

Solvent Welding Instructions for ABS, PVC, & CPVC-CTS Pressure & DWV Piping Systems

Scope

The solvent welding procedure detailed herein applies to all NIBCO ABS-DWV, PVC-DWV, PVC, and CPVC-CTS pressure piping systems including molded fittings and valves. Belled-end pipe and sewer pipe can also be joined in this manner. NIBCO TECHNICAL SERVICES is available for additional solvent-welding guidance and recommendations.

Joining Equipment and Materials

- Cutting Tool
- Rags (non-synthetic, i.e., cotton)
- Deburring Tool
- Cement and Primer Applicators
- Applicator Can or Bucket
- Purple Primer
- Solvent Cement
- Tool Tray
- Notched Boards

TYPES OF CEMENT

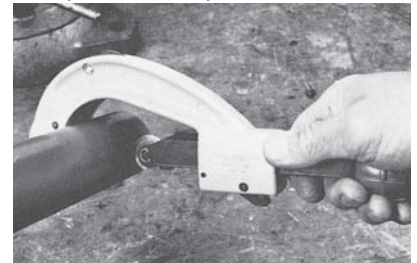
- PVC Solvent Cement - Light Duty Industrial Grade is for use with all Sch. 40, DWV and SDR pipe through 6".
- PVC Solvent Cement - Heavy Duty Industrial Grade is for use with all Sch. 80 and SDR pipe through 6".
- PVC Solvent Cement - Extra Heavy Duty Industrial Grade is for use with all PVC pipe 6" and larger.
- ABS Solvent Cement - For use in joining Sch. 40, SDR, and DWV pipe through 12" size.
- CPVC-CTS, Orange Colored Solvent Cement is for use with all sizes of Copper Tube Size tube and fittings.
- Purple Primer is for use with all PVC and CPVC pipe/tube and fittings.

NOTE: Do not take shortcuts - follow instructions completely.

PIPE/TUBE PREPARATION

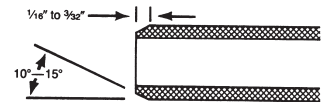
1. Cutting

Plastic pipe/tube can be easily cut with a powersaw, circular saw, band saw, or hand-saw. For best results, use a fine-toothed blade (16-18 teeth per inch) with little or no set (maximum 0.025 inch). A circumferential speed of about 6,000 ft./min. is suitable for circular saws; band saw speed should be approximately 3,000 ft./min. Carbide-tipped blades are preferable when quantities of pipe/tube are to be cut. To insure square-end cuts, a mitre box, hold-down, or jig should be used. Pipe or tubing cutters can be used for smaller diameter pipe/tube when the cutting wheel is specifically designed for plastic pipe.



2. Deburring and Beveling

All burrs, chips, filings, etc., should be removed from both the pipe/tube I.D. and O.D. before joining. Use a knife, deburring tool, or a half-round, coarse file to remove all burrs. All pipe/tube ends should be beveled to approximately the dimensions shown below for ease of socketing and to minimize the chances of wiping the solvent cement from the I.D. of the fitting as the pipe/tube is socketed:



The beveling can be done with a coarse file or a beveling tool such as that manufactured by Reed Manufacturing Company, Erie, Pennsylvania.

FITTING PREPARATION

Prior to solvent welding, all fittings and couplings should be removed from their cartons and exposed for at least one hour to the same temperature conditions as the pipe/tube in order to assure that they are thermally balanced before joining.

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CLEANING

Using a clean, dry cotton rag, wipe away all loose dirt and moisture from the I.D. and O.D. of the pipe/tube end and the I.D. of the fitting. **DO NOT ATTEMPT TO SOLVENT-WELD WET SURFACES.**

DANGER: Solvent cements and primers are extremely flammable and harmful if swallowed. Vapors are harmful. May cause eye irritation and repeated or prolonged skin contact causes skin irritation.

Keep away from heat, sparks and open flame. Use only with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid prolonged breathing of vapor. Close container after each use.

FIRST AID: In case of skin contact, flush with water; for eyes, flush with water for at least 15 minutes and seek medical attention. Wash contaminated clothing before reuse. If swallowed, **DO NOT INDUCE VOMITING**, call a Physician immediately.

PRIMING

The function of purple primer is to penetrate and soften the bonding surfaces of PVC and CPVC pipe/tube and fittings. (Primer is not required with ABS.) It is a product that penetrates rapidly. It is very effective on the hard-finished, high-gloss products now being produced.

Apply primer to the pipe/tube with a paint brush approximately 1/2 of the pipe/tube diameter. A rag is not recommended as repeated contact with skin may cause irritation or blistering.

Apply primer freely in the socket, keeping surface and applicator wet and in motion 5 to 15 seconds. Redip applicator as necessary. Avoid puddling in the socket.



Apply again to the fitting socket. The second application is especially recommended for belled-end pipe and fittings fabricated from pipe stock, for many of them have especially hard inside-surfaces.

For checking penetration, you should be able to scratch or scrape a few thousandths of an inch of the primed surfaces away. Repeated application to either or both surfaces may be necessary. Weather conditions affect priming action. In cold weather more time is required for proper penetration.

NOTE: The pipe/tube ends can be rested on notched boards to keep them clean and for ease of solvent cement application.

Note: There are "one-step" cements available for CPVC that eliminate the need to use a primer. Cements approved for use with FlowGuard® Gold™ CPVC will produce pressure-tight joints when used with NIBCO CPVC pipe and fittings. NIBCO recommends that the use of "one-step" cements be limited to applications where established temperatures are 40°F or higher, following the cement manufacturer's instructions.

SOLVENT CEMENT APPLICATION

Using the proper applicator (see chart - page 158 for specific recommendations) proceed as follows:

1. Apply a full even layer of cement on the pipe O.D. for a distance slightly greater than the depth of the socket of the fitting.
2. Coat the fitting socket with a medium layer, avoiding puddling. On belled-end pipe or fabricated fittings, do not coat beyond the socket depth or allow cement to run beyond the bell.
3. Put a second full even layer on the pipe/tube O.D. Cement Layers must be without voids and sufficient to fill any gap in the joints.



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HANDLING OF PRIMER AND CEMENT

NOTE: Observe the "use prior to" date. Cement has a limited shelf life. Do not permit solvent cement cans to stand open. Do not use cement that has dried to the point where it becomes lumpy and stringy. Dispose of properly. Do not attempt to thin out sluggish cement with thinner or primer. The solvents in the primer and cement are highly flammable, like a fast drying lacquer, and should not be used near an open flame. Use them in a well ventilated area and avoid prolonged breathing of the fumes. Prolonged contact with the skin could cause minor irritation.

JOINING

1. Immediately upon finishing cement application and before it starts to set, insert the pipe/tube to the full socket depth while rotating the pipe or fitting a 1/4 turn to insure complete and even distribution of the cement. Hold joint together for a minimum of 10 to 15 seconds to make sure that pipe/tube does not move or back out of the socket.



2. For pipe sizes 6" and larger, a joining crew consisting of two persons is recommended and the following additional steps necessary:



- a. Rotation of the pipe in the fitting may be omitted.
- b. Hold joint together for 1 to 3 minutes depending on pipe size.
- c. As an aid for joining in these larger sizes it is recommended that a come-along or pipe joining tool similar to that manufactured by Reed Manufacturing Company be used.

EXCESS CEMENT

Immediately after joining and before joint is set, gently place it back onto a level surface, wipe off all excess cement from the circumference of the pipe and fitting.

JOINT INTEGRITY

ABS, PVC, and CPVC-CTS piping joint integrity depends greatly upon following exactly and by intent NIBCO's specific handling, inspection, storage, shipping, fabrication, installation, testing, and operating instructions. Joint integrity also depends greatly upon an infinitely wide, unpredictable, and uncontrollable set of product and environmental conditions that go into determining the length of drying times, before a joint should be moved, handled, or whether intended for low or high working-pressure applications. These conditions include size of pipe, surface temperature of the joint, dry joint interference fit, and relative humidity. Drying times will be faster with smaller pipe/tube, higher surface temperatures, tighter interference fits, and lower relative humidity. Drying times will be slower when these conditions are reversed.

Because of the uncontrollable and unpredictable variety of drying conditions that can exist from job-to-job and moment-to-moment, NIBCO recommends only the drying times and solvent-welding conditions specified below:

1. When exposed to direct sunlight, solvent-welding joining should not be done in atmospheric temperatures below 40°F or above 90°F.
2. NIBCO recommends that 24 hours of joint drying time should elapse for all sizes of pipe and drying temperatures, before the joint is moved or subjected to any appreciable internal or external pressure.

HANDLING

During the initial setting of the cement, which begins about two minutes after application, (on small sizes) be careful not to move or disturb the joint. NIBCO offers, as a non-liability supplier, the following drying times as a guide in aiding the installer, engineer, owner, or other decision making party in deciding at his own risk when the joints are sufficiently dry for movement, handling, low pressure, initial joint testing, application of high pressure tests, and introduction of working pressure. These drying times are based upon a combination of past field experience and laboratory tests.

Solvent Welding Instructions for ABS, PVC, & CPVC-CTS Pressure & DWV Piping Systems (Continued)

ABS, PVC, and CPVC-CTS Joint Movement Times

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	12 Min.	20 Min.	30 Min.
1 1/2 - 2 1/2	30 Min.	45 Min.	1 Hr.
3 - 4	45 Min.	1 Hr.	1 Hr. & 30 Min.
6 - 8	1 Hr.	1 Hr. & 30 Min.	2 Hrs. & 30 Min.
10 - 12	2 Hrs.	3 Hrs.	5 Hrs.

*The temperatures above are only **drying** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

PRESSURE TESTING

CAUTION: AIR OR COMPRESSED GAS ARE NOT RECOMMENDED AS MEDIA FOR PRESSURE TESTING OF PLASTIC PIPING SYSTEMS.

1. Initial joint testing: Initial joint testing of PVC and CPVC-CTS pipe/tube could possibly be accomplished to 10% of its hydrostatic pressure rating after the below drying times have been observed:

PVC and CPVC-CTS Joint Drying Times at 10% Pressure.

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	1 Hr.	1 Hr. & 15 Min.	1 Hr. & 45 Min.
1 1/2 - 2 1/2	1 Hr. & 30 Min.	1 Hr. & 45 Min.	3 Hrs.
3 - 4	2 Hrs. & 45 Min.	3 Hrs. & 30 Min.	6 Hrs.
6 - 8	3 Hrs. & 30 Min.	4 Hrs.	12 Hrs.
10 - 12	6 Hrs.	8 Hrs.	72 Hrs.

*The temperatures above are only **drying** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

2. The PVC pipe and CPVC-CTS tube could possibly be pressure tested up to 100% of its hydrostatic pressure rating after the below drying times:

PVC and CPVC-CTS Joint Drying Times For 100% Pressure

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	4 Hrs.	5 Hrs.	7 Hrs.
1 1/2 - 2 1/2	6 Hrs.	8 Hrs.	10 Hrs.
3 - 4	8 Hrs.	18 Hrs.	24 Hrs.
6 - 8	12 Hrs.	24 Hrs.	48 Hrs.
10 - 12	18 Hrs.	36 Hrs.	72 Hrs.

*The temperatures above are only **drying** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

DO'S AND DON'TS

DO:

- Use the proper applicator.
- Use the proper type of solvent cement for the job.
- Follow the instructions completely.

DON'T:

- Attempt to solvent weld under the following conditions:
 1. If it is raining.
 2. If the atmospheric temperature is below 40°F.
 3. If under direct exposure to sun at atmospheric temperatures above 90°F
- Discard empty cans of solvent, primer or rags in trench or near piping. Concentrated fumes or dripping cement or primer can cause piping failure.

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HOT WEATHER CEMENTING

Since cement contains a solvent, certain precautions or steps should be taken when the atmospheric temperature is above 90°F, to avoid evaporation of the solvent from the cement just prior to joining. Such evaporation will cause the cement to prematurely set before joining, thus, adversely affecting the joint integrity. Use one or a combination of the list below to reduce the chances of this condition occurring:

1. Shade or shelter the joint surfaces from direct exposure to the sun's rays for at least one hour prior to joining and during the joining process.
2. Make cement joints during early morning hours.
3. Apply cement quickly. On 6" and larger pipe, it is recommended that two persons apply cement to pipe surface while the third applies it to the fitting socket.
4. Join pipe to fittings as quickly as possible after applying cement.

COLD WEATHER CEMENTING

Because the solvents in the cement will not evaporate as readily when the temperature is below 40°F, the pipe joints will not set up as rapidly in cold weather. If solvent cementing must be done when the temperature is below 40°F the following suggestions are offered:

1. Store pipe, fittings, cement and primer in a heated area.
2. Prefab as much of the system as possible in a heated work area.
3. Joints that must be made outside should be protected with a portable shelter and heated with indirect heat to surface temperatures above 40°F prior to joining. The shelter and heat should remain in place for at least two hours after joint assembly.
4. Pipe and fittings must be dry prior to joining and the joints should be kept dry until the cement has had sufficient time to set.

CAUTION: DO NOT ATTEMPT TO SPEED THE SETTING OR DRYING OF THE CEMENT BY APPLYING DIRECT HEAT TO THE SOLVENT WELDED JOINT. Forced rapid drying by heating will cause the cement solvents to boil off, forming porosity, bubbles, and blisters in the cement film.

Applicators

Nominal Size	Roller Size	Recommended Brush Width*, in.
1/4	Not Recommended	1/2
3/8		1/2
1/2		1/2
3/4		1/2
1		1/2
1 1/4		1
1 1/2		1
2		1
2 1/2		1 1/2
3		3
4	2	
6	3	
8	7	4
10		4, 6, or 8
12		4, 6, or 8

*Natural bristle brushes should always be specified. It is recognized that the recommended brush width may not always be readily available. However, the selection should come as close as possible to the recommended width in order to insure complete coverage with a minimum number of brush strokes.

REQUIREMENTS

The below estimated PVC, CPVC, and ABS IPS pipe solvent cement requirements should only be considered as a guideline for usage and could vary according to a wide variety of installation conditions. Further, these estimates should in no way be used to restrict the liberal cement application instructions recommended for the pipe.

Number of Joints Per...*

Nominal Size	Pint	Quart	Gallon
1/2	130	260	1040
3/4	80	160	640
1	70	140	560
1 1/4	50	100	400
1 1/2	35	70	280
2	20	40	160
2 1/2	17	34	136
3	15	30	120
4	10	20	80
5	8	16	64
6	N/R	8	24
8	N/R	3	12
10	N/R	N/R	10
12	N/R	N/R	6

*Each joint represents one socket in a fitting.
N/R - Not Recommended.

Solvent Welding Instructions for ABS, PVC, & CPVC-CTS Pressure & DWV Piping Systems (Continued)

The estimated CPVC-CTS solvent cement requirements listed below should only be considered as a guideline for usage and could vary according to a wide variety of installation conditions. Further, these estimates should in no way be used to restrict the liberal cement application instructions recommended for the tube.

Number of Joints Per Pint

Nominal Size	Joints
1/2	255
3/4	170
1	138
1 1/4	95
1 1/2	68
2	38