Doc. No.: PCD 12 (23279) WC
August 2023

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

(*Not to be reproduces without permission of BIS Or used as an Indian Standard*)

Draft Indian Standard

SOLVENT CEMENTS FOR CHLORINATED POLY (VINYL CHLORIDE) (CPVC) PLASTIC PIPE AND FITTINGS

(ICS 83.080.20)

Plastics Sectional Committee, PCD 12

Last date for receipt of comment is **16 October 2023**

FOREWORD

(Formal clause to be added later**)**

This standard covers requirement for solvent cements for Chlorinated Poly (vinyl chloride) (CPVC) plastic pipe, tubing, and socket-type fittings. Solvent cement shall be a CPVC resin-based solution, shall be free-flowing, shall show no gelation or stratification, and shall not contain lumps or any foreign matter. Other requirements include resin content, dissolution, viscosity, shelf stability, hydrostatic burst strength, and hydrostatic sustained pressure strength. Test procedures for solid contents, inert filler determination, viscosity, hydrostatic burst strength, and hydrostatic sustained pressure strength are included in this standard.

To make consistently good joints, the following points should be clearly understood.

— The joining surfaces must be softened and made semifluid.
— Sufficient cement must be applied to fill gap between pipe and fitting.
— Assembly of pipe and fittings must be made while the surfaces are still wet and cement is still fluid.
— Joint strength develops as the cement dries. In the tight part of the joint the surfaces will tend to fuse together; in the loose part, the cement will bond to both surfaces.
— These areas must be softened and penetrated

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.

While preparing this standard considerable assistance has been derived from ASTM F493 Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard provides requirements for Chlorinated Poly (Vinyl Chloride) (CPVC) solvent cements to be used in joining Chlorinated Poly (Vinyl Chloride) pipe, tubing, and socket type fittings.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

IS No.	*Title*
IS 2828 : 2019 / ISO 472 : 2013	Plastics — Vocabulary (*second revision*)
IS 4905 : 2015 / ISO 24153 : 2009	Random Sampling and Randomization Procedures (*first revision*)
IS 13360 (Part 11/Sec 10) : 2022 / ISO 2555 : 2018	Plastics — Methods of testing Part 11 Special properties Section 10 Resins in the liquid state or as emulsions or dispersions — Determination of apparent viscosity using a singular cylinder type rotational viscometer method (*first revision*)
IS 17988 : 2022	Chlorinated Polyvinyl Chloride (CPVC) resin — Specification

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2828 shall apply.

4 CLASSIFICATION

CPVC solvent cement shall be classified based on viscosity as follows:

Type	*Viscosity, Min*
Regular-bodied cements	90 mPa·s (90 cP)
Medium-bodied cements	500 mPa·s (500cP)
Heavy-bodied cements	1600 mPa·s (1600cP)

5 REQUIREMENTS

5.1 General Requirements

5.1.1 The solvent cement shall be a solution of the base CPVC resin conforming to IS 17988.

5.1.2 When rework material is used, the manufacturer shall use only his own clean rework material that is compatible with virgin material and produces a cement that meets the requirements of this specification.

5.1.3 The cement shall be free flowing and shall not contain lumps, undissolved resin or any foreign matter that will adversely affect the ultimate joint strength or chemical resistance of the cement.

5.1.4 The cement shall show no gelation or stratification that cannot be removed by stirring.

5.1.5 When inert fillers and colourants are added, the resulting cement shall meet all requirements of this standard.

NOTE — It is recommended the CPVC solvent cement be orange in color to facilitate identification and minimize unintentional use of other cements that may fail at elevated service temperatures.

5.1.6 The particular solvent system to be used in the formulation of this solvent cement is not specified, since it is recognized that a number of adequate solvent system for CPVC exist. Solvent systems consisting of blends of tetrahydrofuran and cyclohexanone have been found to make cements that meet the requirements of this standard.

5.2 Resin Content

The CPVC resin content shall be minimum 10 percent when tested in accordance with test method given in Annex A.

5.3 Dissolution

The cement shall be capable of dissolving an additional 3 percent by weight of CPVC resin (powder or granular) at 23 ± 2 ºC without evidence of gelation.

5.4 Viscosity

The CPVC solvent cement shall have minimum viscosity as defined in **4** when tested in accordance with the method given in Annex B.

5.5 Shelf Stability

The cement in the container in which it is supplied, shall show no gelation or stratification that cannot be removed by stirring after ageing of 30 days at 49 ºC.

5.6 Hydrostatic Burst Strength

Joints made using 5.08 cm (2 inch) CPVC piping and this cement shall meet the requirements of Table 1 when tested in accordance with the method given in Annex C.

Table 1
(*Clause* 5.6)

Hydrostatic Burst Strength Requirements for Nominal 5.08 cm (2 inch) CPVC Solvent Cement Joints After 2 h Drying at Test Temperature

Sl No.	Temperature, ºC	Burst Pressure, MPa (psi), *Min*
(1)	(2)	(3)
1	23	2.76 (400)
2	82	1.38 (200)

5.7 Hydrostatic Sustained Pressure Strength

Joints made using 1.27 cm (½-inch) CPVC tubing and this cement shall meet the requirements of Table 2 when tested in accordance with the method given in Annex D.

Table 2
(*Clause* 5.7)

Hydrostatic Sustained Pressure Requirements for Nominal 1.27 cm (½-inch) CPVC Solvent-Cemented Joints Tested in water or Air External Environment at 82 ± 2 ºC

Sl No.	Test Condition	Test Duration	Hydrostatic Test Pressure, MPa (psi), *Min*	
			Water Bath	Air Bath
(1)	(2)	(3)	(4)	(5)
1	A	6 min	3.59 (521)	3.80 (551)
2	B	4 h	2.51 (364)	2.78 (403)

6 SAFE HANDLING OF SOLVENT CEMENT

6.1 Solvent cements for plastic pipe are made from flammable liquids. Keep them away from all sources of ignition. Maintain the solvent vapours. Avoid contact of cement with skin and eyes. Manufacturers shall provide guideline for safe use of the product.

7 PACKING AND MARKING

7.1 Packing

The material shall be packed as agreed to between purchaser and supplier.

7.2 Marking

7.2.1 The following shall be marked:

a) Manufacturer’s or trader's name and address or trademark, or both;
b) Lot number of batch on container (not on closure of lid);
c) Quantity of the material;
c) Month and year of manufacturing/packing;
d) Shelf life;
e) Cement type according to viscosity;
f) Recommended Pipe sizes and purpose for which it is intended to be used;
g) Procedure or instructions for application and use;
h) All warnings and cautions necessitated by
    i) Ingredients
    ii) Safe handling and distribution of the products,
k) Any other information as per relevant Rules and Regulations.

NOTES

1. Solvent cement intended for use on potable water systems should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority.
2. It is recommended that the color of the cement also be indicated on the label.

7.2.2 BIS Certification Marking

The product may also be marked with standard mark.

7.2.2.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

8 SAMPLING

For the purpose of this standard, the sampling plan as given in IS 4905 shall be followed.

ANNEX A
(*Clause* 5.2)

TEST FOR RESIN CONTENT

A-1 APPARATUS

A-1.1 Ointment Tins, all metal

A-1.2 Analytical Balance

A-1.3 Vacuum Oven

A-1.4 Desiccator

A-1.5 Centrifuge

A-2 PROCEDURE

A-2.1 Stir the sample thoroughly with a spatula before weighing[1]. Weigh 3.0 ± 0.500 g of the sample to the nearest 1 mg into a tared ointment tin with cover. Place the tin into the vacuum oven[2], and heat at 120 ºC for 45 to 60 min. Discard specimens left in for more than 60 min. The vacuum must be continually in operation to draw off flammable solvents and shall be maintained below 15 mm Hg pressure. Remove the tin from the oven and cap immediately. Place in a desiccator until cooled to room temperature. Weigh the tin and dried sample to the nearest 1 mg.

NOTES

1. This material is usually nonhomogeneous and shall be thoroughly stirred before weighing. The weighing shall also be accomplished quickly to avoid loss of solvent by evaporation.
2. The use of a vacuum oven is mandatory for drying the specimen, because this oven has neither an exposed heating surface nor an open flame, thus avoiding the danger of flashing. The oven also provides an open vacuum to exhaust solvent fumes.

A-2.2 Inert Filler Determination

A-2.2.1 Dissolve most of the dried sample by adding 15 ml of Tetrahydrofuran (THF) to the sample 1 the ointment tin and stirring with a glass rod for 15 min. Collect the liquid decanted from this step, plus the liquid from the next two steps. Dissolve the remainder with a second addition of 15 ml of THF, followed by a third addition of 5 ml of THF to rinse the ointment tin. Centrifuge the entire volume at 20000 rpm for 15 min. Discard the supernatant liquid. Add 15 ml of THF to the tube, mix thoroughly, and transfer the tube contents to the ointment tin. Use 2 ml more THF to wash down the tube, and pour into the ointment tin. Evaporate off the THF in the vacuum oven at 120 ºC for 45 min. Cool in desiccator, weigh the tin to the nearest 1 mg, and determine the weight of inert filler present in the cement.

A-3 CALCULATION

Calculate the percentage of CPVC resin as follows:

$$\text{Resin, percent} = \frac{(B - A - D)}{(C - A)} \times 100$$

where

A = Weight of ointment tin,
B = Weight of tin and specimen after drying,
C = Weight of tin and specimen before drying, and
D = Weight of inert filler, if present.

ANNEX B
(*Clause* 5.4)

TEST FOR VISCOSITY

B-1 GENERAL

B-1.1 A method of determining an apparent viscosity, by the Brookfield Test method, of resins in a liquid or similar state. A spindle, of cylindrical or related form (disc), is driven at a constant rotational frequency in the product being studied. The resistance exerted by the fluid on the spindle, which depends on the viscosity of the product, causes a torque which is indicated by a suitable meter. This measurement may be based on tightening of a spiral spring depending on the torque, indicated by the movement of a needle on a dial. The apparent viscosity by the Brookfield Test method is obtained by multiplying this dial reading by a coefficient which depends on the rotational frequency and characteristics of the spindle.

B-2 APPARATUS

B-2.1 Brookfield-type viscometer – Type A, B or C, chosen according to the product to be tested and the desired precision.

NOTE — The detailed working principle of this apparatus, its description and the characteristics of the three types can be seen in IS 13360 (Part 11/Sec 10).

B-2.1.1 Each viscometer consists of:

— the viscometer body;
— seven interchangeable spindles numbered from 1 to 7 (number 1 being the largest); these spindles carry; mark that indicates the immersion level in the liquid; they are the same for the three types of viscometer; do not use spindles which show signs of corrosion or eccentricity; and
— a detachable frequencies available on the different types of Brookfield viscometer are given in table 3.

TABLE 3
(*Clause* B-2.1.1)

ROTATIONAL FREQUENCIES AVAILABLE FOR THE THREE TYPES OF VISCOMETER

Sl No.	Viscometer Type	Model	Rotational Frequencies, min^{-1}							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	A	RVF	-	-	2	4	10	20	-	-
2		RVF 100	-	-	-	-	10	20	50	100
3		RVT	0.5	1	2.5	5	10	20	50	100
4	B	HAF		1	2	5	10			
5		HAT	0.5	1	2.5	5	10	20	50	100
6	C	HBF		1	2	5	10			
7		HBT	0.5	1	2.5	5	10	20	50	100

B-2.1.2 The shape and size of the spindles are such that the viscosities corresponding to a maximum torque indication on the meter, for the various rotational frequencies, are those given in Table 4.

TABLE 4
(*Clause* B-2.1.2)

SHAPE AND SIZE OF THE SPINDLES

Sl No.	Viscometer type	Rotational frequencies, min $^{-1}$	Spindle number						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1			**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	A	100	0.1	0.4	1	2	4	10	40
3		50	0.2	0.8	2	4	8	20	80
4		20	0.5	2	5	10	20	50	200
5		10	1	4	10	20	40	100	400
6		5	2	8	20	40	80	200	800
7		4	2.5	10	25	50	100	250	1 000
8		2.5	4	16	40	80	160	400	1 600
9		2	5	20	50	100	200	500	2 000
10		1	10	40	100	200	400	1 000	4 000
11		0.5	20	80	200	400	800	2 000	8 000
12	B	100	0.2	0.8	2	4	8	20	80
13		50	0.4	1.6	4	8	16	40	160
14		20	1	4	10	20	40	100	400
15		10	2	8	20	40	80	200	800
16		5	3	16	40	80	160	400	1 600
17		2.5	8	32	80	160	320	800	3 200
18		2	10	40	100	200	400	1 000	4 000
19		1	20	80	200	400	800	2 000	8 000
20		0.5	40	160	400	800	1 600	4 000	16 000
21	C	100	0.8	3.2	8	16	32	80	320
22		50	1.6	6.4	16	32	64	160	640
23		20	4	16	40	80	160	400	1 600
24		10	8	32	80	160	320	800	3 200
25		5	16	64	160	320	640	1 600	6 400
26		2.5	32	128	320	640	1 280	3 200	12 800
27		2	40	160	400	800	1 600	4 000	16 000
28		1	80	320	800	1 600	3 200	8 000	32 000
29		0.5	160	640	1 600	3 200	6 400	16 000	64 000

B-2.2 Thermostatic Liquid Bath — To maintain the product being tested at the test temperature with an accuracy of ± 0.2 °C.

B-2.2.1 Recommended test temperatures, in degrees Celsius, are 23, 25, 40, 55, 70, 85 and 100.

NOTE — If the test has to be carried at higher temperatures, it is advisable to use an extension shaft between the spindle and the apparatus.

B-2.3 Support — To hold the viscometer and move it in a vertical plane.

B-2.4 Beaker — 90 mm to 92 mm in diameter and 115 mm to 160 mm in height.

B-2.5 Thermometer — Graduated in 0.1 °C, to measure the temperature of the product being tested.

B-2.6 Choice of Rotational Frequency and Spindle

B-2.6.1 Choose the rotational frequency – spindle combination taking into account the value of the viscosity to be measured, the desired precision and the velocity gradient. It is necessary to make this choice in such a way that no measurement corresponds to less than 20 percent or more than 95 per cent of full-scale deflection. However, for the best accuracy, it is advisable to keep the range to 40 percent to 95 percent of full scale.

B-3 PROCEDURE

B-3.1 Mount the viscometer, with its guard stirrup, when applicable on its support. Fill the beaker with the product to be tested, taking care not to introduce air bubbles. Then place it in the bath for a sufficient time to reach the desired temperatures. If the product contains volatile matter or is hygroscopic, take care to close the beaker tightly during this operation.

B-3.2 With the beaker still in the bath, hold the spindle at an angle of approximately 45° to the surface of the product and immerse it in the product. Orientate the spindle vertically and connect it to the shaft of the apparatus.

B-3.3 Check that the spindle is vertical, using the bubble level, that the lower end of the spindle is more than 10 mm from the bottom of the beaker and that the spindle is immersed to the underside of the mark on its shaft. Immerse the thermometer in the product.

B-3.4 Wait until the temperature of the product is between the prescribed limits. Start the motor and run at the desired rotational frequency, taking into account the manufacturer's recommendations.

B-3.5 Allow the instrument to run and read the torque meter to the nearest 0.25 percent of maximum value indication, in accordance with the manufacturer's recommendations, when a stable value has been reached on the meter. Look the needle and stop the motor to take the reading.

NOTES

1. If the reading of the torque meter changes slowly, this may indicate that the product is thixotropic or rheopectic. It is also possible to plot the curve of viscosity as a function of period of rotation.
2. Different liquids may have different rheology. For liquids with a thixotropic or rheopectic behaviour, the period of rotation should be fixed, e.g. 1 min (use only 1 period since the reading of the torque meter may depend on time).

B-3.6 Restart the motor and make another measurement. Continue taking measurements until two consecutive values are obtained that do not differ by more than 3 per cent from each other. Take the average of these two values. After each determination, detach the spindle from the apparatus and wash it thoroughly in a suitable solvent.

B-4 TEST RESULTS

B-4.1 Calculate the apparent viscosity, in Pascal seconds, of the product tested, using the formula

$$\text{Apparent viscosity, (in Pascal seconds)} = \frac{A \times k \times l}{1\,000}$$

where

A is the coefficient depending on the type of apparatus whose value is 1 for type A, 2 for type B and 8 for type C;

k is a coefficient depending on the rotational frequency-spindle combination used; in the case of apparatus as specified in IS 13360 (Part 11/Sec 10), the values of *k* are as shown in table 5;

l is the mean of the two values read on the scale.

Table 5
(*Clause* B-4)

Coefficient *k* (scale 0 to 100) for each rotational frequency-spindle combination

Sl No.	Rotational frequencies, min $^{-1}$	Spindle number						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		1 (largest)	2	3	4	5	6	7 (smallest)
2	100	1	4	10	20	40	100	400
3	50	2	8	20	40	80	200	800
4	20	5	20	50	100	200	500	2 000
5	10	10	40	100	200	400	1 000	4 000
6	5	20	80	200	400	800	2 000	8 000
7	4	25	100	250	500	1 000	2 500	10 000
8	2.5	40	160	400	800	1 600	4 000	16 000
9	2	50	200	500	1 000	2 000	5 000	20 000
10	1	100	400	1 000	2 000	4 000	10 000	40 000
11	0.5	200	800	2 000	4 000	8 000	20 000	80 000
	[1)] It may be necessary to calibrate each spindle with liquids of known viscosity and to adopt slightly different values of *k* (*see* clause B-4 in Annex B of IS 13360 (Part 11/Sec 10)).							

B-4.2 Express the results to three significant figures, indicating the type of viscometer (A, B or C), the number of the spindle and the rotational frequency, as in the following example:

Brookfield viscosity (A/3/20) = 4.25 Pa.s
(1 Pa.s = 10^3 cP).

ANNEX C
(*Clause* 5.6)

TEST FOR HYDROSTATIC BURST STRENGTH

C-1 GENERAL

This test method consists of loading a specimen to failure, or a predetermined minimum level, in short time interval by means of continuously increasing internal hydraulic pressure while immersed in a controlled temperature environment. This test method establishes the short time hydraulic failure pressure of thermoplastic or reinforced thermosetting resin pipe, tubing or fittings.

C-2 APPARATUS

C-2.1 Constant Temperature Bath — A water bath or any other fluid bath equipped so that uniform temperature is maintained throughout the bar. The test shall be conducted at 23 ± 2 °C.

C-2.2 Pressurizing System — A device capable of applying an essentially continuously increasing internal hydraulic pressure to the test specimen.

C-2.3 Pressure Gauge — Having a precision of not less than 1 percent of full scaled deflection with a maximum indicating hand. The pressure gauge shall be selected such that the final readings are in the mid 60 per cent of the scale.

C-2.4 Timing Device — Stop watch or equivalent.

C-2.5 Specimen and Closures

C-2.5.1 *Pipe and Tubing* — Either free and / or restrained end closures, that will with stand the maximum test pressure may be used. Closures shall be designed so that they do not cause failure of the sample.

C-2.5.2 *Fittings* — Caps and plugs for fittings shall not extend beyond the bottom thread or the bottom of the socket.

C-3 PROCEDURE

C-3.1 Prepare a test assembly containing at least six nominal 5.08 cm (2 inch) solvent-cemented joints using CPVC pipe and fittings. Cut the pipe into suitable lengths. The socket depth of the fittings shall be 3.81 cm (1½) to 3.97 cm ($1^{9}/_{16}$ inch). The dimensions of the pipe and fitting socket shall be such that the pipe will enter the socket from one third to two thirds of the full socket depth dry when assembled by hand.

C-3.2 Cement the joints in accordance with the recommended solvent cementing procedure given in Annex **E-1** except for **E-1.7**.

C-3.3 Attach suitable end closures and fill the test assembly with water, purging all air, and condition in water or air at the test temperature for 120 ± 5 min, then test immediately.

C-3.4 Increase the internal pressure at a constant rate so as to reach the minimum burst requirement in 60 to 70 s.

C-4 TEST RESULTS

C-4.1 Leakage or separation at any of the joints tested at less than the minimum hydrostatic burst strength requirements specified in Table 1 shall constitute failure in this test.

ANNEX D
(*Clause* 5.7)

TEST FOR HYDROSTATIC SUSTAINED PRESSURE STRENGTH

D-1 GENERAL

D-1.1 This test method consists of exposing specimen of pipes to a constant internal pressure in a controlled environment. Such a controlled environment may be accomplished by immersing the specimens in a controlled temperature water or air bath.

D-2 APPARATUS

D-2.1 Constant Temperature Bath — A water bath or any other fluid bath equipped so that uniform temperature is maintained throughout the bar. The test shall be conducted at 23 ± 2 °C.

D-2.2 Pressurizing System — A device capable of applying an essentially continuously increasing internal hydraulic pressure to the test specimen.

D-2.3 Pressure Gauge — A pressure gauge having an accuracy sufficient to meet the pressure tolerance requirement of **D-2.6.**

D-2.4 Timing Device — A time meter connected to the pressurized fluid side of the system through a pressure or a flow switch or both. The timing device and pressure or flow switch or both together shall be capable of measuring the time when the specimen is at 98percent or more of test pressure with sufficient accuracy to meet the tolerance requirement of **D-2.6**.

D-2.5 Specimen and Closures — Either free and / or restrained end closures, that will with stand the maximum test pressure may be used. Closures shall be designed so that they do not cause failure of the sample.

D-2.6 Time and Pressure Tolerance — When added together the tolerance for the timing device and the tolerance for the pressure gauge shall not exceed ± 2 percent.

D-3 PROCEDURE

D-3.1 Prepare a test assembly containing six nominal ½-in, solvent-cemented joint using CPVC tubing and fitting meeting the requirements of Specification D 2846. Cut the tubing into 15.24 cm (6 inch) lengths and use two couplings and two male adapters. The socket depth of the fitting shall be 1.27 cm (½ inch) to 1.43 cm ($^{9}/_{16}$ inch).

D-3.2 The dimensions of the pipe and fitting socket shall be such that the pipe will enter the socket from one third to two thirds of the full socket depth dry when assembled by hand. Cement the joints in accordance with the recommended solvent cementing procedure given in **E-1**, except in **E-1.4**, do not apply cleaner or primer and do not sand. Ignore **E-1.7**.

NOTE — The purpose of the test method is to evaluate the performance of the CPVC cement alone, and therefore applying cleaner or primer or sanding, in accordance with **E-1.4**, is not required for this purpose.

D-3.3 Dry the solvent-cemented joints in air at 23 ± 2 °C for 14 days ± 2 h. Then dry the cemented joints at 82 ± 2 °C for the drying times specified in Table 6. Being the conditioning step in accordance with **D-3.4** within 30 min.

D-3.4 Attach suitable end closures and fill the test assembly with water, purging all air, and condition at the test temperature for 30 ± 5 min if using a water bath or 120 ± 5 min if using an air bath, then test immediately.

Table 6
(*Clause* D-3.3)
Drying Times for CPVC Solvent Cemented Joints in Water or Air at 82 °C

Sl No.	Test Condition (from Table 2)	Drying Time at 82 °C
(1)	(2)	(3)
1.	A	4 h ± 5 min
2.	B	16 h ± 15 min

D-3.5 Attach to pressure source and place on test at 82°C and the proper hydrostatic pressure ± 70 kPa (± 10 psi) as specified in Table 2. Increase the internal pressure at a constant rate to reach the test pressure in 15 to 20 s.

D-4 TEST RESULTS

D-4.1 Leakage or separation at any of the joints tested at less than the test duration time specified in Table 2 for both test conditions A and B shall constitute failure in this test.

ANNEX E

RECOMMENDED SOLVENT CEMENTING PROCEDURE
(For guidance and information only)

E-1 RECOMMENDED PROCEDURE FOR MAKING SOLVENT-CEMENTED JOINTS WITH CHLORINATED POLY (VINYL CHLORIDE) (CPVC) PIPE AND FITTINGS

E-1.1 Cutting — Cut the pipe square, using a tubing cutter or a fine-toothed hand saw and metre box. Tubing cutters with him cutting wheels designed specially for plastic are recommended.

E-1.2 Burrs — Remove all ridges caused by tube cutter and burrs with sandpaper or knife.

E-1.3 Pipe Fit — Check dry fit of pipe in the fitting to ensure that there is an interference fit. The dry pipe of tubing should enter the fitting socket from one third to two thirds of the full socket depth when assembled by hand.

E-1.4 Cleaning — Clean the pipe end and fitting socket. Wipe away dust, moisture, and foreign materials with a clean dry cloth or use a cleaner, or primer, or and with fine abrasive paper. Cleaner or primer should be that recommended by the cement manufacturer for use with CPVC plastic pipe. Apply the cleaner or primer with an applicator or wear gloves impervious to the solvents, to prevent skin contact.

E-1.5 Cement Application — Apply a heavy thick coat of CPVC cement to the pipe end and a light thin coat to the inside of the fitting socket. If cement dries on either surface before joining, apply another coat.

E-1.6 Joining — Immediately insert the pipe into the fitting with a slight twisting motion until it bottoms in the socket. Quickly align fitting direction. Hold the joint together momentarily until cement has set. Remove excess cement from the joint.

E-1.7 Handling — The joint may be handled immediately with care. Avoid rough handling for 1 h. The joint normally may be pressure tested after 16 h.

E-2 GUIDE FOR CPVC SOLVENT CEMENT SELECTION

E-2.1 It is recommended that only regular-bodied cements be used to join CPVC tubing, since medium-bodied and heavy-bodied cements are generally formulated for larger pipe sizes and have longer open or drying times than regular-bodies cements.

E-2.2 The successful joining of CPVC pipe and fittings, larger than 2 inch, and noninterference-type joints requires the use of solvent cements that have higher-gap filling properties than the minimum-viscosity (90 cP) cements permitted in this specification. 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[1]. A guide to the proper selection of a solvent cement for the various pipe sizes is given in Table 7 and Table 8, where cements are classified into three types (for purposes of identification) as regular-bodies, medium-bodies, or heavy-bodies, based on minimum viscosity and minimum wet-film thickness. Solvent cement manufacturer's recommendations should be followed. The guidelines shown in Table 7 and Table 8 are general ones, and solvent cement properties may vary considerably among manufacturers.

Table 7
(*Clause* E-2.2)
CPVC Cements for Tubing and Schedule 40 Interference Fit

Sl No.	Pipe Size Range, cm (inch)	Cement Type	Tubing		Schedule 40 Interference Fit	
			Min. viscosity, cP/ mPa.s	Min. Wet Film, cm (inch)	Min. Viscosity cP (MPa.s)	Min. Wet Film in. (cm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	0.9525 to 5.08 (3/8 to 2)	Regular-bodied	90	.015 (0.006)	-	-
2	0.3175 to 5.08 (1/8 to 2)	Regular-bodied			90	.015 (0.006)
3	6.35 to 15.24 ($2\frac{1}{2}$ to 6)	Medium-bodied			500	0.30 (0.012)
4	15.24 to 30.48 (6 to 12)	Heavy-bodied			1600	0.61 (0.024)

Table 8
(*Clause* E-2.2)

CPVC Cements for Schedule 80 and Noninterference Fits[2]

Sl No.	Pipe Size Range, cm (inch)	Cement Type	*Min* viscosity, cP/mPa.s	Min. Wet Film Thickness, cm (inch)
(1)	(2)	(3)	(4)	(5)
1	(1/8 to 1 1/4)	Medium-bodied	500	0.30 (0.012)
2	$1\frac{1}{2}$ to 6	Heavy-bodied	1600	0.61 (0.024)

NOTES

1. The wet-film thickness of a solvent cement can be measured by using a Nordson Wet Film Thickness Gage or equivalent, available from Nordson Corp., Amherst, OH 44001, as Nordson No. 79-0015. To use this gage, dip a short length of 1-inch pipe vertically into the cement at a temperature of approximately 23°C (73°F) to a depth of 1.5 to 2 inch. (40 to 50 mm) for a period of 15 s. Remove the pipe from the cement and hold the pipe horizontally for 45 s. Measure the wet-film thickness on the top surfaces of the pipe with the end of the gage about ¼ inch (10mm) from the end of the pipe. With a little care and experience, the wet cement layer can be readily measured to ± 0.002 in. (± 0.05 mm).

2. The cement manufacturer's recommendations should be followed in selecting the proper cement for joining Schedule 80 pipe sizes above 6 inch.