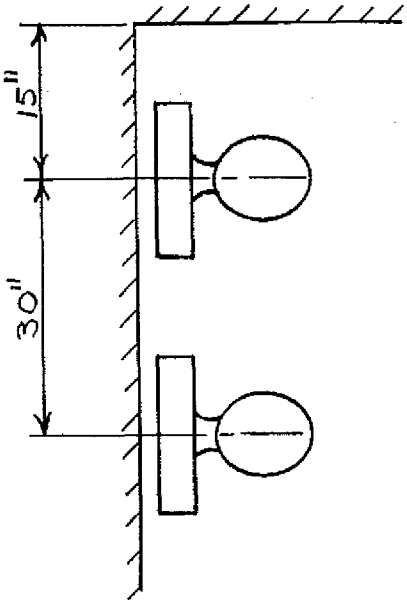
ILHR 84

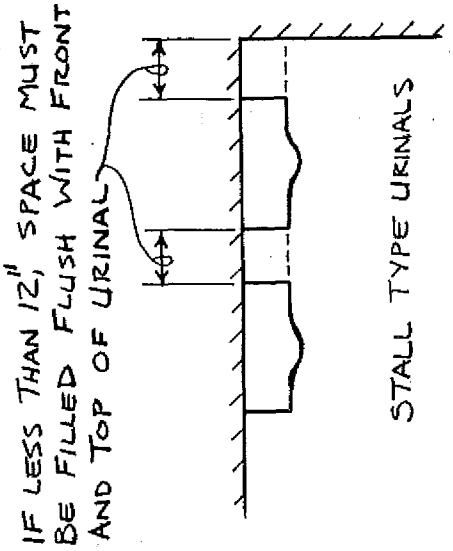
APPENDIX

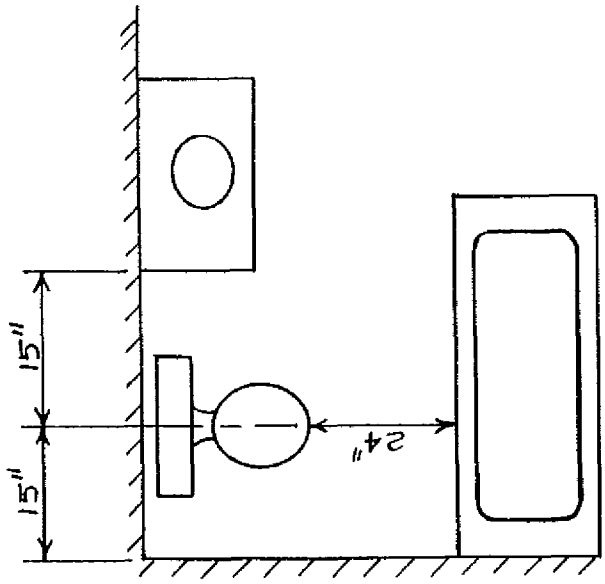
The material contained in this appendix is for clarification purposes only. The notes, illustrations, etc., are numbered to correspond to the number of the rule as it appears in the text of the code.

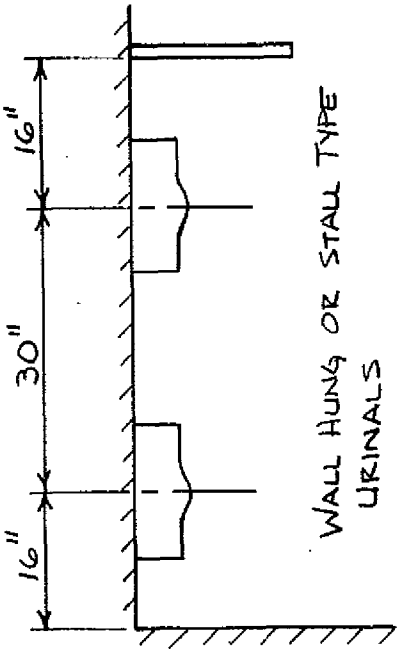
ILHR 84 Appendix

A-84.20 (5) SPACING OF PLUMBING FIXTURES.

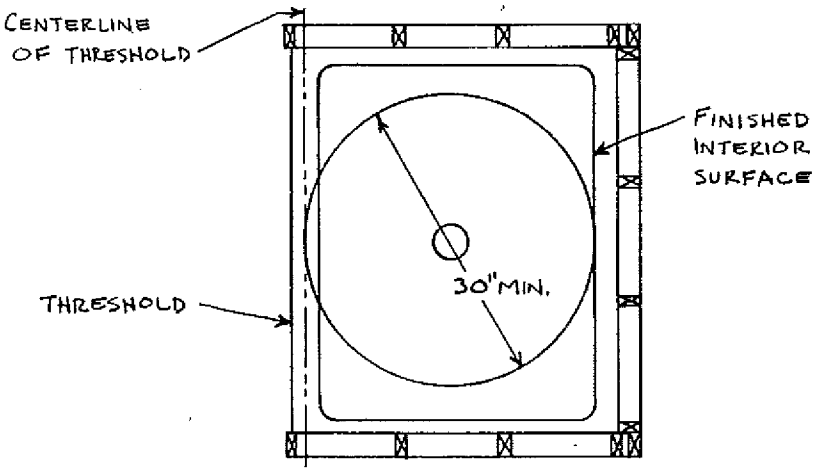


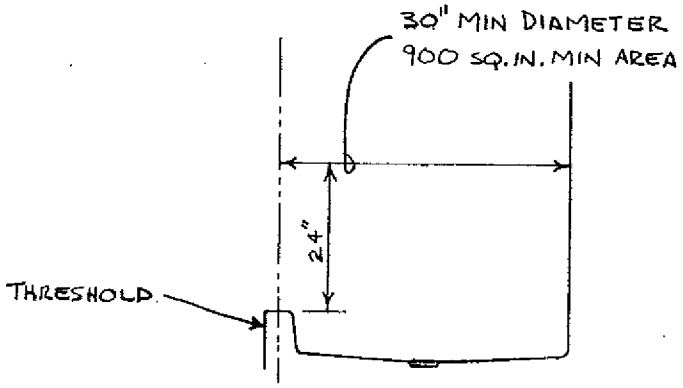




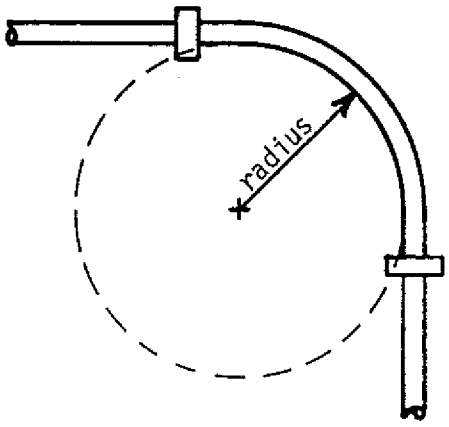


A-84.20 (5) MINIMUM SIZE OF SHOWER COMPARTMENTS.





A-84.30 (4) MEASURING RADIUS OF A BEND IN PB PIPE OR TUBING.



A-Tables 84.30-8 and -9. ASTM D2774. The following is a reprint of excerpts from ASTM D2774-72(R1978), Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

Designation: D 2774 – 72 (Reapproved 1983)

Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping[1]

This standard is issued under the fixed designation D 2774; 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 method has been approved for use by agencies of the Department of Defense and for listing in the DOD Index of Specification and Standards.

INTRODUCTION

In general, thermoplastic pressure pipe can support earth loads without sustaining excessive stress by mobilizing lateral passive soil forces and internal pressure forces. Thermoplastics have the ability to be deformed without a proportionate increase in stress allowing internal forces to oppose external forces. Proper installation technique ensures that the necessary passive soil pressures at the sides of the pipe will be developed and maintained.

Soils in which trenches are dug should be examined and identified and the trenches prepared and backfilled in accordance with sound bedding practices and this recommendation.

1. Scope

1.1 This recommended practice covers procedures and references ASTM specifications for underground installation of thermoplastic pressure piping, 6 in. nominal size and smaller. It is beyond the scope of this document to describe these procedures in detail since it is recognized that significant differences exist in their implementation depending on kind and type of pipe material, pipe size and wall thickness, soil conditions, and the specific end use. Specific pipe characteristics and end use requirements may dictate modification of the procedures stated or referenced herein.

NOTE—The values stated in U.S. customary units are to be regarded as the standard.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

2.1.1 *Pipe and Tubing:*

D 1503 Specification for Cellulose Acetate Butyrate (CAB) Plastic Pipe, Schedule 40[2]

D 1527 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80[3]

D 1785 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120[3]

D 2104 Specification for Polyethylene (PE) Plastic Pipe, Schedule 40[3]

D 2239 Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter[3]

D 2241 Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR) Series[3]

D 2282 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)[3]

D 2446 Specification for Cellulose Acetate Butyrate (CAB) Plastic Pipe (SDR-PR) and Tubing[3]

D 2447 Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80 Based on Outside Diameter[2]

D 2662 Specification for Polybutylene (PB) Plastic Pipe (SDR-PR)[3]

D 2666 Specification for Polybutylene (PB) Plastic Tubing[3]

D 2672 Specification for Joints for IPS PVC Pipe Using Solvent Cement[3]

D 2737 Specification for Polyethylene (PE) Plastic Tubing[3]

D 2740 Specification for Poly(Vinyl Chloride) (PVC) Plastic Tubing[3]

2.1.2 *Joining Materials:*

D 2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings[2]

D 2464 Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80[3]

D 2465 Specification for Threaded Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80[2]

D 2466 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40[3]

D 2467 Specification for Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80[3]

D 2468 Specification for Acrylonitrile-Butadiene Styrene (ABS) Plastic Pipe Fittings, Schedule 40[3]

D 2469 Specification for Socket-Type Acrylonitrile-Butadiene Styrene (ABS) Plastic Pipe Fittings, Schedule 80[2]

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[1] This recommended practice is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.61 on Water Pipe.

Current edition approved Nov. 20, 1972. Published February 1973. Originally published as D 2774 – 69 T. Last previous edition D 2774 – 69 T.

[2] Discontinued, see *1986 Annual Book of ASTM Standards*, Vol 08.04.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

D 2560 Specification for Solvent Cements for Cellulose Acetate Butyrate (CAB) Plastic Pipe, Tubing, and Fittings[3]
D 2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings[3]
D 2610 Specification for Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 40[4]
D 2611 Specification for Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 80[4]
D 2657 Practice for Heat-Joining Polyolefin Pipe and Fittings[2]
D 2683 Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing[3]
2.1.3 *End Use Specification:*
D 2513 Specification for Thermoplastic Gas Pressure Piping Systems[3]
2.1.4 *Miscellaneous:*
D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure[3]
D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[3]
D 2122 Method of Determining Dimensions of Thermoplastic Pipe and Fittings[3]
D 2152 Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion[3]
D 2444 Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)[3]

3. Joining

3.1 Plastic pipe may be joined together or to other pipes of dissimilar material using a number of different techniques. The technique used must be suitable for the particular pipes being joined to one another. Manufacturers should be consulted for specific instructions not covered by existing specifications. When requesting information, the intended service application should be made known.

3.2 Skill and knowledge on the part of the operator are required using recommended techniques to obtain quality joints. Training of new operators should be made under the guidance of skilled operators.

3.3 Joining specifications are listed under 2.1.2 of this recommended practice.

4. Trenching

4.1 *Trench Contour*—The trench bottom should be continuous, relatively smooth, and free of rocks. Where ledge rock, hardpan or boulders are encountered, it is advisable to pad the trench bottom using sand or compacted fine grained soils.

4.2 *Trench Width*—The width of the trench at any point below the top of the pipe should be sufficient to provide adequate room for: (*1*) joining the pipe in the ditch, if this is required; (*2*) snaking a pipe from side-to-side along the bottom of the ditch, if recommended by the pipe manufacturers; and (*3*) filling and compacting the side fills. Minimum trench widths may be utilized with most pressure pipe materials by joining the pipe outside the trench and lowering into the trench after adequate joint strength has been obtained.

4.3 *Trench Depth and Pipe Cover*—Soil conditions, pipe size and necessary cover determine trench depth. Sufficient cover must be maintained to keep external stress levels below acceptable design stresses.[5] Reliability and safety of service may assume major importance in determining minimum cover for any intended service. Local, state or national codes may also govern. Pipe intended for potable water service should be buried at least 305 mm (12 in.) below maximum expected frost penetration. A minimum cover of 609 mm (24 in.) is considered desirable for pipe subject to heavy overhead traffic. In areas of light overhead traffic a cover of 305 to 457 mm (12 to 18 in.) is usually considered sufficient.

5. General Requirements for Bedding and Backfill

5.1 The pipe should be uniformly and continuously supported over its entire length on firm stable material. Blocking should not be used to change pipe grade or to intermittently support pipe across excavated sections.

5.2 Pipe is installed in a wide range of subsoils. These soils should be not only stable but also applied in such a manner as to physically shield the pipe from damage. Attention should be given to local pipe laying experience which may indicate solutions to particular pipe bedding problems.

5.3 Backfill materials according to the requirements of "Soil Types" (see Appendix X1) with a particle size of 12.7 mm (½ in.) or less should be used to surround the pipe. It should be placed in layers. Each soil layer should be sufficiently compacted to uniformly develop lateral passive soil forces during the backfill operation. It may be advisable to have the pipe under pressure.

5.4 Effects of ground freezing should be considered when pipe is installed at depths subject to frost penetration.

5.5 Vibratory methods are preferred when compacting sand or gravels. Best results are obtained when the soils are in a nearly saturated condition. Where water flooding is used, the initial backfill should be sufficient to ensure complete coverage of the pipe. Additional material should not be added until the water flooded backfill is firm enough to walk on. Care should be taken to avoid floating the pipe.

5.6 Sand and gravel containing a significant proportion of fine-grained material, such as silt and clay, should be compacted by hand or, preferably, by mechanical tamper.

5.7 The remainder of the backfill should be placed and spread in approximately uniform layers in such a manner as to fill the trench completely so that there will be no unfilled spaces under or about rocks or lumps of earth in the backfill. Large rocks, frozen clods and other debris greater than 76 mm (3 in.) in diameter should be removed. Rolling equipment or heavy tampers should only be used to consolidate the final backfill.

[4] Discontinued, see *1977 Annual Book of ASTM Standards*, Part 34.

[5] Spangler, M. G., "Secondary Stresses in Buried Pressure Lines," The Iowa State College Bulletin, Engineering Report 23 of the Iowa Engineering Experiment Station, 1954 to 1955.

6. Installation Precautions

6.1 Plastic pipe should be stored so as to prevent damage by crushing or piercing. If stored at any length of time, it should be under cover and not in direct sunlight in accordance with the manufacturer's recommendations.

6.2 Care should be taken to protect the pipe from excessive heat or harmful chemicals. Cleaning solutions, detergents, solvents, etc., should be used with caution.

6.3 Pipe may be bent to a minimum radius recommended by the manufacturer for the kind, type, grade, wall thickness, and diameter of a specified pipe. Otherwise changes in direction should be made using suitable fittings.

6.4 Pipe joined using solvent cementing techniques should not be handled or installed in the ditch until after the joints are sufficiently "cured" to prevent weakening the joint.

6.5 During pipe lowering in operations, care should be taken to avoid imposing strains that will overstress or buckle the piping or impose excessive stress on the joints.

6.6 When ditched pipe has been assembled on top of the ditch, it is advisable to cool the pipe to ground temperature before backfilling to prevent pull out due to thermal contraction.

6.7 Suitable anchoring methods should be used to prevent excessive longitudinal or bending movement of the piping.

APPENDIXES

(Nonmandatory Information)

X1. SOIL TYPES

X1.1 A soil is considered stable if it provides dependable support to the pipe and undergoes only slight volume change with variation in its moisture content. The ability of a soil to provide support depends upon its resistance to consolidation and its shear strength. In general, coarse grained soils are considered stable; in the United Soil Classification these are defined as soils of which 50 percent or less pass U.S. Standard No. 200 sieve.

NOTE X1—The particle passing through No. 200 sieve is about the smallest size visible to the naked eye.

X1.2 Using the group symbols of the Unified Soil Classification (Appendix X3) the following are considered stable backfill: Gw, GP, GM, GC, SW Sp, provided that maximum particle size is not greater than 12.7 mm (½ in.).

X1.3 In terms of all over-all use, gravel with fines and sand are the best backfill materials for pressure pipe. Sand or gravel mixed with silts or clays, in which the sand or gravel constitute at least 50 percent of the mixture, are also suitable. Certain soils should not be used as backfill material; these include organic soils, identified by odor or spongy feel, and fat, highly plastic expansive clay. Frozen soil should not be placed in contact with the pipe.

X2. FIELD IDENTIFICATION OF SOILS

X2.1 *Gravel*—Minimum grain size 6.4 mm (¼ in.).

X2.2 *Sand*—Individual grains visible to the naked eye with maximum particle size about 6.4 mm (0.25 in.). Fine sands display dilatancy and are nonplastic.

NOTE X2—To test for dilatancy, place a pat of moist soil on the palm of the hand. If the soil displays dilatancy, water will appear at the surface of the pat on shaking and disappear when the pat is compressed by the fingers.

X2.3 *Silt*—Individual grains difficult to see with the naked eye. May be slightly plastic. Displays dilatancy. Easily washed from fingers. Low dry-strength.

X2.4 *Lean Clay*—Individual grains difficult to see with the naked eye. Dry lumps have moderate to high strength. Can be rolled into a 3.2-mm (⅛-in.) thread having low to moderate strength. Does not display dilatancy.

X2.5 *Fat Clay*—Shows no or very slow dilatancy and should not be used unless mixed with coarse grained material. Has high dry-strength. Has soapy feel and shiny streak results if fingernail is run over damp surface. Can be rolled into 3.2-mm (⅛-in.) threads having relatively high strength.

X3. UNIFIED SOIL CLASSIFICATION—GROUP SYMBOLS

GW—Well-graded gravels, gravel-sand mixtures, little or no fines.

GP—Poorly graded gravels, gravel-sand mixtures, little or no fines

GM—Silty gravels, poorly graded gravel-sand-silt mixtures.

GC—Clayey gravels, poorly graded gravel-sand-clay mixtures.

SW—Well-graded sands, gravelly sands, little or no fines.

SP—Poorly graded sands, gravelly sands, little or no fines.

SM—Silty sands, poorly graded sand-silt mixtures.

ILHR 84 Appendix

A-84.40 ASTM F402. The following is a partial reprint of excerpts from ASTM F402-80, Practice for Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings.

Designation: F 402 – 80

An American National Standard

Standard Practice for Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings[1]

This standard is issued under the fixed designation F 402; 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.

1. Scope

1.1 This practice covers procedures for safe handling of solvent cements and primers used in joining thermoplastic pipe and fittings. The procedures are general ones and include safeguards against hazards of fire and precautions for protection of personnel from breathing of vapors and contact with skin or eyes.

2. Referenced Documents

2.1 *ASTM Standards:*

D 2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings[2]

D 2560 Specification for Solvent Cements for Cellulose Acetate Butyrate (CAB) Plastic Pipe, Tubing and Fittings[2]

D 2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings[2]

D 2846 Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems[2]

D 2855 Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings[2]

D 3122 Specification for Solvent Cements for Styrene-Rubber Plastic Pipe and Fittings[2]

D 3138 Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components[2]

F 493 Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride), (CPVC) Plastic Pipe and Fittings[2]

F 545 Specification for PVC and ABS Injected Solvent Cemented Plastic Pipe Joints[2]

3. Definition

3.1 *solvent cement*—an adhesive made by dissolving a plastic resin or compound in a suitable solvent or mixture of solvents. The solvent cement dissolves the surfaces of the pipe and fittings to form a bond between the mating surfaces provided the proper cement is used for the particular materials and proper techniques are followed.

3.2 *primer*—an organic solvent, or blend of solvents, which enhances adhesion, applied to plastic pipe and fittings prior to application of a solvent cement.

4. Safety

4.1 A number of the solvents contained in primers and solvent cements are classified as airborne contaminants and flammable and combustible liquids. These primers and solvent cements generally are composed of solvent blends which vary with manufacturers. Follow precautions given herein to prevent fire and injury to personnel. Specific safety information on a particular solvent cement or primer may be found in the Material Safety Data supplied by the manufacturer.

4.2 Avoid prolonged breathing of solvent vapors. When pipe and fittings are being joined in partially enclosed areas, use a ventilating device in such a manner as to maintain a safe level of vapor concentration with respect to toxicity (1 and 3)[3] and flammability (5) in the breathing area. Select ventilating devices and locate them so as not to provide a source of ignition to flammable vapor mixtures.

4.3 Keep solvent cements away from all sources of ignition, heat, sparks, and open flame (5).

4.4 Keep containers for solvent cements and primers tightly closed except when the product is being used. The container type shall be in accordance with Parts 1 to 199, Title 49—Transportation, Code of Federal Regulations. Container labeling shall conform with the requirements of the Federal Hazardous Substance Act as amended.

4.5 Dispose of all rags and other materials used for mopping up spills in a safety waste receptacle. Empty the receptacle daily with proper consideration for the flammable and toxic contents.

4.6 Most of the solvents used in pipe cements and primers can be considered eye irritants and contact with the eye should be avoided as it may cause eye injury. Proper eye protection and the use of chemical goggles or face shields is advisable where the possibility of splashing exists in handling solvent cements or primers. In case of eye contact, flush with plenty of water for 15 min and call a physician immediately.

4.7 Avoid contact with the skin. Wear proper gloves impervious to and unaffected by the solvents when contact with the skin is likely. Application of the primers or solvent cements with rags and bare hands is not recommended. Brushes and other suitable applicators can be used effectively for applying the solvent cement or primers, thus avoiding skin contact. Dispose of used applicators in the same manner as the rags (see 4.5). In the event of contact, remove contaminated clothing immediately and wash skin with soap and water. Ensure that contaminated clothing is free of flammable and toxic materials before wearing them again.

[1] This practice is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems, and is the direct responsibility of Subcommittee F17.20 on Joining.

Current edition approved May 30, 1980. Published September 1980. Originally published as F 402 – 74. Last previous edition, F 402 – 74.

[2] *Annual Book of ASTM Standards*, Vol 08.04.

[3] The boldface number in parenthesis refers to the list of references at the end of this practice.

F 402

REFERENCES

(1) *Threshold Limit Values of Airborne Contaminants,* issued annually American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

(2) *Hygienic Guide Series,* American Industrial Hygiene Assn., Akron, Ohio, AIHAA. Booklets on Cyclohexanone, Dimethylformamide, Methyl Ethyl Ketone, and Tetrahydrofuran.

(3) Occupational Safety and Health Standards Federal Register Title 29, Part 1910.

(4) *Handbook of Chemistry,* Lange, N. A., editor, Eleventh Ed., McGraw-Hill Book Company, Inc., New York, NY, 1973.

(5) "Flammable Liquids," *National Fire Codes* NFICA, issued annually, "Flammable Liquids," National Fire Protection Association.

(6) *Dangerous Properties of Industrial Materials,* Sax, Fifth Ed. Van Nostrand Reinhold Co., New York, NY, 1979.

(7) *Clinical Toxicology of Commercial Products,* Fourth Ed., Williams and Wilkins Co., Baltimore, MD, 1976.