Designation: ~~D2855 – 96 (Reapproved 2010)~~ D2855 – 15

Standard Practice for ~~Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings~~the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets[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 U.S. Department of Defense.

1. ~~Scope~~ 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.~~ two-step (primer and solvent cement) method of joining poly(vinyl chloride) (PVC) or chlorinated poly(vinyl chloride) (CPVC) pipe and piping components with tapered sockets.

NOTE 1—Simplified procedures may be allowed in non-pressure applications where local codes permit.
NOTE 2—Where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions apply.

1.2 The products covered by this practice are intended for use with the distribution of pressured liquids only, which are chemically compatible with the piping materials. Due to inherent hazards associated with testing components and systems with compressed air or other compressed gases, some manufacturers do not allow pneumatic testing of their products. Consult with specific product/component manufacturers for their specific testing procedures prior to pneumatic testing.

NOTE 3—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety hazards should a system fail for any reason.

1.3 This standard practice does not address the one-step method of joining pipe and piping components with tapered sockets with solvent cement without the use of primer.

1.4 The techniques covered are applicable ~~only~~ to ~~PVC pipe, both plain and bell-end, and fittings of the same classes as described in Specification~~joining PVC to PVC or CPVC to CPVC pipe and piping components with tapered sockets. In the remainder of this standard practice, the term "piping components with tapered sockets", ~~D1784.~~ whether it be bell end pipe, spigot connections, or any other type of tapered connections, will be referred to as "fittings."

1.5 ~~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~~ and CPVC pipe, piping components, and solvent cements suitable for use in ~~making solvent-cemented joints~~ joining pipe and fittings is given in Appendix X1.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 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.

1.8 *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.*

[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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***A Summary of Changes section appears at the end of this standard**

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
D1785 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D2241 Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
D2466 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
D2467 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
D2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
D2672 Specification for Joints for IPS PVC Pipe Using Solvent Cement
D2729 Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D2949 Specification for 3.25-in. Outside Diameter Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
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
F438 Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
F439 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
F441/F441M Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
F442/F442M Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR–PR)
F480 Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
F493 Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
F512 Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation
F656 Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
F758 Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
F789 Specification for Type PS-46 and Type PS-115 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings (Withdrawn 2004)[3]
F891 Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
F1866 Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated 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~~ In order to achieve consistently strong and leak-free joining of poly(vinyl chloride) (PVC) or chlorinated poly(vinyl chloride) (CPVC) pipe and fittings, the following principles need to be clearly understood and ~~adhered to:~~ followed:

4.1.1 The joining surfaces must be softened (dissolved) and made semi-fluid. (See Fig. 1.)

4.1.2 ~~Sufficient~~Solvent cement must be applied to the pipe end to fill the gap between pipe and ~~fitting.~~ fitting socket. (See Fig. 2.)

4.1.3 Assembly of pipe and fittings must be made while the surfaces are still wet and ~~fluid.~~ semi-fluid. (See Fig. 3.)

4.1.4 Joint strength develops as the ~~cement dries. In the tight part of the joint~~ solvents evaporate from the joint. At the bottom of the socket where there is an interference fit, the surfaces will ~~tend to~~ fuse together; ~~in the loose part the cement will~~ at the socket entrance where there is a gap, the solvent cement will fill the gap and bond to both surfaces. (See Fig. 4.)

4.2 Penetration and ~~dissolving can be achieved by the cement itself, by a suitable primer, or by the~~ dissolution of the pipe and socket surfaces are achieved by 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~~ solvent cement. ~~Fig. 1~~).

[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

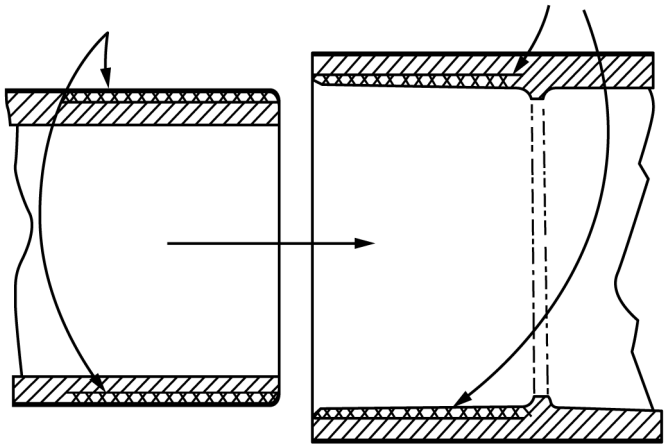

FIG. 1 ~~Areas of Pipe and Fittings to Be Softened (Dissolved) and Penetrated~~Joint Surface Areas that must be Penetrated and Softened

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

4.4 ~~If the cement coatings~~ During assembly, while the layers on the pipe and fittings are wet and ~~fluid when assembly takes place, they will tend to flow~~ semi-fluid, the surfaces will intermingle 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~~ layer~~Fig. 3~~).

4.5 As the ~~solvent dissipates, the cement layer and the~~ solvents evaporate, the dissolved surfaces will harden with a corresponding increase in joint ~~strength. A good~~ strength over time. A properly made joint will ~~take~~withstand 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~~ has fully cured. Assembled 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~~ to withstand handling in accordance with primer and solvent cement manufacturers' recommendations.~~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,~~ A solvent cement bonder/installer must follow all procedures to produce consistently strong and leak-free joints, 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.~~

6. Materials

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

6.2 *Solvent Cement:*

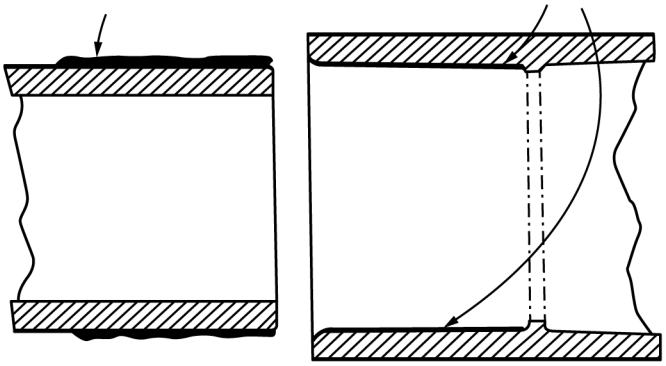

FIG. 2 Solvent Cement Coatings of ~~Sufficient~~Appropriate Thickness

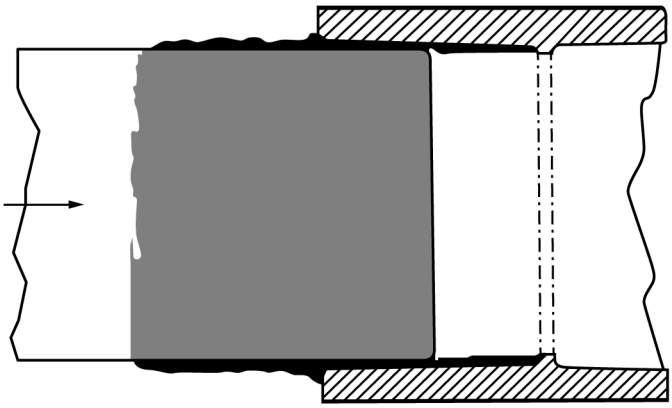

FIG. 3 ~~Assembly of Surfaces While They Are~~ Components must be Assembled while all Surfaces are Wet and Soft

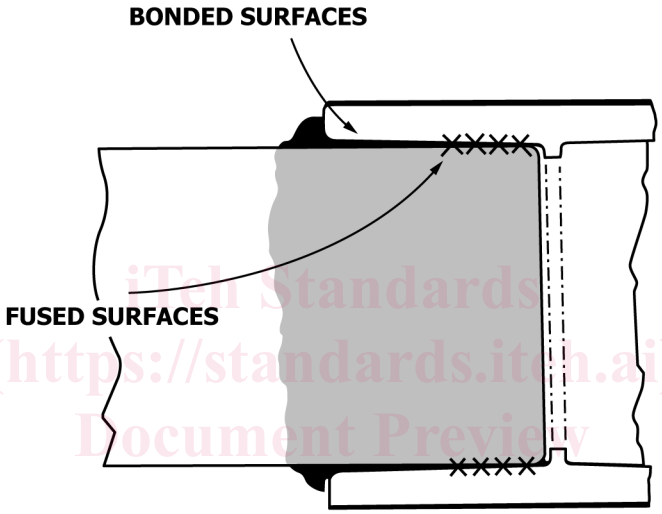

FIG. 4 Bonded and Fused Surfaces of Joined Pipe

6.2.1 *Specification*—The solvent cement should meet all the requirements of Specification D2564. for PVC solvent cement or Specification F493 for CPVC solvent cement.

6.2.2 *Selection*—~~PVC solvent~~ Solvent cements are available in a variety of viscosities and wet film thicknesses to cover the range of pipe sizes from ¼ ~~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.~~ -in. to 30-in. (6.3 to 762 mm) for interference fit joints.

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~~X2.1). ~~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~~ Solvent cements ~~should~~must be stored in a ~~cool place except when actually in use at the job site. These~~ cool, dry place. All solvent 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~~ life. Consult the solvent cement manufacturer for specific ~~storage~~ recommendations on storage conditions and shelf life. The solvent cement is unsuitable for use ~~on the job~~ if it exhibits an appreciable change from the original viscosity, or if ~~a sign~~ signs of gelation ~~is~~ (jelly-like) are apparent. Restoration of the original viscosity or removal of gelation by adding solvents or thinners is not recommended.

6.3 *Chemical Cleaners*—~~Cleaners are of two types, chemical and mechanical (abrasives). Cleaners are~~ Chemical cleaners are used to remove surface ~~impurities (oil, dirt, etc.) and surface gloss.~~ debris only (for example, oil, dirt, grease, hydraulic fluid, paint, etc.). Chemical cleaners are not primers and therefore, do not soften the plastic surfaces. Chemical cleaner does not meet the 10% dissolution rule specified in Specification F656. A chemical cleaner is as follows:

6.3.1 ~~*Chemical Cleaners*—The chemical cleaners are as follows:~~ Cleaner recommended by the pipe, fittings, or solvent cement manufacturer.

~~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: Sandpaper or similar abrasive clothes or grinders shall not be used to clean pipe or fittings.

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

NOTE 4—This practice can remove significant amount of material from the surfaces to be joined which will adversely affect the interference fit of the pipe and fitting and reduce the joint strength.

6.3.2.2 Clean, oil-free steel wool.

NOTE 5—Consult with pipe, fittings, and solvent cement manufacturers for their specific recommendations for mechanical abrading.

6.4 *Primers*—Primers are used to clean, soften, 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 joining. Refer F656. Primers may also be used as cleaners; refer to specific recommendations of the manufacturer. 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 Using a suitable cutter, cut the pipe perpendicular to the 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 pipe axis.

NOTE 6—It is important to cut the pipe perpendicular (square) to the pipe axis. A square cut provides maximum bonding area on the surface of the pipe. Tools used to cut plastic pipe must be in good condition and used in accordance with the tool manufacturer's recommendations. If there is any indication of damage or evidence of cracking after cutting the pipe, cut off at least 2 in. (50.8 mm) beyond any visible crack. Care must be exercised if using ratchet cutters, especially at 50°F (10°C) or lower temperatures, as they may split the pipe if not properly used and maintained. Care must also be exercised if using wheel-type plastic tubing cutters with a blade made for cutting plastic pipe, as they will create raised ridges which are caused by material displacement from the downward force of the cutting wheel and must be removed.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—Chamfering and Deburring:* 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.

7.2.1 *Chamfering.*—Chamfer the exterior pipe edge with a file or a chamfering tool specifically designed for plastic pipe. The chamfer angle shall be between 10° and 22½° with a width range of a minimum 3⁄32 to a maximum 5⁄16 of an inch (2.5 to 7.9 mm) depending upon the pipe diameter (See Fig. 6 for tolerances). It is necessary to chamfer the exterior pipe edge to remove the burrs, raised ridges or sharp edges. or both, from the exterior pipe edge created by the pipe cutting process. (See Fig. 6.)

NOTE 7—Burrs, raised ridges or sharp edges or any combination thereof, if not removed, will scrape away softened socket material and deposit it and solvent cement into the fitting or pipe waterway creating a potential leak path in the joint. This accumulation of softened socket material and solvent cement inside the waterway of the pipe and fitting must be avoided. Chamfering allows the pipe to enter the fitting socket cleanly and uniformly. Chamfering minimizes the potential for a leak path. A chamfering tool or a file is suitable for this purpose. Do not use handheld disc type side grinders to chamfer pipe.

FIG. 5 Apparatus for Cutting PipeCut the pipe straight at a 90° angle.

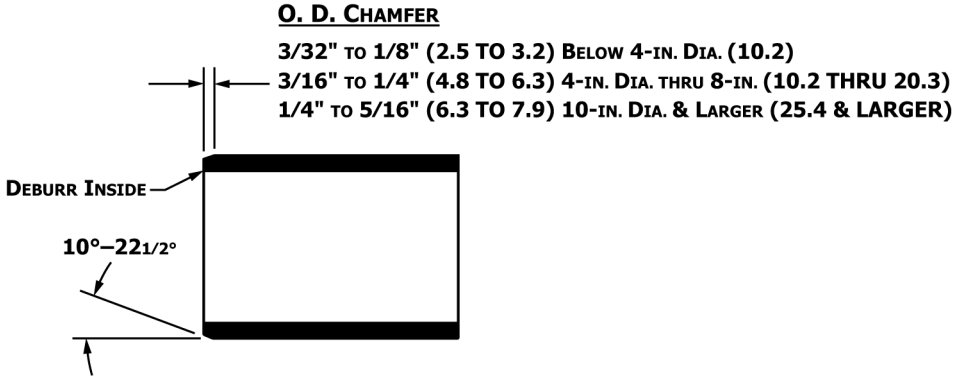

FIG. 6 Chamfer and ~~Deburring of~~Debur the Pipe ~~Edges~~End

7.2.2 *Deburring*—If burrs are present on the inside edge of the pipe, remove with a deburring tool.

NOTE 8—It is important to remove the burrs from the interior (waterway) to prevent obstructions and to enhance fluid flow.

7.3 ~~*Test Dry Fit of the* *Dry* Joint (see~~*Tightness* ~~Fig. 7)~~*Test*— ~~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~~ Prior to applying primer and solvent cement, insert the pipe gently and slowly into the socket until the first sign of resistance is detected to determine the point of interference. Check that an interference fit between the pipe and fitting occurs at approximately ⅓ ~~to~~ to ⅔ of the socket depth. ~~Sometimes, when the pipe and fittings~~Do not force components together.

NOTE 9—Pipe and fittings are designed to have an interference fit. An interference fit occurs when the outside pipe diameter contacts (interferes) with the inside diameter of the fitting. An interference fit is essential to make a strong and leak-free joint and indicates an acceptable dimensional conformance between the components. If the fit between the pipe and fittings is loose, replace the pipe or fittings in order to obtain a proper interference fit between the components. Do not attempt to join pipe and fittings that do not have an interference fit.~~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~~Use a clean, dry cloth to clean the surfaces of pipe and fittings and to remove all foreign materials.

NOTE 10—Proper surface preparation is required to maximize the integrity of the joint. Foreign materials can impede the chemical joining process. Surfaces to be joined must be free of foreign materials (for example, oil, dirt, grease, hydraulic fluid, paint, etc.). If joining surfaces cannot be cleaned by wiping with a clean, dry cloth, a chemical cleaner must be used.

NOTE 11—Check chemical cleaners for compatibility with plastic material. Chemical cleaners only clean the pipe and fittings and will not soften the joining surfaces. Softening of surfaces is only accomplished by primer and solvent cement. If pipe and fittings are not properly cleaned, primer and solvent cement will not soften the joining surfaces. Follow the proper handling procedures provided by the chemical cleaner manufacturer.~~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 *Mark the Pipe:* Measure the socket depth and transfer this measurement to the pipe O.D. with a mark. From this mark, place a second mark 2 in. (50.8 mm) further up the pipe, where possible.

FIG. 7 ~~Pipe Entering Dry Fitting~~Debur and Chamfer the Pipe End