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An American National Standard

Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings[1]

This standard is issued under the fixed designation D2855; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice describes a procedure for making joints with poly(vinyl chloride) plastic (PVC) pipes, both plain ends and fittings, and bell ends, by means of solvent cements. These procedures are general ones for PVC piping. In non-pressure applications, simplified procedures may be used. Manufacturers should supply specific instructions for their particular products, if and when it seems necessary.

1.2 The techniques covered are applicable only to PVC pipe, both plain and bell-end, and fittings of the same classes as described in Specification D1784.

1.3 Pipe and fittings are manufactured within certain tolerances to provide for the small variations in the extrusion, belling, and molding processes and are not to exact size. A partial list of standards for PVC pipe, fittings, and cements suitable for use in making solvent-cemented joints is given in Appendix X1.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 The text of this practice references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the practice.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D740 Specification for Methyl Ethyl Ketone

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

F656 Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

4. Summary of Practice

4.1 To consistently make good joints, the following should be clearly understood and adhered to:

4.1.1 The joining surfaces must be softened (dissolved) and made semi-fluid.

4.1.2 Sufficient cement must be applied to fill the gap between pipe and fitting.

4.1.3 Assembly of pipe and fittings must be made while the surfaces are still wet and fluid.

4.1.4 Joint strength develops as the cement dries. In the tight part of the joint the surfaces will tend to fuse together; in the loose part the cement will bond to both surfaces.

4.2 Penetration and dissolving can be achieved by the cement itself, by a suitable primer, or by the use of both primer and cement. A suitable primer will penetrate and dissolve the plastic more quickly than cement alone. In cold weather, more time and additional applications are required (see Fig. 1).

4.3 More than sufficient cement to fill the loose part of the joint must be applied (see Fig. 2). Besides filling the gap, adequate cement layers will penetrate the surfaces and also remain wet until the joint is assembled.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

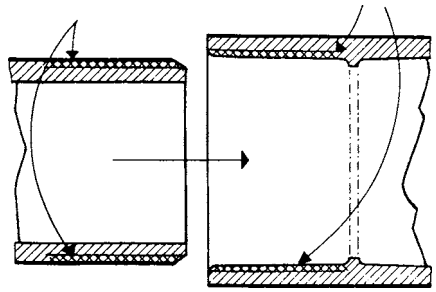

FIG. 1 Areas of Pipe and Fittings to Be Softened (Dissolved) and Penetrated

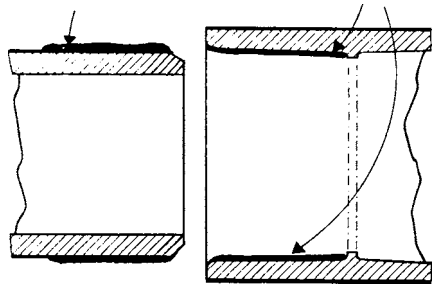

FIG. 2 Cement Coatings of Sufficient Thickness

4.4 If the cement coatings on the pipe and fittings are wet and fluid when assembly takes place, they will tend to flow together and become *one* cement layer. Also, if the cement is wet the surfaces beneath them will still be soft, and these dissolved surfaces in the tight part of the joint will tend to fuse together (see Fig. 3).

4.5 As the solvent dissipates, the cement layer and the dissolved surfaces will harden with a corresponding increase in joint strength. A good joint will take the required working pressure long before the joint is fully dry and final strength is obtained. In the tight (fused) part of the joint, strength will develop more quickly than in the looser (bonded) part of the joint. Completed joints should not be disturbed until they have cured sufficiently to withstand handling. Joint strength develops as the cement dries. Information about the development of bond strength of solvent cemented joints is available (see Fig. 4).

5. Significance and Use

5.1 The techniques described herein can be used to produce strong pressure-tight joints between PVC pipe and fittings, either in shop operations or in the field. However, skill and knowledge on the part of the operator are required to obtain a good quality joint. This skill and knowledge can be obtained by making joints under the guidance of skilled operators and testing them until good quality joints are obtained.

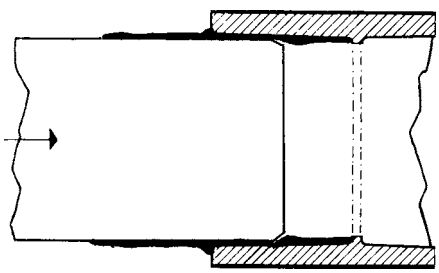

FIG. 3 Assembly of Surfaces While They Are Wet and Soft

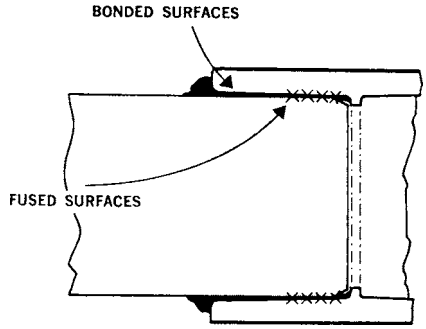

FIG. 4 Bonded and Fused Surfaces of Joined Pipe

6. Materials

6.1 *Pipe and Fittings*—The pipe and fittings should meet the requirements of current applicable PVC piping standards. A list of these standards is given in Appendix X1.

6.2 *Solvent Cement*:

6.2.1 *Specification*—The solvent cement should meet all the requirements of Specification D2564.

6.2.2 *Selection*—PVC solvent cements are available in a variety of viscosities and wet film thicknesses to cover the range of pipe sizes from ⅛ to 12 in. and for interference-fit joints as well as noninterference joints, as found in some Schedule 80 pipe and fittings. One of the general principles of solvent cementing that should be strictly adhered to is: sufficient cement must be applied to fill the gap between pipe and fitting.

6.2.2.1 The ability of a solvent cement to fill a gap in a pipe joint can be determined by considering its viscosity and wet-film thickness (see Note X3.1). A guide to the proper selection of a solvent cement for the various pipe sizes is given in Table X3.1 and Table X3.2, where PVC solvent cements are classified (for purposes of identification) as regular-bodied, medium-bodied, and heavy-bodied cement based on minimum viscosity and minimum wet-film thickness.

6.2.3 *Storage*—PVC solvent cements should be stored in a cool place except when actually in use at the job site. These cements have a limited shelf life when not stored in hermetically sealed containers. Screw top containers are not considered to be hermetically sealed. Consult the cement manufacturer for specific storage recommendations on storage conditions and shelf life. The cement is unsuitable for use on the job if it exhibits an appreciable change from the original viscosity, or if a sign of gelation is apparent. Restoration of the original viscosity or removal of gelation by adding solvents or thinners is not recommended.

6.3 *Cleaners*—Cleaners are of two types, chemical and mechanical (abrasives). Cleaners are used to remove surface impurities (oil, dirt, etc.) and surface gloss.

6.3.1 *Chemical Cleaners*—The chemical cleaners are as follows:

6.3.1.1 Cleaner recommended by the pipe, fittings, or cement manufacturer, and

6.3.1.2 Methyl ethyl ketone (MEK) in accordance with Specification D740.

6.3.2 *Mechanical Cleaners*—The mechanical cleaners are as follows:

6.3.2.1 Fine abrasive paper or cloth (180 grit or finer), and

6.3.2.2 Clean, oil-free steel wool.

6.4 *Primers*—Primers are used to clean, soften, and dissolve the joining surfaces in order to better prepare them for solvent cementing. Primers must be capable of dissolving 10 weight % of PVC resin as required in Specification F656. Primers may also be used as cleaners; refer to specific recommendations of the manufacturer.

NOTE 1—In the event of conflicting instructions from the pipe, fittings, or cement manufacturer, use a primer as well as solvent cement in the joining procedure.

6.4.1 *Primer Specification*—The primer shall meet the requirements of Specification F656.

7. Procedure

7.1 *Cutting the Pipe*—Cut pipe square with the axis, using a fine-tooth hand saw and a miter box, or a fine-tooth power saw with a suitable guide (see Fig. 5). Wood-working blades may be used. A rotary cutter may be used if the cutting blades are specifically designed for cutting plastic pipe in such a way as not to raise a burr or ridge (flare) at the cut end of the pipe. If other tools are not available, a standard rotary metal pipe cutter may be used, provided great care is taken to remove all the ridge raised at the pipe end by the wedging action of the cutting wheels. Failure to remove the ridge will result in the cement in the fitting socket being scraped from the socket surface, producing a dry joint with a high probability of joint failure. Remove all burrs with a knife, file, or abrasive paper.

7.2 *Joint Preparation*—Chamfer or deburr pipe, or both, approximately as illustrated in Fig. 6. Failing to chamfer the edge of the pipe may remove the cement and softened material from the fitting socket, and result in a leaking joint.

7.3 *Test Dry Fit of the Joint (see Fig. 7)*—The solvent cement joint is designed so that there will generally be interference of pipe wall with the fitting socket before the pipe is fully inserted. Insert the pipe into the fitting and check that the interference occurs about ⅓ to ⅔ of the socket depth. Sometimes, when the pipe and fittings are at their tolerance extremes or when Schedule 80 pipe is used, it may be possible to fully insert the dry pipe into the fitting socket until it bottoms. If this occurs, the fit between the pipe and fitting should be snug. If the fit is loose or wobbly, other fittings or pipe should be selected which give a proper fit.

7.4 *Cleaning*—Surfaces to be joined must be cleaned and be free of dirt, moisture, oil, and other foreign material (see Fig. 8). If this cannot be accomplished by wiping with a clean dry cloth, a chemical or mechanical cleaner must be used. If a chemical cleaner is used, apply with an applicator. Skin contact with chemical cleaners should be avoided.

7.5 *Application Procedure*:

7.5.1 *Handling Cement*—Keep the cement can closed and in a shady place when not actually in use. *Discard* the cement when an appreciable change in viscosity takes place, or at the first sign of gelation. The cement should not be thinned. Keep the brush immersed in cement between applications.

NOTE 2—A gel condition is indicated when the cement does not flow freely from the brush or when the cement appears lumpy and stringy.

7.5.2 *Applicator Size*—Apply the cement with a natural bristle, nylon brush or suitable applicator, using a ½-in. (12-mm) brush or dauber for nominal pipe size ½-in. and less, a 1-in. (25-mm) brush or dauber for pipe up through 2-in. nominal pipe size, and a brush width at least ½ of nominal pipe size for sizes above 2 in., except that for pipe sizes 6 in. and larger a 2½-in. (60-mm) brush is adequate. Other applicators may be used provided their use results in an equivalent amount of cement being applied to the joining surfaces.

7.5.3 *Application of Primer and Cement*—PVC solvent cement is fast drying, and therefore the cement shall be applied as quickly as possible, consistent with good workmanship. It may be necessary for two workers to perform this operation for larger sizes of pipe. Under conditions of high atmospheric humidity, quick application is important to minimize condensation of moisture from the air on the cement surface. The surface temperature of the mating surfaces should not exceed 110°F (45°C) at the time of assembly. In direct sunlight or in ambient temperatures above 110°F, the pipe surface may exceed 110°F. The pipe temperature may be reduced by swabbing the surface to be cemented with clean wet rags provided the pipe is thoroughly dried before the primer and cement are applied.

7.5.3.1 First apply primer to inside socket surface (see 7.5.2 for applicator or brush size). Use a scrubbing motion to ensure penetration. Repeated applications may be necessary (see Fig. 9).

7.5.3.2 Next, soften surface of male end of pipe, to be inserted into socket, to depth of fitting socket by uniformly

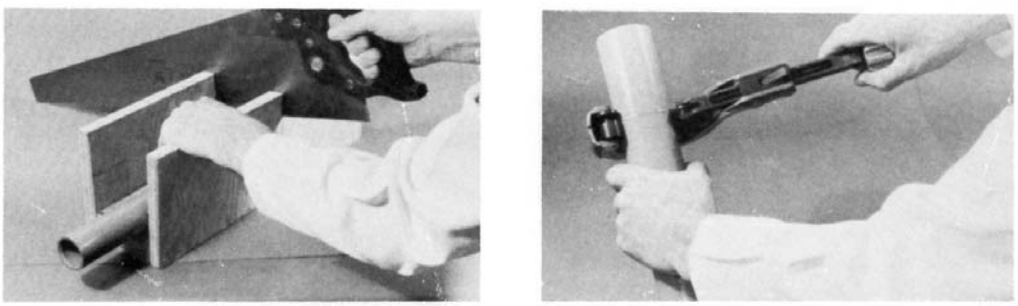

FIG. 5 Apparatus for Cutting Pipe

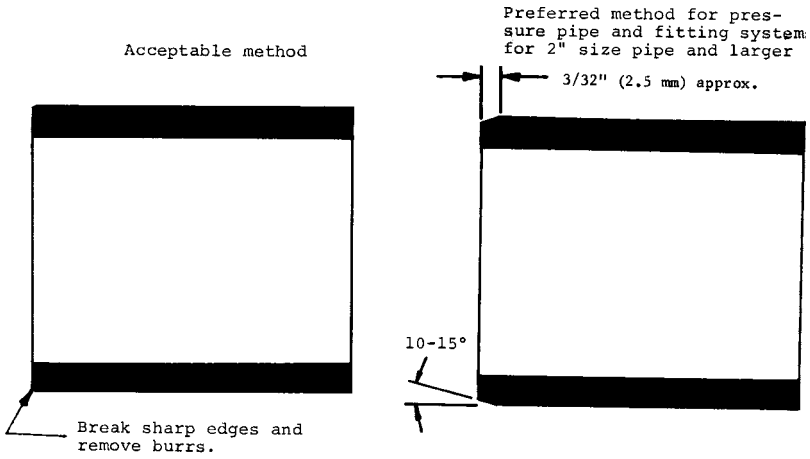

FIG. 6 Chamfer and Deburring of Pipe Edges

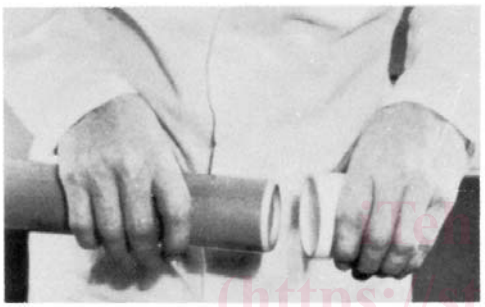

FIG. 7 Pipe Entering Dry Fitting

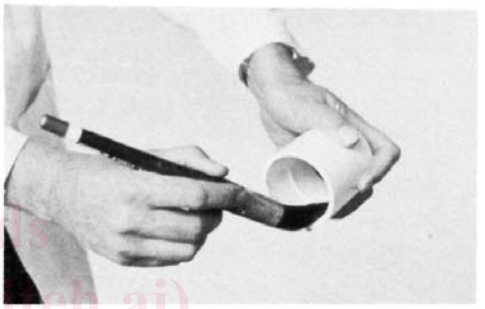

FIG. 9 Application of Primer to Inside Socket Surface

FIG. 8 Cleaning of Pipe with Dry Cloth to Remove Foreign Matter

FIG. 10 Liberal Application of Primer to Soften Surface of End of Pipe

applying a liberal coat of primer. Be sure entire surface is well softened (dissolved) (see Fig. 10).

7.5.3.3 Again, brush inside socket surface with primer; then, without delay, apply cement to pipe while the surfaces are still wet with primer (see Fig. 11).

7.5.3.4 Apply cement lightly but uniformly to inside of socket, taking care to keep excess cement out of socket. This is to prevent solvent damage to pipe (see Fig. 12). Time is important at this stage. Apply a second coat of cement to the pipe end (see Fig. 11).

7.5.4 *Low-Temperature Application*—At temperatures below freezing, 32°F (0°C), solvents penetrate and soften the PVC surfaces more slowly than in warmer weather. For this reason it is recommended that testing be done on a piece of scrap pipe of the same lot to determine if satisfactory penetration of the surfaces can be achieved at the existing temperature. This test can be done by applying the primer, waiting a few minutes and scraping the surface with a knife edge. If sufficient penetration is achieved, some of the plastic surface of the pipe should be soft enough to be removed. If sufficient penetration is not achieved, even with multiple applications of primer, it is unlikely that a suitable joint will result.

7.5.4.1 Individual scrape tests may be needed for pipes and fittings from different manufacturers or even for pipes and fittings of different lots from the same manufacturer, because of possible surface variations. Furthermore, it is good practice to use this test, regardless of ambient temperature, not only because of possible surface variations in pipes and fittings, but also because of differences in pipe primer formulations. If