

TRENCHING REQUIREMENTS
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600.1 GENERAL

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

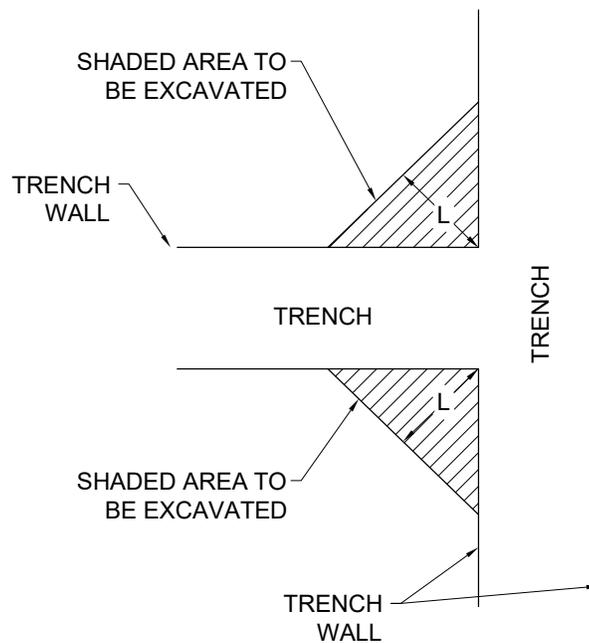
600.2 SEPARATIONS FROM OBSTRUCTIONS

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

600.3 TRENCH BOTTOM

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

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



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

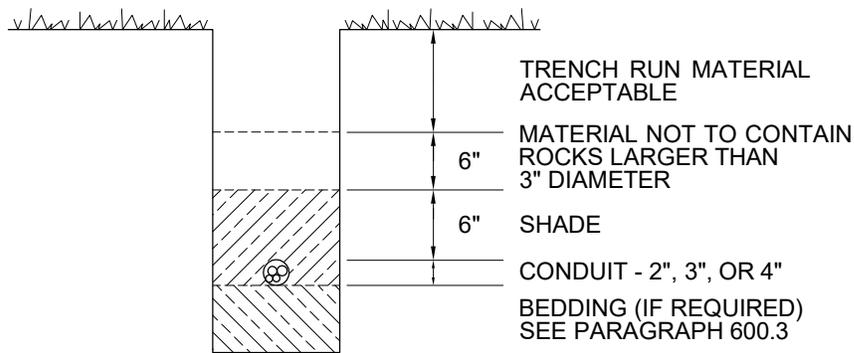
- A) L = 15" FOR 24" RADIUS CONDUIT SWEEPS.
- B) L = 22" FOR 36" RADIUS CONDUIT SWEEPS.
- C) L = 39" FOR 60" RADIUS CONDUIT SWEEPS.

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

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

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

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



TYPICAL TRENCH

NOTES:

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

600.6 REDUCED TRENCH DEPTH FOR DIFFICULT TRENCHING:

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

600.7 UNACCEPTABLE BACKFILL:

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

600.8 COMPACTION:

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

601.0 SPECIAL CONSIDERATIONS

601.1 ENERGIZING UNDERGROUND CABLE

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

601.2 INSPECTION OF CUSTOMER'S WORK

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



602.1-1 ELECTRIC SERVICE ONLY - IN CONDUIT

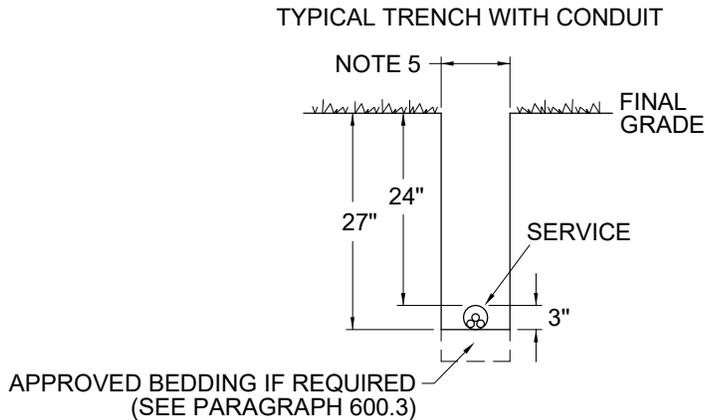


FIGURE 1

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

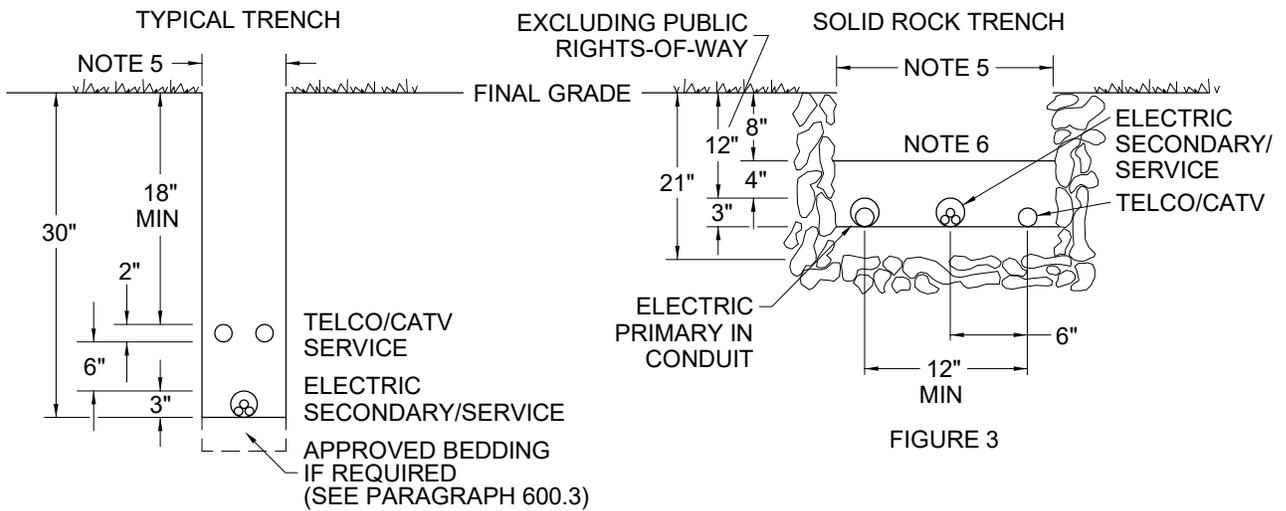


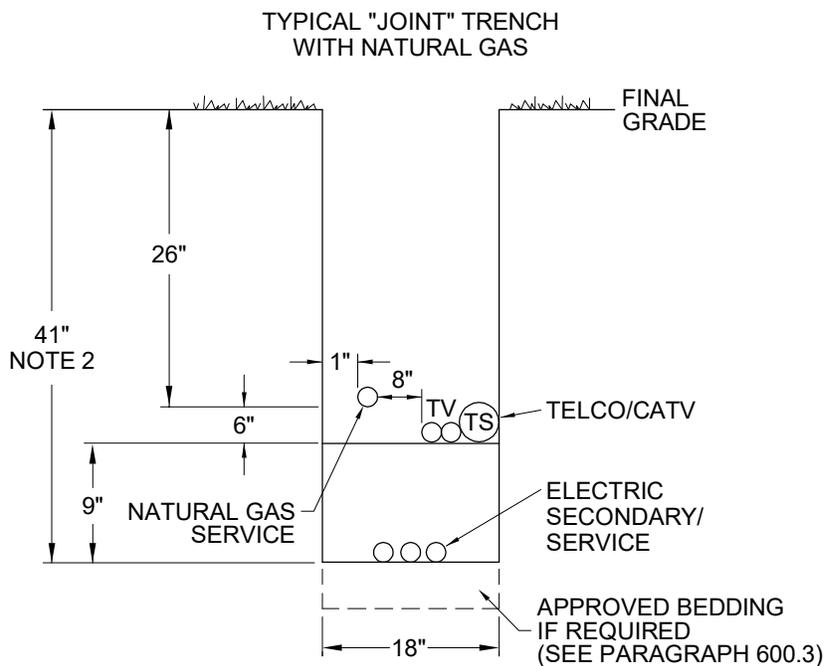
FIGURE 2

FIGURE 3

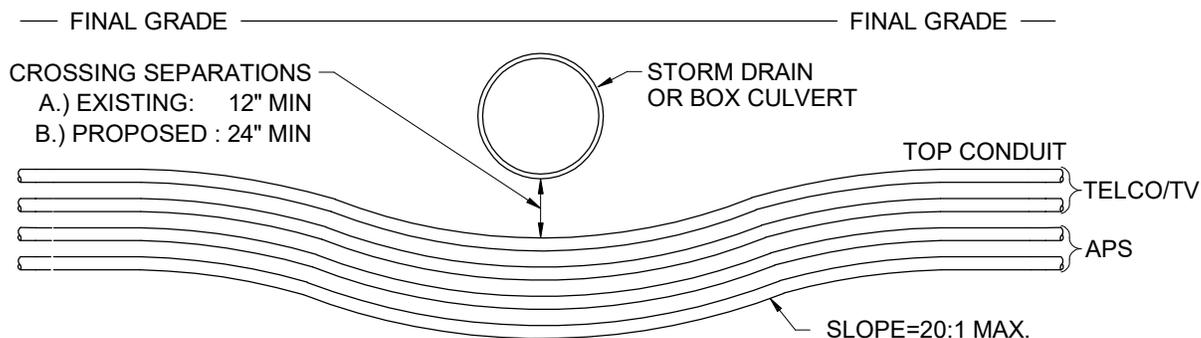
NOTES:

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

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



602.1-4 ELECTRIC SERVICE CONDUITS UNDER STORM DRAIN CULVERT



602.2 MINIMUM COVER OVER FACILITIES IN CITY OF PHOENIX

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

NOTES:

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