

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
ASSISTANT SECRETARY FOR HOUSING -
FEDERAL HOUSING COMMISSIONER

Use of Materials
Bulletin No. 79a

TO: REGIONAL ADMINISTRATORS, DIRECTORS,
OFFICES OF REGIONAL HOUSING, FIELD
OFFICE MANAGERS AND SUPERVISORS

Supersedes UM 79
Dated April 25, 1978

March 7, 1982

SUBJECT: ACRYLONITRILE-BUTADIENE-STYRENE (ABS) AND POLY (VINYL CHLORIDE)
(PVC) PLASTIC DRAIN, WASTE AND VENT PIPE AND FITTINGS

Members of the HUD Staff processing cases and inspecting construction shall use this information in determining acceptability of the subject material for the uses indicated.

This bulletin should be filed with Bulletins on Special Methods of Construction and Materials as required by prescribed procedures. Additional copies may be requisitioned by the field offices.

The technical description, requirements and limitations expressed herein do not constitute an endorsement, approval or acceptance by the Department of Housing and Urban Development of the subject matter, and any statement or representation, however made, indicating approval or endorsement by the Department of Housing and Urban Development is unauthorized and false, and will be considered a violation of the United States Criminal Code 18, U.S.C. 709.

Any reproduction of this Bulletin must be in its entirety and any use in sales promotion or advertising is not authorized.

Subject to good workmanship, compliance with applicable codes, and the methods of application listed herein, the materials described in this bulletin may be considered suitable for HUD Housing Programs, including Housing for the Elderly and Care-Type Housing.

The eligibility of a property under these Programs is determined on the property as an entity and involves the consideration of underwriting and other factors not indicated herein. Thus, compliance with this bulletin should not be construed as qualifying the property as a whole, or any part thereof, as to its eligibility.

The methods of application for the materials listed herein are to be considered as part of the HUD Minimum Property Standards and shall remain effective until this bulletin is cancelled or superseded.

SECTION I - GENERAL STATEMENT

This Bulletin sets forth the requirements and conditions for the acceptance of plastic drainage, waste and vent pipe and fittings manufactured from Acrylonitrile-Butadiene-Styrene (ABS) or Poly (Vinyl Chloride)(PVC) plastic. These materials are acceptable for use in the applications detailed in Section II. Terminology used is consistent with that of the nationally recognized model plumbing codes.

This Bulletin supersedes the following Use of Materials Bulletins and Notice:

<u>Number</u>	<u>Subject</u>	<u>Date</u>
UM 53a	Polyvinyl Chloride Plastic Drainage Waste and Vent Pipe and Fittings	February 22, 1971
UM 54	ABS (Acrylonitrile-Butadiene-Styrene) Plastic Drainage Waste and Vent Pipe and Fittings	March 2, 1970
*UM 79	Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings	April 25, 1978
Notice H 78-99 (HUD)	Clarification of Use of Materials Bulletin No. 79, Acrylonitrile-Butadiene- Styrene and Poly(Vinyl Chloride) Drain, Waste and Vent Pipe and Fittings	September 20, 1978

SECTION II - ALLOWABLE USES

ABS and PVC pipe, fittings and joining materials conforming to the standards and other publications referenced in Section III are acceptable for use in the construction of storm and sanitary drain-waste-vent (DWV) systems and building sewers for single and multifamily structures, including Housing for the Elderly and Care-Type Housing.

Included in these uses are interior storm water conductors, building storm drains, building storm sewers, and drain lines connecting septic tanks and soil absorption systems.

Exposure of ABS and PVC in parking garages, boiler/mechanical rooms or service/storage rooms - such pipe may be exposed in these spaces as long as they are protected from hot surfaces and mechanical damage, and are otherwise properly installed in accordance with the provisions of this Bulletin.

*Revised

SECTION III - REFERENCE STANDARDS

The latest editions of the following publications form a part of this Bulletin:

ASTM Standards and Specifications 1/

- D 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- D 1788 Rigid Acrylonitrile-Butadiene-Styrene (ABS) Plastics
- D 2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
- D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
- D 2564 Solvent Cement for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- D 2661 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings
- D 2665 Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
- D 2855 Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- D 3311 Drain, Waste and Vent (DWV) Plastic Fittings Patterns
- E 119 Standard Methods of Fire Tests of Building Construction and Materials
- *F 628 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe Having a Foam Core

Other Publications

- PPI 2/ TR 3/ 12 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Piping Design and Installation
- PPI TR 13 Poly(Vinyl Chloride) (PVC) Plastic Piping Design and Installation

1/ American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103

2/ Plastic Pipe Institute, A Division of the Society of the Plastics Industry, 355 Lexington Avenue, New York, New York 10017

3/ Technical Report of the Plastics Pipe Institute

*Revised

PPI TR 21 Thermal Expansion and Contraction of Plastic Pipe

PPI Plastics Pipe Manual

NSF 4/ Standard No. 14 Thermoplastic Materials, Pipe, Fittings Valves, Traps and Joining Materials

SECTION IV - MATERIALS

A. Composition and Properties

Pipe, fittings and joint cements shall be manufactured from materials as defined in the following specifications:

<u>Pipe and Fittings</u>	<u>Joint Cements</u>
ABS (Pipe) Type I Grade 2 ASTM D 1788	ASTM D 2235 (for ABS)
*ABS (Pipe) Foam Core ASTM F 628	
ABS (Fittings) Virgin black ASTM D 2661	
PVC (Pipe and Fittings) Virgin Type I (Grade 1 or 2), ASTM D 1784	ASTM D 2564 (for PVC)

B. Dimensional Details and Test Requirements

Dimensions, tolerances, shapes and applicable test requirements for pipe, fittings and joint cements shall conform with the following specifications:

<u>Pipe and Fittings</u>	<u>Joint Cements</u>
ABS ASTM D 2661	ASTM D 2235
*ABS ASTM F 628 (Foam Core)	ASTM D 2235
PVC ASTM D 2665	ASTM D 2564

4/ National Sanitation Foundation, P. O. Box 1468, Ann Arbor, Michigan 48106

*Revised

SECTION V - SYSTEM DESIGN AND INSTALLATION REQUIREMENTS

A. General Requirements

The selection, design, installation and leak testing of plastic piping systems shall conform with all applicable requirements of the HUD Minimum Property Standards, the applicable nationally recognized model code and industry standards of good practice as referenced below and summarized in Appendix A.

B. Requirements for Making Joints and Connections

The materials and installation techniques used for joining pipes and fittings shall assure adequate resistance of the completed system to leaking, and shall assure adequate resistance to joint failure from long-term exposure to the service environment. Only solvent cements with shelf life marking shall be used, and cements shall be used before expiration of the shelf life period. The recommendations of the manufacturer and applicable industry standards shall be followed in making joints and connections. Standards and other publications defining generally accepted practice include the following:

- ABS ASTM D 2661, Appendix XI
- * ASTM F 628, Appendix A1
- PPI TR 12, Paragraph 6.2
- PPI Plastics Piping Manual; Chapter 4, Page 40,
Chapter 5, Pages 48-49

- PVC ASTM D 2855
- ASTM D 2665, Appendix XI.
- PPI Plastics Piping Manual; Chapter 4, Page 40,
Chapter 7, Pages 59-60

C. Control of Expansion and Contraction

Design and installation detail shall provide for accommodation of thermal expansion and contraction without compromising the essential performance of the system. Hangers and supports, restraining fittings or expansion joints, and clearances adjacent to pipe and fittings shall be in accordance with the manufacturer's recommendations and applicable industry standards. Publications defining generally accepted practice include the following:

- ABS ASTM D 2661, Appendix XI
- * ASTM F 628, Appendix A1
- PPI TR 12, Section 4.2
- PPI TR 21
- PPI Plastics Piping Manual, Chapter 5

*Revised

PVC ASTM D 2665, Appendix XI.
PPI TR 13, Sections 4.2 and 6.1
PPI TR 21
PPI Plastics Piping Manual, Chapter 7, Page 56

D. Requirements for Hangers and Supports

Hangers and straps shall not damage the pipe or fittings. Supports shall be provided for horizontal piping at intervals sufficient to prevent deflections (sagging) likely to interfere with drainage or leak resistance. Vertical stacks shall be anchored at appropriate intervals.

Selection and installation of hangers and supports shall be in accordance with the manufacturer's recommendations and applicable industry standards. Publications defining generally accepted practice include the following:

ABS ASTM D 2661, Appendix XI
* ASTM F 628, Appendix A1
PPI TR 12, Paragraph 6.1
PPI Plastics Piping Manual, Chapter 5, Page 50

PVC ASTM D 2665, Appendix XI
PPI TR 13, Paragraph 6.1
PPI Plastics Piping Manual; Chapter 4, Page 41,
Chapter 7, Page 58

E. Requirements for Underground Installation

Techniques used for trenching and back-filling shall not produce stresses and strains, or cutting or abrasive effects, likely to interfere with drainage or leak resistance or to result in structural collapse of pipe or fittings. Earth and live loads shall be less than the manufacturer's published load rating for the material and conditions of installation. Methods of installation used shall be in accordance with the manufacturer's recommendations and applicable industry standards. Publications defining generally accepted practice include the following:

ABS ASTM D 2321
ASTM D 2661, Appendix XI
* ASTM F 628, Appendix A1
PPI TR 12, Paragraph 6.3
PPI Plastics Piping Manual, Chapter 5

PVC ASTM D 2321
ASTM D 2665, Appendix XI
PPI TR 13, Paragraph 6.3
PPI Plastics Piping Manual, Chapter 7

*Revised

F. Requirements for Fire Safety

The following construction requirements for the use of thermoplastic DWV piping in non-fire rated and fire rated construction shall be complied with:

1. All vertical and horizontal runs of plastic pipe (not including fixture trap and trap arm/lateral) in private (habitable room) and public spaces shall be enclosed in walls, partitions, floor/ceiling assemblies, chases or shafts regardless of fire rating of these elements of construction. Exceptions are (a) Unfinished basements of one and two family dwellings (including row type housing) (2) Parking garages (3) Crawl spaces (4) Mechanical equipment rooms (5) and similar areas.
2. DWV systems installed in fire rated walls and chases shall not compromise the fire endurance ratings of such building elements as required in Section 405 of the HUD Minimum Property Standards. The following construction procedures shall be addressed so that fire rating of walls and chases are not compromised.
 - a. All penetrations through required fire resistive walls, partitions or chases, which are cut to allow the passage of plastic pipe, shall not be excessively larger than required for passage of the lateral and shall be back packed or sealed with plaster spackling or suitable non-combustible material and covered with an escutcheon.
 - b. Plastic pipes or laterals penetrating required fire resistive wall membranes shall not be greater than three inches in diameter.
 - c. Thermoplastic stacks and risers in chases more than forty feet in height shall be sleeved with galvanized steel not thinner than eighteen gauge and shall be fire-stopped and back packed as described above at each floor where the pipe is anchored, but not less than every fourth floor. Sleeves shall be not less than four pipe diameters in length or twelve inches, whichever is greater, and shall be positioned midway in the firestop.
 - d. The pipe and fittings of a plastic piping assembly enclosed in a (required) fire resistive wall or chase shall have sufficient clearance so that no part of the assembly, (e.g. fitting body or hub) other than the pipe lateral, penetrates the backside of the wall membrane.
3. Departure from the above construction requirements may be taken only on the basis of tests demonstrating that fire safety is not compromised by the proposed construction.

SECTION VI - HANDLING AND STORAGE REQUIREMENTS

Exposure to sunlight, heat, and cold, impact and superimposed weight can have a deleterious effect on plastic materials. Therefore, care shall be taken in handling and storage so that the performance characteristics of pipe and fittings are not compromised. Handling and storage methods shall be in accordance with the manufacturer's recommendations and applicable industry standards. Publications defining generally accepted practice include the following:

ABS ASTM D 2661, Appendix XI.
PPI TR 12, Paragraph 5
PPI Plastics Piping Manual; Chapter 4, Page 40
Chapter 5, Page 48

PVC ASTM D 2665, Appendix XI.
PPI TR 13, Paragraph 5
PPI Plastics Piping Manual; Chapter 4, Page 40

SECTION VII - DETERMINATION OF COMPLIANCE

Marking - Pipe, fittings and joining materials shall be marked or labeled in accordance with the following standards as applicable:

ABS ASTM D 2235
ASTM D 2661
ASTM D 3311
* ASTM F 628 (Foam Core)

PVC ASTM D 2564
ASTM D 2665

The marking shall indicate the applicable ASTM Specification and shall show the logo of an acceptable independent inspection agency 5/. In addition, the marking shall identify the manufacturer's name or trademark.

5/ One such agency is the National Sanitation Foundation Testing Laboratory, Ann Arbor, Michigan 48106, whose logo for DWV thermoplastic piping products is "NSF-dwv" certifying compliance with the requirements of the standard(s) identified by the marking. This program is administered under the protocol detailed in NSF 14, Thermoplastic Materials, Pipe, Fittings, Valves, Traps and Joining Materials.

*Revised

G U I D E
FOR
GENERALLY ACCEPTED PRACTICE
FOR
THE DESIGN AND INSTALLATION
OF
ABS AND PVC PLASTIC DRAIN, WASTE AND VENT SYSTEMS
AND
BUILDING SEWERS FOR RESIDENTIAL BUILDING

A P P E N D I X A

FOR
HUD USE OF MATERIALS BULLETIN NO. 79a

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
OFFICE OF MANUFACTURED HOUSING AND CONSTRUCTION STANDARDS
CONSTRUCTION STANDARDS DIVISION
WASHINGTON, D. C. 20410

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1. BACKGROUND

It is generally understood that satisfactory plumbing systems depend on accepted good practice for design and installation. Plumbing codes and regulating agencies usually require that installations be made in accordance with established good practice and with the recommendations of the manufacturer.

Although much valuable material is available in several different published documents, HUD examiners and inspectors need a concise and specific summary guide which reflects accepted good practice as it pertains to their particular needs.

2. PURPOSE AND SCOPE

The purpose of this guide is to provide in a single brief document for HUD Field Office use, the essential requirements of acceptable design and installation practice ^{1/}. The guide should be considered as an advisory document to facilitate compliance with industry standards of good practice as referenced in HUD Use of Materials Bulletin No. 79a.

The scope of this guide is limited to ABS and PVC ^{1/} plastic drain, waste and vent systems and building sewers as treated by HUD Use of Materials Bulletin No. 79a.

3. GENERAL INFORMATION ON THERMOPLASTIC DWV PIPE AND METHODS OF FABRICATION

THERMOPLASTIC DWV pipe (ABS and PVC) is usually sold in 10 foot lengths. The pipe diameters and wall thicknesses with which this *guide is concerned are defined by ASTM D 2661 and ASTM F 628 (ABS), and ASTM D 2665 (PVC). These dimensions have been abstracted in Table 3.1.

ABS and PVC plastic DWV pipe and fittings are generally joined with an appropriate solvent cement as defined by ASTM D 2235 (ABS) and ASTM D 2564 (PVC). (See Section 5 for further details).

^{1/} The information contained in this guide was summarized from the document referenced under Section V of HUD Use of Materials Bulletin No. 79a, Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

TABLE 3.1 DIAMETERS AND WALL THICKNESSES OF ABS AND PVC DRAIN-WASTE-VENT PIPE CONFORMING TO ASTM D 2661, *F 628 (ABS) AND D 2665 (PVC)

Nominal Pipe Size	Outside Diameter			Total Wall Thickness			*Inner and Outer Wall Thicknesses -ABS Foam Core		
	Average (Max + Min Diameter Divided by 2)	Tolerance on Average	Permissible Deviations of Diameter from Measured Average (Out- of-Roundness)	Minimum	Tolerance				
	ABS & PVC	ABS & PVC	ABS & PVC	ABS & PVC	ABS & PVC	ABS & PVC	Min. Inner Wall	Min. Outer Wall	
Inches									
1 1/4	1.660	+0.010 -0.000	+0.005	+0.012	0.140	+0.015 -0.000	+0.020 -0.000	0.056	0.028
1 1/2	1.900	+0.010 -0.000	+0.006	+0.012	0.145	+0.015 -0.000	+0.020 -0.000	0.058	0.029
2	2.375	+0.010 -0.000	+0.006	+0.012	0.154	+0.015 -0.000	+0.020 -0.000	0.062	0.031
3	3.500	+0.015 -0.000	+0.008	+0.015	0.216	+0.020 -0.000	+0.026 -0.000	0.087	0.043
4	4.500	+0.015 -0.000	+0.009	+0.015	0.237	+0.024 -0.000	+0.028 -0.000	0.095	0.047
6	6.625	+0.011 -0.011	+0.011	+0.025	0.280	+0.030 -0.000	+0.034 -0.000	0.112	0.056

*Rev1

ABS and PVC pipe can be cut by several methods. Pipe is cut by manufacturers with cut-off saws equipped with carbide-tipped circular blades. These give the best long-term tool performance and produce a neat square pipe cut without burrs. This is considered the best and most efficient means of cutting the pipe in quantity. When cutting pipe in the shop or at the building site, it is recommended that a cut-off radial arm saw be used. When this is not feasible or desirable, a number of alternatives may be utilized. These are: (a) portable electric hand saw with a fine-toothed blade; (b) hand saw and miter box; and (c) wheel type pipe cutter with special wheels for plastic pipe. The portable electric hand saw requires a power supply, requires some care and skill to produce a square cut, and will not cut through a 3 inch pipe in a single pass even with an 8 inch blade. It has the advantage of requiring little time and effort and produces a neat, clean, square cut. The hand saw and miter box requires a stand or base and more physical effort and time. It produces a square cut that requires little de-burring. The pipe cutter requires the most physical effort both in cutting and de-burring. However, it produces a square cut and is quite suitable for cutting pipe up to 2 inches.

4. HANDLING AND STORAGE

4.1 Protection Against Long-Term Exposure to Sunlight

Do not store pipe and fittings in direct sunlight for long periods. However, exposure to sunlight of pipe openly stored at the building site during normal construction periods can be tolerated.

4.2 Support of Stored Pipe

Store pipe in such a manner as to prevent sagging or bending. Provide adequate support where piping is exposed to wind, snow and ice loading.

4.3 Protection Against Abrasion by Sharp Objects

Store and handle pipe and fittings so as to avoid contact with sharp objects.

4.4 Safe Handling of Solvent Cements 2/

4.4.1 General solvents contained in most plastic pipe cements are classified as airborne contaminants and are highly flammable and combustible liquids. Follow the precautions listed herein to avoid injury to personnel and the hazards of fire.

4.4.2 Avoid prolonged breathing of solvent vapors. When pipe and fittings are being joined in enclosed areas, use a ventilating device to remove hazardous vapors. Select ventilating devices and locate them so as not to provide a source of ignition to flammable vapor mixtures.

2/ Information extracted from F 402

- 4.4.3 Keep solvent cements away from all sources of ignition, heat, sparks, and open flame.
- 4.4.4 Keep containers from solvent cements tightly closed except when the cement is being used. The container type shall conform 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.
- 4.4.5 Dispose of all rags and other materials used for mopping up spills in a safety waste receptacle. Empty the receptacle and dispose of the contents daily in a safe manner.
- 4.4.6 Most of the solvents used in the pipe cements can be considered eye irritants and contact with the eye should be avoided as it may cause eye injury. Proper eye protection such as chemical goggles or face shields is required where the possibility of splashing exists in handling solvent cements. In case of eye contact, call a physician immediately and flush with quantities of water for 15 minutes.
- 4.4.7 Avoid repeated contact with the skin. Wear gloves which are impervious to and unaffected by the solvents. Use bristle paint brushes or other applicators not chemically affected to apply the solvents. Application of the solvents with bare hands is not acceptable. Dispose of used applicators in the same manner as the rags in 4.4.5. In the event of excessive skin contact, remove contaminated clothing and wash skin with soap and water. Clean contaminated clothing of flammable and toxic materials before wearing them again.

4.5 Storage of Solvent Cements

Store solvent cements in a cool place except when actually in use at the job site. The cements have a limited shelf life when not stored in hermetically sealed containers. Screw top containers are not considered to be hermetically sealed. Cement containers usually are stamped with a date signifying that the cement should be sold to the user on or before this date.

Consult the cement manufacturer for specific storage recommendations. 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 acceptable after shelf life has expired. Use only cements that are marked with a shelf-life date or date code.

5. MAKING JOINTS AND CONNECTIONS

5.1 ABS

5.1.1 Solvent Cements

Use solvent cements which meet the requirements of ASTM Specification D 2235, Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings, and which are packaged in 1 quart containers or smaller for field use. If, within the shelf life of the cement, thinning is required to reduce viscosity for use with smaller pipe, use only methyl ethyl ketone. The solvent cement shall provide sufficient open time for making good joints and connections but joints must be completed as rapidly as possible after applying the cement. Should delay develop in assembly, an additional coat of solvent cement shall be applied immediately prior to joining. CAUTION. If longer open time (slower drying) is required for particular types of installation special instructions and specifications should be obtained from the cement manufacturer. Any solvent cement of a "long-open-time" type should be evaluated for possible deleterious effects on the pipe and fittings. The use of such solvent cement should be avoided if at all possible.

5.1.2 Socket Fit

ABS pipe and fittings are manufactured to close tolerances. Close tolerances are required to ensure satisfactory "interference" fit between pipe and fitting during the solvent cement joining. Use only pipe and fittings combinations that give interference fits.

Pipe and fittings that give a loose fit in the socket will not properly fuse chemically. Allowable tolerances provide a forced fit, thus assuring chemical fusion and yielding maximum strength of solvent cemented joints. Attempting to compensate for a loose fit after assembly by applying additional cement will result in an unsatisfactory joint.

5.1.3 Joining Technique

- (a) Cutting the Pipe. Cut the pipe square using saws or pipe cutters designed specifically for this material. Protect pipe and fittings from serrated holding devices and abrasion.
- (b) Cleaning Pipe. Remove burrs and wipe off all moisture, dust and other foreign matter from surfaces to be cemented.

- (c) Application of Cement. Using an ordinary pure bristle paint brush of adequate size, or the brush supplied with the can of solvent cement, first apply a moderate even coating of cement in the fitting socket, completely covering the joining surfaces only. (Heavy or excessive applications of cement in the socket may result in an obstruction inside the piping after the joint is completed). Next, without delay apply cement to the outside of the pipe. (Make sure that the coated distance on the pipe is equal to the depth of the fitting socket).
- (d) Assembly. Make the joint as quickly as possible after application of the cement and before the cement dries. Insert the pipe into the fitting socket, turning the pipe slightly while inserting, (e.g. about 1/4 turn, where possible) to ensure even distribution of cement. Make sure that the pipe is inserted to the full depth of the socket, and hold pipe into socket for a few seconds to prevent "backing out." Then immediately remove excess solvent cement from the exterior of the joint with a clean, dry cloth. Should the cement dry too much before the joint is made up, as indicated by difficulty in the insertion of the pipe into the fitting or by apparent dryness of the cement film, reapply cement before assembling. Do not attempt to disturb the pipe-fitting joint until after the cement has set: damage to the joint and loss of fit may result. Handling of the assembly with care is permissible within 2 minutes after joining. Allow 15 minutes for the joint to develop good handling strength.
- (e) Visibility of Marking. Position pipe and fittings so that identifying markings are readily visible for inspection when installed.

5.1.4 Joints

- (a) Threading Connections. Do not cut threads on ABS drain, waste and vent pipe. Molded threads are permitted. Adapter fittings for transition to threaded continuation are required. The joint between the ABS pipe and transition fitting shall be of the solvent cement type. Only approved thread tape or thread lubricant specifically intended for use with ABS plastic pipe shall be used. Conventional pipe thread compounds, putty, linseed oil base products, and unknown mixtures shall be avoided.
- (b) Connections to Traps. Connect threaded traps and trap nuts by means of approved threaded adaptors.
- (c) Connection to Closet Flanges. Install screw-type closet flanges in the drainage system by means of an approved threaded adapter fitting. Install calk-type closet flanges in accordance with the procedures outlined in (f) below.

- (d) Connection to Non-Plastic Piping. When connecting plastic pipe to other types of piping, use only approved types of fittings and adaptors, designed for the specific transition intended. Consult the manufacturer.
- (e) Thread Tightness. Where a threaded joint is made, obtain tightness by maximum hand tightening plus additional tightening with a strap wrench not to exceed one full turn.
- (f) Transition to Bell-and-Spigot Pipe. Make connections or transitions to bell-and-spigot cast iron soil pipe and fittings, and to bell-and-spigot pipe and fittings of other materials, utilizing approved mechanical compression joints designed for this use, or utilizing calked joints made in an approved manner. In calking, pack the joint with oakum or hemp and fill with molten lead to a depth of not less than 1 inch. Allow a period of 4 minutes for cooling, then calk the lead at the inside and outside edges of the joint. Do not overheat the lead; heat to its melting point only.
- (g) Alignment and Grade. Align all piping system components properly without strain. Do not bend or pull pipe into position after being solvent welded. The grade of horizontal drainage and vent piping shall be as specified in the applicable code.
- (h) For further information on making joints and connections with ABS pipe and fittings, consult:

PPI Plastics Piping Manual
PPI TR 12

5.2 PVC

5.2.1 Solvent Cements

Use solvent cements which meet the requirements of ASTM Specification D 2564, Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings, and which are packaged in 1 quart containers or smaller for field use. If, within the shelf life of the cement, thinning is required use only thinner supplied by the cement manufacturer for the specific cement being thinned.

5.2.2 Socket Fit

PVC pipe and fittings are manufactured to close tolerances. Close tolerances are required to ensure satisfactory "interference" fit between pipe and fitting during the solvent cement joining. Use only pipe and fitting combinations that give interference fits. Pipe and fittings that give a loose fit in the socket will not properly fuse chemically. Allowable tolerances provide a force fit, thus assuring chemical fusion yielding maximum strength of solvent cemented joints. Attempting to compensate for a loose fit after assembly by applying additional cement will result in an unsatisfactory joint.

5.2.3 Joining Technique

- (a) Cutting the Pipe. See 5.1.3 (a) above. Cutting requirements for PVC are the same as for ABS.
- (b) Cleaning Pipe. See 5.1.3 (b) above. Cleaning requirements for PVC are the same as for ABS.
- (c) Application of Cement. See 5.1.3 (c) above. Cement application requirements for PVC are the same as for ABS.
- (d) Assembly. See 5.1.3 (d) above. Assembly requirements for PVC are the same as for ABS.
- (e) Visibility of Marking. See 5.1.3 (e) above. Requirements for visibility of markings are the same for PVC as for ABS.

5.2.4 Joints

- (a) Threaded Connections. Do not cut threads on PVC drain; waste, and vent pipe. Molded threads are permitted. Adapter fittings for transition to threaded construction are required. The joint between the PVC pipe and transition fitting shall be of the solvent cement type. Only approved thread tape or thread lubricant specifically intended for use with PVC plastic pipe shall be used. Conventional pipe thread compounds, putty, linseed oil base products, and unknown mixtures shall be avoided.
- (b) Connections to Traps. See 5.1.4 (b) above. Requirements for connection to threaded traps and trap nuts are the same for PVC as for ABS.
- (c) Connection to Closet Flange. See 5.1.4 (c) above. Requirements for connection to closet flanges are the same for PVC as for ABS.
- (d) Connection to Non-Plastic Pipe. See 5.1.4 (d) above. Requirements for connection to non-plastic pipe are the same for PVC as for ABS.
- (e) Thread Tightness. See 5.1.4 (e) above. Requirements for thread tightness are the same for PVC as for ABS.
- (f) Transition to Bell-and-Spigot Pipe. See 5.1.4 (f) above. Requirements for transition to bell-and-spigot pipe are the same for PVC as for ABS.
- (g) Alignment and Grade. See 5.1.4 (g) above. Requirements for alignment and grade are the same for PVC as for ABS.

(h) For further information on making joints and connections with PVC pipe and fittings, see ASTM D 2855, Making Solvent-Cemented Joints With Poly(Vinyl Chloride) (PVC) Pipe and Fittings. This document discusses joints and connections, including cleaners and primers, viscosity of cements for different sizes of pipe, and illustrations showing techniques. See also PPI Plastics Piping Manual and PPI TR 13.

6. CONTROL OF THERMAL EXPANSION AND CONTRACTION

6.1 Thermal Expansion

Allow for thermal expansion and movement in all piping installations by the use of approved methods. Support, but do not rigidly restrain piping at branches or at changes of direction. Do not anchor pipe rigidly in walls. Holes through framing members shall be adequately sized to allow for free movement. The amount of longitudinal thermal expansion for installations subject to temperature changes may be estimated from Tables 6.1-1 and 6.1-2. The linear expansion shown is independent of the diameter of the pipe. Buried piping, or piping installed in the crawl space under a building, is normally subject to less than the ambient temperature change.

ABS and PVC DWV pipes are not normally adversely affected by ordinary operating temperatures in warm spaces (nominally not over 120 F), e.g., parking garages and boiler/mechanical rooms. However, such pipes shall be protected from mechanical damage and from potential damage due to close proximity to hot surfaces.

TABLE 6.1-1. THERMAL EXPANSION TABLE FOR ABS PLASTIC PIPE

Length, feet	Temperature Change, °F						
	40	50	60	70	80	90	100
Length Change in.							
20	0.54	0.67	0.80	0.94	1.07	1.21	1.34
40	1.07	1.34	1.61	1.88	2.05	2.42	2.69
60	1.61	2.01	2.41	2.82	3.22	3.62	4.02
80	2.14	2.68	3.22	3.76	4.29	4.83	5.36
100	2.68	3.35	4.02	4.70	5.36	6.03	6.70

Example:

Highest temperature expected	100 °F
Lowest temperature expected	50 °F
Temperature change	<u>50 °F</u>

For length of run of 60 feet the chart indicates that the installation should provide for a linear expansion of 2.01 inches.

TABLE 6.1-2. THERMAL EXPANSION TABLE FOR PVC PLASTIC PIPE

Length, feet	Temperature Change, °F						
	40	50	60	70	80	90	100
Length Change, in.							
20	0.28	0.35	0.42	0.49	0.56	0.63	0.70
40	0.56	0.70	0.84	0.97	1.11	1.25	1.39
60	0.84	1.04	1.25	1.46	1.67	1.88	2.09
80	1.13	1.39	1.67	1.95	2.23	2.51	2.78
100	1.39	1.74	2.09	2.44	2.78	3.13	3.48

Example:

Highest temperature expected	100 °F
Lowest temperature expected	50 °F
Temperature change	<u>50 °F</u>

For length of run of 60 feet the chart indicates that the installation should provide for a linear expansion of 1.04 inches.

6.2 Methods for Control

6.2.1 Above-Ground DWV Installations

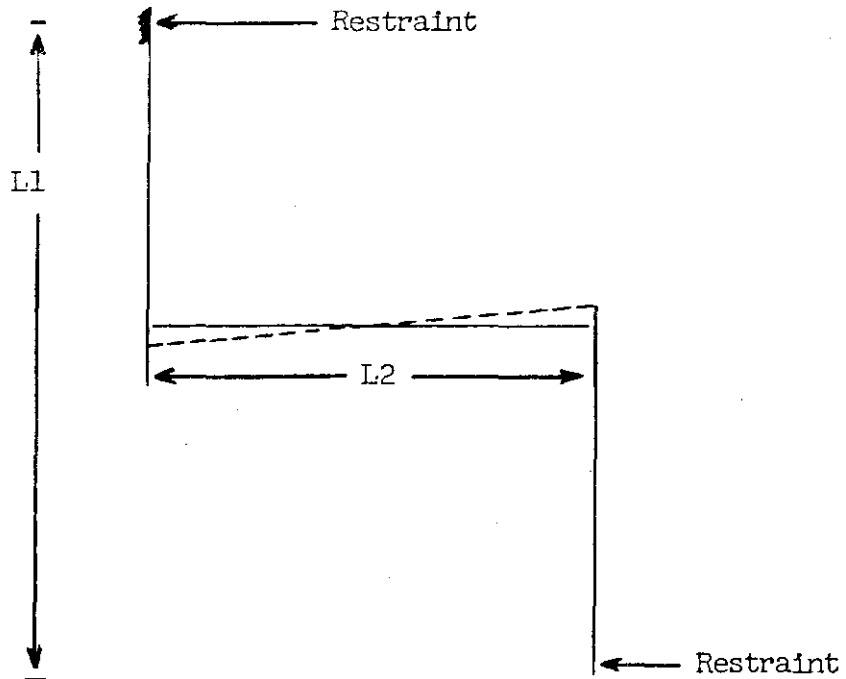
Expansion or contraction seldom presents any problems in DWV installations in one and two family dwellings due to the short lengths of piping involved. It does become of concern in high rise buildings where long stacks are involved, or in large buildings with long runs of above-ground horizontal drains (e.g. suspended building drains). There are three generally recognized methods of accommodating expansion-contraction, as described below.

- (a) If the DWV system is designed with one or more offsets in the stack or building drain, the offsets alone may provide a sufficient means for accommodating thermal expansion. The required lengths of offset for two pipe diameters and three pipe lengths with a temperature change of 50 °F are shown in Table 6.2-1 3/.

3/ See PPI Plastics Piping Manual, Chapter 3 for formula and discussion.

TABLE 6.2-1 MINIMUM LENGTH OF OFFSET, $\frac{4}{L2}$, FOR A 50 °F TEMPERATURE CHANGE

L1 (Length of Run) ft.	DIAMETER in.	L2 (Length of Offset) in.	
		ABS in.	PVC in.
20	3	29	21
	4	33	24
40	3	41	30
	4	47	34
60	3	50	36
	4	57	41

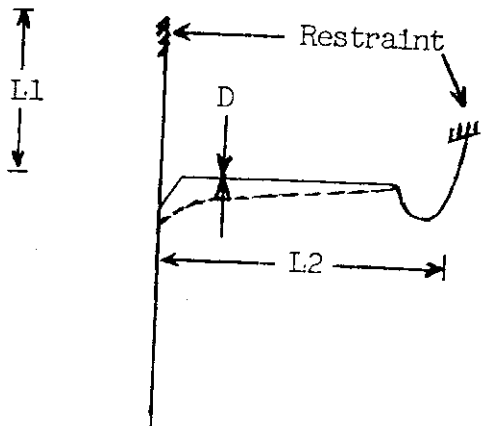


⁴/ Based on Eq (2), Page 25, PPI Plastics Piping Manual

If the main run of pipe (e.g. a soil or waste stack) is subject to longitudinal movement at the point of connection of a branch pipe (e.g., a fixture drain or a trap arm) the minimum length of branch pipe shall be in accordance with Table 6.2-2.

TABLE 6.2-2 MINIMUM LENGTH OF BRANCH, $4/ L_2$, FOR A 50 °F TEMPERATURE CHANGE

L1 (Length of Run) ft.	D (Branch Diameter) in.	L2 (Length of Offset) (Min.)	
		ABS in.	PVC in.
6	1 1/2	10	7.5
	2	12	8.4
	3	14	10
8	1 1/2	12	8.7
	2	13	9.7
	3	16	12
10	1 1/2	14	9.7
	2	15	11
	3	18	13
20	1 1/2	19	14
	2	21	15
	3	26	19
30	1 1/2	23	17
	2	26	19
	3	32	23



- (b) In many designs, expansion joints may be used for either PVC or ABS. There are a number of designs available which are basically a slip joint with an elastomeric seal; others utilize a bellows principle. If these methods are employed, the expansion joints shall be installed at intervals not exceeding 30 ft., and in accordance with the manufacturer's recommendations. Except at unusually low or high ambient temperatures, install the expansion joint in the neutral (midpoint) position so that it can move in either direction to take care of either expansion or contraction. For vertical piping (e.g., soil, waste and vent stacks) the pipe shall be anchored either by securing the branches or by the installation of fixed clamps around the vertical pipe at or near each expansion joint to prevent the joint from telescoping together due to the weight of the stack. The recommendations of the expansion joint manufacturer shall be followed in the application and installation of expansion joints.
- (c) For ABS DWV there is a third method - the use of restraint. Engineering studies have shown that by restraining the pipe every 30 ft. to prevent longitudinal movement, satisfactory installations can be made. Tensile or compressive forces developed by contraction or expansion are absorbed by the piping itself without harm. If the restraint method is used, special stack anchors, available from several manufacturers, shall be used and installed according to the manufacturers' recommendations.
- (d) Except where rigid anchoring of DWV piping is required or is otherwise appropriately provided, pipe hangers and supports shall be installed so as to permit longitudinal movement of the pipe and fittings near walls, ceilings, floors and framing members. Such hangers and supports shall be positioned so that ample clearance is provided to avoid interference with thermal movement.

6.2.2 Underground Piping

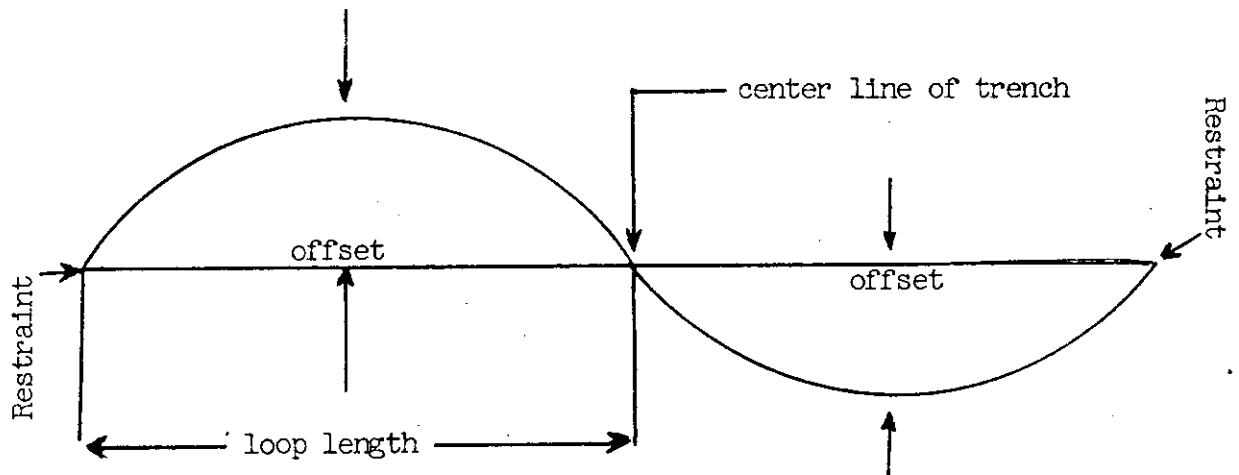
Thermal expansion and contraction is generally not a problem with underground piping such as building drains and building sewers. Movements in buried piping are generally less than in above-ground installations because of the more stable temperature environment and the restraint imposed by the earth cover.

If pipe of 3 in. diameter or less is installed at a temperature lower than the expected maximum service temperature, as in winter, the pipe may be installed straight, brought to the (higher) service temperature and the increased length taken up by snaking. The trenching may then be backfilled in the normal manner. Rigid pipe with solvent cemented joints or other rigid couplings, up to 3 in. nominal size, can be handled by snaking, provided the joint has cured sufficiently. Offsets and loop lengths for snaking rigid pipe are shown in Table 6.2-3.

For larger sizes of pipe, snaking is not practical, or possible, in most cases. When snaking is not possible the line shall be completely installed except that it is left unconnected at one end. The pipe is then brought to within 15 °F of the service temperature and the final connection made. This can be accomplished by "shade" backfilling in summer, i.e. allowing the pipe to cool at night and then connecting early in the morning, or by cooling with water. The stresses produced by the final 15 °F temperature change will be absorbed by the piping without harm.

TABLE 6.2-3 RECOMMENDED OFFSETS AND LOOP LENGTHS FOR SNAKING RIGID ABS/PVC PIPE
(applicable to sizes of 3 in. and less)

Temperature Change, °F	10	20	30	40	50	60	70	80	90	100
Loop Length, ft.	Offset for contraction, in.									
20	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
50	3-3/4	5	6-1/4	7-1/2	8-3/4	10	11-1/4	12-1/2	13-3/4	15
100	7-1/2	10	12-1/2	15	17-1/2	20	22-1/4	25	27-1/2	30



PLAN VIEW

7. REQUIREMENTS FOR HANGERS AND SUPPORTS

Hangers and straps shall not compress, distort, cut or abrade the piping and shall allow free movement of pipe. Support all piping at intervals of not more than 4 ft., at ends of branches and at change of direction or elevation. Supports shall allow free movement. Maintain vertical piping in straight alignment. Support trap arms in excess of 3 ft. in length as close as possible to the trap. Securely fasten closet rings to the floor with corrosion-resistant fasteners with top surface of closet ring 1/4 in. above the finished floor. Stabilize closet bends or stubs against all horizontal or vertical movement. Protect pipe exposed to damage by sharp edges (e.g. in passages through structural members, sheet metal, subflooring etc.) with grommets or sleeves of rubber or plastic.

8. UNDERGROUND PIPING

8.1 Trenching and Bedding

(a) Building drains under floor slabs

Make trench bottoms smooth and of uniform grade with either undisturbed soil or a layer of selected and compacted backfill so that no settlement will be encountered. Pipe must bear on this material throughout the entire length of its barrel.

(b) General recommendations

The width of trench shall be no greater than required to permit joining of the pipe in the ditch.

The trench bottom shall be continuous, relatively smooth and free of rocks. Where ledge rock, hardpan or boulders are encountered, the trench bottom shall be padded using sand or compacted fine grained soils.

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

8.2 Burial Depth

Provide a minimum cover of 24 in. for locations subject to heavy overhead traffic. A minimum cover of 12 to 18 in. is normally adequate for locations subject to no overhead traffic or light overhead traffic. Provide sufficient cover to prevent stress levels in excess of the manufacturer's published load ratings due to the superimposed static and dynamic loads for the applicable installation conditions. Burial depth shall be limited to depths such that combined earth loads and superimposed static and dynamic loads will not yield stress levels in excess of the manufacturer's published load ratings for the applicable installation conditions. Effects of ground freezing shall be considered also when pipe is installed at depths subject to frost penetration.

8.3 Embedment and Backfilling

8.3.1 Embedment

Use a graded, compacted backfill material of particle size of 1/2 in. or less to surround the pipe. Place the backfill in layers, and compact each layer sufficiently to develop uniform lateral passive soil forces against the pipe during the backfilling and compacting operation. Sand and gravel containing a significant proportion of fine-grained material, such as silt and clay, shall be compacted by mechanical tamper or by hand.

8.3.2 Backfilling

The remainder of the backfill above the pipe soil encasement area shall 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 near rocks, or lumps of earth in the backfill. Remove large rocks, frozen clods and other debris greater than 3 in. in diameter from the backfill. The final backfill may be consolidated by using rolling equipment or heavy tampers except that under sidewalks and driveways the backfill shall be compacted in layers. Rolling equipment shall not be used in consolidating initial backfill.

8.3.3 Compaction

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, provide sufficient initial backfill to insure complete coverage of the pipe. Additional material shall not be added until the water flooded backfill is firm enough to walk on. Avoid floating the pipe.

Additional information on underground installation is given in ASTM D 2321, Underground Installation of Flexible Thermoplastic Sewer Pipe. Particular attention must be given to compacting the embedment on both sides and underneath the haunches of the pipe to ensure maximum ability to support soil loads and superimposed static and dynamic loads.

9. PROTECTION OF VENT TERMINALS FROM THE EFFECTS OF LONG-TERM EXPOSURE TO SUNLIGHT

Plumbing vents of ABS or PVC exposed to sunlight shall be protected by exterior type water-base synthetic latex paints. Where roof or ambient temperatures near vent terminal are expected to exceed 165 °F (for ABS) or 140 °F (for PVC) the terminal shall be protected by means of reflective shielding and thermal insulation. Deformation of these materials is based on tests. In the field, experience should be exercised in determining these temperatures.

10. PROTECTION AGAINST FREEZING

Alcohol or petroleum products shall not be used to protect traps, fixtures and devices of ABS or PVC from the effects of freezing water. Use only approved plastic pipe antifreeze packaged for this purpose, or one of the following solutions:

- (a) Sixty percent by weight of glycerin in water mixed at 73 °F.
- (b) Twenty-two percent by weight of magnesium chloride or sodium chloride in water.

11. INSTALLATION IN WARM SPACES

ABS and PVC DWV pipes are not normally adversely affected by ordinary operating temperatures in warm spaces (nominally not over 120 °F), e.g., parking garages and boiler/mechanical rooms. However, such pipes shall be protected from mechanical damage and from potential damage due to close proximity to hot surfaces.

12. PROTECTION AGAINST HARMFUL CHEMICALS AND POWER CLEANING EQUIPMENT

Contractors that perform cleaning services on plastic DWV pipes should be competent and aware of the limitations of these materials.