

CONDUIT INSTALLATION GUIDE

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2.0 PURPOSE

This standard provides placing instructions for plastic conduit and fittings and is adapted from Western Underground Committee Guide #3.4, Plastic Conduit and Fittings Placing Instruction, and NEMA, National Electrical Manufacturers Association Bulletins No. TC- 2, and TC-3 of latest revision.

3.0 BASIC MATERIALS

The plastic conduit and fittings used in this standard are those specified in ANSI/ASTM F512-79 smooth-wall polyvinyl chloride (PVC) , Gray (NEMA TC-2) for conduit and (NEMA TC-3) for fittings.

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4.0 TYPE OF CONDUIT (DUCT)

Type DB PVC with greater pipe stiffness values, designed primarily for direct burial. DB duct may also be concrete encased, either in trenches or in casings or boring, for extra heavy or high dynamic load application.

5.0 TRANSPORTATION

- 5.1 Generally, duct is shipped in self-supporting framed units designed for mechanical unloading. **Framed units should not be dropped from truck bed.**
- 5.2 **Abusive handling should be avoided. Care should be exercised when handling duct in temperatures below 32° F.**

6.0 STORAGE

- 6.1 Framed units should be stored on a level surface. The wood frames should line up, one on top of another, so that the load will be on the wood frames rather than the duct. As a general practice, frames are spaced on 7'-0" centers. Standing height should be limited to 12 feet.
- 6.2 The most desirable method of stacking loose duct is with all duct parallel (nested). To avoid excessive ovality on the bottom row, the stacking height should be limited to 4 feet for EB (Type I) and 5 feet for DB (Type II). The bottom row of duct should be laid on as level a surface as possible. NOTE: DO NOT place sleepers under the duct as excessive deflections and sagging could result.

7.0 INSTALLATION

- 7.1 A duct system is considered to be properly installed if the inside diameter of each duct is adequate to allow free passage of the specified mandrel. (See Section 19.0)
- 7.2 To limit the deflection, the trench bedding, the duct separation, the type of backfill, and the amount of compaction are factors requiring attention.
- 7.3 Backfill compacted to 80% - 95% of the relative density is required as noted in NVE Standards for trenching and excavation (TE0001U) and main trench detail (TE0005U).
- 7.4 All backfill materials used shall conform to the requirements set forth in NVE Material Specification SUB01X.
- 7.5 Observe all local and federal regulations pertaining to the excavation of open trench. Trenches must be backfilled as soon as the conduit is installed. Refer to NVE standard TE0001U for details.

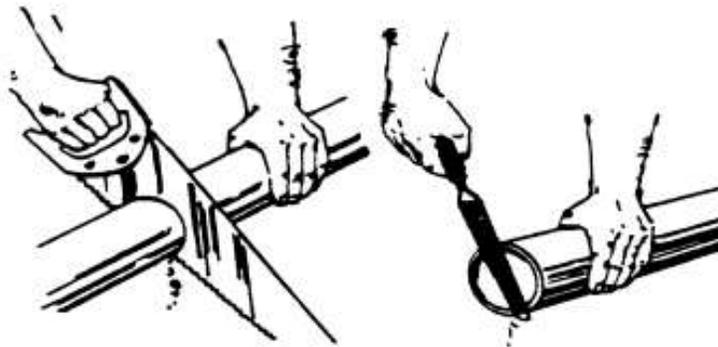
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- 7.6 Make certain that all foreign matter has been wiped from both the conduit and the fittings at the joints.
- 7.7 Changing of **primary or secondary** conduit size is only permitted in vaults, manholes, splice boxes, or pull boxes. Conduit runs will be one size continuously with no reducers allowed. The only exception is that a 3"x 2" reducer may be used with service conduit.
- 7.8 There must be at least 15' of straight conduit between 'back to back' bends/sweeps.
- 7.9 Manufactured bends only, no heat bending of conduit.

8.0 CUTTING DUCT

Cutting - Use a fine tooth wood saw to cut conduit 1/2" to 1-1/2" diameter, or crosscut wood saw on sizes over 2" diameter. A hacksaw can be used on all sizes.

Example:



9.0 MECHANICAL DAMAGE MINIMIZATION

- 9.1 Conduit protection (primary/ secondary), on property line of private property, will require a concrete encasement of the conduit.
- 9.2 Trenches should be backfilled when conduit is laid. Conduit should not be left exposed in an open trench.
- 9.3 Provide support for the full length of conduit when transporting long lengths.
- 9.4 Do not permit unsupported overhangs.

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10.0 CONDUIT FITTINGS

- 10.1 See Conduit Application Guide CD0004U, Vol. 5, for complete list of conduit and fittings.
- 10.2 In general, reducer couplings are not allowed. See Section 7.7.
- 10.3 Use approved adapter/ coupling to convert to other types of conduit.

11.0 CONDUIT TERMINATION

- 11.1 A tapered polyethylene plug with attachment eye will be used to temporarily plug conduit ends and terminators. This is to keep debris and foreign material out of the conduit until use. These temporary plugs will be used **on all conduit stubs** and ends in secondary and primary applications. The use of tape as a means of sealing conduit is unacceptable, and will not be allowed.
- 11.2 Conduit may be terminated in vaults with duct terminators with sand support up to the conduit approach outside of the vault. Bushing reducer adapters (4"x3") can be used in conjunction with duct terminators to facilitate the proper conduit size and location. When duct enters a knockout, terminated ends of conduit must be free of support into the manhole for a distance of at least 10 feet. This is to permit alignment of the conduit and the knockouts opening. The conduit will be supported inside the manhole with proper spacing and will be cut to length after the concrete encasement has cured.

12.0 PVC CEMENT/THINNER/PRIMER

- 12.1 Use only recommended PVC cement from conduit fabricator.
- 12.2 If the cement being used shows signs of jelling, it shall be discarded. In no case shall thinner be used in an attempt to restore jelled PVC cement.
- 12.3 Thinner may only be used to change the viscosity of medium bodied cement for application on 2" PVC pipe or smaller.
- 12.4 In cold weather, less than 50° F. use a primer to soften the joining surfaces before applying the cement. Allow longer cure time.

13.0 CEMENTING CONDUIT

- 13.1 Clean conduit by wiping off all dust, dirt, and moisture from the surfaces to be cemented and then apply a fine abrasive paper or cloth.

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- 13.2 With a non-synthetic bristle brush, apply an even coating of cement to the conduit for the full length of the depth of the socket and apply a uniform coat to sufficiently wet 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.
- 13.3 **Work quickly!** Join the conduit within 15 seconds of applying the cement.
- 13.4 Slip the conduit straight into the fitting with a slight twist (1/4 turn) until it bottoms, make sure joint is completely seated. Hold the joint for 15 seconds, (2 minute plus in cold weather, under 50°F.), so that the conduit does not push out of the fitting. Do not twist or drive pipe after insertion is complete.
- 13.5 The jointed members shall be cured and undisturbed for five minutes or more before they are handled.
- 13.6 Newly assembled joints should be handled carefully until the cement has cured for the recommended set period. After this initial cure, care must be exercised in handling to prevent twisting or pulling the joint apart. Set periods are related to the ambient temperatures as follows: a) 30 minutes minimum at 60°F. to 100°F., b) 1 hour min. at 40°F. to 60°F., c) 2 hrs min. at 20°F. to 40°F. Conduits can be assembled above ground and allowed to lay undisturbed for the weld to cure before being lowered into the ditch.
- 13.7 Be sure and wipe off the excess solvent that is left on the outer shoulder of the fitting. Plastic bristle brushes should not be used. On large diameter conduit, the brush should be a minimum of 1 inch wide.
- 13.8 *Only use small cans of cement since it dries rapidly.* Keep covered when not in use and away from excess heat and flames. Do not use solvent cement thinner for thinning cement which has thickened. See Sections 12.2 and 12.3.
- 13.9 Another fitting or conduit section can be added to the opposite end within two or three minutes if care is exercised in handling so that strain is not placed on the previous assembly. See section 13.6.
- 13.10 The plastic joint must be held rigid after insertion for the cure 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.

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14.0 TEMPERATURE

14.1 See Sections 13.4 and 13.6.

14.2 All plastic conduit and fittings to be joined should be exposed to the same temperature conditions for a reasonable length of time before assembly.

14.3 Precautions - Due to expansion and contraction of plastic duct of 1-1/2" per 100' for every 20°F change in temperature, the following precautions should be taken:

14.3.1 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.

14.3.2 Backfill from center of ditch toward ends or from one tie-in point toward the other end of duct run.

14.3.3 After ditch is backfilled and compacted and duct temperature is the same as that of surrounding soil, lines may be cut off and matched up to connect to the vault duct terminators installed in vault wall. If conduits enters the concrete knock-outs of vault, during the entry, (to manhole, vault, or handhold), conduits shall be grouted into walls and concrete encased for a minimum distance of 15" outside of walls.

15.0 TRENCHING

See NVE Specification TE0001U.

16.0 CONCRETE ENCASED DUCT BANK

16.1 Concrete may be required to be dyed red (12 lbs. of dye per yard).

16.2 Concrete requirements may vary depending on installation necessity. A light concrete mix (three bag slurry mix) is all that is generally required in most cases. A 5 bag mix may be required if a more rigid base is identified and requested by an inspector.

16.3 Concrete encasement is required when conduit is installed under ditches (irrigation and drainage), rivers, streams, foundations, slabs & footings. See CD0003U for further requirements. Primary conduits on private property "side or rear" property lines will require concrete encasement, see Section 9.0. Concrete encasement is also required in any downtown (Reno, etc.) area. Additionally, 90° sweeps in long conduit runs with multiple sweeps may require concrete encasement. Contact a NVE inspector for information or questions.

16.4 Tie and fasten all conduits to prevent floating.

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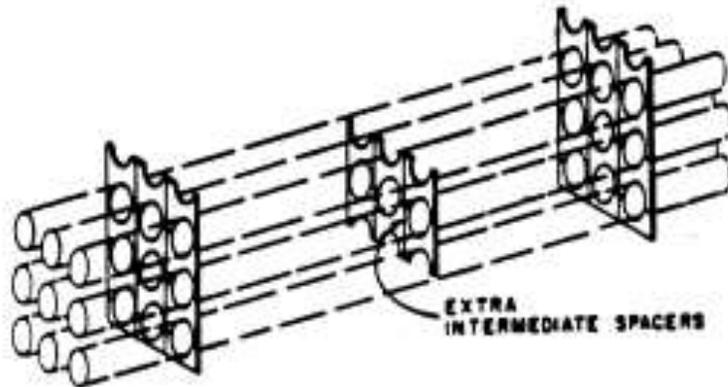
- 16.5 Spacers must be utilized with concrete encasement. Spacers shall be placed between 4' and 10' intervals depending on size of conduit (See Section 17).
- 16.6 Minimum spacing of 1-1/2" between conduits is required.
- 16.7 Minimum concrete encasement shall be 3" on top, bottom and sides of conduit.
- 16.8 Backfill will be as specified in this Standard after concrete has cured. (See Section 7.3)
- 16.9 Conduit is subject to temperature rise as concrete cures. Therefore, allow free end to expand. This can be accomplished by pouring concrete from center of run or from one tie-in point.

17.0 CONDUIT SPACERS

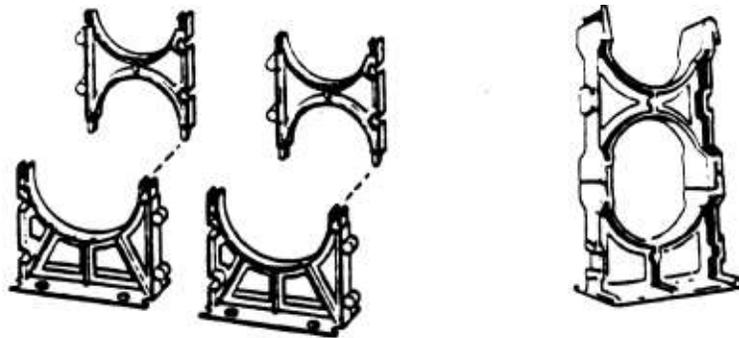
17.1 Duct spacers should be of the type recommended by conduit manufacturer and approved by the utility. Spacers should be of the type with an interlocking device that relieves the conduit of both horizontal and vertical stress. (See NVE Stock Material Sheets for approved manufacturers and catalog numbers.)

	<u>DUCT SIZE</u>	<u>SPACING</u>
24-0750 - 4" base		
24-0760 - 4" Intermediate	0.5" to 2"	4 - 6 feet
24-0770 - 6" base	3"	6 - 8 feet
24-0780 - 6" Intermediate	4" to 6"	8 - 10 feet

- 17.1.1 Spacers must be utilized with concrete encasement and will not be required with other types of backfill.
- 17.1.2 Extra Intermediate Spacers: Due to some distortion of conduit from heat, and/or other means, it may be necessary to install extra intermediate spacers with the duct bank. These extra spacers must be installed within the normal required spacing to maintain the proper horizontal clearance. This horizontal space is required to allow the proper amount of backfill material and/or concrete to infiltrate vertically among the duct to insure proper compaction and protection.



Base spacers, when used, must be 12 inches or more distance from any coupling or joint. When conduit is assembled above ground, the spacer will be supported in vertical position by use of the interlocking device design.



17.2 Spacers should not be located at the center of a radius bend.

17.2.1 On fabricated bends, locate the spacer in the tangent free of the coupling.

17.2.2 On trench formed radius sweeps, locate the spacer midway between the tangent and center of the bend.

18.0 DUCT BANK INSTALLATIONS

Install base spacers in position as specified in Section 17.1 of this specification. The base spacer must provide sufficient clearance off the trench floor to permit the specified layer of concrete and/or select backfill to gather at the bottom. The spacers should be consistent with this specification to prevent excessive deflection from loading or buoyancy forces. The use of bricks or wood is not permitted because these materials may deform the duct wall. Starting at the manhole location, the first lengths of duct are joined to the manhole terminators. When all ducts in bottom tier are terminated to manhole, the

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second tier of ducts should be terminated in the same manner as the first tier. This procedure is followed until the top tier of the duct bank has been terminated. The next lengths of ducts are attached to the first lengths following the same procedure described above for the full length of the duct run.

19.0 MANDRELLING

After the duct has been installed and backfilled a mandrel shall be passed through the duct in the presence of NVE Inspector. If the mandrel fails to pass through the duct being tested, either the duct is obstructed, misaligned, or the curve has too small a radius. **Defective ducts must be exposed and the defect corrected.** After the duct(s) are repaired, repeat the mandrel test in that section of duct. Mandrels are constructed in various sizes, depending upon their use and nature of the section being tested, e.g. duct size. The OD of a test mandrel is normally 80% of the I D of nominal size of the duct. The length of the mandrel will vary depending upon the manufacturer and mandrel type, (testing conduit or removing debris).

20.0 PULL LINE REQUIREMENTS

20.1 Applicant and/or Developer shall supply and install a pull line that meets or exceeds the following requirements in all conduit applications:

- A minimum 1/4" wide, polyester pull line will be of a flat design,
- Shall have a minimum breaking strength of 400 lbs,
- Will have sequential footage markings.
- Examples of pull lines that meet these requirements (NVE stock # 95-7305):
 - Neptco "mule tape" WP400P
 - Condux International 08096203
 - Herculine P400W

20.2 Adequate pull line will be provided at both ends of conduits to facilitate conductor pulling. Extend pull line 3 feet from the conduit end at the service panel, and 5 feet from the conduit at the secondary service box or transformer pad.

21.0 INSPECTION AND PERFORMANCE OF WORK

21.1 Applicant and/or Developer shall, without cost to NVE, secure all necessary permits and licenses, pay all fees and deposits, and arrange for all inspections, as required by all applicable governmental rules, regulations, codes, and ordinances. Work hereunder shall conform to all applicable governmental rules, regulations, codes, and ordinances before work will be accepted by NVE.

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- 21.2 Applicant and/or Developer shall inform Inspector at least 24-30 hours in advance before commencing any item of construction or installation of material to enable proper inspection of materials and workmanship. Materials and/or workmanship failing to meet the requirements of this Specification or installed without prior notice to Inspector will be subject to rejection. If required by Inspector, Applicant shall immediately remove same and furnish and install, at his expense, approved material and/or workmanship. No work shall be embedded in concrete, back filled, or otherwise covered or concealed until such time as it has been inspected and approved by Inspector.

- 21.3 All materials and workmanship shall be first quality in every respect, plumb and true, and according to the specific requirements of the drawings and this Specification. All work shall be subject to inspection by Inspector, who may exercise such control as is required to safeguard the interests of NVE.

- 21.4 Any portion of the work which fails to operate to the satisfaction of Inspector, or any defects which are disclosed by testing shall be made good by Applicant and/or Developer at his expense before the work will be accepted by NVE.

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