
	UNDERGROUND CONDUITS	062288
Asset Type: Electric Distribution	Function: Design and Construction	
Issued by: Lisseth Villareal (LDV2)		Date: 03–25–22
Rev. #20: This document replaces PG&E Document 062288, Rev. #19 For a description of the changes, see Page 20.		

Purpose and Scope

This document covers steel and plastic conduit for electric underground installations, with or without concrete encasement.

General Information

1. Applications for underground conduit are as follows:
 - A. Residential: All residential installations requiring conduit should be made without concrete encasement.
 - B. Light Commercial, Industrial, and Underground Residential Distribution (URD) Feeder: Installation of circuits of this type, which are three-way or less, should normally be made without concrete encasement. In densely populated urban areas, conduit banks involving more than three primary conduits may require concrete encasement.
 - C. Severe exposure to “dig-ins” and other hazards may require concrete encasement of conduit lines.
 - (1) Conduit separation for concrete encasement of conduit lines using spacers to avoid obstacles is illustrated on Page 15.
 - (2) Conduit separation for concrete encasement of conduit lines terminating into a manhole or vault, is illustrated on Page 16.
 - (3) Conduit separation for concrete encasement of conduit lines terminating into an enclosure is illustrated on Page 17.
2. For the minimum design requirements for trenches and conduits installed in PG&E electric distribution system see [Document 038193](#). Trench requirements previously listed in this document have been moved to [Document 038193](#).
3. For the design requirements of conduits installed specifically on bridges see [Utility Procedure TD-2310P-10](#).
4. In April of 2020, PG&E stopped purchasing rigid Polyvinyl Chloride (PVC) DB-120 for conduits, couplings, fittings, and bends for installation in its electric distribution system. PG&E now purchases rigid single wall or co-extruded cellular core wall PVC Schedule 40 conduits, couplings, fittings and bends as the standard conduit type for open trench installations.
5. Rigid single wall or co-extruded cellular core wall PVC Schedule 40 conduits, couplings, fittings, and bends are interchangeable with rigid PVC DB-120 conduits, couplings, fittings, and bends, respectively. This interchangeability is possible because DB-120 and rigid PVC Schedule 40 materials have the same outside diameters.
6. When conduit, including service conduit, is to be installed for PG&E by others, the conduits must meet the requirements listed in this document. The conduit listed below are also acceptable alternatives to the required Rigid single wall or co-extruded cellular core wall PVC Schedule 40.
 - A. Single wall and co-extruded cellular core wall PVC Schedule 80, UL 651 approved conduit that is so marked.
 - B. Hot-dip galvanized rigid steel conduit conforming to American National Standards Institute (ANSI) Specification C80.1.

It is the installer’s responsibility to use the proper fitting to join conduits. This transition may involve changes in both conduit type and size. If equal diameter conduits of different wall thicknesses are joined, the inside edge of the spigot end must be chamfered.

7. The current carrying capacity of an insulated cable is reduced if it is surrounded by other loaded cables. For this reason, conduit banks should be arranged so that each conduit is in an outside position.
8. In commercial distribution systems, consideration should be given to providing one or more spare conduits in the original construction for future load growth requirements. The addition of such conduits at a later time is much more costly.
9. A mandrel must be used to prove that all conduits are free and clear of dirt, rocks, and other debris. For further information refer to [Greenbook 3.4.1](#).
10. A pulling tape with sequential footage markings (**Material Code M560154**) must be installed in all conduits and attached to an end cap. The tape must be proven free and not glued or caught on joints.
11. All conduits must be capped. All conduits not terminating in a subsurface enclosure, pedestal, or vault are to be capped with unglued rigid caps (see Table 12 on Page 8). Conduits terminating in a subsurface enclosure, pedestal, or vault must be capped with temporary plugs (see Table 12 on Page 8).
12. Every effort should be made to obtain a straight, watertight conduit line.
13. When the intrusion of water into buildings can be reasonably expected through lateral service ducts, PG&E is responsible for sealing both ends of the conduit (refer to [Document 063927](#) and [Document 063928](#)). The Rayflute Duct Sealing System (RDSS) conduit sealing system can be ordered for this purpose. RDSS must be used when waterproofing a subsurface transformer enclosure is required. Refer to [Document 072149](#).

Material Specifications

14. PVC conduits and fittings must comply with PG&E engineering material specification [EMS 64](#) which meet the following industry specifications:
 - A. Tensile modulus of 500,000 psi.
 - B. National Electric Manufacturers Association (NEMA): NEMA TC-2 for straight conduit, couplings and NEMA TC-3 for fittings and bends.
 - C. Underwriters Laboratory (UL): UL 651 or Electrical Testing Labs (ETL) that conforms to UL 651.
 - D. UL 651 or ETL conforms to UL 651 must be marked on the outside wall of the PVC schedule 40.
 - E. Rigid solid and single wall or co-extruded cellular core wall PVC Schedule 40 conduits, couplings, fittings, and bends must be gray in color.
 - F. Marking must conform to UL 651 requirements.

Application

15. PVC conduit may be cut with a hacksaw or a fine-toothed wood saw. Clean off burrs. Bevel the inside to eliminate sharp edges.
16. For PVC conduit, apply a thin, uniform coat of cement to both surfaces to be glued. Avoid excessive use of cement to prevent the formation of a bead of cement on the interior shoulder of the joint since, when hardened, the bead can cause cable damage during installation. Immediately after applying the coat of cement to the conduit, insert the conduit into the fitting socket until it bottoms at the fitting shoulder. Turn the conduit 1/4 turn during insertion to distribute the cement evenly. Hold the conduit in place for about 1 minute to prevent backing out in case of tight interference fit joints. Wipe any excess cement away from the outside of the joint. Weather conditions may vary the curing time. When using cement in confined areas, adequate ventilation must be provided. Table 1 below shows the codes to order PG&E approved conduit cement.

Table 1 Cement for Use With Plastic Conduits

Application	Quantity	Approved Manufacturer and Part Number		Material Code
		Oatey	Weld-on Duit 413	
PVC to PVC	1 Quart	30886	12089	490157
	1 Pint	30885	12090	490151

Underground Conduits

17. Use end bells fittings to terminate all conduits, unless the conduit has been terminated in an enclosure equipped with duct terminators. Use cable protectors on reconstruction projects only, when end bells cannot be installed.
18. In applications where a conduit dead-ends, cap the end of the conduit and place a marker ball (material code **M374947**, Refer to [M-60](#) for more information) at the location. Identify the marker ball in construction drawings.
19. Conduits shown in Table 10 (HDPE) and Table 11 (PVC, Bore-Gard schedule 40) on Page 7 are for horizontal directional drilling (HDD) trench-less applications only. However, they can also be used in open trench applications.
 - A. Mechanical couplings and newly approved Shur-lock II couplers (See Figure 31 and Table 24 on Page 14) can be used for joining HDPE to HDPE conduits as well as HDPE to PVC conduits.
20. **Caution:** When pulling conduit(s) in boring applications, be certain to cut the conduits allowing sufficient extra length for the conduit to relax. It may take as long as 72 hours for an excessively stretched conduit to fully relax.
21. **Caution:** Do not use Snap-N-Stack Combo Spacers in concrete encased application.
22. Conduit shown on Table 20 through Table 23 (flexible conduit) on Page 11 through Page 14 are for use in areas with minor soil settlement issues, and for large radius sweeps or re-routes.
23. Backfill containing large rock, paving material, cinders, large amounts of sharply angular substance, or corrosive material must not be placed in excavations where such material may damage conduits, prevent adequate compaction of the fill, or contribute to corrosion of the conduits. Soil compaction must meet PG&E's and any applicable federal, state, county, and local requirements. PG&E specific soil compaction requirements are as follows:
 - A. Trenches that run across or along public roads and streets in the franchise areas must have soil compacted to a minimum of 95% density.
 - B. Trenches that run across private properties and in all other areas must have soil compacted to a minimum of 90% density.
 - C. A compaction test report may be required by PG&E. This report must include the testing company information: Name, Address, Contact information.

References	Location	Document
Minimum Requirements for the Design and Installation of Conduit and Insulated Cable	UG-1: Cable/Greenbook	038193
Methods and Requirements for Installing Residential Underground Electric Services 0–600 V to Customer-Owned Facilities	UG-1: Services/Greenbook	063927
Methods and Requirements for Installing Commercial Underground Electric Services 0-600 Volts to Customer-Owned Facilities	UG-1: Services/Greenbook	063928
Selection of the Type of Underground Equipment	UG-1: General/Greenbook	072149
Engineering Material Specification 63, “High Density Polyethylene (HDPE) Conduits and Fittings”	TIL	EMS 63
Engineering Material Specification 64, “Polyvinyl Chloride (PVC), Conduits, and Fittings”	TIL	EMS 64
Engineering Material Specification 4123, “Backfill Sand	TIL	EMS4123
Electric Distribution Conduits Installed on Bridges	TIL	TD-2310P-10
Request for Variance from Electric Distribution Standards	TIL	TD-2951P-01
Approved “Mark and Locate” Instruments, Equipment, Accessories, and Products	TIL	M60

Rigid Steel Conduit and Fittings

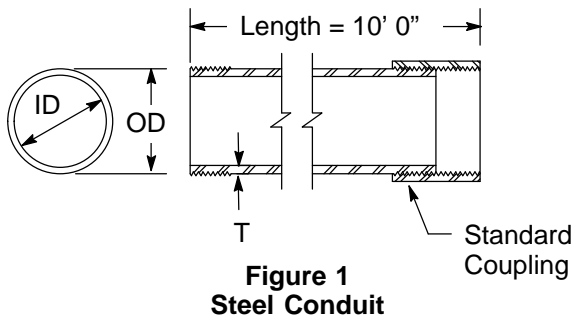


Table 2 Material Material Codes for Rigid Steel Conduit

Conduit Size (inches)	Dimensions (inches)			Weight (lbs.) ¹	Material Code
	OD	ID	T		
2	2.4	2.06	0.154	33	362103
3	3.5	3.06	0.216	69	362092
4	4.5	4.02	0.237	98	362093
5	5.6	5.04	0.258	134	362104
6	6.6	6.06	0.280	177	362141

¹ Weight for one 10-foot length, including one standard coupling furnished with each length.

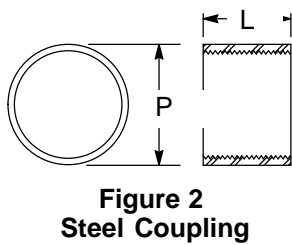


Table 3 Material Codes for Standard Steel Coupling

Conduit Size (inches)	Dimensions (inches)		Material Code
	P	L	
2	2.73	2.18	362105
3	4.00	3.25	362094
4	5.00	3.50	362095
5	6.29	3.75	362106
6	7.39	4.00	362142

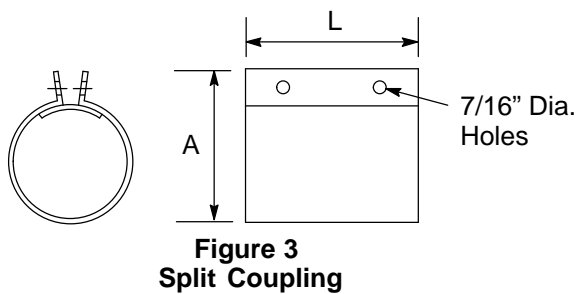


Table 4 Material Codes for Galvanized Steel Split Coupling

Conduit Size (inches)	Dimensions (inches)		Material Code
	A	L	
2	2.5	9	362019
3	3.5	9	362021
4	4.5	9	362023
5 ¹	5.5	9	362107
6 ¹	6.5	9	362143

¹ These sizes are made of zinc-plated malleable iron. Can be installed on rigid steel conduits.

Underground Conduits

Rigid Steel Conduit and Fittings (continued)

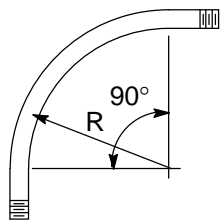


Figure 4
Conduit Sweep
Threaded Both Ends

Table 5 Material Codes for 90° Steel Conduit Sweeps, TBE

Conduit Size (inches)	Radius (inches)	Material Code
2	24	360081
3	36	362091
4	36	362090
	60	360812
5	36	362109
6	36	362144
	48	362145
	60	360813

PVC and HDPE Conduit and Fittings

Notes

1. The depth of all couplings, adapters, swedge reducers, and bell ends must conform to the requirements listed in Table 2 of [ASTM Standard F512](#).



Figure 5
Rigid Plastic Conduit

Table 6 Data and Material Codes for Rigid Plastic Conduit Schedule 40¹

Conduit Size (inches)	Dimensions (inches)				Material Code
	Average Outside Diameter	Minimum Inside Diameter	Wall Thickness		
			Minimum	Maximum	
2	2.375	2.021	0.154	0.113	360153
3	3.500	3.008	0.216	0.148	016471
4	4.500	3.961	0.237	0.184	016472
5	5.563	4.975	0.258	0.221	016473
6	6.625	5.986	0.280	0.257	016474

¹ See Note 14 on Page 2 for material specifications.

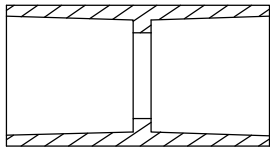


Figure 6
PVC Coupling



Table 7 Material Codes for PVC Swedge Couplings

Swedge Coupling		
Conduit Size (inches)	Minimum Socket Depth	Material Code
2	2.25	360321
3	3.25	360322
4	3.75	360323
5	4.25	360401
6	4.75	360482

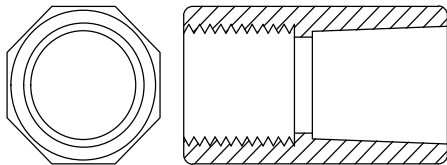


Figure 7
Plastic-to-Steel Adapter



Table 8 Material Codes for Plastic-to-Steel Adapters

Conduit Size (inches)	Minimum Socket Depth	Maximum Socket Depth	Material Code
2	1.125	2.00	360324
3	1.594	3.125	360325
4	1.750	3.375	360326
5	1.937	3.625	360402
6	2.125	3.750	360489

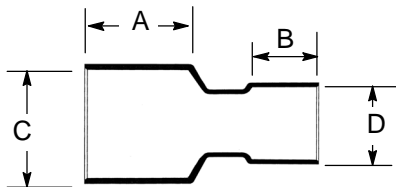


Figure 8
Swedge Reducer

Table 9 Data and Material Codes for PVC Swedge Reducers¹

Reducer Size (inches)	Dimensions (inches)				Material Code
	Minimum Length		Typical Belled End ID		
	A	B	C	D	
3 x 2	2.875	1.750	3.515	2.393	018585
4 x 3	3.375	2.875	4.515	3.515	018584
5 x 4	4.000	3.375	5.593	4.515	360777
6 x 5	5.000	4.000	6.658	5.593	360778

¹ Both belled ends must be chamfered 0.3 inches (min) by 45°.

Underground Conduits

PVC and HDPE Conduit and Fittings (continue)



Figure 9
HDPE Conduit

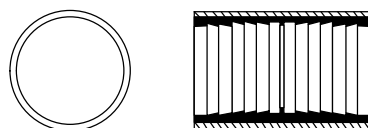


Figure 10
PE Mechanical Coupling

Table 10 High Density Polyethylene (HDPE) Conduit Directional Boring Conduit ¹

Conduit				Mechanical Couplings ^{2, 3}	
Size	Length (feet)	Description	Material Code	Size (inches)	Material Code
2" Sch 80	500	Coil ⁴	360511	2	360690
2" Sch 80	40	Stick	360017		
3" Sch 80	500	Coil ⁴	360644	3	360691
3" Sch 80	40	Stick	360018		
4" Sch 80	625	Coil ⁵	360014	4	360692
4" Sch 80	40	Stick	360015		
5" SDR 13.5	450	Coil ⁵	360012	5	360694
5" SDR 13.5	40	Stick	360013		
6" SDR 13.5	450	Coil ⁵	360010	6	360695
6" SDR 13.5	40	Stick	360011		

¹ Color must be black with at least 3 red longitudinal strips.

² May be used to connect PE conduit to PVC conduit (except in directional drilling apps.)

³ Mechanical couplings are not designed for directional drilling. Fusion joints are required.

⁴ No reel.

⁵ With reel.

Table 11 PVC (Bore-Gard) Directional Boring Conduit

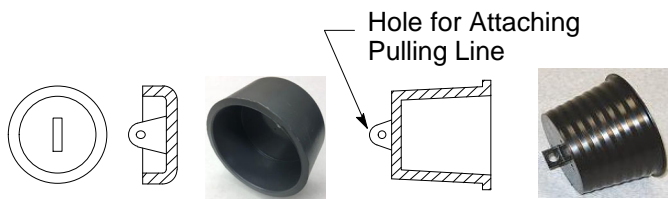


Figure 11
PVC (Bore-Gard, Schedule 40)

Size (inches)	Description	Material Code
3	Conduit 10', Schedule 40	360055
3	Conduit 20', Schedule 40	360056
4	Conduit 10', Schedule 40	360026
4	Conduit 20', Schedule 40	360025
4	Replacement Locking Straps ¹	360031
4	Replacement Seal Gaskets ¹	360029
6	Conduit 10', Schedule 40	360027
6	Conduit 20', Schedule 40	360028
6	Replacement Locking Straps ¹	360032
6	Replacement Seal Gaskets ¹	360030

¹ Package of 10.

PVC Conduit and Fittings (continued)



Rigid Cap

**Figure 12
Rigid Cap**

Cap Plug

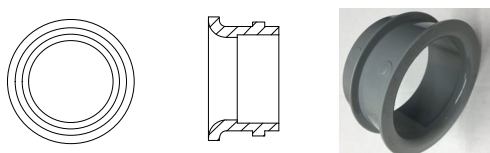
**Figure 13
Plastic Conduit Cap**

Table 12 Material Codes for Rigid Conduit Caps and Cap Plugs

Conduit Size (inches)	Material Codes	
	Rigid Cap	Cap Plug
2	360425	360440
3	360426	360441
4	360428	360443
5	360429	360444
6	360488	360494

Table 13 Material Codes for End Bells

Conduit Size (inches)	Material Code
2	360420
3	360421
4	360423
5	360424
6	360487

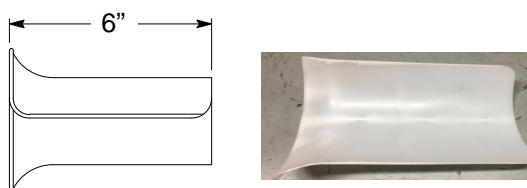


**Figure 14
End Bell**

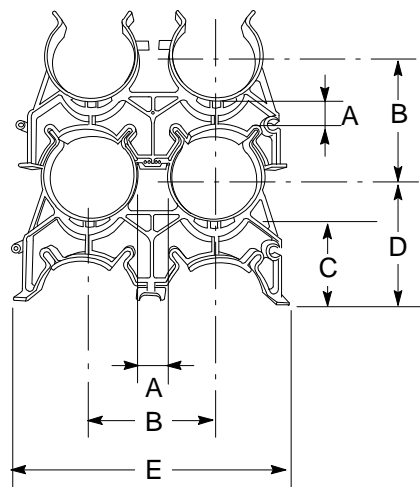
Table 14 Material Codes for Cable Protectors ¹

Conduit Size (inches)	Material Code
2	382034
3	382045
4	
5	
6	

¹ Not for new installations; for replacement only.



**Figure 15
Cable Protector**



**Figure 16
Snap-N-Stack Combo Spacers**

Table 15 Material Codes for Snap-N-Stack Combo Spacers ¹

Conduit Size (inches)	Duct OD (inches)	Horizontal Duct Positions	Dimensions (inches)					Material Material Codes
			A	B	C	D	E	
3	3.500	2	2	5.5	3.63	5.38	11	360459
4	4.500	2	2	6.5	3.88	6.06	13	360460
5	5.563	2	2	7.56	4.38	7.25	15.12	360461
6	6.625	2	2	8.62	4.13	7.38	17.25	360491

¹ Cable spacers allow only for 2" separation between conduits. Cable spacers are used only where is required to route around existing obstructions. Thus, locations where cable spacers are needed are exempt from the requirement of maintaining 3" separation between 600 A distribution circuits.

Underground Conduits

PVC Conduit and Fittings (continued)

Table 16 Material Codes for Rigid PVC Schedule 40 Conduit Bends (sweeps)³

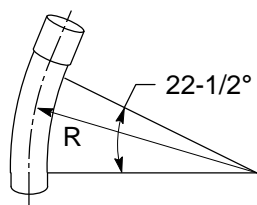


Figure 17
22-1/2° PVC Conduit Bend

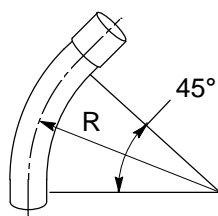


Figure 18
45° PVC Conduit Bend

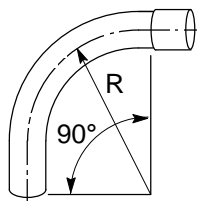


Figure 19
90° PVC Conduit Bend

Conduit Size (inches)	Sweep		Material Code	
	Degree	Radius ¹ (inches)		
2 ²	11-1/4	24	360155	
		36	360156	
	22-1/2	24	360157	
		36	360158	
	45	24	360159	
		36	360160	
	90	24	360161	
		36	360162	
	3 ²	11-1/4	36	360801
		22-1/2	36	360800
		45	36	360403
			24	360405
4 ³	11-1/4	36	360804	
		60	360805	
	22-1/2	36	360760	
		60	360761	
	45	36	360412	
		60	360413	
	90	36	360414	
		60	360415	
	5	11-1/4	36	360808
			60	360809
		22-1/2	36	360806
			60	360763
45		36	360416	
		60	360417	
90		36	360418	
		60	360419	
6	11-1/4	60	360811	
	22-1/2	60	360765	
	45	36	360485	
		60	360486	
	90	36	360483	
		60	360484	

¹ For each conduit bend; first row shows minimum vertical radius, second row shows minimum horizontal radius.

² For 2" and 3" primary conduits 90° degree bends, use 36" vertical radius. 24" vertical radius can be used with secondary and service conduits only.

³ See Notes 1 and 2 on Page 10.

PVC Conduit and Fittings (continued)

Notes in reference to Table 16 on Page 9

1. A 36" may be allowed as the minimum horizontal radius when using 4" PVC conduits bends greater than 5° if field conditions make it not feasible to install 60" radius and if such field conditions are validated by PG&E inspectors.
2. Note 1 above does not apply to secondary service conduits installations. For secondary service conduits installations, 36" is the minimum horizontal radius for 4" conduit. See [Document 063927](#) and [Document 063928](#).

Large Radius Sweeps

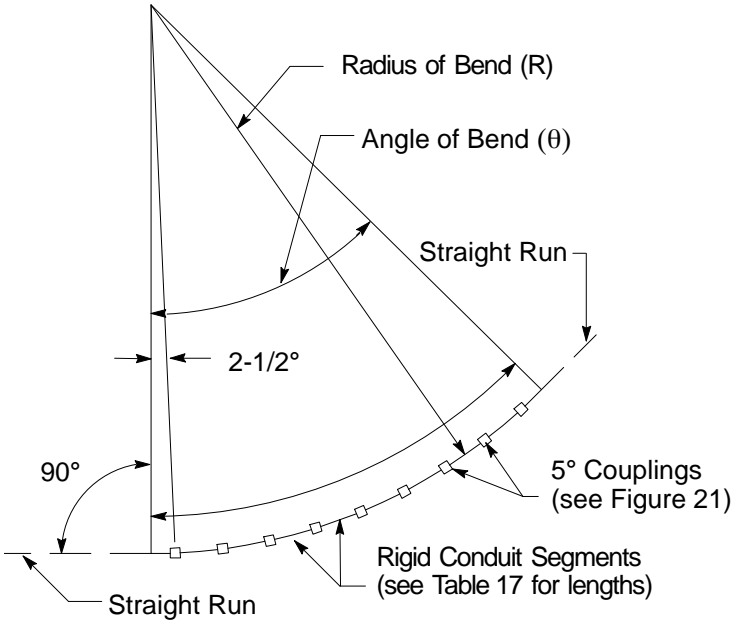


Figure 20
Typical Application of 5° Couplings

Table 17 Length of Rigid PVC Conduit Segments

Approximate Radius of Bend (R)	Length of Rigid Conduit Segments (feet)
11' 6"	1
17' 3"	1.5
23' 0"	2
28' 9"	2.5
34' 6"	3
40' 3"	3.5
46' 0"	4
51' 9"	4.5
57' 6"	5
69' 0"	6
80' 6"	7
92' 0"	8

Table 18 Number of Couplings and Conduit Segments Required

Angle of Bend (θ)	Number of Couplings and Outside Diameter Conduit Segments Required	
	Coupling	Conduit
15°	3	2
30°	6	5
45°	9	8
60°	12	11
75°	15	14
90°	18	17

Example

Radius Bend (R) = 60 Feet
Angle of Bend (θ) = 45°

From Table 17 The nearest value to 60-foot radius is 57' 6".
The length of conduit segments = 5 feet.

From Table 18 For a 45° angle bend:
The number of 5° couplings required = 9.
The number of conduit segments required = 8.

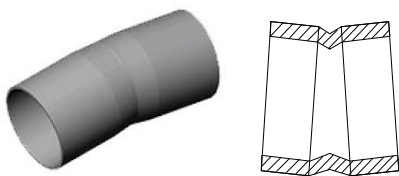


Figure 21
5° Coupling

Table 19 Material Codes for PVC Schedule 40, 5 Degree Coupling

Coupling Size (inches)	Material Code
2	360154
3	360399
4	360400
5	360407
6	360495

Underground Conduits

Flexible (HDPE) Conduit and Fittings

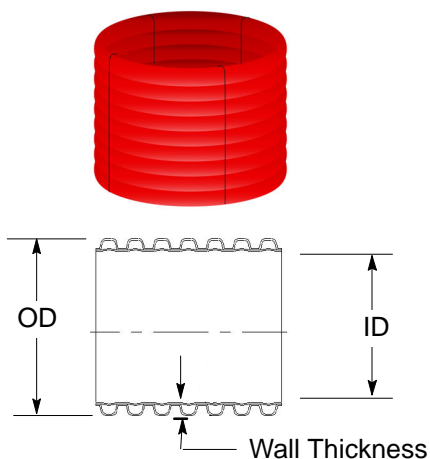


Figure 22
Corrugated Core Flex Conduit

Table 20 Data and Material Codes for Corrugated Core Flex Conduit With Couplers (250' coil) ^{1, 2, 3}

Conduit Size (inches)	Dimension (inches)			Material Code
	Outside Diameter	Inside Diameter	Wall Thickness	
2	2.375	2.050	.163	360095
3	3.500	2.950	.275	360096
4	4.750	3.975	.387	360097

- ¹ Conduit can be used in areas minor soil settlement issues or for re-routes.
- ² Inside wall is corrugated.
- ³ Minimum bending radius is 24 inches for all sizes.

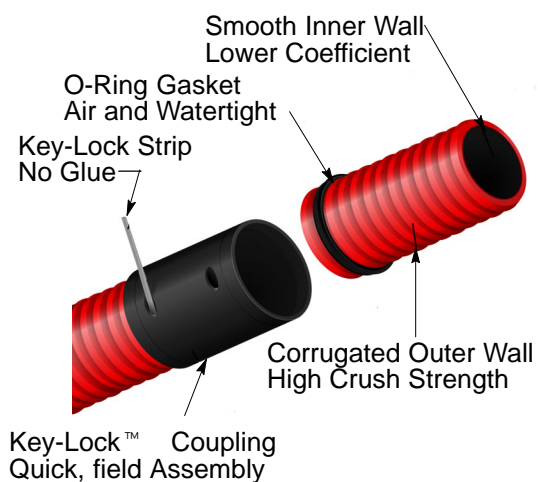


Table 21 Data and Material Codes for Key-Lock™ Couplers ¹

Conduit Size (inches)	Insertion Lengths (inches)	Material Code
2	2.725	360102
3	3.125	360103
4 ²	2.875	360105

- ¹ Kit has coupler, two locks and two gaskets.
- ² Coupler to connect corrugated core flex to corrugated core flex.

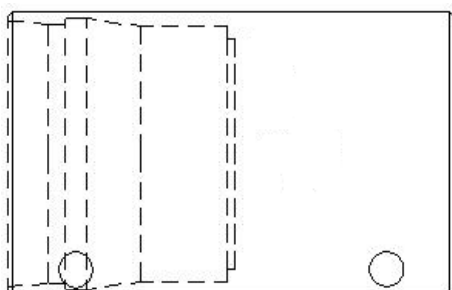


Figure 23
Key-Lock™ Couplers

Flexible (HDPE) Conduit and Fittings (continued)

Install the Key-Lock Coupler Following the Procedure Below

1. Make certain the elastomeric gasket is seated in the second corrugation on 4" conduit and the first corrugation on 6" conduit. Be sure the gasket is positioned as shown on Figure 24.

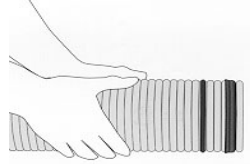


Figure 24
Key-Lock™ Couplers Gasket Position

2. Use only a water-based lubricant. Apply the lubricant to the outside surface of the gasket. A light coating of lubricant should also be applied to the chamfered leading edge of the coupler as shown on Figure 25.



Figure 25
Key-Lock™ Couplers Lubricant Application

3. Insert the gasketed end of the Smooth-Cor® conduit into the coupler. Note the black home-mark, which is used to identify proper coupling as shown on Figure 26.



Figure 26
Key-Lock™ Couplers Insertion

4. Use a mallet and wood block to seat the coupler until the home-mark is covered. Note that the small lock ring on the inside surface of the coupler snaps into a matching corrugation as shown on Figure 27.

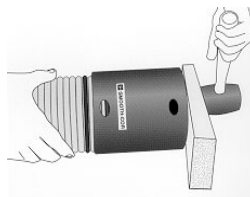


Figure 27
Key-Lock™ Couplers Locked in Place

Underground Conduits

Flexible (HDPE) Conduit and Fittings (continued)

5. Insert the Key-Lock™ strip following the directional arrow into the pre-drilled hole in the coupler. Apply a small amount of lubricant to aid in the insertion. Push the Key-Lock™ strip (in the direction of the arrow on the label) around the entire circumference, locking the grooves in the conduit and coupler securely together. Trim the excess Key-Lock™ strip material from the coupler (optional). See Figure 28 below.

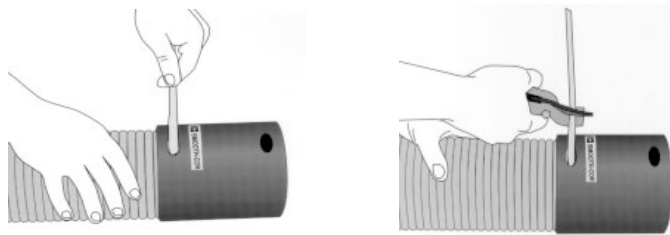


Figure 28
Key-Lock™ Couplers Strip Insertion

Note: When cutting the Smooth-Cor® conduit in the field to a custom length, it necessary to follow the steps below:

1. Cut the conduit at the selected corrugation valley.
2. Place the gasket over the newly cut and cleaned end, making certain to seat the gasket on the second corrugation for 4" conduit. The higher ridge of the elastomeric seal is positioned toward the body of the conduit and the lower ridge toward the end of the conduit. Using a felt marker, place a home-mark on the conduit to achieve proper coupling. When using 4" conduit, place the home-mark on the seventh corrugation. Repeat steps 2-5 as shown on Page 12 and 13 to complete coupling. See Figure 29 below.

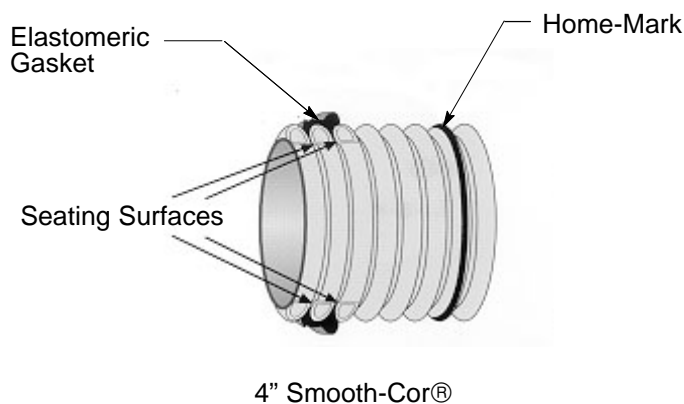


Figure 29
Key-Lock™ Couplers Cut at Customized Length

Flexible (HDPE) Conduit and Fittings (continued)

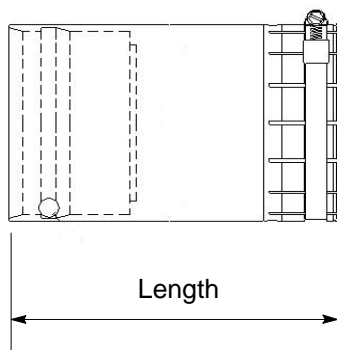
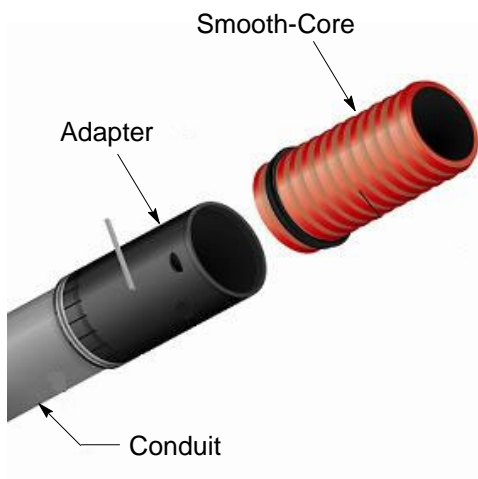


Figure 30
Key-Lock™ Adapter

Table 22 Data and Material Codes for Shurlock/Key-Lock™ (Adapter Smooth-Core-Shur-Lock Kit™ 1, 2)

Conduit Size (inches)	Dimension (inches)	Material Code
	Length	
2	6.7	360106
3	6.63	360107
4	8.0	360108

- ¹ Kit has adapter, one lock, and one gasket.
- ² Adapter works connecting SC conduit to PVC and SC conduit to threaded steel conduit.

Table 23 Required Rigid PVC stub out length ¹

Conduit Size (inches)	PVC Stub Out (inches)
2	14.8
3	14.5
4	15
6	17.5

- ¹ Stub out length needed to provide enough space for the adapter to connect rigid PVC to flexible conduit.

Note

1. The key-lock bell end adapters smooth-core bell are no longer commercially available. Before the end of the flexible conduit run, it is necessary to transition from the flexible conduit to PVC conduit by following the steps below.
 - A. Use appropriate size Shurlock/Key-Lock™ coupler listed in Table 22.
 - B. Use a straight section of at least 18 inches of appropriate size PVC conduit listed in Table 6 on Page 6.
 - C. Use appropriate size end bell for PVC conduit listed in Table 13 on Page 8.



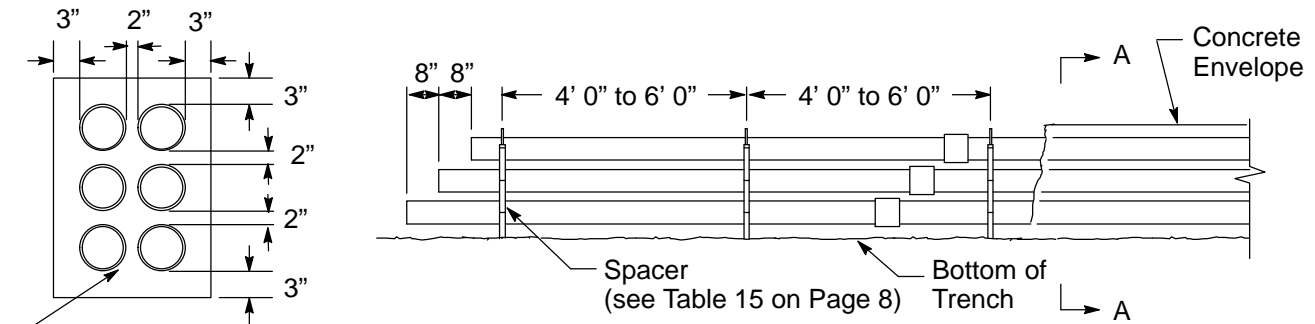
Figure 31
Shur-Lock II Coupler

Table 24 Data and Material Codes for Shur-Lock II Coupler

Conduit Size (inches)	Dimension (inches)	Material Code
	Length	
2	5.70	027241
3	10.75	027242
4	12.00	027243
5	14.25	027244
6	14.25	027256

Underground Conduits

Conduit Construction, Built-up Method



Plastic Conduit
(see Table 6 on Page 6)
Separation between conduits
when using spacer. See
Figure 16 on Page 8.

Section A-A

Figure 32
Typical Straight Run Installation
(6" conduit, 6-way shown)

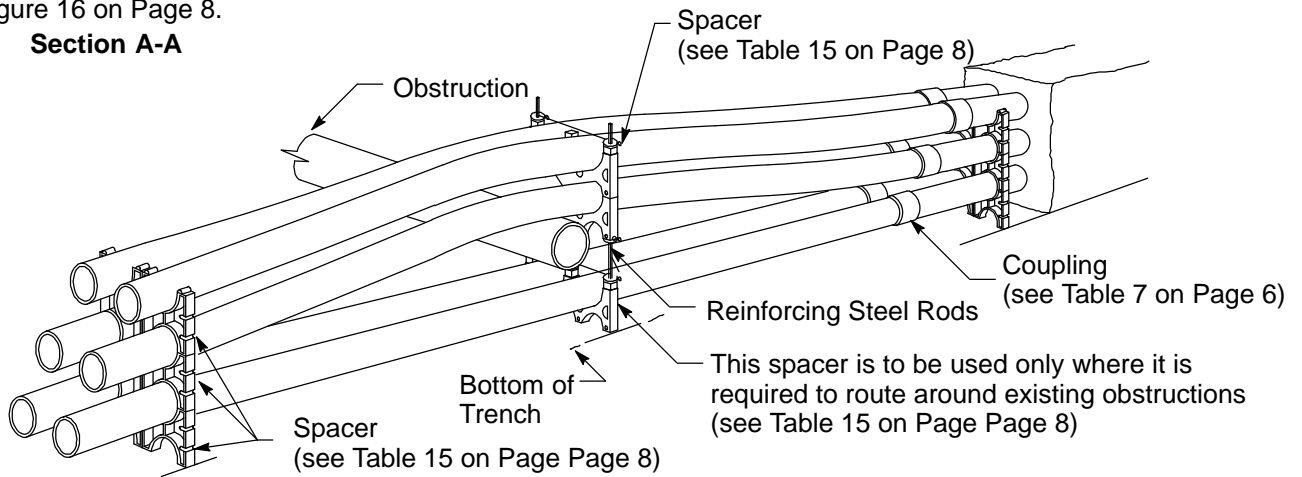


Figure 33
Typical Perspective View of
Installation Around Obstruction

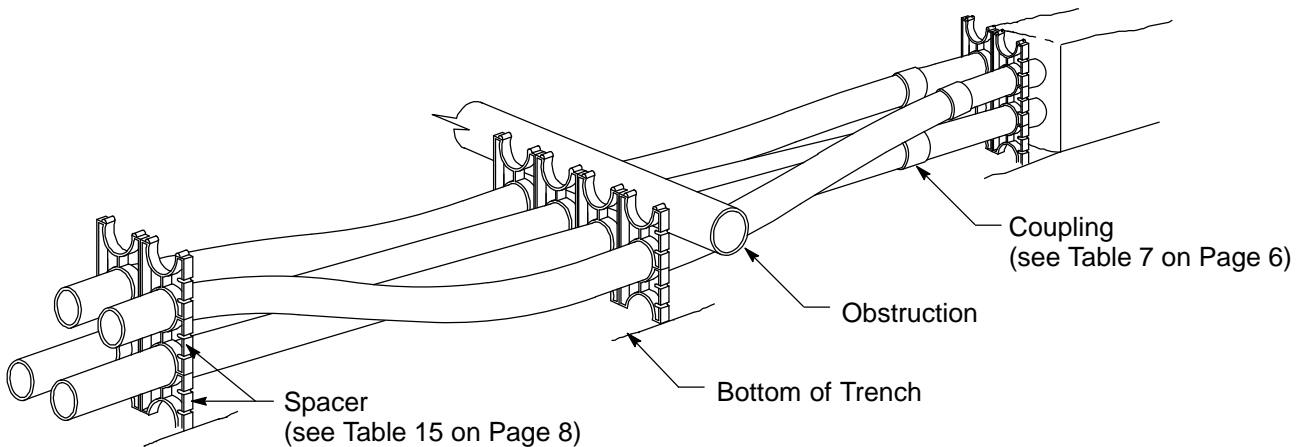


Figure 34
Typical Perspective View of
Installation Under Obstruction

Construction and Termination of Conduit Line into a Manhole or Vault

Notes

1. Slope the conduit sufficiently to provide adequate drainage. On level ground, slope the duct line from the center to each manhole.
2. Local city ordinances may require a minimum cover greater than PG&E's requirements of 24" for conduits containing circuits energized at 750 volts or less, and 36" for conduits containing circuits energized in excess of 750 volts. Depth may be reduced in either case if adequate mechanical protection – as defined in [Section 3.3.6 of the Greenbook](#)– is provided.
3. Where required, the depth of the conduit window may be increased. Where this is necessary, tie the conduit envelope concrete into the manhole reinforcing steel.
4. Vertical staggering of conduits at entrance shown in Detail A will assist in arranging for cable crossover if required.

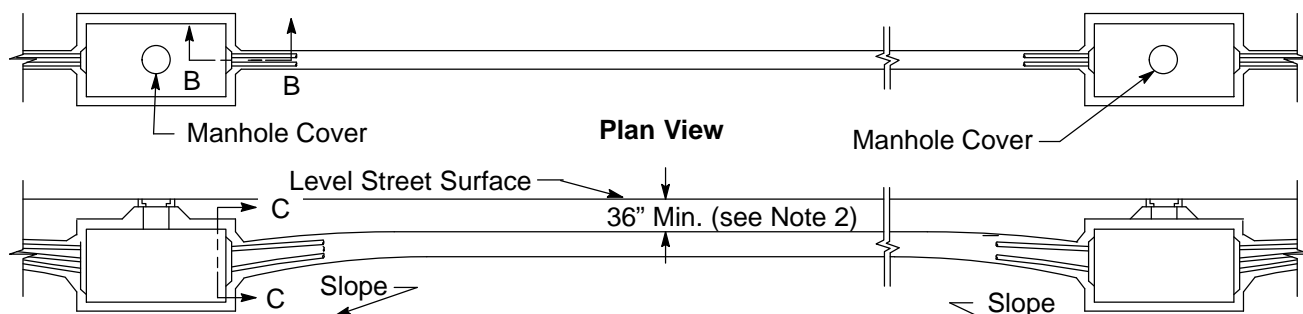


Figure 35
Sectional Elevation
Level Grade

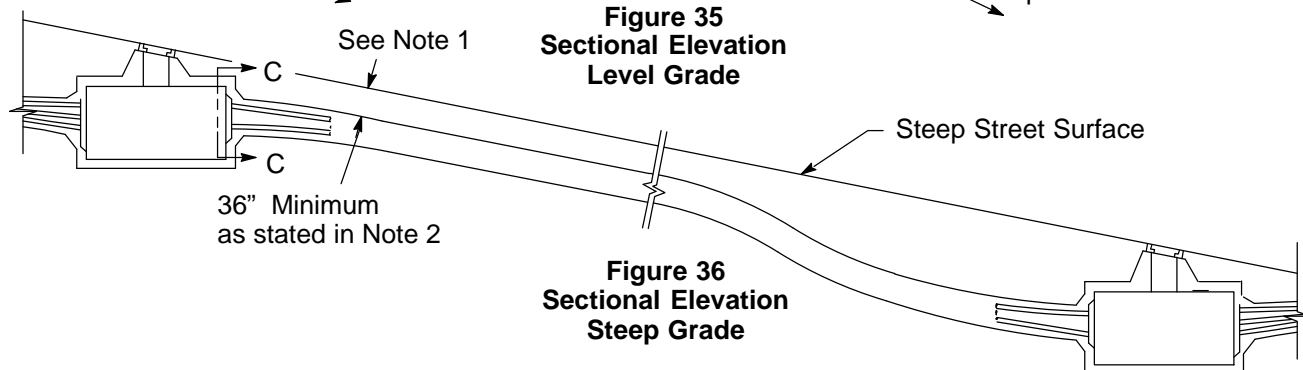
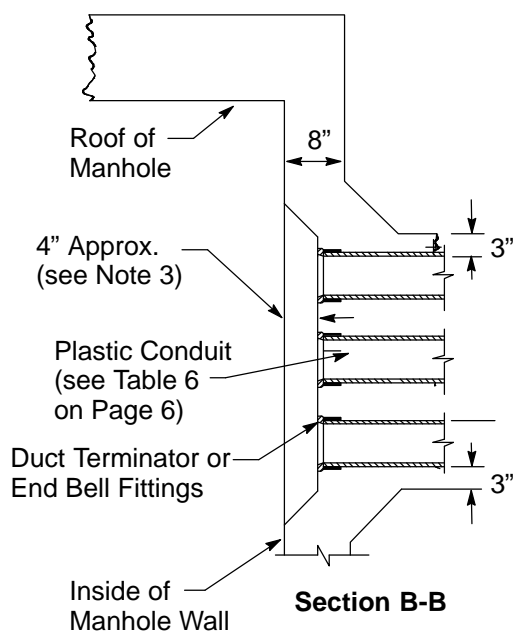
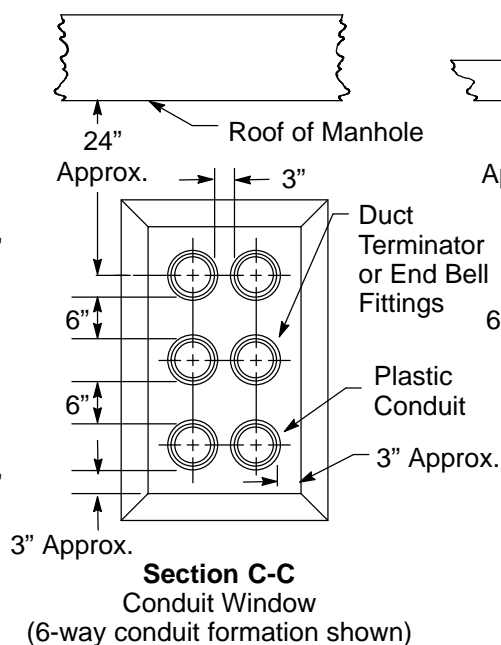


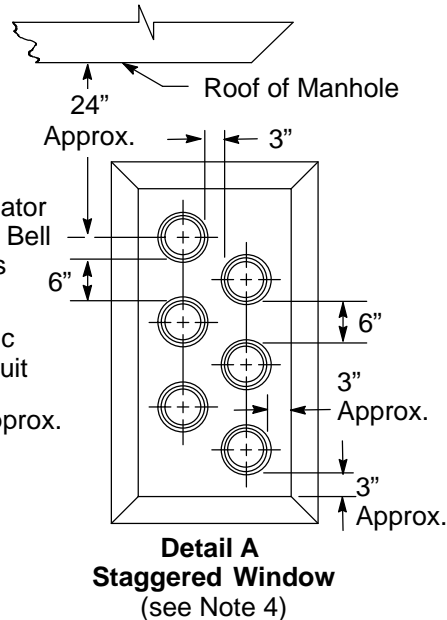
Figure 36
Sectional Elevation
Steep Grade



Section B-B



Section C-C
Conduit Window
(6-way conduit formation shown)



Detail A
Staggered Window
(see Note 4)

Underground Conduits

Concrete Encasement Conduit Configuration Tables

Notes

- For conduit lines two-way and larger, install #4 reinforcing bars in all four corners of the conduit envelope. Overlap bars 15 inches and install a minimum of 3 inches from the top or bottom and 1 inch from the side of the envelope.
- Where the width of the trench is greater than the required width of the envelope, the horizontal spacing between conduits may be increased as long as 3-inch spacing between the conduit and the outside edge of the envelope is maintained.
- Concrete: Normal Weight
Aggregate, ASM, C33 Uniformly Graded
Maximum Aggregate Size 3/4 inch type
Minimum Compressive Strength: $f'_c = 3,000$ pound-force per square inch (psi).

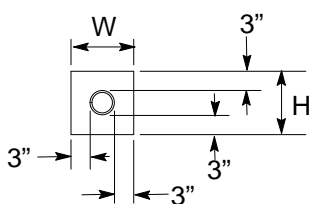


Figure 37
Single Conduit Configuration

Table 25 Dimensions for Single Conduit Configurations

Conduit		Envelope Dim.		Concrete Reqd. Cubic Yards per 100 ft. ¹
Description	Size	W	H	
Single	2"	8-1/2"	8-1/2"	1.9
	3"	9-1/2"	9-1/2"	2.3
	4"	10-1/2"	10-1/2"	2.8
	5"	11-1/2"	11-1/2"	3.4
	6"	12-1/2"	12-1/2"	4.0

¹ Quantities may vary due to variations encountered in construction.

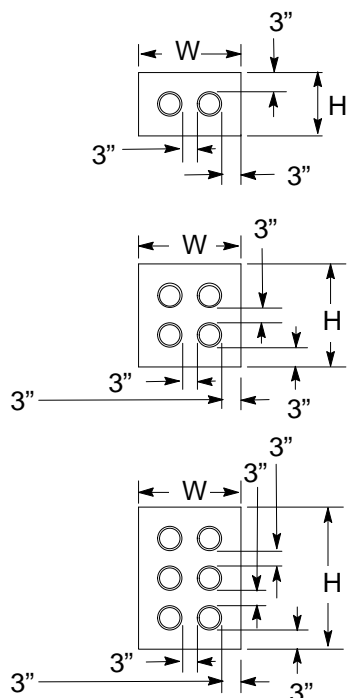


Figure 38
Two, Four, and Six-Way Conduit Configuration

Table 26 Dimensions for Multiple Conduit Configurations

Conduit		Envelope Dim.		Concrete Reqd. Cubic Yards per 100 ft. ¹
Description	Size	W	H	
2-way	3"	16"	9-1/2"	3.9
	4"	18"	10-1/2"	4.9
	5"	20"	11-1/2"	5.9
	6"	22-1/2"	12-1/2"	7.2
4-way	4"	18"	18"	8.3
	5"	20"	20"	10.3
	6"	22-1/2"	22-1/2"	13.0
6-way	4"	18"	25-1/2"	11.8
	5"	20"	29"	15.0
	6"	22-1/2"	32"	18.5
8-way	4"	18"	33"	15.3
	5"	20"	37-1/2"	19.0
	6"	22-1/2"	41-1/2"	24.0

¹ Quantities may vary due to variations encountered in construction.

Instructions for Sealing Conduit Using Foam

Notes

1. Within minutes, polyurethane foam expands to form a water and gas barrier that can be easily removed in the future.
2. Consult the manufacturer's instructions included in each kit.

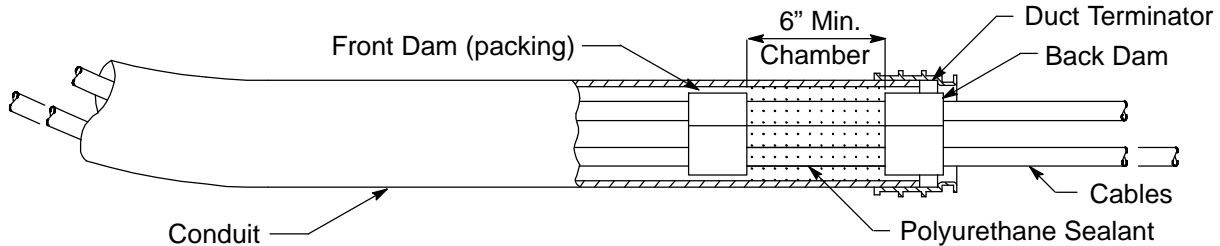


Figure 39
Details of a Polyurethane Seal

- Step 1 Wipe off loose dirt and grime from cables.
- Step 2 Install front dam (packing). Wind a strip of packing around each cable. Push the dam approximately 6 inches to 8 inches into the conduit. Install the back dam in the same manner as the front dam, and push it into the conduit until the dam is flush with the duct terminator.

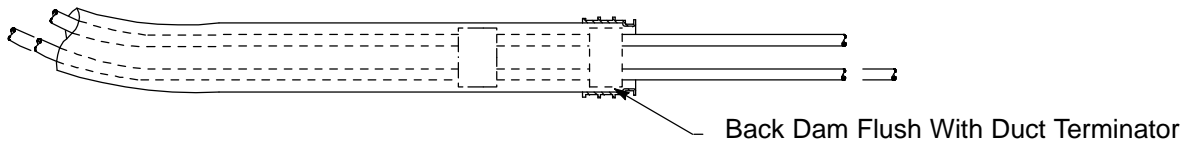


Figure 40
Front Dam Installation

- Step 3 Insert the nozzle into the chamber between the dams and inject polyurethane.

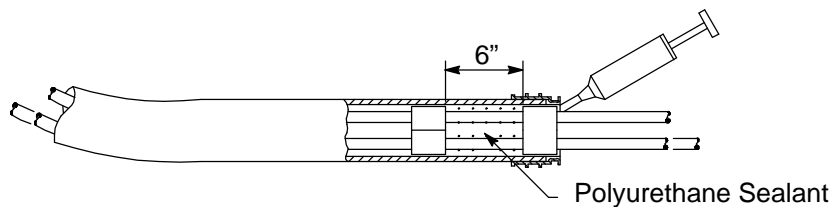


Figure 41
Nozzle Application

Table 27 Material Codes for Polyurethane Conduit Seal Kits ¹

Conduit Size	Material Code	Manufacturer	Catalog Number
2" Through 6"	019178	Dura-Line (Arnco) Hydro Seal	S-60-C6P
	490813	Polywater	FST-250KIT-PGE

¹ Kits have a 12 month shelf-life.

Underground Conduits

Instructions for Sealing Conduit Using RDSS

Notes

1. Consult the manufacturer's instructions included in each kit.
2. Installation tool IT-16 is needed to install RDSS. This tool uses CO₂ cartridges. Both of these materials need to be ordered separately. See Figure 44 on Page 20 .
3. Select the appropriate RDSS size per Table 28.
4. When sealing three or more cables, the RDSS sealing clip listed on Table 34 must be used with the DRSS duct deal. One clip seals up to four cables.
5. Order RDSS as indicated in Table 29 on Page 20.
6. For additional reference, the link below provides an installation video. This video was developed by the manufacturer and may not reflect the use of the company required PPE. When performing this work, please be sure to use the appropriate PPE (i.e. long sleeves, hard hat, etc.) as required by PG&E. The video titled "RDSS – Rayflate Duct Seal System Installation and Removal" is posted in Microsoft Stream. Access Microsoft Stream at <https://web.microsoftstream.com/> from PG&E intranet.

Table 28 RDSS Size Selection

Normal Duct (Conduit) Size (Inches)	RDSS-45 Cable/Cable Bundle Diameter (Inches)	RDSS-60 Cable/Cable Bundle Diameter (Inches)	RDSS-75 Cable/Cable Bundle Diameter (Inches)	RDSS-100 Cable/Cable Bundle Diameter (Inches)	RDSS-125 Cable/Cable Bundle Diameter (Inches)	RDSS-150 Cable/Cable Bundle Diameter (Inches)
1-1/2	0-1.25					
2		0-1.50	0-1.00			
3				0-2.00		
4				0-3.25	0-2.75	
5 ²					0-2.75-4.5	2.50-4.24
6 ²						2.50-5.50
RDSS Clip Size	N/A	75	75	100	125	150

¹ One RDSS clip per RDSS seal is included in the kit.

² For 5" and 6" ducts with cable bundle diameters less than listed on this table or empty; an RDSS-AT/AP-150 device must be used along with RDSS. RDSS-AT/AP-150 must be ordered separately. See Figure 44 on Page 20.



Figure 42
RDSS Seal and Clip



Figure 43
AT/AP-150 Device

Instructions for Sealing Conduit Using RDSS (continued)



Figure 44
IT-16 Installation Tool and CO₂ Cartridges



Figure 45
RDSS Installed

Table 29 Material Material Codes for RDSS Kits and Installation Tool

Item	Material Description	Material Code
1	RDSS-45-PG&E	360213
2	RDSS-60-PG&E	360214
3	RDSS-75-PG&E	360215
4	RDSS-100-PG&E	360216
5	RDSS-125-PG&E	360217
6	RDSS-150-PG&E	360218
7	RDSS-AT/AP-150 Device	360219
8	RDSS-IT-16 Tool	360220
9	Compressed CO ₂ Gas Cylinders	360221

¹ Installation tool re-usable. Unless damaged, only need to order once.

² Only these types of cylinders are compatible with this tool.

Revision Notes

Revision 20 has the following changes:

1. Added Note 1C(1) –1C(3) Page 1.
2. Modified Notes 16 on Page 2 and Note 19 on Page 3.
3. Added compaction requirements to Note 23 on Page 3.
4. Moved, revised and added additional trench requirements from this Document to Document 038193.
5. Revised minimum socket dept information in Table 7 on Page 6.
6. Added new Figure 31 and Table 24 to show information of Shur-Lock II Couplers on Page 14.