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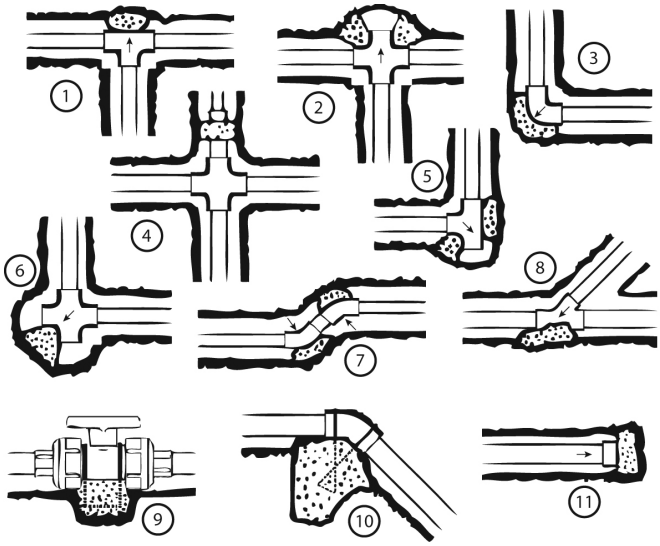
Thrust Blocking

THRUST BLOCKING - Water under pressure exerts thrust forces in piping systems. Thrust blocking should be provided, as necessary, to prevent movement of pipe or appurtenances in response to thrust.

Types of Thrust Blocking:

If thrusts due to high pressure are expected, anchor valves as below. At vertical bends anchor to resist outward thrusts.

1. Thru line connection, tee
2. Thru line connection, cross used as tee
3. Direction change, elbow
4. Change line size, reducer
5. Direction change, tee used as elbow
6. Direction change, cross used as elbow
7. Direction change
8. Thru line connection, wye
9. Valve anchor
10. Direction change vertical, bend anchor
11. End Caps (above or below ground)



Thrust Blocking Is Required Wherever The Pipeline:

- Changes direction (e.g., tees, bends, elbows and crosses)
- Changes size at its reducers
- Stops, as at dead ends
- Valves and hydrants, at which thrust develops when closed

Size and Type of Thrust Blocking Depends on:

- Maximum system pressure
- Pipe size
- Type and size of fittings or appurtenance
- Line profile (horizontal or vertical bends)
- Soil type

See additional information under Installation Gasketed Pipe

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Handling & Joining Methods - Solvent Cementing

Plastic piping systems must be engineered, installed, operated and maintained in accordance with accepted standards and procedures. It is absolutely necessary that all design, installation, operation and maintenance personnel be trained in proper handling, installation requirements and precautions for installation and use of plastic piping systems before starting.

Handling & Storage

Spears® products are packaged and shipped with care to avoid damage. Pipe and fittings should be stored and protected from direct exposure to sunlight. All pipe and accessories should be stored above ground and fully supported so as not to bend or excessively deflect under its own weight. Proper stacking techniques are necessary. Improper stacking can result in instability that may result in pipe damage or personnel injury.

Use care when transporting and storing the product to prevent damage. Piping products should not be dropped or have objects dropped on them. Do not drag pipe over articles or across the ground and do not subject pipe to external loads or over stacking. If extended storage in direct sunlight is expected, pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excessive heat accumulation.

Spears® products should not be stored or installed close to heat-producing sources. PVC storage should not exceed 150°F and CPVC storage should not exceed 210°F. Handling techniques for PVC and CPVC pipe considered acceptable at warm temperatures may be unacceptable at very cold temperatures. When handling pipe in cold weather, consideration must be given to its lower impact strength. In subfreezing temperatures, extra caution in handling must be taken to prevent impact damage.

All pipe should be inspected for any scratches, splits or gouges before use. Damaged sections must be cut out and discarded.

Plastic Piping Tools

Basic Tools used with Plastic Piping

Use tools that have been specifically designed for use with thermoplastic pipe and fittings when installing. A variety of tools that are designed for cutting, beveling, and assembling plastic pipe and fittings, are readily available through local wholesale supply houses dealing in plastic pipe and fittings.

•Warning Tools normally used with metal piping systems, such as hacksaws, water pump pliers, pipe wrenches, etc., can cause damage to plastic pipe and fittings. Visible and hidden fractures, scoring or gouging of material, and over tightening of plastic threaded connections are some of the common problems resulting from the use of incorrect tools and procedures.

Pipe Cutters

Pipe must be square-cut to allow for the proper joining of pipe end and the fitting socket bottom. Wheel type pipe cutters designed for plastic pipe provides easy and clean cuts on smaller pipe sizes. Care should be used with similar ratchet-type cutters to avoid damage to pipe. A slightly raised edge left on the outside of the pipe end after cutting with either device must be removed.

Pipe Cutters for Large Diameter Pipe

Blade cutters made for use with large diameter plastic pipe are easy to adjust and operate for square, burr-less cuts. Blades with carbide edges will provide longer life. With one style blade cutter, pipe ends may also be beveled for solvent joints while being cut by using an optional bevel tool in place of one cutter blade.

Hand Saws

A miter box or similar guide can be used with a fine-toothed saw blade (16 to 18 teeth per inch) having little or no set (maximum 0.025 inch).

Power Saws

Power saws are quite useful in operations where a large quantity of pipe is being cut. Blades designed for plastic pipe MUST be used. A cutting speed of 6,000 RPM, using ordinary hand pressure is recommended.

Pipe Beveling Tools

Power beveling tools, as well as hand beveling tools designed for use with plastic pipe are available. Pipe ends must be beveled (chamfered) to allow easy insertion of the pipe into the fitting and to help spread solvent cement and to prevent scraping cement from the inside of the fitting socket. A recommended bevel of 1/16" to 3/32" at a 10° to 15° angle can be achieved using a plastic pipe beveling tool, but can also be accomplished using a file designed for use on plastic.

Deburring Tools

Special plastic pipe deburring tools remove burrs from pipe ends quickly and efficiently. All burrs must be removed from the inside, as well as the outside, of the pipe ends to properly spread solvent cement when joining pipe and fitting.

Strap Wrenches

Strap wrenches with nylon straps treated for slip resistance and designed for use with plastic pipe provide gripping power for turning without scratching or deforming the pipe.

Chain Vises

Chain vises can be used to hold pipe. Vises made with jaws engineered for use with plastic pipe provide holding power without damage to the pipe.

Pullers & Joining Devices

Pipe and fitting pullers are available for joining large diameter plastic pipe and fittings. These tools are designed to allow the pipe to be inserted to the proper insertion depth, maintain proper alignment during assembly, and hold freshly solvent-cemented connections to prevent the fitting from backing-off until the initial set time is achieved.

Joining Methods -Solvent Cement Welding

Solvent cement welding is the most widely used joining method for PVC and CPVC pipe and fittings. Other methods such as threads, flanges and groove adapters can also be used. These are specifically useful where it is anticipated that the joint will have to be disassembled in the future.

Solvent Cement Safety Precautions

Solvent cement products are flammable and contain chemical solvents. Appropriate safety precautions must be taken BEFORE APPLYING PRIMER AND CEMENT. Read the cement can label!

•CAUTION

Virtually all solvent cements and primers for plastic pipe are flammable and should not be used or stored near heat, spark or open flames. Do not smoke during use. Eliminate all ignition sources. Primer and PVC cement should be stored in closed containers in the shade at temperatures between 40°F and 110°F; CPVC cement at temperatures between 40°F and 90°F. Use of a can with applicator attached to its lid is recommended. ***Verify expiration dates stamped on cements and primers prior to use.***

Avoid breathing vapors. *They should be used only with adequate ventilation. Explosion-proof general mechanical ventilation is recommended. In confined or partially enclosed areas, a ventilating device should be used. Containers should be kept tightly closed when not in use, and covered as much as possible when in use.*

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Handling & Joining Methods - Solvent Cementing

Avoid contact with skin and eyes. May be absorbed through the skin; wearing PVA coated protective gloves and an impervious apron are recommended. May cause eye injury. Use eye protection and avoid eye contact. In case of contact, flush with plenty of water for 15 minutes. If irritation persists, get medical attention. If swallowed, call a physician immediately and follow precautionary statement given on side panel of cement container. Keep out of reach of children.

Refer to Solvent Cement Safety Data Sheet (SDS)

Use Caution with Welding Torches or other equipment where sparks might be involved at construction sites where plastic pipe has recently been solvent welded. Flammable vapors from cemented joints can stay within a piping system for some time. In all cases, lines should be flushed and purged to remove solvent vapors before welding.

Use Caution with Calcium Hypochlorite. Do not use a dry granular calcium hypochlorite as a disinfecting material for water purification in potable water piping systems. Granules or pellets of calcium hypochlorite (including their vapors) may react violently with solvent cements and primers if a water solution is not used. Chlorinated water solutions are nonvolatile and may be pumped into the piping system. Dry granular calcium hypochlorite should not be stored or used near solvent cements or primers.

Actually, solvent cementing is no more dangerous than putting gasoline in your automobile.

Solvent Cement and Primer Spills

Protect work areas prior to starting by using drop cloths in the event of a spill. Accidental spills should be wiped up immediately before the cement sets. Cement and/or primer spills can cause irreparable damage depending on the type of surface affected. Consult the manufacturer of the affected surface for possible suggestions.

Basic Solvent Cement Joints

The following is a general description of basic techniques used to make solvent cement joints. Adjustments will need to be made to method and tools used according to size of piping, but the same principles apply. Additional guidance can be found in ASTM D 2855, Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings. **Important:** Installers should verify that they can make satisfactory joints under varying conditions and should receive training in installation and safety procedures.

To consistently make good joints in PVC and CPVC piping products, the following should be carefully understood:

1. The joining surfaces of pipe and fitting must be softened and made semi-fluid.

2. Sufficient cement must be applied to fill the gap between pipe and fitting.

3. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid.

4. Joint strength develops as the cement dries (cures). In the tight part of the joint (interference area) the surfaces will fuse together; in the loose part the cement will bond to both surfaces.

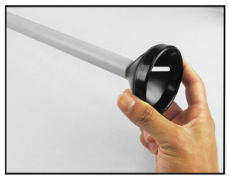
Cutting the Pipe

PVC or CPVC pipe can be cut easily with a ratchet cutter, wheel-type plastic pipe cutter (**NOTE:** be sure to remove any raised ridge produced by wheel cutters), a power saw, or any other fine-tooth saw. It is important that the cutting tools being used are designed for plastic pipe. To ensure that the pipe is cut square, use a miter box when cutting with a saw. Cutting pipe as square as possible provides the maximum bonding surface area.


Be careful not to split the tube if using a ratchet-type cutter, especially in temperatures below 50°F. If any damage or cracking is evident, cut off at least 2" of the pipe beyond any visible crack.

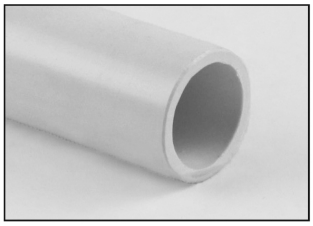
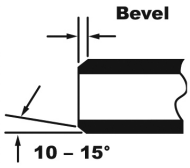
Deburring & Beveling

Burrs and filings can prevent contact between the tube and the fitting during assembly and must be removed from the outside and the inside of the pipe. A deburring/chamfering tool (or file) is suitable for this purpose:

Burrs Being Removed from Outside & Inside

A slight bevel (chamfer) must be placed at the outsided end of the pipe to ease the entry of the tube into the socket and minimize the chance of cement being wiped off the fitting:

Bevel Outside End

Fitting & Joining Preparation

1. Using a clean, dry rag, wipe any loose dirt and moisture from the fitting's socket and pipe end. Moisture can slow the cure time, and at this stage of assembly, excessive moisture can reduce joint strength.

2. Check the dry fit of the pipe and fitting. The pipe should enter the fitting's socket easily 1/4 - 3/4 of the way (interference fit) , or at least have interference between pipe and fitting bottom (net fit). **DO NOT** use any components that appear irregular or do not fit properly. Contact Spears® regarding any questions about usability.

3. Measure socket depth and mark on pipe for reference during cement application.

4. It is advisable to additionally mark pipe and fitting for alignment orientation position, especially with larger fittings.

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Handling & Joining Methods - Solvent Cementing

Solvent Cementing Assembly

Verify the expiration date located on the solvent cement can. The cement can be used for a period of 2 years from the date stamped on the can. When cementing pipe and fittings in extremely cold temperatures, make sure the cement has not "JELLED." Jelled or expired cement must be discarded in an environmentally friendly fashion, in accordance with local regulations. To prolong the life of solvent cement, keep the containers tightly closed when not in use, and cover the container as much as possible during use. If an unopened solvent cement container is subjected to freezing temperatures, the cement may become extremely thick. Place the closed container in a room temperature area where, after a short time period, the cement will return to a usable condition. **DO NOT** attempt to heat solvent cement. The cement must be applied when the pipe and fittings are clean and free from any moisture and debris.

Primer Use - Softening of pipe and fitting joining surfaces can be achieved by the cement itself or by using a suitable primer. A primer will usually penetrate and soften the surfaces more quickly than the cement alone. However, special "one-step" cements formulated for use without primers are available. Check local codes (where required) for acceptable applications.

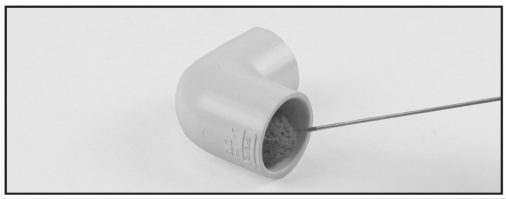
Apply Primer - USING AN APPLICATOR THAT IS AT LEAST 1/2 THE SIZE OF THE PIPE DIAMETER, vigorously scrub joining surface of fitting, of pipe and then again of fitting. Work quickly to apply 2-3 coats in this manner. SOLVENT CEMENT SHOULD THEN BE APPLIED WHILE PRIMER IS STILL WET.

Apply Solvent Cement - USING AN APPLICATOR THAT IS AT LEAST 1/2 THE SIZE OF THE PIPE DIAMETER, WORK THE CEMENT INTO THE JOINING SURFACES USING A CONTINUOUS, CIRCULAR MOTION.

Use sufficient cement, but avoid puddling the cement on or within the fitting and pipe. Puddled cement causes excess softening and damage to the PVC or CPVC material. If interference fit was at the bottom of the socket, use extra cement and make a 2nd application to pipe. WORK QUICKLY SO THAT PIPE AND FITTING CAN BE JOINED WHILE CEMENT IS STILL WET.

Apply the cement in the sequence pictured below:

1. Apply a coat to the pipe to depth of fitting socket
Work the cement into the joining surfaces using a continuous, circular motion.

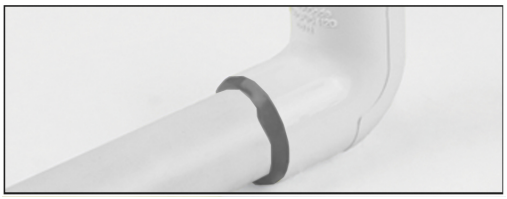


2. Apply a medium coat to the fitting socket
Avoid puddling the cement in the sockets and avoid getting cement in other sockets or threaded connections.

3. Apply a second coat to the pipe end for sizes 1-1/4 inch and larger joints, or if interference fit was at socket bottom during dry-fit.

Assemble Joint

Immediately insert pipe into the fitting socket while rotating the pipe 1/4 turn. Align the fitting in the proper orientation at this time. Make sure the pipe bottoms out at the fitting's stop. Hold the assembly for at least 30 seconds to ensure initial bonding. Tapered pipe sockets can result in pipe backing out of the joint if not held under constant pressure A bead of cement must be present around the pipe and fitting juncture. If this bead is not continuous around the socket's shoulder, insufficient cement was applied and the joint must be disassembled or cut out and replaced.



Any cement, in excess of the bead, can be wiped off with a dry, clean rag.

Set and Cure Times

SET TIME: The initial set time is the recommended waiting period before handling newly assembled joints. After initial set, the joints will withstand the stresses of normal installation. However, a badly misaligned installation will cause excessive stresses in the joint, pipe and fittings.

CURE TIME: The cure time is the recommended waiting period before pressurizing newly assembled joints.

The following basic guidelines should be used:

- The set and cure times for solvent cement depend on pipe size, temperature, relative humidity, and tightness of fit. Drying time is faster for drier environments, smaller pipe sizes, high temperatures, and tighter fits.
- Special care must be taken when assembling products in low temperatures (below 40°F) or high temperatures (above 80°F).
- Extra set and handling times must be allowed in colder temperatures. When cementing pipe and fittings in cold temperatures, make sure the cement has not "JELLED." Jelled cement must be discarded.
- In higher temperatures, make sure both surfaces to be joined are still wet with cement during assembly.
- The assembly must be allowed an initial set, without any stress on the joint
- Following the initial set period, the assembly can be handled carefully by avoiding stress on the joint.

Average Set Times

Temp. Range	Pipe Sizes 1/2"- 1-1/4"	Pipe Sizes 1-1/2"- 2"	Pipe Sizes 2-1/2"- 8"	Pipe Sizes 10"- 15"	Pipe Sizes 16"- 24"
60° - 100°F	2 Min.	5 Min.	30 Min.	2 Hrs.	4 Hrs.
40° - 60°F	5 Min.	10 Min.	2 Hrs.	8 Hrs.	16 Hrs.
0° - 40°F	10 Min.	15 Min.	12 Hrs.	24 Hrs.	48 Hrs.

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Handling & Joining Methods - Solvent Cementing

Average Cure Times

Relative Humidity 60% or Less*	Pipe Sizes 1/2" - 1-1/4"		Pipe Sizes 1-1/2" - 2"		Pipe Sizes 2-1/2" - 8"		Pipe Sizes 10" - 15"	Pipe Sizes 16" - 24"
Temperature Range During Assembly and Cure Periods	Up to 160 psi	Above 160 to 370 psi	Up to 160 psi	Above 160 to 315 psi	Up to 160 psi	Above 160 to 315 psi	Up to 100 psi	Up to 100 psi
60° - 100°F	15 Min.	6 Hrs.	30 Min.	12 Hrs.	1-1/2 Hrs.	24 Hrs.	48 Hrs.	72 Hrs
40° - 60°F	20 Min.	12 Hrs.	45 Min.	24 Hrs.	4 Hrs.	48 Hrs.	96 Hrs.	6 Days
0° - 40°F	30 Min.	48 Hrs.	1 Hr.	96 Hrs.	72 Hrs.	8 Days	8 days	14 Days

•**NOTE** In damp or humid weather allow 50% more cure time. The cure schedules shown are suggested as guides only. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual solvent cement manufacturer's recommendations for the particular cement being used should be followed.

Special Considerations for Working with Solvent Cement Welding

Handling of Cement

Keep cement containers covered while not in use. Cement with the lid left off can become thick and viscous, or gel like. This condition is typically a result of tetrahydrofuran (THF) solvent evaporation and the cement is useless. Do not try to restore the cement by stirring in a thinner. Smaller containers of cement are recommended to be used, especially in warm or hot weather. Prior to opening cans of cement, shake vigorously to properly mix resin and solvents. Solvents contained in PVC and CPVC cements are highly flammable and should not be used near an open flame. The area in which the cement is being used should be well ventilated, and prolonged breathing of the fumes should be avoided, as well as contact with the skin or eyes. Verify the expiration dates stamped on the cements and primers prior to use.

CEMENT AND PRIMER SHELF LIFE

Spears® Products	Shelf Life	Spears® Products	Shelf Life
Primers / Cleaners	3 years	CPVC Solvent Cement	2 years
PVC Solvent Cement	3 years	ABS Solvent Cement	3 years

Hot Weather Use

Problems can be avoided when solvent cementing in 95°F or higher temperatures by taking a few special precautions. Solvent cements evaporate faster at elevated temperatures and can dry out prematurely. This is especially true when there is a hot wind blowing. Dry cement on pipe or fitting socket prior to assembly will not bond. If the pipe has been in direct sunlight for any length of time, surface temperatures may be 20°F to 30°F above air temperature. Solvents attack these hot surfaces faster, deeper and dry out quicker. As a result, it is very important to avoid puddling inside sockets, assemble immediately while wet and to wipe off excess cement at the joint exterior.

Tips for Solvent Cementing in High Temperatures:

1. Store solvent cements in a cool or shaded area prior to use.

2. If possible, store the fittings and pipe, or at least the ends to be solvent welded, in a shady area before cementing.

3. Cool surfaces to be joined by wiping with a damp rag. HOWEVER, be sure that surfaces are dry prior to applying solvent cement.

4. Try to do the solvent cementing in cooler morning hours.

5. Make sure that both surfaces to be joined are still wet with cement when putting them together.

Cold Weather Use

Solvent Cements and primers have excellent cold weather stability and are formulated to have well balanced drying characteristics even in subfreezing temperatures. Good solvent cemented joints can be made in very cold conditions provided proper care and a little common sense are used. In cold weather, solvents penetrate and soften surfaces more slowly than in warm weather. The plastic is also more resistant to solvent penetration, therefore, it becomes more important to pre-soften surfaces. A longer cure time is necessary due to slower evaporation.

Tips for Solvent Cementing in Cold Temperatures:

1. Prefabricate as much of the system as possible in a heated work area.

2. Store cements in a warmer area when not in use and make sure they remain fluid.

3. Take special care to remove moisture, including ice and snow.

4. Use special care to ensure joining surfaces are adequately softened; more than one application may be necessary.

5. Allow a longer cure period before the system is used.

Effects of Tolerances and Fits

PVC pipe and fittings are manufactured to applicable ASTM Standards to produce an interference fit when assembled. However, minimum and maximum allowable tolerances permitted for pipe and fitting can result in variations. For example, fitting with the maximum diameter and the pipe with the minimum diameter, may result in a loose fit. Applying two coats of solvent cement will help assure a good joint. Conversely, if the pipe diameter is on the maximum side and the fitting on the minimum side, the interference may be too great and sanding of the pipe O.D. may be necessary to permit entrance.

Always check dry fits prior to making a joint. If fit is loose, multiple coats and use of an extra heavy bodied cement may be required. Mating components should be checked to assure that tolerances and engagements are compatible (see preceding Basic Solvent Cement Joints instructions). Inspect all pipe and fittings for damage or irregularities. Do not use any components that appear irregular or do not fit properly. Contact the appropriate manufacturer of the product in question to determine usability.

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Handling & Joining Methods - Solvent Cementing

Large Diameter Pipe

Basic Solvent Cement Joint instructions apply to all sizes of pipe, but when making joints larger than 4", the use of two persons is recommended to properly apply cement and immediately assemble the joint while the cemented surfaces are still wet. Alignment of large diameter pipe and fittings during joining is critical since there is a greater potential for movement in the upper portion of a tapered socket that can result in misalignment. Special tools are commercially available for joining large diameter pipe.

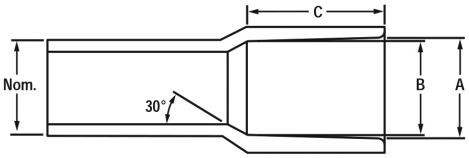
Be sure to use an appropriate size roller applicator with large diameter pipe, along with a heavy or extra-heavy bodied cement that is medium to slow setting. These have increased gap filling capability and allow somewhat longer assembly time. However, applications of heavy coats of solvent cement and speed in making the joint is important. Under a damp or wet condition, solvent cement may absorb some moisture. Excessive moisture can slow down the cure and reduce joint strength. Spears® CPVC-24 heavy body or PVC-19 extra-heavy body solvent cements are excellent for joining large diameter pipe (see Solvent Cement Selection Guide in following sections).

Belled End Pipe

Commercially available belled end pipe can be used to eliminate the need for couplings. Where belled end pipe is used, it is suggested that the interior surface of the bell be penetrated exceptionally well with the primer.

•NOTE some manufacturers use a silicone release agent on the belling plug, and a residue of this agent can remain inside the bell. Silicone will contaminate the joint and not allow proper solvent cement welding. All silicone residue must be removed in the cleaning process prior to solvent cementing.

Belled-End Pipe Dimensions



Nominal Size (in.)	A		B		C.
	Min.	Max.	Min.	Max.	Min.
1-1/4	1.675	1.680	1.648	1.658	1.870
1-1/2	1.905	1.914	1.880	1.888	2.000
2	2.381	2.393	2.363	2.375	2.250
2-1/2	2.882	2.896	2.861	2.875	2.500
3	3.508	3.524	3.484	3.500	3.250
4	4.509	4.527	4.482	4.500	4.000
5	5.573	5.593	5.543	5.563	4.000
6	6.636	6.658	6.603	6.625	6.000
8	8.640	8.670	8.595	8.625	6.000
10	10.761	10.791	10.722	10.752	8.000
12	12.763	12.793	12.721	12.751	8.500
14	14.030	14.045	13.985	14.000	9.000
16	16.037	16.052	15.985	16.000	10.000
18	18.041	18.056	17.985	18.000	12.000
20	20.045	20.060	19.985	20.000	12.000
24	24.060	24.075	24.000	24.015	14.000

Estimated Quantities of Solvent Cement

A variety of conditions can affect the amount of solvent cement required for making reliable joints. These include pipe size, tolerances, socket depths as well as installation conditions and type of cement used. Fitting sockets are tapered for proper assembly, which produces a slight gap at the socket entrance when installed with pipe. As pipe sizes increase, heavier bodied cements should be used for increase gap filling capabilities. It is best to use liberal amounts of solvent cement since insufficient cement use is one of the most common reasons for joint failure. The following information on cement usage is a recommendation only and other factors or unanticipated conditions may be encountered. Quantities are based on use with average socket lengths of Spears® molded and fabricated fittings.

Standard Pipe Joints

Fitting Size (in.)	Joints per Pint	Joints per Quart	Joints per Gallon
1/2	150	300	1200
3/4	100	200	800
1	63	125	500
1-1/4	70	140	560
1-1/2	45	90	360
2	30	60	240
2-1/2	25	50	200
3	20	40	160
4	15	30	120
6	5	10	40
8	3	5	20
10	---	2-3	4-6
12	---	1-2	2-4

Large Diameter Pipe Joints

Fitting Size (in.)	Quarts per Joint	Joints per Gallon
14	0.75	5.33
16	1.25	3.20
18	1.50	2.67
20	2.00	2.00
24	2.75	1.45

Suitable for Oil-Free air handling to 25 psi, not for distribution of compressed air or gas

See MSRP-1 Sheet or Check Spears® On-line Catalog @ www.spearsmfg.com for Pricing

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Handling & Joining Methods - Solvent Cementing

Supplemental Information on Solvent Cementing

Applicators

A wide variety of daubers, brushes, and rollers are available. For proper solvent cement welding of pipe and fittings, the cement applicator must be no less than half the size of the pipe. Sufficient cement cannot be applied using daubers attached to the cement can lid on large diameter products (> 3"dia.) The following chart shows a variety of Spears® applicator sizes for use on different pipe diameters.

SPEARS® APPLICATOR SELECTION GUIDE

For proper solvent cement welding of pipe and fittings, the cement applicator must be no less than half the size of the pipe

DAUBERS	Pipe Diameters						
	1/4"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
3/8" Dauber	•	•	•				
1/2" Dauber			•	•			
3/4" Dauber					•	•	
1-1/4" Dauber							•

ROLLERS & SWABS	SIZE	FOR PIPE DIAMETERS
3020	3" Roller	3" - 6"
6020	4" Roller	3" - 8"
7020	7" Roller	6" +
5520	4" Roller	6" +
6520	6" Roller	6" +
4020	4" Swab	6" +
5020	4" Swab	3" - 8"
4520	4" Swab	6" +

Cleaners

Cleaners can be used to remove dirt, oil and grease from the bonding surfaces of PVC, CPVC, ABS and Styrene pipe and fittings. Use of a cleaner is recommended before priming of pipe and fittings.

Primers

The use of Primer is necessary to penetrate and dissolve the surface of the pipe and fitting prior to the application of cement. Special "one-step" cements formulated for use without primers are available. Check cement instructions and local codes (where required) for acceptable applications. Primer must be applied to both the pipe and fittings. Apply multiple coats of primer to the fitting socket and to the outside of the pipe ensuring that the entire surface is wet. Solvent cement must be applied immediately after primer while the surfaces are still tacky.

Solvent Cements

Solvent cements are produced for joining a variety of commercially available pipe and fitting materials, including PVC, CPVC and ABS plastics. Solvent cements are typically formulated using tetra hydro furan (THF). When properly applied, this solvent dissolves the mating surfaces of the pipe and fittings. Cyclohexanone is a typical retardant used to slow the rate of solvent evaporation. Immediate joining of the wet mating surfaces in one minute or less is essential to eliminate dry spots that will not bond. The bond interface is strongest at the area of interference fit where the softened semi-fluid surfaces of the pipe and fitting chemically fuse. Plastic resin fillers (dissolved PVC or CPVC) in the cement fill the gaps between pipe and fitting. Cements are available in clear, white, gray and other colors to match the pipe or for specific application. **Inert pigments are used for coloration.** For example, white cements are made from titanium dioxide while gray cements are made from titanium dioxide and carbon black. As the solvent evaporates, pipe and fitting joint "cures", except for some residual solvent that dissipates over time. The resulting fused area is why this method is called "solvent cement welding" although no heat is applied to melt and fuse the bonded areas as in metal welding.

Solvent cements are formulated in regular bodied, medium bodied, heavy bodied, extra heavy bodied and specialty cements. Different types of cements have different set and cure times. Low VOC products - with lesser VOC emissions - will contribute to cleaner air and better workplace conditions. All Spears® solvent cement and primer products are certified as Low VOC.

1. Regular Bodied - Cements for smaller diameters (i.e.< 4") and thin-wall classes and Schedule 40 piping with interference fits. Generally referred to as "regular body" such as Spears® PVC-00 and PVC-02 cements, these cements are fast setting.

2. Medium Bodied - Cements for smaller diameters (i.e. < 4") for all classes, Schedule 40 and Schedule 80 pipe with interference fits such as Spears® PVC-05 and PVC-21 cements. These cements have better gap filling capability than regular bodied cement and are also considered fast setting

3. Heavy Bodied & Extra Heavy Bodied - Cements for both small and large diameters of heavier-wall Schedule 80 and Schedule 120 products. Heavy-body such as Spears® PVC-11 and CPVC-24 cements are classified as medium setting and extra heavy-body such as Spears® PVC-19 cement is classified as slow setting. These cements are formulated to fill larger gaps, dry slower and typically take longer to dry in order to provide more time to assemble joints.

4. Specialty Cements - Specialty cements formulated for use with specific products and applications, but can also be used with other applications of similar products . Examples include special cements such as Spears® PVC-25 Wet-N-Dry; transition cements such as Spears® MULTIPURPOSE-90 and Spears® ABS TO PVC-94; product specific cements such as Spears® ABS-71 and ABS-73; and one-step specialty cements. One-step cements do not require the use of primer prior to the application of the cement. Examples include Spears® FS-5 one-step cement for use with FlameGuard® CPVC Fire Sprinkler Products, Spears® LW-4 one-step cement for use with **LabWaste®** CPVC Chemical Drainage Systems; Spears® **EverTUFF®** CTS-5 for use with CPVC hot and cold water plumbing systems, and Spears® LX-5 Low Extractable PVC cement for use in high purity applications (i.e. Spears® LOW EXTRACTABLE PVC products). In addition, special application cements such as Spears® CPVC-24 is formulated for improved chemical resistance to caustics and chemical applications with both PVC and CPVC products. In fact, CPVC-24 is one of the most versatile solvent cements on the market today!

Selecting the appropriate solvent cement and primer for the type of products being joined is important. The following selection guide can be used in selecting the right Spears® solvent cement and primer for your application.

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Solvent Cement Selection Chart

Spears Solvent Cement & Primer Selection Guide

Type	Body	Spears®/IPS Cross Reference		Color	Relative Set	Capacity	Features
		Spears®	IPS				
PVC	Regular	PVC-00	700	Clear	Fast	Schedule 40 - 4"	
		PVC-02	702	Clear	Fast	Schedule 40 - 4"	Dries Clearest,slightly thicker than PVC-00
	Medium	PVC-05	705 (Not in Gray)	Clear/Gray	Fast	All Classes & Schedule 40 - 6" Schedule 80 - 4"	***Industrial Duty*** Primerless Capability[1]
		PVC-21	721	Blue	Fast	Schedule 40 - 6" Schedule 80 - 4"	Primerless Capability[1]
	Heavy	PVC-11	711	Gray	Medium	All Classes & Schedules - 12"	***Industrial Duty***
		PVC-17	717	Clear/Gray	Medium	All Classes & Schedules - 12" Non-pressure - 18"	***Industrial Duty***
	Extra Heavy	PVC-19	719	White/Gray	Slow	All Classes & Schedules Requiring High Gap Filling - 30"	***Industrial Duty***
	Specialty Cements	PVC-25	725	Aqua Blue	Very Fast	All Classes & Schedule 40 - 6" Schedule 80 - 4"	Wet-N-Dry Formulation Primerless Capability[1]
		PVC-26	747	Blue	Very Fast	All Classes & Schedule 40 - 6" Schedule 80 - 4"	POOL-PRO™ Formulation for Pool & Spa Primerless Capability.[1] Fades to clears as it cures.
		PVC-27	727	Clear	Very Fast	All Classes & Schedule 40 - 6" Schedule 80 - 4"	Cold-N-Hot Formulation -15°F to 100°F Primerless Capability[1]
		PVC-37	737	Blue	Very Fast	All Classes & Schedules - 6" Schedule 80 - 4"	Formulated for Wet Conditions Primerless Capability[1]
		PVC-50	750	Blue	Very Fast	Schedule 40 - 6" Schedule 80 - 4"	HOT PVC Formulation Primerless Capability[1]
		PVC-95	795	Clear/ Blue	Fast	All Classes & Schedule 40 - 6" Schedule 80 - 4"	Flexible PVC for Flex-Flex, Flex-Rigid Joints
		LX-5	N/A	Clear	Fast	Low Extractable PVC Systems - 6"	One Step[2] Low Extractable,High Purity Cement
CPVC	Heavy	CPVC-24	724	Gray/ Orange	Medium	All Classes & Schedules PVC or CPVC - All Sizes	Most Versatile,Chemically Resistant Cement for both CPVC & PVC Systems - including Duct - ***Industrial Duty***
	Specialty Cements	LW-5	N/A	Mustard	Medium	Lab Waste® CPVC Drainage Systems - 24"	One Step[2] Cement -Only **LabWaste®** System Chemically Approved Cement
		FS-5	N/A	Red	Fast	CPVC Fire Sprinkler Systems - 3"	One-Step[2] Cement for all CPVC Fire Sprinkler Systems
		CTS-5	FlowGuard Gold	Yellow	Fast	CTS CPVC Systems - 2"	One-Step[2] Cement for all CTS CPVC Systems
ABS	Medium	ABS-71	771	Yellow/Milk	Fast	All ABS Classes & Schedules - 8"	
		ABS-73	773	Black	Fast	All ABS Classes & Schedules - 8"	
Transition & Multipurpose	Medium	ABS TO PVC-94	794	Green	Fast	All Classes & Schedules - 6" (Except Schedule 80)	For ABS-to-PVC Transition Joints
		MULTIPURPOSE-90	790	Clear	Fast	All Classes & Schedules - 6" Schedule 80 - 4"	For PVC and CPVC pressure ABS and Styrene low-pressure systems
Primers & Cleaners		Primer-75	P-75	Aqua Blue		All Classes, Schedules & Sizes PVC & CPVC	Formulated for Wet Conditions ***Industrial Duty***
		Primer-70	P-70	Purple/ Clear		All Classes, Schedules & Sizes PVC & CPVC	***Industrial Duty***
		Primer-68	P-68	Purple/ Clear		All Classes, Schedules & Sizes PVC & CPVC	
		Cleaner-65	C-65	Clear		All Classes, Schedules & Sizes PVC & CPVC	For PVC, CPVC,ABS or Styrene
		Primer Cleaner-64	PC-64	Purple		All Classes, Schedules & Sizes PVC & CPVC	

Notes
1= Primerless Capability indicates a cement can be used without primer in certain applications if local code permits. See specic cement information for further restrictions.
2 = One Step designates a cement specically designed for use without primer. CTS One Step acceptability depends on local code requirements.

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Joining Methods - Threaded Connections

Joining Method - Threaded Connections

Threaded connections require the application of a thread sealant that is compatible with PVC and CPVC material. Spears® recommends the use of Spears® Blue 75™ Thread Sealant.

CAUTION - Use only thread sealants recommended for PVC or CPVC plastic. Other joint compounds or pastes may contain substances that could cause stress cracks in PVC or CPVC materials.

Apply sealant to the male threads only. Make sure all threads are covered. **DO NOT** clog the waterway with excess sealant. If PTFE tape must be used, Spears® recommends a thickness of at least .0025" that meets or exceeds military specification, MIL-T-27730A. **DO NOT** use a combination of tape and thread sealant on the same joint. Apply PTFE tape in the direction of the threads by starting with the first full thread and continuing over the entire thread length. Make sure all threads are covered. Generally, 2 - 3 wraps are sufficient to produce a watertight connection

DO NOT over-torque any threaded connections. Generally, one to two turns beyond finger-tight are required for a threaded connection. Use a smooth-jawed wrench or strap wrench when installing threaded connections.

Threading Pipe

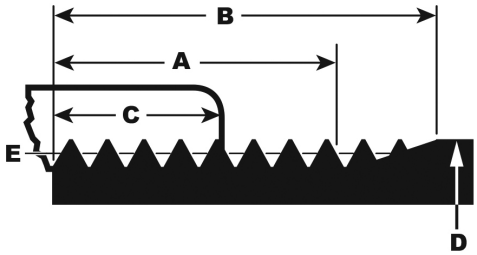
PVC and CPVC pipe can be threaded using either standard hand pipe stocks or power-operated equipment. Since rigid PVC plastic pipe has the same outside diameter as standard steel pipe in comparable sizes, standard steel pipe taps and dies can be used. A cut thread or deep scratch results in a stress concentration point. As a result, only Schedule 80 and Schedule 120 pipe should be threaded. A 50% pressure de-rating is applied to threaded pipe to compensate for this. **DO NOT** thread Schedule 40 pipe. For optimum results in threading, use new taps and dies; but in any case, they should be cleaned and sharpened and in good condition. Power threading machines should be fitted with dies having a 5° negative front rake and ground especially for this type of pipe; tapered guide sleeves are not required. For hand stocks the dies should have a negative front rake of 5° to 10°. Dies which have been designed for use on brass or copper pipes may be used successfully. Carboloy dies give longer service. (Taps should be ground with a 0° to 10° negative rake, depending upon the size and pitch of the thread. Die chasers should have a 33° chamfer on the lead; a 10° front or negative rake; and a 5° rake on the back or relief edge.). Self-opening die heads and collapsible taps, power threading machines and a slight chamfer to lead the tap or dies will speed production; however, taps and dies should not be driven at high speeds or with heavy pressure.

A tapered plug should be inserted into the pipe when threading, to hold the pipe round and to prevent the die from distorting and digging into the pipe wall. This ensures uniform thread depth all the way around. Pipe for threading should be held in a suitable pipe vise, but saw-tooth jaws should not be used. Flanges and close nipples should be threaded in jigs or tapping fixtures. To prevent crushing or scoring the pipe, some type of protective wrap, such as canvas, emery paper, or a light metal sleeve should be used; rounding of chuck jaws will also be helpful. Rigid PVC or CPVC plastic pipe should be threaded without use of lubricants. Standard cutting oils can cause stress cracking in plastics and should not be used. Water-soluble oil or plain water is recommended. Degreasing with any solvents is not recommended, nor should solvents be used in any cleanup. Always clear cuttings from the die.

DO NOT OVER THREAD - To obtain a tight, leak proof joint, the thread dimensions shown in the table should be used. If pipe is over threaded, fittings cannot be run on far enough to make a tight seal.

American National Standards Institute Code B1.20.1 covers dimensions and tolerances for tapered pipe threads. **Only Schedule 80 or heavier wall pipe should be threaded.**

Angle between sides of thread is 60 degrees. Taper of thread, on diameter, is 3/4 inch per foot. The basic thread depth is 0.8 x pitch of thread and the crest and root are truncated an amount equal to 0.033 x pitch, excepting 8 threads per inch which have a basic depth of 0.788 x pitch and are truncated 0.045 x pitch at the crest and 0.033 x pitch at the root.



PIPE THREADS

Nominal Size (in.) (Max.) (In.)	Outside Diameter (in.) D	Number of Threads Per Inch	Normal Engagement By Hand (in.) C	Length of Effective Thread (in.) A	Total Length: End of pipe to vanish point (in.) B	Pitch Diameter at end of Internal Thread (in.) E	Depth of Thread (Max.) (in.)
1/8	0.405	27	0.180	0.2639	0.3924	0.37476	0.02963
1/4	0.540	18	0.228	0.4018	0.5946	0.49163	0.04444
3/8	0.675	18	0.240	0.4078	0.6006	0.62701	0.04444
1/2	0.840	14	0.320	0.5337	0.7815	0.77843	0.05714
3/4	1.050	14	0.339	0.5457	0.7935	0.98887	0.05714
1	1.315	11-1/2	0.400	0.6828	0.9845	1.23863	0.06957
1-1/4	1.660	11-1/2	0.420	0.7068	1.0085	1.58338	0.06957
1-1/2	1.900	11-1/2	0.420	0.7235	1.0252	1.82234	0.06957
2	2.375	11-1/2	0.436	0.7565	1.0582	2.29627	0.06957
2-1/2	2.875	8	0.682	1.1375	1.5712	2.76216	0.10000
3	3.500	8	0.766	1.2000	1.6337	3.38850	0.10000
4	4.500	8	0.844	1.3000	1.7337	4.38713	0.10000
5	5.563	8	0.937	1.4063	1.8400	5.44929	0.10000
6	6.625	8	0.958	1.5125	1.9462	6.50597	0.10000

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Joining Methods - Threaded Connections

Which Threaded Joint Sealant to Use?

- Tape sealants are more susceptible to improper installation
- Paste sealants are more likely to contain incompatible chemicals
- Either type – Paste or Tape – must be properly used but NEVER use both!
- Do not use paste or tape on Gasket Sealed Head Adapters

The Best Choice For Threaded Joints

Spears ® Recommends a Compatible Paste

Paste–type thread sealants fill the threads better than tape. Application is less critical, as long as the sealant is compatible with the particular plastic used. Some "pipe dopes" and pastes can cause chemical stress cracking. Spears® BLUE 75™ thread sealant has been specially formulated and tested for use with these plastic piping components.

The Problem with Using TFE Tape Sealants

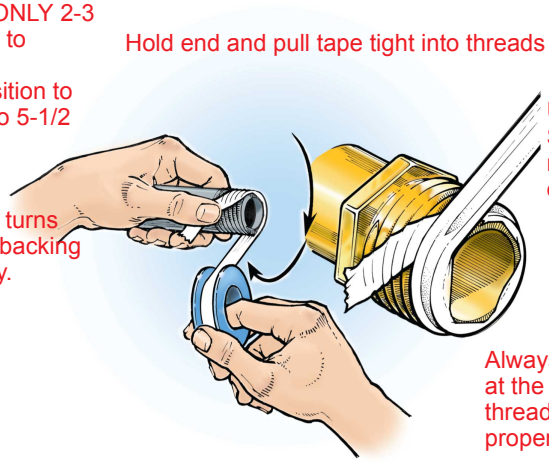
TFE tape sealants require special attention on application. Failure to follow the instructions below can result in female thread breaks due to excessive tape use, difficult assembly due to insufficient tape, leaks due to failure to cover starting threads, and leaks due to incorrectly applied tape that bunches at the thread entrance. Since TFE tape is a really good lubricant, care must be taken not to over-tighten taped joints.

If You MUST Use Tape Sealant, Use It Correctly!

Wrap Tape In Direction of Threads (clockwise for right-hand thread):

- For Head Adapters, use ONLY 2-3 wraps of tape and tighten to specified torque.
- For Female Adapter transition to metal pipe, use ONLY 5 to 5-1/2 wraps of tape.

Joint Assembly:
Tighten threaded joints 1-2 turns beyond finger tight. Avoid "backing up" the wrenched assembly. DO NOT over-tighten.



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Joining Methods - Flanges & Mechanical Grooved Couplings

Joining Method - Flanged Connections

PVC and CPVC flanges are available in several designs, including solid one-piece flanges, two piece Van Stone style flanges featuring a moveable ring for bolt alignment, and blind flanges for capping off a piping run. Flanges are available in socket, spigot and threaded configurations and are coupling devices designed for joining IPS (Iron Pipe Size) plastic piping systems where frequent disassembly may be required, can be used as a transitional fitting for joining plastic to metal piping systems, and for connection to other flanged type valves and equipment. A gasket is used between flanges to form a water-tight seal. Proper gasket material should be selected for fluids compatibility. Most plastic flanges carry a maximum working pressure rating of 150 psi non-shock for water at 73°F. Pressure ratings may vary according to size and construction of the flange. Consult flange manufacturer.

Gaskets

Select appropriate size and bolt pattern gasket. Full faced, 1/8" thick elastomer gaskets with a Shore "A" Durometer of approximately 70 are recommended. Verify that the gasket material is suitable for use with the application fluids.

Bolt Patterns & Selection

Most PVC and CPVC flanges are produced with ANSI B16.5 Bolt Patterns for Class 125/150 flanges. Optional Class 300 bolt patterns (NOT a 300 psi rating), certain ANSI/Metric dual pattern flanges, and metric bolt patterns can be produced. Proper bolt size, number and length should be selected for the specific flanges and equipment being assembled. Bolt length requirements will vary according to the flange or equipment manufacturer. Always use 2-wide flat washers for each bolt, one under the bolt head and one under the nut (do not use thin "fender" washers).

Bolt Torque

Threads should be cleaned and well lubricated (**WARNING:** Use only bolt lubricants compatible with PVC or CPVC material). Actual field conditions may require variations in these recommendations. **UNNECESSARY OVER TORQUING WILL DAMAGE THE FLANGE.** Torque should always be applied in approximately 5 ft-lb. increments using a 180° opposing sequence.

Flange Make-up

Follow proper solvent cementing and/or threaded component procedures as applicable to join the flange to the pipe. Once a flange is joined to pipe, the method for joining two flanges is as follows:

1. Piping runs joined to the flanges must be installed in a straight line position to the flange to avoid stress at the flange due to misalignment. Piping must also be secured and supported to prevent lateral movement which can create stress and damage the flange.

2. With gasket in place, align the bolt holes of the mating flanges by rotating the ring into position.

3. Insert all bolts, washers (two standard flat washers per bolt), and nuts.

4. Make sure the faces of the mating surfaces are flush against gasket prior to bolting down the flanges.

5. Tighten the nuts by hand until they are snug. Establish uniform pressure over the flange face by tightening the bolts in 5 ft.-lb. increments according to the Torque value shown in the following table using a 180° opposing sequence.

6. Care must be taken to avoid "bending" the flange when joining a Spears® flange to a "raised face" flange, or a wafer-style valve. Do not use bolts to bring together improperly mated flanges.

Recommended Flange Bolt Torque for Plastic Flanges

Flange Size (in.)	No. of Bolt Holes	Bolt Dia. (in.)	Min. Bolt Length (in.)[1]	Torque ft.-lb.
1/2	4	1/2	2	12
3/4	4	1/2	2	12
1	4	1/2	2-1/4	12
1-1/4	4	1/2	2-1/4	12
1-1/2	4	1/2	2-1/2	12
2	4	5/8	3	25
2-1/2	4	5/8	3-1/4	25
3	4	5/8	3-1/4	25
4	8	5/8	3-1/2	25
6	8	3/4	4	40
8	8	3/4	4-1/2	40
10	12	7/8	5	64
12	12	7/8	5	95
14	12	1	6	110
16	16	1	6-1/2	110
18	16	1-1/8	6-1/2	110
20[2]	20	1-1/8	5-1/2	110
24[2]	20	1-1/4	5-1/2	110

Note:

1 -Minimum bolt length is based on connecting two (2) Spears® flanges, two flat washers, gasket and nut. Adjustments will need to be made to accommodate valves and other equipment.

2 -Bolt Length for Spears® Fabricated 20 inch & 24 inch Flanges with Plastic Rings

Joining Method - Mechanical Grooved Couplings

In many installations where transition to metal pipe, or where disassembly is a prime factor, metallic grooved style couplings with gasket seal can be used to join PVC and CPVC pipe to alternate IPS size piping materials. In addition to the ease of disassembly, this type of connection also allows for a certain degree of angular adjustment and expansion/contraction. Special rolled-groove pipe can be joined, but easy to use molded Grooved Coupling Adapters then can be solvent cemented to plain end pipe are available for use with metallic grooved couplings.

Only flexible style metallic grooved couplings are recommended for use with plastic pipe. Rigid style couplings should not be used as these can provide a compressive/shear load to plastic pipe resulting in failure. Always check the compatibility of the grooved coupling gasket material with the intended application fluids.

•NOTE A gasket/joint lubricant is recommended to prevent pinching the gasket and to assist the seating and alignment processes during assembly of grooved couplings. Certain lubricants may contain a petroleum base or other chemicals, which will cause damage to the plastic pipe, gasket and adapter. Always verify the suitability for use of the selected lubricant with the lubricant manufacturer.