 800 Amps CT Enclosure

•CT cans must have a hinged door with fixed handles for removing. Doors must be equipped with sealing and locking provisions.

* Type 3R, ANSI 61 gray

Service Ampacity	WxHxD	Cooper B-Line	Milbank	Hoffman
201-800 AMP	36x48x11 in	364811HRTCT	CT364811HC	A483611HCT

CT Landing Platforms

Part #'s or Equivalent

- Forbar type ANSI C12.11 CT's
 - Line & Load side Mechanical Lugs
- * 600V, 50kA AIC

Service Ampacity	WxHxD	Cooper B-Line	Milbank
201-800 AMP	36x48x11 in	6019 HEL	K4729

Approved 6 Terminal, 100A Meter Socket

Manufacturer	Part #
COOPER B LINE	U121315-50365
MILBANK	U3504XL Plus (2) 5T8K2

NOTES:

1. The customer supplies and installs the current transformer enclosure, mounting base, meter enclosure. Avista supplies and installs the current transformers, instrument wiring and meter.
2. The conduit connecting the current transformer and meter enclosures shall enter each enclosure either below (preferred) or above cable terminals and bussing for ease of routing conductors between enclosures.
3. Current transformer enclosure must be bonded and grounded per NEC requirements by customer.
4. Avista will supply, install, and connect conductor to the line side only on UNDERGROUND services. The customer supplies, installs and connects conductor on OVERHEAD services.
5. Customer supplies landing lugs for Avista conductors on UNDERGROUND services.
6. CT landing platforms are rated on diversified load.
7. Inside commercial grow operations cannot exceed 800 amps of true load on single phase service.

AVISTA Utilities Distribution Standards DO-7.313 ESR

4.4.9 Three Phase Current Transformer Metering

3 PHASE CURRENT TRANSFORMER METERING OVERHEAD AND UNDERGROUND 201 TO 800 AMPS

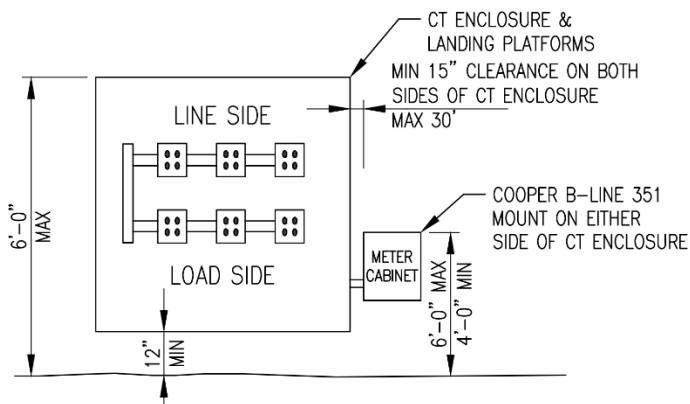


Figure 35– Three Phase Current Transformer Metering 201 to 800 Amps

CT Enclosure

- Removable hinged door(s) w/sealing and locking provisions
- * Type 3R, ANSI 61 gray

Service Ampacity	WxHxD	Cooper B-Line	Milbank	Hoffman
201-400	36X36X11	363611HRTCT	CT363611HC	A363611HCT
401-800	36X48X11	364811HRTCT	CT364811HC	A483611HCT
400 -1200#	48X48X12			A1200NECT*

*Includes Landing Platform

1200A are rotated 90 Degrees with Lineside on Left and Loadside on Right.

CT Landing Platforms

Part #'s or Equivalent

- Forbar type ANSI C12.11 CT's
- * 600V, 50kA AIC

☐ Line & Load side Mechanical Lugs

Service Ampacity	WxHxD	Cooper B-Line	Milbank
201-400 AMP	36x36x11 in	6067 HAL	K4904
401-800 AMP	36X48X11 in	6067 HEEL	K4722

NOTES:

1. The customer supplies and installs the current transformer enclosure, mounting base, meter enclosure. Avista supplies and installs the current transformer, instrument wiring and meter.
2. The conduit connecting the current transformer and meter enclosures shall enter each enclosure either below (preferred) or above cable terminals and bussing for ease of routing conductors between enclosures.
3. Avista will supply, install, and connect conductor to the line side only on UNDERGROUND services. The customer supplies, installs and connects conductor on OVERHEAD services.
4. Hi leg/wild leg on 3 phase 4 wire delta services must be on the right hand side CT landing platform.
5. For alternate enclosure sizing contact Avista Meter Shop at (509)495-4648.
6. Minimum of 15" of Clearance from both sides and 6" clearance on hinge side of Cooper B-Line or Hoffman 351 Meter Can to CT Enclosure.
7. Inside commercial non-diversified grow operations with three phase service must be 120/208 or 277/480 volt.
8. Current transformer enclosure must be bonded and grounded per NEC requirements by customer.

AVISTA Utilities Distribution Standards DO-7.313 ESR

4.5 COMMUNICATION SITE AND CELL TOWER METERING

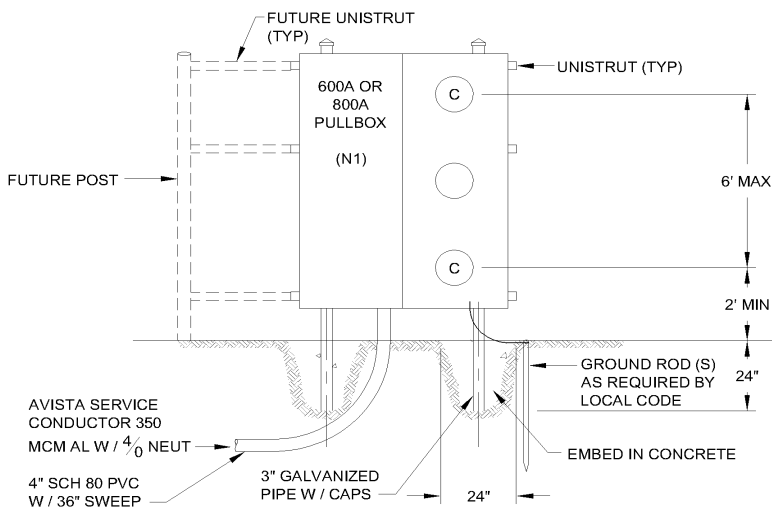


Figure 36 – Communication Site and Cell Tower Metering

These are general Avista Utilities requirements. The customer or their electrician must consult the local electrical code authority for specific requirements. An electrical inspection permit must be displayed before a service connection can be made.

The addition of new meters at existing cell sites shall only be completed after the approval from Avista.

NOTES:

1. 600 AMP pull box with position meter pack for 1 to 3 antenna arrays, 800 AMP pull box with 6 position meter pack for 4 or more antenna arrays.
2. Manual circuit closing sockets required slide type bypasses are unacceptable.
3. Avista will provide and install one set service conductors, lugs and meters.
4. Customer to supply and install all other materials.
5. Meter pack may be mounted on a building if desired.
6. Avista lock is required on the gate to fence areas.
7. Metering must be outside of area of high RF energy so prolonged exposure presents no health risk.

AVISTA Utilities Distribution Standards DO-7.312/DU-9.312 ESR

5.0 SERVICE VOLTAGES













Nominal Voltage	Line-Neutral	Service Voltage Range (N2)		Application
		Line-Line	Transformer (kVa)	
		Single Phase		
120V 2 Wire		--	3-100 – OHD NA - URD	Street and traffic lights, controls, signs etc. 120V 2-wire meter socket required.
120/240V 3 Wire		228-252	3-100 – OHD 15-167-URD	Residential, small commercial. OHD maximum limited by the largest transformer that can be pole mounted
120/208 3 wire		197-218	--	Residential, small commercial where 120/208 three phase is available. Maximum load on a single service may be limited to provide three phase load balance.
480V 3 wire		456-504	3-100 – OHD Special App - URD	Special applications, freeway and ball field lighting, rail and other. URD transformers are special order, contact Engineering. Center tap grounded for safety & limit line to ground voltage.
Three Phase				
120/240V 4 Wire		228-252	3PH 15-500 -OHD	Small commercial / industrial serving a combination of single phase 120/240 and three phase 240V loads. Service may be URD fed from OHD transformer bank.
120/240V 4 Wire		228-252	--	Use to supply large single-phase 120/240 volt loads and small three-phase 240 volt loads. Maximum simultaneous three-phase motor load is 25 hp.
Open Delta		197-218	3PH 15-500 - OHD 3PH 45-1000 - URD	Commercial, small industrial, large apartment buildings. Spokane Core Network. Contact Network Engineering for services in the Core Network.
120/208V 4 wire		456-504	NA	NOT OFFERED FOR NEW SERVICES See DO-4.125 for replacement OHD banks.
480V 3 wire		456-504	3PH 15-500 - OHD 3PH 45-1500 - URD	Resistance grounded service limited to special industrial applications to limit ground faults. Customer to supply grounding resistor. Contact Engineering.
277/480V 4 wire		456-504	3PH 15-500 - OHD 3PH 45-1500 - URD	Large commercial, industrial. Normally limited to loads above 20-30 kVa
277/480V 4 wire		263-291	3PH 15-500 - OHD 3PH 45-1500 - URD	Spokane Core Network. Contact Network Engineering for services in the Core Network.
2400V 3 wire		2340-2520	NA - OHD 3PH 300-1000 - URD	Large pumps, industrial motors. OHD Services are a special application not offered for new services.

Figure 37 – Service Voltages

AVISTA Utilities Distribution Standards DO-6.302/DU-7.600 ESR

NOTES:

1. Available service voltage is determined by Avista based on power and energy needs as well as the supply system on hand in the area. Requests for service voltages, sizes and special applications other than those listed should be referred to Distribution Engineering.
2. Service voltage is measured at the point of delivery. This point is where Utility service conductors and customer service entrance conductors are connected. Service voltage ranges may differ from those listed during emergencies or for some rural customers because of the distance from the source. Voltages may temporarily fluctuate outside the listed ranges as loads start and stop or during fault conditions.
3. Objectionable voltage variations caused by customer loads are corrected at customer expense.
4. Record service voltage at the meter over several days with customer loads operating under stable but maximum conditions to determine if they are within the allowable range. A single reading with a multimeter will provide a quick check only. Normally changes should not be made by adjusting transformer taps.
5. Primary voltage may be measured by using the secondary of a lightly loaded or unloaded transformer. Multiply by primary / secondary voltage ratio or the winding ratio if known.
6. The utility system is designed and operated to limit the maximum voltage unbalance between phases. A maximum of 3% is expected under normal conditions at the point of delivery of an unloaded service. All three phase voltages must still be within the Service Voltage Range. Motors and other three phase equipment may need to be de-rated for unbalance over 1%.

- $\% \text{ Unbalance} = \frac{\text{Max Voltage Deviation from Avg Phase Voltage}}{\text{Avg Phase Voltage}}$

Example: For phase voltages of 230, 232, and 225, the average 229: the maximum deviation from average is 4: and the percent unbalance is $(100 \times 4)/229 = 1.75$ percent.

REFERENCES:

1. ANSI C84.1 – 2006
2. WAC 480-100-373
3. Avista Utilities Schedule 70 Rule 5 "Definitions"
4. Avista Utilities Schedule 70 Rule 16 "Continuity of Service"
5. Avista Utilities Schedule 70 Rule 17 "Optional Phase and Voltage"
6. Avista Utilities Electric Service and Meter Requirements

AVISTA Utilities Distribution Standards DO-6.302/DU-7.600 ESR

6.0 CUSTOMER GENERATION REQUIREMENTS

There are two general forms of Customer generation. The first is interconnected with the utility system to supply energy. The other is an emergency standby system.

6.1 GENERATION INTERCONNECTION

Whether you're thinking about or moving forward with the installation of an electrical generating system, Avista has put together the information you will need to interconnect to our system. In some cases, Avista might also be able to offer a Renewable Generation Incentive (RGI) that provides direct payments to help offset and recover costs of renewable energy systems in Washington State. More information on this incentive can be found at:

<https://myavista.com/energy-savings/green-options/onsite-generation/getting-connected>

Interconnection requirements are separated into two different types of systems.

The various documents required for interconnection differed by system category. Please be sure to read all of the information, as **approvals are required from Avista before generation can be interconnected with the utility**. If you have any questions, please contact the key contacts for either type of system.

Interconnection of systems 500 kW and less:

Contact: Solar at Avista

solar@avistacorp.com

Documents available through our key contact or at:

<https://myavista.com/energy-savings/green-options/onsite-generation/getting-connected>

Interconnection of systems between 500 kW and 20 MW

Contact: Warren Clark at:

warren.clark@avistacorp.com or call 509-495-4186.

Documents available through our key contactor or at:

<https://myavista.com/energy-savings/green-options/onsite-generation/interconnection>

Net-Meter Generation 100 kW or smaller in Washington and Idaho

- ☐ [Submit an application to Avista Utilities](#)
 - ✓ Interconnection inverter must be UL1741 listed.
 - ✓ Electrical schematic drawing must be included.
 - ✓ Include provisions for a lockable visible disconnect if required by Avista Utilities or local jurisdiction.
- ☐ Send Payment to:
 - Solar at Avista, MSC-15
 - 1411 E Mission Ave
 - Spokane, WA 99202
- ☐ Receive written design approval from Avista Utilities.
- ☐ Get an electrical permit from government jurisdiction. Follow the National Electric Code (NEC) as required.
- ☐ Complete the installation.
- ☐ Customer must install a separate meter base for generation production measurement by Avista Utilities. Meter base must be Labeled "Generation Production Meter" with permanent placard. (Avista will provide and install the production meter).
- ☐ Label lockable, blade type, visual open generation disconnect switch with permanent placard.
- ☐ Get inspections from a state electrical inspector.
 - ✓ After final electrical inspection approval contact Avista Utilities for production meter installation and utility inspection. Contact phone (509) 495-4204.
- ☐ Avista Utilities installs new bi-directional and generation production meters.
- ☐ Start generating power.

Load Side Taps are not recommended inside meter can for generation interconnections, contact Avista Utilities for Preapproval before Installation.

Net metered generator disconnect switch must be a lockable, blade type, visual open, disconnect switch and in the generation circuit along with the Production Meter within ten feet of the existing Avista revenue meter and readily accessible by Avista personnel.



Figure 38 – Generation Production Meter and Disconnect Location

AVISTA Utilities Distribution Standards DO-7.330/DU-9.127 ESR

6.2 EMERGENCY / STANDBY GENERATION

These are the minimum requirements for connecting standby and emergency power supplies for use when the normal utility electrical supply is interrupted.

Improperly installed standby and emergency power supplies are extremely hazardous to utility workers, the public and the customer. The customer could be held liable for substantial injuries and damages caused by an improperly installed, maintained, or operated system. A proper installation ensures:

1. Utility workers are not exposed to electrical shock hazards during service restoration.
2. Other customer's appliances are not damaged from operating with inadequate power supplied from a distant source.
3. The standby or emergency power supply will avoid damage from operating on a shorted line or with too large of a load.
4. Electric meters are not be damaged, and
5. Customer wiring is not damaged.

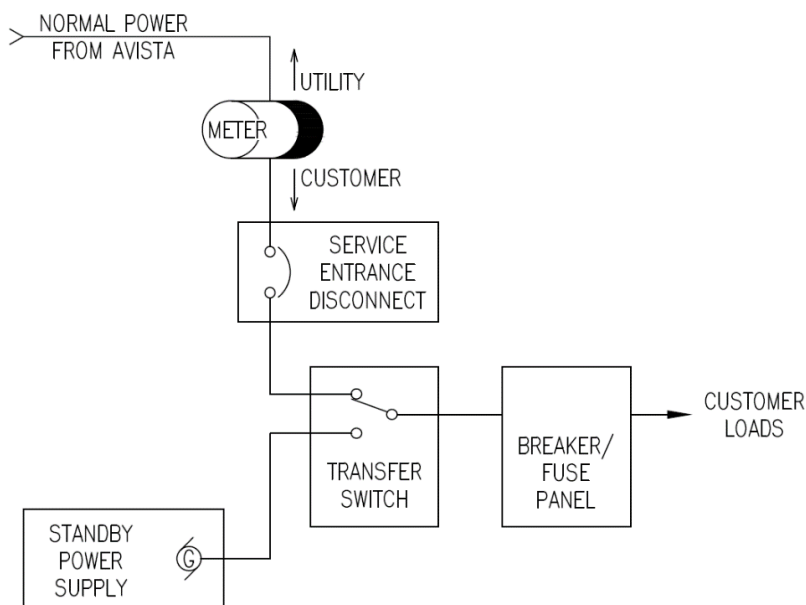


Figure 39 – Standby Generation

NOTES:

- N1. Avista **strictly prohibits the installation of customer owned meter collars, including meter socket transfer switches such as GenerLink.** Avista's engineers do not feel that such installations meet our high standard for customer safety because Avista does not inspect, test, or maintain customer owned equipment and neither the customer nor the fire department would be able to remove or isolate meter collars in the event that the device fails or catches fire
- N2. The Customer is responsible for all costs associated with changes to the service entrance and service drop.
- N3. When operating, the standby or emergency power supply must remain isolated from the utility power system at all times so it will not energize the service drop, transformer or primary line.
- N4. A transfer switch designed to prevent the inadvertent interconnection of normal and standby/emergency power sources shall be installed on the load side of the meter. This switch must disconnect all ungrounded conductors from one power source before connecting them to the other (break before make type).
- N5. A service entrance rated breaker or fused disconnect shall be provided between the transfer switch and meter. This requirement may be met using either service entrance rated transfer equipment (integrated overcurrent protection, disconnect and transfer switch) or separate units for each function.
- N6. The grounded service conductor, system neutral, and system ground must be bonded at the normal utility power service entrance.
- N7. If the standby or emergency power source has a bonded neutral-ground connection (separately derived system), then the transfer switch must switch both the ungrounded conductors, and the grounded system neutral conductor.
- N8. If the standby or emergency power source has an un-bonded, floating neutral (non-separately derived system), then the transfer switch must switch only the ungrounded conductors. The grounded system neutral conductor must remain solidly bonded through the transfer switch.
- N9. If a power inlet is used to connect a mobile standby or emergency power source, then a sign located at the power inlet must clearly indicate if the source must be separately derived (bonded neutral) or non-separately derived (floating neutral).
- N10. The customer shall notify the local Avista office before and after modifying the service entrance. Meter removal must be authorized by Avista. Wiring must comply with all state and local electrical codes and must be approved and tagged by an authorized electrical inspector before the meter is replaced and resealed.
- N11. No customer should work on or permit others to work on his own equipment unless both sources are disconnected, properly tagged and locked out, and the circuit is adequately grounded.

N12. IF THE EMERGENCY POWER SUPPLY IS TO PARALLEL AVISTA'S DISTRIBUTION SYSTEM AT ANY TIME, CONTACT DISTRIBUTION ENGINEERING FOR PROPER COMPLIANCE BEFORE EMERGENCY POWER SUPPLY IS OPERATIONAL.

N13. The Customer's wiring must comply with all state and local electrical codes.

N14. The Customer should contact the local Avista office for additional information.

REFERENCES:

1. NFPA 70 National Electric Code (NEC) Article 700: Emergency Systems
2. NFPA 70 National Electric Code (NEC) Article 701: Legally Required Standby Systems
3. NFPA 70 National Electric Code (NEC) Article 702: Optional Standby Systems
4. NFPA 70 National Electric Code (NEC) Articles 445: Generators
5. NFPA 70 National Electric Code (NEC) Articles 250: Grounding and Bonding

AVISTA Utilities Distribution Standards DO-7.320/DU-9.120/ESR

7.0 SPOKANE NETWORK UNDERGROUND SERVICE POLICY

Spokane Network Underground Service Policy

UPDATED – December 2019

Any Customer served from the core area Spokane Underground System shall conform to all the requirements set forth in Avista's filed tariff (including, without limitation, Schedule 51 – Line Extension, and Schedule 70 – Rules and Regulations) and Avista's "Electric Service Requirements" with the following additional and/or modified requirements:

1. Point of Delivery

- a. A premise will be served at one voltage and at one point of common coupling (PCC).
- b. Avista will work with the Customer to determine whether a spot or grid-connected service is appropriate:
 - i. Spot Connected Service
 1. Customer shall provide an Avista approved vault (see section 2(e)).
 2. Avista is responsible for building and energizing electrical infrastructure within the vault.
 - ii. Grid Connected Service
 1. Customer shall provide a secondary junction enclosure inside their building as specified by Avista.
 - a. Conduit entrance through the building wall/foundation wall will be on side of building nearest existing Avista duct bank or handhole/manhole infrastructure.
 2. Avista is responsible for a Handhole/Manhole housing the electrical grid connection, outside of the building. If there is not an existing Handhole/Manhole, or there is no room for an additional service in the existing Handhole/Manhole, a new Handhole/Manhole, may be required, at Avista's expense, and may require a long lead time.
- c. The Customer's main disconnect, and secondary junction enclosure, must be located inside the building within 15 feet of the conduit entrance through the exterior wall/foundation wall (WAC 296-46B-230-070-11b).
- d. A minimum of 6' must be kept clear in front of the secondary junction enclosure both during construction and throughout the life of the building, to allow for installation of cable pulling tools.
- e. The Customer's electrician will provide at least 2" of clear space around each conduit that terminates in the secondary junction enclosure for installation of cable pulling tools.
- f. Conductors from the Customer's main disconnect, through metering, and into the secondary junction enclosure (or spot vault) are supplied/installed by the Customer and must be copper. The Customer must use the least number of cables appropriate for the service size (as determined by NEC) while using cables that are either #2/0 AWG, or 250/500 kCM.
- g. The Customer's electrician will provide no less than six feet of conductor length in the junction enclosure for Avista to splice on to (in grid-fed applications). For spot vaults, Customer shall coordinate with Avista to determine appropriate cable length to extend into vault.

- h. The Customer's secondary junction enclosure shall be bonded to the building ground system with #4 AWG copper or larger conductor.
- i. The Customer's electrical room shall have a completed floor with a smooth surface. If a door is used to exit the room, it shall be equipped with a panic handle.

2. Service Voltages

- a. . Grid connected services must be 208/120Y.
- b. A spot service voltage can be either 208/120Y volt or 480/277Y based on the following load table. Loads larger than shown in the table will be served on a case-by-case basis.

Customer Load (kVA)	Service Type	Vault Type	Number of Transformers / Voltage Allowed
430	Grid	NA	NA / 208Y
Up to 1000	Spot	2 Bay	2 / 208Y / 480Y
Up to 1500	Spot	3 Bay	3 / 208Y / 480Y
Up to 2000	Spot	3 Bay	3 / 208Y / 480Y
Up to 2500	Spot	3 Bay	3 / 480Y
Up to 3000	Spot	3 Bay	3 / 480Y

Table 12 – Spot Service Voltage

- c. Single-phase 120 volt loads, such as parking lot booths, traffic controllers, and lighting will be served with special permission from Avista and shall not exceed an estimated peak demand of 25 amps.
- d. 208/120Y volt Grid Connected Service
 - i. Avista will own and maintain all equipment located outside the building structure.

- e. 480/277Y volt and 208/120Y volt Spot Networks
 - i. Customer shall be responsible for constructing the transformer vault according to Avista's specifications, including but not limited to:
 - a. Must be located within the building footprint
 - b. Grounding, exterior to the vault, as specified by Avista
 - c. Rated for a 3 hour burn
 - d. Blast resistant
 - e. Transformer (FR3) Oil containment
 - f. An extraction point for vault Transformers and Protectors that can accommodate a forklift or crane extraction. Must be approved by Avista.
 - g. Forced air cooling as designed by Avista. The Customer will provide the air intake and exhaust. Avista will provide all other forced air equipment and monitoring.
 - h. Must not include any other customer-owned or operated infrastructure (water/sewer piping, electric circuits/conduit, etc).
 - ii. Avista shall have exclusive and unrestricted access to the interior of the vault. Avista will be responsible for maintaining the vault except in cases of Customer caused damage.
 - iii. Avista will be responsible for installing transformers, protective devices, primary and secondary cable and interior vault grounding.
- f. Customer-specific electric service costs, excluding any Avista-required network redundancy costs, will be calculated by Avista.
- g. These costs will then be reduced by any available allowance for construction, based on the Customer's added load.
- h. The Customer equipment rating shall have an Ampere Interrupting Capacity (AIC) rating of 100,000 amperes or greater.

3. Service Trench & Ductwork

- a. Avista shall utilize existing service conduits when available, provided they are 4" PVC, structurally sound and contain no other hazards.
- b. New service conduits shall be 4" schedule 40 PVC. The number of conduits required depends on the load plus at least one additional spare. Conduits shall be concrete-encased as specified in Avista Network Standard DN-1.700. Total degrees of sweep from manhole to customer splice enclosure shall not exceed 235 degrees.
- c. The Customer shall be responsible for the following:
 - i. The cost of excavation, backfill, compaction and any associated asphalt patching for the service trench.
 - ii. Providing the exterior building/foundation wall penetration according to Avista requirements.
 - iii. The cost of excavation, backfill, compaction, any associated asphalt patching, ductwork and cables for temporary services, if the temporary service location is different than the permanent service location.
 - iv. The cost of excavation, backfill compaction, ductwork and cables for facilities with no permanent building foundations (usually these are services with an outdoor meter pedestal).

4. Customer Load Requirements

- a. Customer load imbalance between phases shall not exceed 10% at any time. Imbalance shall be defined as the maximum variation from average load per phase. (Schedule 70, Rule 19)
- b. In the case of a grid connected load, or for a spot network that serves more than one Customer account, the Point of Common Coupling (PCC) harmonic current content shall be limited to the requirements of IEEE standard 519-2014. Generally, the requirement shall be no individual harmonic current content greater than 4.0% (10 minute average) of the maximum load seen at the PCC for the given calendar year, and Total Demand Distortion current no greater than 5.0 % (10 minute average) of maximum load seen at the PCC for the given calendar year.

5. Easements

Avista may require an easement for ductwork and/or structures on Customer property. Any such easement shall be granted by customer, without cost or charge, to Avista upon request.

6. Metering

- a. Avista's Meter Department shall specify meter requirements (refer to Section 4.0 of the ESR).
- b. Metering equipment shall be located on the Avista side of the main disconnect.
- c. Meters and current transformers (CT's) cannot have restricted access and cannot be installed in a confined space as defined by WAC 296-809-099. CT's must be located in a 100 kA AIC rated enclosure (CT platforms removed).
- d. Meters and CT's must be installed in a building's electric room, except for small loads connected via outdoor metering pedestal as discussed in 3(c). Door to electric room (if applicable) must be equipped with emergency exit device (panic handle).
- e. Sub-metering on the load side of a Customer's dry-type step down transformer is not recommended and will not be supported by Avista.
- f. Each individual single phase meter position shall be field phase-able so the 3 phase service is/can be balanced.
- g. All 1st floor spaces shall have manual circuit closing sockets.

7. Generation

- a. Closed transition transfer switch (make before break) is not permitted in the Downtown Network for switching Customer's standby or emergency generator.
- b. Any interconnection of a Customer-owned generation facility to the Downtown Network requires review, studies as necessary, and written pre-approval by Avista.

8. Other Items

- a. Customer requested outages
 - i. For non-emergency planned outages the Customer shall provide a minimum of two weeks notice to Avista.
 - ii. The building owner or the contractor contacting Avista to do the service shutdown is responsible to notify all tenants 48 hours in advance of:
 - 1. The date/time and duration of the outage
 - 2. That this is a building owner/contractor-requested outage
 - 3. That Avista will be on site and may require access to the building electric service room
 - iii. To cut service Avista must usually physically cut the cables feeding the service.
 - iv. If any three phase Customer equipment is operating it will be single phased during this process.
 - v. A Customer-requested outage procedure is available upon request.
- b. For new construction, the Customer's technical representative or electrician must provide Avista with final NEC-estimated load calculations, square footage per floor and how each floor will be utilized before equipment is ordered.
- c. The Customer's technical representative or electrician will be responsible for verifying proper phase rotation after a service modification.
- d. Avista will make the determination, in its sole discretion, of whether a Customer will qualify for network service or whether network service is available.
- e. When a new service is installed to replace an existing service to a building, the existing service shall be de-energized as soon as possible from the date of commission.
- f. Structures (i.e. awnings, building protrusions, overhead walkways, etc.) that are located in a manner that interferes with Avista's ability to access and maintain its facilities in a vault or manhole, shall be removed, relocated, or replaced at the Customer's expense. Any such structure to be located near (including air space above) Avista's facilities shall be discussed with Avista Network personnel prior to installation.
- g. Avista retains the right, in its sole and absolute discretion, to modify this policy in order to better assist our Customers.

8.0 ELECTRICAL FORMULAS & COMMON TERMS

To Find	Direct Current	Alternating Current		
		1Ø	2Ø – 4 Wire*	3Ø
Amperes from horsepower	$\frac{hp \times 746}{E \times \% eff}$	$\frac{hp \times 746}{E \times \% eff \times pf}$	$\frac{hp \times 746}{2 \times E \times \% eff \times pf}$	$\frac{hp \times 746}{1.73 \times E \times \% eff \times pf}$
Amperes from kilowatts		$\frac{kw \times 1000}{E \times pf}$	$\frac{kw \times 1000}{2 \times E \times pf}$	$\frac{kw \times 1000}{1.73 \times E \times pf}$
Amperes from kva		$\frac{kva \times 1000}{E}$	$\frac{kva \times 1000}{2 \times E}$	$\frac{kva \times 1000}{1.73 \times E}$
kilowatts	$\frac{I \times E}{1000}$	$\frac{I \times E \times pf}{1000}$	$\frac{I \times E \times 2 \times pf}{1000}$	$\frac{I \times E \times 1.73 \times pf}{1000}$
kva		$\frac{I \times E}{1000}$	$\frac{I \times E \times 2}{1000}$	$\frac{I \times E \times 1.73}{1000}$
Horsepower (output)	$\frac{I \times E \times \% eff}{746}$	$\frac{I \times E \times \% eff \times pf}{746}$	$\frac{I \times E \times 2 \times \% eff \times pf}{746}$	$\frac{I \times E \times 1.73 \times \% eff \times pf}{746}$
Power factor		$\frac{kw \times 1000}{I \times E}$	$\frac{kw \times 1000}{I \times E \times 2}$	$\frac{kw \times 1000}{I \times E \times 1.73}$

*For 3W, 2Ø circuits the current in the common conductor is 1.41 times that in either of the other conductors.

Common electrical terms

Ampere	I = Unit of current or rate of electricity flow	Watthour or Kilowatt hour	Whr = unit of electrical work or kWhr = 1000 whrs
Volt	E = Unit of voltage or potential difference between two points. Similar to pressure.	Horsepower	Hp = measure of the rate work is performed Equivalent to; 746 watts or raising 33,000 lbs, one ft, in one minute
OHM	R = Unit of resistance to electrical flow	Demand factor	The ratio of maximum demand of a system to the total connected load.
Volt amperes or Kilovolt ampere	Va = unit of apparent power or kVa = 1000 volt amperes	Diversity factor	The ratio of the sum of individual maximum demands of the various parts of a system to the maximum demand of the whole system
Watt or Kilowatt	W = unit of real power kW = 1000 watts	Load factor	The ratio of the average load over a designated period of time to the peak load occurring in that period.
Power factor	Pf = ratio of real to apparent power		

Table 13 – Electrical Formulas and Common Terms

CALL BEFORE YOU DIG



**Know what's below.
Call before you dig.**



CALL 2 DAYS BEFORE YOU DIG

NATIONAL # 811

LOCAL AREA NUMBERS

SPOKANE _____ 1-800-424-5555

PULLMAN-MOSCOW _____ 1-800-424-5555

LEWISTON _____ 1-800-324-1585

CLARKSTON-800-5534344

COEUR D'ALENE AREAS:

BENEWAH – SHOSHONE CO _____ 1-800-398-3285

BONNER – BOUNDARY CO _____ 1-800-626-4950

KOOTENAI CO _____ 1-800-428-4950

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