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1. Purpose

This standard provides the minimum placement instructions for direct burial and concrete encased plastic conduits and fittings. All conduits and fittings used shall conform to standard RC-1.

2. Damage Minimization

1. Conduit should not be left exposed in an open trench longer than absolutely necessary.
2. Provide support for the full length of conduit when transporting long lengths.
3. Do not permit unsupported overhangs.
4. Conduit stored for periods of longer than 30 days should be protected from sunlight according to the manufacturer's recommendations.
5. Exposure to sunlight during normal construction is not harmful.

3. Temperature

1. All plastic conduit and fittings to be joined should be exposed to the same temperature conditions for a reasonable length of time before assembly.
2. Due to an expansion and contraction of plastic duct of 1 –1/2" per 100' for every 20 degrees F change in temperature, the following precautions should be taken:
   - A. Allow extra conduit footage at each tie – in for contraction when duct temperature is higher than that of earth; or extra room for expansion, if the reverse condition exists.
   - B. Backfill from center of ditch towards ends or from tie – in point toward other end of duct run.
   - C. After trench is backfilled and compacted and duct temperature is the same as that of surrounding soil, duct may be cut off and matched up for connection with tie – ins. All conduit tie – ins entering manhole, vault or handhole walls shall be grouted into the walls.

4. Preparation for Making a PVC Joint

1. Make certain that all foreign matter has been wiped from both the conduit and fittings at joints.
2. The conduit should be dry before inserting into the fitting. It must bottom to make a good cement weld.

3. Change in conduit sizes must be done at manholes, splice boxes, pullboxes, etc. Reducers must not be used in the conduit line.

5. Cutting PVC Conduit

1. Use a fine tooth wood saw to cut conduit from ½" to 1 ½" diameter, or crosscut wood saw on sizes over 1 ½" diameter. A hacksaw can be used on all sizes. The conduit must be cut straight. Clean off burrs.

6. Cement and Thinner

1. Use only the manufacturer's recommended cement for PVC conduit fabrication.
2. Use only the manufacturers recommended thinner for PVC conduit fabrication.
3. Use thinner to cut consistency when cement thickens.
4. Do not use thinner on PVC conduit.

7. Cementing PVC Conduit

1. Apply a liberal and uniform coat of cement to the conduit for the full length of the depth of the socket and apply a uniform coat to sufficiently wet the socket of the fitting. Excess cement on the fitting should be avoided as it is wiped into the joint and tends to weaken the pipe.
2. Work fast enough to insure a good and uniformly – cemented joint.
3. Slip conduit straight into the fitting with a slight twist until it bottoms. Hold the joint for about 15 seconds. (1 minute in extreme cold weather), so the conduit does not push out of the fitting. Do not twist or drive pipe after insertion is completed.
4. The joined members shall be cured, undisturbed, for five (5) minutes or more before they are handled. After this initial cure, care must be exercised in handling to prevent twisting or pulling the joint. (In cold or damp weather, this interval should be increased to allow for the slower evaporation of the cement). All duct should be assembled above ground and allowed to lay undisturbed for the weld cure before being lowered into the ditch.
5. Be sure to wipe off the excess cement that is left on the outer shoulder of the fitting. Plastic bristle brushes should not be used. On larger diameter conduit the brush should be 1" wide minimum.
6. Use only small cans of cement since it dries rapidly. Keep covered when not in use and away from heat and flames. Cement thinner may be used for thinning cement, which has thickened.
7. Another fitting or duct section can be added to the opposite end within two or three minutes, if care is exercised in handling, so the strain is not placed on the previous assembly.
8. Any joint included in the section of conduit to be bent in the ditch, shall be made up above ground and allowed to lay undisturbed for 12 hours or more before installation.
9. The plastic joint must be held rigid during the curing period in cases where a plastic connection is made with the union under stress due to misalignment or other factors. This will relieve stress on the joint until the conduit is backfilled or encased.

8. Conduit Fittings

Use only approved adapter coupling to convert to other types of conduit.

9. Conduit Termination

1. Cap free end of conduit with a plastic cap.

2. Terminated ends of conduit must be free of support from the manhole for at least 10' to permit alignment of the conduit and the knockout opening. The conduit will be supported inside the manhole with proper spacing and will be cut to length after the concrete has cured.
3. Install end bells that meet ASTM F-512 and NEMA TC-9 to all conduit terminations except pre-installed terminations in concrete structures. A list of pre-approved end bells can be found in MC-39.

10. Conduit Spacers

1. For a single-tier conduit bank, only base spacers are to be used. In multiple – tier conduit banks, intermediate spacers must be used between tiers. When the required number of ducts are built up, securely tie the entire assembly together.
2. The maximum distance between spacers must be as follows:

Duct Size	Maximum Spacing
0" to 2"	6 Feet
3" to 3-1/2"	8 Feet
4" to 6"	10 Feet

3. Approved spacers are as follows:

Spacer Size	Spacer Type	Manufacturer & Catalog Number	
		Carlon	JM Eagle
2 x 3"	Base	-	6266020030
	Intermediate	-	6266030030
	Combo	SP2W30-2	-
3 x 3"	Base	-	6266040030
	Intermediate	-	6266060030
	Combo	SP3W30-2	-
4 x 3"	Base	-	6268020030
	Intermediate	-	6268040030
	Combo	SP4W30-2	-
6 x 3"	Base	-	6268040030
	Intermediate	-	6268060030
	Combo	SP6W30-2	-

4. Intermediate spacers should not be located at the center of a bend.
   A. On fabricated bends, locate the spacer in the tangent.
   B. On the trench formed sweeps, locate spacers midway between the tangent and center of bend.

11. Trench and Backfill

1. The trench must be uniformly graded with the bottom, rock-free and covered with select material. The backfill shall be:
   A. Select fill surrounding direct buried conduit or cable and grounding. Refer to ESR Standard: RT-1 for general trench and backfill requirements.
   B. Select natural fill for the remainder of the backfill, refer to ESR Standard: RT-1.
   C. Vinyl warning markers shall be placed above ducts at 15-18" below the ground surface.
2. Backfill shall be made 6" layers and tamped or flooded after each layer is in place. It shall be dense and compacted sufficiently to prevent future settling. It must meet local ordinances.

3. Flooding is not accepted by all governing entities.

12. Concrete Encasement

1. A trench containing 3 or more conduits (for installation of primary conductors) shall be encased in concrete as per ESR Standard: RC-3.
2. Tie and fasten all conduits to prevent floating.
3. Spacers shall be placed as specified in section 10 of this specification.
4. Minimum spacing of 3” between conduits is required.
5. Minimum concrete coverage shall be 3” on the top, bottom, and sides of the conduits.
6. Backfill will be as specified section 11 after the concrete has cured.
7. Conduit is subject to temperature rise as the concrete cures. Therefore, allow the free end to expand by pouring the concrete from the center of the run or from one tie-in point.

13. Finish Requirements

1. All conduits shall be proven free and clear of dirt and debris by use of an appropriately sized metal mandrel no less than ½” smaller than the inside diameter of the conduit. Conduit must be re-mandrelled, if more than 6 months has elapsed without wire being pulled into it.
2. An approved polyester pull tape having continuous durable footage markings, with a minimum 2500 lbs of pull strength shall be installed in each completed conduit run. The pull tape must be continuous; no knots or splices.
3. Approved pull tape manufacturers include: Arnco, Herculine, Neptco, Duraline, and Canada Cordage, for NVE Stock Code #957308. Refer to NVE Standard MT-15 Pulling Tape.
4. No service conduit is allowed under one building to serve another building.

14. Conduit Debris Seals

1. For 1-1/2 inch and 2 inch CIC/conduit(s) installed in RS-1 handholes and to RS- transformer pads, the raceway(s) shall be sealed with a NVE MC-16 stock number 255050 cold shrink cover.
2. For 3 inch conduit(s) installed in RS-1 handholes and to RS-transformer pads, the raceway(s) shall be sealed with NVE MC-39 stock number 240442 debris shield.
3. For 4 inch conduit(s) installed in NVE RS-1 handholes and to RS- transformer pads, the raceway(s) shall be sealed with a NVE MC-39 stock number 240444 debris shield.

15. Conduit Applications

1. **Underground Straight Lengths**

   A minimum rating of DB-120 for 2" and 3" conduits and DB-60 for 4" and 6" conduits shall be the preferred conduit for buried conduit applications. No portion of a PVC conduit/sweep may be exposed above ground. Each conduit shall be one size conduit continuously, no reducers allowed.

2. **Radius of Conduit Sweeps:**

   Straight sections may be used to change direction of the run using the natural curvature of the conduit only with the listed minimum radii. When a smaller radius is needed, a preformed bend from Table 1 shall be used.

   A. 35' for 2" conduit with max total bends of 360Deg.

   B. 50' for 3" conduit with max total bends of 360Deg

   C. 70' for 4" conduit with max total bends of 360Deg

   D. 100' for 6" conduit with max total bends of 270Deg.

   E. Both straight section sweeps and preformed bends shall be included in the appropriate bend maximum. **Note:** The larger the radius sweep, the better for cable pulling.

3. **Selection criteria for 2", 90° Elbows:**

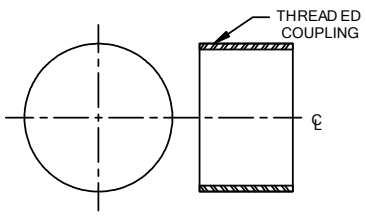
   A. For conduit lengths of less than 500', schedule 40 elbows shall be utilized.

   B. For conduit lengths greater than or equal to 500', fiberglass elbows shall be utilized.

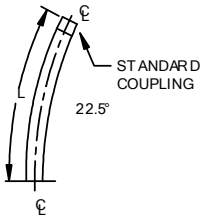
4. **Selection criteria for 3", 4" and 6" 90° Elbows:**

   A. For conduit lengths of less than 100', schedule 40 elbows shall be utilized except in instances NVE determines galvanized rigid steel is required.

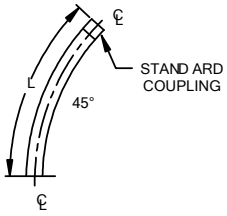
   B. For conduit lengths greater than or equal to 100', galvanized rigid steel elbows shall be utilized.



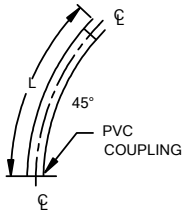
STANDARD RS/IMC
COUPLING



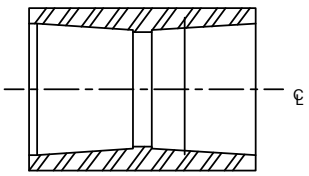
STANDARD PVC
22.5° SWEEP



STANDARD PVC
45° SWEEP



STANDARD FIBERGLASS
45° SWEEP



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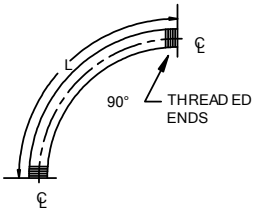
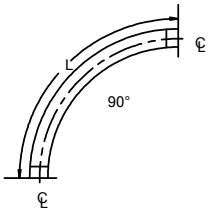
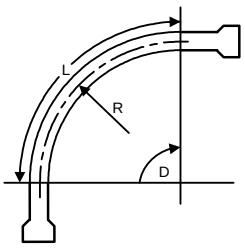
COUPLING



STANDARD GALV. RIGID
STEEL 90° SWEEP



STANDARD PVC
90° SWEEP



Conduit Sweeps and Bends

Table 1. Conduit Sweeps and Bends

Conduit Size	Degree Bend	Radius (Inches)	Length* (Inches)	Stock No.		
				Galv. Steel	Schedule 40	Fiberglass
2”	22.5°	36	14 1/8			
		48	18 7/8			
	45°	36	28 1/4			243335
		48	37 11/16		240915	243336
	90°	36	56 9/16	243304 / 240350	240837	243334
		48	75 3/8		243309	243337
3”	22.5°	36	14 1/8			
		48	18 7/8			
	45°	36	28 1/4			
		48	37 11/16			
	90°	36	56 9/16	240360	243311	
		48	75 3/8	240370	243312	
4”	22.5°	36	14 1/8			
		48	18 7/8			
	45°	36	28 1/4			240351
		48	37 11/16			240352
	90°	36	56 9/16	243326 / 240380	243313	
		48	75 3/8	240390	243327	240354
6”	11.25°	150	29 7/16		243332	
	22.5°	36	14 1/8			
		48	18 7/8			
	30°	48	25 1/8		243331	
	45°	48	37 11/16	243325	243330	
		60	47 1/8		240355	
	90°	48	75 3/8	240400	243314	
		60	94 1/4		240356	

*Length = Bend angle (converted to radians) multiplied by the radius.

NOTES:

1. Do not use stock number 240360 or 240370 with primary cable.
2. Length does not include tangent ends which vary in type and length per manufacturer.

Table 2. Service Conductors

# of Runs	Conductor Quantity	Conductor Size	Conduit		Ampacity			
			Size* (Inches)	Quantity*	100% LF	Total	50% LF	Total
1	3	#2/0 AWG	2	1				
		#4/0 AWG	3	1				
		350 kcmil	3	1				
		500 kcmil	4	1	340		381	
		750 kcmil	4	1	423		483	
	4	#2/0 AWG	2	1	172		191	
		#4/0 AWG	4	1	226		255	
		350 kcmil	4	1	304		246	
		500 kcmil	4	1	372		429	
2	3	500 kcmil	4	2	329	659	378	756
		750 kcmil	4	2	411	823	479	957
	4	#2/0 AWG	2	2	167	334	190	379
		#4/0 AWG	4	2	219	437	253	506
		350 kcmil	4	2	293	585	343	685
		500 kcmil	4	2	357	714	424	848
3	3	500 kcmil	4	3	280	840	348	1044
		750 kcmil	4	3	347	1041	437	1311
	4	#2/0 AWG	2	3	143	429	175	525
		#4/0 AWG	4	3	185	555	232	696
		350 kcmil	4	3	245	735	312	936
		500 kcmil	4	3	297	891	383	1149

***NOTE:** Size/quantity values are minimums.

Table 2. Service Conductors (cont.)

# of Runs	Conductor Quantity	Conductor Size	Conduit		Ampacity			
			Size* (Inches)	Quantity*	100% LF	Total	50% LF	Total
4	3	500 kcmil	4	4	270	1081	344	1375
		750 kcmil	4	4	334	1338	431	1725
	4	#2/0 AWG	2	4	138	553	173	693
		#4/0 AWG	4	4	179	715	229	916
		350 kcmil	4	4	236	942	308	1230
		500 kcmil	4	4	285	1141	377	1580
6	3	500 kcmil	4	6	228	1368	310	1860
		750 kcmil	4	6	281	1686	387	2322
	4	#2/0 AWG	2	6	117	702	158	948
		#4/0 AWG	4	6	151	906	206	1236
		350 kcmil	4	6	197	1182	275	1650
		500 kcmil	4	6	238	1428	335	2010
9	3	500 kcmil	4	9	208	1872	293	2637
		750 kcmil	4	9	255	2295	364	3276
	4	#2/0 AWG	2	9	107	963	149	1341
		#4/0 AWG	4	9	137	1233	194	1746
		350 kcmil	4	9	179	1611	257	2313
		500 kcmil	4	9	215	1935	313	2817

***NOTE:** Size/quantity values are minimums.