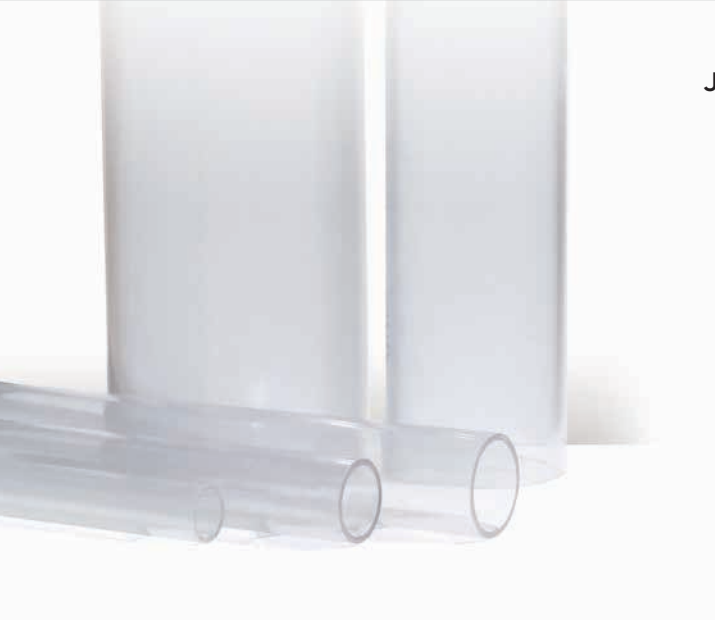




Job or Customer:

Engineer:

Contractor:

Submitted by: Date

Approved by: Date

Order No: Date

Specification:

< STANDARDS >



ASTM D1784
ASTM D1785



NSF 61

PVC is the most frequently specified of all thermoplastic piping materials. It has been used successfully for over 60 years. PVC is characterized by distinctive physical properties, and is resistant to corrosion and chemical attack by acids, alkalis, salt solutions and many other chemicals. It is attacked, however, by polar solvents such as ketones and aromatics.

The benefits of rigid PVC piping are well documented including: lightweight, flexibility, durability, and exceptional corrosion resistance. Clear-Guard™ possesses these benefits with the addition of clarity. Our Clear-Guard provides 360° visibility for several applications including dual-containment, clean room piping, and site glass applications.

With IPEX's new Clear-Guard high pressure clear PVC pipe you can specify Schedule 40 clear pipe for applications where previously only Schedule 80 clear pipe would suffice. Our high pressure formulation, with a long-term hydrostatic design basis of 3,150 psi in accordance with ASTM D2837 allows for better clarity and more versatility for various applications.

Material properties

Properties	PVC	Standards
Cell classification	15334	ASTM D1784
Maximum Service Temperature	140°F	
Specific Gravity, g/cm ³	1.32 g/cm ³ (73°F / 23°C)	ASTM D792
Tensile Strength, psi at 73°F	6,100	ASTM D638
Coefficient of Linear Expansion, in./in./°F	3.8	ASTM D696
Deflection Temperature Under Load	150°F	ASTM D648

Pipe availability

Clear-Guard™ High Pressure PVC Schedule 40 Clear pipe is available as standard 10 foot runs and with plain ends. 20 foot runs are available upon special request.

Size	Product Code	Pressure Rating @ 73°F
1/2"	22003	480
3/4"	22009	390
1"	22014	360
1-1/4"	22026	290
1-1/2"	22031	260
2"	22036	220
3"	22045	210
4"	22053	180
6"	22057	140
8"	22198	120

High Pressure Clear PVC Pipe

Handling & Installation Procedures

IPEX Clear-Guard™ Clear PVC pipe is easily joined by the solvent cementing process, providing a quick, strong, leak-tight seal for pressure applications. To maintain the system's clarity, IPEX recommends the use of clear, medium-bodied, fast-setting cement in conjunction with a clear primer for optimum joint integrity. As an added advantage due to the product's transparency, joint integrity is readily identified during the solvent cement joining process.

installation

To make consistently tight joints, the following points of solvent cementing should be clearly understood:

1. The joining surfaces must be softened and made semi-fluid.
2. Sufficient cement must be applied to fill the gap between pipe and fittings.
3. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid.
4. Joint strength will develop as the cement cures. In the tight part of the joint, surfaces tend to fuse together; in the loose part, the cement bonds to both surfaces.

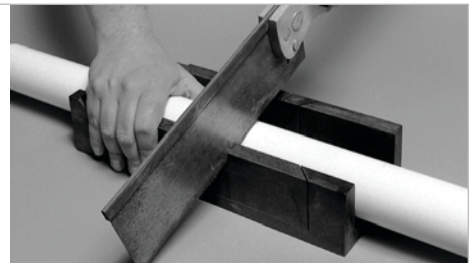
Step 1 Preparation

Assemble proper materials for the job. This includes the appropriate cement, primer and applicator for the size of piping system to be assembled.



Step 2 Cut Pipe

Pipe must be cut as square as possible. (A diagonal cut reduces bonding area in the most effective part of the joint.) Use a handsaw and miter box or a mechanical saw.

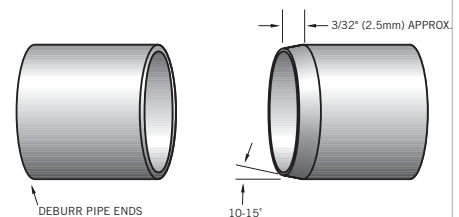


Plastic tubing cutters may also be used for cutting plastic pipe; however, some produce a raised bead at the end of the pipe. This bead must be removed with a file or reamer, as it will wipe the cement away when pipe is inserted into the fitting.



Step 3 Deburr Pipe Ends

Use a knife, plastic pipe deburring tool, or file to remove burrs from the end of small diameter pipe. Be sure to remove all burrs from around the inside as well as the outside of the pipe. A slight chamfer (bevel) of about 15° should be added to the end to permit easier insertion of the pipe into the fitting. Failure to chamfer the edge of the pipe may remove cement from the fitting socket, causing the joint to leak. For pressure pipe systems of 2" and above, the pipe must be end-treated with a 15° chamfer cut to a depth of approximately 3/32" (2.5mm).



High Pressure Clear PVC Pipe

Handling & Installation Procedures

Step 4 Clean Pipe Ends

Remove all dirt, grease and moisture. A thorough wipe with a clean dry rag is usually sufficient. (Moisture will retard cure, dirt or grease can prevent adhesion).



Step 5 Check Fit

Check pipe and fittings for dry fit before cementing together. For proper interference fit, the pipe must go easily into the fitting one quarter to three quarters of the way. Too tight a fit is not desirable; you must be able to fully bottom the pipe in the socket during assembly. If the pipe and fittings are not out of round, a satisfactory joint can be made if there is a "net" fit, that is, the pipe bottoms in the fitting socket with no interference, without slop.

All pipe and fittings must conform to ASTM and other recognized standards.



Step 6 Select Applicator

Ensure that the right applicator is being used for the size of pipe or fittings being joined. The applicator size should be equal to half the pipe diameter. It is important that a proper size applicator be used to help ensure that sufficient layers of cement and primer are applied.



Step 7 Priming

The purpose of a primer is to penetrate and soften pipe surfaces so that they can fuse together. The proper use of a primer provides assurance that the surfaces are prepared for fusion.

Check the penetration or softening on a piece of scrap before you start the installation or if the weather changes during the day. Using a knife or other sharp object, drag the edge over the coated surface. Proper penetration has been made if you can scratch or scrape a few thousandths of an inch of the primed surfaces away.

Weather conditions can affect priming and cementing action, so be aware of the following:

- repeated applications to either or both surfaces may be necessary
- in cold weather, more time may be required for proper penetration
- in hot weather, penetration time may be shortened due to rapid evaporation



High Pressure Clear PVC Pipe

Handling & Installation Procedures

Step 8 Primer Application

Using the correct applicator, aggressively work the primer into the fitting socket, keeping the surface and applicator wet until the surface has been softened. More applications may be needed for hard surfaces and cold weather conditions. Re-dip the applicator in primer as required. When the surface is primed, remove any puddles of primer from the socket.



Step 9 Primer Application

Next, aggressively work the primer on to the end of the pipe to a point 1/2" beyond the depth of the fitting socket.

Immediately and while the surfaces are still wet, apply the appropriate IPEX cement.



Step 10 Cement Application

Stir the cement or shake can before using. Using the correct size applicator, aggressively work a full even layer of cement on to the pipe end equal to the depth of the fitting socket. Do not brush it out to a thin paint type layer, as this will dry within a few seconds.



Step 11 Cement Application

Aggressively work a medium layer of cement into the fitting socket.

Avoid puddling the cement in the socket. On bell end pipe do not coat beyond the socket depth or allow cement to run down into the pipe beyond the spigot end.



Step 12 Cement Application

Apply a second full, even layer of cement on the pipe.

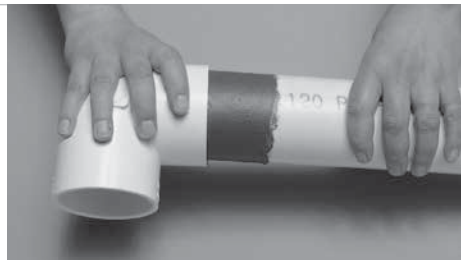


High Pressure Clear PVC Pipe

Handling & Installation Procedures

Step 13 Assembly

Without delay, while the cement is still wet, assemble the pipe and fittings. Use sufficient force to ensure that the pipe bottoms in the fitting socket. If possible, twist the pipe a quarter turn as you insert it.



Step 14 Assembly

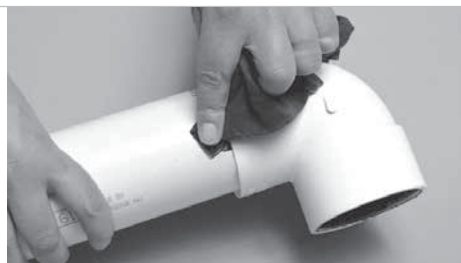
Hold the pipe and fitting together for approximately 30 seconds to avoid push out.

After assembly, a joint should have a ring or bead of cement completely around the juncture of the pipe and fitting. If voids in this ring are present, sufficient cement was not applied and the joint may be defective.



Step 15 Joint Cleaning

Using a rag, remove the excess cement from the pipe and fitting, including the ring or bead, as it will needlessly soften the pipe and fitting and does not add to joint strength. Avoid disturbing or moving the joint.



Step 16 Joint Setting & Curing

Handle newly assembled joints carefully until initial set has taken place. Allow curing to take place before pressurizing the system. (Note: in humid weather allow for 50% more curing time.)

For initial set and cure times for IPEX cements, refer to the table on page 10.

High Pressure Clear PVC Pipe

Handling & Installation Procedures

Cold Weather

Although normal installation temperatures are between 40°F (4°C) and 110°F (43°C), high strength joints have been made at temperatures as low as -15°F (-26°C).

In cold weather, solvents penetrate and soften the plastic pipe and fitting surfaces more slowly than in warm weather. In this situation, the plastic is more resistant to solvent attack and it becomes even more important to pre-soften surfaces with an aggressive primer. Be aware that because of slower evaporation, a longer cure time is necessary.

Tips for solvent cementing in cold weather

- Prefabricate as much of the system as is possible in a heated work area.
- Store cements and primers in a warmer area when not in use and make sure they remain fluid.
- Take special care to remove moisture including ice and snow from the surfaces to be joined.
- Ensure that the temperature of the materials to be joined (re: pipe and fittings) is similar.
- Use an IPEX Primer to soften the joining surfaces before applying cement. More than one application may be necessary.
- Allow a longer cure period before the system is used. **Note:** A heat blanket may be used to speed up the set and cure times.

Hot Weather

There are many occasions when solvent cementing plastic pipe at 95°F (35°C) temperatures and above cannot be avoided. If special precautions are taken, problems can be avoided.

Solvent cements for plastic pipe contain high-strength solvents which evaporate faster at elevated temperatures. This is especially true when there is a hot wind blowing. If the pipe is stored in direct sunlight, the pipe surface temperatures may be 20°F to 30°F (10°C to 15°C) higher than the ambient temperature. In this situation, the plastic is less resistant to attack and the solvents will attack faster and deeper, especially inside a joint. It is therefore very important to avoid puddling the cement inside the fitting socket and to ensure that any excess cement outside the joint is wiped off.

Tips for solvent cementing in hot weather:

- Store solvent cements and primers in a cool or shaded area prior to use.
- If possible, store fittings and pipe or at least the ends to be solvent welded, in a shady area before cementing.
- Try to do the solvent cementing in cooler morning hours.
- Cool surfaces to be joined by wiping with a damp rag.
- Make sure that the surface is dry prior to applying solvent cement.
- Make sure that both surfaces to be joined are still wet with cement when putting them together. With large size pipe, more people on the crew may be necessary.
- Using a primer and a heavier, high-viscosity cement will provide a little more working time.

Note: During hot weather the expansion-contraction factor may increase. Refer to the expansion-contraction design criteria in this manual.

High Pressure Clear PVC Pipe

Handling & Installation Procedures

Joint Cure Schedule

Temperature Range (°F)	Temperature Range (°C)	Pipe Size (in) & system operating pressure							
		1/2 to 1-1/4		1-1/2 to 2		2-1/2 to 8		10 to 14	>16
		<160psi	160 - 370psi	<160psi	160 - 315psi	<160psi	160 - 315psi	<100psi	<100psi
60 to 100	16 to 38	15 min	6 hr	30 min	12 hr	1-1/2hr	24 hr	48 hr	72 hr
40 to 60	4 to 16	20 min	12 hr	45 min	24 hr	4 hr	48 hr	96 hr	6 days
0 to 40	-18 to 4	30 min	48 hr	1 hr	96 hr	72 hr	8 days	8 days	14 days

* The figures in the table are estimates based on laboratory tests for water applications (chemical applications may require different set times). In damp or humid weather allow 50% more cure time (relative humidity over 60%).

Note 1: Due to the many variables in the field, these figures should be used as a general guideline only.

Note 2: Joint cure schedule is the necessary time needed before pressurizing the system.

High Pressure Clear PVC Pipe

Handling & Installation Procedures

Testing

Site Pressure Testing

The purpose of an onsite pressure test is to establish that the installed section of line, and in particular all joints and fittings, will withstand the design working pressure, plus a safety margin, without loss of pressure or fluid.

Generally a test pressure of 1-1/2 times the safe working pressure for the pipe installed is adequate. Whenever possible, it is recommended that hydrostatic testing be carried out. It is suggested that the following hydrostatic test procedure be followed after the solvent-welded joints have been allowed to cure for a minimum period of 24 hours at 73°F (23°C) (timed from the cure of last joint). For more detail, refer to the joint cure schedules in [Table 22](#) in the Installation section of the IPEX Volume I: Vinyl Process Piping Systems; Industrial Technical Manual Series.

Hydrostatic Test Procedure

1. Fully inspect the installed piping for evidence of mechanical abuse and/or dry suspect joints.
2. Split the system into convenient test sections not exceeding 1,000 ft.
3. Slowly fill the pipe section with water, preferably at a velocity of 1.0 fps or less. Any entrapped air should be evacuated by venting from the high points. Do not pressurize at this stage.
4. Leave the section for at least 1 hour to allow equilibrium temperature to be achieved.
5. Check the system for leaks. If clear, check for and remove any remaining air and increase pressure up to 50 psi. Do not pressurize further at this stage.
6. Leave the section pressurized for 10 minutes. If the pressure decays, inspect for leaks. If the pressure remains constant, slowly increase the hydrostatic pressure to 1-1/2 times the nominal working pressure.
7. Leave the section pressurized for a period not exceeding 1 hour. During this time, the pressure should not change.

If there is a significant drop in static pressure or extended times are required to achieve pressure, either joint leakage has occurred or air remains in the line. Inspect for leakage and if none is apparent, reduce the pressure and check for trapped air. This must be removed before further testing.

Any joint leaks should be repaired and allowed to cure fully before re-pressurizing for a minimum of 24 hours.



WARNING

- NEVER use compressed air or gas in PVC/CPVC/PP/PVDF pipe and fittings.
- NEVER test PVC/CPVC/PP/PVDF pipe and fittings with compressed air or gas, or air-over-water boosters.
- ONLY use PVC/CPVC/PP/PVDF pipe for water and approved chemicals.

Use of compressed air or gas in PVC/CPVC/PP/PVDF pipe and fittings can result in explosive failures and cause severe injury or death.



High Pressure Clear PVC Pipe *Handling & Installation Procedures*

PVC is a strong, lightweight material, about one fifth the weight of steel or cast iron. Piping made of this material is easily handled and, as a result, there is a tendency for them to be thrown about on the jobsite. Care should be taken in handling and storage to prevent damage to the pipe.

PVC pipe should be given adequate support at all times. It should not be stacked in large piles, especially in warm temperature conditions, as bottom pipe may become distorted and joining will become difficult.

For long-term storage, pipe racks should be used, providing continuous support along the length. If this is not possible, timber supports of at least 3" bearing width, at spacings not greater than 3' centers, should be placed beneath the piping. If the stacks are rectangular, twice the spacing at the sides is required. Pipe should not be stored more than seven layers high in racks. If different classes of pipe are kept in the same rack, pipe with the thickest walls should always be at the bottom. Sharp corners on metal racks should be avoided.

For temporary storage in the field when racks are not provided, care should be taken that the ground is level and free of sharp objects (i.e. loose stones, etc.). Pipe should be stacked to reduce movement, but should not exceed three to four layers high.

Most pipe is now supplied in crates. Care should be taken when unloading the crates; avoid using metal slings or wire ropes. Crates may be stacked four high in the field.

The above recommendations are for a temperature of approximately 80°F (27°C). Stack heights should be reduced if higher temperatures are encountered, or if pipe is nested (i.e. pipe stored inside pipe of a larger diameter). Reduction in height should be proportional to the total weight of the nested pipe, compared with the weight of pipe normally contained in such racks.

Since the soundness of any joint depends on the condition of the pipe end, care should be taken in transit, handling and storage to avoid damage to these ends. The impact resistance and flexibility of PVC pipe is reduced by lower temperature conditions. The impact strength for both types of piping materials will decrease as temperatures approach 32°F (0°C) and below. Care should be taken when unloading and handling pipe in cold weather. Dropping pipe from a truck or forklift may cause damage. Methods and techniques normally



used in warm weather may not be acceptable at the lower temperature range.

When loading pipe onto vehicles, care should be taken to avoid contact with any sharp corners (i.e. angle irons, nail heads, etc.), as the pipe may be damaged.

While in transit, pipe should be well secured and supported over the entire length and should never project unsecured from the back of a trailer.

Larger pipe may be off-loaded from vehicles by rolling them gently down timbers, ensuring that they do not fall onto one another or onto a hard, uneven surface.

Prolonged Outdoor Exposure

Prolonged exposure of Clear-Guard pipe to the direct rays of the sun is not recommended. If the pipe needs to be stored outdoors, cover the stockpile or the crated pipe with a light colored opaque material such as canvas. If the pipe is covered, always allow for the circulation of air through the pipe to avoid heat buildup in hot summer weather. Make sure that the pipe is not stored close to sources of heat such as boilers, steam lines, engine exhaust outlets, etc.

Scope

This specification sheet covers the manufacturers' requirements for clear PVC Schedule 40 IPS pressure pipe. The pipe shall meet or exceed performance standards set by the American Society of Testing and Materials (ASTM) and NSF International (NSF)

Clear-Guard™ PVC Materials

Rigid PVC (polyvinyl chloride) used in the manufacturing of Clear-Guard schedule 40 High Pressure Pipe complies with the material requirements of ASTM D1784 (formerly Type 1, Grade 1) and has a cell classification of 15334 and a Hydrostatic Design Basis (HDB) of 3150 psi. The compound is listed with NSF for potable water service.

Dimensions

Clear-Guard schedule 40 High Pressure Pipe shall meet the requirements of ASTM D1785.

Marking

Clear-Guard™ PVC Schedule 40 pipe is marked as prescribed in ASTM D1785. The marking includes the following: IPEX; Clear-Guard; IPS PVC and the Schedule and Pressure Rating at 73°F (23°C); ASTM D1785; and NSF 61.

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the world's largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems
- PVC, CPVC, PP, PVCO, ABS, PEX, FR-PVDF, NFRPP, FRPP, HDPE, PVDF and PE pipe and fittings (1/2" – 48")

Products manufactured by IPEX Inc.

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A policy of ongoing product improvement is maintained. This may result in modifications of features and/or specifications without notice.